ENVIRONMENTAL IMPACT ASSESSMENT
"3D" OFFSHORE SEISMIC RECORD
CAN_100, CAN_108 AND CAN_114 AREAS, ARGENTINA

CHAPTER 5 – ENVIRONMENTAL BASELINE

MARCH 2021

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This Chapter is mainly aimed at assessing the area of influence of the project, including its physical, biological and anthropic aspects. This shall enable the evaluation and quantification of the probable environmental impacts derived from the planned activities which shall be properly addressed in the subsequent chapters.

1 INTRODUCTION

The impact that a project may have on the environment depends both on the set of activities and actions involved, and on the elements and processes that make up the environmental system in which it shall be inserted.

As part of the study of the environmental impact of each project, it is necessary to analyze it from an environmental point of view, developing a deep characterization of its general aspects (physical, biological, cultural, and socioeconomic features). This is known as the Environmental Baseline (LBA).

In order to carry out the characterization of the Environmental Baseline, this chapter was nourished by secondary information obtained from the analysis of the antecedent works on each of the topics addressed.

In order to incorporate secondary information to the analysis, the Environmental Baseline had to comply with a set of conditions. Thus, it was important that said information be reliable, which is mainly related to its source (origin), the treatment given to it and its representativeness. It was also created to be as homogeneous as possible, so that the variables analyzed are the same, as well as the criteria used for its preparation, thus allowing comparison between studies and between these and the primary information generated. At the same time, emphasis was placed on the timeliness of the data, so as to generate a smaller time lag between the moment they were taken and the phenomenon to be analyzed. Finally, only the really useful and adequate information considered relevant was used for the analysis to be carried out.

In this way, a characterization of the physical environment (climate, geology and oceanography), the biotic environment (benthos, plankton, nekton and protected areas) and the anthropic environment was possible, especially regarding the activities carried out in the area and over which the implementation of the project may cause interference.

2 AREA OF STUDY AND AREA OF INFLUENCE

The seismic information acquisition areas associated with the blocks identified as CAN_100, CAN_108 and CAN_114 are located in the North Argentine Basin of the Argentine Continental Shelf.

The "CAN_100-108" seismic data acquisition area is located approximately 300 km from the nearest coastal town, Mar del Plata, in the Province of Buenos Aires. The surface that is planned to be explored within the "CAN_114" area is located more than 400 km from the town of Necochea, also in the Province of Buenos Aires. The main access routes are maritime and / or air to and from these locations.

The area of influence of a project is defined as the area over which it shall be possible to measure impacts derived from the actions proposed. The area may be of direct (DIA) or indirect (IIA) influence depending on the direct or indirect impact. The "Guide for the preparation of environmental impact studies" of the former Secretariat of Environment and Sustainable Development (SAyDS, 2019) defines the Area of direct influence (DIA) as "the maximum area surrounding the project and its associated facilities, within which the direct environmental impacts on the identified sensitive receptors can be predicted with reasonable (grounded) confidence and accuracy " and the Area of Indirect Influence (IIA) as "the area within which indirect impacts linked to direct impacts of the project are anticipated, and whose effects could overlap or accumulate with environmental effects of other past, present or future projects".

Obviously, it shall not be possible to determine the area of influence of the project until the impacts have been properly assessed. However, considering similar background, it is possible to determine a study area that, on average, easily encompasses the areas of direct and indirect influence. Consequently, the definition of the Study Area allows the categorization of areas of greatest interest to focus efforts towards them (see Figure 2).

Given that the environmental impacts of an activity, work or project may vary from one component to another and from one activity to another, it is feasible that during the process of identification and delimitation of the area of influence of said project, areas of influence by component, group of components or environment are then added to define the area of influence of the project. In this way, the delimitation of the area of influence can consider one or more polygons.

According to the "Terms of Reference for the preparation of the Environmental Impact Assessment - EIA - in marine seismic exploration projects at depths less than 200 m" of the Ministry of Environment and Sustainable Development of Colombia (2016), "the area of influence of a marine seismic exploration project, corresponds to the aggregation of the following areas: i) polygon of the seismic exploration area, ii) buffer strip or protection, calculated from the acoustic wave propagation models generated, defining as distance the sound level that can potentially affect the structure and function of the ecosystem components (mainly sea turtles and marine mammals), iii) maneuvering areas that the boat needs to change course, due to the fact that, although seismic activity is not carried out in this area, the equipment is deployed, and iv) fraction of the continental zone, when applicable, due to the location of communities that are affected in the normal development of their economic activities (e.g. fishing or tourist operation) deriving from the execution of the project."

For the definition of the 3D Offshore Seismic Record of CAN_100, CAN_108 and CAN_114 Areas, it is necessary to determine the operational area (OA), that is, the space in which the key actions of the project shall be carried out. The criterion used to establish the OA was to consider about 12 km beyond the limits of the seismic data acquisition area in the direction of the acquisition lines (*prime lines*)[1], in order to include the turns that the seismic vessel shall make to perform line changes which, according to the Project Description (Chapter 4), shall not exceed 11 km and a buffer of 2 km in the rest of the perimeter. In this way, the OA comprises the maximum range of the ship's movements during the survey.

The OA also includes the Port of Mar del Plata, where the logistics vessel shall be supplied with fuel, fresh food and consumables every 2 or 3 weeks on average, and it shall also embrace the routes between said port and CAN_100–108 and CAN_114 acquisition areas. Although the port of Buenos Aires has been set as the port of shipment, it shall only be used during mobilization (entry of the seismic vessel into the country) and demobilization (departure from the country of the seismic vessel), hence, this port and this route shall only be used once at the beginning of the project, and once at the end. The project activities are not expected to have a significant impact on these areas given the limited nature of these operations and their common characteristics in shipping activities.

The geographical layout of the project's operational area is presented in Figure 1.

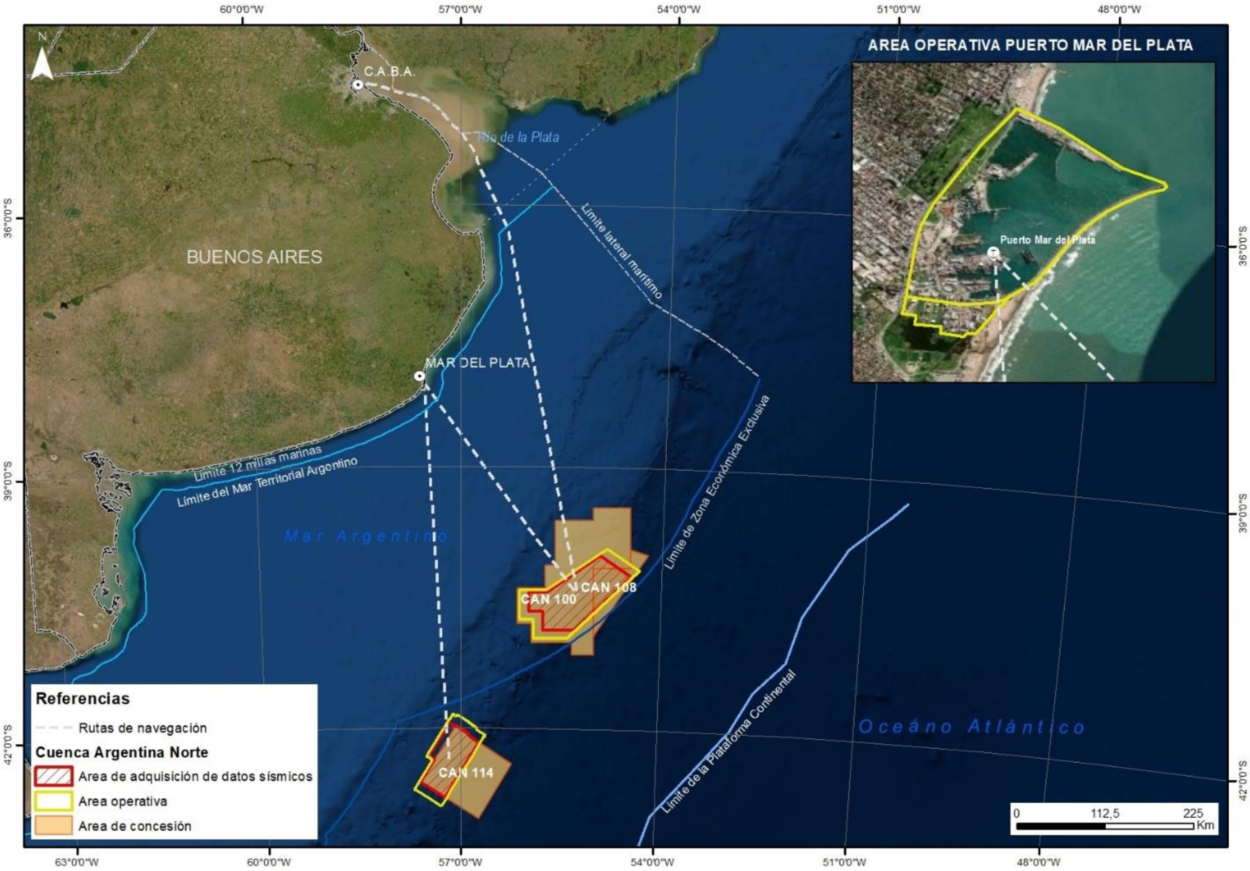


Figure 1. Project operational area.

(**Translation of Figure 1**: Límite lateral marítimo: Maritime Lateral Limit. Límite 12 millas marinas: Limit of 12 Nautical miles. Límite del mar territorial Argentino: Limit of the Argentine Territorial Sea.

[1] The acquisition lines shall be deployed in NW-SE direction.

Límite de Zona Economica exclusiva: Exclusive Economic Zone Limit. Límite de la Plataforma Continental: Continental Shelf Limit. Area Operativa Puerto Mar del Plata: Operative Area of the Port of Mar del Plata. Referencias: References. Rutas de Navegación: Navigation Routes. Cuenca Argentina Norte: Argentine North Basin. Area de Adquisición de Datos sísmicos: Seismic Data Acquisition Area. Area Operativa: Operative Area. Area de Concesión: License Area).

Figure 2 shows the Study Area.

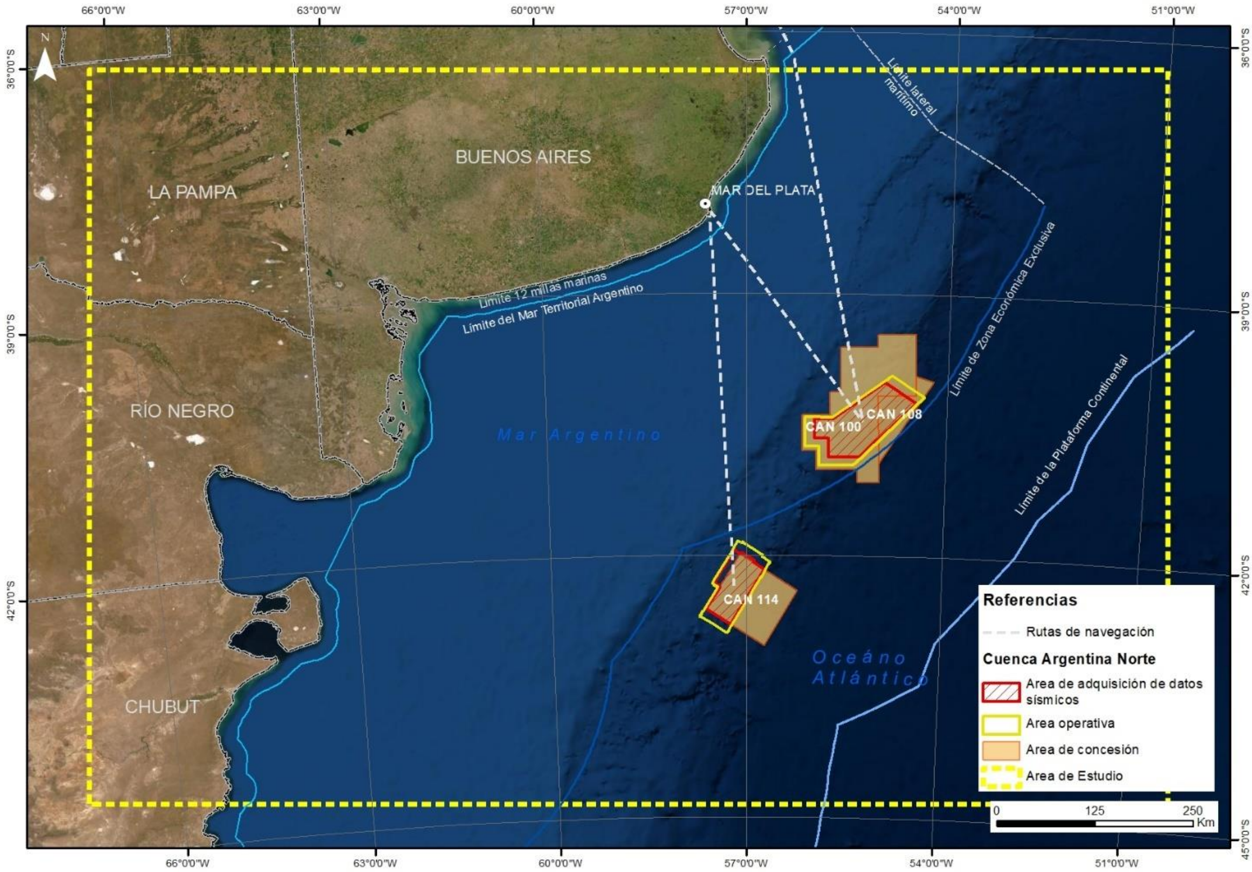


Figure 2. Study Area

(Translation of Figure 2: Límite lateral marítimo: Maritime Lateral Limit. Límite 12 millas marinas: Limit of 12 Nautical miles. Límite del mar territorial Argentino: Limit of the Argentine Territorial Sea. Límite de Zona Economica exclusiva: Exclusive Economic Zone Limit. Límite de la Plataforma Continental: Continental Shelf Limit. Referencias: References. Rutas de Navegación: Navigation Routes. Cuenca Argentina Norte: Argentine North Basin. Area de Adquisición de Datos sísmicos: Seismic Data Acquisition Area. Area Operativa: Operative Area. Area de Concesión: License Area. Area de Estudio: Study Area)

The areas of direct and indirect influence are defined below based on the biotic, physical and anthropic components.

2.1 AREA OF INFLUENCE OF THE BIOTIC COMPONENT

Background data on the potential effects (and their scope) on marine biota typically associated with exploratory seismic records, characterized by the emission of sound energy, have been preliminarily considered. Likewise, incidental hydrocarbon spills or other dangerous substances with potential consequences for marine fauna have been taken into account.

2.1.1 Background on the potential effects on marine biota associated with the emission of sound energy

Marine mammals

The impact of anthropogenic noise on marine mammals has been described in numerous articles and reports, including Richardson et al, (1995) Southall et al. (2007) and Nowacek et al. (2007).

Richardson et al. (1995) provided a framework for evaluating the impact of noise in the aquatic environment by introducing the concept of four zones of influence on the behavior and hearing of marine mammals. These zones are: "audibility zone", "response zone", "masking zone" and "zone of hearing loss, discomfort and injury". However, the methods for establishing these four zones for different species and noise sources are not standardized (Tougaard et al., 2009).

Based on the work of Richardson et al. (1995) Australia (Government of Australia, 2012) has defined 3 impact zones, as follows:

- Audibility Zone: Area within which marine mammals can perceive source noise but show no significant behavioral response. The size of the audible zone is highly dependent on the ambient noise environment, which has been increasing in recent decades.

- Response zone: Area within which marine mammals can react behaviorally to the noise source. This zone may be smaller than the zone of audibility since marine mammals generally do not show significant behavioral responses to noises that are weak but audible.

- Hearing Loss Zone: Area closest to the noise source where noise levels may be high enough to cause a physiological impact such as TTS (temporary hearing threshold change that results in temporary hearing loss) or PTS (permanent threshold change equivalent to hearing damage).

These impact zones define the probable area of influence of a noise source and indicate the distance from which this source is expected to impact on a marine mammal, either in behavior or physiology. This information, together with data on the biological importance of the marine environment as a habitat for the species considered, for example, breeding or resting areas, migration routes or feeding areas, are used to assess the potential impact of a source of noise (Government of Australia, 2012).

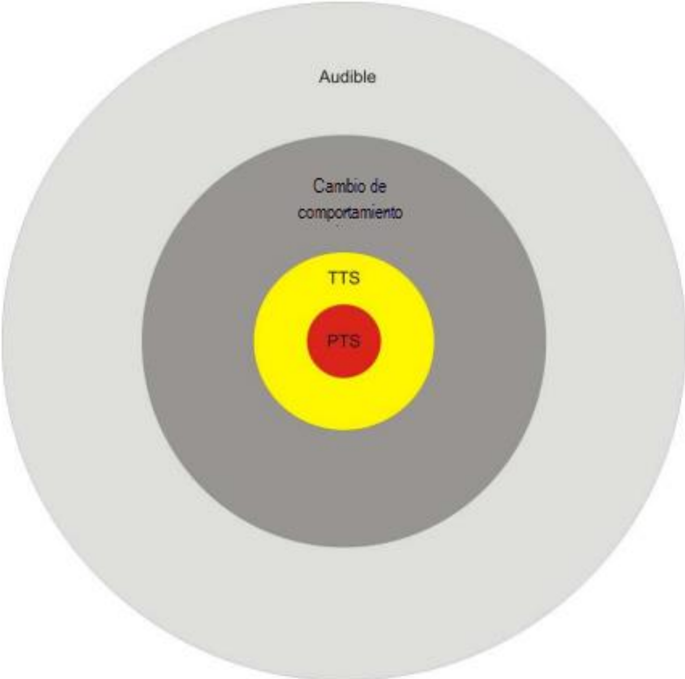


Figure 3 - Impact zones of underwater noise sources, including hearing zone, responsiveness and hearing damage. The area of hearing damage is in turn divided into temporary and permanent threshold displacement zones (TTS and PTS). (Government of Australia, 2012).

(Translation of Figure 3: Audible: Audible. Cambio de comportamiento: Behavior change).

Physiological impacts

Non-auditory physical and physiological effects

Severe physical damage (damage to vital organs) produced by underwater noise would be limited to unusual situations in which animals may be exposed at a short distance from the source of seismic energy for uncommonly long periods (BOEM, 2014).

Hearing damage - Hearing threshold shift

Most of the discussions about the physiological effects of underwater noise have focused on the auditory system, which is probably the most sensitive to noise.

Animals exposed to loud sound may experience reduced hearing sensitivity for some time after exposure. This increase in hearing threshold is known as a noise-induced threshold shift (TS). The amount of TS incurred is influenced by the amplitude, duration, frequency content, temporal pattern, and energy distribution of the noise (Southall et al. 2007). The magnitude of TS generally decreases with time after exposure to noise and, if it eventually returns to zero, it is known as a temporary threshold shift (TTS). If the TS does not return to zero after some time, it is known as a Permanent Threshold Shift (PTS). Sound levels associated with the onset of TTS are generally considered below the levels that shall cause PTS, which is considered hearing damage.

Acoustic impact criteria

Since the mid-1990s, the United States National Marine Fisheries Service (NMFS) has established acoustic thresholds that identify received sound levels above which permanent deterioration of the sound could occur. They are defined as "Level A" ("Level A Harassment -potential injury-"). Historically, the NMFS identified 180 and 190 dB re 1 µPa (rms) for cetaceans and pinnipeds, respectively, as the levels above which one could not be certain that there would be no harmful effects, auditory or otherwise to marine mammals, according to the opinion of bioacoustics specialists summoned by the NMFS before TTS measurements were available. This threshold of 180 dB re 1 µPa (rms) is the most widely used in environmental guides and studies to estimate the impact of noise on marine fauna, and based on which "Exclusion Zones" calculated from the models of acoustic wave propagation are established. The modeling procedure enables obtaining distances of 300 to 3000 meters from the seismic energy source for said threshold, depending on the characteristics of the environment (MAGRAMA, 2012).

Recently, the NMFS has undertaken a rigorous process of reviewing and updating the thresholds to estimate the onset of hearing damage (which the NMFS considers the onset of Level "A" Harassment) incorporating the state-of-the-arts methods. The development of these revised acoustic thresholds included the creation of a Reference Technical Guide[2] that articulates the thresholds and how these were scientifically obtained[3]. The Effects of Oil and Gas Activities in the Arctic Ocean (NOAA, 2016), which compares the safety distances established according to both criteria, indicates that those obtained with the new criteria are generally broadly included within those established with the 180 and 190-dB re 1 µPa (rms) criteria previously applied.

[2] Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing. Available at: https://www.fisheries.noaa.gov/resource/document/technical-guidance-assessing-effects-anthropogenic-sound-marine-mammal-hearing

[3] The aforementioned thresholds match those considered in this study for the assessment of the auditory impact on mammals based on Southall et al., 2019 (see Chapter 7) although there are few examples of application to date that guide on the implementation of these criteria, and there is no history of their application in our country.

Impacts on behavior

Behavioral responses to noise incorporate a variety of effects, including subtle changes in behavior, and more sensible changes in activities and movement. The observable reactions of marine mammals to sound include attraction to the sound source, increased vigilance, modification of their own sounds, cessation of feeding or interaction, alteration of swimming or diving behavior (change of direction or speed), short- or long-term abandonment of habitat (diversion, short- or long-term avoidance), and possibly panic reactions such as booming or stranding (Nowacek et al. 2007, Richardson et al. 1995 and Southall et al. 2007). Masking of sounds of biological importance can interfere with communication and social interaction, and also cause behavioral changes (Government of Australia, 2012).

Studies of the impact of seismic surveys have focused mainly on large whales. These studies have shown avoidance behaviors at ranges of up to 12 km for humpback whales, 5 km for gray whales or 3 km for Greenland whales (MAGRAMA, 2012). The studies gathered by Chicote et al. (2013) indicate that the behavior of cetaceans in response to exposure to a source of seismic prospecting, shows very diverse reactions in different species, and even between different individuals of the same species. The results of the studies showed a variable degree of disturbance of the cetaceans, indicating that the small odontocetes (dolphins, porpoises, pilot whales) showed greater lateral avoidance while the mysticetes (whales) and orcas showed some localized spatial escape. No changes were found in the orientation of the sperm whales, although the number of observations was not enough to perform a reliable statistical analysis. Similar Studies (McCauley et al. 1998 cited in Gordon et al. 2003) have shown different reactions in humpback whales during their migration off the east coast of Australia. In some cases, they observed strong reactions in the behavior of the whales, which accelerated their swim until they reached 10-15 knots of speed, before being sighted at 1500 m from the source of seismic energy. In other cases, the whales stayed longer on surface and one specimen swam in a zig-zag way, until it distanced itself from the seismic energy source. The authors suggested not only that sensitivity to noise sources would not vary solely between species, but also that different whales of the same species might exhibit different levels of sensitivity. Goold (1996, cited in Gordon et al. 2003) monitored acoustic activity in a common dolphin (*Delphinus delphis*) population before, during and after a seismic record off the coast of Wales and observed that in an area of 1 km radius the dolphins were reluctant to a seismic source.

According to Gordon et al. (2003, citado en Chicote et al. 2013) the results of the studies on sperm whales are controversial. Sperm whales are believed to have a superior low-frequency hearing than smaller odontocetes, so they would be more sensitive to pulses from the seismic energy source. However, the studies disagree. Mate et al. (1994) (cited in Gordon et al. 2003) reported a reduction to approximately one third in sperm whale density within a preferential area in the northern Gulf of Mexico two days after the start of the seismic survey. Five days later, the abundance dropped to zero. Bowles et al. (1994) (cited in Gordon et al. 2003) observed that sperm whales ceased to vocalize during some, but not all, periods in which a seismic research vessel was perceived firing at a range of 370 km. However, and in contrast to these reports, other observations suggest that sperm whales show little response and are not excluded from the habitat by seismic surveys (for example, Rankin & Evans, 1998; Swift 1998 cited in Gordon et al. 2003). The compilation made by Gordon et al. (2003) indicate that behavioral changes have been observed in marine mammals in response to exposure to pulses from seismic sources, mostly at distances not exceeding 10 km, and avoidance responses at distances of up to 70 km, in some cases.

Since the delimitation of a "response zone" is related to the behavioral reactions of the target species, it can only be established through behavioral observations, which in many cases are difficult to obtain (not all responses are visible from outside the animal, the number of animals exposed underwater [i.e. not visible], and many of them are found many kilometers from the observers covering a very large area, etc.). Practical measurements are further complicated by the fact that most animals show different reactions to noise depending on previous exposure experiences and their behavioral and physiological states during noise exposure (Tougaard). In this sense, the NMFS has defined, together with the potential injury thresholds, acoustic thresholds that estimate sound levels at which behavioral disturbances could occur in marine mammals, defined as "Level B" ("Level B Harassment -behavioral harassment-")[4]. This acoustic threshold was set at 160 dB re 1 μPa rms for impulsive noises (such as pulses from seismic energy sources). Just as the thresholds for potential injury have been updated by the NMFS since its establishment in the mid-1990s, the "thresholds for behavioral disturbance" have also undergone a revision process incorporating the knowledge obtained from the most recent research (NOAA, 2016). However, to date, no new values have been published for the "Level B" thresholds.

If the source involved in the project of "3D Offshore Seismic Registry of CAN_100, CAN_108 and CAN_114 Areas" and a theoretical intermediate transmission loss between cylindrical and spherical are considered, it can be estimated that the threshold of 160 dB re 1 uPa-m (rms) would be between 50 and 100 km from the source for this project taking into account the above mentioned, and for the sole purpose of delimiting an area of influence that comprises the previously mentioned effects.

Seabirds and Shorebirds

Seismic activities could have effects on sea and shorebirds through various mechanisms, as summarized below.

Disturbance

The responses of birds to disturbance vary depending on the species, the physiological and Breeding status of the individual, the distance of said disturbance, and its type / intensity / duration. Seismic surveys result in both horizontal and vertical sound propagation in the water column. Observations of birds in the vicinity of the seismic records made by Stemp (1985, cited in NOAA, 2016) did not evidence any perceptible disturbance in birds during the emission of the sound pulses. This author concluded that the negative effects of seismic operations were not likely to happen, as long as the activities were carried out far from the bird colonies and their feeding concentrations.

Injuries / Mortality

As mentioned above, the deployment of seismic activity results in both horizontal and vertical sound propagation in the water column. As with other animals, a bird may also be injured by seismic energy if it is very close (<2 m) to the operating source. This situation is rare as birds tend to avoid operating vessels and airborne noise associated with active compressed air sources (NOAA, 2016).

Changes in habitat

Energy from seismic sources can affect invertebrates and fish (prey species used by birds). However, there are very few effects on invertebrates and fish associated with these emissions, unless they are within a few meters of the sound source (McCauly 1994, cited in NOAA, 2016). These disturbance effects are highly local and temporary and are not likely to decrease prey availability for any bird species.

[4] Under the U.S. Marine Mammal Protection Act, "Level B Harassment -behavioral harassment-" is defined as "the act of chasing, torment or nuisance that has the potential to disturb a marine mammal or a population of marine mammals in the wild causing a disturbance of behavioral patterns, including, but not limited to, migration, breathing, lactation, breeding, feeding or sheltering, but which does not have the intensity to injure a marine mammal or marine mammal population in the wild".

Fish & Fisheries

The range of potential effects on fish from loud sound sources, such as seismic energy sources, varies widely, but is mainly influenced by the level of sound exposure, with high sound levels being the most damaging. Although direct physiological effects such as hearing loss or injury, tissue injury or death can occur, indirect effects that modify fish behavior are much more common and likely. These behavioral modifications are highly variable and depend on a number of factors, such as the species, the stage of the life cycle, the time of day, whether the fish have fed, and how sound propagates in a given environment (CNLOPB 2007, cited in NOAA, 2016).

The review by Chicote et al. (2013) points out that changes in swimming behavior, avoidance, alarm responses, concentration in the bottom of fish and cephalopods, among others, were recorded at received levels from 156 dB re 1µPa rms in the experiments carried out by McCauly et al. (2003). These results are consistent with those carried out in wild fish. Some experiments have shown a reduction in the densities of different commercial species in seismic survey areas, at distances greater than 30 kilometers (Dalen and Knutsen, 1986; Engås et al. 1996; Slotte et al. 2003, cited in Chicote et al. 2013). Engås *et al.* (1993, cited in Chicote et al. 2013) found an average 50% reduction in catch and accessibility of cod and haddock within a 20 nautical mile radius from an operating seismic vessel, and showed a 70% decrease in these species in the area of operation (3 x 10 nautical miles). Longline catches of both species were reduced by 44% in the area, although this effect was not noticeable within 18 nautical miles of the survey vessel.

Eggs and larvae are more vulnerable to the effects of noise than juvenile and adult fish, as they are much less mobile and often depend on currents for their mobility. In some cases, the eggs are fixed to the substrate and therefore completely motionless. Davis et al. (1998, cited in NOAA, 2016) has shown that sound levels close to 220 dB re 1 µPa are lethal for fish eggs and larvae. These sound levels correspond to a distance of 0.6 to 3 m from a source of compressed air. Visible damage to larvae can occur at 210 dB re 1 µPa, which corresponds to a distance of approximately 5 m (16 ft) from this source (NOAA, 2016).

Invertebrates

The effects of energy from seismic surveys on invertebrate populations are increasingly discussed based on case studies in European waters of the Atlantic Ocean where cephalopod populations are found. Numerous laboratory studies have attempted to illustrate the possible effects of seismic energy on invertebrate populations, both larval and adult. In a laboratory study of four species of squid, André et al. (2011, cited in NOAA, 2016) showed that exposure to low-frequency sounds caused damage to statocysts, the structures responsible for the sense of balance and position of animals.

Zooplankton

In the review of the information available on the effects of seismic sounds on invertebrates, carried out by the Department of Fisheries and Oceans of Canada (DFO) reported lethal effects and / or sublethal effects on invertebrates (eg crustaceans, gastropods) exposed to sounds from compressed air sources at distances of <5 m under experimental conditions. The authors considered that exposure to seismic energy sources was unlikely to lead to direct mortality of invertebrates, although invertebrates may exhibit short-term behavioral reactions to sound (DFO 2004, cited in NOAA, 2016). They have found few studies on the effects of seismic noise on zooplankton. In the study carried out by NOAA (2016) for the assessment of seismic activities in the Arctic Ocean, it is concluded that zooplankton possibly react to the shock wave very close to the seismic source, but the effects are local.

2.1.2 Oil spills or other dangerous substances

On the other hand, as in most similar projects, an accidental event might occur related to the inherent risk of spills of hydrocarbons or other dangerous substances. If the impact on the sea water occured, the quality of the water, the sediments and the aquatic fauna would be affected.

These risks are common to all ship operations, and must be managed through proper planning and aplicable measures in case of contingencies.

The hazards associated with oil and fuel spills during the development of the project (which are considered more plausible) are the following:

- Leak or spill on deck of small amounts of hydraulic oil or lubricating oil on decks of seismic vessel and support vessels (less than 50 liters based on leak rate analysis from the shipping industry). In this case, most of the spilled material shall be kept in the collection trays and directed to the bilge tanks, preventing its discharge into the water. On the other hand, the containers used in the ships for the storage of hydrocarbons (barrels of up to 200 liters) shall always be used and stored in internal and / or fenced areas where any spill or leak would be totally contained on board.

- Loss of MGO (marine gas oil -diesel-) during the refueling operations of the seismic vessel, as a result of a failure in the hose connection, -although a more probable hypothesis is a leak through a small hole or a crack in the hose (produced by abrasion or mechanical damage)) –. In the event of such a leak, it would result in a highly visible glow on surface of the water, allowing action to be taken to stop the leak (by the supervisors of the operation) before a few liters have been spilled.

The probability of a large fuel spill is remote. The size of typical hydrocarbon spills reported during similar exploration activities is in the range of 50 liters (Aecom, 2018; ERM 2019). The spill of all fuel from the seismic vessel is considered particularly improbable, as the fuel is stored in a series of smaller double-bottomed tanks and their contents are unlikely to be lost simultaneously. In addition, the valves connecting the fuel tanks are kept closed, minimizing the loss of fuel if one of the tanks breaks, while the leaks in the storage tanks are directed to the oily bilge water tanks. Only rarely can a ship-to-ship collision cause the fuel tank to break and spill into the water. The analysis of accident statistics in water transport carried out by the International Association of Oil and Gas Producers (OGP, 2010) shows that collisions between ships represent only 12% of the total ship leakage and that the probability is extremely low. For this to occur, the collision must be strong enough to penetrate the ship's hull in the exact place of the fuel tank, which is unlikely. In addition, the hull of the seismic vessel is double-lined. In this sense, it is worth noting that such a collision is highly unlikely to occur during seismic prospecting since the seismic vessel and the support vessels shall have to comply with the general maritime and navigation safety procedures (use of lights, beacons, radio contact, etc.), added to the navigation exclusion zone that is established around the seismic vessel and the array for its safe navigation (up to 4 km in front of the vessel and on each side, and up to 12 km behind).

2.1.3 Area of Influence of the Biotic Component

When referring to the biotic component, it is considered that the spatial scope of the potential effects on marine mammals also includes the effects upon other environmental factors. In this way, a Direct Area of Influence (DAI) or area of direct impact is established, which is mainly associated with the acoustic propagation of the noise generated by the activity, and its maximum incidence is typically limited to a distance ranging from 500 meters to 3 km from the seismic data acquisition area. In this sense, the DAI is defined as a 3 km buffer surrounding the OA (Operative Areas) of CAN_100–108 and CAN_114 areas. Thus, the DAI comprises a 5 km-distance from the seismic data acquisition area. The surroundings adjacent to the port of Mar del Plata and the shipping routes between said port and the acquisition areas are outside of this polygon, but are also part of the DAI.

Surrounding the DAI, a 100km-buffer area is considered and measured from the seismic data acquisition area that contemplates the scope of the potential effects on mammals that are not related to the damage. This area makes up the Area of indirect influence (AII). The Areas of Direct Influence of the port of Mar del Plata and the logistics route are considered areas of indirect influence.

Regarding accidental events related to spills of hydrocarbons or dangerous substances, the most likely situation would be the loss of fuel in refueling or fuel transfer operations, but unlikely to happen as it has previously been mentioned. These operations shall take place in the port of Mar del Plata, established for logistics services (where the logistics vessel shall be restocked every 2 or 3 weeks), and in the seismic data acquisition area where the seismic vessel shall also be restocked. Environmental assessments and maritime risk studies indicate that the extension of the area affected by a fuel spill in refueling operations, either in open areas or in the port, can be considered as detailed or localized (URS, 2014; SRL, 2017; ERM, 2016; PGS, 2018). Given the small volumes that would be involved in the event of hydrocarbon leaks in these operations, and that they would be carried out under prevention and control protocols if they occured, it is not expected that in the event of an impact, this shall exceed the DAI established for the aforementioned areas.

Beyond these areas, the characterization of the biotic component covers a study area on a broader general scale or “regional area of influence” that includes the environments - and their functional relationships - around the project, embracing all areas of influence defined above. On this scale, a general characterization is carried out with emphasis on the analysis of sensitive environments (ANP, AICAs, Proposed Marine Areas, etc.) (see Figure 2).

In those areas where the general spatial scope is not applicable to a given resource, the analysis of a relevant subzone approximately defined by the polygon called the Detailed Study Area was determined within this “regional area of influence”.

The geographical location of the aforementioned areas of influence for the biotic component is presented in Figure 4.

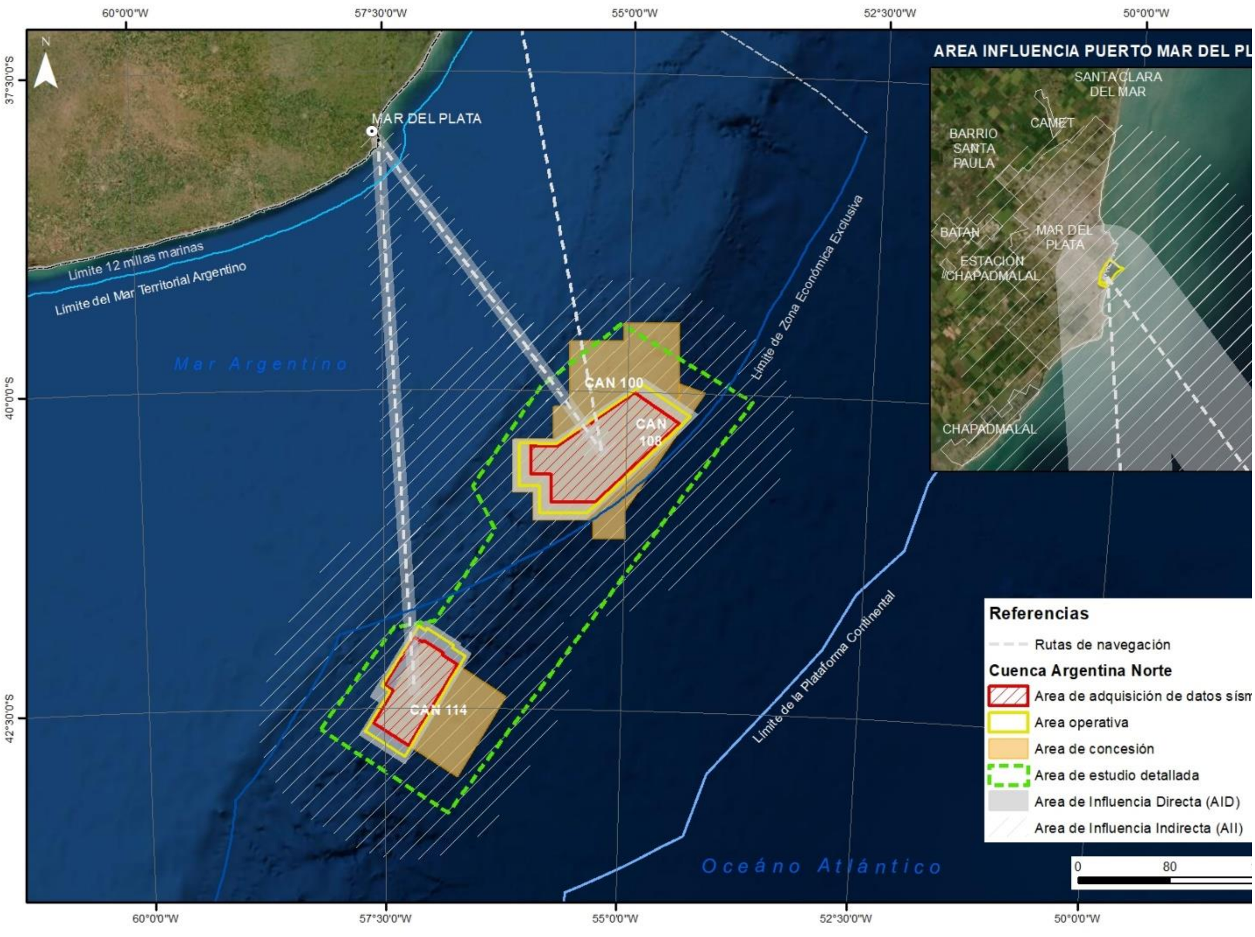


Figure 4. Area of Influence of the Biotic Component.

(**Translation of Figure 4**: Límite 12 millas marinas: Limit of 12 Nautical miles. Límite del mar Territorial Argentino: Limit of the Argentine Territorial Sea. Límite de Zona Economica exclusiva: Exclusive Economic Zone Limit. Límite de la Plataforma Continental: Continental Shelf Limit. Oceano Atlántico: Atlantic Ocean. Area de Influencia Puerto de Mar del Plata: Area of Influence of the Port of Mar del Plata. Referencias: References. Rutas de Navegación: Navigation Routes. Cuenca Argentina Norte: Argentine North Basin. Area de Adquisición de Datos sísmicos: Seismic Data Acquisition Area. Area Operativa: Operative Area. Area de Concesión: License Area. Area de Estudio detallada: Detailed Study Area. Area de Influencia Directa (AID): Area of Direct Influence (ADI). Area de Influencia Indirecta: Area of Indirect Influence (AII).

2.2 AREA OF INFLUENCE OF THE PHYSICAL COMPONENT

Given the nature of the project, the physical variables (geological and oceanographic) shall not be affected by the actions of the project, but, on the contrary, some actions shall be limited and affected by these variables on site.

In this sense, the subcomponents of the physical environment have been described on a general scale in order to help understand the system as a whole, thoroughly characterizing the specific variables within the Detailed Study Area that limit some aspects of the project or the assessment, such as winds, currents, tides and waves, temperature, salinity and speed of sound propagation in water, bathymetry and sediments of the seabed.

2.3 AREA OF INFLUENCE OF THE ANTHROPIC COMPONENT

As mentioned above, the seismic data acquisition areas are located offshore more than 300 km from the nearest coastal area in the province of Buenos Aires, beyond 12 miles from the territorial sea; approximately 310 km from the nearest coastal town (Mar del Plata).

Given the nature of the project, no interactions are foreseen between the project and the territorial coastal strip. It is worth mentioning that marine seismic exploration with modern techniques does not produce significant pulses of airborne noise (Richardson et al., 1991). On the other hand, the project does not require the installation of logistics bases or any infrastructure whatsoever, and determines the port of Buenos Aires as the port of shipment and the Port of Mar del Plata as the port for supplies or logistics services. The operations of the vessels associated with the project do not differ from those of any other vessel docking in these ports.

In this sense, potential interferences of the project on the anthropic environment are considered with reference to fishing activities, offshore hydrocarbon exploitation activities, maritime traffic and the infrastructure that may exist in the offshore space. There are some benefits associated to the project in terms of economic activities such as the demand for local services and labor.

It is estimated that, for the rest of the aforementioned factors, the interferences are limited to the area in which said activities and those of the project overlap, with the exception of fishing and economic agenda. In this sense, the space that involves the project's OA and the surrounding area that comprises the space that can be potentially impacted by the physical presence of the seismic vessel and / or the support vessels are considered. Regarding economic activities, the demand for logistics services may have some very focused effects as to the benefits provided by the port of logistics services (Port of Mar del Plata) and possibly in some other locations as to other supplies / services, but, in any case, there would be scattered aspects of little relevance, which shall not affect local economies. The same can be mentioned regarding the demand for labor, since the project generally requires particularly qualified personnel.

Regarding fisheries and the effects upon the species of fishing interest, as stated by point **Error! Reference source not found.**, this impact is of an indirect nature (since the potential effect occurs on the species of commercial interest, and indirectly on the fishing activities). It is estimated that it could be limited to 50 km from the seismic data acquisition area in order to broadly cover the potential effects of the project on this activity. Regarding the interference caused by the movement of fishing vessels, the impact is limited to the nearby environment defined above for the rest of the vessels.

Then, the ADI of the anthropic component is defined by a surrounding area of 5 km to the Operative Area of the seismic acquisition areas, which involves the space that can be potentially impacted by the presence of the seismic vessel and the support vessels, while the AII is tagged out by a 50 km-buffer from CAN_100-108 and CAN_114 seismic data acquisition areas. Given that the logistics operations in the port do not differ from those of any other ship that reaches port, the impact of these activities shall not exceed the operational area in the port area of the Port of Mar del Plata. As an area of influence of the Port of Mar del Plata, an ADI is established around it, while the City of Mar del Plata is considered as an AII of the port, which makes up the port hinterland.

Beyond these areas, the characterization of the anthropic component comprises an area of study on a broader general and regional scale associated with the identification of the actors or stakeholders of the project.

The geographical display of the aforementioned areas of influence for the anthropic component is presented in Figure 5.

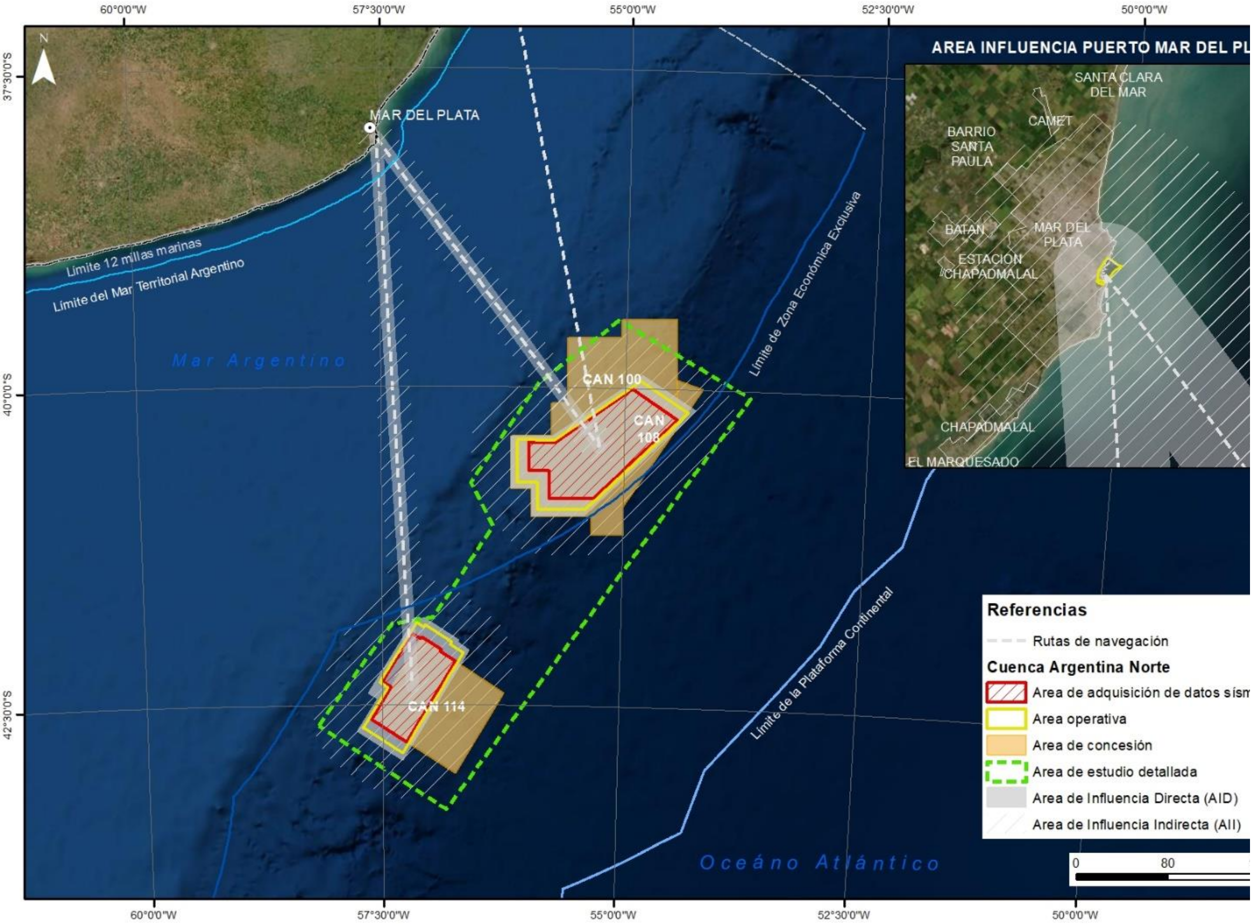


Figure 5. Area of Influence of the Anthropic Component.

(Translation of Figure 5: Límite 12 millas marinas: Limit of 12 Nautical miles. Límite del mar Territorial Argentino: Limit of the Argentine Territorial Sea. Límite de Zona Economica exclusiva: Exclusive Economic Zone Limit. Límite de la Plataforma Continental: Continental Shelf Limit. Oceano Atlántico: Atlantic Ocean. Area de Influencia Puerto de Mar del Plata: Area of Influence of the Port of Mar del Plata. Referencias: References. Rutas de Navegación: Navigation Routes. Cuenca Argentina Norte: Argentine North Basin. Area de Adquisición de Datos sísmicos: Seismic Data Acquisition Area. Area Operativa: Operative Area. Area de Concesión: License Area. Area de Estudio detallada: Detailed Study Area. Area de Influencia Directa (AID): Area of Direct Influence (ADI). Area de Influencia Indirecta: Area of Indirect Influence (AII).

3 PHYSICAL ENVIRONMENT

3.1 GEOLOGY

3.1.1 Structural, geomorphological and geosedimentary context

The earth's crust is divided into two main types, the continental crust and the oceanic crust. Most of the continental crust is above sea level, but another part is submerged in the oceans. This transition zone between continents and ocean basins is known as the continental margin and, although it shares the geological characteristics of the former, it has been deeply shaped by marine processes.

Three main areas can be distinguished on the continental margin:

- Continental shelf: area below sea level that descends gently to a depth that usually reaches 200 meters.

- Continental slope: an area with a very steep incline and a 3,000 - 4,000-meter deep slope.

- Transition zone: the transition zone between the continental crust and the oceanic crust is located between the slope and the abyssal plains, and can be divided in two types: a very deep trench, called the oceanic trench; or a sediments area called “continental emersion”. The trench is formed on the active continental margins (with subduction of tectonic plates) and continental rise on the passive continental margins (without subduction).

The Argentine continental margin (ACM) is located mainly in the South American plate. It is associated with the cortical extension linked to the opening of the Atlantic Ocean from the Middle Jurassic in a geotectonic context dominated by a passive continental margin, although it is associated with active margin sectors in its southernmost portion (Violante et al. 2014).

One of the most important stages that influenced the evolution of the margin was the global marine transgression that flooded regions of present-day Patagonia in the Maastrichtian (70-65 Ma), which gave rise to the first continental shelf of this portion of the South American plate (Malumián 1999, Náñez and Malumián 2008). The deepening of this sea and consequent greater circulation of the waters from the Oligocene (30-32 Ma), led to the development of open sea oceanographic conditions when the Drake passage between South America and Antarctica was definitively opened and the Antarctic Circumpolar Current was installed.

After these major events, the evolution of the ACM began to be dominated more by climatic-oceanographic factors than tectonics, acquiring the final morphosedimentary features that, in the case of the platform, were substantially influenced by the glacio-eustatic processes of the Quaternary (Violante et al. 2014).

The ACM is vast and it includes an extensive platform (~ 960,000 km2), the slope, the continental emersion and numerous systems of submarine canyons. If this region is compared with the 2.7 million km2 of surface of the “continental Argentina”, the magnitude of the enormous territory that extends beyond the coast line emerges (Violante et al, s/f).

Taking the base of the slope as a reference, the ACM extends over more than 3 million km2, which includes approximately 1 million km2 above the 200 m isobath (ENARSA, s/f).

Underwater terraces, underwater canyons and valleys, contour trenches and channels, contour and turbiditic deposits, different types of drifts and abyssal plain deposits stand out on the continental slope, representing the erosive and accumulation geoforms that mainly shape the slope (although also continental emersion) and in many cases they mark the easternmost deposits of terrigenous origin that are taken to the marine basins (Hernández-Molina et al., 2009; COPLA, 2017).

Figure 6 presents the main underwater features of the Argentine continental and insular sector, showing the great extension of the continental shelf. Figure 7 shows the main physiographic features of the study area and the operative areas of CAN_100 - CAN_108 sites, located on the middle and lower sector of the slope that develops from the edge of the Ewing terrace in the northern area of the Bahía Blanca submarine canyon system, as well as CAN_114 operational area located on the middle slope in the southern area of said submarine canyon system, immediately north of the great Ameghino submarine canyon systems.

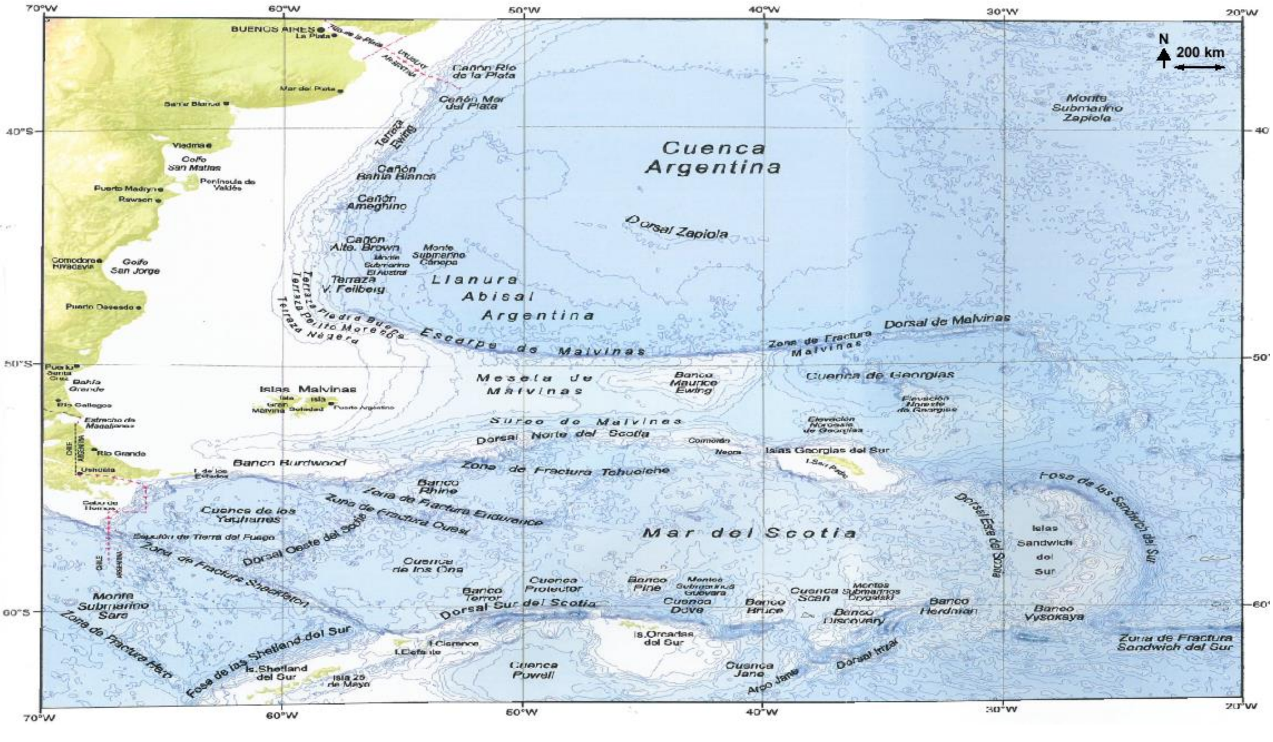


Figure 6. Main submarine features of the Argentine continental and insular sector. Source: COPLA (2017).

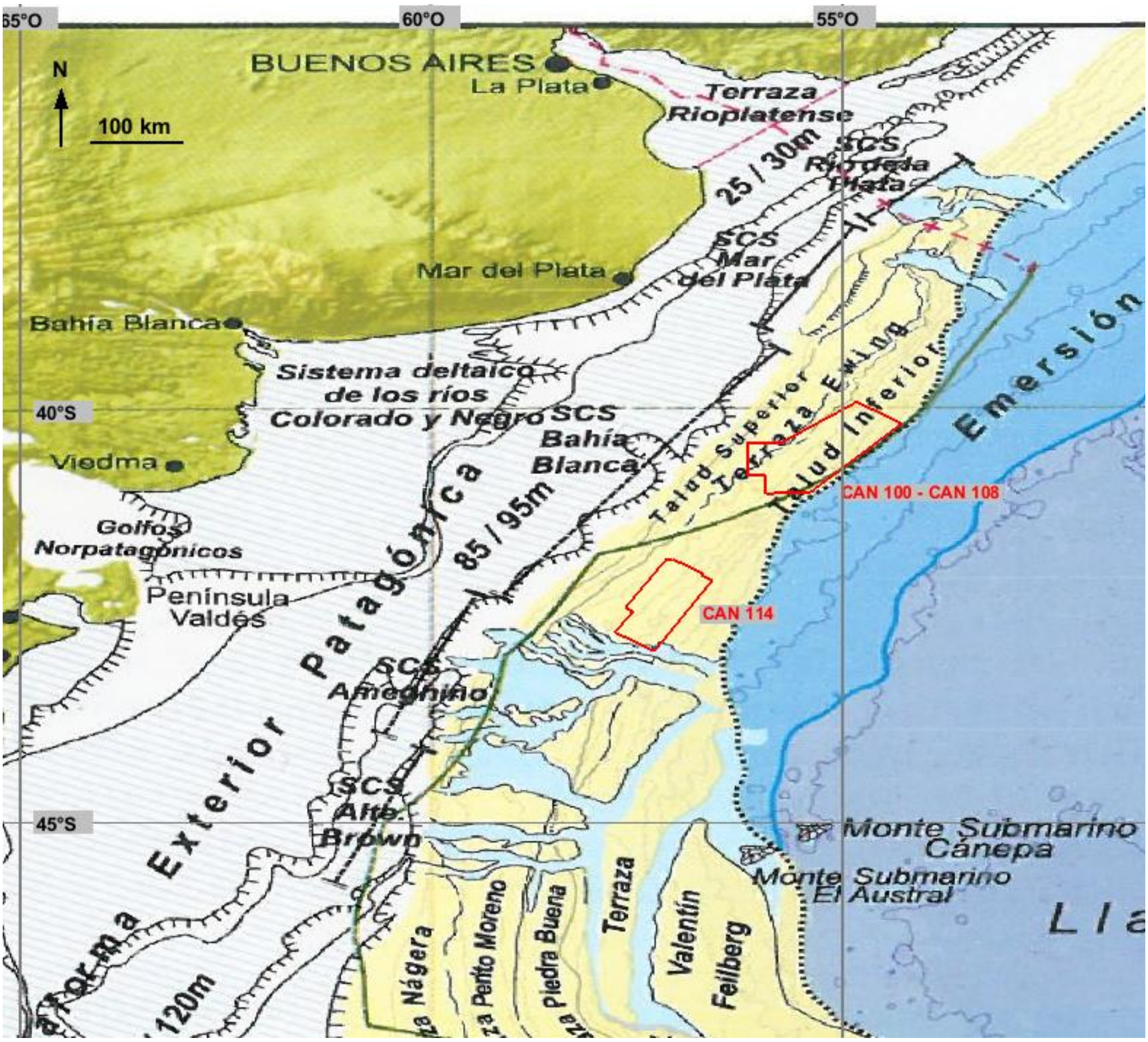


Figure 7. Main physiographic units of the Argentine continental margin in CAN_100 - CAN_108 and CAN_114 operative areas (red polygons). Source: modified from COPLA (2017).

It should be noted that the term 'shelf' or 'continental shelf' is adopted strictly in its geomorphological, not legal, concept [5].

Figure 8 presents a basic diagram of the legal continental shelf and its relationship with the continental margin (when it exceeds 200 M from the baselines from which the territorial sea is measured).

[5] The outer limit of the Argentine legal continental shelf corresponds to that presented to the Commission on the Limits of the Continental Shelf (CLPC) - a scientific organization made up of 21 international experts and created by the United Nations Convention on the Law of the Sea (UNCLOS). The limit was accepted by agreement (unanimously) by said Commission on March 16, 2016.

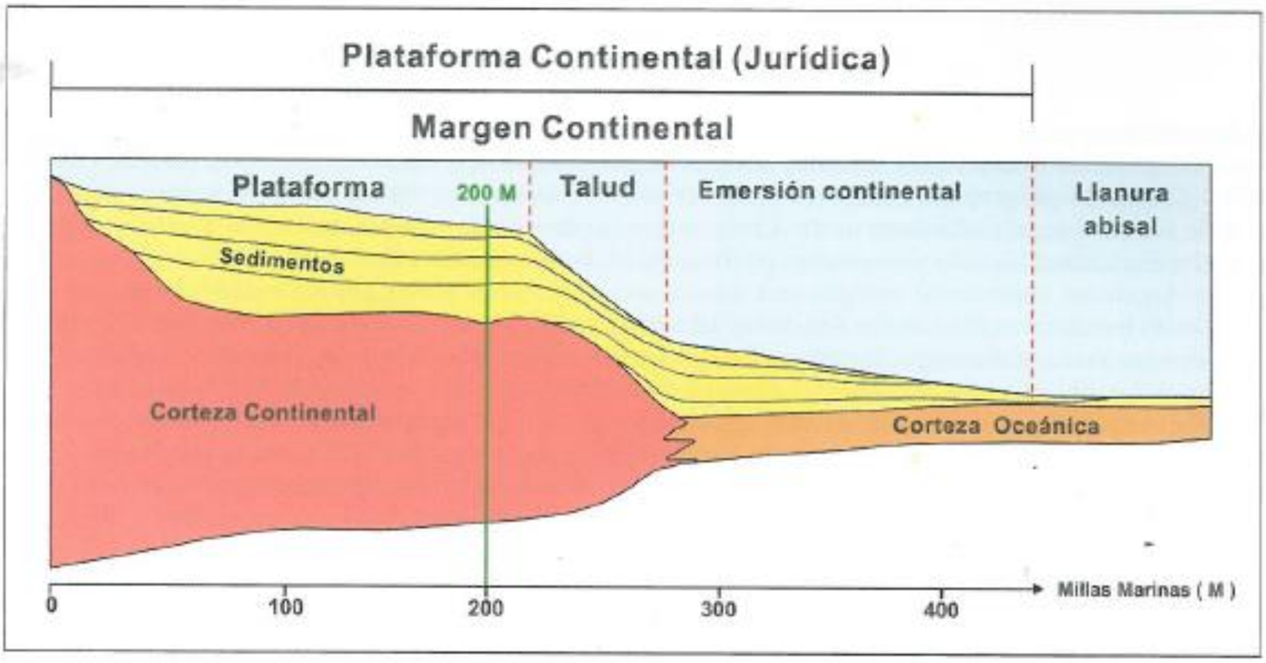


Figure 8. Basic diagram of the legal continental shelf and its relationship with the continental margin (when it exceeds 200 M from the baselines from which the territorial sea is measured). Source: COPLA (2017).

(Translation of Figure 8: Plataforma Continental (Jurídica): Continental Shelf (Legal). Margen Continental: Continental Margin. Plataforma: Platform/Shelf. Talud: Slope. Emersión Continental: Continental Emersion. Llanura Abisal. Abyssal Plain. Sedimentos: Sediments. Corteza Continental: Continental Crust. Corteza Oceánica: Oceanic Crust. Millas Marinas. Nautical Miles.)

3.1.2 Bathymetry and Seabed

Unlike the slope, which is a tectonic formation, the continental emersion is a sedimentary formation characterized by a gentle slope and little ondulation in the study area. It develops around 3,500 to 4,000 m deep and connects with the abyssal plain as from a 5,000 m-depth, being crossed by underwater canyons and valleys, which have been the main route of sedimentary transport to the abyssal plain (Hernández-Molina et al., 2009; COPLA, 2017).

Argentina's continental shelf extends for about 2,400 km between the Río de la Plata and Cabo de Hornos, although the coastline is about 5,300 km long considering its major irregularities. Its width varies between 170 and ~ 1,200 km. The inner edge (towards the continent) is tagged by a steeply sloping coastline whose base reaches -10/20 m on the Buenos Aires coastline increasing its depth toward the south. The outer edge, which marks the transition towards the slope, follows a NE-SW course between 36 ° S (Río de la Plata) and 44º S, from where it gradually changes to N-S to head east around the Falkland Islands at 50ºS, and re-approach the mainland in front of the Strait of Magellan.

The depth of the outer edge (Figure 9) is also variable with a regional trend of deepening from north to south and with changing characteristics, since its profile is convex (greater regional slope towards the outer platform) in the area adjacent to the Pampas region) while being concave (greater regional slope towards the side of the continent) in the region adjacent to Patagonia) (Violante et al 2014).

The variability in the depth of the outer edge of the platform is one of the most interesting aspects of the regional morphological configuration. Southard and Stanley (1976) and Pratson et al. (2007), among others, synthesized the complexity of the variables involved in the modeling of this feature, including structural, isostatic, eustatic, oceanographic processes, continental, coastal and deep marine sedimentary dynamics, and even biological processes, all of them acting differentially during stages of varying sea level positions.

Numerous submarine canyon systems are developed on the slope, and the Alte. Brown-Ameghino (between San Jorge Gulf and Valdés Peninsula) and Río de la Plata-Mar del Plata system stands out.

CAN_100 - CAN_108 and CAN_114 operational areas are located between these two main submarine canyon systems, specifically in the area where the Bahía Blanca submarine canyon system is developed (see Figure 7).

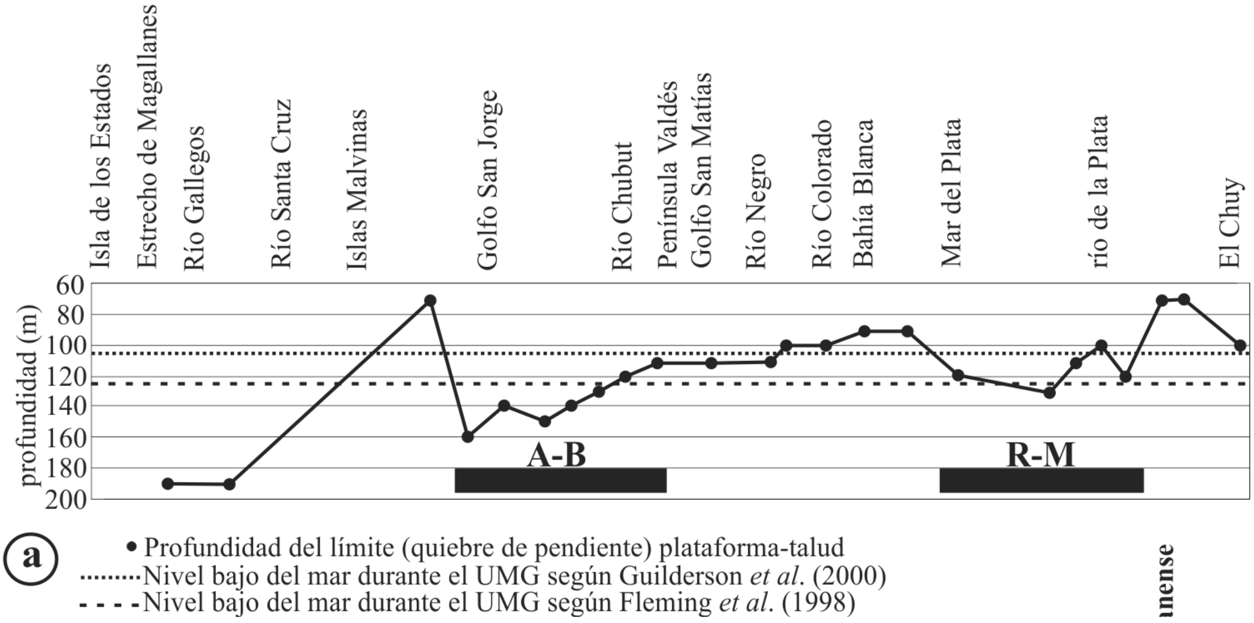


Figure 9. SN profile along the outer platform-slope breakage. Area influenced by the activity of the Río de la Plata-Mar del Plata and Ameghino-Alte Brown submarine canyon systems respectively (see Figure 16 for its location). The operative areas under study are located between these two large underwater canyon systems. Source: Violante et al. 2014.

(Translation of Figure 9: Profundidad (m): Depth (Meters). Profundidad del límite (quiebre de pendiente) plataforma talud: Platform Slope Limit depth (slope breakage). Nivel bajo del mar durante el UMG según Guilderson *et al*. (2000): Low sea level during UMG according to Guilderson *et al*. (2000). Nivel bajo del mar durante el UMG según Fleming *et al*. (1998): Low sea level during UMG according to Fleming *et al*. (1998).

The bathymetry of the seabed in the study area, obtained from GEBCO "The General Bathymetric Chart of the Oceans" global database is presented in Figure 10. The operative area of CAN_100 - CAN_108 is located on the middle and lower slopes and the beginning of the continental emersion between 900 m and 4100 m-deep. On the other hand, the operative area of CAN_114 is located on the middle slope between 1300 and 3000 m-deep.

Two bathymetric profiles were extracted from the aforementioned GEBCO database for each of the seismic exploration areas (see location in Figure 10).

Figure 11 and Figure 12 show the profiles that cross CAN_100-108 and CAN_114 operative area, respectively. The slope of the seabed is also included.

In the profiles corresponding to the CAN_100-108 seismic exploration area, the Ewing terrace is indicated as a distinctive feature of the slope (see Point **Error! Reference source not found.** and Point **Error! Reference source not found.**).

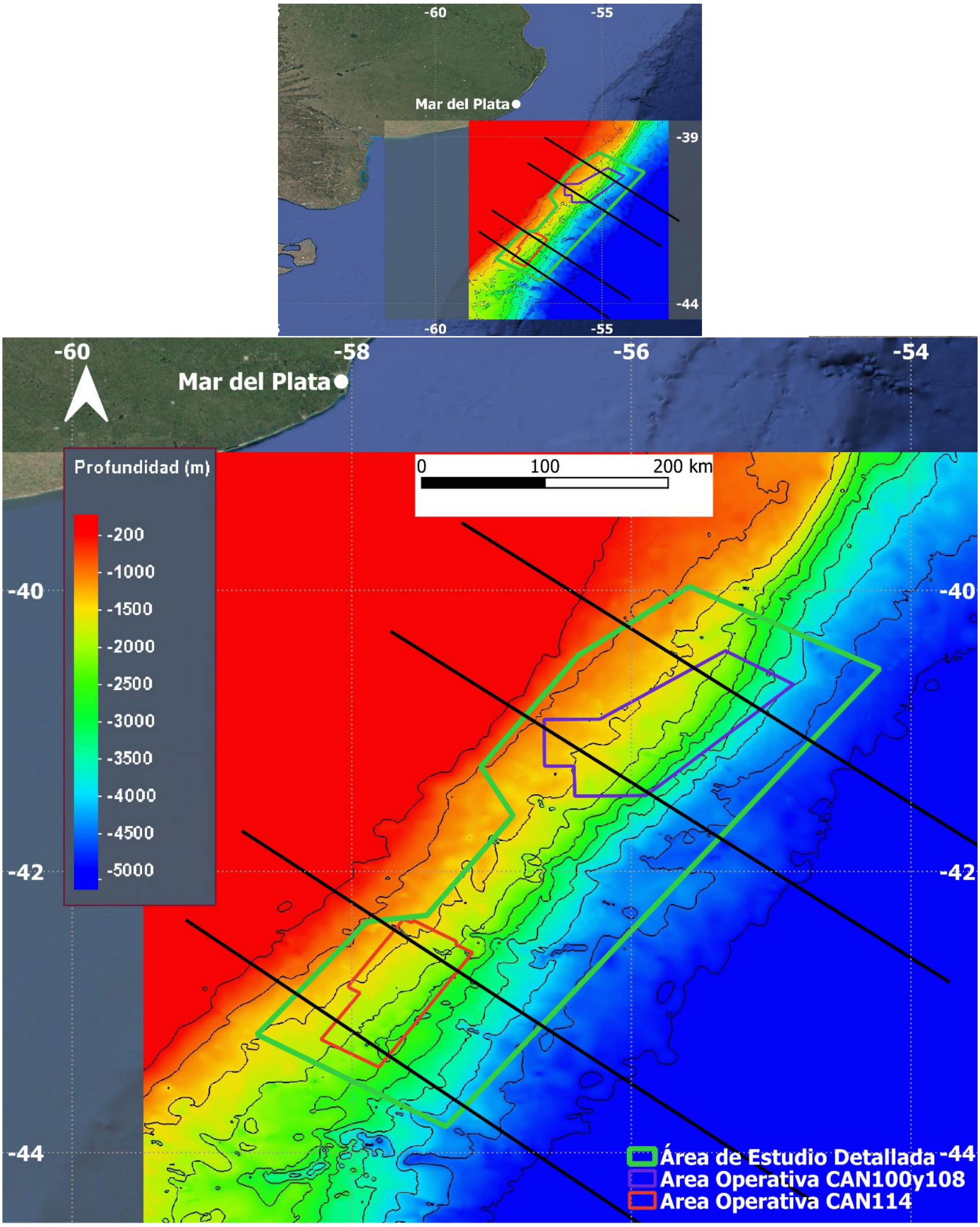


Figure 10. Bathymetry of the study area. Source: GEBCO "The General Bathymetric Chart of the Oceans" global database: https://www.gebco.net/data_and_products/gridded_bathymetry_data/

(Translation of Figure 10: Profundidad (M): Depth (meters). Area de estudio detallada: Detailed study area. Area Operativa CAN 100-108. CAN 100-108 Operative Area. Area Operativa CAN 114: CAN 114 Operative Area.)

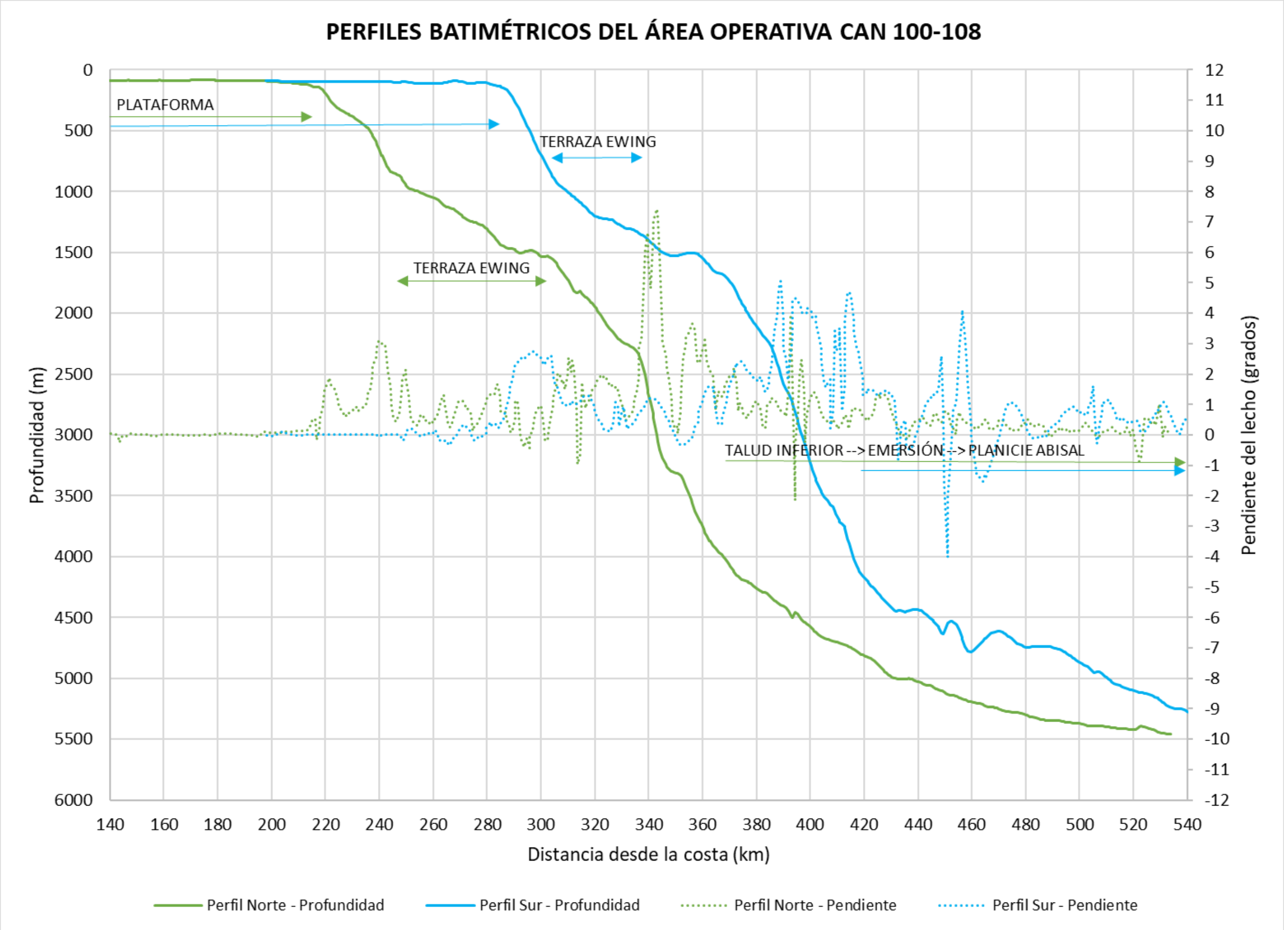


Figure 11. Bathymetric profiles (and their slopes) that cross the operational area corresponding to CAN_114 Area. See location in Figure 10.

(Translation of Figure 11: Perfiles batrimétricos del Area Operativa CAN 100-108: Bathymetric Profiles of CAN 100-108 Operative Area. Plataforma: Platform. Terraza Ewing: Ewing Terrace. Profundidad (M): Depth (meters). Pendiente del Lecho (grados): Seabed slope (degrees). Talud inferior, Emersión, Planicie Abisal: lower slope, emersión, abyssal plain. Distancia desde la costa (Km) : Distance from the coast (Km). Perfil norte- Profundidad: North profile – depth. Perfil sur – Profundidad: South Profile – depth. Perfil Norte – pendiente: North Profile – slope. Perfil Sur – pendiente: South profile – slope.)

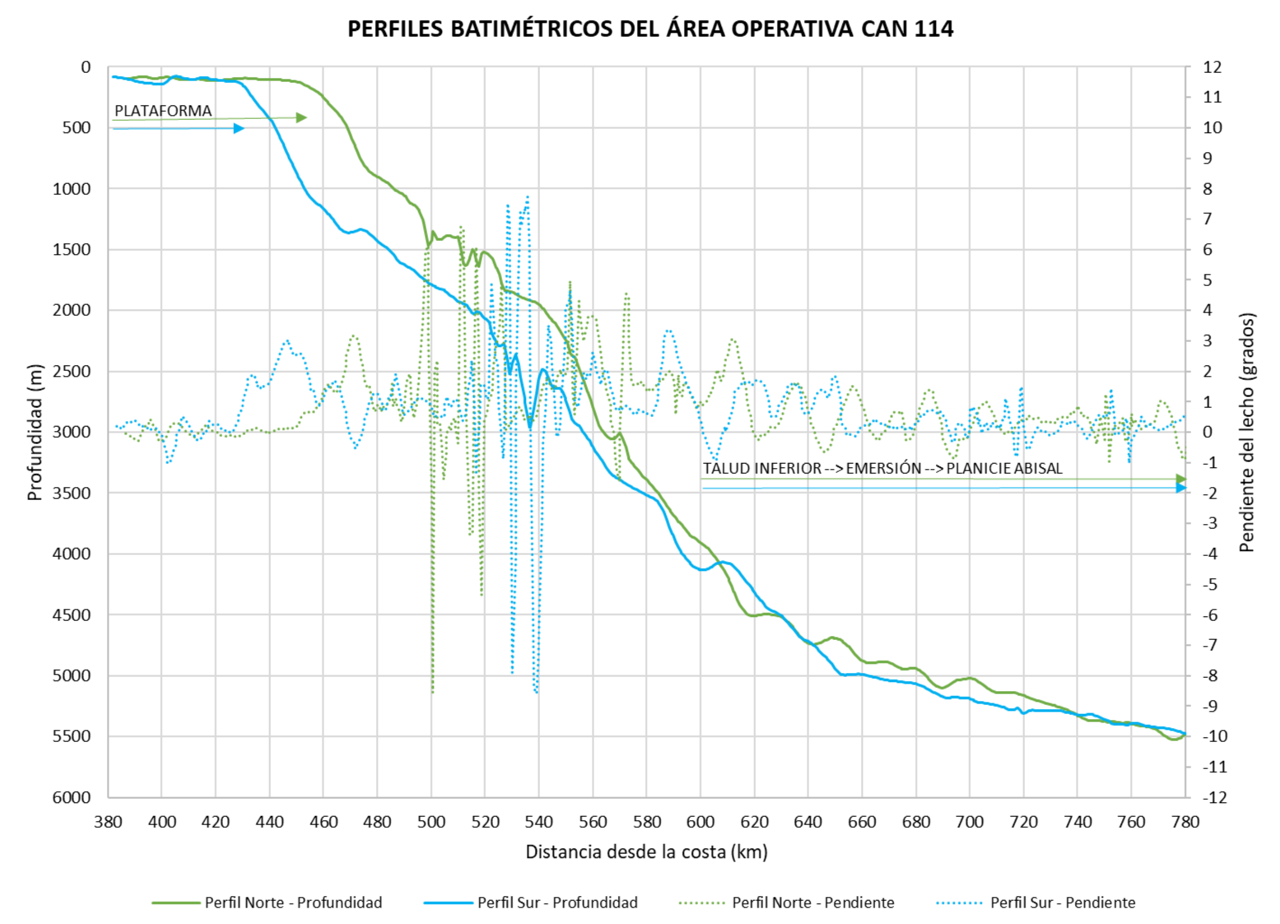


Figure 12. Bathymetric profiles (and their slopes) that cross the operational area corresponding to CAN_114 Area. See location in Figure 10.

(Translation of Figure 12: Perfiles batrimétricos del Area Operativa CAN 114: Bathymetric Profiles of CAN 114 Operative Area. Plataforma: Platform. Profundidad (M): Depth (meters). Pendiente del Lecho (grados): Seabed slope (degrees). Talud inferior, Emersión, Planicie Abisal: lower slope, emersion, abyssal plain. Distancia desde la costa (Km): Distance from the coast (Km). Perfil norte- Profundidad: North profile – depth. Perfil sur – Profundidad: South Profile – depth. Perfil Norte – pendiente: North Profile – slope. Perfil Sur – pendiente: South profile – slope)

3.1.3 Structure

The offshore basins of Argentina are mostly manifestations of extensive retro-arc processes of the Late Triassic / Early Jurassic with a subsequent rifting response in the Upper Mesozoic related to the Gondwana Fracture. Then, the region developed passive margin characteristics throughout the rest of the Tertiary, except in the extreme south, where a folded band is observed due to the interaction of the South American, Scotia and Antarctic Plates, during the Upper Cretaceous and Tertiary.

The extension of the rift stage, associated with the early separation phase of the Gondwana, contributes to the fact that the offshore basins of Argentina are generally arranged perpendicular to the coast due to the rotational nature of the separation of the South American plate from the African plate to the south of the Walvis / Rio Grande Ridge. To the north, the basins are arranged parallel to the coast (ENARSA, s/f).

The basins recognized in the Argentine continental margin (from north to south) are those of: Salado, Colorado, Rawson, Golfo de San Jorge, San Julián, Austral and Malvinas and their extensions on the continental slope (Figure 13). The architecture of the Salado and Colorado basins (seismic exploration area of the project) is shown in Figure 14.

Figure 13. Main sedimentary basins of the Argentine continental margin. Source: ENARSA (s/f).

(Translation of Figure 13: Cuenca: Basin. Oceano Atlantico: Atlantic Ocean)

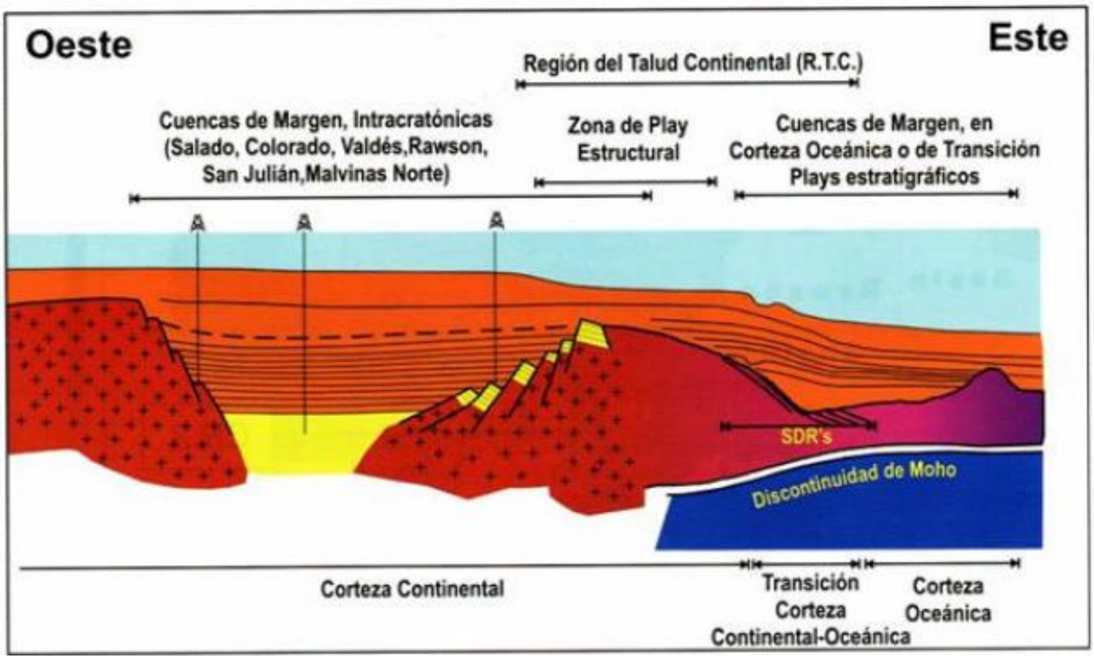


Figure 14. Architecture of the Salado, Colorado and Rawson basins. Source: ENARSA (s/f).

(Translation of Figure 14: Oeste. West. Este: East. Region del Talud Continental: Continental Slope Region. Cuencas de margen Intracratónicas: Intracratonic Margin Basins. Zona de Play Estructural: Structural Play Zone. Cuencas de margen en corteza oceanica o de transición: Margin basins in oceanic or transitional crust. Plays estratigráficos: Stratigraphic plays. Discontinuidad de Moho: Moho Discontinuity. Corteza Continental: Continental Crust. Transición Corteza Continental-Oceánica: Continental/Oceanic Crust Transition. Corteza Oceánica: Oceanic Crust.)

As South America moves west with respect to Africa, the Walvis / Rio Grande Ridge divides the South Atlantic into two parts. The opening to the north is small and narrow, but wider to the south. This explains the development of thick saline mantles to the north of Walvis / Rio Grande and their absence to the south.

In summary, the extensional processes of the offshore basins of Argentina are related to Gondwana partition. Thus, notwithstanding the great variety of names for equivalent geological formations and different observable structural styles in separate basins, the concrete scenario is that the tectone / stratigraphic model is basically common with its peculiarities. Only when reaching the southern end of the South American plate did different sedimentary processes develop in what are now the Austral and Malvinas basins. In general, the tectono / stratigraphic chart of the offshore basins includes a Pre-Rift phase, which corresponds to Precambrian and / or Paleozoic rocks, a continental Rift phase from Neocomian to Aptian and a Drift phase of the superior Cretaceous and tertiary.

The Rift phase gives rise to a mosaic of E-W master faults sometimes interrupted by antithetical faults, creating a network of half grabens with some internal highs. The resulting Teutonic styles can be divided into which the Basament is involved (Rift Phases) and those not linked to the Basament (Drift Phases).

The sedimentation areas of these basins are limited by major structural features. In general, the depocenters of the rifts are located in platform areas, particularly to the north of the Islas Malvinas / San Julián line.

The sedimentary basins identified have continuity on the continent, with the exception of those of Rawson, San Julián and Malvinas, which develop completely under the Atlantic Ocean.

The Argentine continental margin in the study area is of the passive volcanic type, which extends from the border with Uruguay to approximately 48 ° S (COPLA, 2017).

The typical architecture of this margin is presented in Figure 15. It presents a sedimentary cover of surface and subsoil that extends forming the continental rise/emersion, a typical morphological feature of the passive margins.

n this type of margins, a powerful volcanic wedge appears in the seismic profiles through convex reflectors dipping towards the sea called *Seaward Deeping Reflectors* (SDRs) (COPLA, 2017).

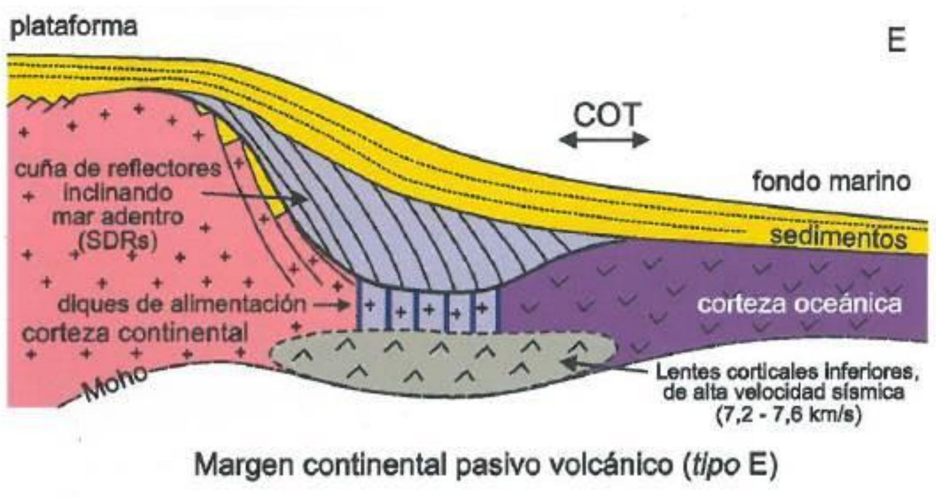


Figure 15. Typical architecture (west-east regional geological section) of the passive volcanic margin. COT: continental-oceanic crust transition zone. Source: COPLA (2017).

(Translation of Figure 15: Plataforma: Platform. Fondo Marino: Seabed. Sedimentos: Sediments. Cuña de reflectores inclinando mar adentro: Wedge of reflectors bending offshore. Diques de alimentación corteza continental: Continental crust feeder dike. Corteza oceánica: Oceanic crust. Lentes corticales inferiores de alta velocidad sísmica: High seismic speed lower cortical lenses. Margen Continental pasivo volcánico (Tipo E): Volcanic passive continental margin (Type E)).

3.1.4 Factors that determined modeling and sedimentation in the Argentine continental margin

The morphosedimentary configuration of the MCA resulted from two main aspects: firstly, the geotectonic inheritance dominated by the endogenous factors involved in the structure and evolution of the margin, among which the flexo-sinking processes seem to have been relevant and, secondly, the external factors conditioned by climate and oceanographic processes, which over time became more important than endogenous ones, becoming dominant in the Cenozoic and manifesting themselves mainly with the glacio-eustatic fluctuations of the Quaternary.

These morphosedimentary characteristics were acquired as a result of the interaction of various factors such as fluctuations in sea level, isostacy, climate, oceanographic processes, sedimentary dynamics and morphology and composition of the pre-transgressive substrate, the most relevant conditioning process being postglacial transgression, responsible for the final configuration of the platform, its terraces and its sedimentary cover (Violante et al. 2014).

The geological history of the shelf is more complex than that of the coastal regions; Its extension and scarce relief have favored a profound modeling effect as a result of the successive marine transgressions and regressions of the Quaternary, which derived in various morphosedimentary features (Violante et al. 2014).

The decrease in sea level during the last glacial period (18,000 years ago) caused the marine waters to recede 120 meters deep below the current level, in such a way that the entire shelf was exposed to subaerial conditions, with remains of ancient continental areas, and current river networks in its subsoil and beaches. The subsequent intermittent rise of the sea resulted in the formation of stepped marine terraces, at different depths, which create the bed of the shelf and are made up of sediments belonging to the primitive submerged beaches of today (Violante et al. 2014). Interruptions in the speed of sea level rise, with the consequent stabilization of the coastline for relatively long times, allowed the modeling of an erosive surface that constitutes the base of each terrace (Parker et al. 1997, Violante 2005, Perillo and Kostadinoff 2005, Ponce et al. 2011).

Variations in sea level did not have a direct effect on the continental slope due to its depths below 120 meters. However, climatic changes took place through variations in the circulation of ocean currents. These currents are significant processes that influence the sedimentary dynamics and the modeling of the underwater topography and have left a strong imprint on permanently submerged environments. The Argentine continental margin is dominated, in its deep regions, by currents of Antarctic origin that circulate from south to north at different depths, following the isobaths (contour currents). The consequence of this oceanic dynamics was a sediment transport that formed large sedimentary sequences along the margin, developing so-called “contournitic” deposits, which appear as accumulations on terraced surfaces (Violante et al. 2014).

Concurrently, the high slopes of the slope favored the action of gravitational processes shown through dense sediment currents (turbidity currents) that slide over them, digging underwater canyons and producing turbiditic deposits and underwater landslides. These processes are more complex in the Buenos Aires margin, where the currents that circulate from south to north interact with others in the opposite direction, forming the Confluence Zone. In this way, the Buenos Aires slope is made up of alternating sediments, formed by both longitudinal and transverse processes, which prevail in the vicinity of the submarine canyons (Violante et al. 2014).

Figure 16 and Figure 17 display the main geomorphological features along with the location of the different terraces and the major systems of underwater canyons.

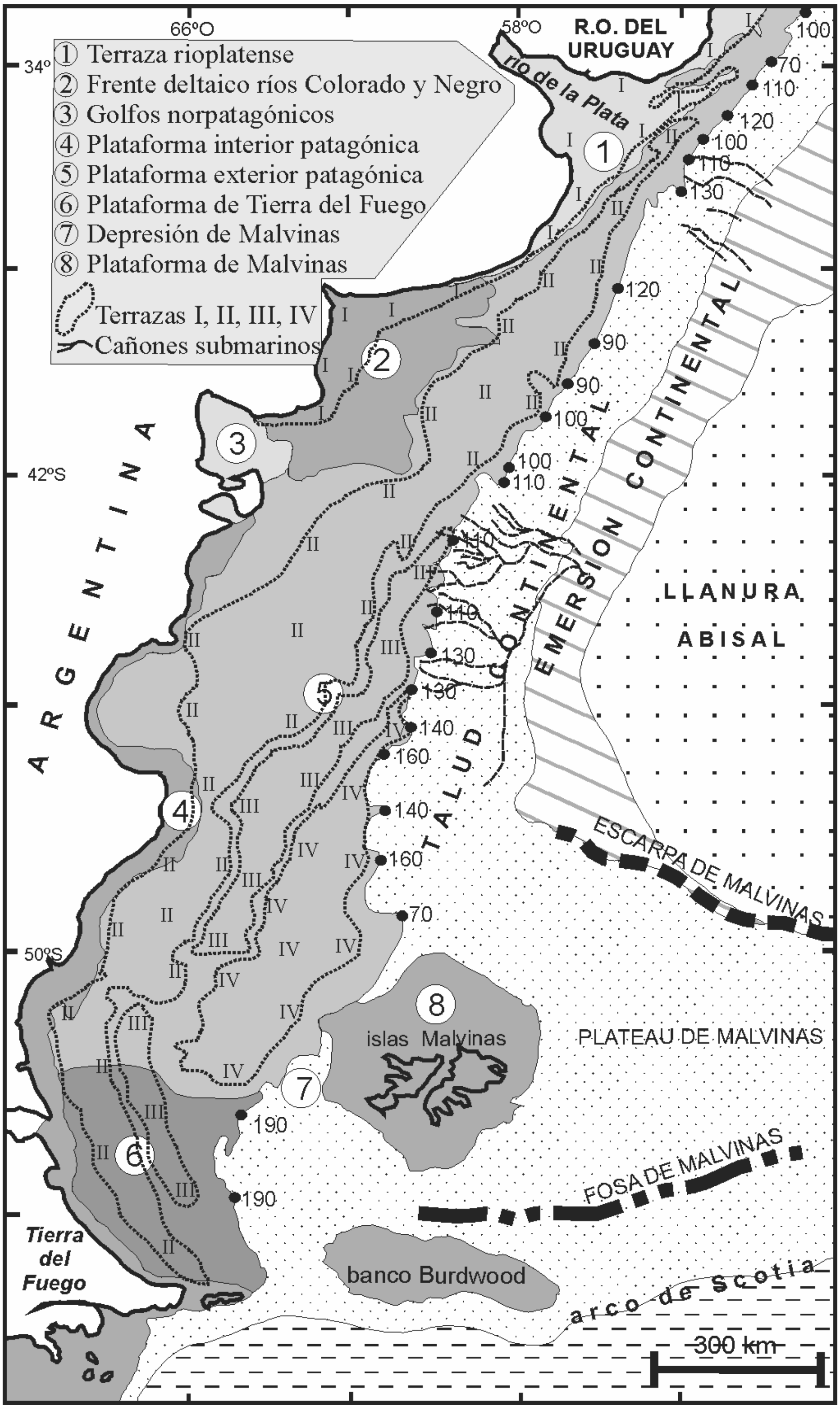


Figure 16. Geomorphological map indicating the depths of the outer platform-slope break (black points). Note the location of the major submarine canyon systems on the slope. Source: Violante et al. 2014 (modified from Parker et al. 1996).

(Translation of Figure 16: 1) Terraza Rioplatense: Rioplatense Terrace. 2) Frente deltáico de Rios Colorado y Negro: Deltaic Front of Colorado and Negro Rivers. 3) Golfos Norpatagónicos: North Patagonian Gulfs. 4)

Plataforma Interior Patagónica: Inner Patagonian Platform. 5) Plataforma Exterior Patagónica: Outer Patagonian Platform. 6) Plataforma de Tierra del Fuego: Tierra del Fuego Platform. 7) Depresión de Malvinas: Malvinas Depression. 8) Plataforma de Malvinas: Malvinas Platform. Terrazas: Terraces. Cañones submarinos: Submarine Canyons. Talud Continental: Continental Slope. Emersión Continental: Continental Emersion. Escarpa de Malvinas: Malvinas escarpment. Fosa de Malvinas: Malvinas ditch. Plateau de Malvinas: Malvinas Plateau. Arco de Scotia: Scotia Arch.)

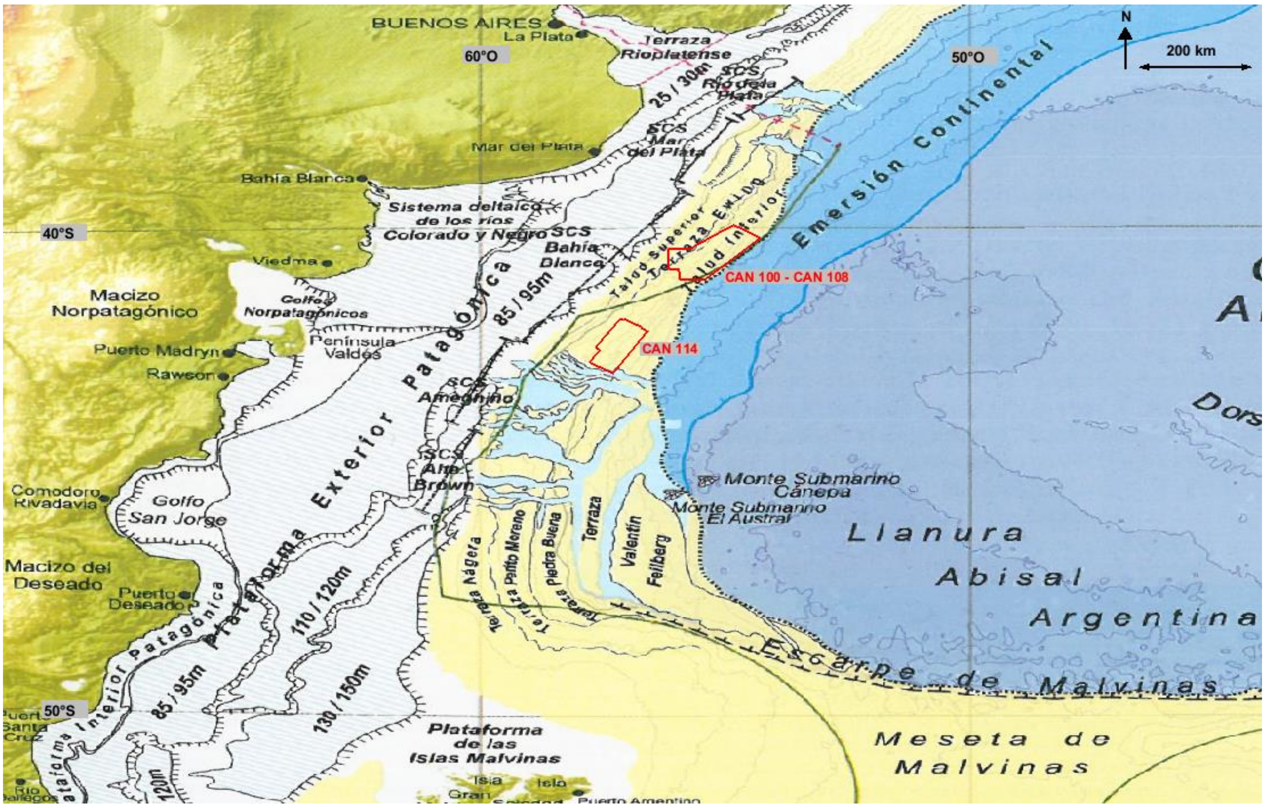


Figure 17. Physiographic units of the continental margin in the study area. SCS: submarine canyon system. Green line: 200 M. The operating area of CAN_100 - CAN_108 and CAN_114 areas is indicated in red. Modified from COPLA (2017).

Paleoclimate variability since the last glacial maximum

Global paleoclimatic factors were essential in the evolution of the extreme south of South America during glacial and postglacial times, added to the influence of regional and local factors such as: a) atmospheric conditions and consequent wind patterns imposed by the variability between anticyclones from the South Pacific and South Atlantic; b) the proximity of the Antarctic ice masses and the continental ice of the southern Andes, and their transformation into volumes of oceanic water after their melting; c) the variable relationship between the surface area of emerged and submerged land through the glacial-postglacial cycle, which led not only to a doubling of the continent during the Last Glacial Maximum when the current platform emerged and its progressive reduction to half of its original extension in postglacial times, but also to consequent climatic changes (Violante et al. 2014). On a global scale, three periods characterized by particular climatic conditions are considered: Last Glacial Maximum, Terminal Glacial and Postglacial (Fleming et al. 1998).

During the Last Glacial Maximum, as a result of the low position of the sea level, there was an increase in the continental Patagonian surface and the subaerial exposure of the platform (Clapperton 1993, Rabassa 2008).

The Terminal Glacial period is characterized by the occurrence of significant and recurrent climatic changes (with recessions and glacial advances) that tagged the transition between the ice age and the current one.

The Postglacial represents the period that evolved towards the current climatic conditions.

Hydrographic conditions

As explained in Point **Error! Reference source not found.**, from the oceanographic point of view, the Argentine continental shelf is dominated by water masses of subantarctic origin that circulate in south to north direction, whose upper levels correspond to the Malvinas current, diluted by the fluvial contributions and the evaporation-rainfall balance, so that regions with water masses of different salinities can be differentiated (Perillo and Kostadinoff 2005, Piola et al. 2001).

In front of the province of Buenos Aires at 38 ° S, these water masses meet others from equatorial areas that circulate from north to south - the upper part being the Brazilian current-, generating the confluence zone (Piola and Gordon 1989, Piola and Matano 2001).

Waves and tides are essential processes in the sedimentary dynamics in the littoral zone with variations along the coasts. Both the wave height and the tide amplitude increase from north to south. The relationship between these factors means that, while on the Buenos Aires coast, storm waves are the dominant factor (D'Onofrio et al. 1999) conditioning the transport and availability of sand in the coastal strip. The action of the tides is much more significant on the Patagonian coasts, depending on their amplitude and current speeds (Glorioso and Flather 1997, Simionato et al. 2004).

The fluvial influence on the Argentine continental shelf derives from the Río de la Plata as the main source of fresh water, discharging between 22,000 and 25,000 m3/ s (Jaime et al. 2002, Giberto et al. 2004, Simionato et al. 2007). This volume of water carries a suspended sedimentary load of about 92 million tons per year according to Milliman and Meade (1983) and 79.8 million tons per year according to Giberto et al (2004) transferred from the Uruguay and Paraná rivers. According to Campos et al. (2008b), 57 million tons per year would go to the ocean. To a lesser extent, the Patagonian rivers contribute to the platform such as Rio Negro (858m3/ s), Rio Santa Cruz (691 m3/ s) and Colorado river (131 m3/ s) which together do not exceed 2000 m3/ s.) (Gaiero et al. 2002, 2003).

Paleoceanographic changes can be summarized from variability in ocean temperatures and displacement of water masses between glacial and interglacial periods. These changes were significantly influenced during the last ice age by the transfer of enormous volumes of water from the marine regions to the continental ones where they accumulated as ice masses, and inversely by the melting of the latter during interglaciations (Violante et al. 2014).

Sea level variations

The great extension of the Argentine continental shelf and its regionally different characteristics make it difficult to establish a curve of relative variations in sea level as a consequence of the complex eustatic, tectonic and isostatic variables that have operated in its evolution (Violante et al. 2014).

Various authors (see a compilation in Violante and Parker, 2000 and Cavallotto et al., 2004) have elaborated curves in different regions of the coastline positions, essentially centered on the marine regression of the last 6,000 years. These curves show the lack of coincidence in the details of the marine fluctuations, which can be considered as a consequence of the influence of local factors (climatic, isostatic, etc.) in each of the regions considered (Violante et al. 2014).

Rostami et al. (2000) stated that there are differences in the behavior of the northern and southern regions of Patagonia, since the predictions of sea level fluctuations and the deglaciation models coincide for the first but not for the second, as a consequence of the high Land surface / submerged relationship given by the exceptional width of the shelf in the south, as well as by the proximity of Antarctica and the influence of the Patagonian ice sheets, and by the occurrence of tectonic processes linked to the subduction and tectonic zones from the not so far Chilean margin.

However, there is no doubt that the rate of rise of the sea level has had fluctuations, evidenced in relics of paleolines of currently submerged coasts that show the stable position that the sea has had at certain times. Possible sea level positions at different key moments of the postglacial transgression are presented in Figure 18 (Violante et al. 2014).

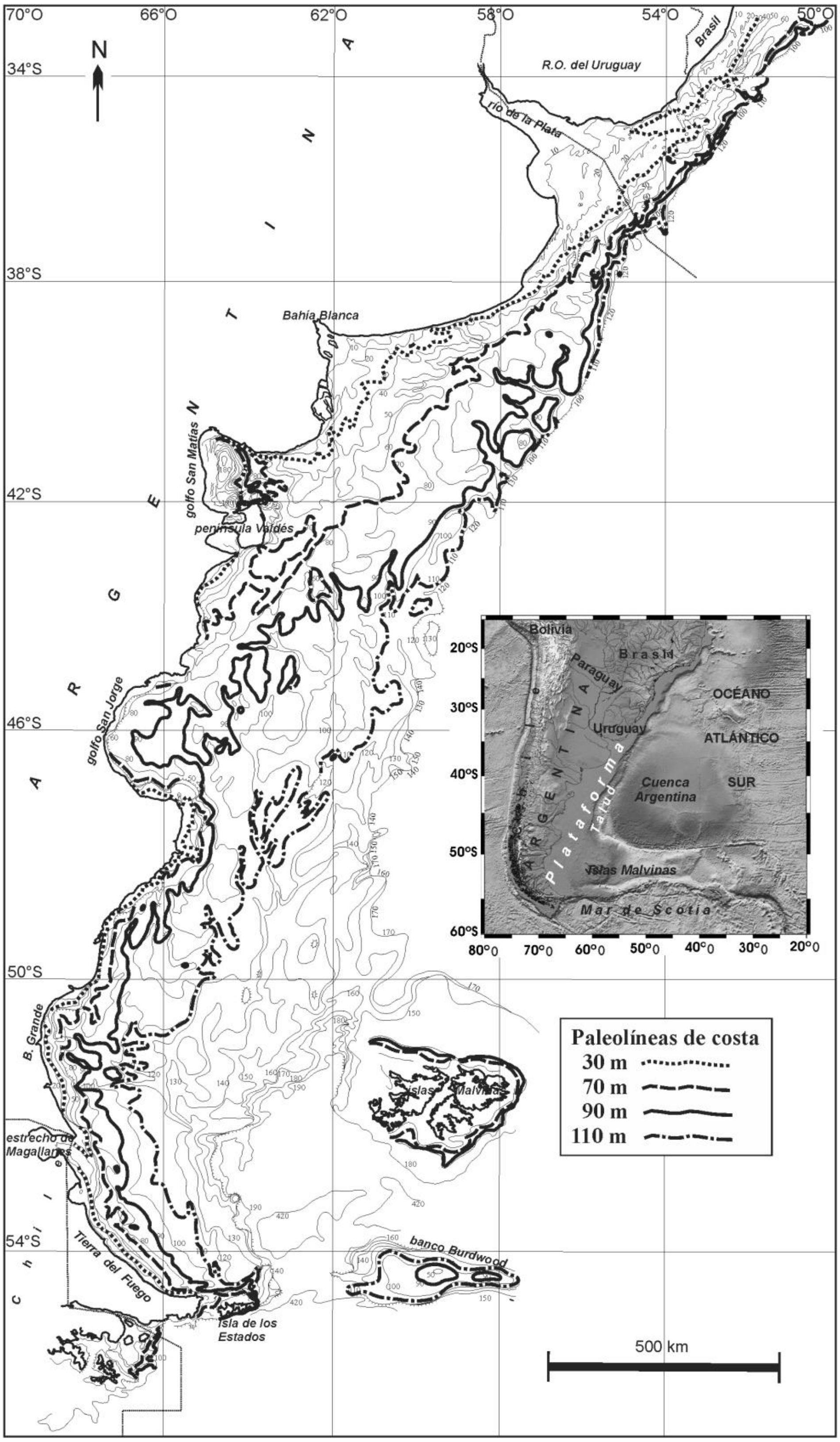


Figure 18. Bathymetric map of the platform, with details of coastal paleolines at different depths. Those of 30, 90 and 110 m are illustrated according to the details evidenced in the Buenos Aires platform plus the 70 m one that would correspond to the base of Terrace I, coinciding with the sea level at the time of occurrence of the Youger Dryas period. Source: Violante et al. 2014.

(Translation of Figure 18: Paleolineas de costa: Coastal Paleolines)

Origin of Sediments

The analysis of the concentration of major elements in surface sediments of the Argentine continental margin shows their terrigenic origin from geochemical aspects (Frenz et al., 2004; Mahiques et al., 2008; Chiessi et al., 2009; Govin et al., 2012).

When it comes to the contribution of sediments, the Argentine continental shelf receives terrigenous sediments from two main areas: The Andes region and the Brasilia Massif. Minor contributions from the Sierras Pampeanas and other regions of central Argentina should not be ruled out.

Notwithstanding the presence of the two associations, the predominance of the first is evident in most of the Argentine continental shelf, as documented by the mineralogical composition at the regional level (Potter, 1994; Marcolini, 2005), as well as by isotopic analysis (Mahiques et al., 2008; Noble et al., 2012) and clay mineralogy (Campos et al., 2008a).

The Andes region was affected by intense Mesozoic and Cenozoic volcanism, whose erosion products were transported eastward by fluvial and wind action, where the latter also contributed in the mobility of volcanic ash and pyroclastic materials. All these materials were deposited and re-transported in the Pampas and Patagonian regions through various multigenetic sedimentary cycles until they finally reached the coasts and the sea (Violante and Rovere 2005). The resulting mineralogical association was defined as a volcanic-pyroclastic one (Teruggi 1954, Etchichuri and Remiro 1963, Gelos et al. 1988). The petrographic analysis of rock fragments found in marine deposits on the slope more than 500 m deep near Mar del Plata (38 ° S) submarine canyon revealed the predominance of materials from Buenos Aires (Tandilia) and Patagonian origin (Bozzano et al. 2011).

The cratonic regions of Uruguay and Brazil are made up of igneous-metamorphic rocks from the Precambrian and Lower Paleozoic, as well as Jurassic basalts, whose erosion products are transported by the Paraná and Uruguay rivers to the Río de la Plata, and from the latter to the platform (Etchichuri and Remiro 1963, Berkowsky 1986). It should be considered that only the sediment surpluses that are not retained in the deltaic-estuarine area of the Río de la Plata reach the platform through this route. The southern limit of these sediments on the platform was established at 35ºS (Etchichuri and Remiro 1963), although later studies indicate that they would reach further south (up to 45ºS) in at least one of the terraces described on the platform (Marcolini 2005, Marcolini and Bozzano 2007).

Sedimentary Dynamics

Given the terrigenous composition of the sediments that make up the platform, the sedimentary dynamics must be considered in an integral way, encompassing both the continental processes that affect the coast as well as the littoral and marine ones.

Sediments are introduced into the dynamic coastal system from the adjacent continent in different ways, both by fluvial and wind transport and by coastal erosion, to be subsequently transferred to the platform.

However, in the case of fluvial and wind transport (the latter including both the contribution of sediments by wind erosion as well as tephras and ashes originating in Andean eruptions) a bypass may occur that takes them directly to the deep areas without remaining in the coastal system. During the postglacial transgression, these processes have occurred at each stage of the eustatic ascent, with variations depending on the rate of ascent, climatic factors, ocean circulation, littoral processes, and changes in sedimentary inputs. Said postglacial transgression acted on a poorly consolidated Neogene-Quaternary substrate causing the progressive sweeping of its surface by the erosive action of the waves and coastal currents with the consequently rapid coastal retreat, manifested through a high rate of coastal erosion and transfer sediment to the adjacent seabed (Urien and Ewing 1974, Parker and Violante 1982, Violante and Parker 2000, 2004, Perillo et al. 2005, Parker et al. 2008). On the platform, the resulting deposits on the erosion surface (ravinement, Swift 1976), are palimpsests or relict according to how they have been affected or not by hydrodynamic conditions.

The total contribution of terrigenous sediments to the platform by direct action of transport agents was estimated at 70x 106 tons / year (Pierce and Siegel 1979, Gaiero et al. 2003), of which 39 x 106 tons / year (56%) correspond to coastal erosion, 29 x 106 tons / year (41%) to wind transport and 2 x 106 tons / year (3%) to river activity. Isla and Cortizo (2005) estimated very different values (243.8x 106 ton / year) for the eroded sediments of the Patagonian cliffs and introduced to the sea, although without a doubt important differences between regions, depending on local factors, must be considered.

The river networks transport relatively small sedimentary volumes to the coastal areas, since the smaller rivers have little transport capacity while the larger rivers generally flow into estuarine environments that contain a large part of detritus. The greater fluvial capacity during past times is evidenced not only by the disproportionate size of the valleys on the continent with respect to current flows, but also by the large amount of gravels of glacifluvial origin that line the Patagonian platform (Perillo and Kostadinoff 2005).

Waves and tides, especially under stormy conditions, are capable of remobilizing large volumes of sediment (Perillo and Kostadinof 2005), as documented by the tidal wave fields that take up some space on the platform where speeds are higher (Servicio de Hidrografía Naval 1961, Urien and Ewing 1974 so et al., Perillo and Kostadinoff 2005).

Regarding the transport by coastal currents, the net circulation is towards the north, with the exception of local cells of opposite circulation influenced both by the morphology of the coastline and by the fluvial contributions.

Violante (2004), following Swift (1976) concepts, considered it to be of a native passive sedimentary system taking into account the prevailing sedimentary dynamics on the platform. Some of the superficial sedimentary structures, such as sandy banks formed by the coastal retreat (shoal retreat massif, Swift 1976) with aligned banks present in the inner Norbonaerense platform (Parker et al. 1978, 1982, Swift et al. 1978, Parker and Violante 1982), are typical of these sedimentation systems.

On the other hand, the mechanisms of sediment transfer from the outer edge of the platform to the upper slope, and from there to the submarine canyons are not yet adequately known, especially because the canyons are largely disconnected from the platform (Ewing and Lonardi 1971). Pierce and Siegel (1979) estimated a sediment transfer to the slope of 17 x 10^6 m^3/year. Sedimentary transport by gravitational processes seems to be predominant at least in the Buenos Aires slope sector (Hernández-Molina et al. 2009, Violante et al. 2010, Krastel et al. 2011).

Figure 19 presented by the morphosedimentary map of the passive volcanic continental margin in the study area. CAN_100 - CAN_108 areas are located on the slope and the beginning of the continental emersion, following the Ewing terrace, in the northern zone of the Bahía Blanca submarine canyon system. On the other hand, the CAN_114 Area is located on the middle slope in the southern area of said system of submarine canyons, immediately to the north of the Ameguino system of submarine canyons.

The corresponding references to the map are presented in Figure 20.

The Ewing terrace (sensus Hernández-Molina et al., 2009) is a pelagic shelf located on the middle slope between 37 ° S and 41 ° S. It develops between 900 m and 1,440 m deep with a width of 35 to 75 km and is limited by two pronounced escarpments, the upper slope and the lower slope.

The submarine canyons are other significant features on the slope, they represent erosive geoforms that shape it and, in many cases, they indicate the easternmost reach of the deposits of terrigenous origin that are carried towards the marine basins. They have been the main route for the sedimentary transfer to the abyssal plain, reaching its greatest development between 2,000 and 4,000 m-deep.

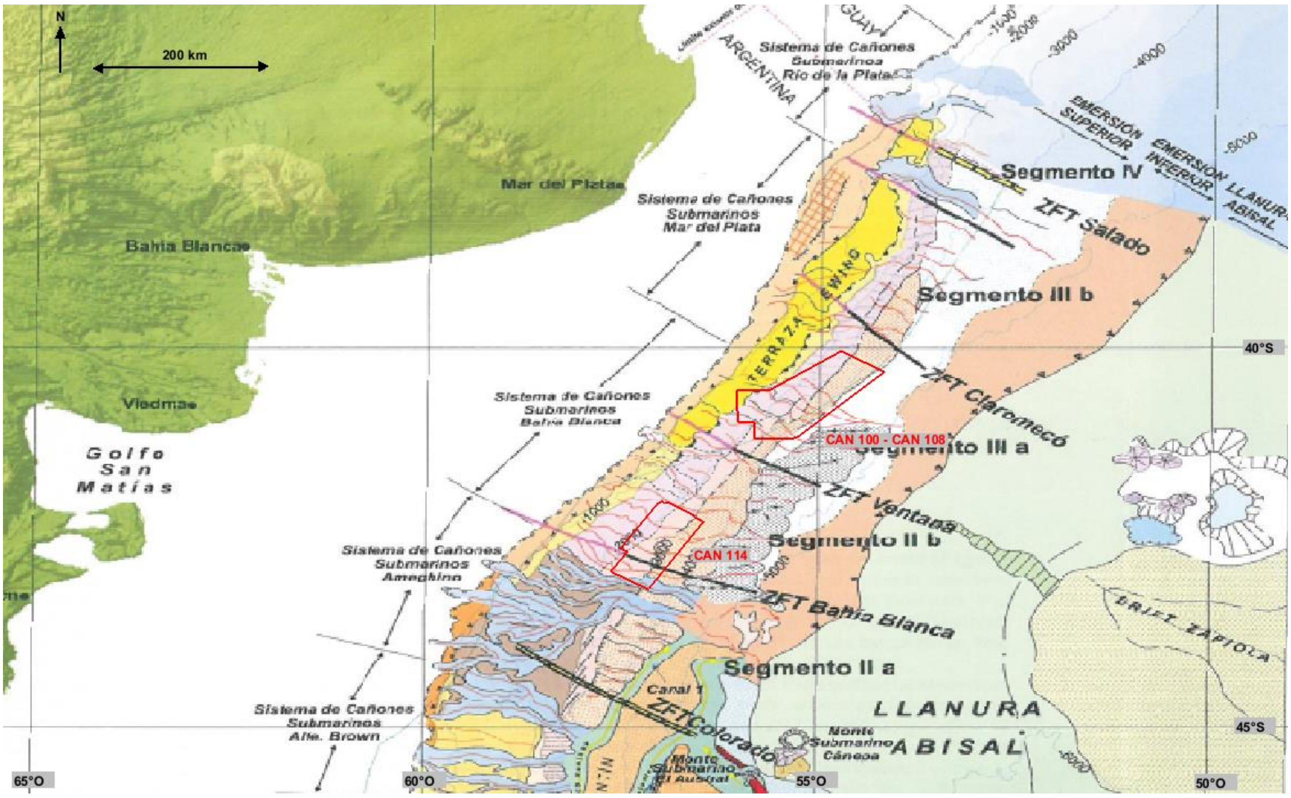


Figure 19. Morphosedimentary map of the passive volcanic continental margin in the study area. The red color indicates the operative area of CAN_100 - CAN_108 and CAN_114 areas. Modified from COPLA (2017).

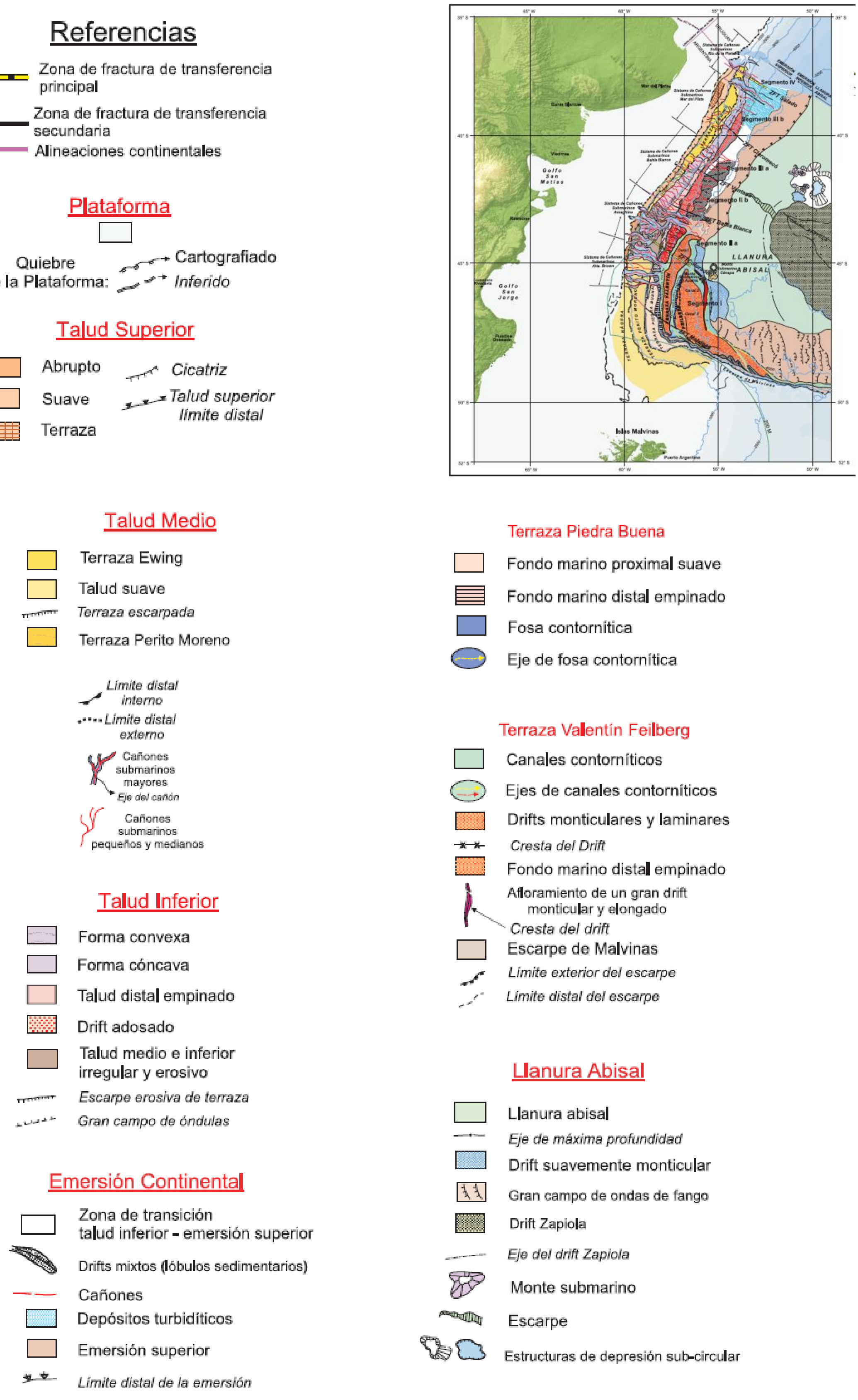


Figure 20. References corresponding to the morphosedimentary map presented in Figure 19. Modified from COPLA (2017).

(Translation of Figure 20: References: Main Transfer Fracture Zone. Secondary Transfer Fracture Zone.

Continental Alignments. Platform: Platform Rupture. Mapping. Inferred. Upper Slope: Abrupt. Soft. Terrace. Pit. Upper slope Distal Boundary. Middle Slope: Ewing Terrace. Soft Slope. Steep Terrace. Perito Moreno Terrace. Internal distal boundary. External Distal Boundary. Major submarine canyons. Canyon Axis. Small and Medium submarine canyons. Lower Slope: Convex shape. Concave shape. Steep distal slope. Attached drift. Irregular and erosive middle and lower slope. Terrace erosive scarp. Large field of waves. Transition zone. Lower slope –upper emersion. Mixed drifts. Sedimentary lobes. Canyons. Turbiditic deposits. Upper emersion. Distal emersion limit. Piedra Buena Terrace. Soft proximal seabed. Steep distal seabed. Contournitic pit. Contournitic pit axis. Valentin Feilberg Terrace. Contournitic channels. Axis of contournitic channels. Slope and laminar drifts. Drift crest. Malvinas scarp. Outer scarp limit. Scarp distal limit. Abyssal Plain. Maximum depth axis. Drift with soft slope. Large field of mud waves. Zapiola Drift. Zapiola Drift axis. Submarine forest. Scarp. Sub-circular depression structures).

Contour depositional system

Until the middle of the 20th century, the knowledge of the Argentine continental margin indicated that the dominant sedimentary processes in the deep regions of the slope and the emersion were gravitational and pelagic.

The influence of bottom currents as significant seafloor modeling agents was unknown, being Hernández-Molina et al. (2009) who first described the complex contour depositional system that developed from Eocene-Oligocene times along 1600 km of the passive volcanic Argentine continental margin.

This system constitutes a sedimentary process associated with deep currents parallel to the margin, capable of building up contour bodies (drifts) along the direction of the current. It is a complex sedimentary dynamic determined by the activity of energetic bottom currents able to produce strong erosion and sedimentation processes on the seabed.

The major morphosedimentary features that make up the contournitic system in the northern sector of the passive margin (north of 43°S) are four terraces: La Plata (T1, at ~500–600 m-deep), Ewing (T2, at 1000-1500 m), T3 (restricted to the interior of the Mar del Plata canyon, at 2500 m on its northern side) and Necochea (T4, at 3500 m). Other deeper terraces have also been mentioned in that sector (Hernández-Molina et al., 2009; Violante et al., 2017).

MARGEN CONTINENTAL ARGENTINO						
Sector meridional		Sector central			Sector septentrional	
MASAS DE AGUA	TERRAZAS				TERRAZAS	MASAS DE AGUA
CM					T0	CB = TW+SACW
CM	Nágera	~ 500 m	?	~ 400 / 600 m	T1 = La Plata	Termoclina prof.
AAIW	Perito Moreno	~ 1000 m		~ 1200 / 1300 m	T2 = Ewing	AAIW
CDW: UCDW	Piedra Buena	~ 2500 m			T3	CDW: UCDW, NADW
CDW: LCDW	V. Feilberg	~ 3500 / 3800 m	~ 3500 m		T4	CDW: LCDW
AABW	sin nombre	~ 5000 / 5500 m	~ 5500 m		T5	AABW

Figure 21. Contour terraces, their depths in different sectors of the margin, and their relationship with water bodies. CM: Malvinas Current. CB: Current of Brasil. TW: Tropical Water. SACW: Central Water of the South Atlantic. AAIW: Antarctic Intermediate Water. CDW: Deep Circumpolar Water. UCDW: Upper Deep Circumpolar Water. LCDW: Lower Deep Circumpolar Water. NADW: North Atlantic Deep Water. AABW: Antarctic Bottom Water. Source: Violante et al. (2017).
(Translation of Figure 21: Margen Continental Argentino: Argentine Continental Margin. Sector meridional: Southern Area. Sector Central: Central Area. Sector Septentrional: Northern Area. Masas de agua: bodies of water. Terrazas: Terraces. Termoclina Prof: Deep Thermocline.)

According to the different factors involved (geotectonic, morphological, sedimentary, oceanographic, etc.) in the characteristics presented by the forms resulting from the dominant processes in the Argentine continental margin, which are the contour and gravitational ones, Hernández-Molina et al. (2009) subdivided the margin from north to south into six regions, each with its own morphosedimentary features (Figure 22).

CAN_100 - CAN_108 and CAN_114 operative areas correspond to the areas named B and C of the passive volcanic margin, respectively.

Contournitic processes stand out in zone B (38-40 ° 30'S) (Hernández-Molina et al., 2009; Violante et al., 2017) with less influence from submarine canyons and gravitational processes. Various types of contournitic bodies have been described in this region, the attached ones being dominant, as well as other depositional, erosive and mixed. Although being subordinate to the contourites, a dense system of narrow submarine canyons that cross the terraces and slopes of the slope, has sufficient capacity to transport sediments towards the emersion, where they shape turbidite lobes and deposits resulting from mass transport, which show a reorientation towards the northeast influenced by the action of deep contour currents, originating separate mixed contournitic bodies (Hernández-Molina et al., 2009). In this region, the extent of the emersion shortens towards the south.

The C Zone (40 ° 30'-42 ° 30'S) corresponds to the area that was defined as the Colorado-Negro Canyon System (Lonardi and Ewing, 1971) or Bahía Blanca (Hernández-Molina et al., 2009). This system is composed of at least twenty small, narrow canyons and generally of reduced morphological expression. Contournitic bodies develop between them, both connected and with mound. The thickness of the contournitic system in this sector would reach about 1200 m. Given the importance of the depositional processes at the base of the slope, the reduced lateral extension of the Ewing Terrace and the abundance of landslides and evidence of mass transport in the middle slope, gravitational processes seem to play a relevant role here. In particular, the Bahía Blanca canyon is one of the few examples in the MCA of a canyon that enters deep into the rise and still reaches the abyssal plain with a possible significant influence on the sedimentary processes of the northwestern edge of the Argentine Basin (Violante et al., 2017).

The contournitic bodies are made up of different sedimentary facies with heavy, sandy, silty and muddy textures.

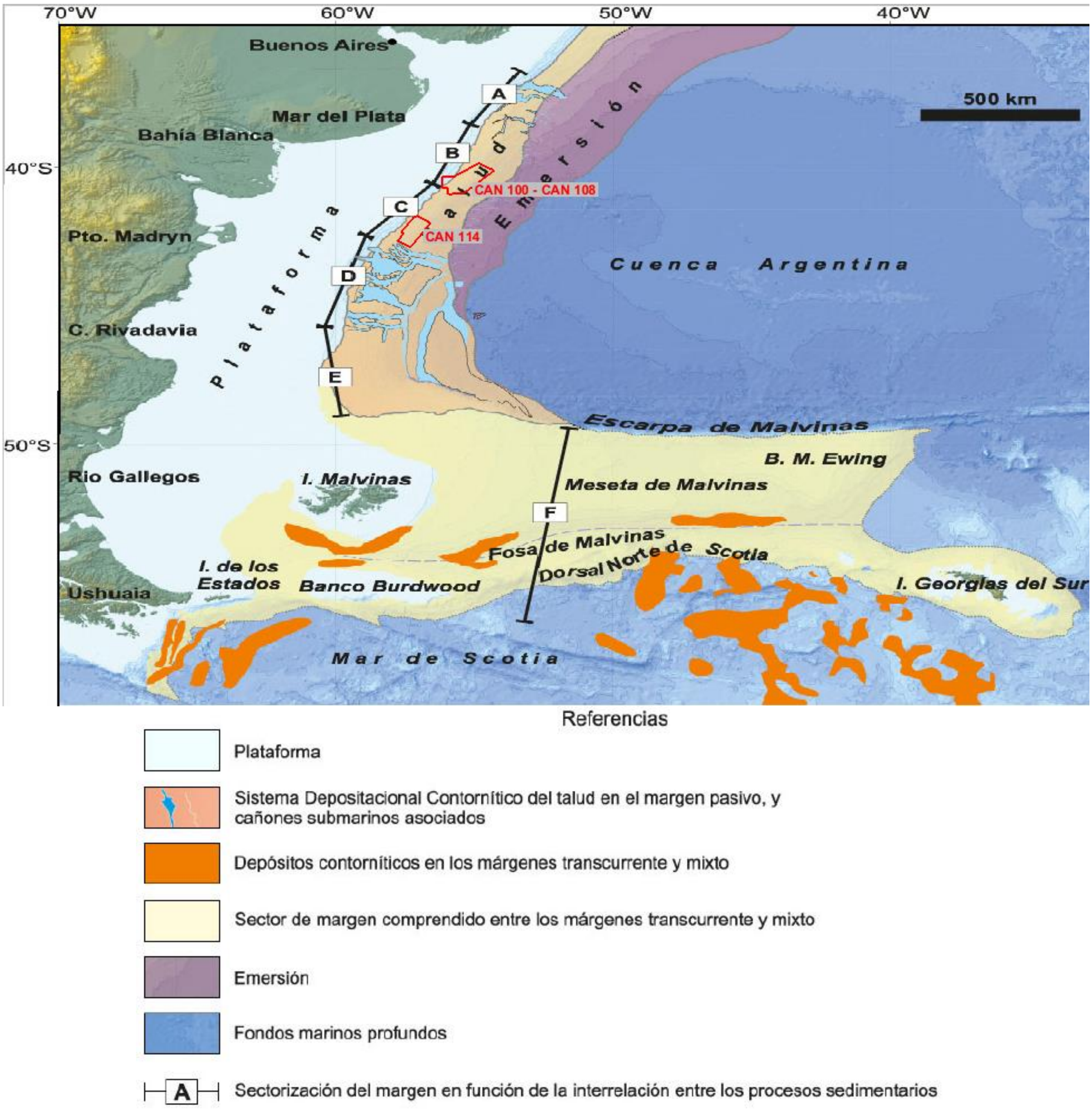


Figure 22. Zoning of the Argentine continental margin based on the main active deep marine processes, and Contournitic Depositional Systems. The red color indicates the operative area of CAN_100 - CAN_108 and CAN_114 areas. Modified from Violante et al. (2017).

(Translation of Figure 22: Referencias: References. Plataforma: Platform. Sistema Depositacional Contournitico del talud en el margen pasivo y cañones submarinos asociados: Contournitic Depositional System of the slope in the passive margin and associated submarine canyons. Depósitos contorníticos en los margenes transcurrente y mixto: Contournitic deposits in the transcurrent and mixed margins. Emersión: Emersion. Fondos marinos profundos: Deep seabed. Sectorización del margen en función de la interrelación entre los procesos sedimentarios: Sectorization of the margin according to the interrelation between the sedimentary processes).

3.1.5 Sediments

The sediments corresponding to the upper levels of the subsoil of the Argentine continental shelf are represented by sequences from the Upper Pliocene-Holocene period (Parker et al. 1999, 2008).

The most recent sedimentary unit of the subsoil of the Argentine continental shelf corresponds to the post-Last Glacial Maximum sedimentary pack with an age between ~ 18 ka and the present (Violante et al., 1992; Parker et al., 1999, 2008; Violante and Parker, 2000, 2004), defined as a depositional sequence identified by high resolution seismic surveys carried out in the marine areas of eastern Buenos Aires. The sequence extends from the outer edge of the platform (and even sectors of the slope) to the coastal plains, being limited by the transgressive surface at its base, while the top is represented by the current topographic surface. Its thickness averages about 5 m to 10 m, being greater in the Buenos Aires platform where it reaches 10-15 m, and less in the Patagonian where it generally does not exceed 5 m with a discontinuous distribution (Urien and Ewing, 1974; Parker et al., 1996, 1997; Urien et al., 2003). The internal seismic configuration of the sequence is generally chaotic and non-transparent, indicating high sand content, although it is transparent or free of internal reflections in places where its sludge proportion increases, such as in estuarine environments.

The surface sedimentary layer of the platform is essentially made up of sands, which cover around 65% of its surface. Shells and gravels follow with a contribution of approximately 25% (Urienand Ewing, 1973; Parker et al., 1997, 1999, 2008; Violante and Parker, 2000, 2004; Violante, 2004; COPLA, 2017).

The surface sedimentary textures of the seabed according to the Atlas of Environmental Sensitivity of the Argentine Coast and Sea (2008) is presented in Figure 23, along with the location of bottom samples extracted in the area of which the aforementioned Atlas does not provide information.

The Atlas shows that a sandy texture prevails on the platform, while the mud is the dominant material on the deeper areas of the margin, i.e. the slope and the emersion.

The information of the samples was obtained through GeoMapApp, an application of Lamont-Doherty Earth Observatory of Columbia University that allows the search, visualization and analysis of global data sets of the branches of geophysics, geology, oceanography physics, climatology and others.

The description of the material found in the samples is presented in Table 1.

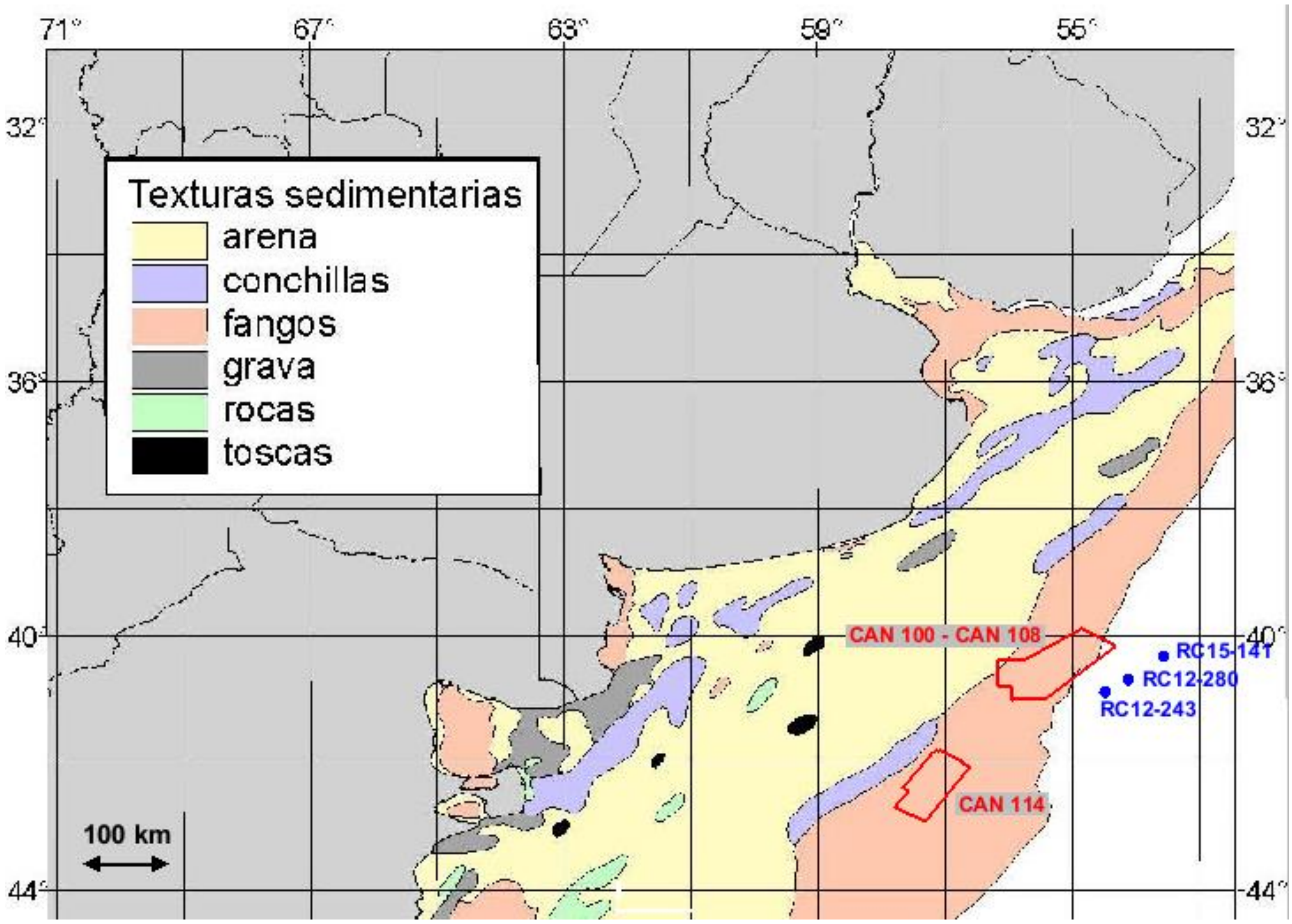


Figure 23. Superficial sedimentary cover of the seabed of the Argentine continental margin. The operating area of CAN_100 - CAN_108 and CAN_114 areas is indicated in red and the location of the samples is shown in blue. Source: Atlas of environmental sensitivity of the Argentine coast and sea (2008) and GeoMapApp (www.geomapapp.org).

(Translation of Figure 23: Texturas sedimentarias: Sedimentary Textures. Arena: Sand. Conchillas: Shells. Fangos: Mud/Sludge. Grava: Gravel. Rocas: Rocks. Tosca: Stone.)

Table 1. Description of the material found in the samples. Source: GeoMapApp (www.geomapapp.org).

RC12-243 (Depth of bed: 4700 m):
0-127 cm: sandy clay, with sheets of sand (94-95 cm, 107-108 cm and 115-116 cm)
127-131 cm: sand
131-567 cm: sandy clay, with sheets of sand (147-148 cm, 173-177 cm, 180-182 cm, 183-187 cm, 426-429 cm and 467-469 cm)
RC12-280 (Depth of bed: 4750 m):
0-330 cm: sandy clay
330-332 cm: sand
332-433 cm: sandy clay
RC15-141 (Depth of bed: 4900 m):
0-2 cm: clay; coarse fraction (<1%): mainly quartz, with some fragments of igneous rocks and dark minerals.
2-18 cm: sandy clay; coarse fraction (approx. 7%): mainly quartz, with some fragments of igneous rocks and dark minerals.
18-462 cm: sandy clay; coarse fraction (approx. 10%): mainly quartz, with some fragments of igneous rocks and dark minerals.
462-468 cm: volcanic ash.
468-626 cm: sandy clay.
626-630 cm: unconsolidated sands; coarse fraction (approx. 95%): mainly quartz, with some fragments of igneous rocks and dark minerals.
630-1090 cm: sandy clay; coarse fraction (7-25%): mainly quartz, with some fragments of igneous rocks and dark minerals.

In the operative areas of CAN_100 - CAN_108 and CAN_114 areas, the sedimentary thickness is very important, reaching over 2.5 km (Figure 24).

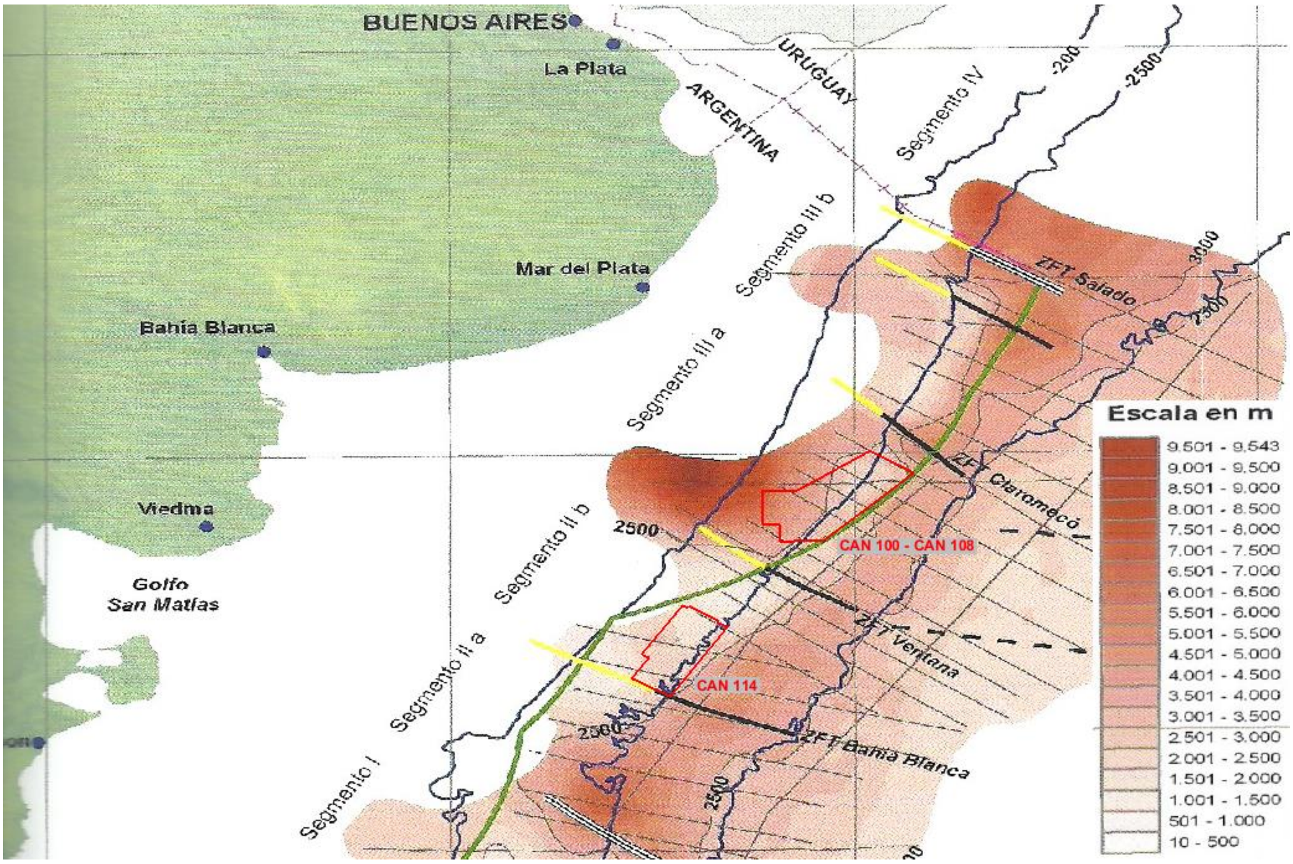


Figure 24. Sedimentary thickness map of the Argentine continental margin. The operating areas of CAN_100 - CAN_108 and CAN_114 areas are indicated in red. The thick dark blue lines indicate the 200 m, 2500 m and 5000 m isobaths. The thin black lines correspond to isopachs (scale in meters). Modified from COPLA (2017).

3.1.6 Geological Hazard

Different natural processes of geological origin affect planet Earth, caused by internal or external activity. Earthquakes and volcanism, which are mountain-forming processes, belong to the first case. External processes are activated by meteorological agents (water, snow, wind) or by the forces of gravity and other erosive processes, which modify the earth's surface.

The concept of geological hazard refers only to the effect of the process, through a qualitative estimate of the possibility or probability of its occurrence, regardless of the consequences it may have or the losses it may cause.

As to this project, the only subject to be developed is the seismicity of the study area.

In the project area, the Argentine coast corresponds to a passive margin coastline, with an extensive continental shelf implying a certain tectonic stability (Codignotto et al. 1992).

The National Institute for Seismic Prevention of Argentina (INPRES) is in charge of the set up and maintenance of the National Accelerometer Network. It is an instrument that makes it possible to obtain a graph called an accelerogram, which shows the variation of accelerations at its location according to time.

The so-called design earthquake/seism is determined from the analysis of the different earthquakes registered in the country and in other places in the world with similar seismic characteristics. In general, the most destructive movement that can occur in a certain area is assumed, with a 500 year-recurrence.

The seismic hazard, which implies that a certain amplitude of ground movement may occur in a set time interval, depends on the level of seismicity in each area. The Seismic Zoning Maps detect zones with different levels of Seismic Hazard.

In the Seismic Zoning Map of the INPRES-CIRSOC 103 Regulation, 5 zones are identified. A value that allows comparing the seismic activity in each one of them is the maximum ground acceleration "as" for the design seism defined above. This acceleration is expressed in "g" units (acceleration due to gravity).

Figure 25 shows the aforementioned Seismic Zoning Map. The operational areas of the project are located offshore from the southern coast of Buenos Aires and northern Patagonia, being areas of seismic danger with 0 value (very low).

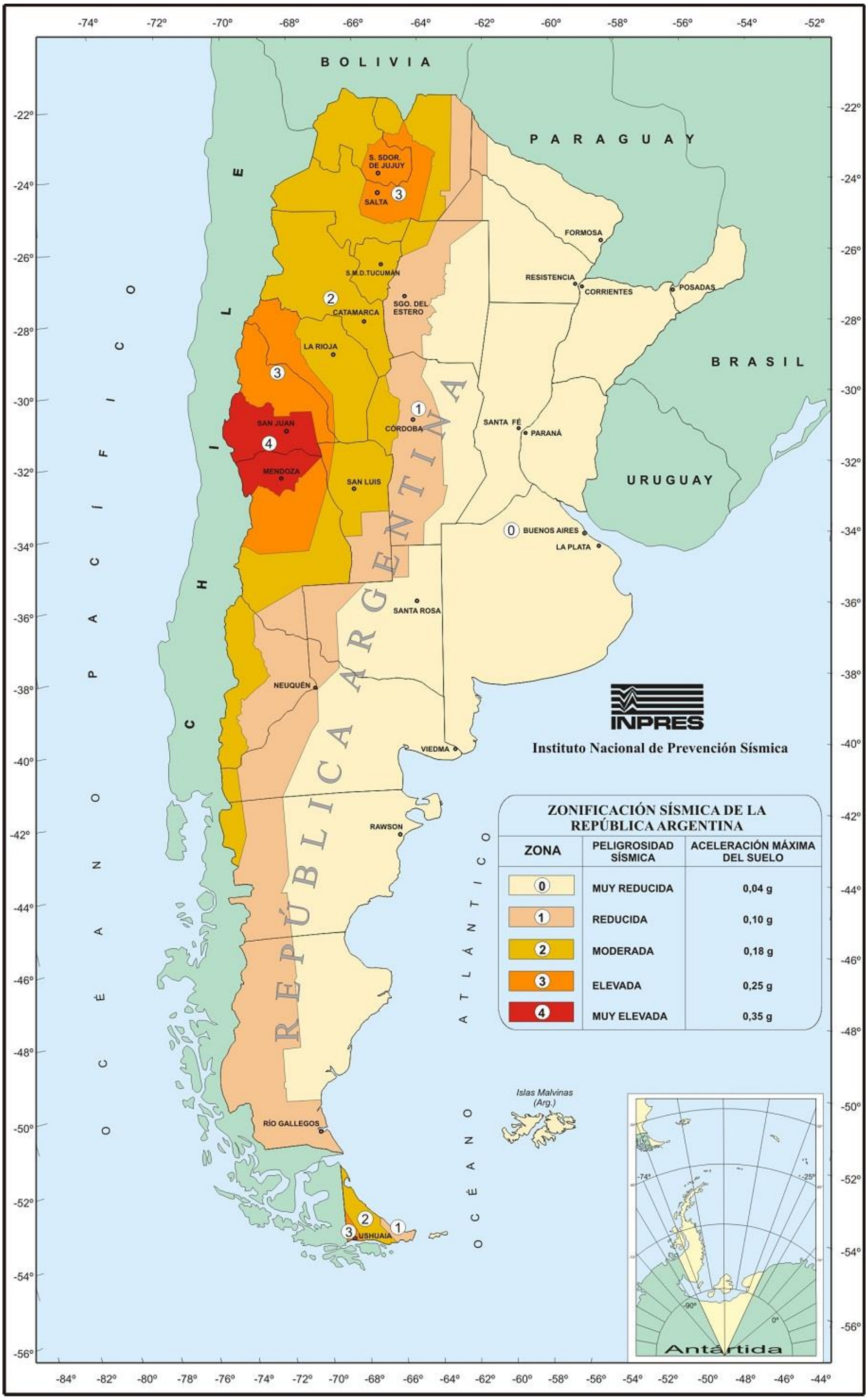


Figure 25. Seismic Zoning Map of the National Institute for Seismic Prevention of Argentina (INPRES).

(Translation of Figure 25: Zonificación Sísmica de la República Argentina: Seismic Zoning of the Argentine

Republic. Zona: Area. Peligrosidad Sísmica: Seismic Hazard. Aceleración máxima del suelo: Maximum Acceleration from the ground. Muy reducida: Very limited. Reducida: limited. Moderada: moderate. Elevada: High. Muy elevada: Very high.)

3.2 OCEANOGRAPHY

3.2.1 Bodies of Water and Flow

The main source of the water bodies of the continental shelf is the subantarctic water, transported from the north of the Drake Passage by the "Cabo de Hornos" current that flows between the Atlantic coast and the Falkland Islands (Islas Malvinas), as well as by the Malvinas current that flows along the edge of the shelf (Figure 26 y Figure 27). On the other hand, there are small continental discharges that provide fresh water and a source of low salinity water given by the flow that enters through the Strait of Magellan. The latter is a consequence of the high rainfall that occurs in the Pacific Ocean near the coast of Tierra del Fuego, as well as the melting of the continental ice that drains into the strait through important canyons (Bianchi et al., 2005).

As a consequence of the aforementioned contributions, the following water masses are observed on the Argentine continental shelf (Bianchi et al., 2005): Coastal Water with low salinity (<33.4 UPS), Platform Water or medium platform (between 33.4 UPS and 33.8 UPS), Malvinas Water (> 33.8 UPS) and High salinity coastal water in the area near the "San Matías" and "Nuevo" gulfs (> 34.0 UPS), where the diversion to the sea of the intrusion or plume of low salinity waters derived from the discharge through the Strait of Magellan takes place (Figure 28).

It should be noted that the isohaline of 33.8 UPS and 33.4 UPS in Figure 28, mark the edges of two ocean fronts (where the properties of the water change abruptly): the slope front, between Malvinas waters and the waters of the middle platform, and the tidal front that develops during the summer season between the near-homogeneous coastal waters in the vertical and the stratified waters of the middle platform (Bianchi et al., 2005).

The Magellan plume, derived from the discharge of slightly saline waters through said Strait at a latitude of 52.5 ° S, constitutes a distinctive feature of the platform. This flow has a very important extension, reaching 42 ° S. There is a lot of uncertainty regarding its flow, but it does have an enormous influence on the area (Piola et al., 2018).

The Malvinas current has originated in the deviation around the Patagonian shelf of the northern branch of the Antarctic Circumpolar Current, which flows east carrying cold, low-saline subantarctic waters (34.0 PSU) (Guihou et al, 2020; Piola and Gordon, 1989) and rich in nutrients (Acha et al., 2004) from the Drake Passage along the upper portion of the slope of the Argentine continental shelf.

After crossing the Drake Passage, the Malvinas current surrounds the shallow Burdwood (or Namuncurá) bank and the Falkland Islands (Islas Malvinas), outlining the topography drawn by the edge of the continental shelf (Campagna et al. 2006).

Another very important source of water masses for regional oceanographic characterization in the Southwest Atlantic area is the water transported by the Brazilian current. This current flows southward along the continental margin of South America (it makes up the western limit of the so-called subtropical gyre of the South Atlantic), transporting warm, saline waters of subtropical origin.

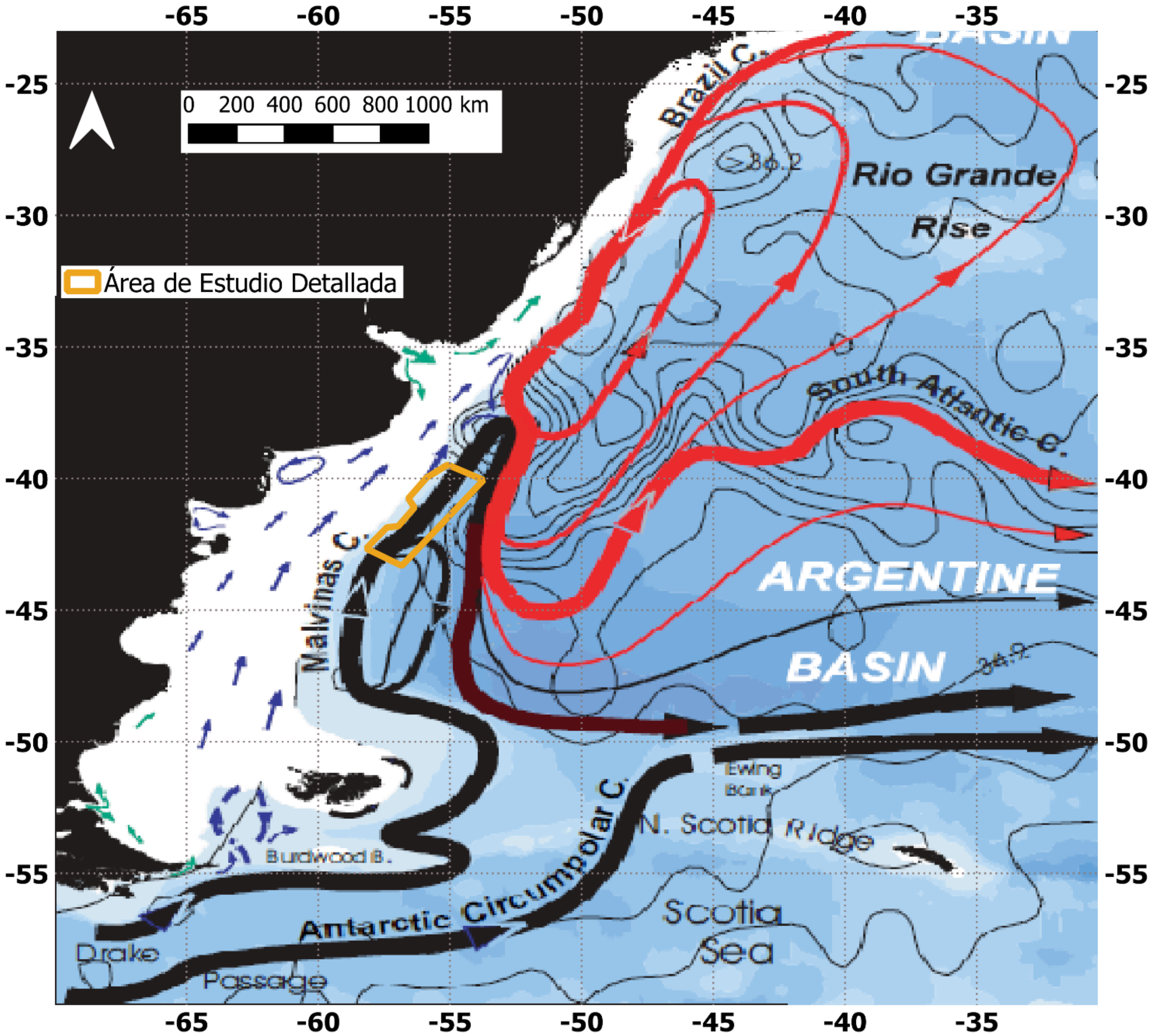


Figure 26. Diagram of the upper circulation of the main currents of the Southwest Atlantic. The black lines correspond to the flow of Antarctic and subantarctic waters, associated with the Antarctic Circumpolar Current and the Malvinas Current respectively. The red lines represent the flow of subtropical waters carried by the Brazilian current. On the Patagonian continental shelf, the blue and green arrows represent the middle surface currents. The fine black isolines show the salinity field at 200 m depth, used to infer part of the circulation pattern. At the Brazil-Malvinas confluence, a strong salinity front develops which extends in a meandering pattern into the interior of the ocean, forming the South Atlantic current. Source: Piola et al. (2017).

(Translation of Figure 26: Area de Estudio detallada: Detailed Study Area)

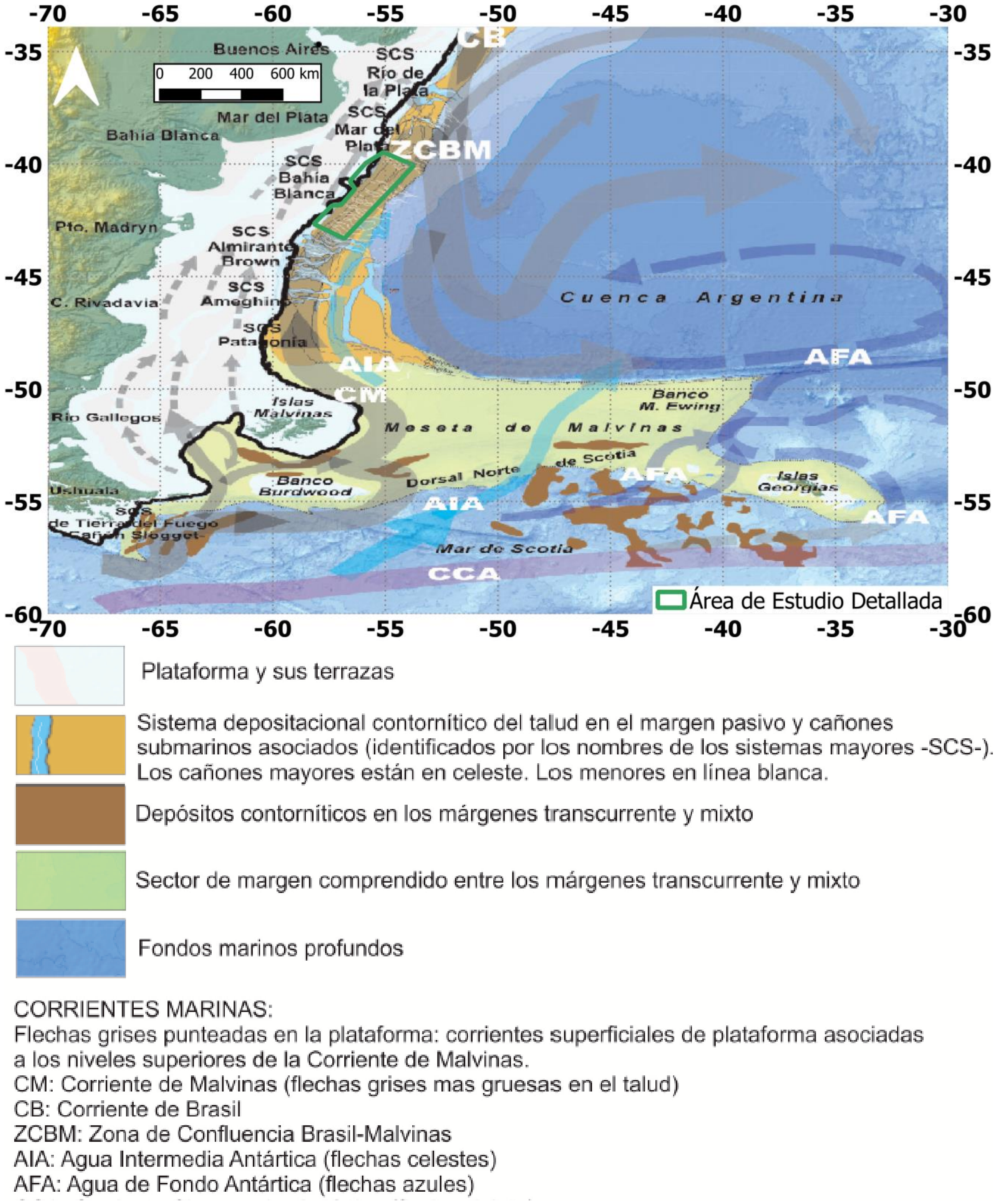


Figure 27. Rasgos morfo-sedimentarios y corrientes características del Margen Continental Argentino. Source: Violante, et al. 2017.

(Translation of Figure 27: Area de Estudio detallada: Detailed Study Area. Plataforma y sus Terrazas: The Continental Shelf and its terraces. Sistema depositacional contornítico del talud en el margen pasivo y cañones submarinos asociados (identificados por los nombres de los sistemas mayores - SCS): Contournitic depositional system of the slope in the passive margin and associated submarine canyons (identified by the names of the major systems - SCS). Depositos contorníticos en los margenes transcurrente y mixto:

Contournitic deposits in the transcurrent and mixed margins. Sector de margen comprendido entre los márgenes transcurrente y mixto: Margin sector between transcurrent and mixed margins. Fondos marinos profundos: Deep Seabed. CORRIENTES MARINAS: Sea currents. Flechas grises punteadas en la plataforma: corrientes superficiales de plataforma asociadas a los niveles superiores de la Corriente de Malvinas: Grey arrows dotted on the platform: surface platform currents associated with the upper levels of the Malvinas Current. CM: Corriente de Malvinas (flechas grises gruesas en el talud): CM: Malvinas Current (thick grey arrows on the slope). CB: corriente del Brasil: CB: Brazilian current. CZBM: Zona de confluencia Brasil-Malvinas: CZBM: Brazil-Malvinas Confluence Zone. AIA: Agua intermedia antártica (Flechas celestes): AIA: Antarctic Intermediate Water (Light-blue Arrows). AFA: Agua de fondo Antartica (Flechas azules): AFA: Antarctic Bottom Water (Blue Arrows).

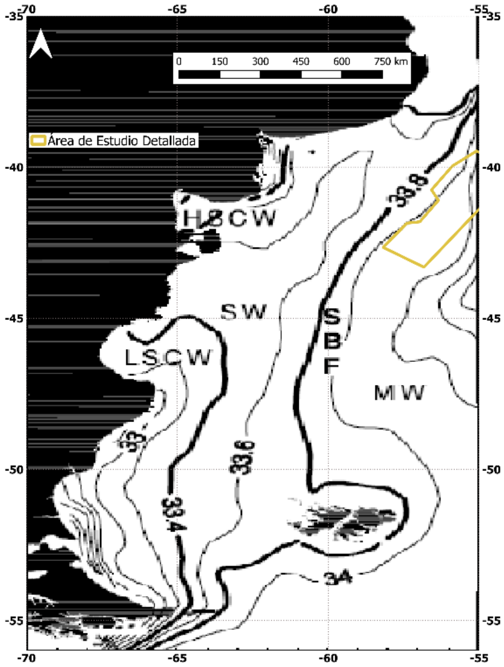


Figure 28. Horizontal distribution of the superficial climatological salinity of the Argentine continental shelf. The isohalines that separate the different bodies of water (33.4 UPS and 33.8 UPS) are highlighted). The abbreviations correspond to: Low Salinity Coastal Water -LSCW-, High Salinity Coastal Water -HSCW-, Shelf Water-SW-, Malvinas Water (Malvinas Water -MW-) and slope front (Shelf Break Front -SBF-). Source: Bianchi et al., 2005.

(Translation of Figure 28: Area de estudio detallada: Detailed Study Area).

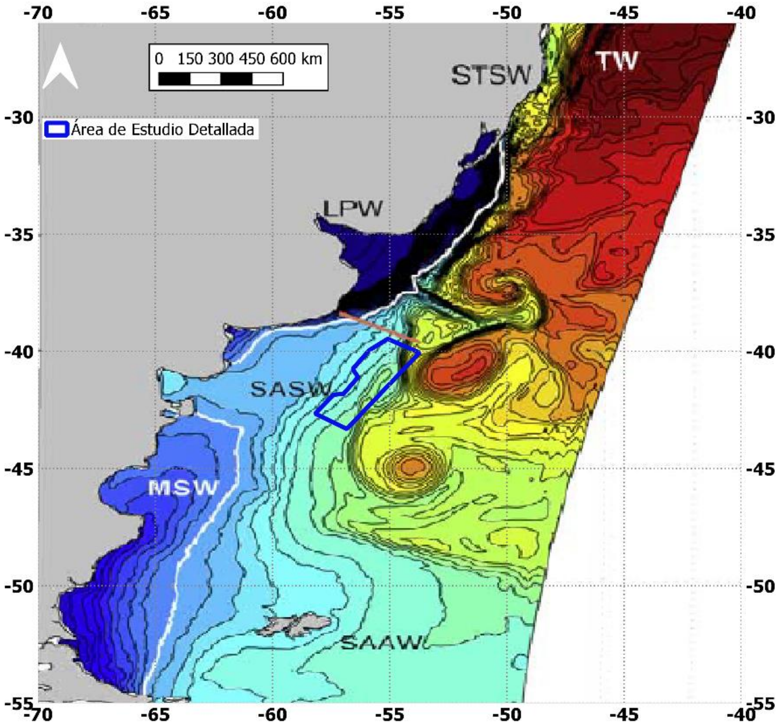


Figure 29. Superficial salinity distribution. Snapshot obtained from the POM model (Palma et al. 2008).
The main bodies of water shown are: Strait of Magellan Water (MSW), Sub-Antarctic Shelf Water (SASW), Subtropical Shelf Water (STSW), La Plata River Water (LPW), Sub-Antarctic Water (SAAW) and Tropical Water (TW).
The white line indicates the 33.5 psu contour. Note the release of high-salinity anticyclonic eddies from the Brazilian current. Source: Palma et al. 2008.
(Translation of Figure 29: Area de estudio detallada: Detailed Study Area).

The upper layer of the mass of water transported by the Brazilian current, is called Tropical Water (Tropical Waters, TW), and is characterized by its high potential temperature (>20C) and high salinity (S> 36 PSU). The temperature is due to the heat coming from the atmosphere in low latitudes, while the high salinities derive from the loss of waters of lower salinity that occurs in middle latitudes. In this upper layer, the presence of relatively thin layers of low salinity is also observed, which probably respond to the mixture between TW and platform waters and rivers. Below the TW layer is the South Atlantic Central Water (SACW), which is characterized by its strong thermocline and halocline (observe the θ-S relationship in the temperature range 20 - 10 C, Figure 31). The SACW water mass has a very stable θ-S pattern that presents only minor variations, at the southern limit of the Brazilian current, caused by air-sea interaction during winter (Piola et al., 2017).

The Brazilian and Malvinas currents join near 38º south latitude (moving north or south depending on the season of the year) in the deep-water environment of the slope and form the Brazil / Malvinas (Subtropical Front) confluence zone, becoming the thermohaline front with the highest concentration of energy in all the world's oceans. Subtropical and subantarctic waters coexist and mix there creating important physical-chemical gradients which favour the presence of high concentrations of nutrients with important biological consequences for the entire ecosystem.

After encountering the Malvinas Current, the Brazilian Current branches off and one of its branches (the outermost) forms the South Atlantic Current (Campagna et al. 2006), while the main flow of the Malvinas current describes a sharp turn and forms the return flow of the Malvinas that heads southeast. This return flow generates the surfacing of deep waters that enrich the nutrient content of the surface waters (Campagna et al. 2006).

It should be highlighted that, although the circulation on the continental shelf depends on the propagation of the tidal wave, the wind tension, the fresh water discharges and the contour currents (Malvinas and Brazil currents), the relative contribution of each of these forcing the circulation pattern varies between the different regions that make up said platform.

On the Patagonian continental shelf, the circulation is dominated by strong tides (Glorioso and Flather 1997, Palma et al. 2004a), significant fresh water discharges (Piola et al. 2005) and strong and persistent winds (Palma et al. 2004b, Piola and Matano 2001). While in the area of interest of the present study (Detailed Study area) the tidal amplitudes are relatively small (Palma et al., 2004a), and the wind pattern is characterized by weak intensities and large seasonal variations (Palma et al., 2004b).

The schematization of the circulation of the Southwest Atlantic is presented in Figure 27 and Figure 28. Figure 29 shows the main water masses of the aforementioned oceanic sector together with the superficial distribution of salinity, corresponding to the results obtained by Palma et al. (2008) with the POM model (Princeton Ocean Model).

The Brasil-Malvinas Confluence generates one of the most spectacular eddy fields in the global ocean (Piola et al., 2001). In these eddies, the anomaly of temperature and surface salinity can present values of up to 10C and 2 UPS and, therefore, they form an important mechanism for the transfer of salt and heat. The variability of the confluence zone is illustrated by Figure 29 with the presence of an *eddy* intrusion located around 45S, 54W and, further north, a second *eddy* about to break away.

It should be specifically noted that, as observed in Figure 29, the Detailed Study area is located in the area of influence of the Malvinas current and its convergence with the Brazilian current (Subtropical Front). Consequently, both the temperature and the salinity of the water can present a high space-time variability. The large-scale meanders and *eddies* that come from the two currents, generate intrusions from a warm water body (Brazil current) into a cold water body (Malvinas current) and vice versa. In this way, the Detailed Study area, in addition to being characterized by the mixture of these two marine currents, can be bathed by both the cold waters of the Malvinas current and the warm waters of Brazil. Therefore, the seismic exploration vessel may be moving either in the confluence zone, or in Malvinas or Brazilian waters at any time of the year.

Next, the vertical profiles (temperature and salinity) and the characteristic T-S diagrams of the water masses of the Brazilian (Figure 30) and Malvinas currents (Figure 31) are presented. Figure 32 shows the different water masses present in the Detailed Study area by T-S diagrams prepared based on the data downloaded from the World Ocean Database (see Figure 31 for the identification of the confluence zone and the Malvinas- Brazil currents). It should be undedrlined that the comparison of both figures (Figure 31 and Figure 32) determines the presence of water masses from the Brazilian and Malvinas currents and the confluence of both in the study area.

Figure 33 illustrates the vertical distribution of temperature and salinity in cross sections located at 38.25S, 39.75S and 41.75S latitudes. These profiles represent the average conditions at the extremes of the seasonal cycle (hot and cold) and were prepared based on observations carried out during the 1911-2010 period and compiled in the Regional Oceanographic Data Base (BaRDO) of the National Institute of Fisheries Research and Development, INIDEP (Baldoni, et al. 2015).

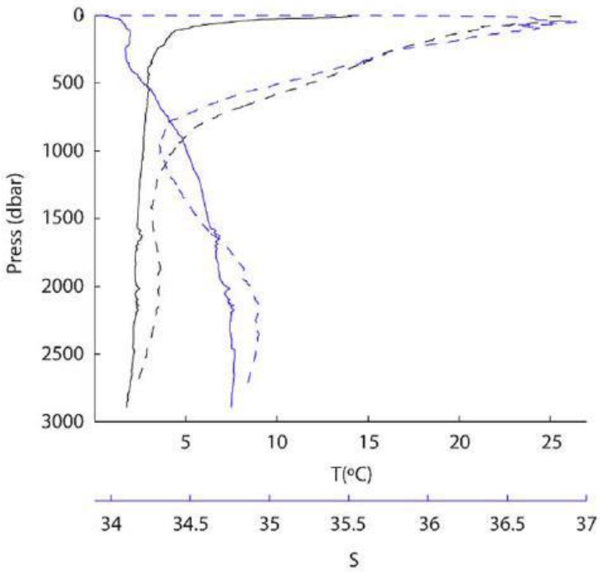


Figure 30. Vertical profiles of temperature and salinity of the Malvinas current (solid line) and the Brazilian current (dotted line). Source: Orúe-Echevarría et al. (2019).

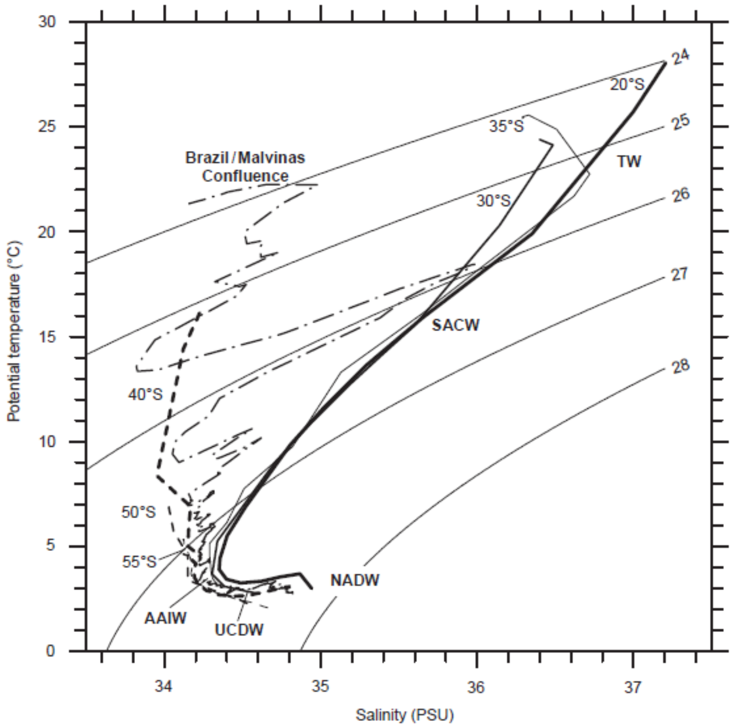


Figure 31. T-S diagram of oceanographic stations carried out along the Brazilian current (from 20 ° S in the Brazilian basin to 35 ° S, solid lines) and along the Malvinas current (from 55 ° S in the north of the Drake Passage up to 40 ° S, dashed lines). These stations are located between the 1000 m and 2000 m isobaths near the cores of these western contour currents. The station at the Brazil / Malvinas Confluence is also included after the separation of the western edge (dotted and dashed line). Density anomaly isolines (Sθ) are included.
TW: Tropical Water; SACW: South Atlantic Central Water; NADW: North Atlantic Deep Water; AAIW: Antarctic Intermediate Water; UCDW: Upper Circumpolar Deep Water. Source: Piola et al. (2017).

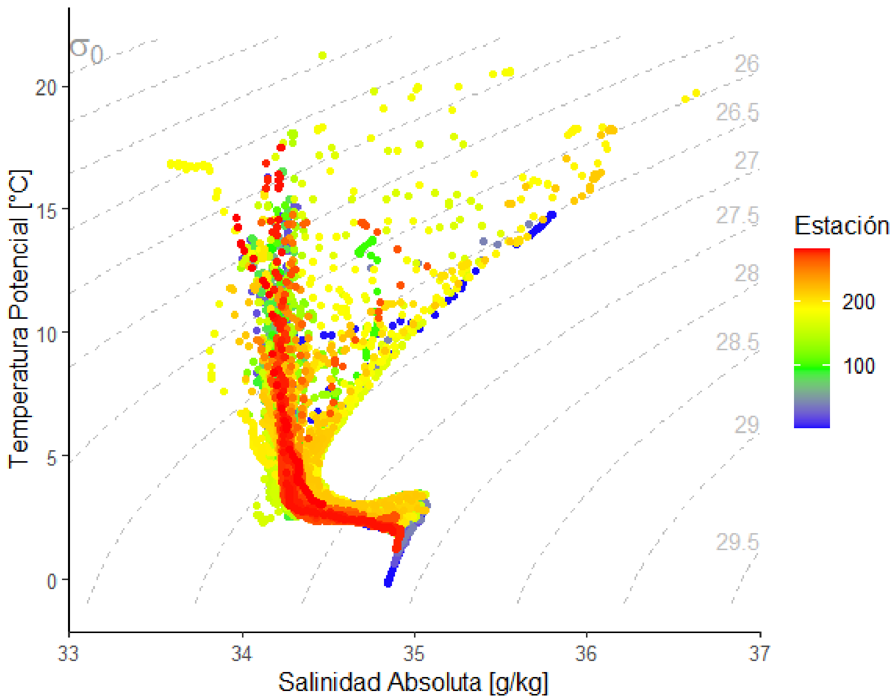


Figure 32. T-S diagram of all temperature and salinity profiles downloaded from NOAA's World Ocean Database 09 (http://www.nodc.noaa.gov), recorded in the Detailed Study area.
(Translation of Figure 32: Temperatura potencial: Potential temperature. Estación: Station. Salinidad Absoluta: Absolute Salinity.)

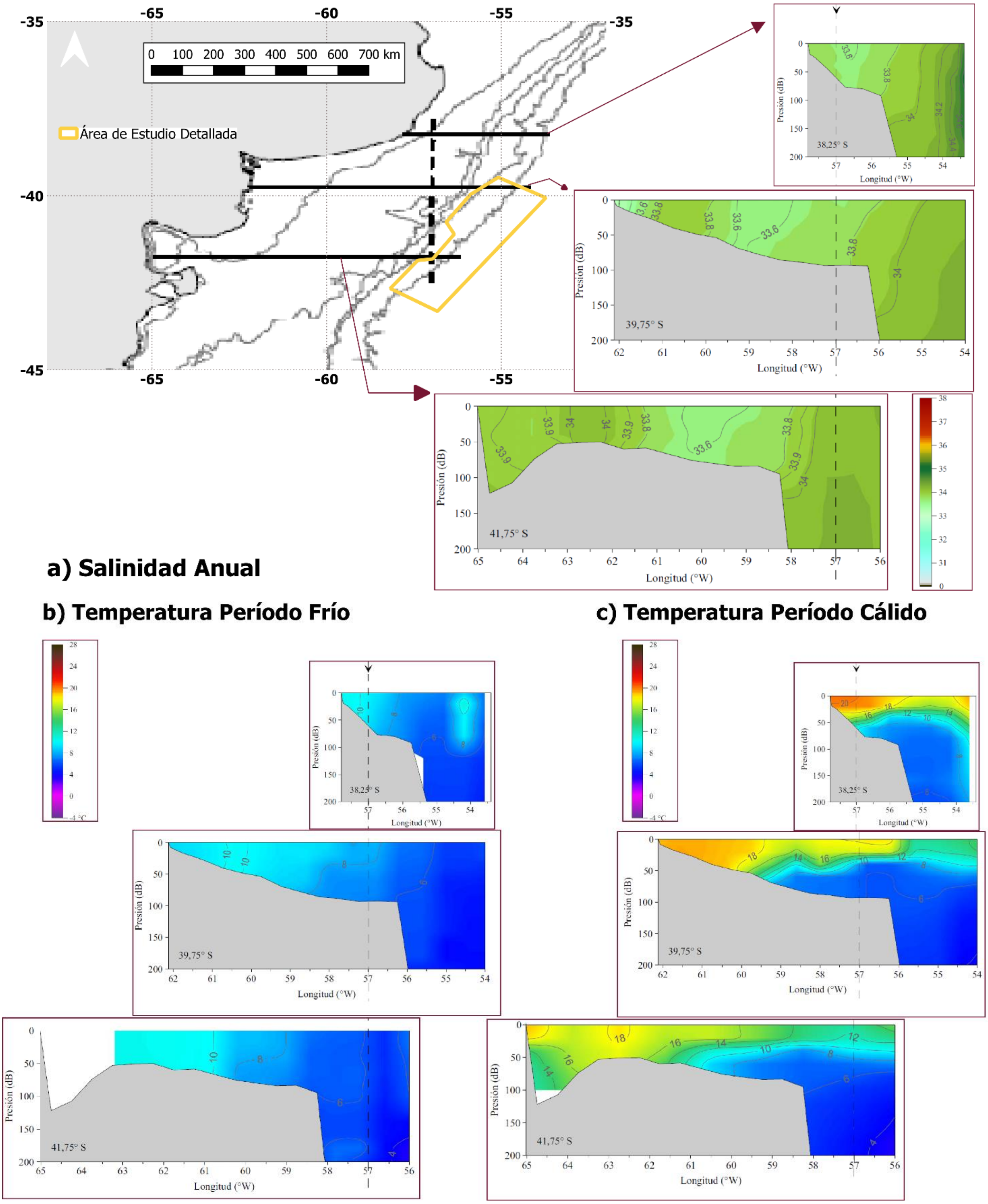


Figure 33. Vertical sections of temperature and salinity, at 38.25 S, 39.75 S and 41.75 S latitudes. a) Annual salinity distribution, b) Temperature distribution during the cold period, c) Temperature distribution during the warm period. Source: Baldoni et al. 2015.

(Translation of Figure 33: Area de Estudio detallada: Detailed Study Area. Salinidad Annual: Annual Salinity. Temperatura período frío: Cold period temperature. Temperatura período cálido: Warm period temperatura. Presión: Pressure. Longitud: Longitude.)

3.2.2 Currents

According to a study carried out by Palma et al. (2008) the average depth circulation in the platform consists of a north direction flow with average velocities of approximately 3.5 cm / s and peaks of more than 7 cm / s. The circulation intensifies in the outer zone of the platform, where it is influenced by the Malvinas current. South of 49ºS there is a well-defined jet in the inner sector of the platform.

The vertical structure of the circulation follows Ekman's solution, which explains the effect of the wind handling currents at depth, as in the case study. It states that when a constant wind blows over an ideal, flat, homogeneous and unlimited sea, there shall be a movement of the most superficial waters in a 45 ° deviated direction (towards the left in the southern hemisphere) with respect to that of the wind. This movement is transmitted towards the successive deeper layers with an exponential attenuation due to friction and continuously deviating in an anticyclonic direction (Ekman spiral, Figure 34).

This means maximum surface speeds and different speeds for each depth, with the direction vector rotating counterclockwise. This pattern can be observed in Figure 35, where the vertical structure of the circulation in the Patagonian platform is observed, being equivalent to a flow of two layers, the upper one goes directly to the northeast and the lower one in the opposite direction. Palma et al. (2008).

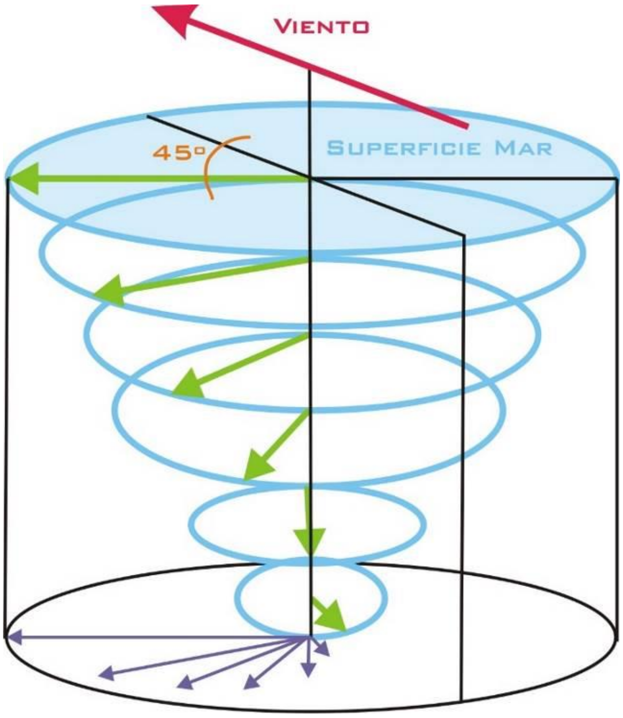


Figure 34. Ekman Spiral.

(Translation of Figure 34: Viento: Wind. Superficie del Mar. Sea Surface.)

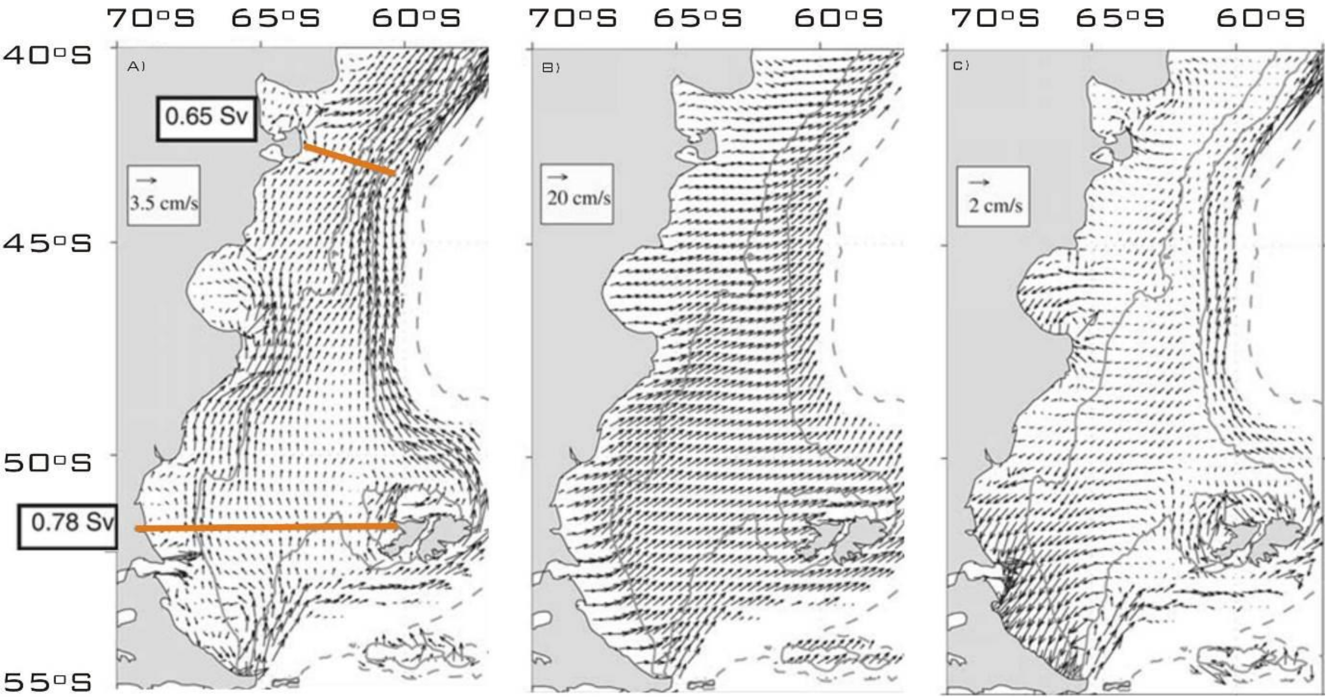


Figure 35. Average annual circulation in the Argentine continental shelf sector. A) Average depth velocity vectors. The numbers within the boxes indicate the transportation (in Sv) through the indicated section. B) Surface velocity vectors. C) Velocity vectors of the lower layer. Solid grey lines indicate the 100 and 200 meter isobaths; the dotted line corresponds to the 1000 m isobath. The vectors are indicated for depths less than 500 m. Source: Palma et al. 2008.

Figure 36 shows the vectors of the current velocity for different periods of the year, according to the variability of the convergence position.

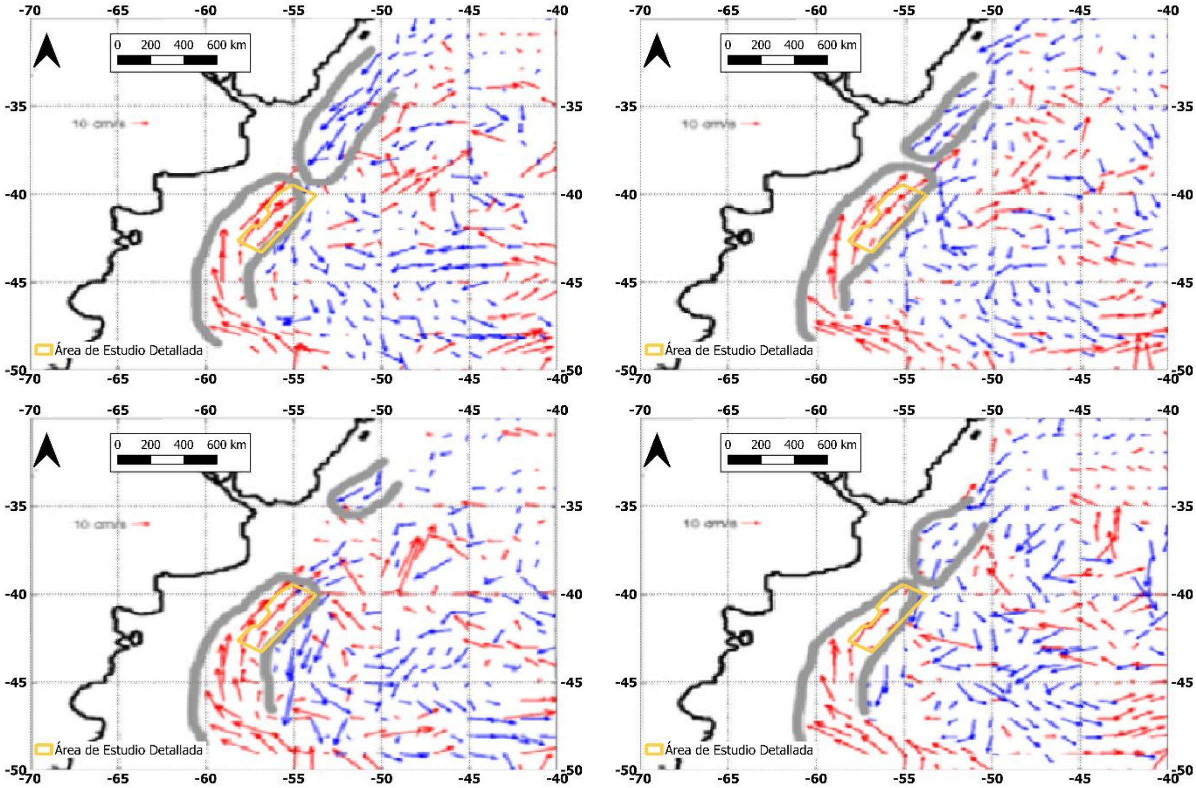


Figure 36. Variability of the convergence position for different periods of the year. The vectors represent the current velocity for one quarter, between 800 and 1100 dbar. The vectors in red are directed to the north, and those in blue to the south. The thick grey lines indicate the extent of the Brazilian and Malvinas currents. From left to right and top to bottom: January-March, April-June, July-September, October-December. Image taken from EIA, S and B SISMICA OFFSHORE 3D AREA 3 - Uruguay. Source: Ezcurra & Schmidt S.A. 2013.

(Translation of Figure 36: Area de estudio detallada: Detailed Study Area)

In relation to the speed of the currents, Figure 37 shows a section of the speed of the marine currents (in cm / s) on the outer platform and the continental slope at a latitude between 38ºS and 39ºS. The light blue colors represent northward flow (positive values), associated with the Malvinas current. The green-yellow-red colors (negative values) represent southward flow, associated with the return of the Malvinas and Brazilian currents (Piola et al. 2008).

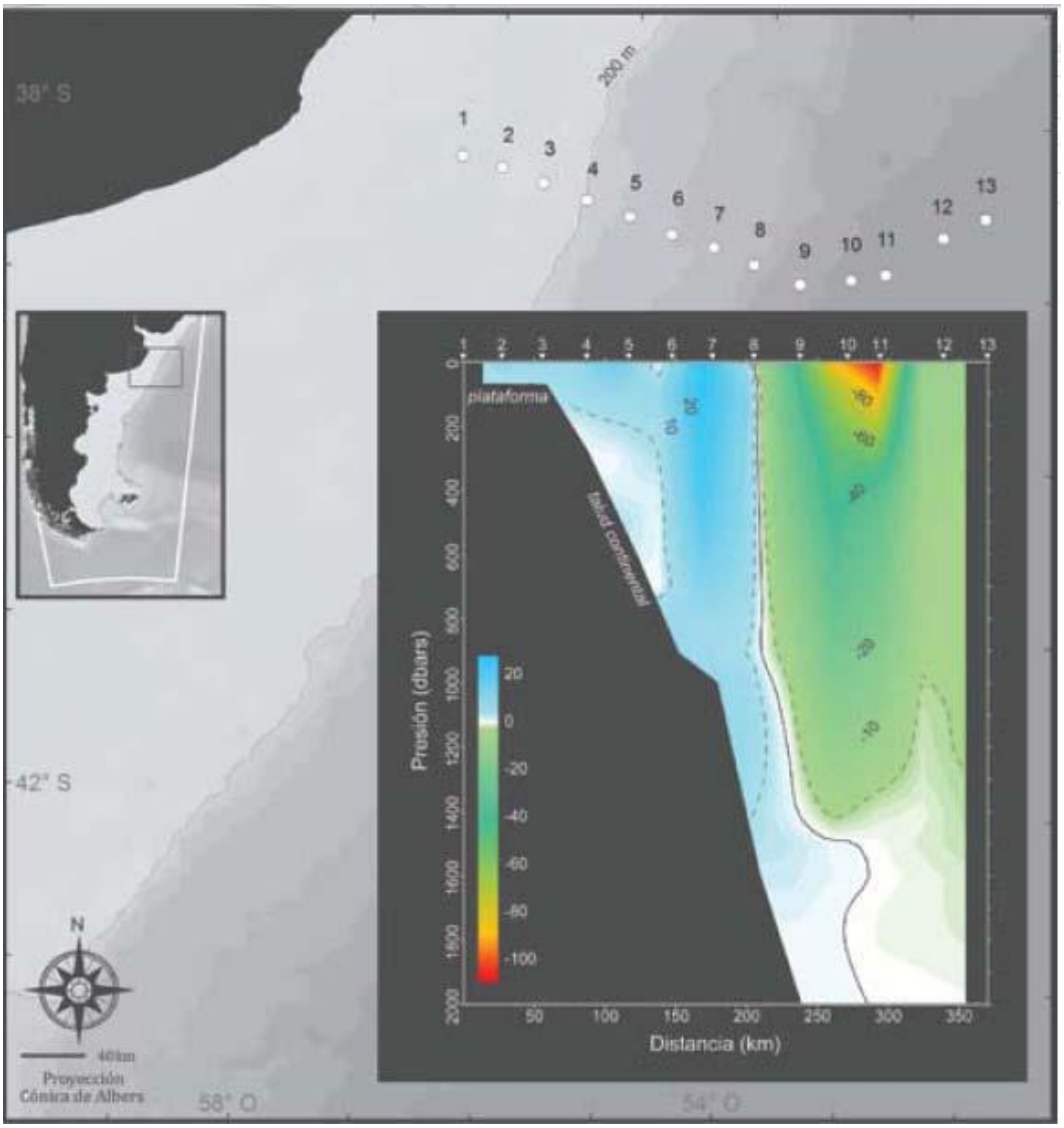


Figure 37. Speed section of the marine currents on the outer platform and the continental slope. Source: Ezcurra & Schmidt S.A. 2013 (modified from Piola et al. 2008).

(Translation of Figure 37: Distancia (Km): Distance (Km).)

Palma et. al (2008) propose a model to simulate currents on the continental shelf and in the adjacent deep ocean. According to the model, the circulation forced by the wind is characterized by a flow towards the NE and a reduction of the transport of mass towards the N. The currents present a significant seasonal variation north of 45ºS and these changes appear in the seasonal variations of the transport. In autumn the model suggests a cyclonic (hourly) circulation on the central platform.

Figure 38 shows surface currents in autumn and spring. Due to the effect of the prevailing west wind, these simulations, which do not include the Malvinas current, suggest that the surface layer water flows mainly towards the ENE and is exported to the deep ocean through the continental slope.

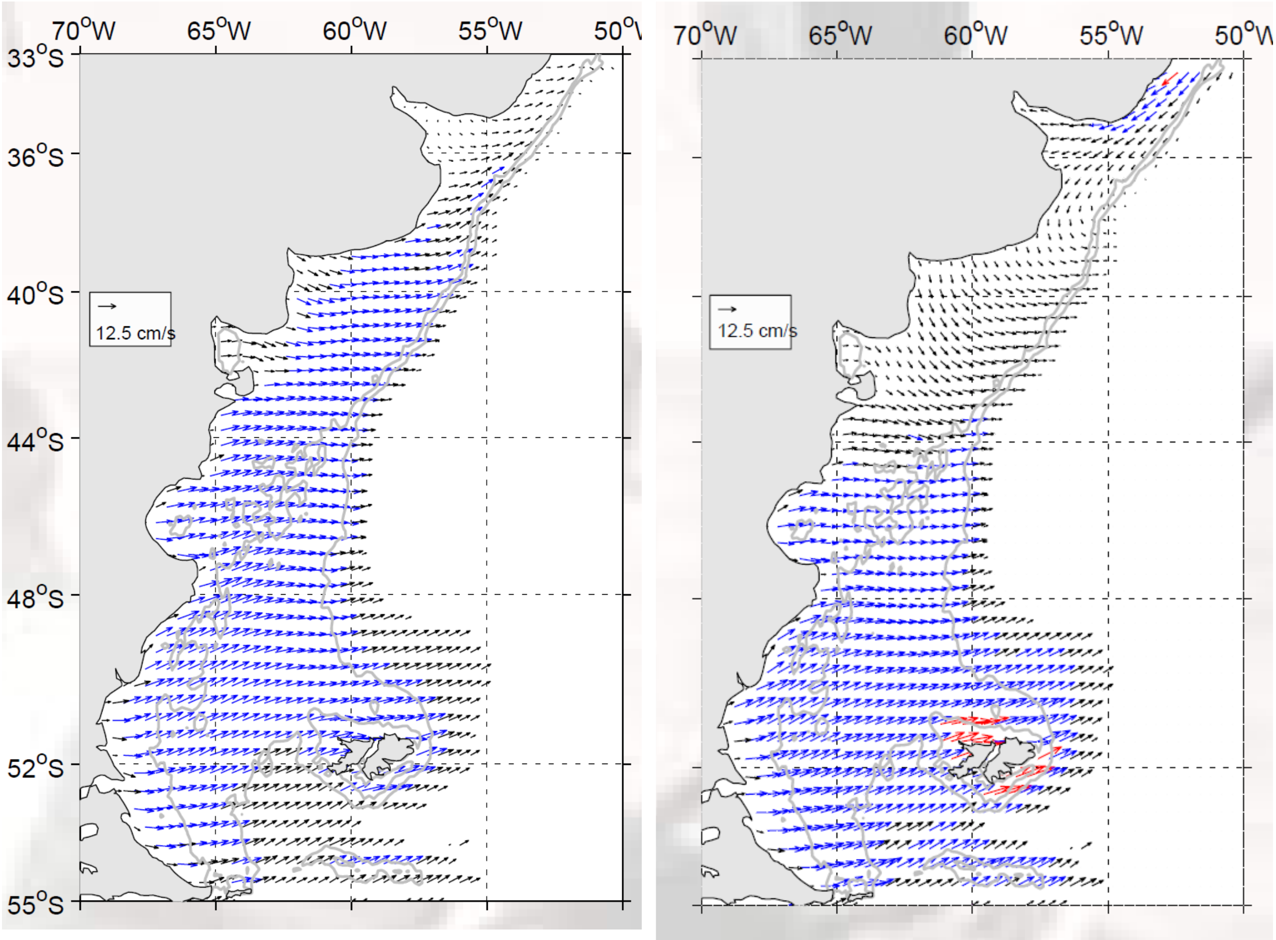


Figure 38. Surface currents in autumn (left) and spring (right) generated by a barotropic model (uniform density) forced with climatological winds (ECMWF). The red vectors represent average speeds between 15 and 20 cm / s, blue between 10 and 15 cm / s and black less than 10 cm / s. The grey lines represent the 100 and 200 m isobaths. Source: Palma et. al (2008).

In the real ocean, the Malvinas current plays an important role and forces the surface flow mainly to the NE. The conservation of mass suggests that the flow towards the E near the coast must be compensated by an opposite transverse circulation in the deep layers (Figure 39).

The current speed in the Cabo de Hornos area exceeds 60-70 cm / s (Zyranov and Sererov, 1979). The average velocity of the divergent Malvinas current reaches 25 cm / s to 50 cm / s (Servicio de Hidrografía Naval, 1993) (Naval Hydrography Service).

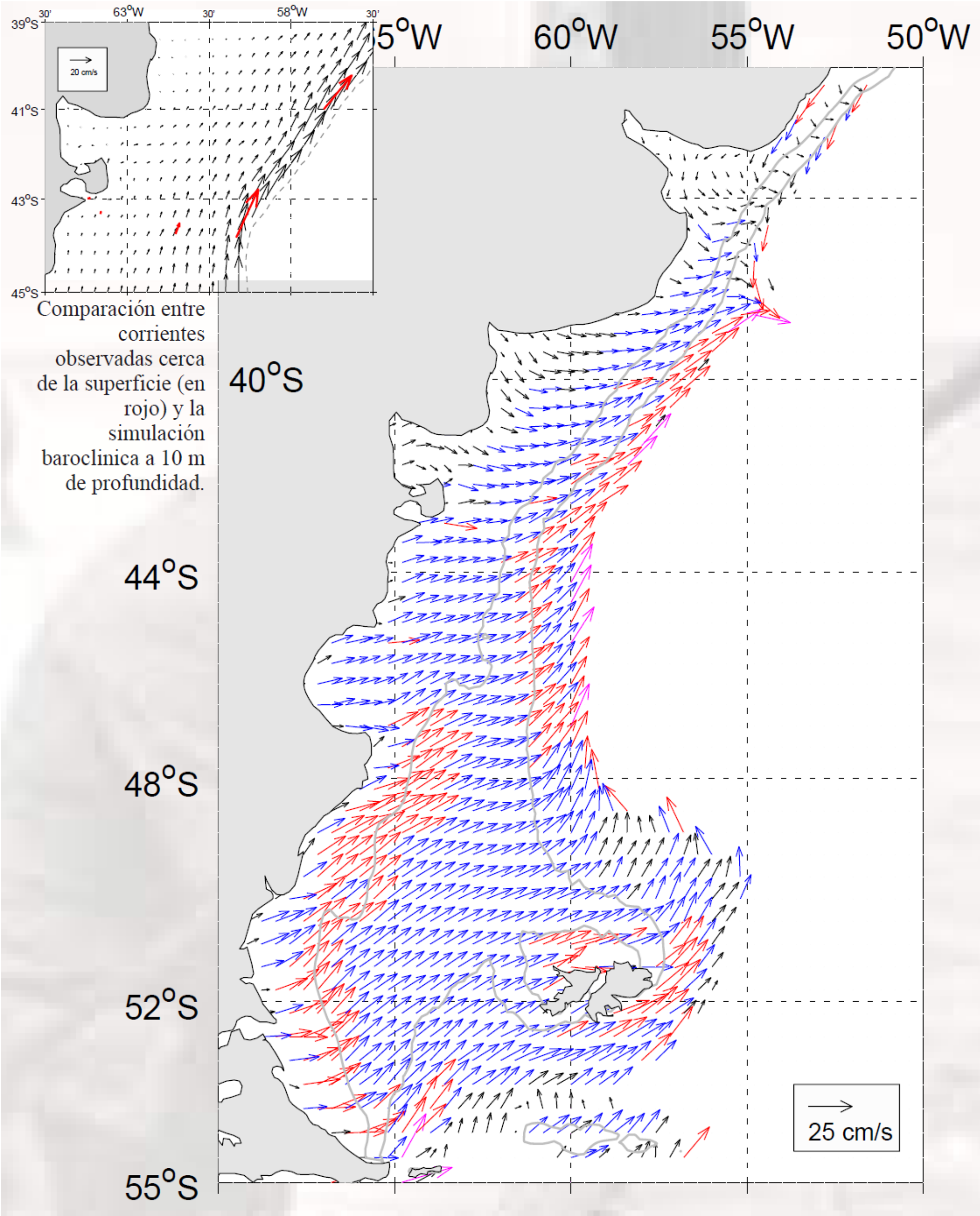


Figure 39. Average annual currents at 10 m-deep generated from a baroclinic simulation (with vertical stratification) that includes the Malvinas current. Note how the currents on the platform deviate to the N and NE on the outer platform and increase their intensity towards the slope. The grey lines represent the 100 and 200 m isobaths of the model. Source: Palma et. al (2008).

(Translation of Figure 39: Comparación entre corrientes observadas cerca de la superficie (en rojo) y la simulación baroclínica a 10 m de profundidad: Comparison between currents observed near the surface (in red) and 10m-deep baroclinic simulation).

On the annual average, mass transport decreases uniformly northward. However, in autumn the northern part of the domain shows an intense transport towards the NE, associated with the relatively intense flow in that direction over the entire platform south of 38ºS (Figure 40). The reversal of the currents in spring in this sector of the platform (Figure 40) produces a weak transport towards the SW.

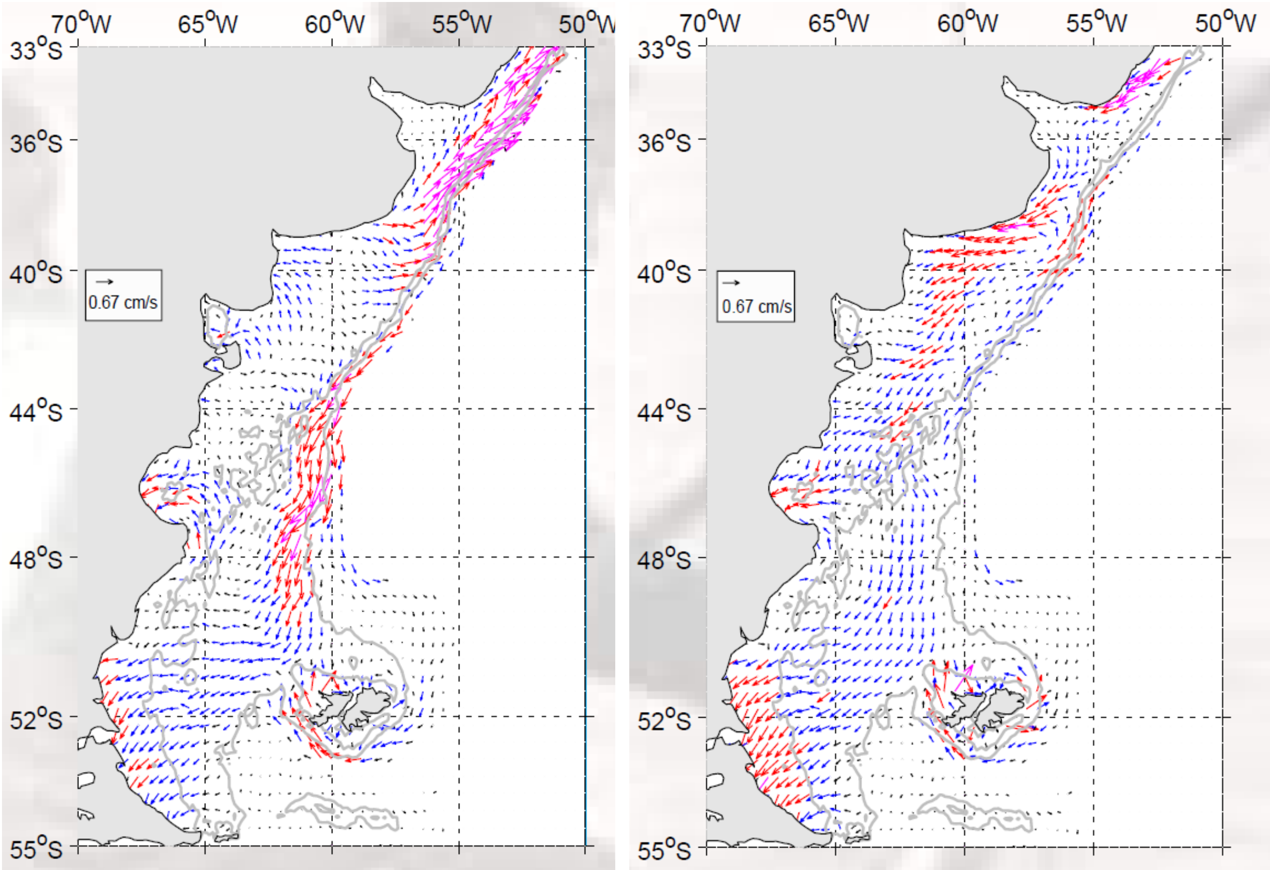


Figure 40. Undercurrents in fall (left) and spring (right). The magenta vectors represent average speeds greater than 1 cm / s, red between 0.5 and 1 cm / s, blue between 0.25 and 0.5 cm / s and black less than 0.25 cm / s. The grey lines represent the 100 and 200 m isobaths. Source: Palma et. al (2008).

North of 41ºS, the intensity of the wind decreases towards the north and the direction shows significant seasonal variations. On the other hand, rainfall exceeds evapotranspiration by approximately 50 mm / year and continental discharge further north is noticeable. An average annual discharge of between 15 and 20x10^3 m^3/s is estimated for the Río de la Plata, and it can double this value on extraordinary occasions.

According to Piola and Rivas (1997) there are disagreements regarding the direction and magnitude of the currents in the region. The numerical models that include the effect of the average wind and the mass field indicate the existence of an average flow towards the NNE with surface velocities of about 0,10 m / s between the coast and the slope. However, on occasions, the influence of the waters of the Río de la Plata would also manifest south to the latitude of Mar del Plata.

By analyzing biological and environmental data, Balech (1949, 1965, 1971) also infers a flow towards the NNE, but proposed the existence of a countercurrent towards the SSW in summer which he called Coastal Warm Drift.

Boltovskoy (1970, 1981) also suggests that the presence of warm waters in the Buenos Aires coastline is restricted to the north of 40ºS and that it is mainly due to seasonal warming. The appearance of subtropical species in the coastal region is due to the infiltration of a western branch of subtropical waters to the west of the Malvinas current that would reach the coastal area due to the effect of the wind and *eddies*.

The monthly average current fields in the present study area are shown in Figure 41, Figure 42, Figure 43, Figure 44, Figure 45, Figure 46, Figure 47, Figure 48, Figure 49, Figure 50, Figure 51 y Figure 52.

These current fields are a product of the COPERNICUS Space Program, formerly GMES (Global Monitoring for Environment and Security), which is the European Program aimed at promoting the European capacity for Earth Observation and Monitoring. This product is accessed through the “My Ocean” Platform.

In the hereinabove mentioned figures, the polygons correspond to CAN_100 - CAN_108 (white color) and CAN_114 (fuchsia color) operative areas.

There is great variability in the field of currents within the area of interest, both in intensity and direction, which is associated with the dynamics of the confluence of the Brazilian and Malvinas currents.

The west branch (Patagonian current) of the Malvinas current runs on the platform.

The eastern branch of the Malvinas current can be clearly distinguished on the slope front tracing the edge of the continental shelf, with speeds of 1 m / s in some sectors.

When meeting the warm current of Brazil that flows south, the Malvinas current draws a sharp turn to the south facing the province of Buenos Aires, becoming the Malvinas return current, with speeds reaching 1.5 m / s.

As a product of the high dynamics of the confluence, numerous large-scale meanders and *eddies* are produced, which are detachments of the two currents that generate intrusions of a body of warm water (Brazilian current) in a body of cold water (current of Malvinas) and vice versa.

The area is characterized by significant seasonal variations, as the Brazilian and Malvinas currents meet north or south depending on the season of the year.

The typical water mass is that of Malvinas within CAN_114 operative Area towards the south, with speeds that do not exceed 0.5 m / s, except in the area closest to the edge of the platform where the current can reach somewhat higher speeds.

Towards the north, the operational area CAN_100 - CAN_108 is covered by both the cold water mass of Malvinas and the warm water of Brazil in their confluence area, as well as by the mixing zone between them with their big *eddies* and/or meanders.

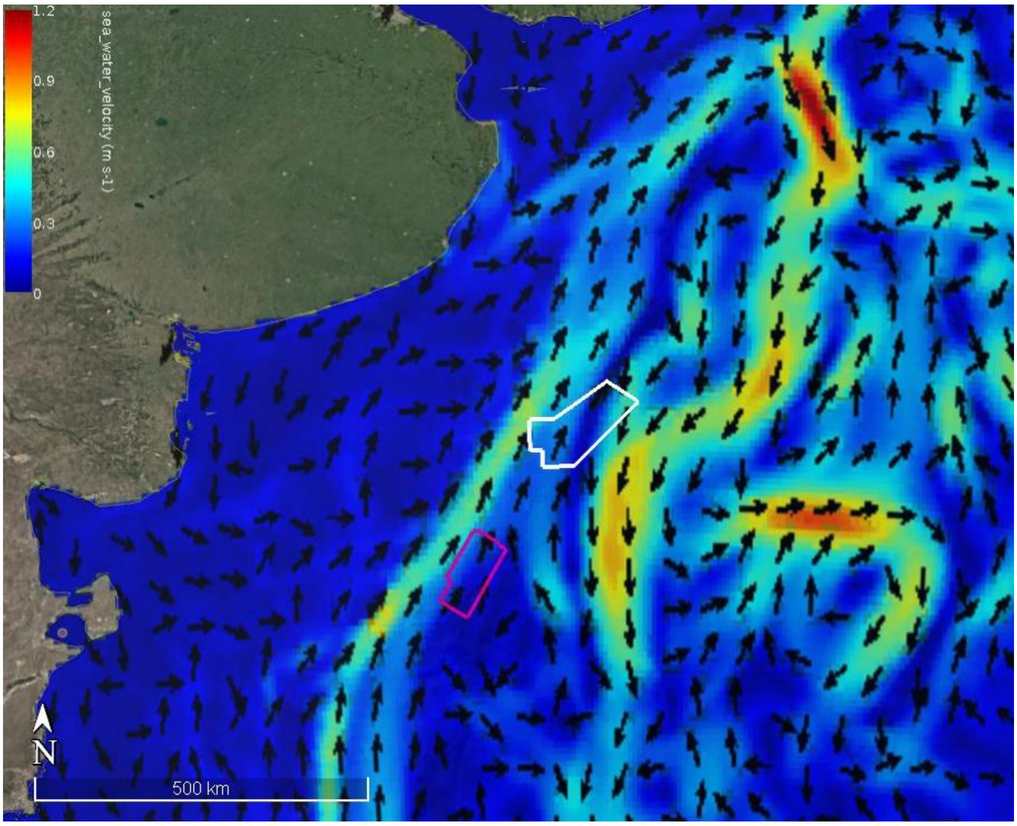


Figure 41. Average surface speed (m / s) for the month of January. Source: COPERNICUS Space Program, "My Ocean" platform.

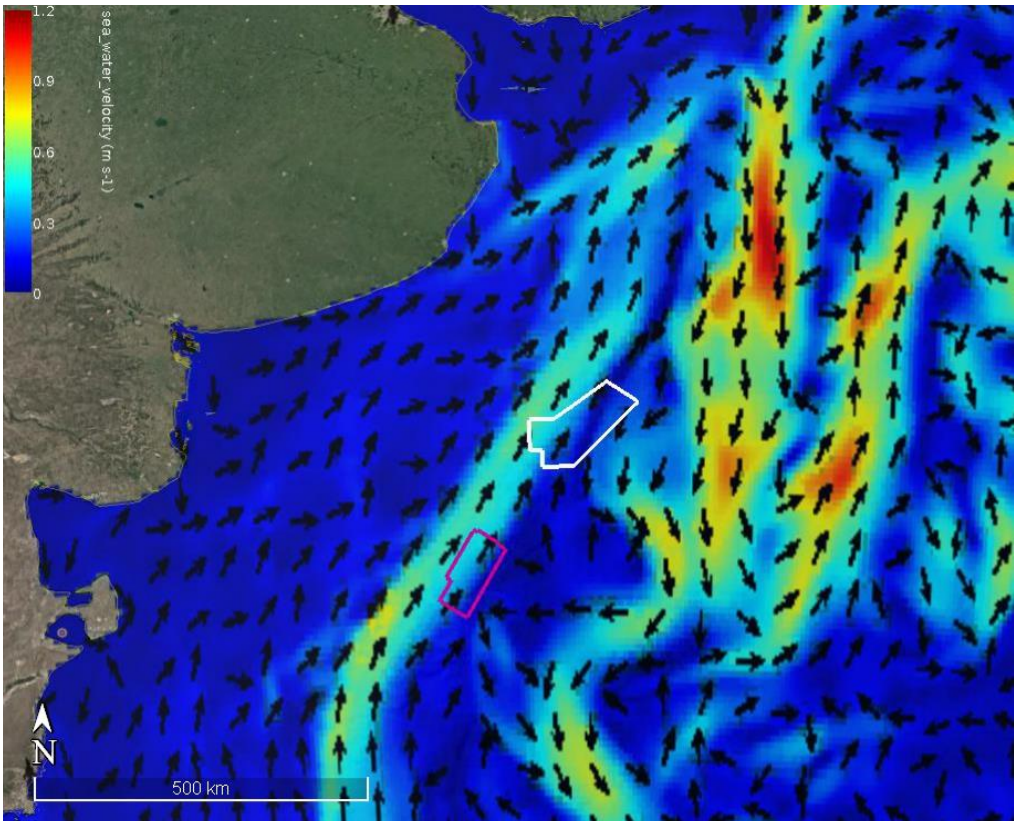


Figure 42. Average surface speed (m / s) for the month of February. Source: COPERNICUS Space Program, "My Ocean" platform.

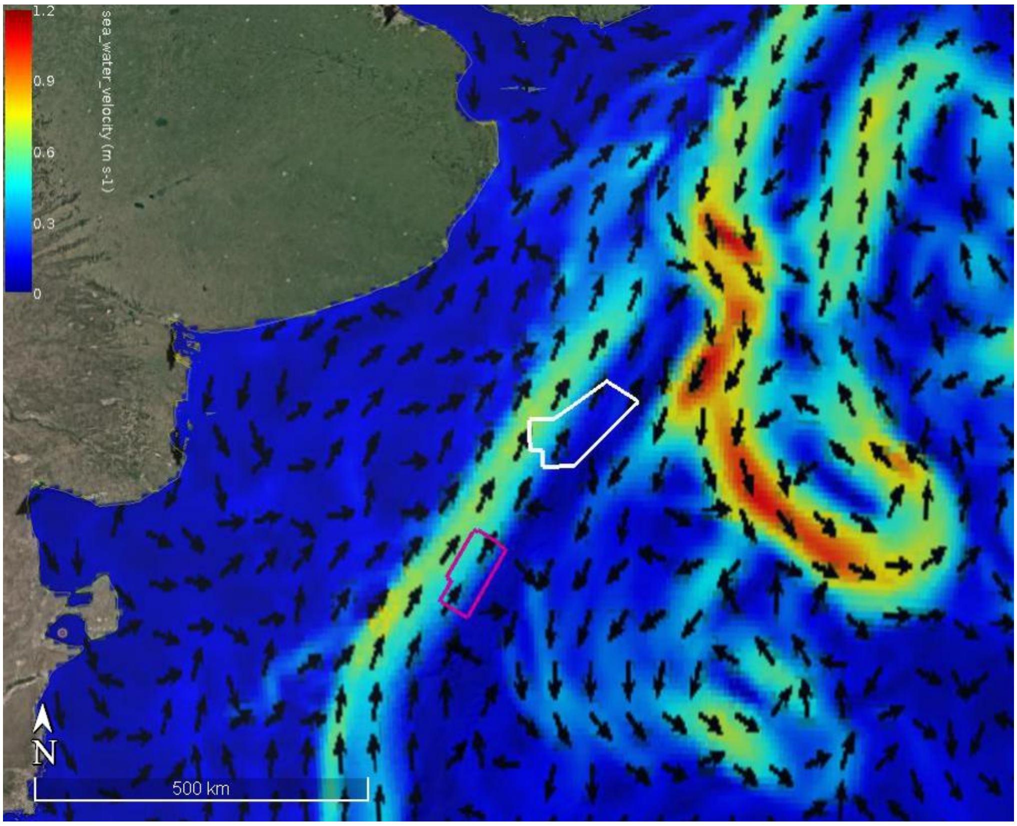


Figure 43. Average surface speed (m / s) for the month of March. Source: COPERNICUS Space Program, "My Ocean" platform

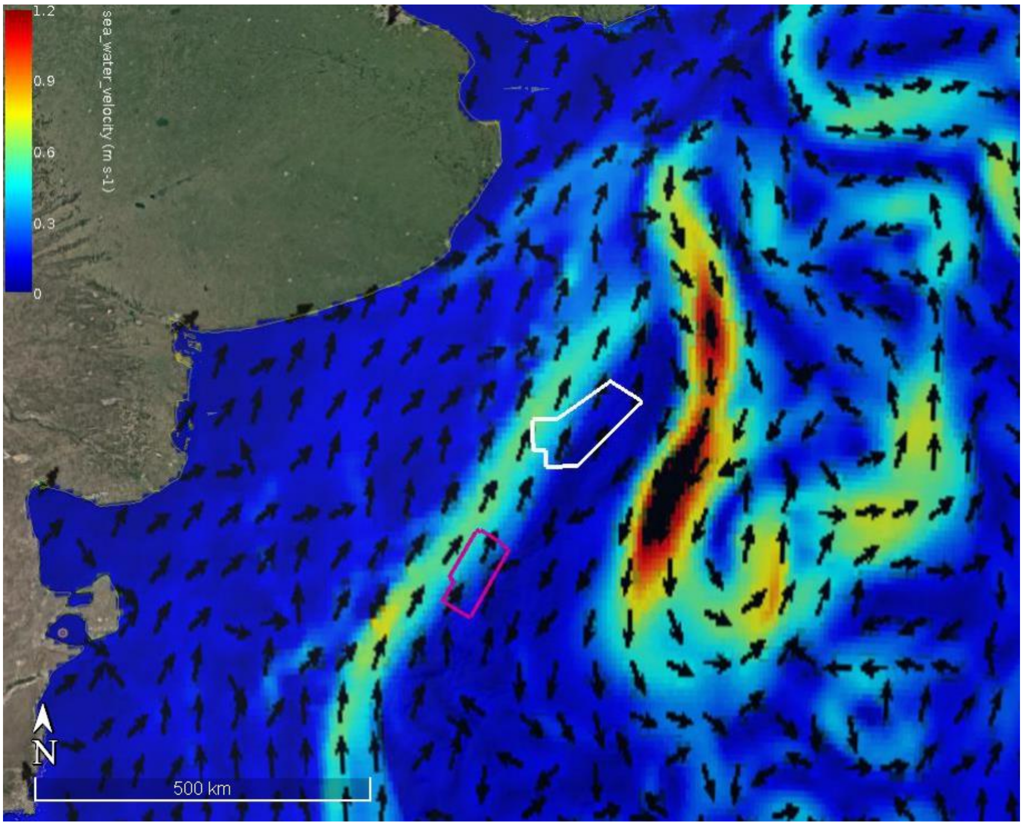


Figure 44. Average surface speed (m / s) for the month of April. Source: COPERNICUS Space Program, "My Ocean" platform.

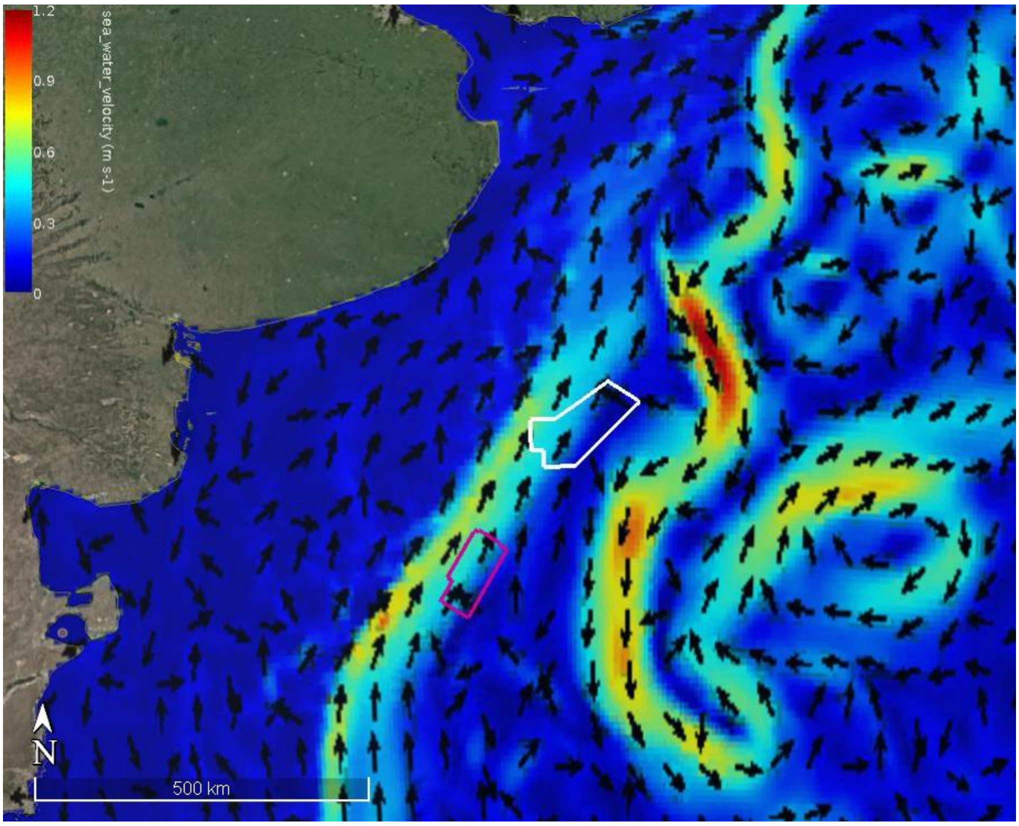


Figure 45. Average surface speed (m / s) for the month of May. Source: COPERNICUS Space Program, "My Ocean" platform.

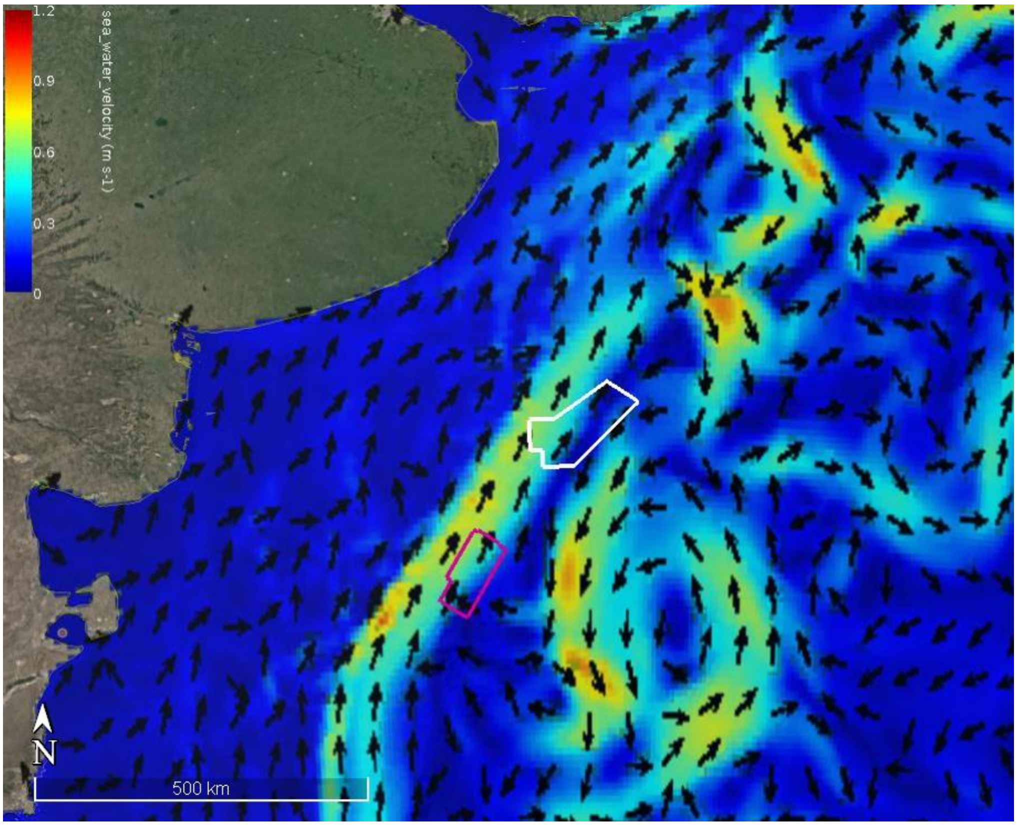


Figure 46. Average surface speed (m / s) for the month of June. Source: COPERNICUS Space Program, "My Ocean" platform.

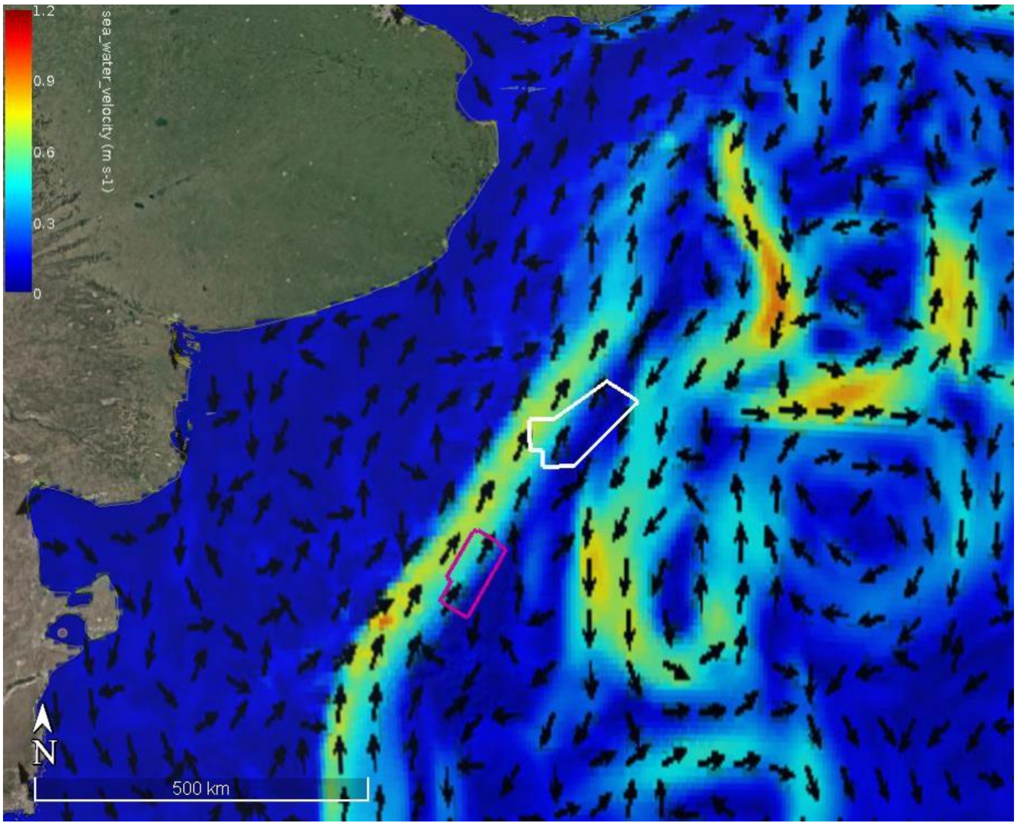


Figure 47. Average surface speed (m / s) for the month of July. Source: COPERNICUS Space Program, "My Ocean" platform.

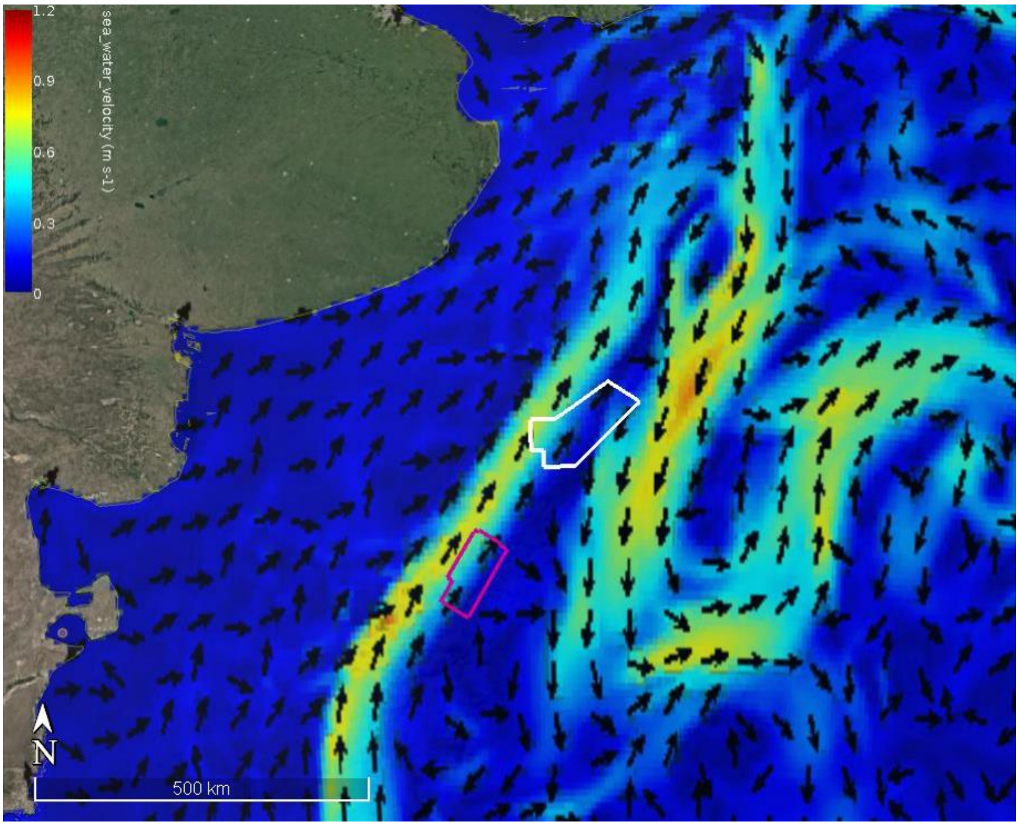


Figure 48. Average surface speed (m / s) for the month of August. Source: COPERNICUS Space Program, "My Ocean" platform.

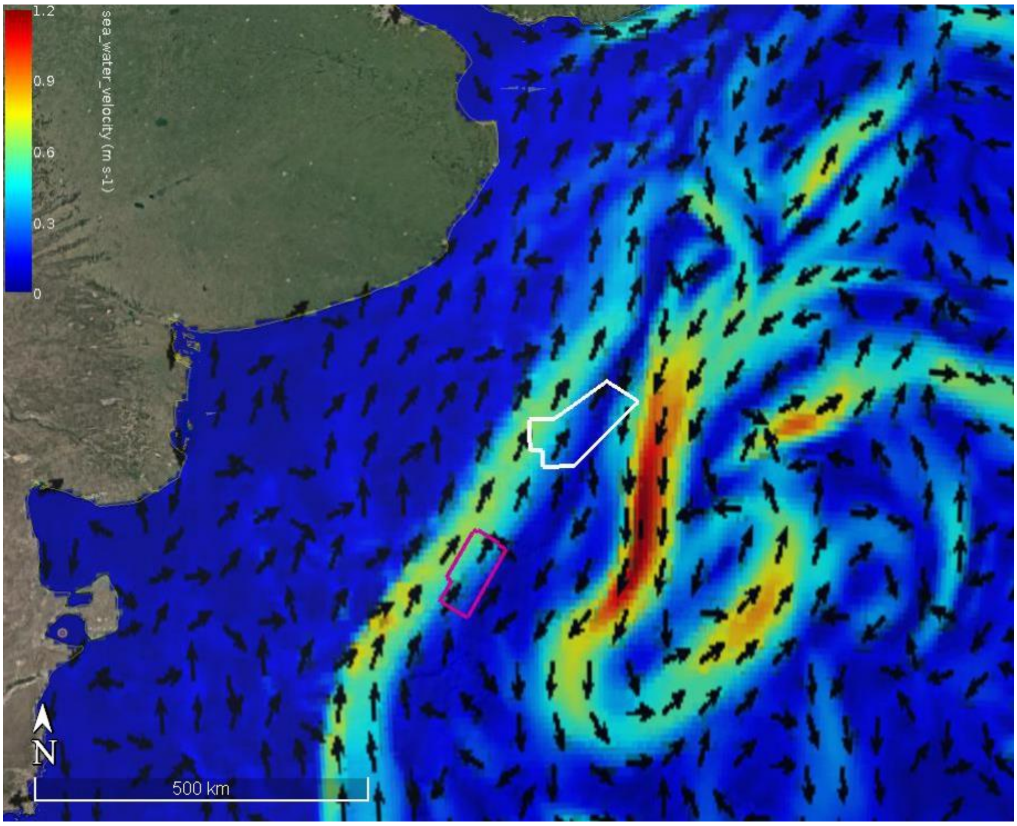


Figure 49. Average surface speed (m / s) for the month of September. Source: COPERNICUS Space Program, "My Ocean" platform.

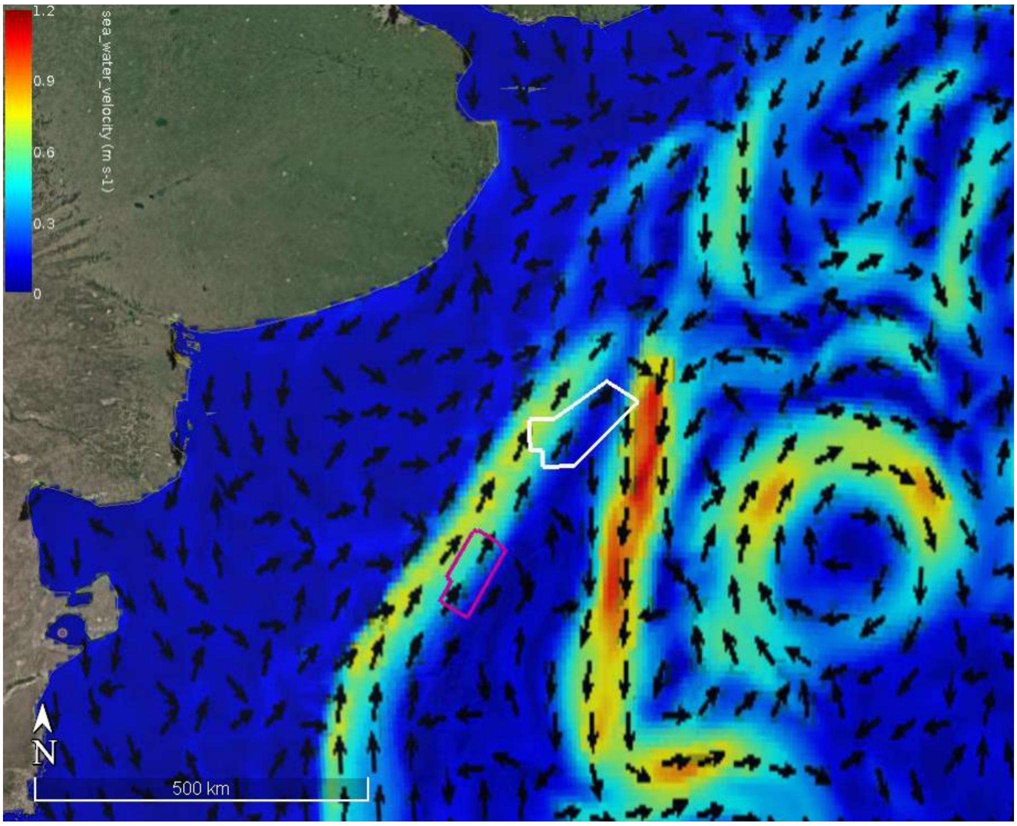


Figure 50. Average surface speed (m / s) for the month of October. Source: COPERNICUS Space Program, "My Ocean" platform.

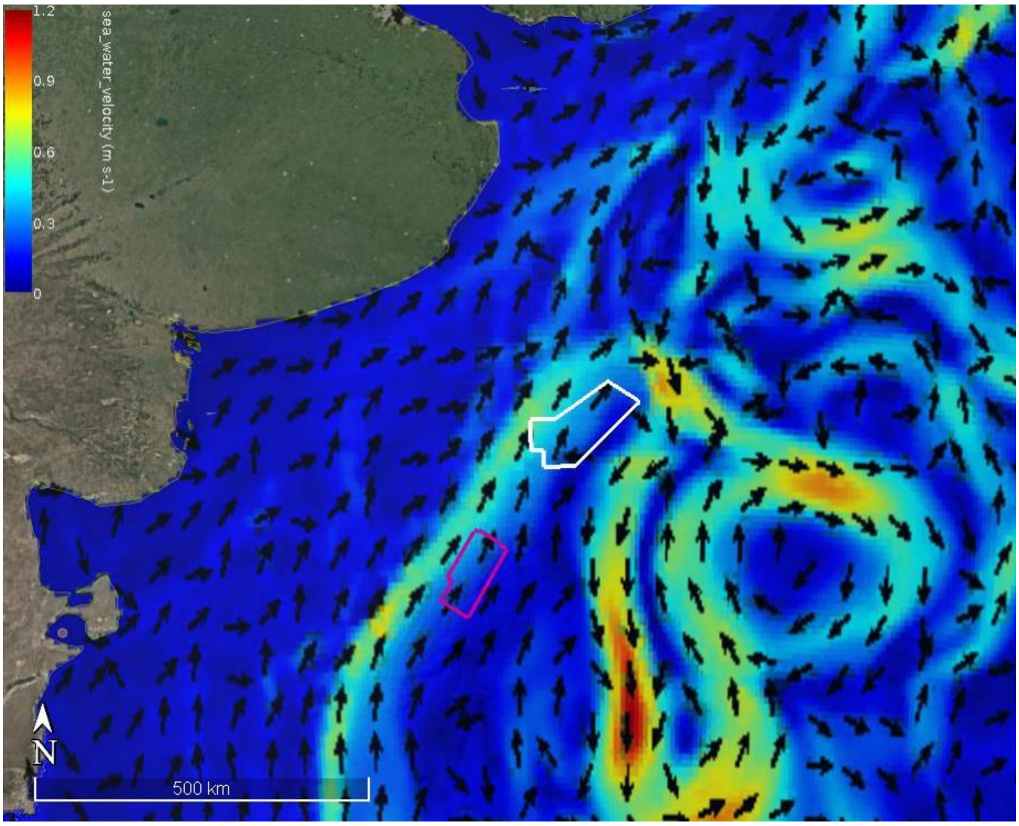


Figure 51. Average surface speed (m / s) for the month of November. Source: COPERNICUS Space Program, "My Ocean" platform.

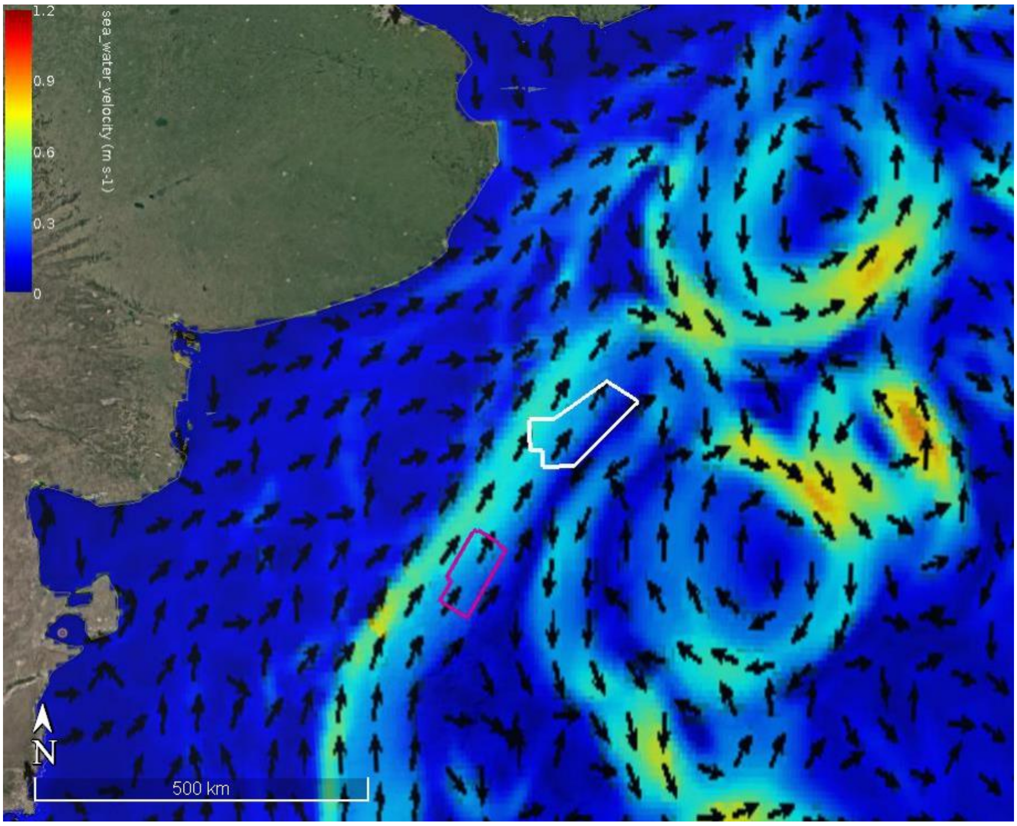


Figure 52. Average surface speed (m / s) for the month of December. Source: COPERNICUS Space Program, "My Ocean" platform.

3.2.3 Tides

In a simulation, the forcing tide can be characterized by the amplitude and phase of the main harmonic (M2), the dissipation rate of the tides, and the tidal energy flow (Palma et al., 2004). The M2 Harmonic is part of an amphidromic system located in the proximity of the Greenwich meridian and 60 S (Genco et al., 1994). It spreads from the southwest to the northeast and its amplitude decreases, due to friction effects, from a maximum of 4 m in Bahía Grande to less than 30 cm north of Bahía Blanca (Figure 53).

When the tidal pattern presents great amplitude, the tides influence the magnitude of the vertical mixing, as it occurs in the Patagonian Platform. It should be noted that in the Detailed Study area, located beyond the edge of the continental shelf (not legal - see Point **Error! Reference source not found.**), the amplitude of the tide and consequently its speeds are of small magnitude, so its contribution to the current total field is negligible.

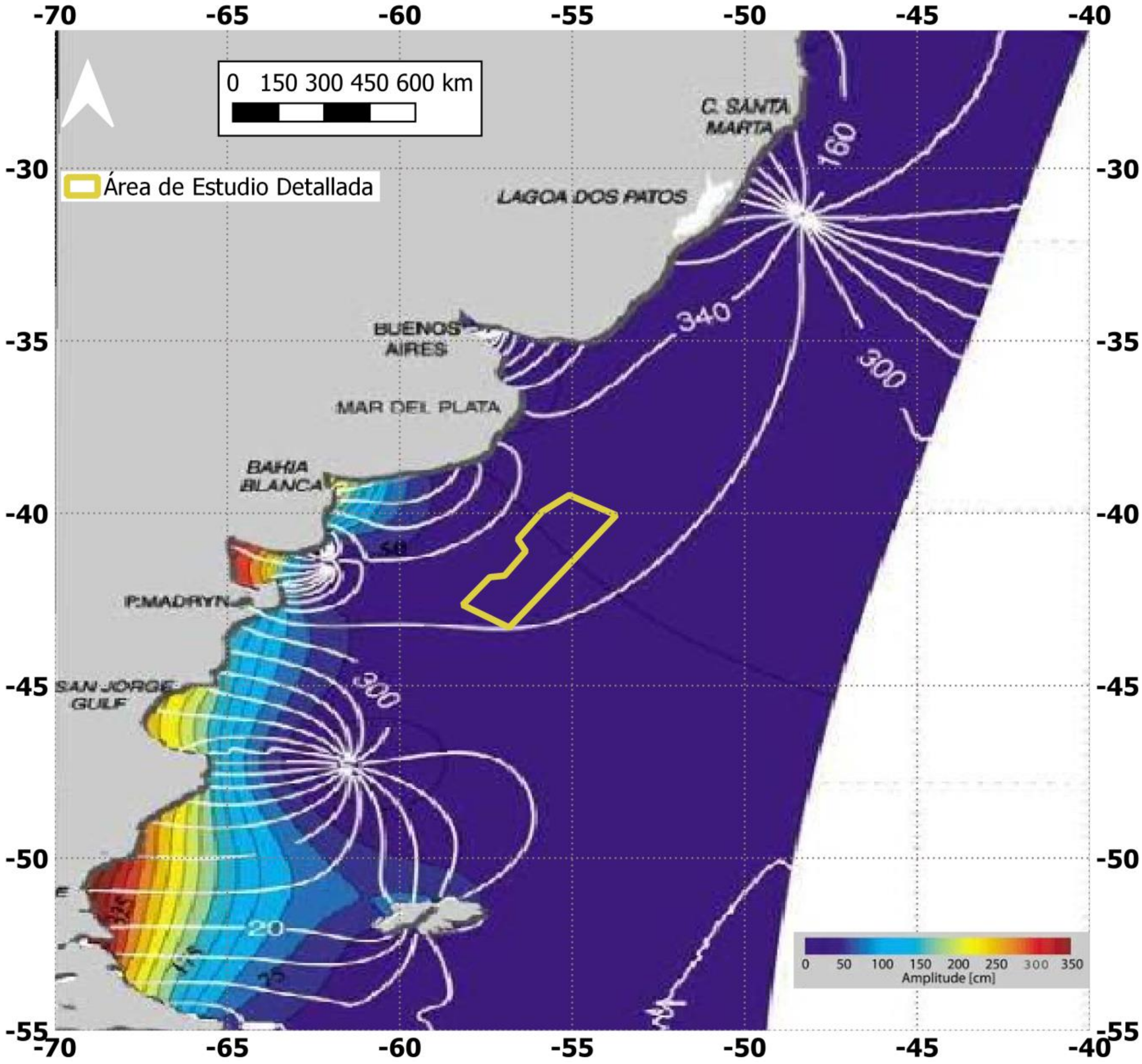


Figure 53. Co-tidal chart and amplitudes of the main lunar tidal component (M2) every 20º. Source: Palma et al., 2004.

(Translation of Figure 53: Area de Estudio detallada: Detailed Study Area).

3.2.4 Wave Climate

The wind system in the study area generates a very rough sea in all seasons of the year with waves of varying height and direction (Environment Technology & Resource 1997). In this sense, the increase in sea-state is typically generated as a result of storms taking place through the Drake Passage and over South America. The storms coming from the west rapidly generate increases in the sea state, but they do not last more than 2 or 3 days, unless the area is affected by consecutive storms (Upton and Shaw 2002).

Dragani et al. (2010) studied the trends in the last decades of the annual average and maximum wave values in the eastern sector of the South American continental shelf between 32 ° S and 40 ° S, based on in situ and remote observations and numerical simulations carried out through the forced SWAN model with NCEP / NCAR re-analyses (NCEP: National Centers for Environmental Prediction, NCAR: National Center for Atmospheric Research).

Figure 54 shows the study area and the location of different wave analysis points.

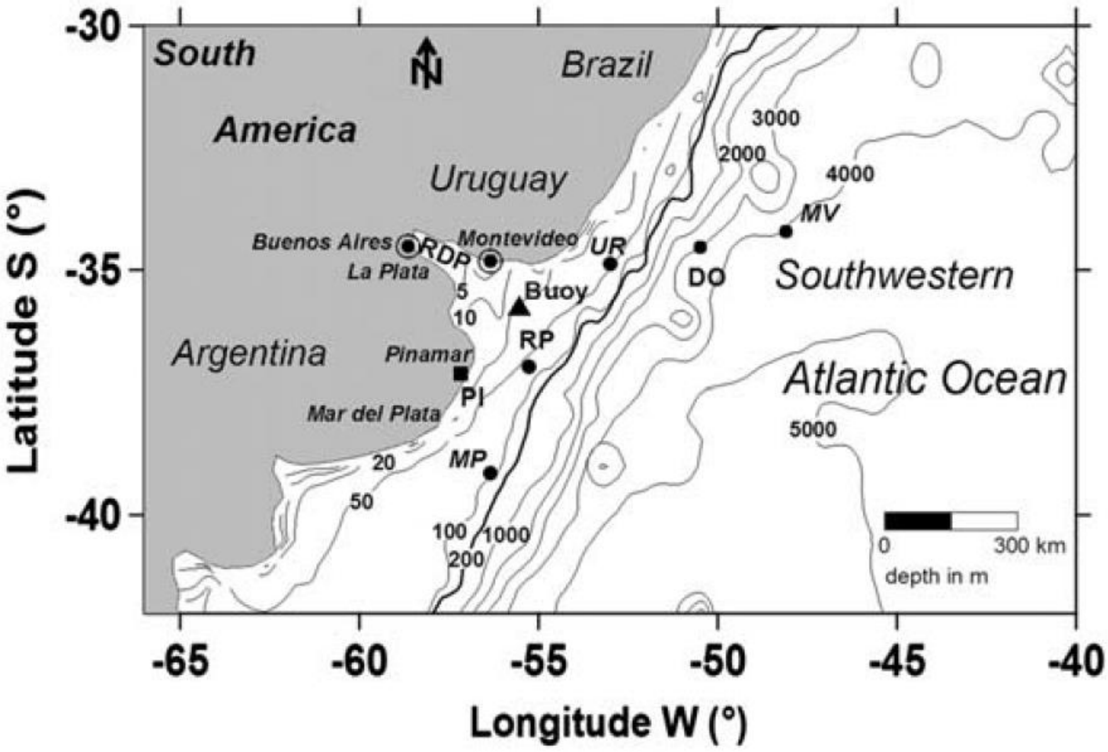


Figure 54. SWAN model implementation area. The wave height study points are MP: Mar del Plata continental shelf, RP: Río de la Plata mouth, UR: Uruguayan continental shelf, DO: deep ocean and MV: maximum variation. RDP: Río de la Plata. The triangle shows the position of a Datawell Waverider olimeter. Source: Dragani et al. (2010).

The series of mean annual wave heights recorded by remote observations (TOPEX Ocean Topography Experiment) between 1993 and 2002 are shown in the Figure 55 for UR, MP and DO points indicated in Figure 54).

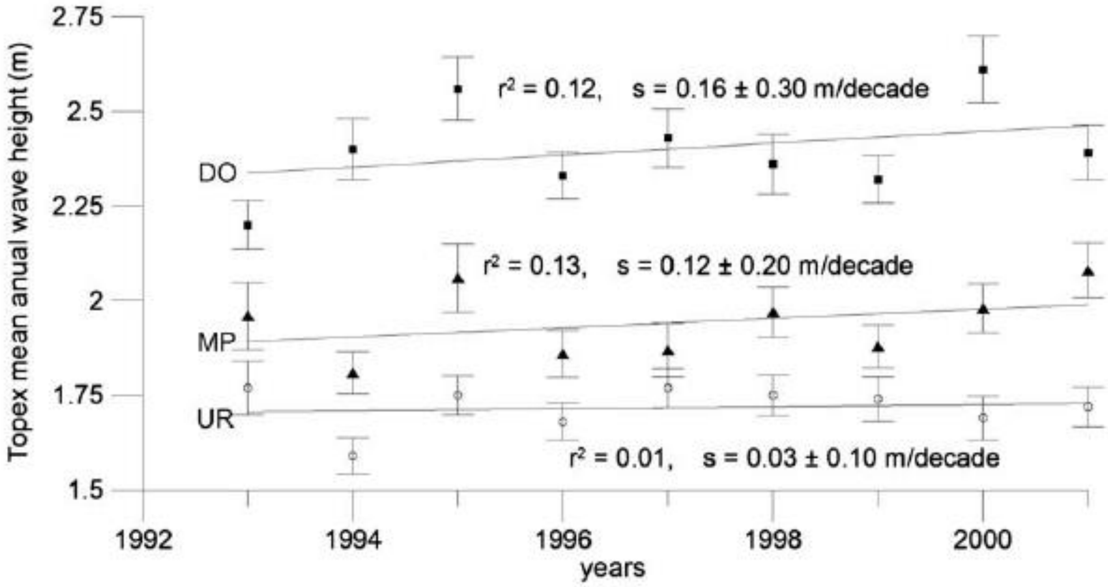


Figure 55. Annual averages of significant wave height (TOPEX, 1993-2002 period) in UR, MD and DO (see location in Figure 53). The corresponding minimum squares regression lines are included. Source: Dragani et al. (2010).

It is possible to observe a great interannual variability, with a slight tendency to increase in height. The largest increases were recorded between 1994 and 1995 in the three points and between 1999 and 2000 in DO.

On the other hand, the results obtained through the regional application of the SWAN mathematical model forced by the NCEP / NCAR wind field for the 1971-2005 period in the calculation domain presented in Figure 54 (Dragani et al. 2010), which includes regions as dissimilar as the shallow Río de la Plata, the Uruguayan continental shelf, part of the Brazilian and Argentine continental shelves, the outer edge of the shelf and a sector of the Southwest Atlantic Ocean.

The mean fields (1971-2005 period) of mean square height and wave period obtained by modeling with SWAN are presented in Figure 56.

It can be observed that the height and the wave period gradually decrease towards the coast, from approximately 2.5 m / 4.5 s in the southeastern sector of the model to less than 1.0 m / 2 s at the mouth of the Rio de la Plata. Directions are predominantly west to north of 37 ° S and northwest to south.

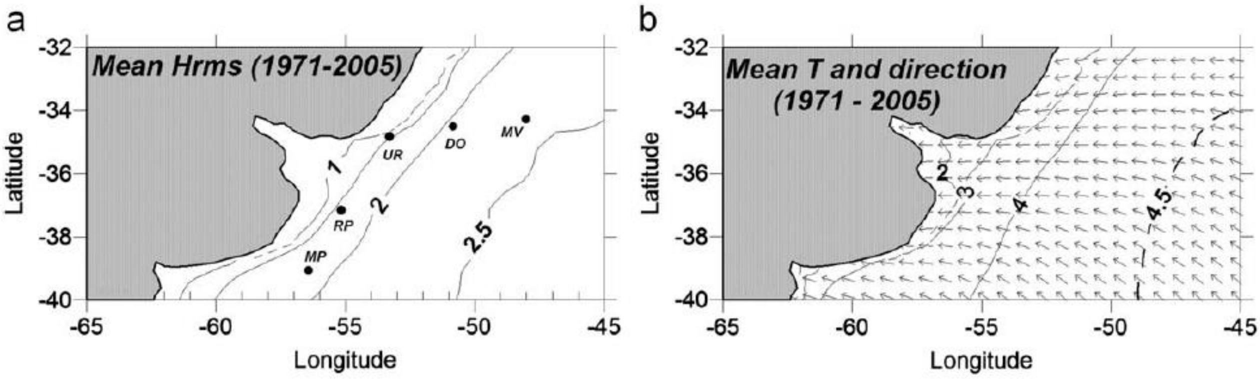


Figure 56. SWAN model of 1971-2005 period: (a) mean quadratic significant wave height (meters) and (b) mean period (seconds) and mean direction of propagation (unscaled arrows). Source: Dragani et al. (2010).

The time series obtained from annual maximums of significant wave height are presented in Figure 57, showing a slight upward trend, in the same way as for the mean annual heights of TOPEX (Figure 55).

It is important to highlight that the results obtained by the SWAN model reflect only the swell produced by the acting wind on the calculation domain ("sea"), since the one that enters through the limits of the model ("swell") is not considered in simulations.

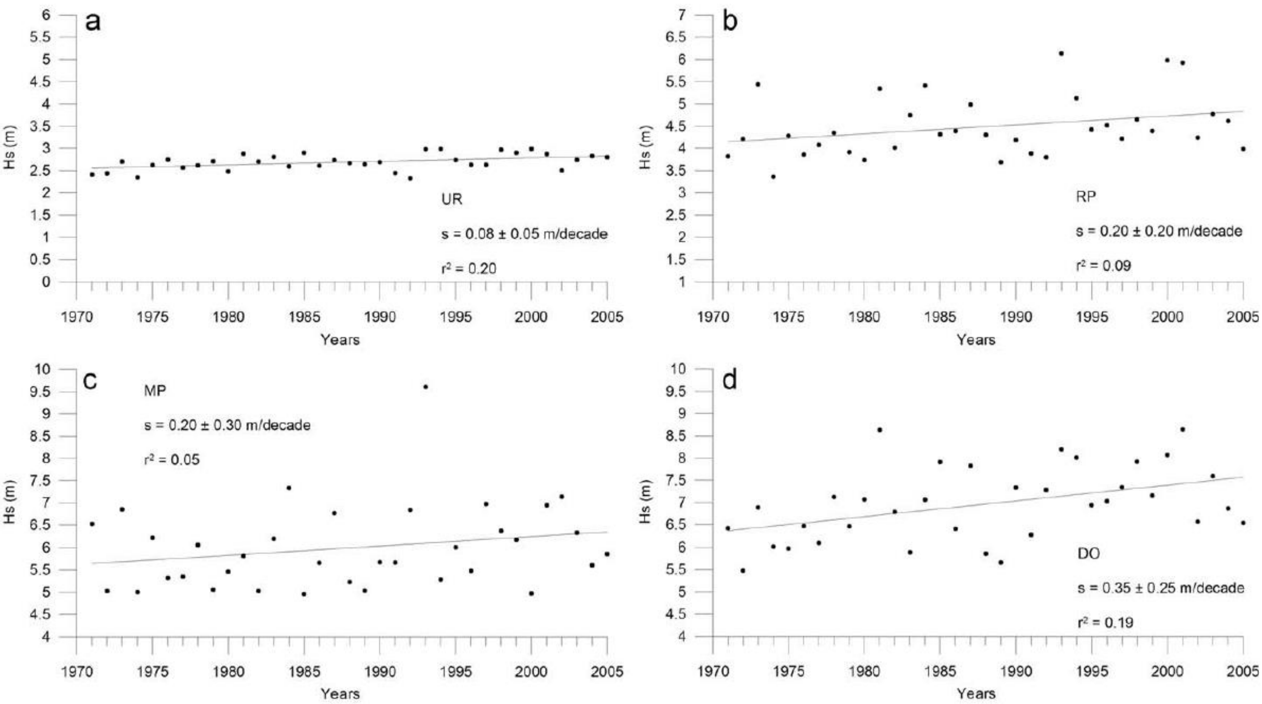


Figure 57. Annual maximums of significant wave height (SWAN model, 1971-2005 period) in UR (a), RP (b), MP (c) and DO (d) (see location in Figure 53). The corresponding minimum squares regression lines are included. Source: Dragani et al. (2010).

According to Dragani et al. (2010) and different studies cited by them, these variations could be a consequence of the occurrence of changes in the lower circulation of the atmosphere in the Southwest Atlantic.

Wave climate information is also available through different global models. The content provided by the Global Atlas of Ocean Waves (1970-2011 period) is presented below.

The Global Atlas of Ocean Waves is based on VOS (Voluntary Observation Vessel Program) observations and is the result of a cooperation project funded by the European Union whose participants are PP Shirshov Institute of Oceanology, Russian Academy of Science (Moscow), Southampton Oceanography Center (Southampton) and Royal Netheralands Meteologigal Institute (De Bilt).

Figure 58 shows the mean annual wave height according to said source and Figure 59, shows the corresponding periods.

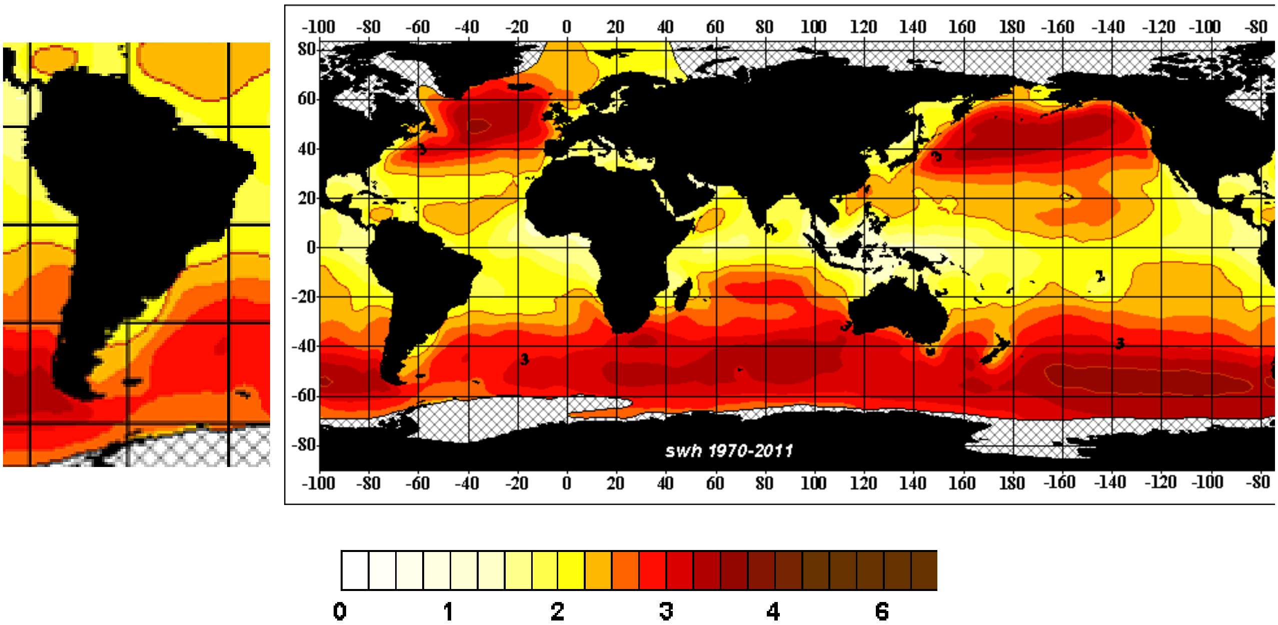


Figure 58. Mean annual wave period (in seconds) for the 1971-2005 period. Source: Global Atlas of Ocean Waves.

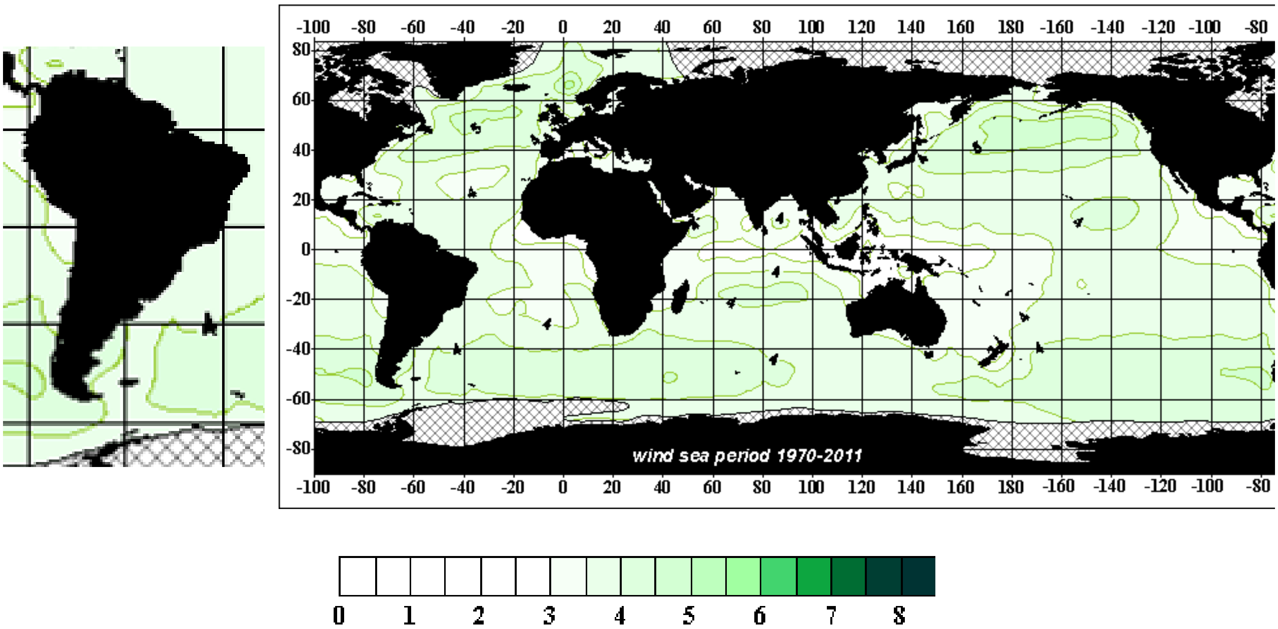


Figure 59. Mean annual wave period (in seconds) for the 1971-2005 period. Source: Global Atlas of Ocean Waves.

The analysis of wind and wave data series from the IOWAGA project (Integrated Ocean Waves for Geophysycal and other Applications), developed by the IFREMER research institute (France), is presented below. The numerical model applied in obtaining the database corresponds to WAVE-WATCH III, which is a third-generation wave model developed by NOAA / NCEP (National Oceanic and Atmospheric Administration / National Centers for Environmental Predictions). It was implemented in its GLOBAL grid mode, with winds coming from the ECMWF (European Center for Medium-Range Weather Forecasts) base.

The data is organized by month and with a 3-hour time interval. The cell size of the data grid varies by area, from the French Atlantic coast grid with a 1/30 ° resolution to the GLOBAL grid with a 0.5 ° resolution.

The information provided by this database includes not only the description of the total energy spectrum corresponding to each moment of the record, but also provides specific information on the energy component provided by the waves generated by local winds (sea) and by the different main components associated with oceanic waves propagated from different generation zones (swell).

Monthly validations with buoy measurements have shown excellent reliability of this model.

Figure 60 shows a map of CAN_100 - CAN_108 and CAN_114 operating areas, and of two IFREMER nodes located in each of said areas.

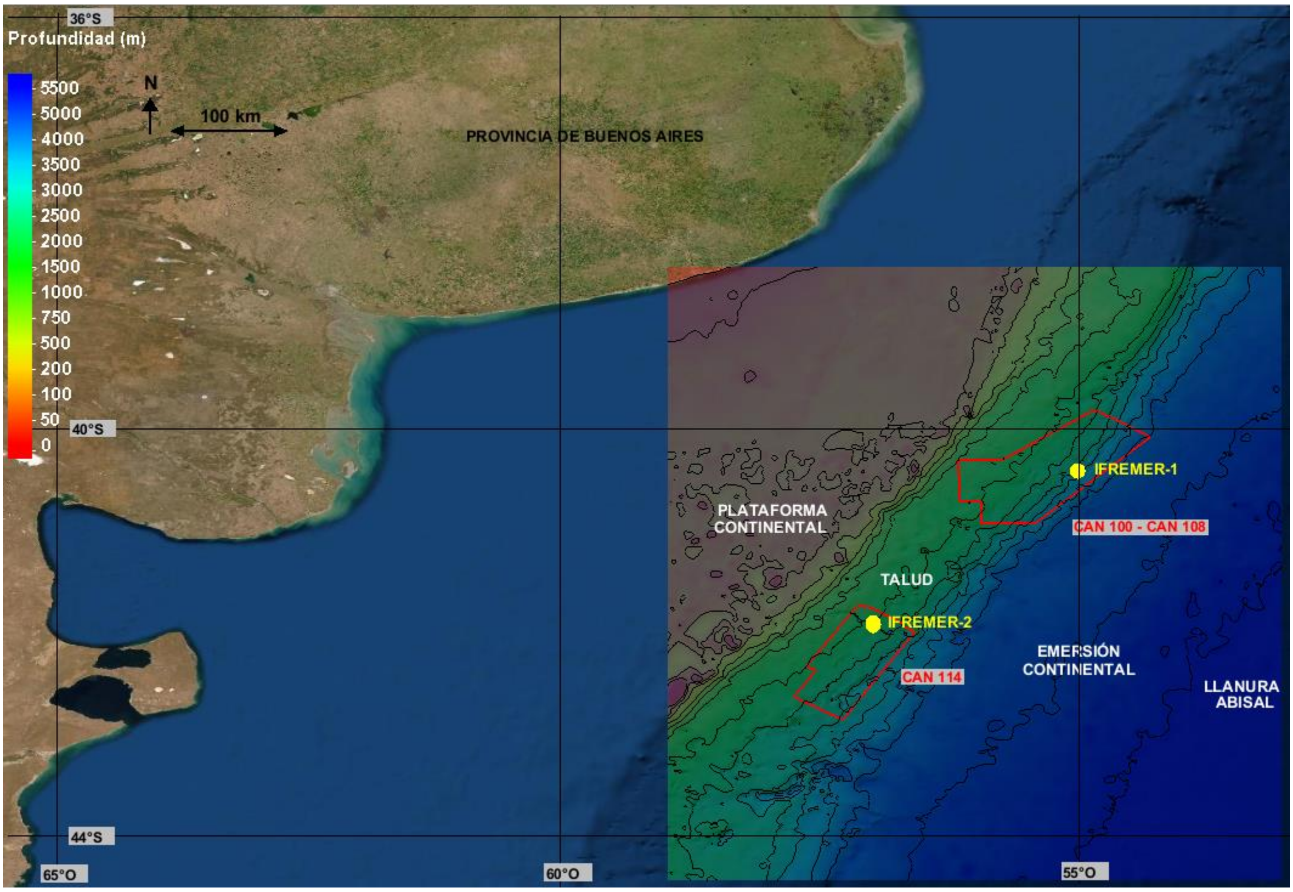


Figure 60. Location of the analyzed IFREMER database nodes, on the bathymetry of the study area. Bathymetry source: GEBCO global database "The General Bathymetric Chart of the Oceans": https://www.gebco.net/data_and_products/gridded_bathymetry_data/

(Translation of Figure 60: Profundidad: Depth. Provincia de Buenos Aires: Province of Buenos Aires. Plataforma Continental: Continental Shelf. Talud: slope. Emersion Continental: Continental Emersion. Llanura abisal: Abyssal Plain.)

Data on wind intensity and direction were extracted from IFREMER-1 (CAN_100 - CAN_108 area) and IFREMER-2 (CAN_114 area) nodes, as well as significant height (hs), peak period (tp) and peak direction (dp) of the waves for the last 10 full years (2009 to 2018 period).

The directional distributions for the waves hs and tp of the IFREMER-1 and IFREMER-2 nodes are presented in Figure 61 and Figure 62 respectively.

It can be observed that the waves have mainly N-NNE and SW-WSW directions in both nodes, the first being those of longer periods, exceeding 14 s. This swell heading towards the N-NNE is about marine swell, which are regular period waves, generally greater than 10 seconds, that propagate in the open ocean several kilometers away from their generation area with almost no loss of energy.

Waves with shorter periods (less than 8 seconds) correspond to Sea or wind wave. This wave, of less regular periods than the Swell, is generated locally due to the regional winds.

In the two analyzed nodes there are waves exceeding 4 m in height and whose major occurrence corresponds to those directed towards the N-NNE.

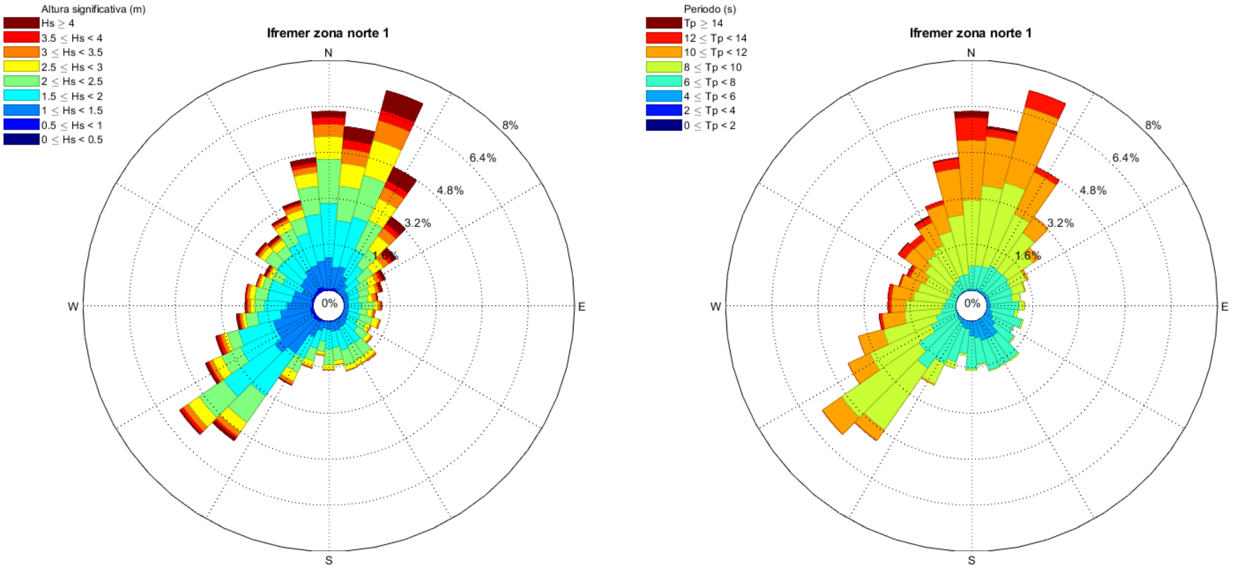


Figure 61. Directional wave distribution for IFREMER 1 node. Hs left, Tp right, 2009 to 2018 period.

(Translation of Figure 61: Altura significativa (m): Significant Height (meters). Ifremer zona norte 1: North zone Ifremer 1. Período: period.)

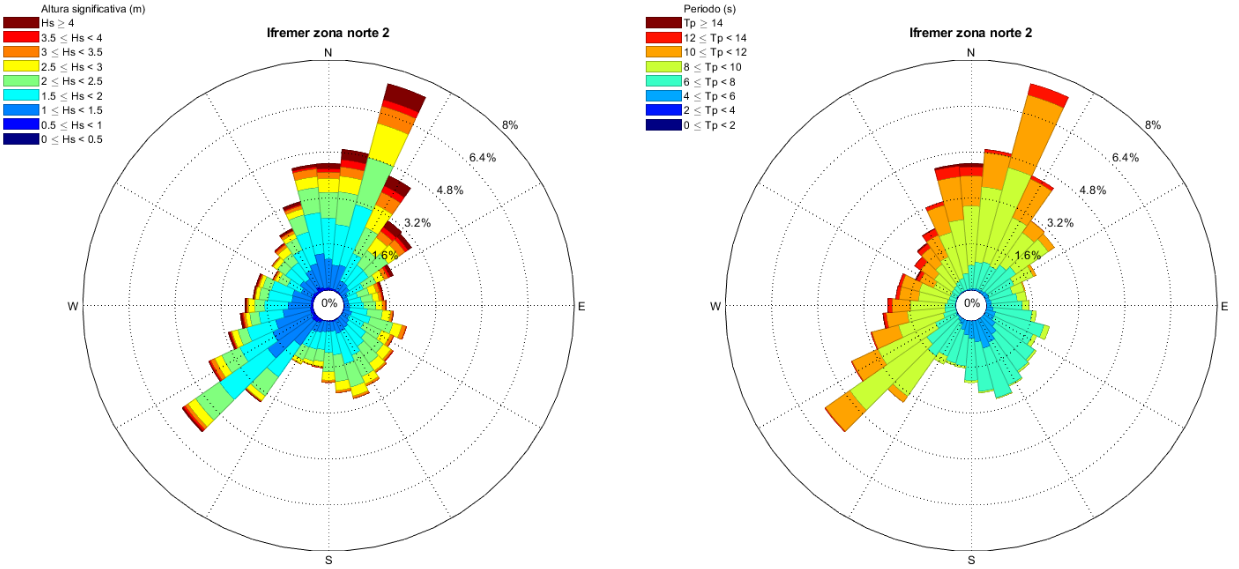


Figure 62. Directional wave distribution for IFREMER 2. Hs left, Tp right, 2009 to 2018 period.

(Translation of Figure 62: Altura significativa (m): Significant Height (meters). Ifremer zona norte 2: North zone Ifremer 2. Período: period).

The seasonal analysis of the wave time series is presented below.

For IFREMER-1 node, the seasonal directional distributions are observed in Figure 63 for hs, and in Figure 64 for tp. In the case of IFREMER-2 node, these distributions are presented in Figure 65 and Figure 66, respectively.

The highest waves are registered predominantly during autumn and winter heading towards the N-NE in the Detailed Study area. It should be noted that the campaign shall take place in the October-March period in order to avoid the worst conditions of the waves.

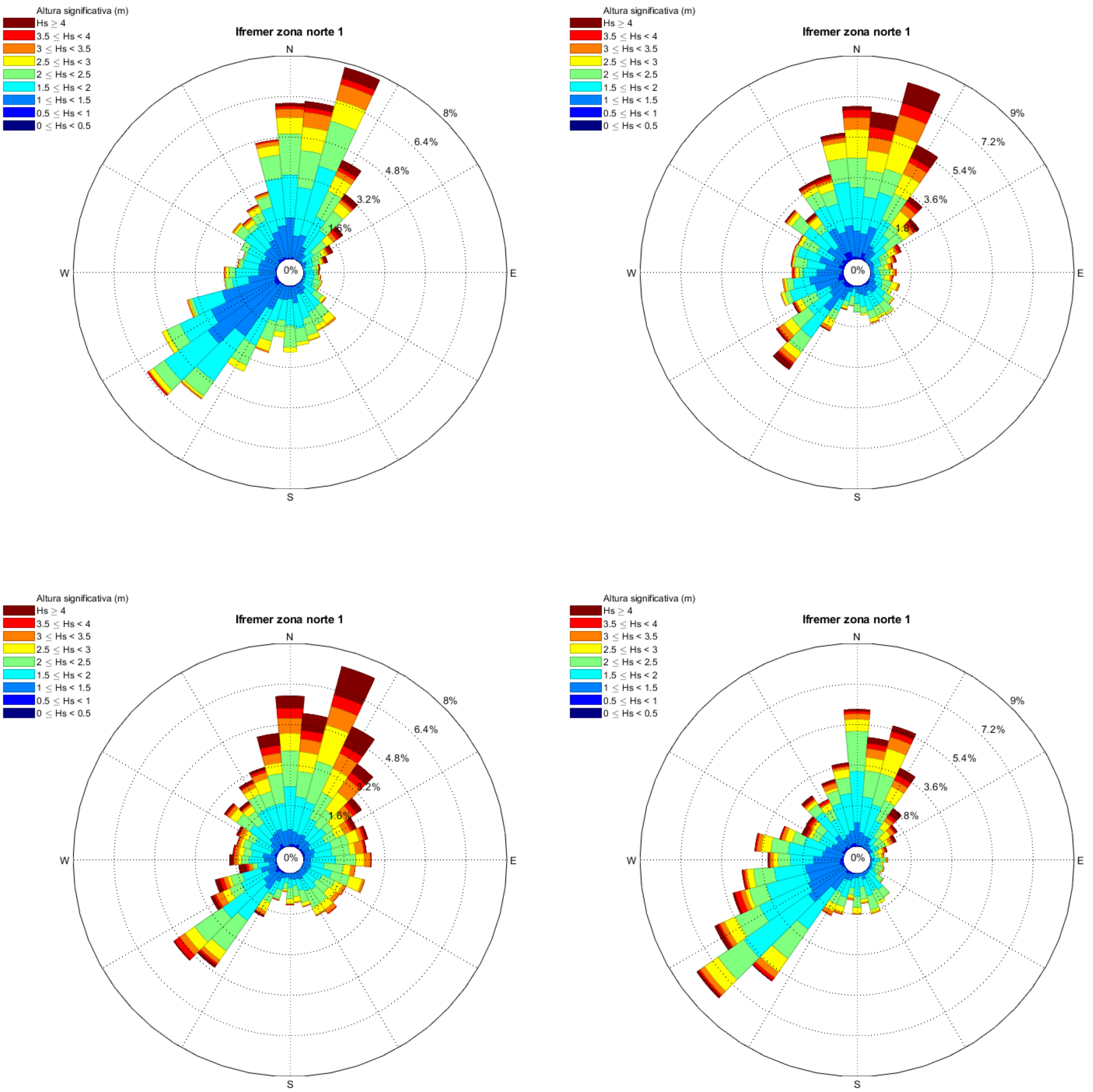


Figure 63. Directional wave distribution for the IFREMER-1 node, Hs divided by season, 2009 to 2018 period. From top to bottom and from left to right: summer, fall, winter and spring.

(Translation of Figure 63: Altura significativa (m): Significant Height (meters). Ifremer zona norte 1: North zone Ifremer 1)

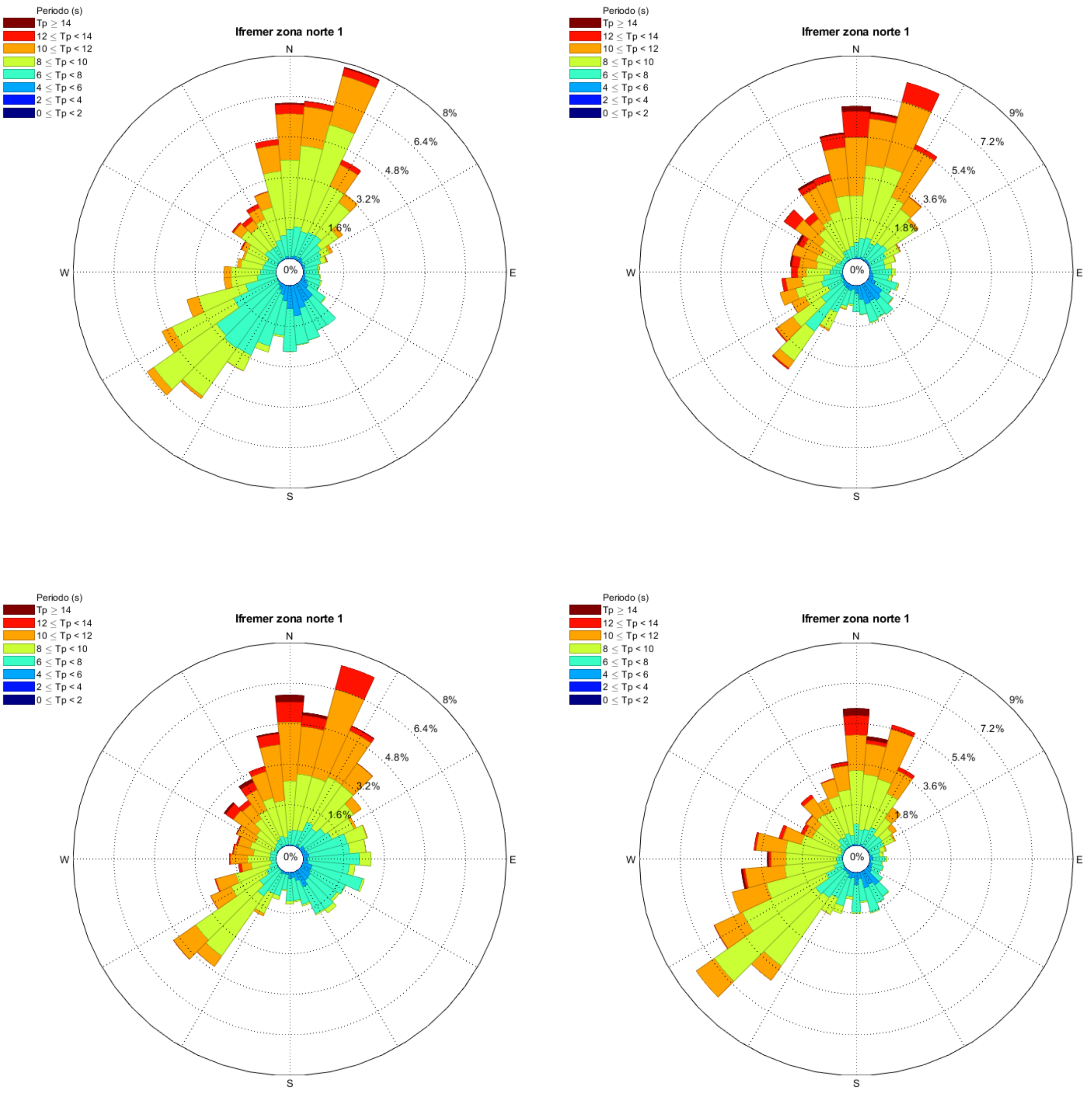


Figure 64. Directional distribution of the waves for the IFREMER-1 node, Tp divided by season, 2009 to 2018 period. From top to bottom and from left to right: summer, fall, winter and spring.

(Translation of Figure 64: Período (s): Period (s). Ifremer zona norte 1: North zone Ifremer 1)

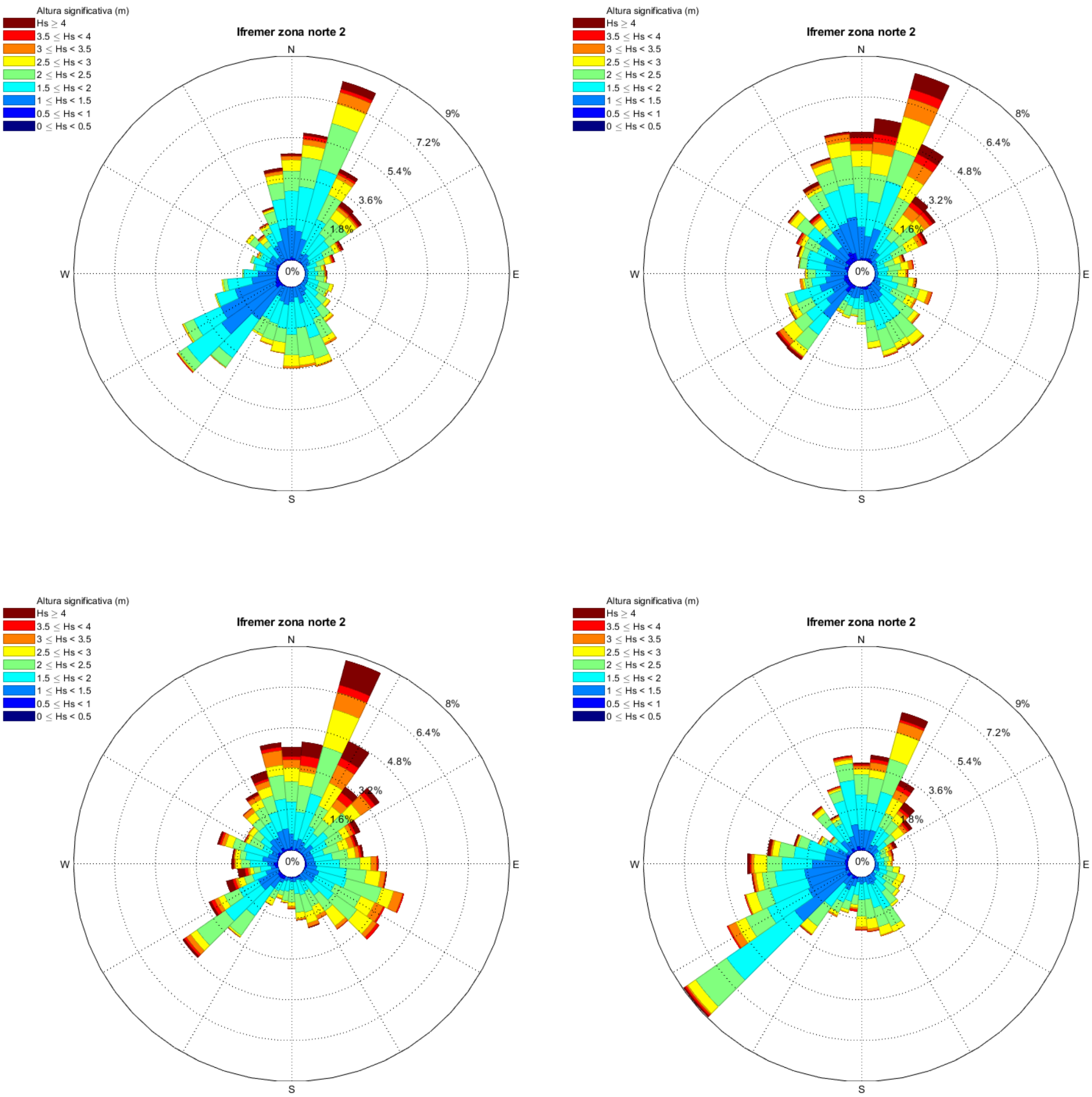


Figure 65. Directional wave distribution for the IFREMER-2 node, Hs divided by season, 2009 to 2018 period. From top to bottom and from left to right: summer, fall, winter and spring.

Translation of Figure 65: Altura significativa (m): Significant Height (meters). Ifremer zona norte 2: North zone Ifremer 2)

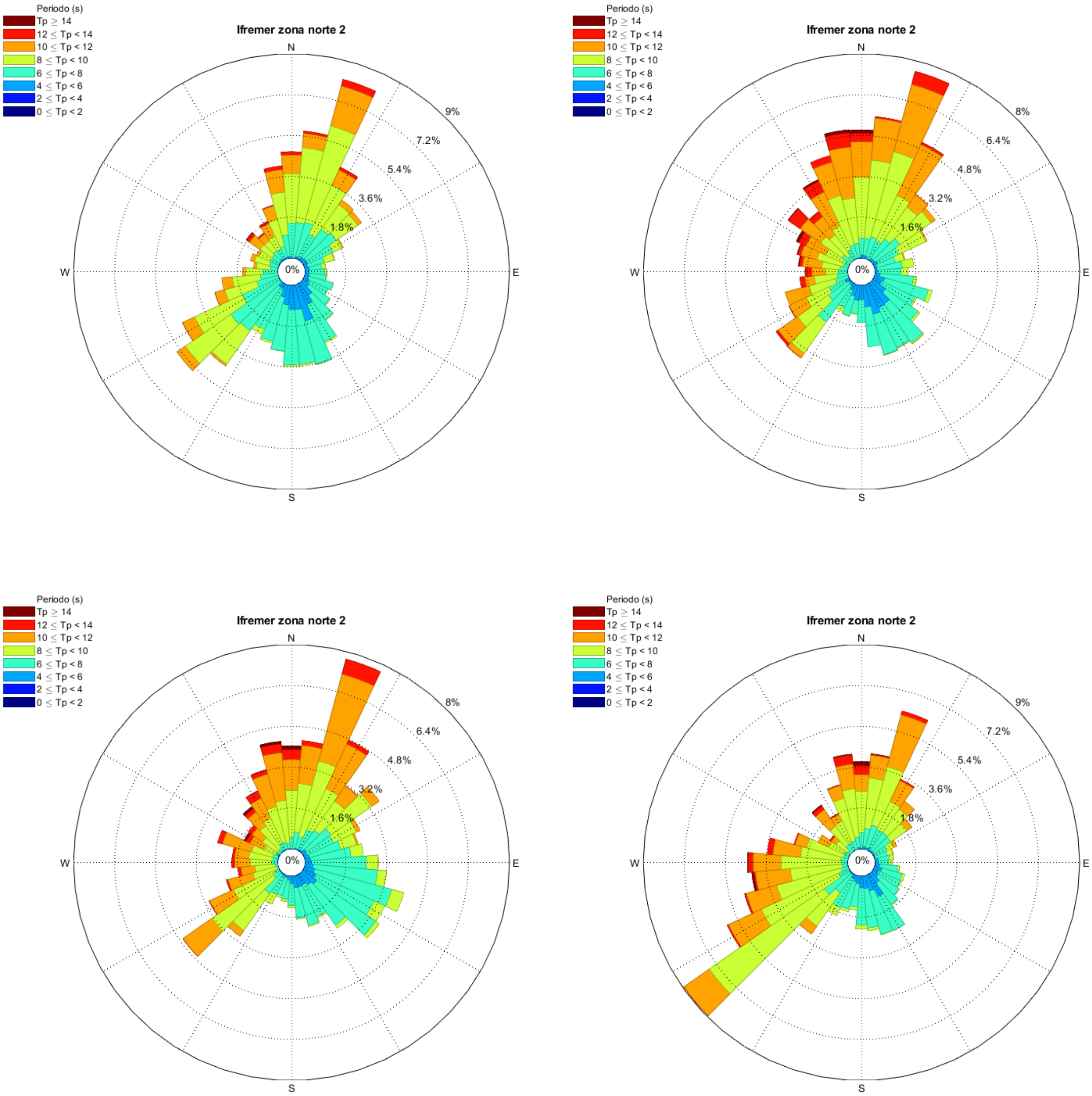


Figure 66. Directional distribution of the waves for the IFREMER-2 node, Tp divided by season, 2009 to 2018 period. From top to bottom and from left to right: summer, fall, winter and spring.

(Translation of Figure 66: Período (s): Period (s). Ifremer zona norte 2: North zone Ifremer 2)

3.2.5 Physico-chemical parameters of seawater

In the same way as with the current fields, the different physicochemical parameters of seawater provided by the COPERNICUS Space Program were extracted through “My Ocean” Platform.

The following figures show the temperature, salinity, dissolved oxygen, nitrates, phosphates, silicates, phytoplankton and chlorophyll (a) fields on the sea surface for the months of January (summer), April (autumn), July (winter) and October (spring), namely:

Figure 67, Figure 68, Figure 69 and Figure 70: temperature in summer, autumn, winter and spring, respectively.

Figure 71, Figure 72, Figure 73 and Figure 74: salinity in summer, autumn, winter and spring, respectively.

Figure 75, Figure 76, Figure 77 and Figure 78: dissolved oxygen in summer, autumn, winter and spring, respectively.

Figure 79, Figure 80, Figure 81 and Figure 82: nitrates in summer, autumn, winter and spring, respectively.

Figure 83, Figure 84, Figure 85 and Figure 86: hosphates in summer, autumn, winter and spring, respectively.

Figure 87, Figure 88, Figure 89 and Figure 90: silicates in summer, autumn, winter and spring, respectively.

Figure 91, Figure 92, Figure 93 and Figure 94: phytoplankton in summer, autumn, winter and spring, respectively.

Figure 95, Figure 96, Figure 97 and Figure 98: chlorophyll (a) in summer, autumn, winter and spring, respectively.

In the aforementioned figures, the polygons correspond to the areas of operation and of direct influence of CAN_100 - CAN_108 Area (white color) and CAN_114 Area (fuchsia color).

The temperature and salinity fields reveal the presence of the cold Malvinas current, the warmer and more saline current of Brazil and the extraordinary process that makes up their confluence.

The area object of this study is characterized by regions of high productivity that can be similar to "oases". Sea fronts can be considered as such, since they occupy a small area of great importance in regulating the transport of salts, heat, nutrients, sea-atmosphere interactions and various ecosystemic processes. The biological processes taking place in those areas determine particular ecological properties, necessary for an increase in primary production (Schejter et al. s/f).

Subtropical and subantarctic waters coexist and mix there creating important physical-chemical gradients which favour the presence of high concentrations of nutrients with important biological consequences for the entire ecosystem. Likewise, the return flow of the Malvinas current, which heads southeast, generates the emergence of deep waters that enrich the nutrient content of the surface waters.

On the other hand, the slope front region located on the edge of the continental shelf, and which extends for more than 1,500 km, is one of the most productive in the world.

High concentrations of nutrient appear along this front transported by the subantarctic waters of the Malvinas current. Primary production, determined by chlorophyll and phytoplankton, is associated with the presence of nutrients.

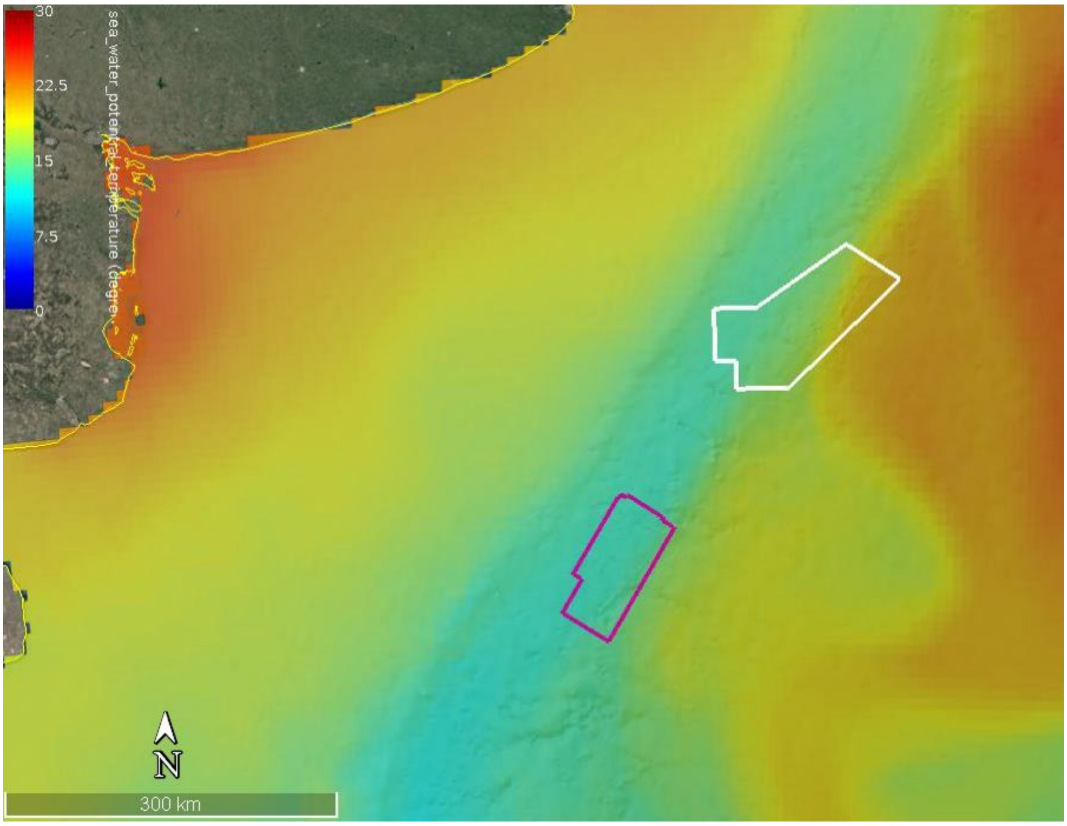


Figure 67. Potential surface temperature (ºC) for the month of February. Source: COPERNICUS Space Program, "My Ocean" platform.

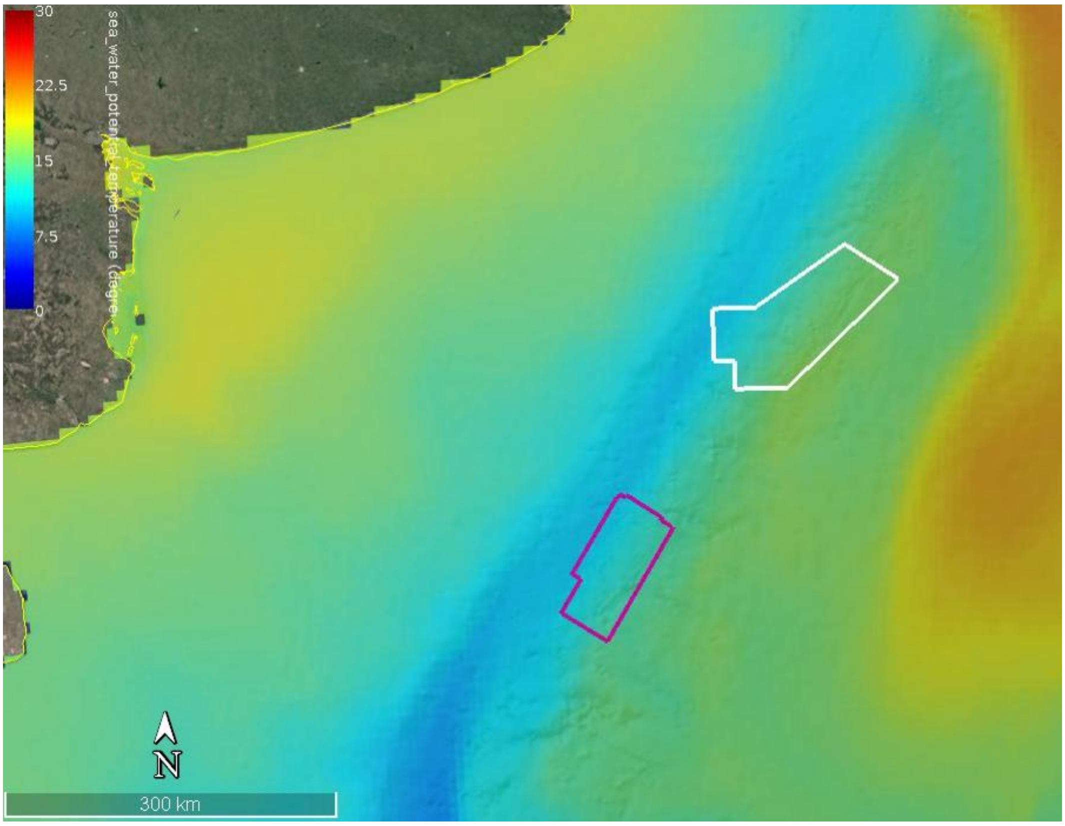


Figure 68. Potential surface temperature (ºC) for the month of April. Source: COPERNICUS Space Program, "My Ocean" platform.

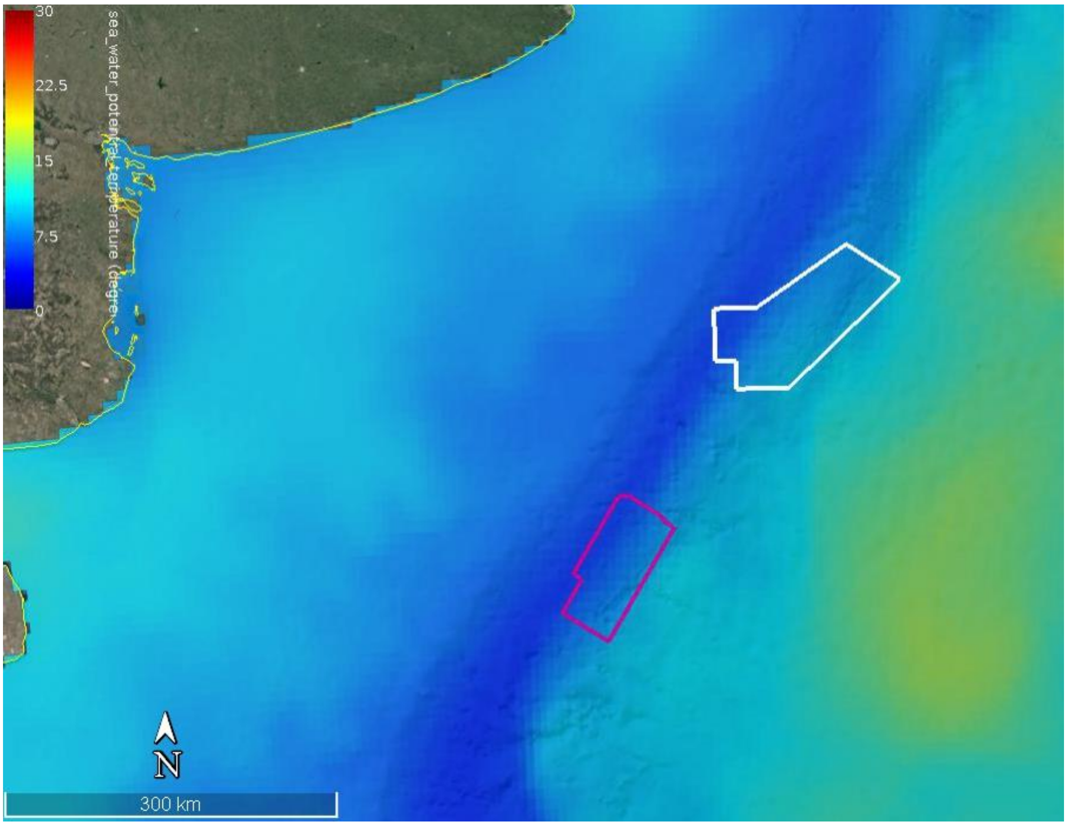


Figure 69. Potential surface temperature (ºC) for the month of July. COPERNICUS Space Program, "My Ocean" platform.

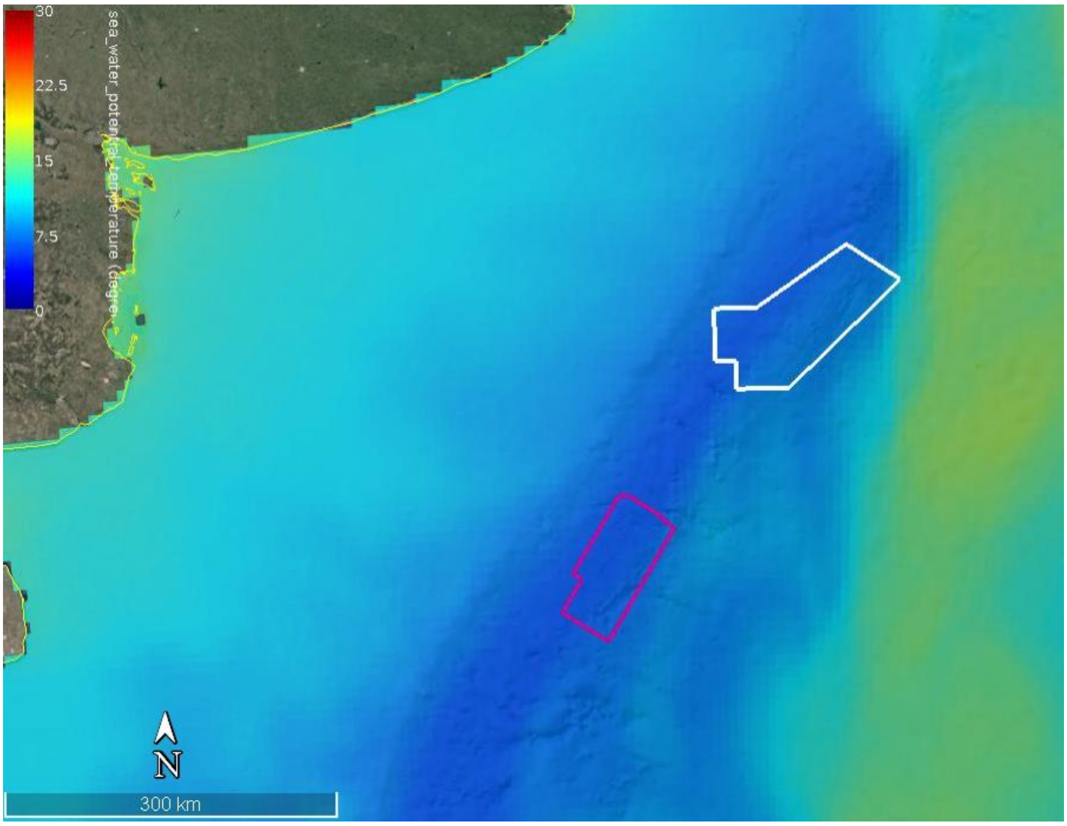


Figure 70. Potential surface temperature (ºC) for the month of October. Source: COPERNICUS Space Program, "My Ocean" platform.

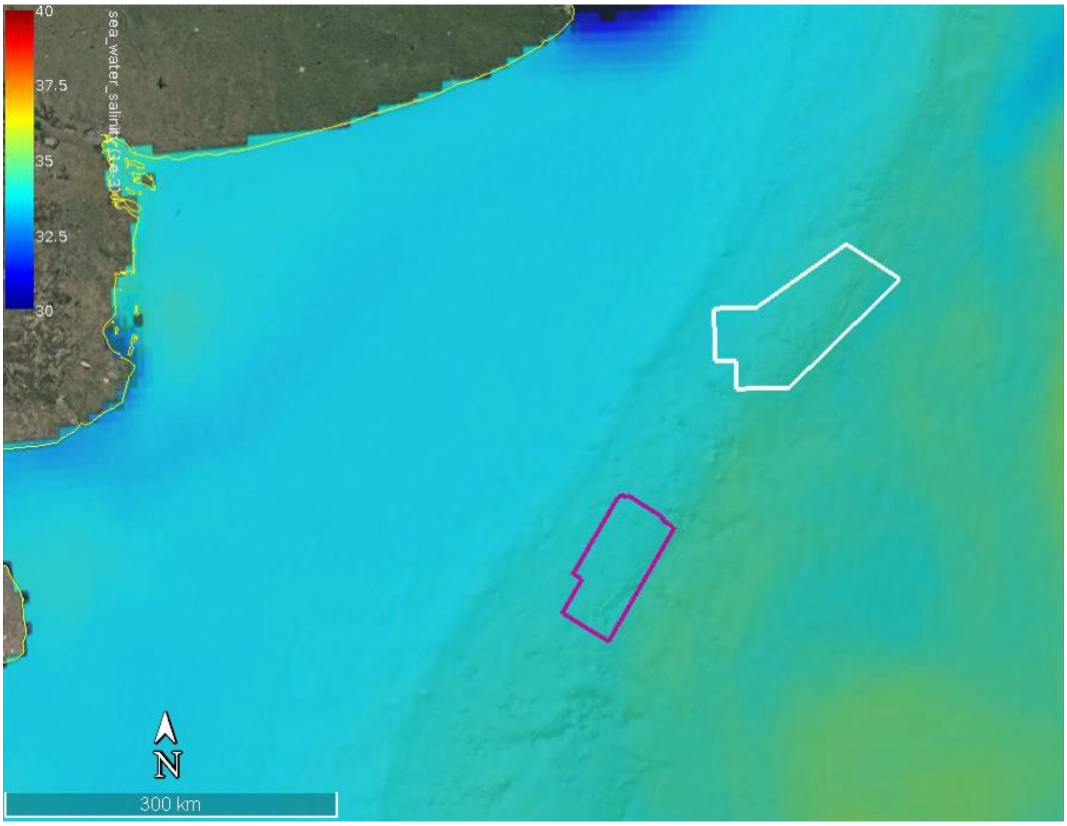


Figure 71. Salinity ($^0/_{00}$) on surface for the month of February. COPERNICUS Space Program, "My Ocean" platform.

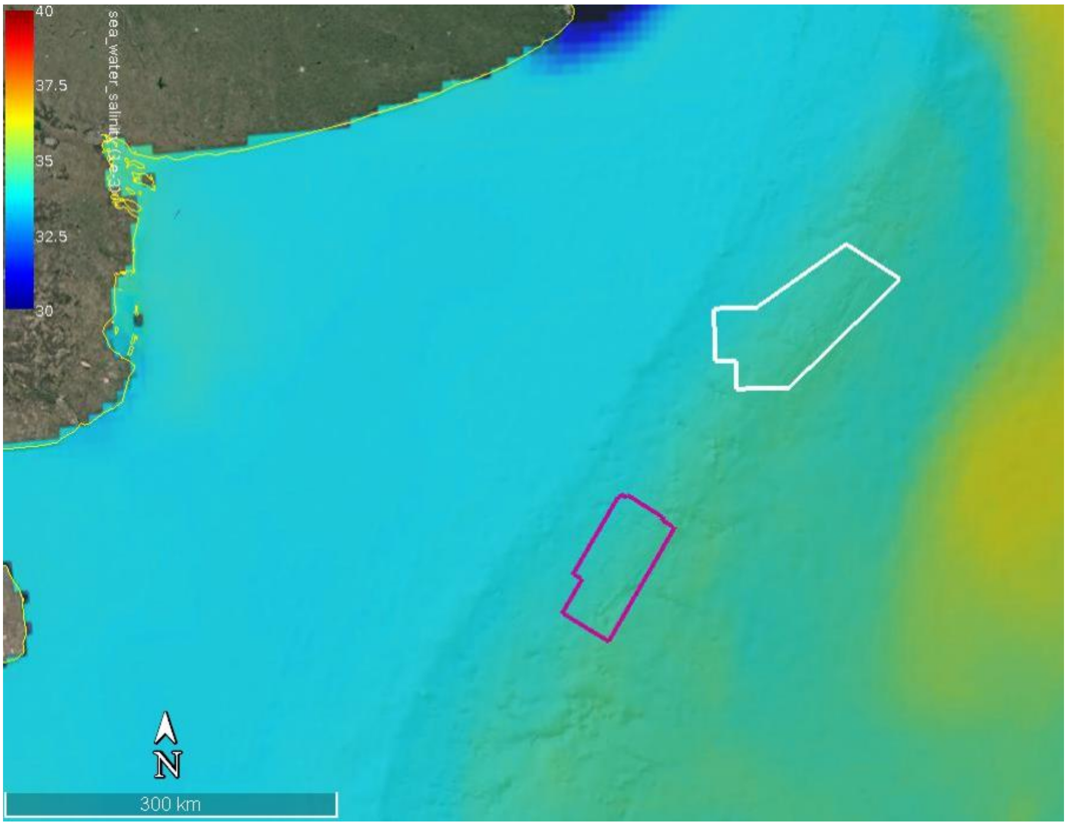


Figure 72. Salinity ($^0/_{00}$) on surface for the month of April. Source: COPERNICUS Space Program, "My Ocean" platform.

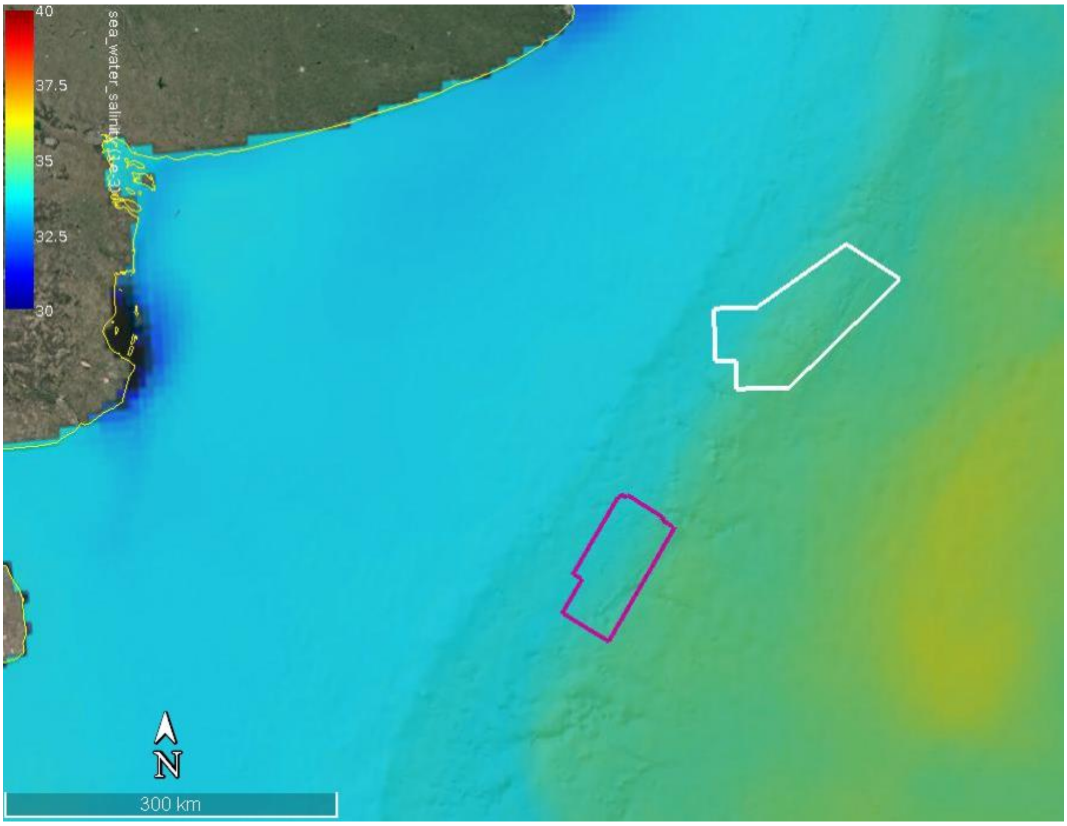


Figure 73. Salinity ($^0/_{00}$) on surface for the month of July. COPERNICUS Space Program, "My Ocean" platform.

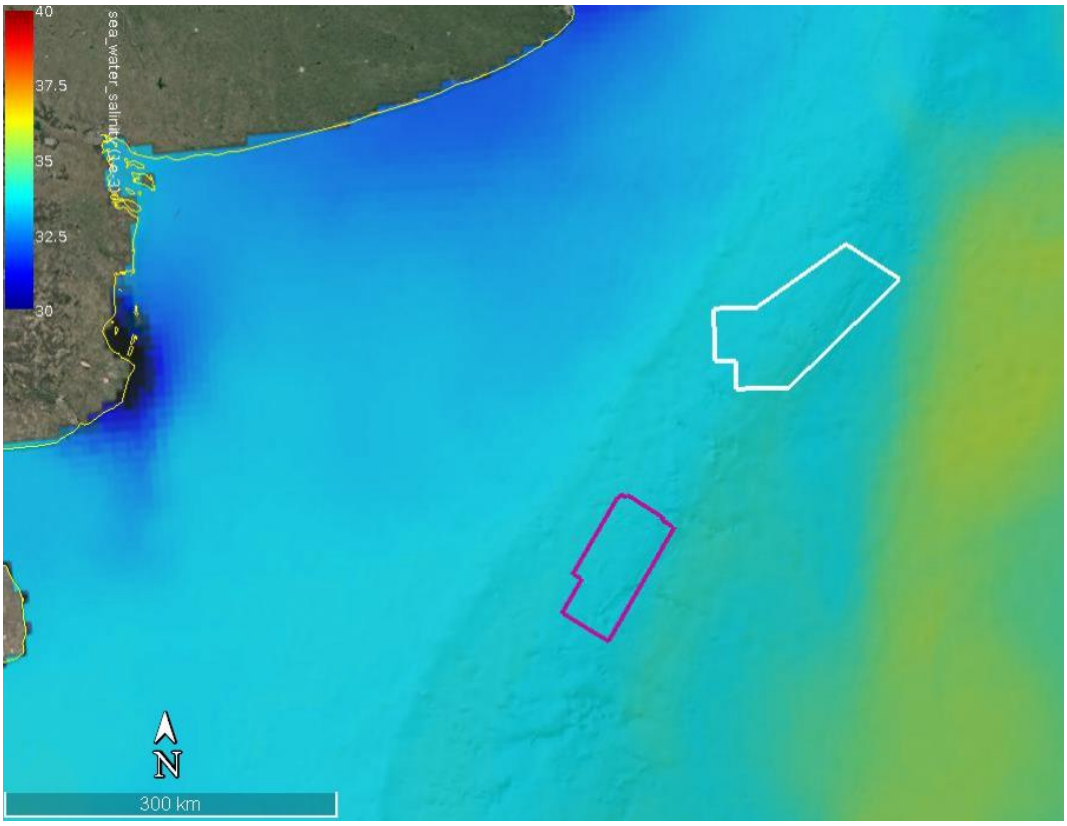


Figure 74. Salinity ($^0/_{00}$) on surface for the month of October. Source: COPERNICUS Space Program, "My Ocean" platform.

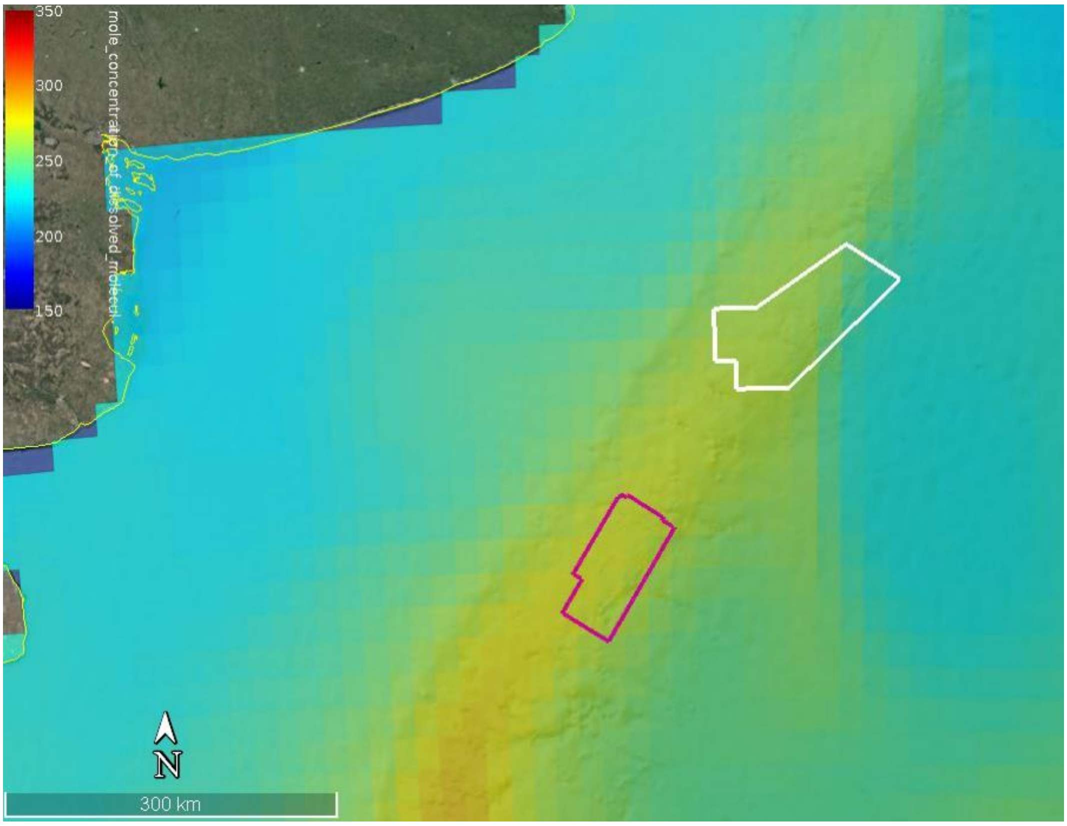


Figure 75. Dissolved Oxygen (mmol / m3) on surface for the month of February. Source: COPERNICUS Space Program, "My Ocean" platform.

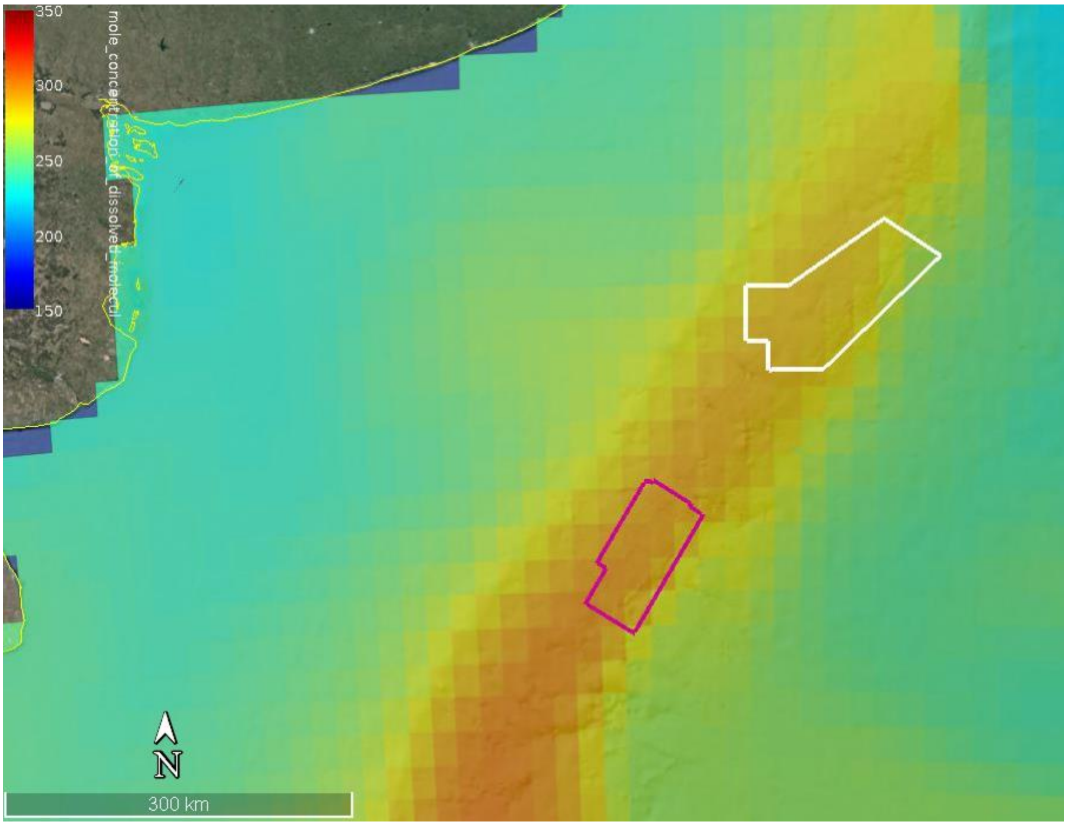


Figure 76. Dissolved Oxygen (mmol / m3) on surface for the month of April. Source: COPERNICUS Space Program, "My Ocean" platform.

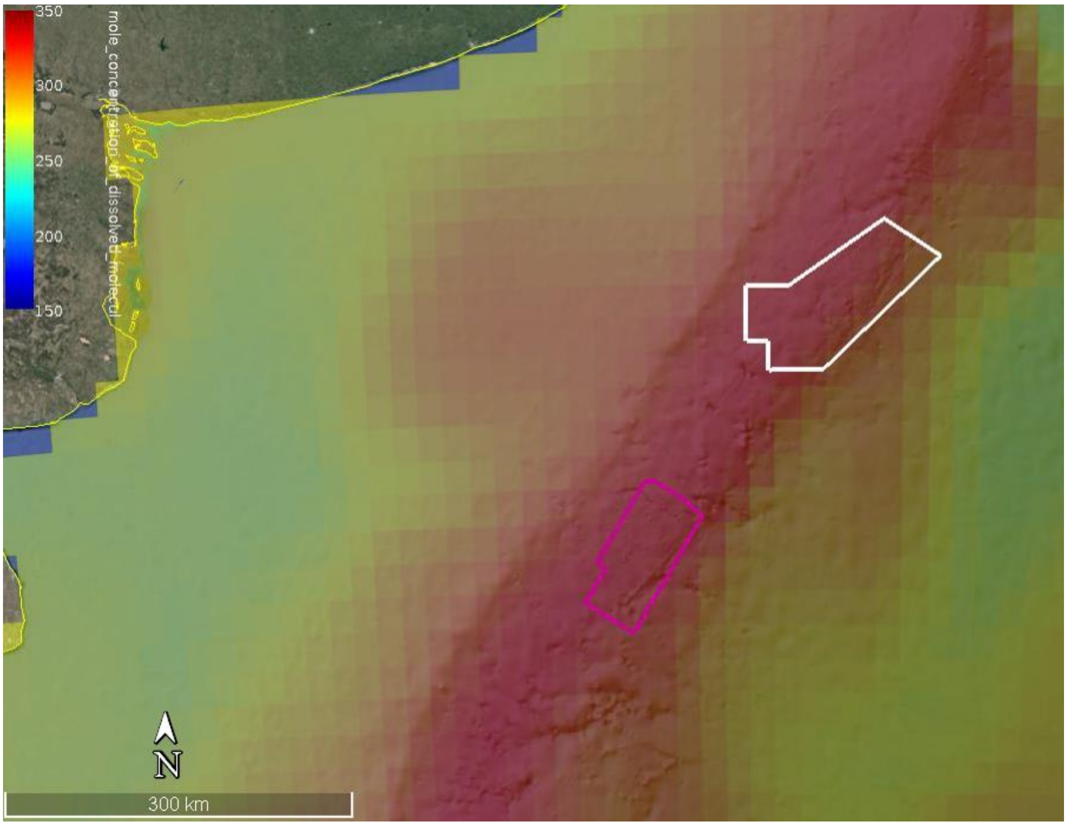


Figure 77. Dissolved Oxygen (mmol / m3) on surface for the month of July. COPERNICUS Space Program, "My Ocean" platform.

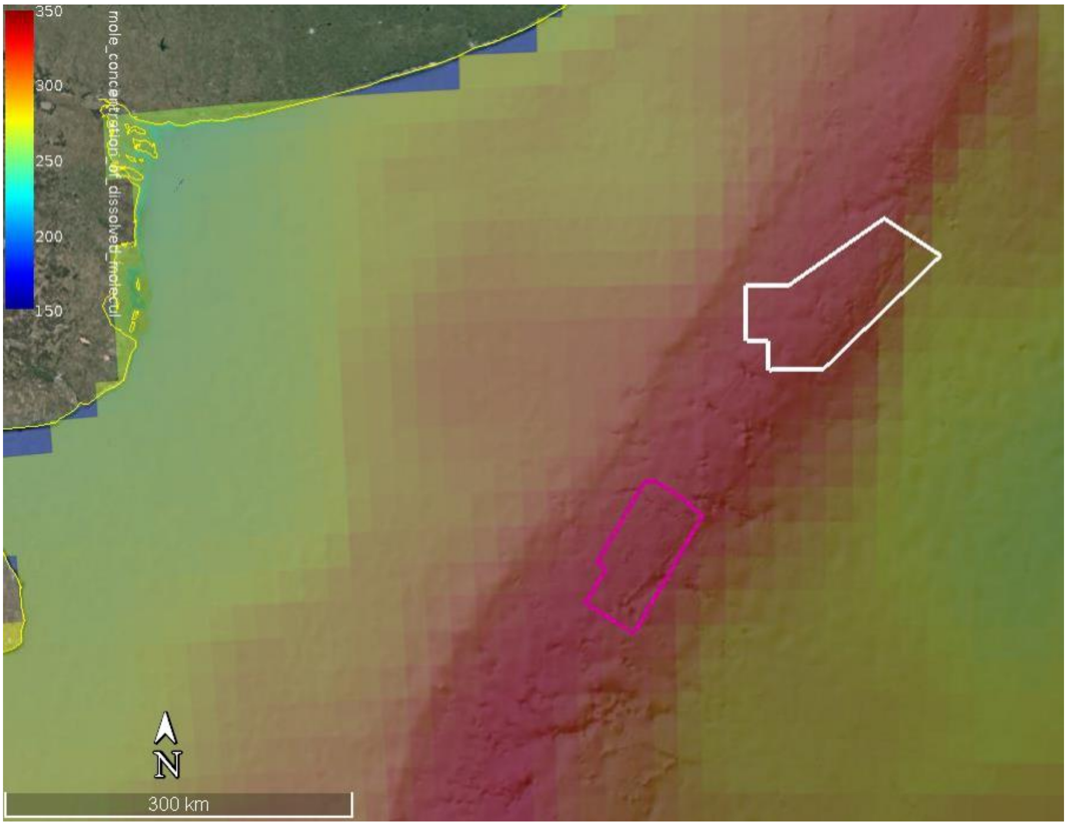


Figure 78. Dissolved Oxygen (mmol / m3) on surface for the month of October. Source: COPERNICUS Space Program, "My Ocean" platform.

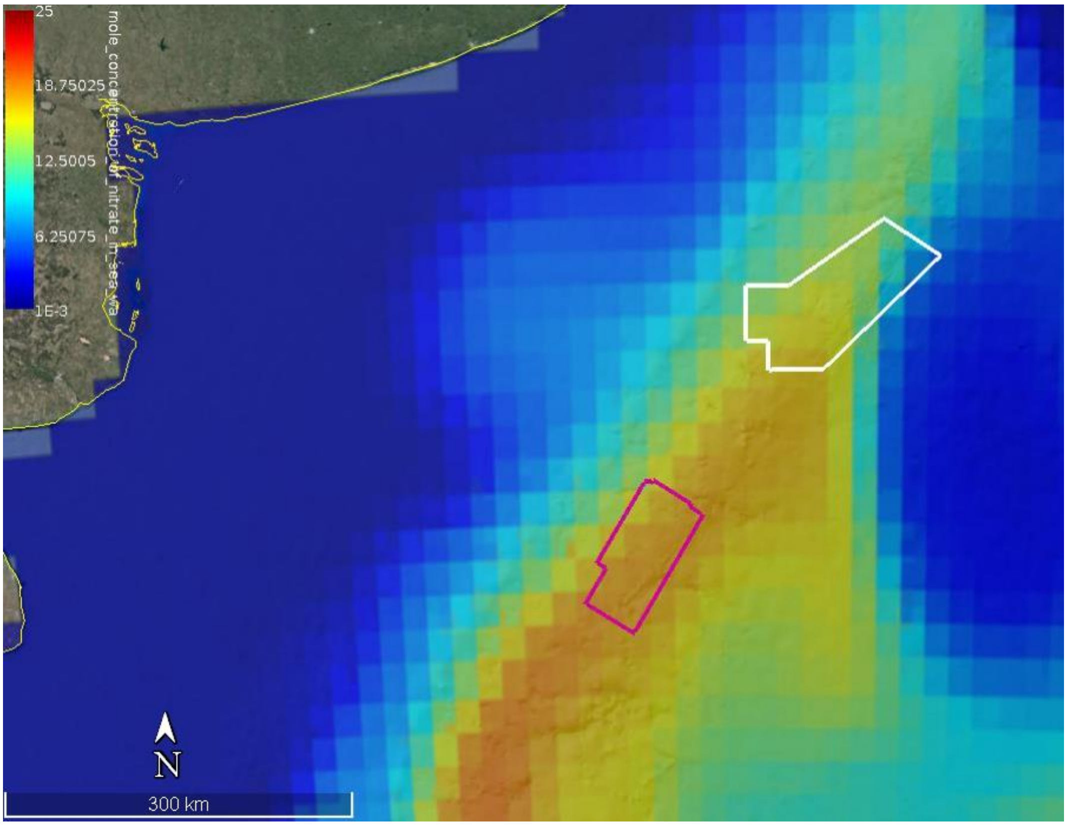


Figure 79. Nitrate (mmol / m3) on surface for the month of February. Source: COPERNICUS Space Program, "My Ocean" platform.

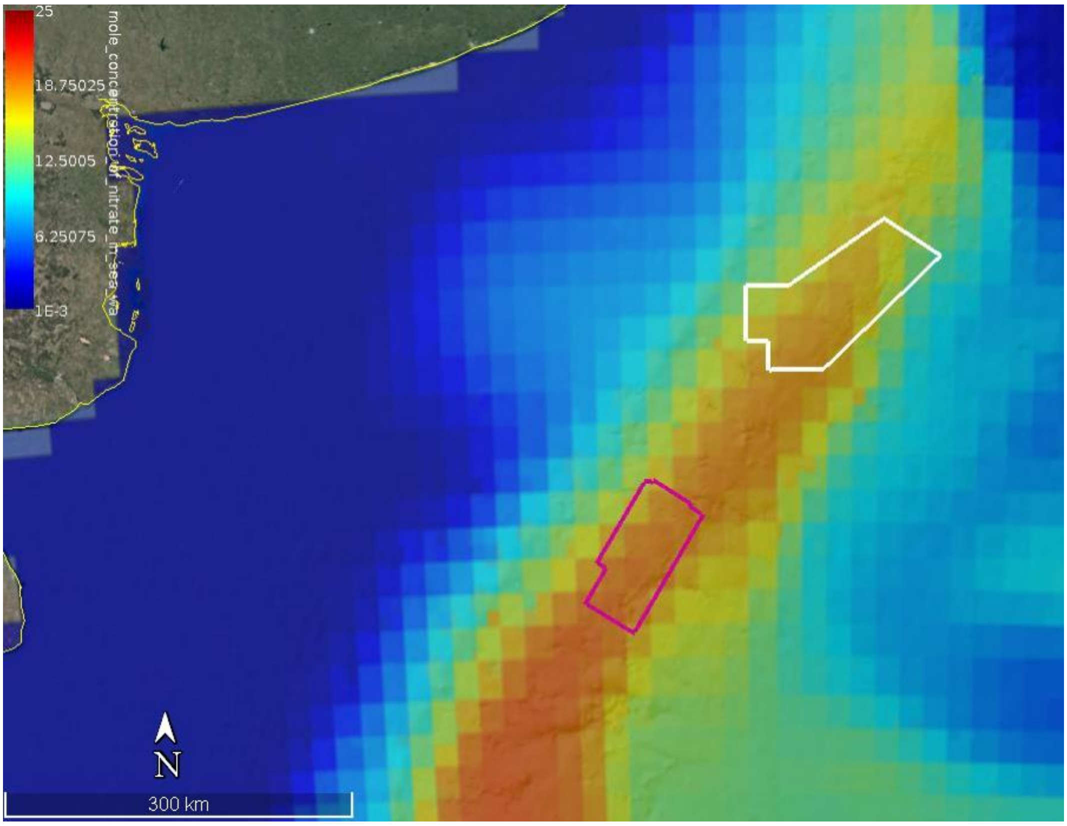


Figure 80. Nitrate (mmol / m3) on surface for the month of April. Fuente: COPERNICUS Space Program, "My Ocean" platform.

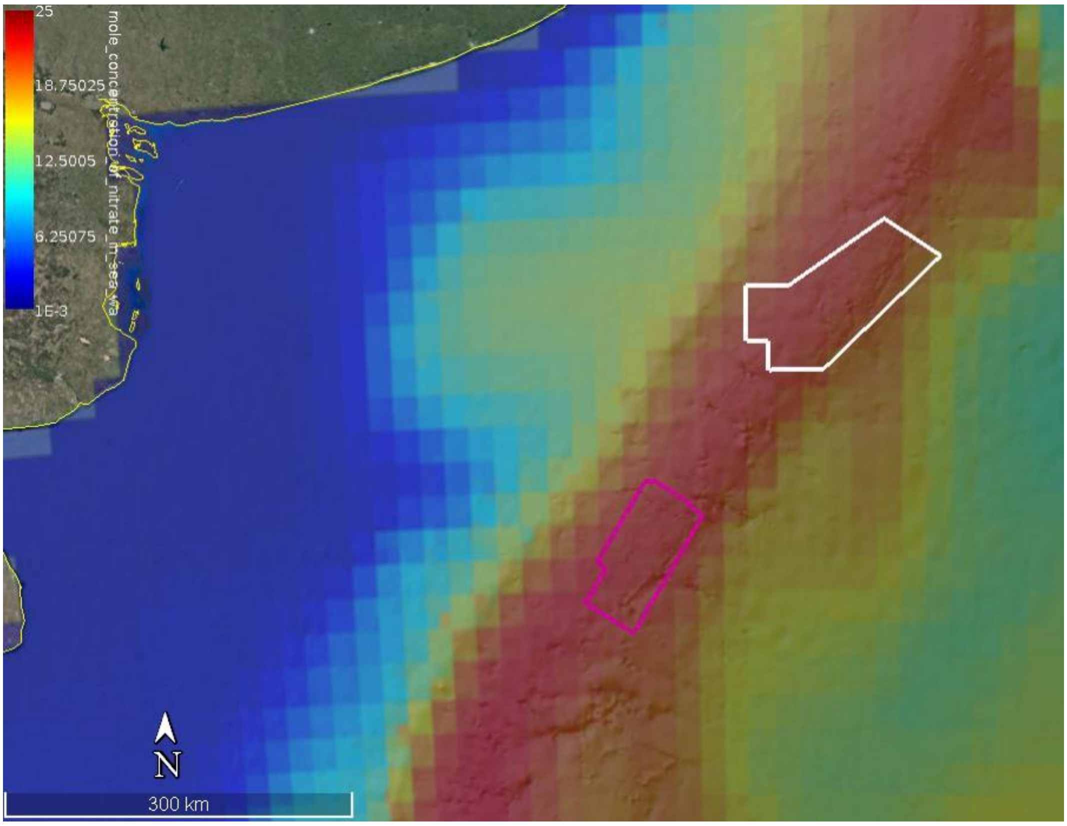


Figure 81. Nitrate (mmol / m3) on surface for the month of July. COPERNICUS Space Program, "My Ocean" platform.

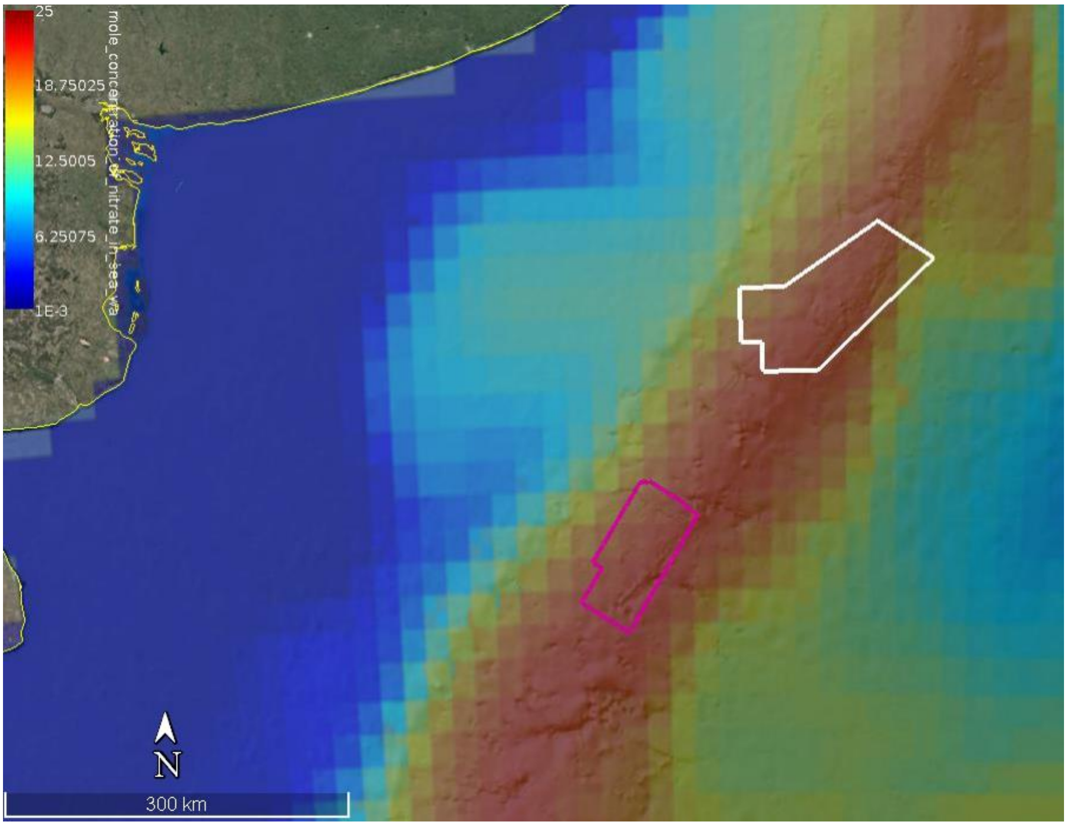


Figure 82. Nitrate (mmol / m3) on surface for the month of October. COPERNICUS Space Program, "My Ocean" platform.

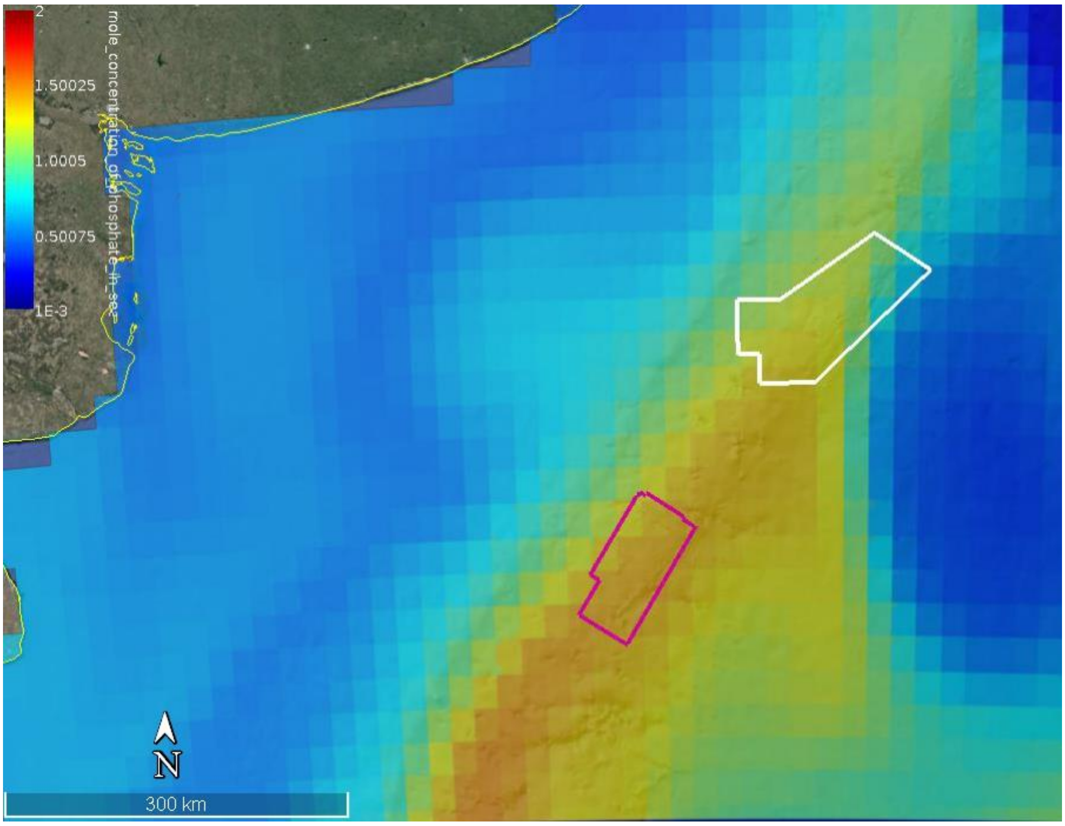


Figure 83. Phosphate (mmol / m3) on surface for the month of February. COPERNICUS Space Program, "My Ocean" platform.

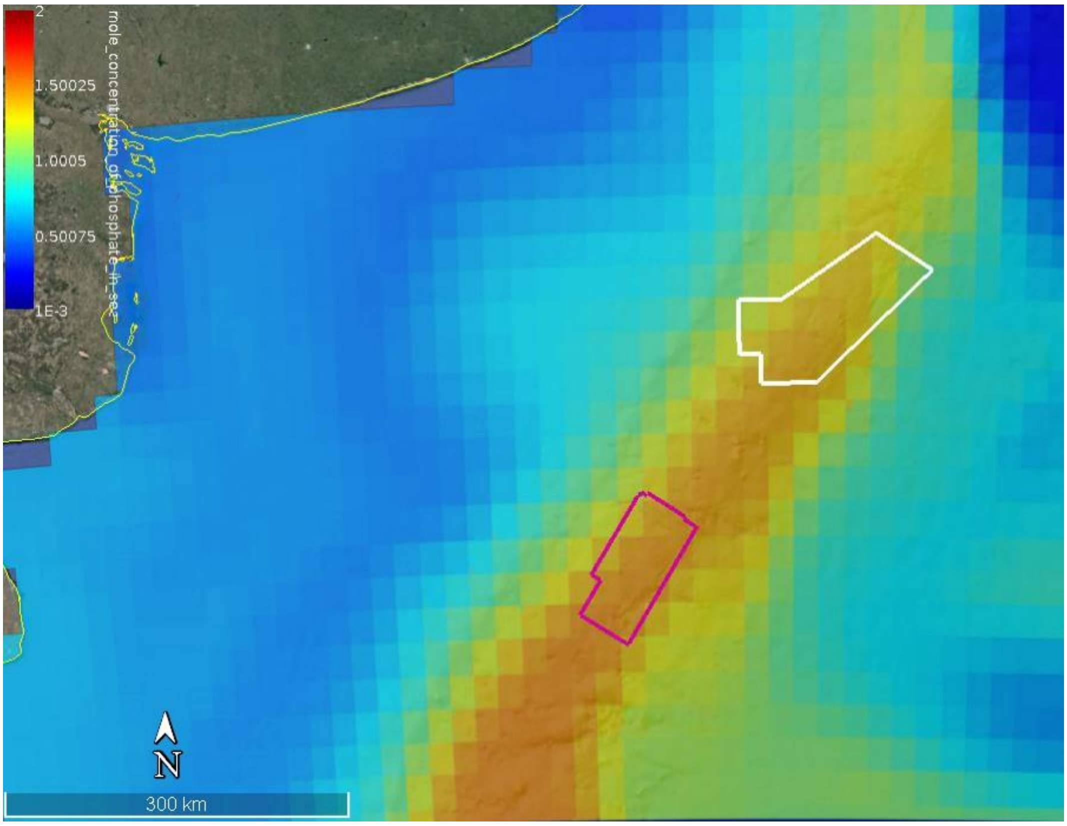


Figure 84. Phosphate (mmol / m3) on surface for the month of April. Source: COPERNICUS Space Program, "My Ocean" platform.

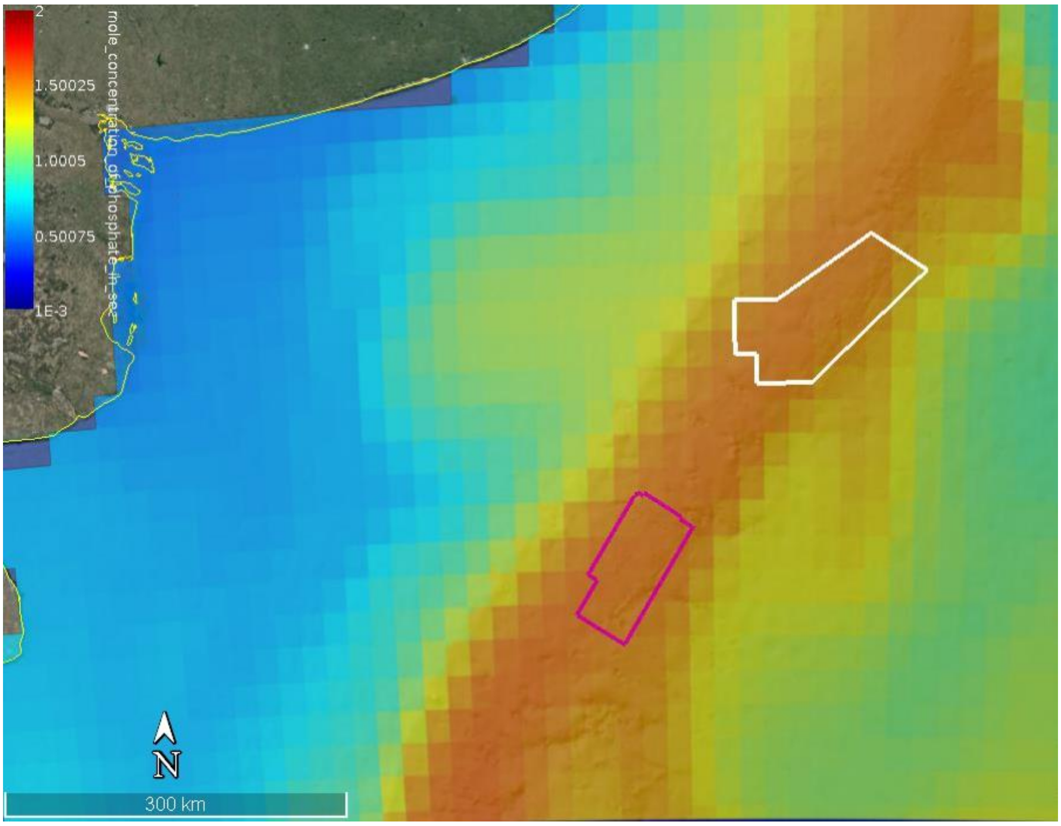


Figure 85. Phosphate (mmol / m3) on surface for the month of July. COPERNICUS Space Program, "My Ocean" platform.

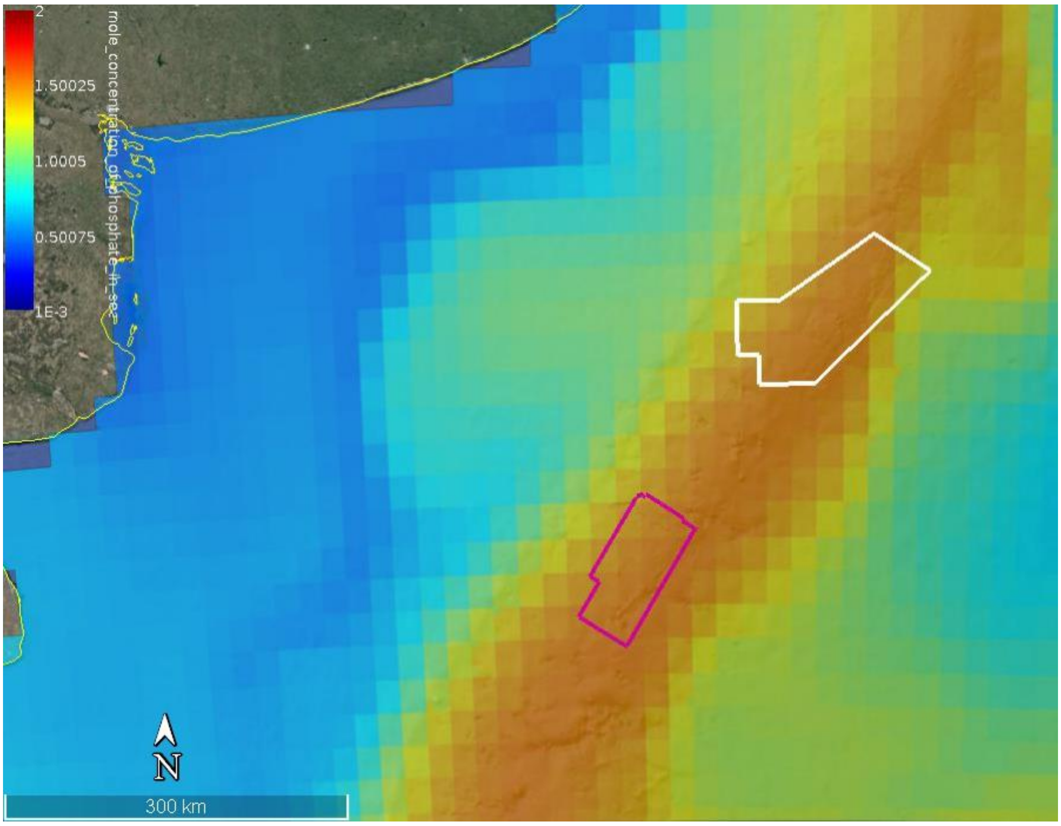


Figure 86. Phosphate (mmol / m3) on surface for the month of October. Source: COPERNICUS Space Program, "My Ocean" platform.

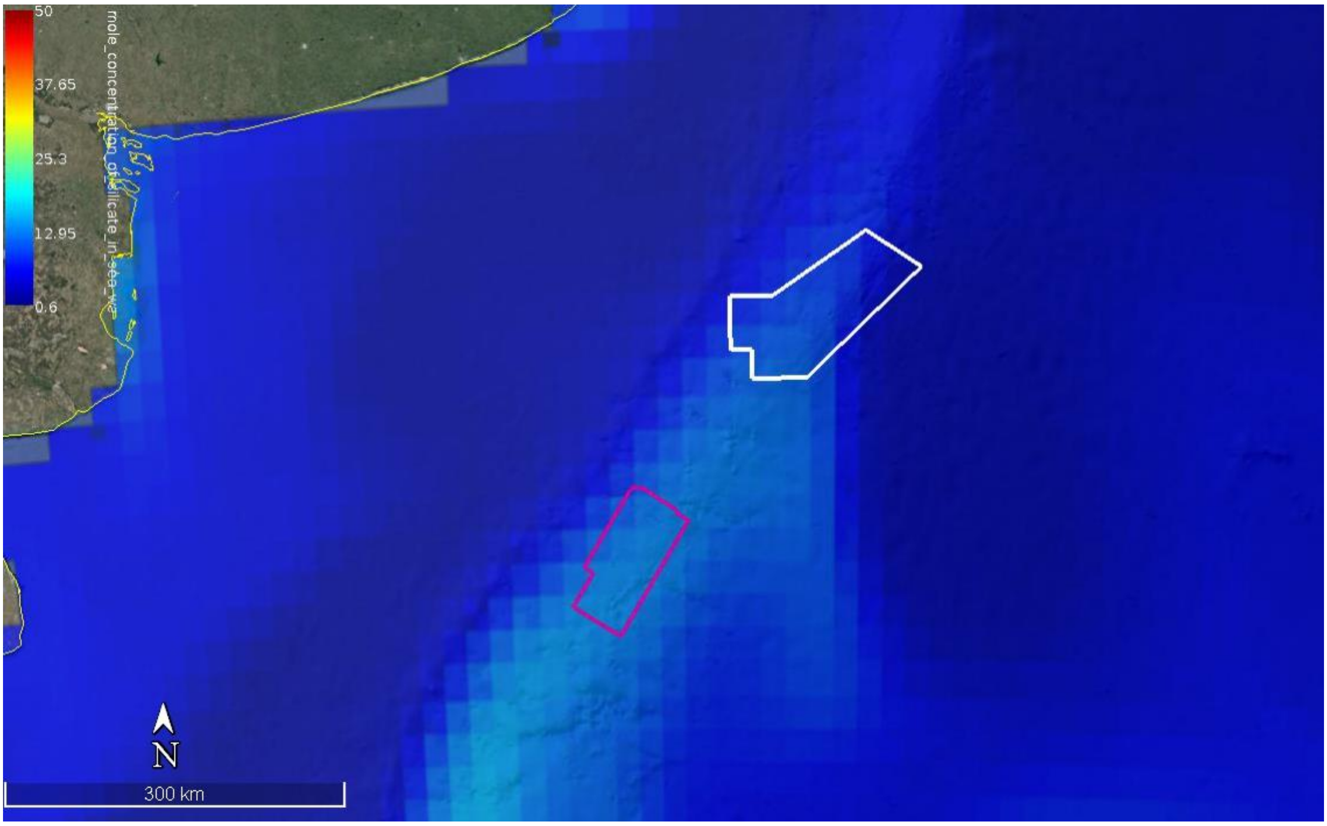


Figure 87. Silicate (mmol / m3) on surface for the month of February. Source: COPERNICUS Space Program, "My Ocean" platform.

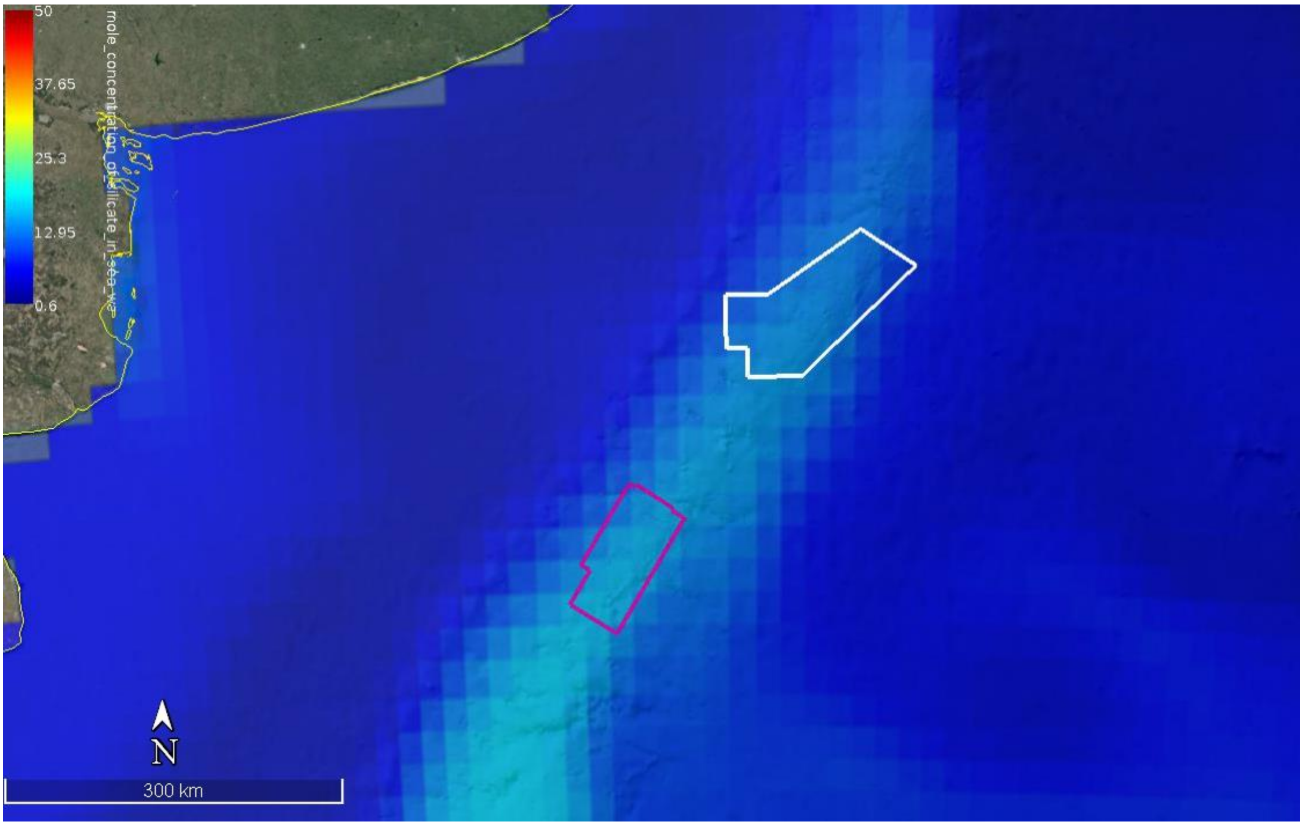


Figure 88. Silicate (mmol / m3) on surface for the month of April. Source: COPERNICUS Space Program, "My Ocean" platform.

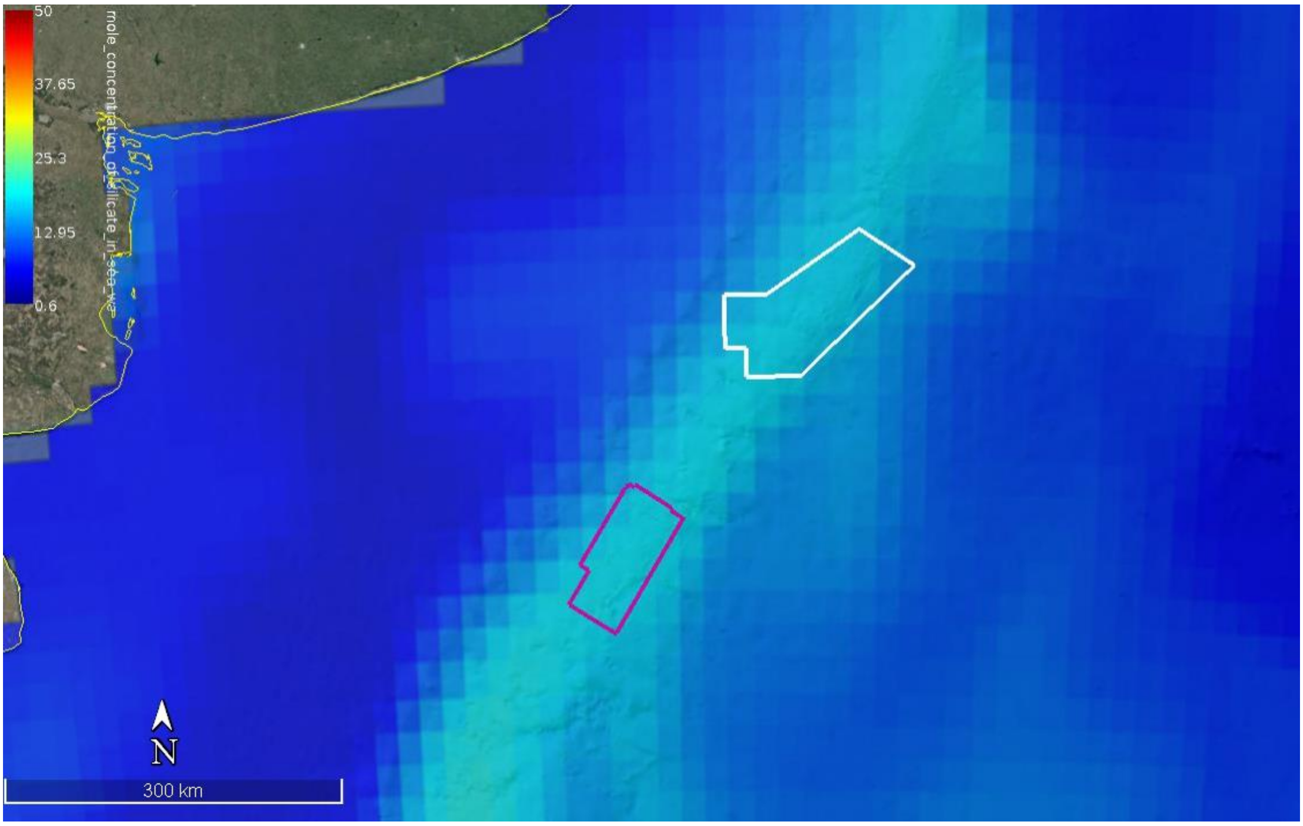


Figure 89. Silicate (mmol / m3) on surface for the month of July. ource: COPERNICUS Space Program, "My Ocean" platform.

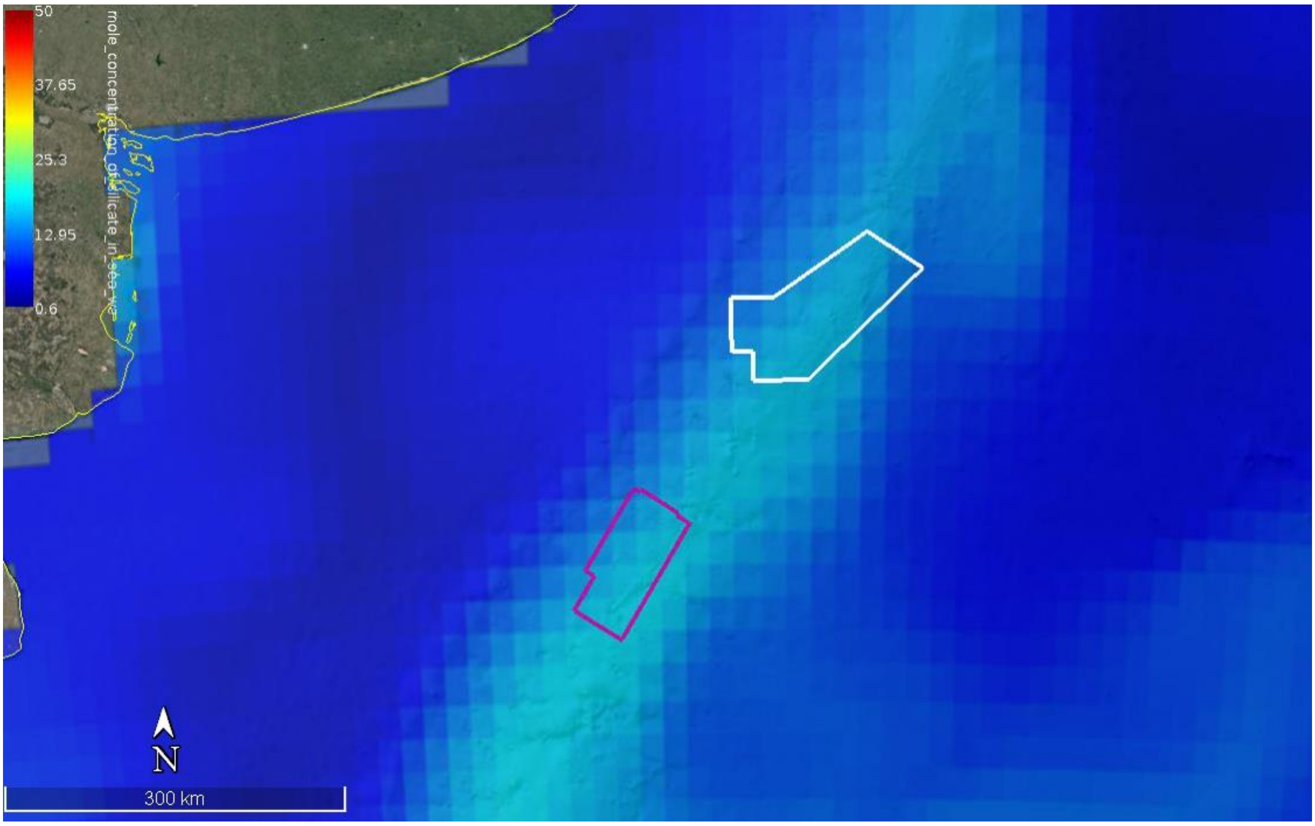


Figure 90. Silicate (mmol / m3) on surface for the month of October. Source: COPERNICUS Space Program, "My Ocean" platform.

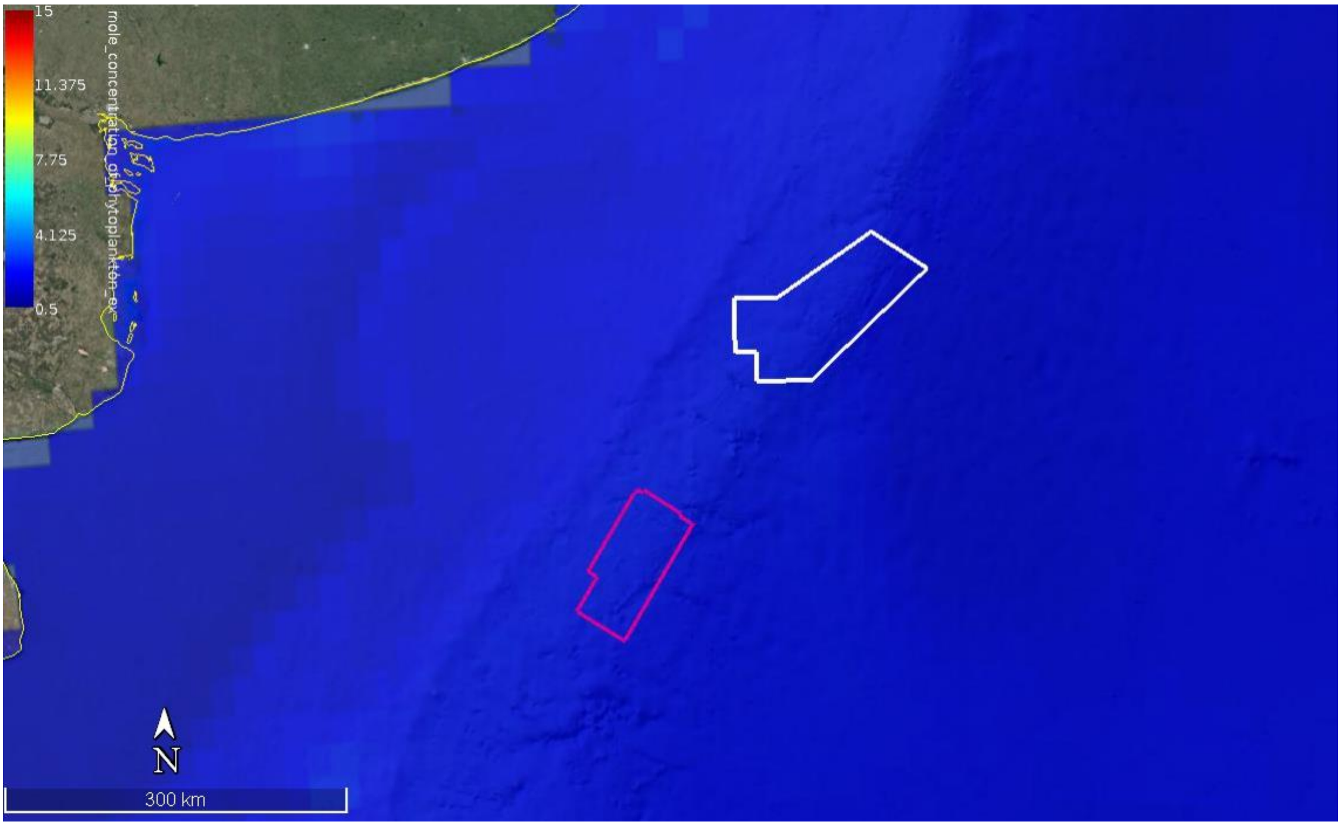


Figure 91. Phytoplankton (mmol / m3) on surface for the month of February. Source: COPERNICUS Space Program, “My Ocean” platform.

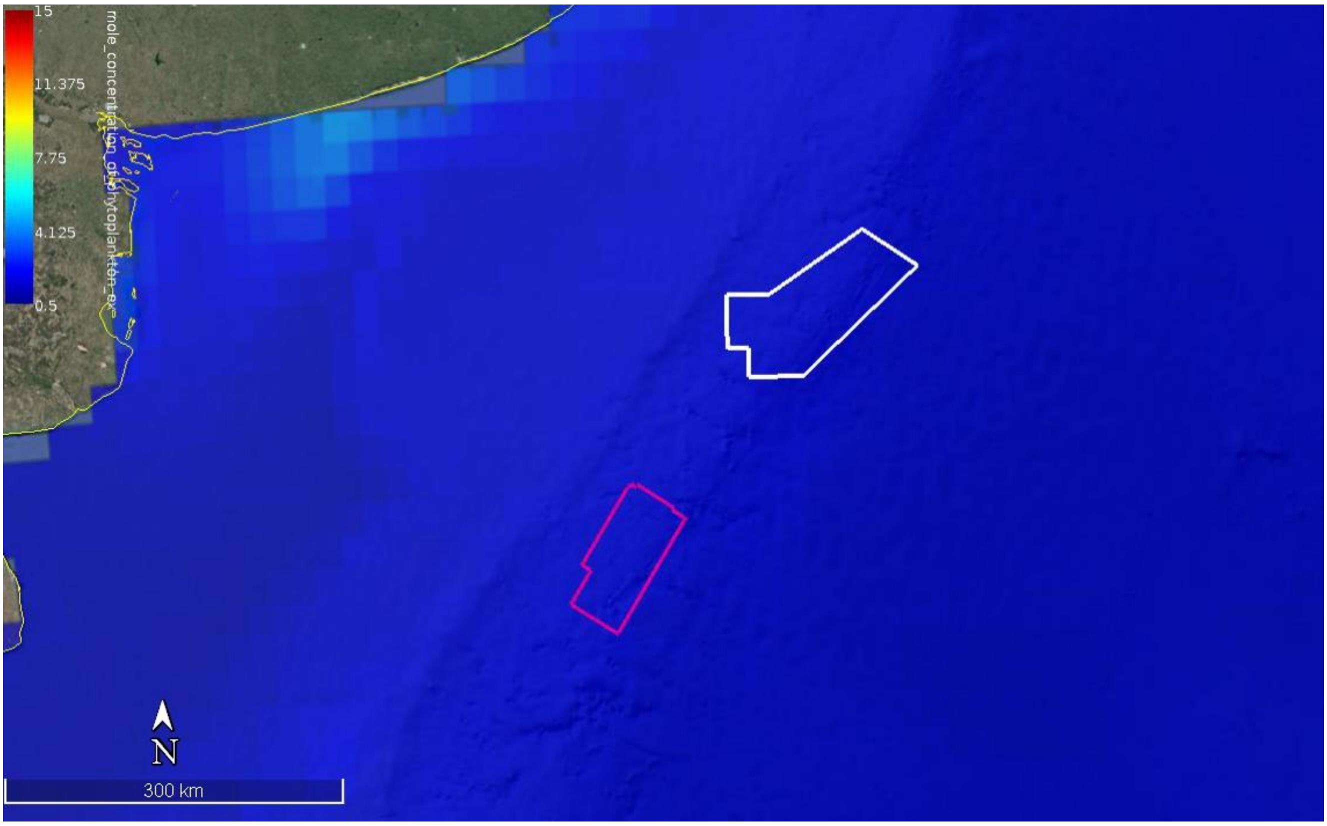


Figure 92. Phytoplankton (mmol / m3) on surface for the month of April. Source: COPERNICUS Space Program, “My Ocean” platform.

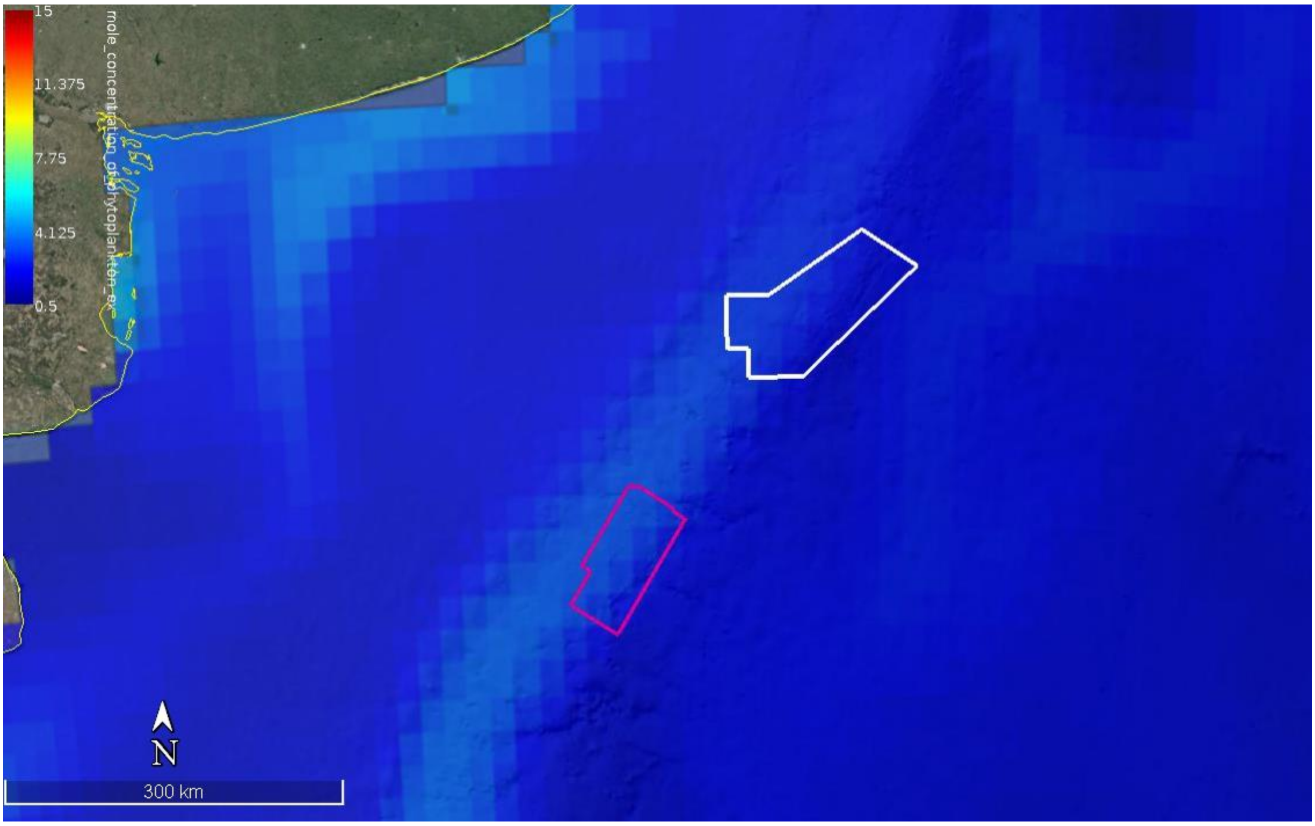


Figure 93. Phytoplankton (mmol / m3) on surface for the month of July. Source: COPERNICUS Space Program, "My Ocean" platform.

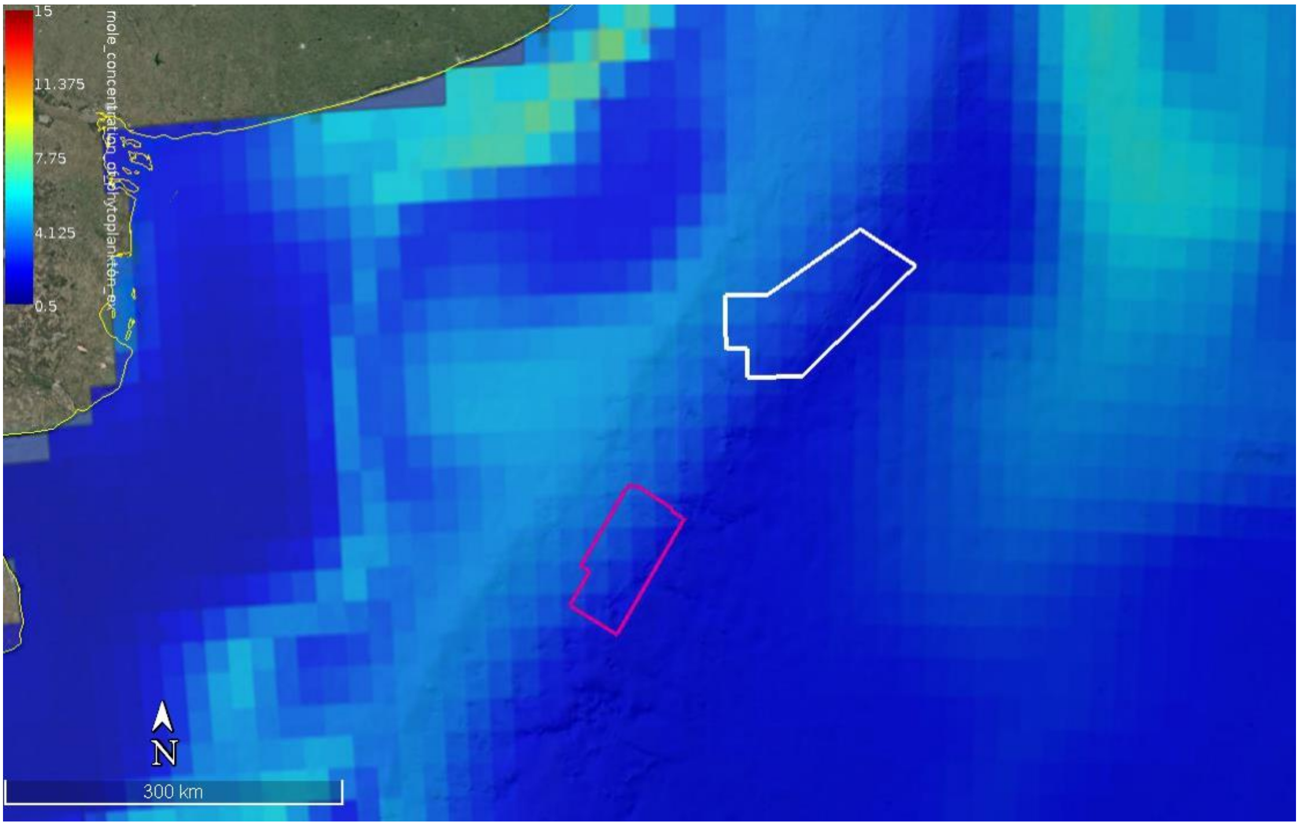


Figure 94. Phytoplankton (mmol / m3) on surface for the month of October. Source: COPERNICUS Space Program, "My Ocean" platform.

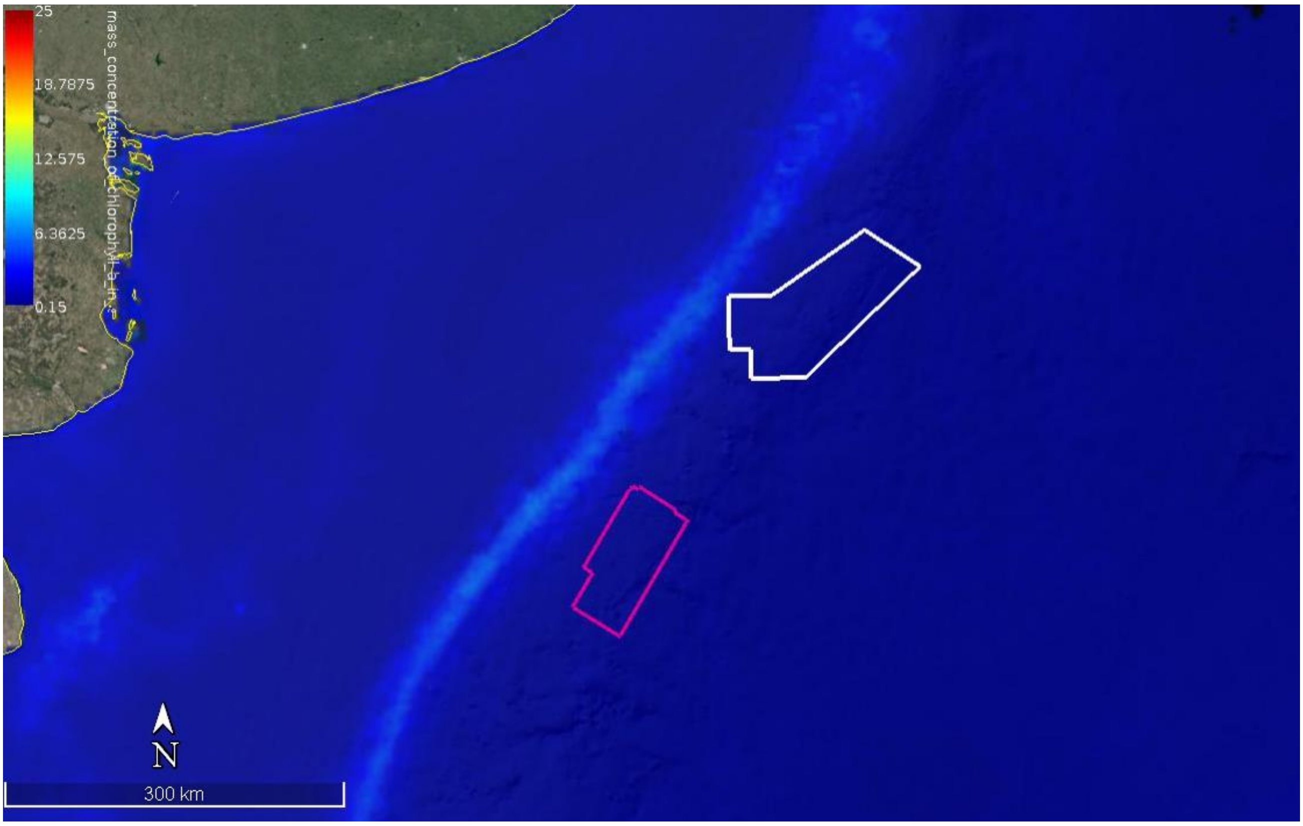


Figure 95. Chlorophyll (a) (mg / m3) on surface for the month of February. Fuente: Source: COPERNICUS Space Program, "My Ocean" platform.

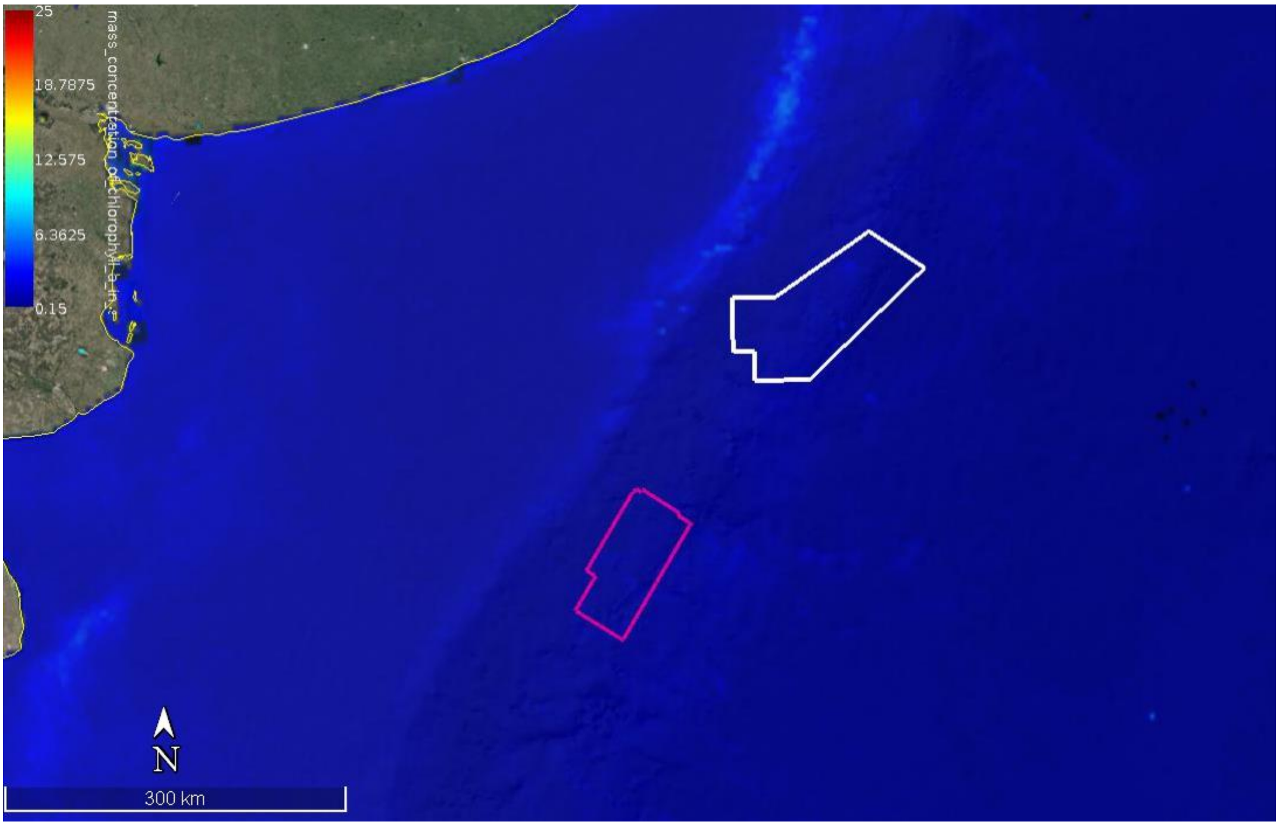


Figure 96. Chlorophyll (a) (mg / m3) on surface for the month of April. Source: COPERNICUS Space Program, "My Ocean" platform.

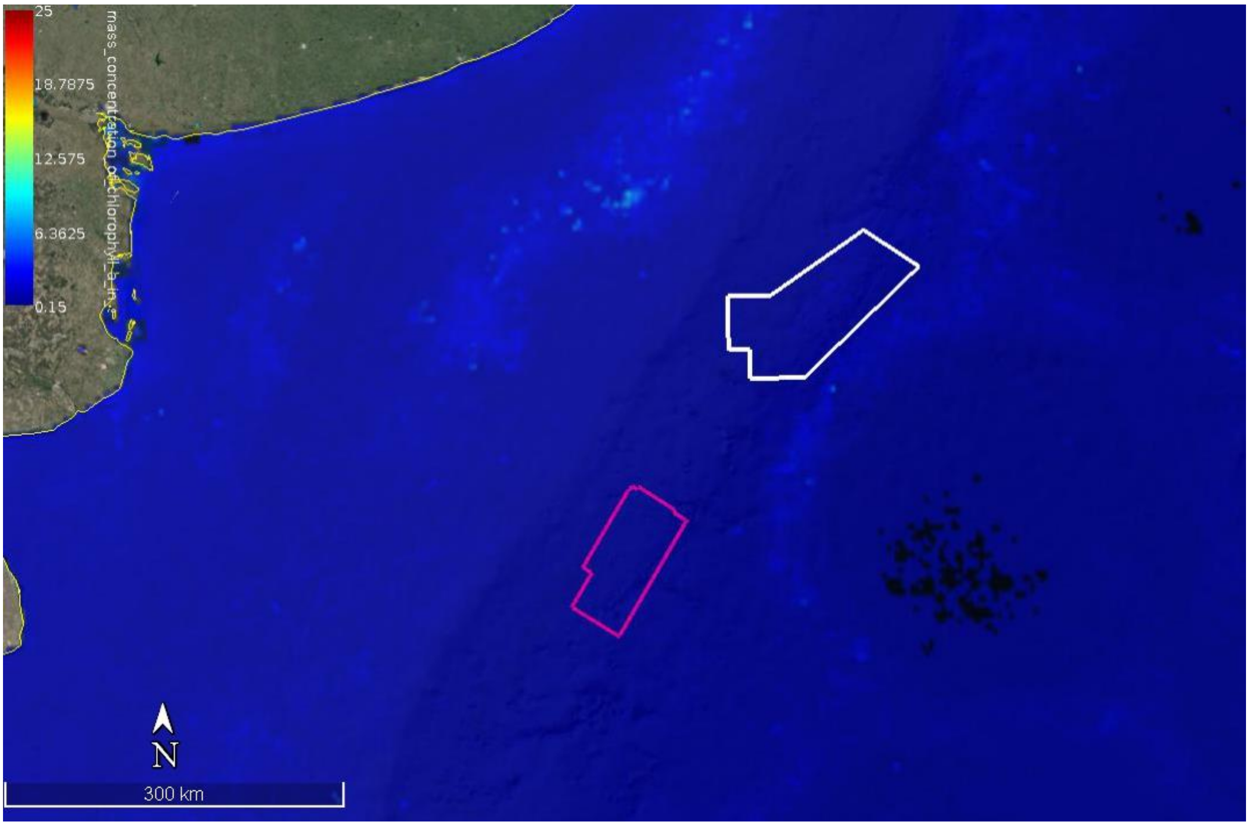


Figure 97. Chlorophyll (a) (mg / m3) on surface for the month of July. Source: COPERNICUS Space Program, "My Ocean" platform.

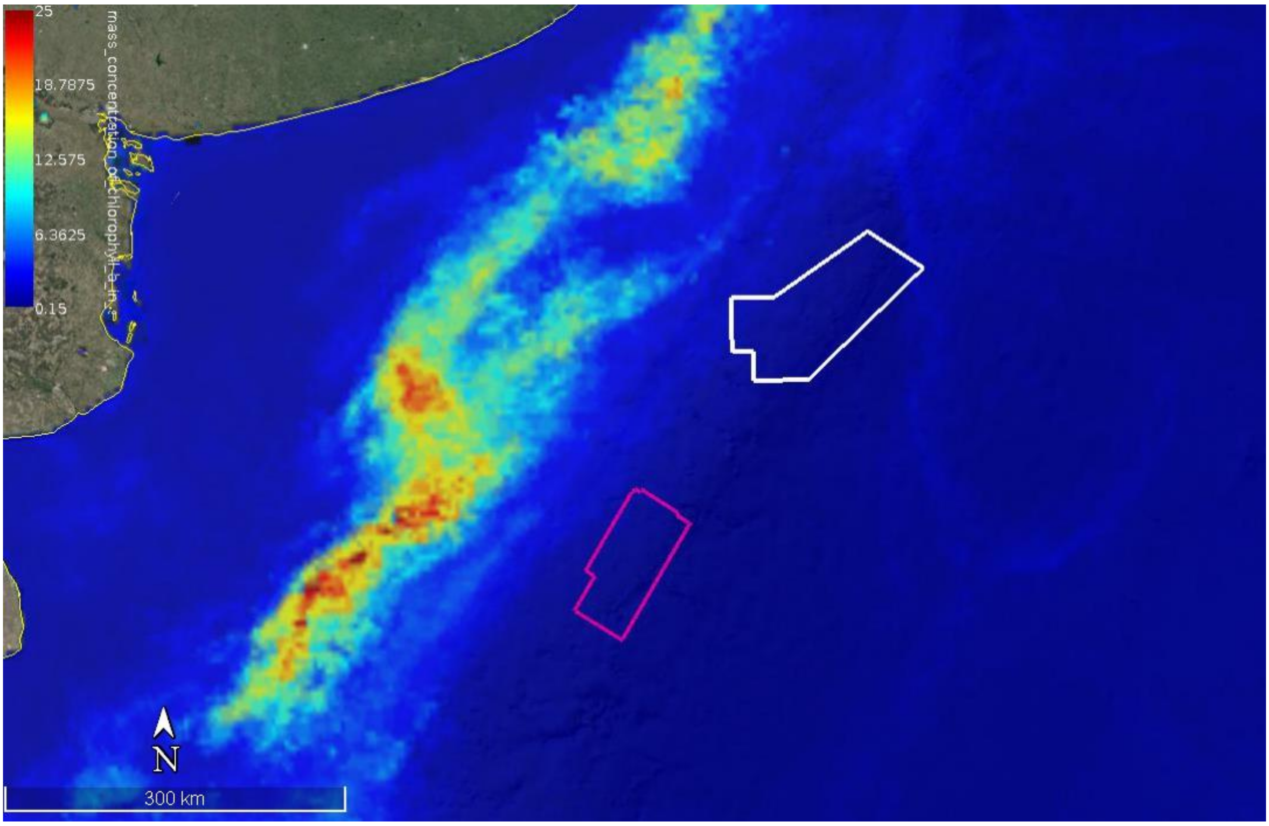


Figure 98. Chlorophyll (a) (mg / m3) on surface for the month of October. Fuente: Source: COPERNICUS Space Program, "My Ocean" platform.

3.3 CLIMATOLOGY

The local atmospheric circulation is controlled by weather changes in the study area through the combination of high-pressure systems of the South Pacific and South Atlantic. The southwesterly circulation, associated with the high pressure system of the South Atlantic, causes advection of warm and humid air from subtropical regions. Cold anticyclones over southern Argentina periodically (particularly in winter) drive cold maritime air masses from the Southwest Atlantic over the littoral are (FREPLATA, 2004).

Table 2 displays the seasonal climatic detail of the sea of the Southwest Atlantic Ocean (Bottomley, 1990).

Table 2. Climatic table for the area located between 35ºS-40ºS and 60ºW-50ºW in the Southwest Atlantic Ocean. Source: Bottomley (1990).

Month	V (m/s)	PV (%)	P (mb)	Temperature (ºC)			e (mb)	r (%)	C (%)
				Sea	Air	D			
Jan	5,3	18	1012	20,5	20,6	0,1	19,1	78	46
Feb	6,4	10	1012	20,6	20,1	-0,6	18,5	78	41
Mar	6,8	17	1016	19,9	18,7	-1,3	16,8	77	47
Apr	6,4	14	1016	18,6	17,6	-1,1	16,1	79	46
May	5,6	29	1016	15,8	14,9	-1,0	14,0	82	61
Jun	5,9	32	1015	13,1	12,3	-0,7	12,2	83	66
Jul	6,4	24	1019	10,9	10,8	-0,1	10,6	80	65
Aug	6,5	19	1018	11,7	11,1	-0,5	10,9	80	54
Sep	5,9	16	1018	12,0	12,1	0,0	11,7	84	55
Oct	5,4	23	1015	13,6	13,9	0,2	13,5	84	49
Nov	5,9	26	1014	16,2	16,5	0,3	15,5	81	58
Dec	6,0	27	1011	18,7	18,5	-0,2	16,9	78	51
Annual	6,0	21	1015	16,0	15,6	-0,4	14,6	80	53
V= Medium wind PV= permanence of the wind P= mean atmospheric pressure D= Tsea-Tair					e= mean vapor pressure r= Average relative humidity C= Cloudiness				
The shading highlights the period in which the project shall take place.									

As previously mentioned (see Point **Error! Reference source not found.**), the Argentine continental shelf is dominated by subantarctic waters diluted by fluvial inputs and the evaporation-precipitation balance, so that regions with water masses of different salinities can be differentiated (Perillo and Kostadinoff 2005, Piola et al. 2010).

Likewise, there is a strong seasonal variability caused by the circulation of two currents: the Malvinas current of cold subantarctic waters, low salinity and rich in nutrients, which flows northward, and that of Brazil of subtropical, warm and saline waters, which flows to the south.

These currents determine the oceanographic and biological rhythms of the area. The confluence of the two is characterized by an important high-energy thermohaline front, with numerous eddies and meanders of great amplitude (detailed information on the confluence phenomenon is presented in Point **Error! Reference source not found.**).

The position of the convergence of these currents varies in latitude, 3 ° to 4 ° approximately throughout the year, being further south during the summer and further north during the winter (Figure 99, 2Mp Program of the National Commission of Space Activities -CONAE – and Figure 101, Boschi 1997).

Average water temperatures in summer and winter are presented in Figure 101. It can be seen that the average water temperatures in summer vary from 22 ° C off the coast of Buenos Aires to 6 ° C south of Falkland Islands (Islas Malvinas), while in winter they range between 12 ° C and 2 ° C respectively.

The area holds significant seasonal variations. Provost, et al. (1992) show surface temperature variations from measurements carried out in the convergence zone. Temperatures vary between 24º and 6º for the summer and winter seasons (Figure 100).

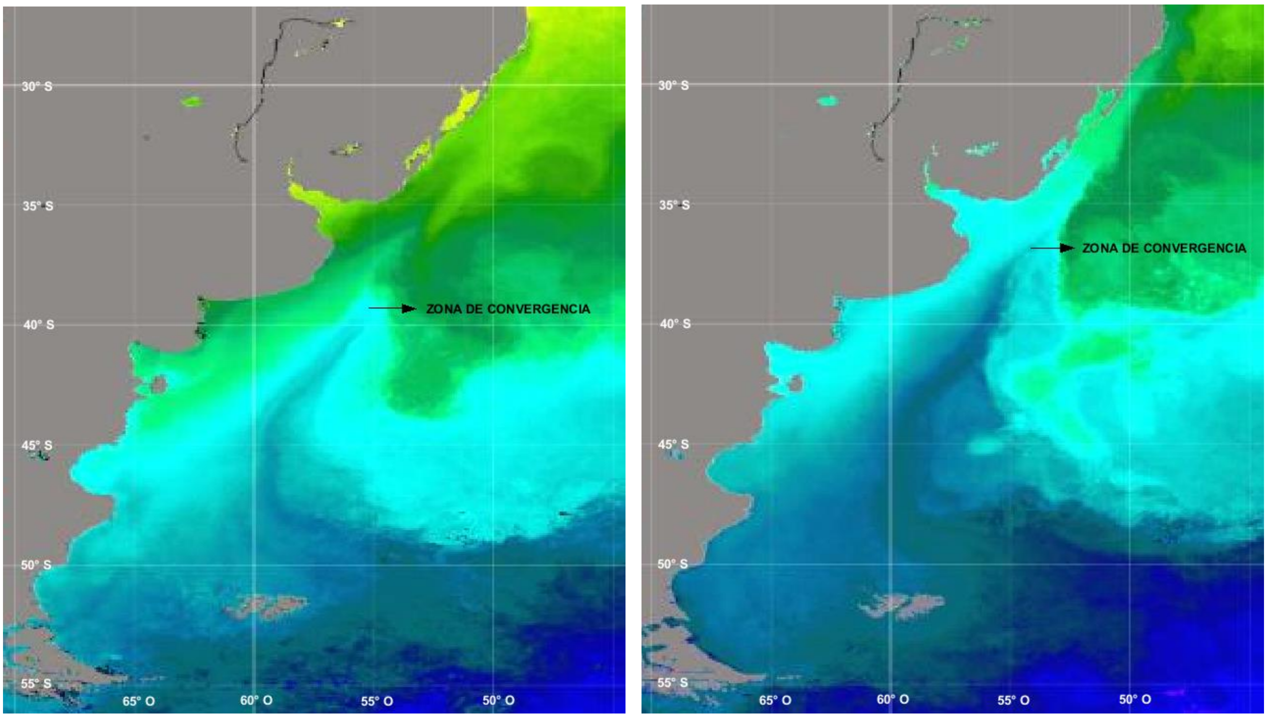


Figure 99. Surface water temperatures in the convergence zone of the cold Malvinas current and the warm Brazilian current. Left: austral summer; right: southern winter. Source: 2Mp Program of the National Commission for Space Activities -CONAE-, https://2mp.conae.gov.ar/index.php/materiales-educativos/material-educativo/imagenes-satelitales/821-temperatura-superficial-del-mar.

(Translation of Figure 99: Zona de Convergencia: Convergence Zone.)

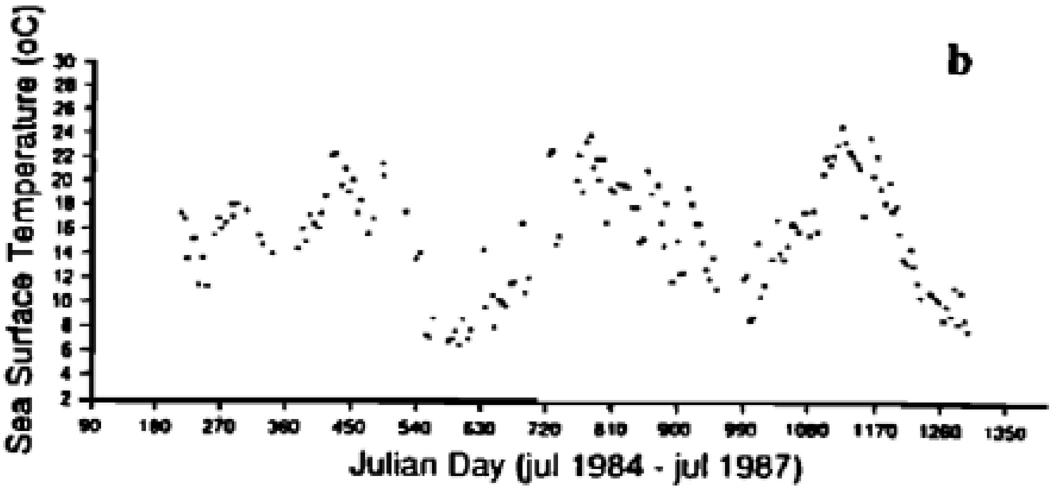


Figure 100. Surface temperature variations over 3 years. Source: Provost et al. (1992).

Above the sea, the air temperature quickly adjusts to the surface temperature of the water due to the sea-atmosphere heat exchange. Figure 102 shows the average surface air temperatures (Höflich, 1984) for the months of January and July respectively. These display features similar to those of the sea. The isotherms are relatively parallel and the horizontal thermal gradient is greater in summer than in winter.

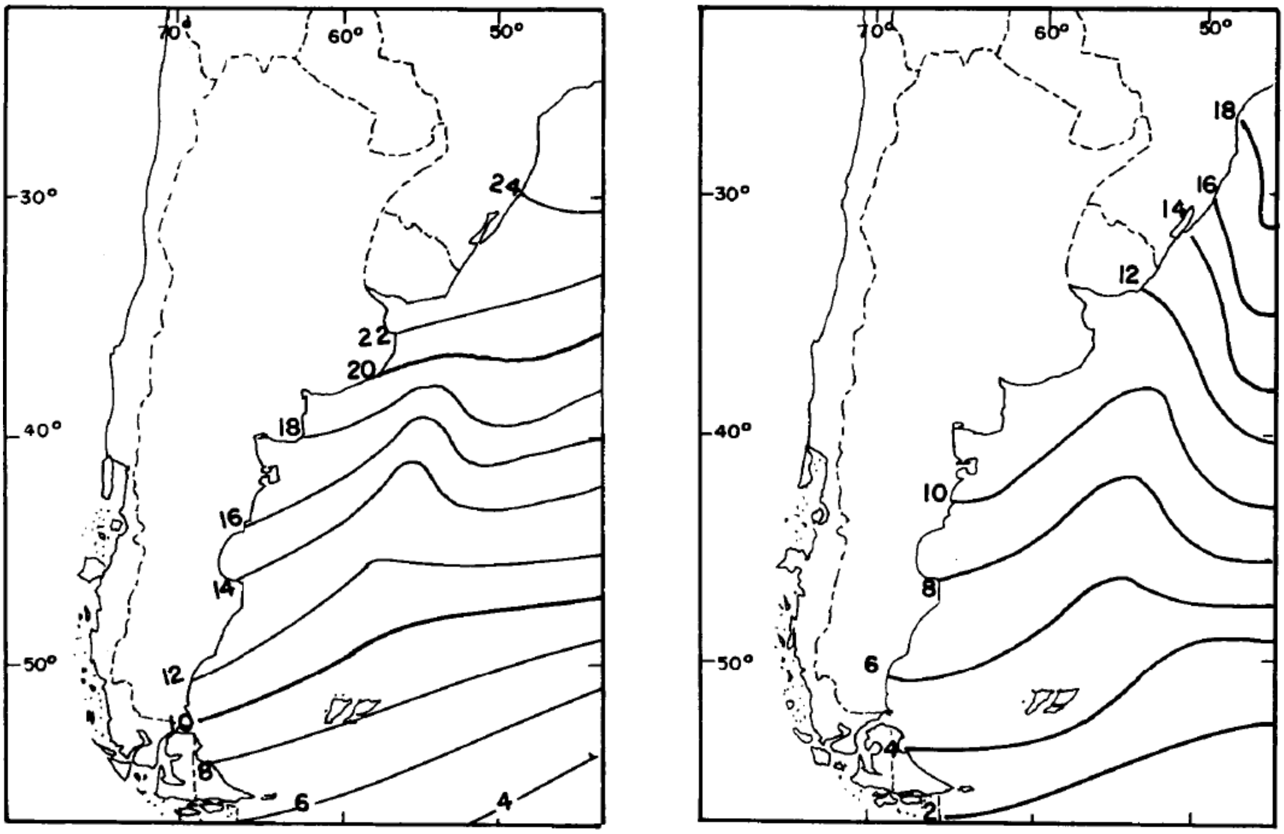


Figure 101. Sea surface temperature (ºC) of the months of January (left) and July (right). Source: Boschi (1997).

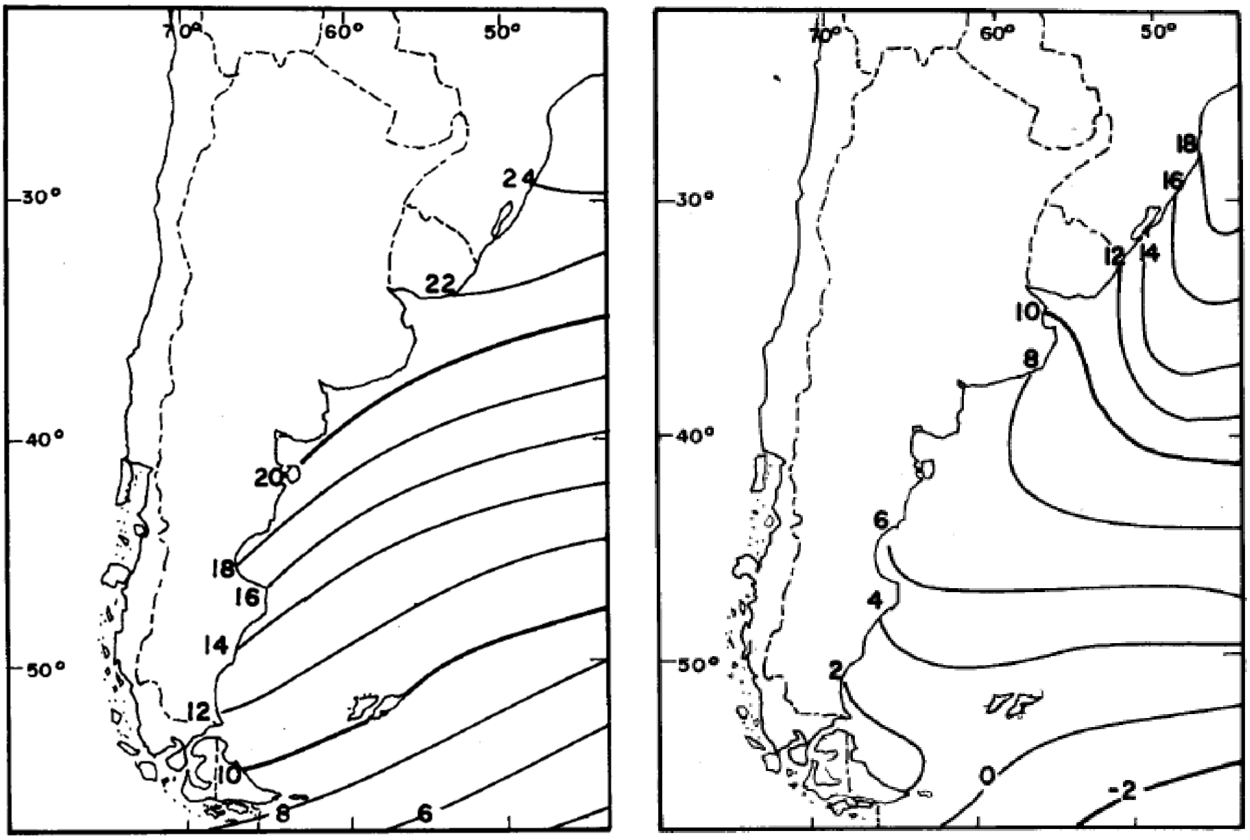


Figure 102. Surface air temperature (ºC) of the months of January (left) and July (right). Source: Boschi (1997).

The temperature difference between the sea and the air (T_{sea} -T_{air}) is an important indicator of the stability of the air in marine areas. Positive values indicate an unstable stratification that stimulates atmospheric turbulence and the flow of heat from the sea to the atmosphere, as the air heats up and absorbs water vapor. This heat and humidity spread rapidly to higher layers of the atmosphere producing the formation of clouds, precipitation, etc. Negative values show stable stratification and indicate that the atmosphere is being cooled down. But this cooling does not spread as quickly nor shall it reach very high layers of the atmosphere, producing the formation of fogs or *stratus* clouds in some cases. This temperature difference, although small, is responsible for the generation of atmospheric processes that partly affect the development of time systems over the sea. One of the most characteristic examples is the formation of sea fogs. Over the epicontinental Argentine sea, the atmosphere transfers heat to the sea during the summer season. In winter, on the other hand, the heat flow is reversed and the sea transfers heat to the atmosphere (Boschi, 1997).

The scarce annual rainfall in Patagonia, less than 250 mm, also characterizes the western sector of the Argentine Sea up to a distance of 150 km to 200 km from the coast; thereafter, rainfall increases to the east up to about 700 mm per year on the Malvinas current and decreases in the Falkland Islands (Islas Malvinas) themselves (600 mm to 650 mm). In the same sense, the rainfall frequency also increases (Boschi, 1997).

Air humidity can be obtained in different ways. One of them is the vapor pressure which is defined as the saturation pressure of water vapor at a given temperature. This variable indicates the degree of saturation of the atmosphere. Since evaporation always exists over the seas, saturation can only be reduced by vertical exchange with relatively drier air. Then, the relative humidity in the sea represents a balance between evaporation and the vertical exchange of water vapor (Boschi, 1997).

In the Southwest Atlantic Ocean between 30ºS and 40ºS, the relative humidity equals 80% (Figure

103). Table 2 shows the monthly average variation of relative humidity and vapor pressure. It can be seen that the relative humidity is constant throughout the year. Vapor pressure, like temperature, is a function of latitude, although its gradient is stronger at lower latitudes.

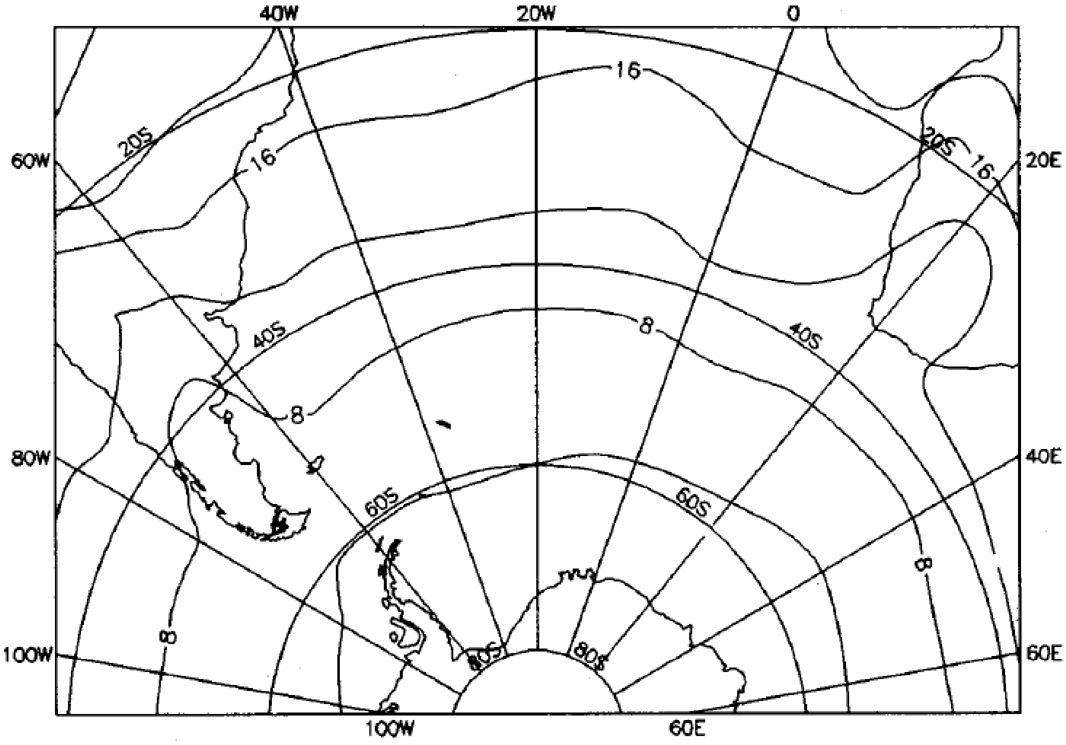


Figure 103. Air humidity (g / kg) 100 m above mean sea level of the month of January. Source: Boschi (1997).

Cloudiness refers to the percentage of sky covered by clouds including all types present. In January, cloudiness reaches its minimum value of 40% of covered sky in the maritime sector between Mar del Plata and the Valdés Peninsula; thence it increases to 50% at 30 ° S and to 80% at 55 ° S. In July, the average cloudiness varies from 55% in 30 ° S to 60% in the latitude of San Clemente del Tuyú and to 70% in latitudes of Tierra del Fuego and the Falkland Islands (Islas Malvinas) (Table 2, Boschi, 1997).

Atmospheric pressure can be considered as the weight of air per unit area over height, and at a given level, it varies from place to place and over time. The horizontal variations in pressure are much smaller than the vertical ones; however, small horizontal pressure variations are extremely important for wind direction and speed.

Figure 104 Maps show the mean pressure values for the months of January and July and it is observed that the subtropical anticyclone dominates the region towards low latitudes in both summer and winter. The center of the anticyclone is located approximately at 30º S and its value exceeds 1020 hPa in summer, while in winter, it moves towards the north, approximately at 25ºS, with a value higher than 1024 hPa. In both months, the position of the center is far from the South American coast, reaching approximately the 10ºW meridian in winter (closest position) and 5ºW in summer (Boschi, 1997).

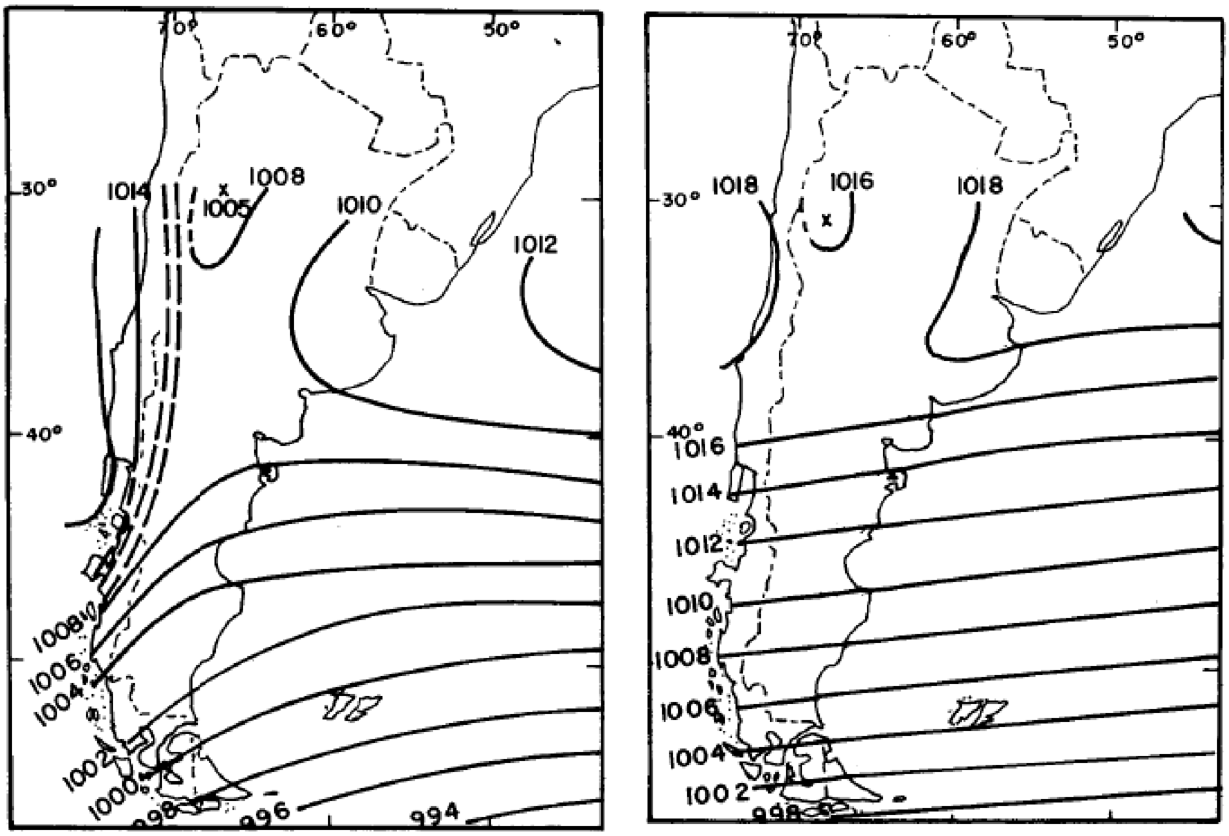


Figure 104. Surface pressure (hPa) of the months of January (left) and July (right). Source: Boschi (1997).

For the surface wind, Boschi (1997) found that the isotach lines present directions approximately parallel to the coast, so that the wind speed increases over the Argentine Sea both towards the east and towards the south, reaching very high values in latitudes of the southern Patagonia and Tierra del Fuego, as well as in the area of the Falkland Islands (Islas Malvinas), showing 8 m / s in January and 10 m / s in July.

The almost equidistant and parallel course of the isotach lines (Figure 105) also appears in the case of isolines of frequency of strong wind and gale (Figure 106). Gale is defined when wind speeds are greater than 8 according to the Beaufort scale. The increase of the three parameters described towards the east is due to the rise of the cyclogenetic processes in the same direction; their highest values in July correspond to the greater intensity of the circulation of the west winds and the greater frequency of their disturbances in this season of the year (Boschi, 1997).

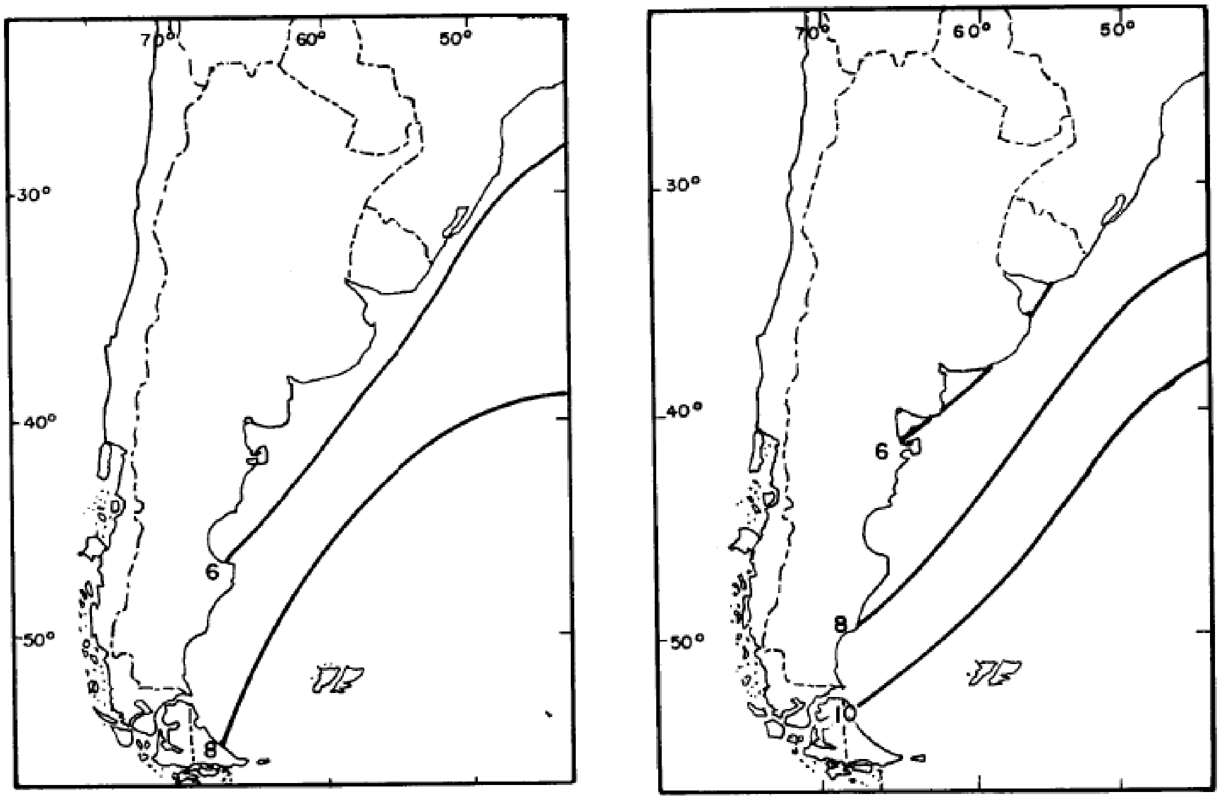


Figure 105. verage wind speed (m / s) of the months of January (left) and July (right). Source: Boschi (1997).

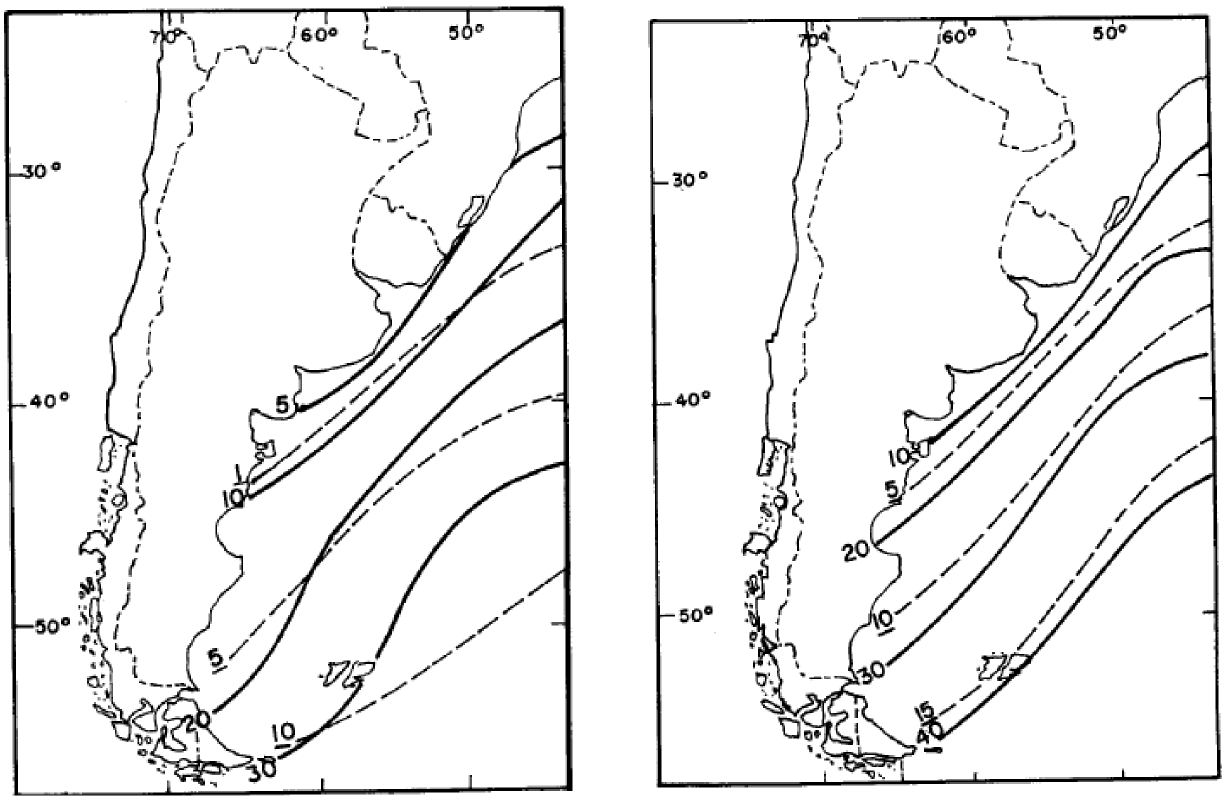


Figure 106. Frequency of strong wind (> 6 on the Beaufort scale, full line) and gale (> 8 Beaufort, dotted line) of the months of January (left) and July (right). Source: Boschi (1997).

The analysis of wind and wave data series from the IOWAGA project (Integrated Ocean Waves for Geophysycal and other Applications), developed by the IFREMER research institute (France), is presented below. The project uses the winds from the ECMWF (European Center for Medium-Range Weather Forecasts) base.

The data is organized by month and with a 3-hour time interval. The cell size of the data grid varies by area, from the French Atlantic coast grid with a 1/30 ° resolution to the GLOBAL grid with a 0.5 °resolution.

Figure 60 shows the position of the two IFREMER nodes analyzed: IFREMER-1 node (CAN_100 - CAN_10 operational area 8) and IFREMER-2 node (CAN_114 operational area).

Wind intensity and direction data have been gathered from these nodes for the last 5 complete years (2014 to 2018 period).

Figure 107 displays the compass roses drawn up for each of these IFREMER nodes.

In both nodes, IFREMER-1 (CAN_100 - CAN_108 Area) and IFREMER-2 (CAN_114 Area), it is observed that the winds are predominantly from the NNW, followed by those from the WSW, the latter being the most intense, with speeds exceeding 15 m / s.

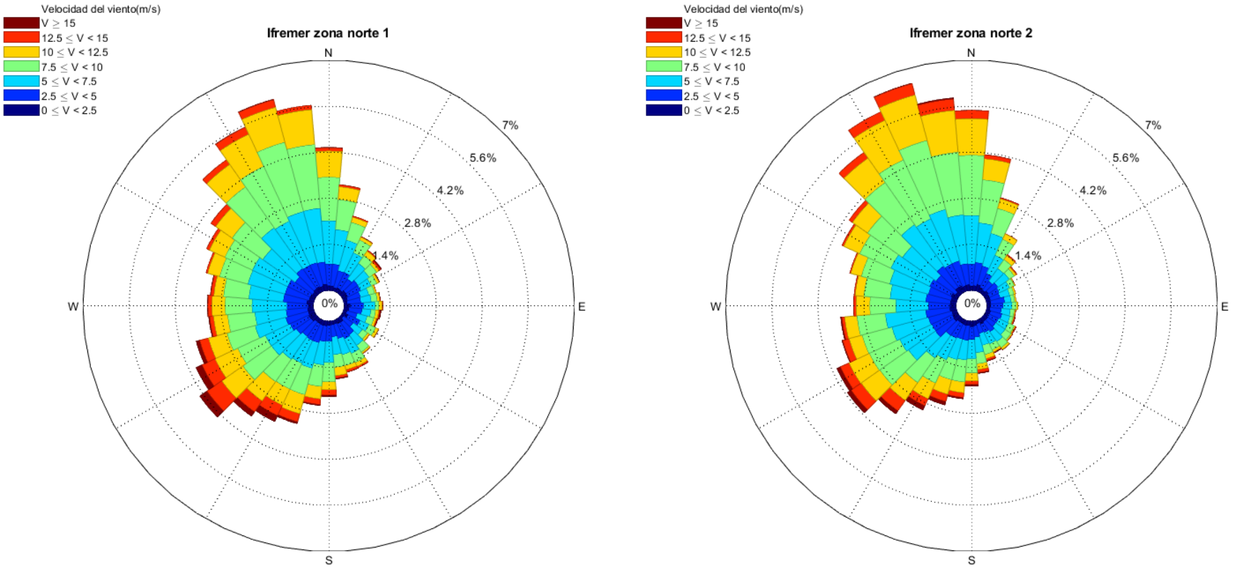


Figure 107. Wind compass roses for the IFREMER-1 and IFREMER-2 nodes, 2009 to 2018 period.

Next, the seasonal analysis of the wind time series is presented herein.

Figure 108 and Figure 109 display the wind compass roses for the IFREMER-1 and IFREMER-2 nodes, respectively, for the summer, autumn, winter and spring seasons.

The most intense winds that occur more frequently in autumn and winter are those coming from the WNW. It should be noted that the Project shall take place in the October-March period in order to avoid the worst conditions of the waves.

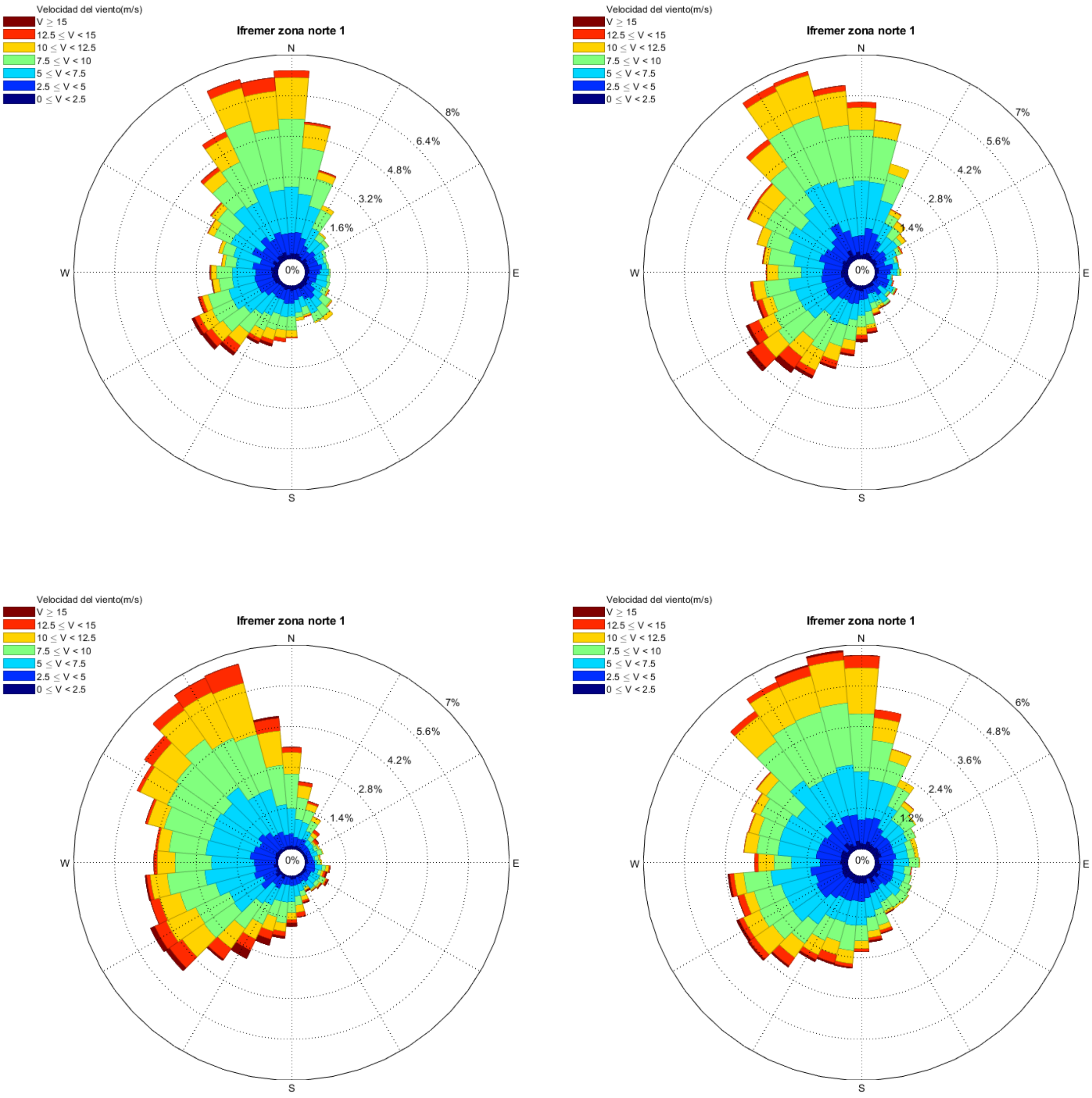


Figure 108. Wind Compass roses for the IFREMER-1 node, seasonal division, 2009 to 2018 period. From top to bottom and from left to right: summer, fall, winter and spring.

(Translation of Figure 108: Velocidad del viento: Wind speed. Zona Norte. North Zone).

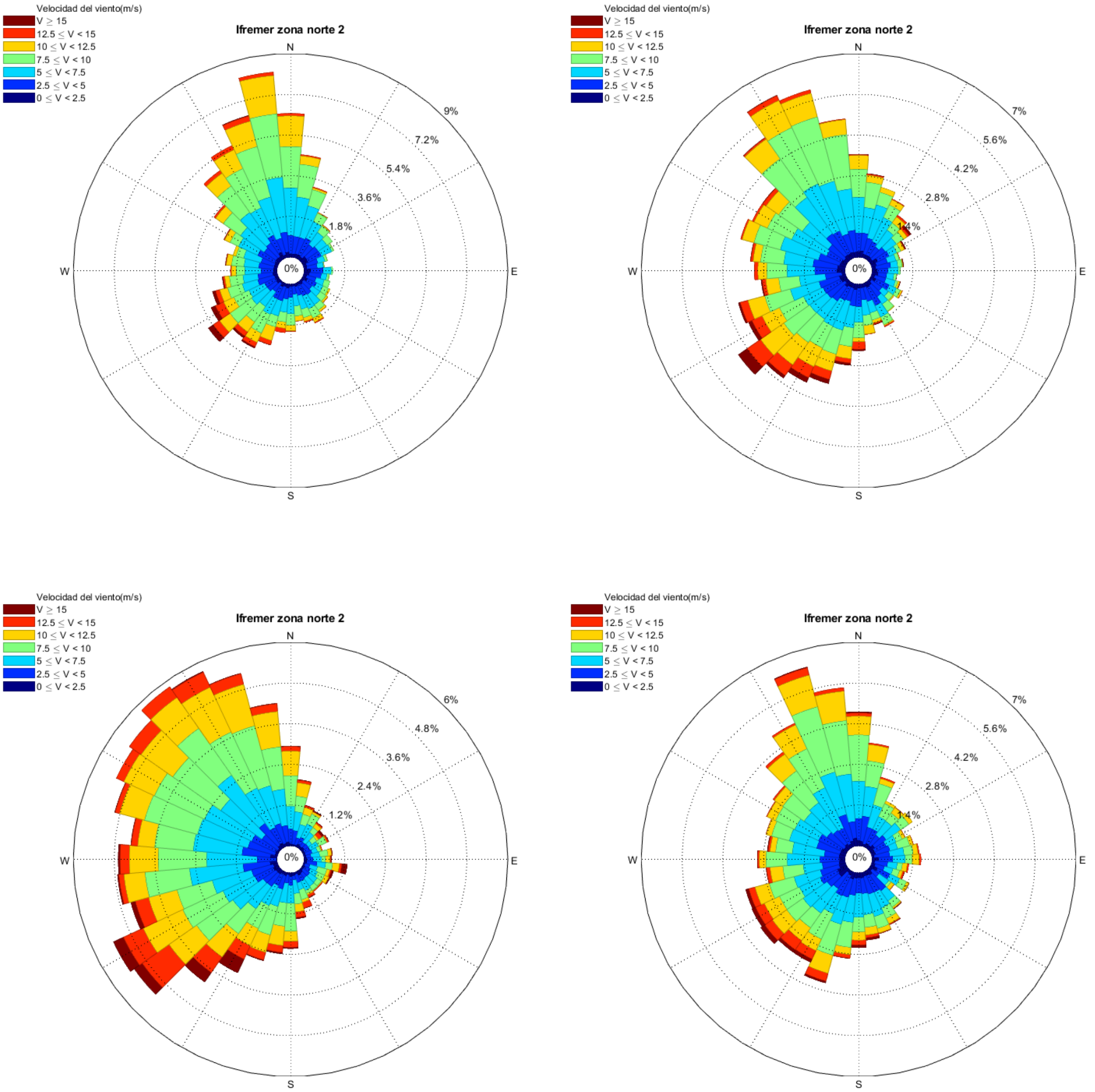


Figure 109. Wind Compass roses for the IFREMER-2 node, seasonal division, 2009 to 2018 period. From top to bottom and from left to right: summer, fall, winter and spring.

(Translation of Figure 109: Velocidad del viento: Wind speed. Zona Norte: North Zone).

4 BIOTIC ENVIRONMENT

As mentioned, the operational area of the Project is located on the area of the Argentine Sea which embraces part of the Argentine Continental Shelf and the Continental Slope (Figure 1). These areas make up an oceanic marine ecosystem of high biological diversity and high productivity known as the Argentine Sea Ecoregion.

Although the seismic data acquisition areas are immersed in the Argentine Sea, there are sensitive areas from the biological point of view on the adjacent coasts because they have significant biodiversity. Species of the different trophic levels gather to benefit from Patagonian coastal waters which represent areas of high productivity. The intertidal areas host a particular fauna which feed numerous marine and coastal birds. In addition, the adjacent land areas are sites which host sea, shorebird and marine mammal settlements.

Within the framework of this project, it is important to mention that the coastal areas would not be directly affected, with the exception of the transit of ships to and from the area of operations, for which the Port of Mar del Plata shall be used as a shipping and disembarking area.

There is a strong hydrological variability imposed by the circulation of two currents along the edge of the slope in the Argentine Sea: the Malvinas and the Brazilian Currents (see Point 0). The first is made up of sub-Antarctic waters, cold, low salinity and rich in nutrients, which flow to the north. The Brazilian Current presents subtropical, warm and saline waters that flow south.

The masses of water that flow over the continental shelf (Subantarctic Patagonian Current) are of subantarctic origin, and originate both by detachment of edge currents (Antarctic Circumpolar Current - Malvinas Current), and by the contribution of waters from subpolar continental spills (Tierra del Fuego channels and Strait of Magellan). This results because the southern tip of the American continent is strongly influenced by the Antarctic Convergence Current. The Malvinas Current emerges from this current and flows in a predominantly south-north direction along the edge of the continental shelf.

These currents meet in the so-called Confluence Zone in front of the Argentine shelf, on the continental slope, near 38º south latitude (Figure 110), one of the regions with the highest concentration of energy of all the oceans of the world, where the mixture of subtropical and subantarctic waters determines important physicochemical gradients and favors the presence of high concentrations of nutrients with important biological implications for the entire ecosystem.

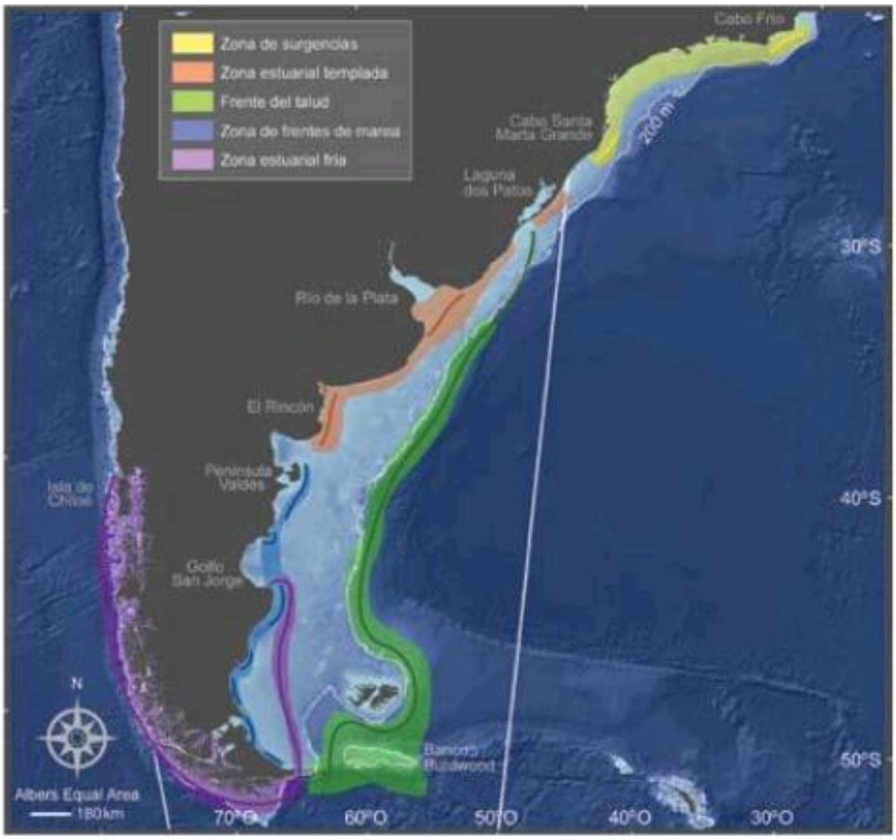


Figure 110. Main frontal zones of high productivity of the southern cone. Source: Acha et al. 2004.

(Translation of Figure 110: Zona de surgencias: emergence zone. Zona estuarial templada: Warm estuarine zone. Frente del talud: Slope front. Zona de frentes de marea: Tidal front zone. Zona estuarial fría: Cold estuarine zone.)

In this context, the waters of the Argentine Continental Shelf result from the mixture of coastal, subantarctic and subtropical water masses. Their relative proportions and mixing degree vary according to latitude and longitude. As a whole, the Argentine Sea forms one of the most extensive and biologically important warm seas on the planet.

The Argentine Sea holds two zoogeographic provinces: the Argentine Province and the Magellanic Province (Figure 111). The first one extends from the south of Brazil (23 ° S) and crosses the Uruguayan coast to the mouth of the Rio Negro (41º S). The waters off the Buenos Aires coast are part of the so-called Buenos Aires District. On the other hand, the Magellanic Province extends from the north of the Island of Chiloé (40º S) in the Pacific Ocean, passing through Cabo de Hornos, taking up most of the Patagonian continental shelf, including the Falkland Islands (Islas Malvinas) and most of the deep sector of the Buenos Aires platform, separating from the coast at approximately 42-43º S and continuing north until 35º S, about 100-150km from the coast and with depths between 60 and 200 m. This Magellanic Province, characterized by the presence of warm-cold waters, is subdivided into two districts: Surchileno and Patagónico. The Project's area of operations is located on the border between the Argentine Province and the Magellanic Province, which implies the presence of fauna and flora components of both districts.

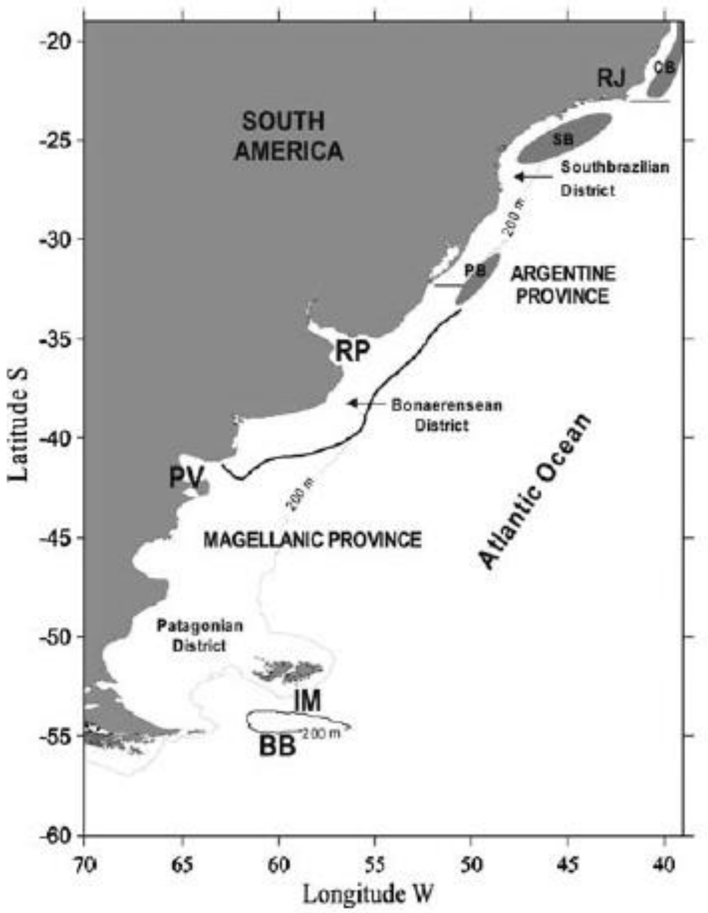


Figure 111. Location of the zoogeographic Provinces. Source: Menni et al. 2010

The main benthic organisms (including fish) typical of the Argentine Province (Table 3) and the Magellanic Province (Table 4) are mentioned below (Balech y Erlich, 2008).

Table 3. Organisms of the Argentine Province. Source: Balech and Erlich, 2008.

Celenterados	Equinodermos	Crustáceos	Moluscos	Peces
Renilla reniformis	*Astropecten cingulatum*	*Artemesia longinaris*	*Mytilus edulis platensis*	*Micropogonias furnieri*
Bunodactis marplatensis	*Enoplopatiria marginata*	*Pleoticus muelleri*	*Glycimeris longior*	*Cynoscion guatucupa*
Phymactis clematis	*Luidia* spp.	*Neohelice granulata*	*Adrana electa*	*Macrodon ancylodon*
Corynactis carnea	*Poraniopsis mira*	*Cyrtograpsus angulatus*	*Mactra janeiroensis*	*Umbrina canosai*
	Arbacia dufresnei	*Platyxanthus crenulatus*	*Aequipecten tehuelchus*	*Pagrus pagrus*
	Encope emarginata	*Ovalipes trimaculatus*	*Amiantis purpuratus*	*Nemadactylus bergi*
	Mellita platensis		*Pitar rostratus*	*Acanthistius patachonicus*
	Amphiodia planispina		*Calliostoma coppingeri*	*Percophis brasiliensis*
	Ophioplocus januari		*Buccinanops monilifer*	*Parona signata*
			Diodora patagonica	*Pseudopercis semifasciata*
			Brachidontes rodriguezi	*Mustelus schmitti*
			Mactra patagonica	*Engraulis anchoita*
			Mesodesma mactroides	*Scomber japonicus*
			Tagelus plebeius	*Seriola lalandei*
			Notocochlis isabelleana	
			Urosalpinx rushii	
			Muricopsis necocheanus	
			Adelomelon brasiliana	
			Macoma uruguayensis	

Table 4. Organisms of the Magellanic Province. Source: Balech and Erlich, 2008.

Celenterados	Equinodermos	Crustáceos	Moluscos	Peces
Antholaba achates	*Cycethra verrucosa*	*Lithodes santolla*	*Modiolus patagonicus*	*Macruronus magellanicus*
Isotealia antarctica	*Partiriella fimbriata*	*Paralomis granulosa*	*Aulacomya atra*	*Merluccius australis*
Phiaella falklandica	*Poraniopsis echiniaster*	*Peltarion spinosulum*	*Ostrea puelchana*	*Micromesistius australis*
	Arbacia dufresnei	*Libidoclaea granaria*	*Ensis macha*	*Salilota australis*
	Pseudechinus magellanicus	*Munida* spp.	*Mactra* sp.	*Dissostichus eleginoides*
	Austrocidaris canaliculata	*Euphausia vallentini*	*Mulinia edulis*	*Eleginops maclovinus*
	Cosmasterias lurida	*Euphausia longirostris*	*Protothaca antiqua*	*Patagonotothen ramsayi*
		Tryphosites chevreuxi	*Tawera gayi*	*Iluocoetes fimbriatus*
		Tmetonyx serratus	*Tegula patagonica*	
		Themisto gaudichaudii	*Capulus compressus*	
			Amauropsis andersoni	
			Mangelia purissima	
			Photinula coerulescens	

(Translation of Tables 3 and 4: Celenterados: Coelenterates. Equinodermos: Echinoderms. Crustáceos: Crustaceans. Moluscos: Mollusks. Peces: Fish.)

Next, a characterization of the main biotic components of the oceanic marine ecosystem in the project's area of influence is presented.

4.1 PLANKTON

Plankton corresponds to the group of aquatic organisms that move with the water column. It is composed of autotrophic (phytoplankton) and heterotrophic (zooplankton) organisms. Phytoplankton is made up of planktonic algae that represent the basis of the food web of aquatic ecosystems. Zooplankton is mainly made up of microinvertebrates organisms, whose biological cycle is developed entirely in plankton (holoplankton); and by organisms that are part of plankton only during a part of their life cycle (meroplankton), such as eggs and larval stages of invertebrates and vertebrates.

These organisms set up the first trophic levels of the ecosystem, being of important value as a food source for the higher trophic levels. Its abundance, biomass and distribution are decisive in the structure of the trophic network that supports the aquatic environment. Therefore, the alterations in the plankton generate cascading effects upon the rest of the trophic network, turning these organisms into indicators of the prevailing environmental conditions.

4.1.1 Phytoplankton

4.1.1.1 Spatial distribution

In some areas of the ocean there is a mixture of different water masses where changes in the properties of the water (mainly salinity, temperature or turbidity) intensify and reach the maximum gradient. These areas are called Frontal Zones which take up a relatively small area with respect to the entire neritic sector, and show high biological productivity. There are several and diverse fronts in the waters of the Argentine sea (Allega et al. 2020) (Figure 112).

The frontal systems are characterized by a flow of energy that enters the ecosystem through the phytoplankton, crosses the zooplankton and flows towards the upper trophic levels between which fishery resources are found.

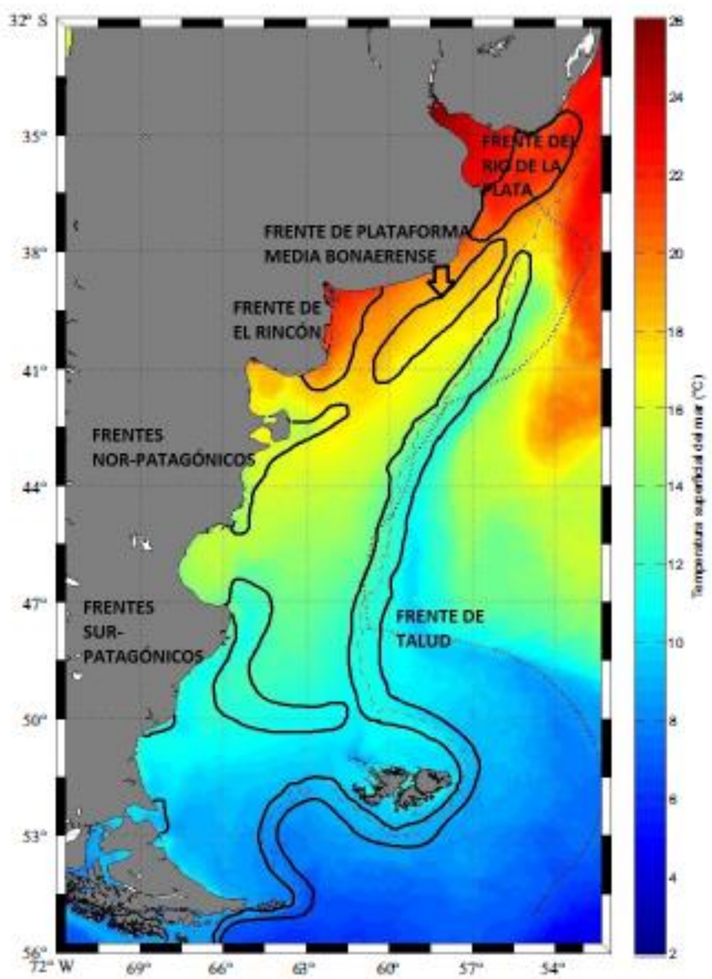


Figure 112. Graphic of the main frontal areas of the ZEEA made on the basis of a sea surface temperature map. Source: Allega et al. 2020.

(Translation of Figure 112: Frente del Rio de la Plata: Rio de la Plata Front. Frente de Plataforma Media Bonaerense: Bonaerensean Middle Platform Front. Frente de “El RIncon”: “El RIncon” Front. Frentes Nor-

Patagónicos: Nor-Patagonian Fronts. Frentes Sur- Patagónicos: South-Patagonian Fronts. Frente del Talud: Slope Front.)

Phytoplankton production varies depending on the two characteristic currents of the area. In this sense, the areas influenced by the Brazilian Current show a reduced concentration of chlorophyll, between 0.02 and 0.20 mg / m3 (Campagna et al. 2006). On the other hand, the Malvinas Current waters display a high concentration of chlorophyll, which ranges between 0,20 y 2,25 mg/m^3.

Although there is an important concentration of chlorophyll, and therefore, of phytoplankton along the Malvinas Current, there are certain areas where the concentration becomes very important.

One of them is where the confluence of the Brazil / Malvinas currents occurs, where subtropical and subantarctic waters mix, bringing about important physical-chemical gradients and favoring the presence of high concentrations of nutrients with important biological implications for the entire ecosystem. The high concentration of chlorophyll is not limited only to the fronts in the Brazil / Malvinas confluence zone, but it also reaches the most homogeneous waters. Productivity is based on the fact that both streams contribute with certain elements that favor the growth and concentration of phytoplankton. The Malvinas current provides subantarctic waters rich in nutrients, and that of Brazil, the stability required for the growth of phytoplankton (Campagna et al. 2006).

Regarding the distribution of the species, the fronts constitute a dispersal barrier and define biogeographic patterns of marine organisms. Phytoplankton are dominated by flagellates and few diatom species in the warm waters near the fronts. The waters of the Brazil / Malvinas confluence are dominated by temperate diatoms (*Leptocylindrus, Pseudonitszchia, Rhizosolenia, Fragilariopsis* and small *Chaetoceros* and *Odontella*). The dinoflagellate population in this area is made up of a mixture of heterotrophic species from cold and subtropical waters. A few autotrophic forms are also abundant, contributing to the maximum chlorophyll recorded in these waters. In surface waters where chlorophyll values are high, between 38º and 40º S, there are foraminifera typical of cold waters (*Globigerina bulloides, Neogloboquadrina pachyderma*) in a greater proportion than those observed north or south of said position. The diatom flora of the Malvinas current, south of the confluence area, is more diverse and is dominated by cold-water species of the *Pseudomitzchia, Rhysozolenia, Fragilariopsis and Thalassiosira* types, among others) (Cañete 2005). Through the use of microscopy and pigment analysis, Carreto et al. (2003) determined the presence of three phytoplankton associations in a section that crossed the Río de la Plata from the estuarine zone to the oceanic sector: 1) Estuarial and coastal communities dominated by the *cryptophyte Cryptomonas* sp., with the presence of the heterotrophic *flagellate Noctiluca scintillans*. 2) Communities of the continental shelf and the Malvinas Current dominated by the coccolithophore *Emiliania huxleyi*. 3) Community of the Brazilian Current characterized by the abundance of the picoplanktonic cyanobacteria *Synechococcus* sp.

The following figure shows concentrations of coccolithophores with a SeaWifs image in real color displaying the band of high reflectivity in the vicinity of the slope (Garcia et al 2005).

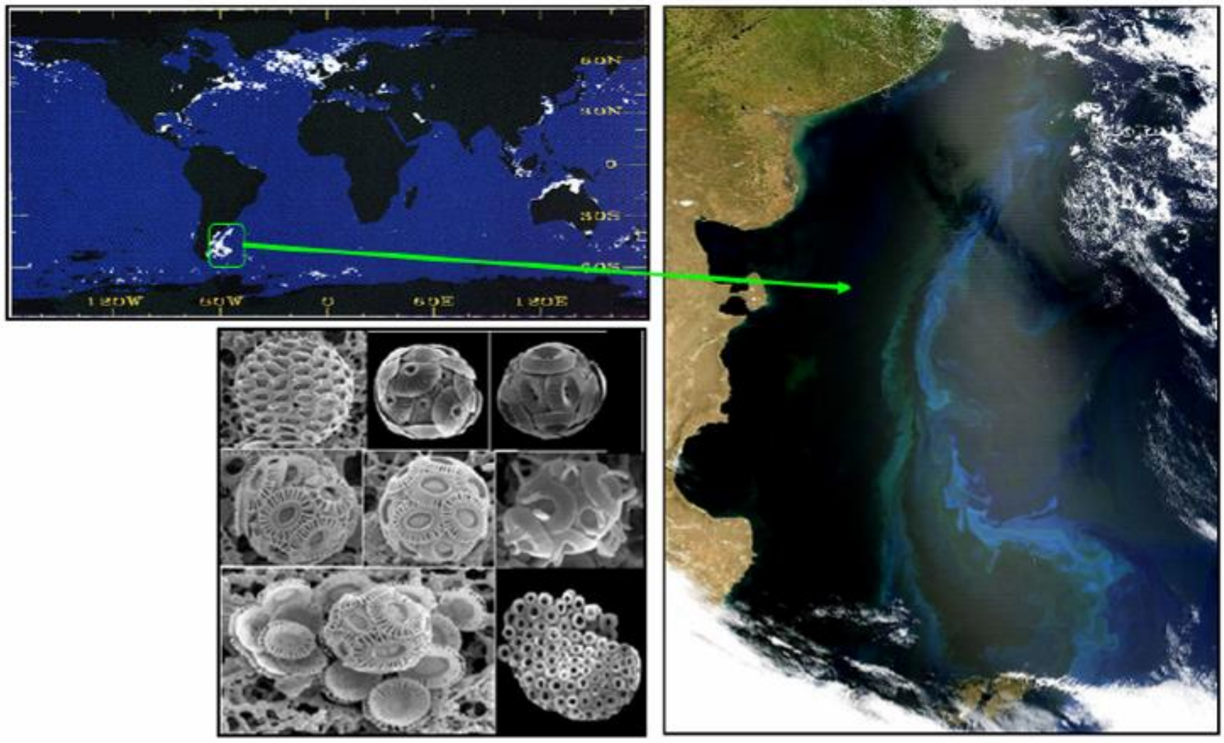


Figure 113. Real image of coccolithophores Concentrations. On the left below, detailed photographs of microscopic calcite shells of different species of coccolotophores. Source: García et al. 2005.

The Argentine exclusive economic zone (ZEEA) has 6 fronts, as mentioned above: Rio de la Plata Front, Continental Slope Front, Middle Platform Front, “El Rincón” Front, North Patagonian and South Patagonian Fronts. The indirect area of influence of the project is located in the "Frente del Talud Continental" (Continental Slope front) system, with significant concentrations of phytoplankton (Romero 2008; Cepeda et al. 2018).

The Front of the Slope is defined between the waters of the Malvinas Current and the waters that are on the platform at depths less than 200 m. Upwelling processes occur along the front where the Malvinas Current provides nutrients to the illuminated layers on the adjoining platform, giving rise to an important phytoplankton production that sustains the food web of the region, especially in spring (October to December) and summer (January to March). The zooplankton of this region is very diverse and is composed of great abundances of amphipods hyperidae, euphasids, salps and carnivorous zooplankton species, among which the jellyfish *Desmonema gaudichaudi* stand out due to the large biomasses reached during their frequent demographic explosions. The vicinity of this front constitutes one of the most important fishing grounds for Argentine squid (*Illex argentinus*), common hake (*Merluccius hubbsi*), Patagonian sea bass (*Zygochlamys patagónica*), Southern Blue Whiting (*Micromesistius australis*), southern hake (*Merluccius australis*), hoki (*Macruronus magellanicus*) and toothfish (*Dissostichus eleginoides*) (Allega et al. 2020).

Olguín et al. (2006) carried out the first study on the spatial distribution patterns of phytoplankton (mainly diatoms) at a mega-scale in the Southwest Atlantic Ocean. The changes in the composition of the assemblage along the transect allowed the identification of 5 discrete areas: Subtropical, Southern Transitional, Northern Transitional, Subantarctic and Antarctic. Diversity does not change much with latitude, but diversity is the highest north of 40 ° (Figure 114).

The phytoplankton assemblage corresponds to the “Transicional del Norte” combination for the edge of the slope in the area of indirect influence of the project. This assemblage is characterized by the presence of 119 registered diatom species, 20 of which are restricted species but invariably not very abundant. Thirteen (13) species of diatoms were found in this area; Among these, *Chaetoceros contortus*, *Pseudo-nitzschia* multiseries, and *C. rostratus* are particularly abundant, with the exception of *P. fraudulenta*, whose range extends beyond 55 °. The rest of these diatoms are practically absent south of 41 ° (Olguín et al. 2006).

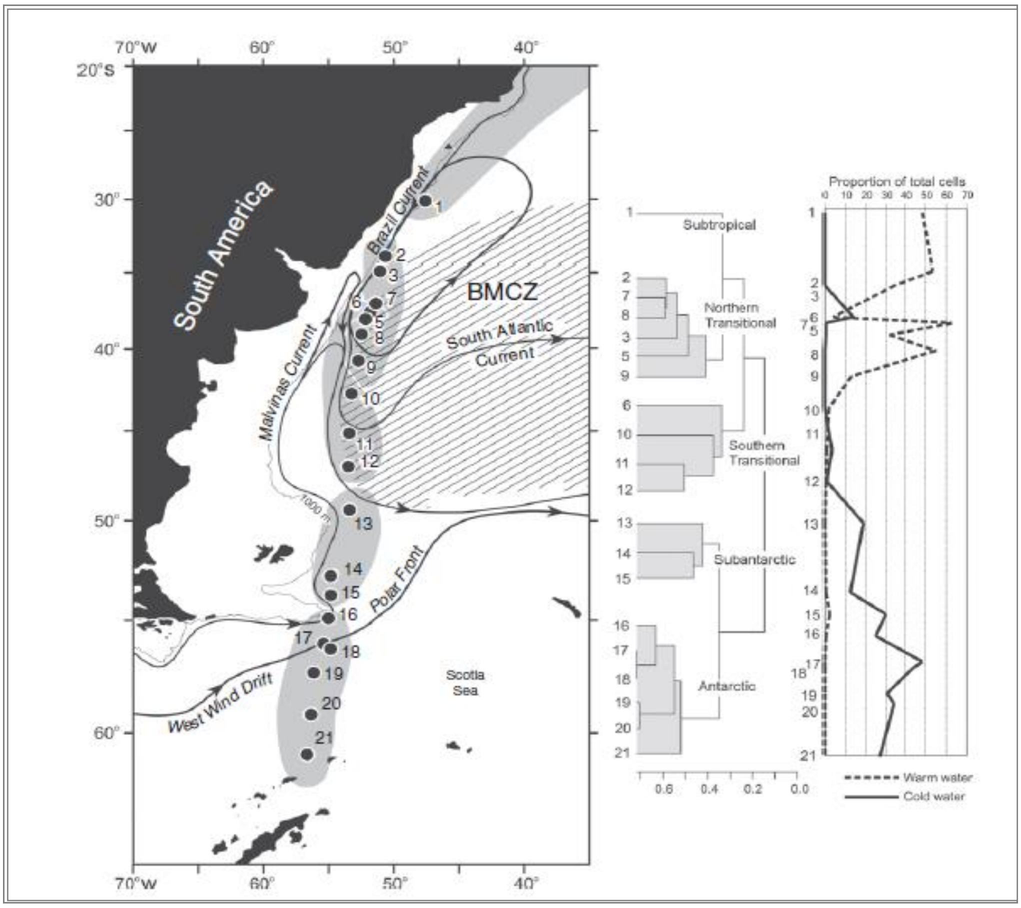


Figure 114. Geographic zoning of the area based on the integrated data of diatoms and depths for the sites surveyed by UPGMA analysis. Source: Olguín et al. 2006.

4.1.1.2 Temporary distribution

Phytoplankton production in the Argentine Sea describes an annual increase and subsequent decrease bimodal cycle, typical of temperate-cold water ecosystems with seasonal thermoclines. The maximum phytoplankton production occurs in spring, beginning with intense growth during the months of October and November in shallow coastal waters north of the shelf. The production wave gradually expands towards the South and moves away from the coast as it enters the summer period. A secondary maximum of primary production is observed in the first months of autumn (Campagna et al. 2006).

In general, after the peak of primary spring production there is a reduction in the concentration of nutrients, especially silicates, which limits the growth of diatoms, so that there is a change in the phytoplankton flora in favor of coccolithophores, dinoflagellates and other small flagellates that have the ability to use nutrients from the mineralization of organic compounds (Campagna et al. 2006).

According to Lutz et al. (2009) the first study in the Argentine and Antarctic Continental Shelf showed that phytoplankton production was higher in the north than in the south of the shelf breaking point at the beginning of spring, and that the production efficiency per unit of chlorophyll increases as the season draws on. As can be seen (Figure 115), the maximum chlorophyll changed position from one week to the next on the sampling dates, which possibly influenced the positioning of the zooplankton that uses them. Although the slope area of the Argentine Continental Shelf is considered of high biological production caused by various factors, satellite images show dynamic situations and rapid changes in the position of phytoplankton blooms. This suggests that although it is an area of high biological production favored by the emergence of nutrient-rich waters provided by the Malvinas Current, and which are used by algae when environmental conditions are favorable in spring, they would not remain statically in the slope but would be transported quickly. This mobility, which determines the presence of zooplankton, could be due to circulation patterns derived from the confluence of the Brazilian and Malvinas currents and their interactions in the central region of the platform. However, as observed in the work carried out by Palma et al. (2004 and 2008) another possibility of rapid change in the position of the phytoplankton biomass is produced by the presence of winds over the sea surface that would promote a rapid sweep.

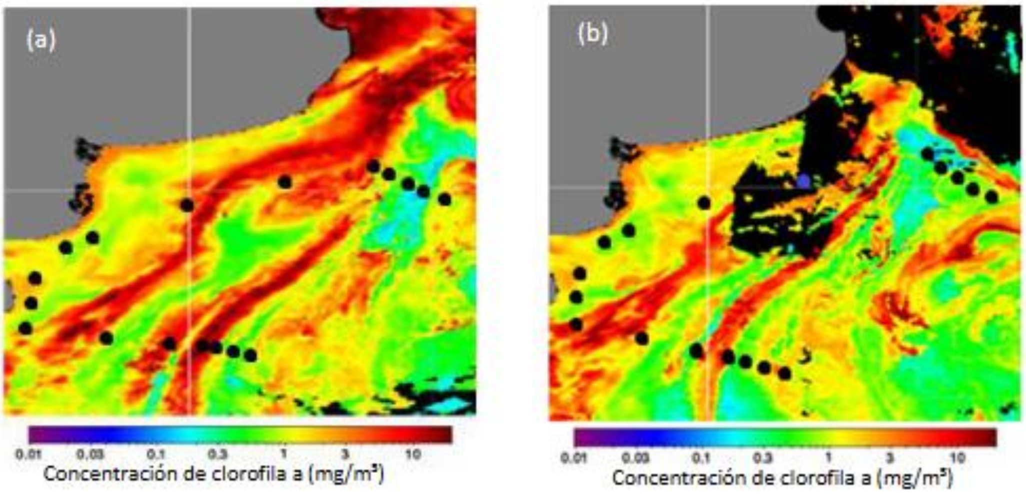


Figure 115. Concentration of "a Chlorophyll" determined in the study region. Compound satellite image (a) of 8 days between November 9 and 16 and compound satellite image (b) of 8 days between November 17 and 24, 2010. Source: Priotto 2017.

(Translation of Figure 115: Concentración de clorofila a (mg/m3): Concentration of "a Chlorophyll" (mg/m3)).

Segura et al. (2013) sampled 70 stations in 3 periods (Figure 116) to distinguish different types of photosynthetic and Bio-optical phytoplankton (PBPT). These authors examined the main taxonomic composition and percentage of "a chl" in fractions smaller than 5 *um* found in the PBPT. The results show that there is a high degree of variability in the photosynthetic and bio-optical properties, which indicates that the phytoplanktonic communities adapt to the high heterogeneity in the environmental conditions of this region.

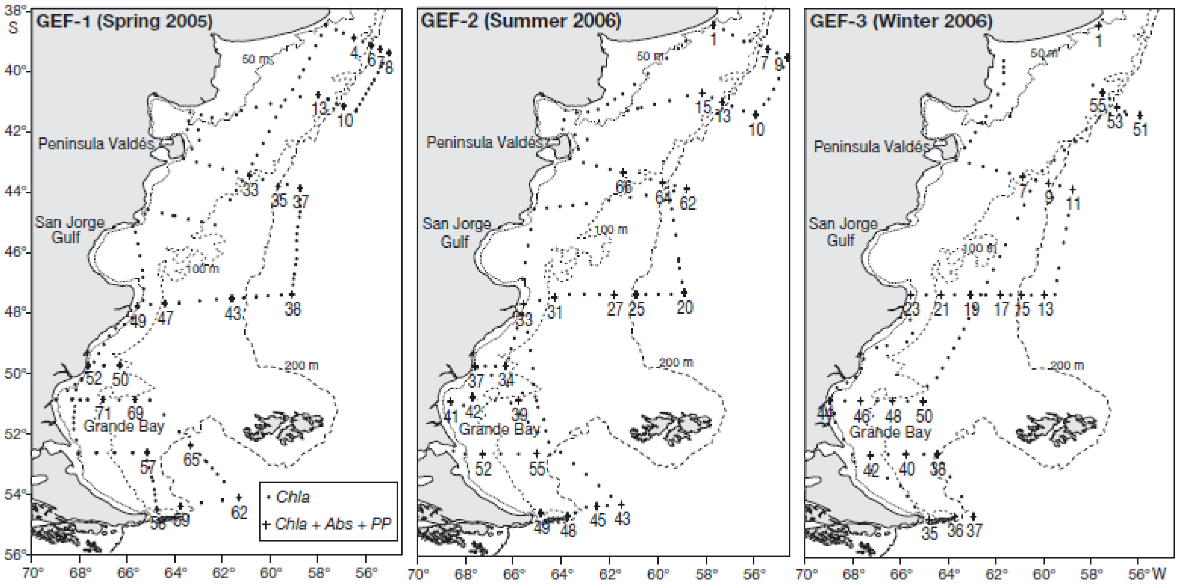


Figure 116. Positioning of the 3 cruise ship stations (GEF-1, GEF-2 and GEF-3). The Symbols indicate where samples were collected at the stations. *Chl a* represents the points where only chl a was measured on the surface, and *Chl a + Abs* (Absorption + PP (primary field production) represents the primary production in each station. Source: Segura et al 2013.

Figure 117 shows that the highest concentrations of *chl a* on the surface belong to the summer season for the indirect area of influence of the project (Segura et al 2013).

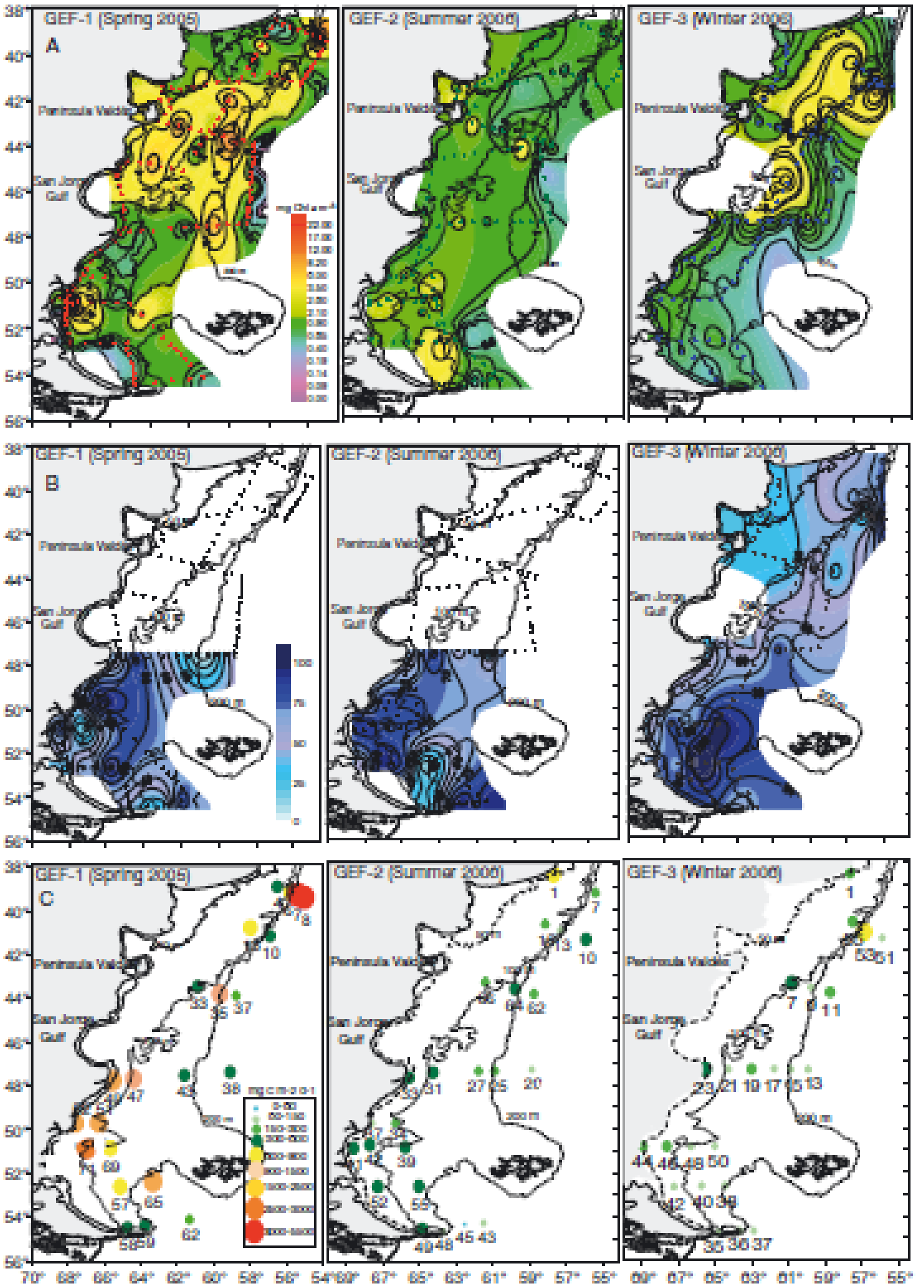


Figure 117. Distribution of (A) total Chl a surface, (B) percentage of *Chl a* surface in the fraction less than 5 *um*, and (C) daily integrated primary productivity of the 3 campaigns. Source: Segura et al. 2013.

Figure 118 displays the satellite chlorophyll distribution maps, an indicator of phytoplankton biomass (Allega et al. 2020). A development of phytoplankton is observed in almost the entire shelf during spring, due to the increase in solar radiation, the stratification of the water column in many places (allowing the phytoplankton to remain in the illuminated layer) and the availability of nutrients that were distributed throughout the column by the winter mix. The highest concentrations are recorded along the continental slope front, near Peninsula Valdéz, and in Bahía Grande. Chlorophyll values decrease during the summer (largely due to nutrient depletion) in the mid-platform region and are concentrated in the slope and Southern Patagonia, as well as in the southern part of the Valdéz Peninsula. During the autumn, the concentration of chlorophyll falls throughout the region, but the average values remain along the platform (up to the slope) with presence in coastal regions. The lowest concentrations occur in winter, mainly due to low solar radiation and the active mixing of the water column. However, in the northern zone the beginning of spring flowering is evident. This general pattern of distribution presents intra and inter-annual variability (Negri et al. 2010).

The maximum values of phytoplankton productivity are recorded during the spring and summer seasons for the Slope Front, in the Project´s indirect area of influence.

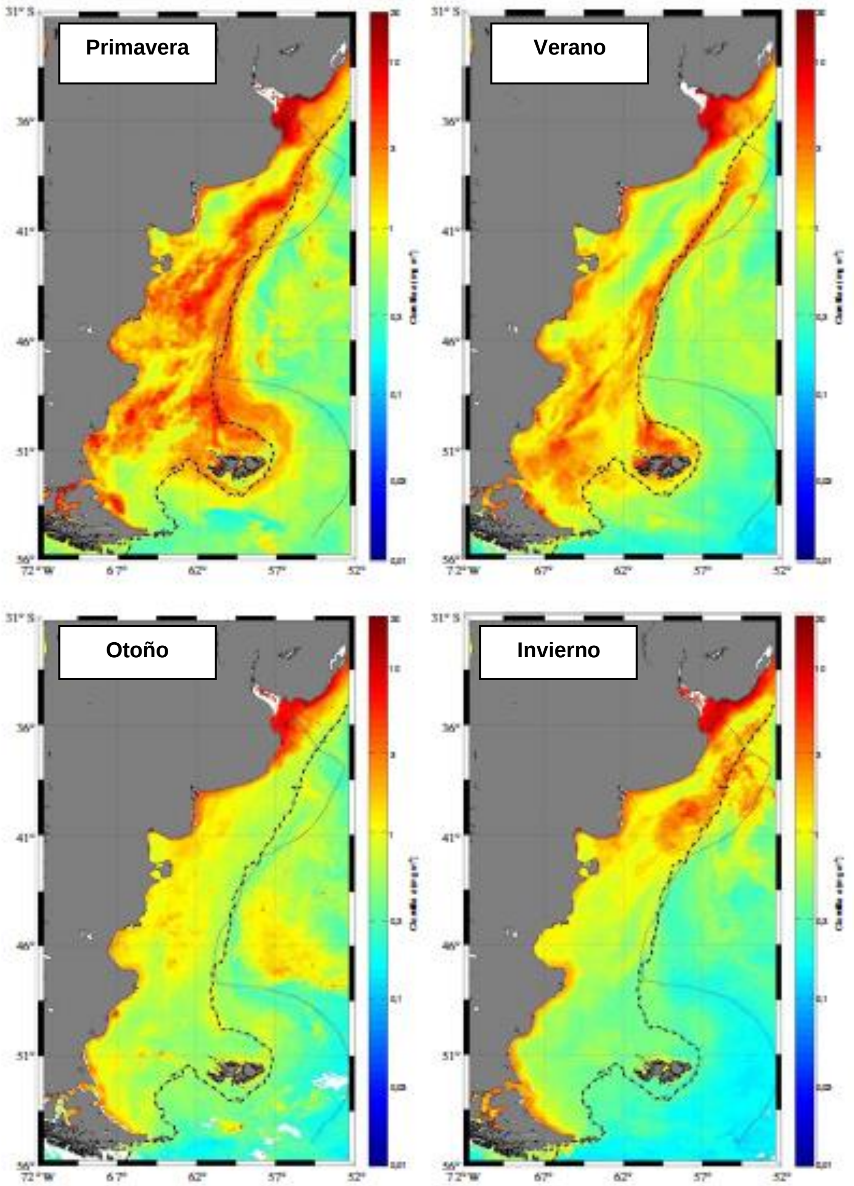


Figure 118. Satellite chlorophyll distribution maps in the four seasons of 2018: summer (January-February-March), autumn (April-May-June), winter (July-August-September) and spring (October-November-December). MODIS AQUA images of 4 km resolution composed every 3 months, processed by the Remote Sensing Subprogram of INIDEP. Source: Allega et al. 2020.

(Translation of Figure 118: Primavera: Spring. Verano: summer. Otoño: Autumn. Invierno: Winter.)

4.1.2 Zooplankton

The zooplankton production cycle adopts typical patterns of temperate-cold seas, with a seasonal variation in its biomass related to the explosive spring growth of phytoplankton, which experiences a progressive gradient from the coast to the slope and from North to South, according to the abundance of nutrients and the stabilization of the water column.

More than 1,000 species of marine zooplankton live in the waters of Malvinas and Brazil currents. Most of the species are scarce and their representation in taxonomic groups is uneven: more than 80% of the individuals correspond to less than 20% of the species. Figure 119 shows the quantity of species of several zooplankton groups for the world ocean and the Argentine Sea and their adjacencies (Boltovskoy et al 1999).

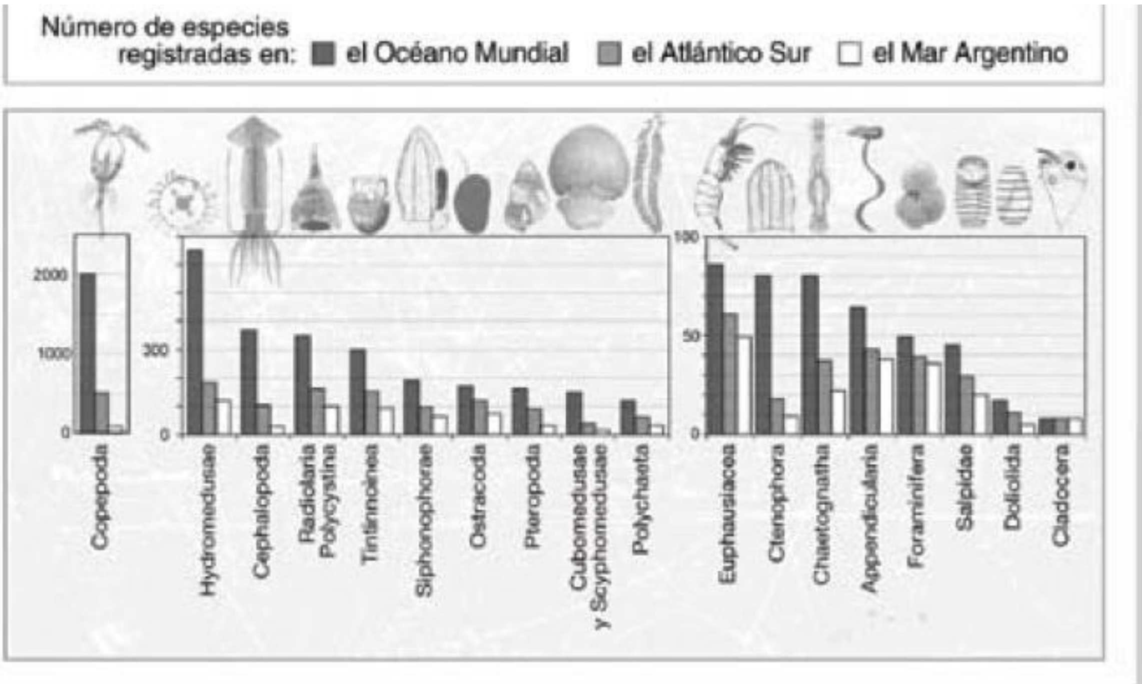


Figure 119. Diversity of the zooplankton comparing the ocean, the Patagonian sea and their adjacencies. Source: Boltovskoy et al. 1999.

(Translation of Figure 119: Número de especies registradas en: Number of species registered in. El océano mundial: the world oceans. Atlántico Sur: South Atlantic. Mar Argentino: Argentine Sea.)

Regarding the composition of zooplankton and the fraction that comprises organisms less than 5 mm long (mesozooplankton) is mainly made up of copepods (89%) and occasionally ostracods, pteropods, juvenile forms of euphausiids and amphipods and also larvae from other crustaceans and fish eggs (Sabatini et al. 2001). This fraction contributes approximately between 50 and 60% of the total biomass of zooplankton in autumn and spring, respectively. The two dominant species of calanoid copepods are: *Drepanopus forcipatus* (widely distributed in shelf waters) and *Calanus australis* (found in inner and middle shelf waters). In general, mesozooplankton shows a slight tendency to increase in coastal waters (near the 50 m isobath), decreasing in intermediate waters and increasing again in the area of the slope and adjacent waters (Campagna et al. 2006).

Macrozooplankton (made up of organisms over 5 mm long) mainly include euphausiids (krill), amphipods and chaetognaths (Sabatini et al. 2001). One of the most important zooplankton organisms in the area is krill, since it represents the food source of many species of fish, cetaceans, pinnipeds, penguins and other marine birds that visit the area. The pelagic crustaceans of the genus *Euphausia* (euphausiids) are known by that name. On the other hand, the amphipod group is practically monospecific and is represented almost exclusively by *Themistho gaudichaudii*. This species constitutes the key food for most of the fish species that are distributed in the area (Campagna et al. 2006).

4.1.2.1 Spatial distribution

Cepeda (2006) studied the spatial variation of mesozooplankton biodiversity in a sector of the Buenos Aires coastal platform. A total of 15 species of copepods and 5 species of cladocera were identified in the Project´s indirect area of influence. Other groups of appendicularia, chaetognaths, jellyfish, petropods, and various types of mesozooplankton larvae were also recorded, such as polychaetes, lamellibranchia, balanidae, and calyptosis and euphasid furcilia. Lamellibranchia appendicularia and larvae were dominant in the mesozooplankton community. Three faunal areas were identified: estuarine, coastal and internal platform (indirect area of influence) whose characteristic organisms of each area are observed in Figure 120. Stratification was the variable that best explained the spatial distribution obtained.

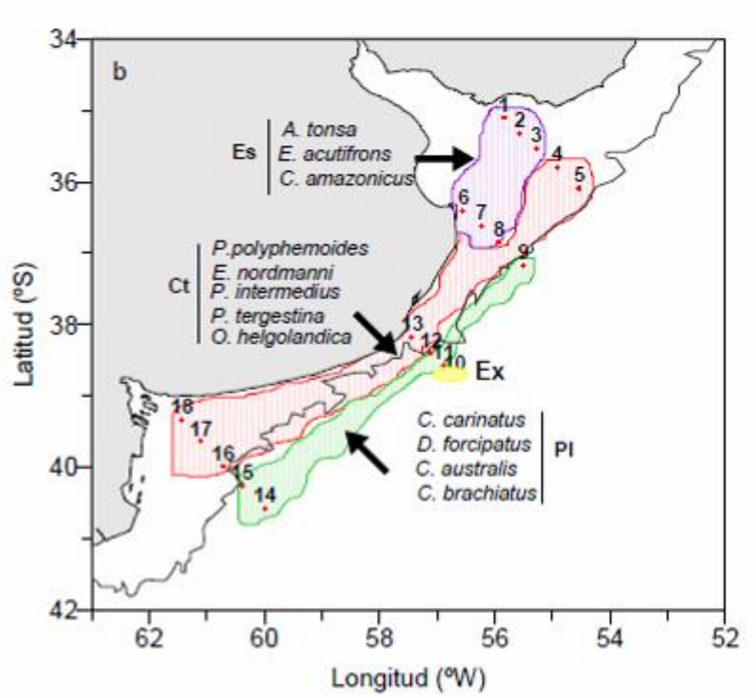


Figure 120. Mesozooplankton from a sector of the Buenos Aires coastal shelf (November 2002). Source: Cepeda, 2006.

(Translation of Figure 120: Latitud: Latitude. Longitud: Longitude)

Di Mauro (2011) agrees with what was found by Cepeda (2006) on the distribution and abundance of platform mesozooplankton. This analysis groups 4 well represented wildlife areas. The Platform area, close to the study area, was defined by large copepods such as *Calanoides carinatus*, *Drepanopus forcipatus* and *Centropages brachiatus*. The species *Clausocalanus brevipes, Ctenocalanus vanus, Oithona helgolandica*, *Microsetella norvegica* also contributed high percentages to the formation of the group, although in some cases they were also found in coastal stations. These species, with mostly herbivorous habits (Mauchline, 1998), would be favored by spring phytoplankton blooms during the study period. The *Clausocalanus brevipes* species also has the ability to produce resistance eggs (Mauchline, 1998), which would allow it to succeed in environments like this one where food availability is not permanent.

Cepeda et al. (2018) conducted a review of the available information on the diversity and ecology of zooplankton in the South Atlantic Ocean. The focus was on the copepods and secondarily the hyperid and euphasiid amphipods. In this work, the structure and dynamics of zooplankton communities in relation to water masses, frontal areas and circulation in general were specifically considered in the north platform, the Valdéz frontal system and the south platform. Figure 121 points out the detail of the relative abundance in the study area.

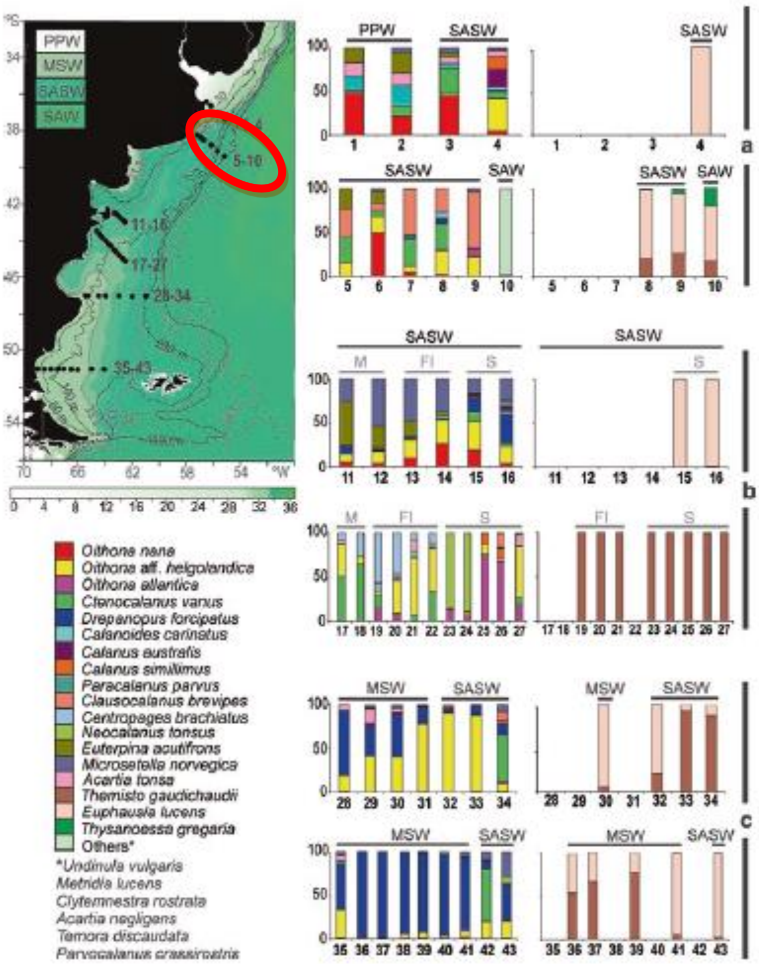


Figure 121. Relative abundance of copepod and macrozooplankton species along different transects that cross the platform. a) North platform; b) Valdez Frontal System over Northern Patagonia; c) Southern Patagonia Platform. The horizontal distribution of the annual average of surface salinity corresponding to the masses is observed; PPW: waters of "Del Plata" Plume; MSW: waters of the Strait of Magellan; SAW: Waters of the subantarctic shelf and Malvinas current; SASW: Waters of the subantarctic shelf. M: mixed waters. Frontal interface (FI) and stratified (S) representing 3 sectors of the Valdéz Front. The red box indicates the transect of the southern platform, close to the study area. Source: Cepeda et al. 2018.

The distribution and abundance of the main species present in the entire platform and the edge of the Slope are observed in Figure 122 (Cepeda et al. 2018). With varying abundances throughout the seasons, the main components for the SASW zone consist of adults and late copepodites of *D. forcipatus*, C5 copepodites and adult females of *C. australis* and the amphipod *T. gaudichaudi*i. While the SASW zone is characterized by C4-5 copepodites of *D. forcipatus*; females and late copepodites of *C. vanus*, *C. brevipes* and *C. smillimus*; the cyclopoid *O.aff.helgolandica* and *O. atlantica*; *T. gaudichaudii*, juveniles of euphasids. Epipelagic seasonal migrants such as *N. tonsus C5, Subeucalanus longiceps* and *M. Luces* have been recorded in low numbers on the external platform, near the slope (Ramirez and Sabatini 2000. Significant contributions from small species such as *O. aff. Helgolandica* and *M. norvegica* have only recently become evident from fine mesh sampling. *C. vanus* appears fourth in abundance, more concentrated in offshore waters, while the relative numerical importance of *C. australis* appears to be lower than previously established using thicker nets (Antacli et al. 2010; 2014).

The SAW and SASW water bodies are so closely related in origin that their associated communities are similar. Differences in the abundance of the species is the result of distinctive life histories and the development of the population could be more important to define the sets. The mid-level SASW community can be characterized as an ecotone set, related to an extension of the MSW community, but with strong contributions from the SAW (Cepeda et al. 2018).

MSW water bodies are characterized by adults and late copepods of D. forcipatus, C5 copepods and adults, female C. australis, and the amphipod T. gaudichaudii. SASW is mainly characterized by C4–5 copepods of *D. forcipatus*; females and late copepods of *C. vanus*, *Clausocalanus brevipes* and *C. simillimus*; the cyclopoids *O. aff. helgolandica* and *O. atlantica*; *T. gaudichaudii*; and euphausiid juveniles. Epipelagic seasonal migrants such as *N. tonsus C5*, *Subeucalanus longiceps* and *M. lucens* are also recorded, although in small numbers, on the outer shelf near the slope (Ramírez and Sabatini 2000). Due to the wide extension of the continental shelf, the SAW community has only a minor representation in the area of the Patagonian front, compared to what is historically recorded. The important contributions of small species, such as *Oithona aff. helgolandica* and *Microsetella norvegica* have only recently become evident from sampling with fine mesh nets (Antacli et al. 2010, 2014b). In terms of both numerical abundance and occurrence, these copepods rank second and third in the community, respectively, after *D. forcipatus*, which is consistently the most conspicuous component of mesozooplankton in the southern ACS system, by far exceeding in number to any other species in all seasons. *Ctenocalanus vanus* appears as the fourth most numerous species, concentrated mainly in marine waters, while the relative numerical importance of *C. australis* appears to be lower than previously established using thicker nets (Cepeda et al 2018).

The indirect area of influence of the project shows that the macrozooplankton stands out with the hyperid *amphipod T. gaudichauddi* and the *euphasia Euphasia lucens* (Figure 122). The species *O.aff.helgolandica* and *O. atlantica* are other species of importance to the north of the survey area.

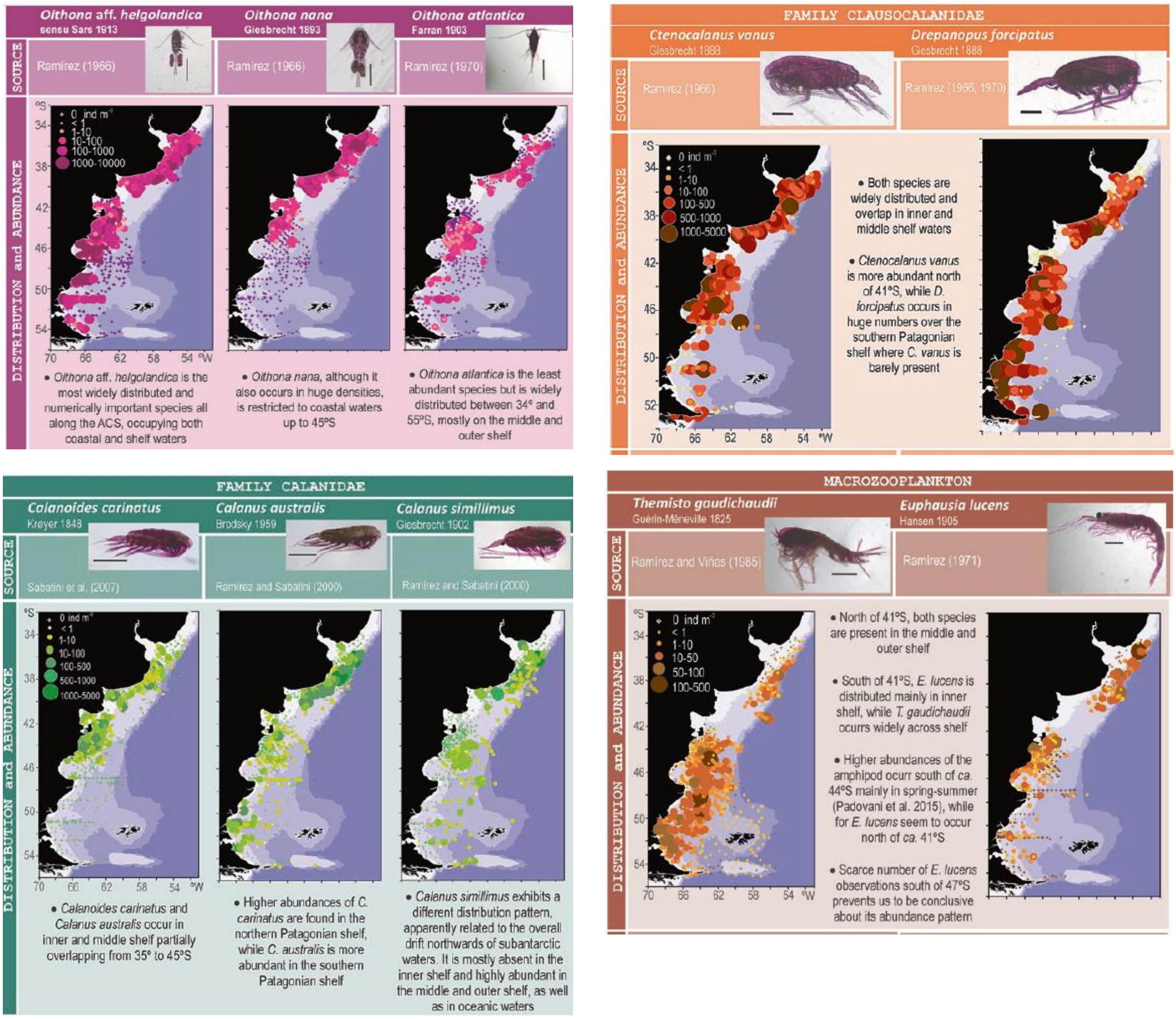


Figure 122. Distribution and abundance of zooplankton species in the Argentine Sea. Source: Cepeda et al. 2018.

4.1.2.2 Temporary Distribution

The shelf is characterized by seasonal changes in plankton communities, typical of regions with cold temperatures, with a tagged seasonality in the abundance of mesozooplankton after the spring bloom of phytoplankton (Sabatini et al. 2016).

Most of the copepod species show differentiated population structures for the northern and southern areas of the southern Patagonian shelf, these differences also apply to the feeding and breeding activities of the populations of *D. forcipatus* and *C. australis* (Antacli et al. 2014; Sabatini et al. 2016). This is probably due to the importance of temperature, which has a tagged latitudinal gradient along the southern Patagonian shelf, cooler to the south (Sabatini et al. 2004).

The total abundance of mesozooplankton increases approximately 2.5 times from early spring to late summer and then decreases by at least four orders of magnitude in winter. Copepods represent more than 70 to 80% of all mesozooplankton in most of the southern Patagonian shelf during all seasons. Although the seasonal differences in abundance are striking, the spatial distribution of mesozooplankton is very similar throughout the season, with relatively higher concentrations mainly in and around Bahía Grande. The biomass of the primary producers increases locally in this area during the months of April and summer (Lutz et al. 2010; Dogliotti et al. 2014), and large biomasses of mesozooplankton are repeatedly recorded at the end of the productive season (Sabatini 2008: Antacli 2014).

The influence of the Malvinas current and the strong forcing of the tides on the local frontal dynamics seem to be strengthening in Bahía Grande and are probably generating a recirculation area rich in nutrients (Sabatini 2004; Piola 2018). A significant proportion of production can be retained there on a temporary scale, allowing the development of abundant primary and secondary producers (Sabatini et al. 2016).

Population level analyzes of key species such as medium and large copepods (*D. forcipatus* and *C. australis*) and amphipods (example *T. gaudichaudii*) indicate high productivity during spring and early summer, being the end of the summer the beginning of the less productive season in the southern Patagonian shelf, with the thriving of the microbial food web, showing limiting conditions for copepods (Lutz et al. 2010: Antacli 2014). At this time of year, the population of the two dominant copepods (largely C4 and C5 copepodites) store lipids, and the species are distributed differently in the water column. Most of the *D. forcipatus* population is concentrated in the upper layers up to 50 m, while *C. australis* retreats to deeper waters, even near the bottom. The sampling results suggest that while *D. forcipatus* still feeds in the upper water column, most of the *C. australis* population may be entering a period of stopped metabolism at depth, and therefore it does not feed or barely does (Sabatini et al. 2008). In late summer, adult females and late copepods of *D. forcipatus* and *C. australis* show low foraging activity, although both populations show some ongoing spawning (Antacli et al. 2014). The diet of adult females during late summer, based on intestinal content analysis, indicates that *D. forcipatus* conveniently feeds on the smallest but most abundant particles in the environment. The intestinal content of *C. australis* suggests a relatively higher ingestion of autotrophic prey, particularly large diatoms. The ability to ingest small food particles could give *D. forcipatus* an important advantage over larger copepods and is perhaps one of the reasons for its overwhelming numerical abundance in some areas of the southern Patagonian shelf (Antacli et al. 2014).

The hyperiid *T. gaudichaudii* reaches its highest biomass in this area of the platform (Sabatini and Alvarez Colombo 2001; Padovani et al 2015), where its population develops on the basis of very high concentrations of copepods as food and adequate water temperatures. Very large biomasses of this amphipod have been reported in the Bahia Grande area on the inner and middle shelf, mainly in summer-autumn (Sabatini and Alvarez Colombo 2001). The local population has a longer Breeding period (spring-summer), a larger number of cohorts (two main ones) and a smaller maturity size (around 10 mm) than other populations of *T. gaudichauddi* at similar latitudes. This adaptation would favor greater abundances, placing the southern Patagonian shelf system among the most favorable for the development of this amphipod in any part of its global distribution range (Padovani et al. 2015). *T. gaudichaudii* strongly supports the planktivorous fish and squid community in the area (Padovani et al. 2012). Due to this trophic relevance, T. gaudichaudii has been ptoposed as a kind of "wasp waist", channeling the flow of energy in a short and efficient food chain, a role similar to that of krill in Antarctic waters (Cepeda et al 2018).

For the Slope Front, in the indirect area of influence of the project, the highest zooplankton biomass is recorded from the beginning of spring to the end of summer, mainly composed of macrozooplankton, with the species *T. gaudichauddi* and *E. lucens* standing out. *O.aff.helgolandica* and *O. atlantica* are other species of importance to the north of the survey area.

4.1.2.3 Gelatinous zooplankton

Jellyfish, salps and ctenophores are categorized as part of the gelatinous zooplankton (GZ). These represent a functional group composed of different phyla (example Chaetognatha, Ctenophora, Cnidaria, Chordata, etc), and contain a high water content in their body (greater than 95%) which gives them the peculiar gelatinous appearance and a certain degree of transparency and fragility (Tapia and Genzano 2019). The GZ is composed of meroplanktonic species with adapted benthic stages, and holoplankton species that associate only in part of their life cycle.

GZ fulfills several ecological roles, such as considerable effects on the plankton community through direct predation and competition for food, effects on trophic cascades, and various non-trophic interactions with other biological groups (Schiariti et al. 2018). However, due to the highly seasonal presence of many gelatinous species, their structuring effect is often temporary (Tapia and Genzano 2019).

Recently, Díaz Briz et al. (2017) quantified the occurrence of gelatinous zooplankton (ctenophora, salps and jellyfish) in stomach contents of fish in the South Atlantic Ocean. The samples were obtained from October to April, from 1986 to 2000 of the BO "Oca Balda" INIDEP campaigns. One hundred and seven (107) species were analyzed and GZ was found in 39 of them. In total, there are 44 species of fish that feed on ZG, 5 were not reported in this work. Some species of fish are frequent consumers of ZG, and others only occasionally. Only a few species of fish feed on ZG as their main source of nutrition. Most of these families are jellyfish of the Stromateioidei suborder and have a series of anatomical adaptations in their digestive tract that facilitate the predation of these organisms (Harbinson 1993). Figure 123 shows the spatial distribution of the samples obtained with the trawl net and the red dots represent where ZG occurred in the stomachs of the fish.

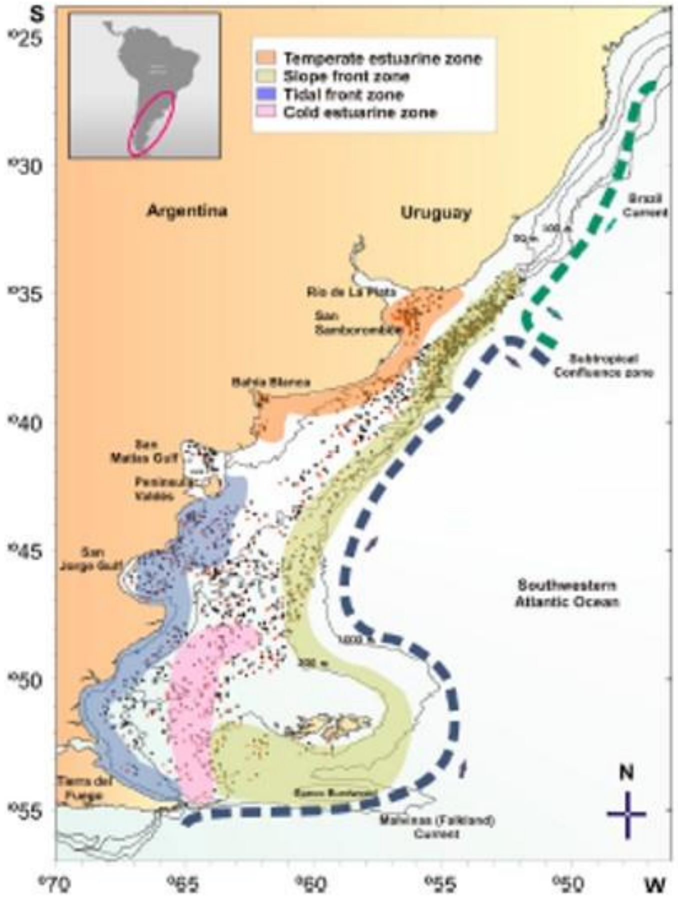


Figure 123. Study area of the Argentine and Uruguayan platform taken from the work of Díaz Britz et al. (2017). The colored areas indicate the different frontal zones of the region. The black points correspond to the total samples per trawl net and the red points represent where there was occurrence of ZG in the stomachs of the fish.

Figure 124 unfolds the distribution of fish stomachs with ZG in the Argentine and Uruguayan Continental Shelf, with the intake of ctenophores being the most uniform in the entire area with similar frequency values. Ctenophores were taken at high levels in almost all areas of the continental shelves of Argentina and Uruguay. Salps are more frequent prey on the slope and the southern platform. In contrast, jellyfish are ingested more in coastal areas, the slope and the southern shelf (Díaz Britz et al. 2017).

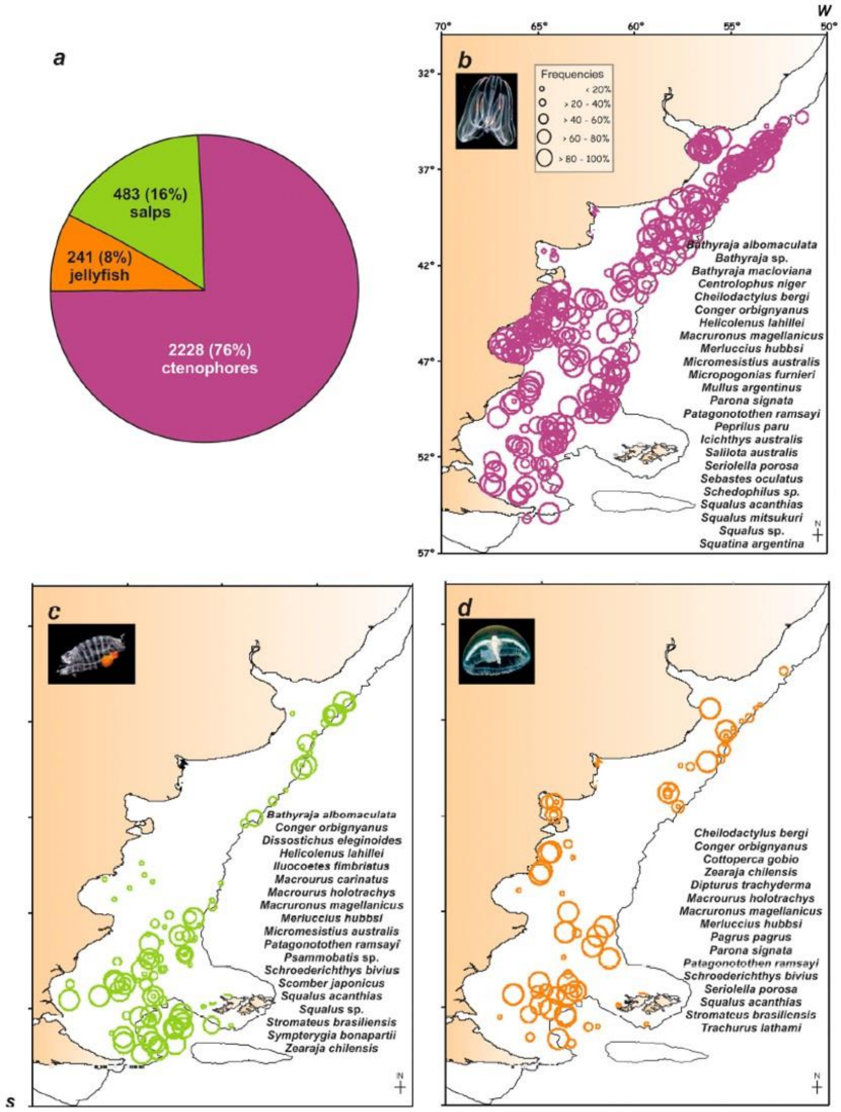


Figure 124. Results of stomach analysis. a) Number of stomachs with ZG item and its equivalent in %; b-d) spatial distribution of fish stomachs with: b- ctenophores, c- salps and d-jellyfish. Source: Diaz Britz et al. 2017.

The fronts consist of intersections of two bodies of water with different physical and chemical properties, which generally imply high biological activity. Usually in these areas, vertical and horizontal mixing increases primary (phytoplankton), and secondary (zooplankton) production, providing great availability of food that attracts nektonic organisms (fish, turtles, and marine mammals) allowing the transfer of energy at higher trophic levels. This fact highlights the importance of ZG intake by fish. Large aggregations of ZG are commonly observed in these areas under certain circumstances, dominating the rest of the zooplankton. As can be seen, the frontal areas play a key role in the interactions between the ZG and the fish (Díaz Britz et al. 2017).

There is presence of fish stomachs with ctenophores, with a low ZG diversity in the Project´s indirect influence area. The main groups of ZG are tenophores, salps and jellyfish. The most frequent in the indirect influence area are the Ctenphores. No studies were found on the seasonal distribution of the ZG for the survey area.

4.2 BENTHOS

The benthos is made up of both plant and animal organisms that live at the bottom, semi-buried, fixed or that can move without going too far from it, from the high tide mark to the bottom of the deepest trenches. Benthic communities are very diverse depending on the nature of the substrate (rock, sand, silt) and depth. There are usually much higher stable conditions on the seabed than in pelagic waters, where plankton and nekton are found, and which are subject to constant movements and changes. Plant organisms are directly affixed to the bottom, while animals can anchor, bury, or slither. Its habitat is usually the surface and the upper few centimeters of the material of the ocean floor formed by sand, rocks or mud. Benthic organisms have little or no swimming capacity, which allows them to adopt shapes that do not meet hydrodynamic requirements and, since they do not face buoyancy problems, they can develop thick skeletal structures like shells and reach considerable sizes.

Benthic invertebrates play an essential role in marine ecosystems. Many represent commercially exploited species that support very important fisheries, such as prawn (*Pleoticus muelleri*), scallop (*Zygoclamys patagónica*) or spider crab (*Lithodes santolla*). Furthermore, they have a close relationship with fish species of commercial interest, either because they are components of their diets as they generate habitats for spawning, or because they constitute shelter or food for larval or juvenile stages (Giberto et al. 2015, Giberto et al. 2017, Vázquez et al. 2018). Likewise, some benthic organisms behave as ecosystem engineers and set up highly structured environments that allow the development of highly biodiverse communities, as in the case of “marine animal forests” (Rossi et al. 2012, 2017). There are suspensivore sessile organisms within said environments such as sponges, corals, bryozoans, brachiopods and certain mollusks (Rossi et al. 2017).

Certain groups of benthic invertebrates (sponges, cnidarians, tunicates, brachiopods) are called Taxa Indicators and they stand out due to their ecological role and their high susceptibility to any natural or anthropic change. When biomasses greater than 10 kg 1,200 m-2 are recorded in these groups, the habitats are framed as Vulnerable Marine Ecosystems (VMEs). Approximately 90 macroinvertebrate taxa were detected in the southern Patagonian zone (48 ° S-55 ° S) between 50 and 400 m-deep, including several TI, some of which are very frequent and abundant (Allega et al. 2020).

4.2.1 Phytobenthic communities

On the coasts of the Province of Buenos Aires, the abundance (large volumes of algae that the sea occasionally deposits on the coasts, mainly on the beaches) of algae is infrequent and of lesser magnitude than on the Patagonian coast. Becheruci ME and Benavides H (2016) characterized the floristic composition and the humid biomass of the species that make up three bursts of algae that occurred in 2012 and 2013 on the beaches of Quequén, Necochea and Mar del Plata with the purpose of contributing to the knowledge of the local sub-tidal populations.

A total of 19 species of macroalgae were identified, previously registered in marine algae catalogs in the Province of Buenos Aires, and in various ecology studies carried out in the intertidal areas of Mar del Plata and Quequén; with the exception of *Ahnfeltiopsis sp*. and unidentified Gigartinaceae.

Table 5. Percentage of relative biomass (%) of macroalgae recorded on the beaches of Necochea, Quequén and Mar del Plata. Source: Becheruci y Benavides, 2016.

(Translation of Table 5: Orden: order. Especie: Species. Biomasa húmeda relativa: Relative wet biomass. Restos de especies no identificadas: Remains of unidentified species).

Phylum	Orden	Especie	Biomasa húmeda relativa (%)		
			Necochea	Quequén	Mar del Plata
Heterokontophyta	*Dictyotales*	*Dictyota* spp.	35.28	47.68	0.09
Rhodophyta	*Corallinales*	*Jania rubens* (L) Lamour	19.64	3.78	2.82
		Bossiella sp.	0.18	0.02	0.85
		Corallina officinalis Linnaeus	10.44	1.61	13.18
	Ceramiales	*Anotrichium furcellatum* (J. Agardh) Baldock	7.97	12.05	3.52
		Pterosiphonia sp.	1.29	2.83	0.03
		Callithamnion sp.	0.24	-	0.15
		Ceramium spp.	0.15	0.13	0.58
		Chondria sp.	1.57	0.25	2.85
		Delesseriaceae sp	1.43	0.16	-
	Rhodymeniales	*Rhodymenia* sp.	2.37	0.61	23.15
		Gastroclonium trichodes (C. Pujals) B. Santelices, I.A. Abbott & M.E. Ramírez	0.15	-	-
	Gigartinales	Gigartinaceae *no identificada.*	0.71	1.40	32.85
		Ahnfeltiopsis sp.	-	-	14.33
		Gymnogongrus torulosus (J.D. Hooker & Harvey) F. Shmitz	-	-	0.43
Chlorophyta	*Ulvales*	*Ulva intestinalis* Linnaeus	-	-	0.06
		Ulva lactuca Linnaeus	0.04	-	-
	Cladophorales	*Chaetomorpha* sp.	0.03	-	-
	Bryopsidales	*Codium fragile* (Suringar) Hariot	3.76	-	5.01
Restos de especies no identificadas		14.76	29.49	0.06	

4.2.2 Fauno benthic communities

Regarding the fauno benthic communities, Bastida et al. (1992) studied the specific composition of the benthic macroinvertebrate communities of the Argentine Continental Shelf. The communities of the Patagonian district are dominated by mollusks (filum Mollusca), echinoderms (filum Equinodermata) and bryozoans (filum Bryozoa) in that order. Brachiopods (phylum Brachiopoda) are the next largest group.

These authors identified two regions within the Patagonian District, which differ fundamentally due to their specific richness. The communities of the inner region (<100 meters deep) presented less specific richness than those of the outer region (100-200 meters deep). In fact, practically all the species reported in the internal region are identified in the external region, but not in the opposite direction. While the macroinvertebrate benthic communities of the external region present 16.3% of exclusive species for the Argentine Continental Shelf, the communities of the internal region only present 0.54% (Bastida et al. 1992). The differences between the communities seem to be due to the temperature of the waters and, secondly to the bottom morphology. The outer region is influenced by the Malvinas Current and therefore its waters are colder. On the other hand, the inner region is influenced by the Sub-Antarctic Patagonian Current, with wamer waters. In fact, many of the species of the outer region, but not of the inner one, are species associated with low temperatures such as *Solariellakempi, Beania costata* and *Ampidostoma giganteum* (Bastida et al. 1992). The polychaete annelids (Annelida phylum, Polychaeta class) are another faunal group very well represented in the benthic communities of the Argentine Continental Shelf. Its diversity and abundance are significantly high for all depths (Perry, 2005).

The indirect influence area of CAN_100 and CAN_108 seismic data acquisition areas overlaps with "B" area in the inner region of the platform. It displays 112 species of macroinvertebrates, a group sub-dominated by bryozoans and echinoderms, of which only one species is exclusive to this area (Figure 125). While CAN_114 Area is located in "C" area under the influence of the Malvinas current (high productivity and low temperatures) with a total of 152 species, it shows a high percentage of exclusive species (16.30%). The community is dominated by bryozoans and brachiopods, the echinoderms being less abundant than in "B" area.

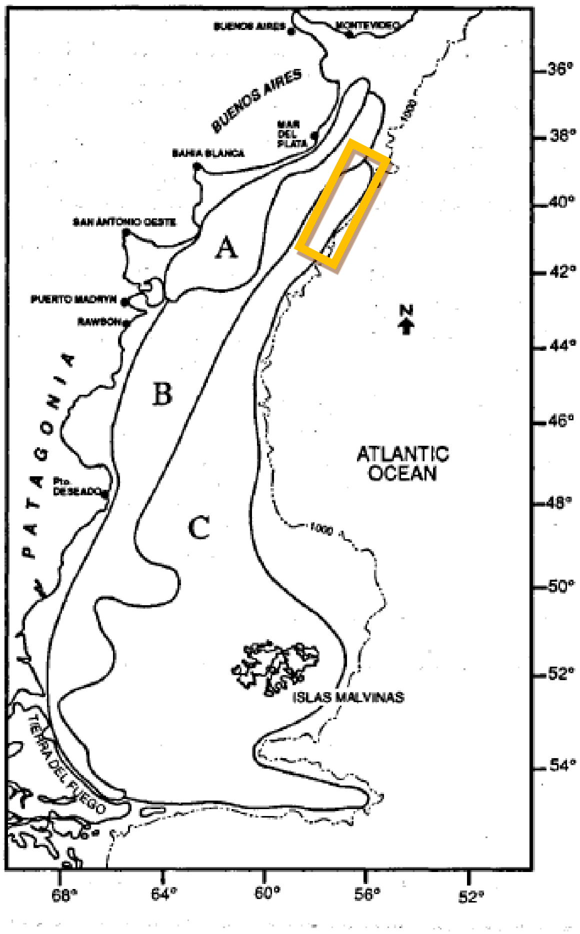


Figure 125. Map with the stations defined by Bastida et al. 1992, noting the overlap with CAN_100, CAN_108 and CAN_114 areas.

4.2.2.1 Benthic communities associated with the Management Unit (MU).

In the area of the external platform and the slope, studies were carried out to characterize the benthos using the location of management units (MU) for the Patagonian scallop fishing (Bremec and Giberto 2017). A compilation and updating of the information of the benthic communities of different sectors was carried out, being poriferous, echinoderms, hydroids, infaunal and epibiontic organisms, the most common companion fauna of the Patagonian scallop.

The scallop, *Zyglochamys patagónica*, is one of the dominant species in the benthic communities of the slope front, especially in the strip that fluctuates between 80 and 120 m, in which it is distributed forming the dense additions that are exploited (Bogazzi et al., 2005). The Management Units are seen in Figure 126. According to the available data, the functioning of the benthic ecosystem in this area is closely linked to the flow of energy that arrives from the surface as “rain of phytoplankton” and as by-products of the activity that takes place in the first meters of the water column (Acha, 2015).

To date, the list of taxa caught incidentally as part of the monitoring of Patagonian scallop fishing areas and identified in routine work reaches about 90 species (Schejter et al. 2014). Specific studies carried out on different zoological groups have contributed to broadening the knowledge about the fauna richness in these areas and provide information on porifers, echinoderms, hydroids, infaunal organisms, the most frequent demersal and benthic fish and sponge endobionts (Schejter et al 2017). As a result, the benthic richness known to date has been estimated in about 250 species (Schejter et al 2013), which include more than 50 epibiont organisms from the Patagonic Scallop (Romero et al 2017: Schejter et al 2017).

The seismic data acquisition area named CAN_100 - CAN_108 is located in a position close to UM B, while CAN_114 to UM C (Figure 126).

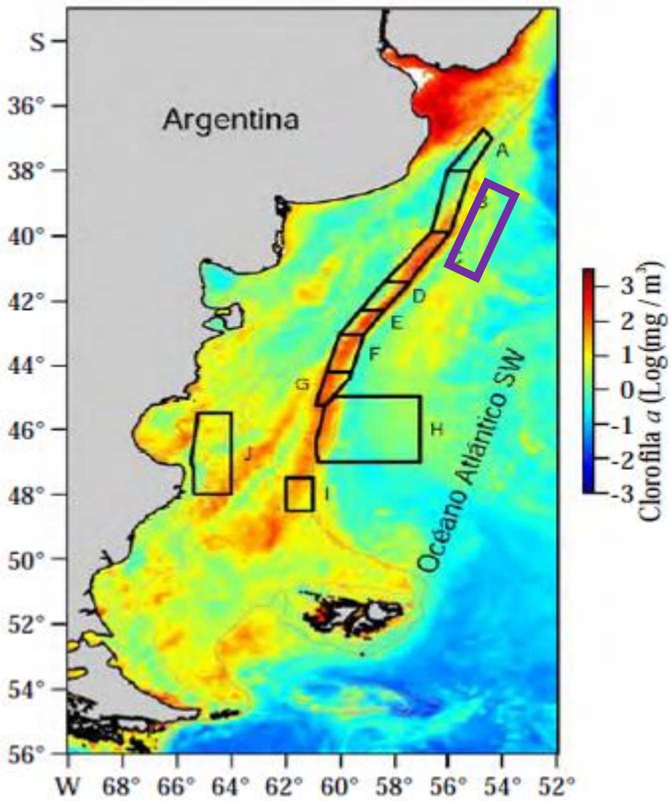


Figure 126. *a* Chlorophyll satellite image corresponding to the summer of 2010 showing maximums at the location of the slope front. The location of the Management Units for scallop fishing (A-J) is shown. The purple box represents the study area. Source: Schejter 2017.

The scallop plays a very important role as an ecosystem engineer, providing substrate and shelter to a large number of organisms associated with this bivalve in the fishing areas that comprise the sponge Tedania sp., the anemone *Actinostola crassicornis*, the echinoderms *Ophiactis asperula*, *Ophiacantha vivípara*, *Ophiura lymani*, *Sterechinus agassizii*, *Diplosterias brandti, Ctenodiscus australis, Psolus patagonicus* and *Pseudocnus dubiosus* (Bremec et al. 2003). High densities of the tubicultural polychaete *Chaetopterus cf. antarticus*, the *Labidiaster radiosus* starfish and the *Gorgonocephalus chilensis* basket starfish are registered in A and B MU (Management Units. In area B, the main taxa associated with the scallop were the sponge and various species of echinoderms, among which the *Ctenodiscus australis* and *Diplasterias brandti* starfish, the *Austrocidaris canaliculata* sea urchin, and the ophiura *Ophiactis asperula* should be mentioned. At the southernmost end of “B” Management Unit, high-density of the Sympagurus dimorphus hermit crab and the Sterechinus agassizii sea urchin are also found (Schejter and Mantelatto 2015). The "C" Managment Unit presents a lower density of scallops than other areas having a higher species richness than more exploited areas, as well as a sponge biomass that represents between 22 and 90 e of the catch (Schejter and Bremec, 2013). South of "C" Management Unit, very high biomasses of ophiuroids are recorded, mainly of *Ophiactis asperula* and *Ophiacantha vivípara*, and in certain sectors there are also high-density patches of *Flabellum cf. Curvatum* coral and of Sterechinus agassizii sea urchin (Escolar, 2010).

Patagonian scallop fishing surveys have also made it possible to collect benthic fauna at the outer limit of the "C" Management Unit, at depths of 400 m (Figure 127). Echinoderms were predominant in these locations, as well as the presence of false corals (*Stylasteridae*) and soft corals, among which sea pens (*Pennatulacea*) and primnoids stand out. In order to detect Vulnerable Marine Ecosystems in international waters in the southwestern Atlantic, cold-water coral reefs were detected in deeper areas of this region, mainly composed of the *Bathelia candida* species, coral gardens that, in turn, present a large quantity of associated fauna, located between 400 and 1000 meters deep, as well as sponge fields, found between 250 and 1300 meters deep (Portela et al 2012, Schejter 2017, Campodonico 2019).

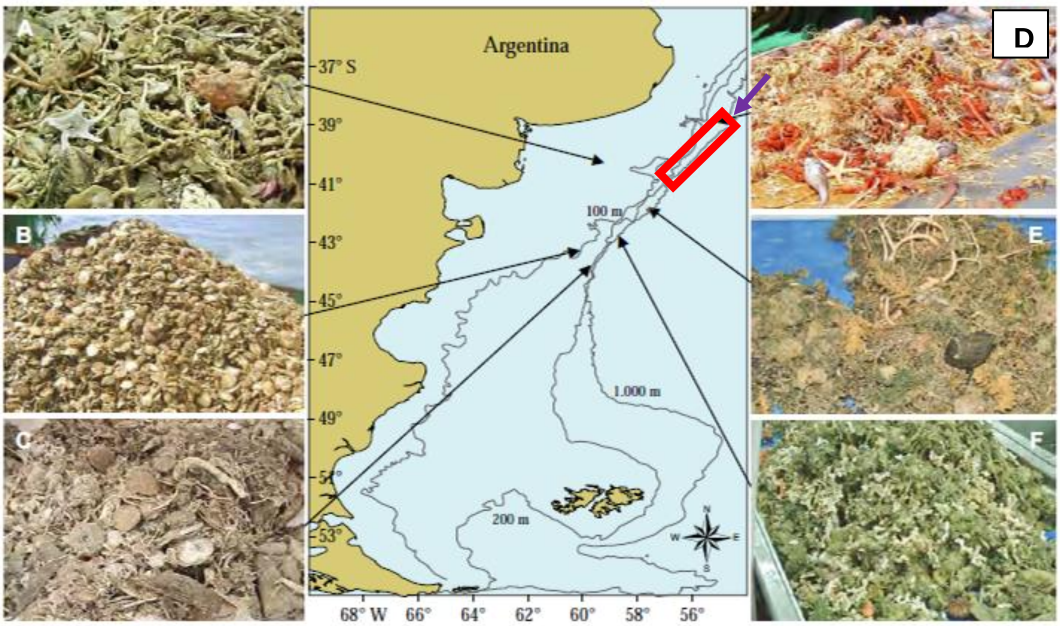


Figure 127. Catches collected with trawl nets through research and prospecting campaigns. B- UM in front of slope, C- head of submarine canyon (350 m), E-external area of C UM (400 m), E-F- Coral and reef gardens (400-1000m). Source: Schejter et al 2017. The red box indicates the survey area.

The spatial distribution of the scallop coincides with the location of three frontal systems: the Slope front, the North Patagonian front and the South Patagonian front (Bogazzi et al. 2005) (Figure 128). Under the influence of the Slope front and along the 100 m isobath, there are the most profitable scallop banks from the fishing point of view (Bogazzi et al. 2005). These fronts are important feeding and breeding habitats, often acting as concentration areas for pelagic larvae or as barriers to their dispersal. The presence of scallops would be related to the sediments of sand and very thin sand (Mandirolas et al. 2005, Lasta 2013). The scallop is the dominant species and acts as an ecosystem engineer (Schejter et al. 2014).

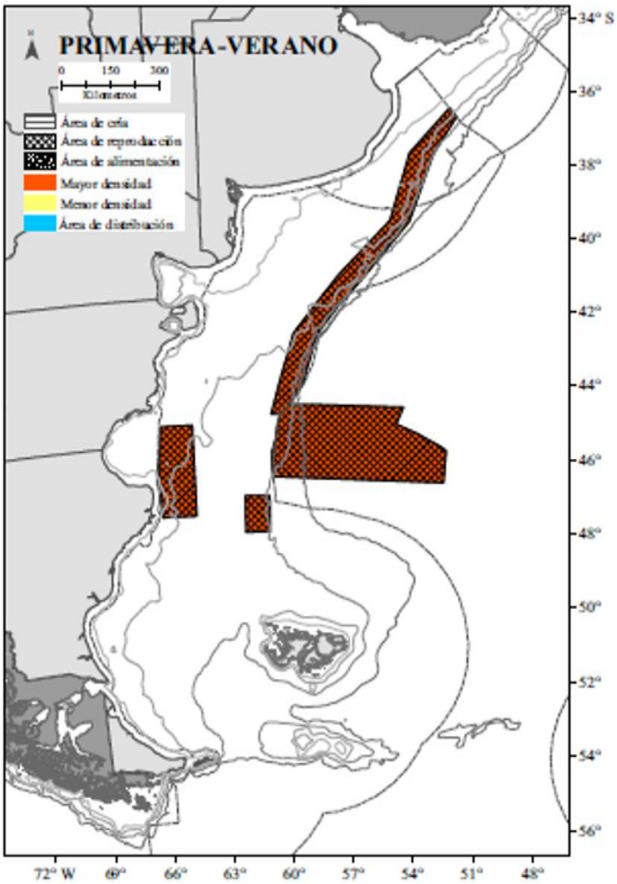


Figure 128. Diagram of the areas with high densities of Patagonian scallop *Zygochlamys patagónica*, indicating the sensitive areas regarding the reproduction of the resource. Source: Allega et al. 2019.
(Translation of Figure 128: Primavera-Verano: Spring – Summer. Area de cría: breeding area. Area de reproducción: breeding area. Area de alimentación: Feeding Area. Mayor densidad: Higher density. Menor densidad: lower density. Area de Distribución: Distribution Area.)

In conclusion, a low density is observed in the biomass of scallops within the area of indirect influence. No feeding or breeding areas of Patagonian scallops appear in the Project´s direct area of influence.

The Patagonian scallop has so far shown a recruitment behavior that suggests very uncertain dynamics to foresee. Scallop stocks can fluctuate widely from one year to another without presenting a clear pattern, such is the case of populations whose recruitment would be strongly influenced by hydrographic conditions. Currently, this fishery already shows a reduction in the biomass of catches and a limitation of the feasible fishing areas. The biomass that supports the current and immediate future catches of the fishery is due only to localized recruitments, which are not enough to maintain the levels of catches similar to those taking place at the beginning of the fishery (Campodonico et al 2019; Allegra et al 2020).

The most profitable scallop banks from the fishing point of view are located under the influence of the Front of the Slope and along the 100 m isobath. The activity of the scallop fishing fleet is low or null in CAN_100-108 Area. A high density of the scallop resource is not observed in CAN_114 area, however there appears a high density during the first quarter of the year in the area of indirect influence (Figure 129).

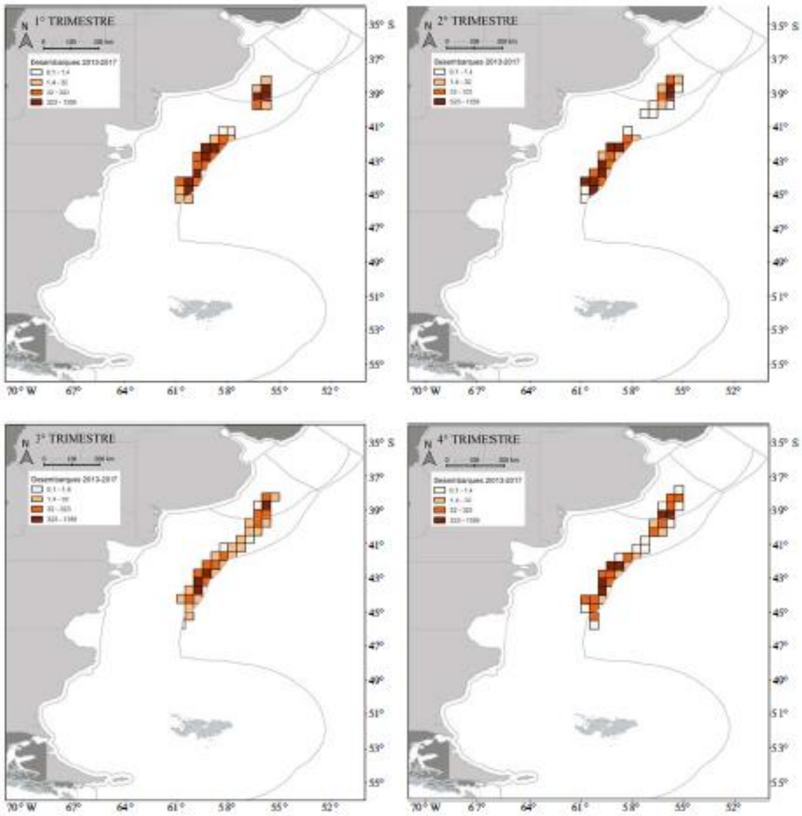


Figure 129. Distribution (t) of the fleet that operated on the scallop resource during the 2013-2017 period (scallop). Source: Allega et al. 2020.
(Translation of Figure 129: Trimestre: Quarter)

4.2.2.2 Vulnerable Marine Ecosystems

A "Vulnerable Marine Ecosystem" is called any marine ecosystem whose specific structure and function may be threatened, according to the best available scientific information and the precautionary principle, as a consequence of the stress caused by physical contact with bottom gear in the sea during fishing operations, including, in particular, reefs, seamounts, hydrothermal vents, cold-water corals or cold-water sponge fields.

From 2007 to 2010, the Spanish Institute of Oceanography carried out a series of 13 multidisciplinary research campaigns in international waters of the Southwest Atlantic in collaboration with the General Secretariat of Fisheries, owner of the “Miguel Oliver” B / O. These campaigns were framed within the activities of the IEO structural project aimed at studying fisheries and marine resources in waters of the Southwest Atlantic (ATLANTIS Project). The general objective of these campaigns was the description, within an ecosystem approach, of the EMVs and the possible interactions with fishing activities in the study area (Del Rio et al., 2012).

Colonial species originate very complex three-dimensional structures in their slow growth that host a large number and diversity of both sessile organisms, such as other species of colonial and solitary corals, alcyonaceans, gorgonians, antipatharia, bryo-zoos, hydrozoans, porifera, barnacles, etc., as well as invertebrates of a fragile nature that live and feed on them. These colonial corals require hard or consolidated substrates for their fixation and development. Due to their great fragility to the direct or indirect impact of various human activities, including bottom fishing, these organisms, as they present annual growth rates of scarce mm, are one of the priority protection groups themselves for being a primary structural part of EMVs.

The two colonial species observed in the IEO ATLANTIS Project were mostly *Bathelia candida,* Moseley 1881, and *Solenosmilia variabilis* Duncan, 1873 to a much lesser extent. A great biodiversity of epifauna was observed on these colonial species. On the other hand, the existence of areas with an abundance of solitary scleractinias adapted to life on sediments, as is the case of the Flabellidae family, mainly *F. thouarsi* Milne Edwards and Haime, 1848 and *F. curvatum* Moseley, 1881 among other species.

Figure 130 shows the resulting map with the positions of all the vulnerable or sensitive organisms (sets and dredgers) according to the United Nations and OSPAR criteria, obtained in the investigation campaigns of the Miguel Oliver B / O.

The area of direct influence for CAN_114 zone partly overlaps with the presence of fragile species which are also considered Indicator Taxa, to the north of the areas considered Vulnerable Marine Ecosystems.

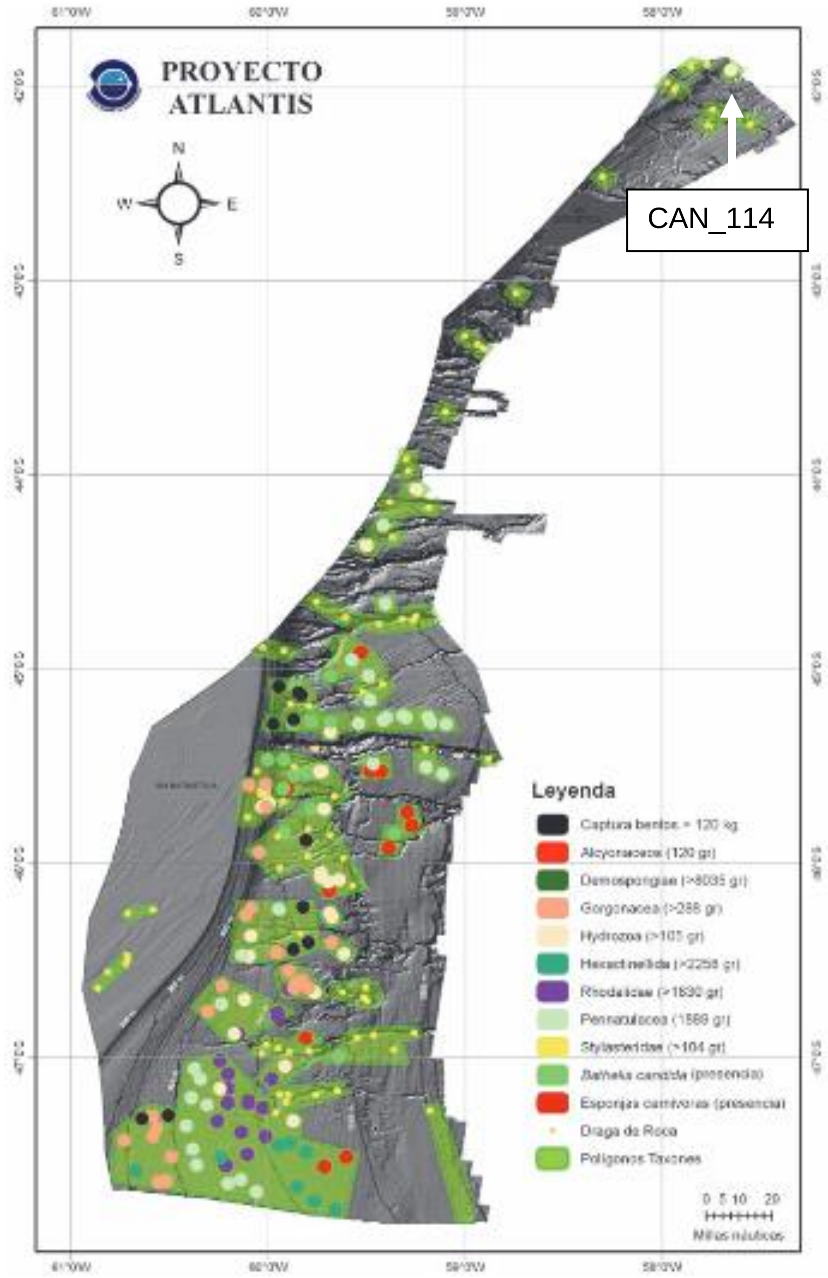


Figure 130. Positions of all organisms (sets and dredgers) considered vulnerable or sensitive according to the United Nations and OSPAR criteria, obtained in the investigation campaigns of the Miguel Oliver B / O. The conservation polygons that surround them are also represented. Source: Del Río et al. 2012.

(Translation of Figure 130: Proyecto Atlantis: Atlantis Project. Leyenda: Legend/Key. Coloured boxes with illegible data)

4.2.2.3 Sampling of the Benthos by the ARA "Puerto Deseado" (BO)

In order to describe the benthic communities in the detailed study area, a bibliographic search of campaigns recently carried out by CONICET and INIDEP, as well as the tool available in the SHN Geoportal (http: // geoportal.ddns.net / # / burdwood) were used to complete the search.

During the 2012 ARA Puerto Deseado (BO) Oceanographic Vessel campaign, 33 sets were made with different fishing gear, approximately between 200 and 3000 meters deep in front of the city of Mar del Plata. Figure 131 displays the sample stations covered by the BO.

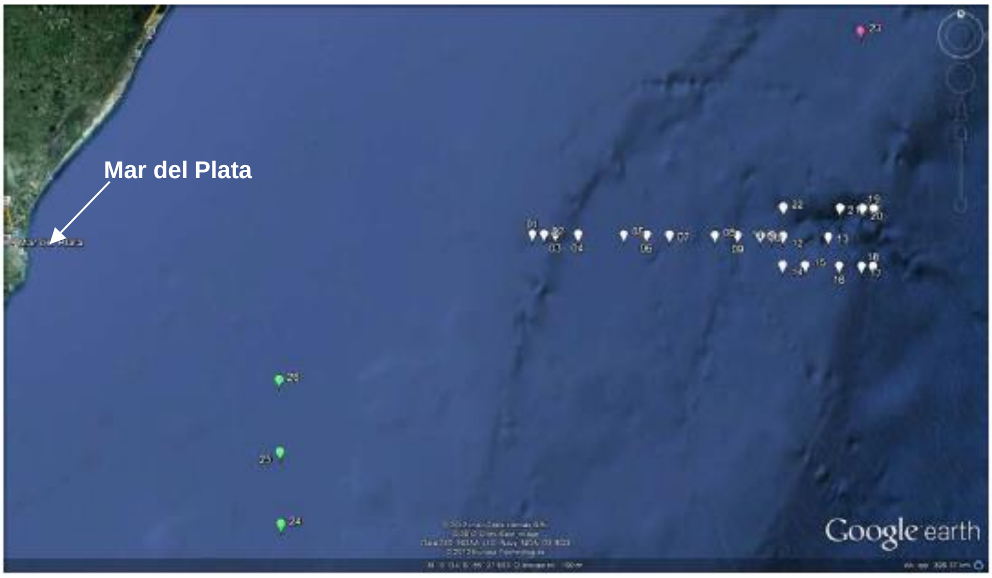
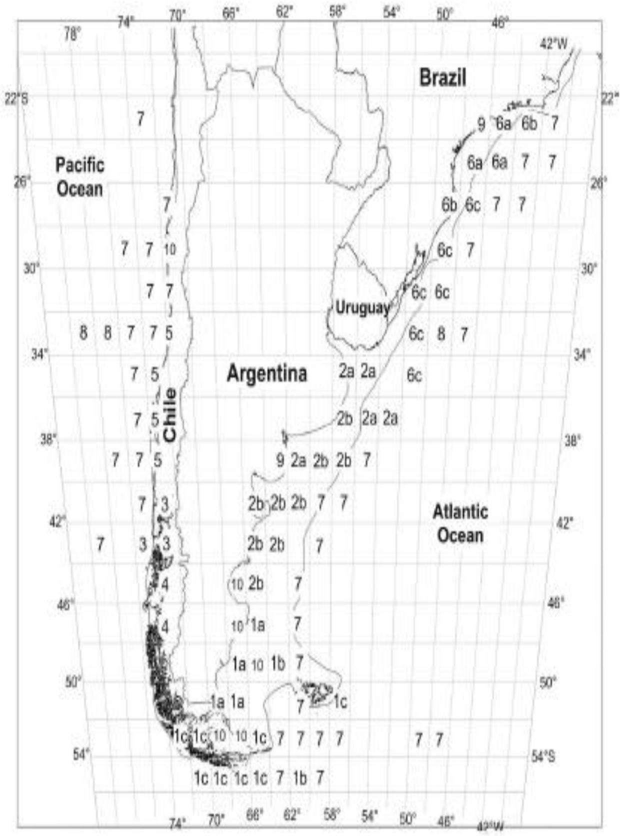


Figure 131. General location of the sampled stations (Campaign Report Underwater Canyon B / O "Puerto Deseado". August 10-17, 2012. CONICET).

4.2.2.4 Cnidaria

Rodriguez et al (2017) analyzed the assemblages of Hydromedusae in South America (from 22 ° S-56 ° S to 40 ° W- 80 ° W) associated with water masses and the influence of the life cycle on the distribution of jellyfish. The variation in relation to the environments they inhabit was explained by depth and temperature. The distribution patterns of hydromedusae in the South Atlantic were associated with neritic water bodies, supporting previously proposed biogeographic provinces. This work suggests that the meroplankton hydromedusae appeared to have a more restricted distribution than the holoplanktonic ones.



	Contribución a la similaridad intragrupo	
Especies	2-A	2-B
Bougainvillia muscus		3.18
Amphinema dinema		3.13
Leuckartiara octona		3.38
Probocidactyla mutabilis	19.95	13.83
Coryne eximia		13.83
Euphysa aurata		10.28
Hybocodon chilensis		2.15
Eucheilota ventricularis	19.95	3.26
Laodicea undulata		7.54
Cosmetirella davisii	6.07	
Mitrocomella frigida	1.9	
Mitrocomella brownei		10.28
Clytia lomae		1.75
Clytia simplex		5.09
Clytia gracilis		2.12
Clytia hemisphaerica	10.55	
Olindias sambaquiensis		3.44
Solmundella bitentaculat	1.99	
Cunina octonaria	5.28	
Liriope tetraphylla	19.95	
Halitrephes maasi		7.54
Rhopalonema velatum	5.87	
Meroplancton (%)	64	92
Holoplancton (%)	36	8

Figure 132. Spatial distribution of the hydromedusae assemblages obtained through the cluster analysis. 2. It corresponds to the Argentine biogeographic province (a- Uruguayan and b- Rionegrensis groups). Source: Rodríguez et al 2017.

(Translation of Figure 132: Especies: Species. Contribución a la similaridad intragrupo: Contribution to intra-group similarity).

Benthic Cnidarians (Corals)

A group of animals of the Phylum Cnidaria (Scleractinia, Antipatharia, Octocorallia, Stylasteridae, Milleporidae, some Zoanthidea and three Hydryactiniidae) with a continuous or discontinuous skeleton of calcium carbonate and / or with horns or antlers morphologies are classified under the name of "corals". The diversity sustained by communities dominated by cold-water corals is typically very high because the structuring species that form them seek refuge, habitat, and constitute breeding areas for many other organisms, both vertebrates and invertebrates. Although there are coral records in almost the entire Argentine Continental Shelf, the areas of the slope between 42 ° S and 48 ° S and 200 to 1,500 m deep are optimal for the development of habitats dominated by these organisms, characterized by strong currents, a large amount of nutrients and adequate temperatures (Allega et al. 2020).

Among the true coral species, *Bathelia candida* stands out for being one of the deep reef-forming species, which are located precisely on the slope (Cairns and Polonio 2013). Coral gardens, which are aggregations of colonies or individuals of more than one species (Buhl-Mortensen et al 2017), have been located mainly on the continental edge between 400 and 1,000 m deep, in large sandy areas with little slope (Del Rio et al 2012). In other deep areas where the soft and muddy substrate predominated, several species of sea pens (Pennatulacea) were recorded, being *Anthoptilum grandiflorum* the most frequent (Del Río et al. 2012; Schejter et al 2018). Likewise, these areas occasionally coexist with other habitats, such as sponge banks, characterized as "vulnerable" (Del Río et al. 2012, Durán Muñoz et al. 2012, Portela et al. 2012; 2015).

The detailed study area of the project does not overlap with the areas of higher coral density.

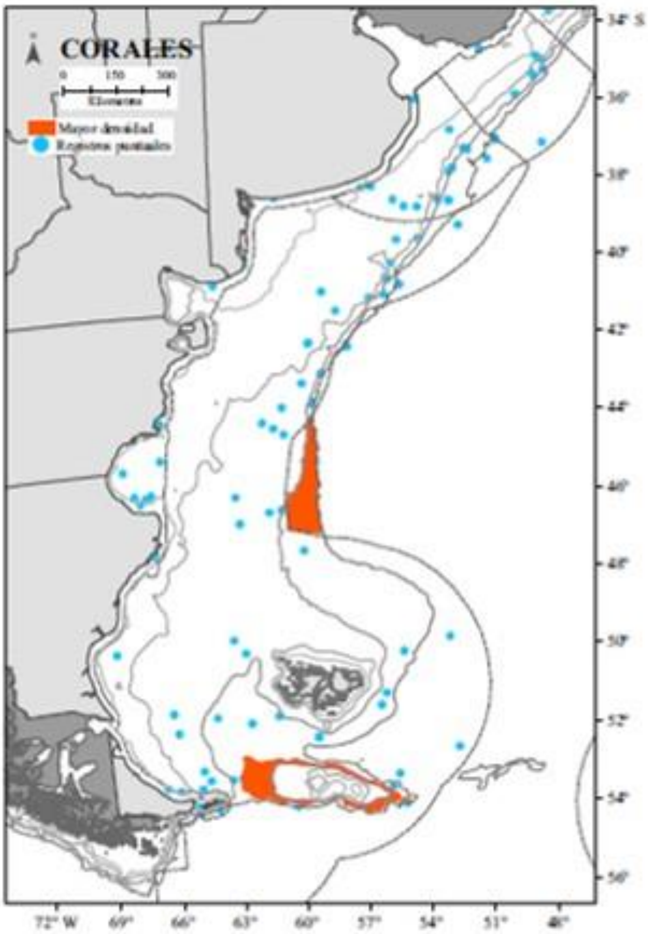


Figure 133. Corals recorded on the Argentine continental shelf. The regions in which high densities have been registered are indicated, corresponding to Vulnerable Marine Ecosystems. The light blue dots represent specific records of different species of corals. Source: Allega et al. 2020.
(Translation of Figure 133: Corales: Corals. Recuadro naranja: Mayor densidad: Orange box: More density. Puntos celestes: Registros puntuales: Light blue dots: specific records).

As a result of the 2012 Continental Slope campaign, cnidarians were found in 97% of the casts, and they were the predominant organisms in some of them (Example *Flabellum sp*. in Set No. 4 and *Anthomasthus sp*. in Set No. 26. Representatives of the Hydrozoa, Scyphozoa and Anthozoa classes were collected, the anthozoa being the most diverse and abundant (particularly the Actiniaria, Scleractinia and Pennatulacea orders). In total, at least one species of *hydrozoa*, at least two species of scyphozoa, at least 14 species of Actiniarios were collected: *Actinostola crassicornis, Antholoba achates, Isosicyonis alba, Metridium senile lobatum*, at least two species of Hormathiidae and others), five species of corals (*Bathelia candida, Flabellum sp* and others), four species of penatulaceans (*Pennatula argentina* and others), and an undetermined number of octocorals. Table 6 shows the distribution of the most characteristic species found during the campaign and their depth (Lauretta and Penchaszadeh, 2012).

Table 6. Summary of the most representative species found during the campaign (Lauretta and Penchaszadeh, 2012).

(Translation of Table 6: Clase: class. Orden: Order. Especie: Species. Lance (L): Set. Profundidad: Depth.)

Clase	Orden	Especie	Lance	Profundidad (m)
Hexacorallia	Actiniaria	*Antholoba achates*	L3; L33.	250 – 308
		?Actinostola crassicornis	L3; L33.	250 – 308
		?Isosicyonis alba	L3; L19; L33.	250 – 1508
		Hormathiidae sp.	L3; L4; L5; L8; L10; L11:L14; L25; L33.	250 – 1950
	Scleractinia	*Bathelia candida*	L10; L11; L12; L13; L15; L20; L31.	852 – 2010
		Flabellum sp.	L1; L2; L3; L4; L5; L6; L7; L8; L10; L12; L15; L18; L19; L25; L26; L27; L28; L29; L30; L31.	201 – 1950
Octocorallia	Pennatulacea	*Pennatula argentina?*	L2; L8; L9; L10; L14; L19; L25; L26; L27; L28; L29;	327 – 1950
	Alcyonacea	*Anthomastus* sp.	L7; L8; L26; L25;	647 – 1950
		Primnoidae sp.	L5; L6; L8; L9; L10; L11; L16; L19; L25; L26.	527 – 1950

4.2.2.5 Macro crustaceans of economic and ecological interest

Decapods are best known for their commercial interest. This group is made up of crabs, lobsters, shrimp, prawns and spider crabs. Most of the higher decapods are opportunistic, generalist, and sometimes scavenger carnivores. They create very numerous populations and possess gregarious habits that allow the formation of easily catchable swarms. Another remarkable characteristic of the group is its role as main prey for many species of fish, mollusks and other animals. Therefore, they are considered important links in the food chains of the worldwide seas. Five species of economic interest are registered within the indirect area of influence of the project.

Munida gregaria **(Fabricius, 1793)**
Common name: Prawns or lobsters

The distribution is restricted to the southern hemisphere, mainly South America and New Zealand. In South America it is distributed along the Pacific Ocean from Chlioé Island (47 ° S) to Cape Horn (56 ° S), and northwards through the Atlantic Ocean to the coasts of Uruguay (27 ° S), including the Falkland Islands (Islas Malvinas) (Figure 134). The bathymetric distribution ranges from the subtidal to 1,100 m depth (Zaixso and Boraso, 2015).

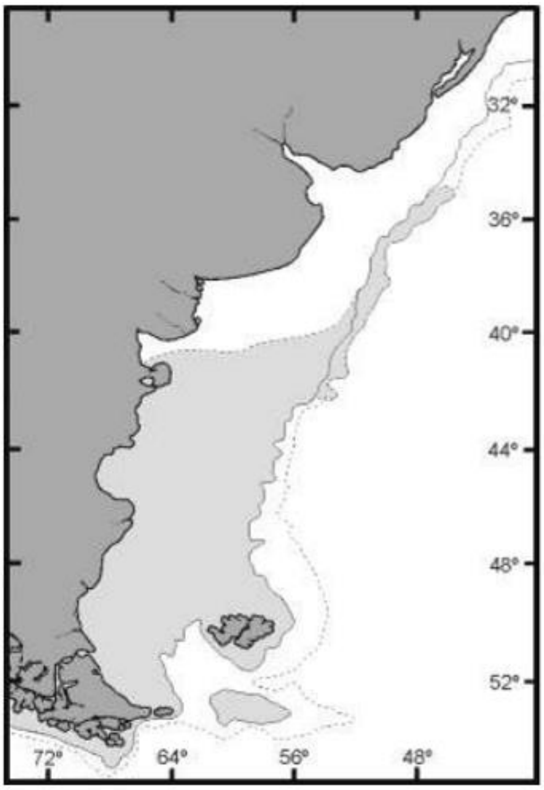


Figure 134. Distribution of the prawn in the Argentine sea. Source: Zaixso and Boraso, 2015.

In the Beagle Channel it feeds on crustaceans, algae, polychaetes, debris and sediments. On the other hand, the species represents an important percentage of the bycatch. Approximately 7,000 tonnes of *Munida spp*. were caught in the hake and prawn fishery in 2000 on a total of 24,000 tons of accompanying fauna (Zaixso and Boraso, 2015).

The *M. gregaria* shrimp has two different and simultaneous feeding habits: it is predatory and deposivorous. As a predator it feeds mainly on crustaceans, macroalgae and polychaetes, while as a deposivore it is capable of ingesting particulate organic matter, sediment and biological material associated with the upper layer of marine benthos, such as foraminifera, diatoms and nematodes (Romero et al. 2004). These two complementary and simultaneous feeding habits occur throughout the year, without any seasonal difference and regardless of the depth at which the animals are found. *M. gregaria* is also considered an omnivorous and opportunistic species (Romero et al. 2004).

***Lithodes santolla* (Molina, 1782)**
Common name: common spider crab

It is distributed from the SE coast of Tierra del Fuego and Isla de los Estados in the Atlantic, and, towards the north, there are no records of the species until San Jorge Gulf. From there it is present towards the north on the shelf and descending in depth (Figure 135). Offshore Buenos Aires, on the continental slope. It would tipically reach up to 700 m from the intertidal to 200 m depth.

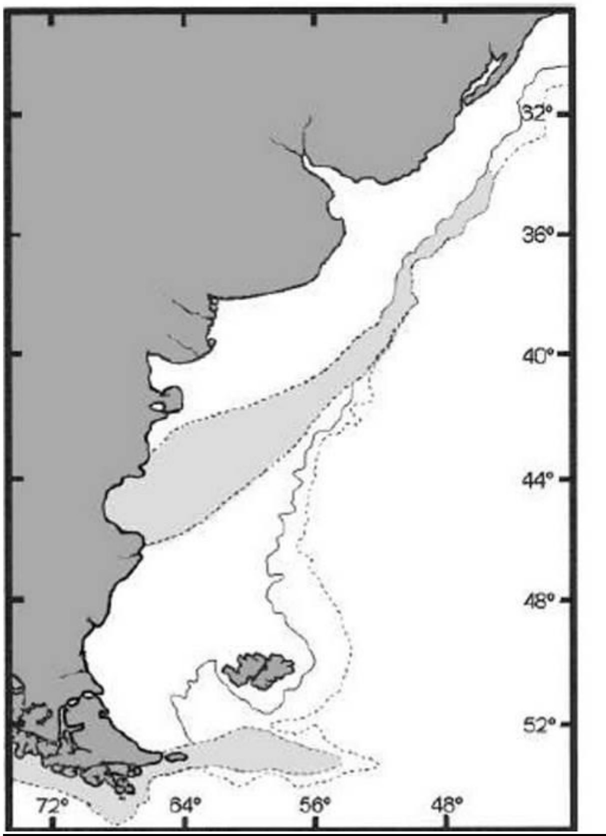


Figure 135. Distribution of the common spider crab in the Argentine sea. Source: Zaixso and Boraso, 2015.

It is found in shallow waters during the summer and at greater depths in winter in the Beagle Channel. The movements are carried out following the isobaths, with short displacements, for example, 14 km in 70 days. In the population of San Jorge Gulf there is a remarkable breeding migration to shallow waters: towards the end of spring they approach the central coasts and the northern sector of the Gulf, where they mate, and as from January they scatter towards deeper waters. In San Jorge Gulf it feeds on fish, prawns, bivalve mollusks and sea urchins.

Four effective sectors of Spider Crab can be identified in Argentina (Figure 136). The Central Patagonian Sector, called the Central Management Area for this species (between 43 ° 30´S and 48 ° C), is the most important since it produces a large part of the unloading volume (Allega et al., 2019). The most abundant nuclei in the Central Area are located within the San Jorge Gulf (San Jorge Gulf High Yield Sector) and in platform waters (North High Yield Sector and South High Yield Sector).

The effective sector Patagonia Sur is the second in importance and is distributed south of 48 ° S.

Only one breeding and moulting site is recorded in the so called CAN_100-108 area of direct influence of the project, but with a very low density of crabs. The CAN_114 area of direct influence of the project does not overlap with king crabs´ breeding or feeding sites. There are no landings from this area.

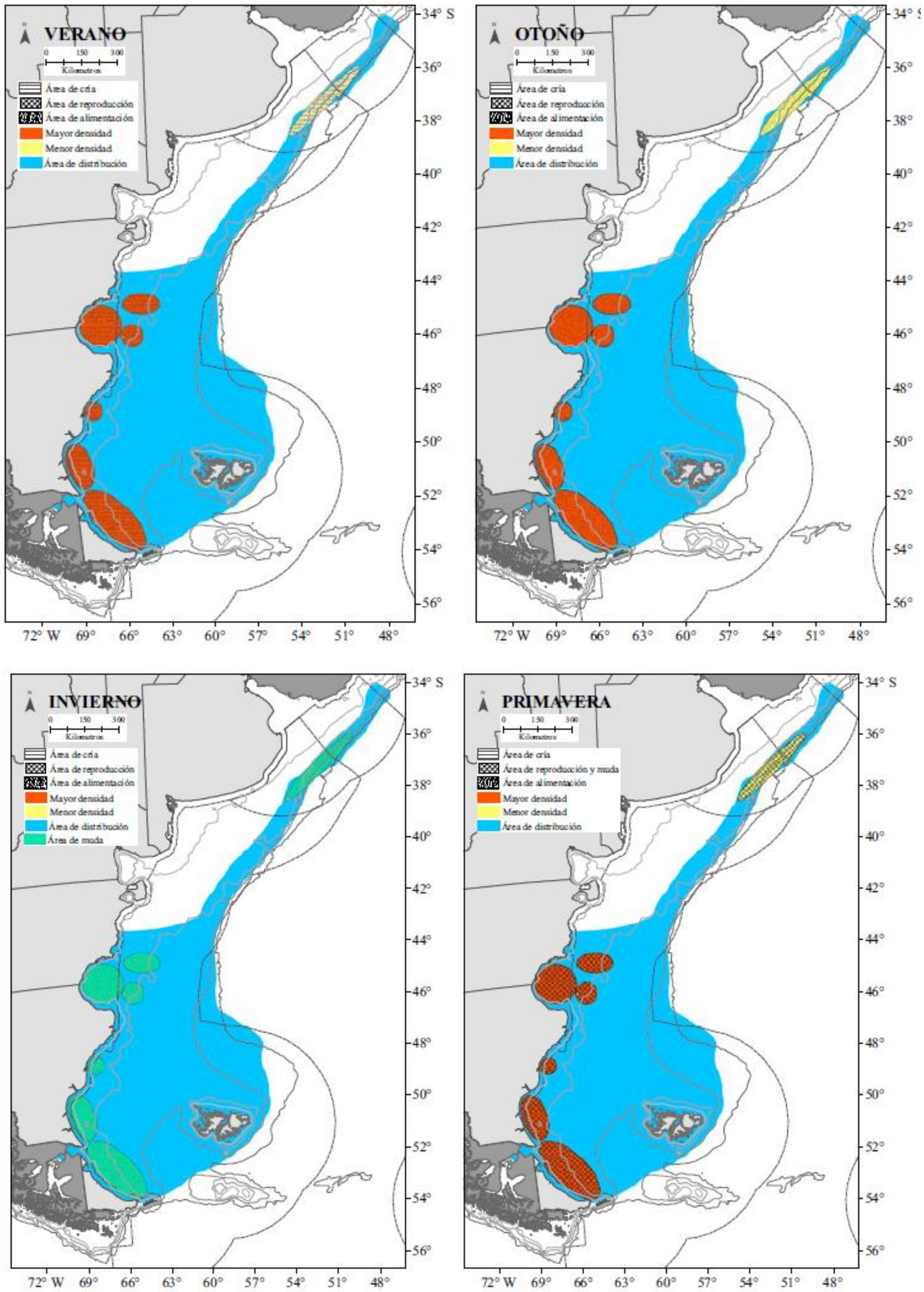


Figure 136. Spatial-temporal distribution of the *Lithodes santolla* Crab, indicating the sensitive areas in relation to the breeding and feeding of the species. Source: Allega et al. 2020.
(Translation of Figure 136: Verano: Summer. Area de cria: Breeding area. Area de Reproducción: Reproduction Area. Area de Alimentación: Feeding Area. Mayor Densidad: Higher density. Menor densidad: Lower density. Area de Distribución: Distribution Areas. Otoño: Autumn. (coloured boxes: idem previous description). Invierno: Winter. (coloured boxes: idem previous description) Area de muda: Moulting area. Primavera: Spring. (coloured boxes: idem previous description) + Area de reproducción y muda: Breeding and Moulting Area.)

Thymops birsteini **(Molina, 1782)**
Common Name: Lobster, Deepwater Lobster

This species is distributed in waters of the Argentine slope, from 55 ° S to 36 ° S (ZCPAU), although some findings have also been made in shelf waters. It also appears in the vicinity of the Falkland Islands (Islas Malvinas) and South Georgia. The known bathymetric distribution of the species places it 122 and 1,940 meters deep, with an average catch depth of 885 m (Firpo et al. 2004, Boschi 2016). The temperature of the bottom in the lines oscillates between 2.2 and 5.5 ° C. It prefers muddy substrates where it builds burrows. Yau et al. (2002) filmed them on the slope of the South Georgia Islands, between 600 and 1500 m entering and leaving caves with a 20-25 cm-diameter. The incubation period is unknown. Data have also been gathered from research campaigns and during the prospecting for benthic crustaceans established by the Federal Fisheries Council, the BP "Wiron IV" carried out specific activities with traps in waters of the Buenos Aires slope between 1057 and 1357 m depths (Firpo et al. 2004) where 263 specimens (54 kg) were collected, with CPUE values that ranged between 4 and 113 specimens per line; It was estimated that the weight of the abdomen or tail represents 27% of the total weight of the animal. The total length of the males ranged between 161 and 245 mm with a mean of 198.9 mm, the average weight was 192 g. Females ranged from 163 to 267 mm with an average of 183.5 mm. In the Southern Georgias, a differential bathymetric distribution by sex and size was observed, with the largest recorded sizes between 1000 and 1400 m (Boschi 2016).

Chaceon notialis
Common name: red crab

In our country, the red crab is located in the Atlantic sector of the "Magellanic Biogeographic Province, from the mouth of the Río de La Plata to the south, the latitudinal limit of its distribution being unknown. Some species of gerionidae inhabit partially buried in muddy or sandy bottoms and others in caves and rock formations on the platform and slope, mainly at depths between 200 and 1000 m. Different species of this family have an important commercial value. Regarding the life cycle, mating occurs between a larger male with a moulting mature female, the eggs are carried by the females for a long period and constitute an ovigerous mass greater than 22% of their body weight (Boschi 2016).

Ovalipes trimaculatus
Common name: Swimming crab

The swimming crab is a cosmopolitan species that has a worldwide distribution. In the Atlantic Ocean it is found from the southeast of the United States, through Central America, the southeast of Brazil and Uruguay to the Argentine Patagonia. In Argentina, it can be seen on the coast of the Provinces of Buenos Aires, Río Negro and Chubut and is typically found in the infralitoral floor of soft bottoms. It has an omnivorous diet, mainly feeds on invertebrates and fish, ingesting both living and dead organisms. Regarding their Breeding strategy, copulation occurs when females molt and males are potentially polygynous. Although mature females were found carrying eggs in studies conducted in summer months, the breeding season has not yet been determined (Boschi 2016).

4.2.2.5.1 Peracarid Crustaceans

In the 33 sets of the BO 2012 campaign, an abundance of peracarid crustaceans was obtained (Chiesa et al. 2012). In a preliminary analysis of Set 12, carried out with an epibentonic drag with a 1 mm mesh network, the following taxa could be recognized:

Orden Cumacea

Diastylidae
Gro. *Vemakylindrus*

Leuconidae
Gro. *Leucon*

Lampropidae
Gro. *Paralamprops*
Gro. *Hemilamprops*

Nannastacidae
Gro. *Campylaspis*

The Lampropidae family was the most abundant among the analyzed material. The members of this family mainly inhabit deep and / or cold waters.

Orden Isopoda

Acanthaspidiidae
Acanthaspidia

Ischnomesidae
Gro. indet.

Haploniscidae
Gro. indet.

Stenetriidae
Tenupedunculus

Munnopsidae
Echinozone
Disconectes

Janiridae
Iathrippa

Joeropsidiidae
Joeropsidae

Paramunnidae
Abyssianira
Pleurosignum
Neasellus

Sphaeromatidae
cf. *Moruloidea*

Ischnomesidae, Haploniscidae, and Acanthaspidia (Acanthaspidiidae) are typical deep-sea taxa, all of which are highly diverse in Antarctic waters. This is the first BO campaign where representatives of these families and genders are obtained. Likewise, 4 species of *Tenupedunculus* (Stenetriidae) were mentioned in the literature for waters of the slope. However, they were not found in previous campaigns. It is highly probable that the species of these families (Ischnomesidae, Haploniscidae, Acanthaspidiidae and Stentriide) correspond to new species.

Order: Amphipoda

Ampeliscidae

Caprellidae

Dexaminidae

Iphimediidae

Ischyroceridae

Leucothoidae

Liljeborgiidae

Lysianassidae

Oedicerotidae

Phoxocephalidae

Podoceridae

4.2.2.5.2 Decapod crustaceans

During the "Underwater Canyons- Continental Slope BO 2012" campaign, a total of nine species were collected: three species of Caridea shrimp from the Hippolitidae family and Pandalidae, one Astacidea lobster from the Nephropidae family, one species of Anomura Galatheidea lobsters from the Galatheidae family , a species of deep-sea crab Anomura Paguroidea from the Lithodidae family, a hermit crab species from the Parapaguridae family, a Brachyura crab species from the Geryonidae family and a Majidae family species (Scelzo, 2012).

Listado de Especies de Crustáceos Decapodos colectados por el B/I Puerto Deseado/CONICET durante la capaña "Cañones Submarinos 2012".

Suborden PLEOCIEMATA
Infraorden CARIDEA

Familia Hypollitidae

1. *Corismus tuberculatus* **Bate, 1888**

Material examinado: Hembra 15.1 mmLC
Lance 15. Fecha: 12/8/2012. Localidad 38° 0,500´S- 54° 25,069´W
Prof. 1200 m. Sal. 33.8‰. Temp. 6.04°C
Observaciones: Según Boschi et al., (1992) la especie era conocida para las latitudes entre 45°59´y 54°°10´, y a profundidades entre 400-540 m., por lo que las presentes capturas amplian la distribución geográfica y batimétrica de la especies.

Familia Pandalidae

2. ***Austropandalus grayi*** **(Cunningham, 1871)**
Observaciones: El material fotografiado a bordo correspondería a la especie *A.grayi* pero lamentablemente se ha extraviado el ejemplar y no forma parte de las colecciones. Carecemos de datos del lance de pesca.

3. ***Indeterminate caridea.***

Infraorden ASTACIDEA
Familia Astacidae

4. *Thymops birsteini* **(Zarenkov & Semenov, 1972)**
Figs.

Material examinado: Macho LC con rostro 58.6mm. LC sin rostro 43.1 mm
Lance 19. Fecha: 13/8/2012. Localidad 37° 56,688´S- 54° 10,997´W
Prof. 1508 m. Sal. 33.859‰. Temp. 5.7ºC

Macho LC con rostro 46.9mm. LC sin rostro 34.8 mm
Lance 26. Fecha: 15/8/2012. Localidad 37° 52,303´S- 53° 57,433´W
Prof. 1738 m. Sal. 33.724‰. Temp. 6.53ºC.
Observaciones: Datos previos de captura de la especie indican una distribución batimétrica hasta 1500 m (Boschi et al., 1992). Con las presentes captura se amplía hasta 1738 m de profundidad.

Infraorden ANOMURA
Superfamilia Galathoidea
Familia Galatheidae

5. *Munida spinosa* Henderson, 1885

Material examinado:

Una hembra 24.1 mmLC, Dos hembras ovígeras 18.4 y 26.1mmLC. Tres machos: 10.5, 14.2 y 17 mmLC.
Lance 15. Fecha: 12/8/2012. Localidad 38° 0,500´S- 54° 25,069´W
Prof. 1200 m. Sal. 33,8‰. Temp. 6,04ºC

2 hembras 13.4 y 16.5mmLC.
Lance 19. Fecha: 13/8/2012. Localidad 37° 56,688´S- 54° 10,997´W
Prof. 1508 m. Sal. 33.859‰. Temp. 5.7ºC

Hembra ovígera 22 mmLC
Lance 31. Fecha: 16/8/2012. Localidad 38° 1,499´S- 54° 44,171´W.
Prof. 819 m. Sal. 33.74‰. Temp. 6.8ºC

Dos ejemplares: macho 24.1 mm LC, hembra 22 mmLC
Lance 26. Fecha: 15/8/2012. Localidad 37° 52,303´S- 53° 57,433´W
Prof. 1738 m. Sal. 33.724‰. Temp. 6.53ºC.

Dos ejemplares: hembra ovígera 19 mmLC, una hembra rota sin medir
Lance 16. Fecha: 12/8/2012. Localidad 37° 57,288´S- 54° 23,456´W
Prof. 1307 m. Sal. 33.83‰. Temp. 5.95ºC.

Observaciones: Información bibliográfica previa (Scelzo, 1973. Boschi et al., 1992) indica que la especie tiene una distribución batimétrica entre 100-1100 metros de profundidad, con lo cual los ejemplares obtenidos en la presente campaña amplían la batimetría hasta 1738 metros.

Superfamilia Paguroidea
Familia Lithodidae

6. *Paralomis formosa* Henderson, 1888

Macho 31.2 y 56.5 mm LC hembra 32.4 mmLC.
Lance 19. Fecha: 13/8/2012. Localidad 37° 56,688´S- 54° 10,997´W
Prof. 1508 m. Sal. 33.859‰. Temp. 5.7°C
Observaciones: el material ha sido obtenido dentro del rango batimétrico y localidad geográfica previamente para la especie. Uno de los ejemplares muestra una abundante epibiosis de crustáceos cirripedios del género *Lepas sp.*

Inafraorden BRACHYURA
Superfamilia Portunoidea
Fam. Geryonidae

8. *Chaceon notialis* Manning & Holthuis, 1989
Figs.

Material examinado: 17,8 mmAC
Lance 15. Fecha: 12/8/2012. Localidad 38° 0,500´S- 54° 25,069´W
Prof. 1200 m. Sal. 33,8‰. Temp. 6,04°C

Cuatro machos: 11 mmAC, 43.8 mmAC, 49.4mmLC, 50.1 mmAC.
Lance 19. Fecha: 13/8/2012. Localidad 37° 56,688´S- 54° 10,997´W
Prof. 1508 m. Sal. 33.859‰. Temp. 5.7°C

Observaciones: Scelzo y Valentini, (1974) citan a la especie como *Geryon quinquedens* y posteriormente descripto como *Chaceon notialis* por Manning y Holthuis (1989) el material ha sido obtenido dentro del rango batimétrico y localidad geográfica previamente para la especie. La especie es la de mayor tamaño de cangrejo de aguas argentina y habita aguas profundas de la provincia de Buenos Aires, entre Argentina y Uruguay, donde esta especie de "cangrejo rojo" es explotado comercialmente por la flota pesquera de este último país.

9. Brachyura indet. (Majidae? Parthenopidae?)

Material examinado: 1 ejemplares: Hembra mm LC
Lance 3. Localidad: 37°59´S-55°09´W. Fecha: 10/8/2012
Prof. 250 m. Sal. 33.65‰. Temp. 7.26°C
Observaciones: Ejemplar roto. No citado por Boschi et al., 1992. Material llevado a la Universidad Nacional de Mar del Plata para determinar especie. Se carece de fotografías de este ejemplar.

4.2.2.6 Molluscs

Class: Gastropoda: They constituted one of the groups of invertebrates present from the first sets as from 200 m deep and until the last (Pastorino et al. 2012). The presence in the campaign of larger forms belonging to the Volutidae family with two dominant species: *Odontocymbiola pescalia* and *Provocator corderoi* is visible in most of the stations above 300 m. A specimen of *Zidona palliata*, a relatively rare species of this same family, was collected alive 1000 meters-deep. The Naticidae family was well represented by several species including *Bulbus carcellesi* and *Falsilunatia eltanini* with specimens of juveniles and adult of various sizes. Both rare species, the latter only known for its hard parts, were recently described. This family is well represented by many species and some of them are clearly new to science. The Turridae family included representatives in all sets, however, it is so little known that it requires a much more detailed study for the specific assignment. Likewise, the Muricidae were represented by very little known or recently described species such as *Trophon columbarioides* or *Trophon mucrone* or recognized from a few specimens such as *Trophon clenchi*. Other families such as Marginellidae, Buccinidae, Epitoniidae, Olividae are well represented in many sets. On the other hand, ovigerous capsules of various species of the Volutidae and Naticidae families were collected in the same samples (Pastorino et al. 2012).

Class: Bivalvia: most of these forms are of infamous habits, beyond the reach of the fishing gear used. However, in one of the sets performed at about 2400 m depth, several dead specimens with less articulation were collected as well as a specimen with soft parts of an apparently new species of the genus *Laubiericoncha* (Vesicomyidae Family), with no representatives described in these latitudes. Other groups of bivalve, including representatives of the Nuculidae family, were collected at various depths (Pastorino et al. 2012).

Class: Cephalopoda: two specimens of Octopodidae were collected, still to be identified (Pastorino et al. 2012).

Class: Aplacophora: On the other hand, some species such as *Neomedia hertwigi*, a known form, but of unusual size (30 cm in length) not present in local repositories was collected and preserved for genetic studies purposes (Pastorino et al. 2012).

Class: Scaphopoda: At least two forms of this class were collected in large numbers and are in the process of being studied for their specific assignment (Pastorino et al. 2012).

Class: Polyplacophora: 13 specimens were found in sets 4,6,11,15 and 25. These individuals have external morphological characteristics similar to the *Leptochiton medinae* species (Lepidopleuridae: Leptochitonidae). They were found at depths between 528 to 1950 m. It is a characteristic species of the Magellanic Biogeographic Province. The limits of this province are far from the coast in the latitudes covered by the sampling, which is compatible with the area of influence of the Malvinas current (Figure 137) (Pastorino et al 2012).

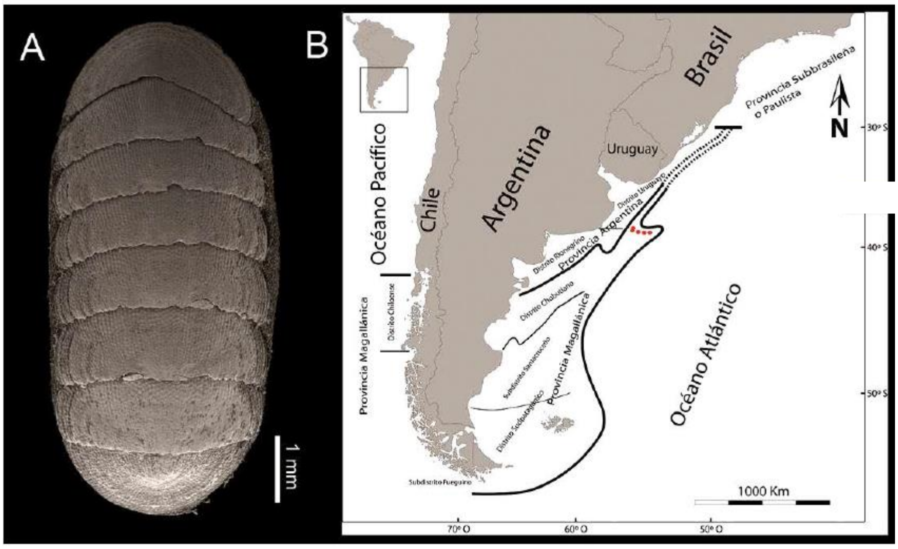


Figure 137. A-*Leptochiton medinae*. B. Biogeographic Provinces of the Southwest Atlantic. The dots mark the sets through which *L. medinae* was collected. Source: Pastorino et al. 2012.

4.2.2.7 Echinoderms

Table 7 shows the taxa identified during the B / O “Puerto Deseado” 2012 campaign on the continental slope for each of the classes and the corresponding sets through which they were collected (Brogger and Martinez).

Table 7. Echinoderm species collected on the Continental Slope. Source: Brogger and Martinez, 2012.

(Translation of Table 7: Clase: class. Orden: Order. Familia: Family. Especie: Species. N°Lance: Fishing Set N°.)

Clase	Orden	Familia	Especie	N° Lance
Crinoidea	Comatulida	Antedonidae	*Isometra vivipara*	1, 2, 5, 10, 11, 12, 19, 31, 33
Holothuroidea	Molpadiida	Molpadiidae	*Molpadia* sp.	8, 14, 19, 21, 24, 25, 28
Holothuroidea	Molpadiida	Molpadiidae	*Paracaudina* sp.	8, 9, 10, 14, 19, 23, 27, 33
Holothuroidea	Dendrochirotida	Cucumariidae	sp. 1	14
Holothuroidea	Dendrochirotida	Psolidae	*Psolus murrayi*	8, 33
Holothuroidea	Dendrochirotida	Psolidae	*Psolus patagonicus*	33
Holothuroidea	Dendrochirotida	Psolidae	*Psolus segregatus*	25, 33
Holothuroidea	Dendrochirotida	Psolidae	*Psolus* sp. 1	14
Holothuroidea	Dendrochirotida	Psolidae	*Psolus* sp. 2	15
Holothuroidea	Dendrochirotida	Psolidae	*Psolus* sp. 3	33
Holothuroidea	Dendrochirotida	Cucumariidae	*Cladodactyla crocea*	8, 32, 33
Holothuroidea	Aspidochirotida		sp. 1	19, 25, 28, 29
Ophiuroidea	Euryalida	Gorgonocephalidae	*Gorgonocephalus chilensis*	3, 14, 33
Ophiuroidea	Euryalida	Gorgonocephalidae	*Astrotoma agassizii*	10, 11, 15, 16, 31
Ophiuroidea	Euryalida	Asteronychidae	*Asteronyx loveni*	20, 21, 26, 29
Ophiuroidea	Ophiurida	Ophiacanthidae	*Ophiacantha vivipara*	1, 2, 3, 5, 11, 33
Ophiuroidea	Ophiurida	Ophiacanthidae	*Ophiochondrus stelliger*	5, 10, 15, 31
Ophiuroidea	Ophiurida	Ophiacanthidae	sp. 1	5, 15, 16
Ophiuroidea	Ophiurida	Ophiacanthidae	sp. 2	16, 26
Ophiuroidea	Ophiurida	Ophiacanthidae	sp. 3	31
Ophiuroidea	Ophiurida	Ophiuridae	*Ophiura lymani*	3, 4, 5, 6, 8, 33
Ophiuroidea	Ophiurida	Ophiuridae	*Ophiocten amitinum*	3, 10, 12, 14, 19, 24, 26, 31, 32, 33
Ophiuroidea	Ophiurida	Ophiuridae	*Ophioplinthus inornata*	5, 6, 7, 8, 10, 11, 12, 14, 16, 19, 22, 24, 31
Ophiuroidea	Ophiurida	Ophiuridae	sp. 1	14, 24,
Ophiuroidea	Ophiurida	Ophiuridae	sp. 2	31
Ophiuroidea	Ophiurida	Ophiactidae	*Ophiactis asperula*	1, 2, 3, 5, 33
Ophiuroidea	Ophiurida	Ophiolepididae	*Ophiomusium lymani*	18, 21, 22
Ophiuroidea	Ophiurida	Amphiuridae	sp. 1	5, 6, 12, 16, 24, 25, 26, 31
Ophiuroidea	Ophiurida		sp. 1	10
Ophiuroidea	Ophiurida		sp. 2	10
Ophiuroidea	Ophiurida		sp. 3	22
Ophiuroidea			spp.	13, 17, 23, 27, 28
Echinoidea	Camarodonta	Temnopleuridae	*Pseudechinus magellanicus*	1, 2, 3, 33
Echinoidea	Camarodonta	Echinidae	*Sterechinus agassizii*	3, 5, 6, 8, 14, 16, 31
Echinoidea	Camarodonta	Echinidae	sp. 1	19
Echinoidea	Camarodonta		sp. 1	10
Echinoidea	Cidaroida	Cidaridae	*Austrocidaris canaliculata*	4, 5, 8, 10, 14, 31
Echinoidea	Cidaroida	Cidaridae	sp. 1	15, 16, 25, 26
Echinoidea	Cidaroida	Cidaridae	sp. 2	16, 33
Echinoidea			sp. 1	24
Echinoidea	Spatangoida		sp. 1	2, 3, 5, 14, 33
Asteroidea	Paxillosida	Ctenodiscidae	*Ctenodiscus australis*	1, 2, 3, 5, 7, 8, 10, 14, 19, 25, 26, 28, 32, 33
Asteroidea	Paxillosida		sp. 1	4, 24
Asteroidea	Paxillosida		sp. 2	24
Asteroidea	Velatida	Pterasteridae	*Calyptraster* sp.	3, 5, 10
Asteroidea	Valvatida	Goniasteridae	*Hippasteria* sp.	14, 16
Asteroidea	Valvatida		sp. 1	28
Asteroidea	Forcipulatida		sp. 1	3, 33
Asteroidea			sp. 1	2, 3, 5, 8, 24, 25, 32, 33
Asteroidea			sp. 2	5, 22
Asteroidea			sp. 3	10, 15
Asteroidea			sp. 4	1, 3, 8, 10, 15, 16, 19, 22, 26, 32
Asteroidea			sp. 5	5, 10, 24, 25
Asteroidea			sp. 6	5, 15
Asteroidea			sp. 7	10, 19, 27

4.2.2.8 Deep Sea Tunicate

A total of 14 different morphospecies of tunicates were recorded in the campaign, of which 10 are

Colonial and 4 Solitary. All of them belong to the Ascidiacea Class (Maggioni 2012).

4.2.2.9 Polychaeta

The polychaetes were surveyed during the 2013 Continental Slope II and III Campaign: a total of 11 families were identified: Ampharetidae, Aphroditidae, Eunicidae, Lumbrineridae, Maldanidae, Nereididae, Onuphidae, Polynoidae, Sabellidae, Sternaspidae and Terebellidae. The most frequent were Polynoidae, Ampharetidae and Eunicidae, which appeared in most of the samples and therefore in broader ranges of depths such as 780 to 3282 m (Palomo and Calla 2013).

4.2.2.10 Turbellaria

In the 2013 campaign of the BO Puerto Deseado, a total of 20 sets were carried out with different Maricola Tricladida were found in two of the samples. These are novel citations due to the latitude / longitude and depth at which they were found. Specimens of other groups of invertebrates were also separated and fixed (example Sipunculida, Echiura, Priapulida and Brachipoda) for their subsequent determination (Brusa and Damborenea, 2013).

Table 8. Materials transported to the Laboratory of Invertebrate Zoology of "La Plata" Museum. Source: Brusa y Damborenea 2013.

(Translation of Table 8: Lance: Fishing Set. Profundidad: Depth)

LANCE	PROFUNDIDAD	Protozoa-Foraminiferida	Porifera	Cnidaria-Hydrozoa	Cnidaria-Anthozoa	Platyhelminthes-"Turbellaria"	Nemertea	Mollusca-Bivalvia	Mollusca-Gastropoda	Mollusca-Scaphopoda	Annelida-Polychaeta	Sipuncula	Arthropoda-Crustacea	Arthropoda-Chelicerata	Nematoda	Bryozoa	Brachiopoda	Echinodermata-Asteroidea	Achinodermata-Ophiuroidea	Echinodermata-Holoturoidea	sedimento
45	2934											+						Paxillosida	+		
46	3282															+					
47	2950															+					
48	2958	+?															+				
49	2711	+									?					2 morfos	+				+
50	3447	+	2 morfos													4 morfos	+				
51	2212	+		Hidrocoral?							+										
52	1970																				
53	1963	+			*Flabellum* sp. (MLP-Oi3810); *Anthomastus* (MLP-Oi3816)			+		+	ejemplares; tubos hialinos;		Cirripedia *Lepas* sp.		+	+		+	+		
54	2845										*Sternapsis* sp										
55	1712	+	+	colonia	*Flabellum* sp.					+	ejemplares, tubos 2 morfos		*Serolis* sp.								
56	2204		+	Hidrocoral, 2 morfos	Pennatulida, otros octocorales											+					
57	1853	+		colonia	colonia			2 morfos		+	+		Ostracoda								+
58	1444			+	*Pennatula argentina*; *Flabellum* sp (MIP-Oi3811)						Polychaeta (MLP-Oi3812)		Serolidae								
59	1398	+	+	Hidrocoral	*Pennatula argentina;* Octocoralia morfo 1 MLP OI 3615; Octocoralia morfo 2; *Bathelia candida* (Oi3813); *Flabellum* sp. (Oi3814)		?	+			tubos		microcrustaceos	picnogonidos	+	+			+		
60	1584		esponjas rojas		Gorginida						poliquetos con puestas; en galerias de gorgonidas		Amphipoda		+						
61	2161					Cocones Tricladida	+								+						
62	1404																				
63	1310	+		colonias							*Sternapsis* sp.	en caracol									+
64	1395	+		+	*Flabellum* sp., Gorgonacea	Cocones Tricladida		+	+	+	+		*Serolis* sp.; microcrustaceos	picnogonidos	+				+	+	

4.3 NEKTON

Nekton is a community of organisms embracing those generally macroscopic animal species that have a great swimming capacity. Traditionally, the organisms that usually make up this community are: fish (bone and cartilaginous), cephalopods (squid), reptiles (sea turtles), marine mammals (whales, dolphins, and sea lions), and those birds that are intimately related to the marine environment (such as terns, albatrosses and petrels, among others). The group of species belonging to the nectonic community plays an important role in the marine ecosystem at the highest trophic levels (Nybakken and Bertness, 2004). Some groups of species that make up the nekton (chondrichtes, birds, mammals and reptiles) have common characteristics, in addition to being top predators, most of them present similar life history strategies: late maturity, low Breeding rate and longevity. This set of characteristics makes them extremely vulnerable to a population decline, even if they suffer low mortality levels (Bastida et al., 2007). It is known that, for many species of birds, turtles, marine mammals and sharks, the interaction with the fishing activity constitutes one of the main threats to their survival together with the pollution of the marine environment, the degradation of habitat and the relationship with introduced species (Franco-Trecu et al., 2009). The species recorded for the detailed study area of the project are hereinbelow described.

4.3.1 <u>Fish and Cephalopods</u>

4.3.1.1 General Characterization

As part of this point, those species whose range of distribution covers the project area are mentioned and / or briefly described, either throughout the year or seasonally. When the information was available, emphasis was placed on the trophic aspects of the species in order to assess their link with other communities that may be impacted, and on the breeding aspects and breeding areas.

Next, the main characteristics of those species that could be linked to the area of seismic exploration activities are presented, considering only those that inhabit the outermost edge of the platform with records greater than 500 m, as well as the Argentine continental slope.

Tabla 9 summarizes the species identified in the project area and their adjacencies. The richness totals 69 species of fish. A total of 33 species of fish are registered for CAN_100, CAN_108 and CAN_114 areas of direct influence of the project. Fourteeen (14) species, as well as 19 species of bony fish were identified among the most prominent cartilaginous fish, being mostly Rajiformes.

Tabla 9. Species detected in the area of direct influence of the project (*) and adjacent to the slope and edge of the platform. Source: OBIS; Nakamura et al. 1986; Diaz de Astarloa and Bruno 2012; Diaz de Astarloa et al. 2013.

ORDER	FAMILY	SPECIES	COMMON NAME
Rajiformes	Arhynchobatidae	*Bathyraja macloviana**	Patagonian Skate
		*Bathyraja albomaculata**	White-dotted skate
		Bathyraja griseocauda	Greytail skate
		*Bathyraja scaphiops**	Cuphead skate
		*Bathyraja brachyurops**	Broadnose skate
		*Bathyraja magellanica**	Magellan Skate
		*Bathyraja cosseasuae**	Joined-fins skate
		Bathyraja multispinnis *	Multispine skate
	Rajidae	*Zearaja chilensis* *	Yellownose skate
		Amblyraja doellojuradoi *	Southern thorny skate
		*Psammobatis normani**	Shortfin sand snake
		*Psammobatis rudis**	Smallthorn sand skate
Squaliformes	Squalidae	*Squalus acanthias**	Picked dogfish
Carcharhiniformes	Scyliorhinidae	*Schorederichthys bivius* *	Narrowmouthed catshark
Chimeriformes	Callorhynchidae	*Callorhinchus callorhynchus* *	Plough-nosed chimaera
Gadiformes	Macruridae	*Coryphaenoides filicauda*	Grenadier
		Coelorhynchus fasciatus *	Banded whiptail
		Macrourus holotrachys	Bigeye grenadier
		Macrourus carinatus	Ridge scales rattail
		Lucigadus nigromaculatus	Blackspotted grenadier
		Haplomacrourus nudirostris	Naked snout rattail
	Muraenolepididae	*Muraenolepis marmorata*	Marbled moray cod
	Merluciidae	*Merluccius hubbsi**	Argentine Hake
		Merluccius australis	Southern Hake
		*Macruronus magellanicus**	Patagonian Grenadier
	Moridae	*Antimora rostrata*	Blue Antimora
		Lepidion ensiferus	Patagonian Codling
		Guttigadus kongi	Austral Cod
		*Notophycis marginata**	Dwarf codling
		*Salilota australis**	Tadpole Codling
	Gadidae	*Micromesistius australis**	Southern Blue whiting
	Centropholidae	*Seriolella porosa*	Choicy ruff
	Phycidae	*Urophycis cirrata*	Gulf Hake
Pleuronectiformes	Achiropsettidae	*Mancopsetta maculata**	Antarctic armless flounder
		Mancopsetta milfordi *	Finless flounder
Scorpaeniformes	Psychrolutidae	*Cottunculus granulosus**	Fathead

ORDER	FAMILY	SPECIES	COMMON NAME
		Psychrolutes marmoratus	Fathead
	Liparidae	*Praematoliparis anarthractae*	Snailfish
		Paraliparis cf. anarthractae	Snailfish
		Paraliparis eltanini	Snailfish
	Congiopodidae	*Congiopodus peruvianus*	Horsefish
	Sebastidae	*Sebastes oculatus*	Patagonian redfish
Anguiliformes	Congridae	*Ariosoma opistophthalmum*	Conger
		Bassanago albescens	Hairy conger
		Conger orbignianus	Argentine Conger
		*Pseudoxenomystax albescens**	Conger eel
	Synaphobranchidae	*Diastobranchus capensis*	Basketwork eel
Nocanthiformes	Halosauridae	*Aldrovandia phalacra*	Hawaiian halosaurid fish
	Notacanthidae	*Notacanthus sexspinis*	Spiny-back eel
		Notacanthus chemnitzii	Snubnosed spiny eel
Myctophiformes	Myctophidae	*Mictophidae sp.*	*Mictophidae*
Perciformes	Zoarcidae	*Ophthalmolycus macrops*	Eelpout
		Plesienchelys stehmanni	Eelpout
		Phucocoetes cf. latitans	/
		*Illucoetes fimbritatus**	Eelpout
		*Lycenchelys bachmanni **	Eelpout
	Stromateidae	*Stromateus brasiliensis**	Southwest Atlantic Butterfish
	Gempylidae	*Thyrsites atun**	Snoek
	Notothenidae	*Disssotichus eleginoides**	Patagonian Toothfish
		*Patagonotothen ramsayi**	Longtail southern cod
	Epigonidae	*Epigonus robustus**	Robust cardinalfish
	Bovichtidae	*Cottoperca gobio*	Channel Bull blenny
	Centrolophidae	*Schedophilus griseolineatus*	/
Stomiiformes	Sternopthychidae	*Argyropelecus aculeatus*	Lovely hatchetfish
	Stomiidae	*Stomias boa*	Boa dragonfish
		Bathophilus vaillanti	/
Ophidiiformes	Ophidiidae	*Genypterus blacodes**	Pink cusk-eel
	Bythitidae	*Cataetyx messieri*	Patagonian Forkbeard
Aulopiformes	Notosudidae	*Scopelosaurus lepidus**	/
	Ipnopidae	*Bathypterois longipes*	Abyssal spiderfish

4.3.1.2 Cartilaginous Fish

Order: Squaliformes

1- *Squalus acanthias* (Picked dogfish)

Its distribution is remarkably wide since it embraces coastal, shelf and slope waters (Figure 138). It can be found up to 350 m deep (Menni et al. 2010) and feeds mainly on fish and cephalopods when it is adult, and on macroplankton (jellyfish, ctenophores, salps) in juvenile stages. Spawning would take place in winter (Oddone et al. 2015), although Chavez et al (2016) point out that the period would be from winter to spring. The species is viviparous with a biennial and asynchronous Breeding cycle (Colonello et al 2016).

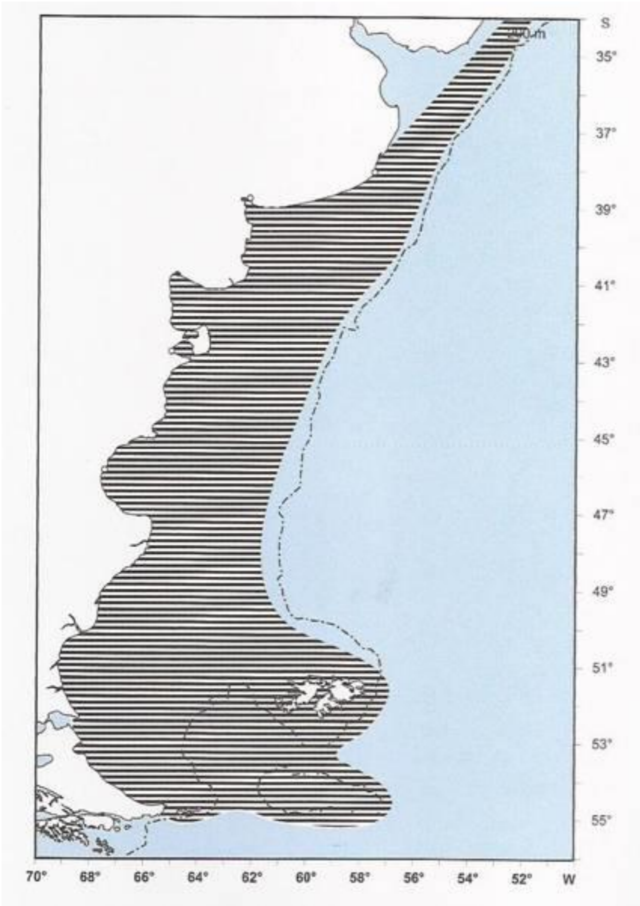


Figure 138. Geographical distribution of S*. acanthias.* Source: Cousseau and Perrota 2013.

Order: Carcharhiniformes

2- *Schorederichthys bivius* (Narrowmouthed catshark)

This species has a very wide distribution range that encompasses the entire Argentine Sea (Figure 139) and is found between 50 to 350 m-deep in northern Patagonia (Figure 140). Catches are recorded up to 150 m on the North Patagonian shelf (Figure 141). Its general trophic spectrum is made up of cephalopods (39%), fish (36%), benthic crustaceans (18%), other benthic invertebrates (6%) and gelatinous zooplankton (1%). In the Bonaerense and North Patagonian Platforms, the main prey were fish, and cephalopods in the southern shelf. Although no differences were observed in the diet between males and females, a change in the diet of the catshark was found around 64 cm in total length (Sanchez et al. 2009). The breeding of this species is carried out on the platform.

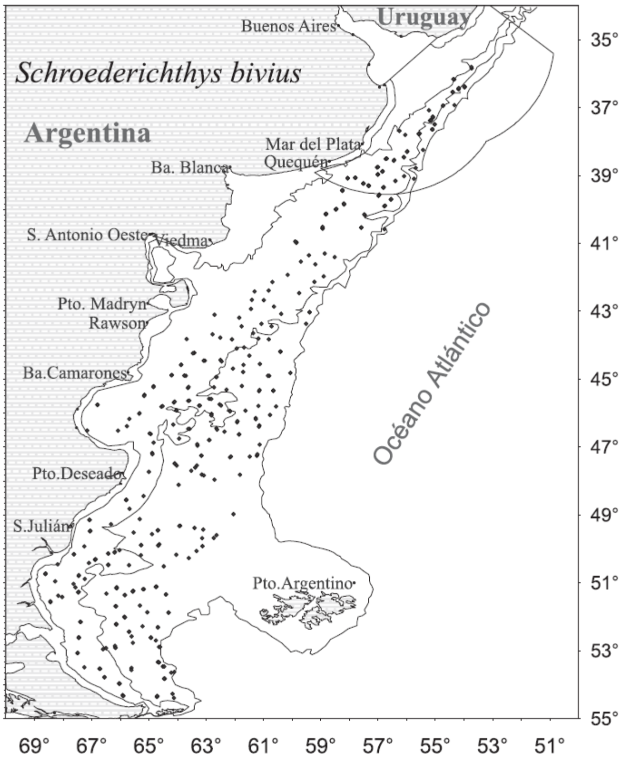


Figure 139. Distribution of *S. bivius* in the Argentine Sea. Source: Wőhler et al. 2011.

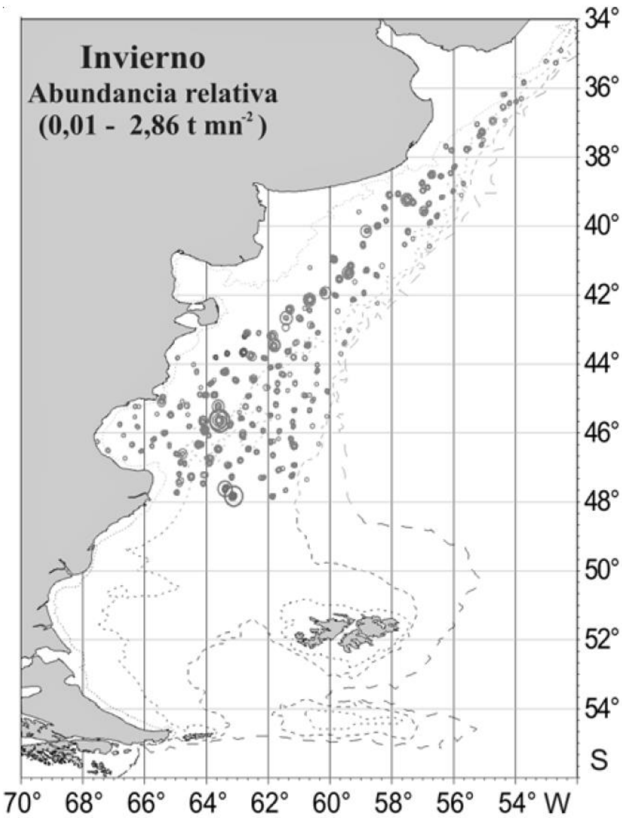


Figure 140. Abundance of *S. bivius* (t/mn^2) in the northern Patagonian shelf. Source: Sanchez et al. 2009.

(Translation of Figure 140: Invierno: Winter. Abundancia relative: relative abundance).

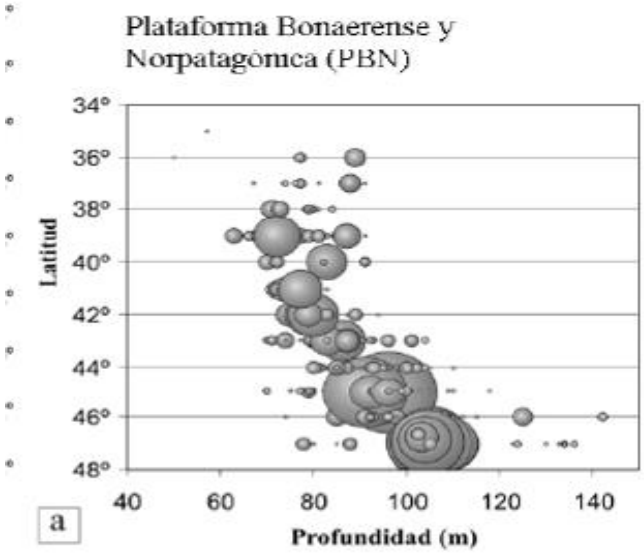


Figure 141. Distribution of *S. bivius* according to depth and latitude. Source: Sanchez et al. 2009.

(Translation of Figure 141: Plataforma Bonaerense and Norpatagónica: Bonaerense and Norpatagonic Shelf).

Order: Rajiformes[6]

3- Amblyraja doellojuradoi (Southern thorny skate)

In the Atlantic, it can be found at latitudes greater than 36º S, at 80 to 600 m-deep, with the highest frequency between 36º S and 42º S, on the intermediate and external platform (Figure 142). Menni et al. (2010) mention a depth range between 100 and 1200 m. The species has a Breeding peak in autumn, but would cycle throughout the year (Delpiani 216). It feeds on crustaceans (crabs, amphipods, etc.) polychaetes and to a lesser extent, small fish (Sánchez and Mabragaña 2002), but its diet is predominantly carcinophagous and it also eats fish and polychaetes (Delpiani et al. 2013).

[6] It approximately includes 65 especies, but there is not much information about them.

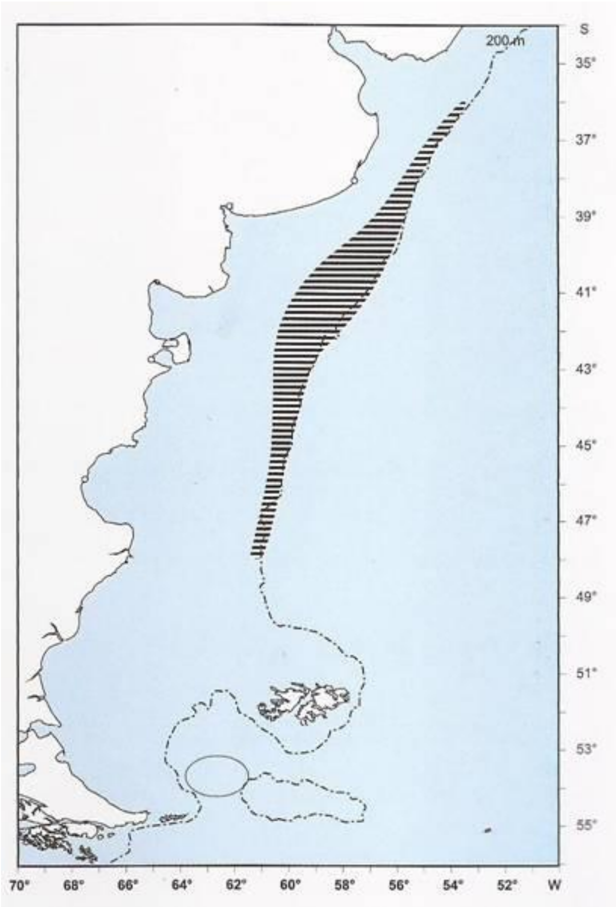


Figure 142. Geographical Distrution of *A. doellojuradoi*. Source: Cousseau and Perrota 2013.

4- *Bathyraja brachyurops* (Broadnose skate)

It is distributed from southeastern Brazil to 52º S on the Chilean coast (Figure 143). In the Atlantic, it embraces the intermediate and external platform in the north up to approximately 47º S, and the entire platform and slope south of that latitude. Menni et al. (2010) mention that its depth range can reach 1500 m, although the studies by Ruocco et al. (2007) show it as a species that can only be found at the edge of the slope. Arkhipkin et al (2008) recorded catches up to 500 m (Figure 144). It feeds mainly on fish, particularly in smaller sizes, but also eats crustaceans, squid, polychaetes and other invertebrates (Bellegia et al. 2008). It breeds almost all year round except in January (Arkhipkin et al. 2008).

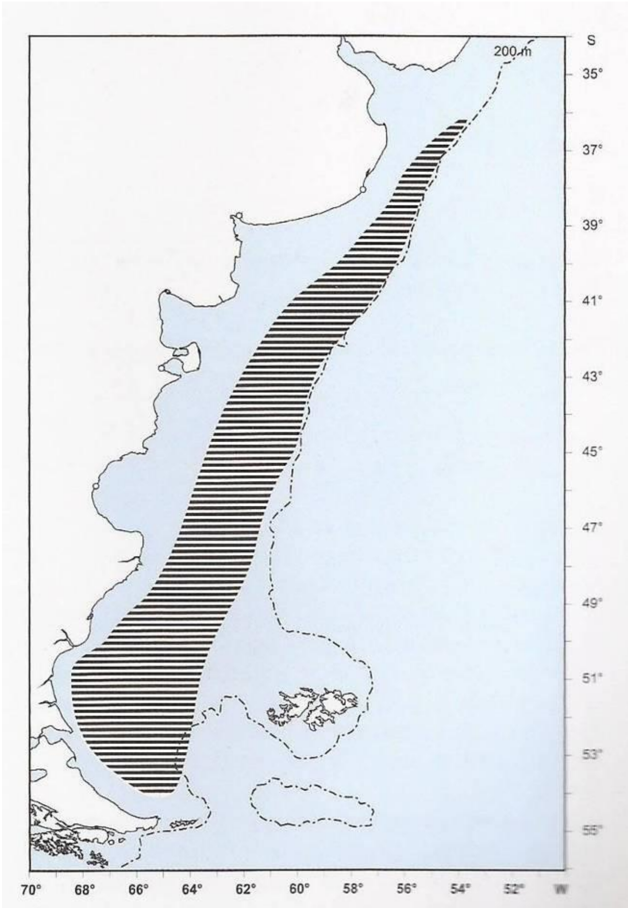


Figure 143. Geographical distribution of *B. brachyurops*. Source: Cousseau and Perrota 2013.

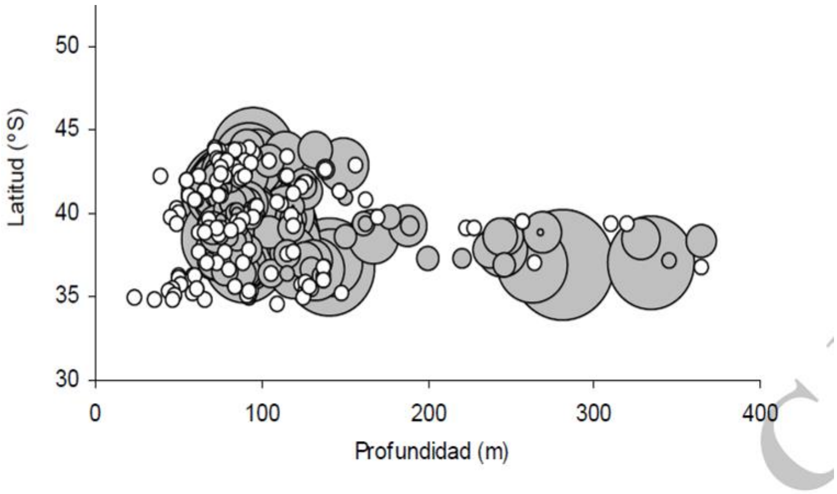


Figure 144. Distribution of *B. brahyurops* according to depth and latitude (1993-1994). Source: Ruocco et al. 2007.

(Translation of Figure 144: Latitud: Latitude. Profundidad: depth)

5- *Psammobatis normani* (Shortfin sand snake)

It is distributed in the southern cone of South America in Pacific waters from 30º S, and to 37º S in the Atlantic, near the Province of Buenos Aires, 50 m to 200 m-deep (Figure 145). The diet is made up of crustaceans, cephalopods and, to a lesser extent, fish. It is caught by medium and large vessels, with bottom trawls.

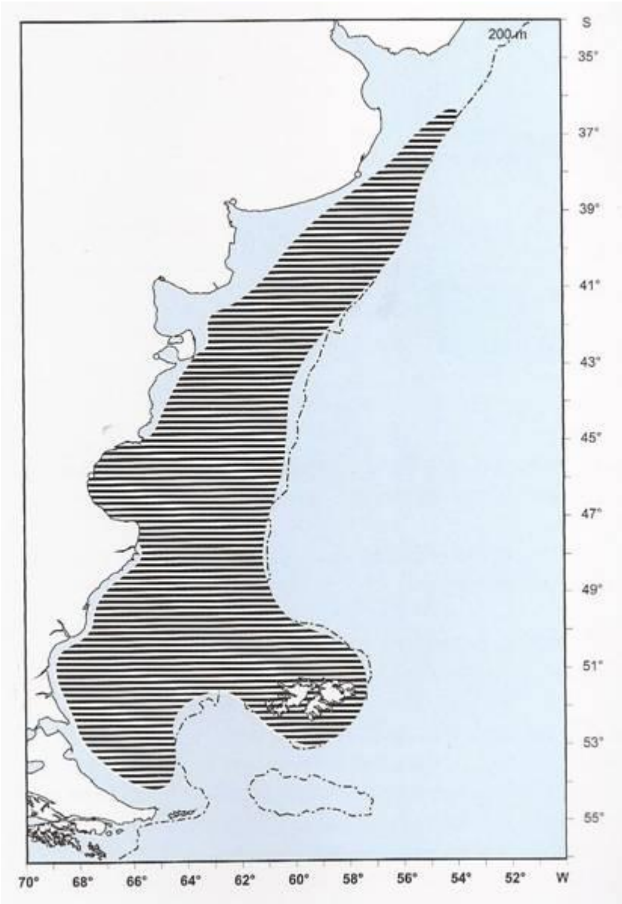


Figure 145. Gographical distribution of *P. normani*. Source: Cousseau and Perrota 2013.

6- *Psammobatis rudis* (Smallthorn sand skate)

In Argentina, it is found from 37º S to 55º S, 50 to 200 m-deep (Figure 146). Their diet is similar to P. normani but polychaetes and small fish are less important. It is caught by medium and large vessels with bottom trawls.

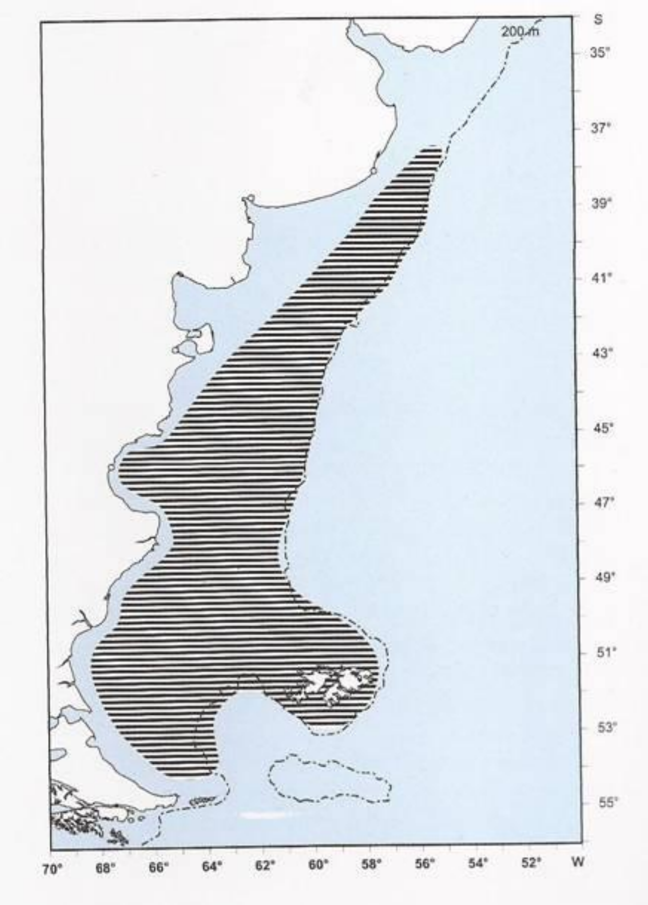


Figure 146. Geographical distribution of *P. rudis*. Source: Cousseau and Perrota 2013.

7- *Bathyrraja macloviana* (Patagonian Skate)

It inhabits the southern American cone, from 36 ° S in the Atlantic to 51 ° S in the Pacific. Figure 147 displays its distribution in Argentina. It is oviparous and males mature sexually from 53 cm in length and females from 56 cm in length. It feeds mainly on polychaetes and to a lesser extent on crustaceans (amphipods, isopods, crabs).

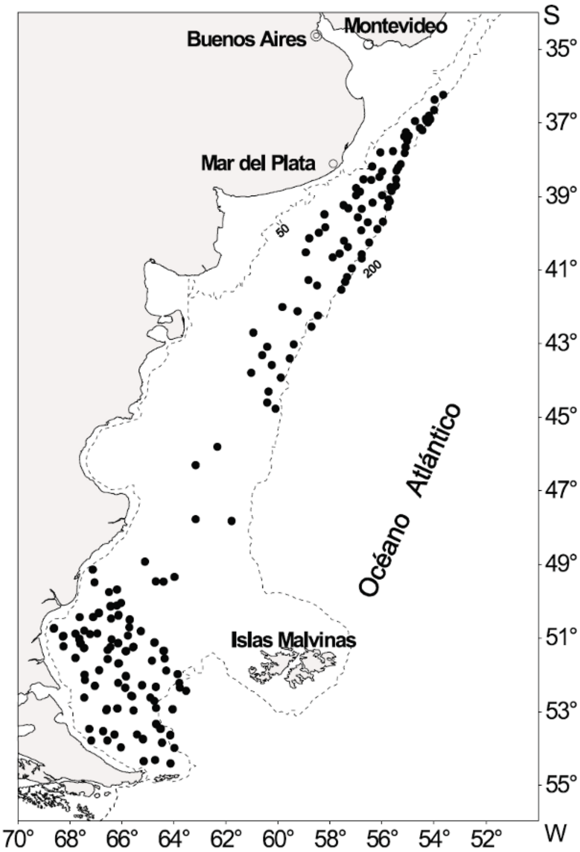


Figure 147. Distribution area of *B. macloviana.* Source: Cousseau et al. 2010.

8 - *Zearaja chilensis* (Yellownose skate)

It inhabits the southern cone of South America, from Arica, in the Pacific (18º S), to at least 34º in the Atlantic (Figure 148) and is endemic in the temperate waters of South America (Licandeo and Cerna 2007). It is distributed up to 350 m-deep, with the highest incidence between 50 m and 150 m (Cousseau and Perrotta, 2000) but Menni and Stehmann (2000) point out that the species has been caught between 58 and 435 m-deep. Its breeding, like other deep-sea Rajiformes, would be extended throughout the year without presenting seasonal spawning peaks (Colonello and Cortes 2014). Vázquez et al. (2016) note that this species deposits ovigerous capsules at depths of up to 1000 m.

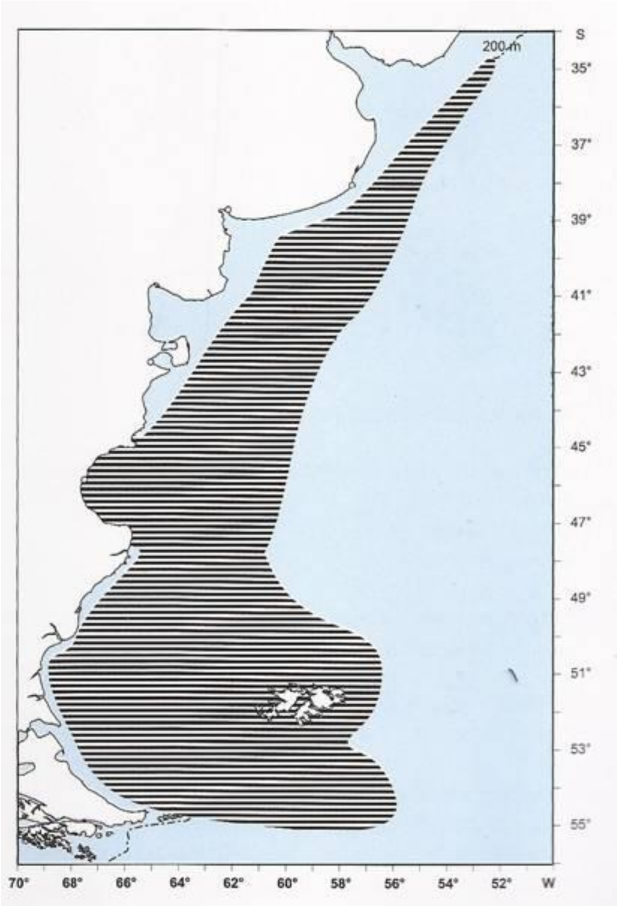


Figure 148. Geographic distribution of *D. chilensis*. Source: Cousseau and Perrota 2013.

9 - *Bathyraja magellanica* (Magellan skate)

It is widely distributed on areas close to the slope in the northern sector and on the platform in the southern area (Figure 149). It inhabits depths between 50 and 550 meters (Menni and Stehmann 2000). It feeds on fish, followed by amphipods, isopods and decapods (Barbini et al. 2010).

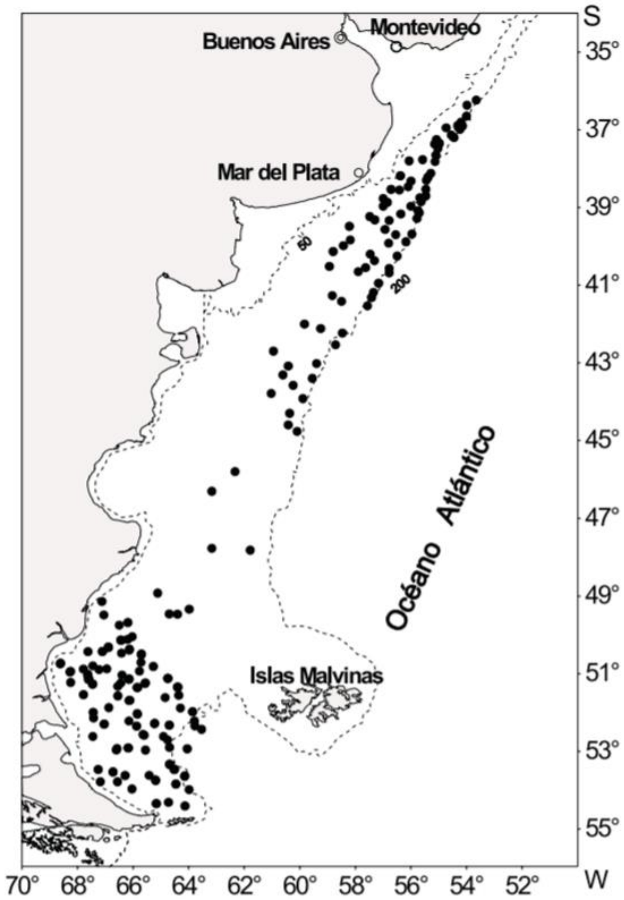


Figure 149. Distribution of *B. magallánica* in the southern Patagonian shelf. Source: Cousseau et al 2000.

10 - *Bathyrraja cousseauae*

This apparently wide-ranging species visits moderate depths, having been found in the northern section of the slope almost 300 m-deep (Diaz de Astarloa and Mabragaña 2004) (Figure 150). This is consistent with what was observed by Bellaggia et al. (2014). Its main diet is composed of fish followed by isopods and amphipods (Bellegia et al. 2014).

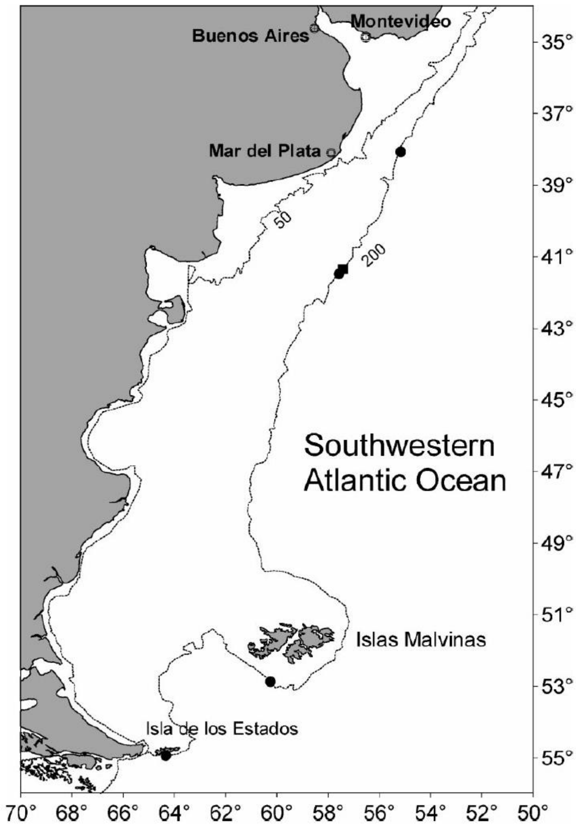


Figure 150. Preliminary distribution of *B. cousseauae.* Source: Diaz de Astarloa and Mabragaña 2004.

11 - *Bathyraja multispinnis* (multispine skate)

The scarce information on this species shows a wide latitudinal distribution circumscribed to deeper areas in the platform and edge of the slope, reaching almost 500 m (Figure 151 and Figure 152). The diet is composed of decapods, the main species being *Peltarion spinosulum* and *Libidoclaea granaria*, while isopods were the second most important prey and polychaetes and mollusks had much less relevance (Belleggia et al. 2014).

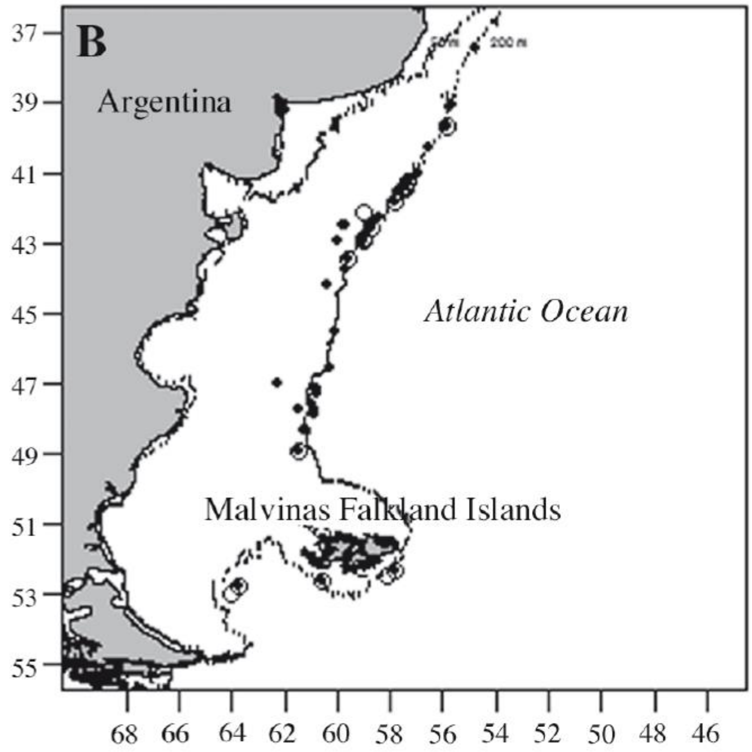


Figure 151. Distribution of *B. multispinnis*. Source: Belleggia et al. 2014.

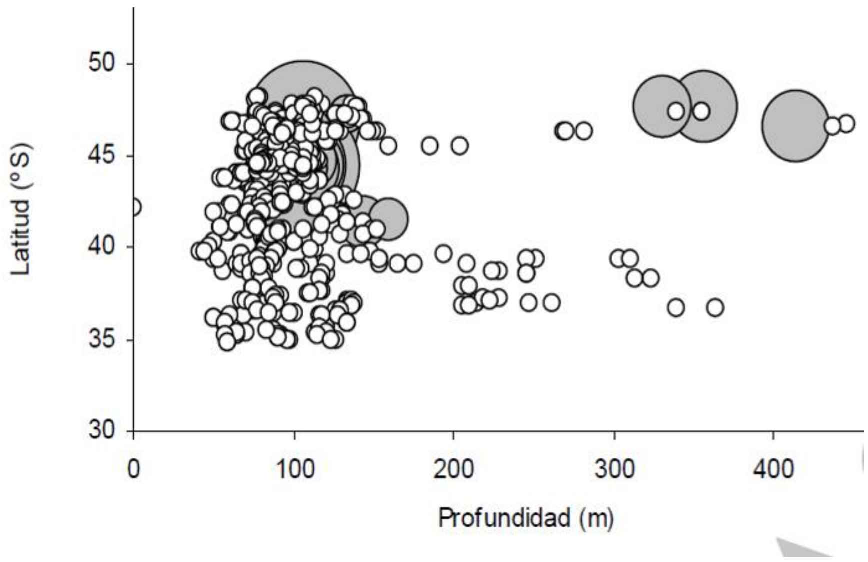


Figure 152. Distribution of *B. multispinnis* according to depth and latitude. Source: Belleggia et al. 2014.

(Translation of Figure 152: Latitud: Latitude. Profundidad: Depth).

12 - *Bathyraja scaphiops* (cuphead skate)

No biological information is available on this species, limiting itself to a still preliminary recognition of its geographical distribution, which shows a narrow range of distribution limited to the upper sector of the slope (Figure 153 and Figure 154).

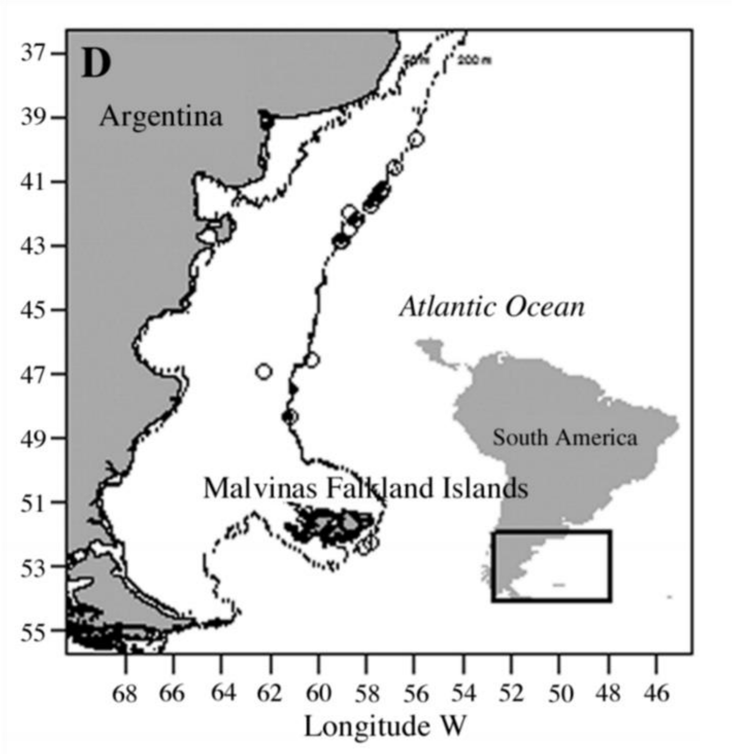


Figure 153. Distribution of *B. scaphiops*. Source: Belleggia et al. 2014.

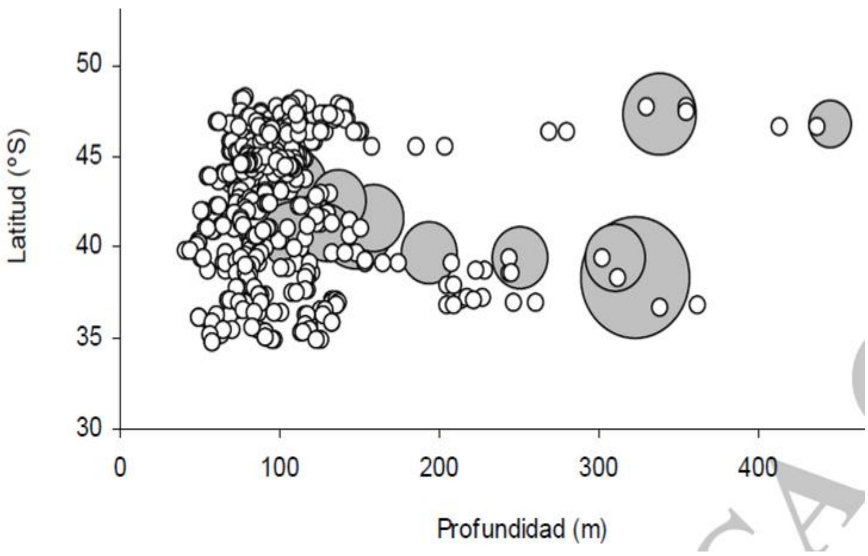


Figure 154. Distribution of *B. scaphiops* according to depth and latitude. Source: Belleggia et al. 2014.

(Translation of Figure 154: Latitud: Latitude. Profundidad: Depth)

13 - *Bathyraja albomaculata* (White-dotted skate)

This species is distributed close to the project area (Figure 155 and Figure 156). Spawning takes place between 200 and 300 m (Henderson et al. 2005).

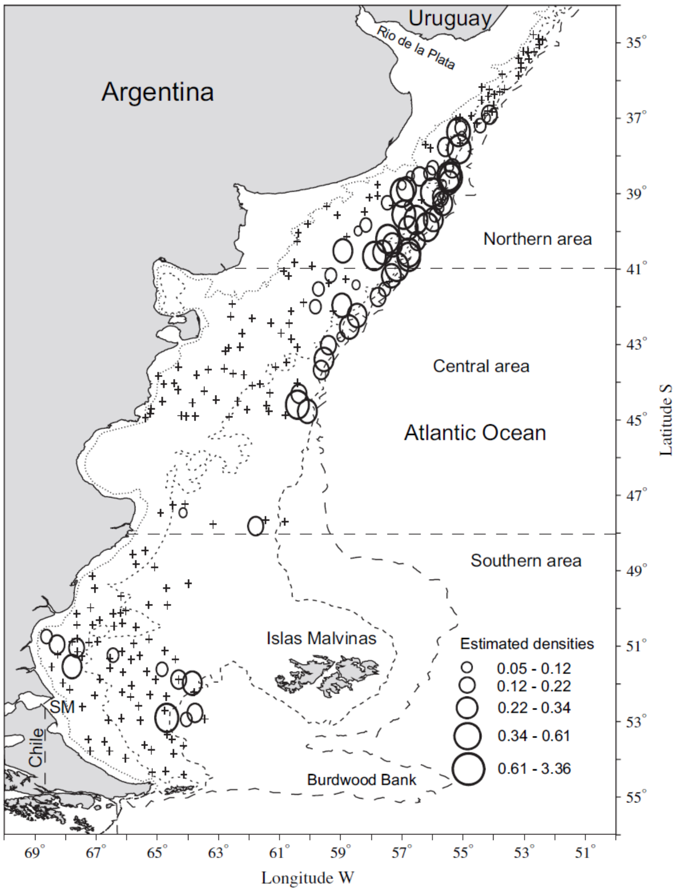


Figure 155. Distribution and density of *B. albomaculata* (t/mn^2). Source: Belleggia et al. 2014.

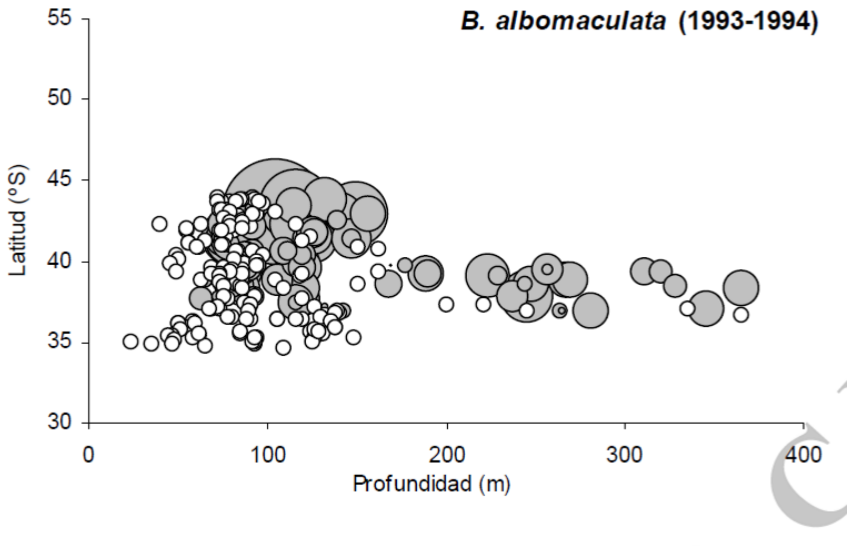


Figure 156. Distribution of *B. albomaculata* according to depth and latitude. Source: Belleggia et al. 2014.

(Translation of Figure 156: Latitud: Latitude. Profundidad: Depth)

Other species such as *Bathyrraja macloviana, B. multispinnis* and *B. griseocauda* were not included in the analysis since their known depth ranges do not exceed 200 m and therefore exceed the platform.

Although not much biological information is available on ray or skates, it has been seen that in addition to laying their eggs in platform areas, they also do so on the edge of the slope where significant egg densities have been found (Colonello 2019), hence, it is feasible that those individuals who are deeper and already close to the project area spawn there. Chondrichthyans are commonly found down to depths of approximately 1200 m (Menni 2010).

Order: Chimaeriformes

14 - *Callorhinchus callorhynchus* (Plough-nose chimaera)

Species of very wide distribution that is found from Uruguay to Tierra del Fuego, inhabiting shallow waters up to the 200 m isobath (Figure 157). It inhabits coastal, platform and slope waters. There seems to be a segregation between juveniles and adults, since the former inhabit shallow waters and the latter deeper areas. Euryphaga eats polychaetes, cephalopods, annelids, gastropods, bivalves, etc. Juveniles inhabit shallow waters, but adults are found in coastal, shelf and slope waters. In northern Patagonia, the species has oviparous Breeding activity, which extends throughout the year, but the main Breeding and spawning activity is from July to February (Di Giacomo and Perier 1991; Chierichetti et al. 2017). Fishing is carried out both by the coastal fleet and by medium and large vessels with a bottom trawl that operate on the high seas. It represents an important resource for both traditional and industrial fishermen (Di Giácomo and Perier 1991) and it has recently become a more important target species (Bernasconi et al. 2015).

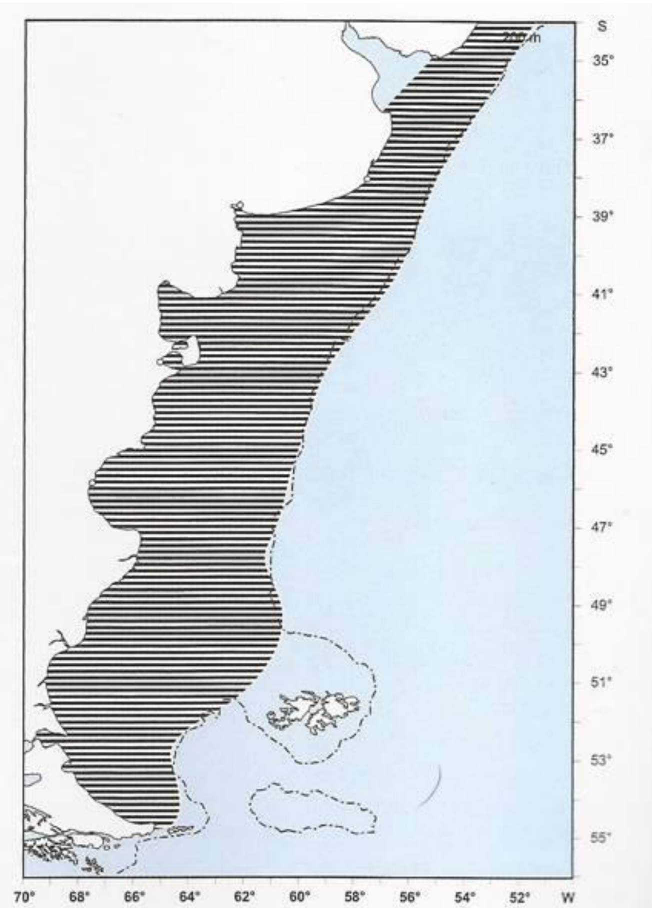


Figure 157. Geocraphic distribution of *C. callorhynchus*. Source: Cousseau and Perrota 2013.

Diversity of chondrichthyes and spawning areas

The richness of chondrichthyans in the Southwest Atlantic Ocean has a diverse distribution mainly associated with sea fronts (Lucifora et al. 2012; Sabadín 2019). In several regions close to the continental slope, the existence of hotspots or areas of high diversity and richness of Chondrichthyes species have been proposed (Figure 158) (Lucifora et al. 2012). On the platform, the greatest richness is located between 34 ° S and 44 ° S, 80 m-deep, corresponding to an ecotonal region or a mixture of typical species of the provinces (Colonello et al. 2014). In this region there is the co-occurrence of species that live throughout the year at depths greater than 50 m, which migrate seasonally from the coast to deep waters and species whose distribution would seem limited to the region, for example, the Freckled sand snake (*Psammobatis lentiginosa*) and Freckled cat shark (*Scylirhinus haeckelii*).

Regions with high species richness and functional diversity are considered key sites for the conservation and management of chondrichthyans. Likewise, the high endemism of Chondrichthyes in the waters of the platform and the slope (Figure 159) stands out in this region (Lucifora et al 2012: Colonello et al 2014).

The previous analyzes for different species of chondrichthyans suggest that the project's area of influence is bordering on a sector of high diversity of these species located on the edge of the platform and up to 1000 of the slope, but it is not necessarily a high effort fishing zone.

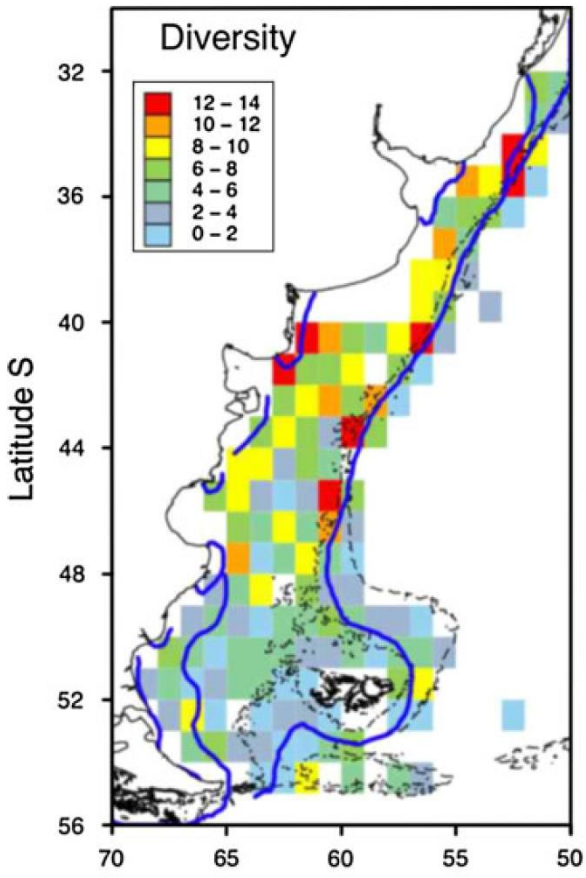


Figure 158. Number of chondrichthyan species. The blue line represents the sea fronts. Source: Lucifora 2012.

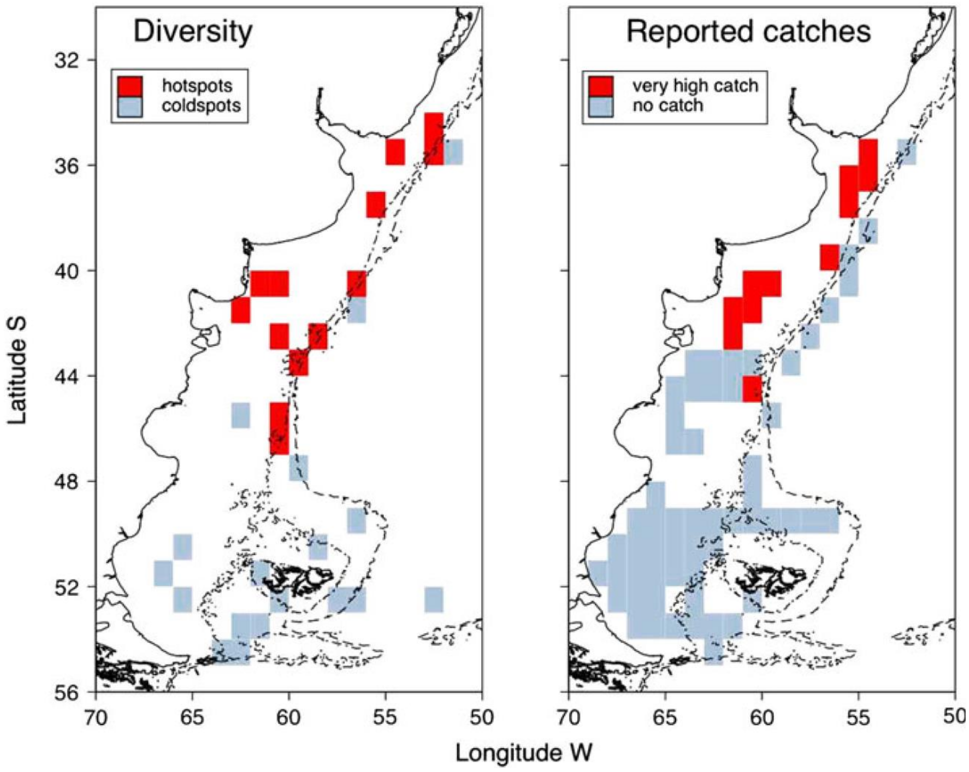


Figure 159. Distribution of sectors with high and low diversity and chondrichthyan fishing effort. Source: Lucifora 2012.

Sensitive shark areas have been identified in coastal waters of Patagonia (Figure 160). It has been proposed that Bahía Engaño and Ría Deseado contain Dusky smooth-hound birth areas during the spring and summer months, as well as the brown catshark and dogfish breeding (Allega et al 2020).

The narrowmouthed catshark (*Schoroederichthys bivius*) and the Picked dogfish (*Squalus acanthias*) are abundant and frequent sharks in the Magellanic Province (Colonello et al 2014). The first is an oviparous species that uses much of the continental shelf to lay its eggs (Colonello et al. 2020), associated with benthic organisms such as sponges and corals (Vazquez et al 2018). The spiny shark is a viviparous species with a biennial and potentially asynchronous Breeding cycle, that is, the females give birth to the embryos after a gestation that lasts two years without detecting a specific time and place of birth (Colonello et al. 2016).

A high diversity of rays/skates of the *Zearaja*, *Amblyraja*, *Psammobatis* genus and particularly *Bathyraja* is recorded at depths greater than 50 m (Figure 160). Several of these species use large areas of the continental shelf to lay their eggs on the bottom (Colonello 2018, 2019; Allega et al 2020). In certain areas close to the 200 m isobath, high concentrations of eggs have been observed, which coincide with high catch yields estimated from data gathered by on board observers (Colonello 2019).

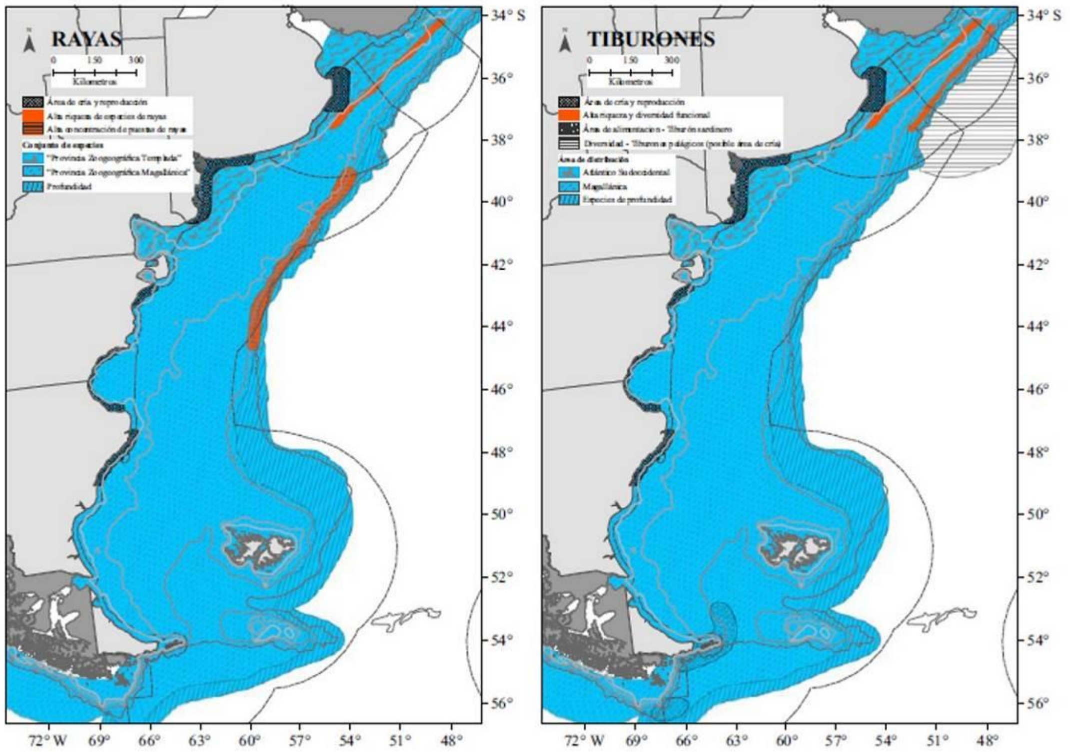


Figure 160. Scheme of the zoogeographic distribution and sensitive areas of Chondrichthyes, associated with high species richness, functional diversity, breeding and feeding. Source: Allega et al. 2020.

(Translation of Figure 160: Rayas: Rays/skates (left). Tiburones: Sharks (right). Reference coloured boxes: illegible)

Colonello et al (2019) determined the presence of chondrichthyes eggs collected in the Patagonian scallop fishery. Eggs were collected by on board observers in 86 commercial tidal sets aimed at Patagonian scallops between 38.30 ° and 45 ° S. The proportion of eggs with and without content per set was estimated, and the spatial distribution was analyzed. The spatial distribution of the eggs was also compared with the spatial distribution of the yields of rays per set, estimated by observers aboard the fresh fishing fleet targeting common hake. The results allowed us to conclude that, within the oviparous chondrichthyans set, only the rays would use the scallop banks as spawning areas. Among the species of rays, the highest proportions corresponded to *Bathyraja brachyurops, B. macloviana* and *B albomaculata*. The presence of eggs of these species was related to high yields estimated by observers aboard the commercial fleet. The diversity of development stages of the eggs suggests that the laying areas would be repeatedly visited throughout the spawning season.

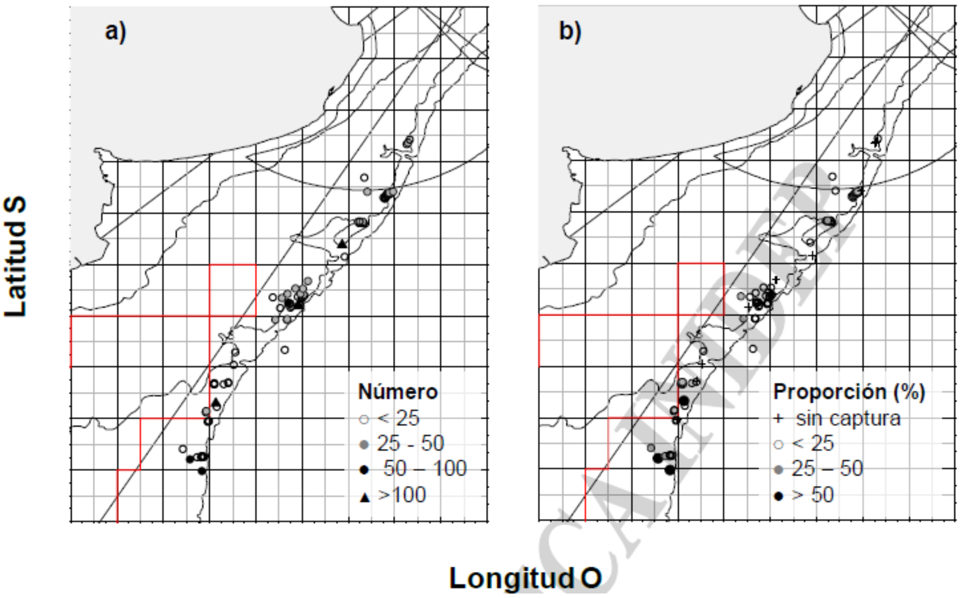


Figure 161. Spatial distribution of the number of eggs (a) and the proportion of eggs with content (b) in fishing sets aimed at Patagonian scallops. The 50, 100 and 200 m isobaths, as well as the ZCPAU are indicated. Source: Colonello et al 2019.

(Translation of Figure 161: Latitud: Latitude. Longitud: Longitude. Número: number. Proporción: Proportion. Sin captura: No catch.)

4.3.1.3 Bony Fish

A- Platform-Slope Distribution Species

1 - *Merluccius hubbsi* (Common Hake)

It is a pelagic-demersal species that is widely distributed in the Southwest Atlantic, up to 54 ° 30'S (Angelescu and Prenski 1987). It inhabits between 50 and 500 m deep in the southern continental shelf of Argentina, preferably up to 200 m (Figure 162).

It carries out two types of migrations, one vertically, with a daily rhythm, and the other horizontally, with a seasonal rhythm. It moves up to the upper layers of the sea to feed during the night; then it moves to shallower depths in spring to breed, returns to waters of intermediate depths (70 - 100 m) where it disperses to feed in the summer and early autumn, and then it returns to deep waters (150 - 400 m). It shows important differences in the distribution between the winter and summer periods (Figure 163).

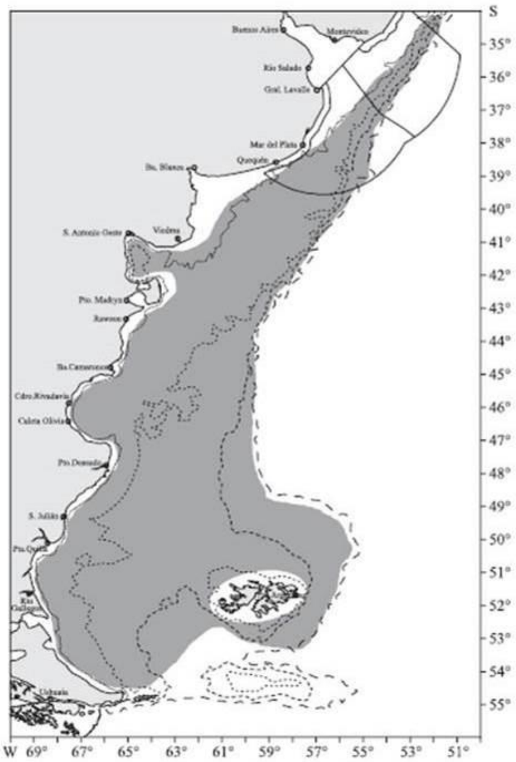


Figure 162. Geographic distribution of *M. hubbsi*. Source: Bezzi et al. 2004.

The Hake has a relatively long Breeding cycle, and spawning specimens appear practically throughout the year in different sectors of the shelf (Macchi et al. 2004). The highest breeding activity presents periods limited to certain months that differ in hake fishing (Macchi et al. 2010).

The stock north of 41 ° S breeds mainly in autumn-winter between 35 ° S and 38 ° 30´S, with a spatial displacement of spawning towards lower latitudes as the laying season progresses (Rodriguez and Macchi 2010). The highest yields in the number of active females, that is, those that are able to spawn, are located north of 37 ° 30´S, between 50 and 100 m deep. The highest concentrations of the resource are located south of 37 ° 30´S near the 200 m isobath.

The distribution and abundance of hake from the North 41 ° S during spring presents the highest yields north of 37 ° 30´S, but in a greater range compared to the autumn (Lounge and Molinari 2011). Adult individuals greater than 35 cm TL are concentrated at greater depths than juveniles (Irusta et al. 2017).

Despite the temporal and spatial difference in the breeding of both hake fishing groups, spawning seems to be associated with the presence of bottom thermal fronts. This could favor larval survival taking into account that these hydrographic structures could act as food concentration zones and also as retention areas for the first stages of life (Macchi et al. 2010). In both groups, the breeding areas of juvenile individuals are associated with the spawning areas.

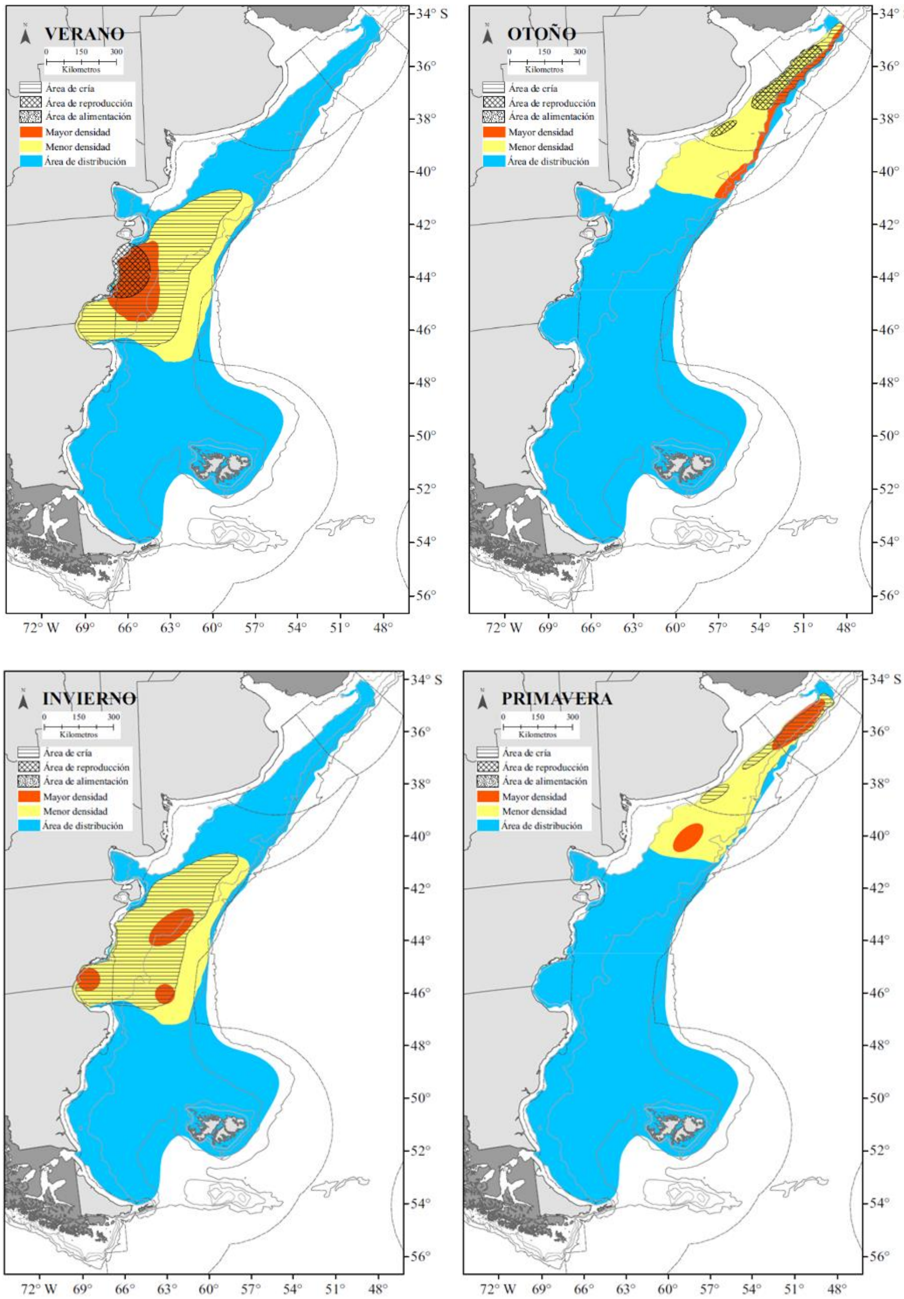


Figure 163. Distribution area of the common hake (Merluccius hubbsi), presenting the breeding areas and those of higher density. Source: Allega et al. 2020.

(Translation of Figure 163: Verano: Summer. Otoño: Autumn. Invierno: Winter. Primavera: Spring. Kilometros: kilometers. Reference boxes: Area de cría: Breeding area. Area de reproducción: Reproduction area. Area de alimentación: Feeding Area. Mayor densidad: Higher density. Menor densidad: Lower density. Area de distribución: Distribution Area.)

The area does not overlap with the breeding sites of the common hake. During the fall, it is observed that the area is close to the nucleus of greater density of the resource.

Studies by age or size have shown that the largest individuals are distributed in the winter until they almost reach the slope (Figure 164).

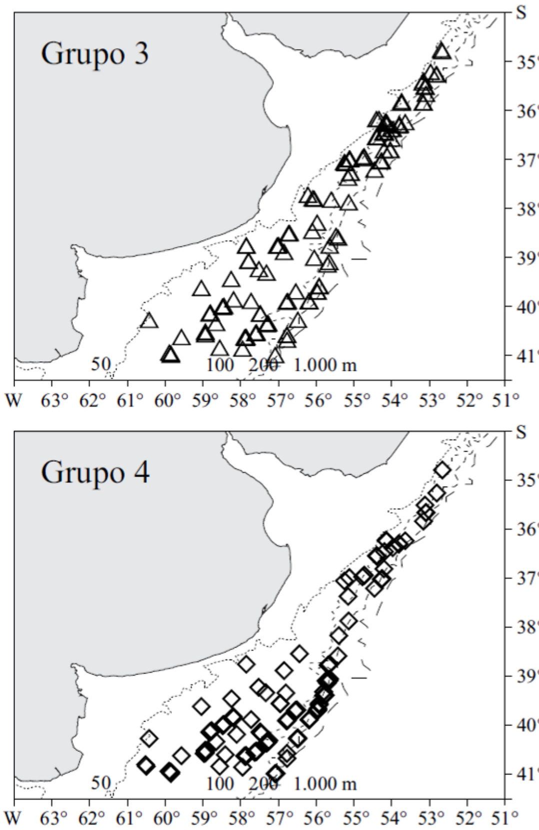


Figure 164. Distribution of hakes sized 31-40 cm (Group 3) and greater than 40 cm (Group 4). Source: Louge et al. 2014.

It is a generalist and opportunistic species in its diet, which varies throughout the life cycle and is mostly made up of zooplankton crustaceans (*Themisto gaudichaudii*, *Euphausia lucens*° and °*Munida*°*spp,* and mainly *Illex argentinus* during the summer (Sánchez and García de la Rosa 1999) (Bellegia et al. 2014). It exhibits daily vertical migrations, being closer to the surface at night, and horizontal migratory and trophic migrations, seasonal in nature, between platform and slope, moving in spring to shallower waters to breed. In autumn and winter it does so towards the north of its distribution, in front of Uruguay and the Province of Buenos Aires, between 50 and 200 m. During the summer period, it breeds off the coasts of Santa Cruz and Chubut. Macchi et al. (2005) point out that the breeding peak takes place in January (Figure 165). The species leaves the deeper shelf waters to concentrate 50 meters deep on the shoreline where spawning takes place (Macchi et al. 2005).

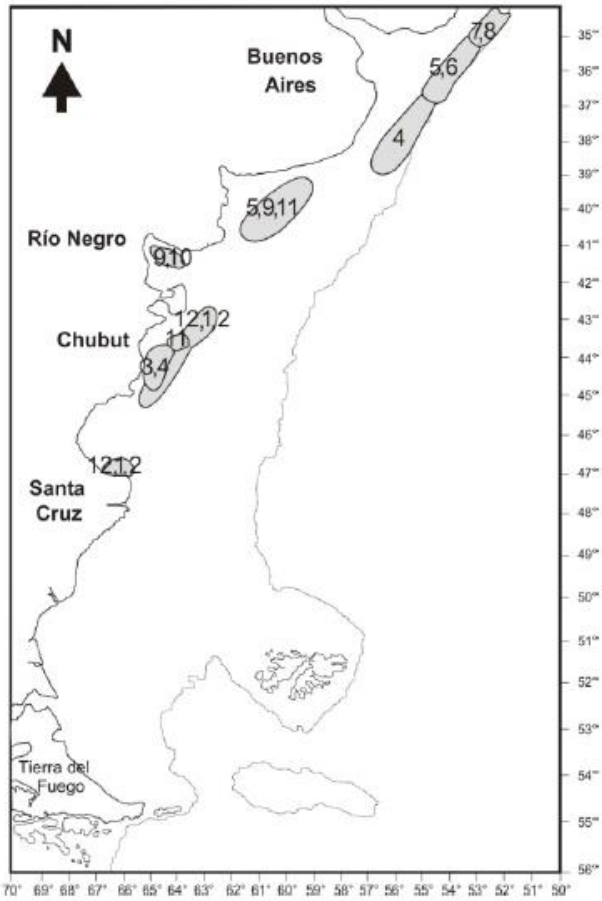


Figure 165. Hake spawning area. The numbers indicate the breeding month according to the geographical area. Source: Aubone et al. 2004.

2- *Genypterus blacodes* (Pink cusk-eel)

It is a benthic-demersal species that is distributed on the platform from 35 ° to 55 °. It is present in the coastal waters of the shelf up to the slope, reaching up to 55º S, although south of 49º it shows low densities all year round (Cordo 2004) (Figure 166). It is also concentrated on the edge of the slope and canyons. It performs both horizontal and bathymetric migrations, occupying the shallower areas in spring and summer for breeding purposes. The highest concentration of this species is observed between 42º and 48º S between 50 and 300 m. It reaches the highest densities during the winter season in front of Tierra del Fuego (Renzi 1986) even when, between 49º and 55º S, the concentrations are low all year round. The adults tend to concentrate outside the underwater canyons on the edge of the platform, thus facilitating their catch. In spring and summer they move towards shallower waters of the platform. It has been determined that spawning takes place on the platform between 45º and 47º S at depths that do not exceed 150 m and that coincides with the summer concentration of the species (Machinandiarena 1996). It has an eminently carnivorous trophic niche feeding on hake, notothenioids, pollock, zoids and cephalopods, crustaceans, polychaetes, etc. The pink cusk-eel has a high trophic level of 4.3 according to the ZCPAU (Vögler et al. 2009) and 5,06 on the southern shelf (Ciancio et al. 2008). Juvenile hakes can be the main food in breeding areas. The pink cusk-eels > 80 cm TL prey on hake (Sánchez and Prenski 1996). Feeding is related to height, in addition to local availability (Cordo 2004).

The breeding areas are located on the middle platform and although there are high densities near the edge of the slope, the area is smaller compared to that located on the shelf (Figure 166).

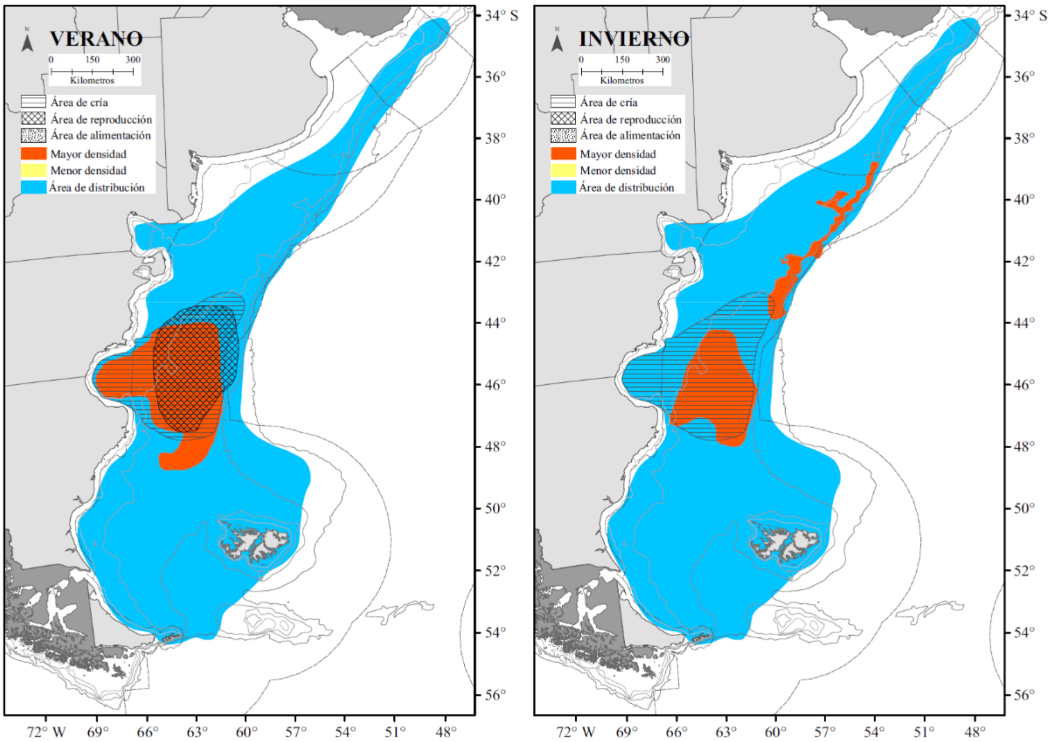


Figure 166. Geographic distribution of *G. blacodes* in the Argentine Sea. Source: Allega et al. 2020.

(Translation of Figure 166: Verano: summer. Invierno: winter. Reference boxes: Area de cría: Breeding area. Area de reproducción: Reproduction area. Area de alimentación: Feeding Area. Mayor densidad: Higher density. Menor densidad: Lower density. Area de distribución: Distribution Area.)

3- *Stromateus brasiliensis* (Southwest Atlantic butterfish)

It is distributed in platform and slope waters, from southern Brazil to Tierra del Fuego (Figure 167). With demersal and pelagic habits, it feeds mainly on *Peisos petrucnkevitchi* but also on ctenophores and polychaetes, and it acts as an accompanying fauna of demersal and benthic species. The breeding process would take place towards the end of winter and early spring (Perrotta et al. 2006). It is caught by both the coastal and offshore fleets, with bottom trawls.

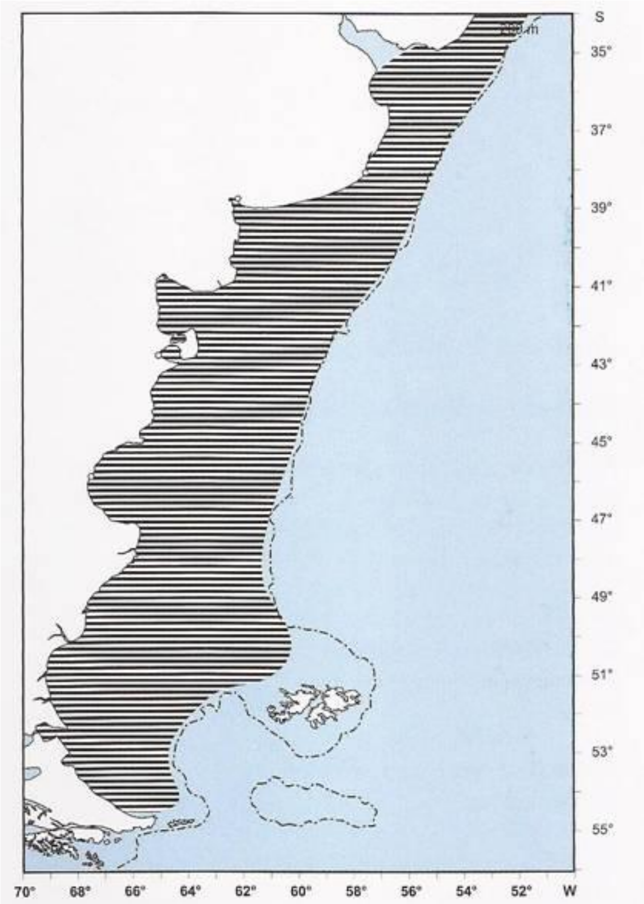


Figure 167. Geographic Distribution of *S. brasiliensis.* Source: Cousseau and Perrota 2013.

4- Thyrsites atun (snoek)

Species widely distributed on the platform and slope (Figure 168). Their diet is based on crustaceans, cephalopods, and fish such as anchovies, sardines, carangidae, and mugilidae.

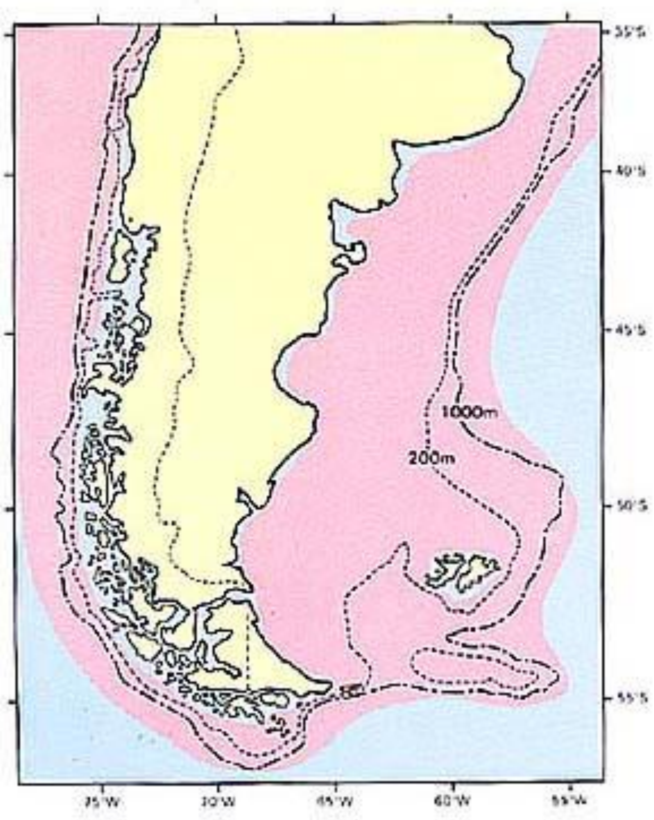


Figure 168. Geographic Distribution of *T. atun*. SOurce: Nakamura et al. 1986.

5- *Merluccius australis* (Southern Hake)

The southern Hake has demersal habits and its distribution is associated with the Malvinas current, south of 50 °, although it is also found in lower latitudes (Otero et al 1982). It lives between 100 and 1000 m-deep (Giussi et al 2005;2016). With a mainly ichthyophagus trophic niche, it feeds on species such as hoki, Polish and cephalopods of the species *Illex argentinus, Doryteuthis gahi*, *Onkya ingens* (Garcia de Rosa 1997; Giussi et al 2004). It has a secondary malacophagus diet with a trophic level of 4.5 (Mari and Sanchez, 2002). Breeding takes place between July and September in the middle of parallels 51 to 55, 200 to 400 m-deep (Cotrina 1981) but it is also mentioned that they can take place between October and November adjacent to the Falkland Islands (Islas Malvinas) (Ciechomsky et al 1975).

B- Species ditributed on the slope

6- *Salilota australis* (Tadpole codling)

The tadpole codling is a widely distributed demersal species associated with the Malvinas Current) that lives between 30 and 900 m deep, but has also been found in the shallow waters of the Beagle Channel and the Strait of Magellan (Figure 169). The species is mostly distributed between 100 and 150 m in spring and between 150 and 200 m in autumn, with records up to 300 m (Cassia and Hansen 2005).

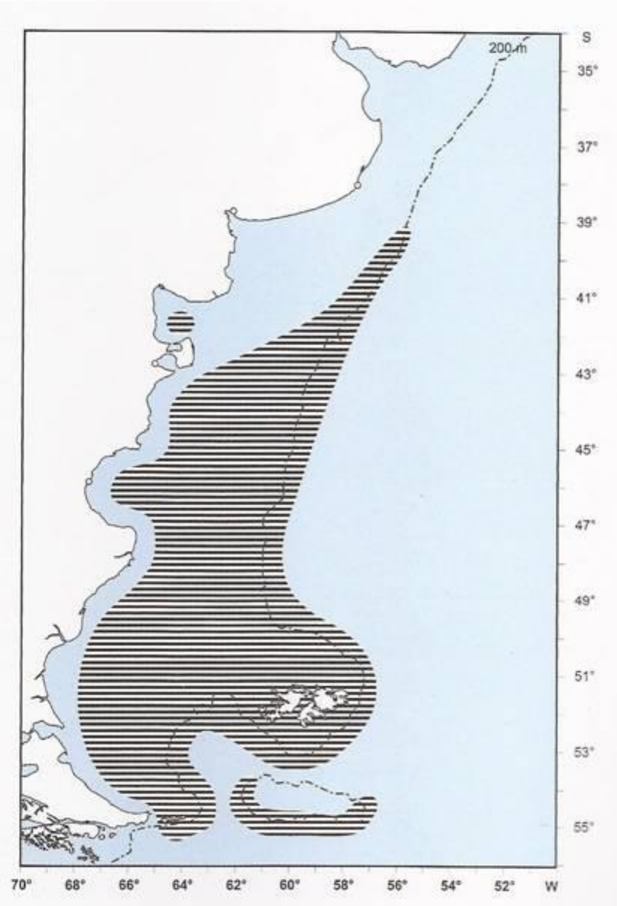


Figure 169. Geographic distribution of *S. australis*. Source: Cousseau and Perrota 2013.

The adults are present throughout the year distributed along the dispersal range of the species. Breeding takes place in spring to the west and south of the Falkland Islands (Islas Malvinas) in areas beyond 200 m, finding juvenile specimens all year around south of 49º S.

Both in spring and winter, it can be seen in moderate to high densities in surrounding waters to the northwest of Malvinas as well as in the Patagonian-Fuegian platform, having detected very high concentrations located south of 51 ° (Figure 170). During the summer, on the contrary, it spreads out along the South-Patagonian platform, being able to reach the shallow waters of the north of Tierra del Fuego.

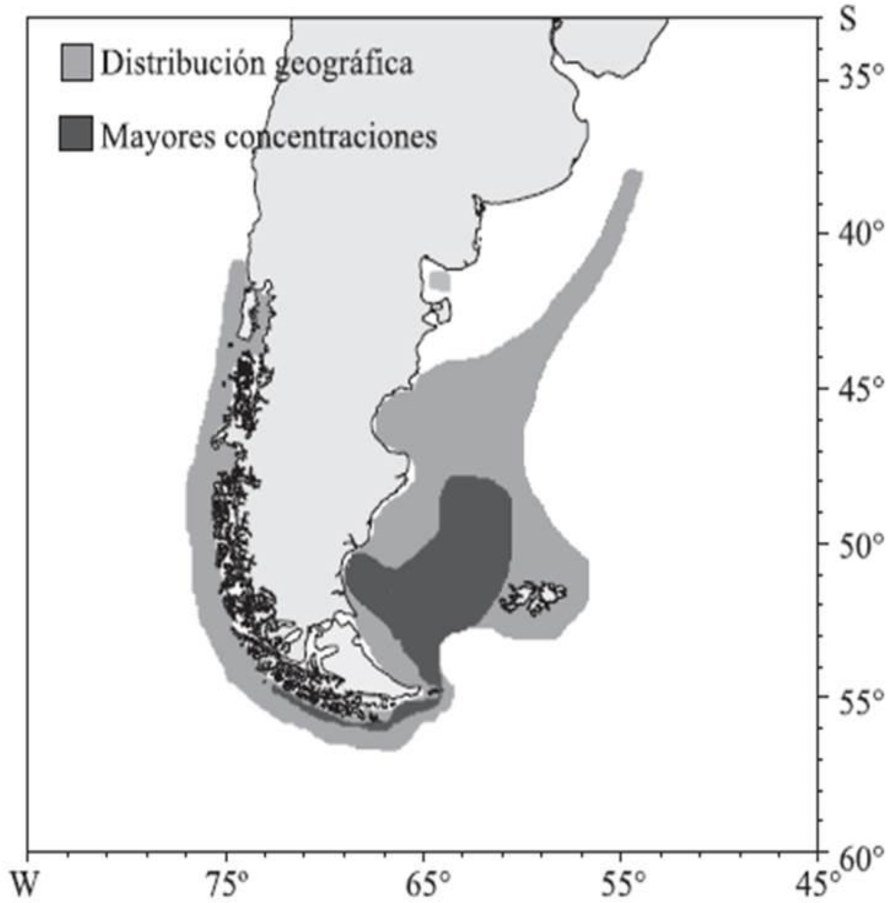


Figure 170. Geographic distribution of *Salilota australis*. Source: Wöhler et al 2001.

(Translation of Figure 170: Distribución geográfica: Geographic distribution. Mayores concentraciones: Major concentrations)

Adults feed on fish, cephalopods, and benthos. It takes up the trophic spectrum of a carcinophagous and ichthyiophageal carnivore (Pérez Comas 1980) eating gamarids and amphipods in February-June, squid between July and October and isopods from November to January (Arkhipkin et al. 2001). Juveniles feed on pelagic crustaceans, larvae, and fish eggs. Medium-sized adults make vertical movements, which allow them to feed on both pelagial neritic components (fish and cephalopods) and benthic (stomatopods, lobsters, isopods, crabs, etc.). It is caught with a trawl net.

7- *Micromesistius australis* (Southern Blue Whiting)

Its distribution range covers between the isobaths of 200 and 1000 m and temperatures between 3.8 and 6.5 C, presenting a distribution that varies seasonally around the Falkland Islands (Islas Malvinas), Burdwood Bank and waters of the slope, so it belongs to the Magellanic fauna. It is also detected in Chilean waters west of the Strait of Magellan (Figure 171). It is a highly mobile neritic-demersal species that can reach the north to an area close to the project site. The species presents seasonal breeding and dispersal migrations. Breeding takes place in September and October and from January to March in summer when it spreads out to feeding grounds in the Scotia Sea. This species has a noticeable tendency to remain grouped in shoals, whose size, density and position in the water column is variable, although they are generally associated with the edge of the platform and the beginning of the slope. Their mobility is quite high, both horizontally and vertically, dispersing to a greater extent during the night hours and concentrating during the day, carrying out the so-called vertical diurnal migrations.

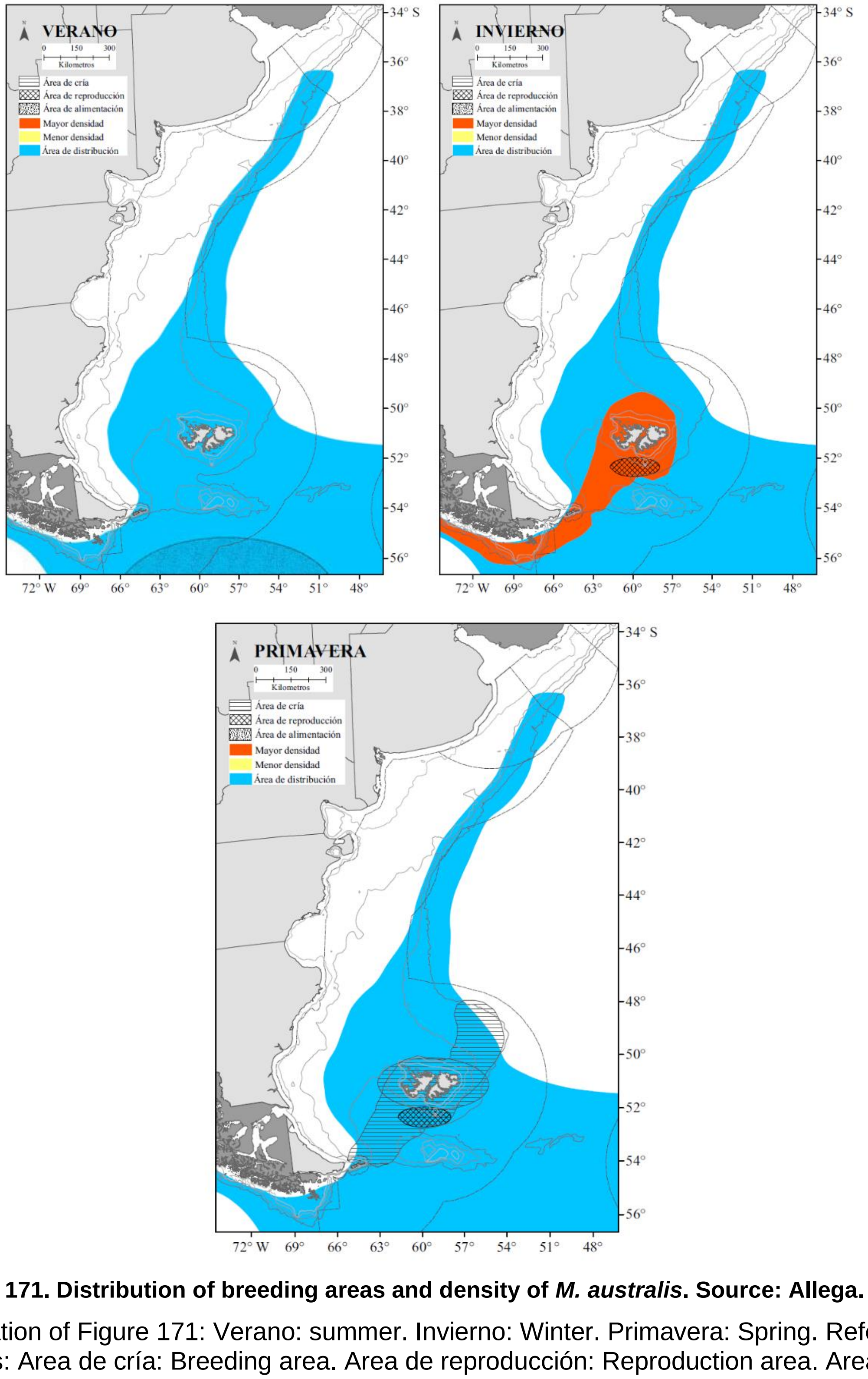


Figure 171. Distribution of breeding areas and density of *M. australis*. Source: Allega. 2020

(Translation of Figure 171: Verano: summer. Invierno: Winter. Primavera: Spring. Reference boxes: Area de cría: Breeding area. Area de reproducción: Reproduction area. Area de alimentación: Feeding Area. Mayor densidad: Higher density. Menor densidad: Lower density. Area de distribución: Distribution Area)

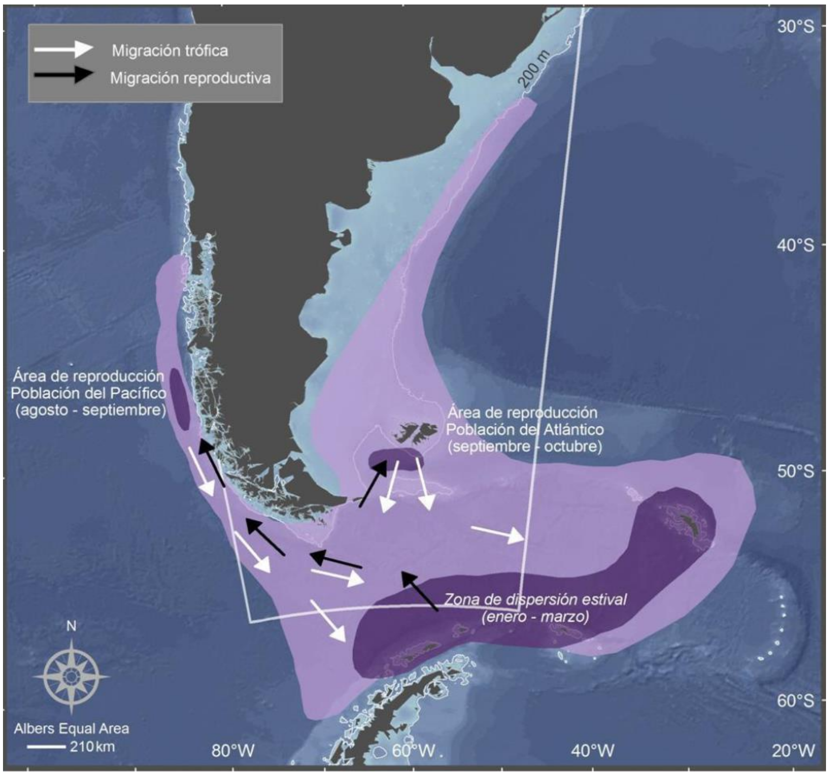
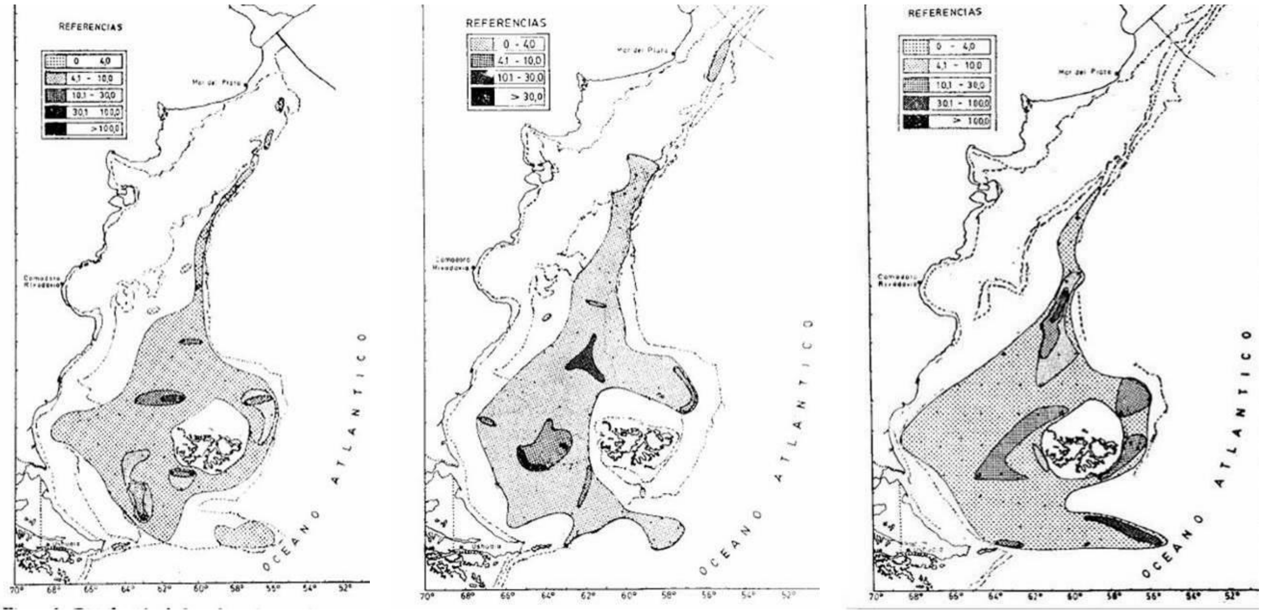


Figure 172. Breeding and trophic migration patterns of the Southern Blue Whiting. Source: Cañete et al 2008.

(Translation of Figure 172: Migración Trófica: Trophic Migration. Migración Breeding: Breeding Migration. Area de reproducción Población del Pacífico Agosto-Septiembre: Breeding Area, Pacific Group August-September. Area de Reproducción Población del Atlántico Septiembre-Octubre: Breeding Area Atlantic Group September-October. Zona de dispersión estival Enero-Marzo: Summer dispersion area January-March)

It is a microphagous species whose diet is made up of 90% crustaceans, mostly euphausiids and amphipods. Mollusks (loliginidae and ommastrephidae) are next in importance and fish are occasionally part of their diet (Wöhler et al. 2001). Its trophic level was estimated at 3.3 (Ciancio et al 2008). In turn, the Southern blue whiting represents the predominant food of primary and secondary carnivores such as spiny shark, common hake, southern hake and hoki. Therefore, it can be considered a key species of the Patagonian shelf. Breeding activity takes place south of the Falkland Islands from late July or August to November with a peak in September (Pájaro and Macchi 2001; Macchi et al. 2005). It is caught by large vessels operating on the high seas, with semi-pelagic trawls.

Figure 173 displays the seasonal distribution of the species obtained through experimental fishing. It is observed that the southern blue whiting is present throughout the year, with very low densities in the northern part of the slope during winter.



Winter **Spring** **Summer**

Figure 173. Distribution Area of the Southern Blue Whiting (*Micromesistius australis*) during the year. Source: Perrotta, 1982.

(Translation of Figure 173: Referencias: References)

8- *Notophycis marginata* (Dwarf codling)

Benthopelagic species that is distributed on the platform to the edge of the slope (Figure 174).

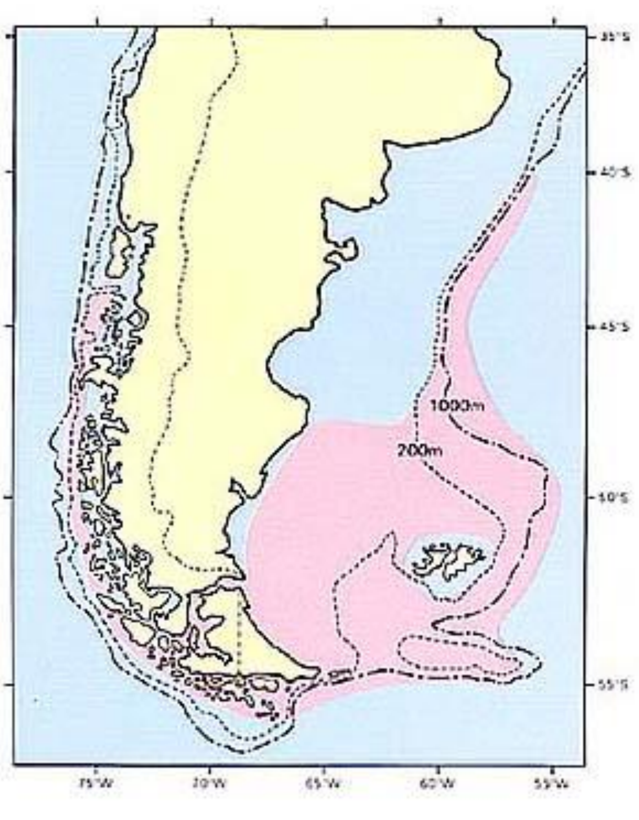
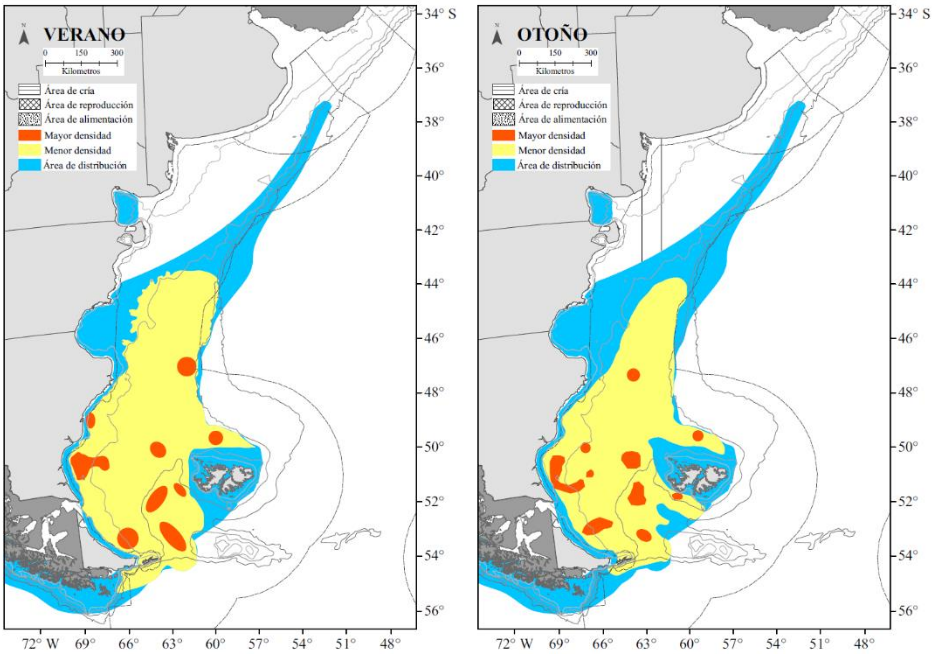


Figure 174. Geographic Distribution of *Notophycis marginata*. Source: Nakamura et al. 1986.

9- *Macruronus magellanicus* (Patagonian Grenadier)

This species has a wide geographic distribution in South America. It inhabits from 33 ° S in the Southeast Pacific Ocean to 37 ° S in the Southwest Atlantic (Figure 175). The PCA is present in the latter within cold-temperate waters, as well as in the continental slope where the Malvinas current stands out. The species forms groups at different stages of its life cycle, associated with water masses of different areas (coastal, shelf or continental slope) throughout the year (Giussi and Zavatteri 2018). Also, the species has a seasonal geographic dispersion. During the warm season (spring-summer) it is mainly concentrated south of 48 ° S, in shelf waters. In autumn, it moves towards more southern areas between 50 ° S and 54 ° S, and in winter it would migrate towards waters of the continental slope reaching lower latitudes, probably related to the Malvinas current (Giussi et al. 2016).

The breeding season and area in Atlantic waters could not be reliably established since only signs of this biological process have been detected. It has not yet been possible to define spawning areas, macroscopic and microscopic observations as well as behavioral observations would indicate that there could be small Breeding focal points in regions located at different depths, even near the continental slope during the winter and spring months.



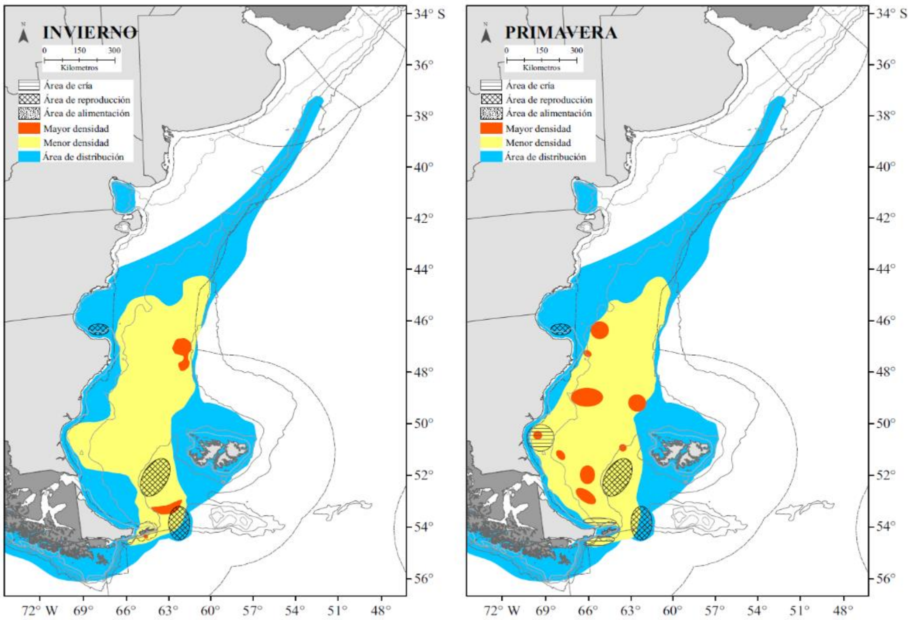


Figure 175. Distribution of breeding areas and density of *M. magellanicus*. Source: Allega et al 2020.

(Translation of Figure 175: Verano: Summer. Otoño: Autumn. Invierno: Winter. Primavera: Spring. Reference boxes: Area de cría: Breeding area. Area de reproducción: Reproduction area. Area de alimentación: Feeding Area. Mayor densidad: Higher density. Menor densidad: Lower density. Area de distribución: Distribution Area).

Their age distribution also varies according to the different bodies of water characterized by their temperature and salinity (Giussi et al. 2016), concentrating the youngest individuals in shallow southern waters. The breeding areas would be located south of 48 ° S in shallow waters of the Patagonian gulfs (San Matías and San Jorge) (Perrier and Di Giacomo 1999), but mature individuals have also been detected between 52 and 55 S and 200 m-deep, while Machinandiarena and Ehrlich (1999) found a breeding area off the coast of Tierra del Fuego and Islas de los Estados. Between 52 ° S and 55 ° S Giussi et al (2004) suggest that slope displacements could occur towards coastal spawning areas south of 48 ° S. Eggs and larvae are detected in November and January between 50 ° and 54 ° S, 400-600 m-deep.

This species makes daily vertical movements to feed, the main prey being planktonic crustaceans (50-95%) (Giusssi et al. 2016) (Figure 176). The main species in this group include the amphipod *Themisto gaudichadii* and the euphausid *Euphausia sp*. Larger adults eat fish (Giussi et al. 2004). It is a generalist species with 3.95 trophic level (Ciancio et al 2008). (Ciancio et al 2008).

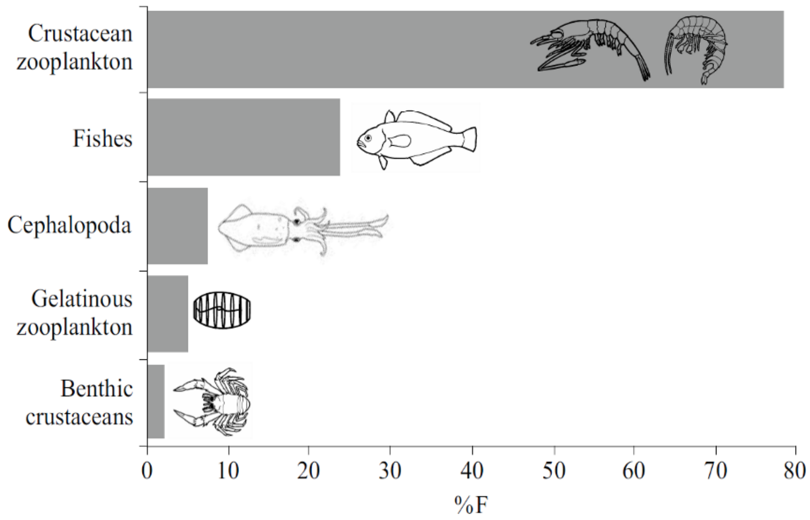


Figure 176. Trophic spectrum of the Patagonian Grenadier. Source: Giussi et al. 2016.

10- *Coelorhynchus fasciatus (Banded Whiptail*)

It is widely distributed in the Southern Hemisphere: Australia, New Zealand, South Africa and South American Pacific and Atlantic waters (Figure 177). In the latter it is found along the edge of the continental shelf and slope, between 400m and 800m-deep. It feeds mainly on crustaceans, both pelagic (amphipods and euphasics) and benthic (isopods), and to a lesser extent polychaetes. It is caught by medium and large vessels, with bottom trawls.

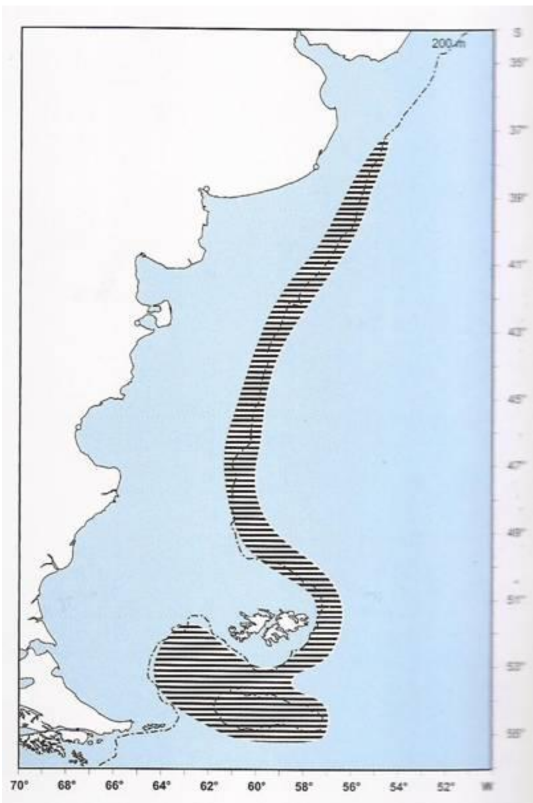


Figure 177. Geographic Distribution of *C. fasciatus* in the Argentine Sea. Source: Cousseau and Perrota 2013.

11- *Dissostichus eleginoides* (Patagonian Toothfish)

The toothfish is a notothenionid with a demersal-benthic behavior widely distributed in the Atlantic, Pacific and Indian oceans and the north of the Antarctic convergence. In the Southwest Atlantic, its distribution is influenced by the Malvinas Current and extends between 37 ° S and 56 ° S on the slope and platform. However, the highest concentrations are located to the south and northeast of the Falkland Islands (Islas Malvinas), on the slope of the Province of Buenos Aires and between Burdwood Bank and Isla de los Estados (Figure 178) (Troccoli and Martinez 2018).

The most important spawning areas in waters of the Southwest Atlantic would be found south of parallel 53 ° S, around the Burdwood Bank and south of Tierra del Fuego and Isla de los Estados (Pajaro et al 2005; Laptikhovsky et al 2006). The spawning season would range from June to October south of 54 ° S (Prenski and Almeyda, 2000). Patagonian toothfish larvae have been found in areas near the Falkland Islands (Islas Malvinas) between 100 and 200 m-deep in spring (Ehrlich et al 1999), and post larvae between 53 ° S and 54 ° 30´S, 100 to 490 m-deep. Laptikhovsky et al (2006) point out that adults carry out large trophic migrations around the Falkland Islands (Islas Malvinas) and on the Patagonian shelf, as well as breeding migrations in the Burdwood Bank area.

Between 150 to 600 m-deep, it usually ingests *Micromesistius australis*, *Salilota australis*, *Macruronus magellanicus* and *Stomias boa*, eating mytophids between 700 and 900 m. At greater depths it preys on crustaceans such as *Pasiphaea acutifronts*, *Pandalopsis ampla*, etc., grenadiers, the squid *Onykia ingens*, the octopus *Octopus tehuelchis*, etc. Juveniles ingest euphausiids and adults notothenids and mytophids in deep water, while the latter prefer notothenoids, zoids and cephalopods.

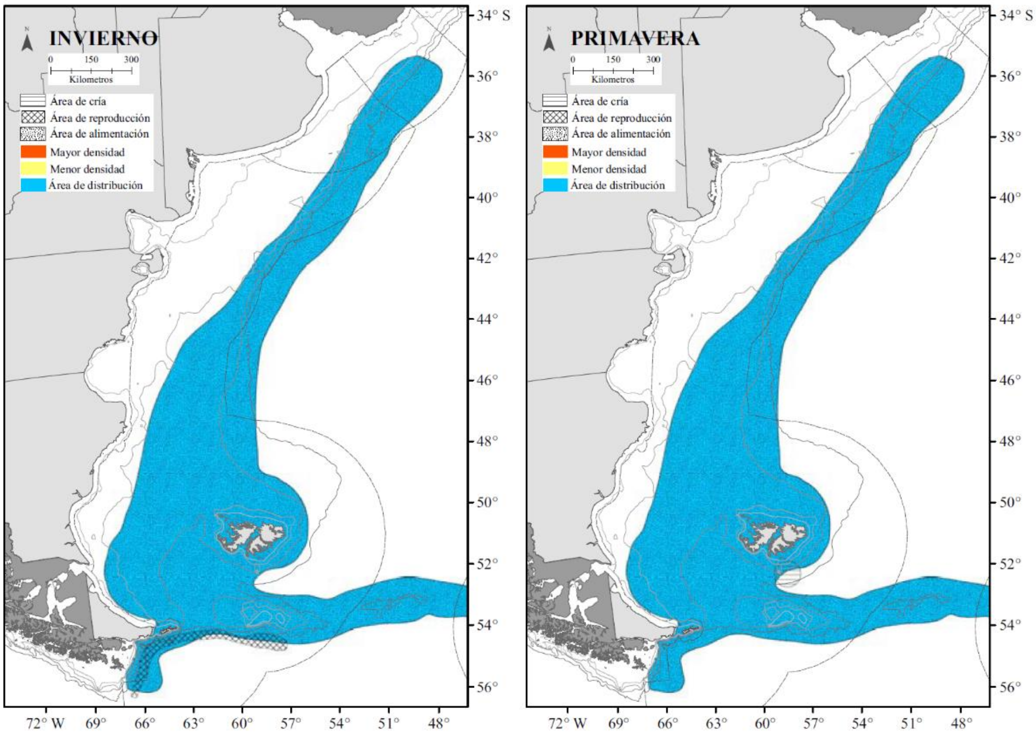


Figure 178. Geographic Distribution of *D. eleginoides*. Source: Allega et al. 2020.

(Translation of Figure 178: Invierno: Winter. Primavera: Spring. Reference boxes: Area de cría: Breeding area. Area de reproducción: Reproduction area. Area de alimentación: Feeding Area. Mayor densidad: Higher density. Menor densidad: Lower density. Area de distribución: Distribution Area).

12- *Patagonotothen ramsayi* (Longtail southern cod)

Species with demersal-benthic characteristics, which inhabits deep platform waters but also reaches coastal areas in Santa Cruz and Tierra del Fuego (Figure 179). Its depth range varies from 150 to 400 m (Laptikhovsky and Arkhipkin, 2006). It is the most common of the notothenids of the Argentine shelf and is part of the accompanying fauna of the hake. Adults ingest euphasid amphipods, salps, thalliacs, ophiura, and squid. It is caught by medium and large vessels, with bottom trawls.

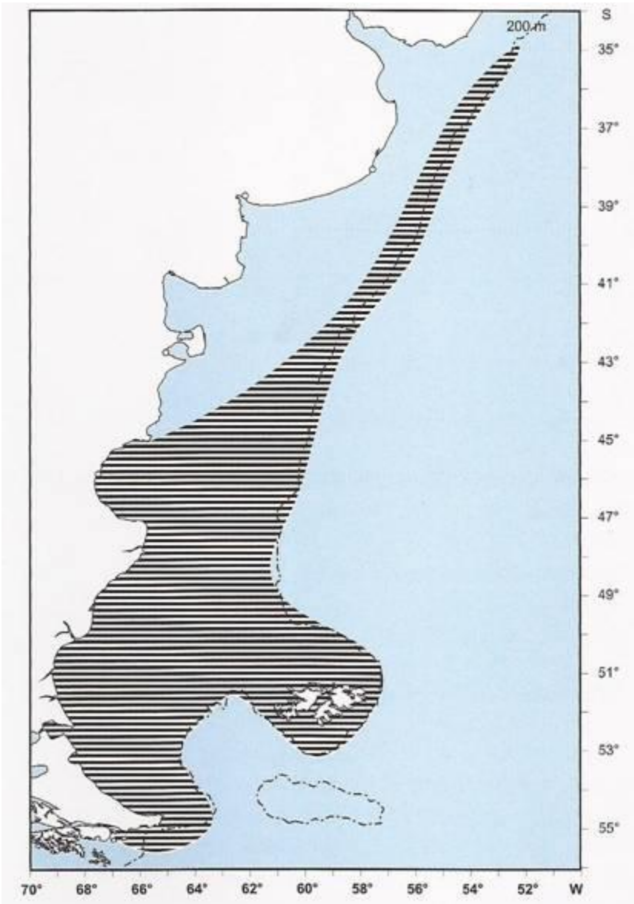


Figure 179. DIstribution of *P. ramsayi*. Source: Cousseau and Perrota 2013.

13- *Cottunculus granulosus* (Fathead)

It is distributed on the platform around the Falkland Islands (Islas Malvinas), Burdwood Bank and throughout the slope (Figure 180).

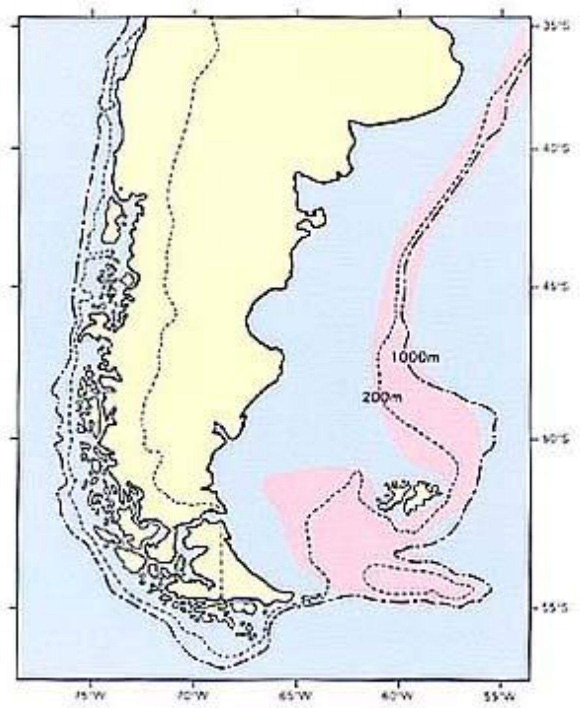


Figure 180. Geographic distribution of *C. granulosus* in the Argentine Sea. Source: Nakamura et al. 1986.

14- *Epigonus robustus* (Robust cardinalfish)

Species that reaches the northern sector of the slope and would be associated with the Brazilian current (Figure 181).

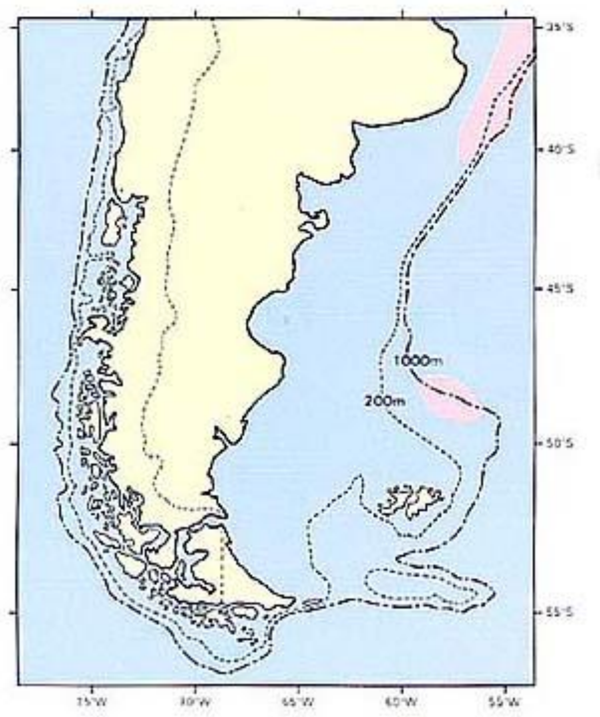


Figure 181. Geographic Distribution of *E. robustus* in the Argentine Sea. Source: Nakamura et al.

1986.

15- *Illucoetes fimbriatus* (Eelpout)

Species inhabiting the slope and platform of Malvinas and Burdwood Bank (Figure 185).

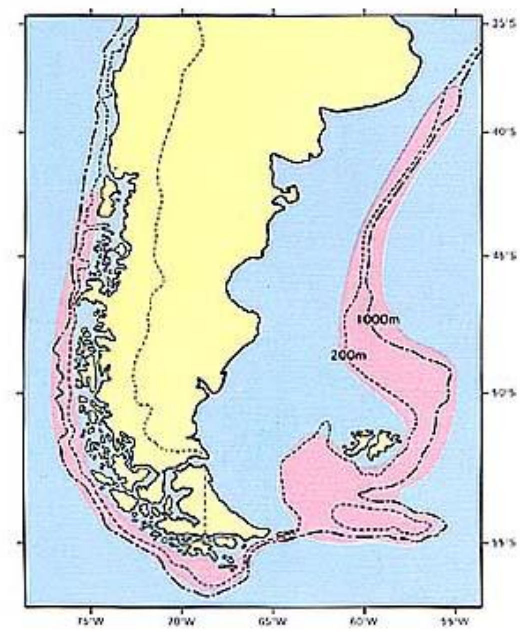


Figura 182. Geographic distribution of *I. fimbriatus* in the Argentine Sea. Source: Nakamura et al. 1986.

16- *Lycenchelys bachmanni* (Eelpout)

It occupies only the central and northern sector of the slope (Figure 183).

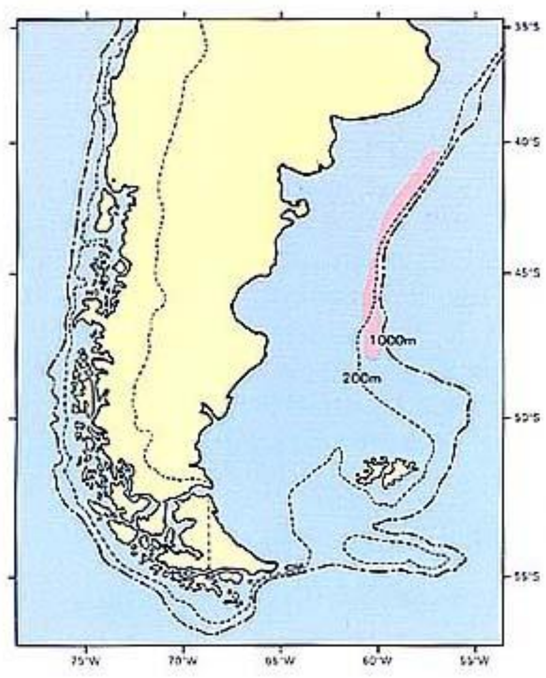


Figure 183. Geographic Distribution of *L. bechmani* in the Argentine Sea. Source: Nakamura et al. 1986.

17- *Pseudoxenomystax albescens* (Conger eel)

The species inhabits the middle and upper portion of the slope (Figure 184).

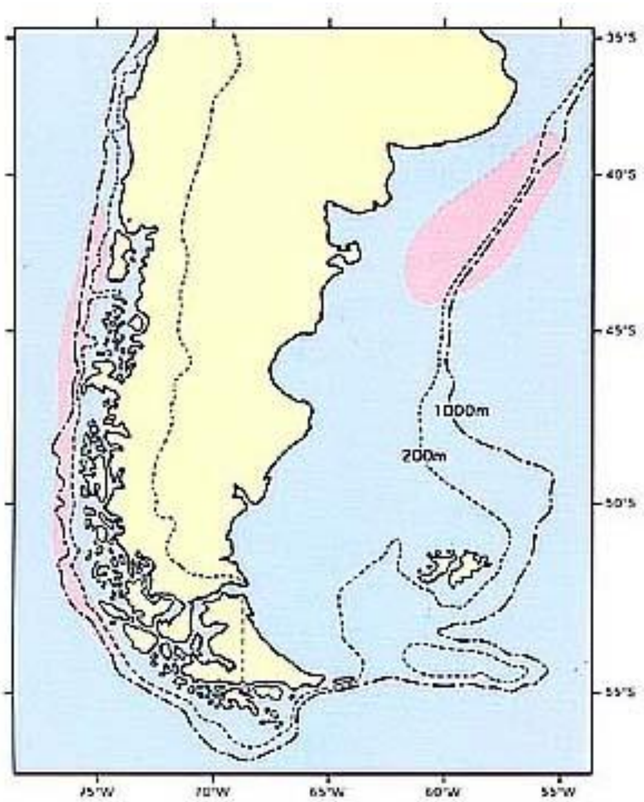


Figure 184. Geographic distribution of *P. albescens* in the Argentine Sea. Source: Nakamura et al. 1986.

18- *Mancopsetta maculata* (Antarctic armless flounder)

This species has been found in the external platform and the slope up to 34º S, located between 130 to 860 m deep (Figure 185). It is caught by the deep sea fleet with bottom trawls.

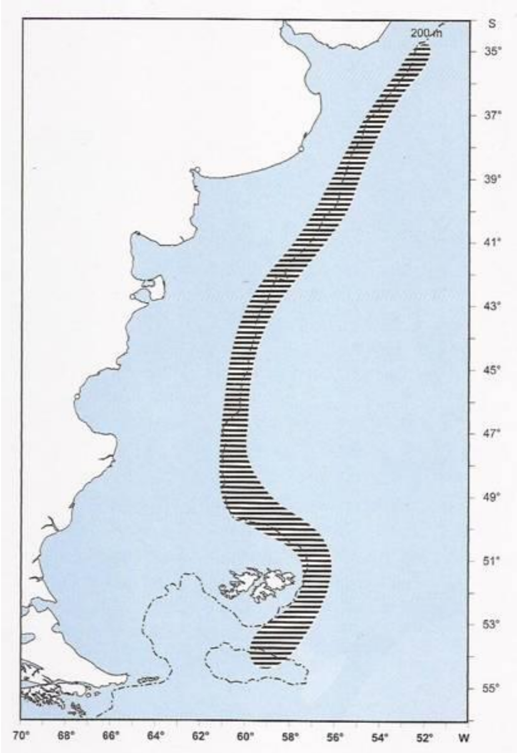


Figure 185. Distribution of *M. maculata*. Source: Cousseau and Perrota 2013.

19- *Mancopsetta milfordi* (Finless flounder)

This species embraces the slope and the southern platform (Figure 200).

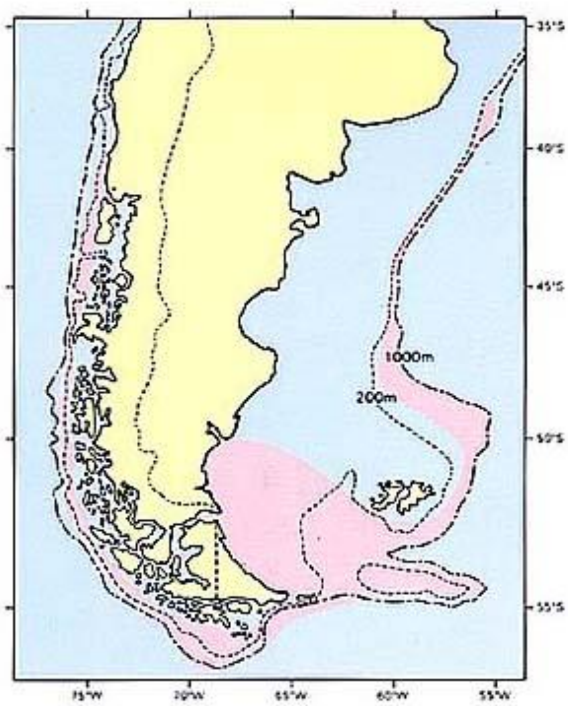


Figure 186. Distribution of *M. milfordi*. Source: Nakamura et al. 1986.

20- *Scopelosaurus lepidus*

This species extends on the slope from the north of the province of Buenos Aires to the center of Patagonia (Figure 187).

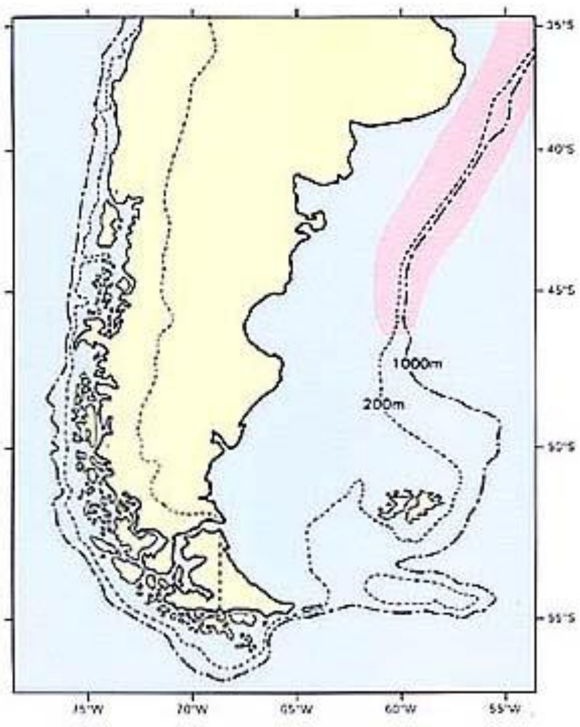


Figure 187. Distribution of *S. lepidus*. Source: Nakamura et al. 1986.

Other species in the area of regional influence of the project

Other deep-lying species have been recorded on the slope such as: *Congiopodus peruvianus, Guttigadus kongi, Haplomacrourus nudirostris, Macrourus holotrachys, Sebastes oculatus, Seriolella porosa, Bassanago albescens, Bathophilus vaillanti* (up to 4,900 m deep), *Cotratus griophilus marmophilus, Psycholine griophilus griophilus, Urophycis cirrata.* These data were obtained by consulting the OBIS database (Ocean Biogeographic Information System, OBIS http://www.iobis.org/) based on the geographical location of the prospecting area.

From specific studies carried out from the edge of the platform towards the slope (Astarloa and Bruno 2012), it has been found that the most abundant species that inhabit along this gradient correspond to the Macruronidae family, followed by Moridae and Congridae, to a lesser extent (Figure 188).

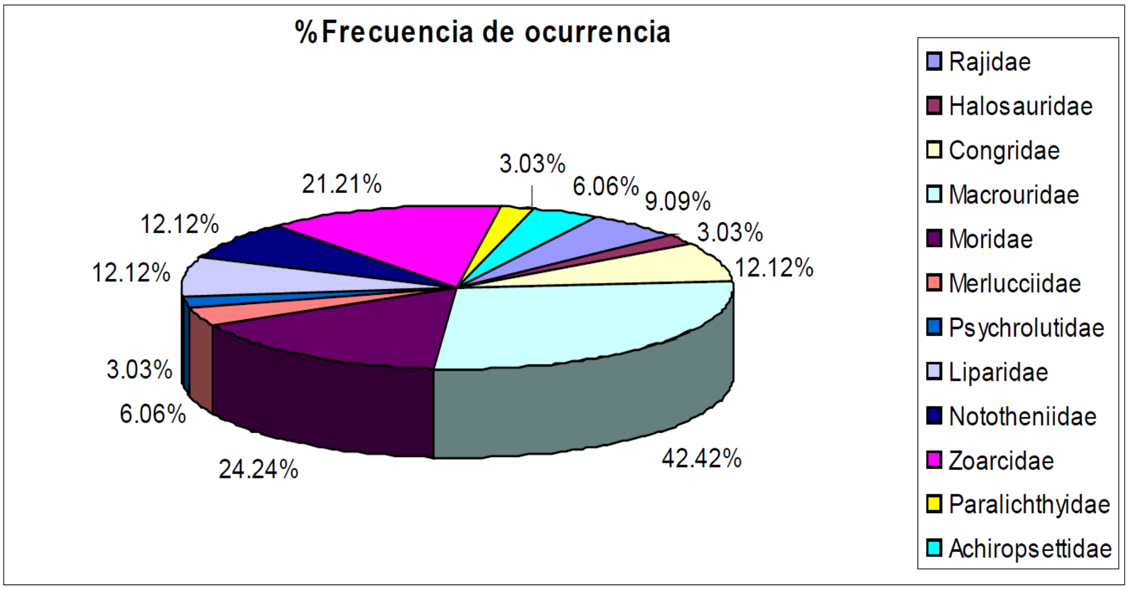


Figure 188. Occurrence Frequency by families on the continental slope. Source: Astarloa and Bruno 2012.

The highest abundance of fish was observed between 250 and 500 m deep and it tends to decrease as it gets deeper, being minimal at depths greater than 1000 m. The greatest richness (number of species) was appreciated between 250 and 1000 m deep, reaching a minimum at 850 m deep (Figure 189).

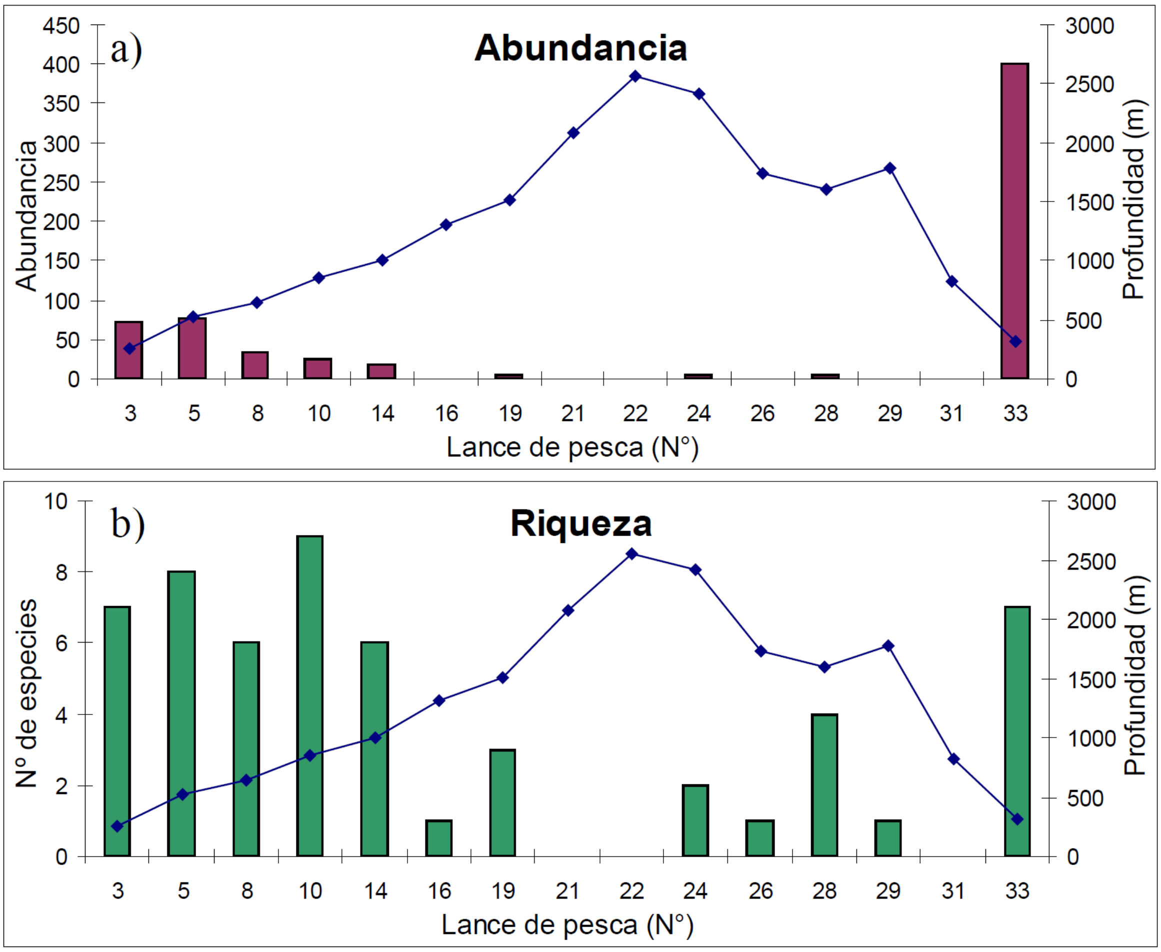


Figure 189. Abundance and richness of species associated with depth in the continental slope. Source: Astarloa and Bruno 2012.

(Translation of Figure 189: Abundancia: Abundance. Profundidad: Depth. Lance de Pesca: Fishing Set)

Pelagic Species of the Shelf

Two species of fishing importance that inhabit between 50 and 200 m deep can occasionally be registered in the Project´s indirect area of influence which are *Scomber japonicus* (mackerel) and *Lycengraulis anchoíta* (anchovy).

The **Mackerel** inhabits brackish and marine waters of the Mediterranean and Black Seas and the Atlantic and Southwest Indian Oceans. In our country, its presence has been described up to 45 ° S in waters of the intermediate platform. Based on information collected by INIDEP in research campaigns and on board observers, they have recently found a distribution extension in the southern limit up to 47 ° 30´S (Buratti and Orlando 2019). So far, a single Breeding habitat has been identified, which extends from 36 ° 30 ´S to 39 ° S and less than 100 m deep, with the highest concentrations of eggs located north of Mar del Plata. The optimum temperature range for breeding is between 14.5 and 20 ° C, the optimum being close to 16-17 ° C. At surface temperatures higher than 19-20 ° C, the schoals move away from the coastal sector looking for platform waters with lower records. The activity peak takes place in December (females are mature from October to January), when fishing activity is carried out by the "rada-ría" fleet. During the Breeding season, the mackerel feeds on zooplankton and anchovy, moving towards and away between the coastal sector and the platform

to feed.
The Mackerel is distributed in depths below 100 m, which does not coincide with the prospecting area. Their presence in the area could be occasional.

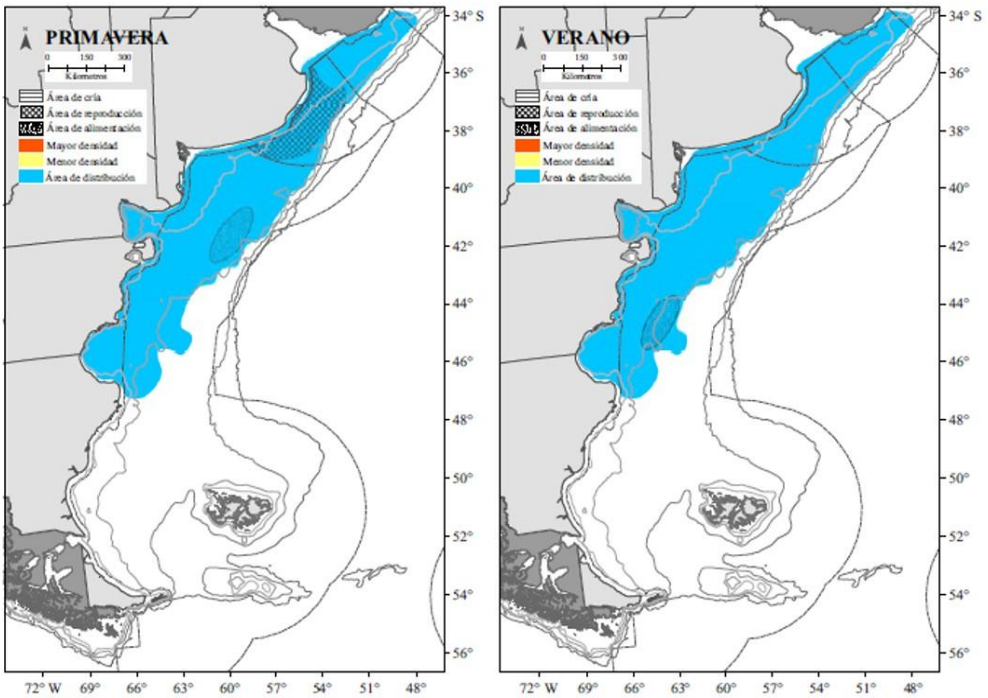


Figure 190. Diagram of the spatial-temporal distribution of the mackerel, *Scomber colias*. The sensitive areas are indicated in relation to the breeding and feeding of the resource during the first and last quarter of the year. Fuente: Allega et al. 2020.

(Translation of Figure 190: Reference boxes: Area de cría: Breeding area. Area de reproducción: Reproduction area. Area de alimentación: Feeding Area. Mayor densidad: Higher density. Menor densidad: Lower density. Area de distribución: Distribution Area).

The **anchovy** is a small pelagic fish that has a wide distribution in the Southwest Atlantic, from Cabo Frio in Brazil to Patagonia and in depths ranging from shallow waters to the outside of the continental slope (Allega et al. 2020). During the Breeding peak (October-November) the presence is massive in sea surface temperatures between 13 and 16 ° C. At the end of spring the shoals leave the coastal waters and are mainly found in the intermediate and outer platform, where they feed intensely (December-May). During the end of autumn, they move further away from the coastal regions of the SE of the Province of Buenos Aires, reaching the external platform and waters on the continental slope between 33 ° S and 37 ° S, where they are mainly found during the winter (May-June).

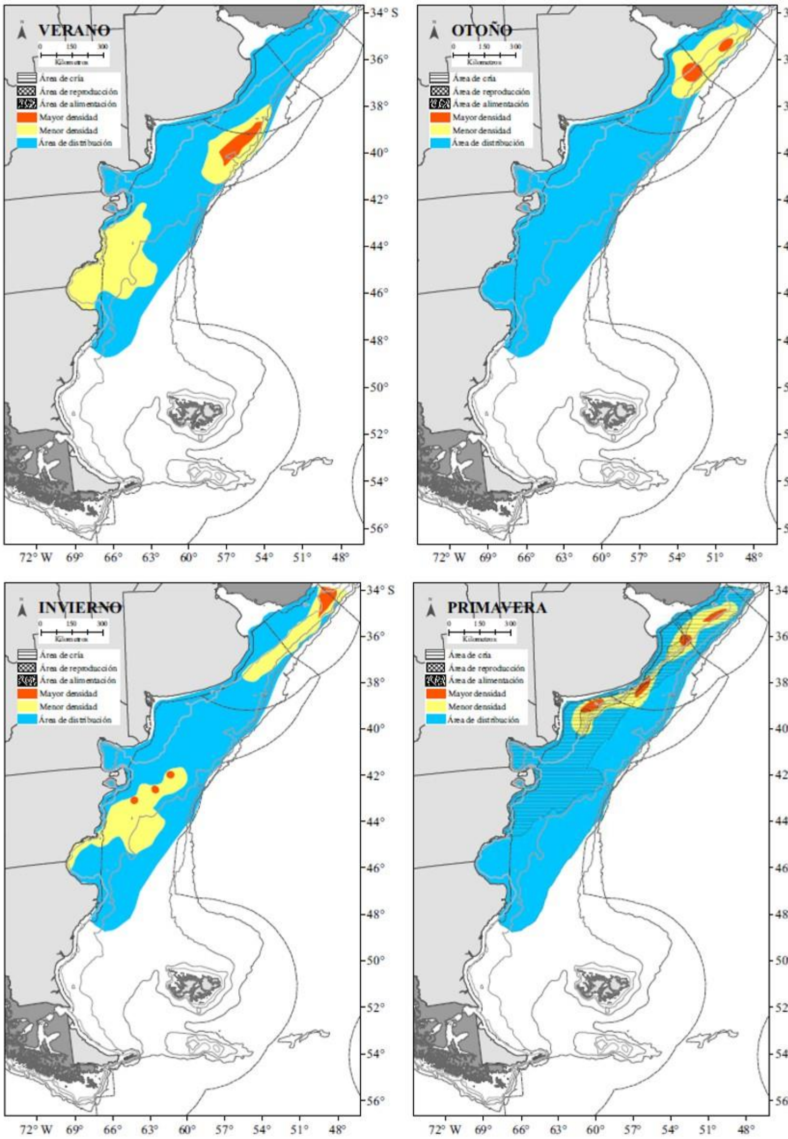


Figure 191. Diagram of the spatial-temporal distribution of the anchovy. The sensitive areas are indicated in relation to the breeding and feeding of the resource. Source: Allega et al. 2020.

(Translation of Figure 191: Verano: Summer. Otoño: Autumn. Invierno: Winter. Primavera: Spring. Reference boxes: Area de cría: Breeding area. Area de reproducción: Reproduction area. Area de alimentación: Feeding Area. Mayor densidad: Higher density. Menor densidad: Lower density. Area de distribución: Distribution Area).

The anchovy is distributed in the coastal zone and the middle platform, in depths of less than 100 m, which does not overlap with the prospecting area. Their presence in the area could be occasional.

Warm water species

The occasional presence of these species would be associated with the transport of warm subtropical water from the Brazilian continental shelf (Milessi et al. 2011). This group is made up of *Elops saurus* and *Caulolatilus chrysops*, *Pomacanthus paru*, which presented the first record for Argentine waters (Milessi et al. 2013), *Aluterus monoceros* for which the southern limit of its distribution is extended to 39º S (Necochea) (Bruno et al. 2014) and *Nesiarchus nasutus* (Spath et al. 2015).

Depth species

Some deep chondrites such as *Somniosus antarcticus, Squalus mitsukurii, Symbolophorus boops, Myliobatis goodei* may occasionally be recorded in the project area. Within the Rajidae family the records belong to the following species: *Atlantoraja platana, Bathyraja griseocauda, Bathyraja papilionifera.* There may also be some deep-seated Osteichthyes such as *Congiopodus peruvianus, Guttigadus kongi, Haplomacrourus nudirostris, Iluocoetes fimbriatus, Macrourus holotrachys, Sebastes oculatus, Seriolella porosa, Bassanago albescens, Bathophilus vaillanti (up to 4.900 m-deep), Cottoperca gobio, Cottunculus granulosus, Psychrolutes marmoratus, Schedophilus griseolineatus, Urophycis cirrata* (Ocean Biogeographic Information System, OBIS http://www.iobis.org/).

4.3.1.4 Cephalopods

Four species of cephalopods are registered within the detailed study area of the project; *Doryteuthis sanpaulensis, D. gahi, Onykia ingens*, and *Illex argentinus*. The species are hereinbelow described;

Doryteuthis sanpaulensis (Squid)

It is a coastal species of warm-temperate waters, which are distributed in the Southwest Atlantic between 20 ° S and 46 ° S (Figure 192). Juveniles and pre-adults (1 to 9 cm LM) are found on the Buenos Aires coast throughout the year, being more abundant in September and February. Adults (10-19 cm lm), maturing or already mature, on the other hand, appear from July to January, with significant breeding concentrations between October and December. Their diet is based on loliginidae, made up of crustaceans, fish and cephalopods. In turn, different species of marine mammals include *D. sanpaulensis* as food.

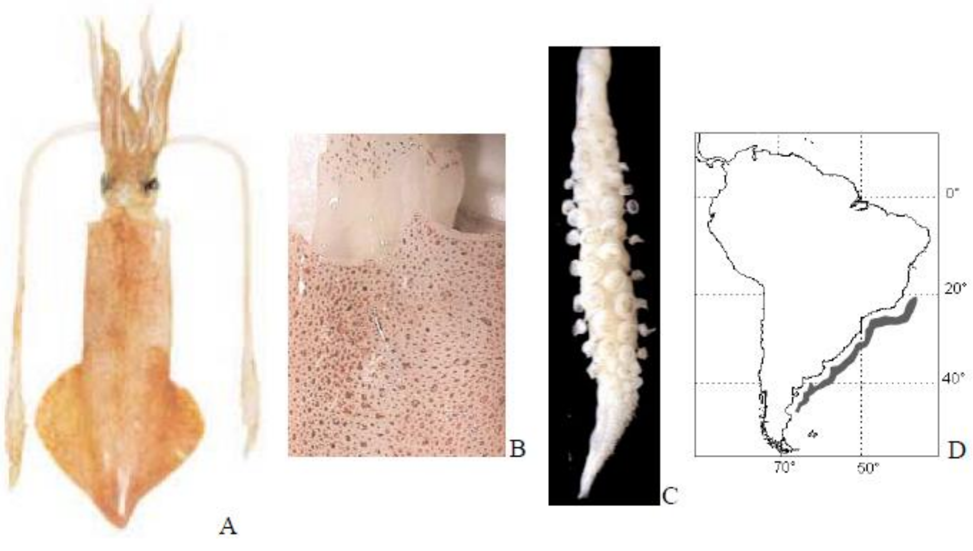


Figure 192. *D. sanpaulensis*. Dorsal view (A), detail of the chromatophores on the ventral surface (B) and of the tentacular club (C). Distribution area (D). Source: Brunnetti et al. 1999.

Doryteuthis gahi **(Patagonian squid)**

It is distributed on the shelf around the southern tip of South America from southern Peru in the Pacific to southern Argentina and the Falkland Islands (Islas Malvinas) in the Atlantic (Figure 193) (Arkhipkin et al. 2013). In Argentina, it takes up the continental shelf to a greater extent up to approximate northern latitudes of 36 ° S, following the rise of the Malvinas current along the slope in years of colder temperatures.

Figure 193. Distribution of *Doryteuthis gahi.* Source: Jereb and Roper 2010.

It is a squid of small size measuring between 13-17 cm in total length. It is most abundant around the Falkland Islands (Islas Malvinas), targeted by commercial fishery with a total annual catch of around 50,000 t. D. gahi is the squid that tolerates the coldest waters within the family as it is found in waters derived from subantarctic subsurface masses.

It breeds in waters with temperatures between 4 and 11 ° C, with an embryogenesis duration of 15 months in spring-summer and 4-5 months in winter. The population structure consists of two cohorts with different breeding seasons (squids that spawn in autumn and others in spring, without modifying the areas used for spawning). Both cohorts have an annual life cycle and their diet consists of planktonic crustaceans such as euphasids and the pelagic amphipod *Themisto gaudichaudii*. Larger squid can cannibalize smaller squid, and *D. gahi* is an important prey for most nectonic fish, seabirds, and marine mammals that inhabit the Patagonian shelf (Arkhipkin et al 2013).

D. gahi performs ontogenetic migrations within the continental shelf; the juveniles and adults reach more oceanic areas. Squid size increases within a depth range of 50-400 m. Juveniles migrate out of the shelf and feed, grow and mature on the outer shelf (more than 150 m). Mature individuals are found in shallower waters (less than 100 m) which could indicate that Breeding migrations take place in more coastal waters. The largest squids are grouped in intermediate waters between 200 and 300 meters deep.

D. gahi is the second most commercially important species in the southeastern Atlantic Ocean and has been recorded in catches since 1983. As from 1987, directed fishing was established and its exploitation has been regulated to date (Brunetti 1999, Rosas 2013).

***Onykia ingens* (Greater hooked squid)**

It is a species of the Onychoteuthidae family that has been related to the seabed of the continental shelf around 200 meters, inhabiting the southern oceans with a circumpolar distribution in the subantarctic region. Vertical migrations have been suggested based on mature females captured deeper (740 meters) than juveniles. *O. ingens* is considered a terminal spawner so migration to deeper and colder waters would allow the maintenance of female tissue after spawning. It is an important species in ecosystems since it is abundant in the bathypelagic region, although it is also found around the Falkland Islands (Islas Malvinas) in shallower waters (Hoving et al 2016). It is used as food by various predators such as marine mammals and birds (Rosas 2013).

Ecotrophic studies of large specimens of *O. ingens* have shown that myctophid fish are the main prey, and this trend is due to the fact that smaller organisms prey on crustaceans and cephalopods, and in juvenile-adult stages they change to a diet based mainly on fish and cephalopods (Rosas 2013).

The main species of fish that this squid preys in adult sizes are *Gymnoscopelus nicholsi* and *S. australis*, in smaller sizes it preys on the *Euphausia lucens*, the *Munida gregaria*, the amphipod *T. gaudichaudii*, and the *D. gahi* squid (Rosas 2013). This diversity of predators and prey emphasizes the importance of *O. ingens* in the trophic webs of southern ecosystems.

At the fishing level, *O. ingens* has been collected as bycatch in the last decade by the commercial fleet in the southern oceans, who have caught large specimens.

***Illex argentinus* (Argentine Shortfin squid)**

Neritic-oceanic species that is distributed from 23º S to 54º S, with a frequent presence between 35º S and 52º appearing throughout the platform and slope, and being the most important cephalopod in the Southwest Atlantic from the point of view of its fishing importance. Its highest concentration, however, is associated with the presence of subantarctic waters and mainly with the Malvinas current, which is why it is distributed on the edge of the slope between 80 and 400 meters deep, varying according to the season.

Its population dynamics is complex and four groups of spawning are distinguished, which differ in their areas and spawning times: South Patagonian summer spawning, Buenos Aires-North Patagonian and spring spawning.

The South Patagonian subpopulation is the least known and its breeding area could be located from 48 ° S to 45 ° S along the area swept by the Malvinas current. The concentrations of the Bonaerense-Norpatagonica subpopulation occur on the external platform and slope (38 ° -39 ° S). In autumn there are important pre-Breeding concentrations along the external platform and continental slope that do not overlap in time. South of 44 ° S, these concentrations occur between March and May and correspond to the South-Patagonia Subpopulation, while, north of 44 ° S, the concentrations correspond to the Buenos Aires-North Patagonia subpopulation. The species would spawn on the external platform and its limit with the slope (45 ° to 48 ° S) and the eggs corresponding to the southern spawning areas would be carried by the Malvinas current to the north where they hatch when meeting the Brazilian current (Haimovici et al. 1998, Brunetti et al 1999). The breeding areas, on the other hand, are located in the middle and northern platform in winter and spring (Ivanovic et al. 2016: Allega et al. 2020) (Figure 194).

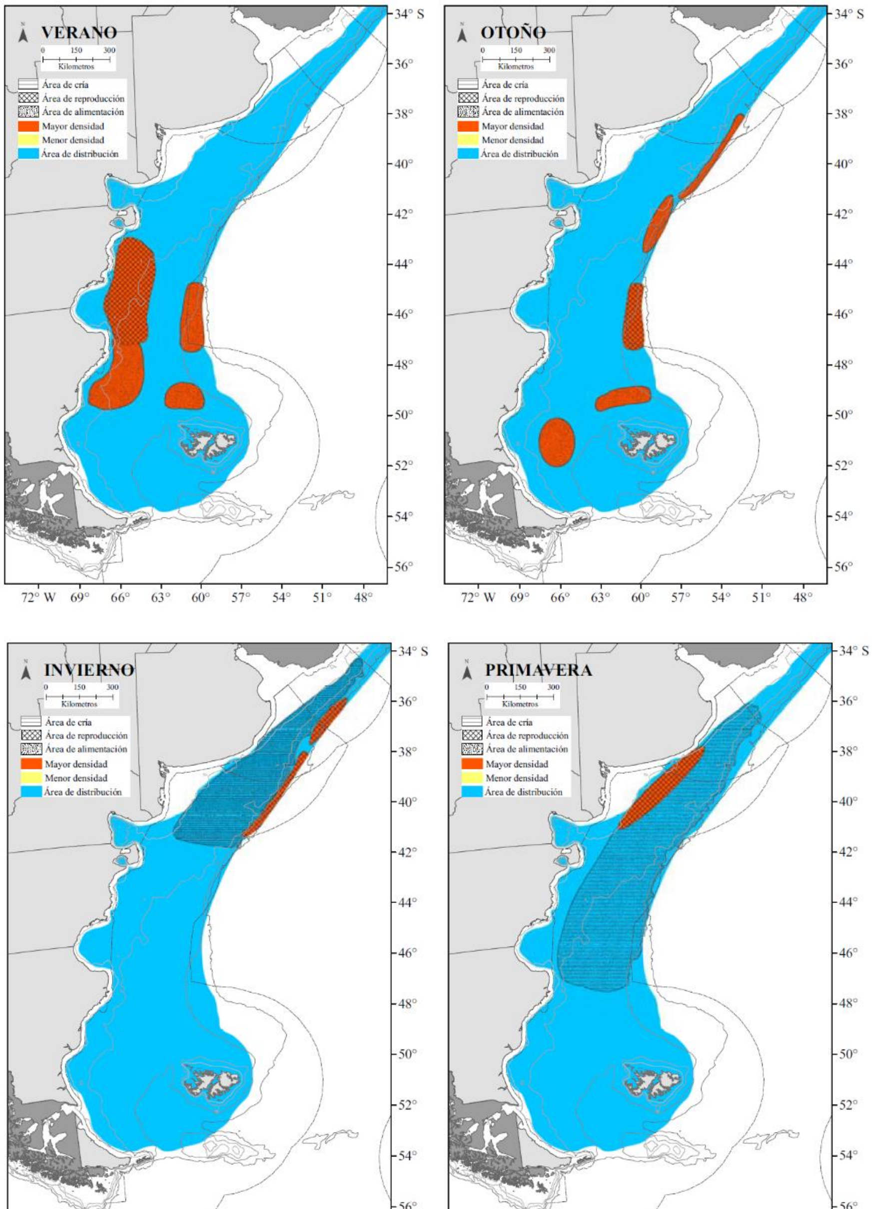


Figure 194. Distribution of breeding, feeding, distribution and density areas of *Illex argentinus*. Source: Allega et al. 2020.

(Translation of Figure 194: Verano: Summer. Otoño: Autumn. Invierno: Winter. Primavera: Spring. Reference boxes: Area de cría: Breeding area. Area de reproducción: Reproduction area. Area de alimentación: Feeding Area. Mayor densidad: Higher density. Menor densidad: Lower density. Area de distribución: Distribution Area

An analysis of the shifts and movements of the subpopulations can be seen in the following Figure.

The large centers of concentration of adults to the south of 44 ° S disappear completely in winter, indicating that the South Patagonian subpopulation has migrated after spawning, while the Buenos Aires-North Patagonian subpopulation remains until the beginning of spring. In spring, significant concentrations are generated in the Buenos Aires-North Patagonian shelf between 50 and 100 m deep and this includes, on the one hand, juveniles from the spawning of both subpopulations mentioned and pre-adults from the summer spawning subpopulation and adults from the spring spawning subpopulation. Two areas of important concentrations are detected in summer. One between 43 ° and 45 ° S formed by summer spawning adults and the other between 46 ° and 48 ° S formed by spawning pre-adults of the South Patagonian subpopulation (Brunetti et al. 1999).

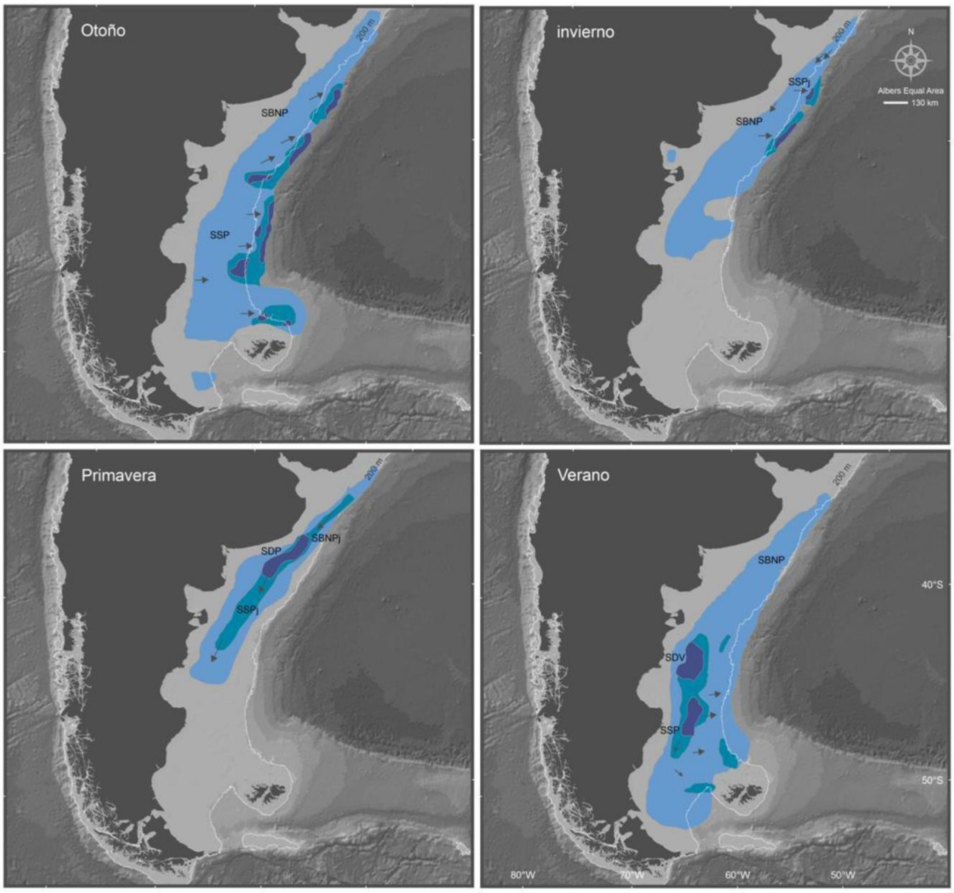


Figure 195. Squid distribution considering the South Patagonian (SSP) and Buenos Aires-North Patagonian (SBNP) subpopulations associated with spawning and breeding areas. Source: Brunetti et al. 1999.

(Translation of Figure 195: Otoño: Autumn. Invierno: winter. Primavera: Spring. Verano: Summer).

During the summer, in the Southern Patagonian Platform (44 ° S and 51 ° S), almost all squid (72-85%) feed on crustaceans, being the amphipod *Themisto gaudichaudi* the main prey. Its trophic level is 3.7 (Ciancio et al. 2008). The daily feeding aggregations and vertical migrations of the species coincide with the highest biomass concentrations and vertical migration of this amphipod (Ciechomski and Sánchez 1983; Sabatini and Álvarez Colombo 2001). Squid feed mainly during the day, beginning at dawn and peaking in the afternoon (Ivanovic and Brunetti 1994, Mouat et al. 2001).

Although the project's area of influence is located within the Argentine squid distribution area, the direct area of influence does not overlap with the spawning, breeding, or feeding sites. The areas with the highest concentrations and Breeding groups would be found in the indirect area of influence of the project in spring and summer, but the area of direct influence would be partially synchronized with the pre-Breeding concentrations of the Buenos Aires-North Patagonian subpopulation grouped in high density at the edge of the platform during the autumn and winter. Squid larvae are recorded for the indirect area of influence of CAN_100-108 and CAN_114, but it is also possible to find them in the prospecting area, turning the latter into a sensitive site for this species. However, these larvae come from spawning areas located in other zones of the Argentine Sea.

4.3.1.5 Ichthyoplankton

The dominant ichthyoplankton in the project area corresponds to species that are distributed under the predominance of the influence of subantarctic waters and the Malvinas current in the superficial and sub-superficial layers and in a deeper flow of Antarctic intermediate waters.

An important component of the ichthyoplankton are the myctophids whose larvae are distributed along the slope (75-900 m-deep) in subantarctic waters of the Malvinas current. Within the myctophids, other deep-sea species are considered, such as Gonostomatidae, among others (Bertolotti et al. 1996).

Myctophid larvae occur year-round and during the winter months they dominate in generally low abundance of ichthyoplankton. The distribution of mycthophiid larvae can be observed in the Figure 196 and are therefore present in the indirect area of influence of the project (Bertolotti et al. 1996).

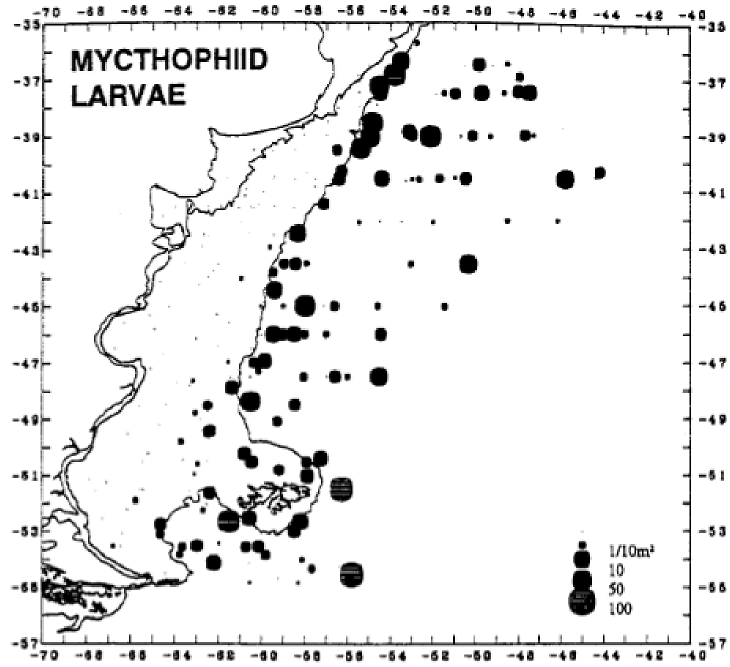


Figure 196. Occurrence of mycthophiid larvae in the study area. Source: Bertolotti et al. 1996.

4.3.1.6 State of conservation

Macrocrustaceans

Five species of macrustaceans of economic interest are registered within the detailed study area; *Munida gregaria, Lithodes santolla, Thymops birsteini, Chaceon notialis* and *Ovalipes trimaculatus.*

Only IUCN (International Union for Conservation of Nature) *Thymops birsteini* is categorized as Least Concern (UICN 2020).

Cephalopods

Four species of cephalopods are registered within the study area; *Doryteuthis sanpaulensis, D. gahi, Onykia ingens*, and *Illex argentinus*. Its current state of conservation is indicated in Table 10.

Table 10. Cephalopods registered for the project area and its IUCN category. Source: own elaboration.

PHYLUM MOLLUSCA			
Class: Cephalopoda			
Family	Species	Common name	UICN
Loliginidae	*Doryteuthis sanpaulensis*	Sao Paulo Squid	Least Concern
Loliginidae	*Doryteuthis gahi*	Patagonian Squid	Least Concern
Loliginidae	*Onykia ingens*	Greater Hooked Squid	Least Concern
Omastrephidae	*Illex argentinus*	Argentine Shortfin Squid	Least Concern

Fish

Table 11 presents the list of ichthyofauna and its IUCN categorization (2020). The dominant category is Not Evaluated (NE: 62%), followed by the Least Concern and Near Threatened. Three species in the vulnerable category stand out within the chondrictes; *Bathyraja albomaculata, Zearaja chilensis* and *Squalus acanthias* and one in the critically endangered category (*Bathyraja griseocauda*). Figure 197 shows that most of the species that enter or are close to the project area are not yet evaluated or are under the Least Concern category.

Table 11. Threatened fish species present in the area of influence, according to their conservation status (UICN 2020). Source: own elaboration.

SCIENTIFIC NAME	COMMON NAME	CLASS	IUCN 2020
*Bathyraja macloviana**	Patagonian skate	Chondrichthyes	NT
*Bathyraja albomaculata**	White-dotted skate	Chondrichthyes	VU
Bathyraja griseocauda	Graytail skate	Chondrichthyes	EN
*Bathyraja scaphiops**	Cuphead skate	Chondrichthyes	NT
*Bathyraja brachyurops**	Broadnose skate	Chondrichthyes	LC
*Bathyraja magellanica**	Magellan skate	Chondrichthyes	DD
*Bathyrraja cosseasuae**	Joined-fins skate	Chondrichthyes	NE
Bathyraja multispinnis *	Multispine skate	Chondrichthyes	NT
Zearaja chilensis *	Yellownose skate	Chondrichthyes	VU
Amblyraja doellojuradoi *	Southern thorny skate	Chondrichthyes	LC

SCIENTIFIC NAME	COMMON NAME	CLASS	IUCN 2020
*Psammobatis normani**	Shortfin sand skate	Chondrichthyes	DD
*Psammobatis rudis**	Smallthorn sand skate	Chondrichthyes	DD
*Squalus acanthias**	Picked dogfish	Chondrichthyes	VU
Schorederichthys bivius *	Narrowmouthed catshark	Chondrichthyes	NT
Callorhinchus callorhynchus *	Plownose chimaera	Chondrichthyes	NE
Coryphaenoides filicauda	Grenadier	Osteichthyes	NE
Coelorhynchus fasciatus *	Banded whiptail	Osteichthyes	NE
Macrourus holotrachys	Bigeye grenadier	Osteichthyes	NE
Macrourus carinatus	Ridge scaled rattail	Osteichthyes	NE
Lucigadus nigromaculatus	Blackspotted grenadier	Osteichthyes	NE
Haplomacrourus nudirostris	/	Osteichthyes	NE
Muraenolepis marmorata	Marbled moray cod	Osteichthyes	NE
*Merluccius hubbsi**	Argentine Hake	Osteichthyes	NE
Merluccius australis	Southern Hake	Osteichthyes	NE
*Macruronus magellanicus**	Patagonian grenadier	Osteichthyes	NE
Antimora rostrata	Blue Antimora	Osteichthyes	LC
-Lepidion ensiferus	Patagonian codling	Osteichthyes	NE
Guttigadus kongi	Austral cod	Osteichthyes	NE
*Notophycis marginata**	Dwarf codling	Osteichthyes	NE
*Salilota australis**	Tadpole codling	Osteichthyes	NE
*Micromesistius australis**	Southern blue whiting	Osteichthyes	NE
Seriolella porosa	Choicy ruff	Osteichthyes	NE
Urophycis cirrata	Gulf hake	Osteichthyes	LC
*Mancopsetta maculata**	Antarctic armless flounder	Osteichthyes	NE
Mancopsetta milfordi *	Finless flounder	Osteichthyes	NE
*Cottunculus granulosus**	Fathead	Osteichthyes	NE
Psychrolutes marmoratus	Blobfish	Osteichthyes	NE
Praematoliparis anarthractae	Snail-fish	Osteichthyes	NE
Paraliparis cf. anarthractae	Snail-fish	Osteichthyes	NE
Paraliparis eltanini	Snail-fish	Osteichthyes	NE
Congiopodus peruvianus	Horsefish	Osteichthyes	NE
Sebastes oculatus	Patagonian redfish	Osteichthyes	NE
Cataetyx messieri	Patagonian forkbeard	Osteichthyes	LC

SCIENTIFIC NAME	COMMON NAME	CLASS	IUCN 2020
Ariosoma opistophthalmum	Conger	Osteichthyes	LC
Bassanago albescens	Hairy conger	Osteichthyes	LC
Conger orbignianus	Argentine conger	Osteichthyes	LC
*Pseudoxenomystax albescens**	Conger eel	Osteichthyes	LC
Diastobranchus capensis	Basketwork eel	Osteichthyes	NE
Aldrovandia phalacra	/	Osteichthyes	LC
Notacanthus sexspinis	Spiny-back eel	Osteichthyes	NE
Notacanthus chemnitzii	Snub-nosed spiny eel	Osteichthyes	LC
Bathypterois longipes	Abyssal spiderfish	Osteichthyes	LC
Mictophidae sp.	Myctophidae	Osteichthyes	NE
Ophthalmolycus macrops	Eelpout	Osteichthyes	NE
Plesienchelys stehmanni	Eelpout	Osteichthyes	NE
Phucocoetes cf. latitans	/	Osteichthyes	NE
*Illucoetes fimbritatus**	Eelpout	Osteichthyes	NE
*Lycenchelys bachmanni **	Eelpout	Osteichthyes	NE
*Stromateus brasiiensis**	Southwest Atlantic butterfish	Osteichthyes	NE
*Thyrsites atun**	Snoek	Osteichthyes	NE
*Disssotichus eleginoides**	Patagonian Toothfish	Osteichthyes	NE
*Patagonotothen ramsayi**	Longtail southern cod	Osteichthyes	NE
*Epigonus robustus**	Robust cardinalfish	Osteichthyes	NE
Cottoperca gobio	Channel Bull blenny	Osteichthyes	NE
Schedophilus griseolineatus	/	Osteichthyes	NE
Argyropelecus aculeatus	Lovely hatchetfish	Osteichthyes	LC
Stomias boa	Boa dragonfish	Osteichthyes	LC
Bathophilus vaillanti	/	Osteichthyes	LC
*Genypterus blacodes**	Pink cusk-eel	Osteichthyes	NE
*Scopelosaurus lepidus**	/	Osteichthyes	LC

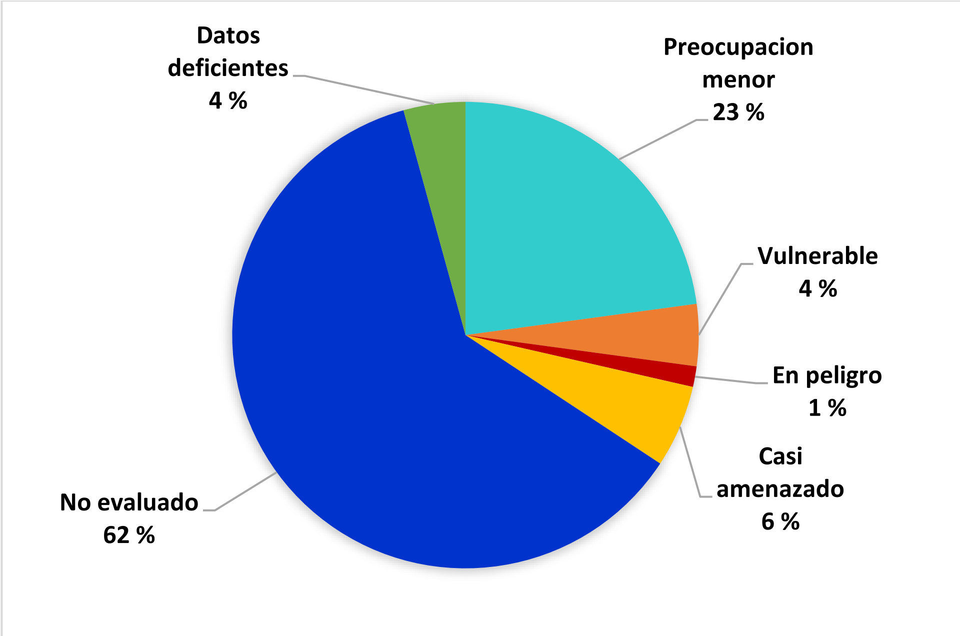


Figure 197. Percentage of fish species classified in the project area according to the IUCN categories UICN (2020).

(Translation of Figure 197: Datos deficientes: Insufficient data. Preocupación menor: Least Concern. Vulnerable: Vulnerable. En peligro: Endangered. Casi amenazado: Almost Threatened. No evaluado: Not Evaluated).

No classification categories were found at the National level (SAyDS, 2007).

4.3.1.7 Fisheries

4.3.1.7.1 General characteristics

Angelescu and Prenski (1987) defined five regional fishing groups according to the abundance of the species of greatest fishing interest (Figure 198). Of all these sets, the one with the greatest relationship with the project area corresponds to the group of deep waters on the continental slope.

With depths between 220 and 2,300 meters, this set is made up of cold water species linked to the Malvinas current. As stated by Angelescu and Prenski (1987), the boundaries of the groups move mainly due to oceanographic conditions, so deep-shelf species are likely to enter the slope, and therefore approach the Project area. The species of the continental slope as a whole have in some cases the ability to migrate vertically to feed from the middle and superficial layers. Among the species belonging to this group, grenadiers stand out (*Coelorhynchus spp., Coryphanoides spp., Cynomacrurus spp., Hymenocephalus spp., Macrourus spp., Malacocephalus spp*. and *Ventrifossa spp.*) followed by the southern blue whiting (*Micromesistius australis*), the Argentine hake and southern hake (*Merluccius hubbsi* and *Merluccius australis*) and the Patagonian grenadier (*Macruronus magellanicus*).

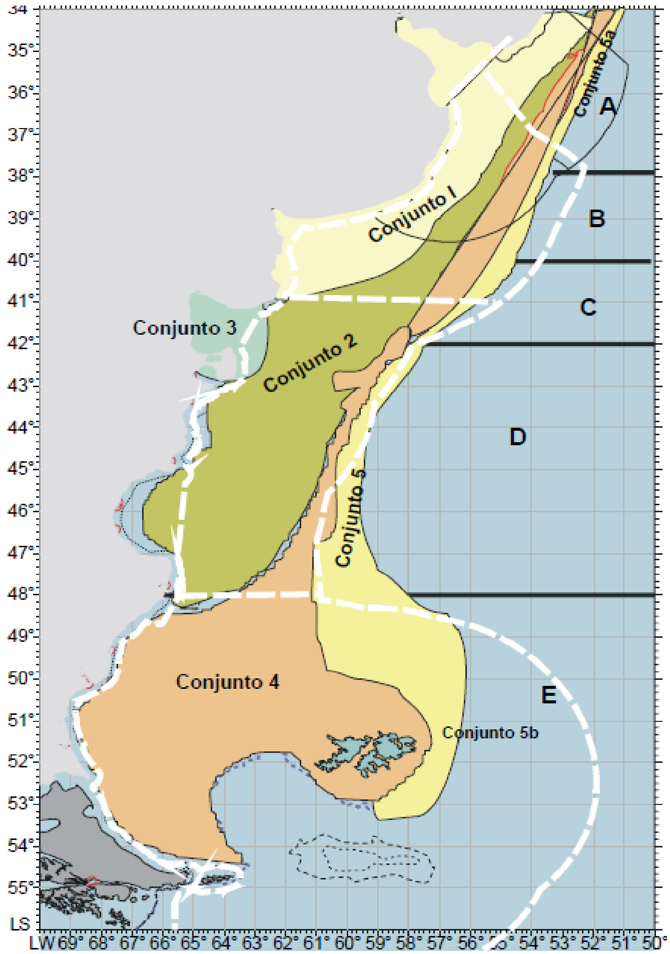


Figure 198. Representation of fishing groups/sets. 1: 1: Buenos Aires coastal group; 2: Set of the internal and external platform of the Patagonian sectors up to 48 ° S; 3: Set of the "Matías", "San José" and "Nuevo" Gulfs; 4: Southern set of the Patagonian-Fuegian and Falkland Islands (Islas Malvinas) platform; 5: Set of deep waters of the continental slope. Source: Boschi et al. 2007.

(Translation of Figure 198: Conjunto: Group or Set).

4.3.1.7.2 Characteristics of the fishing fleet

The vessels that make up the National fishing fleet can be divided, from the point of view of their operation type, into trawlers (most of the Argentine fleet) and vessels equipped with specific and selective gear and tools (beam trawlers, jiggers, longliners and tramps). On the other hand, depending on the type of fish preservation and processing methods on board, the fleet can be subdivided into fresh vessels, freezers and factories (MAGyP 2010, Allega et al. 2020).

Fresh vessels are those which transport the merchandise caught in a refrigerated manner, regardless of the fishing gear used and its loading and navigation capacity. The fresh fleet comprises: a- estuary vessels, b- coastal c- part of the offshore fleet.

a- Estuary Fishing fleet

They are units with or without cold capacity (ice), with or without a hold and with a reduced navigation time. This fleet based in Patagonian ports mainly catches hake, shrimp and to a lesser extent pollock and squid (Figure 199 and Figure 200).

Flota rada o ría	
N° de barcos: 147	
Eslora (m)	mín.: 8,7
	máx.: 23,6
HP	mín.: 36
	máx.: 542
TRB (t)	mín.: 4
	máx.: 67
Bodega (m³)	mín.: 0
	máx.: 70

Figure 199. Characteristics of the estuary fleet. Source: https://www.magyp.gob.ar/sitio/areas/pesca_maritima/plan/PAN-AVES/index.php.

(Translation of Figure 199: Flota rada o ría: Estuary Fleet. N° de barcos: Number of vessels. Eslora: length. Bodega: Hold.)

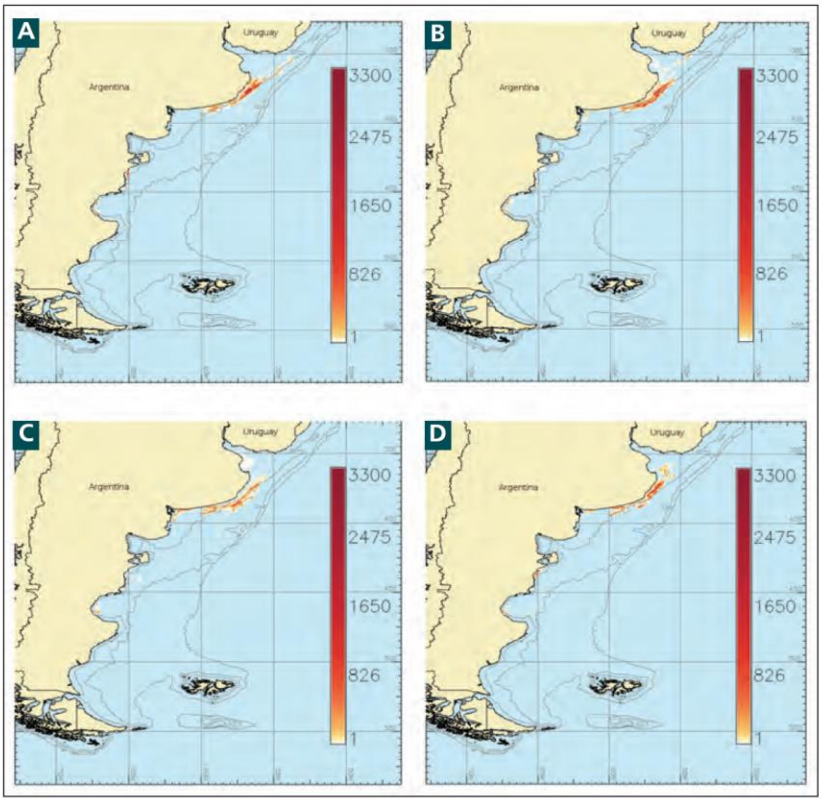


Figure 200. Seasonal distribution of the fishing effort of the estuary fleet. a): summer; b) autumn; c) winter; d: spring. https://www.magyp.gob.ar/sitio/areas/pesca_maritima/plan/PAN-AVES/index.php.

b- Coastal fishing fleet

It includes boats that have the capacity to give cold (mechanical equipment or ice), whose dimensions, load capacity and autonomy allow in some cases to navigate for a period of up to 30 days. Depending on the resources to which their operations are directed, the vessels mainly use bottom trawling nets (sea bass, net whiting, assorted coastal and hake) or medium-water trawling (anchovy and mackerel).

This fleet operates on species that make up the coastline variety. The fleet concentrates on catching hake in summer, sea bass, whiting and rays all year round but more significantly in autumn, and anchovy in winter (Figure 201 and Figure 202).

Flota costera	
N° de barcos: 115	
Eslora (m)	mín.: 9,2
	máx.: 27,0
HP	mín.: 60
	máx.: 830
TRB (t)	mín.: 4
	máx.: 107
Bodega (m³)	mín.: 5
	máx.:215

Figure 201. Characteristics of the coastal fleet. Source: https://www.magyp.gob.ar/sitio/areas/pesca_maritima/plan/PAN-AVES/index.php

(Translation of Figure 201: Flota costera: Coastal Fleet. N° de barcos: Number of vessels. Eslora: length. Bodega: Hold).

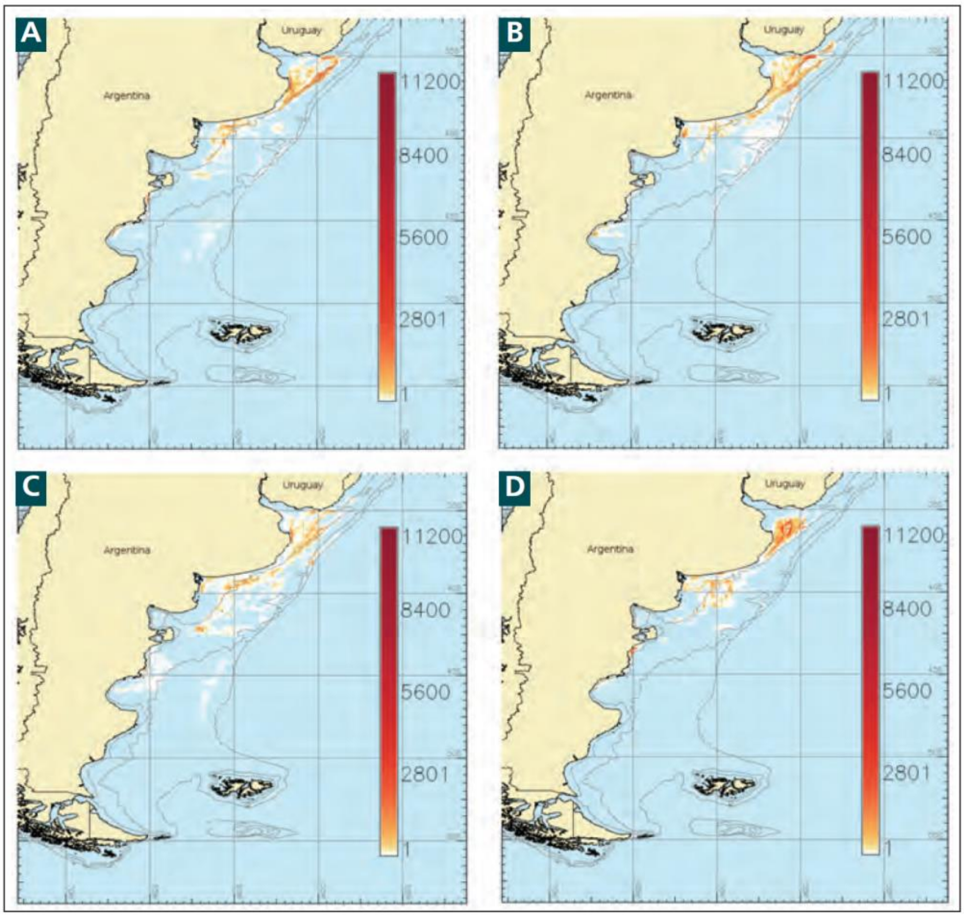


Figure 202. Seasonal distribution of the fishing effort of the coastal fleet. a): summer; b) autumn; c) winter; d): spring. Source: https://www.magyp.gob.ar/sitio/areas/pesca_maritima/plan/PAN-AVES/index.php

c- Deep Sea Wet-fish Stern Trawlers

It is made up of deep-sea wet fish Stern boats that have mechanical freezing systems (plates-tunnels or others). According to the characteristics of their operations, the freezing vessels can be bottom trawlers (common hake and accompanying fauna, southern demersal species and scallops), beam trawlers (shrimp), jiggers (Argentine squid), (spider crab) and longliners (toothfish, haddock and rays), being able to elaborate the products in different ways, given their status as floating industrial plants.

The Deep Sea Wet-fish Stern Trawlers fleet operates in coastal waters as well as medium and external platforms, with hake and rays representing the main species that are caught. The contribution of pelagic species also takes place in winter and spring and the hoki in summer (Figure 203 and Figure 204).

Flota fresqueros de altura	
N° de barcos: 143	
Eslora (m)	mín.: 20,1
	máx.: 71,7
HP	mín.: 330
	máx.: 2700
TRB (t)	mín.: 64
	máx.: 914
Bodega (m^3)	mín.: 50
	máx.: 1227

Figure 203. Characteristics of the wet fish stern trawler fleet. Source: https://www.magyp.gob.ar/sitio/areas/pesca_maritima/plan/PAN-AVES/index.php

(Translation of Figure 203: Flota fresquera de altura: Deep sea wet-fish SternTrawler. N° de barcos: Number of vessels. Eslora: length. Bodega: Hold).

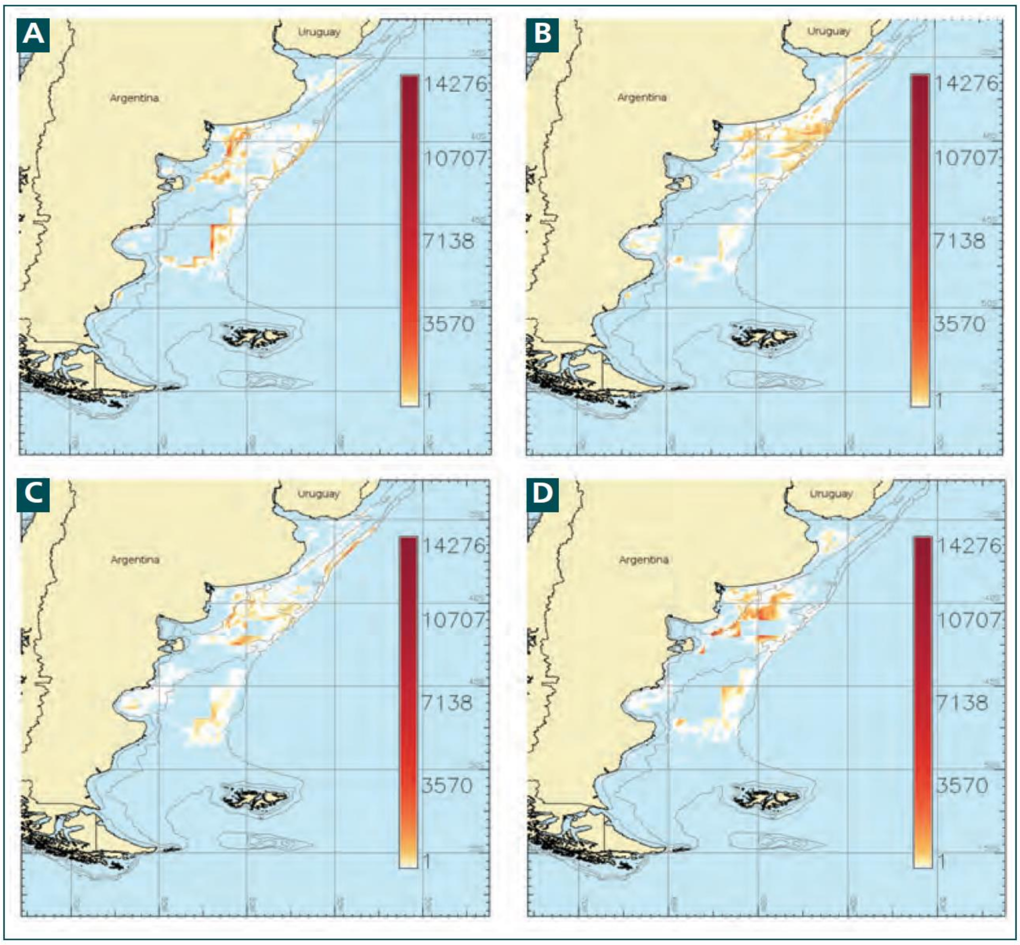


Figure 204. Seasonal distribution of the fishing effort of the Wet-fish Stern Trawler fleet. a): summer; b) autumn; c) winter; d): spring. Source: https://www.magyp.gob.ar/sitio/areas/pesca_maritima/plan/PAN-AVES/index.php

The Freezer Trawler Fleet is made up of freezer trawlers, longliners, beam trawlers and jiggers. This fleet operates on hoki, common hake, pollock, squid (Figure 205 and Figure 206).

Flota congeladores ramperos	
N° de barcos: 58	
Eslora (m)	mín.: 30,5
	máx.: 112,8
HP	mín.: 678
	máx.: 8100
TRB (t)	mín.: 98
	máx.: 3889
Bodega (m^3)	mín.: 145
	máx.: 4531

Figure 205. Characteristics of a freezer trawler. Source: Ministry of Agriculture, Livestock and Fisheries (https://www.magyp.gob.ar/sitio/areas/pesca_maritima/plan/PAN-AVES/index.php)

(Translation of Figure 205: Flota congeladores ramperos: Freezer Trawler fleet. N° de barcos: Number of vessels. Eslora: length. Bodega: Hold).

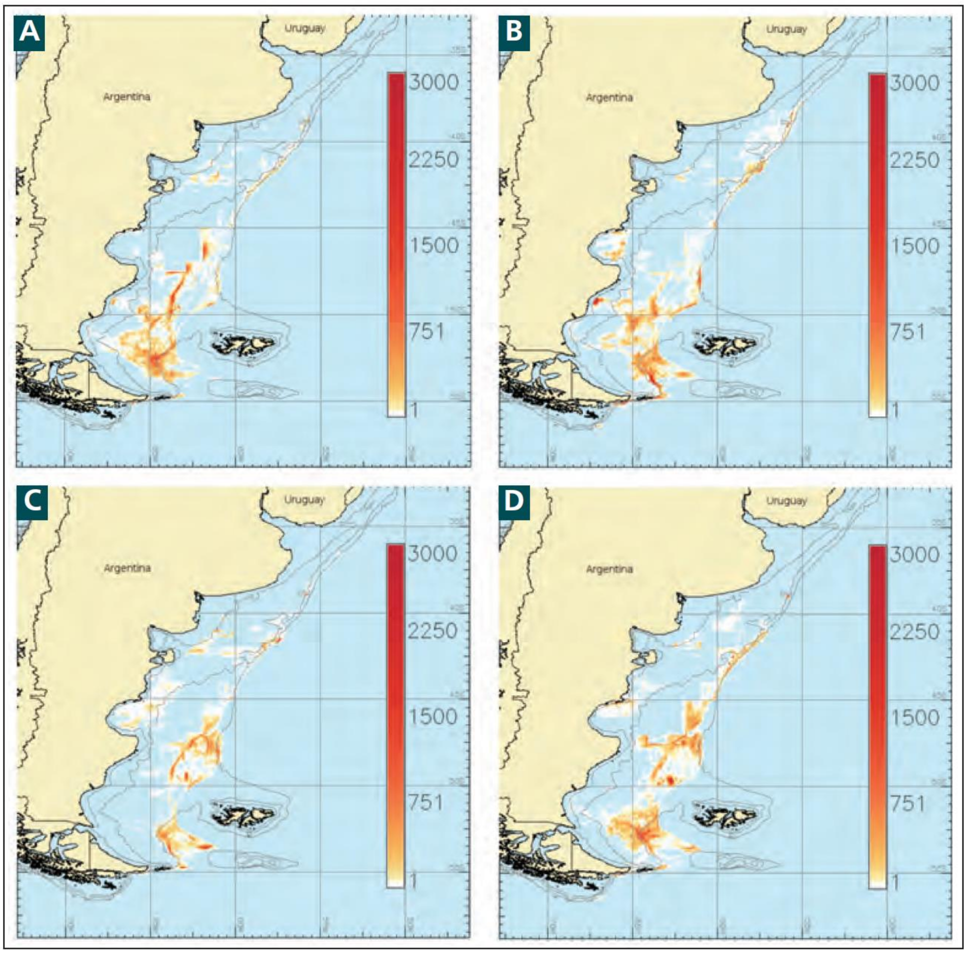


Figure 206. Seasonal distribution of the fishing effort of the freezer trawler fleet. a): summer; b) autumn; c) winter; d): spring. Source: https://www.magyp.gob.ar/sitio/areas/pesca_maritima/plan/PAN-AVES/index.php

Longliner fleet

The longliner fleet is located in Patagonia, primarily in waters of external platform and slope. The catch systems are heterogeneous. Historically, some vessels used specialized longlines to catch rays, toothfish and pollock. Currently the fleet has a single longliner specialized in southern species (Figure 207 and Figure 208).

Flota palangrera	
N° de barcos: 6	
Eslora (m)	mín.: 45,2
	máx.: 55,8
HP	mín.: 987
	máx.: 2268
TRB (t)	mín.: 267
	máx.: 711
Bodega (m^3)	mín.: 180
	máx.: 788

Figure 207. Characteristics of the longliner fleet. Source: https://www.magyp.gob.ar/sitio/areas/pesca_maritima/plan/PAN-AVES/index.php

(Translation of Figure 207: Flota palangrera: Longliner Fleet. N° de barcos: Number of vessels. Eslora: length. Bodega: Hold).

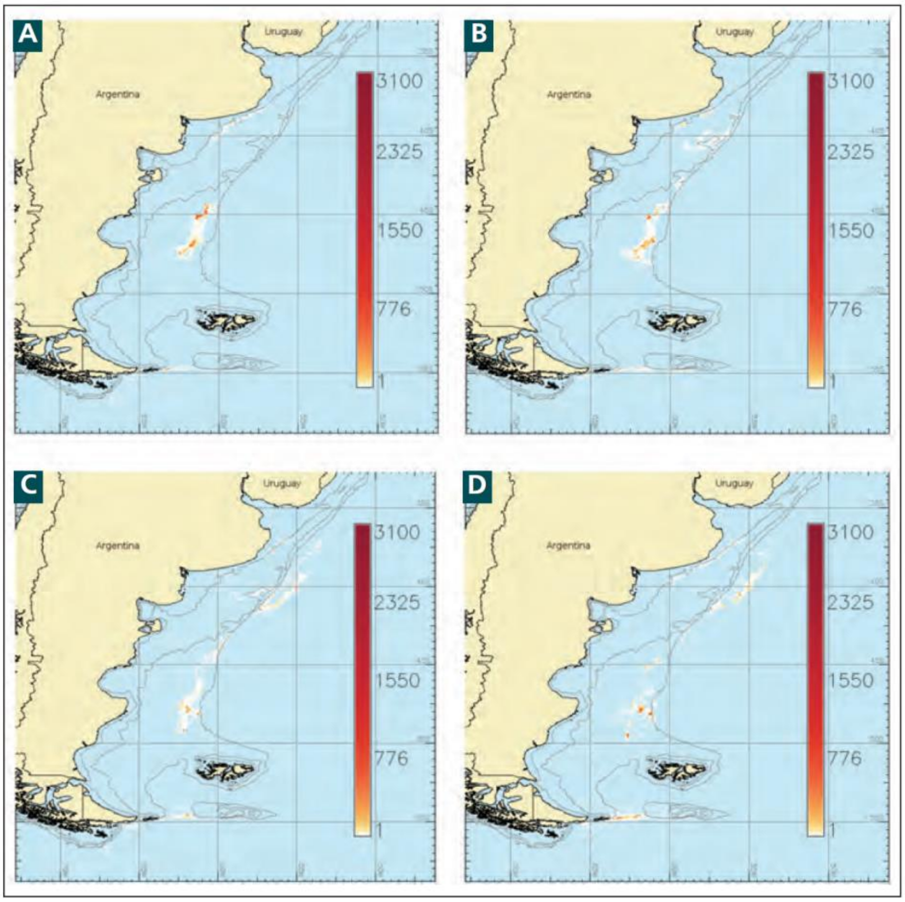


Figure 208. Seasonal distribution of the fishing effort of the longliner fleet a): summer; b) autumn; c) winter; d): spring. https://www.magyp.gob.ar/sitio/areas/pesca_maritima/plan/PAN-AVES/index.php

Figure 209 presents the catch detail of this fleet for some relevant species that inhabit the edge of the slope.

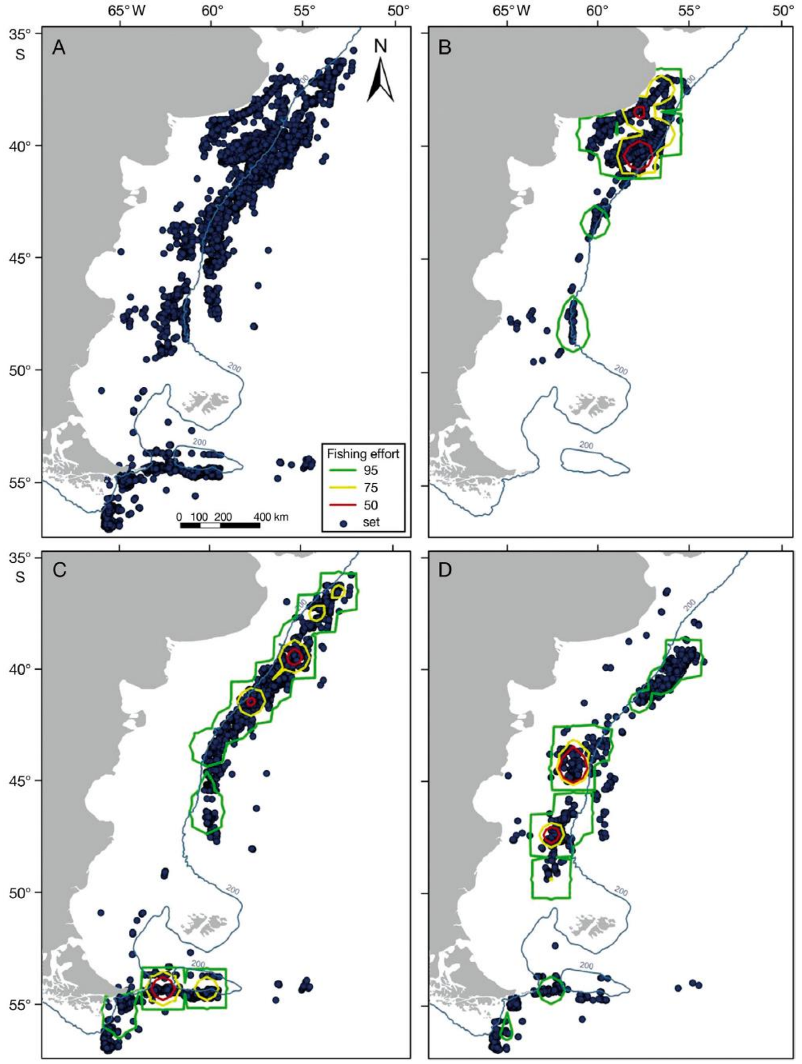


Figure 209. Distribution of the longliner fleet between 2001 and 2010; B: fleet aimed at catching *D. chilensis*; C: fleet aimed at catching *D. eleginoides*; D: fleet aimed at catching *G. blacodes*. Source: Favero et al. 2013.

The Beam Trawler Fleet comprises double-rig trawler-type vessels aimed at catching shrimp (Figure 210 y Figure 211).

Flota tangonera	
N° de barcos: 77	
Eslora (m)	mín.: 26,0
	máx.: 54,2
HP	mín.: 425
	máx.: 2002
TRB (t)	mín.: 116
	máx.: 805
Bodega (m^3)	mín.: 100
	máx.: 600

Figure 210. Characteristics of the Beam Trawler fleet. Source: https://www.magyp.gob.ar/sitio/areas/pesca_maritima/plan/PAN-AVES/index.php

(Translation of Figure 210: FLota Tangonera: Beam Trawler Fleet. N° de barcos: Number of vessels. Eslora: length. Bodega: Hold).

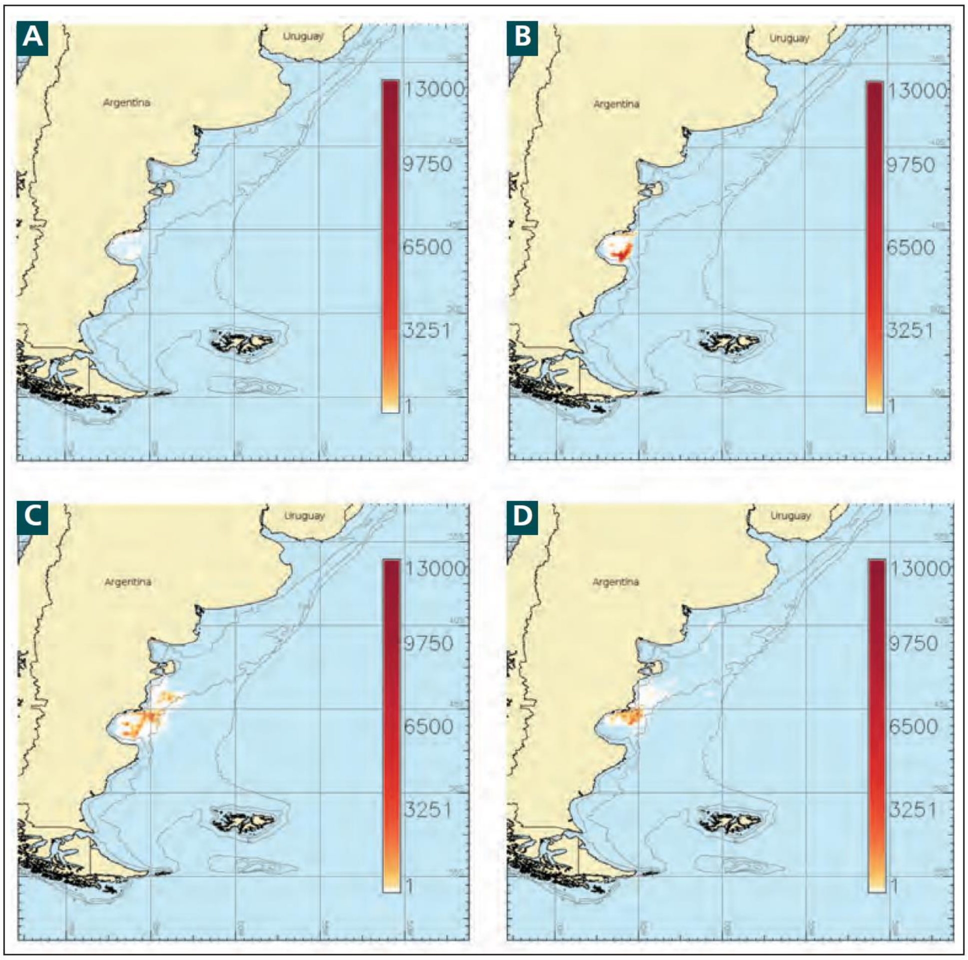


Figure 211. Seasonal distribution of the fishing effort of the Beam trawler fleet. a): summer; b) autumn; c) winter; d): spring. Source: https://www.magyp.gob.ar/sitio/areas/pesca_maritima/plan/PAN-AVES/index.php

The jigger fleet is exclusively aimed at squid fishing (Figure 212 and Figure 213), taking place in the northern management unit from May to August, while in the southern management unit the fishing season runs from February to June.

Flota potera	
N° de barcos: 88	
Eslora (m)	mín.: 32,2
	máx.: 72,3
HP	mín.: 738
	máx.: 2400
TRB (t)	mín.: 123
	máx.: 1232
Bodega (m^3)	mín.: 110
	máx.: 1773

Figure 212. Characteristics of the jigger fleet. Source: Ministry of Agriculture, Livestock and Fisheries (https://www.magyp.gob.ar/sitio/areas/pesca_maritima/plan/PAN-AVES/index.php)

(Translation of Figure 212: Flota Potera: Jigger Fleet. N° de barcos: Number of vessels. Eslora: length. Bodega: Hold).

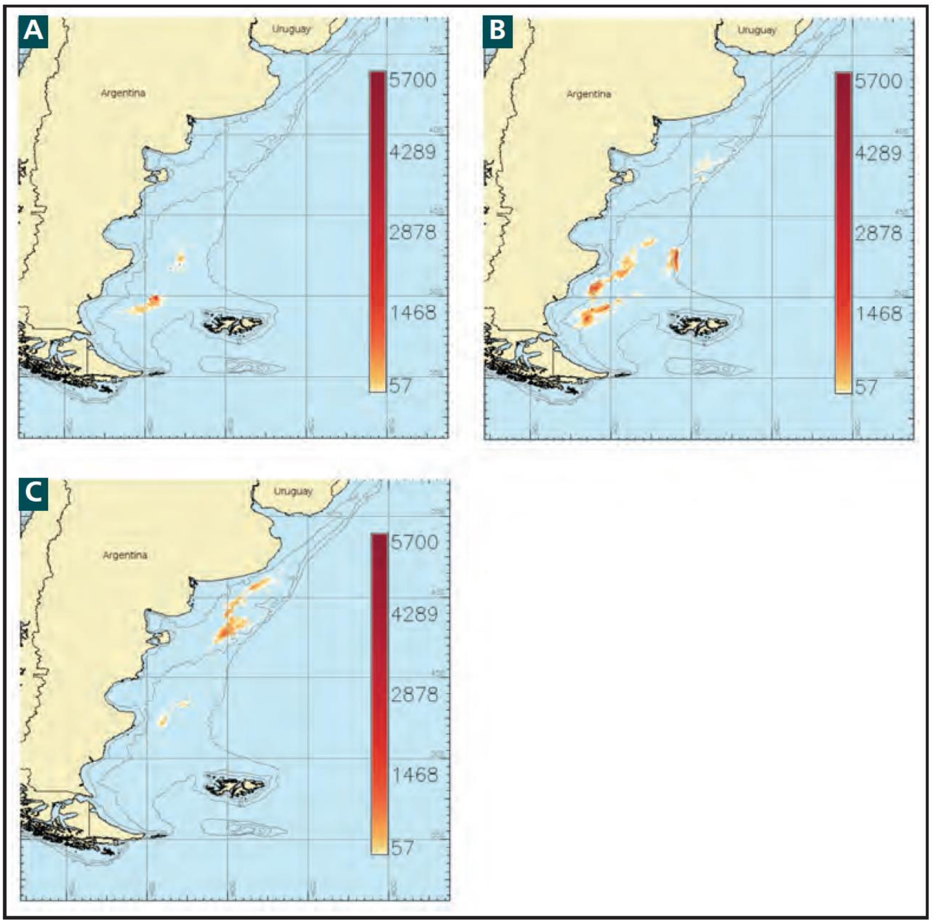


Figure 213: Seasonal distribution of the fishing effort of the Jigger fleet a): summer; b) autumn; c) winter. Source: Ministry of Agriculture, Livestock and Fisheries. (https://www.magyp.gob.ar/sitio/areas/pesca_maritima/plan/PAN-AVES/index.php

Figure 214 describes the situation of the fishing fleet, noting that the main fishing area is distributed in the outermost sector of the platform.

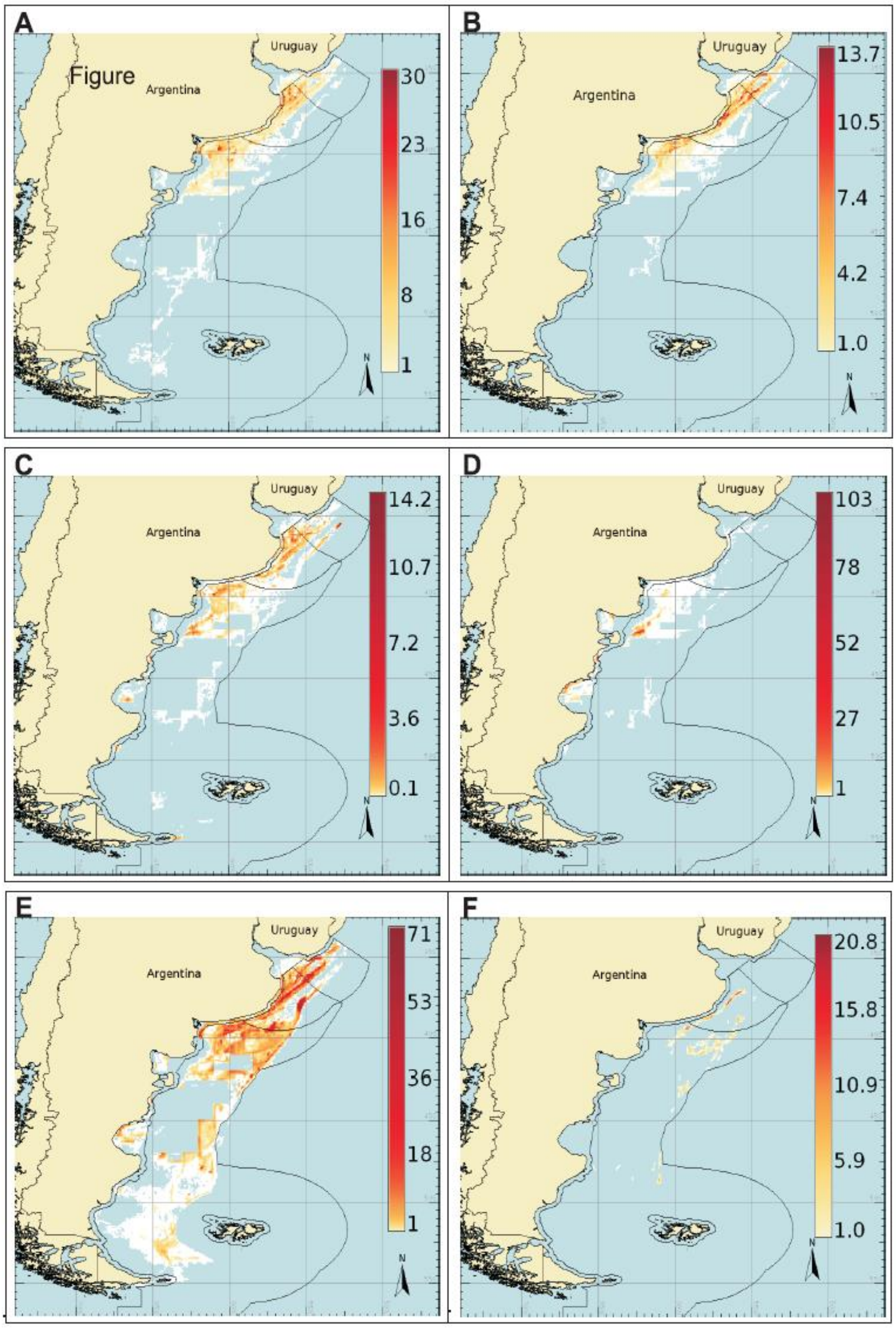


Figure 214. Chondrichthyan fishing areas in 2008. A) dogfish; B) angelfish; C) other sharks; E) stingrays caught by trawling; F) rays caught by longlines. The color scale indicates catches in kilograms per unit of information. Source: Wőhler et al. 2011.

As can be seen in the following figure, the highest percentage of catch is provided by the deep-sea wet-fish stern trawlers and freezer trawlers.

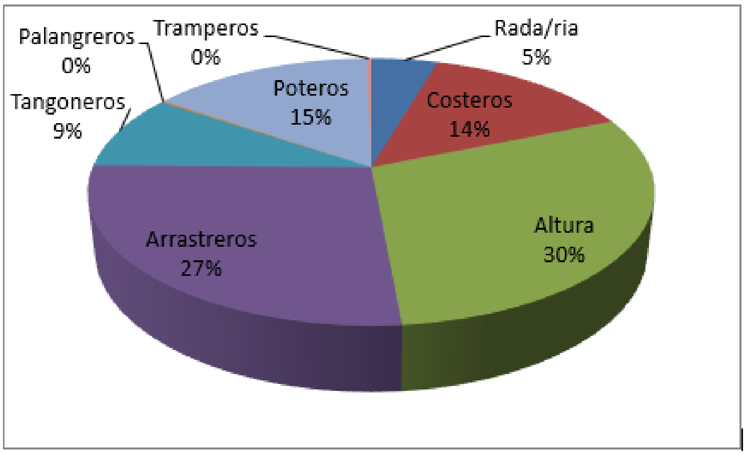


Figure 215. Proportion of catches contributed by different types of fishing vessels, 2008-2019 period. Data: https://www.argentina.gob.ar/agricultura-ganaderia-y-pesca.

(Translation of Figure 215: Arrastreros: Trawlers. Altura: Deep sea vessels. Costeros: Coastal vessels. Rada/Ria: Estuary Vessels. Tramperos: Trap vessels. Poteros: Jigger vessels. Palangreros: Longliner vessels. Tangoneros: Beam Trawler Vessels.)

In the area of regional influence of the project, the operating fisheries are mainly wet-fish stern trawlers and freezer trawlers (Figure 216). There is no recorded bycatch of chondrichthyans.

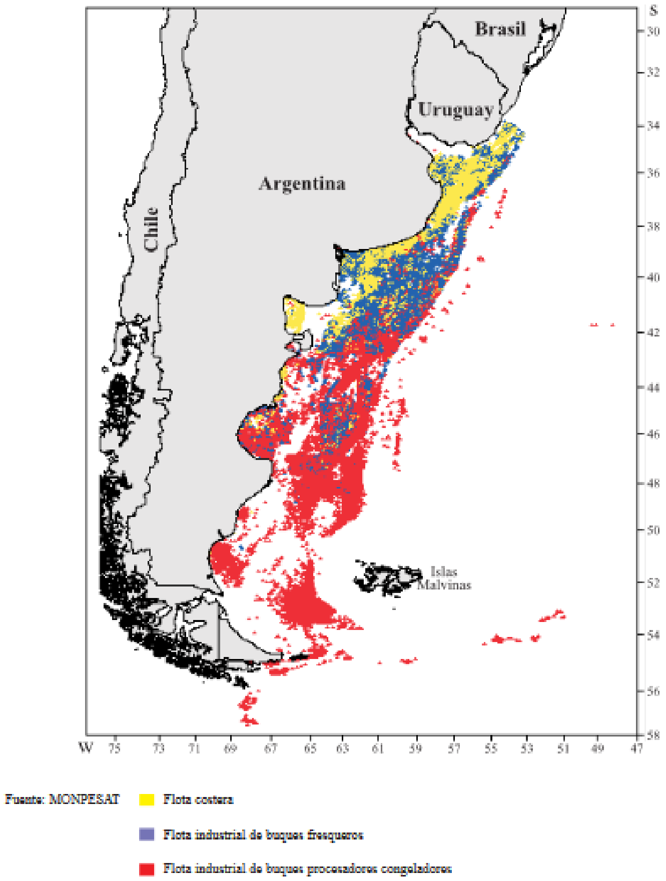


Figure 216. Fishing areas of the National fishing fleet, in the year 1998. Source: Bertolotti et al. 2001.

(Translation of Figure 216: Flota costera: Coastal fleet. Flota industrial de buques fresqueros: Industrial Fleet of Wet-fish Stern Trawlers. Flota industrial de buques procesadores congeladores:

Industrial fleet of Freezer Trawlers).

4.3.1.7.3 Description of the North Operational Area and Temporal Variation of the fleet activity

The Argentine Sea fishing fleet has a structure capable of extracting and processing more than 800,000 tons based on the exploitation of fishing resources in the Exclusive Economic Zone (EEZ), mainly based on the export of fish and molluscs. It has been estimated that five species account for approximately 90% of the catches (Figure 217).

The marine fishing sector currently has a catching and processing structure of great magnitude (above 700,000 t per year) distributed throughout the Exclusive Economic Zone. The activity is mainly oriented to exports, with import values being of little relevance.

Bony fish are part of the group of species that dominate the catches of the Argentine fleet (Figure 217). At the species level, more than 90% of landings in 2017 correspond to 5 species of fish: hake (44%), shrimp (27%), squid (12%), hoki (5%) (Figure 218).

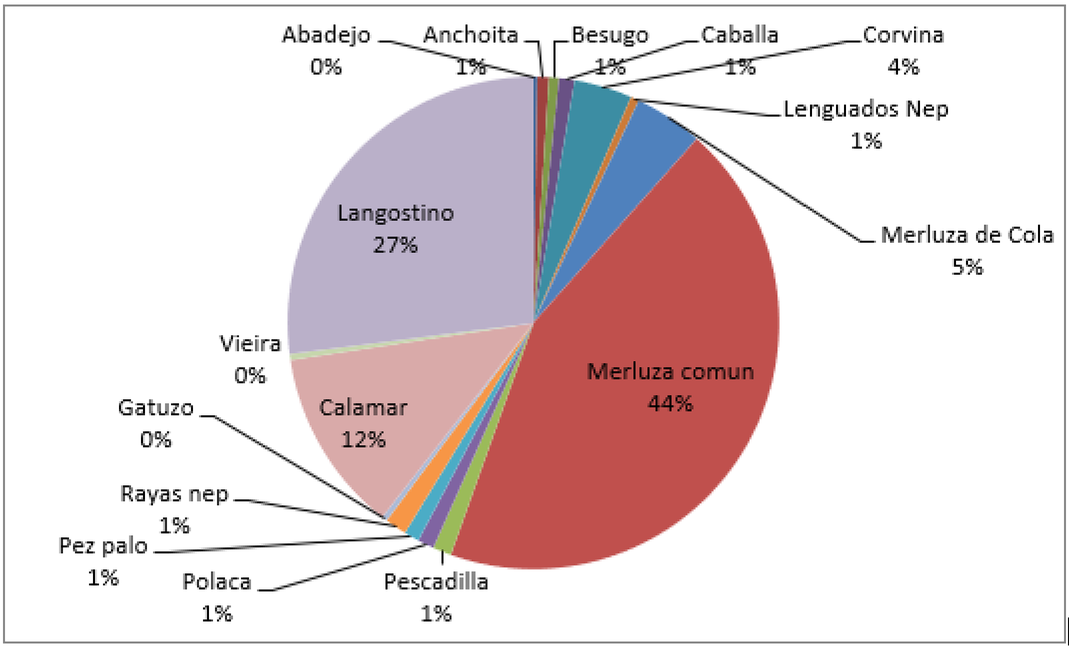


Figure 217. Main species caught. Data: https://www.argentina.gob.ar/agricultura-ganaderia-y-pesca

(Translation of Figure 217: Merluza común: Common hake. Merluza de cola: Hake. Lenguados: Flounders. Corvina: Sea bass. Caballa: Mackerel. Besugo: Red sea bream. Anchoita: Anchovy. Abadejo: Pollock. Langostino: Prawn. Vieira: Scallop. Calamar: Squid. Gatuzo: Narrownose smooth-hound shark. Rayas: Ray/skate. Pez palo: Brazilian flathead. Polaca: Southern Blue Whiting. Pescadilla: whitefish.)

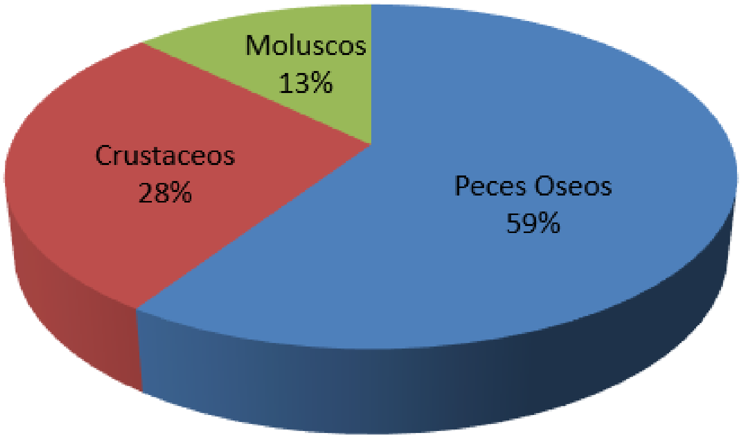


Figure 218. Proportion of catch by group of organisms corresponding to the catch of 2017. Source: https://www.argentina.gob.ar/agricultura-ganaderia-y-pesca

(Translation of Figure 218: Moluscos: Mollusks. Crustáceos: Crustacean. Peces oseos: Bony fish).

A noticeable seasonality in operations is evidenced when analyzing the fleet operations in the North Zone for the 2017 period. Figure 220, Figure 220 and Table 12 show that the greatest activity is concentrated in the months of February to June. Regarding the individual operation of each type of fleet, it is appreciated that said seasonality is distributed throughout the year; the jigger fleet operates between the months of February to May (summer-autumn); the freezer trawler fleet works between the months of May to December, mainly on the common hake resource; and the deep-sea wet-fish stern trawler fleet that also specializes in hake, operates from March to October (Figure 220). Tabla 13 displays the effort represented in the number of vessels per fleet and the seasonality of said operation (Prodoscimi 2019).

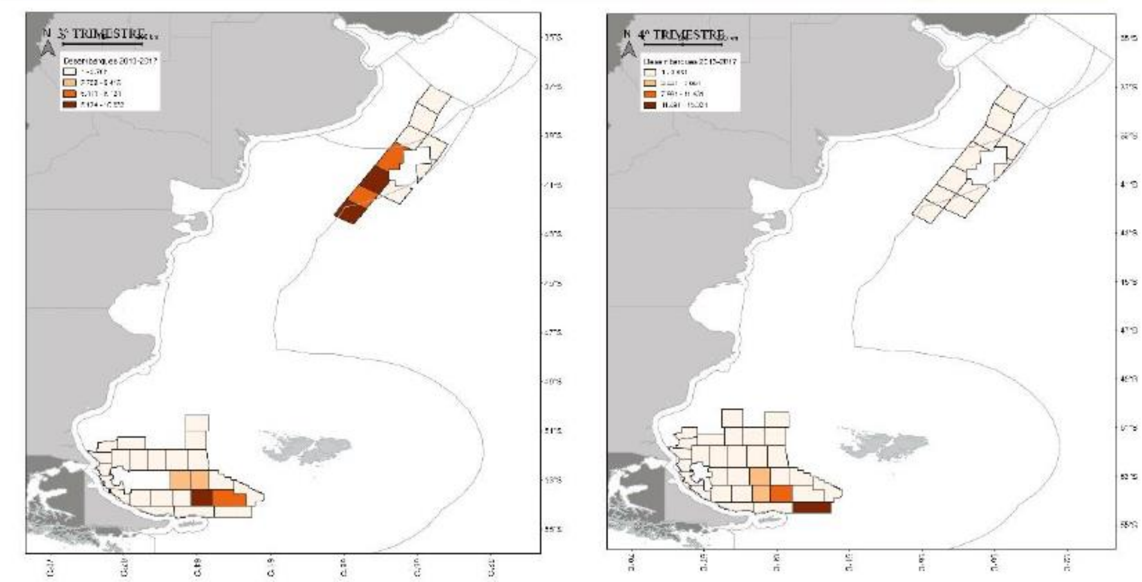


Figure 219. Quarterly distribution of accumulated landings (t) from the north and south areas during the 2013-2017 period. Source: Prosdocimi 2019.

(Translation of Figure 219: 3° Trimestre: Third Quarter. 4° Trimestre: Fourth Quarter, respectively. Reference boxes: Illegible)

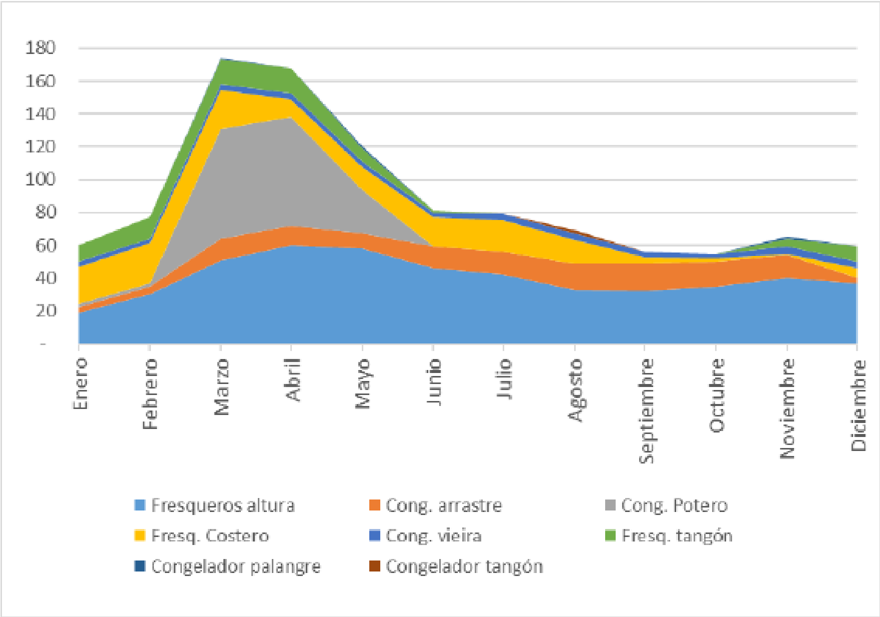


Figure 220. Monthly distribution of the number of vessels per fleet in the northern area during 2017. Source: Prosdocimi 2019.

(Translation of Figure 220: Enero: January. Febrero: February. Marzo: March. Abril: April. Mayo: May. Junio: June. Julio: July.Agosto: August. Septiembre: September. Octubre: October. Noviembre: November. Diciembre: December. Fresqueros de altura: Deep-sea Wet-fish Stern Trawler. Fresquero costero: Coastal wet-fish trawler. Congelador Palangre: Freezer Longliner. Congelador arrastre: Freezer Trawler. Congelador Vieira: Scallop Freezer fleet. Congelador Tangón: Beam Trawler. Congelador Potero: Jigger Fleet. Fresquero Tangon: Wet-fish Beam Trawler).

Table 12. Number of vessels per fleet that took part in the northern area landings during 2017. Source: Prosdocimi 2019.

Translation of Table 12: Months of the year: Idem Figure 220. Flota: Fleet. Fresqueros de altura: Deep-sea Wet-fish Stern Trawler. Congelador arrastre: Freezer Trawler. Potero: Jigger. Fresquero costero: Coastal wet-fish trawler. Congelador Vieira: Scallop Freezer fleet. Fresquero Tangon: Wet-fish Beam Trawler. Otras flotas: Other fleets

Flota	Ene.	Feb.	Mar.	Abril	Mayo	Jun.	Jul.	Ago.	Sep.	Oct.	Nov.	Dic
Fresquero de altura	653	1023	4052	8541	15271	6621	4793	4350	3518	1474	1399	1374
Congelador arrastre	11	113	1476	481	1393	2093	3756	4793	5054	2785	2064	246
Poteros	2	10	9083	7149	362							
Fresquero Costeros	564	205	559	491	1308	738	923	772	250	70	21	60
Congelador vieira	612	610	540	672	553	490	506	327	133	246	394	355
Fresquero tangón	302	266	905	1207	669	60		1			53	96
Otras flotas			100		48			3			8	
Total	**2.143**	**2.227**	**16.716**	**18.541**	**19.604**	**10.003**	**9.977**	**10.247**	**8.955**	**4.575**	**3.938**	**2.130**

Tabla 13. Number of vessels per fleet that took part in the northern area landings during 2017. Source: Prosdocimi 2019.

(Translation of Table 13: Months of the year: Idem Figure 220. Flota: Fleet. Fresqueros de altura: Deep-sea Wet-fish Stern Trawler. Congelador arrastre: Freezer Trawler. Potero: Jigger. Fresquero costero: Coastal wet-fish trawler. Congelador Vieira: Scallop Freezer fleet. Fresquero Tangon: Wet-fish Beam Trawler. Otras flotas: Other fleets).

Flota	Ene.	Feb.	Mar.	Abril	Mayo	Jun.	Jul.	Ago.	Sep.	Oct.	Nov.	Dic
Fresquero de altura	19	30	51	60	58	46	42	33	32	35	40	37
Congelador arrastre	3	5	13	12	9	13	14	16	17	15	14	3
Poteros	2	2	67	66	27							
Fresquero Costeros	23	24	24	11	14	18	19	14	4	2	1	6
Congelador vieira	3	3	3	4	3	3	4	4	3	3	4	4
Fresquero tangón	10	13	15	15	8	1		1			5	9
Otras flotas			1		1			2			1	
Total	**60**	**77**	**174**	**168**	**120**	**81**	**79**	**70**	**56**	**55**	**65**	**59**

Table 14 presents the total landings, in tons, of the main species from the northern area during 2017 and Figura 221 shows their distribution throughout the year. Although hake and squid are the species with the highest volumes declared in the area, it is worth noting the relevance of the area for the scallop fishery.

Table 14. Landings (t) per month, corresponding to each of the main species present in the northern area. Source: Prosdocimi 2019.

(Translation of Table 14: Months of the year: Idem Figure 220. Especie: Species. Merluza común: Common Hake. Calamar: Squid. Rayas: Rays/skates. Vieira: Scallop. Abadejo: Pollock. Resto de las especies: Rest of the species.)

Especie	Ene.	Feb.	Mar.	Abr.	May.	Jun.	Jul.	Ago.	Sept.	Oct.	Nov.	Dic.
Merluza común	334	668	5007	8803	15596	8088	8540	9093	8306	3854	2976	1572
Calamar *Illex*	20	58	9687	7234	584	65	43	104	9	33	20	6
Rayas nep	665	398	725	1310	2248	957	562	468	393	259	229	128
Vieira (callos)	612	610	540	672	553	490	506	327	133	246	394	355
Abadejo	151	218	379	317	270	125	99	49	66	24	39	21
Resto de las especies	361	274	378	206	353	277	228	204	48	158	281	48
Total	**2.143**	**2.227**	**16.716**	**18.542**	**19.604**	**10.003**	**9.977**	**10.247**	**8.955**	**4.575**	**3.938**	**2.130**

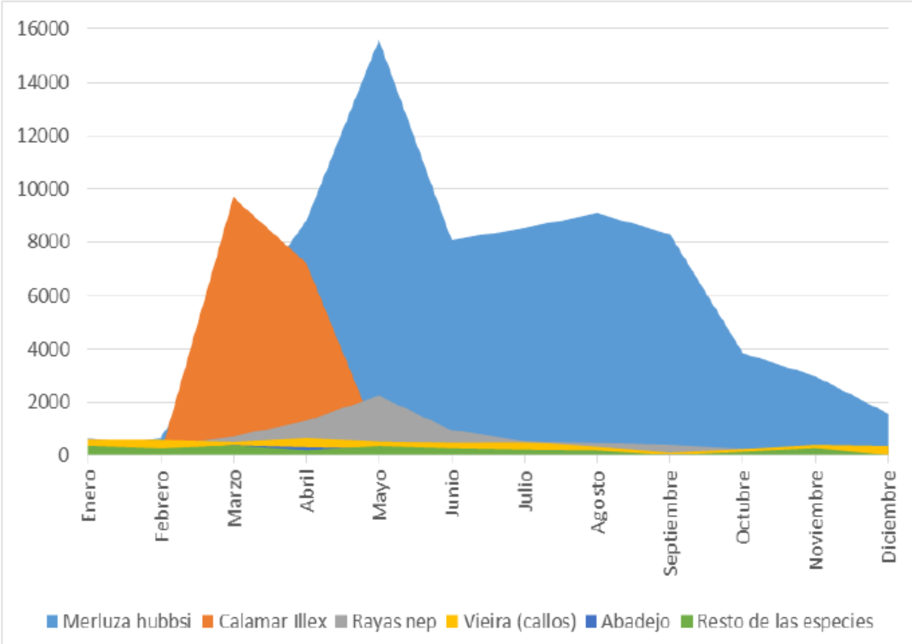


Figura 221. Monthly distribution of landings (t) from the northern area during 2017. Source: Prosdocimi 2019.

(Translation of Figure 221: Months of the year: Idem Figure 220. Merluza Hubbsi: Argentine Hake. Calamar: Squid. Rayas: Rays/skates. Vieira: Scallop. Abadejo: Pollock. Resto de las especies: Rest of the species

Figure 222 presents the quarterly distribution of landings. These maps were prepared using the information on landings from the database of the National Directorate of Fisheries Coordination generated from the information gathered from the fishing parties (statements) and landing records (findings in port) (Martinez-Puljack et al. 2018, Prosdocimi 2019).

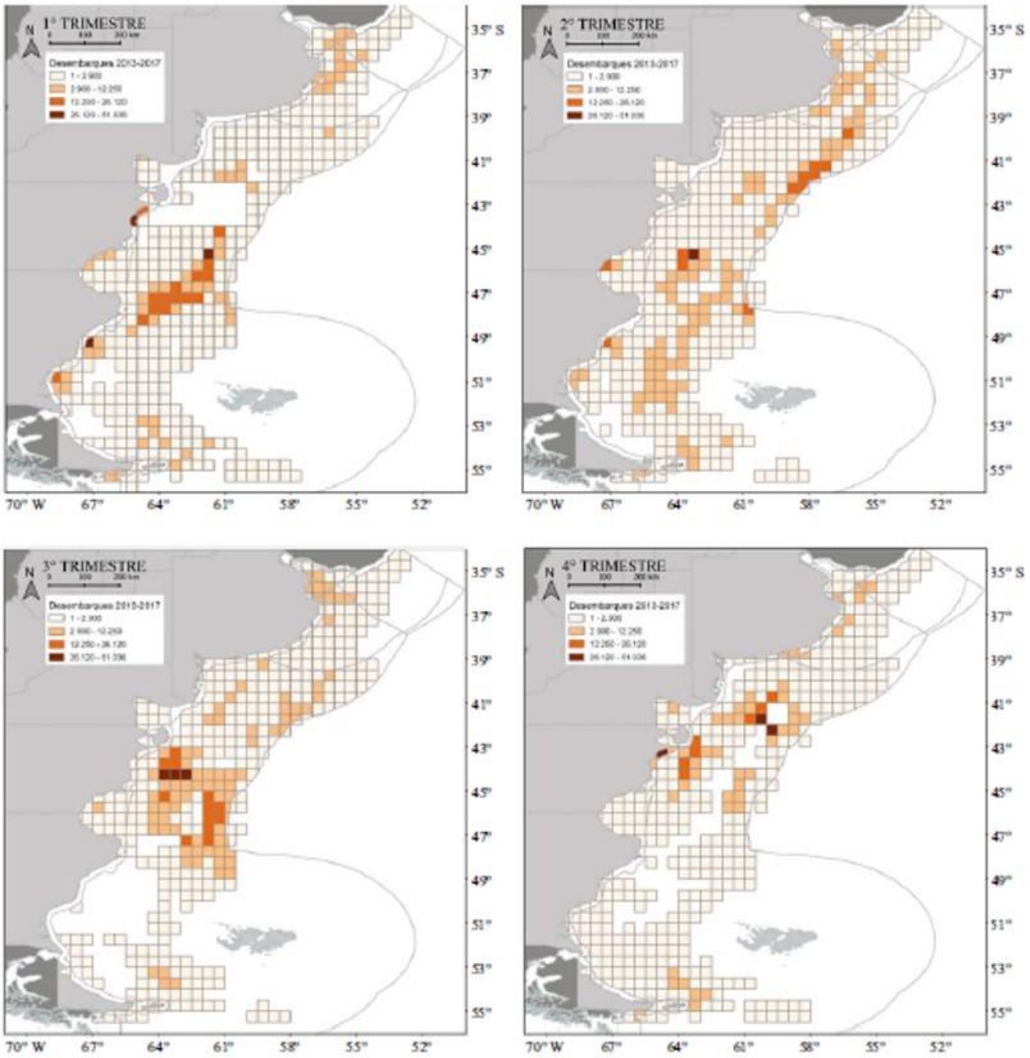


Figure 222. Distribution of landings (t) by quarter, made by the Argentine commercial fleet in the Argentine Economic Exclusive Zone, during the 2013-2017 period. Source: Prosdocimi 2019.
(Translation of Figure 222: Trimestre: Quarter. Reference boxes: Illegible).

The highest density of catches is concentrated in the Buenos Aires and Patagonian shelf, with relevance in the April-June period close to the edge of the slope in the northern sector. The prospecting area is close to the landing areas during the 2nd quarter of the year.

When analysing the fleet operations in the Northern basin, there is no evidence of a high volume of landings by the Argentine commercial fleet for the 2013-2017 period.

From Figure 223 to Figure 228 the spatial distribution of the different fishing fleets with respect to the detailed study area defined for the project, allowing to appreciate a marginal relationship with the fishing areas is shown.

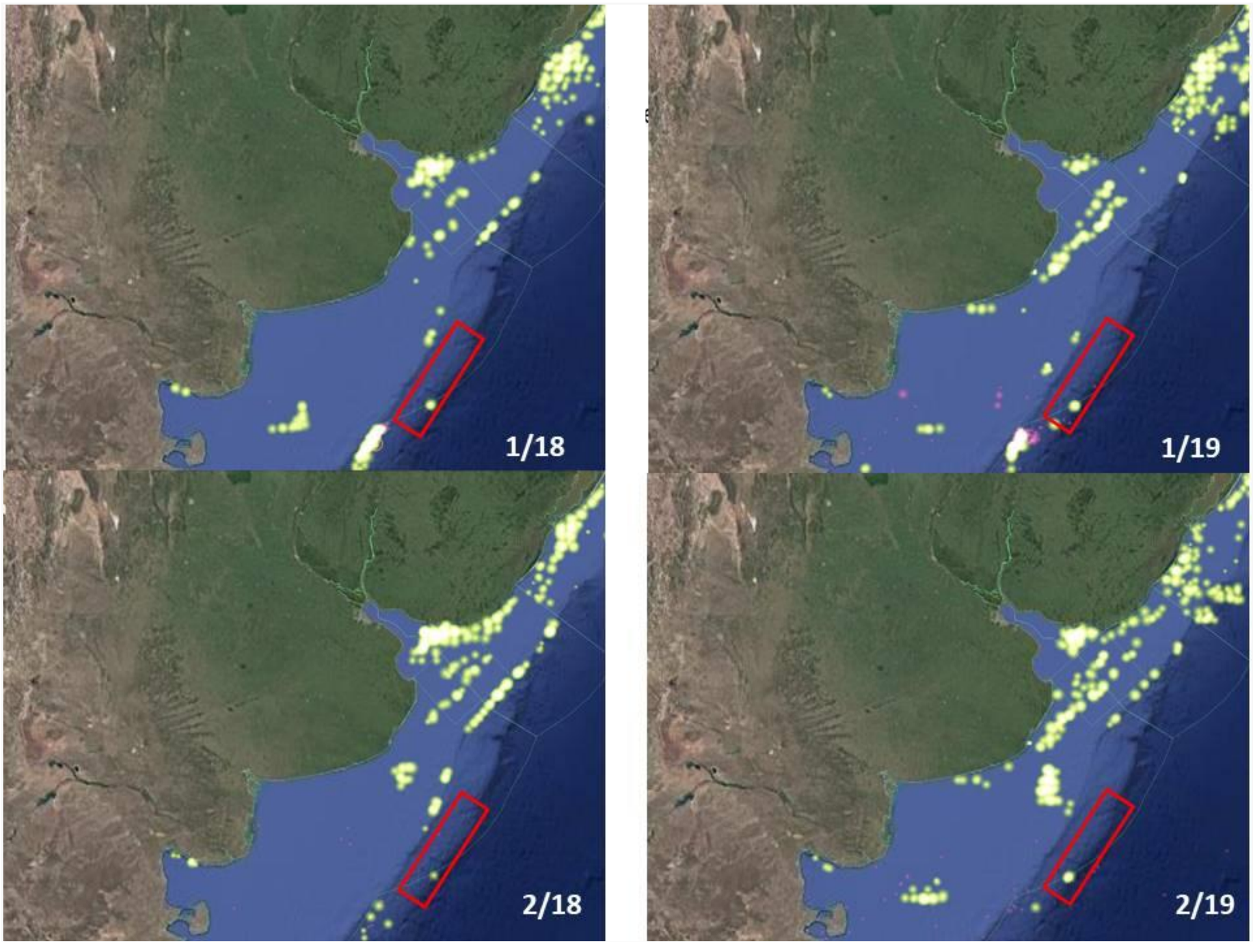


Figure 223. Location of fishing vessels regarding the indirect area of influence of the project (red rectangle). Source: www.globalfishingwatch.org.

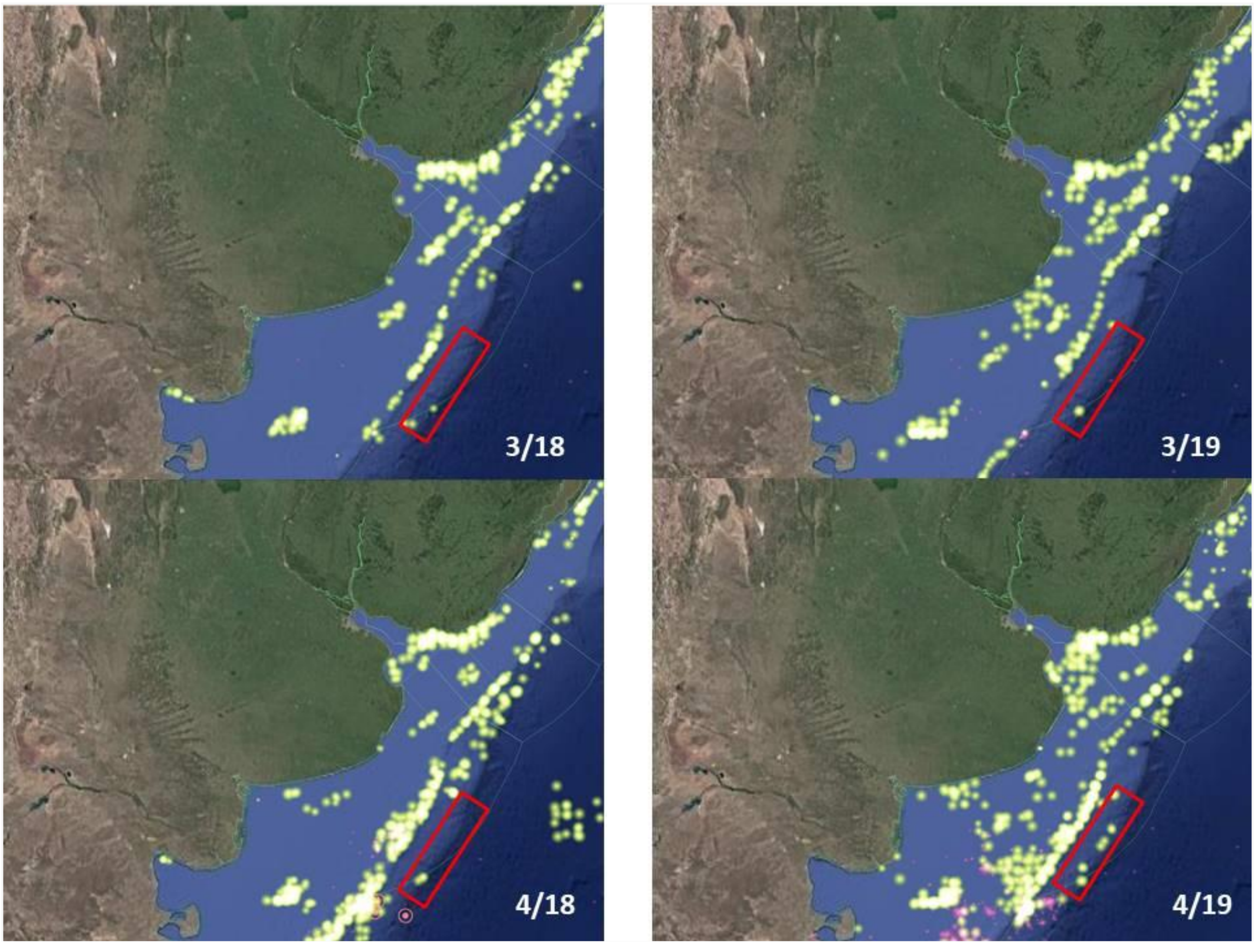


Figure 224. Location of fishing vessels regarding the indirect area of influence of the project (red rectangle). Source: www.globalfishingwatch.org.

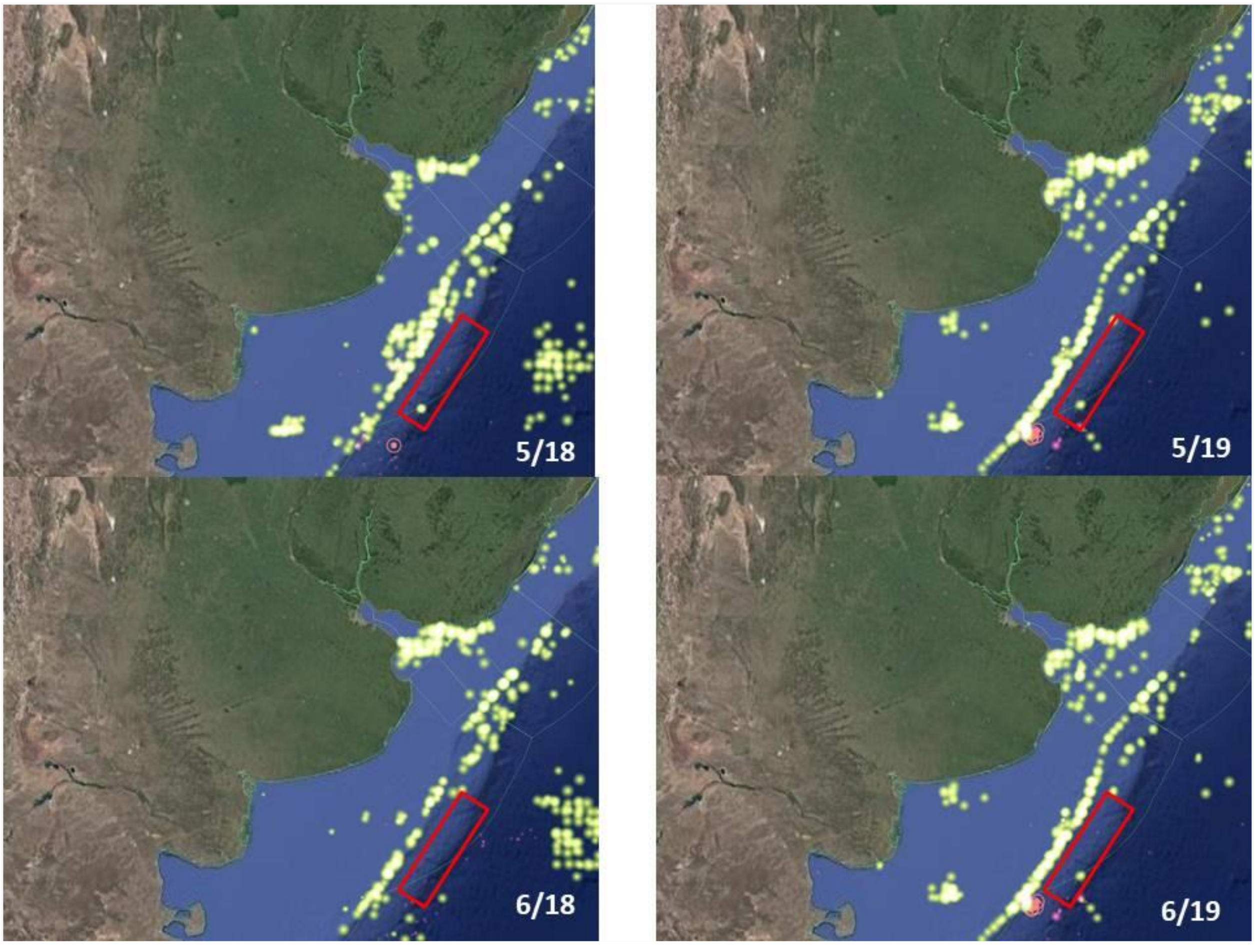


Figure 225. Location of fishing vessels regarding the indirect area of influence of the project (red rectangle). Source: www.globalfishingwatch.org.

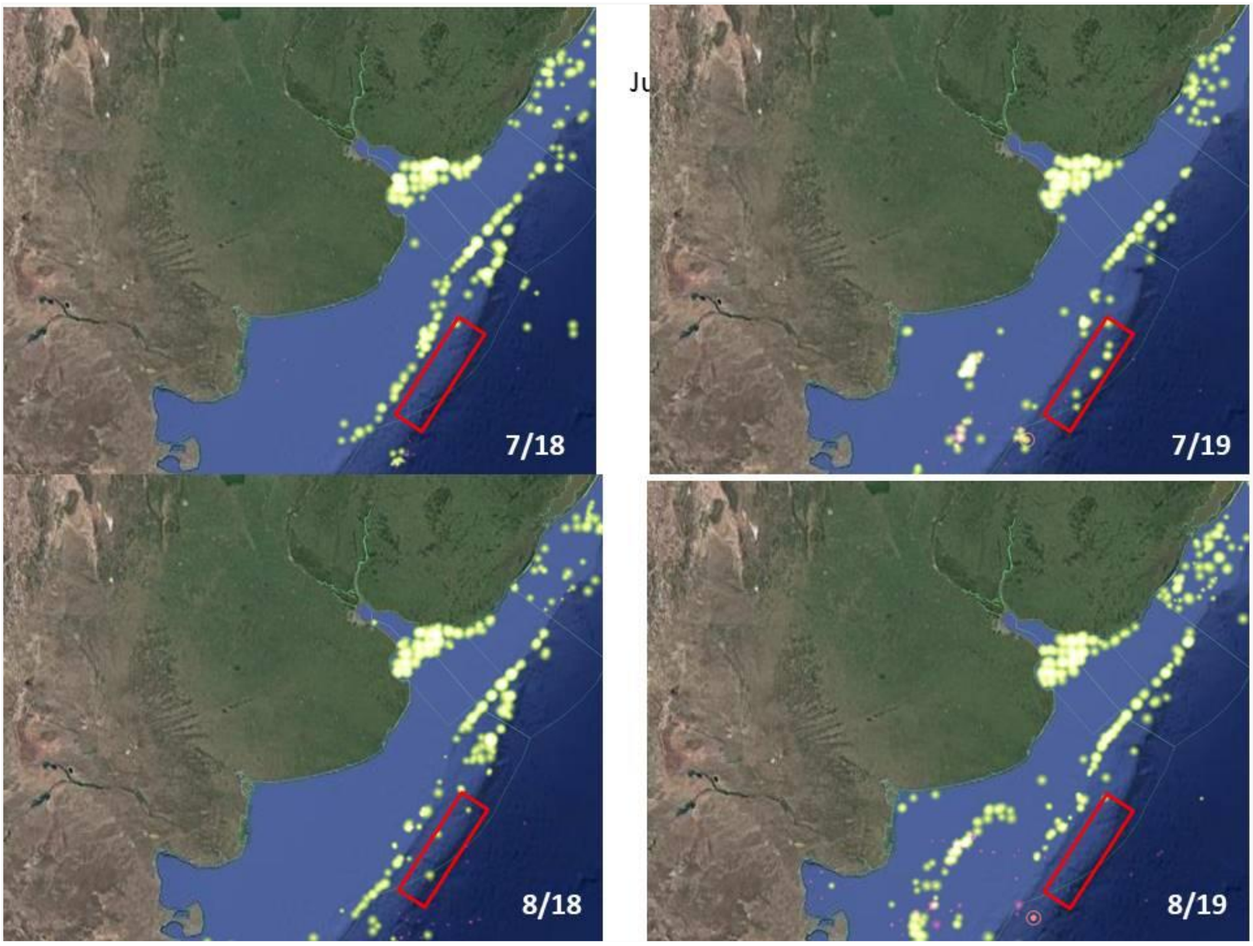


Figure 226. Location of fishing vessels regarding the indirect area of influence of the project (red rectangle). Source: www.globalfishingwatch.org.

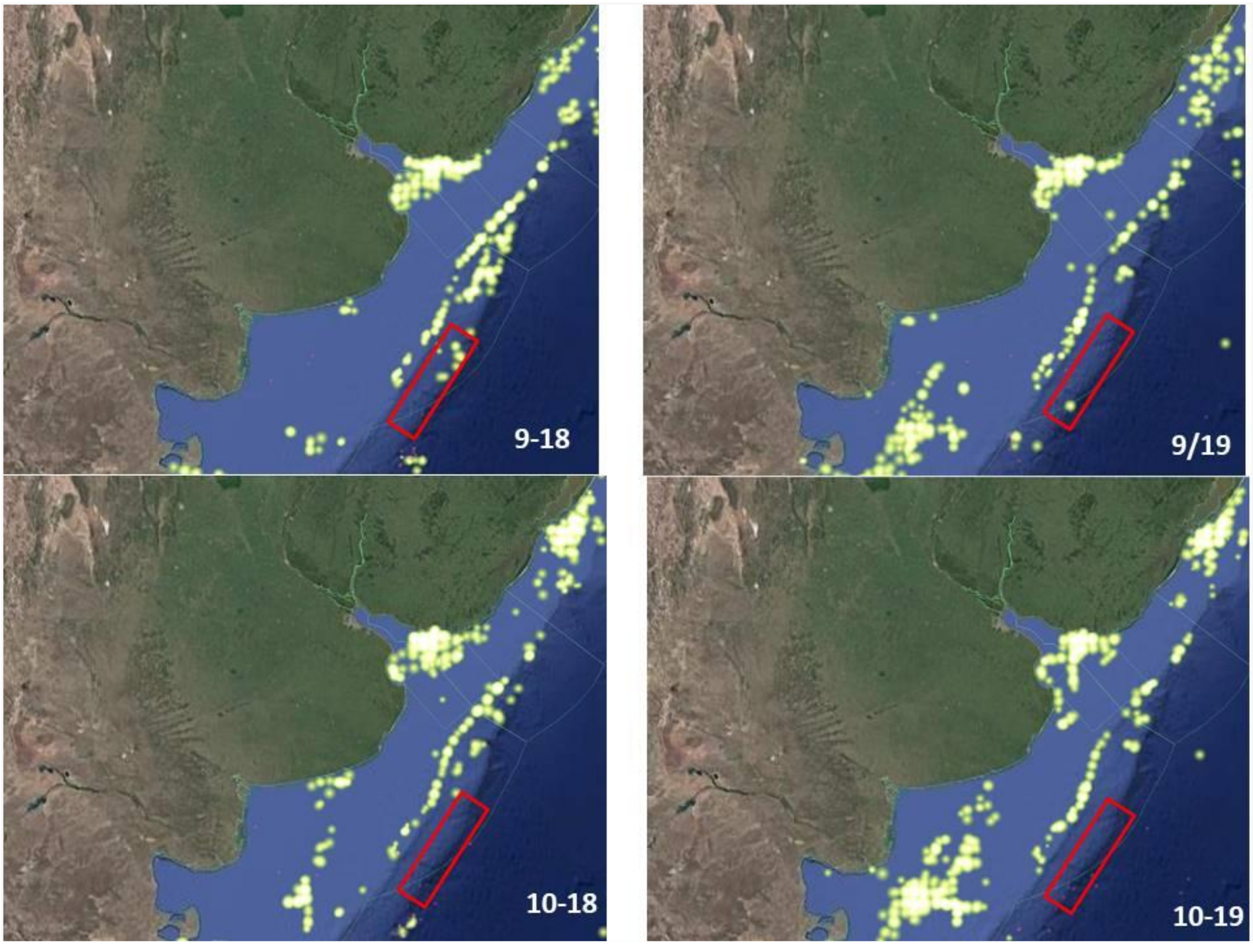


Figure 227. Location of fishing vessels regarding the indirect area of influence of the project (red rectangle). Source: www.globalfishingwatch.org.

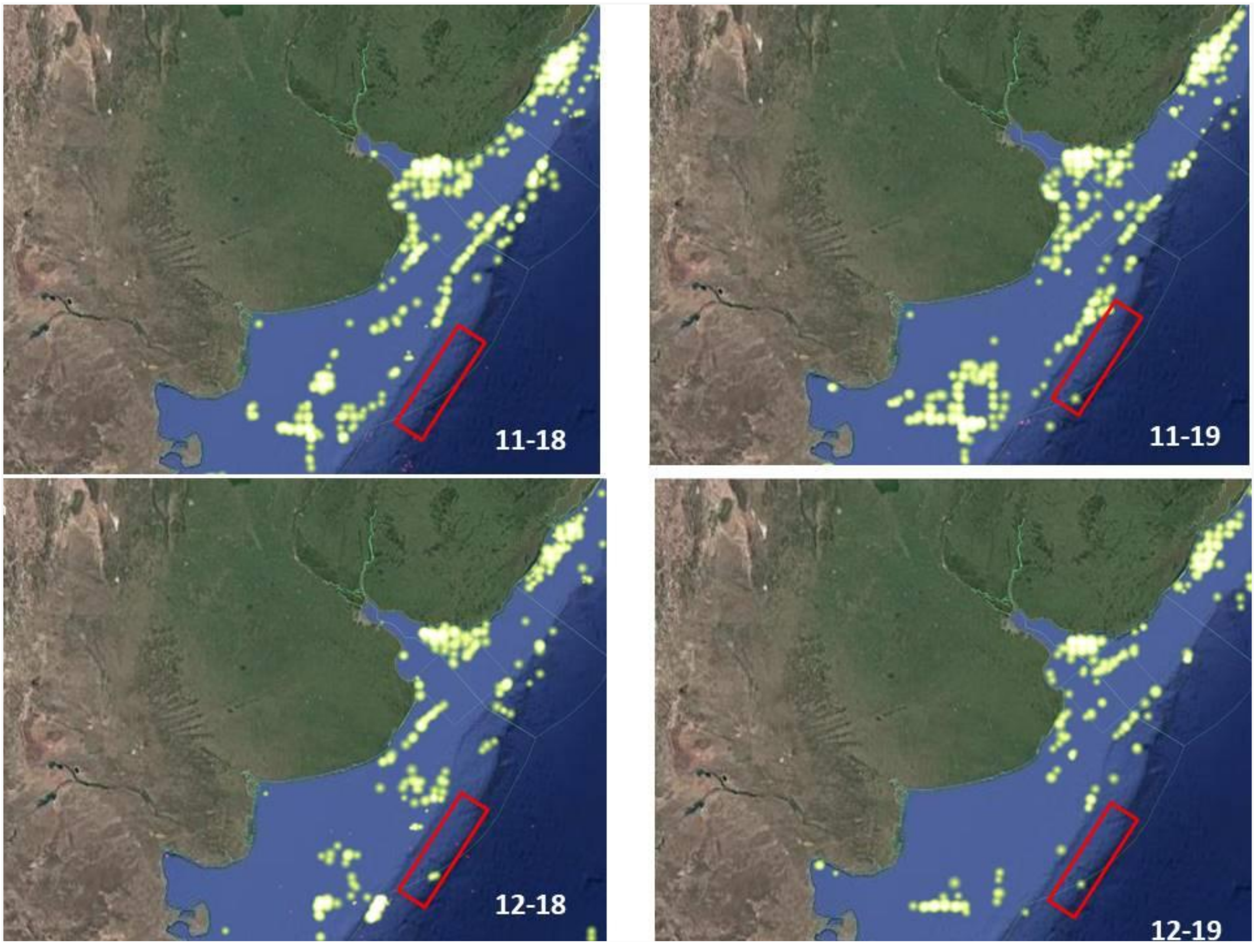


Figure 228. Location of fishing vessels regarding the indirect area of influence of the project (red rectangle). Source: www.globalfishingwatch.org.

By integrating the temporary nature of the catches in the area adjacent to the project, it is observed that the most critical period due to fishing effort occurs between March and June (2nd quarter).

4.3.1.7.4 Main landing ports associated with the project

Mar del Plata is the main landing port for bony and cartilaginous fish. It has received 63% of the catches for the 2000-2018 period, hence, it is expected that the fleet interfering with the project activities shall correspond mainly to vessels from that port (Figure 229) (MAGyP).

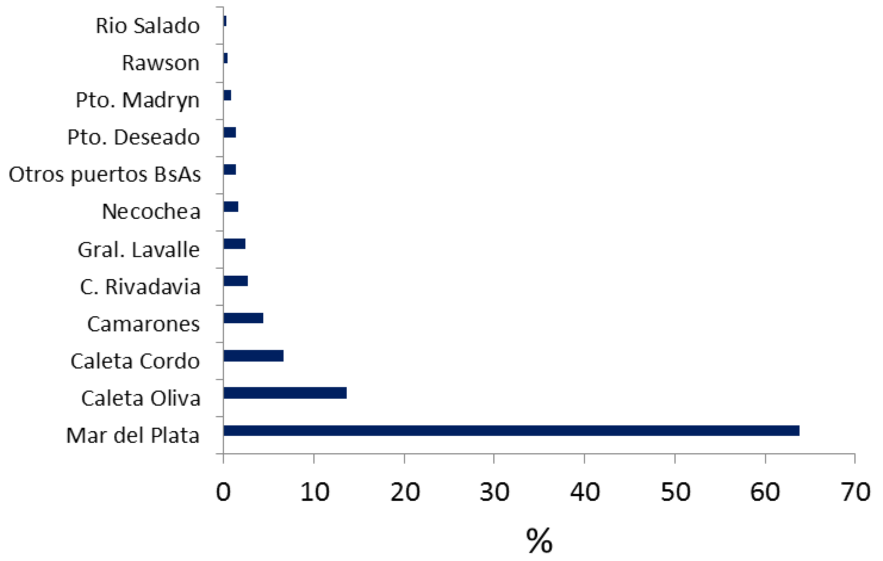


Figure 229. Relative importance of catches entering Argentine ports. Source: MAGyP 2018

Figure 230 displays the number of vessels (total) by type of fleet, and Figure 231 shows the annual percentage by species and fleet that reported catches of southern demersal fish (2004-2016) (Gorini and Giussi 2018).

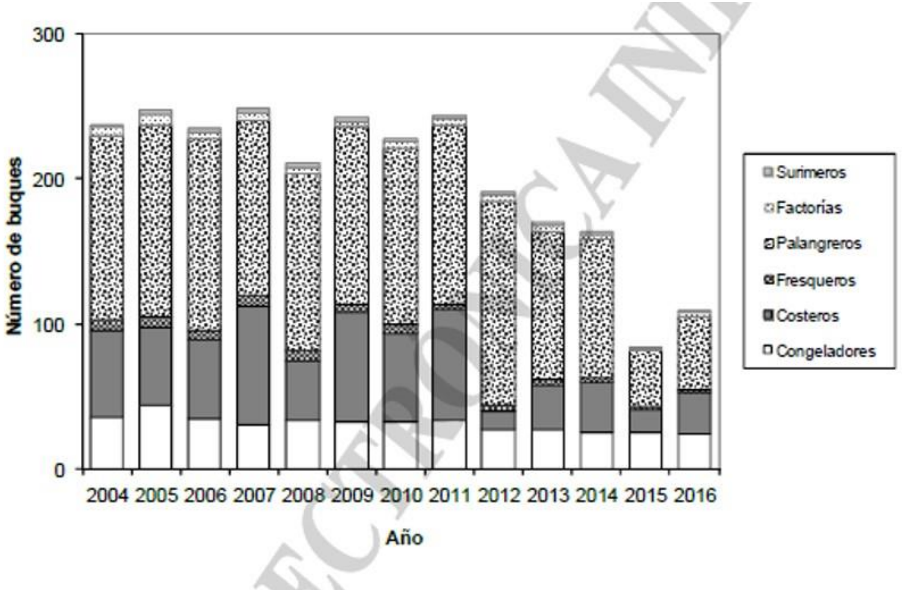


Figure 230. Number of vessels that reported catches of southern demersal fish by type of fleet (2004-2016). Source: Gorini and Giussi 2018.

(Translation of Figure 230: Número de Buques: Number of vessels. Año: year. Surímeros: Surimi Fleet. Factorías: Factory Fleet. Palangreros: Longliner fleet. Fresqueros: Wet-fish Stern Trawler fleet. Costeros: Coastal Fleet. Congeladores: Freezer trawler fleet.)

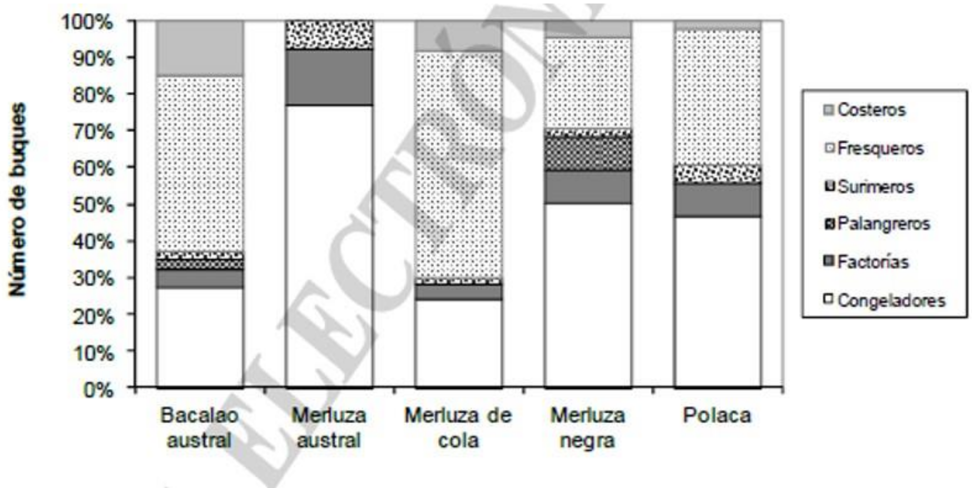


Figure 231. Annual percentage of Argentine vessels that reported catches of southern demersal fish by species and type of fleet (2004-2016). Source: Gorini and Giussi 2018.
(Translation of Figure 231: Número de Buques: Number of vessels. Costeros: Coastal Fleet. Fresqueros: Wet-fish Stern Trawler fleet. Surímeros: Surimi Fleet. Palangreros: Longliner fleet. Factorías: Factory Fleet. Congeladores: Freezer trawler fleet. Bacalao austral: Southern cod. Merluza Austral: Southern Hake. Merluza de cola: Hoki. Merluza negra: Patagonian toothfish. Polaca: Southern Blue Whiting.

For more information see Anthropic Environment: **Error! Reference source not found.** Fishing Activity- Primary Fishing Sector (catches).

4.3.1.7.5 Species of commercial interest

4.3.1.7.5.1 Fisheries of Macrocrustacean

Within the macrocrustaceans of economic interest we can mention three species (red crab, swimming crab and lobster) but only two of them are found in the indirect area of influence of the project to the north of the area of operation of CAN_100-108 areas; the red crab and the spider crab.

Southwest Atlantic Red crab (*Chaceon notialis*)

Between December 2003 and February 2004, a preliminary survey was carried out on this species in Argentina, with the "Wiron IV" fishing vessel, aimed at determining its commercial potential in Argentine waters of the Argentine-Uruguayan Common Fishing Zone (ZCPAU). The results obtained showed its presence between 37 ° S and 38 ° S latitudes, at depths close to 1000 m; the bathymetric distribution of the species in the Argentine sector of the ZCPAU seems to reach greater depth than that observed in Uruguay (300 to 1000 m). Figure 232 presents the catches obtained in this survey expressed in number of individuals per line of 100 traps (Wyngaard et al. 2006).

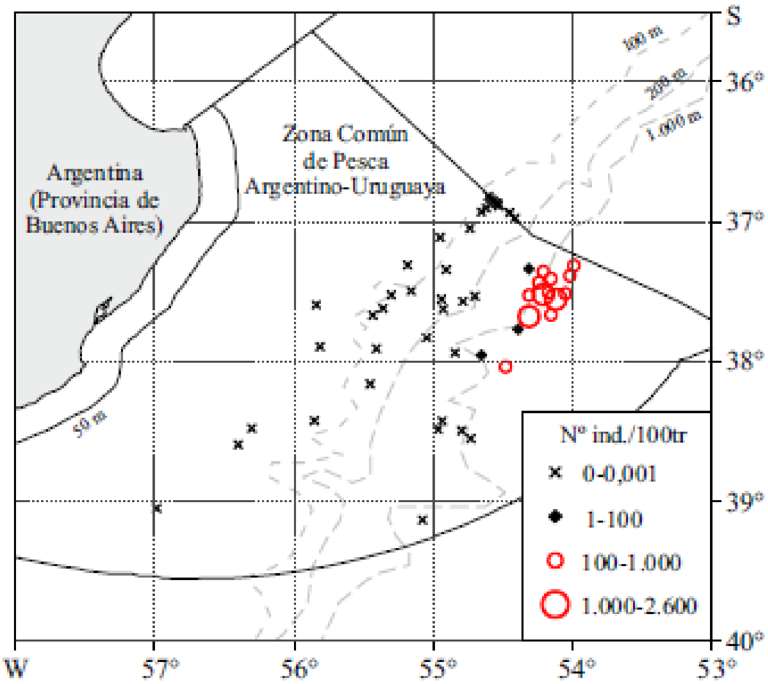


Figure 232. Distribution of the red crab catches obtained in the survey carried out with the "Wiron IV" Fishing Vessel during 2003-2004. Source: Boschi 2016.

(Translation of Figure 232: Zona común de pesca Argentino - Uruguaya: Argentine-Uruguayan Common Fishing Zone. N° ind: Number of individuals. Argentina, Provincia de Buenos Aires: Argentina: Province of Buenos Aires. Argentina.)

The observed red crab catches consisted almost exclusively of males, the most important yields were concentrated near 37 ° 30´S parallel, at depths greater than 1000 m. The catches were around 2,500 specimens per line of 100 traps (approximately 330 kg) and the sizes observed were smaller than those described for the Uruguayan fishery. Due to vessel limitations, it has not been possible to establish the outer limit of the distribution beyond 1200 m-deep (Boschi 2016).

Rowing Crab (*Ovalipes trimaculatus*)

The rowing crab catches in Argentina are small and incidental, as a companion fauna of the fishing of coastal species. Landings are made mainly in the ports of Mar del Plata, San Antonio Oeste and Quequen-Necochea (80, 18 and 2% respectively average 1991-2003), with a small market that remains relatively stable. This species is considered to have a high commercial value due to the quantity and quality of its meat, however, landings never exceeded 95 t (Boschi 2016).

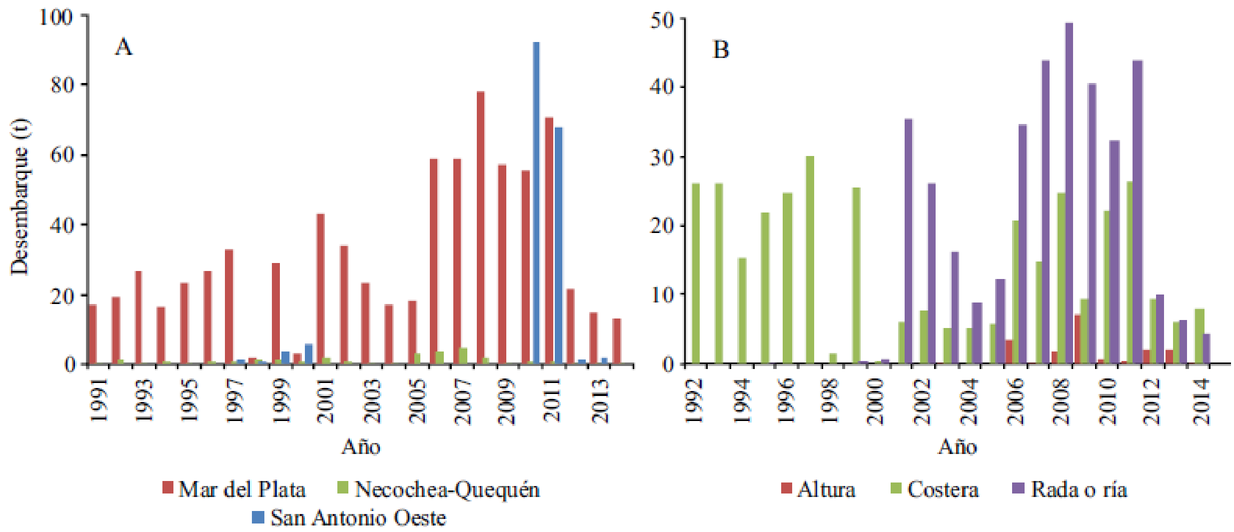


Figure 233. Evolution of rowing crab landings in the ports of Mar del Plata, San Antonio Oeste and Necochea - Quequen (A) and landings in the port of Mar del Plata by fleet (B). Source: Boschi 2016.

(Translation of Figure 233: Desembarque: Landing. Año: Year. Altura: Deep sea fleet. Costera: Coastal fleet. Rada/Ría: Estuary Fleet).

The landings made by the coastal and estuary fleet between 2004-2013 in the three most important ports mentioned above come mainly from two sectors, one north of Mar del Plata between 37 ° S and 38 ° S, and the other in front of San Antonio Oeste (Figure 234). In both cases the highest catches were obtained between the 50 m isobaths and the coast.

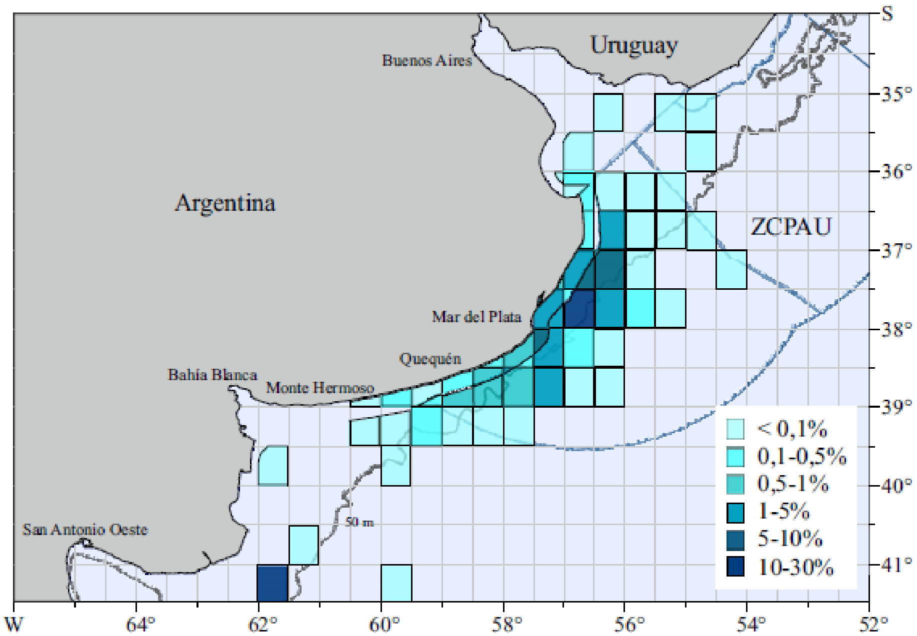


Figure 234. Percentage contribution of each grid to rowing crab catches during the 2004-2012 period in the ports of Mar del Plata, San Antonio Oeste and Necochea-Quequén. Source: Boschi 2016.

Patagonian lobsterette (*Thymops birsteini*)

In Argentina, the information available on the species has been collected for the most part by INIDEP observers aboard the commercial fleet targeting toothfish, a species that has a geographic distribution similar to that of the lobsterette. These vessels operate along the slope, fishing with trawl nets, longlines or fish traps, and occasionally catch lobster. In the case of longliners, they report that it is frequent to extract lobster specimens on longline hooks, when they operate in submarine canyons transverse to the continental slope. More than 1,000 specimens have been registered, collected in 127 fishing sets. The limiting factor to carry out an exploratory activity in order to locate profitable concentrations of this species to sustain an exploitation, requires the availability of vessels equipped with proper technology and gear to operate 400 to 2000 m-deep (Boschi 2016) (Figure 235).

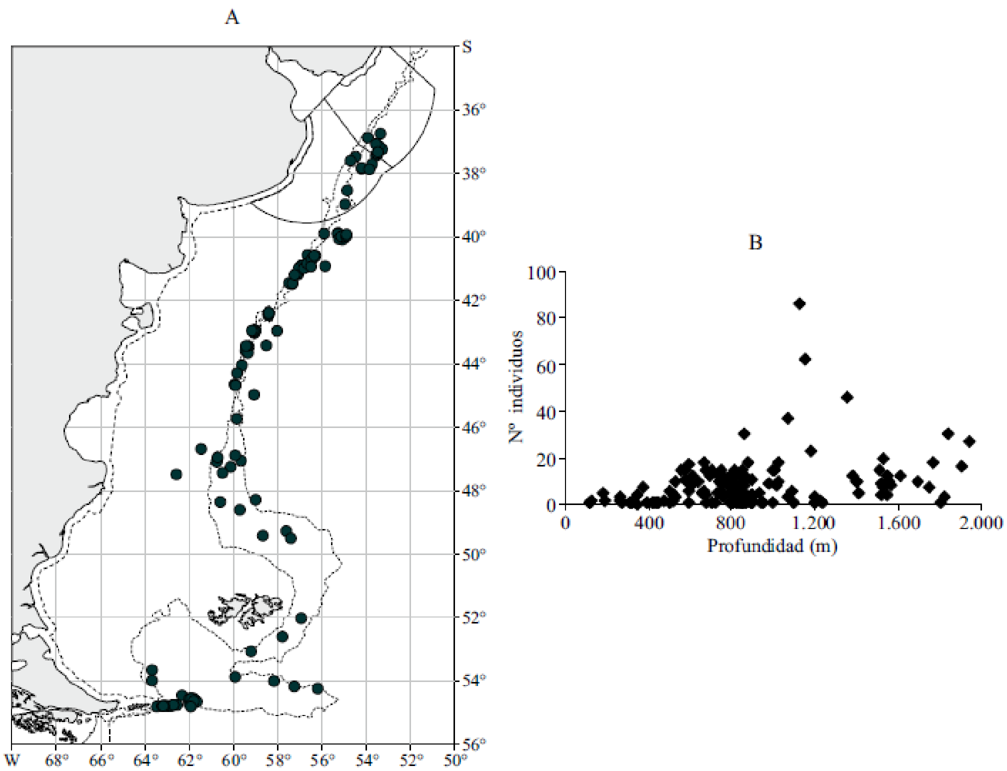


Figure 235. Distribution (A) and depth of fishing sets (B) where the Patagonian lobsterette (Thymops birsteini) was caught. Source: Boschi 2016.

(Translation of Figure 235: N° individuos: number of individuals. Profundidad: Depth).

The exploitation of the red crab is not carried out in Argentina, the rowing crab is far from the prospecting area since it is concentrated in the 50 m isobath (estuary fleet). Meanwhile, the lobster is only occasionally caught by vessels that operate along the slope (with trawls, longlines or pots).

4.3.1.7.5.2 Fisheries of Cephalopods

Prandoni (2018) recorded the cephalopod species in the catches of the Argentine commercial trawler fleet (2003-2017). *Illex argentinus* is the most abundant and sought after ommastrephidae, fished to a greater extent by national and overseas fishing vessels using the “jigging” method or jiggers. This fishery is one of the three most important fisheries in the world in terms of total catches: 328,793 t of the species were caught in the Argentine Sea in 2017 (Brunetti et al.1999: Ivanovic et al.2017; Jereb and Roper 2010). In terms of profits, the Argentine fleet landed a total of 117,039 t of Argentine squid during 2015, with an export balance of about 95,000 t, which generated revenues of more than 100 million dollars (SSPy A 2018).

In addition, there are two other species of loliginidae commonly called "squid"; *Dolytheuthis sanpaulinensis* and *Dolytheuthis gahi*, whose meat is of better quality. Another important species is *Onykia ingens*, which is larger and has little commercial interest, and the oceanic *Ommastrephes bartramii* and *Martalia hyadese*, also potentially exploitable, but with subtropical and subpolar distributions respectively (Brunnetti et al 1998: Jere and Roper 2010).

Three species of squid stand out in the indirect area of influence of the project;

Doryteuthis gahi

The Patagonian Squid is the most fished species in terms of the number of sets, being caught in a total of 12,885 sets by 154 different boats between 2003 and 2017. The catches were quite distributed among different fleets, although the majority of catches were in freezers / factory vessels of southern species, it also appears in freezer trawlers for hakes, surimeros and others. During the 2003-2017 period, this species accounted for 38% of the total sets of the entire fleet in terms of cephalopod catch and 31% in number of catches by weight (Prandoni 2018).

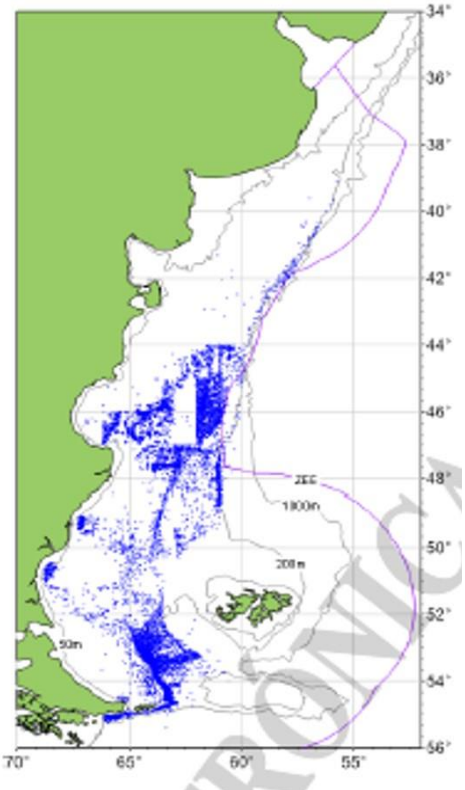


Figure 236. Map of *D. gahi* catches (n = 12,885) in the Argentine sea. Source: Prandoni 2018.

The range of depths depending on its location, generally on the platform or the beginning of the slope, was between 50 and 350 m-deep. However, the vast majority appeared in fishing sets less than 500 m deep. The range of temperatures was highly variable depending on its geographical distribution: from colder temperatures in the south (min: 0.5 ° C) to higher temperatures in the north of its distribution (max: 15.8 ° C) (Figure 237) (Prandoni 2018). The nucleus of this fishery, therefore, has no spatial relationship with the area of influence of the project.

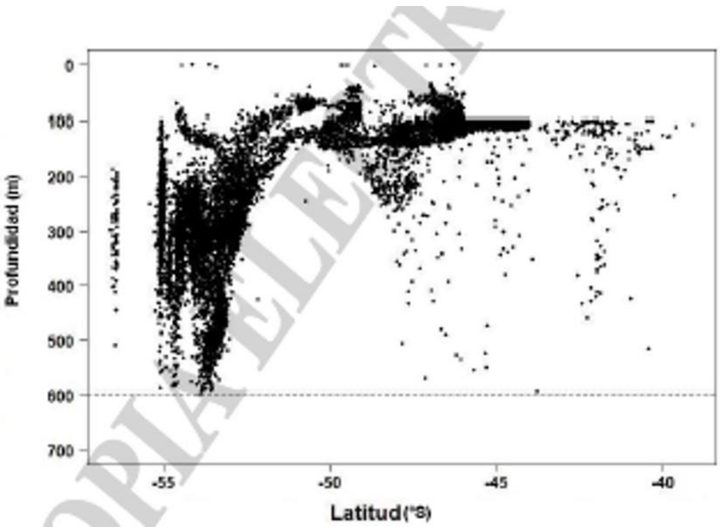


Figure 237. Profile of mean depths in latitude of the fishing hauls/sets of the species (points). The dashed line represents the maximum depth of appearance. Source: Prandoni 2018.
(Translation of Figure 237: Profundidad: Depth. Latitud: Latitude).

*Onykia ingens (*Greater Hooked squid*)*

O. ingens is the second species with the highest presence in the 2003-2017 period, caught in a total of 11,678 sets by 69 different vessels (38%) of the total sets of the entire fleet in terms of cephalopod catch). The majority of catches were registered in part by freezer-processing vessels of southern species (48% of the total) and surimeros (25% of the total). Almost a thousand and a half tons (1,449,119) were fished in total, of which 1,248 t were discarded; the average number of kilos of fish per set was 129 kg. It accounted for 67% of the total amount of catches by weight and, hence, it was the species with the highest catch by weight (Prandoni 2018).

The geographical distribution of catches of *O. ingens* was similar to that of *D. gahi*, although it differs in some aspects (Figure 238). The majority of catches came about with surimero and processor vessels in southern species of cold southern waters of the continental shelf, between Tierra del Fuego and the Falkland Islands (Islas Malvinas) (52°- 56° S), progressively following the continental platform towards the north at medium depth until reaching the waters of the continental platform near the slope, occupying the latter, whose northern latitude limit is near the Province of Buenos Aires (until approx. 38° S).

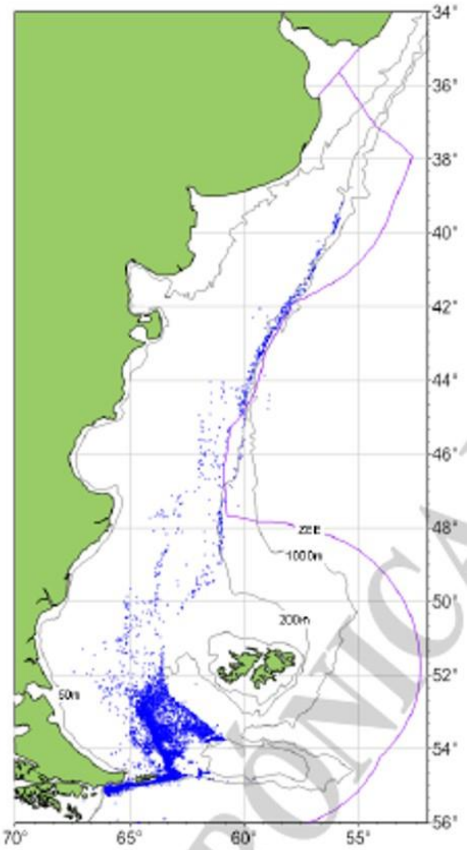


Figure 238. Map of *O. ingens* catches (n = 11,678) in the Argentine Sea. Source: Prandoni 2018.

The depth range was between 100 and 1893 m depending on its location, generally on the shelf or the beginning of the slope. However, the vast majority appeared in less than 500 m-deep fishing sets. The temperature range of the catch areas was also highly variable depending on their geographical distribution: from colder temperatures in the south (min: 0.8 ° C) to higher temperatures in the north (max: 13.8 ° C) (Figure 239) (Prandoni 2018). For this species, the same considerations apply as for *D. gahi*, taking into account the very marginal relationship that the fishing sites have with the project area.

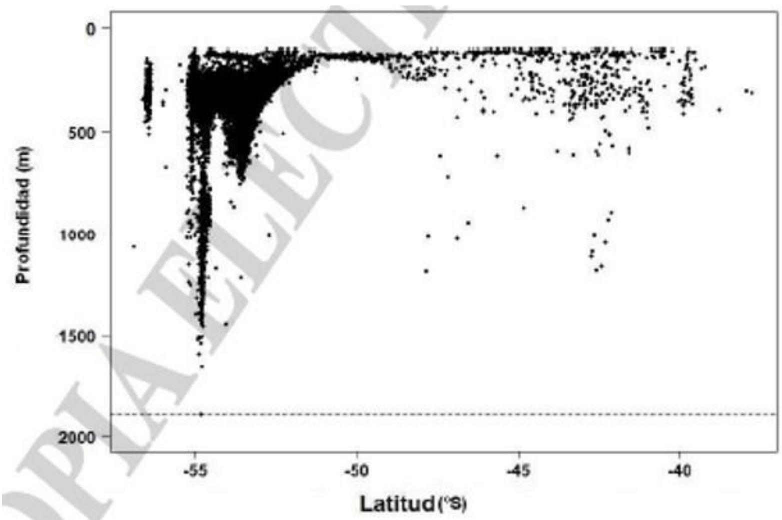


Figure 239. Profile of mean depths in latitude of the species fishing hauls/sets (points). The dashed line represents the maximum depth of appearance. Source: Prandoni 2018.
(Translation of Figure 239: Profundidad: depth. Latitude: Latitude).

Illex argentiniensis

The Argentine squid fishing season runs from February 1 to August 31, when the species is migrating over the continental shelf. The rest of the year a ban is applied to protect juveniles. The management of the fishery considers two Management Units (MU) that are distributed to the north and south of 44 ° and based on the population structure, the characteristics of the ecosystems in which the Stocks inhabit and the commercial yields (Figure 240). The fishing season begins in the southern MU where, between February and early March, the SDV is fished on the internal platform (Figure 240-1° quarter). Then the fleet moves south and east to fish for the SSP (Figure 240- 2nd quarter). Fishing in the southern MU is the most important period in terms of total catches. In recent years, the season began in January to maximize the use of post-Breeding concentrations of SDV. Historically, the exploitation of the SBNP began in May in the northern MU, although in recent years fishing began in April in order to catch squid before its emigration to deep waters. Late in the winter, the catches in this MU fall on the SDP (Figure 240- 2nd and 3rd quarter) (Allega et al. 2020).

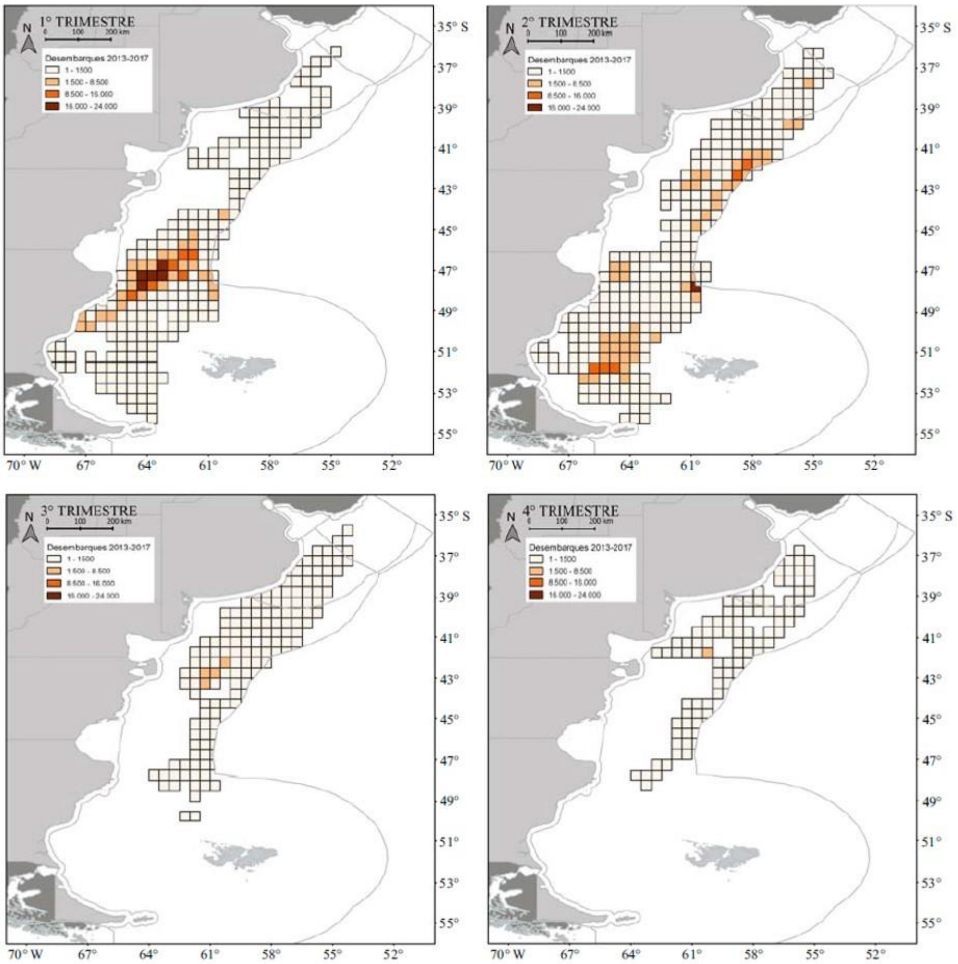


Figure 240. Distribution of landings (t) of the Argentine squid by quarter, *Illex argentinus*, during 2013 - 2017 period. Source: Allega et al. 2020.

(Translation of Figure 240: Trimestre: Quarter. Desembarques: landings)

Analysis of Cephalopods fisheries

The deep-sea fleet accounts for the highest fishing effort in terms of percentage of sets and catches of cephalopods by weight; while the coastal fleet registered the minimum total catches in Table 15.

Table 15. Abundance of species and vessels according to the fishery. Source: Prandoni 2018.

(Translation of Table 15: Pesquería: Fishery. N° Especies: Number of Species. Especies dominantes: predominant species. N° Barcos: number of vessels. N° Lances: number of fishing sets. Lances: fishing sets. Congelador Procesador: Freezer trawler. Especies australes: southern species. Cong.Procesador, merluceros: Freezer trawler for fishing hake. Surímeros: Surimero. Tangonero: Beam Trawler. Fresquero Merlucero: Wet fish stern trawler for fishing hake. Fresqueros anchoíta: Wet fish stern trawler for fishing anchovy. Fresquero caballa: Wet fish stern trawler for fishing mackerel. Fresquero Raya: Wet fish stern trawler for fishing rays/skates. Costero fresquero+ flota amarilla: Coastal Wet fish stern trawler + Yellow fleet.)

PESQUERÍA	n.Especies	Sps.Dominantes	n.Barcos	Barcos (n. Lances)	Kg Total	% Lances	% kg
Cong. Procesador Especies Australes	9	*O. ingens* *D. gahi*	36	San Arawa II (3.893) Echizen Maru (3.131)	758.135	36%	34%
Cong. Procesador Merluceros	7	*D. gahi* *O. ingens*	53	Fonseca (489) Pescagen IV (468)	457.446	18%	21%
Surimeros	8	*O. ingens* *D. gahi*	5	Tai An (3.269) Yamato (1.027)	752.652	14%	34%
Tangoneros	8	*D. sanpaulensis* Octopodidae	107	Arbumasa XVIII (589) Borrasca (478)	86.263	24%	4%
Fresqueros Merluceros	7	*D. gahi* *D. sanpaulensis*	59	Virgen María (291) Sirius II (196)	87.333	7%	4%
Fresqueros Anchoíta	1	*D. gahi*	5	Atrevido (51) Rafaela (16)	859	<1%	1%
Fresqueros Caballa	2	*D. sanpaulensis* *O. ingens*	2	Centauro 2000 (16) Atrevido (14)	173	<1%	1%
Fresqueros Raya	3	*D. sanpaulensis* Octopodidae	1	Chiarapesca 56 (56)	363	<1%	1%
Costeros Fresqueros + Flota Amarilla	5	*D. sanpaulensis* Octopodidae	10	Porto Bello II (142) Nono Pascual (35)	6.744	1%	2%

Most of the catches corresponded to the southern species freezers and / or processor trawlers, the freezer trawlers for hake fishing , beam trawlers for prawn fishing and surimeros (Figure 241). The fleet fishing southern species was the one that recorded the greatest variety, while the Beam trawlers fleet is the one with the largest number of operating vessels. As can be seen, the fleet that is closest to the project area corresponds to the hake freezers and wet-fish Stern trawlers.

In general, the fisheries with the highest presence of O. ingens (most caught species by weight) had more total catches by weight (kg) and higher (%) percentage over the total. In the case of the Surimi fleet, for example, only 14% of the total sets represented 34% of the total catches by weight of all fleets.

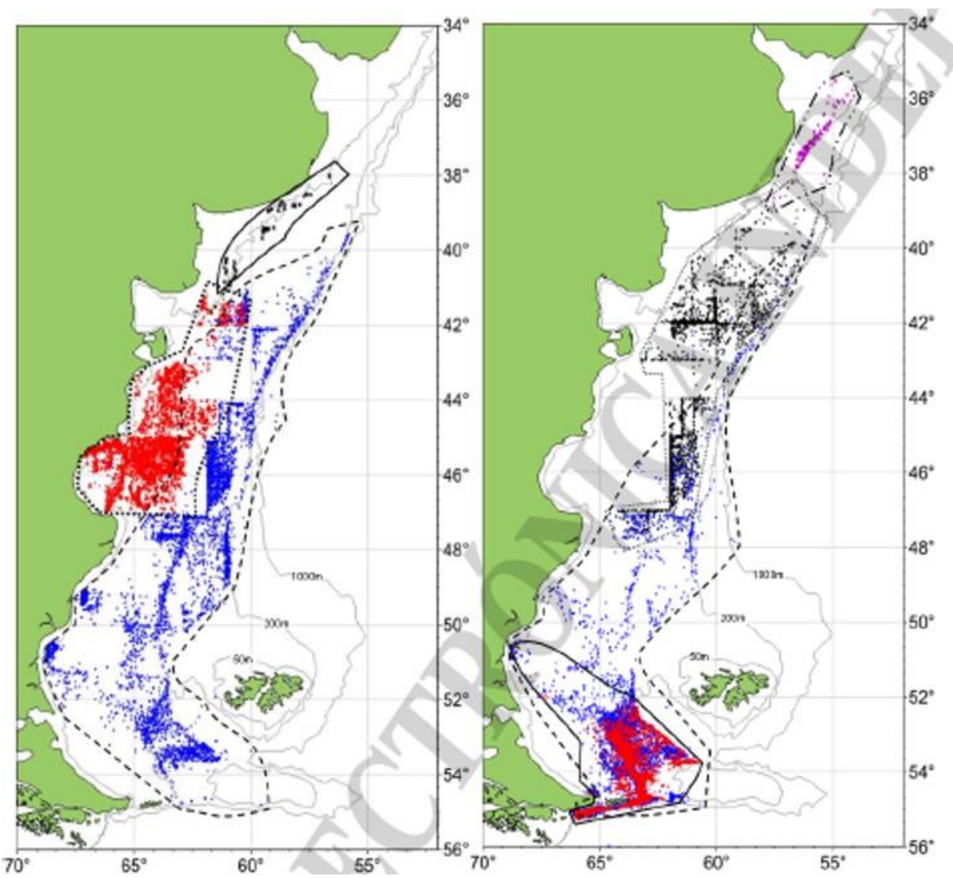


Figure 241. Maps with fishing hauls/sets of Cephalopod species classified by fishing fleet. A- Dashed line: hake Freezer trawlers (blue): dotted line: Beam Trawlers (red); Solid line: Wet-fish Stern Trawlers fishing anchovy (black). B- Dashed line: Southern species Freezer Trawlers (blue); solid line: surimeros (red); dashed dotted line: Varied Wet-fish stern trawlers coastal fleet (purple), dotted line: Wet-fish stern trawlers fishing hake (black). Source: Prandoni 2018.

The area of direct influence of CAN_100-108 and CAN_114 sites does not overlap with those areas with the highest cephalopod landings of the 2003-2017 period. The closest fleet to the area is that of freezer trawlers of southern species.

4.3.1.7.5.3 Fisheries of Cartilaginous Fish

Cartilaginous Fish

In trawl fisheries carried out by freezer vessels operating south of 54 ° S, it is common to observe the bycatch of large sharks, such as the porbeagle (Lamna nasus) (Cortés et al. 2017) and the southern sleeper shark (Somniosus antarcticus) (data provided by the “On-Board Observers Program of INIDEP). These species are important internationally due to their conservation status. Seasonality and size structure indicate that their breeding areas are in the more temperate zones, while the adult feeding areas are in colder ones (Cortes and Waessle 2017). Available studies indicate that sensitive areas for porbeagle sharks are found south of 54 ° S during the summer and fall months (Cortes et al. 2017).

The largest landings of rays in Argentine ports correspond to catches made in the vicinity of the 50 m isobaths (between 35 ° and 38 ° S) and the 200 m isobath (between 37 ° and 40 ° S) remaining outside the prospecting area. Probably, these catch areas belong to high concentrations of these resources (Figure 242) (Allega et al. 2020).

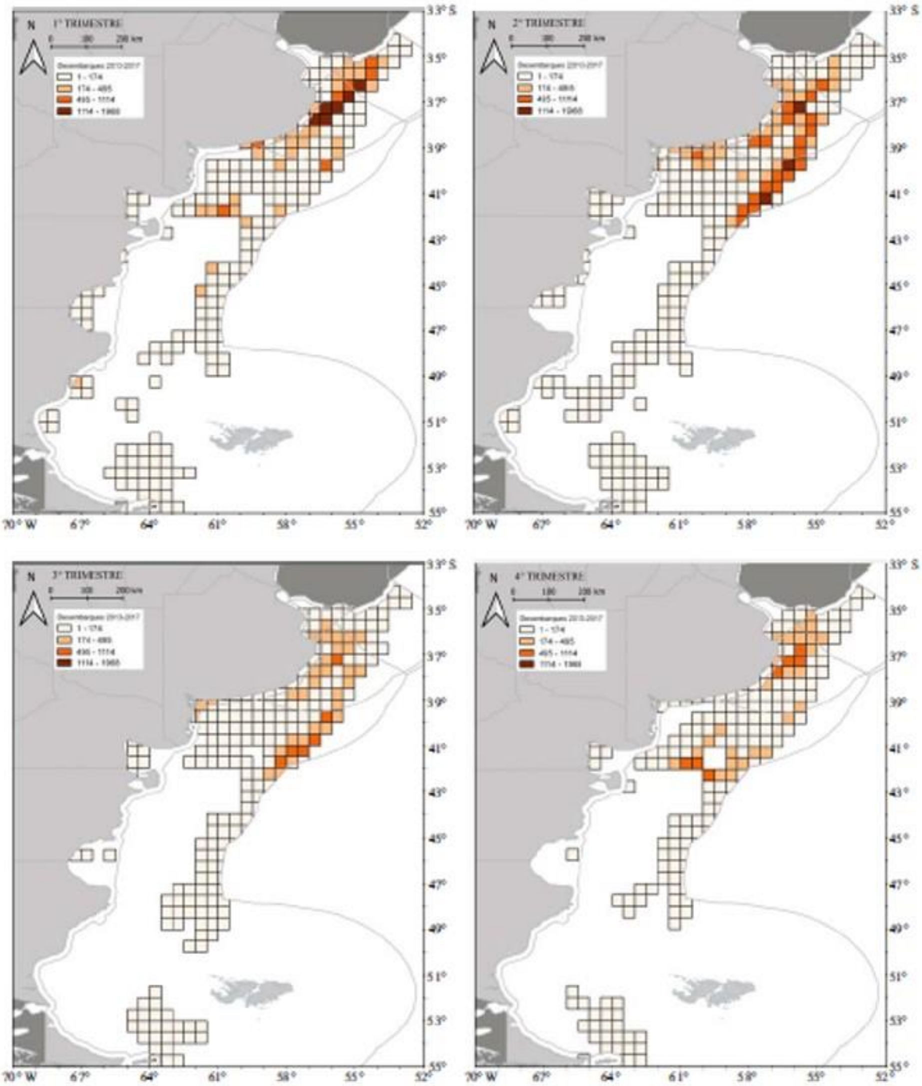


Figure 242. Distribution of quarterly landings (t) of chondrichthyans, during the 2013-2017 period. Source: Allega et al. 2020.
(Translation of Figure 242: Trimestre: Quarter. Desembarques: landings).

Previous analyzes for different chondrichte species suggest that the project area is poor in chondrichthyan diversity. Likewise, the breeding areas for both sharks and rays are far from the survey area. The highest concentrations of ray eggs have been detected in areas close to the 200 m isobath, outside the survey area.

4.3.1.7.5.4 Fisheries of Bony Fish

The Hake from the North 41 ° S stock was the main landing in the Port of Mar del Plata with 25,000 t, followed by the sea bass (14,642 t), mackerel (13,531 t), red sea bream (5,759 t), anchovy (3,943 t), and pollock (2,505 t) among other species (MAGyP 2020).

The Hake represents 45.8% of the total catches in Mar del Plata and 55.5% of the total hake caught in Argentina (MAGyP 2020).

The area of influence of the project has marginal fishing importance for most of the species, such as common hake, hoki, toothfish, southern hake, cod, pollock, and squid. Only the toothfish and pollock species are considered relevant for the area of direct influence of CAN_100-108 and CAN_114 areas.

The main fisheries of bony fish are described below;

1) Common Hake (*Merluccius hubbsi*)

The Hake is a pelagic demersal species of temperate-cold waters related to the Malvinas Current. It is distributed over the Argentine and Uruguayan Continental Shelf from 34 °S to 55 °S between 50 and 400 m deep (Irusta et al. 2017). So far, three management units have been described: The North unit between 34 ° S and 41 ° S, the South unit, from 41 ° S to 55 ° S and the San Matías Gulf unit.

Although the highest yields of hake are located in the San Jorge Gulf sector and in the Patagonian closed area for juveniles, more mature and larger than 35 cm individuals are registered towards deep waters near the 200 m isobath (Dato 2011). Currently, the main fishing areas of the fishing fleet are located to the north and east of the closure season area for the protection of Patagonian juveniles, accessing the north of 41 ° S in autumn (Irusta et al 2017). The largest annual landing comes from the 41 ° S. Freezer trawlers, by contrast, record their highest catches south and southeast of the closed season area for most of the year. In summer, the largest catches are located between 41 ° S and 43 ° S. The depth sector near the continental slope between 45 ° S and 47 ° S, called the "blue hole", has been intensively exploited as the closure area for juveniles has been expanded. In the area adjacent to the Argentine Exclusive Economic zone, the foreign fleet, mainly Spain, have historically reported high catches of hake in the FAO fishery statistics for area 41 (Santos and Villarino, 2018).

The area of influence of the project does not overlap with the breeding areas of the common hake. During the fall, the area is close to the nucleus of greater density of the resource.

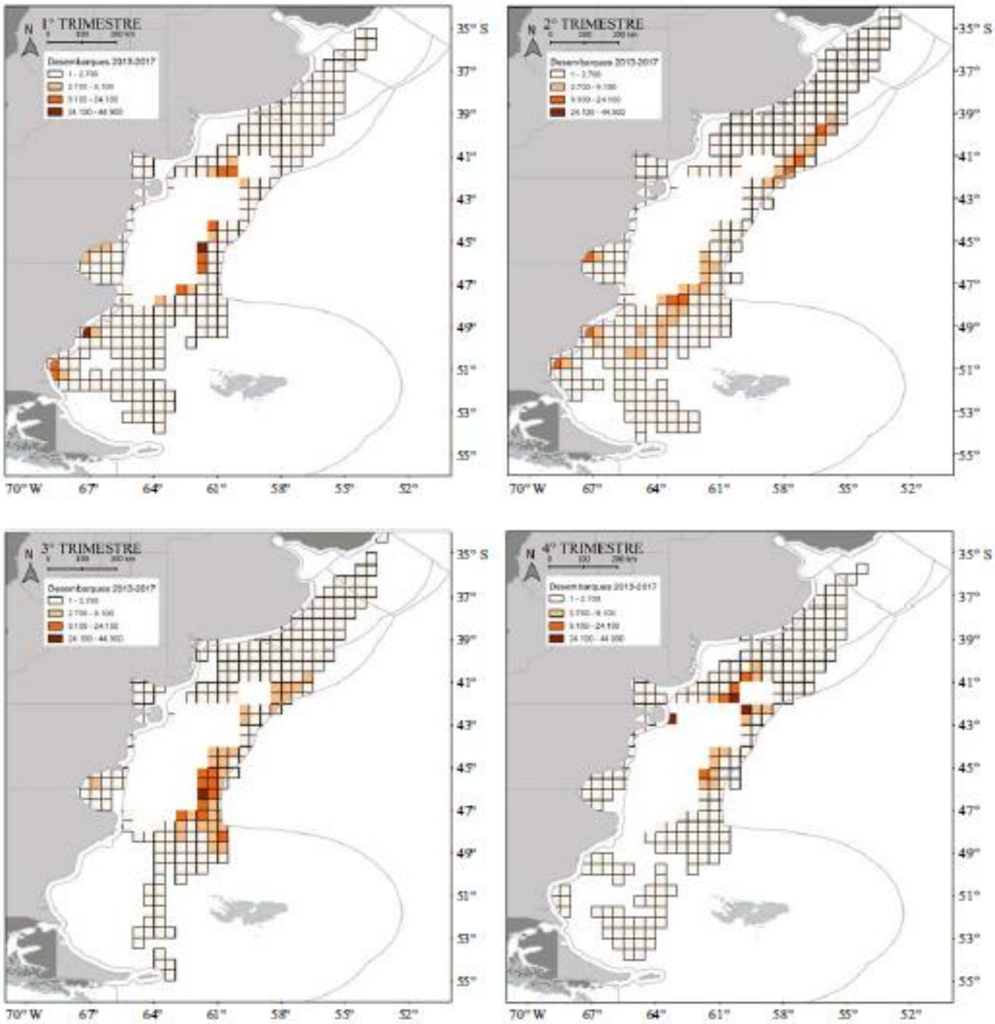


Figure 243. Distribution of quarterly landings (t) of the common hake, during the 2013-2017 period. Source: Allega et al. 2020.

(Translation of Figure 243: Trimestre: Quarter. Desembarques: landings)

The area of influence of the project does not overlap with the areas of greatest fishing landings for this species.

The catch of hake in the northern sector peaked at just over 100,000 tonnes in 2002 and then ranged from 20,000 to 40,000 tonnes (Figure 244).

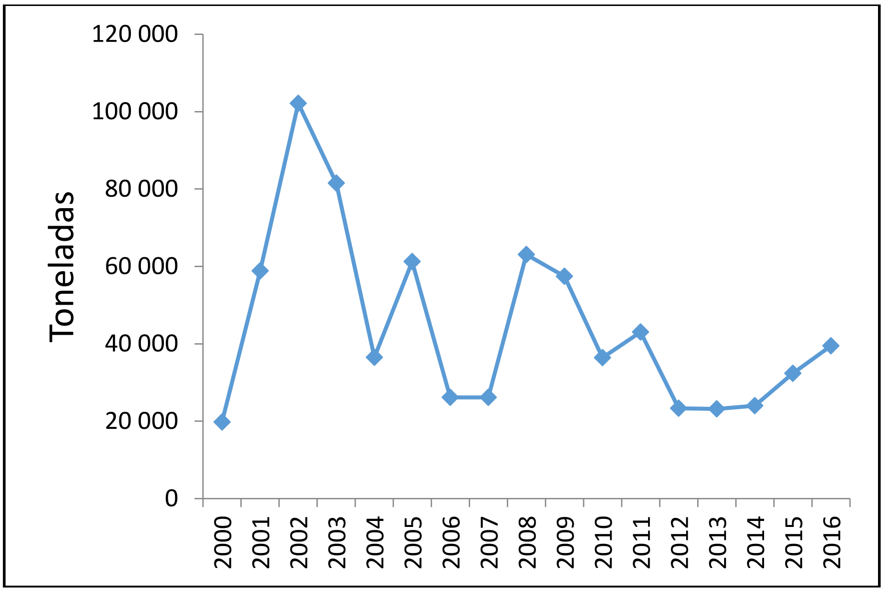


Figure 244. Catches of common hake corresponding to the northern stock. Source: https://www.argentina.gob.ar/agricultura-ganaderia-y-pesca.

(Translation of Figure 244: Tonelada: Ton).

The exploitation of hake in open sea areas is carried out with processing vessels (factories and freezers) and offshore vessels (Stern Trawlers). Freezer trawlers have prevailed in catches in recent years due to their technological update, which led to an increase in effort and landings (Dato et al., 2003). On the other hand, some of the freezer trawlers that operate on this species may be Beam Trawlers aiming the effort toward shrimp fishing (Villarino et al., 2000). Some occasional catches are also made by jiggers and longliners that catch squid and haddock.

2) Chub mackerel (*Scomber japonicus*)

A population structure of two stocks (northern and southern) separated at 39 ° S was adopted for management purposes, although a third stock could be distributed in Patagonian waters (Buratti 2015).

Since the 1990s, the southern area has been exploited by coastal and Stern Trawlers fleets in the late winter and early spring in the area called “El Rincón”. Numerous schoals are concentrated in this sector near the 50 m isobath. Mackerel landings from the south have fluctuated considerably between the maximum recorded in 2006 (26,500 t) and the minimum (888 t). On the contrary, the Estuary fleet landed 4,890 t, the highest value in the last decade (Orlando 2018).

The mackerel is distributed at less than 100 m-deep, which does not coincide with the direct area of influence of the project. Its presence in the area could be occasional (Figure 245).

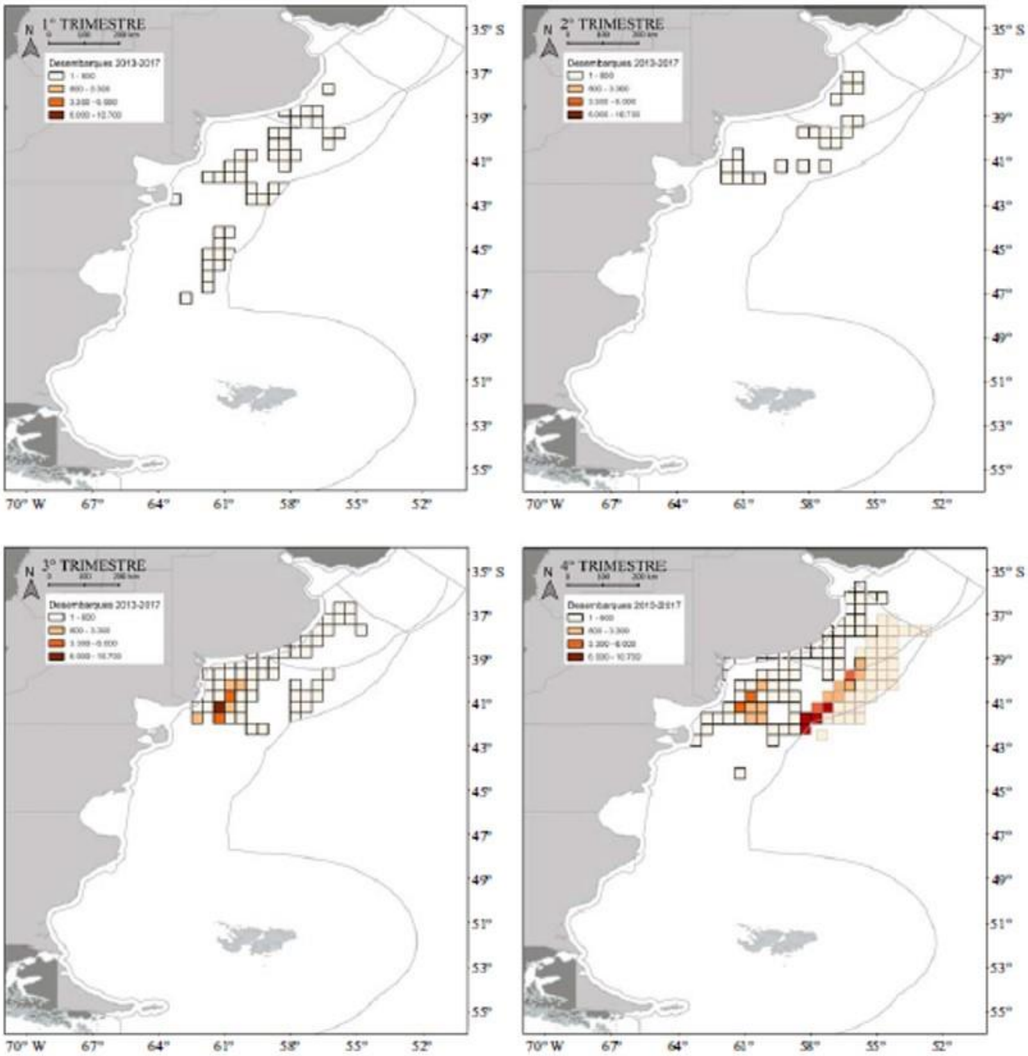


Figure 245. Distribution of quarterly landings (t) of mackerel, during the 2013-2017 period.

(Translation of Figure 245: Trimestre: Quarter. Desembarques: landings)

<u>3) Argentine Anchovy (*Engraulis anchoíta*)</u>

The fisheries administration is carried out considering two management units in Argentina: northern or Buenos Aires area (34 ° S-41 ° S) and Patagonian (41 ° S- 48 ° S). Both groups are close together towards the end of spring and beginning of summer, when an approximate limit can be established towards 41 ° S. On the contrary, during the winter the schoals of adults of both groups are separated by a distance greater than 500 km. The stock that is distributed between 28 ° S and 41 ° S develops an extensive migratory cycle. During the winter, and to a lesser extent during part of the spring, a variable fraction of the group is found southern Brazil waters. In August-September, the shoals approach coastal waters and the Argentine intermediate platform, coming from the NE.

The Buenos Aires group is under-exploited, with landings well below its fishing potential. In the last ten years, an average of 15,000 tons were landed, while in 2018 only 8,500 tons (Orlando 2018).

The anchovy is distributed in the coastal zone and the middle platform, in less than 100 m depths, which does not overlap with the area of direct influence and its presence in the area could be occasional (Figure 246).

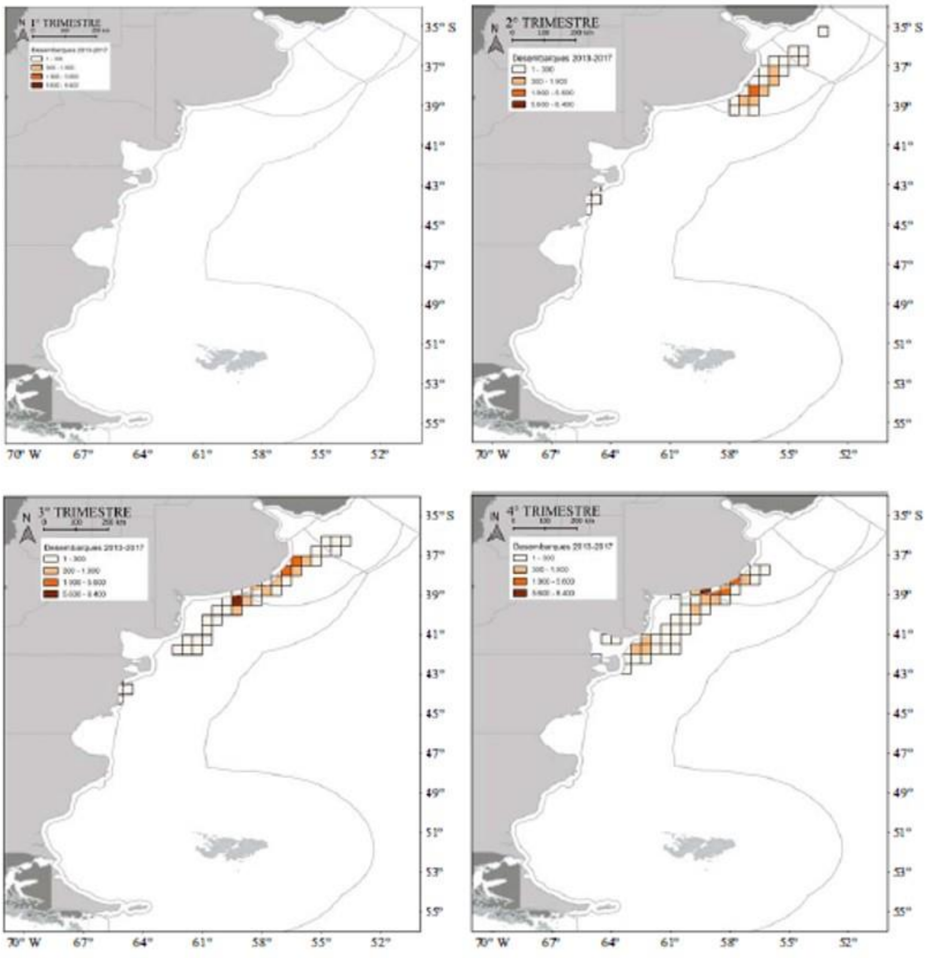


Figure 246. Distribution of quarterly landings (t) of anchovy, during the 2013-2017 period. Source: Allega et al 2020.

(Translation of Figure 246: Trimestre: Quarter. Desembarques: landings)

4) Tadpole codling (*Salilota australis*)

Figure 247 shows the total decrease of the catches obtained for this species since 1980. As of 2009, the catches have indicated a decreasing trend with minimal records in the last two years. During 2016, the total landing in the Southwest Atlantic was 5,153 t, with a 39% participation of the Argentine fleet in said catch (Gorini and Giussi 2018).

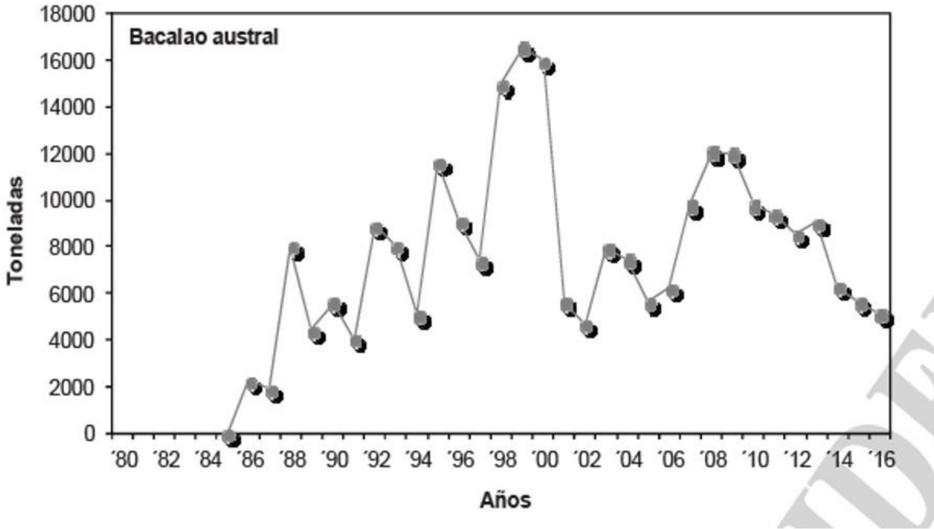


Figure 247. Total catches of the tadpole codling in the Southwest Atlantic Ocean from 1980 to the present. Source: Gorini and Giussi 2018.

(Translation of Figure 247: Toneladas: Tons. Bacalao Austral: Tadpole codling. Años: years).

Figura 248 displays the number of Argentine vessels that reported catches of the tadpole codling by type of fleet for the 2004-2016 period (Gorini and Giussi 2018).

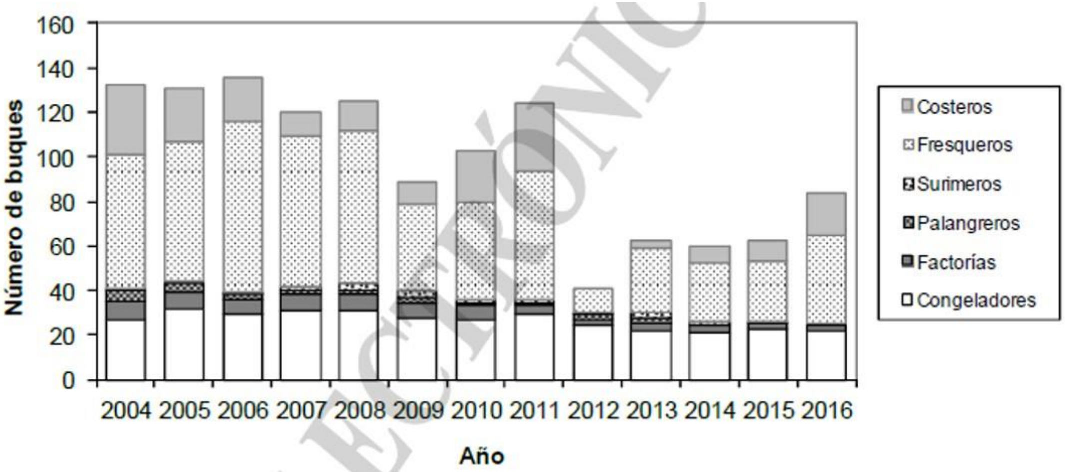


Figura 248. displays the number of Argentine vessels that reported catches of the tadpole codling by type of fleet for the 2004-2016 period (Gorini and Giussi 2018.)

(Translation of Figure 248: Número de Buques: Number of vessels. Año: year. Costeros: Coastal Fleet. Fresqueros: Wet-fish Stern Trawler fleet. Surímeros: Surimi Fleet. Palangreros: Longliner fleet. Factorías: Factory Fleet. Congeladores: Freezer trawler fleet.)

Of the total landed, 80% was caught by freezer trawlers (80%) and factory trawlers (16%) (Figure 249).

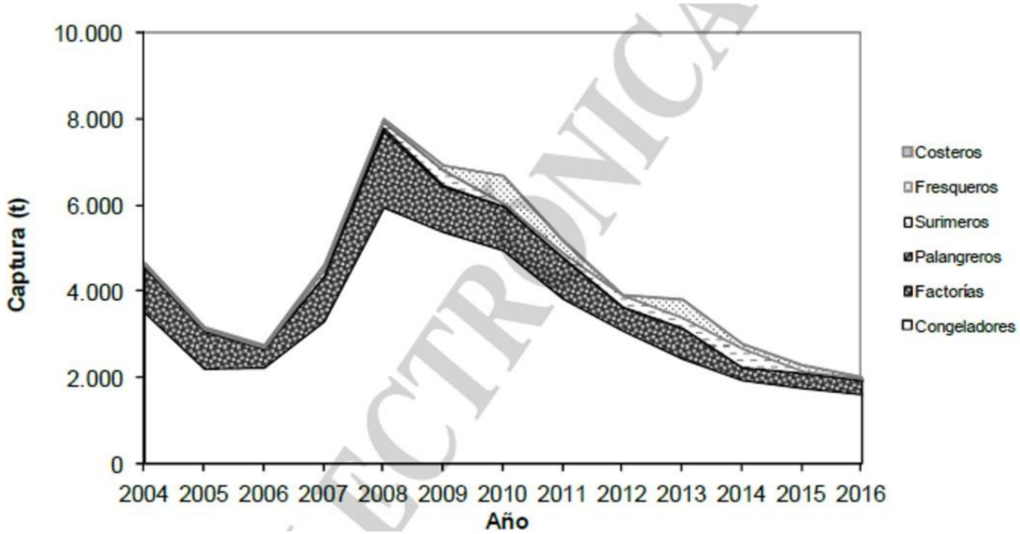


Figure 249. Argentine annual catch (t) of tadpole codling by type of fleet (2004-2016 period). Source: Gorini and Giussi 2018.

(Translation of Figure 249: Captura: catch. Año: year. Costeros: Coastal Fleet. Fresqueros: Wet-fish Stern Trawler fleet. Surímeros: Surimi Fleet. Palangreros: Longliner fleet. Factorías: Factory Fleet. Congeladores: Freezer trawler fleet.)

The main unloading ports used were Ushuaia (42%) and Puerto Madryn (31%). Mar del Plata represents 24% of the landings of the resource (Gorini and Giussi 2018).

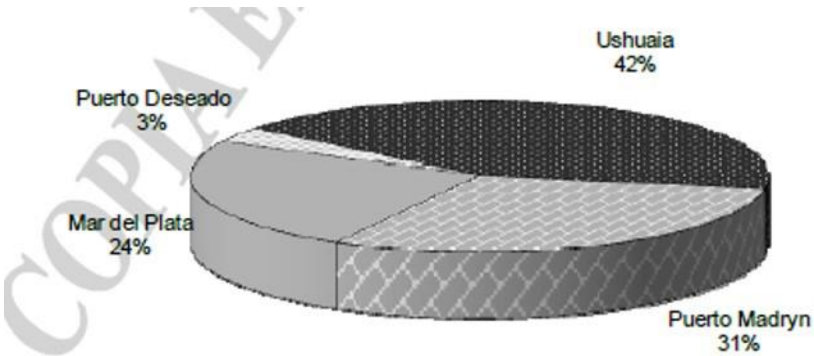


Figure 250. Annual landing (t) of the tadpole codling in the main Argentine ports). Source: Gorini and Giussi 2018.

The fleet catching this species in the project's area of influence exerts a minimum fishing effort (Figure 251) (Gorini and Giussi 2018).

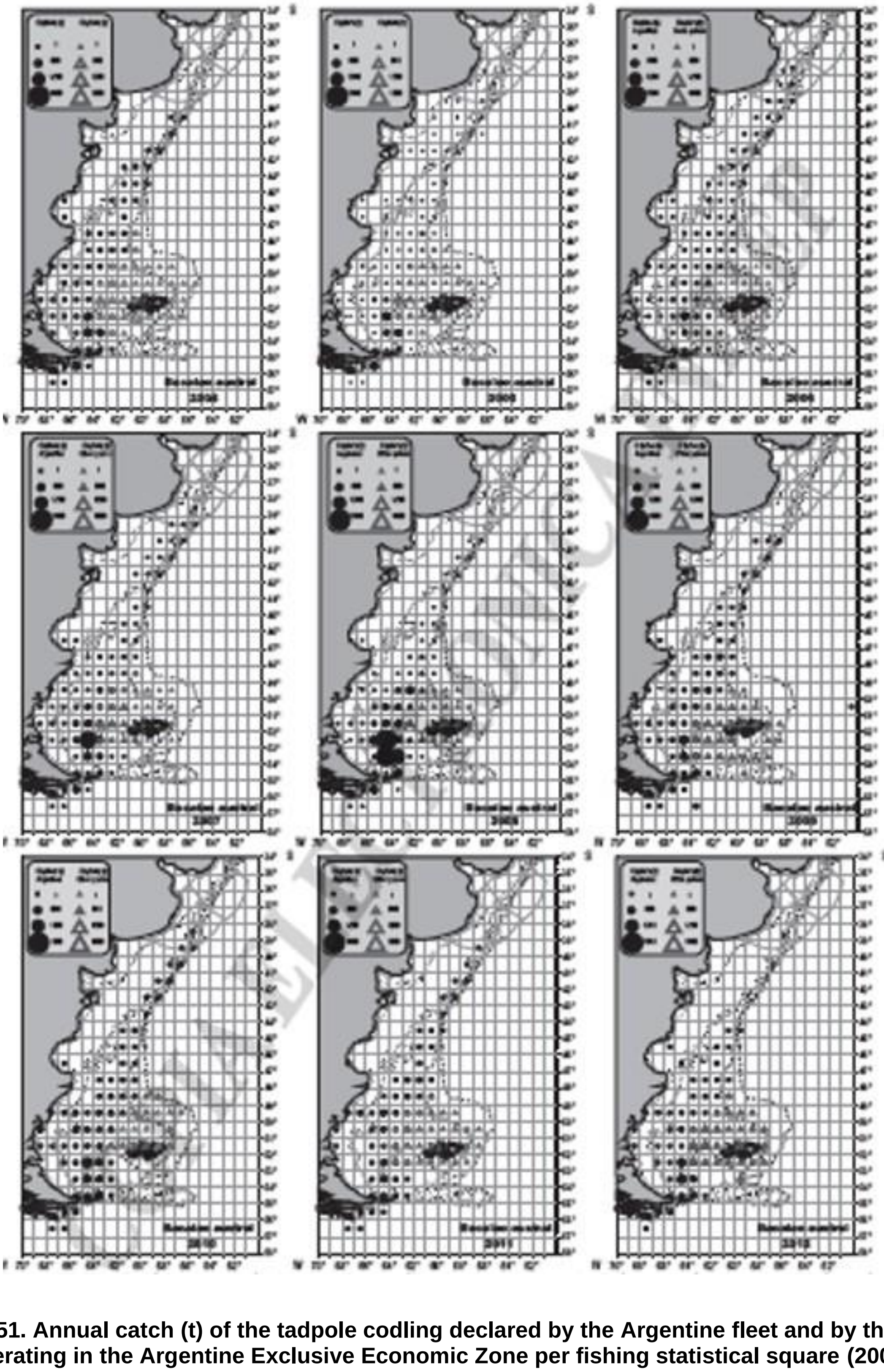


Figure 251. Annual catch (t) of the tadpole codling declared by the Argentine fleet and by the foreign fleet operating in the Argentine Exclusive Economic Zone per fishing statistical square (2004-2012). Black circle: Argentine fleet catch. Open triangle: foreign fleet catch. Source: Gorini and Giussi 2018.

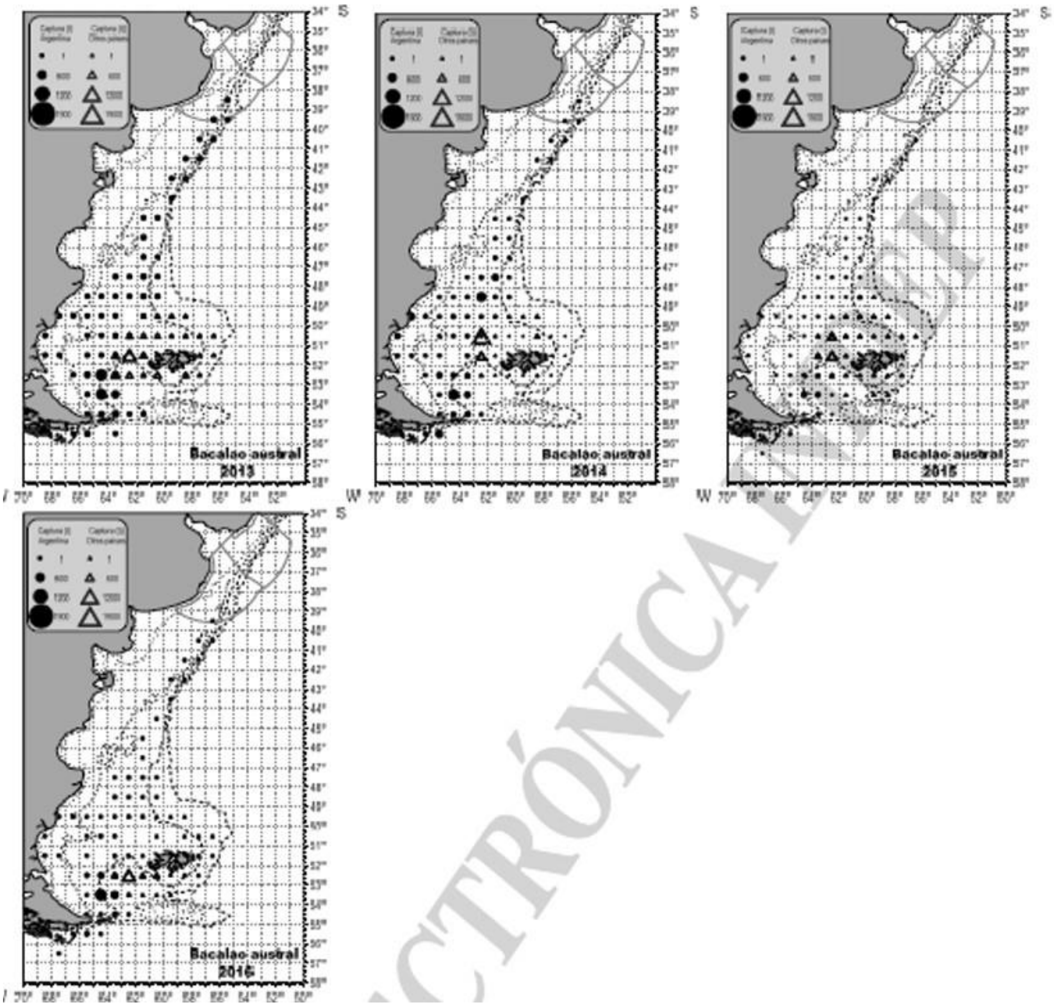


Figure 252. Annual catch (t) of the tadpole codling declared by the Argentine fleet and by the foreign fleet operating in the Argentine Exclusive Economic Zone per fishing statistical square (2013-2016). Black circle: Argentine fleet catch. Open triangle: foreign fleet catch. Source: Gorini and Giussi 2018.

The species is caught mainly between May and July, with its peak in December (Figure 253) (Gorini and Giussi 2018).

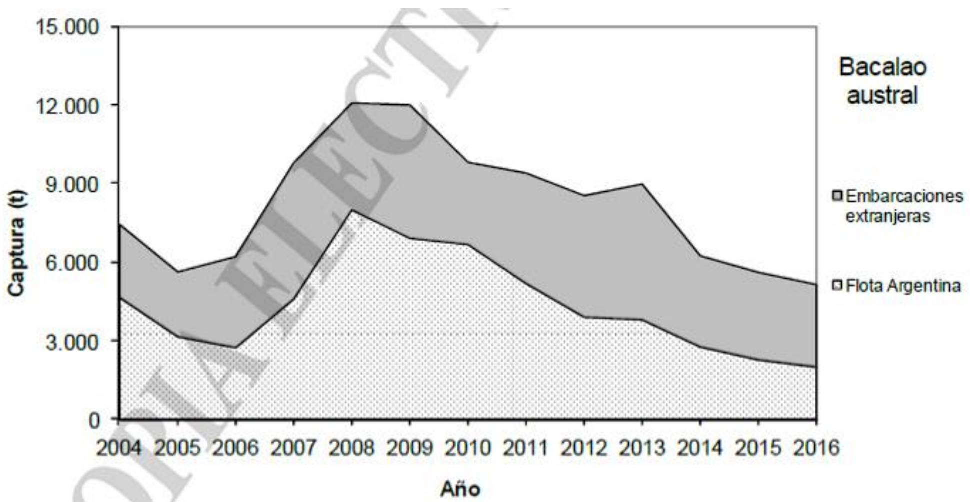


Figure 253. Annual catch (t) of the tadpole codling declared by the Argentine fleet, the Uruguayan

fleet and the foreign fleet that operated in the Argentine Exclusive Economic Zone (2004-2016 Period). Source: Gorini and Giussi 2018.
(Translation of Figure 253: Captura: catch. Bacalao Austral: Tadpole codling. Embarcaciones extranjeras: Foreign fleet. Flota Argentina: Argentine fleet. Año: year).

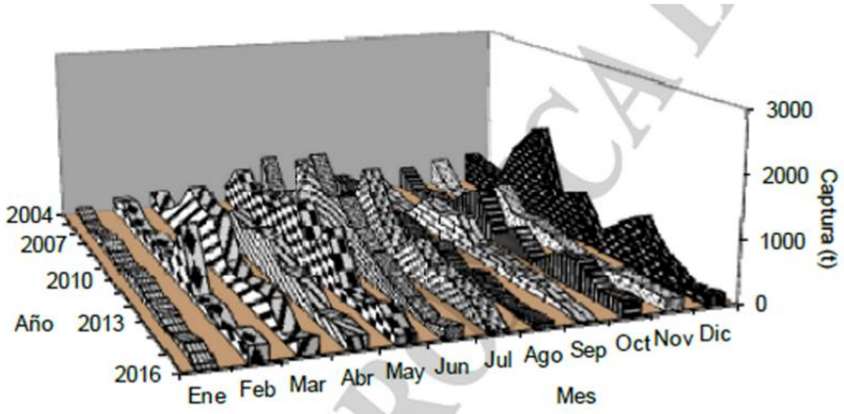


Figure 254. Monthly catch (t) of the tadpole codling declared by the Argentine fleet 2004-2013. Source: Gorini and Giussi 2018.
(Translation of Figure 254: Año: year. Captura: catch. Mes: Month. Below: the months of the year from January to December).

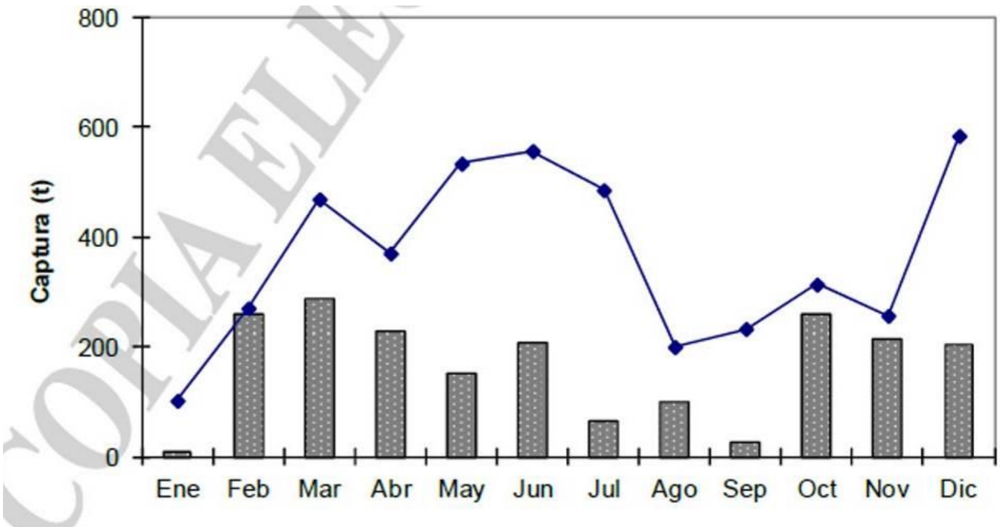


Figure 255. Declared monthly catch (t) of the tadpole codling for the Argentine fleet (2016). The line corresponds to the monthly average of the analyzed period. Source: Gorini and Giussi 2018.
(Translation of Figure 255: Captura: catch. Below: the months of the year from January to December).

5) Southern Hake (*Merluccius australis*)

In 2016, 3,604 t were reported, a much lower catch than that declared in previous years (Figure 256). This was mainly due to the decrease of those declared by the foreign fleet that operated in the surrounding waters of Falkland Islands (Islas Malvinas).

Of the total caught, 85% was obtained by the Argentine fleet, which has begun to direct its efforts to the species and has stopped fishing for it as a companion fauna.

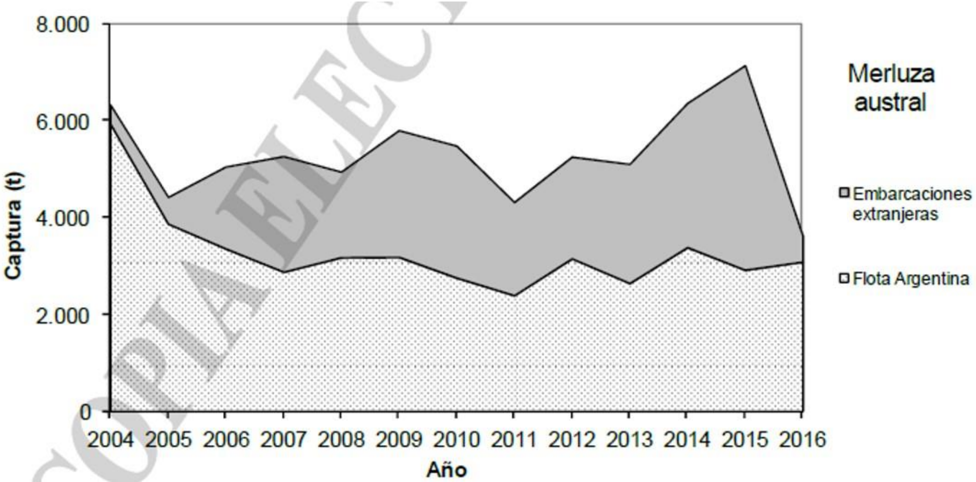


Figure 256. Annual catch (t) of southern hake declared by the Argentine fleet and by the foreign fleet operating in the Argentine Exclusive Economic Zone (2004-2016 Period). Source: Gorini and Giussi 2018).
(Translation of Figure 256: Captura: catch. Merluza Austral: Southern Hake. Embarcaciones extranjeras: Foreign fleet. Flota Argentina: Argentine fleet. Año: year).

The monthly Argentine catches of 2016 continued to show the trend observed during previous years, with the highest landings taking place from February to May.

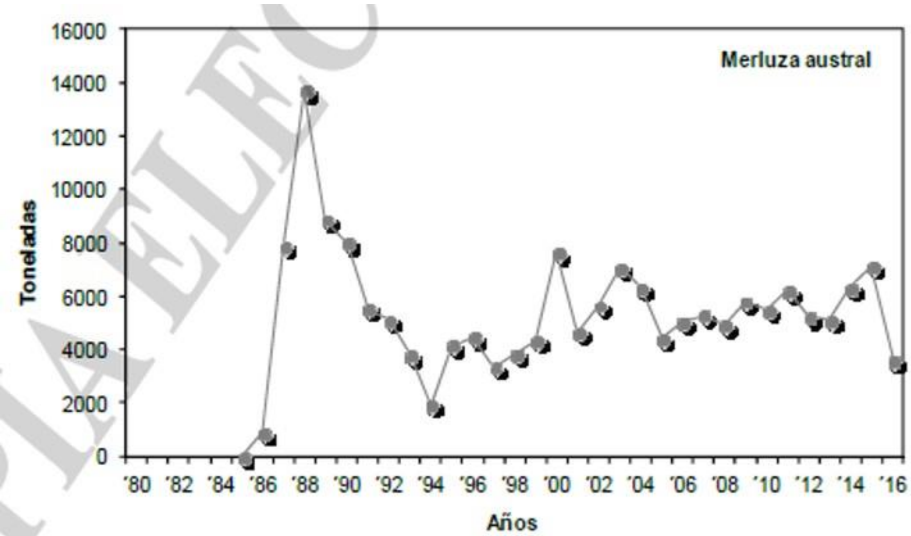


Figure 257. Total catches of the Southern Hake in the Southwest Atlantic Ocean from 1980 to the present. Source: Gorini and Giussi 2018.
(Translation of Figure 257: Toneladas: Tons. Merluza Austral: Southern Hake. Años: years).

Figure 258 shows the number of Argentine vessels that reported catches of southern hake by type of fleet for the 2004-2016 period (Gorini and Giussi 2018).

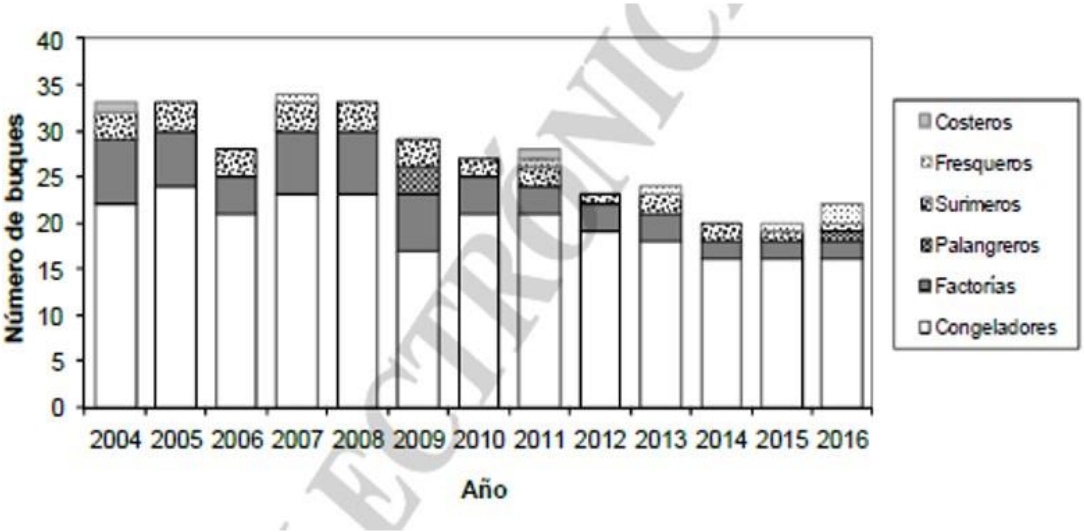


Figure 258. Number of Argentine vessels that reported catches of southern hake by type of fleet for the 2004-2016 period. Source: Gorini and Giussi 2018.

(Translation of Figure 258: Número de Buques: Number of vessels. Año: year. Costeros: Coastal Fleet. Fresqueros: Wet-fish Stern Trawler fleet. Surímeros: Surimi Fleet. Palangreros: Longliner fleet. Factorías: Factory Fleet. Congeladores: Freezer trawler fleet.)

The catches of this species are controlled by freezer vessels (44%) and factory vessels (28%) in second place (Figure 259).

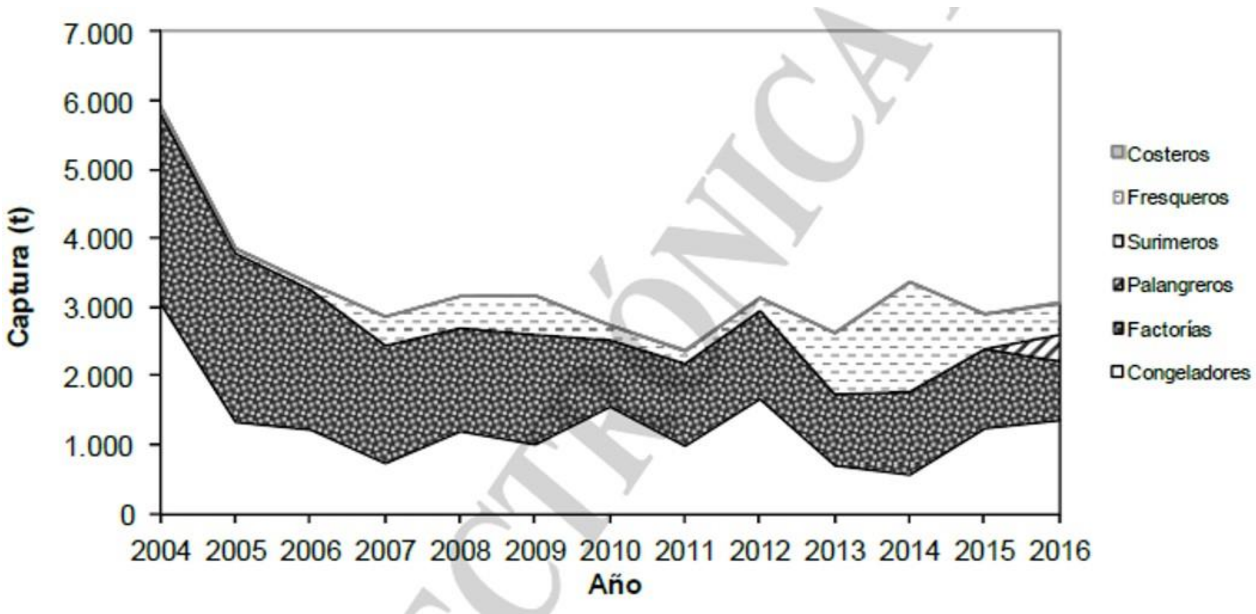


Figure 259. Argentine annual catch (t) of Southern Hake by type of fleet (2004-2016 period). Source: Gorini and Giussi 2018.

(Translation of Figure 259: Captura: catch. Año: year. Costeros: Coastal Fleet. Fresqueros: Wet-fish Stern Trawler fleet. Surímeros: Surimi Fleet. Palangreros: Longliner fleet. Factorías: Factory Fleet. Congeladores: Freezer trawler fleet.)

The main landing port is Usuahia (71 %). Mar del Plata represents 24% of the landings of the resource (Gorini and Giussi 2018).

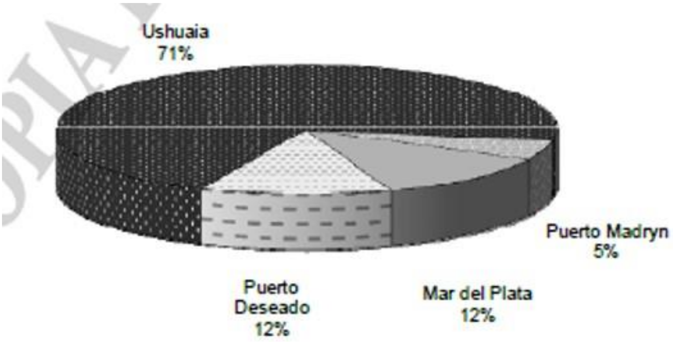


Figure 260. Annual landing (t) of southern hake in the main Argentine ports (2016). Source: Gorini and Giussi 2018.

The fleet that catches this species in the project's area of influence exerts minimal fishing effort (Figure 261 and Figure 262) (Gorini and Giussi 2018).

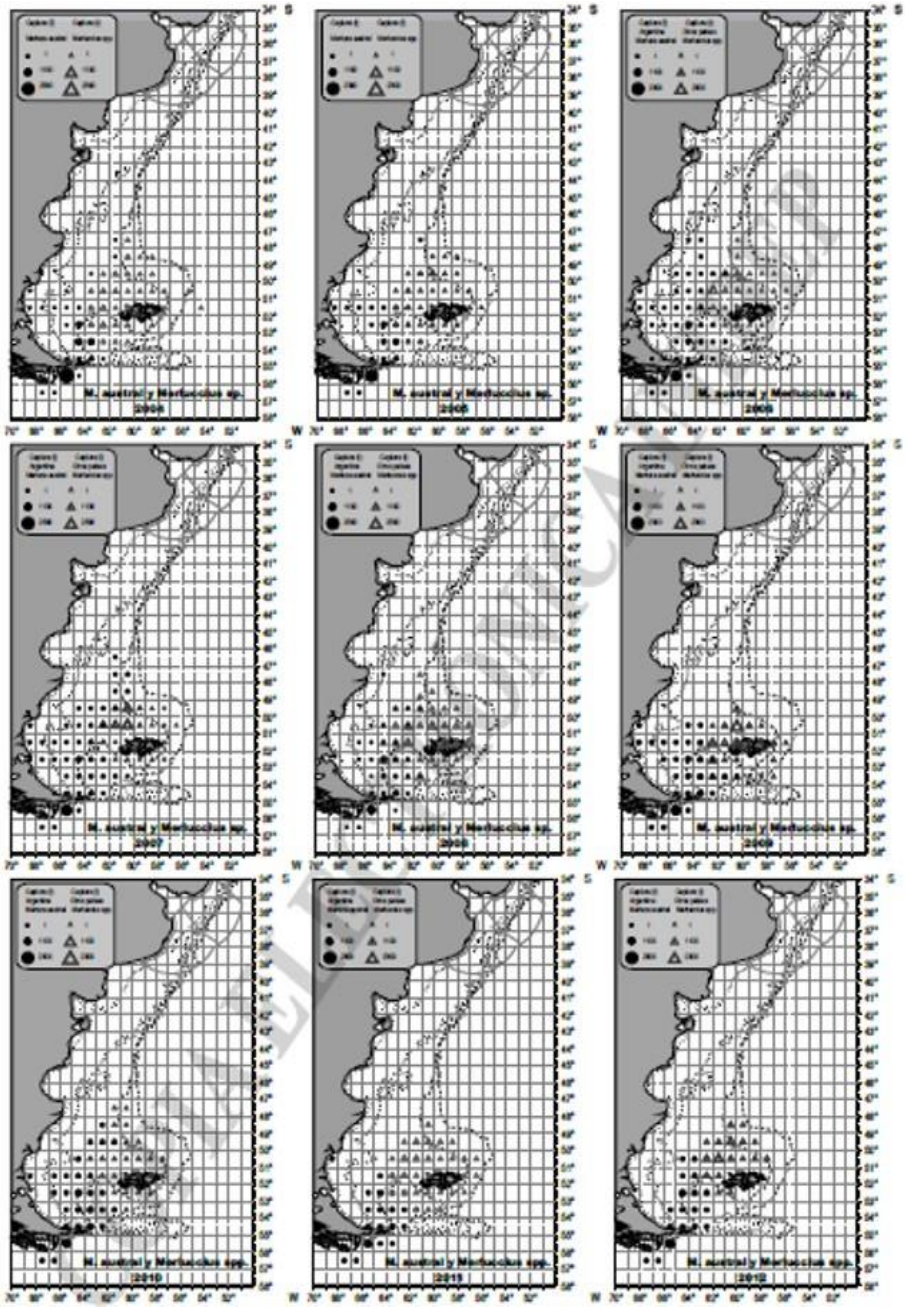


Figure 261. Annual catch (t) of the southern hake declared by the Argentine fleet and by the foreign fleet operating in the Argentine Exclusive Economic Zone per fishing statistical square (2004-2012). Black circle: Argentine fleet catch. Open triangle: foreign fleet catch. Source: Gorini and Giussi 2018.

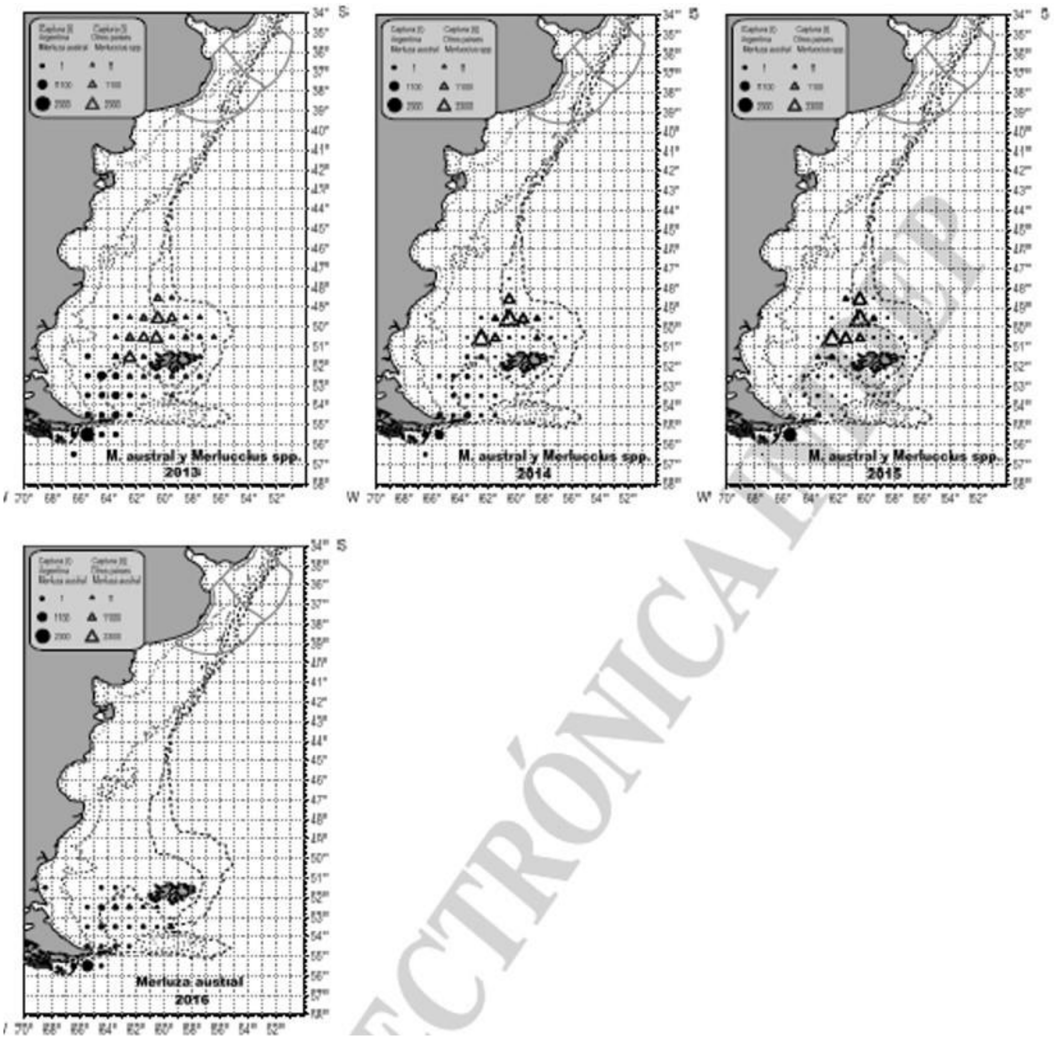


Figure 262. Annual catch (t) of the southern hake declared by the Argentine fleet and by the foreign fleet operating in the Argentine Exclusive Economic Zone per fishing statistical square (2013-2016). Black circle: Argentine fleet catch. Open triangle: foreign fleet catch. Source: Gorini and Giussi 2018.

This species is caught mostly between March and May () and mainly by freezer trawlers (Figure 264).

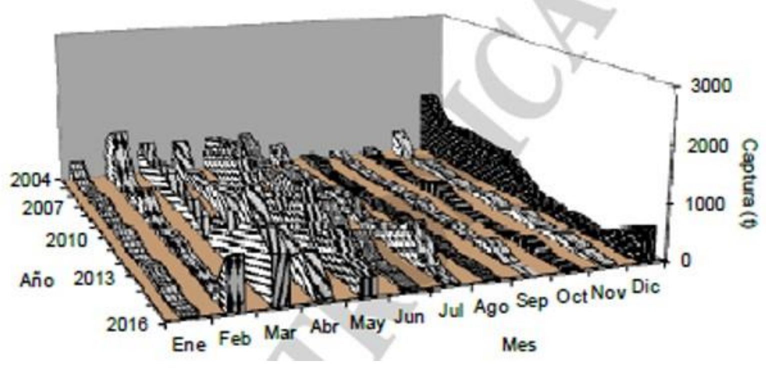


Figure 263. Monthly catch (t) of southern hake declared by the Argentine fleet that operated in the

Argentine Exclusive Economic Zone (2004-2016).

(Translation of Figure 263: Año: year. Captura: catch. Mes: Month. Below: the months of the year from January to December).

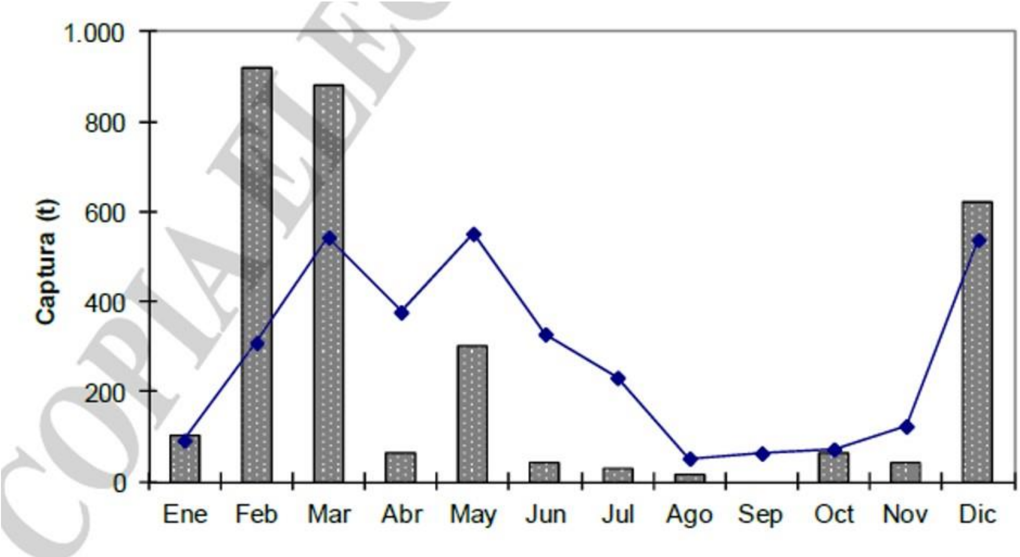


Figure 264. Monthly catch (t) of southern hake reported by the Argentine fleet (2016). The line corresponds to the monthly average of the analyzed period Source: Gorini and Giussi 2018.

(Translation of Figure 264: Captura: catch. Below: the months of the year from January to December).

6) Patagonian Grenadier *(Macruronus magellanicus)*

The Patagonian Grenadier is fully exploited south of 50 ° S, where the highest concentrations are located (Giussi et al. 2016). Since 2010, the Patagonian Grenadier fishery has been under the Individual Transferable Catch Quotas (CITC) system through which the catch areas and volumes are variable (Gorini and Giusssi, 2018).

The Patagonian Grenadier does not present sensitive areas for the project's area of influence, nor is there a high density of landings for the 2013-2017 period.

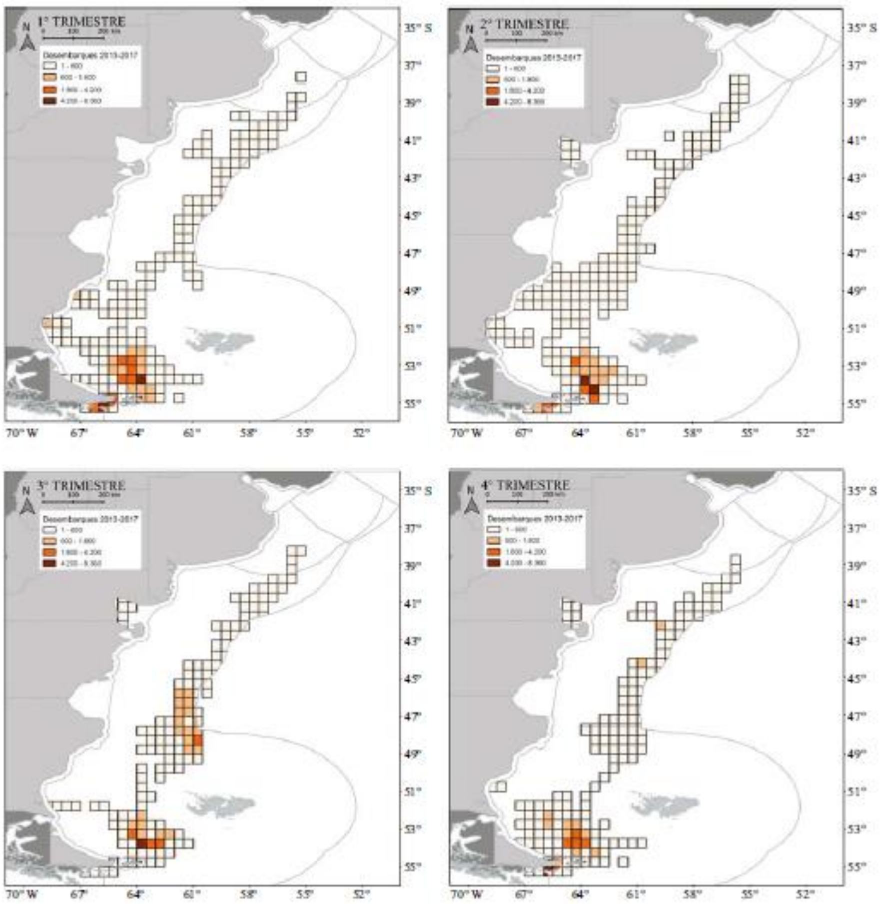


Figure 265. Distribution of quarterly landings (t) of the Patagonian Grenadier during the 2013-2017 period. Source; Allega et al. 2020.

(Translation of Figure 265: Trimestre: Quarter. Desembarques: landings)

Figure 266 shows the total catches of this species from 1980 to the present. Until 2009, catches were high and then began a decreasing trend until reaching the minimum declared value in 2016: 47,159 t (Gorini and Giussi 2018).

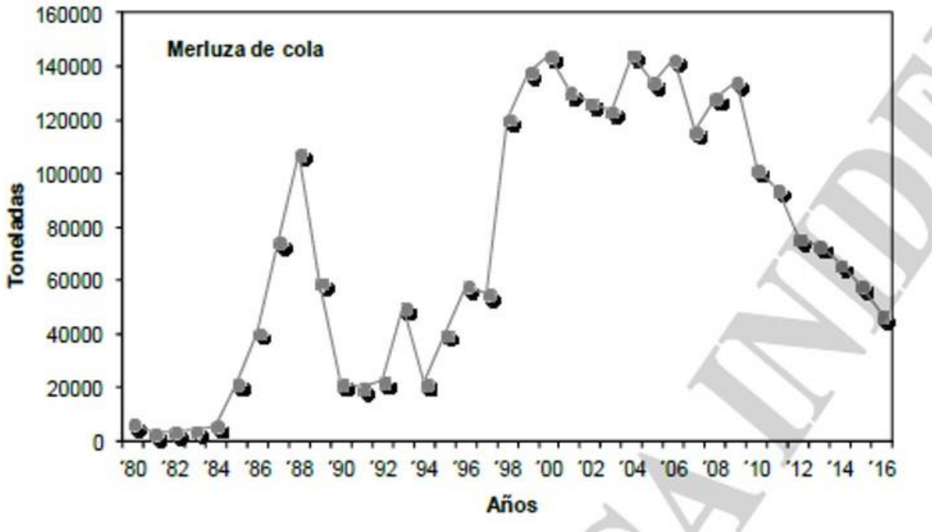


Figure 266. Total catches of the Patagonian Grenadier in the Southwest Atlantic Ocean from 1980 to the present. Source: Gorini and Giussi 2018.

(Translation of Figure 266: Toneladas: Tons. Merluza de cola: Patagonian Grenadier. Años: Years).

The freezer and surimero vessels were the ones with the highest participation in the catches of the species and used the cities of Ushuaia, Puerto Madryn and Mar del Plata as the main landing ports, in that order of importance (Gorini and Giussi 2018).

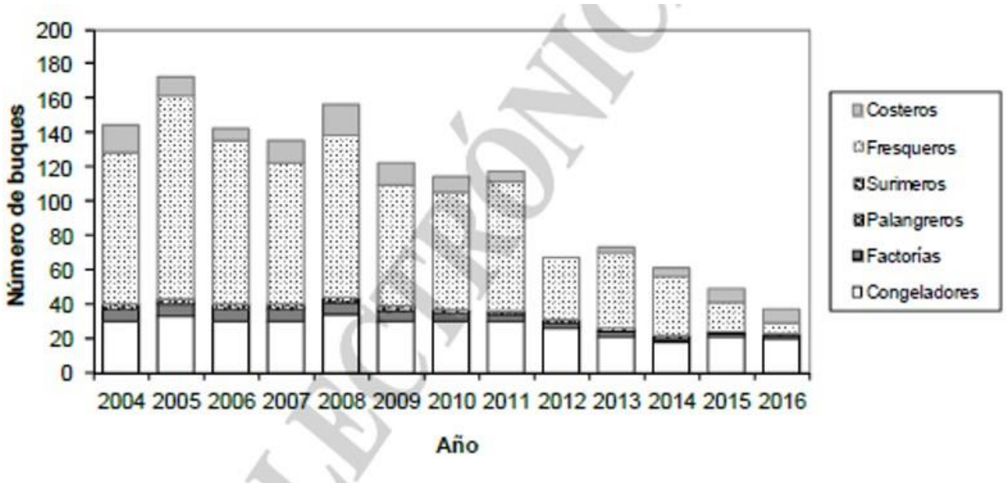


Figure 267. Number of Argentine vessels that reported catches of the Patagonian Grenadier by type of fleet for the 2004-2016 period. Source: Gorini and Giussi 2018.

(Translation of Figure 267: Número de Buques: Number of vessels. Año: year. Costeros: Coastal Fleet. Fresqueros: Wet-fish Stern Trawler fleet. Surímeros: Surimi Fleet. Palangreros: Longliner fleet. Factorías: Factory Fleet. Congeladores: Freezer trawler fleet.)

The catches of this species are controlled by freezer vessels (53%), surimero vessels (27%) and factory trawlers (20% (Figure 268).

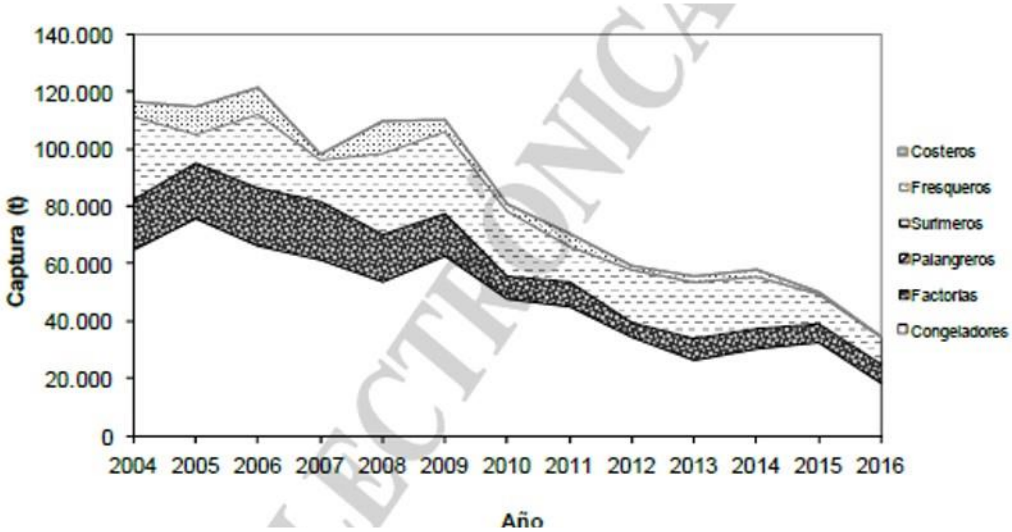


Figure 268. Argentine annual catch (t) of the Patagonian Grenadier by type of fleet (2004-2016 period). Source: Gorini and Giussi 2018.

(Translation of Figure 268: Captura: catch. Año: year. Costeros: Coastal Fleet. Fresqueros: Wet-fish Stern Trawler fleet. Surímeros: Surimi Fleet. Palangreros: Longliner fleet. Factorías: Factory Fleet. Congeladores: Freezer trawler fleet.)

Usuahia is the main landing port (72 %). Mar del Plata represents 18% of landings (Gorini and Giussi 2018).

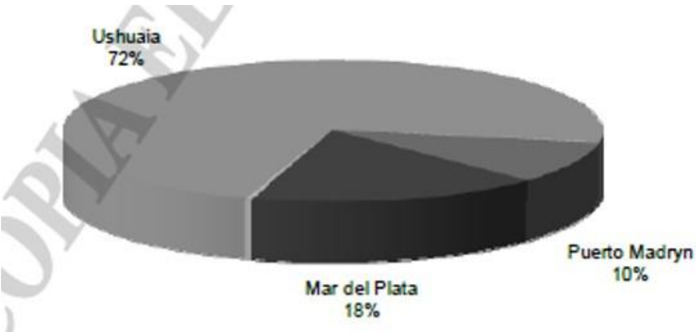


Figure 269. Annual landing (t) of the Patagonian Grenadier in the main Argentine ports (2016). Source: Gorini and Giussi 2018.

Figure 270 and Figure 271 indicate that the catch of this species is minimal in the project's area of influence (Gorini and Giussi 2018).

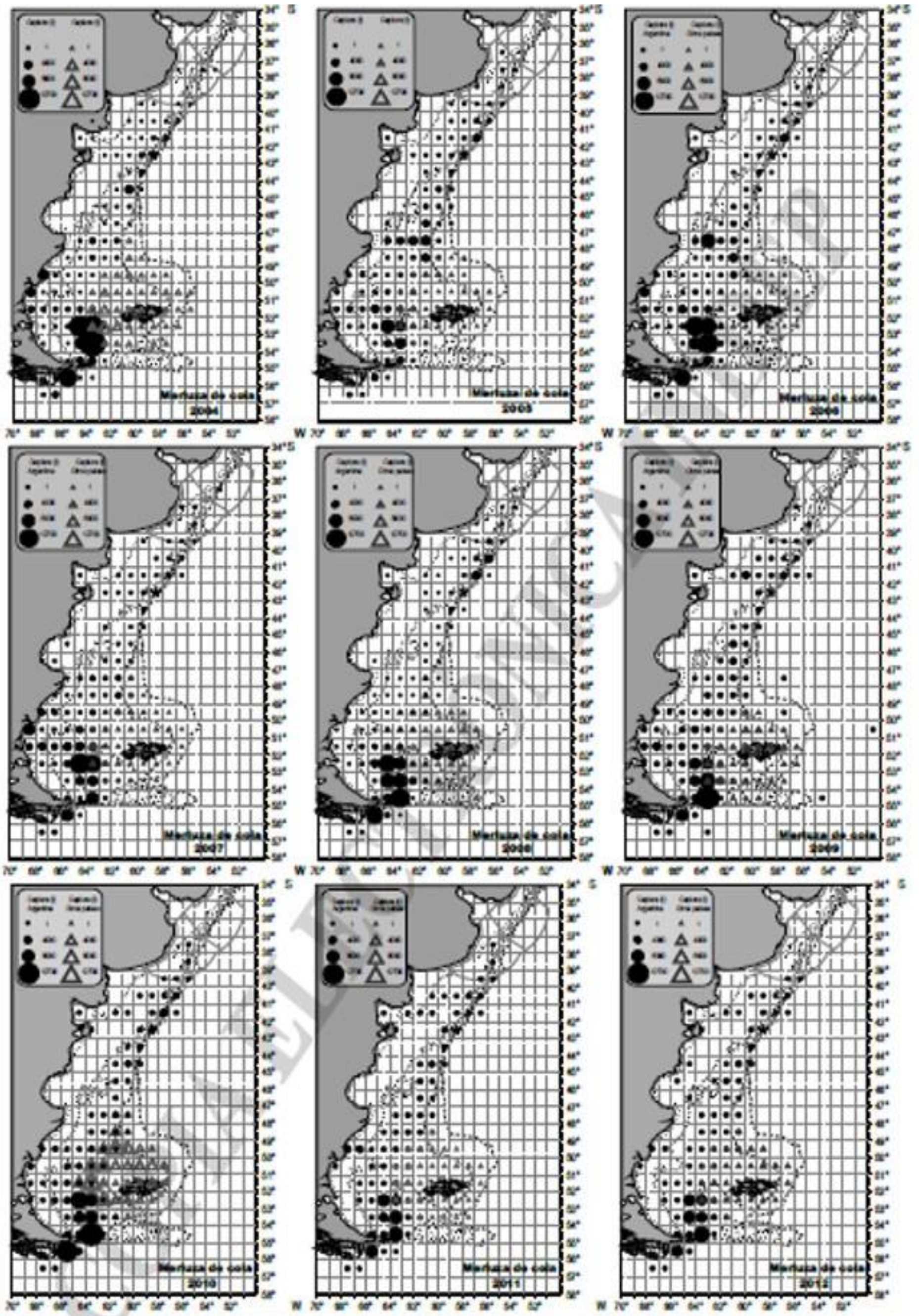


Figure 270. Annual catch (t) of the Patagonian Grenadier declared by the Argentine fleet and by the foreign fleet operating in the Argentine Exclusive Economic Zone per fishing statistical square (2004-2012). Black circle: Argentine fleet catch. Open triangle: foreign fleet catch. Source: Gorini and Giussi 2018.

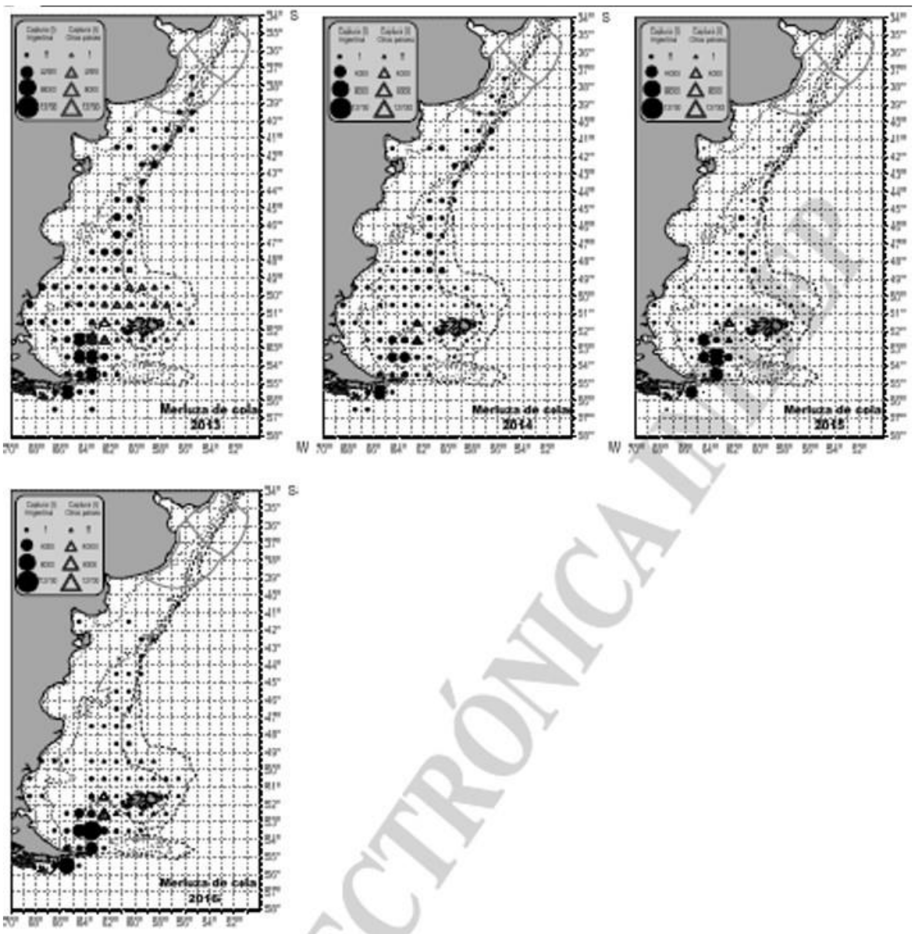


Figure 271. Annual catch (t) of the Patagonian Grenadier declared by the Argentine fleet and by the foreign fleet operating in the Argentine Exclusive Economic Zone per fishing statistical square (2013-2016). Black circle: Argentine fleet catch. Open triangle: foreign fleet catch. Source: Gorini and Giussi 2018.

The Patagonian Grenadier, which was initially caught as a companion species (Prenski et al. 1997), has become, in recent years, one of the target catches of the freezer and factory fleet, having suffered strong fishing pressure until 2008, with a subsequent sharp drop (Figure 272).

The catch period for this species is long, with a peak in May and a secondary peak in December (Figure 273).

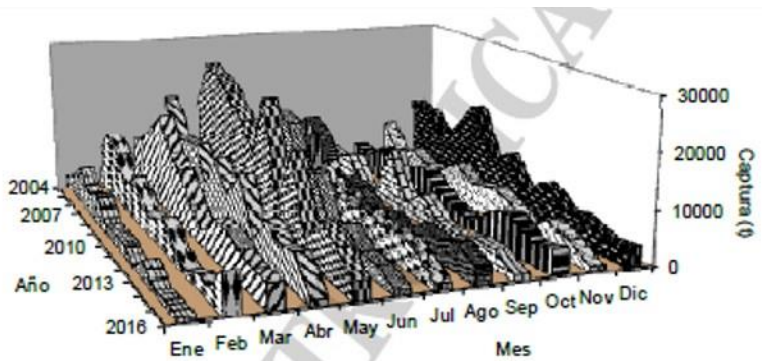


Figure 272. Monthly catch (t) of the Patagonian Grenadier declared by the Argentine fleet that operated in the Argentine Exclusive Economic Zone (2004-2016). Source: Gorini and Giussi 2018.

(Translation of Figure 272: Año: year. Captura: catch. Mes: Month. Below: the months of the year from January to December).

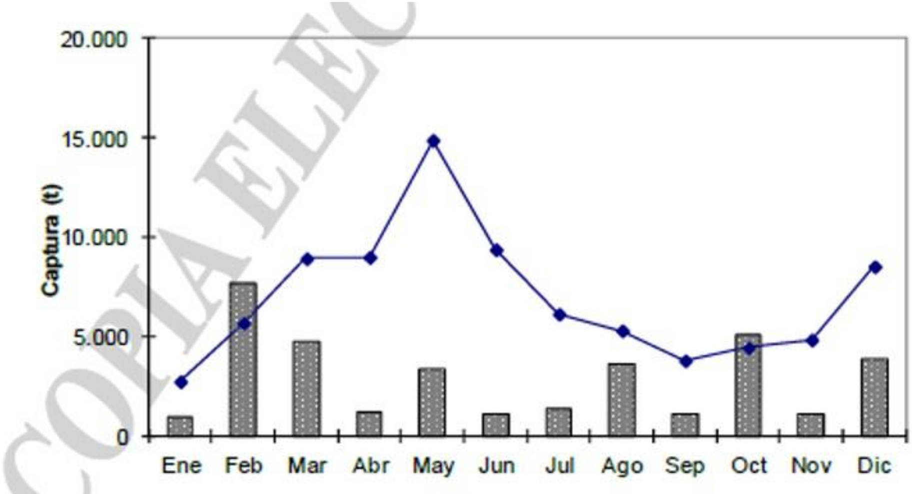


Figure 273. Monthly catch (t) of the Patagonian Grenadier reported by the Argentine fleet (2016). The line corresponds to the monthly average of the analyzed period Source: Gorini and Giussi 2018.

(Translation of Figure 273: Captura: catch. Below: the months of the year from January to December).

7) Patagonian toothfish (*Dissostichus eleginoides*)

Since 2010, the Patagonian toothfish fishery has been under the Individual Transferable Catch Quotas (CITC) system, and currently, fishing is mainly carried out with bottom trawls. Regarding the seismic data acquisition areas, the highest proportion of catches (95%) was obtained in the grids that make up the Area for the Protection of Juvenile Patagonian Toothfish (APJMN): 54 ° S- 55 ° S and 62 ° W - 64 ° W. The importance of this fishing ground near Isla de los Estados has already been mentioned by different authors (Prenski and Almeyda 1997: 2000; Martinez et al 2001; Troccoli and Martinez, 2018). The trawling fleet works in the so-called southern basin and in waters west of the Falkland Islands (Islas Malvinas), while the longline fleet, which currently consists of a single vessel, does so on the slope area between 39 ° S and 48 ° S, without being able to determine a preferential time for it either.

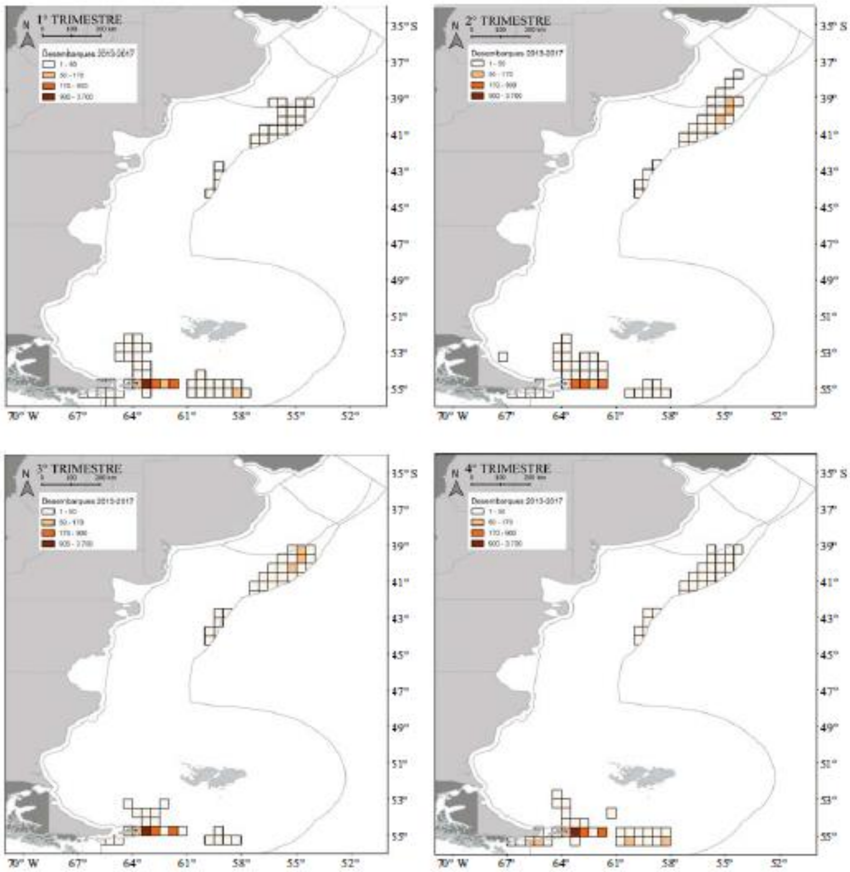


Figure 274. Distribution of quarterly landings (t) of the Patagonian toothfish during the 2013-2017 period. Source: Allega et al. 2020.

(Translation of Figure 274: Trimestre: quarter. Desembarque: Landing).

Figure 275 displays the total catches obtained for this species from 1980 to the present. In 2016 they reached 5,765 t, 63% of which was declared by the Argentine fleet (Gorini and Giussi 2018).

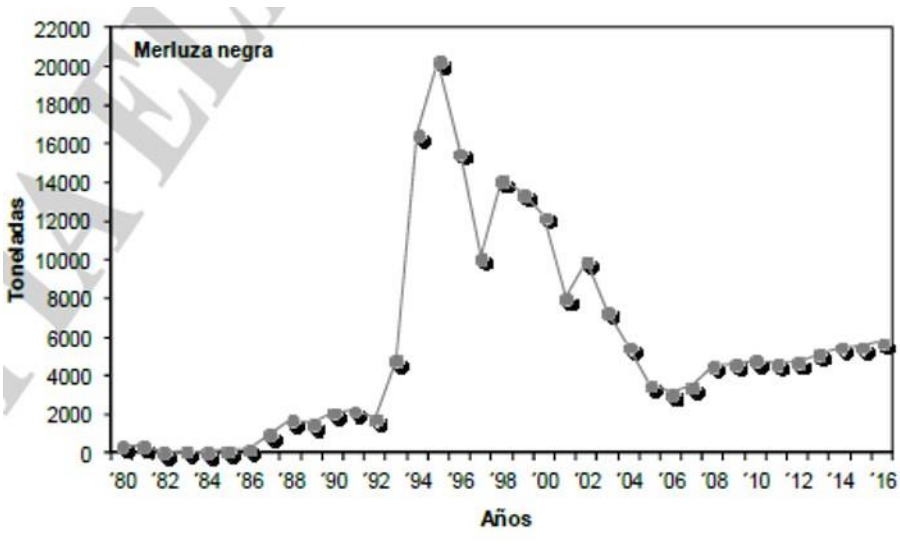


Figure 275. Total catches of the Patagonian toothfish in the Southwest Atlantic Ocean from 1980 to the present. Source: Gorini and Giussi 2018.

(Translation of Figure 275: Merluza negra: Patagonian Toothfish. Toneladas: Tons. Años: Years).

74% was declared by trawlers, of which freezers were the ones that contributed the most to the total (42%). The low percentage of participation of longline vessels (26%) was due to the decrease in the size of the fleet, reduced to a single operating unit (Gorini and Giussi 2018).

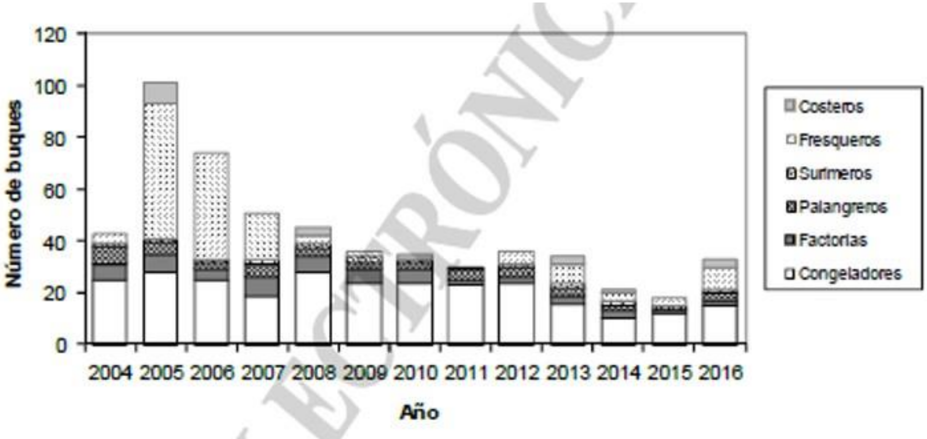


Figure 276. Number of Argentine vessels that reported catches of the Patagonian toothfish by type of fleet for the 2004-2016 period. Source: Gorini and Giussi 2018.

(Translation of Figure 276: Número de Buques: Number of vessels. Año: year. Costeros: Coastal Fleet. Fresqueros: Wet-fish Stern Trawler fleet. Surímeros: Surimi Fleet. Palangreros: Longliner fleet. Factorías: Factory Fleet. Congeladores: Freezer trawler fleet.)

The catches of this species are controlled by freezer vessels (42%), longliners (26%) and factory trawlers (25 %) (Figure 277).

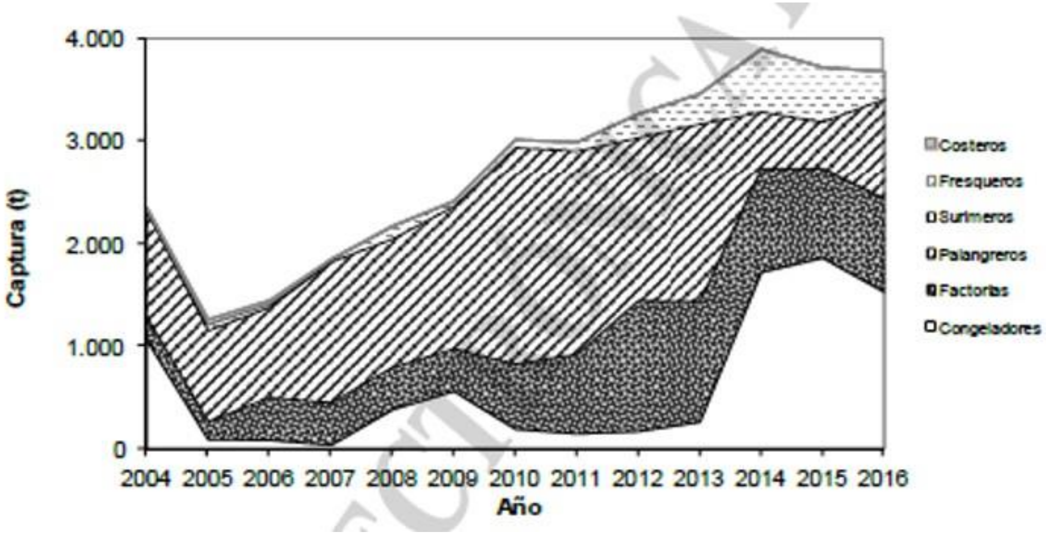


Figure 277. Argentine annual catch (t) of the Patagonian toothfish by type of fleet (2004-2016 period). Source: Gorini and Giussi 2018.

(Translation of Figure 277: Captura: catch. Año: year. Costeros: Coastal Fleet. Fresqueros: Wet-fish Stern Trawler fleet. Surímeros: Surimi Fleet. Palangreros: Longliner fleet. Factorías: Factory Fleet. Congeladores: Freezer trawler fleet).

The city of Usuhaia (72%) is the main port where the species is landed (Figure 278).

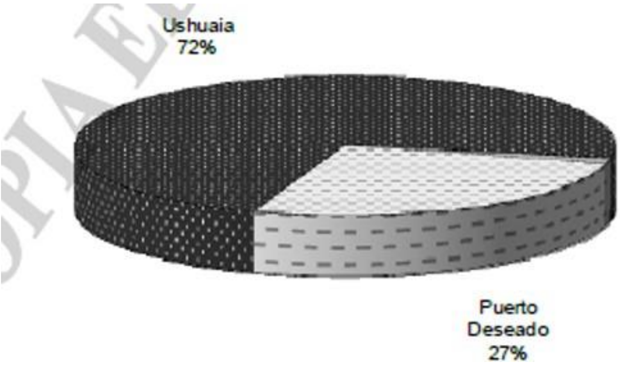


Figure 278. Annual landing (t) of the Patagonian toothfish in the main Argentine ports (2016). Source: Gorini and Giussi 2018.

It is a species with high commercial value but which is only related to the project area in the southernmost sector of the Fuegian platform. This species presented high catch values in the southernmost region, and in less important areas in front of the Buenos Aires slope (Prenski 2000). Catches have recently become uniform due to fishing pressure in the southern sector.

Figure 279 and Figure 280 indicate that the catch of this species is minimal in the project's area of influence (Gorini and Giussi 2018).

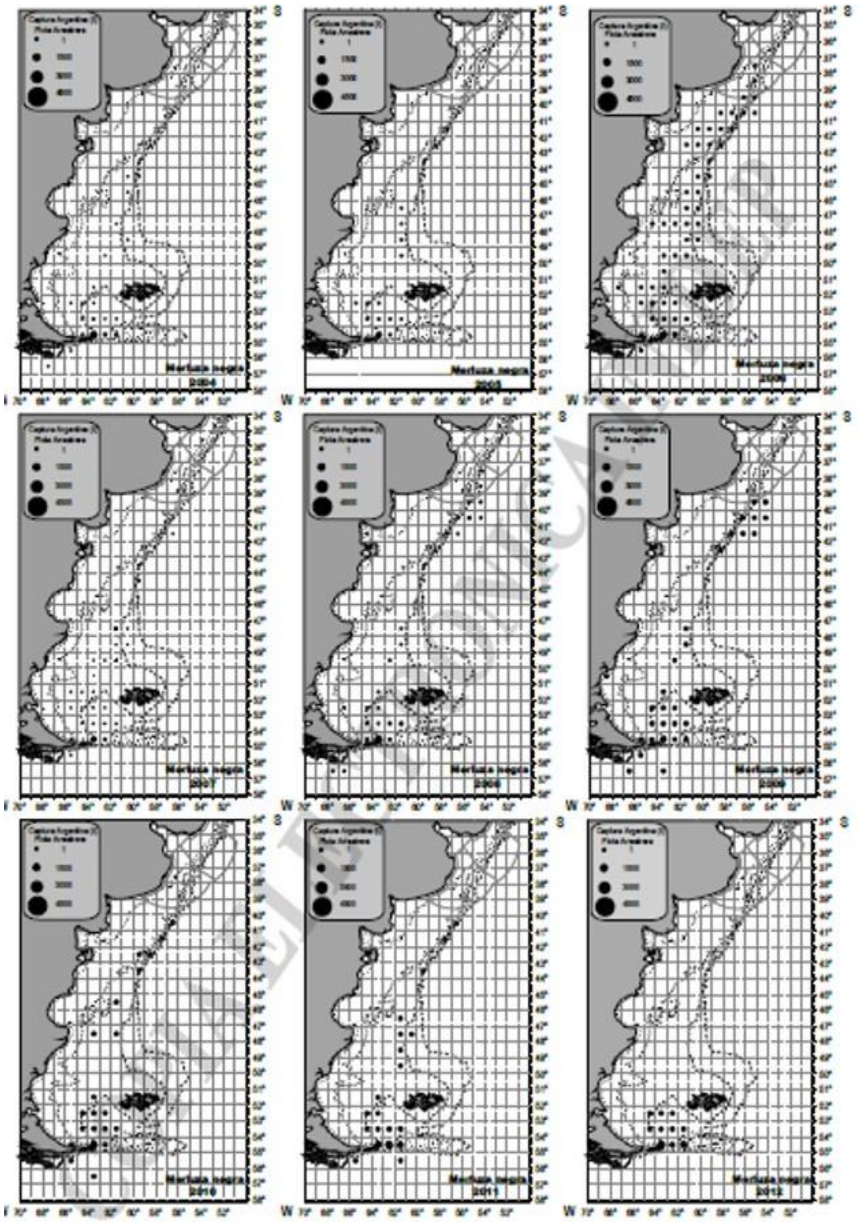


Figure 279. Annual catch (t) of the Patagonian toothfish reported by the Argentine trawling fleet per statistical fishing square (2004-2012). Source: Gorini and Giussi 2018.

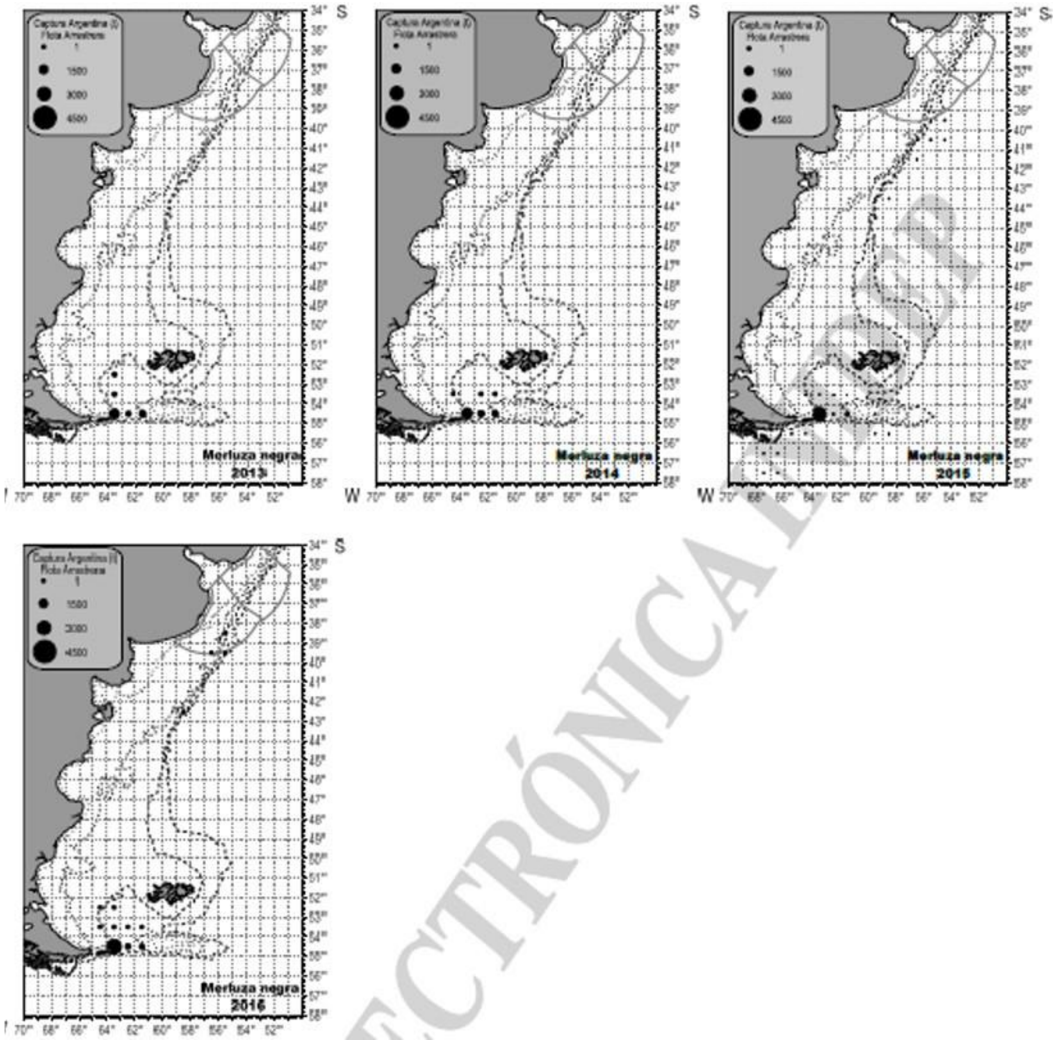


Figure 280. Annual catch (t) of the Patagonian toothfish reported by the Argentine trawling fleet per statistical fishing square (2013-2016). Source: Gorini and Giussi 2018.

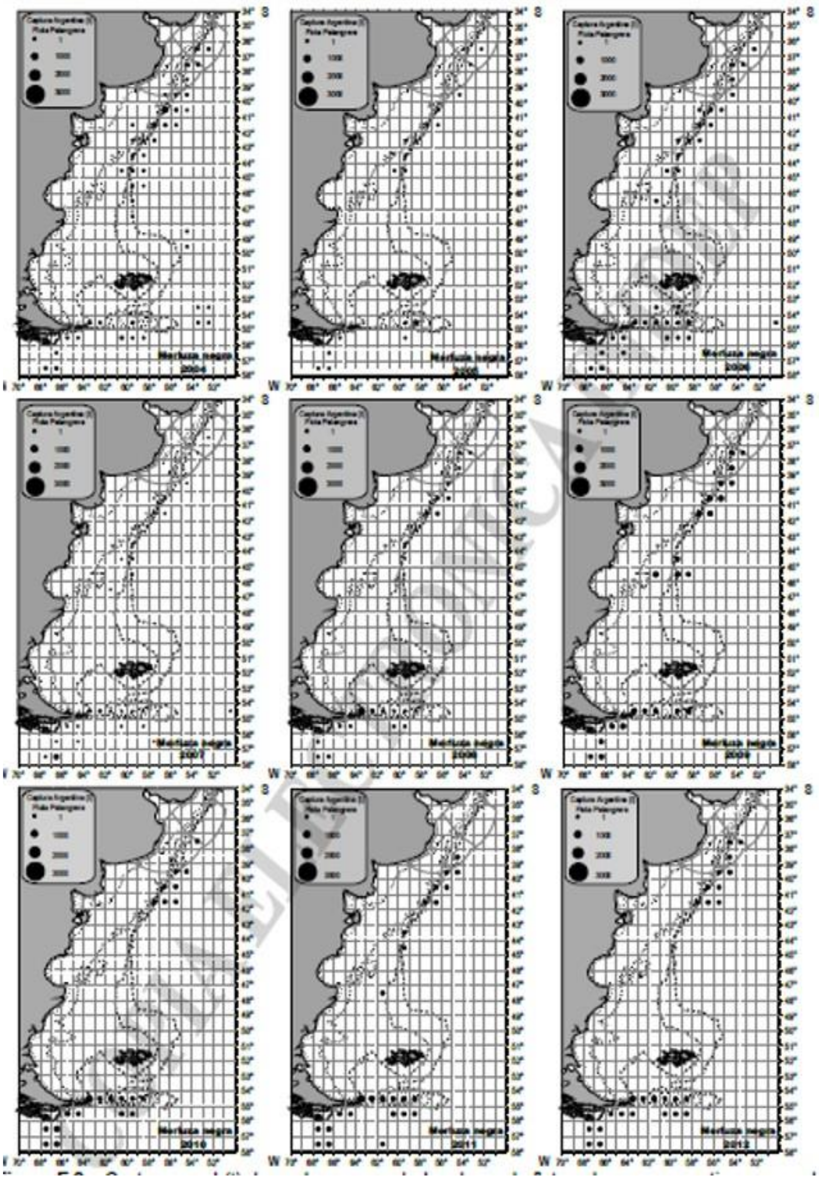


Figure 281. Annual catch (t) of the Patagonian toothfish reported by the Argentine trawling fleet per statistical fishing square (2004-2012). Source: Gorini and Giussi 2018.

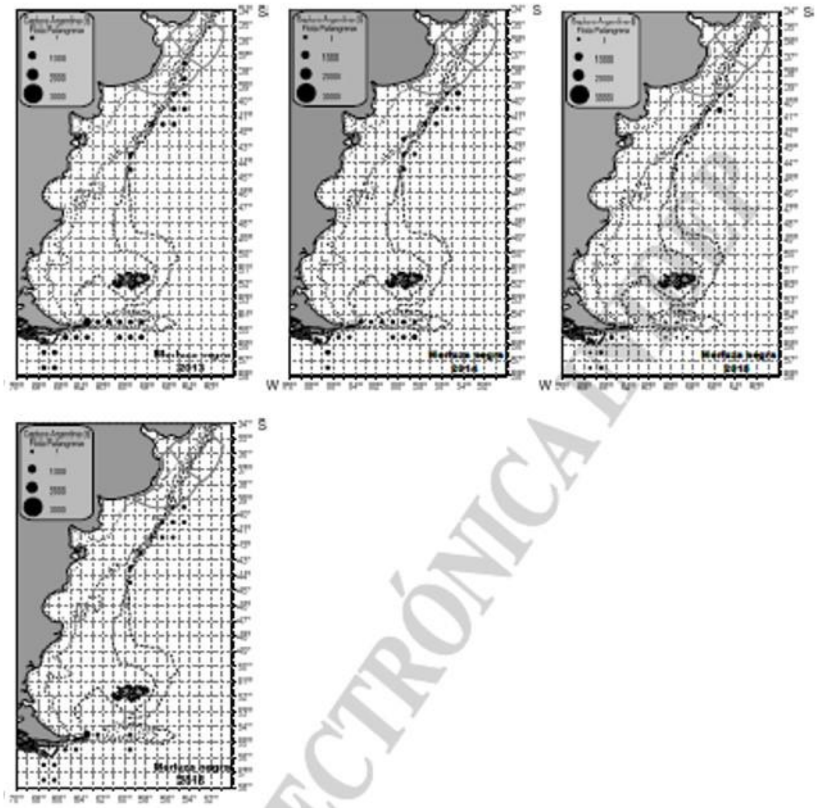


Figure 282. Annual catch (t) of the Patagonian toothfish reported by the Argentine longliner fleet per statistical fishing square. Source: Gorini and Giussi 2018.

The species is caught almost all year round, with greater activity between September and December and much less in the summer season (Figure 283).

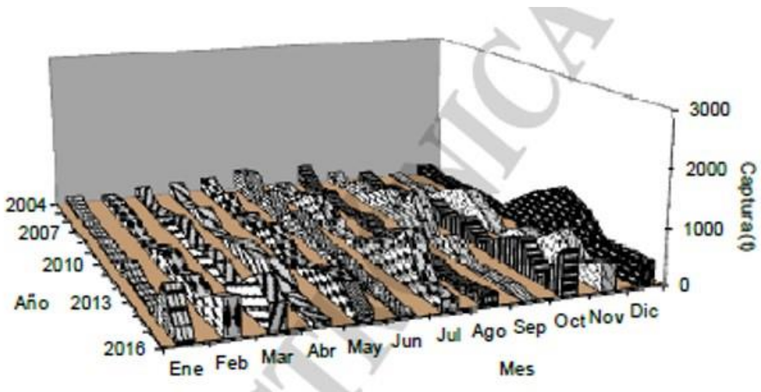


Figure 283. Monthly catch (t) of the Patagonian toothfish declared by the Argentine fleet that operated in the Argentine Exclusive Economic Zone (2004-2016). Source: Gorini and Giussi 2018.

(Translation of Figure 283: Año: year. Captura: catch. Mes: Month. Below: the months of the year from January to December).

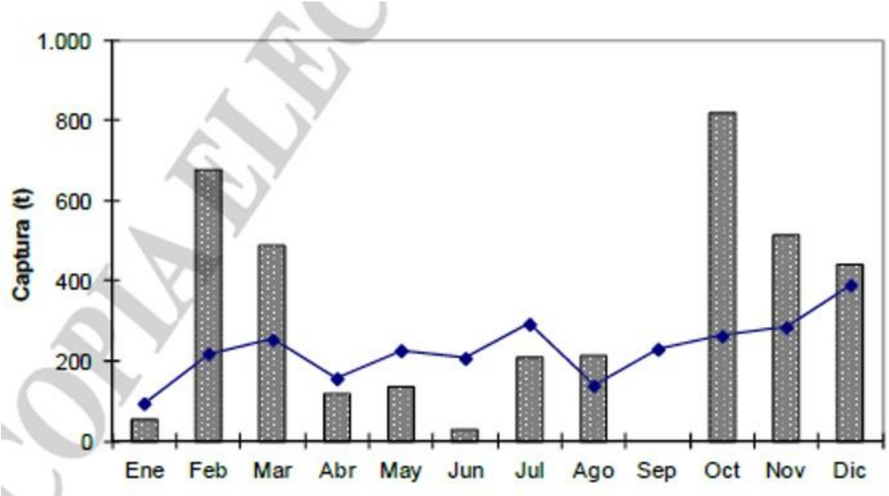


Figure 284. Monthly catch (t) of the Patagonian toothfish reported by the Argentine fleet (2016). The line corresponds to the monthly average of the analyzed period Source: Gorini and Giussi 2018.

(Translation of Figure 284: Captura: catch. Below: the months of the year from January to December).

8) Southern blue whiting (*Micromesistius australis*)

Figure 285 presents the total catches obtained for this species from 1980 to the present. The catch declared in 2016 (18,562 t) was higher than the historical minimum, obtained in 2011 (7,492 t), and could be a slight indication of recovery of the fishing stock (Gorini and Giussi 2018).

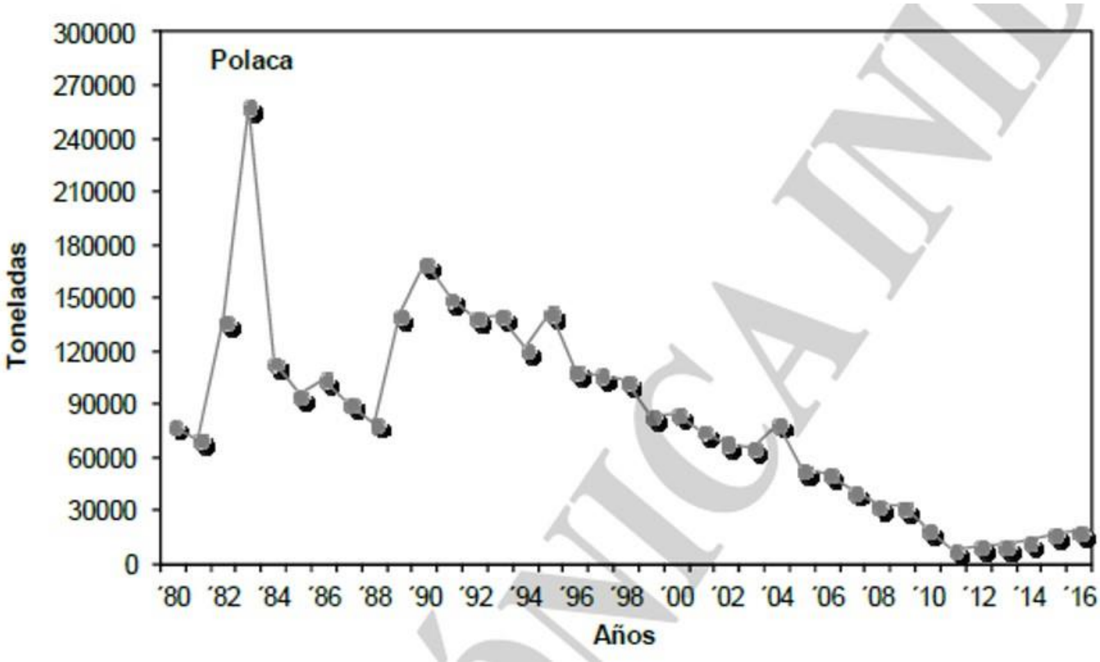


Figure 285. Total catches of the Southern blue whiting in the Southwest Atlantic Ocean from 1980 to the present. Source: Gorini and Giussi 2018.
(Translation of Figure 285: Polaca: Southern blue whiting. Toneladas: Tons. Años: years).

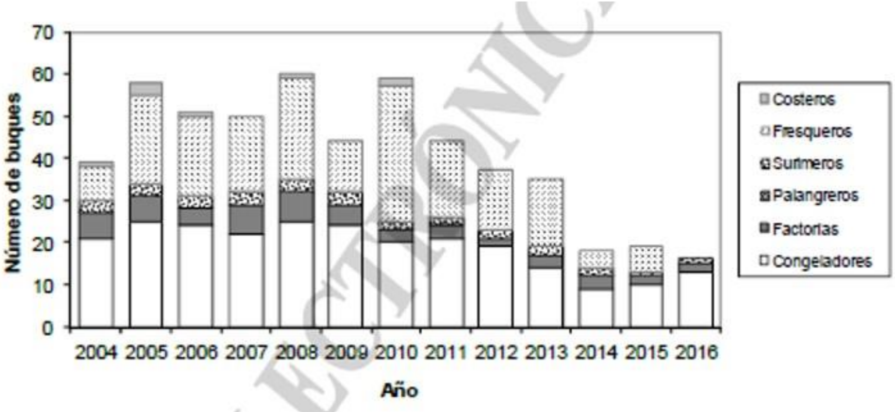


Figure 286. Number of Argentine vessels that reported catch of the Southern blue whiting by type of fleet for the 2004-2016 period. Source: Gorini and Giussi 2018.

(Translation of Figure 286: Número de Buques: Number of vessels. Año: year. Costeros: Coastal Fleet. Fresqueros: Wet-fish Stern Trawler fleet. Surímeros: Surimi Fleet. Palangreros: Longliner fleet. Factorías: Factory Fleet. Congeladores: Freezer trawler fleet).

The Southern blue whiting fishery has been suffering a very tagged reduction that has tended to stabilize as of 2012 with low values (Figure 287).

The largest landings of this species come from Surimi vessels (94%) (Figure 287).

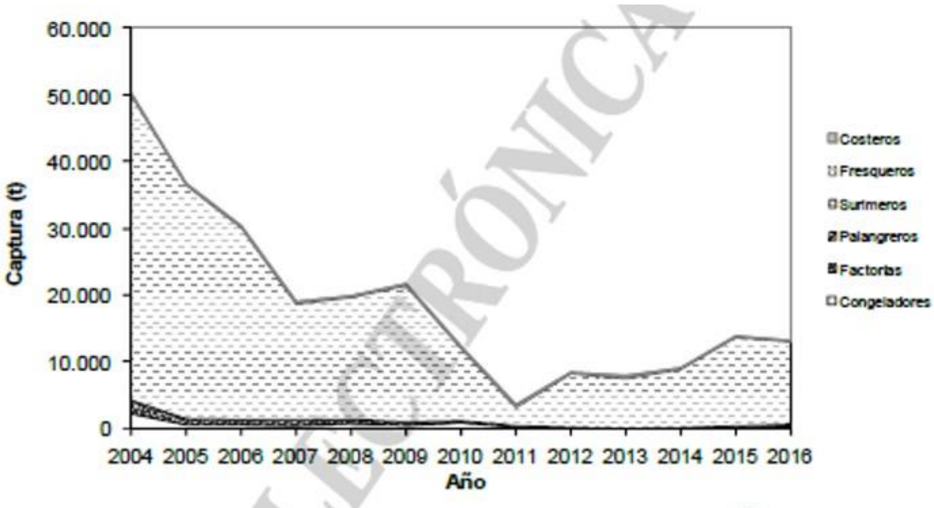


Figure 287. Annual Argentine catch (t) of the Southern Blue Whiting by type of fleet (2004-2016 period). Source: Gorini and Giussi 2018.

(Translation of Figure 287: Captura: catch. Año: year. Costeros: Coastal Fleet. Fresqueros: Wet-fish Stern Trawler fleet. Surímeros: Surimi Fleet. Palangreros: Longliner fleet. Factorías: Factory Fleet. Congeladores: Freezer trawler fleet).

The city of Usuhaia is the main port where the species is landed (Figure 288).

Figure 288. Annual landing (t) of the Southern blue whiting in the main Argentine ports (2016). Source: Gorini and Giussi 2018.

Figure 289 and Figure 290 indicate that the catch of this species is minimal in the project's area of influence (Gorini and Giussi 2018).

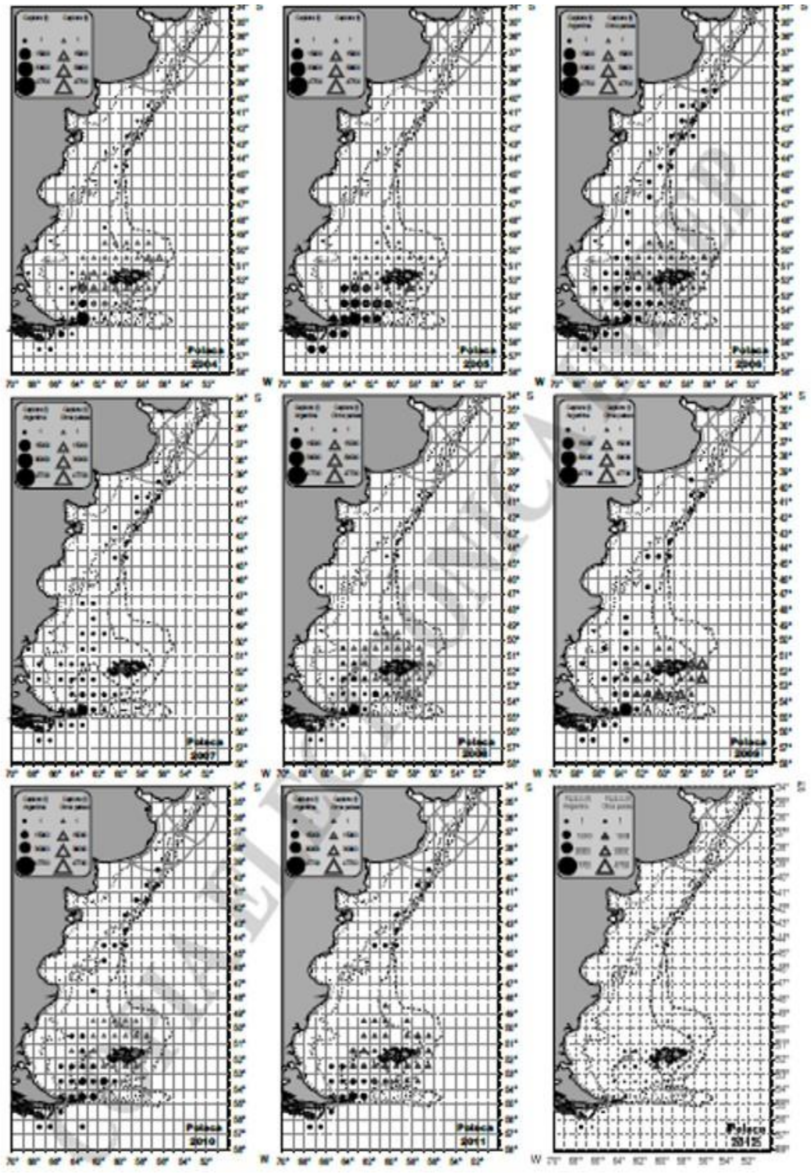


Figure 289. Annual catch (t) of the Southern blue whiting declared by the Argentine fleet and by the

foreign fleet operating in the Argentine Exclusive Economic Zone per fishing statistical square (2004-2012). Black circle: Argentine fleet catch. Open triangle: foreign fleet catch. Source: Gorini and Giussi 2018.

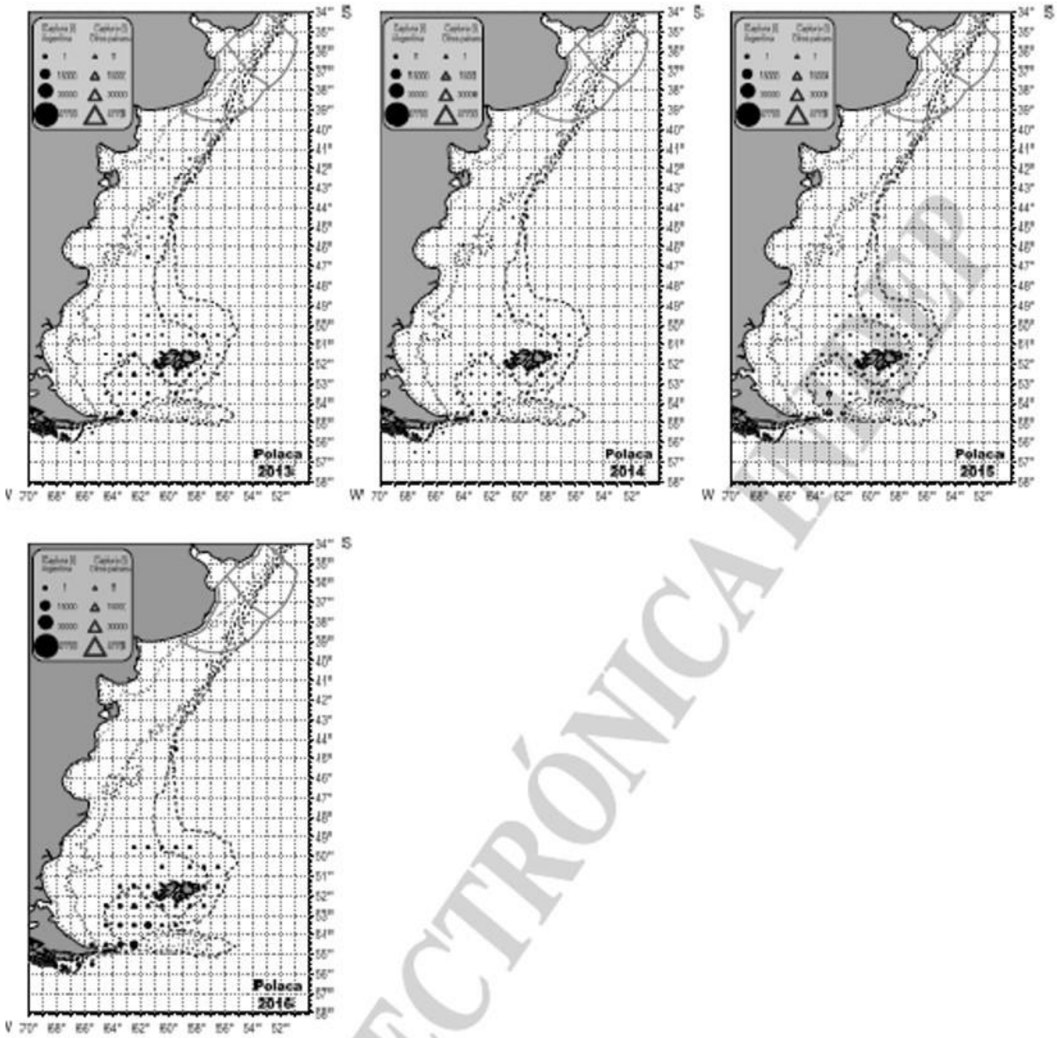


Figure 290. Annual catch (t) of the Southern blue whiting declared by the Argentine fleet and by the foreign fleet operating in the Argentine Exclusive Economic Zone per fishing statistical square (2013-2016). Black circle: Argentine fleet catch. Open triangle: foreign fleet catch. Source: Gorini and Giussi 2018.

The catch of this species exhibits a tagged seasonality, predominantly from March to June, and from November to December (Figure 291 and Figure 292).

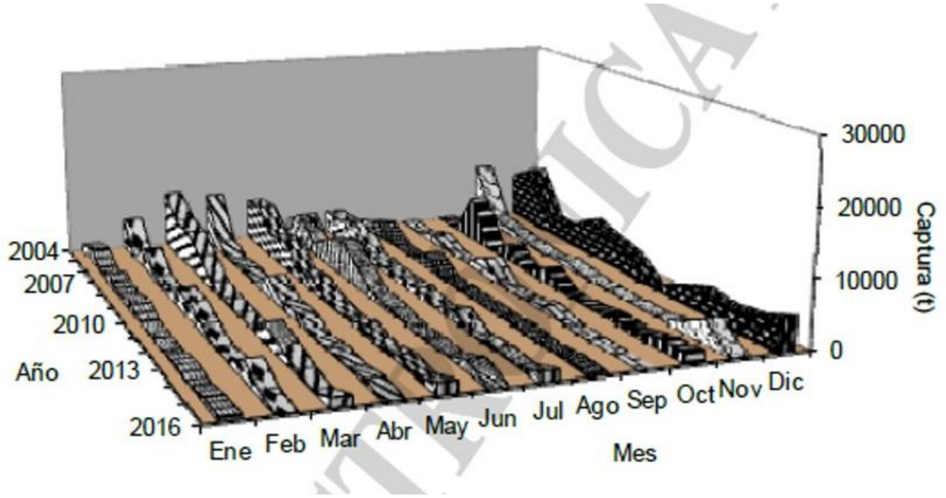


Figure 291. Monthly catch (t) of the Southern blue whiting declared by the Argentine fleet that operated in the Argentine Exclusive Economic Zone (2004-2016). Source: Gorini and Giussi 2018.
(Translation of Figure 291: Año: year. Captura: catch. Mes: Month. Below: the months of the year from January to December).

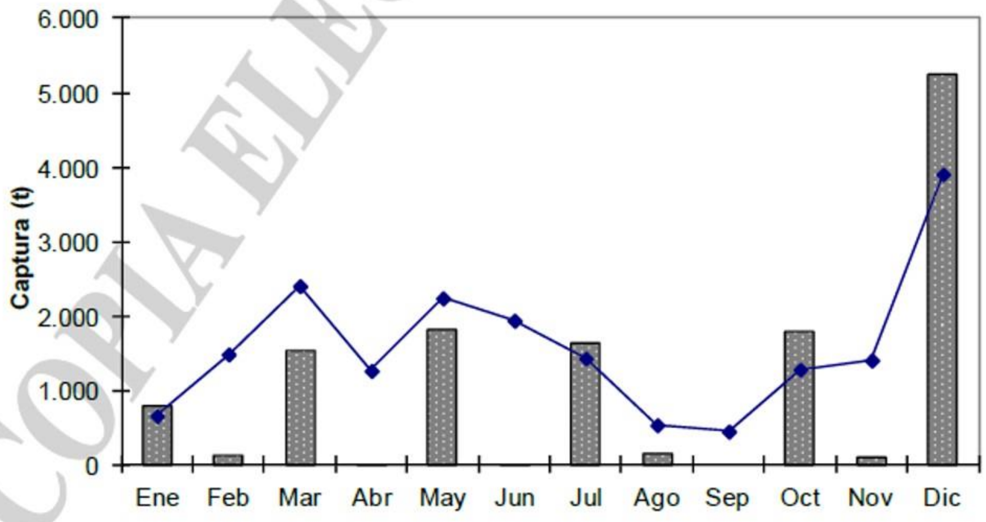


Figure 292. Monthly catch (t) of the Southern blue whiting declared by the Argentine fleet (2016). The line corresponds to the monthly average of the analyzed period Source: Gorini and Giussi 2018.

(Translation of Figure 292: Captura: catch. Below: the months of the year from January to December).

9) Pink cusk-eel (*Genypterus blacodes)*

It is a species that is not part of the fishing activity of the shelf, but is caught as part of the accompanying fauna of the hoki, common hake and pollock. On the other hand, the catch of this species near the Falkland Islands (Islas Malvinas) is obtained as a companion species of the hoki, even though part of the fishing fleet also seeks its catch during the breeding period (September-October) to the southwest of the Islands (Wöhler et al. 2001a).

The population density of this species in the southern shelf sector is low, with the most concentrated fishery in the central sector of Patagonia (Figure 293).

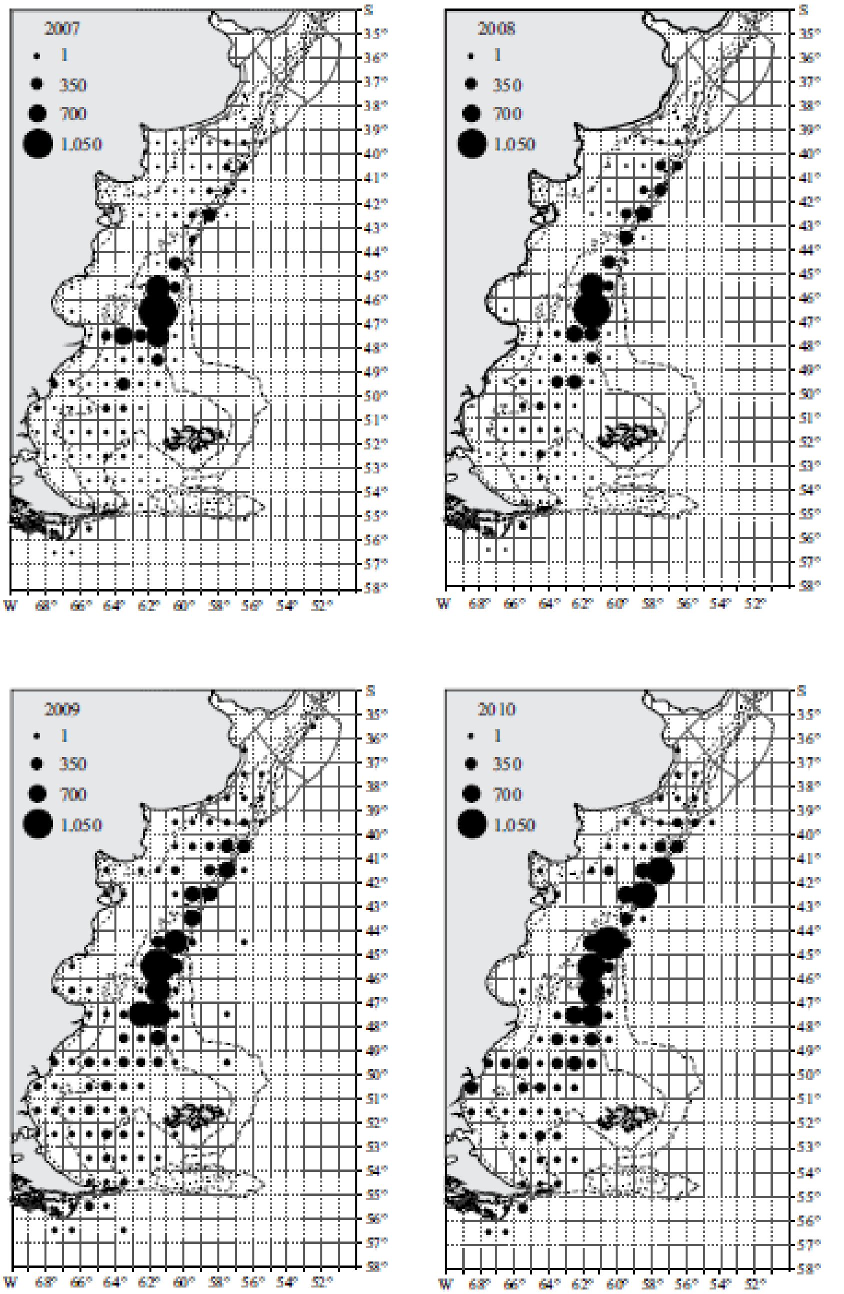


Figure 293. Pink cusk-eel catches by the Argentine trawling fleet between 1996 and 1999. Source: Gorini et al. 2015.

On an annual scale, it can be seen that the highest catches take place between the months of July to August even when the fleet operates on the edge of the platform all year round (Figure 294).

Biological characteristics determine that the pink cusl-eel is a highly vulnerable species to fishing exploitation. The assessment carried out during 2018 (Di Marco, 2019) showed a decreasing trend of the total and breeding biomass, placing it below the Target and Limit Biological Reference Points. Hence, the Enforcement Authority has regulated measures to moderate the fall, such as the annual decrease in the Maximum Allowable Catch, not allowing directed fishing, establishing catch quotas and closed areas.

The Pink cusk-eel landings ranged around 20,000 t between 1991 and 2011 and decreased to around 3,000 t in 2017. It is caught mainly by trawlers as an accompanying fauna in the hake fishery (Cordo 1998). Around 78% of the Argentine catch of this species would be incidental (50% in the hake fishery and 28% in other fisheries) and 22% is directed. Historically, most of the catch was produced by the wet-fish Stern trawler fleet ranging between 60 and 80% of the total Argentine catch, followed by freezer vessels amounting to 30 and 20%. The distribution of the declared catches shows a clear seasonality, being significantly higher those of the third quarter related to the high summer breeding concentrations that are partially protected by the ban on juvenile hake of the southern area.

It is observed that during the 2nd and 3rd quarters they produce the maximum landings for the project's area of influence and it not overlap with sensitive sites for this species.

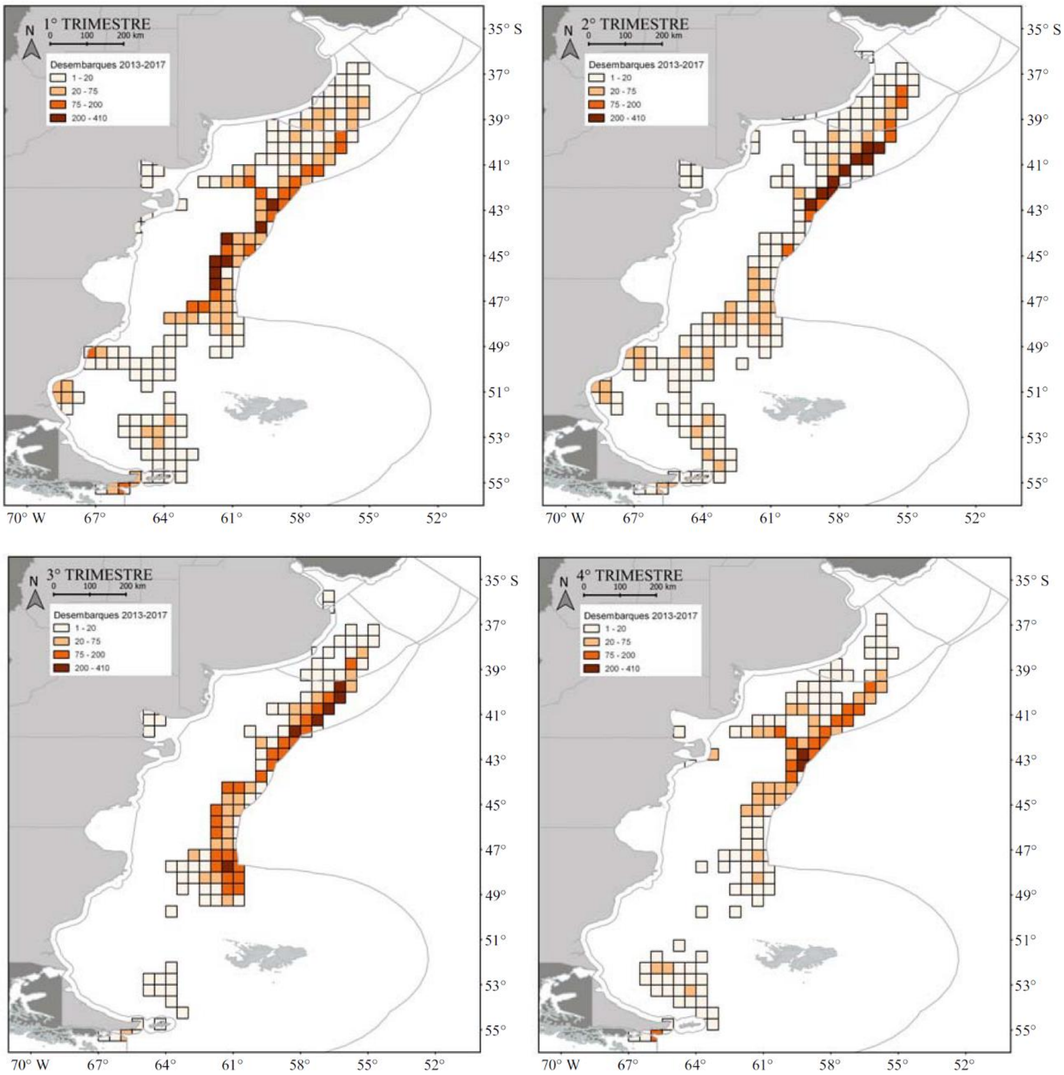


Figure 294. Distribution of the Pink cusk-eel landings, 2013-2017 period. Source: Allega et al. 2020.

(Translation of Figure 294: Trimestre: Quarter. Desembarques: Landings)

In general, this species is caught as a companion fauna for hake fishing. It is very vulnerable to high fishing pressure, and its catch has been drastically reduced since 2006 (Figure 295).

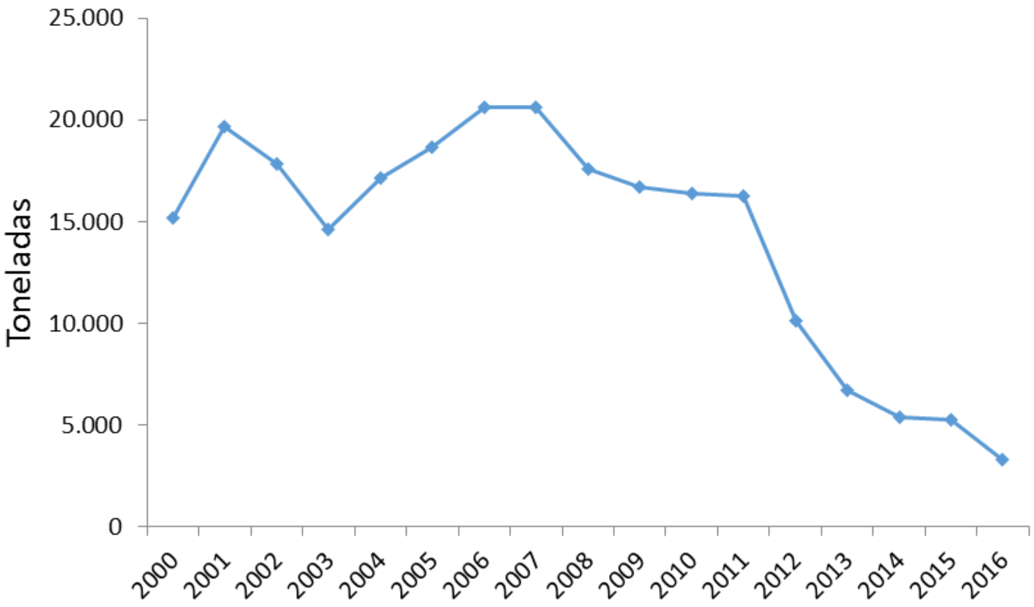


Figure 295. Pink cusk-eel catches. Source: https://www.argentina.gob.ar/agricultura-ganaderia-y-pesca.

The Pink cusk-eel is caught primarily between the months of March and April and as a companion fauna for hake fishing in October and November (Figure 296). The highest frequency of catches is recorded in the month of August and they are carried out mainly by the Stern Trawlers fleet, followed by freezer vessels (Figure 297).

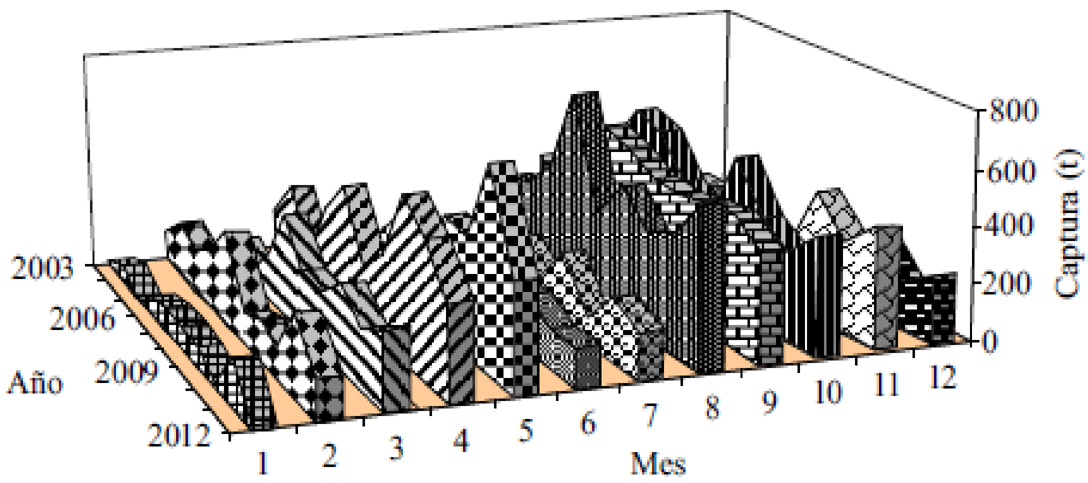


Figure 296. Monthly variation in the catch of the Pink cusk-eel between 2003 and 2012. Source: Gorini et al. 2015.

(Translation of Figure 296: Año: year. Captura: Catch. Mes: Month).

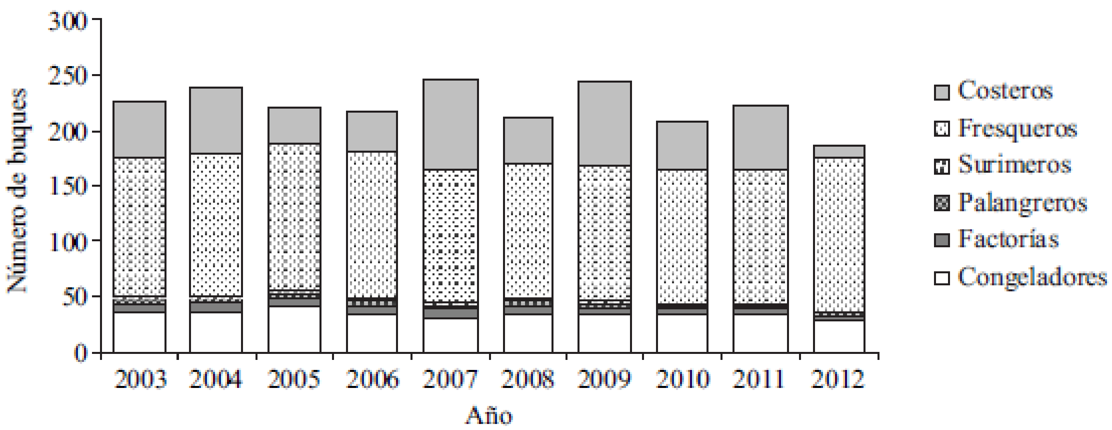


Figure 297. Pink cusk-eel landings according to the type of fleet for the 2003-2012 period. Source: Gorini et al. 2015.

(Translation of Figure 297: Número de Buques: Number of vessels. Año: year. Costeros: Coastal Fleet. Fresqueros: Wet-fish Stern Trawler fleet. Surímeros: Surimi Fleet. Palangreros: Longliner fleet. Factorías: Factory Fleet. Congeladores: Freezer trawler fleet).

Table 16 summarizes the temporary characteristics of the adjacent fisheries in the project area.

Table 16. Temporary distribution of the fishing activity of the species that may have a seasonal and spatial link with the project area.

Species	E	F	M	A	M	J	J	A	S	O	N	D
Roosterfish	■	■							■	■	■	■
Hake					■	■	■	■	■			
Hoki		■	■	■	■	■	■	■	■	■	■	■
Pollock *		■	■	■	■	■	■	■	■	■	■	
Patagonian toothfish *								■	■	■	■	■
Southern blue whiting			■	■	■	■					■	■
Cod		■	■	■	■	■				■	■	■
Patagonian Hake			■	■	■							■
Squid *					■	■	■	■	■			

***¨species of greater fishing importance.**

4.3.2 Reptiles

4.3.2.1 Species

The list of probable sea turtle species was prepared using the locations corresponding to the area of influence of the seismic data acquisition areas (CAN_100, CAN_108 and CAN_114), by consulting open databases of georeferenced occurrences and distribution maps of the species (Table 17). The macrotaxonomic classification and nomenclature followed is that contained in the Ocean Biodiversity Information System (OBIS - Ocean Biogeographic Information System, http://www.iobis.org/).

Table 17. Consulted sources of georeferenced open data for occurrences of sea turtles.

Reference Source	URL
OBIS, Ocean Biogeographic Information System	https://obis.org/
Base de datos SWOT (State of the World's Sea)	http://seamap.env.duke.edu/swot
Convención de Especies Migradoras (Convention on Migratory Species) (CMS)	http://www.cms.int
Convención Interamericana para la Protección y Conservación de las Tortugas Marinas (Inter-American Convention for the protection and conservation of sea turtles)	http://www.iacseaturtle.org
South Atlantic Sea Turtle Network	http://www.seaturtle.org
CID/Karumbé- Marine Turtles of Uruguay	http://www.karumbe.org/web/publi.htm
CICMAR from Uruguay	http://cicmar.org
Proyecto TAMAR de Brasil (Brazil TAMAR Project)	http://www.tamar.org.br
PRICTMA-Tortugas marinas de Argentina (Sea Turtles of Argentina)	https://www.facebook.com/PRICTMA-Tortugas-Marinas-de-Argentina-120843725160/
Model of the Argentine Sea	http://atlas-marpatagonico.org
NOAA	https://www.fisheries.noaa.gov/sea-turtles

Table 18 presents the list of species for the whole study area. Of the 7 species of sea turtles currently recognized, there are 3 potentially present in the project's area of influence, two confirmed for the detailed study area, and only one (loggerhead turtle) with records within the operational area and that of direct influence of CAN_100 - 108 sites.

Table 18. Sea turtle species appearing in the project area.

Order	Family	Species	Common name	Presence[a]
Testudines	Cheloniidae	*Caretta caretta*	Logerhead sea turtle	3
		Chelonia mydas	Green sea turtle	1
	Dermochelydae	*Dermochelys coriacea*	Leatherback sea turtle	2

[a] Presence categories. 1 – species only reported through global distribution maps. 2 - publications that present data on the occurrence of the species for the study area. 3- publications with data on the occurrence of the species within the operational areas.

4.3.2.2 Conservation Status

Table 19 describes the conservation status of the marine turtle species potentially present in the study area. At the local level, all species are threatened with categories, the most critical species being the leatherback turtle, which at the local level is endangered. According to the latest version of the IUCN Red List of Threatened Species of January 2020, all species of sea turtles in the Southwest Atlantic region are within global categories of threat of extinction and its population is declining.

Table 19. Conservation status of appearing sea turtle species.

Species	Common Name	MAyDS[a]	UICN[b]
Caretta caretta	Logerhead sea turtle	A	VU[1]
Chelonia mydas	Green sea turtle	A	EN[2]
Dermochelys coriacea	Leatherback sea turtle	EP[3]	VU

[a] MAyDS. Res. 1055/13. Categorization of Reptiles and Amphibians of Argentina. EP - endangered, A - threatened, V- vulnerable, NA- not threatened, CI- insufficiently known.

http://servicios.infoleg.gob.ar/infolegInternet/anexos/215000-219999/219633/norma.htm.

[b] IUCN (International Union for Conservation of Nature and Natural Resources) 2020-1: Red List of Endangered Species (www.iucnredlist.org LC: low risk, does not qualify for conservation categories; NT: low risk, close to threatened. VU: vulnerable; EN: endangered; CR critically endangered.

[1] Although the species is considered a vulnerable category (VU) globally, the review by Casale and Tucker (2017) would consider the populations of the Southwest Atlantic as of Least Concern (LC).

[2] Although the species is considered in a vulnerable category (VU) at a global level, the review by Broderick and Patricio (2019) considers that the populations of the southwest Atlantic are increasing as a result of the conservation measures that have been put into practice and qualify them as Least Concern (LC).

[3] This is the most critical species locally as it is in danger of extinction.

4.3.2.3 Legal instruments for its conservation

Argentina is signatory to various international agreements for the protection and conservation of various species, including sea turtles such as:

- Inter-American Convention for the Protection and Conservation of Sea Turtles (CIT): Approved by National Law 26,600 (2010).
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES): Approved by National Law 22,344 (1982). Appendices 2013 version

(http://www.cites.org/sites/default/files/esp/app/2013/S-Appendices-2013-06-12.pdf). All sea turtles are in Appendix I, which includes species that are in danger of extinction and CITES prohibits international trade of these species, except when the import is carried out for non-commercial purposes, for example, for scientific research. In these exceptional cases, trade may take place provided it is authorized by the granting of both an import permit and an export permit (or re-export certificate).

- Convention on the Conservation of Migratory Species of Wild Animals (CMS): Approved by National Law 23.918 (1991). https://www.cms.int/en/species/appendix-i-ii-cms. Appendix I lists endangered migratory species and Appendix II lists migratory species whose conservation status is unfavorable and that require international agreements to be concluded for their conservation, care and use, as well as those whose conservation status would benefit considerably from international cooperation resulting from an international agreement.

- Convention on Wetlands of International Importance (Ramsar, 1971): Approved by National Laws 23,919 (1991) and 25,335 (2000).

- Convention on Biological Diversity (CBD): Approved by National Law 24,375 (1994).

- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Substances (LC 1972): Approved by Law 21.947 (1979) (and its 1996 protocol). International Convention to Prevent Pollution from Ships (MARPOL 73/78): Approved by Law 24.089 (1992).

- United Nations Convention on the Law of the Sea (UNCLOS): Approved by National Law 24,543 (1995).

The following can be pointed out at the National level:

- Resolution 1.055 / 2013 SAyDS: Categorization of amphibians and reptiles of the Argentine Republic. http://servicios.infoleg.gob.ar/infolegInternet/anexos/215000-219999/219633/norma.htm.

- National Law 22,421 / 1981: Law of Conservation and Protection of Wild Fauna and its Regulatory Decree 666/1997 and Resolutions 1089 (of the year 1998), 3 (of the year 2001) and 91 (of the year 2003) protect sea turtles at the National level, entrusting the National Institute for Fisheries Research and Development (INIDEP) the quantification of the catch of reptiles, birds and marine mammals.

- National Law 24.922 / 1997: Federal Fishing System and its Regulatory Decree 748/1999. The Undersecretariat of Fisheries and Aquaculture (SSPyA) is the Enforcement Authority.

- Resolution SAyDS 513/2007: It Prohibits the hunting, capture, interprovincial transit, trade in federal jurisdiction and the export of live specimens, products and by-products of wild fauna, including the sea turtles in Annex I.

- National Law 25.675 / 2002: General Law of the Environment. The Secretariat for the Environment and Sustainable Development (SAyDS)[10] is the Enforcement Authority.

- National Strategy on Biological Diversity and National Advisory Commission for the conservation and sustainable use of biological diversity (CONADIBIO).

- Associated with the International Convention to Prevent Pollution from Ships (MARPOL 73/78) mentioned above. There are also numerous ordinances and provisions of the Argentine Coast Guard (PNA).

- National Action Plan for the Conservation of Sea Turtles (PAN-Tortugas Marinas), made up of CFP Resolution No. 14-2018 and COFEMA Resolution No. 317-2015, available at: https://www.magyp.gob.ar/sitio/areas/pesca_maritima/plan/PAN-TORTUGAS/index.php

The Samborombón Bay Ramsar site is the current Argentine protected area with the highest conservation value for sea turtles. However, it is located more than 350 km from the seismic data acquisition areas and more than 200 km from the Port of Mar del Plata, so the aforementioned site shall not be affected by the project. The other coastal areas closest to the port area do not present protected areas with conservation value for sea turtles, although they register strandings and incidental catches of adults.

4.3.2.4 Vulnerable species

All species of sea turtles are long-distance migrants whose populations nest several thousand kilometers in the Southwest and Southeast Atlantic. They are poikilothermic vertebrates, which depend on the temperature of the environment to regulate their metabolic activity and therefore are conditioned to the presence of warm waters. The region of the slope to be surveyed corresponds to a water transition zone, with Platform and subtropical waters of Brazil predominantly on the surface, and subantarctic waters of the Falkland Islands (Islas Malvinas) in depth that provide a wide diversity of habitats and food resources that allow the superposition of marine species of warm, temperate and cold waters in different sectors of the water column. Based on the above, the presence of sea turtles for the study area is only associated with the Brazilian current.

The main threats recognized for sea turtles come from their interaction with artisanal and industrial fishing activities, contamination of the aquatic environment with plastic waste which is confused with food, modifications in nesting beaches due to tourist activities, hotel and port developments and the use of its shell as an ornament (Domingo et al 2006, Domingo et al 2016, Falabella et al 2019).

The main recipients of the potential impacts of the prospecting activities are considered to be species with confirmed occurrences in the study area that are abundant or frequent, or potentially present species that present some level of local or global threat. Although all the species meet at least one of these criteria and their main characteristics are described below, the loggerhead turtle and the leatherback turtle would be the ones most likely to be found in the area near CAN_100 and CAN_108 during the summer season.

4.3.2.5 Biological and ecological characterization of the main species of sea turtles

The descriptions are based on the sources that appear in Table 18, unless expressly mentioned. The distribution maps of the population stocks of the SW Atlantic are based on the publication of Wallace et al 2010, which has been replicated in other portals (for example, SWOT).

The area of regional influence is located in the migratory corridor of the species of sea turtles and therefore they are considered to be present in the area of influence of the project.

Loggerhead Turtle - Caretta caretta

Geographical distribution. The loggerhead turtle inhabits tropical and sub-tropical waters. Genetic studies have confirmed the presence of different stocks, the Southwest Atlantic being the one corresponding to the project area (Figure 298). It is very common to register strandings and accidental catches of this species along the Buenos Aires coast, mainly from spring to early fall.

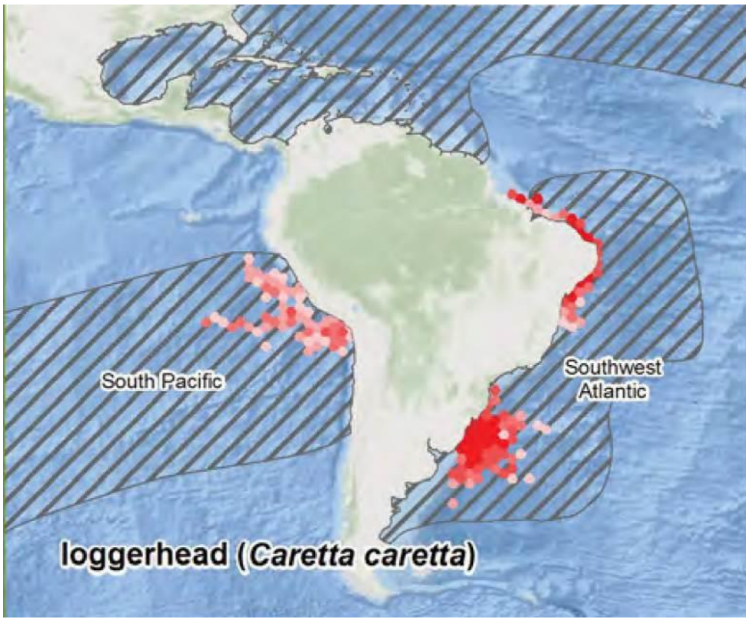


Figure 298. Geographic distribution area of loggerhead turtle populations for South America. The red areas show the activity of individuals tagged and monitored with satellite telemetry, and the striped pattern indicates the potential distribution areas of each stock. Source: Wallace et. al., 2010.

Reproduction. Loggerhead turtles breed on sandy beaches on the Brazilian coast of Bahia, Espírito Santo and Rio de Janeiro (Mansfield et. al., 2017). After hatching and leaving the nest they begin an oceanic phase in which they remain from 4 to 19 years, being later recruited in neritic areas where benthic or epipelagic prey abound, where they remain between 10 to 39 years feeding. When they reach sexual maturity, they begin migrations between feeding and breeding areas, with intervals of several years. During non-Breeding periods they remain in the neritic feeding areas, which sometimes coincide with the areas of juvenile development. The IUCN considers that an age of 30 years is equal to or greater than the age of first maturity, and that Breeding longevity is equal to or greater than 15 years, so 45 years could be considered moderate for a generation.

Feeding. Loggerhead turtles are generalists consuming an important variety of benthic invertebrates with a lot of flexibility in their diet according to supply (Seney and Musick 2007).

Areas of activity and migration. The main foraging areas for larger juveniles and sub-adults are located along the continental shelf and slope in waters of the exclusive economic zones of Brazil, Uruguay and northern Argentina, and the adjacent international waters (Mansfield et. al., 2017). Recent studies of satellite monitoring (González Carman et. Al., 2016), indicate that the estuary of the Río de la Plata is an important feeding area from spring to autumn, with areas of constant fidelity on the part of the tagged individuals. Barceló et al., (2013) verified that the latitudinal movements depend on the season of the year and the water temperature, also obtaining information on the diving characteristics of 5 tagged specimens. The maximum diving depths were between 100 and 300 m, indicating potential benthic feeding in some cases. The temperatures recorded on the surface were 19.8 ± 2.3 ° C, with a range between 10.2 and 28.4 ° C. The turtles showed affinity for areas with moderate to high levels of primary production (0.43 ± 0.89 mgm-3°chlorophyll a).

Population status. The population abundance and its trends at a global or local level are unknown.

Conservation Status. Although the species is considered a vulnerable category (VU) globally, the Casale and Tucker review of 2017 would consider the populations of the Southwest Atlantic as of Least Concern (LC). However, this species is considered Threatened at the local level according to the categorization of amphibians in Argentina given by Resolution 1055/13 of SAyDS.

Hybridization in loggerhead turtle: The spatial distribution of hawksbill turtle (Eretmochelys imbricata) is tropical, with late adults and juveniles occasionally present in coastal habitats in Uruguay, but not recorded as bycatch by the Argentine fishing fleet in the open sea (PAN -Turtles). This led to consider that they would be outside the area of influence of the project. However, due to the variations in the location of the confluence of the Brazilian and Malvinas currents, it is valid to consider their presence for the Argentine sea in a general way. Prosdocimi et al (2014) present a map that indicates the presence of hawksbill turtles in the estuary of the Río de la Plata and in the area known as El Rincón. These records correspond to late juveniles, indicating that the one from the Río de la Plata (Bruno and Albareda, 2009) was caught alive in April 2009 by an artisanal coastal fishery of San Clemente del Tuyú by gill nets, and that of "El Rincón" was found dead off the coast of Monte Hermoso in March 2010. Both locations are considered coastal and not open sea. The DNA analyzed from these specimens would be a hybrid of female loggerhead turtle with male hawksbill turtle, which would explain their presence in more temperate latitudes, given the distribution of the loggerhead turtle. According to Proetti et al (2014), this hybridization phenomenon seems to be very frequent in certain breeding areas of Brazil, and the hybrid juveniles would use the feeding sites of the loggerhead turtle.

Green Turtle- *Chelonia mydas.*

Geographic distribution. The green turtle reaches the tropical and subtropical oceans around the world (Figure 299). There are several populations or genetic stocks, particularly those of the south-central Atlantic where the Project area is located. It is usually found from the estuary of the Río de la Plata to Puerto Pirámides, Province of Chubut. Juveniles are present in neritic waters throughout the South American continent and the oceanic islands (Domingo et. Al., 2006). Particularly, they are present all year round in Uruguayan coasts along the salinity gradient defined by the confluence of the freshwater discharge from the Río de La Plata and the oceanic masses. Their presence in the Project latitude would be during the months of the summer period.

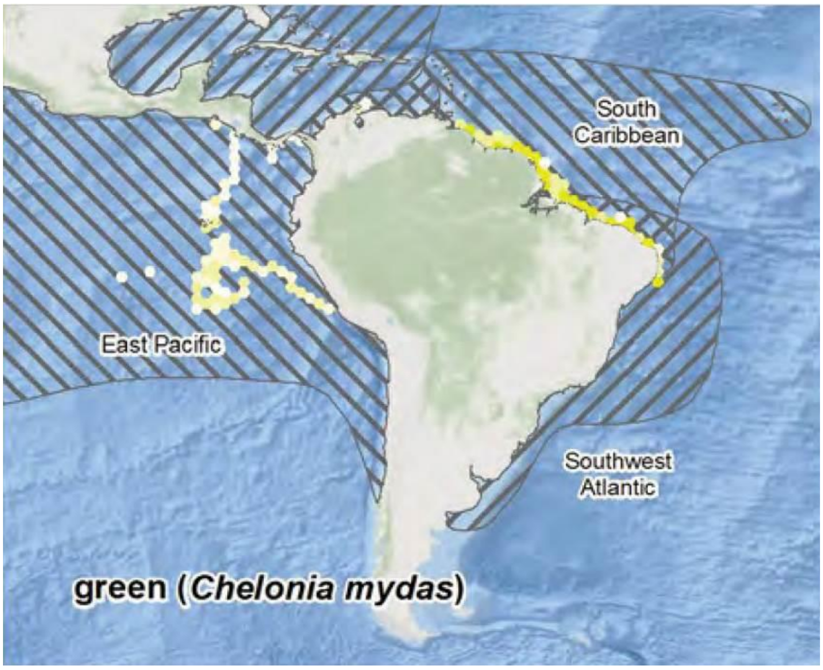


Figure 299. Geographic distribution area of green turtle populations for South America. The yellow Areas show the activity of individuals tagged and monitored with satellite telemetry, and the striped pattern indicates the potential distribution areas of each stock. Source: Wallace et. al., 2010.

Reproduction. Green turtles alternate in three different types of habitat, depending on their life stages. Mature turtles often return to the exact beach from which they hatched. They nest on the beaches of oceanic islands in the South Atlantic such as Trinidad, Atol das Rocas, and Fernando de Noronha, Isla de Aves (Venezuela), the most notable nesting site being Ascensión Island. Less frequently, they also nest on the north coast of Bahia, in Brazil, on the coasts of Suriname, and also of Guinea Bissau in Africa (Caraccio, 2008; Caraccio et al. 2008). In the first five years of their lives, turtles spend most of their time in convergence zones in the open ocean. These young turtles are rarely seen as they swim in deep, pelagic waters. Instead, adult turtles spend most of their time in shallow coastal waters, rich in seagrass beds. This particular species is recognized for being very selective in terms of feeding and mating sites, so much so that entire generations can alternately migrate between the same nesting and mating areas. Females usually mate every two to four years.

Males, on the other hand, travel to the mating grounds every year. Mating times vary between different populations. For almost all green turtles in the Caribbean, the mating season runs from June to September, but the French Guyana subpopulation nests between March and June. It is considered that they take 20 to 50 years to reach maturity. Turtles are known to reach ages of up to 80 years.

Feeding. *Chelonia mydas* forages in widely distributed sites throughout the region and changes its feeding pattern throughout its life cycle. From newborn to three to five years they are pelagic carnivores, consuming mini-nekton from the open ocean. Young immature turtles live on jellyfish (cnidarians) and small crustaceans. Then, as they enter adulthood, they gradually become more herbivorous and visit shallower waters, being frequently found in seagrass beds of *Zoostera, Thalassia* and *Posidonia* near the coast, but can also feed on macroalgae, mollusks and fish.

Areas of Activity. Green turtles migrate great distances between their selected foraging grounds and the beaches where they hatched. Unlike the nesting sites that are quite concentrated, there is an important feeding and breeding area for juvenile turtles along the entire coast of Brazil and Uruguay that includes oceanic locations such as Cerro Verde, Punta del Diablo and Valizas- Cabo Polonio and estuarine sites such as Bajos del Solıs (Lopez-Mendilaharsu et. al., 2006).

Population status. The population abundance and its trends at a global or local level are unknown.

Conservation Status. Although the species is an endangered category (EN) at a global level, the review by Broderick and Patricio (2019) considers that the populations of the southwest Atlantic are increasing as a consequence of the conservation measures that have been put into practice and qualify them as of Least Concern (LC) for this region, despite the need of permanent monitoring. However, this species is considered Threatened at the local level pursuant to the categorization of amphibians in Argentina given by Resolution 1055/13 of SAyDS.

Threats. As large, well-protected animals, adult green turtles have few enemies and predators. They are food for humans and large sharks that feed on adult turtles. Young and newborn turtles have many more predators, including various species of crabs, marine mammals, and shorebirds.

Leatherback sea turtle - *Dermochelys coriacea*

Geographical distribution. It inhabits all the tropical and subtropical oceans and even ventures into sub-arctic waters. Genetic studies have confirmed the presence of different stocks, the Southwest Atlantic being the one corresponding to the project area (Figure 300). Satellite telemetry studies have confirmed migration routes across the South Atlantic (Fossette et al. 2014).

Figure 300. Geographic distribution area of Leatherback sea turtle populations for South America. The green areas show the activity of individuals tagged and monitored with satellite telemetry, and the striped pattern indicates the potential distribution areas of each stock. Source: Wallace et. al., 2010.

Figure 301 shows the course of a specimen caught in the Río de La Plata followed by a satellite transmitter for almost two years, where the entrance in the project area is observed during the summer.

Figure 301. Satellite tracking of Zoe, a leatherback turtle, caught in the Rio del Plata estuary in October 2006, released near the town of Kiyu, in San Jose, Uruguay, and tracked until July 2008. Sources: http://www.prictma.com.ar/seguimiento.php?id=2, y http://google-earth-es.blogspot.com.ar/2008_02_01_archive.html, accedidas 10/3/2017.

Reproduction. Leatherback turtles mate in the sea. Males never leave the water once they enter it as young turtles. The females mate every three to four years, returning to the beaches where they hatched themselves to lay their eggs. A female can lay up to 100 eggs in each deposition, producing 3 to 10 lays per season. The interval between one laying and the next is about nine days. The first mating occurs after the turtle is ten years old.

Feeding. Leatherback turtles mainly feed on different species of jellyfish. The beak is hooked, allowing it to bite into jellyfish, salps, and siphonophores, and its throat has inward-pointing baleens that help it swallow them. Due to the transparent nature of their prey, leatherback turtles often suffocate by eating bits of drifting plastic. Dead specimens have been found with plastic bags, pieces of hard plastic and fishing line in the stomach. While jellyfish make up the majority of their food, they can also eat fish, crustaceans, squid, sea urchins, and algae. It can eat a quantity of prey equivalent to its own weight each day.

Areas of Activity. This species presents breathing and cardiovascular physiological adaptations for deep and prolonged diving. Its metabolic rate is approximately 3 times higher than expected for a reptile of its size, which, together with its counter-current heat exchangers and its large size, allows it to maintain a body temperature of up to 18 ° C above the surrounding water. It can submerge for a long time (an hour or more) thanks in part to the extraction of oxygen from the water with its long papillae located in the throat and the recovery of dissolved oxygen in its tissues. Diving depths up to 1,280 m have been recorded. Deep and long-duration dives are not the most common, being less than 250 m the most frequent with 10–20 minute-duration (López-Mendilaharsu et. al., 2009).

Fossette et al (2014) analyzed the spatial distribution and density of the species from satellite telemetry data carried out between 1995 and 2010. This study highlights that the tagged specimens showed densities between October and March in areas close to the project area (Figure 302). As has been pointed out for the other species of sea turtles in the region, the Rio de la Plata estuary is an important feeding area.

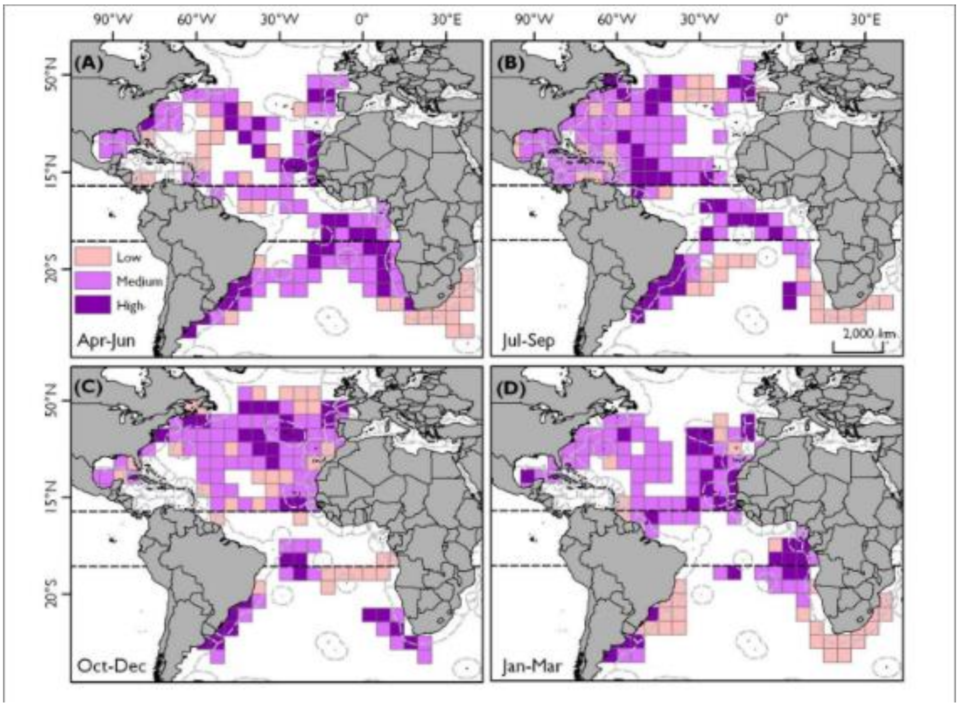


Figure 302. Distribution and seasonal density of leatherback turtles estimated from satellite telemetry data between 1995 and 2010. Source: Fossette et. al., (2014).

Conservation Status. The species is considered vulnerable (VU) by the IUCN according to the last evaluation of the year 2013. However, this species is considered Endangered at the local level pursuant to the categorization of amphibians in Argentina given by Resolution 1055/13 of SAyDS.

4.3.2.6 Life Cycle of Sea turtles

Figure 303 presents the general life cycle of sea turtles. Spawning areas are located in coastal environments, generally thousands of km from the areas where adult individuals spend most of their lives, so all species are long-distance migrants.

Sea turtles orient themselves with the help of the magnetic field (Lohman 2001), exhibiting innate senses of orientation and navigation (Lohman 2012). Recent studies have found that the net movements of turtles in their first years of life are the result of the interaction between the orientation and swimming behavior of the turtles and the processes of oceanic circulation (Mansfield et al 2017). The latitudinal location of the nests, the time of hatching of the eggs and the spatial patterns of the marine currents shall determine trajectories that keep individuals within the platform or move them towards open oceanic waters. Genetic studies confirm the presence of individuals belonging to populations that nest several thousand kilometers away in the Southwest and Southeast Atlantic (Wallace et al 2010).

There are no breeding areas for sea turtles in our country. The area of regional influence is located in the migratory corridor of the species of sea turtles and therefore they are considered to be present in the area of influence of the project.

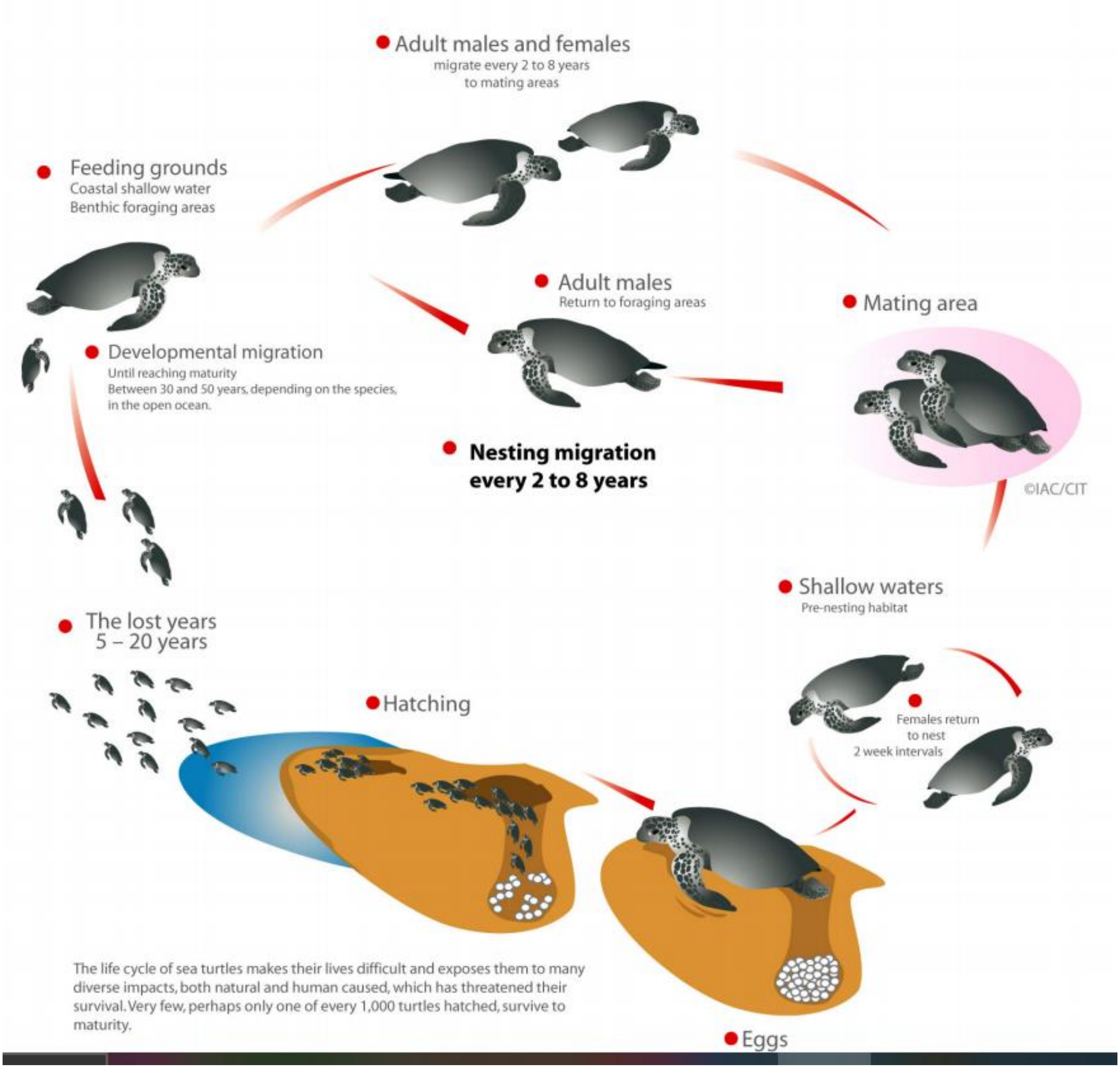


Figure 303. Sea Turtles life cycle. Source: http://www.iacseaturtle.org/docs/publicaciones/11-ciclo-de-vida-ESP.pdf

4.3.2.7 Threats

Various authors point out that the main recognized threats come from their interaction with artisanal and industrial fishing activity, contamination of the aquatic environment with plastic waste which is confused with food, modifications in nesting beaches due to tourist activities, hotel and port developments and the use of their shell as a food ornament (Morabito et al 2011, Acuña et al 2014, González Carman 2012, Wallace et al 2013). There are other additional threats such as the reduction of nesting areas due to rising sea levels and light pollution in the marine environment derived from the use of artificial lighting to fish cephalopods or other species (CMS 2019).

4.3.3 Seabirds

4.3.3.1 Species

An initial list of probable seabird species for the detailed study area was prepared from the global or regional distribution maps present in field guides and portals (Table 20). The occurrence of these species was confirmed by consulting open databases of georeferenced occurrences and recent publications. The taxonomic nomenclature used in the *Handbook of the Birds of the World Alive* (2020) is followed, with the common names used in the Categorization of the Conservation Status of Native Birds (2015).

Table 20. Main sources consulted for occurrences of seabirds.

Reference sources	URL or quote
Argentine and Uruguayan Birds Field Guide	Narosky and Yzurieta 2010
Collins Field Guide to Birds of South America - no passeriformes	Rodriguez Mata et al 2006
CMS, Convention on Migratory Species	http://www.cms.int
Handbook of the Birds of the World Alive	https://www.hbw.com/species
(ACAP) Agreement on the Conservation of Albatrosses and Petrels	http://www.acap.aq
Seabird Maps and Information for Fisheries (FS). Tools to assess the interaction between fisheries and the distribution of seabirds	https://www.fisheryandseabird.info/
Global Biodiversity Information Facility GBIF	http://www.gbif.org/
OBIS, Ocean Biogeographic Information System	https://www.obis.org/
eBird , Bird Observation Database	https://ebird.org/explore
Falabella et al 2009. Atlas of the Patagonian Sea (AMP)	http://atlas-marpatagonico.org
Reports of campaigns carried out by researchers from CONICET from CENPAT and CADIC on board the "Rio Deseado" vessel	https://proyectosinv.conicet.gov.ar/informes-de-campana/
National Action Plan to Reduce Interaction of Birds with Fisheries (**PAN AVES**) in the Argentine Republic.	http://cfp.gob.ar/wp-content/uploads/2017/09/PANAVES.pdf
Publications with spatial distribution of seabirds densities on the Argentine continental shelf and the South Atlantic Ocean	Montalti and Orgeira 1998, Orgeira 2001, Favero et al 2005, Favero et al 2013, Rey and Huettmann 2020, BirdLife International 2004.
Scientific Committee on Antarctic Research-Marine Biodiversity Information Network (SCAR-MarBIN)	http://data.biodiversity.aq/

Fourty-nine (49) potentially present species were counted for the study area with 46 confirmed occurrences in recent years (Table 21). The following order is displayed in the project area: Spheniciformes (penguins), with 6 species; Procellariiformes (petrels, albatrosses and shearwaters) with 34 species, Pelecaniformes with 1 species and Charadriformes (plovers and jaegers) with 8 species.

Table 21. Seabird species present in the project area.

Order	Family	Common Name	Scientific Name	Presence[a]
Spheniciformes	Spheniscidae	King Penguin	*Aptenodytes patagonicus*	2
		Emperor Penguin	*Aptenodytes forsteri*	1
		Chinstrap Penguin	*Pygoscelis antarcticus*	1
		Magellanic Penguin	*Spheniscus magellanicus*	3
		Macaroni Penguin	*Eudyptes chrysolophus*	2
		Rockhopper Penguin	*Eudyptes chrysocome*	2
Procellariiformes	Diomedeidae	Royal Albatross	*Diomedea epomophora*	2
		Northern Royal Albatross	*Diomedea sanfordi*	2
		Wandering Albatross	*Diomedea exulans*	3
		Tristan Albatross	*Diomedea dabbenena*	2
		Sooty Albatross	*Phoebetria fusca*	3
		Light-mantled Albatross	*Phoebetria palpebrata*	2
		Yellow-nosed Albatross	*Thalassarche chlororhynchos*	3
		Black-browed Albatross	*Thalassarche melanophris*	3
		Grey-headed Albatross	*Thalassarche chrysostoma*	2
		Shy Albatross	*Thalassarche cauta*	2
		White-capped Albatross	*Thalassarche steadi*	2
	Procelariidae	Common Giant-Petrel	*Macronectes giganteus*	3
		Hall´s Giant Petrel	*Macronectes halli*	3
		Southern Fulmar	*Fulmarus glacialoides*	2
		Pintado Petrel	*Daption capense*	2
		Soft-Plumaged Petrel	*Pterodroma mollis*	2
		Atlantic Petrel	*Pterodroma incerta*	3

Order	Family	Common Name	Scientific Name	Presence[a]
		White-headed Petrel	*Pterodroma lessonii*	2
		Trinidade Petrel	*Pterodroma arminjoniana*	2
		Blue Petrel	*Halobaena caerulea*	2
		Antarctic Prion	*Pachyptila desolata*	2
		Slender-billed Prion	*Pachyptila belcheri*	2
		Grey Petrel	*Procellaria cinerea*	2
		White-chinned Petrel	*Procellaria aequinoctialis*	3
		Large Shearwater	*Calonectris borealis*	2
		Cory´s Shearwater	*Calonectris diomedea*	2
		Sooty Shearwater	*Ardenna grisea*	3
		Great Shearwater	*Ardenna gravis*	3
		Manx Shearwater	*Puffinus puffinus*	2
		Little Shearwater	*Puffinus assimilis*	2
	Hydrobatidae	White-bellied Storm-Petrel	*Fregetta grallaria*	2
		Black-bellied Storm-Petrel	*Fregetta tropica*	2
		Wilson´s Storm-Petrel	*Oceanites oceanicus*	3
		White-faced Storm-Petrel	*Pelagodroma marina*	2
Pelecaniformes	Pelecanoididae	Common Diving-Petrel	*Pelecanoides urinatrix*	1
Charadriformes	Stercorariidae	Chilean Skua	*Stercorarius chilensis*	2
		Brown Skua	*Catharacta -antárctica (=Stercorarius antarcticus)*	2
		South Polar Skua	*Catharacta maccormicki*	2
		Great Skua	*Catharacta pomarinus*	2
		Arctic Skua	*Stercorarius parasiticus*	2
		Long-tailed Skua	*Stercorarius longicaudus*	2
	Laridae	Arctic Tern	*Sterna paradisaea*	2
		Antarctic Tern	*Sterna vittata*	2

a. Presence categories. 1 – species only reported through global distribution maps. 2 - Between 1 to 5 publications that present data on the species occurrence. 3- more than 5 publications with data on the species occurrence and / or estimates of abundance or more frequent times.

The very frequent and abundant species in the region are: Magellanic Penguin (*Spheniscus magellanicus*), Wandering Albatross (*Diomedea exulans*), Sooty Albatross (*Phoebetria fusca*), Yellow-nosed Albatross (*Thalassarche chlororhynchos*), Black-browed Albatross (*Thalassarche melanophris*), Common Giant Petrel (*Macronectes giganteus*), Hall´s Giant Petrel (*Macronectes halli*), Atlantic Petrel (*Pterodroma incerta*), White-chinned Petrel (*Procellaria aequinoctialis*), Sooty Shearwater (*Ardenna grisea*), Great Shearwater (*Ardenna gravis*) and Wilson´s Storm Petrel (*Oceanites oceanicus*).

4.3.3.2 Conservation Status

Table 22 presents the list of species with confirmed presence along with their Categorization of the Conservation Status of Native Birds (CAT-AR 2015), and the Red List of threatened species prepared by the IUCN 2020-1 version (most of the species were evaluated in 2018 or before).

Table 22. Conservation status of the seabirds species present.

Family	Common Name	Scientific Name	CAT-AR 2015 [1]	UICN-2020 [2]
Sphenisci-dae	King Penguin	*Aptenodytes patagonicus*	NA	LC
	Emperor Penguin	*Aptenodytes forsteri*	VU	NT
	Chinstrap Penguin	*Pygoscelis antarcticus*	VU	LC
	Magellanic Penguin	*Spheniscus magellanicus*	VU	NT
	Macaroni Penguin	*Eudyptes chrysolophus*	AM	VU
	Rockhopper Penguin	*Eudyptes chrysocome*	EN	VU
Diomede-idae	Royal Albatross	*Diomedea epomophora*	VU	VU
	Northern Royal Albatross	*Diomedea sanfordi*	VU	EN
	Wandering Albatross	*Diomedea exulans*	AM	VU
	Tristan Albatross	*Diomedea dabbenena*	NA(oc)	CR
	Sooty Albatross	*Phoebetria fusca*	NA(oc)	EN
	Light-mantled Albatross	*Phoebetria palpebrata*	NA	NT
	Yellow-nosed Albatross	*Thalassarche chlororhynchos*	EN	EN
	Black-browed Albatross	*Thalassarche melanophris*	VU	LC
	Grey-headed Albatross	*Thalassarche chrysostoma*	EC	EN
	Shy Albatross	*Thalassarche cauta*	NA	NT
	White-capped ALbatross	*Thalassarche steadi*	NA(oc)	NT

Family	Common Name	Scientific Name	CAT-AR 2015 [1]	UICN-2020 [2]
Procelari-idae	Common Giant Petrel	*Macronectes giganteus*	VU	LC
	Hall´s Giant Petrel	*Macronectes halli*	NA	LC
	Southern Fulmar	*Fulmarus glacialoides*	NA	LC
	Pintado Petrel	*Daption capense*	NA	LC
	Petrel collar gris	*Pterodroma mollis*	NA	LC
	Atlantic Petrel	*Pterodroma incerta*	NA	EN
	White-headed Petrel	*Pterodroma lessonii*	NA(oc)	LC
	Trinidade Petrel	*Pterodroma arminjoniana*	NA(oc)	VU
	Blue Petrel	*Halobaena caerulea*	NA	LC
	Antarctic Prion	*Pachyptila desolata*	NA	LC
	Slender-billed Prion	*Pachyptila belcheri*	VU	LC
	Grey Petrel	*Procellaria cinerea*	NA(oc)	NT
	White-chinned Petrel	*Procellaria aequinoctialis*	AM	VU
	Large Shearwater	*Calonectris borealis*	NA	LC
	Cory´s Shearwater	*Calonectris diomedea*	NA	LC
	Sooty Shearwater	*Ardenna grisea*	NA	NT
	Great Shearwater	*Ardenna gravis*	NA	LC
	Manx Shearwater	*Puffinus puffinus*	NA	LC
	Little Shearwater	*Puffinus assimilis*	IC	LC
Hydro-batidae	White-bellied Storm Petrel	*Fregetta grallaria*	NA(oc)	LC
	Black-bellied Storm Petrel	*Fregetta tropica*	NA	LC
	Wilson´s Storm Petrel	*Oceanites oceanicus*	NA	LC
	White-faced Storm Petrel	*Pelagodroma marina*	NA(oc)	LC
Pelecanoidid ae	Common Diving Petrel	*Pelecanoides urinatrix*	NA	LC
Stercora-riidae	Chilean Skua	*Stercorarius chilensis*	EN	LC
	Brown Scua	*Catharacta antárctica (Stercorarius antarcticus)*	VU	LC
	South Polar Skua	*Catharacta maccormicki*	AM	LC

Family	Common Name	Scientific Name	CAT-AR 2015 [1]	UICN-2020 [2]
	Great Skua	*Catharacta pomarinus*	NA(oc)	LC
	Arctic Skua	*Stercorarius parasiticus*	NA	LC
	Long-tailed Skua	*Stercorarius longicaudus*	NA	LC
Laridae	Arctic Tern	*Sterna paradisaea*	NA	LC
	Antarctic Tern	*Sterna vittata*	NA	LC

[1] Res. MADS 795/17 Ref. Wild Fauna - Categorization of the Conservation Status of Native Birds 2015. 13/11/2017 (BO 14/11/2017). EN endangered, T threatened, V vulnerable, NT not threatened, NT (oc) not threatened because it occurs occasionally, DD data deficient. (https://avesargentinas.org.ar/sites/default/files/Categorizacion-de-aves-de-la-Argentina.pdf)

[2] IUCN (International Union for Conservation of Nature and Natural Resources) 2020-1: Red List of Endangered Species (www.iucnredlist.org): CE critically endangered, EN endangered, VU vulnerable, NT near threatened or low risk , LC least concern (not threatened).

Although the schemes are equivalent in terms of the definition of the categories, the species do not necessarily coincide in their categorization. According to the categorization of birds in Argentina (2017), 8 of the identified species are under some category of threat of extinction (CE, EN and VU) and 9 are almost threatened (VU). According to the most recent publication of the IUCN Red List (2020), 12 species are presented under threat categories (CR, EN and VU) and 7 as near threatened (NT).

4.3.3.3 Legal Instruments for its conservation

Argentina is signatory to various International Agreements for the protection and conservation of various species, including sea turtles such as:

- Convention on the Conservation of Migratory Species of Wild Animals (CMS): Approved by National Law 23.918 (1991). All Procellariiformes are included in Appendix II.
- Agreement on the Conservation of Albatrosses and Petrels (ACAP), approved by Law 26.107 (2006).
- Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES): Approved by National Law 22,344 (1982).
- Convention on Wetlands of International Importance (Ramsar, 1971): Approved by National Laws 23,919 (1991) and 25,335 (2000).
- Convention on Biological Diversity (CBD): Approved by National Law 24,375 (1994).
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Substances (LC 1972): Approved by Law 21.947 (1979) (and its 1996 protocol). International Convention to Prevent Pollution from Ships (MARPOL 73/78): Approved by Law 24.089 (1992).

- United Nations Convention on the Law of the Sea (UNCLOS): Approved by National Law 24,543 (1995).

At the National level, the most relevant are the following:

- Categorization of the Conservation Status of Native Birds 2015. Res. MADS 795/17 Ref. Wildlife – 13/11/2017 (BO 14/11/2017)

- National Action Plan to reduce the interaction of birds with fisheries in the Argentine Republic PAN-Aves. 2010, updated in June 2019 (https://www.magyp.gob.ar/sitio/areas/pesca_maritima/plan/PAN-AVES/index.php)

- National Law 22,421 / 1981: Law of Conservation and Protection of Wild Fauna and its Regulatory Decree 666/1997 and Resolutions 1089 (of the year 1998), 3 (of the year 2001) and 91 (of the year 2003) protect sea turtles at the National level, entrusting the National Institute for Fisheries Research and Development (INIDEP) the quantification of the catch of reptiles, birds and marine mammals.

- National Law 24.922 / 1997: Federal Fishing System and its Regulatory Decree 748/1999. The Undersecretariat of Fisheries and Aquaculture (SSPyA) is the Enforcement Authority.

- Resolution SAyDS 513/2007: It Prohibits the hunting, catch, interprovincial transit, trade in federal jurisdiction and the export of live specimens, products and by-products of wild fauna.

- National Action Plan to reduce the interaction of birds with fisheries in the Argentine Republic. Federal Fisheries Council Res N ° 3 4-5-2010

- National Law 25.675 / 2002: General Law of the Environment. The Ministry of Environment and Sustainable Development (MAyDS) is the Enforcement Authority.

- National Strategy on Biological Diversity and National Advisory Commission for the conservation and sustainable use of biological diversity (CONADIBIO).

- Associated with the International Convention to Prevent Pollution from Ships (MARPOL 73/78) mentioned above. There are also numerous ordinances and provisions of the Argentine Coast Guard (PNA)

4.3.3.4 Vulnerable Species

Various authors point out that the distribution of seabirds is not uniform, presenting higher concentrations in areas where oceanographic characteristics promote high abundances of prey, such as oceanographic fronts associated with subtropical convergence and the continental slope (Orgeira 2001, Favero et al. 2005) and also where the food supply is made more available through human activities, particularly fisheries (Rey and Huettmann, 2020).

The detailed study area is located on the continental slope, which exerts a particular attraction on seabirds due to the concentration of planktonic organisms, fish and cephalopods that feed and breed in these waters (Orgeira 2001). Seabirds can detect prey additions on fronts in different ways.

Visual signals are generally associated with the presence of surface predators (eg, other birds) or subsurface predators (eg, large fish, seals, sea lions, whales, and even penguins). The latter concentrate prey near the surface where, in turn, they can be reached by surface or with restricted diving skills predators. Smell in seabirds (and particularly in Procellariiformes) has been highlighted as an important sense used for locating food.

When zooplankton (such as Antarctic krill) feed on phytoplankton, aromatic compounds (eg, dimethyl sulfide) are released into the sea and, consequently, into the atmosphere; albatrosses and petrels can detect these compounds and other odors, which are used as a remote signal of the presence of abundant food patches.

After analysing data from incidental catches of birds, Favero et al (2005) mention that the abundances are greater where the temperature gradient coincides with the slope, as occurs along the northwest edge of the Malvinas Current, with abundance peaks between May and October, occasionally reaching coastal waters. The study area is located near the front of the slope, which is considered an area of high environmental sensitivity (Figure 304).

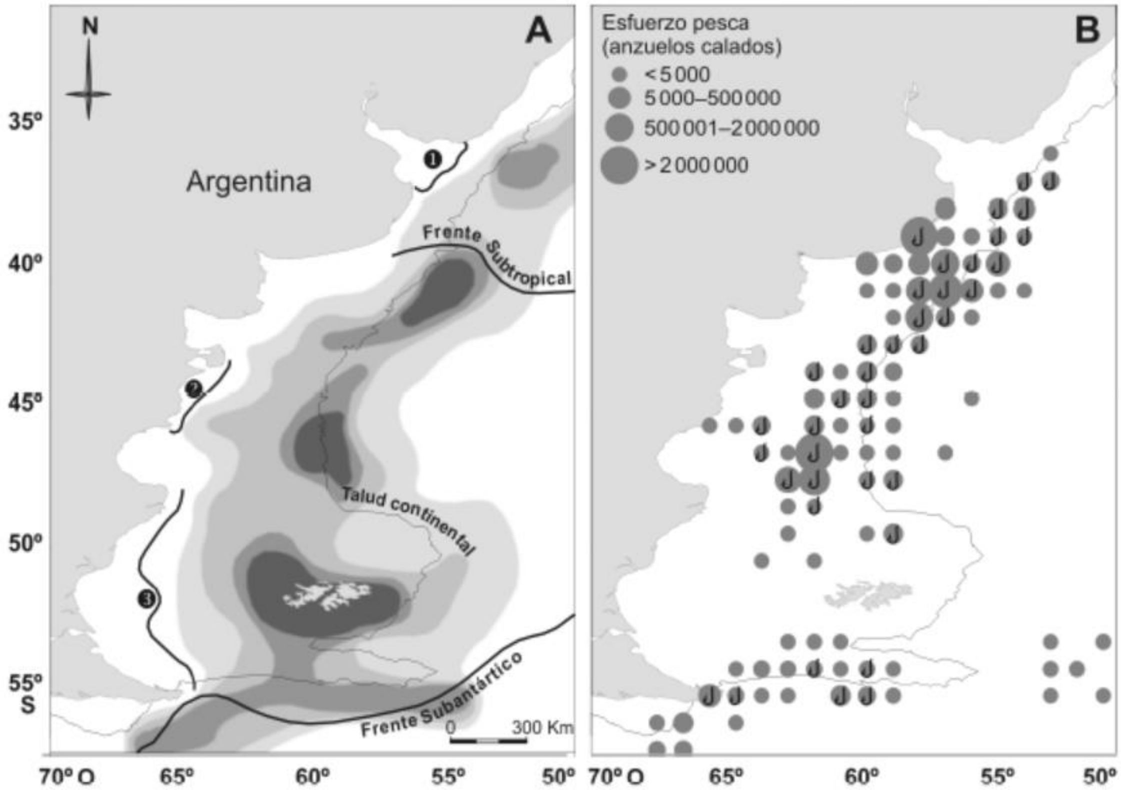


Figure 304. Areas with the highest concentration of pelagic seabirds. A. Main coastal and pelagic fronts present on the Argentine continental shelf (adapted from Acha et al. 2004) and areas of higher concentration of birds, expressed on an arbitrary scale of increasing intensity (darker areas indicate higher concentrations). 1: Rio de la Plata front, 2: Peninsula Valdés tidal front, 3: Patagonian Atlantic front. B. Total effort of the Argentine longline fishery between 1999–2004 expressed in number of hooks set and distribution of incidental mortality of albatrosses and petrels, indicated by the distribution of hooks, for the same period. Source: Favero et al. 2005.

(Translation of Figure 304: Esfuerzo de pesca, anzuelos calados: Fishing Effort, hooks set. Frente Subtropical: Subtropical Front. Talud Continental: Continental Slope. Frente Subantártico: Sub-Antarctic Front.)

The main recipients of the potential impacts of the prospecting activities are considered to be species with confirmed occurrences in the study area that are abundant or frequent, or potentially present species presenting some level of local or global threat. Table 23 displays the list of selected species.

Table 23. Vulnerable seabird species.

Common Name	Scientific Name	Presence	CAT2015	UICN-2018
Magellanic Penguin	*Spheniscus magellanicus*	3	VU	NT
Macaroni Penguin	*Eudyptes chrysolophus*	2	AM	VU
Rockhopper Penguin	*Eudyptes chrysocome*	2	EN	VU
Royal Albatross	*Diomedea epomophora*	2	VU	VU
Northern Royal Albatross	*Diomedea sanfordi*	2	VU	EN
Wandering Albatross	*Diomedea exulans*	3	AM	VU
Tristan Albatross	*Diomedea dabbenena*	2	NA(oc)	CR
Sooty Albatross	*Phoebetria fusca*	3	NA(oc)	EN
Yellow-nosed Albatross	*Thalassarche chlororhynchos*	3	EN	EN
Black-browed Albatross	*Thalassarche melanophris*	3	VU	LC
Grey-headed Albatross	*Thalassarche chrysostoma*	2	EC	EN
Common Giant Petrel	*Macronectes giganteus*	3	VU	LC
Hall´s Giant Petrel	*Macronectes halli*	3	NA	LC
Atlantic Petrel	*Pterodroma incerta*	3	NA	EN
Trinidade Petrel	*Pterodroma arminjoniana*	2	NA(oc)	VU
White-chinned Petrel	*Procellaria aequinoctialis*	3	AM	VU
Sooty Shearwater	*Ardenna grisea*	3	NA	NT
Great Shearwater	*Ardenna gravis*	3	NA	LC
Chilean Skua	*Stercorarius chilensis*	2	EN	LC
Wilson´s Storm Petrel	*Oceanites oceanicus*	3	NA	LC
Brown Skua	*Catharacta -antárctica (=Stercorarius antarcticus)*	2	VU	LC
South Polar Skua	*Catharacta maccormicki*	2	AM	LC

4.3.3.5 Biological and ecological characterization of vulnerable species

All the species considered present a distribution area that overlaps with the study area; there are occurrence records in some of the areas of direct and indirect influence. However, the species do not breed in the high seas, having their nesting and breeding sites hundreds or thousands of kilometers from their feeding areas. Those breeding in the Falkland Islands (Islas Malvinas) (eg, black-browed albatross) or in the South Georgia Islands (eg, wandering albatrosses) use the platform and its slope from 60 ° S to 35 ° S as a feeding area, in front of the Río de la Plata near the Brazil-Malvinas confluence. They all carry out large migrations between their breeding and feeding areas. Procellariiformes and Charadriformes stand out for their extraordinary flying abilities and their extensive travels of several thousand kilometers. They carry out daily or seasonal migrations, moving between breeding and feeding areas using migratory routes or corridors that pass over the slope. These distances can vary considerably throughout the breeding period and between males and females. All species are top predators and good divers, feeding on squid, pelagic fish (anchovies and myctophids), salps, crustaceans (krill), and also floating garbage, such as fisheries waste.

Next, details of the individual and ecological characteristics of each species are provided, with information taken from sources indicated in Table 18, except otherwise quoted. The global distribution maps are from Seabird Maps and Information for Fisheries (FS) or the Red List of the International Union for Conservation of Nature (IUCN), the tables of Breeding times of albatrosses and petrels have been taken from the ACAP (Agreement for the Conservation of Albatrosses and Petrels), as well as many of the maps that summarize the follow-up studies.

Magellanic Penguin - *Spheniscus magellanicus*

It is distributed in the coastal waters and the platform of the Patagonian Sea (Figure 305). It breeds in colonies located along the coasts of the Atlantic and Pacific oceans in South America. There are 66 colonies in Argentina located in the four Patagonian provinces, and at least 41 of them dwell in the Malvinas Islands.

Figure 305. Global distribution of *Spheniscus magellanicus*. Source: FS

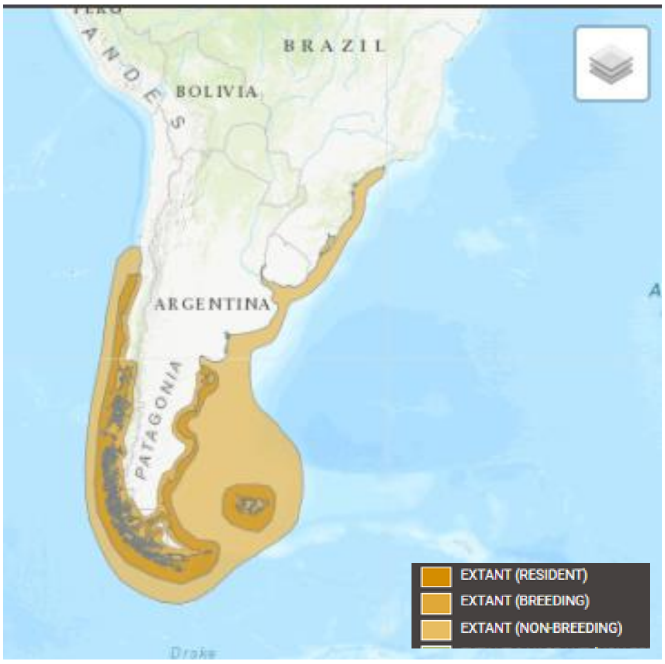


Figure 306. Global distribution of *Spheniscus magellanicus*. Source: UICN.

Patagonian penguins breed in colonies, building hole-shaped nests in areas near the coast, preferably under bushes. It is a monogamous species where males and females contribute equally in the construction of the nest, the incubation of the egg and the feeding of the chicks. The laying begins in early October, each female lays two eggs, which are incubated for 40 days. The chicks are born during November, with their first molt in February, acquiring the final plumage a year later.

It feeds on schoals of anchovy, Fueguian sardines, juvenile marine silverside hake and also squid, particularly in Brazilian waters (Pinto Marques et al 2018). It dives 120m-deep, with a normal range between 20-50m. During the early breeding stage, Magellanic penguins can travel considerable distances over the waters of the shelf, moving up to 500 km away from the colony. In the incubation stage of the eggs, an adult of the pair can stay up to 2 weeks at sea, recovering energy after nesting. During the rearing of the chicks, the ranges of the feeding areas are notoriously reduced, using coastal areas relatively close to their colonies. In the migratory season the Magellanic penguins travel north to Uruguay and Brazil. Adults that breed in the southern extreme of Argentina migrate over coastal waters of the continental shelf, while those that breed in the Falkland Islands (Islas Malvinas) use the continental shelf and slope (Figure 307).

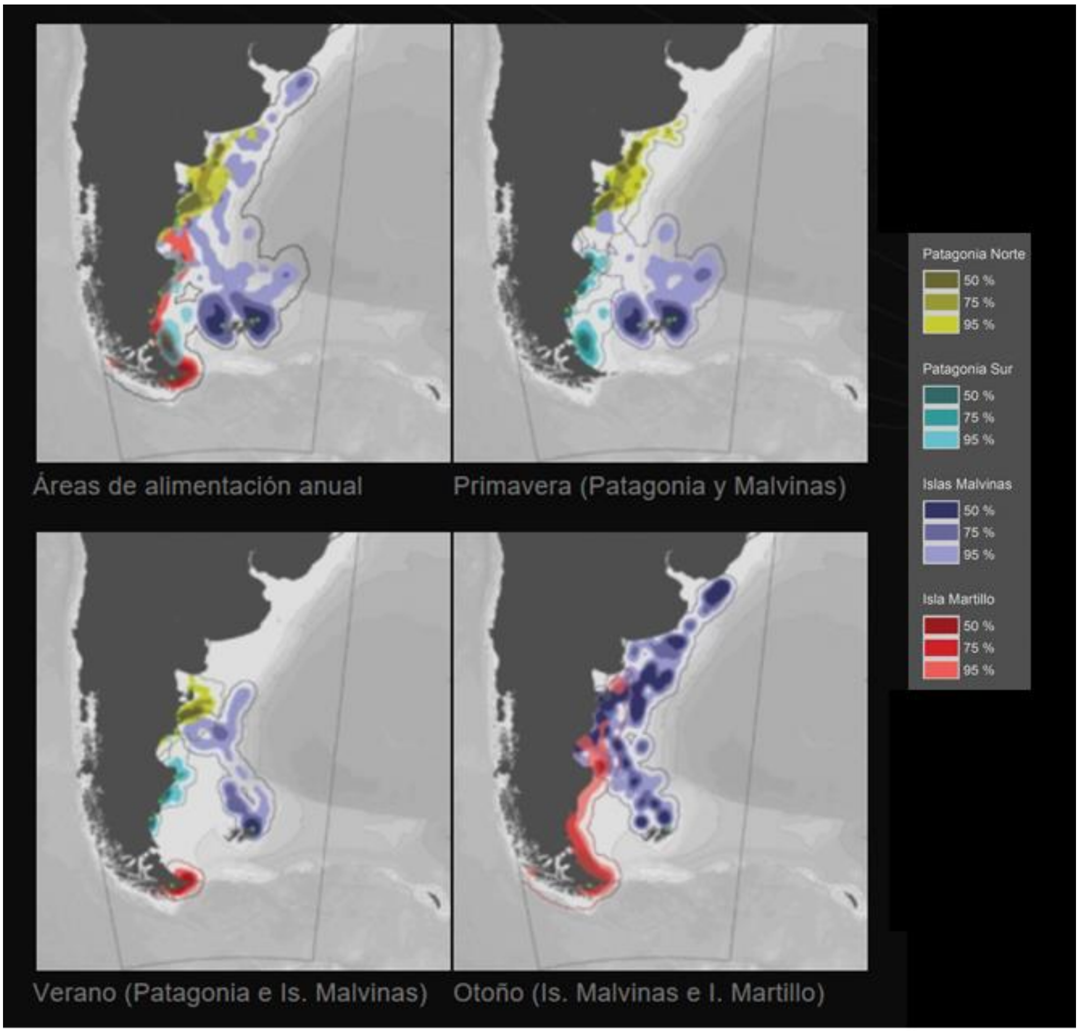


Figure 307. Feeding areas of populations of Spheniscus magellanicus at different times of the year. Source: Atlas of the Patagonian Sea.

(Translation of Figure 307: Areas de Alimentación Annual: Annual Feeding Areas. Primavera (Patagonia y Malvinas): Spring (Patagonia and Falkland Islands (Islas Malvinas)). Verano (Patagonia e Islas Malvinas): Summer (Patagonia and Falkland Islands (Islas Malvinas)). Otoño (Islas Malvinas e Islas Martillo): Autumn (Malvinas and Martillo Islands). Patagonia Norte: North Patagonia. Patagonia Sur: South Patagonia.)

Regarding population levels, there is a minimum estimate of 1,026,000 Breeding pairs, distributed in some 950,000 pairs along the Atlantic coast and at least 76,000 pairs in the Falkland Islands (Islas Malvinas). 86% of the world's population breeds on the coasts and islands of the Patagonian Sea. The abundance of individuals would be relatively stable, in the south of Argentina (Santa Cruz and Tierra del Fuego and islands) it would be increasing, while the most abundant colonies of Chubut - Punta Tombo and Isla Leones, in the north of Patagonia would be declining. Recent demographic information suggests that these declines would be partly due to emigration processes, mediated by the recruitment of individuals outside their native colony, having verified the establishment of new colonies in Rio Negro and north of Chubut.

When it comes to threats, it is a species that follows vessels and the mortality of individuals due to bycatch has been documented in fisheries in Argentina and southern Brazil. Mortalities have been recorded due to oil pollution (both chronic and caused by spills). Mortalities potentially linked to the effects of climate change have also been reported, affecting mostly juvenile individuals and chicks that die from starvation, although the mortality levels reported so far do not indicate a risk of extinction for the species.

Macaroni Penguin - *Eudyptes chrysolophus*

It is a nesting species from Argentina with regular presence in Patagonian jurisdictional waters up to the Antarctic sector. Birds use the waters of the continental shelf but also travel to the Front Polar Zone moving away several thousand kilometers from the colony when they are not breeding (heading to colder waters and fronts (especially the Polar Frontal Zone (Figure 308). Juvenile individuals frequently reach the coasts of Brazil, although these latitudes are not considered part of the typical geographic range.

Figure 308. Distribution of *Eudyptes chrysolophus*. A Global distribution. B. Distribution in the Patagonian Sea. The breeding areas are in red, the distribution of resident populations is in green, the distribution of non-Breeding individuals is in blue. Source: A. UICN. B. Forum for the Conservation of the Patagonian Sea and areas of influence, 2019.

Eudyptes chrysolophus Eudyptes chrysolophus breeds in at least 258 colonies at 55 breeding sites including southern Chile, the Falkland Islands (Islas Malvinas), the South Georgia and the South Sandwich Islands, the Islas Orcadas del Sur and the South Shetland Islands, Bouvet Island, the Prince Edward and Marion Islands, the Crozet Islands, the Kerguelen Islands, the Heard and McDonald Islands, and very locally on the Antarctic Peninsula.

Macaroni penguins nest on flat, rugged terrain, often walking hundreds of meters through steep rocky grounds to nesting sites. Whatever the place, the breeding cycle is characterized by a high level of synchrony with a spawning period that lasts less than 2 weeks. Rearing areas often have little or no vegetation due to bird erosion.

Macaroni penguins are pelagic prey hunters at moderate depths, generally less than 50m, but can reach up to 158m. They are largely daytime seekers, although they also dive at night. They feed mainly on euphausiids; in South Georgia they feed on Antarctic krill (*Euphausia superba*), while in Crozet and Kerguelen they have a more diverse diet, feeding on small euphausiids, amphipods (*Themisto gaudichaudii*) and small numbers of myctophidae fish. Their diets show a change after incubation, with an increase in the proportion of fish. They depend mainly on crustaceans during their winter dispersal. They also show wide changes in their feeding range throughout their breeding cycle. For example, hatching birds from Crozet head to the distant, turbulent waters of the Subantarctic Front, while birds from South Georgia and Kerguelen head to the waters of the Polar Front. During the incubation period, they feed on the platform and slope in the areas closest to the colonies, increasing their range during rearing. Satellite tracking data during winter revealed that Kerguelen individuals showed strong year-over-year fidelity to their hibernating sites. They spent most of their time in a narrow latitudinal band that oceanographically corresponds to the Frontal Polar Zone.
In contrast, South Georgia individuals spend most of their time widely distributed throughout the Scotia Sea during the winter.

It is considered the most abundant penguin species in the world. The global population is estimated at 12,600,000. There are significant populations on the Crozet Islands (2.2 million pairs, including 1 million on the Iles des Pingouins), Kerguelen (1.8 million pairs), Heard Island (1 million pairs), South Georgia (1 million pairs) and Marion Island (290,000 pairs). The population of the Patagonian Platform region is estimated to be 25,000 breeding pairs. The population of the Islas Malvinas (Falkland Islands) is estimated at no more than 1000 individuals. The rest of the population is in Chile in at least 12 known colonies. Diego Ramírez is the largest colony with 15,600 pairs.

Climate change is considered the main cause of the recent declines. Large-scale environmental changes, particularly those related to sea temperatures, could be contributing to habitat loss, indirect effects on ecosystems, direct species mortality, and reduced Breeding success. The historical and continuing competition for prey with the *Arctocephalus spp*. sea lions in South Georgia has contributed substantially to the reductions seen in recent decades, as the sea lion population has increased from about 30,000 to about 3 million. Increased seal populations could also block access to breeding sites, thus inhibiting colony growth, as demonstrated on Bouvet Island. In the South Georgia population, predation appears to be a secondary concern, as local penguin declines begin long before seal predation increases. The *Macronectes spp*. giant petrels prey on immature penguins. Commercial fishing can pose a threat from bycatch and competition for resources. Longline fishing in winter feeding grounds and harvesting of Antarctic krill can affect food availability. Invasive mammals, including cats, mice, and rabbits, are present on several subantarctic islands, but their current impact on the species is negligible. Marion Island breeding colonies have previously shown declines after outbreaks of avian cholera and other unknown diseases. Human impacts can also include disturbances caused by tourists, scientists, the construction of new scientific facilities, and fishing. Oil spills have been significant on a local scale. Most of the breeding islands are protected as reserves of various kinds, and the Heard and McDonald Islands is a World Heritage site. The elimination of rats and mice in South Georgia has been completed, but the results are not yet known.

Rockhopper Penguin - *Eudyptes chrysocome*

It is a nesting species in Argentina with regular presence in waters from the Province of Buenos Aires to the Drake Passage. Its global distribution extends between 46 ° A and 54 ° S in the Atlantic, Indian and South Pacific Oceans. There are two subspecies , *Eudypes chrysocome chrysocome* that inhabits the Patagonian Sea, and *Ecfiholi* which is present in the other regions (Figure 309). *Ec chrysocome* breeds in the Falkland Islands (Islas Malvinas) colonies and in the southern islands of Argentina and Chile (Isla de los Estados, Isla Pingüino, Isla Ildefonso, Diego Ramirez, Isla Noir, Isla Barnevelt, Cape Horn, Isla Terhalten and Isla Buenaventura). This species can hybridize with the Macaroni penguin in the Falkland Islands (Islas Malvinas).

Breeding colonies can be at sea level in high areas and there may even be colonies inland. Couples return to the colonies in October. They lay two eggs that are incubated during November and December for 32-34 days. In February, the chicks shed their plumage and leave the colony. In most colonies only one chick is raised, but in Malvinas it is common to raise two chicks. Their life cycle lasts 11.5 years.

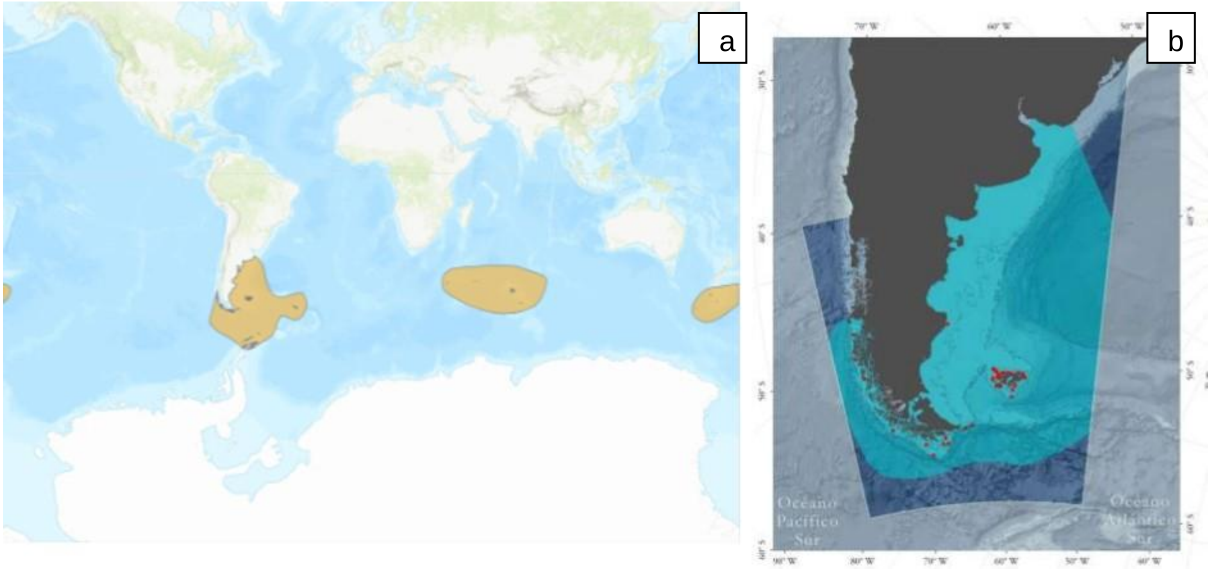


Figure 309. Distribution of *Eudyptes chrysocome*. A Global distribution. B. Distribution in the Patagonian Sea. The breeding areas are in red, the distribution of non-breeding individuals is in blue. Source. A. UICN. B. Forum for the Conservation of the Patagonian Sea and areas of influence, 2019.

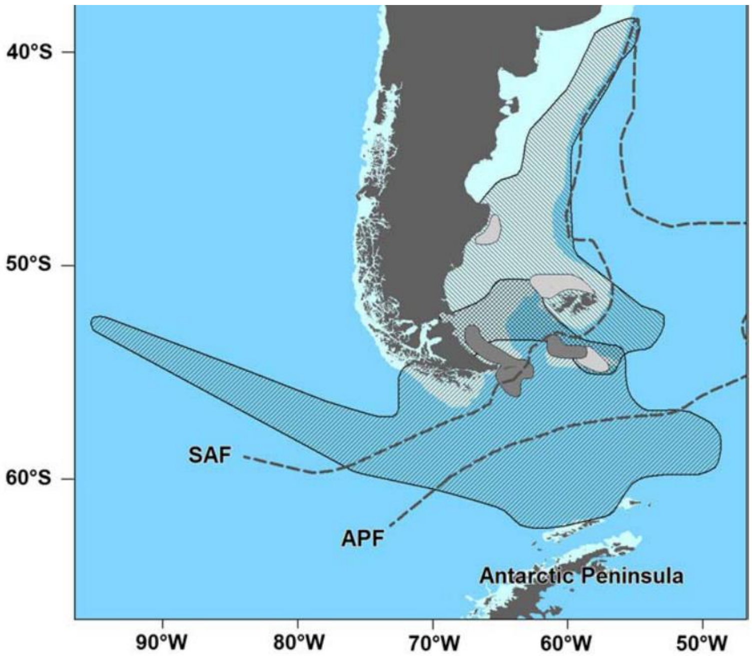


Figure 310. Winter distribution areas of rockhopper penguins from Isla de los Estados and Falkland Islands (Islas Malvinas). The darker shaded areas correspond to the main winter feeding areas. Source: Putz et al 2006.

They are opportunistic predators, eating a variety of fish, euphausiids, amphipods, and cephalopods. They may have a more specialized diet for part of the year. The Malvinas and South Georgia populations restrict their movements to shelf waters during the non-breeding season. They feed preferentially on prey at the bottom, diving between 5 and 80 m, up to a maximum of 113 m, both during the day and at night. In general, they feed alone or in small groups.

The global world population is estimated at 2,400,000 breeding pairs with a decreasing trend. Regarding the population abundances for the subspecies that inhabit here, 135,000 pairs have been counted in 2010 for Isla de los Estados, on Pinguino Island: 1,061 pairs in 2014, on Ildefonso Island 86,400 pairs in 2006, Diego Ramirez: 132,721 pairs in 2002, Isla Negra: 158,200 pairs in 2005, Isla Barnevelt: 10,800 pairs in 1992, Cape Horn: 600 pairs in 1992, Isla Terhalten: 3,000 pairs in 2008 and Isla Buenaventura: 500 pairs in 1992. According to past estimates, most of the populations have had long-term population reductions, about 20-24% for Falkland Islands (Islas Malvinas) and Isla de los Estados respectively, but these decreases have been much greater, between 40-70% in the islands of the Indian Ocean of the South Pacific.

Climate change appears to be an important factor in the population declines of this species. At the beginning of 2016, many dead juvenile penguins were found on the coasts of Puerto Deseado, Tierra del Fuego and in the Falkland Islands (Islas Malvinas), probably due to starvation. The greatest probabilities of survival occur when sea temperatures are similar to or moderately cooler than the historical averages, and are reduced when the anomalies are positive, that is, with temperatures higher than normal (Raya Rey et al. 2007, Dehnhard et al. 2014). They are also affected by increases in the frequency of storms at breeding sites. Climate change can also affect competition and predation by increasing pinniped populations, but is considered to be less important than lack or displacement of food due to weather conditions. Threats from oil spills are very low today. The penguins of Isla de los Estados have high levels of mercury, although they feed on lower trophic levels than other populations. The effect of the stamping of the colonies by deer and goats introduced in Isla de los Estados is unknown. In other places, the introduction of cattle on islands, cats and rats have affected the colonies, but it is not known if they have had a significant impact, although the introduction of pigs in the Aucklands islands has reduced the populations of this penguin. There have been rare cases of avian cholera on Cambell Island in 1985 and avian pox in the Falkland Islands (Islas Malvinas). In 2002/03 there was also a red tide event that caused significant mortalities in the Malvinas.

Until 1950, the collection of eggs was common in the Falkland Islands (Islas Malvinas). Penguins are caught for use as bait in crabbing on some Chilean islands, and it is believed that the extinction of the penguins on Recalada Island was due to anthropic causes. Bycatch mortality is considered to be much lower than mortality from natural causes. Human activities near or in the areas of the colonies, such as tourism, research, are considered low, although they can vary and are too restricted at a local scale to affect populations globally.

Royal Albatross - *Diomedea epomophora*

It is a pelagic species which regularly visits the Argentine sea. It nests biannually in New Zealand colonies (mainly Campbell Island) and is distributed in subantarctic and subtropical waters of the southern hemisphere (Figure 311).

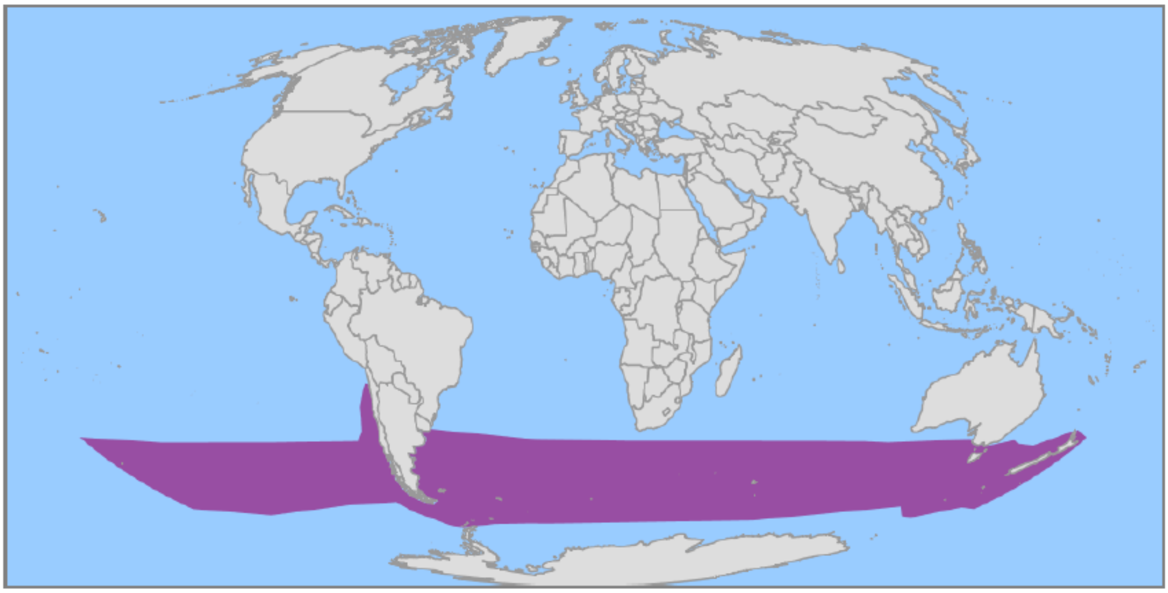
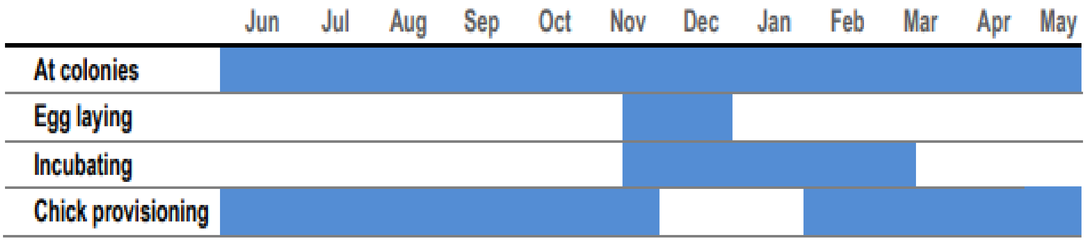


Figure 311. Global distribution of *Diomedea epomophora*. Source: FS.

Adults return to colonies in October. Laying takes place from late November to late December. The chicks hatch from the beginning of February to the beginning of March and start to fly only after 224-253 days, from the beginning of October to the beginning of December. They usually return to the colony for the first time after 5 years. Maturity is reached between 6-12 years.

Table 24. Breeding calendar of *Diomedea epomophora*. Source: ACAP.



It is a solitary species that feeds on cephalopods, tunicates, and fish. They are considered to feed on marine carrion or dying prey, and to a lesser extent, they are active hunters. They show changes in feeding behavior in the vicinity of fishing vessels. The Argentine Sea is visited mainly by immature and post-Breeding adults which are frequently associated with fishing vessels.

At a global level, a population of 8,000 Breeding pairs is estimated with a stable trend or slightly increasing. There are no estimates of abundance in the Argentine Sea.

The main current threat in waters of the continental shelf is bycatch in longline vessels in the Common Fishing Zone with Uruguay, and also trawlers due to impacts on the trawl cables or on the net probe cable in Stern Trawler and freezer vessels. The activity of longline vessels has decreased considerably in the Argentine Sea. Given that the Breeding populations are stable, the level of bycatch in Argentine waters may not be a threat at the moment. As a precautionary measure, a certain risk remains due to the impact that fisheries and their gear can generate in the region, especially those that use net probe cable. Another additional threat is the ingestion of plastic and hooks from fishing discards.

<u>Northern Royal Albatross -*Diomedea sanfordi* -</u>

It is a pelagic species with a circumpolar distribution in the southern hemisphere (Figure 312) a regular visitor to the Argentine sea, although less frequent than *D. epomophora*.

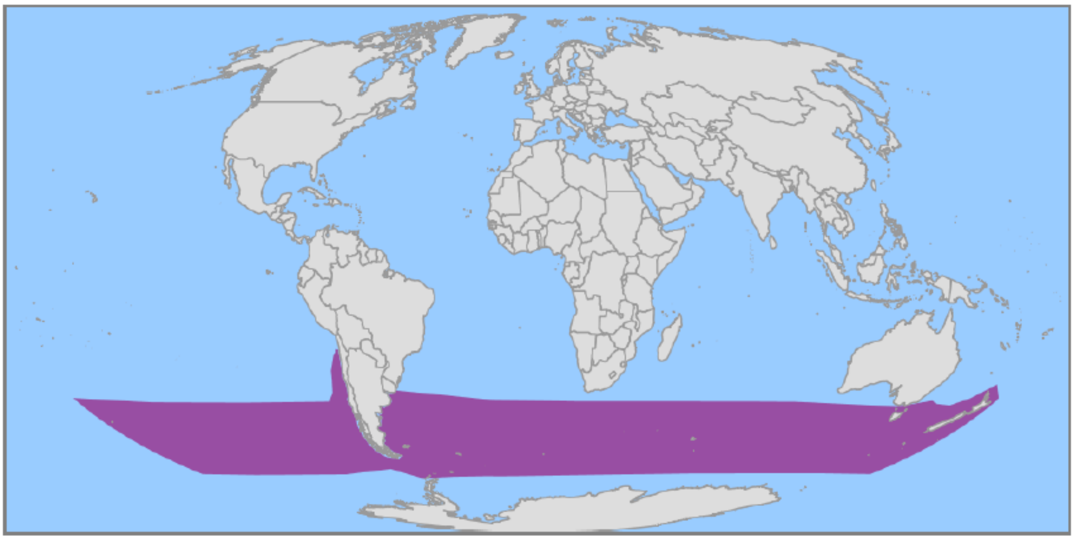


Figure 312. Global Distribution of *Diomedea sanfordi*. Source: FS.

This species nests biannually in New Zealand colonies (mainly Chatham and Taiaroa Head Islands). Breeding adults forage in waters around nesting sites, but the species generally shows circumpolar movements in southern seas with a circumpolar distribution in subantarctic and subtropical waters of the southern hemisphere.

It feeds on fish, cephalopods, and fish discards, both during the day and at night. Non-breeding and juvenile individuals reach the Argentine Sea to feed (Figure 313).

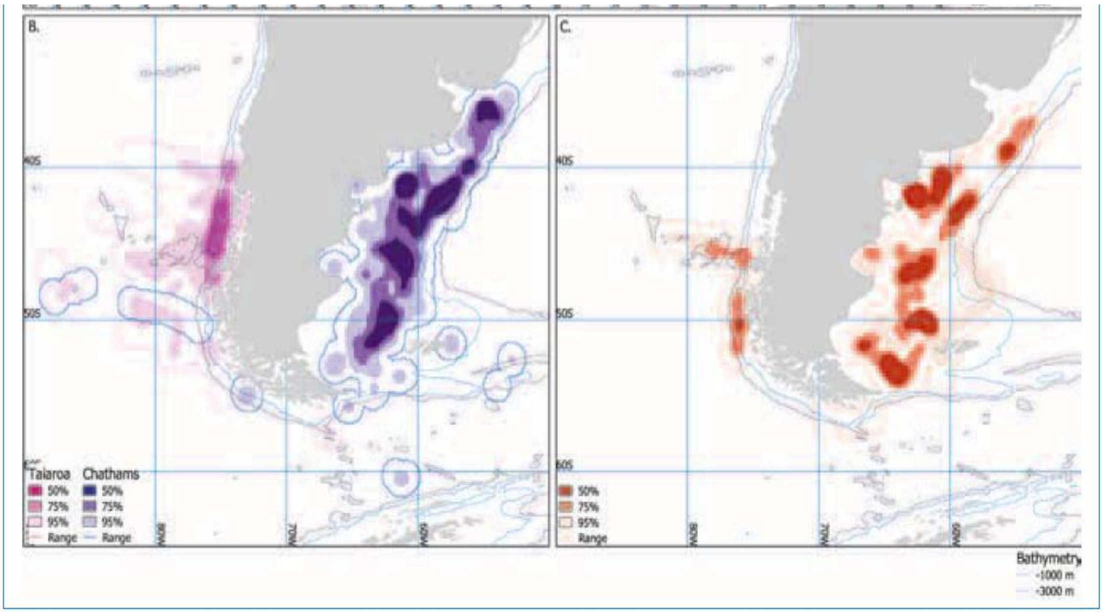


Figure 313. Foraging areas of non-breeding individuals of *D. sanfordi* from the Chathams and Taiaroa Head colonies (New Zealand)). Left: adults with failed reproduction/breeding, followed by satellite between January and October. Right: Feeding areas of the young tracked between March and November. Source: BirdLife International 2004.

A global population of 17,000 to 26,000 mature individuals is estimated, with about 5,200 breeding pairs per year. With decreasing population trends, there are no estimates of abundance in the Argentine Sea, although this species is generally observed in low numbers counted from fishing vessels.

Incidental catches of this species in Argentine fisheries are occasional. The population that visits Argentine waters is shared with other close neighboring countries of South America where longline fishing is still a source of considerable mortality, such as Brazil and Uruguay. On the islands where it nests, the breeding success of the species has been affected by extreme weather events, the thinning of the eggshell caused by pollutants, and even the presence of terrestrial predators.

Wandering Albatross - *Diomedea exulans*

It is distributed circumpolarly in the southern hemisphere, from the ice pack to 30 ° S (Figure 314). Regional nesting sites are South Georgia (closest to project area), Prince Edward, Marion, Crozet, Kerguelen and Macquarie Islands. The mature adults of the Georgia islands are distributed from southern Brazil to the Antarctic peninsula and from the Tristan da Cunha Islands to southern Chile in waters over 1,000 m-deep, mostly outside the Argentine Sea.

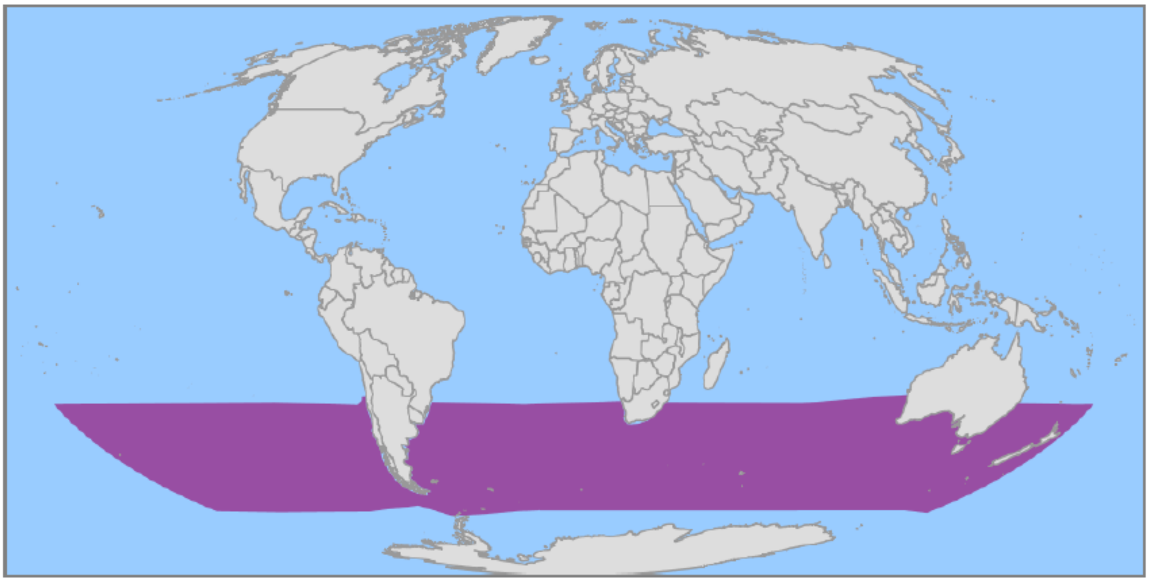


Figure 314. Global Distribution of *Diomedea exulans*. Source: FS.

It breeds every two years, although not all the breeders do. Almost 30% of successful breeders and 35% of the failed ones (average) stop reproducing in the expected year. The breeding season lasts one year (Table 25). The adults return to the colonies in November, about 27 days before laying. The latter takes up a five-week period, from December to January. Hatching takes place mostly in March after an average incubation of 78-79 days. In the South Georgia Islands, many hatchlings become fledged in December after 278 days in the nest. The birds usually return to the colonies when they are 5-7 years old, with a highly variable range between 3 (South Georgia Islands) and 14 years (Croizet Islands). The age of first maturity is between 7 and 10 years, with the females maturing in general about a year before the males.

Table 25. Breeding calendar of *Diomedea exulans*. Fuente ACAP.

(Translation of Table 25: En colonias: At colonies. Puesta de huevos: Egg laying. Incubación: Incubation. Cuidado del polluelo: Chick Provisioning.)

The diet is made up of fish, squid, and occasionally krill and jellyfish, also feeding on fish discards. It feeds mostly during the day, taking its prey through a surface flyover. Their dives do not exceed 60 cm in depth. It is a species known for following fishing vessels, sometimes in large groups and competing vigorously for discards from fisheries. The toothfish *Dissostichus eleginoides* is the main fish in their diet, potentially obtained as discards from fishing vessels.

Satellite tracking data indicate that breeding birds forage long distances from colonies (up to 4,000 km) and that they have feeding strategies that change throughout the breeding season. The records corresponding to tagged adults in the South Georgia Islands showed that the slope and the Argentine Basin are identified as the main feeding areas (Figure 315). During the chick-rearing period (March-December), the adults travel to the most productive sites of the Patagonian continental slope (Figure 316- a). During spring and summer they are concentrated in the northern part of the basin and the slope, around the subtropical convergence in front of the Río de la Plata and on the southern slope, particularly to the east of the Isla de los Estados. Unlike other albatrosses, it rarely uses the shallow waters of the continental shelf. Females tend to focus on the northernmost areas, particularly east of the mouth of the Rio de la Plata and east of Peninsula Valdez. Males are more common to the south, along Diego Ramírez's southern boundary with Burdwood Bank. There is a significant overlap but males are rare north of the Rio de la Plata and females seldom venture into the western sector between Isla de los Estados and Diego Ramírez. The south of the Patagonian Platform is used by non-breeding birds as well, being an important feeding area throughout the year (Figure 316-b).

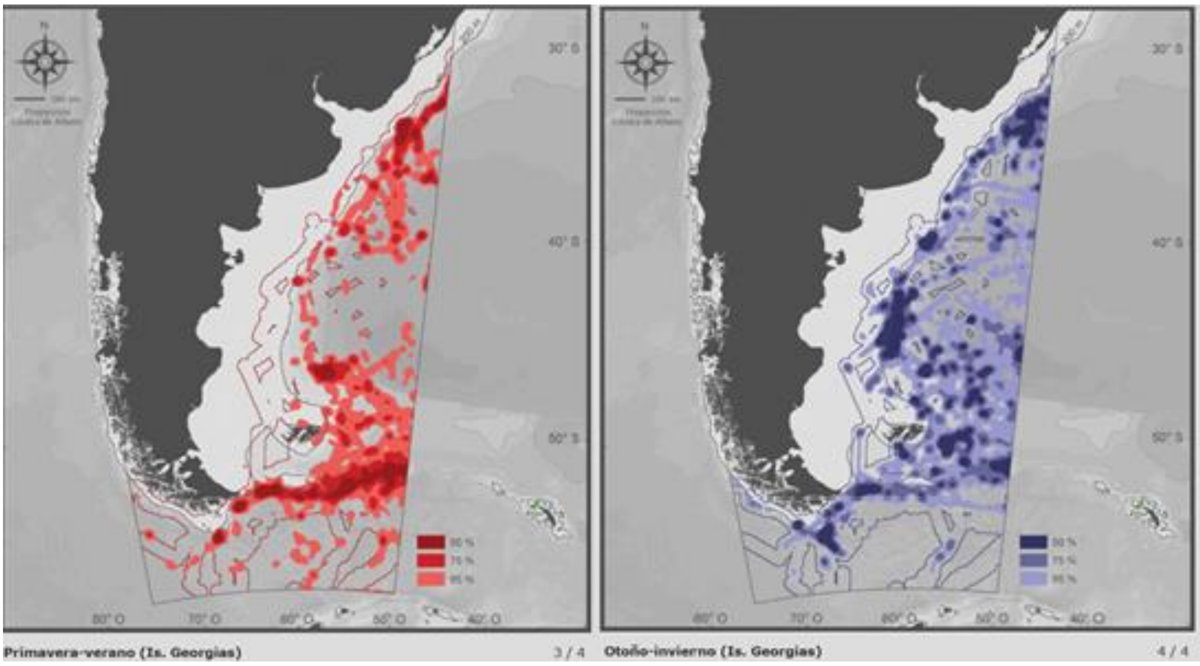


Figure 315. Concentration areas of *Diomedea exulans* tagged adults from the South Georgia Islands. A. Summer concentrations. B. Winter. Fuente: Source: Atlas of the Patagonian Sea.

(Translation of Figure 315: Primavera-verano: spring-summer. Otoño-invierno: autumn-winter).

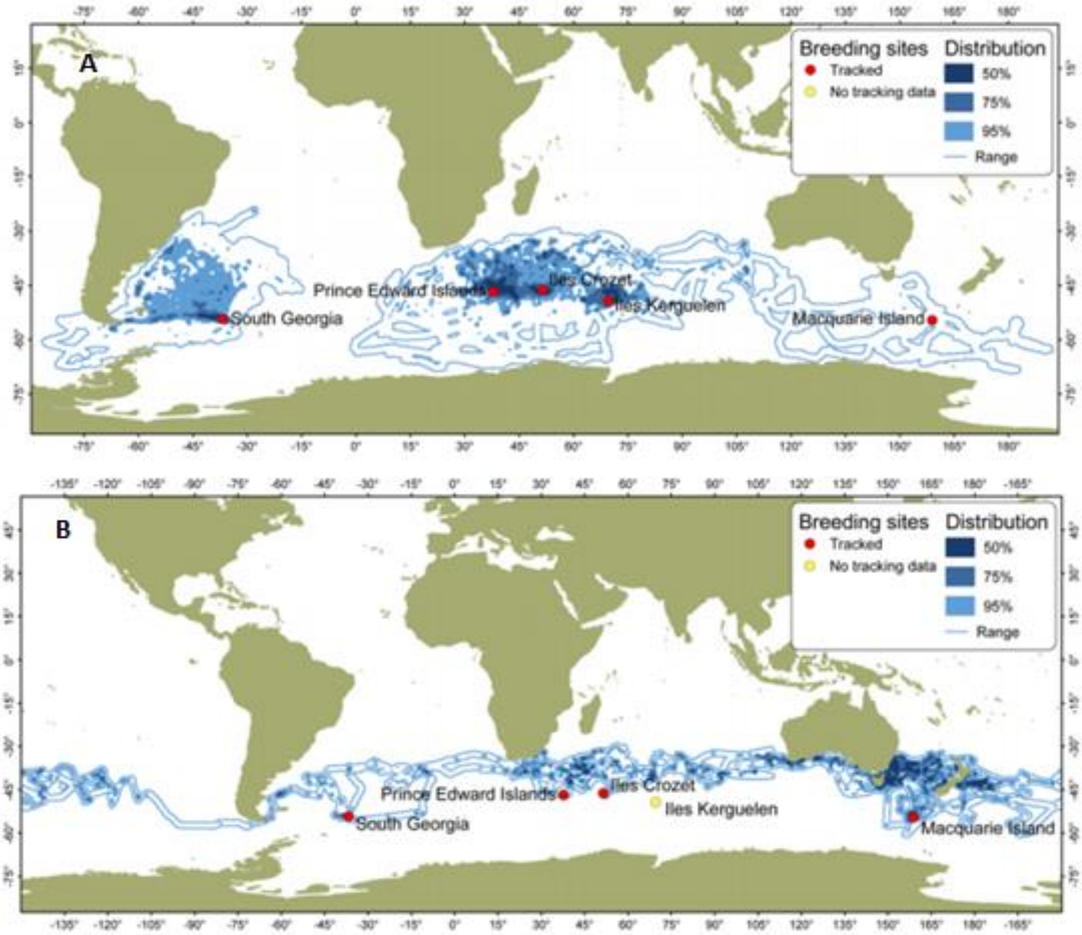


Figure 316. *Diomedea exulans* satellite tracking data. A. Breeding individuals. B. Non-Breeding individuals. Source: ACAP, based on data provided by BirdLife's Global Procelariform Tracking Database.

A global population of 20,100 mature individuals is estimated to nest on subantarctic islands with a decline tendency. In the group of colonies of the South Georgia islands, which constitutes 17.6% of the global population, a 30% reduction took place between 1984 and 2004, but more recent data are not available.

They detect fishing vessels and divert their course to follow them. They frequently eat the discards from fishing vessles, which has negatively impacted their populations as they become trapped in nets and hooks. Although longline fishing in Argentina is very limited, the fleets operating in southern Brazil and Uruguay are active. Although all D. exulans nesting sites are legally protected and have restricted access, sea lions and elephant seals strongly prey on chicks in breeding areas. Chicks are vulnerable to the accumulation of marine debris from anthropogenic causes and remains from fisheries, such as secondary ingestion of discarded hooks.

Tristan Albatross *Diomedea dabbenena* -

It is a species with restricted distribution in the subtropical South Atlantic (Figure 317). Its breeding is restricted to Gough Island in the mid-Atlantic Ocean in the Tristan da Cunha archipelago, having become extinct on Tristan da Cunha Island, and only 2-3 pairs were found breeding on Inaccessible Island.

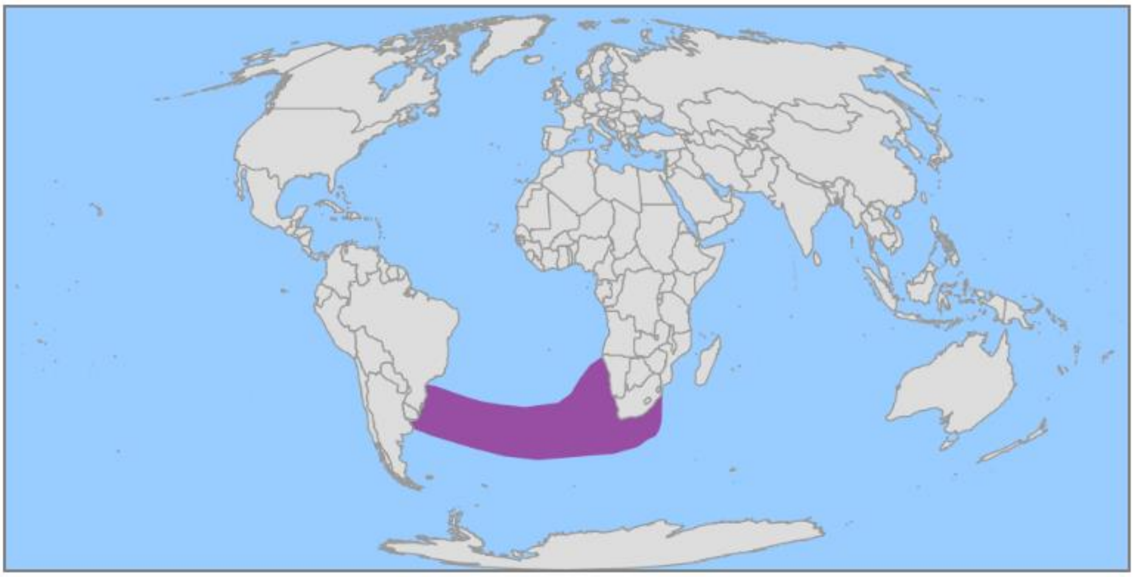


Figure 317. Global distribution of *Diomedea dabbenena*. Source: FS

Diomedea dabbenena forms colonies and breeds every 2 years. Each Breeding cycle lasts 12 months. The laying of eggs occurs in January - February (exceptionally at the end of December), they hatch in March - April and the chicks leave the nest in November - January, after having spent 8 - 9 months in the nest (Table 26). Immature birds return to their nesting colonies 3 - 7 years after being born. Most *D. dabbenena* return to their natal colony at an average age of 10 years (range 4-20 years).

Table 26. Breeding calendar of *Diomedea dabbenena*. Source: ACAP.

(Translation of Table 26: En colonias: At colonies. Puesta de huevos: Egg laying. Incubación: Incubation. Cuidado del polluelo: Chick Provisioning).

	Jun	Jul	Aug	Sep	Oct	Nov	Dic	Ene	Feb	Mar	Abr	May
En colonias	X	X	X	X	X	X	X	X	X	X	X	X
Puesta de huevos								X	X			
Incubación								X	X	X		
Cuidado del polluelo	X	X	X	X	X	X	X			X	X	X

D. dabbenena is a pelagic species, which feeds on fish and cephalopods. Outside of the breeding season, the species disperses, feeding in the waters of the South Atlantic, around South Africa and occasionally in the Indian Ocean (Figure 318).

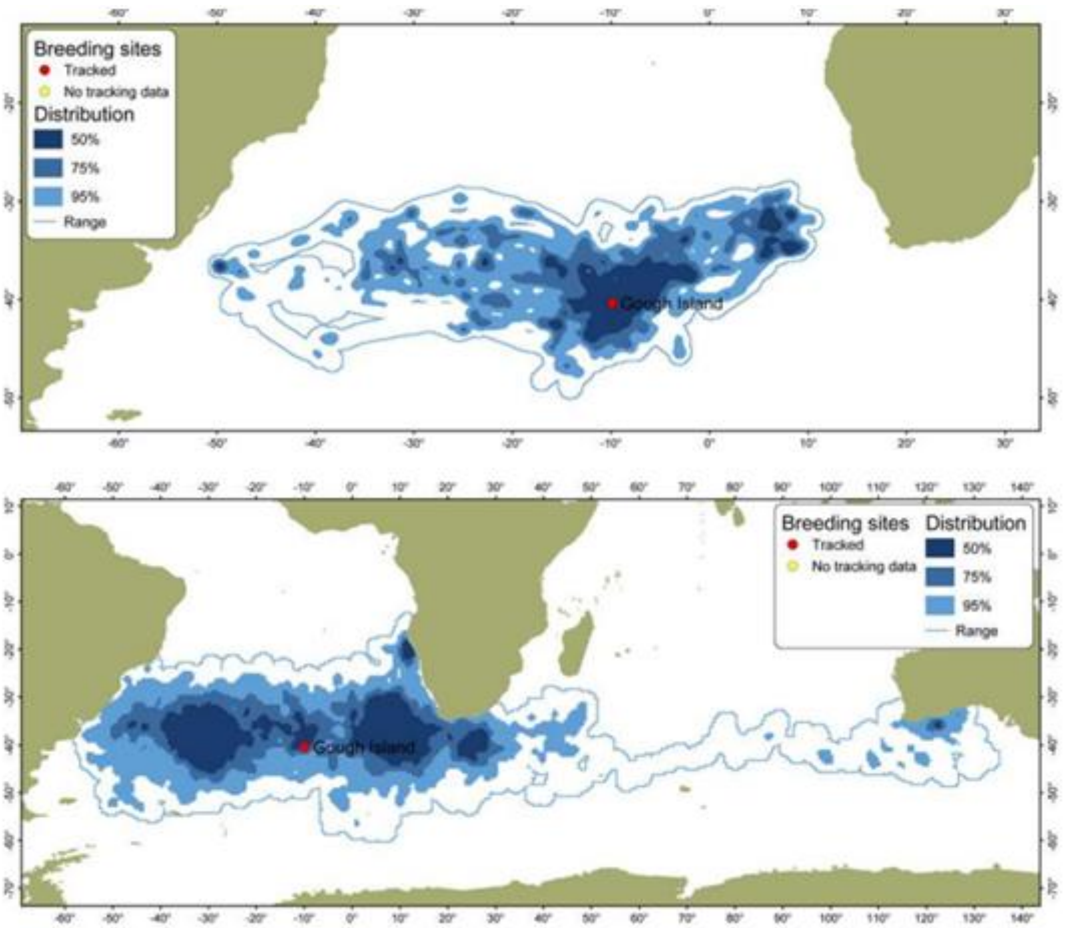


Figure 318. Satellite tracking data for *Diomedea dabbenena* from two individuals tagged on Gough Island. A. Breeding individual. B. Non-Breeding individual. Source: ACAP, based on data provided by BirdLife's Global Procelariform Tracking Database.

The annual breeding population is estimated between 1,500 and 2,400 pairs, which is equivalent to a total population of 9,000 to 15,000 individuals for this species that breeds biannually. Recent censuses indicate that Gough's population has decreased 28% in the last five decades.

The main threat to adults and juveniles is mortality from the longline fishery that operates in the waters of Brazil and Uruguay. While both breeding sites are legally protected, the greatest threat to Pelagic species that nests in the South Atlantic and Indian Oceans, in the Prince Edward and Marion Islands (South Africa), Kerguelen Island, Crozet Island, Amsterdam Island and Saint Paul Island (France), as well as in the Gough and Tristán da Cunha Islands (United Kingdom). The pelagic distribution of P. fusca occurs mainly between 30 ° S and 60 ° S south of the Indian and Atlantic Oceans, with a southern limit at 65 ° S, near Antarctica, and a northern limit near 20 ° S (Figure 319). Adults move north in winter, from sub-Antarctic to subtropical seas, while immature birds tend to stay in subtropical waters year-round.

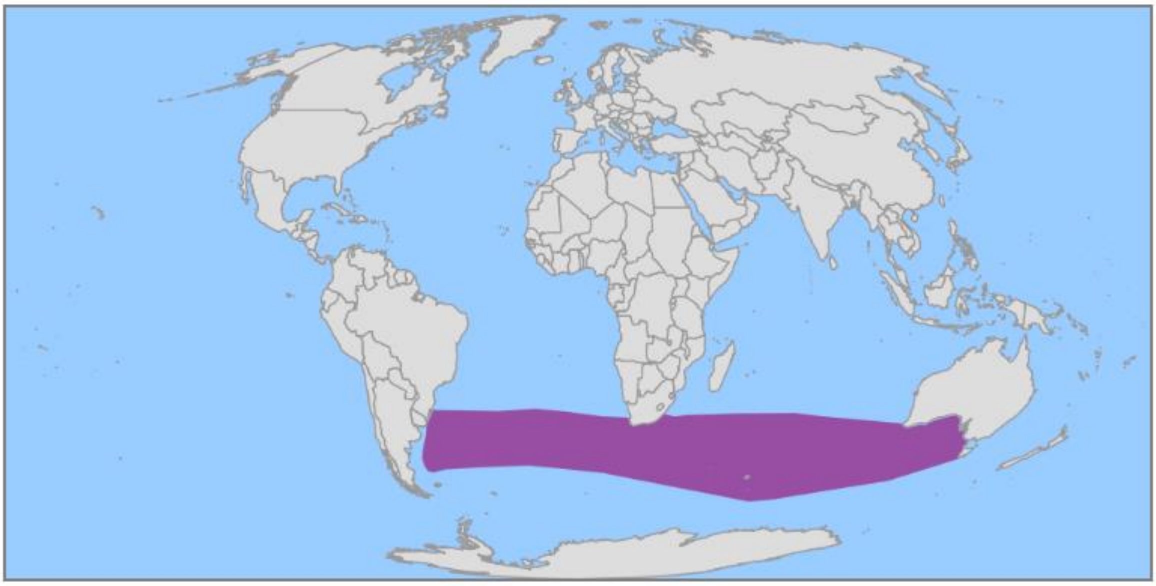
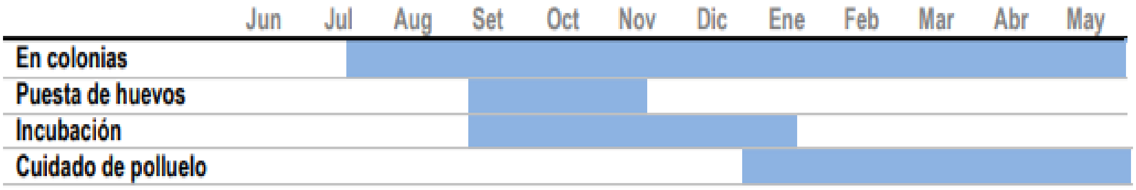


Figure 319. Global distribution of *Phoebetria fusca.* Source FS.

Phoebetria fusca is a biannual breeder that lays a single egg without a laying replacement (Table 27). This species nests alone or in small colonies or 'clusters', building pedestal nests along sheltered cliff edges. The birds are loyal to their nesting colonies, reaching the Marion, Gough and Crozet Islands at the end of August, but a month earlier they arrive at the main group of islands of Tristán da Cunha. The egg-laying range is from mid-September to the end of October. The incubation task is shared by males and females. Eggs hatch from early to mid-December after incubation periods of 70-71 days on average; the chicks are incubated for an additional 21 days and fledge in May. The first reproduction in Crozet occurs at 11.8 years, but it is unknown for other colonies.

Table 27. Breeding calendar of *Phoebetria fusca*. Source: ACAP.

(Translation of Table 27: En colonias: At colonies. Puesta de huevos: Egg laying. Incubación: Incubation. Cuidado del polluelo: Chick Provisioning).



Since it is not a diving species, it feeds in pelagic environments on what it catches on the surface of the water, preferably during the day. Squid, fish, crustaceans, as well as carrion, occupy an important place in their diet, although the proportions vary by year and location. Scavenging behavior is based on the identification of various squid taxa, which are known to float after death. This species relies on seabird carrion more than other albatrosses, and includes dead penguins and small petrels in its diet. Adults make a combination of long flights at the beginning of the incubation period, search flights in circles later in the incubation and linear search flights during brooding (Figure 320).

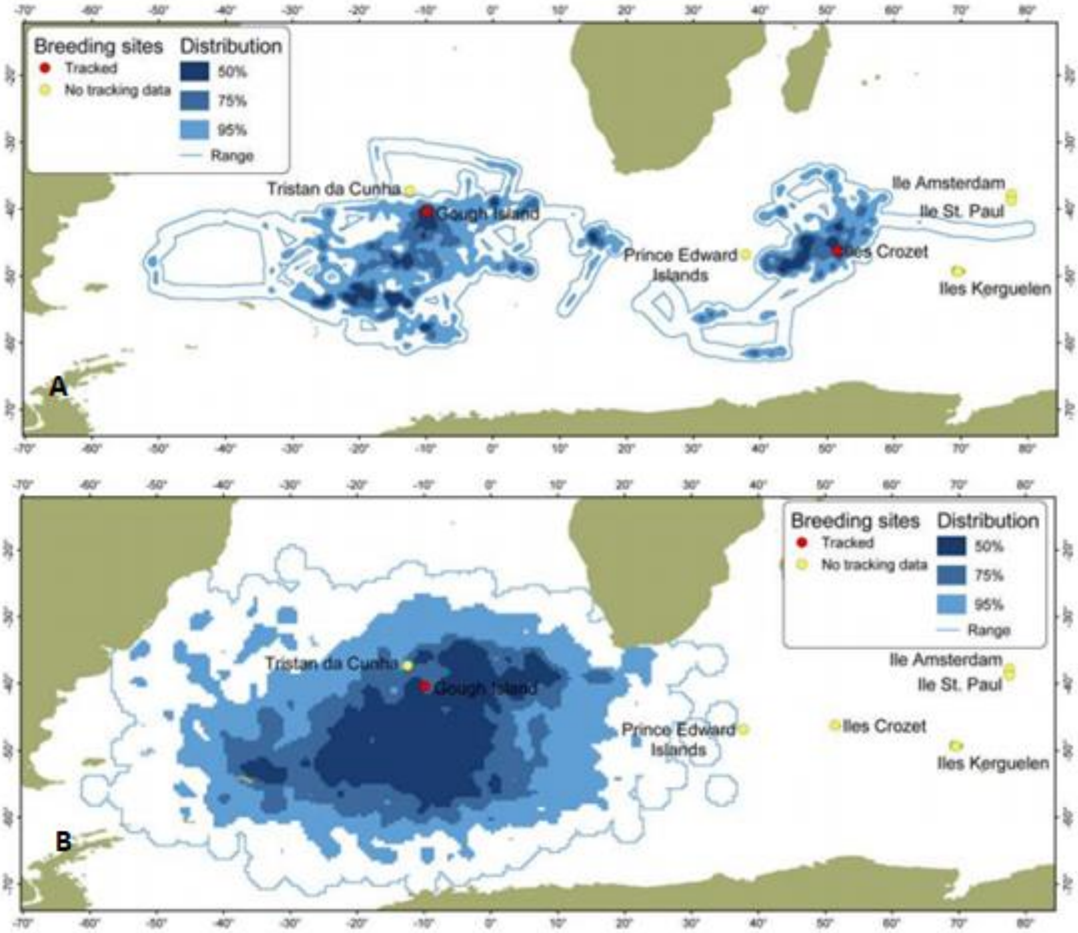


Figure 320. Phoebetria fusca satellite tracking data from individuals tagged on Gough and Crozet Islands. A. Breeding individuals. B. Non-Breeding individuals. Source: ACAP, based on data provided by BirdLife's Global Procellariform Tracking Database.

The estimated global population is 26,000 to 29,000 individuals with a decreasing trend. Known population sizes are: 5,000 pairs on Gough Island, 4,125-5,250 in the Tristan da Cunha group, 1,720 in Prince Edward and Marion Islands, 2,620 pairs in Crozet Islands, five pairs in Kerguelen and 300-400 in Amsterdam Island. Various populations have experienced population declines during the 1980s and 1990s.

The main threat to *P. fusca* is the mortality associated with fishing, specifically that of the longline, and this is the probable reason behind its population decline. These birds forage in subtropical seas visited by Asian longline fishing vessels, being threatened by bycatch. The lack of reports of flock of birds indicates the shortage of observers in feeding grounds, rather than a low mortality rate. Plastic debris has been found in stomach contents and in cuds. Nesting areas may be lost due to fires to eliminate vegetation and the chicks may also be exposed to predation by introduced species. The collection of eggs and chicks is currently prohibited on islands of the Tristan da Cunha group.

Yellow-nosed Albatross -*Thalassarche chlororhynchos*

It is a non-Breeding visitor to the Argentine Sea with restricted distribution in the South Atlantic (Figure 321). It is endemic to the Tristan da Cunha archipelago (breeding on the four major islands (Tristan, Gough, Nightingale, and Inaccessible), as well as the Middle and Stoltenhoff satellite islands.

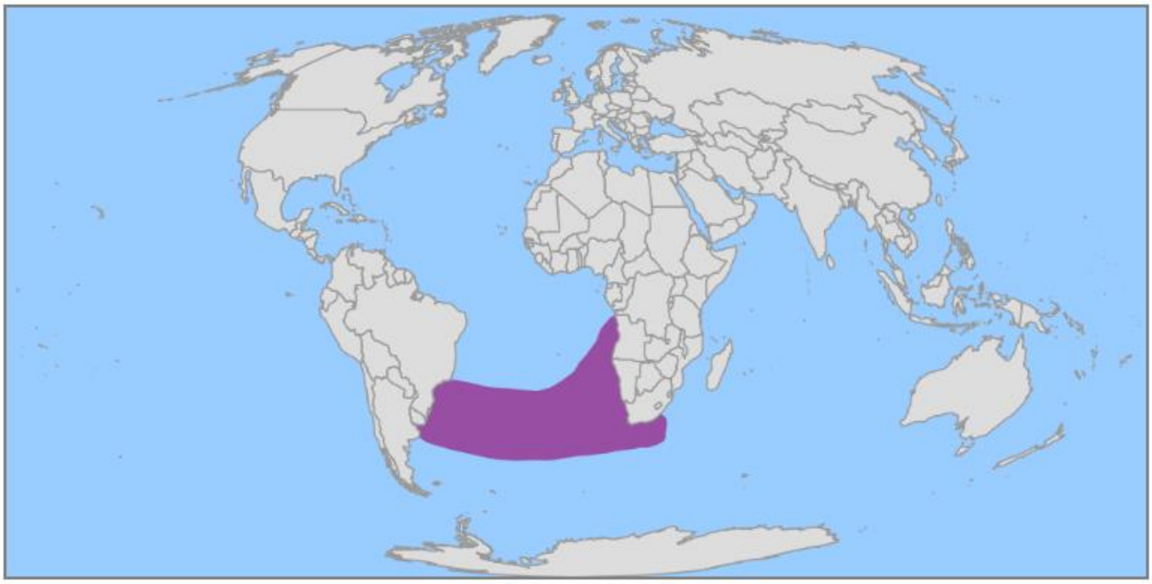


Figure 321. Global distribution of *Thalassarche chlororhynchos*. Source: FS.

It is a species of annual breeding (Table 28). Birds make it to the colonies between the end of August or September and remain until the fledging of the chicks (March-April). Egg laying begins in September, they hatch in late November and early December, and the chicks fledge in April. Juvenile birds return to nesting colonies at 5 years, but may take up to about 13 years.

Table 28. Breeding calendar of *Thalassarche chlororhynchos*. Source: FS.
(Translation of Table 28: En colonias: At colonies. Puesta de huevos: Egg laying. Incubación: Incubation. Cuidado del polluelo: Chick Provisioning).

	Jun	Jul	Aug	Sep	Oct	Nov	Dic	Ene	Feb	Mar	Abr	May
En colonias			X	X	X	X	X	X	X	X	X	
Puesta de huevos				X	X							
Incubación				X	X	X	X					
Cuidado de polluelo						X	X	X	X	X	X	

Thalassarche chlororhynchos feeds on what it catches on the surface of the water and on occasional dives. Their diet consists predominantly of pelagic and cephalopod fish species. It also feeds in association with marine mammals or with sport fishing that brings bait to the surface. The presence of demersal fish species, cephalopods, and species used in longline fisheries in the diets of bycatch birds suggests that they also feed heavily on discards from fisheries, which sometimes include hooks.

Current information on foraging areas is based largely on observations at sea and re-catch from longline fishing operations. The distribution is essentially limited to the South Atlantic Ocean, predominantly between 25-50 ° S, but this species extends north into coastal waters of Namibia and Angola, particularly during its first year. It is present in Atlantic coastal waters all year round and in South Africa, it is more common to observe it in winter. The population that arrives in Argentina is observed mainly between November and February in territorial seas of Buenos Aires, Rio Negro and north of Chubut, however, it is more abundant in the waters of Uruguay and Brazil (Figure 322).

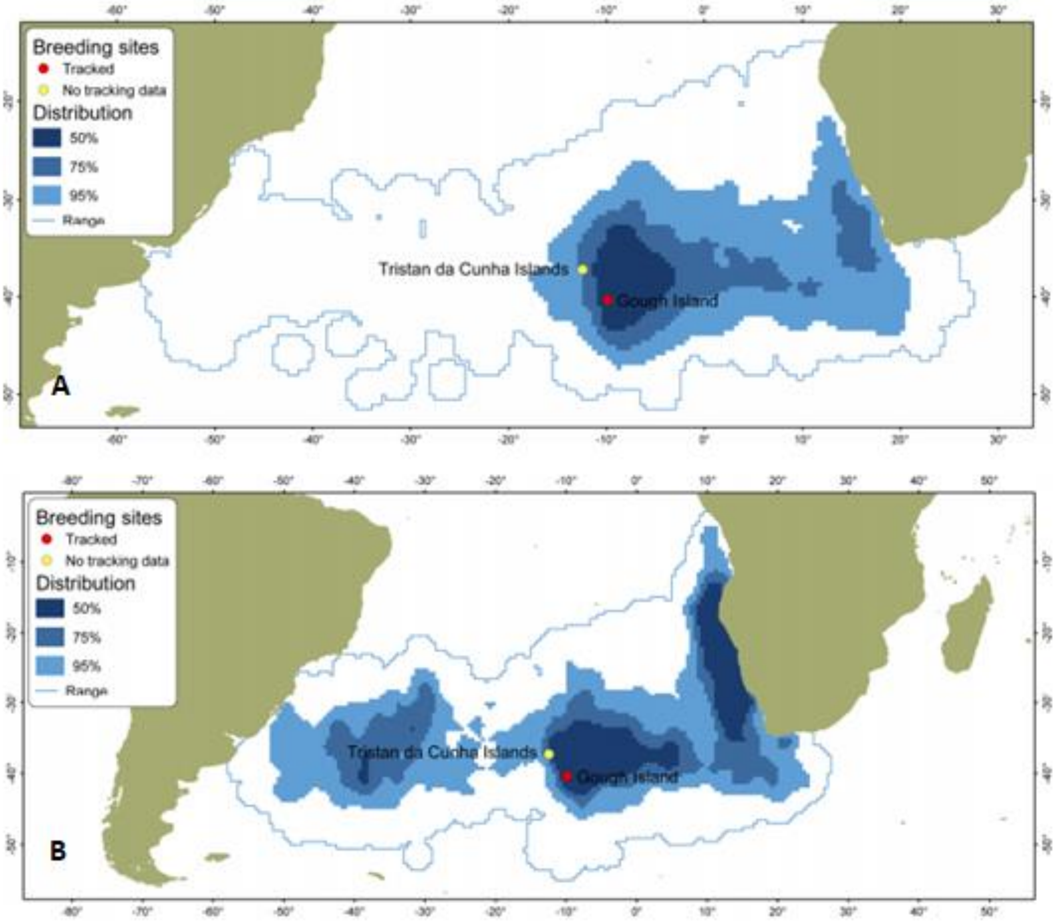


Figure 322. Satellite tracking data of *Thalassarche chlororhynchos* tagged individuals on Gough Island. A. Breeding individuals. B. Non-Breeding adult individuals. Source: ACAP, based on data provided by BirdLife's Global Procelariform Tracking Database.

The world population is estimated at 50,000-80,000 individuals, but the methodology behind this estimate is uncertain. Population estimates and modeling suggest that the population would be declining steadily by more than 50% in three generations time.

Thalassarche chlororhynchos is thought to be one of the most frequently killed species in longline and trawl fisheries. For this reason, the main cause of the observed population decline is considered to be bycatch in longline fisheries for swordfish, tuna and shark developed in the South Atlantic by Brazil, Namibia and South Africa. In Argentina, this species was part of the bycatch during the 1990s and early 2000s, but this type of fishery currently operates in a limited way in the Argentine Sea. There is no evidence of problems with trawl fisheries in Argentina. Another threat concerns the ingestion of plastics, but its effects at the population level are unknown.

Black-browed Albatross -*Thalassarche melanophris*

Resident and abundant species in the Argentine Sea. It has a circumpolar distribution in the southern hemisphere, with a range from subtropical to polar waters, but in general, they do not go further north than 40ºS (Figure 323). Most breeding birds are found in the subantarctic zone, while non-breeding birds are located in both subtropical and subantarctic zones. It nests on seven subantarctic islands or archipelagos - South Georgia Islands, Crozet, Kerguelen, Heard and McDonald, Macquarie, Antipodes, Campbell, as well as in the Falkland Islands, in archipelagos of southern Chile - Diego Ramírez, Evangelistas, Diego de Almagro, and Ildefonso, with two additional populations recently discovered on islets of Tierra del Fuego and in the Magallanes region.

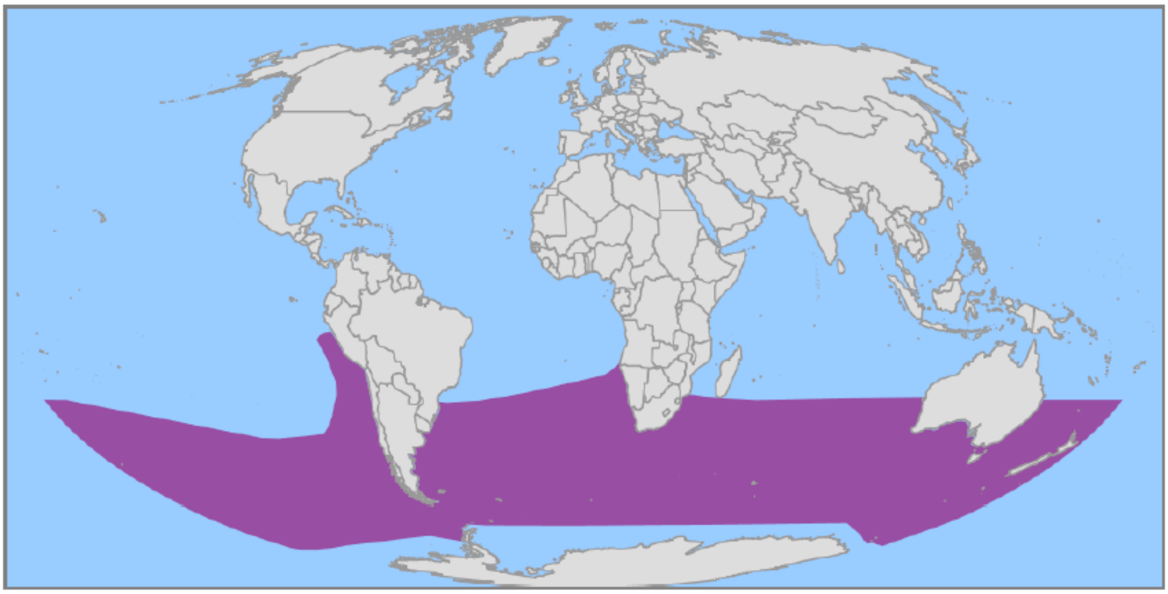
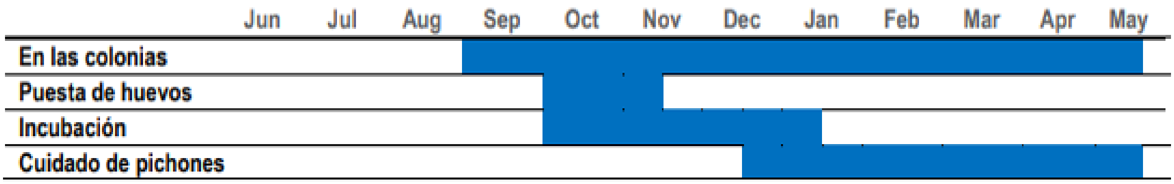


Figure 323. Global Distribution of *Thalassarche melanophris*. Source: FS.

Thalassarche melanophris is a colonial species that breeds annually, however, only 75% of successful breeders and 67% of failed breeders nest the following year. 90% of the global population breeds on the coast and islands of the Patagonian Sea and southern Chile (Diego de Almagro, Ildefonso and Diego Ramírez islands). Each breeding cycle covers about eight months (Table 29). The birds begin to return to the colonies between the beginning and the end of September, depending on the location. The laying is of a single egg. In the South Georgia Islands, egg laying occurs in late October and early November, with chicks hatching in late December and early January after an average incubation of 69 days and becoming independent after 117 days in April - May. Immature birds begin to return to land at least two years after becoming independent; juveniles return for the first time at age six. The average age of the first nesting is between 8 and 13 years.

Table 29. Breeding calendar of *Thalassarche melanophris*. Source: ACAP.

(Translation of Table 29: En colonias: At colonies. Puesta de huevos: Egg laying. Incubación: Incubation. Cuidado del polluelo: Chick Provisioning).



They feed in surface waters mainly on krill and fish, but also eat the discards from fishing boats and killer whales. They are shallow divers, who do not go below 4 m to catch their prey. They prefer less than 1000m depths, but they frequently feed in deep waters of the Patagonian Sea slope north of the Falkland Islands (Islas Malvinas) and with the polar front (Figure 324). During incubation (spring), they feed on a larger area of the Argentine Sea, preferring warmer waters (16 ° C) and areas with steep slopes (>3°). The populations of South Georgia feed in oceanic waters, especially at the confluence of the Brazilian and Malvinas currents. When the chicks are bred in the summer, they should feed in waters closer to the colony, preferring to do so in neritic environments (0–500 m), following the edge of the platform, the upper portion of the slope (500–1000 m) , and finally the oceanic environments (> 1000 m) (>1000 m).

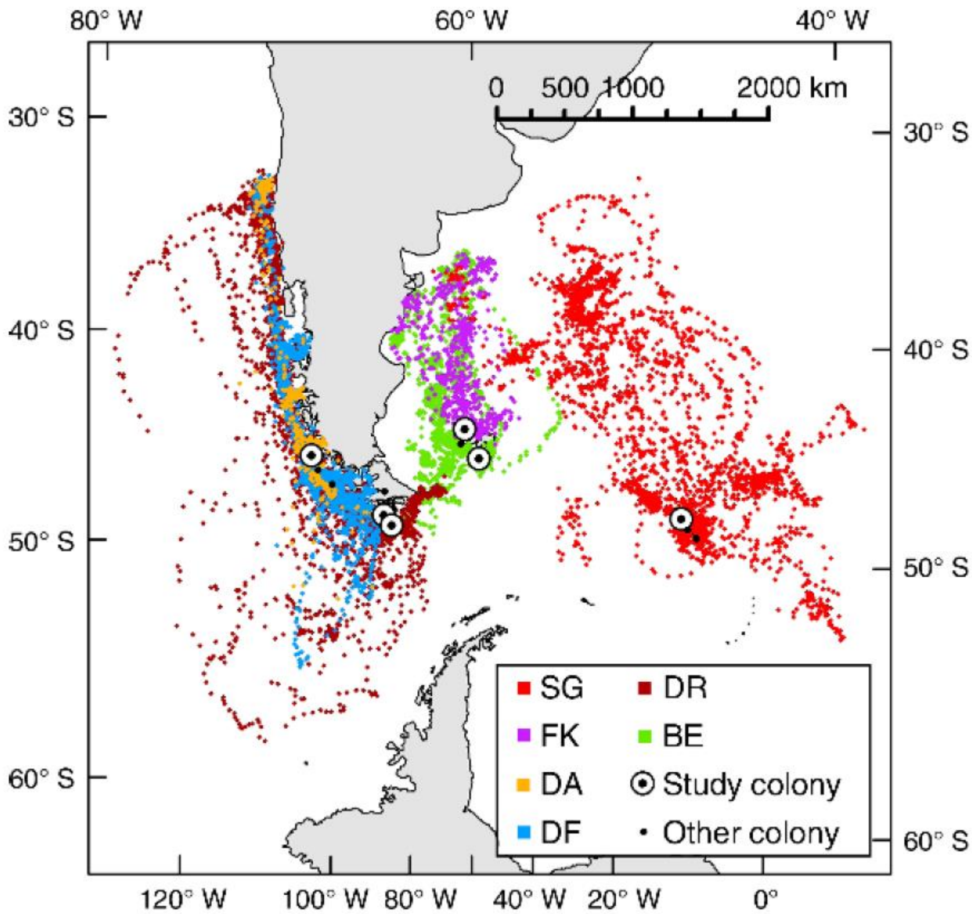


Figure 324. ARGOS positions of *Thalassarche melanophris* adults during the incubation period from six different colonies. SG, NW of South Georgia; FK, NE Falkland Islands (Islas Malvinas); DA, Diego de Almagro Island; DF, Ildefonso Islands; DR, Diego Ramirez Islands. Source: Rey and Huettmann (2020).

At the end of the breeding season, the adults of the black-browed albatross from the Falkland Islands (Islas Malvinas) explore feeding sites far from the colony, distributing widely throughout the continental shelf of the Patagonian Sea (Figure 325). Juveniles of the Black-browed Albatross from the Falkland Islands (Islas Malvinas) are more widely dispersed and travel further north than adults. The main areas used are the continental shelf and the slope north of 40ºS. This difference in food exploration areas is very noticeable according to the Breeding status (Figure 326). It should also be emphasized that populations that come from very different nesting colonies converge in feeding areas (Figure 327), as is the case for other species of birds that use the Argentine Sea.

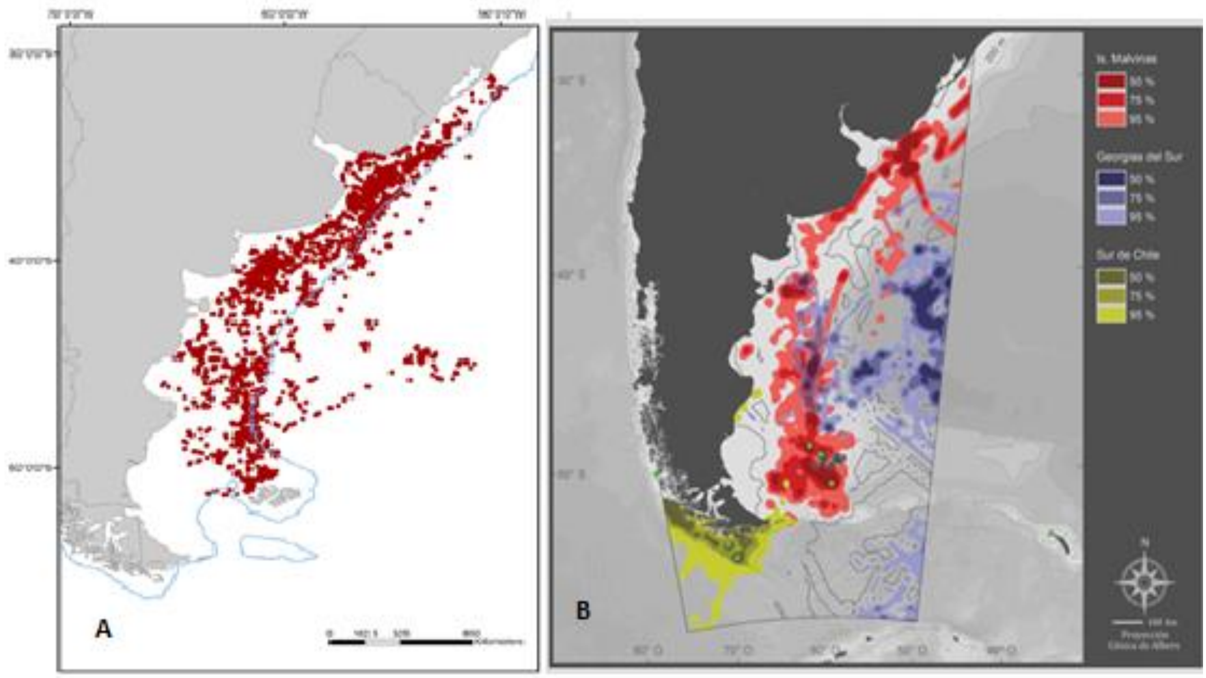


Figure 325. *Thalassarche melanophrys* concentration areas. A. Sea locations of adult Black-browed Albatross equipped with satellite transmitters during the non-breeding period of the 2011 season. Source: Gandini, P. and Frere E. 2012. B. Locations corresponding to tagged individuals of different geographical origin. Source: Atlas of the Patagonian Sea (AMP).

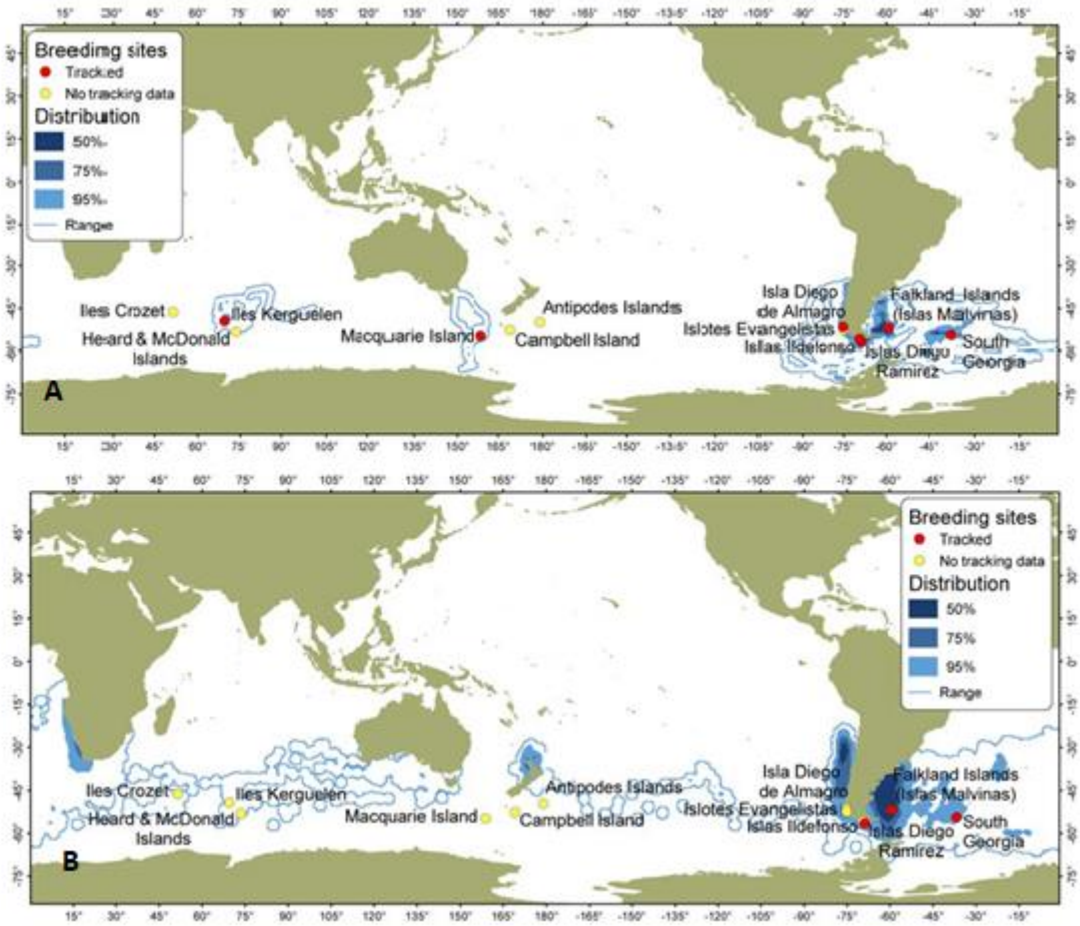


Figure 326. Satellite tracking data of tagged *Thalassarche melanophris* individuals in South Atlantic colonies. A. Breeding individuals. B. Non-Breeding individuals. Source: ACAP, based on data provided by BirdLife's Global Procelariform Tracking Database.

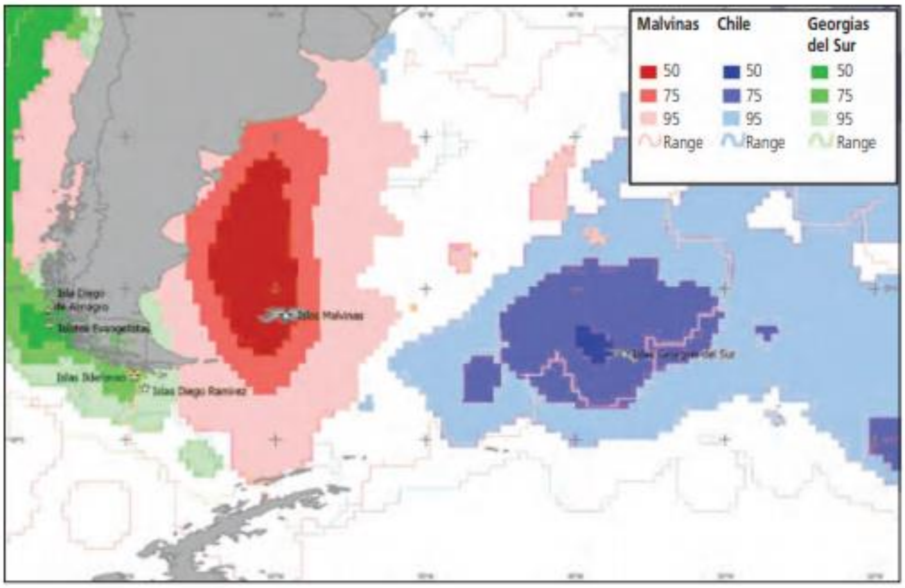


Figure 327. Detail of the distribution in the Atlantic and South Pacific of non-breeding *Thalassarche melanophris* from the South Georgia Islands, the Falkland Islands (Islas Malvinas) and an island south of Chile. Source: PAN-Aves, adapted from BirdLife's Global Procelariform Tracking Database.

The black-browed albatross is the most abundant species of albatross in the world with an estimated population of between 1,000,000 and 2,500,000. The total breeding population is estimated at about 530,000 pairs, of which 60% breed in Malvinas, 20% in South Georgia and the remaining 20% in Chile. Generally speaking, since the '70s or' 80s populations have significantly declined, with recent rates estimated on 5% per year on some islands. During the last two decades, the Malvinas population has decreased from about 500,000 to less than 400,000 pairs.

The main threats would be at sea, as a result of fisheries-related mortality and potential changes in krill abundance, due in part to conditions of climatic variability. It is a species with numerous records of plastic intake (Tavares et al 2017). There are few threats on land that can be considered as causing changes in the population levels of the breeding sites. In the Falkland Islands (Islas Malvinas), where the largest population of this species is found, 91% of the breeding population is on uninhabited islands, within protected areas, and 48% is present on islands without introduced predators.

Grey-headed ALbatross -*Thalassarche chrysostoma*

It is a species with circumpolar distribution that reaches Antarctic waters (Figure 328). It nests annually or biannually on the subantarctic islands or archipelagos: South Georgia, Diego Ramírez and Idelfonso (Chile), Crozet, Kerguelen, Macquarie, Prince Edward and Campbell.

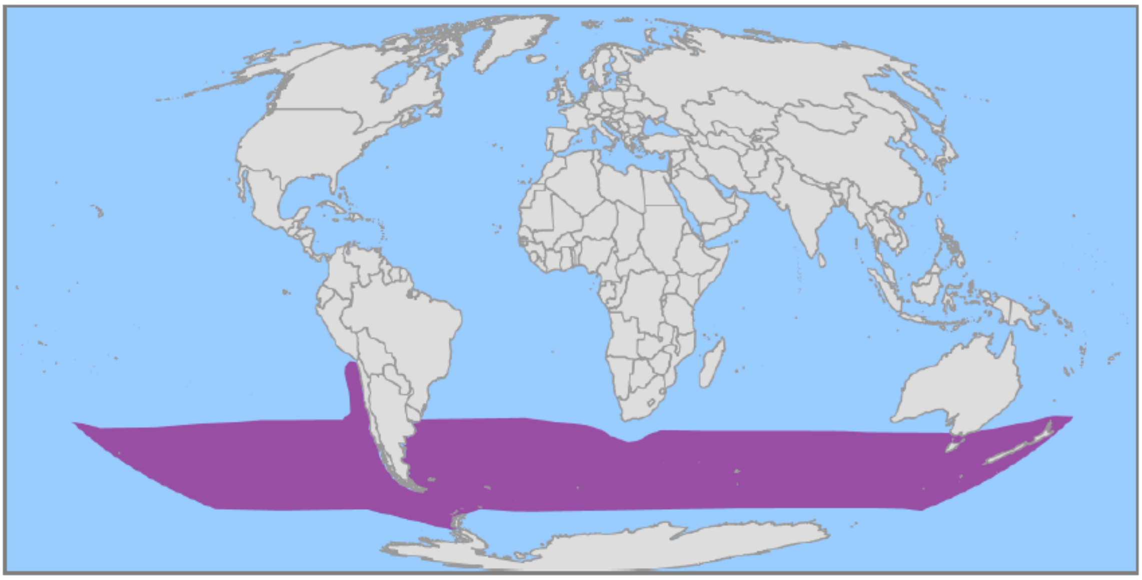


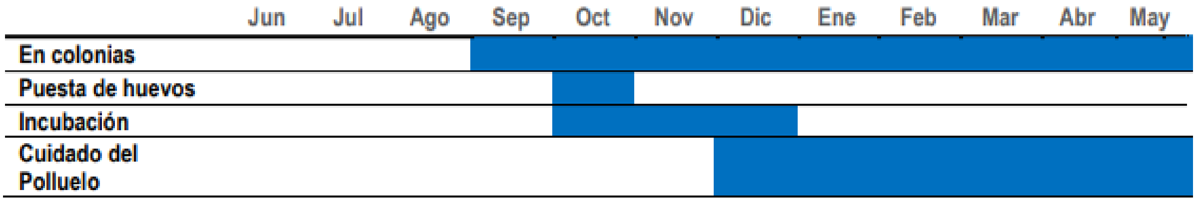
Figure 328. Global Distribution of *Thalassarche chrysostoma.* Source: FS.

Thalassarche chrysostoma is a biannual breeding species, although a small proportion breed yearly. Nesting begins in early September-October with the massive return of individuals to the colony. Egg laying occurs in October and lasts for a period of 15-20 days, with the average date being mid-October for most sites. Incubation lasts an average of 72-74 days, with most chicks hatching in December and the rearing period lasts until the end of April-May when they are around 116-145 days old (Table 30). Immature individuals return to the colony when they have reached at least three years of age, but the age of 6-7 years is more common. The average age of the first brood ranges from 7 to 13 years.

Table 30. Breeeding calendar of *Talassarche chrysostoma* at their nesting sites. Source: ACAP.

(Translation of Table 30: En colonias: At colonies. Puesta de huevos: Egg laying. Incubación:

Incubation. Cuidado del polluelo: Chick Provisioning).



They are opportunistic carnivores that feed on what they catch on the surface of the water, but can dive up to 6m deep. The diet includes cephalopods, fish, crustaceans and penguin remains, depending on the locality and the breeding stage. Although most dives take place during daylight hours, a considerable proportion of prey can be eaten at night. The upwelling and convergence areas such as fronts are important feeding areas (Figure 329).

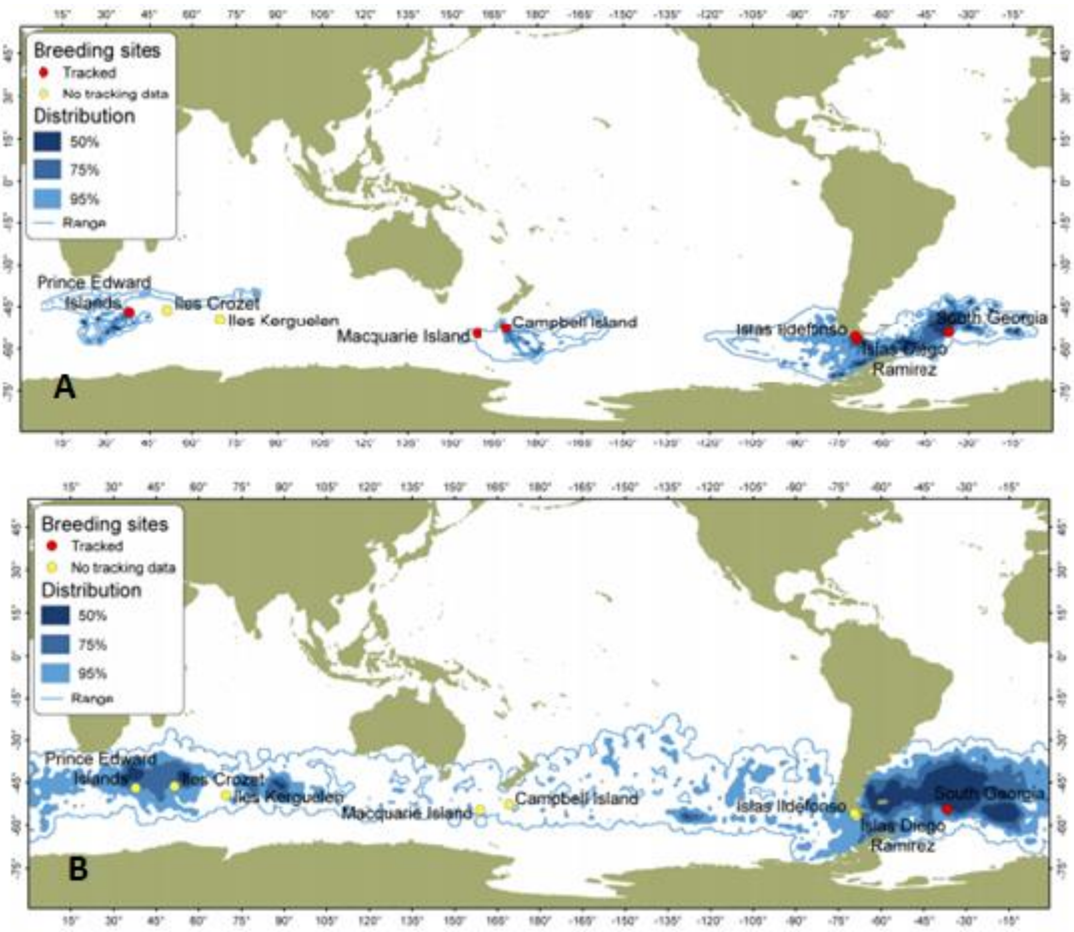


Figure 329. Satellite tracking data of tagged *Thalassarche chrysostoma* individuals in South Georgia colonies. A. Breeding individuals. B. Non-Breeding individuals. Source: ACAP, based on data provided by BirdLife's Global Procelariform Tracking Database.

Nesting populations on the South Georgia Islands make up 49.8% of the total global population, estimated at 250,000 individuals, with 80,000–95,000 declining breeding pairs.

One of the problems is found in the sea associated with incidental catch in bottom longline fisheries, although catch levels in jurisdictional waters have been reduced in our territory, but they are still active in Chile. Fishing in high seas waters and the edge of the slope outside the Argentine Sea may be causes of undocumented mortality that affect this species. Plastic remains in regurgitated pellets have been reported. In general, it is considered that there are no threats in the nesting areas except for the presence of exotic species such as rats or cats on an island.

Common Giant Petrel - *Macronectes giganteus*

This species has a wide circumpolar distribution restricted to the southern seas. It ranges from 40 ° S (Gough Island) to around 68 ° S, in Antarctica. There are colonies in northern Patagonia and Isla de los Estados in continental Argentina, and it also nests in the Falkland Islands (Islas Malvinas), southern Chile, the Antarctic Peninsula and subantarctic islands (Figure 330).

It presents pronounced dimorphism, with males being 15% larger and 40% heavier than females.

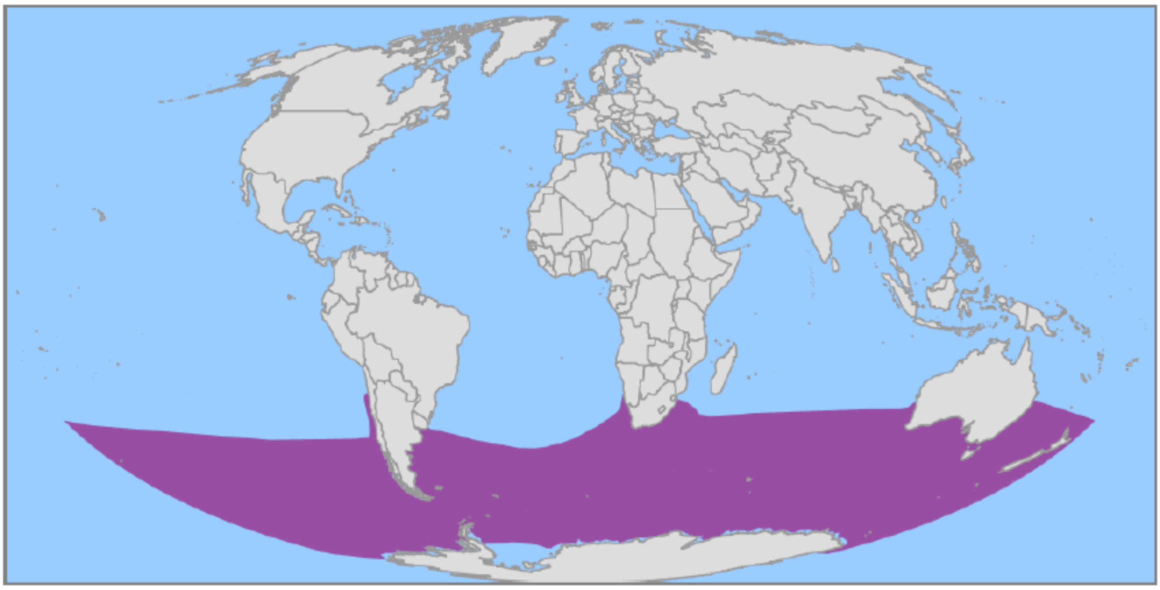
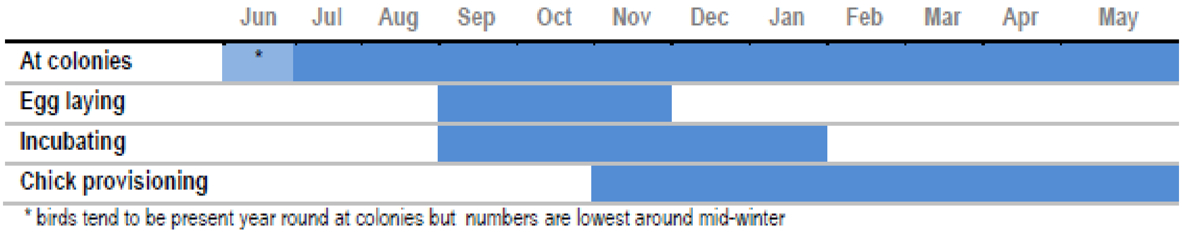


Figure 330. Global Distribution of *Macronectes giganteus.* Source: FS.

It breeds annually in lax colonies, but each individual can go 1-2 years without breeding. Adults arrive in colonies from July-August to September, depending on latitude and location. The laying takes place in mid-October in the Antarctic colonies, but it starts earlier in lower latitudes, from the end of August to the end of September. On average, the eggs are incubated for 6 days, hatching from late October to late January. Colonies show egg losses greater than chick losses. Chicks are cared for and fed in the nest for 24-26 days until fledging. Males feed their young more often than females. Male chicks stay longer in the nest and leave it heavier than females. Fledglings generally leave the colony about 100-130 days after hatching. This period extends from the end of March to the end of April in Patagonia after 86-125 days in the nest (Table 31).

Table 31. Breeding calendar of *Macronectes giganteus* at their nesting sites. Source: ACAP.



It feeds mainly on carrion (remains of penguins, marine mammals, other birds), but also on squid, nototheniid fishes and crustaceans, varying according to the seasons, and the sexes. Garbage and fishing discards from vessels make up an important part of the diet.

The Common giant petrel of the colonies of the Patagonian coast uses coastal and pelagic areas of the continental shelf, the slope, the north of the San Jorge Gulf and Islas de los Estados, and the waters in the extreme north of the white area in front of Rio de la Plata. Although there are areas of shared use (slope in front of the San Jorge Gulf and waters near the colonies), the juveniles of the common giant petrel show greater dispersion than the adults and mainly use areas north of the Patagonian Sea (Río de la Plata, Uruguay and southern Brazil) (Figure 331).

Data for the common giant petrel from the southern Patagonian coast suggest some degree of sexual segregation in the use of foraging areas. The females are mainly pelagic, while the males feed in coastal waters close to colonies of seals, elephant seals and penguins. At the end of the breeding season, adults move further away from the colonies of the South Georgia Islands and make intensive use of the southern area of the Patagonian Sea, around the Falkland Islands (Islas Malvinas) and some coastal areas around Puerto Santa Cruz and Río Grande (Tierra del Fuego) (Figure 332).

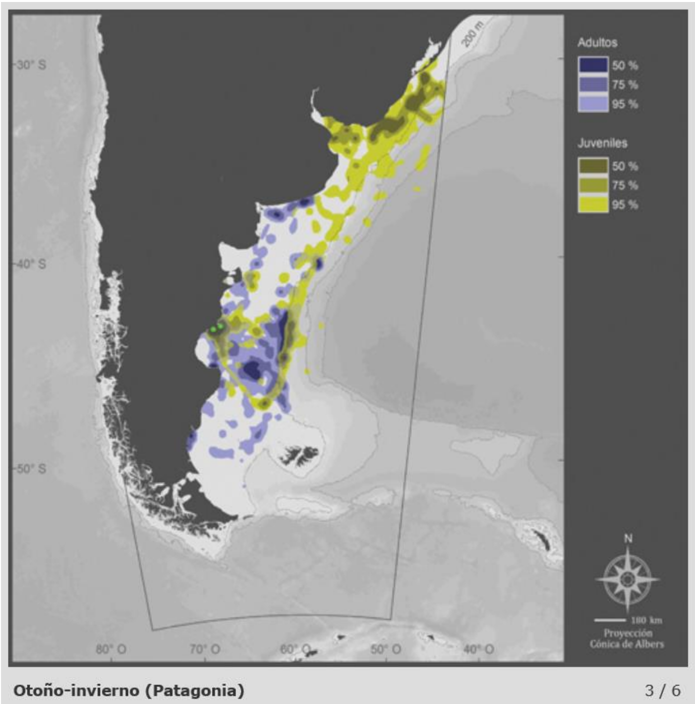


Figure 331. Concentrations of adults and juveniles of individuals from the Patagonian coasts, tagged with geolocators. Source: Atlas of the Patagonian Sea.

(Translation of Figure 331: Adultos: Adults. Juveniles: juveniles. Otoño-invierno: Autumn-winter. Patagonia).

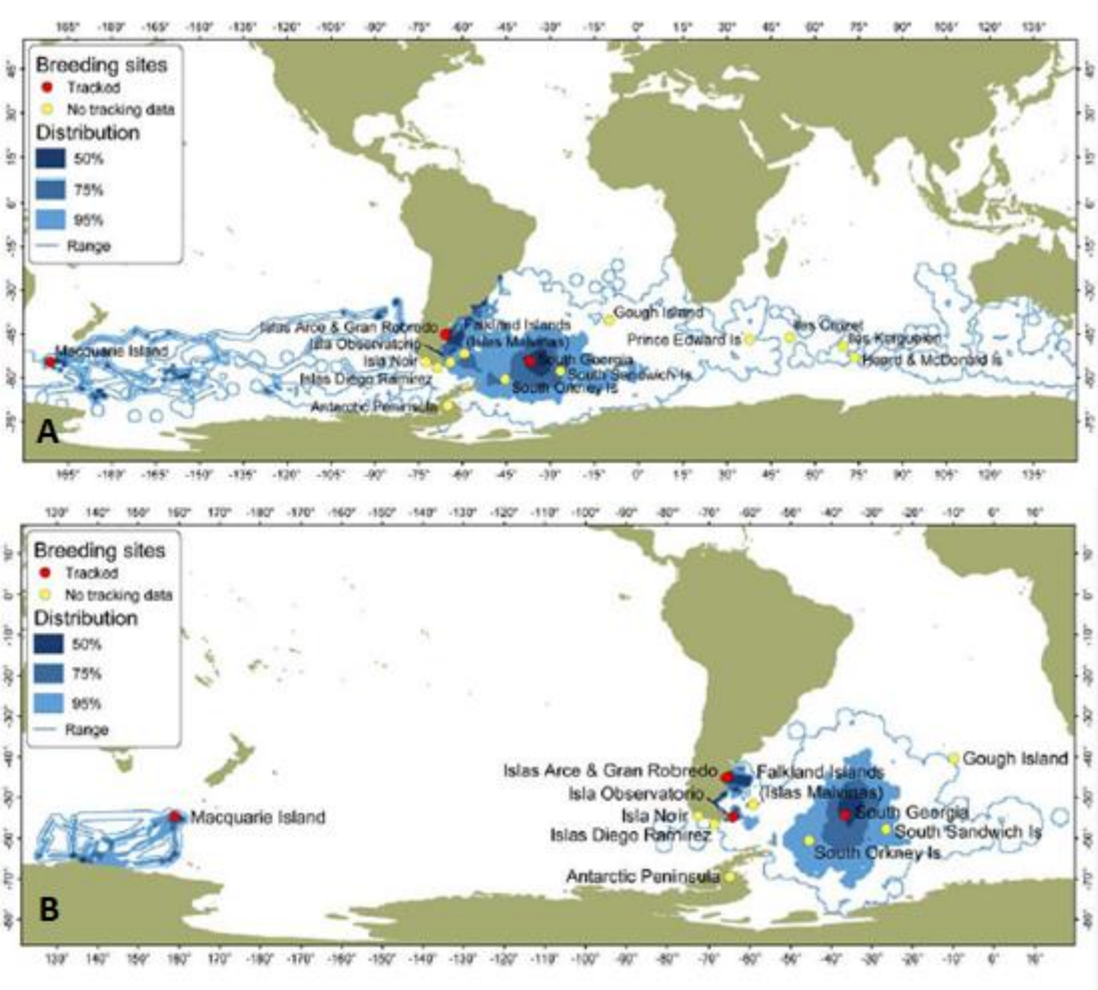


Figure 332. Satellite tracking data of tagged individuals of *Macronectes giganteus* in South Georgia colonies. A. Breeding individuals. B. Non-Breeding individuals. Source: ACAP, based on data provided by BirdLife's Global Procelariform Tracking Database.

A total population of 46,800 Breeding pairs and an estimate of about 100,000 mature individuals is estimated. The colonies of South Georgia, Orcadas and South Shetland concentrate approximately 78.5% of the declining global population. The colonies in northern Patagonia (Arce and Gran Robredo) and those of the Falkland Islands (Islas Malvinas) are increasing or remain stable.

M.giganteus is the only species registered by Argentina in the ACAP (Albatross and Petrels Conservation Agreement). Colonies of the species are protected in the Patagonia Austral Coastal Marine Interjurisdictional Park (Law No. 5,668 National Law No. 26,446) on the Arce and Gran Robredo islands.

Very little is known about the mortality and survival rates of adults and juveniles at sea. In the oceanic environment, an incidental mortality of 4% was reported for the longline fishery of the Argentine Sea between 1999 and 2001. The activity of longline vessels has decreased considerably in the Argentine Sea, whose landings reached their peak in 1995, having dropped since then (Favero et al. 2013). Even though interactions between this species have been described with fisheries operating with a trawl, both coastal and high seas, there is no evidence of mortality due to this interaction, although the possibility of cryptic mortality must not be ruled out.

The number of common giant petrels killed in illegal fisheries outside jurisdictional boundaries is considered to be high. The threats mentioned for the rearing period include the ingestion of plastics, contamination by organochlorine pesticides and heavy metals, human disturbances (establishment of research bases near colonies, tourism), predation by introduced animals, destruction of habitat by livestock.

Hall´s giant petrel - *Macronectes halli*

The breeding range of *M. halli* covers the subantarctic and convergence zone, including the South Georgia Islands, Prince Edward Islands, the Crozet and Kerguelen Archipelagos, Marion Island and the islands of New Zealand, Campbell, Antipodes and Chatham (Figure 333). *Macronectes halli* nest on the surface, in colonies or in solitary breeding pairs. This species exhibits strong fidelity to its breeding islands and also close mating ties, generally doing so for life.

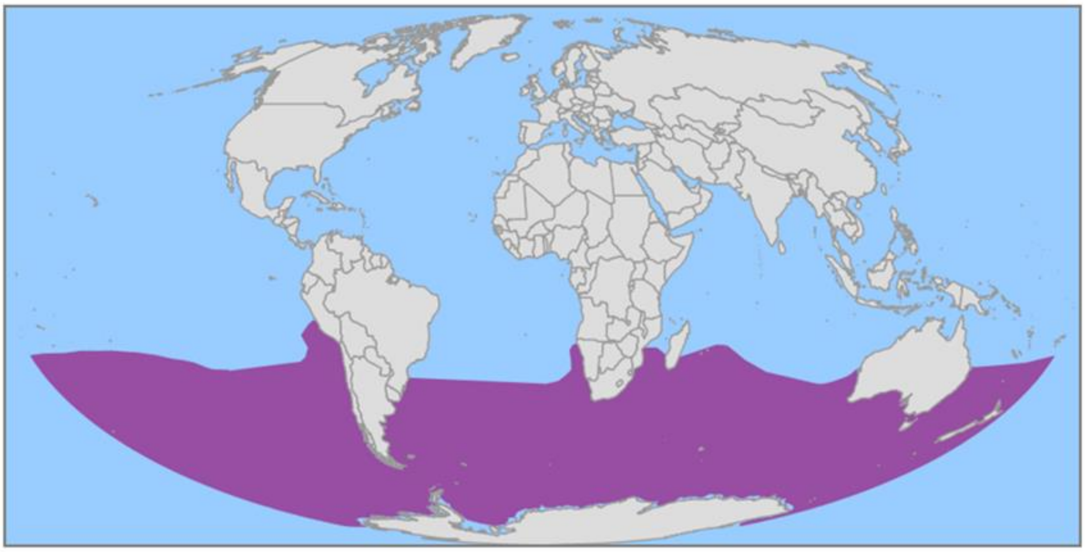
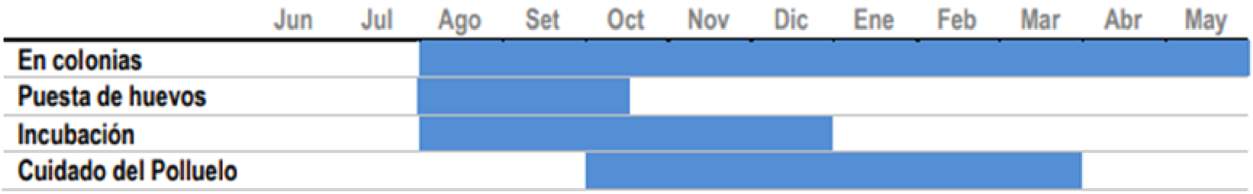


Figure 333. Global Distribution of Macronectes halli. Source: FS.

The nesting season generally begins in August when the birds arrive at the colonies and lay a single egg between August and early October (Table 21). Both sexes contribute to incubation (59-60 days) and the provision of food. According to the colonies, one of the sexes spends a significant greater proportion of its time incubating. The rearing period of the chicks is between 112 - 124. The age of first reproduction is 4-11 years. It is common for a good part of the population to spend years without breeding.

Table 32. Breedinge cycle of *Macronectes halli*. Source: ACAP.

(Translation of Table 32: En colonias: At colonies. Puesta de huevos: Egg laying. Incubación: Incubation. Cuidado del polluelo: Chick Provisioning).



Giant petrels are considered the main scavengers in Sub Antarctic and Antarctic waters, but they are also predators. As it is considered an opportunistic aggressive species, *M. halli* can take prey on the surface of the water, but it also uses shallow diving and even dives down to 2 m-deep. On some islands, penguin carcasses are the main component of the diet, which also includes carcasses of seals, burrowing petrels, fish and cephalopods, carcasses of whales, dead albatross chicks, boat waste and algae. Breeding of *Macronectes halli* appears to be programmed to take advantage of the abundance of carcasses in the breeding season for seal pups or sea lions, an important food source during chick care. Males showed a more flexible feeding between the coastline and pelagic habitats, probably taking advantage of the availability of seal carcasses, while females were consistently more pelagic. The breeding individuals of the Georgia Islands (Figure 334) as well as the juveniles of the Crozet and Kerguelen Islands (Figure 335) present areas where they spend more time feeding.

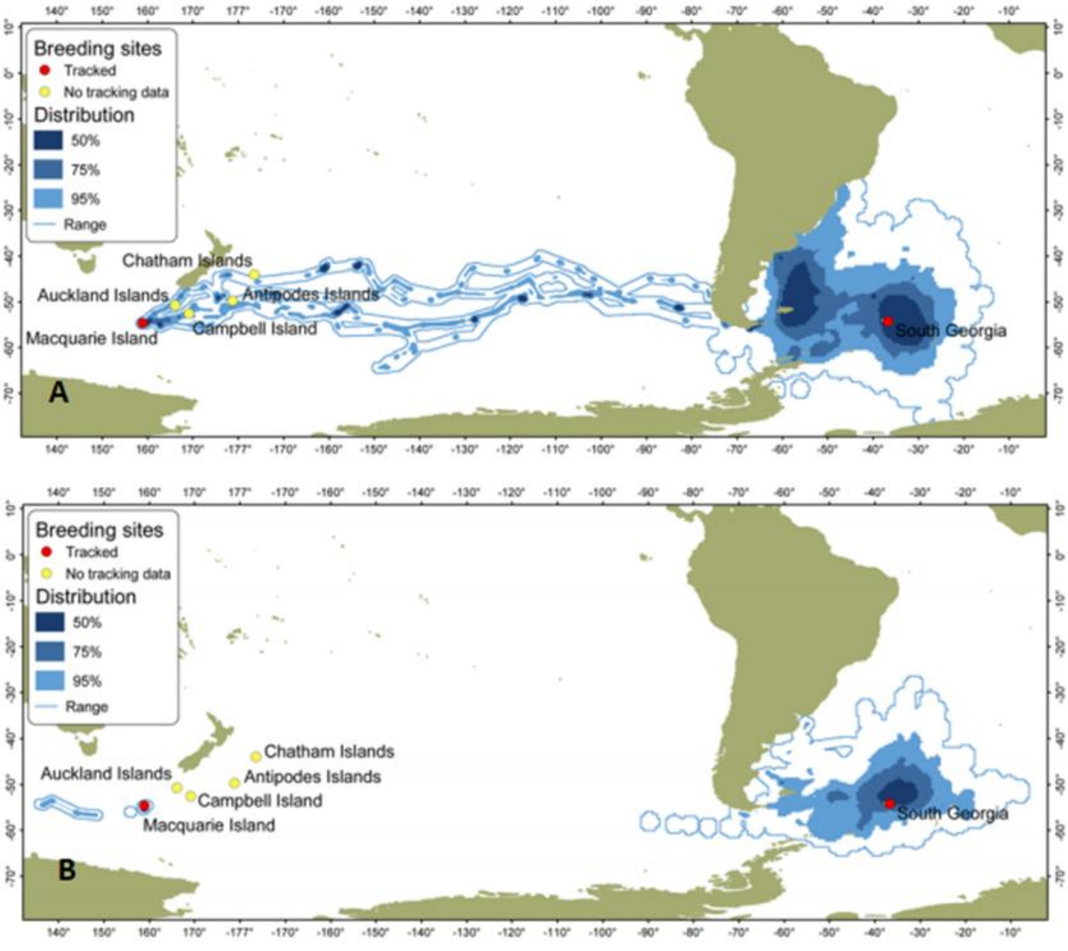


Figure 334. Satellite tracking data of tagged individuals of *Macronectes halli* in South Georgia colonies. A. Breeding individuals. B. Non-breeding individuals. Source: ACAP, based on data provided by BirdLife's Global Procelariform Tracking Database.

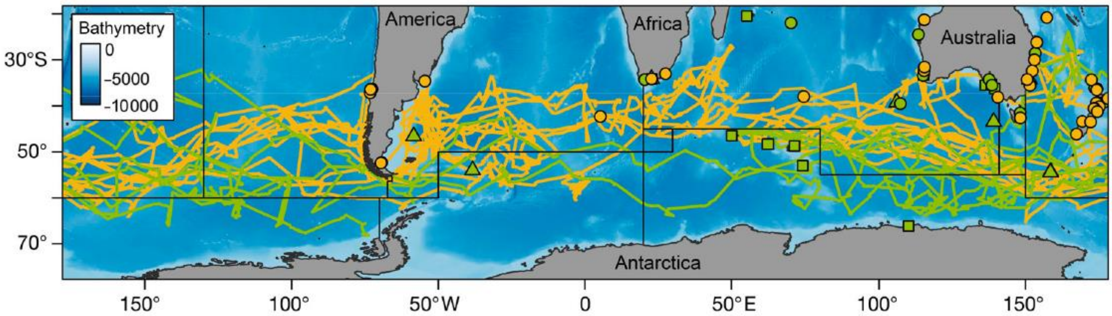


Figure 335. Satellite tracking data of juvenile *Macronectes halli* (yellow) individuals in their first months of travel, tagged on Crozet and Kerguelen islands. Source: Thiers et al 2014.

The *M. halli* population has shown increases and decreases in its breeding range. In many sites, however, census data are infrequent and / or of low precision, hindering a detailed assessment of population trends. The northern giant petrels that visit the study area come from the South Georgia Islands, where the largest breeding population of *M. halli* is found, and one third of the world population. There, the breeding population increased by about 60% between 1978 and 1996 and it is believed that it was due to the increase in the number of *Arctocephalus spp*. sea lions, which are a source of carrion and also the increase in pelagic food sources, such as waste from fishing operations. But there are only censuses from the late 1990s where the breeding population in South Georgia was estimated at 11,210 pairs. On other islands and in Antarctica, census data have been very occasional and mostly show declining trends.

The most serious threat to *M. halli* is commercial fishing activity in the Southern Ocean. Longline fishing for *Dissostichus eleginoides* toothfish is of particular concern as this type of demersal fishing threatens to be restricted on the continental shelf of subantarctic areas around islands where albatrosses and petrels nest. Although some of these fisheries use measures to reduce seabird mortality, many activities are still illegal, unregulated and unreported, and hence, difficult to regulate or control. Females may have higher mortality as they tend to have larger pelagic ranges and longer foraging trips than males. Trawling can also injure or kill *M. halli* through collisions with sonar cables and cables used for trawling rigging. Other threats at sea can include ingestion or entanglement with marine debris (both plastic and other related to fishing), accumulation of pollutants from oil spills, and firing from fishing boats to reduce the theft of baits. Contamination by pollutants through their food sources is also a potential concern, with relatively high concentrations of hexachlorobenzene (HCB) and mercury, and increasing concentrations of DDE (dichlorodiphenyl-dichlorethylene). When compared to other seabirds, *M. halli* has high levels of lead, mercury, and selenium in its feathers and other tissues.

There are several documented land-based threats to *M. halli*, but currently none are considered to have the scope or severity of causing population level changes. Human disturbance at nesting sites that are close to research stations or visitors to the nesting area could result in decreased breeding success or even colony abandonment. Introduced animals such as cats and black rats caused egg and chick mortality on Macquarie Island in the past. Cats were eliminated in 2000 and eradication programs for European rats, mice and rabbits have been developed, but were suspended due to climate issues in 2010. Their current status is unknown.

<u>Atlantic petrel - *Pterodroma incerta*</u>

The distribution in the sea is restricted to the South Atlantic, from the east coast of South America to the west coast of Africa (Figure 336).

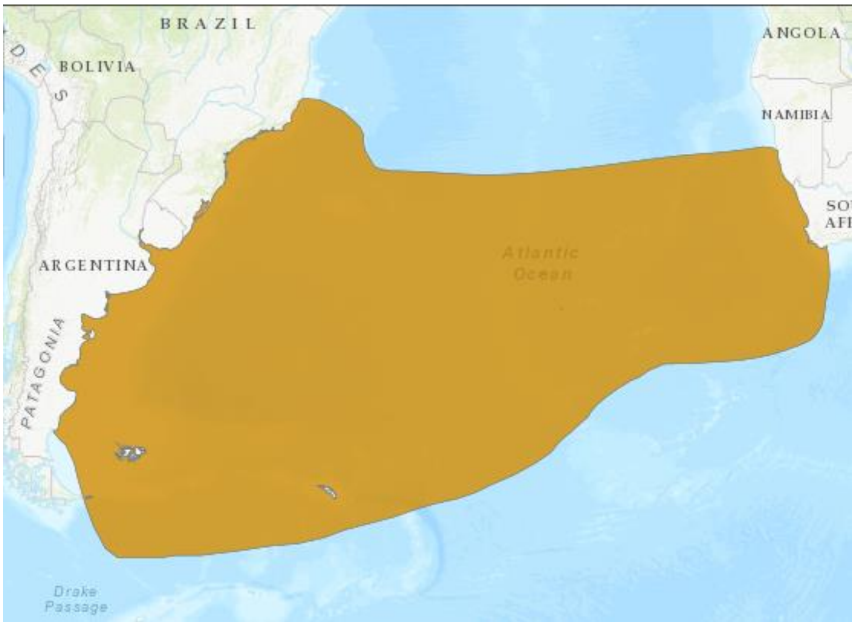


Figure 336. Global distribution of *Pterodroma incerta*. Source: UICN.

It breeds in colonies and nests in holes in peaty soils with fern cover at 50-300 m and even up to 700 m elevation. It is known that the laying takes place during a week in mid-April and there is a mass exodus outside the island after the molt. Age of first maturity, breeding frequency, egg survival, and chick survival are unknown.

It is a species which thrives in pelagic and neritic waters. They feed mainly on squid, fish and crustaceans. The confluence area between the Malvinas and Brazil currents is used throughout the year by groups of different ages and breeding conditions (Figure 337).

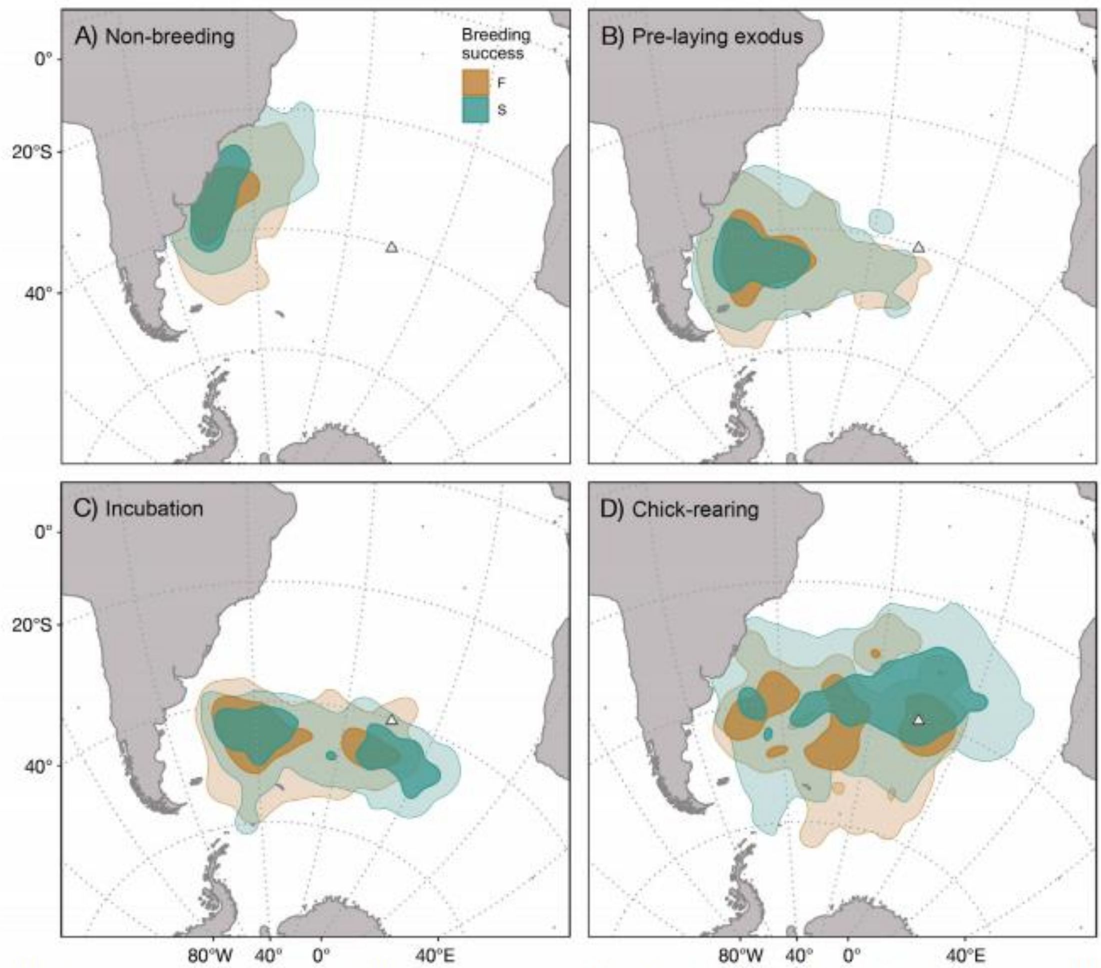


Fig. 2. Year-round distributions of adult Atlantic petrels (successful [S] and failed [F] breeders separately). Filled contours refer to 50% (darker polygons) and 95% (lighter polygons) kernel utilization distributions (core areas of activity and the areas of active use, respectively) in the South Atlantic Ocean at each phenological phase. Triangle: breeding colony at Gough Island

Figure 337. Satellite tracking data of individuals of *Pterodroma incerta* tagged in breeding colonies on Gough Island at different stages of the breeding cycle. A. Non-breeding period. B. Pre-laying exodus. C. Incubation. D. Chick-rearing. Source: Pastor-Prieto et al 2019, Ramos et al 2017.

On Tristan Island, the estimate of the number of breeding pairs was 100 to 200 in the 1970s but is now unknown. On Gough Island, approximately 1.8 million adult individuals were estimated in 2004, but more recent studies based on the nest occupancy rate suggest between 630,000 and 1,100,000 pairs and a 20% breeding success.

At sea, it is preyed upon by other birds, such as *Stercorarius antarcticus*. On land, one of the main threats in the past was exploitation as a food resource during winter by the inhabitants of Tristan Island. However, as of 1940 this resource began to decline and currently it is very unlikely to be exploited. In Gough, recent studies showed that the observed low breeding success could be due to predation on chicks by the common mouse and by rats. The colonies were also seriously affected by Hurricane Catarina in March 2004.

Trinidade Petrel - *Pterodroma arminjoniana*

Pterodroma arminjoniana is a species with a disjunct distribution area. The subspecies *P. a. arminjoniana* is present in the South Atlantic, breeding on Trindade Island and Martin Vaz Islets, in the South Atlantic, off the coast of Espírito Santo, Brazil. The subspecies *P. a. heraldry* is found in the Indian Ocean, breeding on Round Island, near Mauritius Island, and on North Keeling Island, which belongs to Australia.

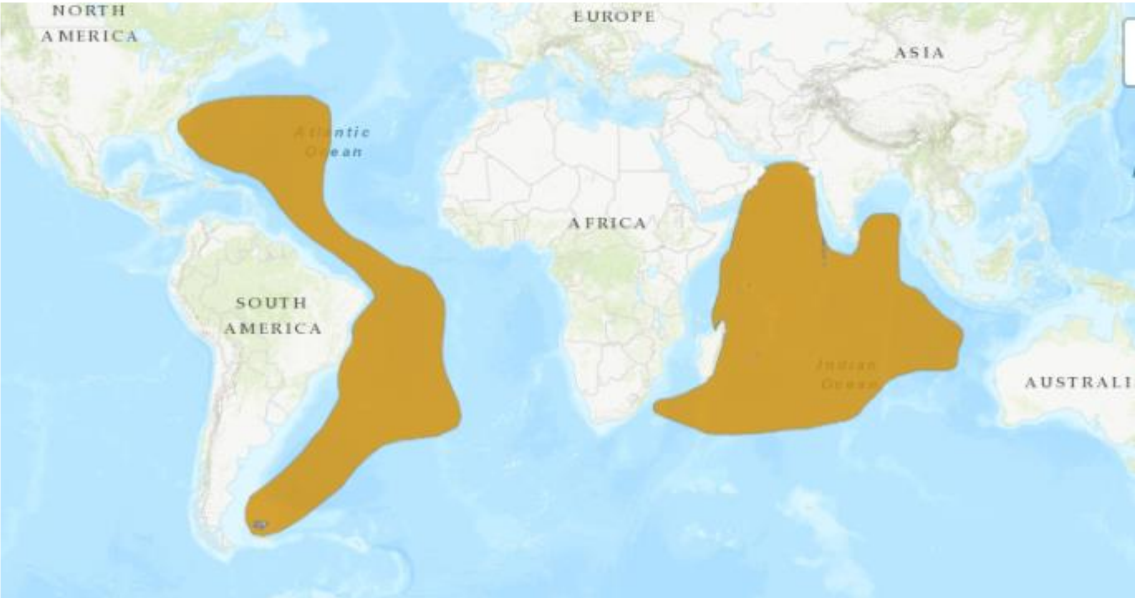


Figure 338. Global distribution of Pterodroma arminjoniana. Source: UICN.

Nesting colonies of the Trinidade petrel are on oceanic islands and atolls, nesting in crevices and other cavities of cliff ledges, ridges or rocky slopes up to 1000 meters high. Sometimes they nest in areas with dense vegetation. The breeding season varies substantially throughout its range. *P. a. arminjoniana* is present on the island of Trindade throughout the year (every month) and breeeds in two well-defined periods with some overlap and apparent fidelity of individuals in one period. Peak times for breeding-spawning activities are October and April. There is no information available on the lifespan of these petrels.

According to Kruger et al (2016), the subspecies P. a. arminjoniana is a transequatorial migrant, feeding in the tropical and temperate waters of the Southwest Atlantic during the breeding season and spending the non-breeding season in offshore waters of the Northwest Atlantic. Their main diet consists of Oegopsid squid and to a lesser extent clupeid fish and stomatopod and isopod crustacean. (Leal et al 2017). This species rarely follows boats and is not attracted to bait or fish discards.

The estimated population is 2.500-9.999. Luigi et al. (2008) have revised the previous population estimate of 15,000 individuals globally (Brooke 2004) to only 1,130 breeding pairs.

On the islands where they nest, they were preyed upon by non-indigenous predatory mammals, including wild pigs (Sus scrofa) and cats (Felis catus). Wild pigs and goats (Capra hirca) also destroyed the vegetation on the islands, degrading potential nesting areas. They were later eliminated in the 1990s. Since 1967, Brazilian legislation has provided protection to all seabirds by prohibiting the pursuit, killing, disruption of colonies, and the use of bird by-products. Nevertheless there are also threats due to human development.

The Brazilian navy expressed interest in building a small air base on the island, although this has yet to become a reality, it could cause habitat loss, degradation and disturbance of birds. Experimental wind turbines have also been built in the waters surrounding Trinidade Island, with plans to build more in the future.

Pterodroma a. arminjoniana is considered vulnerable because it has a very small breeding area and population, where it is prone to human impacts and stochastic events, which could lead to the species being critically endangered or extinct in a short period of time. *Pterodroma a. heraldica* has a wider breeding range and is considered to be of Least Concern (LC), although the populations of Round Island are also considered threatened under Commonwealth Environmental legislation in Australia.

White-chinned Petrel- *Procellaria aequinoctialis* -

The white-chinned petrel is a species distributed in the southern hemisphere that has the widest use of the Patagonian Sea (Figure 339). Regional nesting sites are located in the Falkland Islands (Islas Malvinas), South Georgia, Prince Edward, Crozet, Kerguelen, Auckland, Campbell and the Antipodes, possibly on Macquarie Island (Australia).

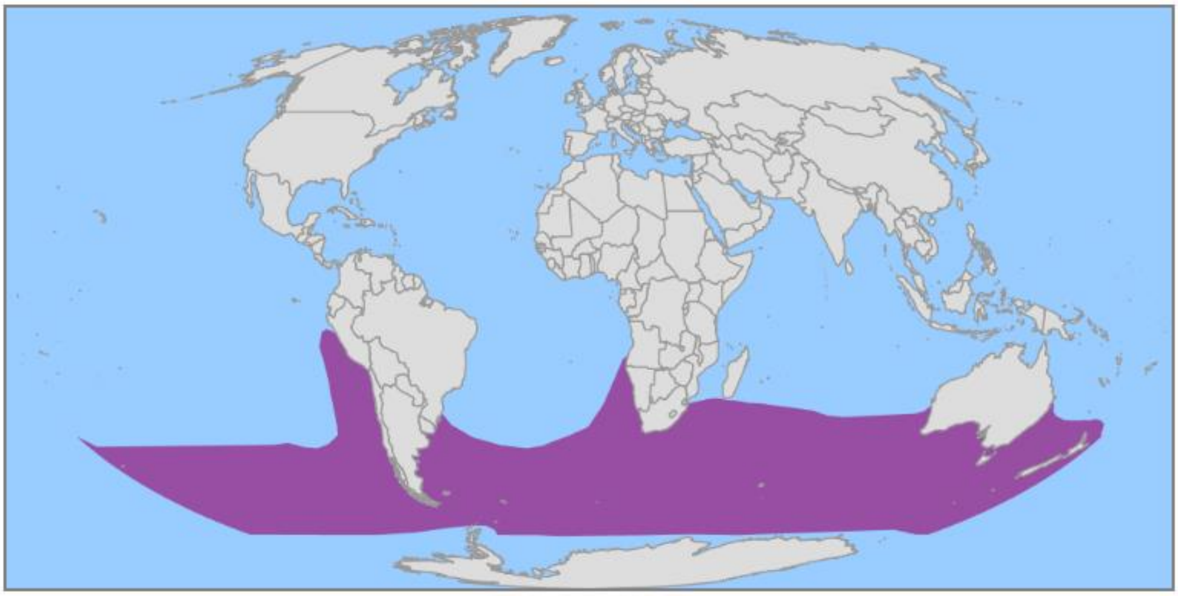


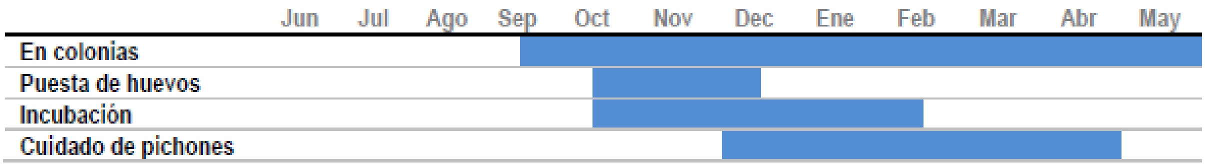
Figure 339. Global distribution of *Procellaria aequinocatalis*. Source: FS.

Procellaria aequinoctialis is a colonial species that nests annually, and is the largest petrel (c. 1100 - 1500 g) that nests in caves. The breeding season runs from October to May (Table 33). The first birds arrive at their breeding colonies in mid-September, about 50 days before laying, although the established breeders return in mid-October and leave about two weeks later when the exodus occurs. Eggs are usually laid from mid-October to mid-November. In the South Georgias Islands, 92% of the eggs are laid in the first 15 days. A single egg is incubated for approximately 59 days. The chicks become independent after about 98 days. Failed breeders leave in February, two months earlier than successful birds. The age of first reproduction is 6 years on average (4-9 year-range).

Table 33. Breeding calendar of *Procellaria aequinoctalis* in the South Georgias Islands. Source: ACAP.

(Translation of Table 33: En colonias: At colonies. Puesta de huevos: Egg laying. Incubación:

Incubation. Cuidado del polluelo: Chick Provisioning).



They feed by shallow collecting, but are capable of diving up to 15 m in search of prey or to catch bait from longline hooks. It feeds preferentially on Antarctic krill *Euphausia superba*, squid, small pelagic fish and the amphipod *Themisto gaudichaudii* can also be abundant. Tunicates and fish discards are also components of the diet, which varies according to the nesting location, season of the year and breeding stage. During the breeding season, the chicks also receive food probably obtained from the baits of the hooks of longline fisheries.
In the Argentine Sea, white-chinned petrels feed mainly from the colonies of the Falkland Islands (Islas Malvinas) and the South Georgia Islands, using both areas of the continental shelf and the slope of the Patagonian Sea, highlighting the surroundings of the Malvinas Islands and some platform areas in front of the Province of Chubut (Figure 340- A).

During the pre-laying and incubation periods (spring), individuals from the South Georgia Islands make 2000 km extensive trips in order to feed on the Patagonian shelf and the slope, particularly in front of the San Jorge Gulf and Valdés Peninsula, around the Falkland Islands (Islas Malvinas) and some areas of the Argentine Basin. During the breeding season (summer), the longest trips are infrequent, the birds feed in the area of the polar front, in subantarctic waters of the platform and the slope located in the southern area of the Patagonian Sea. Males and females feed on the Patagonian shelf between incubation turns (Figure 340- B and C). The failed breeders appear to be moving south towards the South Orcadas Islands. In autumn, the adults feed in the northern area of the platform and the slope, especially in front of the Río de la Plata, Uruguay and southern Brazil. In winter, both adults and juveniles are more abundant in coastal areas throughout a wide area from the southeast of Brazil to the south of the Patagonian shelf, and during the last part of winter, 20% of the birds use the region of the Humboldt current in western Chile (Figure 340- D).

Both in autumn and spring (breeding) the highest densities are observed near the continental shelf, more than in the pelagic zone and also outside Chile in the cold waters of the convergence zone.

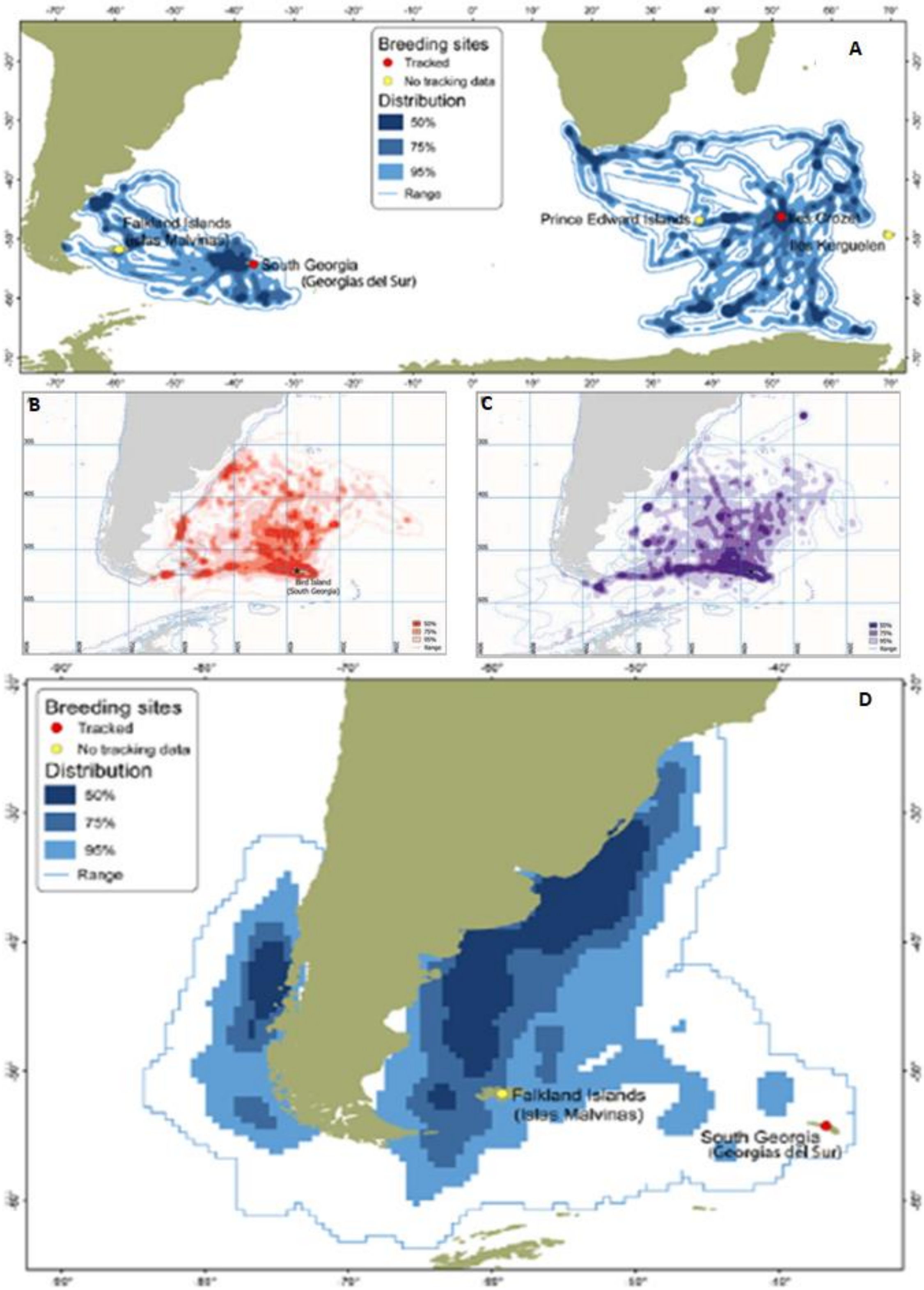


Figure 340. Satellite tracking data of tagged *Procellaria aequinoctialis* individuals. A. Breeding individuals tagged in South Georgia and Croizet. Females (B) and males (C) in breeding stage from South Georgias. D. Non-breeding individuals. Sources: (A and D) ACAP, based on data provided by BirdLife's Global Procelariform Tracking Database; (B and C) BirdLife International (2004).

Population data are scarse and census data are not yet available for several breeding sites. It is considered that 40% of the world's population is found in the South Georgias Islands, with an estimated 900,000 associated breeding pairs. In the South Georgia and Prince Edward Islands, the 2004 censuses indicated decreasing trends for the past 20 years. For most sites, there is no demographic parameter data to know if this trend can be generalized.

It is one of the most vulnerable species to incidental mortality in fisheries, being more frequently observed during winter, associated with longline vessels and trawlers in southeastern Brazil and Argentina. In the trawl fishery, birds are usually killed when they collide with trawl cables or get caught in the meshes of the net; some collide with the net cables. Currently, the most serious threat on most of the Islands is predation by introduced rodents (Black Rat *Rattus rattus* and Norway Rat *R. norvegicus*).

There is also degradation of the nesting areas due to the erosion generated by the populations of double-haired sea lions (*Arctocephalus gazella*). Detailed demographic analyzes on the Crozet and Kerguelen Islands indicated that the climate together with the fisheries has affected the populations and is responsible for their decline. Other authors also consider the ingestion of plastic particles and feeding fledglings with plastics a threat (Tavares et al 2017).

Sooty shearwater - *Ardenna grisea*

The sooty shearwater is an abundant and ubiquitous species in all oceans (Figure 341). It is a trans-equatorial migrant species, with breeding areas in the southern hemisphere that migrates to the northern hemisphere during winter.

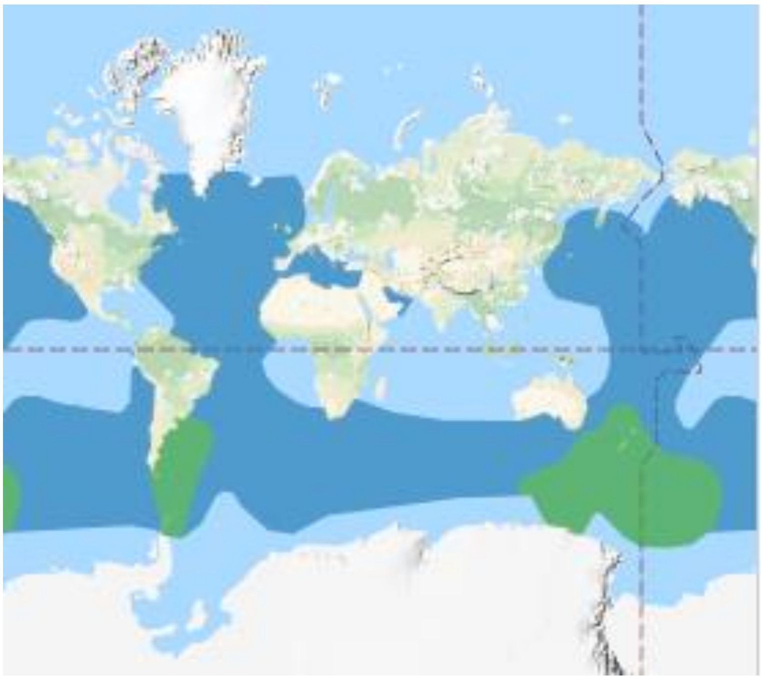


Figure 341. Global distribution of Ardenna grisea. Populations of resident non-breeding individuals are in green. Source: http://datazone.birdlife.org/species/factsheet/sooty-shearwater-ardenna-grisea.

It breeds on temperate and subantarctic islands of New Zealand, Australia, Tristan da Cunha, Falkland Islands (Islas Malvinas), Isla de los Estados in Tierra del Fuego on the Fuegian islands of Chile. It nests on islands, islets and hills in numerous colonies. They dig holes under the cover of tussok grass (*Poa flabellata*) or low shrubs. Egg laying takes place in November-December, and the breeding season runs until April-May. Parents take short (1-3 days) and long (5-15 days) provisioning trips; Longer journeys allow foraging along the Antarctic Polar Front, reducing competition near breeding grounds and allowing large colonies to persist.

The transequatorial migration begins in May in the breeding colonies and returns in September. The Malvinas and Isla de los Estados populations migrate to the North Atlantic, reaching 60 ° N (Figure 342). Young individuals do not return to their natal colony until after 4 years of age. Some individuals present migration patterns similar to those of *Sterna paradisea* (Egevang et al 2010, Hedd et al 2012). The main stops on the return flight to the south are at the confluence between the Malvinas and the Brazilian current, and in the waters of the northern Patagonian continental shelf.

They feed during the day on krill, small fish and squid that they catch while diving, generally up to 20m with 60m-maximum. It also feeds on fish discards. They generally feed in littoral waters and shelf waters. In the Southwest Atlantic, they are observed in large flocks along the subantarctic front.

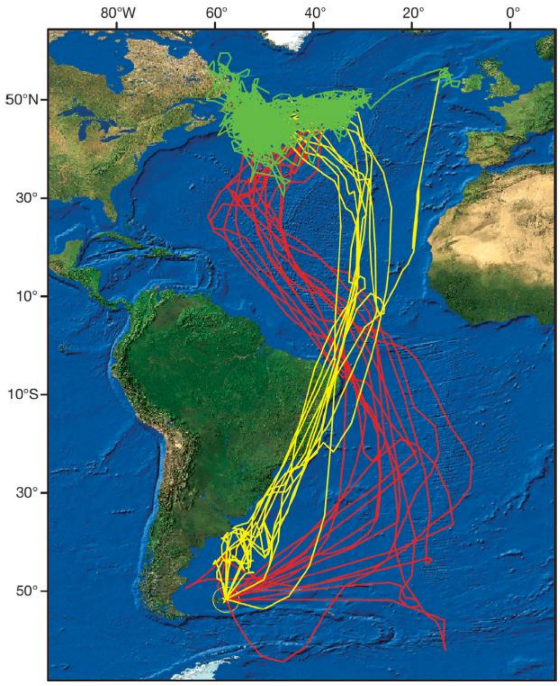


Figure 342. Trans-equatorial migration and distribution during the non-breeding season of individuals tagged on Kidney Island, Malvinas, and followed up in 2008 and 2009. In red, the migration route north at the beginning of winter, in green, the main feeding area in the non-breeding season, and in yellow, the south migration route in spring. Source: Hedd et al 2012.

In Australia, there are colonies on 17 islands, all of which contain fewer than 1,000 pairs. Some colonies have as many as 200,000 pairs in southern Chile, with the largest colony of up to 4 million individuals on Isla Guafo. Between 10,000 and 20,000 pairs have been registered in the Falklands (Islas Malvinas). New Zealand holds more than 180 colonies. The world population amounts to 4.4 million couples, which is approximately 19.0-23.6 million individuals. Although it is an extremely large species, there are persistent signs of a current decline.

Climate change is considered the greatest natural threat to this species. It is caught incidentally in longline, trawl and gillnet fisheries, both during the breeding season and during winter migration to the northern hemisphere. It is under intense competition for fisheries that catch the same prey. The species is also subject to direct persecution, and the catch of young birds ("muttonbirding") on islands in the Pacific Ocean. Both the brown rat *Rattus norvegicus* and the domestic rat *R. rattus* are present within the species' breeding range, and although predation of eggs and chicks by rats has been demonstrated, the extent of the impact is unknown).

<u>Great shearwater- *Ardenna gravis*</u>

It is distributed throughout the Atlantic Ocean and is one of the few transequatorial migratory species, with breeding areas in the southern hemispheres that migrates to the northern hemisphere in the complementary season (Figure 343).

Figure 343. Global distribution of *Ardenna gravis*. Source: FS.

It breeds on Nightingale, Inaccessible, Tristan da Cuhna, Gough oceanic islands and also on Kidney Island in the Falklands (Islas Malvinas). It nests in large colonies and lays a single egg in nests that are small holes in open grassland on sloped terrain. They return to the colonies in mid-September. The breeding season from the copulation, laying and rearing of chicks runs from October to April.

It feeds on fish (particularly schools of tuna), squid, and fish remains, which it catches by plunging and diving. Normal diving depth is between 2-5m with maximums of 18m.

During the breeding season, it feeds exclusively in the southern hemisphere, in upwelling areas associated with canyons and submarine banks and plateaus, where it coincides with pelagic fisheries. Their migrations follow a circular pattern, moving first north and then east to cross the Atlantic during the month of August, and then go south along the Atlantic coast (Figure 344 and Figure 345). They overwinter (non-breeding) in the productive waters of the North Atlantic gulfs, such as Maine, Georges Grand Banks, Greenland, and Europe.

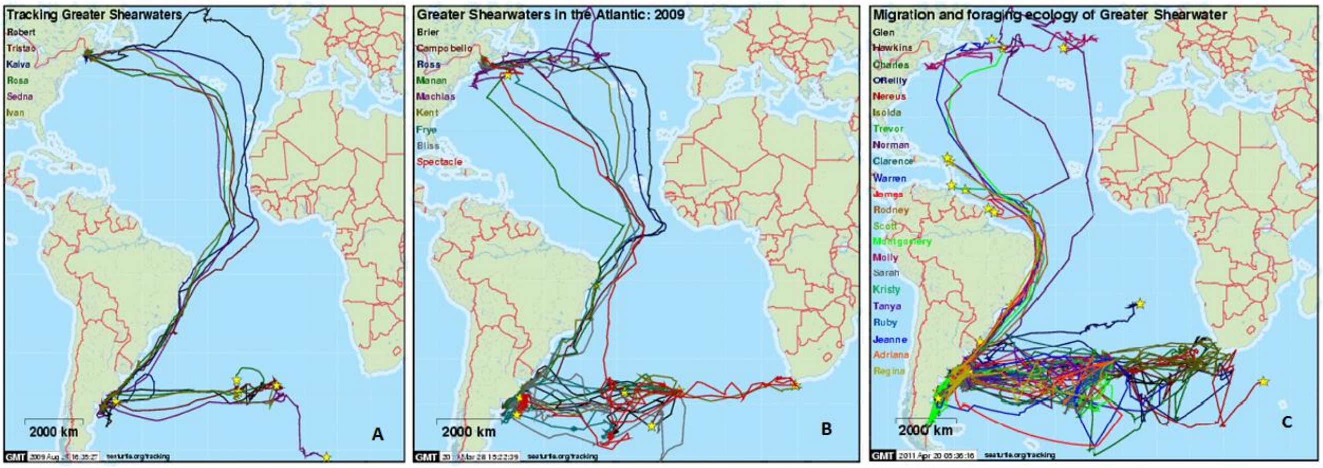


Figure 344. Satellite tracking data of tagged individuals and *Ardenna gravis* specimens. Source: http://www.seaturtle.org/tracking/index.shtml, A: project_id=436, B: project_id=452, C: project_id=176.

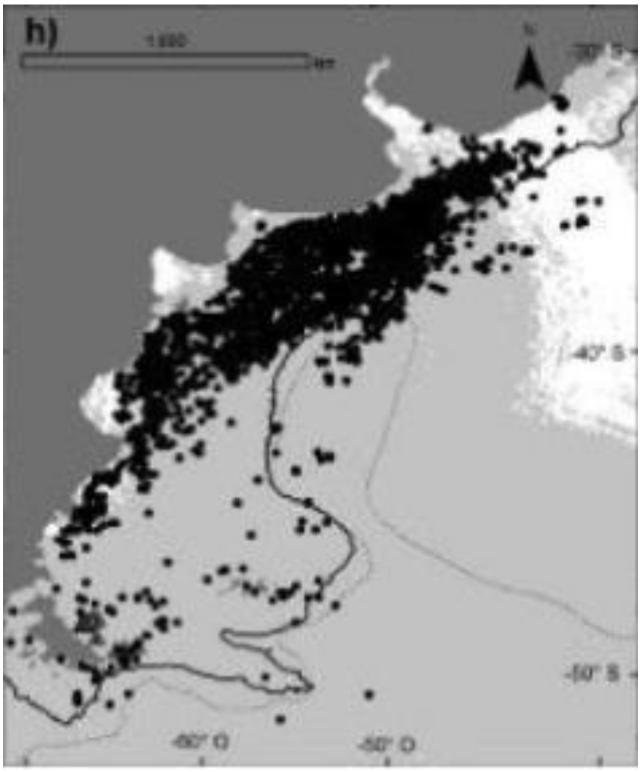


Figure 345. Compilation of satellite records of *Ardenna gravis* on the shelf and Argentine Sea. Fuente: Rey and Huettman 2020.

Their populations are estimated between 15,000,000 - 20,000,000. The high geographical extent of the species, its high population size and population trends considered stable, determine that it does not meet the necessary criteria to be considered a threatened or vulnerable species.

It is a gregarious species and often follows fishing boats in large flocks. It is one of the species with incidental catch by the Argentine platform and slope edge fisheries. It shows numerous records of plastic intake (Tavares et al 2017). Hurricanes, storms and other meteorological phenomena can affect nests on land.

Common skua - *Catharacta chilensis*

This species extends along the South American coasts from Peru to Tierra del Fuego and from there to the southern end of Samborombón Bay, in Argentina, across the Atlantic (Figure 346).

It is a non-migrant, gregarious species. The Common Skua breeds from south-central Chile and southern Argentine Patagonia to Tierra del Fuego. It nests on islets and remote coastal areas. In Argentina it breeds from the San Jorge Gulf (Viana Island), Chubut, to the Beagle Channel, in Tierra del Fuego. In Tierra del Fuego, at least 10 colonies have been recorded on the Beagle Channel. The breeding period begins in November, with massive congregations of individuals.

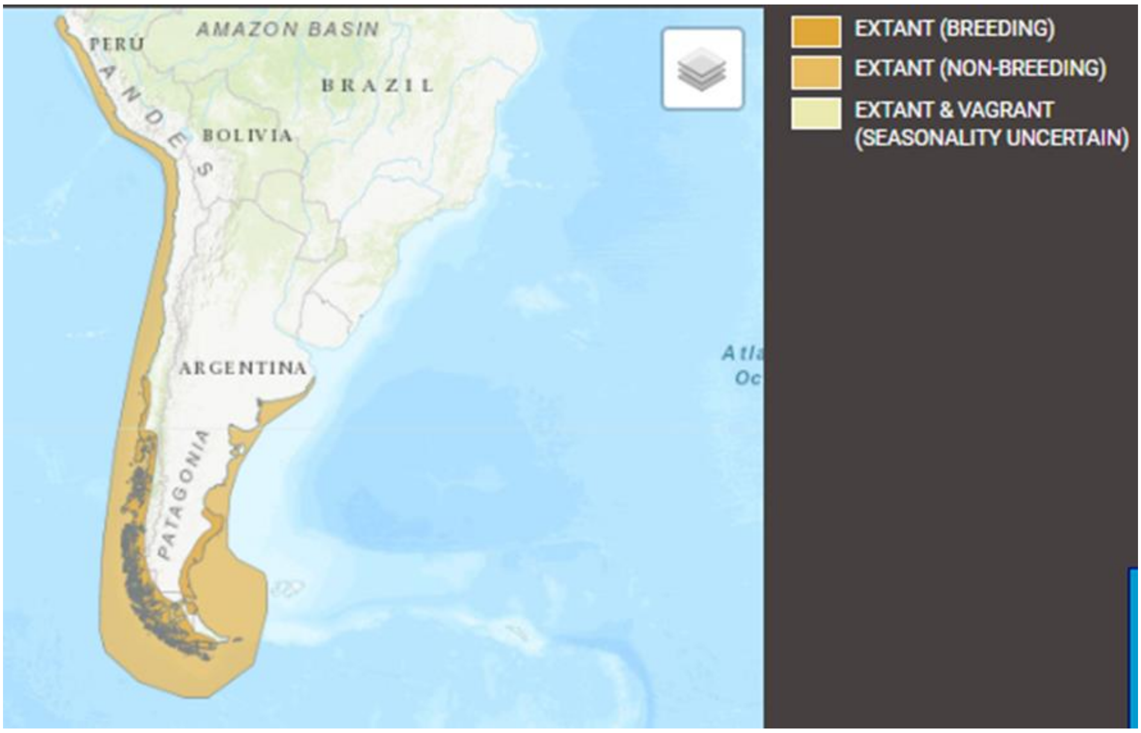


Figure 346. Global distribution of Catharacta chilensis. Source: UICN.

Population estimates consider the existence of about 2,500 to 10,000 mature individuals, but information on population trends is very scarce.

It feeds on the surface during the day, and can dive shallowly. As regards the interaction with the fisheries, the skuas generally obtain their food by stealing the discard from other associated seabirds. They have also been recorded feeding on waste in garbage dumps.

There are no documented incidental catches in fisheries for this species, but there are some for others of the same type. The eggs and chicks are known to have been harvested for food on some islands, but the extent of this threat is unknown.

Wilson´s Storm Petrel - *Oceanites oceanicus*

Wilson´s storm petrel has an extensive and pelagic distribution throughout the southern hemisphere, and in the Indian and Atlantic oceans. (Figure 39). Three subspecies are recognized*: O. o. oceanicus* breeds on high latitude subantarctic islands; *O. o. exasperatus* breeds on the Antarctic continent; y *O. o. chilensis* breeds in the Chilean fjords.

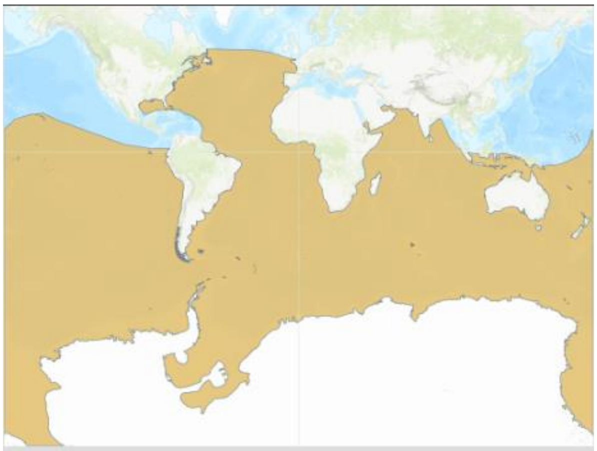


Figure 347. Global distribution of *Oceaniites oceaniicus*. Source: UICN.

The breeding area includes the subantarctic islands from Cape Horn (Chile), the Falklands (Islas Malvinas), South Georgia, the South Sandwich Islands, the South Orcadas Islands, the Shetland Islands of the South, I. Bouvetøy in Crozet, and the Heard, Macquarie, Balleny, Scott and Peter islands in the Kerguelen archipelago; there are also some colonies on the Antarctic continent. It breeds on rocky islets, on cliffs and among rocky areas. Laying takes place in October-November. The species experiences a trans-equatorial migration around May, spending the winter season in the North Atlantic latitudes (up to 77 ° N), the northern Indian Ocean, central North Pacific. It visits coastal areas, most commonly during the non-breeding season, concentrations around marine mammals, ship, or ocean fronts.

It feeds in cold waters on continental shelves or on the coast, with a diet consisting mainly of planktonic crustaceans (especially krill) and fish, but also squid, gastropods, polychaetes. Its diet occurs during day and night, making very shallow dives. Said diet changes from being made up mainly of crustaceans during egg formation to a higher proportion of fish during chick rearing and molting.

Population estimates consider the existence of a stable population of 8 to 20 million individuals.

They are easily attracted to fishing boats pulling nets. The species is threatened by invading predators. On Kerguelen and Crozet Islands, rats have been reported to take chicks and eggs, causing nest failure, and cats can take adults in addition to chicks.

South Polar Skua - *Catharacta maccormicki*

The south polar skua is a species that breeds off the coasts of Antarctica. Some authors consider *Catharacta skua, C. antarctica* and *C. maccormicki* as separate species, while others include *Catharacta lonnbergi* and *C. antarctica* as a subspecies of *C. skua* and others consider *Catharacta maccormicki* as a subspecies of *C. skua*.

It breeds during summer in relatively snow-free coastal areas in Antarctica, particularly in the Ross Sea. Within the Argentine Antarctic sector, breeding pairs are recorded in the Antarctic Peninsula, the South Shetland Islands and the South Orcadas Islands.

It is a trans-equatorial migrant species that overwinters in the Pacific and the North Atlantic, reaching as far as Greenland and even Denmark (Figure 348).

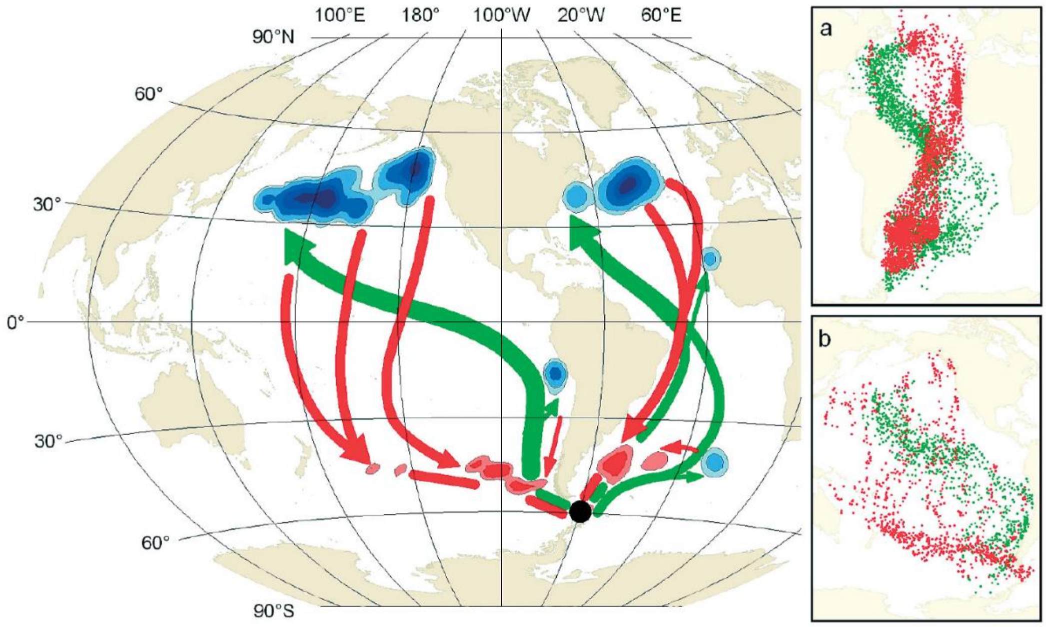


Figure 348. Migration and winter routes of Catharacta maccormicki of tagged individuals on King George Island in the Falklands (Islas Malvinas). Fall migration patterns are shown in green, winter areas in blue, spring migration, and rest stops in red. a. Migration routes in the Atlantic. b. Migration routes in the Pacific.

It usually feeds on fish, but it also steals food captured from the beaks of gulls, terns, and even albatrosses, and also preys on penguins, especially when there are nearby colonies, other birds, rabbits, and carrion.

The total population is estimated at 10-20 thousand individuals, which are equivalent to 5,000-13,000 breeding pairs. The trends recorded in localities holding information on more than one breeding season are variable. The differences in trends between sites may be due to natural variations in the populations of the species, possibly related to food availability or to unidentified causes, or they may be due to temporal decoupling between censuses that prevents a consistent population trend from being calculated. This species could reach the Endangered category for Argentina based on its population size, since it is considered to be below 2,500 individuals.

There are currently no factors that make up genuine threats to the species.

Brown Skua - *Catharacta antarctica* (= *Stercorarius antarcticus*)

It has a wide circumpolar distribution range, associated with isolated subantarctic islands (Figure 349). It is considered to be a complex made up of three subspecies: *Catharacta antárctica antarctica*, *Catharacta antárctica hamiltoni* and *Catharacta antárctica lonnbergi* (Ritz et al. 2008), of which *C. a. lonnbergi* would be the one of probable presence since it has records in temperate areas. It hybridizes with *Catharacta maccormicki* (Ritz et al 2006) and *Catharacta chilensis* (Gandini and Frere 1998) in the areas where these species coexist.

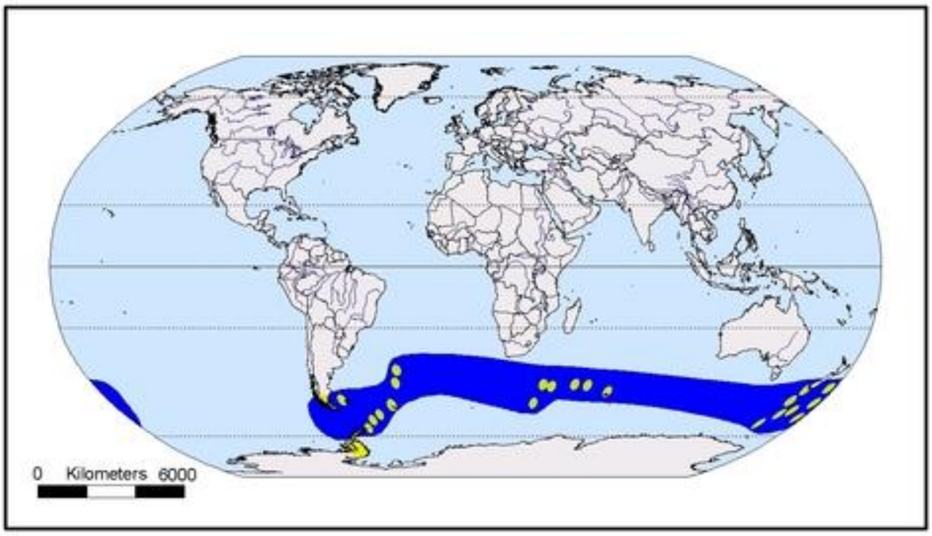


Figure 349. Global distribution of Catharacta antárctica. Source: https://eaaardatosext.files.wordpress.com/2010/12/stercorarius-antarctica-map.jpg Basado en Del Hoyo et al 1996. In blue, the feeding and wintering area and in yellow the areas where it nests and the feeding territories during the breeding season.

The main breeding grounds are on subantarctic islands within the Antarctic Convergence, but it also breeds on islands near New Zealand.

In Argentina, the breeding distribution includes the provinces of Chubut and Santa Cruz, the Malvinas Islands and South Georgias (Yorio et al. 1998). On the maritime coast, it breeds from October-November to February in several colonies between 44 ° 46'-45 ° 07'S, being the White Islands, south of the province of Chubut, its main breeding area (Yorio et al. 1998, Yorio 2005). The breeding season begins in October-November and continues until December. They form loose colonies, the females are polyandrous and highly territorial. They lay one or two eggs that incubate for a month. The chicks usually move from the nest within a few days of hatching, but remain in the parents´ territory. They begin to fly approximately 50 days after hatching, but depend on their parents' diet for another month before migrating between February and April (Phillips et al 2007). Molting is carried out outside the nesting colony. They reach sexual maturity after 5 years, usually after 8. Chick mortality is high, mainly due to predation by other skuas or lack of food. They exhibit high loyalty to the natal colony and return there to breed every year.

It is a long-lived and predatory species that feeds on the surface both during the day and at night. It tends to prey on other birds, mammals, fish, zooplankton and cephalopods, with a predominance of terrestrial and coastal feeding during the breeding season (Reinhardt et al 2000, Phillips et al 2004). It often steals prey and follows fishing boats (Yorio and Caille 1999). There is no evidence that this species is a diver. It moves alone or in small groups in the open sea. In the non-breeding stage, it usually spends most of its time in water. It prefers deep subantarctic waters (2750 to 4100 m), but is also present in the waters of the Brazil-Malvinas confluence on the continental slope (Phillips et al 2007).

During the non-breeding stage (winter) it is distributed further north to the Malvinas-Brazil confluence. Information on its distribution on the Argentine continental shelf was limited to a few observations obtained mainly in the North Patagonian gulfs and in the Malvinas Islands during the breeding season. More recent studies on observations on board fishing vessels (Seco Pon et al 2017) and satellite monitoring (Phillips et al. 2007) have broadened the information for the shelf zone and the continental slope. Both studies would confirm the presence of this species in the vicinity of the detailed study area during the non-breeding season (Figure 350 and Figure 351).

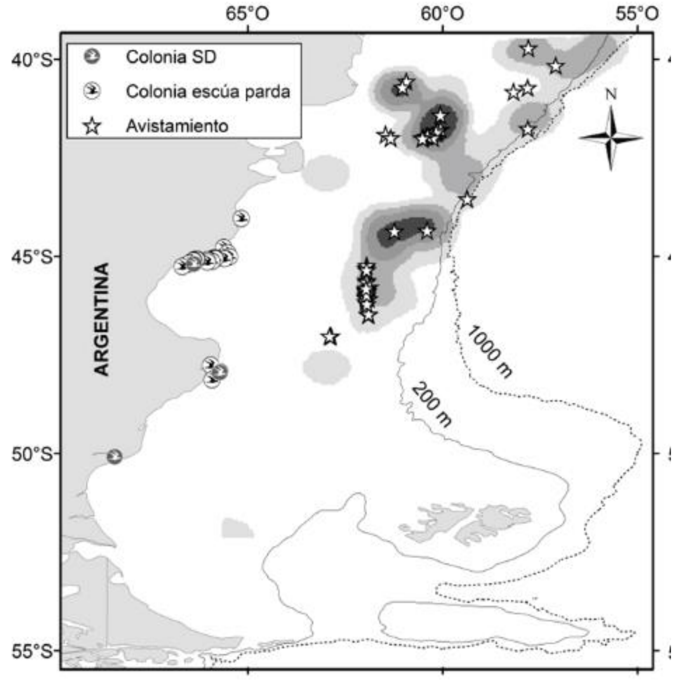


Figure 350. Distribution of sightings of *Antarctic Catharacta* (brown skua) associated with fisheries from wet-fish stern trawlers. In gray, the distribution of fishing effort between 2008 and 2014, stars show the sighting sites and circles on the coast display the location of breeding colonies. Source: Seco Pon et al. 2017.

(Translation of Figure 350: Colonia SD: SD colony. Colonia skua parda: brown skua colony. Avistamiento: Sighting).

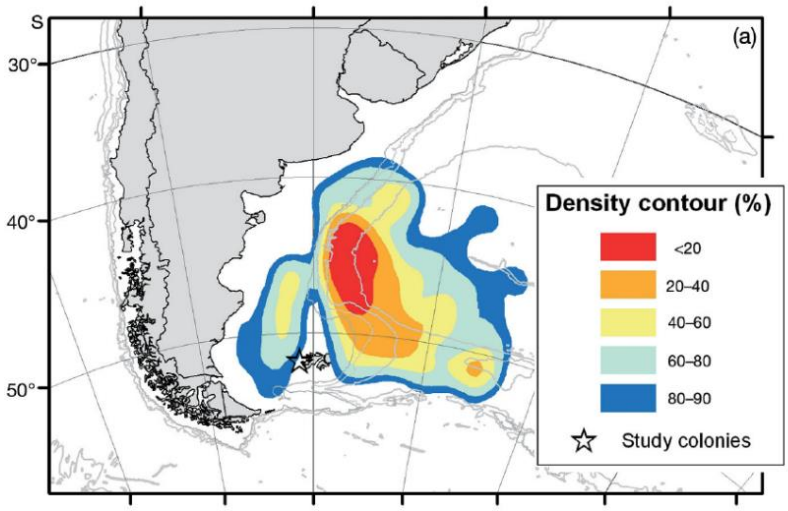


Figure 351. Position density distribution of 4 individuals of Catharacta antartica tagged in colonies of the Falkland Islands (Islas Malvinas) and followed up during the winter of 2004. Source: Phillips et al.

2007.

Yorio (2005) points out that information about the population status and biology is scarce, particularly in the Argentine maritime coast. Although the global population values are unknown, it is considered that its population size would range between 26,000-28,000 individuals, with a decreasing trend (Furness et al 2020). Although there are no systematic evaluations, the number of territories in New Island (Malvinas) has decreased by 47% between the two censuses carried out in 2004 and 2009, which would account for a decrease of 12.1% per year (BirdLife International 2021).

Yorio and Caille (1999) and more recently Seco Pon et al (2017) point out the presence of the brown skua in the waters of the Argentine Sea in interaction with high-altitude trawling, high-altitude longline in the waters of Uruguay and Brazil, and trawling fisheries in relatively coastal waters of the North Patagonian gulfs but not in more distal sectors of the continental shelf and slope such as those corresponding to the survey area.

4.3.4 Marine mammals

4.3.4.1 Species

An initial list of probable marine mammal species for the detailed study area was drawn up from global or regional distribution maps present in reference books, field guidelines, and websites (Table 34). The appearance of these species was confirmed by consulting open databases of georeferenced occurrences and recent publications. The taxonomic nomenclature and common names used in the Categorization of Mammals in Argentina according to their 2019 Risk of Extinction are followed.

Table 34. Main sources consulted for occurrences of marine mammals.

Reference sources	URL or citation
Categorization of the Mammals of Argentina according to their Risk of Extinction- 2019 (CAT-Ar)	http://cma.sarem.org.ar/es/especies-nativas
International Union for Conservation of Nature, Red List (UICN 2020-1)	
(IWC, International Whaling Commision)	http://iwc.int/home
(CMS, Convention on Migratory Species)	http://www.cms.int
Global Biodiversity Information Facility GBIF	http://www.gbif.org/
OBIS, Ocean Biogeographic Information System	https://www.obis.org/
Marine mammals of the Worlds (MMW)	Jefferson et al 2008
WCD World Cetacea Database (Perrin 2020).	http://www.marinespecies.org/cetacea on 2020-04-02
Encyclopedia of Marine Mammals (EMM) 3a ed.	Würsig et al (2017)
Atlas of the Patagonian Sea (AMP)	Falabella et al 2009. http://atlas-marpatagonico.org
Marine Mammals of Patagonia and Antarctica	Bastida y Rodríguez (2010)
National Action Plan to Reduce the Interaction of Marine Mammals with Fisheries in the Argentine Republic (PAN-Mamíferos)	https://www.magyp.gob.ar/
Reports of campaigns carried out by researchers from CONICET from CENPAT and CADIC on board the "Rio Deseado" vessel	https://proyectosinv.conicet.gov.ar/informes-de-campana/
Specific publications on the study area.	Mandiola et al 2015.

Fourty-one (41) potentially present species were counted for the project's area of influence, with confirmed occurrences for only 13 of them (Table 35). Four species of Pinnipeds (Carnivora) have been recorded: The South American fur seal (Arctocephalus australis), the Antarctic fur seal (Arctocephalus gazella), the South American sea lion (Otaria flavescens) and the southern elephant seal (Mirounga leonina). Regarding Cetaceans (Cetartiodactyla), occurrences for 4 species of whales have been recorded - the right whale, the blue whale, the sei whale and the fin whale, 4 species of dolphins - the Long-finned pilot dolphin (Globicephala melas), the bottlenose dolphin (Tursiops truncatus), dusky dolphin (Lagenorhynchus obscurus) and killer whale (Orcinus orca) and sperm whale (Physeter macrocephalus).

Table 35. Marine mammal species present in the project area.

Order	Family	Scientific Name	Common Name	Presence[a]
Carnívora	Otaridae	*Arctocephalus australis*	South American Fur Seal	3
		Arctocephalus gazella	Antarctic fur seal	3
		Arctocephalus tropicalis	Subantarctic fur seal	1
		Otaria flavescens	South American sea lion	2
	Phocidae	*Hydrurga leptonyx*	Leopard seal	1
		Leptonychotes weddellii	Weddell seal	1
		Lobodon carcinophaga	Crabeater seal	1
		Mirounga leonina	Southern elephant seal	3
Cetartiodactyla	Balaenidae	*Eubalaena australis*	Southern right whale	3
	Balaenopteridae	*Balaenoptera acutorostrata*	Northern minke whale	1
		Balaenoptera bonaerensis	Antarctic minke whale	1
		Balaenoptera borealis	Sei whale	2
		Balaenoptera edeni	Eden´s whale	1
		Balaenoptera musculus	Blue whale	2
		Balaenoptera physalus	Fin whale	2
		Megaptera novaeangliae	Humpback whale	2
	Neobalaenidae	*Caperea marginata*	Pygmy right whale	1
	Delphinidae	*Delphinus delphis*	Common dolphin	1
		Feresa attenuata	Pygmy killer whale	1
		Globicephala melas	Long-finned pilot whale	2
		Grampus griseus	Risso´s dolphin	1
		Lagenorhynchus australis	Peale´s dolphin	1

Order	Family	Scientific Name	Common Name	Presence[a]
		Lagenodelphis hosei	Fraser´s dolphin	1
		Lagenorhynchus cruciger	Hourglass dolphin	1
		Lagenorhynchus obscurus	Dusky dolphin	2
		Lissodelphis peronii	Southern right whale dolphin	1
		Orcinus orca	Killer whale	2
		Pseudorca crassidens	False killer whale	1
		Stenella attenuata	Pantropical spotted dolphin	1
		Stenella coeruleoalba	Striped dolphin	1
		Tursiops truncatus	Bottlenose dolphin	2
	Ziphidae	*Berardius arnuxii*	Arnoux´s beaked whale	1
		Hyperoodon planifrons	Southern bottlenose whale	1
		Mesoplodon grayi	Gray´s beaked whale	1
		Mesoplodon hectori	Héctor´s beaked whale	1
		Mesoplodon layardii	Strap-toothed whale	1
		Tasmacetus shepherdi	Shepherd´s beaked whale	1
		Ziphius cavirostris	Cuvier´s beaked whale	1
	Kogidae	*Kogia breviceps*	Pygmy sperm whale	1
		Kogia sima	Dwarf sperm whale	1
	Physeteridae	*Physeter macrocephalus*	Sperm whale	3

a. Presence categories. 1 – species only reported through global distribution maps. 2 - Between 1 to 5 publications showing data on the species occurrence. 3- more than 5 publications with data on the species occurrence and / or estimates of abundance or more frequent times.

4.3.4.2 Conservation Status

Tabla 36 displays the list of species with confirmed presence along with their Categorization of Mammals in Argentina according to their Extinction Risk (CatAr-2019), and the Red List of threatened species prepared by the IUCN version 2020-1.

Tabla 36. Conservation status of the marine mammal species.

Scientific Name	Common Name	CatAr-2019[a]	UICN-2020-1[b]
Arctocephalus australis	South American fur seal	LC	LC
Arctocephalus gazella	Antarctic fur seal	LC	LC
Arctocephalus tropicalis	Subantarctic fur seal	LC	LC
Otaria flavescens	South American sea lion	LC	LC
Hydrurga leptonyx	Leopard seal	LC	LC
Leptonychotes weddellii	Weddell seal	LC	LC
Lobodon carcinophaga	Crabeater seal	LC	LC
Mirounga leonina	Southern elephant seal	LC	LC
Eubalaena australis	Southern right whale	LC	LC
Balaenoptera acutorostrata	Northern Mink whale	DD	LC
Balaenoptera bonaerensis	Antarctic Mink whale	DD	NT
Balaenoptera borealis	Sei whale	EN	EN
Balaenoptera edeni	Eden´s whale	DD	LC
Balaenoptera musculus	Blue whale	EN	EN
Balaenoptera physalus	Fin whale	EN	VU
Megaptera novaeangliae	Humpback whale	LC	LC
Caperea marginata	Pygmy right whale	DD	LC
Delphinus delphis	Common dolphin	LC	LC
Feresa attenuata	Pygmy killer whale	NA	LC
Globicephala melas	Long finned pilot whale	LC	LC
Grampus griseus	Risso´s dolphin	LC	LC
Lagenorhynchus australis	Peale´s dolphin	LC	LC
Lagenodelphis hosei	Fraser´s dolphin	DD	LC

Scientific Name	Common Name	CatAr-2019[a]	UICN-2020-1[b]
Lagenorhynchus cruciger	Hourglass dolphin	DD	LC
Lagenorhynchus obscurus	Dusky dolphin	LC	LC
Lissodelphis peronii	Southern right whale dolphin	DD	LC
Orcinus orca	Killer whale	LC	DD
Pseudorca crassidens	False killer whale	DD	NT
Stenella attenuata	Pantropical spotted dolphin	NA	DD
Stenella coeruleoalba	Striped dolphin	LC	LC
Tursiops truncatus	Bottlenose dolphin	VU[c]	LC
Berardius arnuxii	Arnoux´s beaked whale	DD	DD
Hyperoodon planifrons	Southern bottlenose whale	DD	LC
Mesoplodon grayi	Gray´s beaked whale	DD	DD
Mesoplodon hectori	Héctor´s beaked whale	DD	DD
Mesoplodon layardii	Strap-toothed whale	DD	DD
Tasmacetus shepherdi	Shepherd´s beaked whale	DD	DD
Ziphius cavirostris	Cuvier´s beaked whale	DD	LC
Kogia breviceps	Pygmy sperm whale	DD	DD
Kogia sima	Dwarf sperm whale	NA	DD
Physeter macrocephalus	Sperm whale	VU	VU

[a] Categorization of the Mammals of Argentina according to their Extinction Risk - 2019 (CAT-Ar) (http://cma.sarem.org.ar/es/especies-nativas) : CR critically Endangered, EN Endangered, VU vulnerable , LC Least Concern, NA Not Threatened, DD Data Deficient.

[b] UICN (International Union for Conservation of Nature and Natural Resources) 2020-1: Red List of Endangered Species (www.iucnredlist.org): CR critically endangered, EN endangered, VU vulnerable, NT near threatened or low risk , LC least concern (not threatened), DD Data Deficient.

[c] Two populations of Tursiopstruncatus would co-occur in Argentine waters: *T. t. gephyreus* corresponds to the population present in Bahía San Antonio, Río Negro and has EN category, which differs genetically from *T. t. truncatus* that makes up the populations of Uruguay and southern Brazil and for which there is no information available to categorize it (DD).

There are five threatened species, 4 of them with confirmed presence for the study area. The names of Argentine and IUCN categories are equivalent in terms of meaning, but not necessarily in terms of threatened species. For example, the sei, blue and fin whales are endangered (EN) in Argentina, but globally, (IUCN) the fin whale is only vulnerable (VU). The sperm whale is vulnerable in both categories, while the bottlenose dolphin is vulnerable for Argentina, but it is not threatened globally. There is insufficient information to assess the risk of extinction threat (DD) of the largest proportion of species with probable presence in the study area (DD).

4.3.4.3 Legal instruments for its conservation

Argentina is signatory to various international agreements for the protection and conservation of various species, including marine mammals such as:

- Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES): Approved by National Law 22,344 (1982).
- Convention on the Conservation of Migratory Species of Wild Animals (CMS): Approved by National Law 23.918 (1991).
- Convention on Wetlands of International Importance (Ramsar, 1971): Approved by National Laws 23,919 (1991) and 25,335 (2000).
- Agreement on Biological Diversity (CBD): Approved by National Law 24,375 (1994).
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Substances (LC 1972): Approved by Law 21.947 (1979) (and its 1996 protocol). International Agreement to Prevent Pollution from Ships (MARPOL 73/78): Approved by Law 24.089 (1992).
- United Nations Convention on the Law of the Sea (UNCLOS): Approved by National Law 24,543 (1995), especially articles 65 and 120 of said law.
- Antarctic Treaty of 1961.
- Convention for the Conservation of Antarctic Seals (entered into in London on June 1, 1972 and in force since 1978).

The following can be pointed out at the National level:

- National Law 22,421 / 1981: Fauna Law and its Regulatory Decree 666/1997 and resolutions 1089 (of the year 1998), 3 (of the year 2001) and 91 (of the year 2003) that prohibit the hunting of cetaceans throughout the national territory, and entrusting the National Institute for Fisheries Research and Development (INIDEP) to quantify the catch of reptiles, birds and marine mammals.
- National Law 24.922 / 1997: Federal Fishing System and its Regulatory Decree 748/1999. The Undersecretariat of Fisheries and Aquaculture (SSPyA) is the Enforcement Authority.
- Resolution SAyDS 513/2007: It Prohibits the hunting, catch, interprovincial transit, trade in federal jurisdiction and the export of live specimens, products and by-products of wild fauna.
- National Law 25.675 / 2002: General Law of the Environment. The Secretariat for the Environment and Sustainable Development (SAyDS)[10] is the Enforcement Authority.
- Likewise, the southern right whale was declared a National Natural Monument in Argentina (Law No. 23,094).
- Management Plan for the Conservation of the Southern Right Whale.

- National Action Plan to Reduce the Interaction of Marine Mammals with Fisheries in the Argentine Republic (PAN-Mammals). 2015.

- National Strategy on Biological Diversity and National Advisory Commission for the conservation and sustainable use of biological diversity (CONADIBIO).

- Associated with the International Convention to Prevent Pollution from Ships (MARPOL 73/78) mentioned above. There are also numerous ordinances and provisions of the Argentine Coast Guard (PNA).

Pinnipeds (Carnivora) have protection in all National Parks, Marine Protected Areas and Provincial Reserves with marine coastline. There are Specially Protected Antarctic Zones (ASPA) within the Argentine Antarctic sectors set up by the Antarctic Treaty where breeding colonies or groups of non-breeding males are located. Cetaceans (Cetartiodactyla) have particular protection in marine parks. The Patagonia Austral Coastal Marine Inter-jurisdictional Park (Chubut), Pingüino and Makenke Island Inter-jurisdictional Marine Parks, and Monte León National Park (Santa Cruz), and Isla de los Estados Wild Nature Reserve (Tierra del Fuego), dependent on the National Parks Administration, the Punta Bermeja Natural Protected Area (Río Negro), Peninsula Valdés (Law 4772) and Punta León (Law 4617) in the province of Chubut, the Monte Loayza Provincial Natural Park (Laws 3454 and 2737), and the Caleta Olivia Provincial Natural Reserve (Law 3028), both in the province of Santa Cruz; in the Antarctic Specially Protected Area (ASPA) No. 132 “Potter Peninsula” located on the 25 de Mayo Island, South Shetland Islands. The South Georgias and South Sandwich Islands were declared Marine Protected Area (IUCN Category I) in 2012 by the local government (http://www.gov.gs/32110-2/).

4.3.4.4 Threats

The main threats to marine mammals include climate change (Simmonds and Eliott 2009), accidental catches (Riet Spriza et al., 2013), ship collisions, ecotourism, environmental pollution including plastics (Panti et al 2019) and also the risk of disease transmission via sewage from cities that are not properly treated (Mathavarajah et al 2020). Marine mammals are also affected by noise pollution (Duarte et al 2021), which is considered a significant current threat due to the considerably increase in the level and scope of sounds generated by human activities (ship noise; active sonar; synthetic sounds (artificial tones and white noise); acoustic deterrent devices; noise from energy infrastructures, construction and seismic studies). The impact of these threats gets worse by persistent general problems, such as the alteration and loss of marine mammal habitat and the general degradation of the marine environment (Jefferies 2016).

4.3.4.5 Vulnerable species

The area of influence of the project is located on a high seasonal biological productivity region due to the confluence of the Malvinas and Brazil currents, and the presence of the slope front with high concentrations of planktonic organisms, fish and cephalopods that feed and breed in these waters.

In order to assess which would be the main receptor species of the potential impacts of the prospecting activities, those with local or global threat levels and species with confirmed occurrences in the areas of direct and indirect influence that are abundant/frequent or potentially present species were considered. The southern right whale is also a National Monument species. Table 37 shows the list of the 9 selected species.

Table 37. Vulnerable marine mammal species.

Scientific Name	Common Name	Presence	CatAr-2019	UICN-2020-1

Arctocephalus australis	South American Fur Seal	3	LC	LC
Arctocephalus gazella	Antarctic fur seal	3	LC	LC
Mirounga leonina	Southern elephant seal	3	LC	LC
Eubalaena australis	Southern right whale	3	LC	LC
Balaenoptera borealis	Sei whale	2	EN	EN
Balaenoptera musculus	Blue whale	2	EN	EN
Balaenoptera physalus	Fin whale	2	EN	VU
Tursiops truncatus	Bottlenose dolphin	2	VU	LC
Physeter macrocephalus	Sperm whale	3	VU	VU

4.3.4.6 Biological and ecological characteristics of the main vulnerable species

All the species considered present a distribution area that overlaps with the study area, with records of occurrence in any of the operation areas or within the analyzed zone. Next, details of the characteristics and ecological characteristics of each species are provided, with information taken from the sources indicated in Table 34, mostly from the Categorization of Mammals of Argentina, and completed with data from the Marine Mammals of the Word (Jefferson et al. 2015), and the Encyclopedia of Marine Mammals books (Würsig et al 2017), unless indicated by an additional citation. The global distribution maps are taken from the Marine Mammals of the World book (MMW, Jefferson et al 2015).

South American fur seal - *Arctocephalus australis*

In the Southwest Atlantic Ocean, the species is distributed over a coastal area of 5,000 km, from the coasts of Rio Grande do Sul, Brazil to Tierra del Fuego, Argentina, including the Falkland Islands (Islas Malvinas) (Figure 352). Regarding their distribution in the sea, fur seals inhabit both the coastal area and the entire Patagonian platform, reaching the edge of the slope.

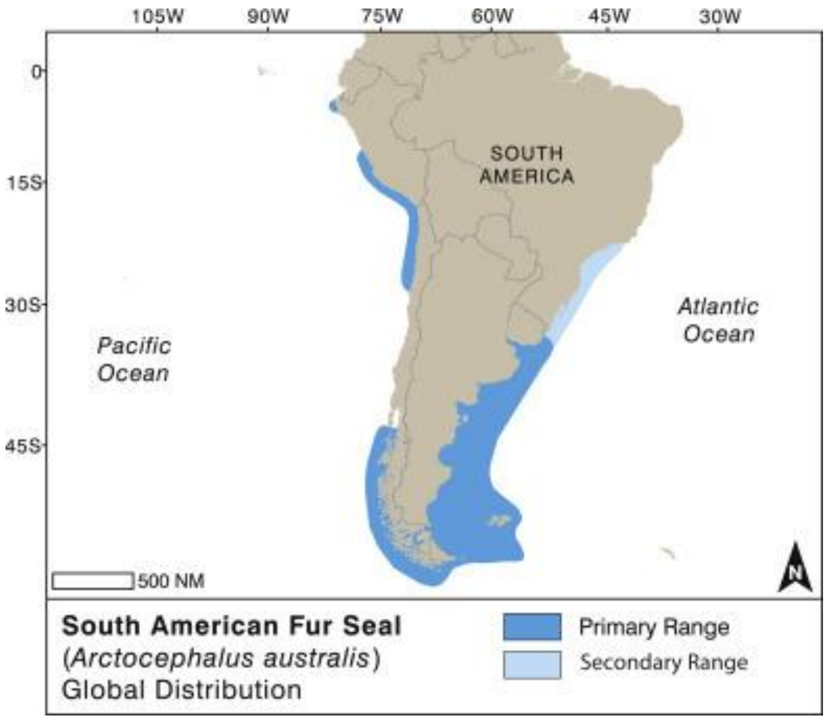


Figure 352. Global Distribution of *Arctocephalus australis*. Source: MMW

In Argentine waters, its distribution includes about 25 colonies on the Patagonian coast, Isla de los Estados and islets of the Beagle Channel, as well as about 10 breeding colonies in the Falkland Islands (Islas Malvinas). The current breeding colonies on the Atlantic coast are not homogeneously distributed, but rather show a patchy distribution, with the highest breeding activity in the north and south extremes of the region (Figure 353).

It is a polygynous species, with on land breeding areas and the formation of harems of variable size, between 2 and 13 females, averaging 5 or 6 females per male. Females reach sexual maturity between 2 and 4 years. Males develop sexually between 5 and 6 years; although only between the ages of 7 and 8 do they have the ability to retain females and copulate with them. Females give birth to only one young per breeding season. Based on observations made in Isla de Lobos (Uruguay) and Isla Guafo (southern Chile), the breeding season elapses between the second week of November and the first of February, observing the peak of births in mid-December and that of mating a few days later.

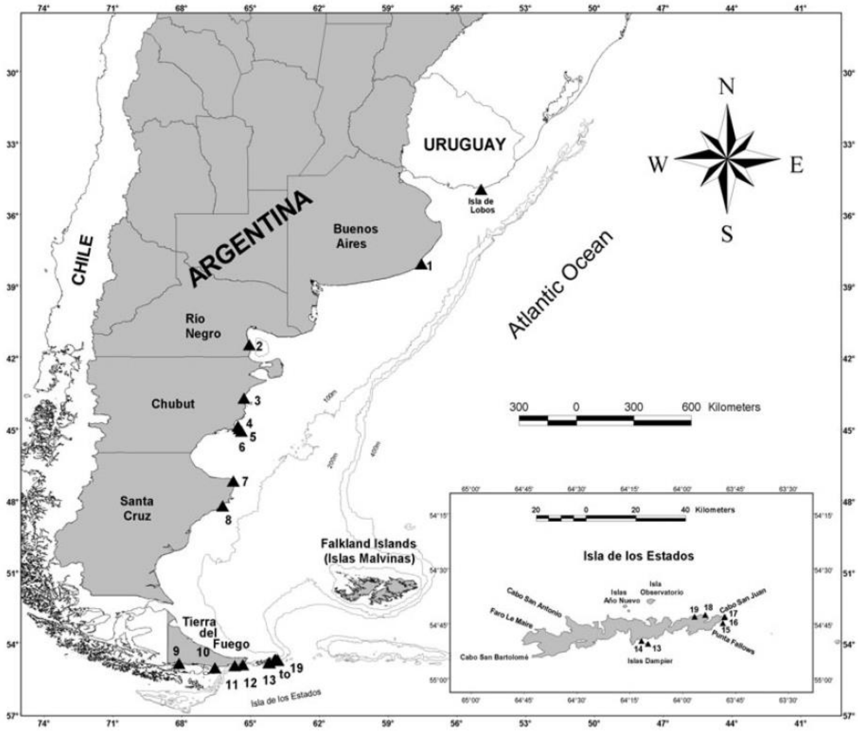


Figure 353. Location of the main breeding colonies of Arctocephalus australis. Source: Crespo 2015.

The South American fur seal is a high trophic level predator in the marine ecosystems of the Patagonian shelf. It is an opportunistic generalist predator that feeds mainly on pelagic and demersal prey from the neritic environment and edge of the shelf. Their diet varies depending on the availability of resources along the Argentine coast. They feed mainly on sea bass, anchovies and squid in Buenos Aires waters; squid, anchovies, hake and decapod crustaceans in Patagonia; and Fuegian sardines, squid, notothenid fish and lobsters in Tierra del Fuego and the Falkland Islands (Islas Malvinas). South American fur seals were recorded diving between 50 and 600 m deep in the water column without a clear bathymetric preference.

This fur seal seasonally changes its range of action. Through satellite monitoring of adult females in the Malvinas Islands (Isla Pájaro) and Uruguay (Isla de Lobos) it could be seen that they travel a few kilometers from the colony to feed during the nursing period, although some specimens may move more than 600 km; while, as the lactation period advances, the females expand their feeding areas. Outside the breeding season, adult males from the Falkland Islands (Isla Afelpada Norte) (Islas Malvinas) show average movements of 251 ± 239 km, although some individuals are capable of moving more than 900 km. On the other hand, a study with adult females followed by satellite from the Falkland Islands (Islas Malvinas) (Punta Voluntario and Isla Afelpada Norte) suggests that the area of action may vary geographically between individuals from different colonies. Numerous specimens were observed in the vicinity of the study area during the summer of 2006-2007 (Mandiola et al 2015) (Figure 354).

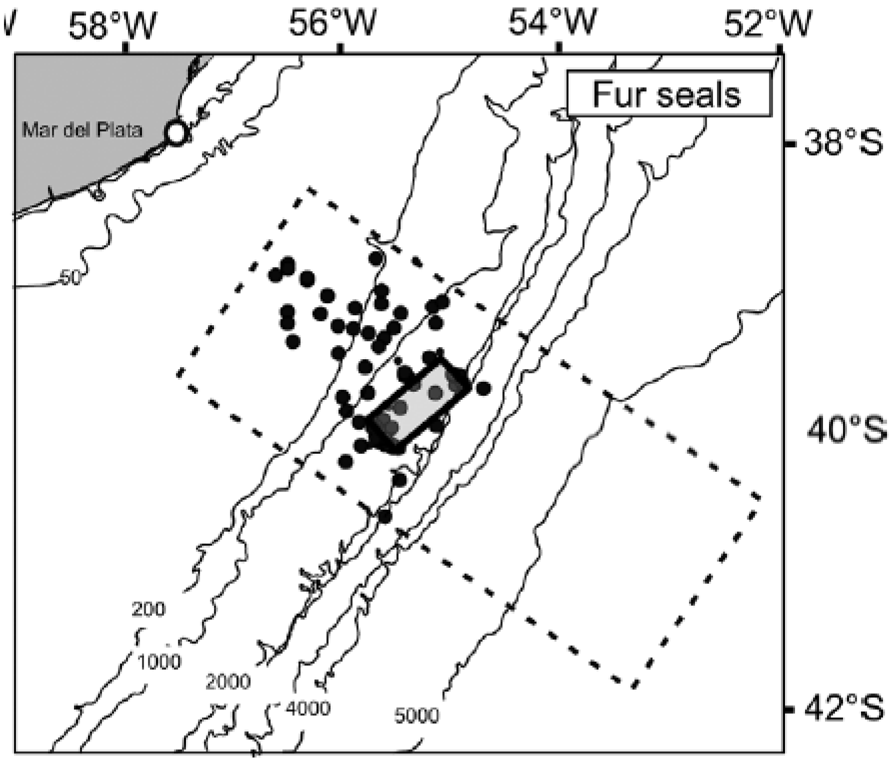


Figure 354. ***Arctocephalus autralis*** **sightings in the vicinity of the study area. Source: Mandiola et al 2015.**

The distribution pattern of the breeding colonies has been attributed to natural factors since the abundant archaeological and historical evidence suggests a continuous historical distribution from southern Brazil to Tierra del Fuego. In Argentine waters, the species has about 25 colonies on the continental coast, Isla de los Estados and islets of the Beagle Channel and a total population of ≈25,000 individuals. In the Falkland Islands (Islas Malvinas), 36,425 offspring were registered in 2018, which represents 48% of the species production. Currently the highest density of individuals for the species in the National Territory is found in the Malvinas Islands, and the rest in islands off the coast of Chubut and Isla de los Estados. Due to the population increase of the species, the re-occupation of historical areas has been registered in the last decades. Since 1987 a seasonal colony has been registered in Punta Mogotes (Mar del Plata) in the province of Buenos Aires, and many concentrations have also been recently observed in Necochea. Likewise, as of 2006, a significant number of fur seals were detected in the San Matías Gulf on Islote Lobos and swimming in the surroundings during the post-breeding season. Like the rest of the Atlantic fur seal population, the breeding colonies on the Argentine coast show signs of recovery. For the Chubut islands, based on censuses carried out in the late 1940s, early 1970s, and between 1996 and 2013, a population increase rate of 8% was estimated. On the coasts of Tierra del Fuego and Isla de los Estados, surveys in 2012 estimated a positive trend with respect to the censuses carried out in 1997. The population trend would be positive in the Falkland Islands (Islas Malvinas).

During the 1970s and part of the 1980s, fur seals were illegally hunted in southern Chile and Argentina to bait crab traps. However, with the overexploitation of the fishing resource in question, the hunting pressure on the fur seal has decreased. There is a great overlap between the areas used by fur seals and the fisheries on the Patagonian shelf, although operational interactions are infrequent. However, individuals have recently been observed feeding during the fishing maneuvers of trawlers in Buenos Aires waters. Its predators include the killer whale and the leopard shark.

The ingestion of marine litter (mainly, plastics derived from fishing activity and remains of bags) has been recorded in juvenile fur seals found dead on the Buenos Aires coast, although no injuries were observed in the digestive tract. In the San Matías Gulf, individuals with packing bands around their necks have also been observed. The limited number of breeding areas could make this species particularly vulnerable to the effects of epidemics and various human activities that could have consequences on the population if a disturbance occurs. The oil activity carried out on the Patagonian platform (oil tanker transport route, exploration and exploitation areas) always poses a risk, it is advisable to remember the spill that occurred in 1997 off Isla de Lobos, Uruguay.

<u>Antarctic Fur seal - *Arctocephalus gazella*</u>

The Antarctic fur seal is widely distributed in the Southern Ocean, its colonies being located on islands south of the Antarctic Convergence (Figure 355).

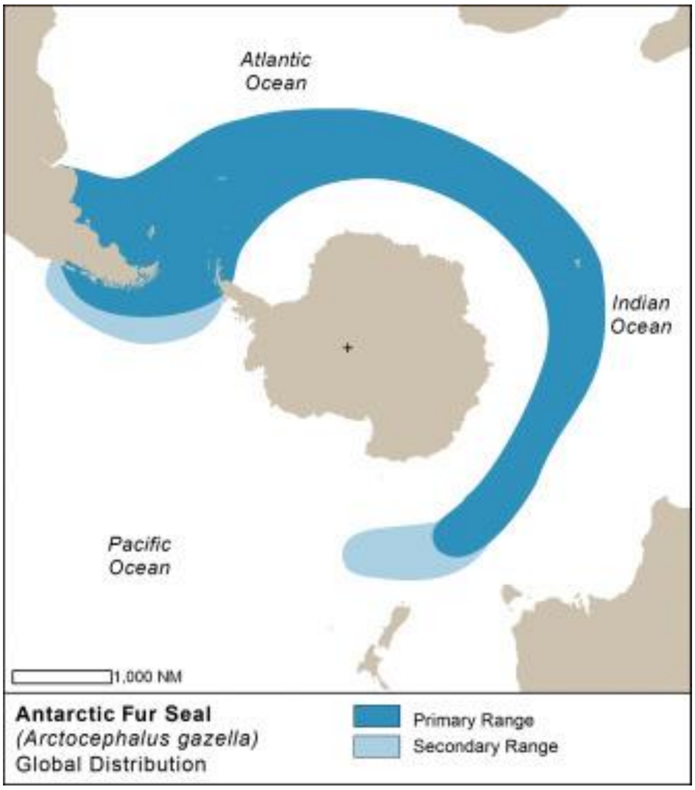


Figure 355. Global distribution of*Artocephalus gazella*. Source: MMW.

The largest proportion of the world population of this species breeds on the South Georgia Islands, but there are also colonies on the Shetland, Orcadas and South Sandwich Islands, and on other subantarctic islands such as Prince Edward, Crozet, Kerguelen, Heard, McDonald and Bouvet. Towards the end of October, the males reach the coasts where they compete with each other for territory. They can form harems of up to 20 females. The latter arrive at the end of November and give birth to a seal which they nurse for about a week. Once in the estrus period, copulation occurs and they begin to alternate periods of feeding in the sea and nursing on land. Lactation lasts almost 4 months, during which the offspring can increase up to 100 g per day. Females mature sexually at 3 years, and males on the other hand mature between 3 and 4 years, but they just hold a harem and breed at 7.

It is a top predator in the trophic network of the marine ecosystem of the Southern Ocean Studies on its food ecology based on conventional techniques (fecal matter, stomach contents) or through biomarkers (fatty acids, stable isotopes) indicate that krill, *Euphausia superba*, and various Nototenoid and myctophid fish species constitute the most important portion of their diet, followed by cephalopods, and to a lesser extent penguins, although the proportions of these prey items may vary between sexes, ages, geographic locations and years of sampling. It can dive 350 m-deep.

Studies on movements in the sea of this species are limited. In South Georgias, a pattern of sexual segregation was observed in ocean movements during the breeding season, with males being located mainly in neritic waters, at an average distance of 40 km from the coast and females, on the edge of the platform at about 100 km from the colony. In the post-breeding season, the males disperse to greater distances reaching the South Orcadas Islands (ca. 850 km) y las hembras pueden traspasar la Convergencia Antártica hasta la plataforma patagónica y Frente subantártico.

Population trends are decreasing in all its colonies, but there are no updated data. It is considered to be the most abundant fur seal species in the world. The South Georgias Islands colony, which represents 95% of the world's population, experienced a steady increase from the 1930s to 2000, when a total of 4,500,000 to 6,200,000 individuals was estimated. However, more recent estimates indicated an abundance of 550,000 adult females which would represent a decline of 24% during the 1984-2012 period. Regarding the populations of the South Sandwich Islands and South Orcads, an annual production of offspring of less than 1,000 has been estimated. The latest censuses carried out in various subantarctic islands of the Orcadas and South Shetlands during the past decade have indicated the presence of subadult and adult males with maximum peaks of occurrence on land in February-March and population declines if compared to records of the previous decades.

This species was intensively exploited commercially for the value of its fur from the late 18th to the early 20th century. Commercial hunting began in the South Georgias Islands in the 1790s. By 1822 more than 1,000,000 individuals had been caught and their population was virtually extinct, leading to activity interruption. It was later resumed in 1870 until 1907 when it was deemed no longer profitable. Commercial hunting began in 1820 in the South Shetland Islands and by 1821 some 250,000 individuals had been killed and their populations declined sharply. A similar situation occurred with smaller colonies in the Orcadas and South Sandwich Islands. At the end of the commercial hunt, few hundred individuals had survived in its distribution area.

Southern elephant seal - *Mirounga leonina*

This species is distributed circumpolarly on subantarctic islands near the Antarctic convergence (Figure 356) but juvenile males can reach the edge of the Rio de la Plata seafront slope on their foraging trips. There are important colonies in Peninsula Valdés, which is the only continental elephant site in the world, and also in the Falkland Islands (Islas Malvinas). There is also a minor colony in Monte Loayza, Santa Cruz.

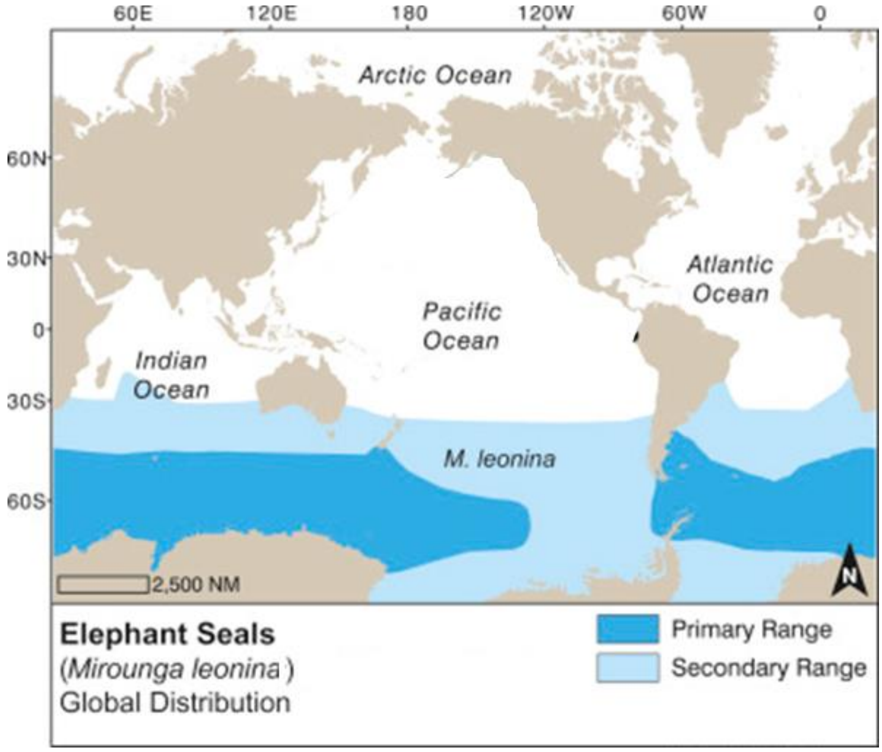


Figure 356. Global distribution of *Mirounga leonina*. Source: MMW.

Its life cycle alternates periods of permanence on land for breeding and molts with other foraging periods in the open sea. It is a polygynous species that breeds on the coast during the southern spring. Harems have a variable number of females (2 to 125) and are controlled by at least one dominant male. Males arrive at the coastal colonies from the third week of August, while females do so mainly between September and October. Females give birth to only one per year, usually 5 days after reaching the beach. The peak of births has a lag of 22 days in the different colonies. Lactation lasts approximately 23 days. During which they fast and stay with the offspring. The young fast on land for between one and three months, then go out to sea in search of their first solid food. Three weeks after giving birth, the female copulates, weans her young and returns to the sea to feed. The adults' stay on land is very short, not exceeding a total of two months for breeding and one month for molting, which means that they spend 80% of their life in the open sea, remaining submerged most of the time. Sexual maturity is reached between 4 and 5 years in males (although they do not actively participate until 7-10 years), and between 3 and 4 years in females, achieving an active reproductive life of 15 years. 14 year-old males were observed dominating harems in Isla 25 de Mayo and females breeding until they are 21 years old.

The species is an important top predator of the southern marine ecosystem, given its ability to access a great variety of habitats in a wide latitudinal range. Their main prey are squid and fish, but crustaceans also contribute significantly to their diet. Differences in trophic habits have been found according to sex and age class. They stand out for their diving abilitites reaching 400 meters-deep, and up to 1,500 meters, remaining underwater for periods of up to 120 minutes.

The area of action of the species is difficult to calculate since the feeding areas can be located thousands of kilometers away and can vary according to the colonies under study and even the components of the population according to their sex-age category (juveniles, adults, males or females). Individuals followed by satellite recorded displacements of up to 8,600 km from the sites where they breed or moult (Figure 357). The elephants of the population of Península Valdés feed in the area of the slope and edge of the continental shelf. During the feeding season they move solitary, and apparently males and females feed in different regions. The results of the studies of individuals tagged with satellite transmitters indicated that dives on the continental shelf go mostly to the bottom, while dives on the slope can reach up to 1,500 m deep, although most reach only mid-water (300-600 m). The dives are deeper during the day. The females spend most of their time in deep water in front of the platform between 36º S and 50º S latitude, with less localized movements than those of the males and with dives that do not reach the bottom.

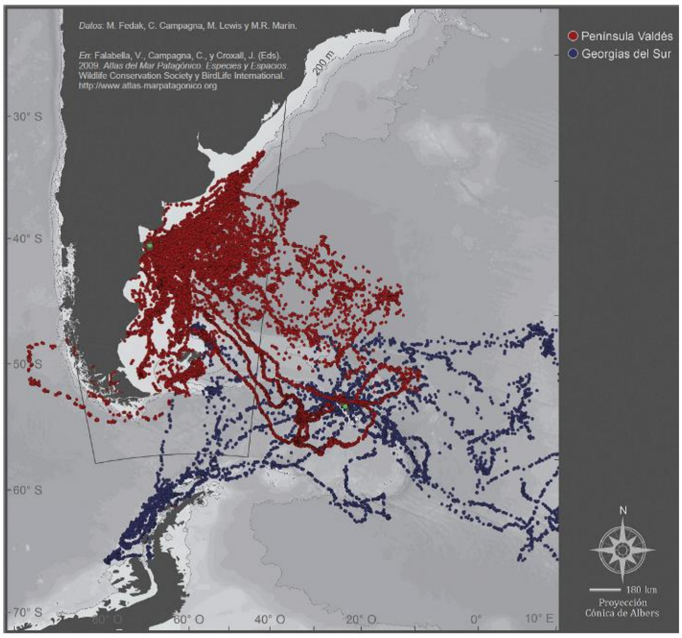


Figure 357. Areas of action for elephant seals tagged in Peninsula Valdez and South Georgias. Source: Atlas of the Patagonian Sea.

Peninsula Valdés, in Chubut, is the only breeding colony with continental settlement that has had a positive population increase rate, although at present the population seems to have stabilized with an annual production of 16,200 young. It is estimated that the number of mature individuals in the national territory is close to 220,000.

In the pelagic phase, there is interaction with fisheries with unknown mortality rates. Said interactions are not significant for the viability of populations of the species, however, intensive fishing can impact important prey populations. There are records of entanglement with fishing debris floating in the sea ("ghost fishing") and entanglement in monofilament lines from jigger vessels fishing for squid. The possible effects of global climate change on the species are not well known, but they can negatively affect prey populations or change the marine habitat. On land, southern elephant seals were subjected to intensive commercial hunting in the early 19th century mainly due to the large amount of fat that could be extracted for oil. This practice ceased in 1964 and since then they have not been commercially exploited. At present it is a charismatic species and constitutes an emblematic tourist resource of the Valdés Peninsula and its surroundings, in the province of Chubut. In the continental Patagonian settlements, it may have interactions associated with the human presence in coastal areas used for sport fishing and recreation, where conservation measures do not apply. Faced with human proximity during lactation, there may be maternal abandonment and subsequent death of offspring. There may also be exposure to a variety of diseases, including morbilliviruses, from contact with species of domestic animals. There are records of the contamination of the coastal habitats of the colonies, even within protected areas, with various residues from anthropic activities such as boxes and plastic bottles, buoys, ropes, fishing net meshes and hooks, among others.

***Eubalaena australis*- Southern right whale**

The southern right whale has a circumpolar type distribution (Figure 358). On the Argentine coast, it is distributed from the north of the province of Buenos Aires to Tierra del Fuego and the Malvinas Islands, with its maximum concentration in the breeding zone of Peninsula Valdés. Since the mid-1980s it has expanded its distribution towards the San Matías Gulf and in recent years the number of sightings has increased in San Antonio Bay and in the coastal migration areas of the north of the province of Buenos Aires.

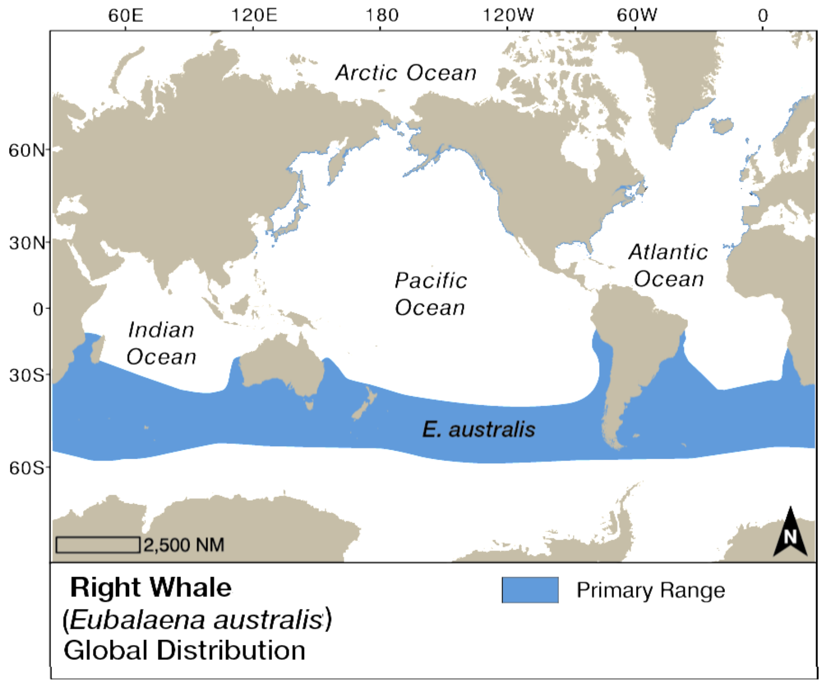


Figure 358. Global distribution of *Eubalena australis*. Source: MMW.

Peninsula Valdés is one of the most important areas for the breeding of southern right whales. During the breeding season, the population of Península Valdés begins to arrive gradually during the fall. The reproductive cycle of a female ranges from 3–5 years. They have a promiscuous mating system, in which a female can mate with several males on the same day. The breeding and rearing areas are mainly limited to the Nuevo and San José gulfs and their surroundings. They enter the gulfs following the isobaths of between 5 and 10 m and they gather in well-defined localities. The gestation period is approximately 12–13 months. The first births take place in August and the last at the end of October. Births have also been recorded in southern areas and on the coast of the Province of Buenos Aires. The lactation period can vary between 8–17 months; followed by a period of anestrus of approximately 12 months. Females reach sexual maturity between 7–15 years and have their first offspring between 9–12 years with a size over 12 m. A time between generations of 27 years is estimated.

The southern right whale is a generalist predator that feeds on zooplankton and the trophic spectrum includes adult and juvenile stages of euphausiids such as krill (*Euphausia superba*), large and medium-sized copepods, ichthylolankton, lobster larvae *Munida gragaria* and other groups of micronekton. The only known predator of this species is the killer whale (Orcinus orca), although there are few records of attacks. They do not usually make extended dives or dive to great depths, being their range of 5 - 80 m. Their periods of immersion almost never exceed 10 minutes, although there are exceptional records of 20 minutes in Valdés and 40 minutes in the southern feeding areas. Its maximum travel speed is around 15 km / h.

During the breeding season, they remain in the Peninsula Valdés area throughout the winter and spring, and they gradually abandon it as December approaches, when almost all the specimens are migrating to feeding areas. During the month of September, the number of whales usually reaches a maximum, which was recently close to a thousand. Whales often move from one place to another, so they can be found anywhere on the peninsula or in the center of the gulfs.

Knowledge of foraging areas outside the reproductive period is derived from historical catches by whaling ships (Figure 359) and from more recent studies of individuals tagged and followed up by satellite (Figure 360 and Figure 361). It displays feeding zones near the edge of the shelf extending to fully oceanic zones, and with greater certainty for the areas of high summer productivity around the Antarctic Convergence. The records of tags followed up by satellite indicate that the project area is used by individuals of southern right whales.

The sounds produced by this species, both on the surface and underwater, are related to the composition, size, sex and type of activity of their groups. The simplest sounds and the most predictable structure are associated with communications that are established between individuals separated by important distances. The most complex and variable sounds are associated with groups of whales that carry out some social activity. The greater the social complexity, the greater the intricacy of sounds.

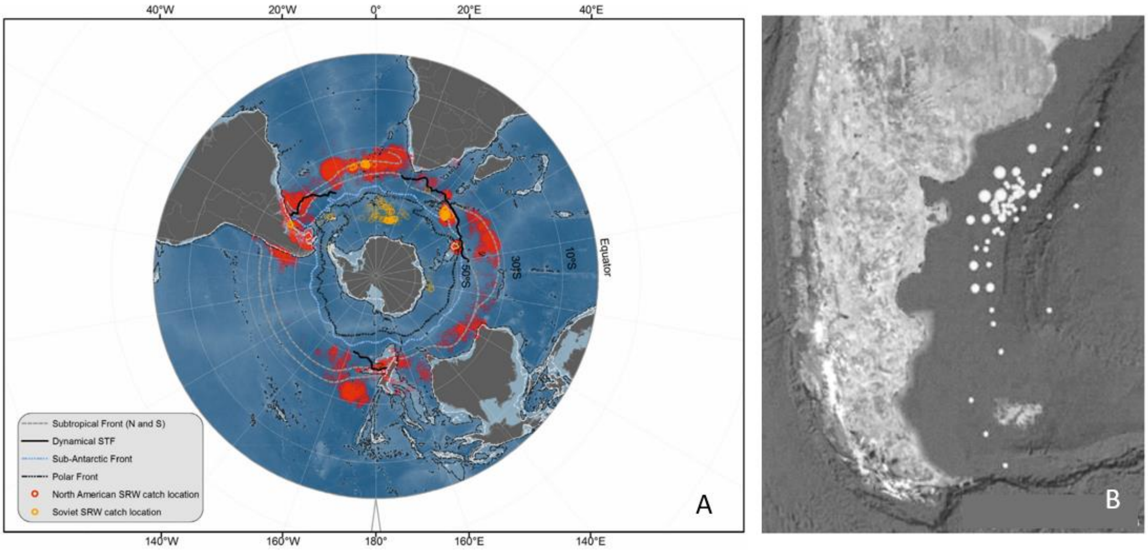


Figure 359. Feeding areas of southern right whales. A. Circumpolar foraging areas obtained from historical records of whaling ships. Source: González Carman et al 2019. B. Detail of the catch locations of a Russian whaler in 1960, where the large dots indicate 80-100 whales, the medium ones 40-70 and the small 1-10. Source: Rowntree et al. 2007.

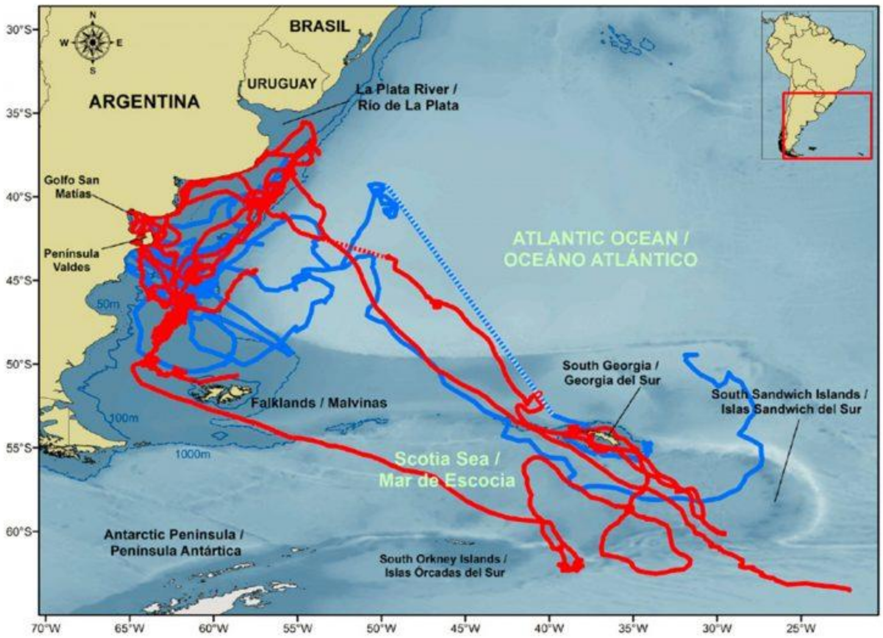


Figure 360. Satellite monitoring records of southern right whales tagged offshore in 2014/15 (Golfo Nuevo, Peninsula Valdés are in blue) and 2016/17 (Golfo San Matías is in red). Source: Zerbini et al. 2018.

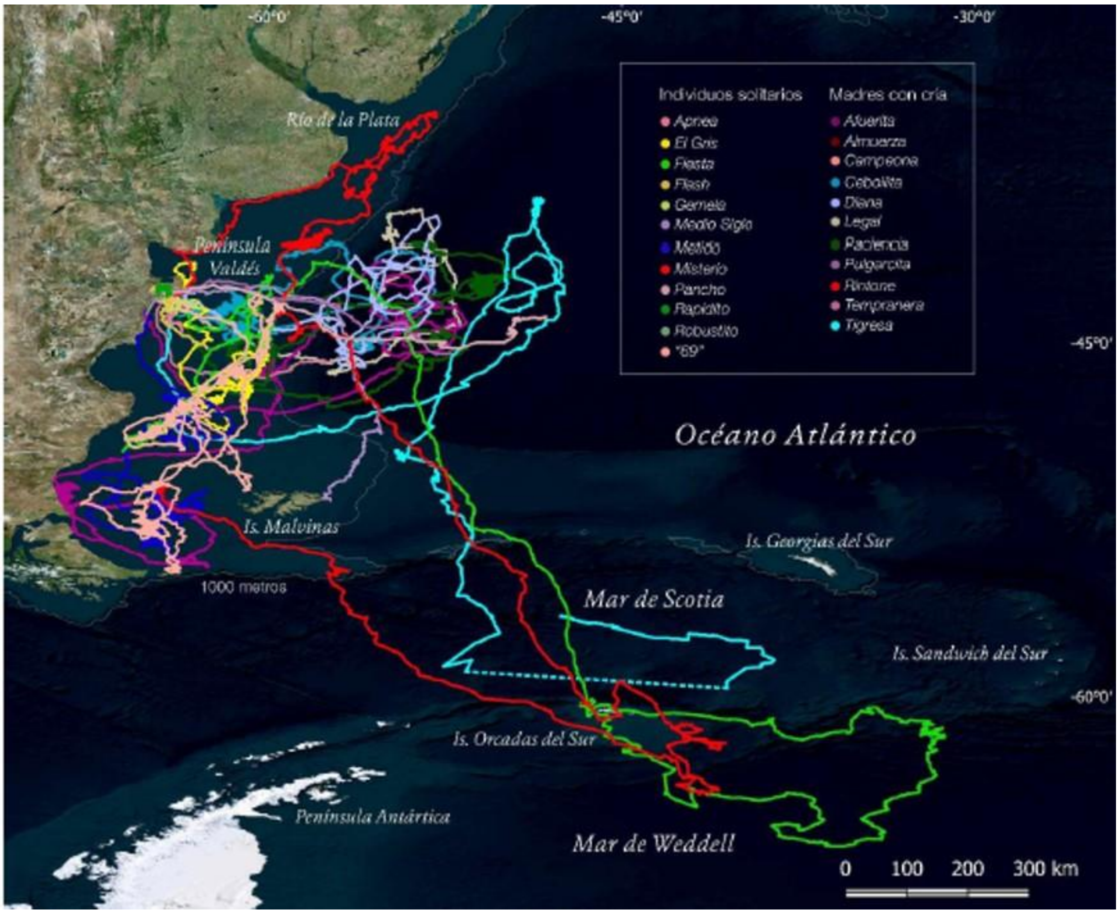


Figure 361. Complete tours of 23 right whales tagged with satellite transmitters in September 2019 in the New Gulf of Península Valdés. Each color shows the movements recorded for an individual. Source: http://siguiendoballenas.org/

(Translation of Figure 361: (within the box: Individuos solitarios: solitary individuals. Madres con cría: Mothers with offspring).

It is estimated that the original population throughout its range was 100,000 before whaling started in the 11th century. During the last decades of the 20th century, the populations of *Eubalaena australis* in Argentina, Brazil, South Africa and Australia have shown evidence of a strong recovery, doubling within a 10–12 year-period. There are no data on the total number of mature individuals, but there are currently about 700 reproductive females. In recent years, a population growth of the southern right whale of the Southwest Atlantic has amounted to 0.06% for the total number of whales and 2.30% for the offspring, and there has been a trend to recolonize areas of distribution prior to commercial exploitation.

There are few reports of gillnets and collisions of southern right whales with boats. Also, there are few deaths from infections and to date no recognized relevant pathogens have been detected in cetaceans. The increase in open dumps in coastal urban areas has caused a population explosion of kelp gulls in recent years. Consequently, the most common pathological finding in the right whales of Peninsula Valdés, particularly in calves less than three months old, are injuries caused by kelp gulls. It has recently been reported that these whales are exposed to phycotoxins during their stay in Peninsula Valdés, which demonstrates the natural risk to which this species is exposed during the blooms of toxic phytoplankton that frequently occur in the Argentine Sea. (Currently there are no threats to the species, except for the wounds caused by seagulls to the young in the Valdés Peninsula area).

Sei whale - *Balaenoptera borealis*

The species is cosmopolitan, mostly oceanic (Figure 362). It is mainly found in subantarctic areas in the southern hemisphere in summer, being able to enter Antarctic zoness without approaching the ice pack.

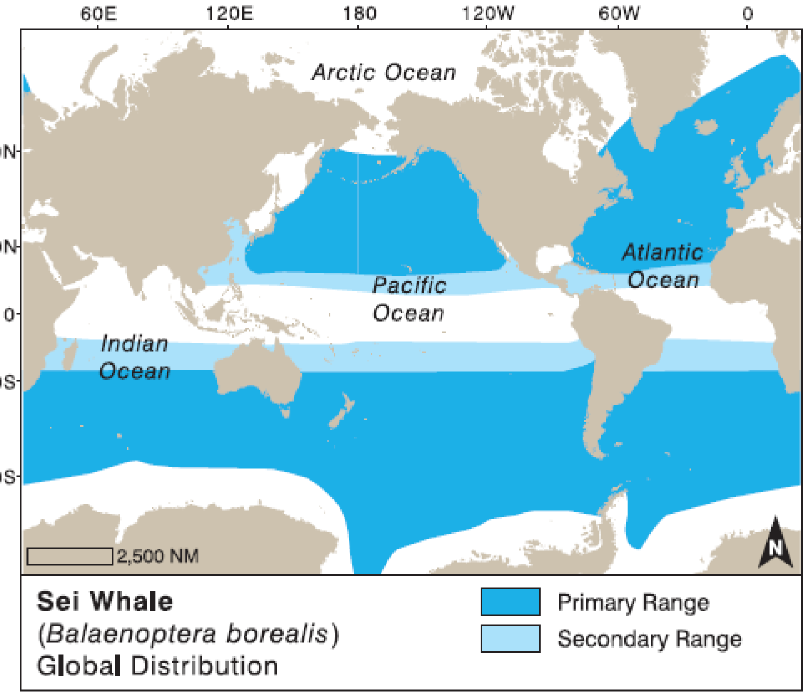


Figure 362. Global distribution of *Balaenoptera borealis*. Source: MMW.

It has a breeding cycle of two or three years. The peak of conceptions for the Southern Hemisphere would occur in June. The gestation period is approximately one year, generating one litter per year which generally consists of a single young. Weaning occurs at approximately 7 months. The age of reproductive maturity is approximately 10 years.

It is a carnivorous species. The sei whale usually feeds using the technique of filtering prey not eaten by other whales, such as copepods, for example. It can also feed on euphausiids, schoals of fish and squid. The killer whale is among the natural predators of the species (*Orcinus orca*).

It makes migrations between foraging areas in subpolar latitudes in summer and reproductive areas in lower latitudes in winter. It can swim up to 60 / km per hour in short periods and can also form aggregations of 20-100 individuals in feeding areas. It can be seen regularly in the center of the San Jorge Gulf between January and August, and sporadically between the months of September and December. It was seen in the project´s study area during the summer of 2006-2007 (Figure 363).

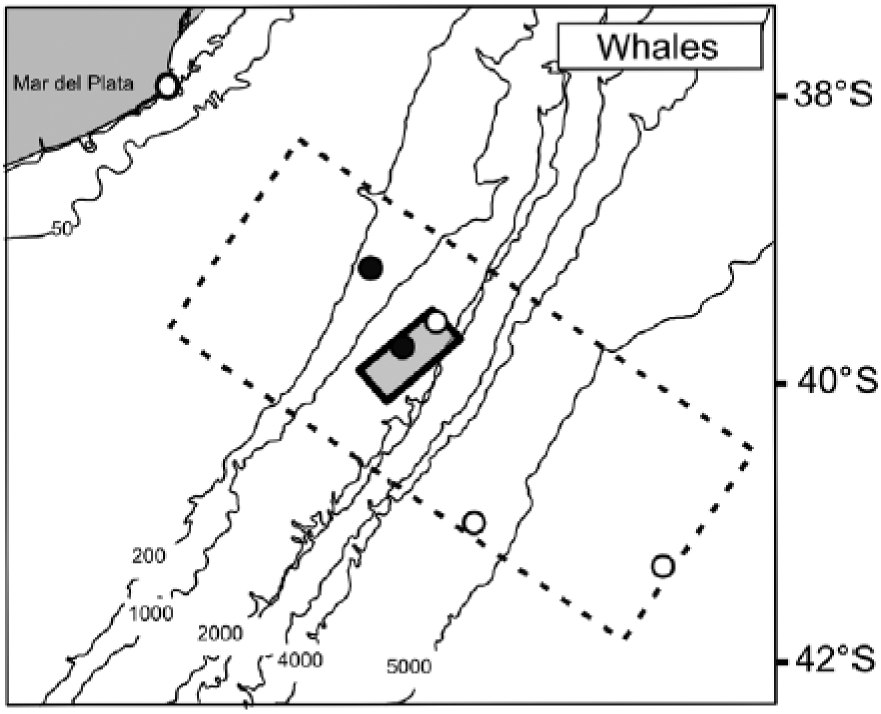


Figure 363. Records of *Balaenoptera borealis* in the vicinity of the study area. The white dots represent sightings of the species and the black ones of other unidentified whales. Source: Mandiola et al 2015.

B. borealis suffered a notable reduction in its population numbers in the 20th century. In our region there were substantial hunts in the South Georgia Islands, as well as in Brazil, and also pelagic hunts based in the Falkland Islands (Islas Malvinas), the South Shetland Islands and the South Orcadas Islands, among others). Since 1979 the species has been protected from commercial catch. Although the estimates for the species are not good in the southern hemisphere, 100.000 specimens were reduced to 24,000 after commercial catches. There is no population trend information for Argentina, but sighting records have increased in certain sectors of Argentina in recent years (Golfo San Jorge), which could indicate a slow recovery of the species in the country.

Since 1979 an international ban was established on the hunting of Sei Whale and the hunting of cetaceans is prohibited in Argentina. The krill fishery in the Antarctic can affect the distribution and availability of this prey item. Several strandings of the species were recorded in Tierra del Fuego, but none could be directly associated with anthropic causes, but rather with the topography of the area (e.g. Bahía San Sebastián). The collision with boats is a potential threat to the species. There is a record of at least one fatal collision of a female with a boat in Chile.

Blue whale - *Balaenoptera musculus*

The blue whale is the largest whale, with a cosmopolitan distribution -except for the Arctic (Figure 364). It has three populations: in the North Atlantic, in the Pacific and in the South Atlantic. Few studies are available for the Southern Hemisphere, so many of the data on the ecological characteristics of the species herein presented belong to studies carried out in other populations.

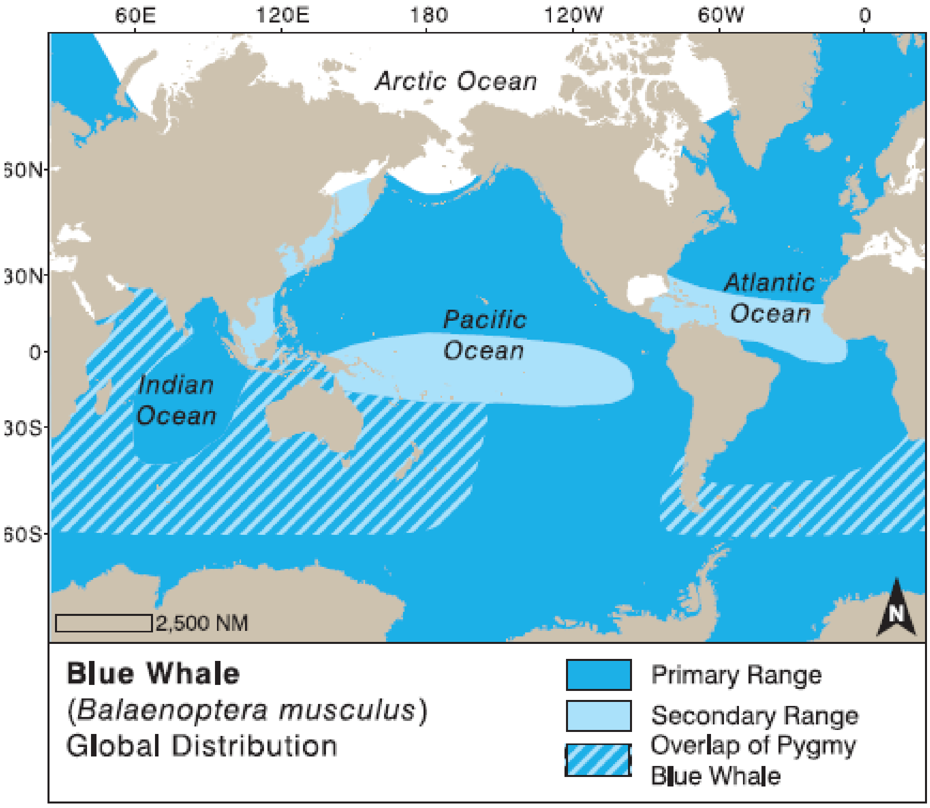


Figure 364. Global distribution of *Balaenoptera musculis*. Source: MMW.

Specific breeding areas are unknown in every ocean. Adult females reproduce every 2-3 years. Breeding shall take place in warmer waters during the southern winter. Gestation takes between 10-11 months. The young are suckled for 7 months, then the females can go a year without breeding or becoming pregnant in that same season. They reach sexual maturity between 5 and 10 years. Although 80-90 year-old individuals have been registered, the follow-ups with recognitions of individuals by photo suggest 40 years of age.

It is a carnivorous species, preferably planktophagous, which in the southern hemisphere feeds almost exclusively on krill (plentiful in cold water upwelling areas). Its diet follows the daily migration patterns of krill. During the day they dive up to 10 m where the layers of euphausiids concentrate during the day and they rise to eat on the surface towards the night, when their prey also rise.

It is a migratory species, generally solitary or in groups of 2-3 although there may be more than 50 in areas with a high concentration of food. It can steadily swim at 28km / hour for a long period against the more typical 3-7km / hour of other whales. During the summer it could be found in Antarctic waters and in low latitudes in winter.

The International Whaling Commission (IWC) recognizes six main feeding areas for blue whales, corresponding to different stocks or subpopulations (Figure 365). Blue whales vocalize year-round with peaks from mid-November to winter months: most frequencies are low-frequency or infrasonic with 17–20 Hz sounds. Their sounds, at 188 dB (re: 1 µ Pa at 1 m), are the loudest and lowest made by any animal, and can generally be heard for hundreds of kilometers to thousands of lm under optimal oceanographic conditions and can cover entire oceans. Vocalization patterns have been used to trace populations.

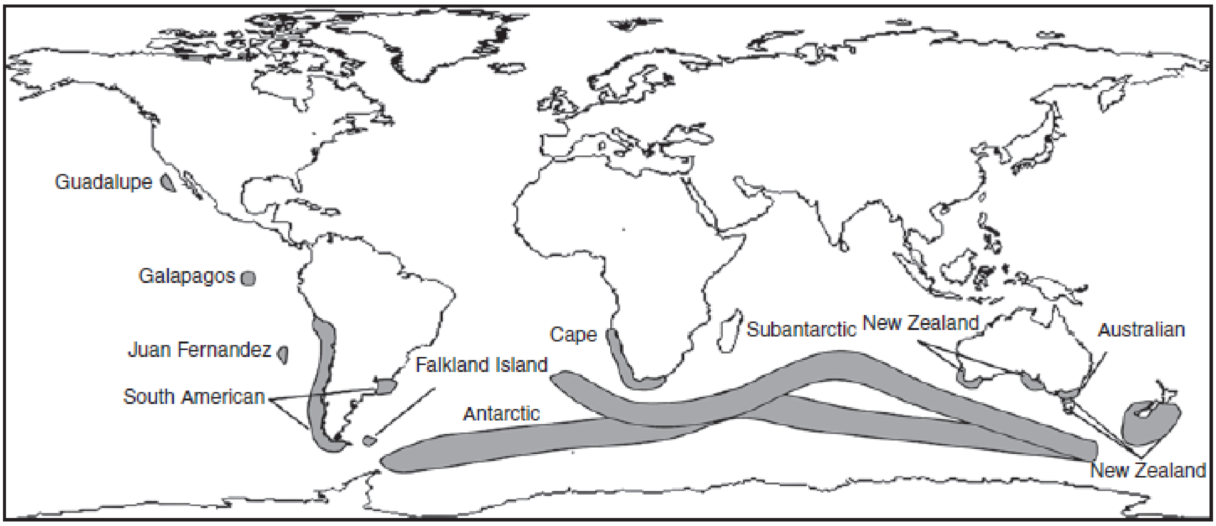


Figure 365. Known foraging grounds for *Balaenoptera musculus*. Source: Sears and Perrin (2008).

There are no abundance data for Argentina. For Antarctica and Subantarctica, 341,830 specimens were caught during the 20th century and about 40,000 were captured near the South Georgias Islands. Currently, a population abundance <2% at pre-exploitation levels is estimated for the Southern Hemisphere.

The Antarctic blue whale was an abundant species in the past that was extensively caught almost to extinction. There is no documentation of natural mortality, although Orca attacks have been occasionally observed. The krill fishery in the Antarctic can affect the distribution and availability of this prey item. In the northern hemisphere, photographs of blue whales show signs of contact with fishing gear, but no entanglements have been reported in our region. It is also known that they can accumulate contaminants such as PCBs that could affect the reproductive success of some individuals. Blue whales react strongly to approaching ships, and the degree depends on the distance, speed and direction of the vessel, so the increase in ship traffic to the Antarctic Peninsula can become a potential risk for the species due to collision. The increase in anthropogenic noise is also cited as a threat, since it disguises or interrupts communication between individuals.

Fin whale - *Balaenoptera physalus*

It is the most distributed cetacean in the world, found in all the worldwide seas and oceans. It tends to be distributed between temperate and cold waters, being less common in tropical waters as it does not approach polar ice (Figure 366). Although it is a mainly oceanic species, it can be observed in coastal areas with narrow continental shelves and at great depths near the coast.

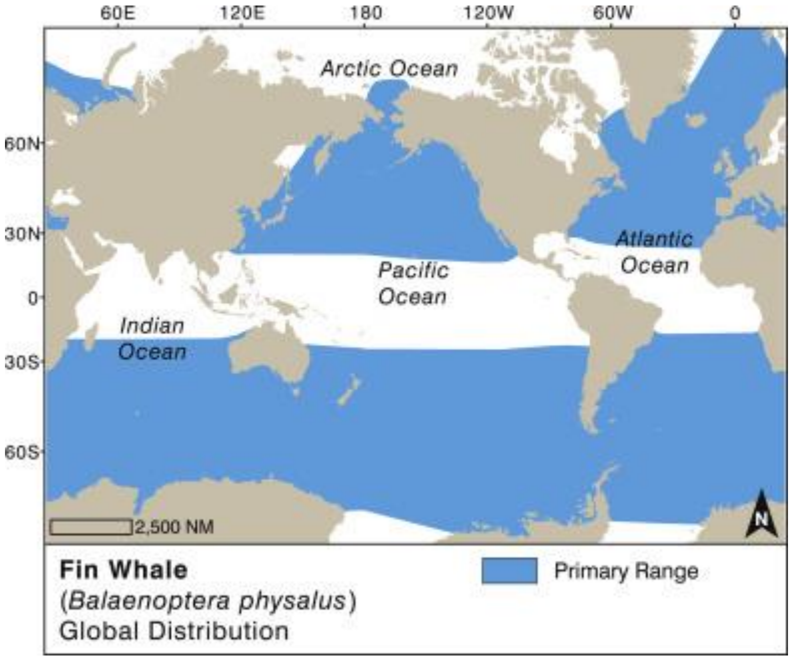


Figure 366. Global distribution of *Balaenoptera physalus*. Source: MMW.

Little is known about their breeding and it is unknown whether there are stable breeding and rearing areas. Mating occurs in winter between May and July. The gestation period lasts 11 months. The births occur early spring. Females give birth to a single calf every 2 years and the lactation takes up between 6 and 7 months. At birth, the young weigh about 2,000 kg and measure between 5-6 m. Females have a period of sexual rest of about 6 months. The age of first sexual maturity is between 6 and 10 years in males and between 7 and 12 years in females when they reach a total length of 20-25m. Their age distribution is not precisely known, but they can reach up to 80-90 years.

The fin whale feeds on a variety of organisms depending on availability, geographical area and season of the year. It feeds preferentially on euphausiids and other small crustaceans, compact schoals of pelagic fish and squid, varying the prey type in its diet depending on the geographical area. It feeds through the filtering technique like other species, but with the particularity of turning over one side to eat. They are relatively fast swimmers. Dives are limited to 100-200 m and do not usually last more than 3-10 minutes.

Populations in the southern hemisphere move to Antarctic waters during the summer to feed, but most of the animals remain in mid-latitudes. Breeding takes place in winter and they do not feed during that season. Its distribution and breeding areas during the winter months are almost unknown. They move alone, or in small groups of 2 to 7 individuals, but in highly productive areas larger concentrations can be added. It also forms groups with blue whales, and hybridize with them. Migration routes follow areas of low intensity and geomagnetic gradient. Not all components of the population move together. Pregnant females are the first to initiate seasonal movements, followed by adult males and then females at breeding rest. The last to migrate are suckling females and juveniles of both sexes. They communicate using simple sounds in high-frequency pulses, which can be heard from tens to hundreds of kilometers.

Their populations were split by whaling activity during the 20th century, with more than 725,000 whales being caught in the southern hemisphere between 1905-1976. Estimates of abundance made after commercial exploitation would indicate that stocks in the southern hemisphere are recovering more slowly than those in the north. Since its migratory routes are mainly in deep waters, the records of sightings in the Argentine Sea are generally scarce, with the exception of the south-central coast of the San Jorge Gulf where numerous observations of the species have recently been recorded.

The killer whale is its only natural predator. Because of its size, the fin whale was the most intensively hunted species after the blue whale in all oceans worldwide. Since the mid-1970s, the species has been protected in the southern hemisphere and the North Pacific, but in the past decade, small-scale commercial and scientific catches (≤ 10 individuals per year) have restarted in Antarctica and Greenland (Cooke 2018). Currently, the main risks it faces are collisions with boats and noise pollution generated by different human activities. The increase in anthropogenic noise also affects this species, since it covers up their vocalizations. To a lesser extent, it can also be affected by bycatch in fishing nets.

Bottlenose dolphin - *Tursiops truncatus*

At a global level, the species is distributed primarily in the temperate and tropical seas of the world without reaching beyond 45 ° north or south latitude. It shows higher densities near the coast, but it is also distributed in pelagic waters on the shelf, especially along the edge of the slope, and also around oceanic islands (Figure 367). There would be two different forms, one coastal and another more oceanic in different regions of its distribution. The coastal population in Argentine waters could could be *T. t. gephyreus*, which is the population of Bahía San Antonio, Río Negro, differing genetically from *T. t. truncatus* that makes up the populations of Uruguay and southern Brazil, which would be more oceanic.

In general, females mature at 5-13 years of age, while males do so between 9 and 13. The calvings occur in spring-summer. Calves are usually suckled for a period of 1.5 - 2 years, or more. Females typically live over 50 years, while males live 40-45 years. The breeding season for *T. t. gephyreus* occurs between late spring and early summer. The breeding interval is calculated at 3.5 ± 1.03 years, with a range between 2 and 5, and 3.5 births per year are estimated. Whale calves´ mortality is estimated at 22%, but this value may be underestimated as a consequence of the low number of reproductive females in the population (17%).

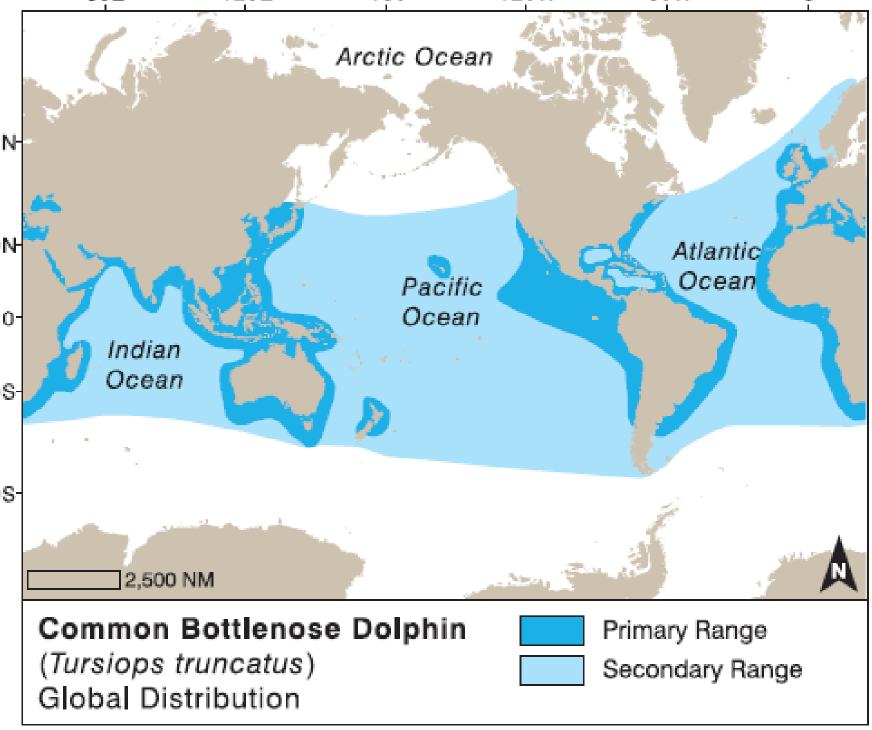


Figure 367. Global distribution of *Tursiops truncatus*. Source: MMW

The bottlenose dolphin is a generalist high trophic predator preferring sciaenidae, scombids and mugilids, but can also eat shrimp and other crustaceans. In the coastal areas of Argentina its main prey are: *Micropogonias furnieri, Pagrus pagrus, Percophris brasiliensis, Geotria australis* and *Stromateus brasiliensis*. Feeding events have been reported where they possibly consumed bream, sea bass, mullet and shoal anchovies. It is a very strategic species to catch its prey, either alone or collectively to corner schools.

It usually goes in groups of less than 20 individuals, and they present a complex and closed social structure. In open waters, there may be much larger groups associated with other cetaceans, both other dolphins and whales. It presents populations that are permanent residents, and others that carry out seasonal migrations. There are movement patterns between Bahía San Antonio, Bahía San Blas and Bahía Blanca. Likewise, sightings were reported in the north of Buenos Aires. Females with their young whales appear to have more restricted ranges of action.

Around 600,000 animals are estimated globally, but given the genetic differences between subpopulations, it is necessary to take into account only those that are in the region. Less than 300 individuals of *T. t gephyreus* combined with *T. t. truncatus* are estimated. In past decades a considerable reduction in sightings has been observed off the coast of Buenos Aires and Chubut, with certain areas where the dolphins have almost completely disappeared. Furthermore, there are no new coastal areas where the presence of this species has grown substantially over time, which rules out any hypothesis of changes in distribution matters. The information of the *T. t. gephyreus* from Río Negro indicate that the population is reduced by at least 1.1% per year.

There are two records of *Orcinus orca* predation events on bottlenose dolphins in front of Balneario de Las Grutas. The reduction of the stocks of their prey due to overfishing and destruction of the benthic communities caused by the fisheries is considered an important threat. In Argentina there are few records of bycatch in fishing nets, nor of collisions with boats. Given the low number of individuals in the local coastal populations, another type of threat may be caused by the catches for oceanariums (mainly in the province of Buenos Aires and Chubut). The increase in shipping traffic, specifically in San Antonio Bay, (mainly marine mammal sighting tourism, and secondarily fishing and cargo) seems to be the main threat to the populations of this region, increasing chemical and acoustic pollution. Several authors suggest that population reduction could be more associated with low reproductive success than with fishing mortality or collisions. In this sense, the specimens stranded on the Argentine coast showed high levels of heavy metals, indicating that this could be the cause of the low recruitment rate (low number of reproductive females) in the specimens from San Antonio Bay.

<u>Sperm Whale - *Physeter macrocephalus*</u>

It has a cosmopolitan distribution and goes from the tropics to the ice shelf in both hemispheres (Figure 368). Genetic studies have shown that there is a low genetic differentiation between the oceans and a low subdivision within them.

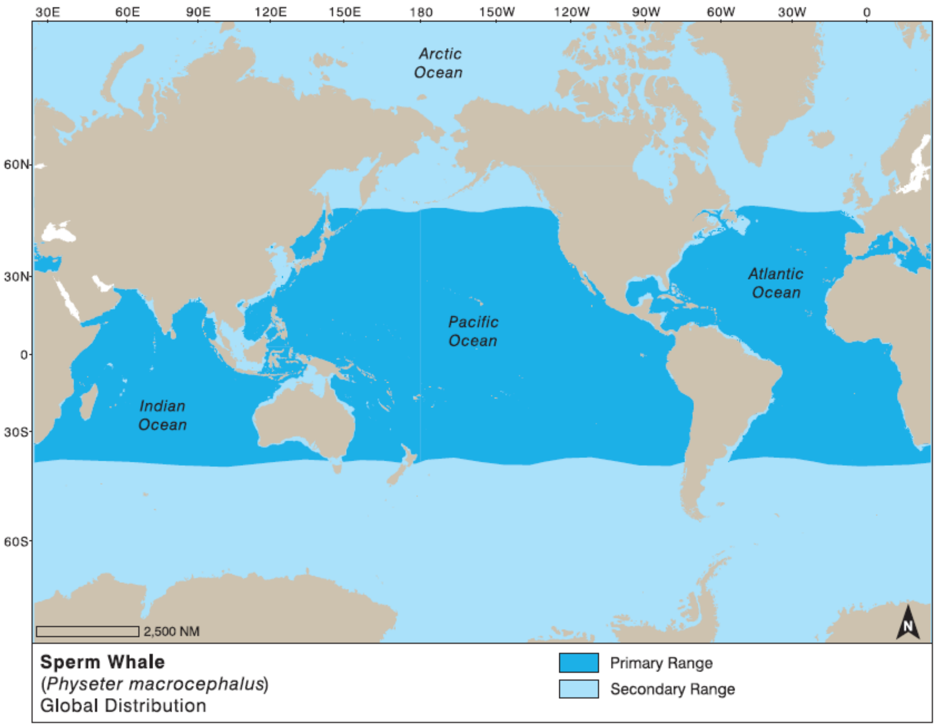


Figure 368. Global distribution of *Physeter macrocephalus*. Source: MMW.

Breeding areas take place in tropical and subtropical regions. The populations of the southwest Atlantic are found off the coast of Brazil, from 5 ° S to the south of Cabo Frio at 23 ° S, but most said population is concentrated in the Bank of Abrolhos. They present a polygynous social structure, where males are temporarily associated with groups of adult females and their young for short periods of time. The breeding period occurs in spring-summer and most of the births in summer-autumn. Females invest a lot of energy and time in raising their young, so the calvings are widely spaced, every 4 or 5 years. The gestation period exceeds a year and the lactation of the offspring lasts for several years, although during the second half the feeding is mixed. Females only mature as from the age of 20 while the males do so as from the age of 25. Many specimens do not manage to breed until they are 30 years old because they have not achieved social maturity. Males compete with each other to mate with females, migrating from one group of females to another. The species is long-lived. A 40-year-old beached specimen was reported off the Brazilian coast. In the case of females, maximum ages of 64 years were determined in specimens stranded in Australia. It is believed that the species can exceed 80 years of life.

They feed mainly on large squid and different species of fish, eating up to one ton per day. Their echolocation system allows them to locate and catch their prey. Only adult males venture beyond 40 ° S.

Sperm whales migrate between feeding and breeding grounds across the continental slope, approximately 200 miles offshore. Sperm whales usually move in herds of up to 50 individuals. They are animals with a very particular, narrow and hierarchical social structure. They produce a great variety of sounds that is linked to the communication of the herd which can move at speeds between 5 and 30 km. Females form groups with their offspring and young from previous litters. On the other hand, there is a group of adult or sub-adult males that are linked with groups of females in the breeding seasons, and solitary adult males have also been sighted outside the reproductive periods. The sizes of the herds are variable and they can reach the hundreds of individuals in breeding seasons. In the Falkland Islands (Islas Malvinas), maximum group sizes of 18 individuals have been recorded, with an average of 2–4 individuals, although the most frequent sightings are those of the solitary. They can also remain static during training of the young for shallow or deep dives depending on their age. Adult males are the ones that most frequently migrate to high latitudes, the rest are concentrated in tropical and temperate areas.

They have great ability to dive to great depths that can exceed 3000 m, holding their breath for more than an hour. Females tend to dive shallower, not exceeding 1000 m and with shorter dives. They tend to hyperventilate on the surface for prolonged periods. Bastida and Rodríguez (2003) point out that there is a significant concentration in the north of the province of Buenos Aires on the 1000 m isobath during spring/summer and sightings at these depths have also been recorded in the vicinity of the study area (Figure 369). In the area of the Falkland Islands (Islas Malvinas) and South Georgias, the sightings are mainly concentrated in the 1,000 meter isobath.

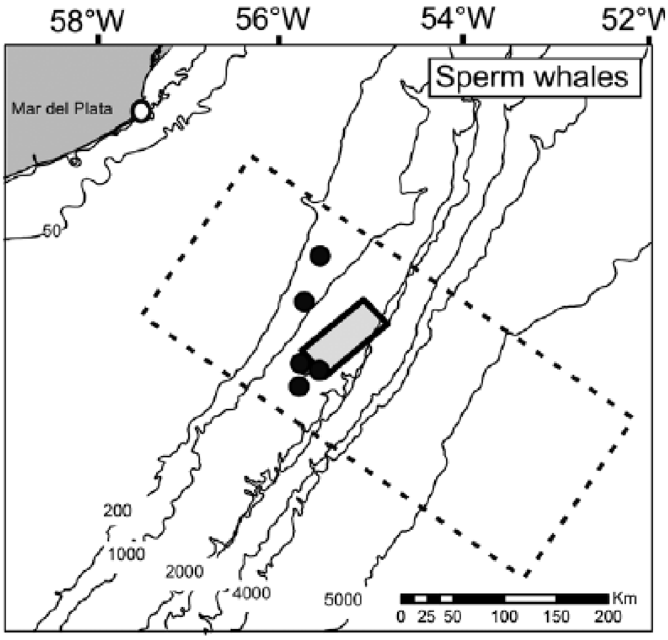


Figure 369. Sightings of *Physeter macrocephalus* in the vicinity of the study area. Source: Mandiola et al. 2015.

There have been concentrations of animals associated with the toothfish and squid fisheries in Argentina, one of them located north of the province of Buenos Aires (and another situated southeast of Tierra del Fuego and close to the Falkland Islands (Islas Malvinas), both groups on the 200-meter isobath). However, occasional sightings of the species have been recorded throughout the entire Argentine shelf. Likewise, animal sightings have been made from the coast in the San Jorge Gulf.

The intense whaling activity since the beginning of the 19th century on sperm whale populations produced important population impacts in various regions of the world. During the 1980s, it is estimated that the world population of sperm whales increased with international protection. The estimated global population size ranges between 300,000 and 450,000 animals worldwide. But peak rates of increase for sperm whale populations are very low so population growth / recovery is expected to take some time. In our country, there are no estimates of abundance or population trend for this species in the Argentine Sea.

Gillnets in fishing nets are rare in Argentine waters. Very few cases of bycatch have been recorded off the coast of the province of Buenos Aires and near the area of Tierra del Fuego and the Falkland Islands (Islas Malvinas). There is a high rate of interaction with longline fisheries in Argentine waters, where the animals feed on the fish caught by the fleets, damaging them. Since 2003, longliners have adopted the use of “sperm whales” (cachaloteras) as a mitigation measure to reduce this interaction. Different levels of contaminants have been recorded in sperm whales worldwide, however, the effects on their health are unknown. The ingestion of plastics has been documented. The effects of noise on sperm whales are also uncertain. Although a significant presence of sperm whales was observed in Argentine waters in the vicinity of seismic prospecting vessels, its effect has not been assessed. The collision with boats has been registered in other parts of the world. There are conflicts of the species with fisheries, which has led to the implementation of mitigation measures that reduce this economic impact.

4.4 PROTECTED AND SENSITIVE AREAS

As part of this topic, environmentally sensitive zones are included, which are areas that are generally protected by means of some legal tool for conservation purposes.

4.4.1 Protected Natural Areas, MAB-UNESCO Biosphere Reserves and Ramsar Sites

Protected Natural Areas (PNA) embrace both National and Provincial Parks, as well as Natural, Ecological and Multiple-Use Reserves and Private Reserves, among other categories. They are intended to safeguard the natural heritage and are generally chosen as representative samples of a natural formation or because they have characteristics that make them unique. In particular, Argentina is trying to protect a significant portion of the different ecoregions of the country. These PNAs were defined with the aim of ensuring a certain order and zoning the complex environmental diversity of the territory, based on its phytogeography. Thus, Argentine protected areas allow the protection of representative samples of the country's ecosystems, biodiversity, genetic, landscape and cultural resources. However, only some regions have adequate levels of protection. In addition, this coverage is very unevenly distributed among the different ecoregions that make up the geographic diversity of the Argentine Republic.

In order to establish a federal scope of coordination between the provinces and the national state to implement the policies on the PNAs, the Federal System of Protected Areas (SiFAP) was created in 2003 through an agreement entered into between the Administration of National Parks (NPA), Ministry of the Environment and Sustainable Development and the Federal Council for the Environment (CoFeMA). SiFAP keeps an updated registry of the member PNAs, among other functions [7].

Currently, there are eight management categories applied to a total of twenty-three conservation figures distributed throughout the Buenos Aires coastal-marine zone (Celsi et. al., 2016). The largest number of these Protected Natural Areas (PNAs) is within the provincial orbit, being the Provincial Organism for Sustainable Development (OPDS), that which administers 76% of the areas listed under some category. Additionally, there are areas administered by municipalities, by national bodies and by specific committees.

The Provincial Natural Reserves are part of the System of Protected Natural Areas of the province of Buenos Aires. It recognizes 6 categories of protection including Integral Reserves, Defined Objective Reserves, Multiple Use Reserves, Wildlife Refuges, Natural Parks and Natural Monuments, the first four being represented on the Buenos Aires coast. The Multiple Use Nature Reserves, Defined Objective Nature Reserves, Comprehensive Nature Reserves and Wildlife Refuges are cited for the study area.

[7] Federal System. https://www.argentina.gob.ar/ambiente/tierra/protegida/sifap

The Natural Reserves of Multiple Use constitute representative PNAs of the landscape, where the investigation of the ecosystems is emphasized and they admit a zoning that considers: an intangible zone (aimed at conservation); a muffling zone (which protects the intangible zone and allows management evaluations to be carried out); and one or more experimental zones (aimed at assessing the effects of human action on the natural system). For the study area, this is the case of the RNs: “Mar Chiquita”, “Arroyo Zabala”, “Arroyo Los Gauchos”, “Bahía Blanca, Bahía Falsa and Bahía Verde”, and “Bahía San Blas”. The Defined Objective Natural Reserves are meant to protect some of the components (natural or cultural) of the environment, in isolation or jointly, admitting different sub-categories: botanical, fauna, geological, paleontological, educational, and others. They allow the regulated development of human activities, as long as the possibilities of exploitation and use of the resources are compatible with the conservation objectives. This is the case, for example, of the "Restinga del Faro" Geological and Faunal Natural Reserve.

The Integral Natural Reserves have as a primary objective the maintenance of nature in the most pristine conditions possible and, therefore, human activity is limited almost exclusively to the development of scientific explorations. Within the provincial system, the "Islote de la Gaviota Cangrejera" or "Islote del Puerto" Natural Reserve has this category, in the vicinity of Puerto Ingeniero White, Bahía Blanca. The Wildlife Refuges are established in areas with special characteristics, where the conservation of fauna is prioritized, with hunting being explicitly forbidden. In this area of the Buenos Aires maritime coast there are two refuges: “Mar Chiquita” and “Bahía San Blas”.

In addition to the above, there are Municipal Natural Reserves, which are administered and created by municipal ordinance. The objectives, conservation priorities, and other guidelines for its management and / or zoning shall depend on the operational and legal framework of each municipality. The NMR "Faro Querandí" is within this category, in addition to two other areas of mixed management with the province: the NR "Puerto Mar del Plata" and the NR "Costera de Bahía Blanca".

The **MAB-UNESCO Biosphere Reserves** are those areas made up of terrestrial, marine and coastal ecosystems, recognized by the UNESCO Program on Man and the Biosphere. Solutions are promoted in each of them to reconcile the conservation of biodiversity with its sustainable use, economic development, research and education. Biosphere reserves consist of three interrelated zones that fulfill three related, complementary and mutually reinforcing functions. The core zone (they can be one or more), which is made up of a strictly protected ecosystem (therefore coinciding with the PNAs mentioned in the previous point). The buffer zone and the transition zone, which is the strip of the reserve where a greater number of activities are authorized to promote sustainable economic and human development from a social, cultural and ecological point of view.

Argentina has a National Network of Biosphere Reserves, represented by 15 reserves distributed in our country, several of which are coastal, located in the Province of Buenos Aires and Chubut [8].

Finally, the Convention on Wetlands, also known as the Ramsar Convention, focuses mainly on the conservation and wise use of wetlands through local and national actions thanks to international cooperation. The Argentine Republic approved the Convention on Wetlands in 1991 through the enactment of Law 23,919, which entered into force in September 1992 after the deposit of the ratification instrument. The Implementation Authority of the Ramsar Convention at the national level is the current Ministry of Environment and Sustainable Development of the Nation.

[8] The man and the Biosphere: MaB Program. https://www.argentina.gob.ar/ambiente/tierra/protegida/programa-mab

There are some wetlands that are recognized by the Convention as wetlands of international importance due to their particular characteristics. These environments are called **Ramsar Sites** and become part of a special list. Argentina has 23 Ramsar Sites [9].

Argentina holds 61 coastal marine protected areas (APCM), including national parks, provincial and municipal reserves, biosphere reserves (MaB) and Ramsar sites. The Legal instruments for the creation of these areas are also diverse: municipal ordinances, provisions, resolutions, decrees and Provincial laws, National laws and, the Provincial Constitution when it comes to Tierra del Fuego. The APCM are registered within the Federal System of Protected Areas (SiFAP).

In relation to the project analyzed, it is important to mention that its operating area is more than 300 km from the coast, so there shall be no interaction with the coastal Natural Protected Areas. In this sense, as part of the areas that could be affected, the Natural Protected Areas, Biosphere Reserves or Ramsar Sites near the support port, that is, Mar del Plata, were considered; this being the only sector where some interference could eventually be registered.

In the surroundings of the Port of Mar de Plata, a total of 4 protected Natural Areas (NPA and R.B. MAB) were counted:

- Multiple Use Natural Reserve and Albufera de Mar Chiquita Biosphere Reserve - Wildlife Refuge.
- "Mar Chiquita Dragones de Malvinas" National Defense Reserve.
- Natural Reserve of Defined Geological and Faunal Objects "Restinga del Faro".
- Botanical, Faunal and Educational Natural Reserve "Puerto Mar del Plata".

The Natural Reserve of Defined Geological and Faunal Objects "Restinga del Faro" and the Natural Botanical, Faunistic and Educational Reserve "Puerto Mar del Plata" are inserted within the area of direct influence of the logistics route.

[9] Ramsar sites web. https://www.argentina.gob.ar/ambiente/agua/humedales/sitiosramsar

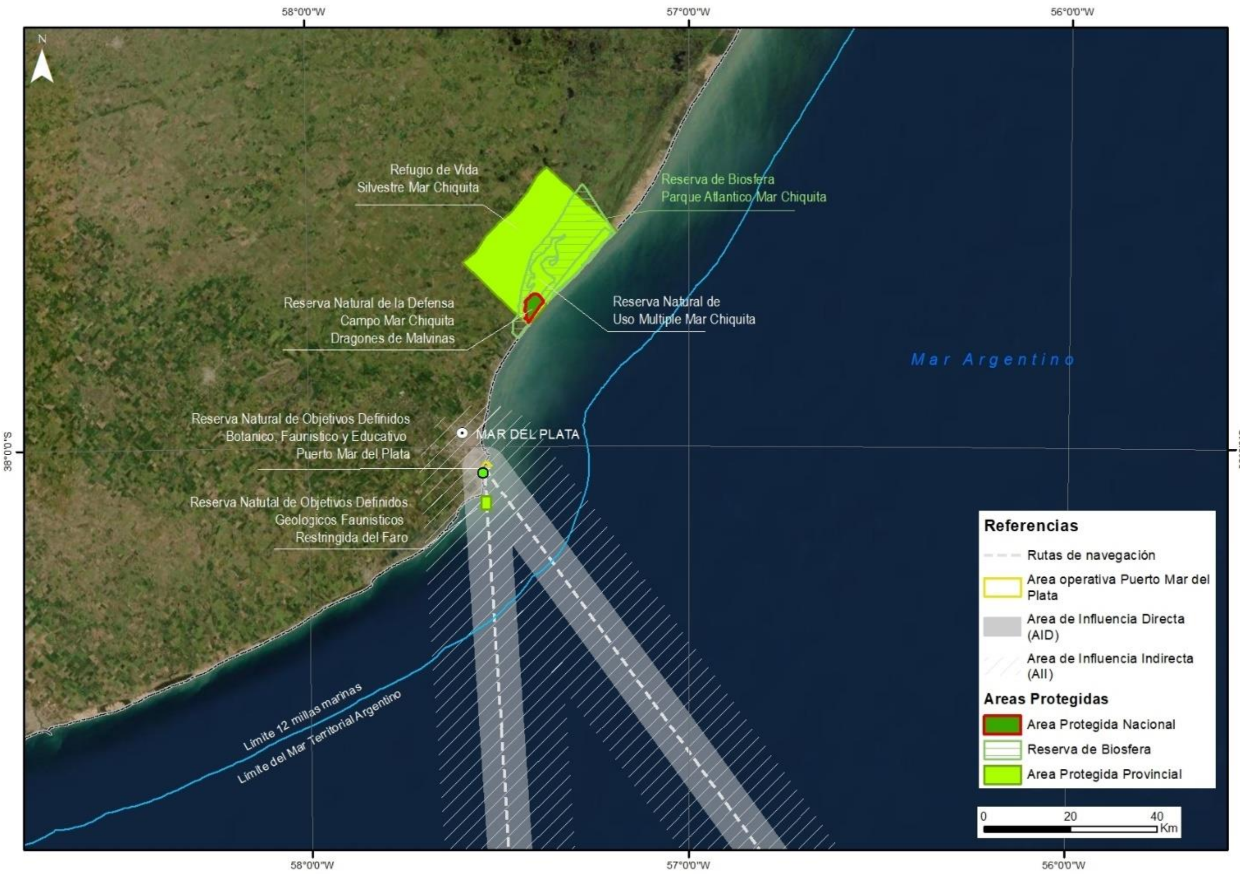


Figure 370. Protected Areas near the Support Port - Mar del Plata. Source: own elaboration based on SIFAP (http://www2.medioambiente.gov.ar/) and own editions.

(Translation of Figure 370: References.City of Mar del Plata. Navigation Routes. Direct Area of Influence (DAI). Indirect Influence Area (IIA). **Protected Areas.** National Protected Area. Biosphere Reservoir. Provincial Protected Area. Mar Chiquita Atlantic Park Biosphere Reservoir. Mar Chiquita Wildlife Refuge. Mar Chiquita. Multiple Use Natural Reservoir. Defense Nature Reservoir. Mar Chiquita Field. Falkland Islands (Malvinas Argentinas) Dragons. Natural Reservoir of Defined Botanical, Fauna and Educational Objectives. Mar del Plata Port. Natural Reservoir of Defined Geological and Fauna Objectives - Restricted Lighthouse
12 Nautical Mile-Limit. Limit of the Argentine Territorial Sea. Argentine Sea)

Table 38. Protected Areas of Buenos Aires. Source: SIFAP (http://www2.medioambiente.gov.ar/)

Protected Area	Surface area	Jurisdiction	General Objective	Specific Objective
Multiple Use Natural Reserve and " Mar Chiquita" coastal lagoon Biosphere Reserve - Wildlife Refuge	3.000 ha	Provincial	Protection of specific natural characteristics	Conservation and protection of the Dunícola cordon of the Buenos Aires Atlantic Coast and the only lagoon in Argentina

Protected Area	Surface area	Jurisdiction	General Objective	Specific Objective
"Mar Chiquita Dragones de Malvinas" National Defense Reserve	1.700 ha	National	Protection of specific natural characteristics	Preserve grassland ecosystem, with the presence of tall and short grasslands, psamophile vegetation, wetlands and dunes.
"Restinga del Faro" Natural Reserve of Defined Geological and Faunal Objects	714 ha	Provincial	Preservation of species and genetic diversity. Protection of specific natural characteristics	Preserve geological site and sand dune ecosystem. Associated fauna such as birds and aquatic mammals, especially the two-haired sea lion
"Puerto Mar del Plata" Botanical, Faunal and Educational Natural Reserve	42 ha	Provincial and municipal	Preservation and conservation of species, education and environmental interpretation	Protection of flora and fauna of the place and environments it contains: Grassland, Pampean lagoons, Coastal dunes.

As mentioned in the Point **Error! Reference source not found.**, As mentioned in the Point , there is a settlement of sea lions in the Port of Mar del Plata, specifically on a small beach located on the inner coast of the southern breakwater, a few meters from its beginning. The species was declared a Natural Monument of Mar del Plata in 1994, through Ordinance 9440. This establishes the prohibition of any action or omission that directly or indirectly implies mistreatment, damage, catch or captivity of the specimens, unless justified otherwise. The most outstanding characteristic of the colony is that only male specimens prevail, which mate on the Uruguayan coasts. They can be observed throughout the year.

4.4.2 High Conservation Value Protected Areas as Potential Marine Protected Areas (Future Protected Areas 2020)

Currently, Argentina has 3 entirely marine protected areas (MPAs), Yaganes, south of Tierra del Fuego and Namuncurá / Banco Burdwood I and II, in the South Atlantic. All of them are located thousands of kilometers from the seismic data acquisition areas.

The Namuncurá-Banco Burdwood I marine protected area was created in 2013 by Law 26,875 (enacted by Decree No. 1058/2013). This Marine Protected Area is made up of 2 categories: (a) west of meridian 60º45´O, a multiple-use sector under the category of National Marine Reserve and (b) east of meridian 60º45´O, an area of greater protection under the category of National Marine Park.

The Yaganes Marine Protected Area and the Namuncurá-Banco Burdwood II were created by Law 27,490 in 2018 (enacted by Decree No. 1137/2018). The first falls into the management categories of Strict Marine National Reserve and Marine National Reserve, and has a total area of thirty-two thousand three hundred thirty-six with three square kilometers (32.336,3 km2). Yaganes is made up of the management categories of Strict Marine National Reserve, Marine National Park and Marine National Reserve with a total area of sixty-eight thousand eight hundred thirty-four with thirty-one square kilometers (68.834,31 km2).

The enforcement authority was the Chief of the Cabinet of Ministers, and the Secretary of

Environment and Sustainable Development of the Nation (SAyDS)[10]. The AMPNBB has a Management Plan, approved in December 2016. In November 2014, Argentina approved Law 27037 that sets up the National System of Marine Protected Areas (SNAMP). The regulation provides the legal framework for the creation of marine protected areas outside the provincial jurisdiction [11]. Currently, the National Parks Administration (NPA) is the Enforcement Authority of the National System of Marine Protected Areas (Law 27.037), which includes AMPNBB I, II and Yaganes.

Marine protected areas (MPAs) are one of the most powerful tools to prevent the overexploitation of resources and the degradation of marine habitats. It is aimed at preserving and managing the biodiversity. They are flexible tools that can be adjusted to meet different needs, from strict preservation to multipurpose designs and reserves with mobile and seasonal limits.

According to the Convention on Biological Diversity and the UN Sustainable Development Goals to which Argentina adhered, it must have protected at least 10% of its marine surface by 2020. In this context, marine zones proposed to be established as national marine parks have been defined (additional tide to existing marine protected areas), which seek the survival of marine birds and mammals and conserve the oceans that regulate the temperature and thus the planetary climate.

The proposed future marine protected areas emerge within this framework. These sites relevant to the biodiversity of the Argentine Sea have no creation proposals for now. The closest to the prospecting area is the Slope Front (FT), located 30 km from the prospecting area (and 17 km from the direct area of influence) and therefore, it is situated in the indirect area of influence of the seismic acquisition site. The Middle Platform Front (FPM) is located 114 km from the prospecting areas and outside its area of influence. The "Profundo" and "El Rincón" RCP are at greater distances. Both the Slope Front (FT) and the Middle Platform Front (FPM) shall be crossed by the logistics route that connects the CAN_114 Area with the Port of Mar del Plata.

[10] Current Ministry of the Environment and Sustainable Development

[11] Marine Protected Areas. https://www.argentina.gob.ar/ambiente/agua/areas-marinas-protegidas

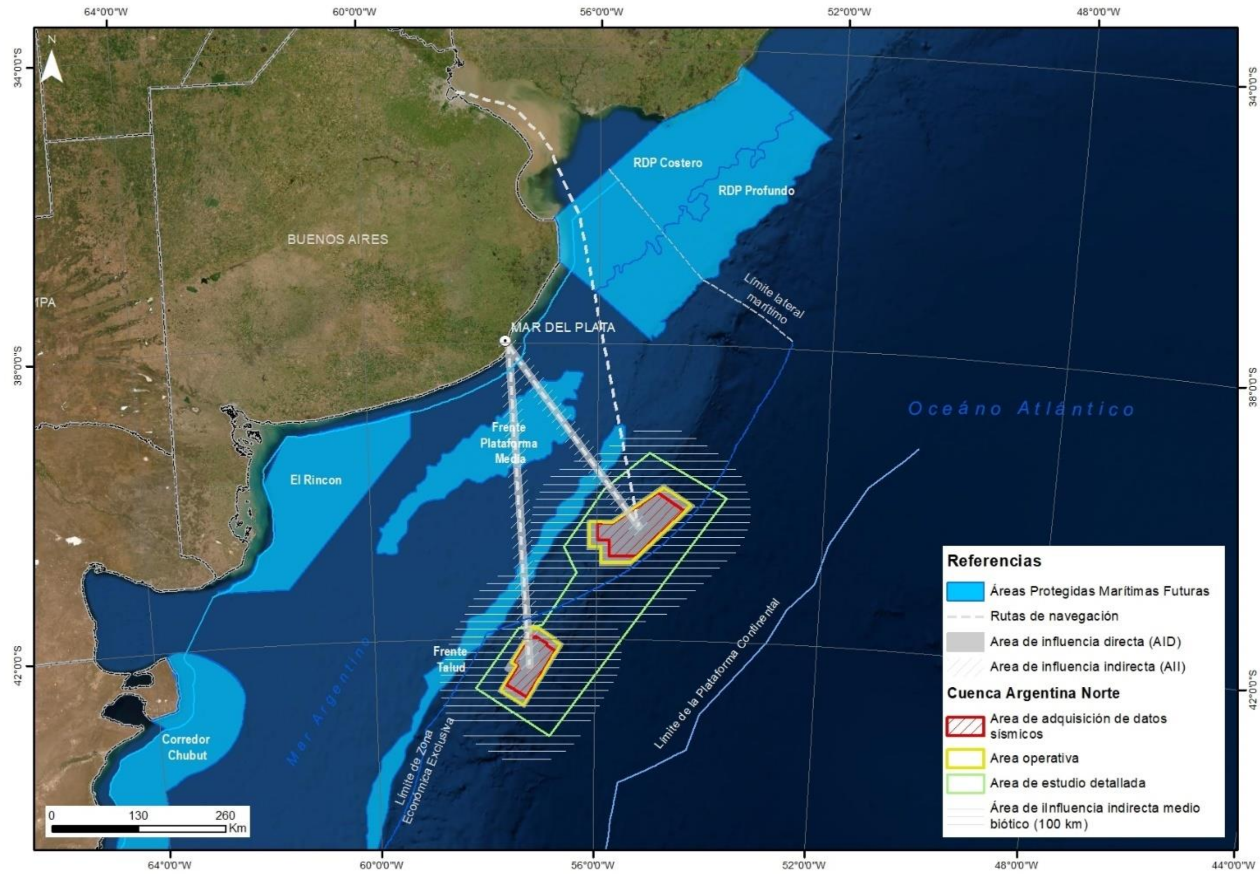


Figure 371. Detail of areas proposed to be approved by the Congress. Source: Own elaboration based on the Forum for the Conservation of the Patagonian Sea and Areas of Influence.

(Translation of Figure 371: References. Province of Buenos Aires. City Mar del Plata**.** Future Maritime Protected Areas. Navigation Routes. Direct Area of Influence (DAI). Indirect Influence Area (IIA). Argentine North Basin**.** Seismic data acquisition area. Operative area. Detailed study area. Biotic environment indirect influence area (100 km). Atlantic Ocean. Argentina Sea. El Rincón. Chubut Maritime Corridor. Front Middle Platform. Mainland Limit Platform. Maritime Lateral Limit. Coastline Remote Desktop Protocol (RDP). Deep RDP. Exclusive Economic Zone).

1 - Slope Front (FT)

The slope front is one of the most extensive and persistent ocean fronts of the Patagonian Sea, with a key ecological and functional role for the Patagonian marine ecosystem. This area of high productivity of the outer platform that borders the slope extends for more than 2,000 km. It supports a complex trophic web, includes spawning areas for commercially important species and is a feeding area and migratory passage for top predators. At least seven species of threatened seabirds feed in the area.

In the surroundings of the project area, the slope front area is excluded from the Argentine Exclusive Economic Zone.

It belongs to the biogeographic region of the temperate seas of South America, within the Magellanic Province and the ecoregion it embraces is the Patagonian Platform. The conservation status of the slope front is classified as vulnerable.

It includes habitat types such as the Platform and slope pelagic and benthic environments.

There are no specific studies on species richness for this sector. Its high productivity is inferred by regional fisheries and scientific knowledge (satellite monitoring) on migratory routes and feeding areas for birds and marine mammals.

One of its main uses is the intense fishing activity of Argentine squid (*Illex argentinus*) and demersal fish by foreign trawlers (especially Spanish).

This area is threatened by illegal, unreported and unregulated fishing, as well as by the destruction of seabed communities by trawling activities.

The main government agencies involved in managing the system are listed below: Ministry of Foreign Relations and Worship; Federal Fisheries Council, Undersecretary of Fisheries and Aquaculture; Secretariat of Environment and Sustainable Development (SAyDS)[10].

The buffer zone is within a special fishing area for freezer trawlers.

Figure 372. Argentine squid (left) and jigger boat (right).

2 - Middle Platform Front (SMRP)

This area corresponds to the platform thermohaline front, whose mean satellite chlorophyll concentrations in spring reach between 3 and 4 mg / m3. It plays a key ecological role as the main breeding area for anchovy, and spawning area for common hake and squid. The area is 22,000km2.

It belongs to the biogeographic Region called Temperate Seas of South America, within the Temperate Province of the Southwest Atlantic. It is mainly aimed at the protection of breeding areas for various species of fish, mostly Anchovy.

The Magellanic Penguin Corridor is close to this area. It is located in the biogeographic region of the temperate seas of South America. Magellanic Province. Ecoregion: North Patagonian Gulfs and Uruguay - Buenos Aires Platform. It protects pelagic and benthic platform environments. This corridor makes up a marine strip that extends between 20 and 40 nautical miles, following the line of the Argentine coast, from the Province of Chubut to the Río de la Plata. The jurisdiction corresponds to the Argentine - Uruguayan Common Fishing Zone and the Exclusive Economic Zone of Argentina.

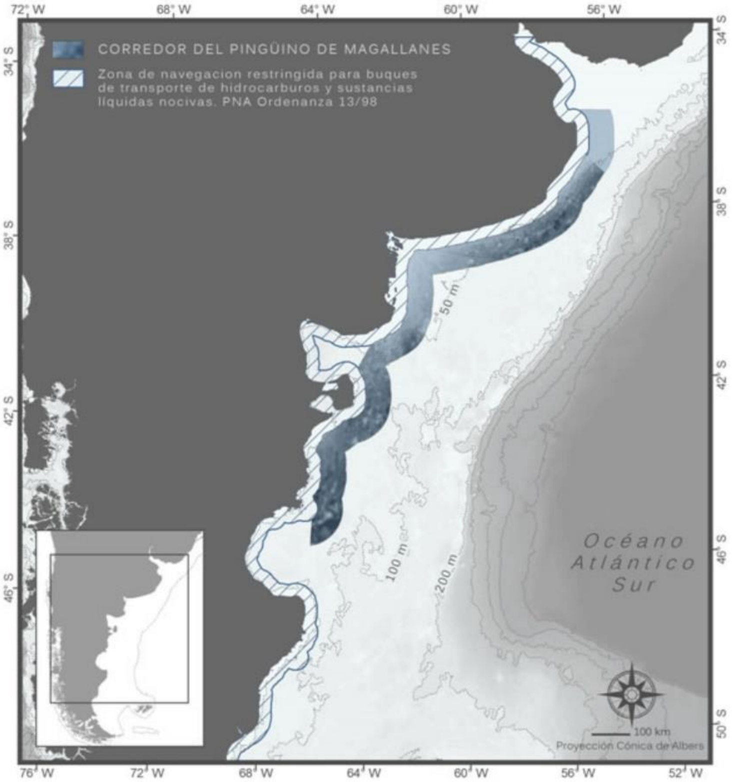


Figure 373. Location map of the Magellanic Penguin Corridor.

(Translation of Figure 373: Corredor del Pinguino de Magallanes: Magellanic Penguin Corridor. Zona de navegación restringida para buques de transporte de hidrocarburos y sustancias líquidas nocivas. PNA Ordenanza 13/98: Restricted navigation area for oil tankers carrying hydrocarbons and hazardous liquid substances. Argentine Coast Guard Ordinance 13/98).

There are no specific studies on the biodiversity of the area. Satellite tracking studies indicate that many species of birds and marine mammals use it to feed. The main relevance of the area is based on integrating part of the Patagonian migratory route of the Magellanic penguin. The corridor has been proposed to minimize the potential interaction generated by the overlap between the migratory population of the species and the hydrocarbon transport routes and commercial navigation. It embraces an area of 112,500km2. Its conservation status is Vulnerable.

Figure 374. Magellanic penguin.

The Migratory Corridor is a marine strip that runs along the Argentine platform in a north-south direction, from the Río de la Plata (37º S) to the southern limit of the province of Chubut (46º S). It integrates several relevant areas with different levels of overlap: The Magellan penguin Migratory Corridor in its entire area, a coastal sector of the corridor in front of the province of Chubut and an Area of Importance for the Conservation of Seabirds (AICA Marina Valdés). It covers an area of approximately 100,000km2.

4.4.3 Special Protection Zones on the Argentine Coast

The **Special Protection Zones on the Argentine Coast** have been defined in Ordinance No. 12/98 and arise as a result of a cooperation agreement signed in 1993 and re-elaborated in 2015 between the Secretariat of Environment and Sustainable Development and the Argentine Coast Guard (PNA) in order to mark out those areas especially protected against potentially polluting action that could come from navigation, port and related tasks.

The Special Protection Zones are "*Those that need special care measures for the protection of the environment, the PNA being empowered to establish them and determine the most appropriate measures to protect them against contamination from navigation*".

It is important to mention that these areas are the result of compiling existing information on national and provincial laws and decrees applied in this regard, Ramsar wetlands, national parks, national and provincial nature reserves, shorebird breeding areas and marine mammal breeding areas, even municipal ordinances and ministerial resolutions of the littoral provinces, since, in most cases, they overlap with the categories previously described.

Twelve Special Protection Zones were established: 1. Bahía de Samborombón; 2. Bahía San Blas; 3, Caleta Los Loros; 4. Bahía San Antonio; 5. Golfo San José; 6. Golfo Nuevo; 7. Punta Tombo; 8. Cabo Dos Bahías - Bahía Bustamante; 9. Ría de Puerto Deseado - Cabo Blanco; 10. Cabo Vírgenes; 11. Bahía San Sebastián - Río Grande; 12. Bahía de Ushuaia - Bahía Lapataia. Later, with the advent of the first Coastal National Park in Monte León, one more was added: 13. Ría de Santa Cruz - Isla Monte León.

All of these are coastal-marine areas, far from the seismic prospecting area and None of them is close to the support Port.

4.4.4 Priority Aquatic Areas (AAP)

In the framework of the Transboundary Diagnostic Analysis of the Río de la Plata and its Maritime Front (FREPLATA, 2004), an assessment of aquatic biodiversity has been carried out in order to characterize and divide the aquatic biodiversity of the Río de la Plata and its Maritime Front, and Identify Priority Aquatic Areas (PSA), either because of their significant biodiversity or because of their functional importance for the ecosystem, which shall guide future conservation and management efforts. The identification of AAP was carried out on the basis of 3 ecological criteria: species richness, species of particular interest - whether social, commercial or functional (focal species) - and population and ecosystem processes.

In the fluviomarine zone, 2 large PAAs (3 and 4) appeared, identifying 4 core areas within the Turbidity Front. In the Atlantic coastal zone, 2 important areas were identified, the Uruguayan Atlantic Coast (5) and the Argentine Atlantic Coast (8). In the Uruguayan Atlantic Coast, the information allowed to locate 2 high priority nuclei. On the platform, the area associated with the banks of mussels and hard substrates (sand banks) appeared as prominent, within which 2 priority nuclei were located. The entire area associated with the Slope Front stood out for its ecological attributes, and 2 nuclei could also be identified.

The core area closest to CAN_100, CAN_108 and CAN_114 seismic prospecting area is the so-called Edge of the South Slope (7.1), which is located 250 km away. The Priority Aquatic area containing it is the Slope Edge located 93 km from the CAN_114 seismic data acquisition area and therefore overlaps only marginally with the area of indirect influence of the prospecting areas. On the other hand, the Costa Atlántica Argentina (8) APP is located in the area of influence of the port of logistic support and the logistics route, while the latter crosses the Banco de Mejillones APP (6) (Figure 375).

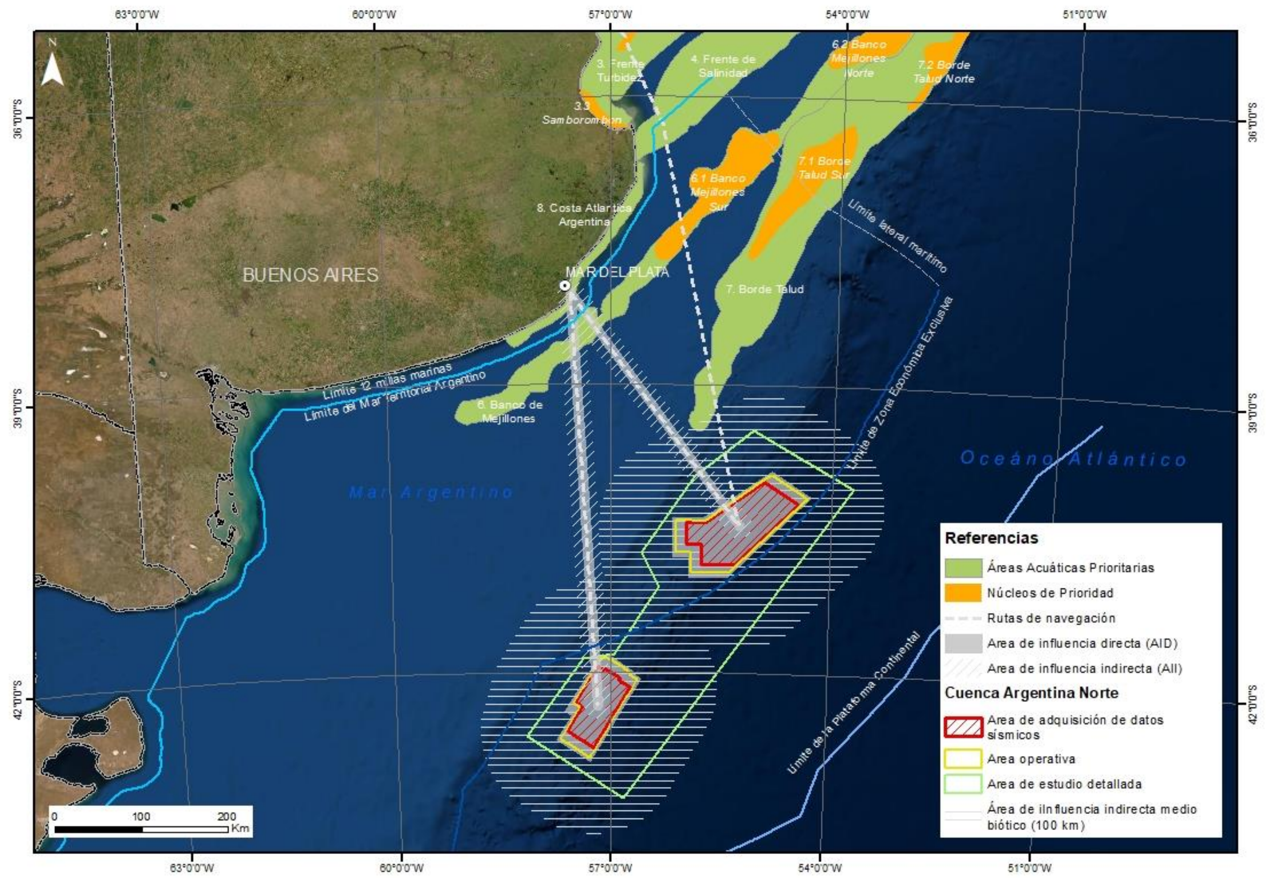


Figure 375. Priority Aquatic Areas for Conservation in the Río de la Plata and its Maritime Front. Source: own elaboration based on FREPLATA (2004).

(Translation of Figure 375: **References.** Priority Aquatic Areas. Priority Cores. Navigation Routes. **Argentine North Basin.** Province of Buenos Aires. City of Mar del Plata. Seismic Data Acquisition Area. Operative area. Detailed study area. Indirect Biotic Environment Area of Influence (100km). Atlantic Ocean. Argentine Sea. 12 Nautical Mile-Limit. Argentine Territorial Sea Limit. Continental Shelf Limit Exclusive Economic Zone Limit. Maritime Lateral Limit. 3. Front Turbidity. 3.3 Samborombon Bay 4. Salinity Front. 6. Mussels Bank. 6.1 Mussels Bank. 6.2 North Mussel Bank. 7. Slope Edge. 7.1 South Slope Edge. 7.2 North Slope Edge. 8. Argentina Atlantic Coast.).

4.4.5 Areas of importance for the conservation of birds – AICAS-

In addition to these legally protected areas, there are certain sectors of the Argentine territory that have been identified as ecologically relevant due to some particular aspect.

The “Important Bird Areas” (IBAs) program led by the BirdLife International Federation emerges internationally considering the protection of valuable sites for biological diversity one of the most effective measures for Bird conservation. The "Aves Argentinas" foundation identified **Areas of Importance for Bird Conservation (AICAS)** (Di Giacomo, et al., 2007).

Regarding the area of influence of the Port of Mar del Plata, the following AICAs have been identified (Figure 376):

- **BA22 Estancia Medaland (Medaland Ranch).** The ranch is located in the southeast of the flooded pampas and contains four predominant grassland plant communities such as salty grasslands (*Distichlis spp.* and *Stenotaphrum secundatum*), wet grasslands (*Cyperus, Eleocharis sp., Paspadilium sp.* and *Phyla canescens*), Spartina densiflora and psamophytic grassland of *Stipa spp.* and *Juncus acutus*. Many streams and ponds are juxtaposed between these communities. The following can be found in the country: Rufous-chested Plover (*Charadrius modestus*), the Lesser Golden-Plover (*Pluvialis dominica*), the Tawny-throated Dotterel (*Oreopholus ruficollis*) and the highest abundance of Buff-breasted Sandpiper (*Tryngites subruficollis*). Given the importance at the population level of the Buff-breasted sandpiper, the conservation of this area becomes key in relation to this and other migratory species that use it as a wintering ground. Likewise, for typical grassland species such as the Black and white monjita and other endemic species of this biome.

- **BA11 Mar Chiquita Biosphere Reserve.** It is a coastal lagoon with brackish waters, connected to the sea by a narrow mouth. It is located 37 km north of the city of Mar del Plata. It is bordered to the east by dunes and the ocean, and by islets to the west margin. Its waters are calm and it receives water contributions from several water courses (Las Gallinas, Grande, Vivoratá, and Dulce streams and channels 5 and 7), the marine influence is variable and the water level depends on the contribution of rainfall and the direction and intensity of the winds. In this way, a salinity gradient is observed from the mouth to the interior of the wetland, whose depth ranges between 3.5 m in the floods and 0.5 m in low water levels (average of 0.8 m). The marine sector is characterized by algae; and there are fields of cultivation and grazing in the surroundings of the water body. It also houses an important vertebrate fauna (32 species of fish, 10 of amphibians, 17 of reptiles, more than 190 of birds and 28 of mammals). The lagoon has an important birdlife made up of more than 190 species, six of which are globally threatened. The dot-winged Crake (*Porzana spiloptera*) and Bay-capped Wren-Spinetail (*Spartonoica maluroides*), inhabit the cordgrass of Spartina densiflora and *Juncus acutus*. The Greater rhea (*Rhea americana*) prefers grassland and flechillar areas during the non-breeding period, and tends to move to the vicinity of water bodies during the reproductive season. The Magellanic plover (*Pluvianellus socialis*) has been registered once in the lagoon and three in the vicinity. The Speckled Rail (*Coturnicops notatus*) and the Hudson´s canastero (*Asthenes hudsoni*) are also frequent. The Cinnamon Warbling Finch (*Poospiza ornata*) which is endemic in Argentina, has two records in the area. In addition, globally threatened marine species such as the Southern Giant Petrel (*Macronectes giganteus*), the white-chinned petrel (*Procellaria aequinoctialis*), the black-browed Albatross (*Thalassarche melanophris*) and the Yellow-nosed Albatross (*T. chlororhynchos*) use waters close to the coast. The water body and the surrounding lagoons are an important wintering area for *Anatidae* and waders.
  Between April 1983 and April 1984 the total number of recorded shoreline species was 19 and the number of individuals was 14,209, of which 9,802 were migrants from North America. The reserve has been considered "a site of international importance" according to the results of the aquatic bird censuses.

- **BA12 Punta Mogotes beach and Port of Mar del Plata.** It is located between the southern breakwater of the port of Mar del Plata and Punta Cantera, an area known locally as Punta Mogotes - Waikiki. This last AICA is inserted within the area of direct influence of the logistics route of the vessels that are going to operate. It borders the Atlantic Ocean (E), and with an important resort complex and the Port Nature Reserve (W). In the northern sector there is a group of fishing industries and the mouth of the lagoons included in the reserve, an area preferred by birds to rest. The dominant landscape is the sandy beach. The area of beaches adjacent to the southern breakwater of the port is an important resting site for shorebirds and seabirds. Sixty-two (62) species have been recorded between 1992 and 2003. The presence of the Olrol´s gull (Larus atlanticus) should be highlighted, practically during all the months of the year. Fifty in summer (up to 359), and a few hundred in winter are likely to be found (up to 2,176 specimens, mostly young and sub-adults). The area is used by laridae mainly the kelp gull (*Larus dominicanus*), the brown-hooded gull (*Chroicocephalus maculipennis*), the South American tern (*Sterna hirundinacea*), the king tern (*Sterna maxima*), the yellow-billed tern (*Sterna sandvicensis*) and the Snowy-crowned Tern (*Sterna trudeaui*), which use the port and nearby sea as foraging areas. The presence of up to 4,000 individuals of South American tern (*S. hirundinacea*) has been recorded. Flocks of wader species such as the Red Knot (*Calidris canutus*), the Sanderling (*Calidris alba*) and the Hudsonian Godwit (*Limosa haemastica*) use the tide line in their migratory passage. The adjacent harbor and its breakwaters are frequently visited by globally threatened pelagic birds such as the black-browed albatross (*Thalassarche melanophris*), the Southern giant petrel (*Macronectes giganteus*) and the white-chinned petrel (*Procellaria aequinoctialis*). The yellow-billed sandwich tern (Sterna sandvicensis acuflavidus) and the Antarctic tern (Sterna vittata) have also been recorded.

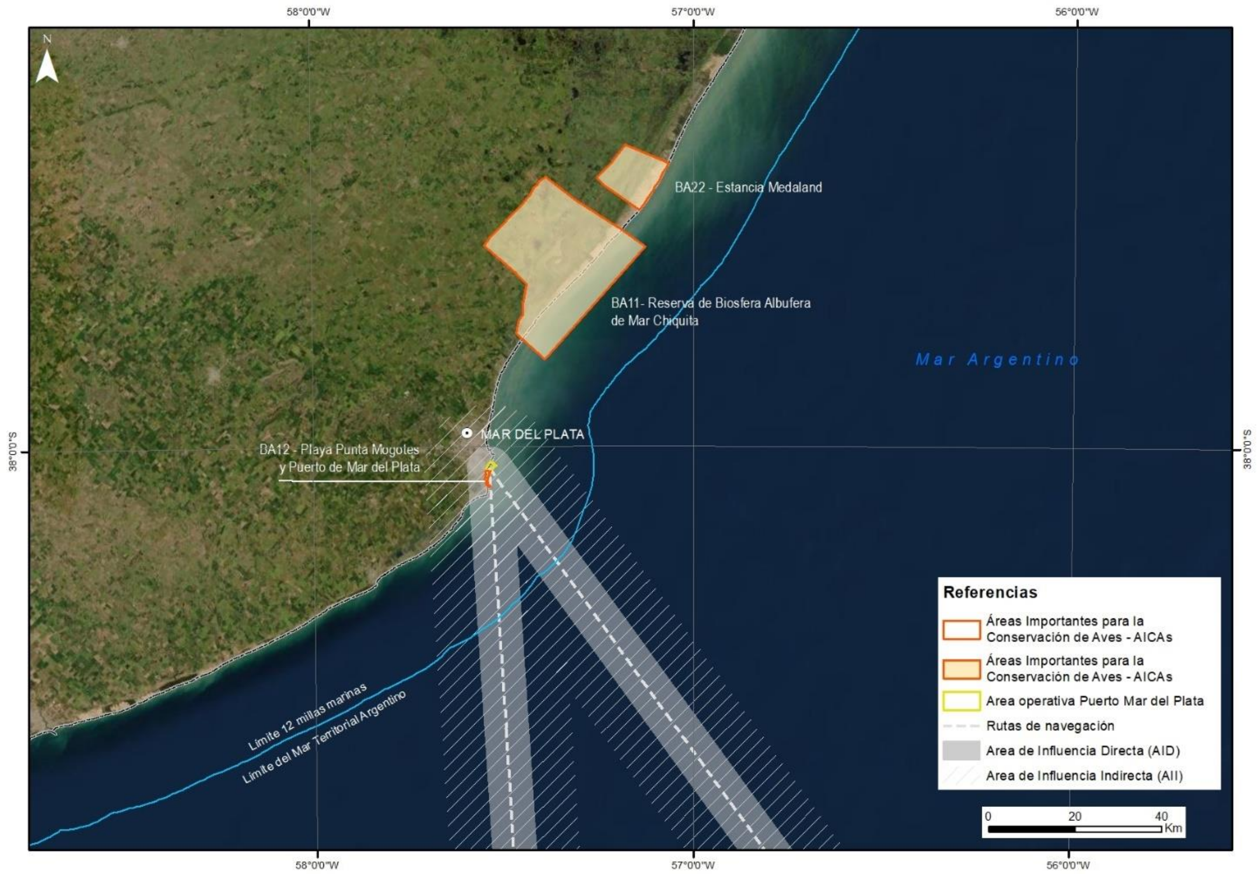


Figure 376. Priority AICAs for aquatic birds in the vicinity of the Support Port of Mar del Plata. Source: own elaboration.

(Translation of Figure 376: **References. City of Mar del Plata.** Important areas for the conservation of Birds IACBs-(AICAs). Important areas for the conservation of Birds IACBs-(AICAs). Mar del Plata Operative Area. Navigation Routes. Direct Area of Influence (DAI). Indirect Influence Area (IIA). 12 Nautical Mile-Limit. Limit of the Argentine Territorial Sea. Argentine Sea. BA12 Punta Mogotes Seaside and Mar del Plata Port. BA11 Mar Chiquita Biosphere Coastal Lagoon Reservoir. BA22 Estancia Medaland.)

These AICAs correspond to terrestrial or coastal zones, not covering the marine environment. Considering that there are particular situations requiring special treatment, Dellacasa et al., (2018), **55 Marine AICAS** were defined in Argentina after having considered the different activities and life stages of seabirds (for example breeding, feeding, maintenance and migration). According to BirlLife there are 4 types of marine AICAs: marine extensions of breeding colonies, non-breeding coastal concentrations, feeding areas for pelagic birds, bottlenecks for migration. At a global level there are 4 basic criteria to identify Areas of importance for the conservation of birds; globally threatened species, restricted range species, set of species restricted to a biome and congregations. It should be mentioned that these areas are "candidate sites" to date, awaiting the final confirmation by BirdLife International [12].

Only one marine AICA area is proposed for the study area near the Port of Mar del Plata:

- **Mar Chiquita coastal lagoon.** The lagoon is a wintering area for aquatic birds, waders and terns. Part of the lagoon works as a non-breeding concentration site for juvenile, sub-adult and adult crabeater gulls. In addition, it is a non-breeding settlement area for the skimmer. It comprises 4.9km2 and 200 m wide.

The following stand out regarding Pelagic marine AICAS:

- **Waters of the Northern Patagonia Slope:** It is an area on the continental slope in front of El Rincón, crossed by the 100, 200 and 1,000 m isobaths. It is characterized by the presence and use of space by two large albatrosses, the wandering and the northern royal, very long-lived species that begin to reproduce between 11 and 12 years. The feeding trips are extensive and can cover more than 7,000 km in two weeks. Both species follow ships with the goal of consuming their discards, thus increasing the threat of a negative interaction. The total surface of the proposed area would be 6,080 km2. It shall be crossed by the logistics route that connects the Port of Mar del Plata with CAN_114 Area.

12 https://www.avesargentinas.org.ar/sitios-candidatos-aica-marinas-%C3%A1reas-costeras-y-pel%C3%A1gicas-importantes-para-la-conservaci%C3%B3n-de-las

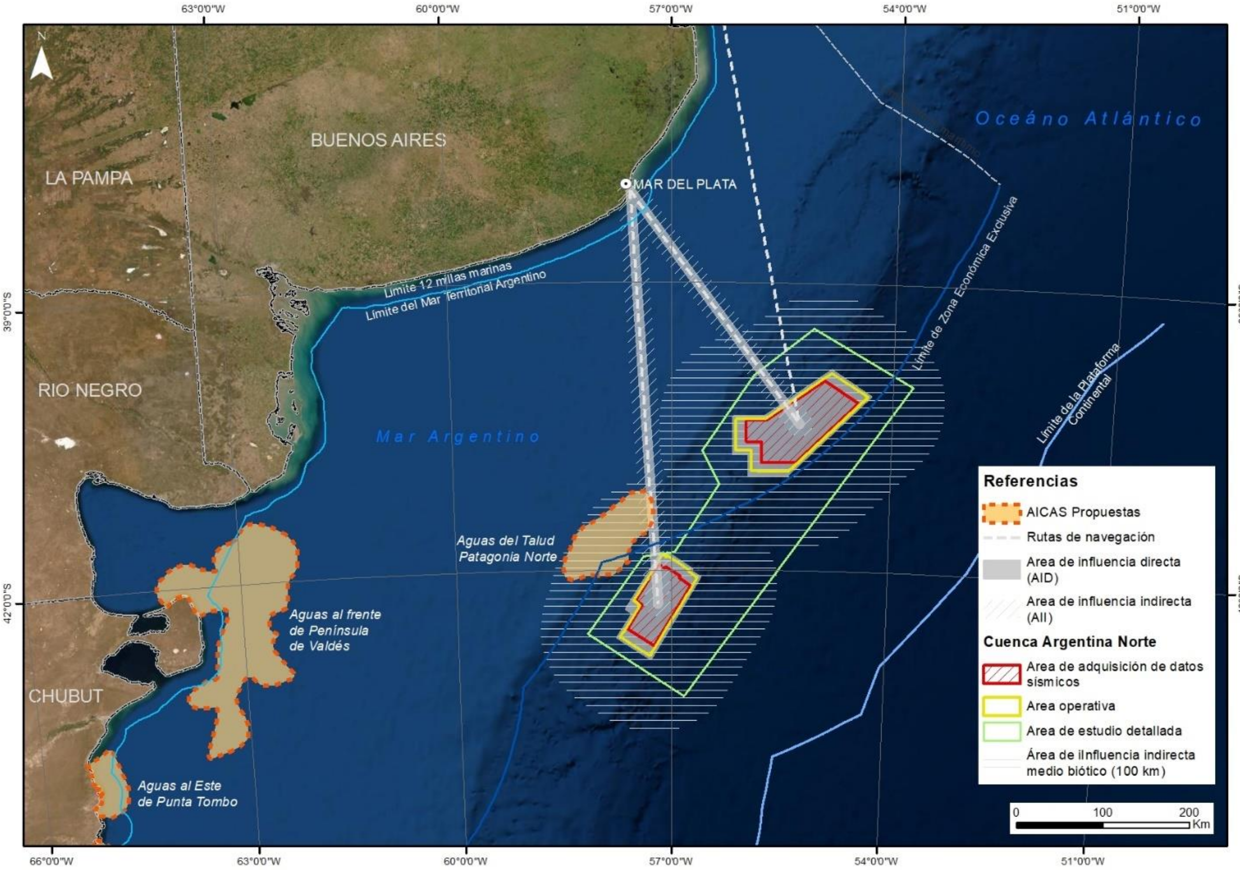


Figure 377. Pelagic AICAs Candidate in the study area and its surroundings.

(Translation of Figure 377: References. City of Mar del Plata. Important areas for the conservation of Birds IACBs-(AICAs). Important areas for the conservation of Birds IACBs-(AICAs). Mar del Plata Operative Area. Navigation Routes. Direct Area of Influence (DAI). Indirect Influence Area (IIA). 12 Nautical Mile-Limit. Limit of the Argentine Territorial Sea. Argentine Sea. BA12 Punta Mogotes Seaside and Mar del Plata Port. BA11 Mar Chiquita Biosphere Coastal Lagoon Reservoir. BA22 Estancia Medaland.)

4.4.6 Bird Migratory Corridors and Hemispheric Shorebird Reserve Network (RHRAP)

Migratory birds move between breeding and wintering areas using migration routes or corridors, which they faithfully follow year after year. In this regard, Petracci, et al. (2005) identified 3 main corridors which are oriented in a north-south direction (Figure 378).

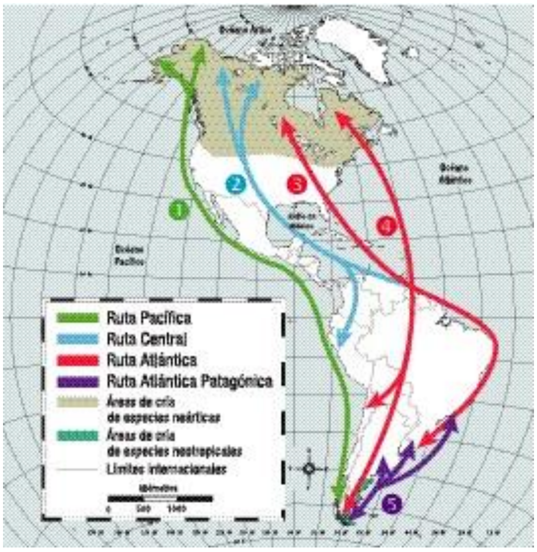


Figure 378. Main migratory corridors in America. Source: Petracci et al. (2005).

(Translation of Figure 378: Reference box: illegible)

According to the authors and depending on the species, they can use the same route or combine different ones during roundtrip flights. Some birds shall have to fly paths of up to 4,000 kilometers non-stop. The feasibility of successfully carrying out its annual migratory cycle is the combined product of the probability of completing each component: breeding, migration and wintering. Any event that threatens one of them shall put the entire process at risk. To this end, the Hemispheric Network of Shorebird Reserves has been created to protect the most important sites for these birds.

This network is the first hemispheric system of networked nature reserves aimed at protecting shorebird species and their habitats in America. The main objective of the network is to protect critical sites for shorebirds: breeding, wintering, transit and stopover areas during migration. There are three classifications for sites: hemispheric, international, or regional. To qualify as hemispheric, a site must be used by more than 500,000 shorebirds per year, or more than 30% of a species. The international site must present a population of at least 100,000 birds per year or more than 10% of a species. And the regional one at least 20,000 per year, or 5% of a species.

The Hemispheric Sites of Argentina are the following: Bahía Lomas (Tierra del Fuero), Atlantic Coast Reserve (Tierra del Fuego) and Laguna Mar Chiquita (Córdoba), International Site Bahía de San Antonio (Río Negro), Bahía de Samborombón (Buenos Aires) and the Gallegos River Estuary (Santa Cruz) and Peninsula Valdés as a Regional Site (Chubut), Estancia Medaland (Buenos Aires) and the Bahía Blanca Estuary (Buenos Aires)[13].

None of these WHSRNs are located in the immediate vicinity of the areas affected by the project.

[13] Western Hemisphere Shorebird Reserve Network. http://whsrn.org/es/sitios-whsrn/mapa-de-sitios

4.5 THREATENED SPECIES PRESENT IN THE AREA OF INFLUENCE

As explained throughout this chapter, the area is inhabited, permanently or temporarily, by various species whose survival faces different degrees of threat worldwide, according to the categorization of the International Union for the Conservation of Nature and the Natural Resources (IUCN, 2014). The IUCN Red List of Threatened Species (www. Https ://www.iucnredlist.org/) is the most comprehensive inventory of the conservation status of animal and plant species worldwide. Its objective is to bring to the public the urgency of conservation problems, as well as to help the international community reduce the risks of species extinction. The list is updated annually with a thorough analysis of the evaluations it contains every four or five years. It uses a set of criteria to assess the risk of extinction of thousands of species and subspecies, which are usually applicable to practically all taxa on the planet.

The Red List of species considers nine criteria structured from highest to lowest risk (the official abbreviations come from the original name in English):

- Extinct *(EX)*,
- Extinct in the wild *(EW)*,
- Critically Endangered *(CR)*,
- Endangered *(EN)*,
- Vulnerable (VU),
- Near threatened *(NT)*,
- Least Concern *(LC)*,
- Data deficient *(DD)*,
- Not evaluated (NE) (species not evaluated for any of the other categories).

The VU, EN and CR categories make up the group of "threatened species" in a nominative way. The list also incorporates the "not evaluated" (NE) categories for species that have not yet been classified, and "Data deficient" (DD) for species that do not hold enough information for a rigorous classification.

The conservation status according to the IUCN has been consulted for the analyzed groups considering the most up-to-date reviews for each one of them.

On the other hand, they have been categorized by different institutions such as SAREM at the national level (Argentine Society for the Study of Mammals) in the case of mammals, AHA (Argentine Herpetological Association) in the case of reptiles and amphibians, and AOP (Del Plata Ornithological Association) for birds. These categorizations are updated very frequently. In accordance with article 4 of its Regulatory Decree No. 666/97 of Law 22,421 on Protection and Conservation of Wild Fauna, the MAyDS has the power to categorize wild fauna according to the following order: endangered species, threatened species, vulnerable species, non-threatened species and insufficiently known species. In any case, the most updated classification can be found in the annexes to Resolution 1055/13 where the conservation status of the species and subspecies of native amphibians and reptiles is indicated. Regarding mammals, the most up-to-date is Resolution 1.030 / 04. These national categorizations defined by the MAyDS were also consulted.

Finally, the Convention on the Conservation of Migratory Species of Wild Animals (CMS) approved by National Law 23.918 (1991) was consulted.

4.5.1 Fish

The richness totals 69 species of fish. A total of 33 species of fish are registered for the area of influence of the project. Fourteeen (14) species, as well as 19 species of bony fish were identified among the most prominent cartilaginous fish, being mostly Rajiformes.

Table 39 presents the list of ichthyofauna and its IUCN categorization (2020) for the Direct Area and the project's surroundings. The dominant category is Not Evaluated (NE: 62%), followed by the Least Concern and Near Threatened. Three vulnerable species (*Bathyraja albomaculata, Zearaja chilensis* and *Squalus acanthias*) and one critically endangered (*Bathyraja griseocauda*) stand out within the chondrictes.

Table 39. Threatened fish species present in the area of influence, according to their conservation status (UICN 2020). *Within the detailed study area.

SCIENTIFIC NAME	COMMON NAME	CLASS	IUCN 2020
*Bathyraja macloviana**	Patagonian Skate	Chondrichthyes	NT
*Bathyraja albomaculata**	White-dotted skate	Chondrichthyes	VU
Bathyraja griseocauda	Greytale skate	Chondrichthyes	EN
*Bathyraja scaphiops**	Cuphead skate	Chondrichthyes	NT
*Bathyraja brachyurops**	Broadnose skate	Chondrichthyes	LC
*Bathyraja magellanica**	Magellan skate	Chondrichthyes	DD
*Bathyrraja cosseasuae**	Raya de aletas juntas	Chondrichthyes	NE
Bathyraja multispinnis *	Joined-fins skate	Chondrichthyes	NT
Zearaja chilensis *	Yellownose skate	Chondrichthyes	VU
Amblyraja doellojuradoi *	Southern thorny skate	Chondrichthyes	LC
*Psammobatis normani**	Shortfin sand skate	Chondrichthyes	DD
*Psammobatis rudis**	Smallthorne sand skate	Chondrichthyes	DD
*Squalus acanthias**	Picked dogfish	Chondrichthyes	VU
Schorederichthys bivius *	Narrowmouthed catshark	Chondrichthyes	NT
Callorhinchus callorhynchus *	Plownose chimarea	Chondrichthyes	NE
Coryphaenoides filicauda	Grenadier	Osteichthyes	NE
Coelorhynchus fasciatus *	Banded whiptail	Osteichthyes	NE
Macrourus holotrachys	Bigeye Grenadier	Osteichthyes	NE
Macrourus carinatus	Ridge scales rattail	Osteichthyes	NE
Lucigadus nigromaculatus	Blackspotted Grenadier	Osteichthyes	NE
Haplomacrourus nudirostris	/	Osteichthyes	NE
Muraenolepis marmorata	Marbled moray cod	Osteichthyes	NE
*Merluccius hubbsi**	Argentine Hake	Osteichthyes	NE
Merluccius australis	Southern Hake	Osteichthyes	NE
*Macruronus magellanicus**	Patagonian Grenadier	Osteichthyes	NE
Antimora rostrata	Blue Antimora	Osteichthyes	LC
Lepidion ensiferus	Patagonian codling	Osteichthyes	NE
Guttigadus kongi	Austral cod	Osteichthyes	NE

SCIENTIFIC NAME	COMMON NAME	CLASS	IUCN 2020
*Notophycis marginata**	Dwarf codling	Osteichthyes	NE
*Salilota australis**	Tadpole codling	Osteichthyes	NE
*Micromesistius australis**	Southern Blue whiting	Osteichthyes	NE
Seriolella porosa	Choicy Ruff	Osteichthyes	NE
Urophycis cirrata	Gulf Hake	Osteichthyes	LC
*Mancopsetta maculata**	Antarctic armless flounder	Osteichthyes	NE
*Mancopsetta milfordi **	Finless flounder	Osteichthyes	NE
*Cottunculus granulosus**	Fathead	Osteichthyes	NE
Psychrolutes marmoratus	Fathead	Osteichthyes	NE
Praematoliparis anarthractae	Snailfish	Osteichthyes	NE
Paraliparis cf. anarthractae	Snailfish	Osteichthyes	NE
Paraliparis eltanini	Snailfish	Osteichthyes	NE
Congiopodus peruvianus	Horsefish	Osteichthyes	NE
Sebastes oculatus	Patagonian redfish	Osteichthyes	NE
Cataetyx messieri	Brótula patagónica	Osteichthyes	LC
Ariosoma opistophthalmum	Conger	Osteichthyes	LC
Bassanago albescens	Hairy Conger	Osteichthyes	LC
Conger orbignianus	Argentine Conger	Osteichthyes	LC
*Pseudoxenomystax albescens**	Conger eel	Osteichthyes	LC
Diastobranchus capensis	Basketwork eel	Osteichthyes	NE
Aldrovandia phalacra	Hawaiian halosaurid fish	Osteichthyes	LC
Notacanthus sexspinis	Spiny-back eel	Osteichthyes	NE
Notacanthus chemnitzii	Snubnosed spiny eel	Osteichthyes	LC
Bathypterois longipes	Pez tripode	Osteichthyes	LC
Mictophidae sp.	Myctophidae	Osteichthyes	NE
Ophthalmolycus macrops	Eelpout	Osteichthyes	NE
Plesienchelys stehmanni	Eelpout	Osteichthyes	NE
Phucocoetes cf. latitans	/	Osteichthyes	NE
*Illucoetes fimbritatus**	Eelpout	Osteichthyes	NE
*Lycenchelys bachmanni **	Eelpout	Osteichthyes	NE

SCIENTIFIC NAME	COMMON NAME	CLASS	IUCN 2020
*Stromateus brasiiensis**	Southwest Atlantic Butterfish	Osteichthyes	NE
*Thyrsites atun**	Snoek	Osteichthyes	NE
*Disssotichus eleginoides**	Patagonian Toothfish	Osteichthyes	NE
*Patagonotothen ramsayi**	Longtail Southern cod	Osteichthyes	NE
*Epigonus robustus**	Robust cardenalfish	Osteichthyes	NE
Cottoperca gobio	Cannel Bull blenny	Osteichthyes	NE
Schedophilus griseolineatus	/	Osteichthyes	NE
Argyropelecus aculeatus	Lovely hatchetfish	Osteichthyes	LC
Stomias boa	Boa dragonfish	Osteichthyes	LC
Bathophilus vaillanti	/	Osteichthyes	LC
*Genypterus blacodes**	Pink cusk eel	Osteichthyes	NE
*Scopelosaurus lepidus**	/	Osteichthyes	LC

No classification categories were found at the National level (SAyDS, 2007).

4.5.2 Reptiles

Of the 7 species of sea turtles currently recognized, there are 3 potentially present in the project's area of influence, two confirmed for the detailed study area, and only one (loggerhead turtle) with records within the operational area and that of direct influence of CAN_100 - 108 sites. According to the latest version of the IUCN Red List of Threatened Species of January 2020, all species of sea turtles in the Southwest Atlantic region are within global categories of threat of extinction and its population is declining. All species are also on the CMS and CITES appendices. Of the three confirmed for the study area, their classification is herein below described by Table 40.

Table 40. Threatened species of turtles present in the area of influence, according to their conservation status.

Species	Common Name	MAyDS[a]	UICN[b]
Caretta caretta	Loggerhead Sea turtle	A	VU[1]
Chelonia mydas	Green Sea turtle	A	EN[2]
Dermochelys coriacea	Leatherback turtle	EP[3]	VU

[a] MAyDS. Res. 1055/13. EP: endangered, A: threatened, V: vulnerable, NA: not threatened, IC: insufficiently known.

http://servicios.infoleg.gob.ar/infolegInternet/anexos/215000-219999/219633/norma.htm.

[b] IUCN (International Union for Conservation of Nature and Natural Resources) 2020-1: Red List of Endangered Species (www.iucnredlist.org LC: low risk, does not qualify for conservation categories; NT: low risk, close to threatened. VU: vulnerable; EN: endangered; CR critically endangered.

[1] Although the species is considered a vulnerable category (VU) globally, the review by Casale and Tucker (2017) would consider the populations of the Southwest Atlantic as of Least Concern (LC).

[2] Although the species is considered within a vulnerable category (VU) at a global level, the review by Broderick and Patricio (2019) considers that the populations of the southwest Atlantic are increasing as a result of the conservation measures that have been put into practice and qualify them as Least Concern (LC).

[3] This is the most critical species locally as it is in danger of extinction.

In relation to the convention on the conservation of migratory species of wild animals (CMS), approved by National Law 23.918 (1991), it is important to mention that the 3 species of turtles are included in Appendix I.

4.5.3 Birds

Fourty-nine (49) potentially present species were counted for the study area with 46 confirmed occurrences in recent years. The following order is displayed in the project area: Spheniciformes (penguins), with 6 species) Procellariiformes (petrels, albatrosses and shearwaters) with 34 species, Pelecaniformes with 1 species and Charadriformes (plovers and jaegers) with 8 species.

Table 41 displays the list of species with confirmed presence along with their Categorization of the Conservation Status of Native Birds (CAT-AR 2015), and the Red List of threatened species prepared by the IUCN 2020-1 version (most of the species were evaluated in 2018 or before).

Table 41. Conservation status of the species of seabirds present in the area.

Family	Common Name	Scientific Name	CAT-AR 2015 [1]	UICN-2020 [2]
Sphenisci-dae	King Penguin	*Aptenodytes patagonicus*	NA	LC
	Emperor Penguin	*Aptenodytes forsteri*	VU	NT
	Chinstrap Penguin	*Pygoscelis antarcticus*	VU	LC
	Magellanic Penguin	*Spheniscus magellanicus*	VU	NT
	Macaroni Penuin	*Eudyptes chrysolophus*	AM	VU
	Rockhopper Penguin	*Eudyptes chrysocome*	EN	VU
Diomede-idae	Royal Albatross	*Diomedea epomophora*	VU	VU
	Northern Royal Albatross	*Diomedea sanfordi*	VU	EN
	Wandering Albatross	*Diomedea exulans*	AM	VU
	Tristan Albatross	*Diomedea dabbenena*	NA(oc)	CR
	Sooty Albatross	*Phoebetria fusca*	NA(oc)	EN
	Light-mantled Albatross	*Phoebetria palpebrata*	NA	NT
	Yellow-nosed Albatross	*Thalassarche chlororhynchos*	EN	EN

Family	Common Name	Scientific Name	CAT-AR 2015 [1]	UICN-2020 [2]
	Black-browed Albatross	*Thalassarche melanophris*	VU	LC
	Grey-headed Albatross	*Thalassarche chrysostoma*	EC	EN
	Shy ALbatross	*Thalassarche cauta*	NA	NT
	White-capped Albatross	*Thalassarche steadi*	NA(oc)	NT
Procelari-idae	Common Giant Petrel	*Macronectes giganteus*	VU	LC
	Hall´s Giant Petrel	*Macronectes halli*	NA	LC
	Southern Fulmar	*Fulmarus glacialoides*	NA	LC
	Pintado Petrel	*Daption capense*	NA	LC
	Soft-Plumaged Petrel	*Pterodroma mollis*	NA	LC
	Atlantic Petrel	*Pterodroma incerta*	NA	EN
	White-headed Petrel	*Pterodroma lessonii*	NA(oc)	LC
	Trinidade Petrel	*Pterodroma arminjoniana*	NA(oc)	VU
	Blue Petrel	*Halobaena caerulea*	NA	LC
	Atlantic Prion	*Pachyptila desolata*	NA	LC
	Slender-billed Prion	*Pachyptila belcheri*	VU	LC
	Grey Petrel	*Procellaria cinerea*	NA(oc)	NT
	White-chinned Petrel	*Procellaria aequinoctialis*	AM	VU
	Large Shearwater	*Calonectris borealis*	NA	LC
	Cory´s shearwater	*Calonectris diomedea*	NA	LC
	Sooty Shearwater	*Ardenna grisea*	NA	NT
	Pardela cabeza negra	*Ardenna gravis*	NA	LC
	Manx Shearwater	*Puffinus puffinus*	NA	LC
	Litlle Shearwater	*Puffinus assimilis*	IC	LC
Hydro-batidae	White-bellied Storm Petrel	*Fregetta grallaria*	NA(oc)	LC
	Black-bellied Storm Petrel	*Fregetta tropica*	NA	LC
	Wilson´s Storm Petrel	*Oceanites oceanicus*	NA	LC
	White-faced Storm	*Pelagodroma marina*	NA(oc)	LC

Family	Common Name	Scientific Name	CAT-AR 2015 [1]	UICN-2020 [2]
	Petrel			
Pelecanoi-didae	Common diving Petrel	*Pelecanoides urinatrix*	NA	LC
Stercora-riidae	Chilean Skua	*Stercorarius chilensis*	EN	LC
	Brown Skua	*Catharacta antárctica (Stercorarius antarcticus)*	VU	LC
	South Polar Skua	*Catharacta maccormicki*	AM	LC
	Great Skua	*Catharacta pomarinus*	NA(oc)	LC
	Arctic Skua	*Stercorarius parasiticus*	NA	LC
	Long-tailes skua	*Stercorarius longicaudus*	NA	LC
Laridae	Arctic Tern	*Sterna paradisaea*	NA	LC
	Antarctic Tern	*Sterna vittata*	NA	LC

[1] Res. MADS 795/17 Ref. Wild Fauna - Categorization of the Conservation Status of Native Birds 2015. 13/11/2017 (BO 14/11/2017). EP Endangered, AM Threatened, VU vulnerable, NA not threatened, NA (oc) not threatened because it occurs occasionally, IC insufficiently known. (https://avesargentinas.org.ar/sites/default/files/Categorizacion-de-aves-de-la-Argentina.pdf)

[2] IUCN (International Union for Conservation of Nature and Natural Resources) 2020-1: Red List of Endangered Species (www.iucnredlist.org): critically endangered, EN endangered, VU vulnerable, NT near threatened or low risk, LC least concern (not threatened).

Although the schemes are equivalent in terms of the definition of the categories, the species do not necessarily coincide in their categorization. According to the categorization of birds in Argentina (2017), 8 of the identified species are under some category of threat of extinction and 9 are almost threatened. According to the most recent publication of the IUCN Red List (2020), 12 species are presented under threat categories (CR, EN and VU) and 7 as near threatened (NT).

As regards the convention on the conservation of migratory species of wild animals (CMS), approved by National Law 23.918 (1991), it should be mentioned that all Procellariiformes and the Arctic Tern are included in Appendix II.

For further details, see **Error! Reference source not found.** and **Error! Reference source not found.** Points.

4.5.4 Marine mammals

Fourty-one (41) potentially present species were counted for the detailed study area, with confirmed occurrences for only 13 of them. Four species have been recorded as to Pinnipeds (Carnivora): South American Fur seal (Arctocephalus australis), the Antarctic fur seal (Arctocephalus gazella), South American sea lion (Otaria flavescens) and the southern elephant seal (Mirounga leonina). Regarding Cetaceans (Cetartiodactyla), there are recorded occurrences for 4 species of whales - the right whale, the blue whale, the sei whale and the fin whale, 4 species of dolphins - Long-finned pilot whale (Globicephala melas), the bottlenose dolphin (Tursiops truncatus), dusky dolphin (Lagenorhynchus obscurus) and killer whale (Orcinus orca) and sperm whale (Physeter macrocephalus).

The following Table presents the list of species with confirmed presence with their Categorization of the Mammals of Argentina according to their Extinction Risk (CatAr-2019), and the Red List of threatened species prepared by the IUCN 2020-1 version.

Table 42. Conservation status of the marine mammal species in the area.

Scientific Name	Common Name	CatAr-2019[a]	UICN-2020-1[b]
Arctocephalus australis	South American fur Seal	LC	LC
Arctocephalus gazella	Antarctic fur seal	LC	LC
Arctocephalus tropicalis	Subantarctic fur seal	LC	LC
Otaria flavescens	South American sea lion	LC	LC
Hydrurga leptonyx	Leopard seal	LC	LC
Leptonychotes weddellii	Weddell seal	LC	LC
Lobodon carcinophaga	Crabeater seal	LC	LC
Mirounga leonina	Southern elephant seal	LC	LC
Eubalaena australis	Southern right whale	LC	LC
Balaenoptera acutorostrata	Northern minke whale	DD	LC
Balaenoptera bonaerensis	Antarctic Minke whale	DD	NT
Balaenoptera borealis	Sei whale	EN	EN
Balaenoptera edeni	Eden´s whale	DD	LC
Balaenoptera musculus	Blue whale	EN	EN
Balaenoptera physalus	Fin whale	EN	VU
Megaptera novaeangliae	Humpback whale	LC	LC
Caperea marginata	Pygmy right whale	DD	LC
Delphinus delphis	Common dolphin	LC	LC
Feresa attenuata	Pygmy killer whale	NA	LC
Globicephala melas	Long-finned pilot whale	LC	LC
Grampus griseus	Risso´s dolphin	LC	LC
Lagenorhynchus australis	Peale´s dolphin	LC	LC
Lagenodelphis hosei	Fraser´s dolphin	DD	LC
Lagenorhynchus cruciger	Hourglass dolphin	DD	LC
Lagenorhynchus obscurus	Dusky dolphin	LC	LC
Lissodelphis peronii	Southern right whale dolphin	DD	LC

Scientific Name	Common Name	CatAr-2019[a]	UICN-2020-1[b]
Orcinus orca	Killer whale	LC	DD
Pseudorca crassidens	False killer whale	DD	NT
Stenella attenuata	Pantropical spotted dolphin	NA	DD
Stenella coeruleoalba	Striped dolphin	LC	LC
Tursiops truncatus	Bottlenose dolphin	VU[c]	LC
Berardius arnuxii	Arnoux´s beaked whale	DD	DD
Hyperoodon planifrons	Southern bottlenose whale	DD	LC
Mesoplodon grayi	Gray´s beaked whale	DD	DD
Mesoplodon hectori	Héctor´s beaked whale	DD	DD
Mesoplodon layardii	Strap-toothed whale	DD	DD
Tasmacetus shepherdi	Shepher´s beaked whale	DD	DD
Ziphius cavirostris	Cuvier´s beaked whale	DD	LC
Kogia breviceps	Pygmy sperm whale	DD	DD
Kogia sima	Dwarf sperm whale	NA	DD
Physeter macrocephalus	Sperm whale	VU	VU

[a] Categorization of the Mammals of Argentina according to their Extinction Risk - 2019 (CAT-Ar) (http://cma.sarem.org.ar/es/especies-nativas) : CR critically endangered, EN endangered, VU vulnerable , LC Least Concern NA Not Threatened, DD Data Deficient.

[b] UICN (International Union for Conservation of Nature and Natural Resources) 2020-1: Red List of Endangered Species (www.iucnredlist.org): CR critically endangered, EN endangered, VU vulnerable, NT near threatened or low risk , LC least concern (not threatened), DD Data Deficient.

[c] Two populations of *Tursiops truncatus* would co-occur in Argentine waters: *T. t. gephyreus* corresponds to the population present in Bahía San Antonio, Río Negro and has EN category, which differs genetically from *T. t. truncatus* that forms the populations of Uruguay and southern Brazil and for which there is no information to categorize it (DD).

There are five threatened species, 4 of them with confirmed presence for the study area. The names of Argentine and IUCN categories are equivalent in terms of meaning, but not necessarily in terms of threatened species. For example, the sei, blue and fin whales are endangered (EN) in Argentina, but globally, (IUCN) the fin whale is only vulnerable (VU). The sperm whale is vulnerable in both categories, while the bottlenose dolphin is vulnerable for Argentina, but it is not threatened globally. There is insufficient information to assess the risk of extinction threat (DD) of the largest proportion of species with probable presence in the study area.

In relation to the convention on the conservation of migratory species of wild animals (CMS), approved by National Law 23.918 (1991), it is important to mention that *Eubalaena australis, Balaenoptera borealis, Balaenoptera physalus, Balaenoptera musculus, Megaptera novaeangliae, Tursiops truncatus ponticus, Physeter macrocephalus Lagenorhynchus obscurus, Arctocephalus australis, Otaria flavescens, Balaenoptera bonaerensis* and *Balaenoptera edeni* are included in the appendices.

For further details, see **Error! Reference source not found.** and **Error! Reference source not found.** Points.

5 ANTHROPIC ENVIRONMENT

The delimitation of the relevant anthropic environment was based on the area of influence defined for the project and its socio-economic use; comprising the Port of Mar del Plata, the logistical support port defined for the Project, CAN_100-CAN_108 Area being located 300 km from Mar del Plata, and finally CAN_114 Area more than 440 km from Necochea.

The seismic acquisition area is a maritime zone and its development is directly linked to fishing activity and to national and international administrative agencies. The project is developed beyond the 12 miles corresponding to the territorial sea; CAN_100-CAN_108 Area is within the Exclusive Economic Zone (EEZ), while CAN_114 Area is outside it, but within the jurisdiction of the National State, since it is the Continental Shelf, duly measured and explored, in accordance with the requirements of the CONVEMAR [14].

The information presented and analyzed is based mainly on the survey of secondary sources: academic documents, INDEC censuses and statistics, NGO surveys, georeferenced information available in free software (such as Google earth), official websites of institutions and national organizations, among others.

5.1 DESCRIPTION AT REGIONAL LEVEL

This section briefly describes the Argentine political-administrative conditions. It seeks, on the one hand, to provide a general and synthetic panorama of the socio-economic context of the country in which the project shall be developed and, at the same time, to give accurate information to contextualize the political-administrative and economic situation of the maritime zone that shall be affected by it.

5.1.1 Administrative and Political context

As already mentioned, the project is located in the maritime zone according to the CONVEMAR [15]. This zone is under the sovereignty of the coastal country for the purposes of exploration, exploitation, conservation and administration of both living and non-living natural resources [16]. It is an area that is governed by Argentine regulations and its competent authorities.

The study areas correspond to the Offshore International Public Tender N ° 1 (Round N ° 1) for the award of exploration permits for the search for hydrocarbons offshore the National scope.

Next, an image is displayed detailing those areas presented in the northern sector of the aforementioned public tender: 14 blocks corresponding to the North Argentina Basin (CAN).

[14] Convention on the Law of the Sea.

[15] It was incorporated in the Argentine Law through Act N° 24.543 in 1995.

[16] See: Convención de las Nacionales Unidas sobre el Derecho del Mar – 1982 (http://www.un.org/depts/los/convention_agreements/texts/unclos/convemar_es.pdf)

Figure 379. View of the blocks in the northern sector of the Offshore International Public Tender N ° 1 (Round N ° 1). Source: Secretariat of Energy - Ministry of Finance, available at: https://costaafuera.energia.gob.ar/docs/presentaciones/Presentacion%20Ronda%201%20%20CONEXPLO%202018%20Mendoza.pdf.

(Translation of Figure 379: Límite lateral Marítimo Argentino - Uruguayo. Argentine - Uruguayan lateral maritime limit. Límite de la plataforma continental: Continental shelf limit. Límite de la zona económica exclusiva: Exclusive Economic Zone limit).

To a greater degree of approximation, CAN_108 Area and CAN_114 Area are located in the North Basin in Zone 5 along with five other areas as can be seen in the following image.

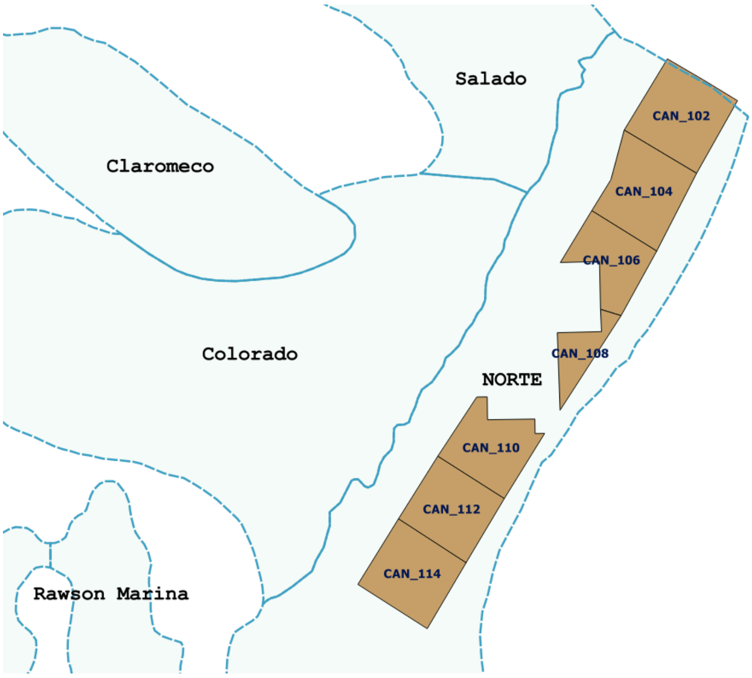


Figure 380. Location of CAN_108 and CAN_114 Area and the other Areas that make up Zone 5. Fuente: "Source: "Bid opening scheme for the Offshore International Public Tender N° 1. Resolution 65/2018". Secretariat of Energy - Ministry of Finance.

On the other hand, it should be noted that through Resolution 55/2020 of the Ministry of Energy, the government authorized YPF to grant 50% of an offshore exploration permit to EQUINOR.

In August 2019, YPF and EQUINOR entered into an agreement for offshore exploration in Argentina through a partnership in the CAN_100 block. Said agreement determined the main terms and conditions for the assignment of the aforementioned 50%, which shall allow both companies to expand their alliance in the exploration of the Argentine offshore.

5.1.2 Nearby coastal towns

- City of Mar del Plata

The CAN_100-CAN_108 Area under study is located more than 300 km from the coast of the City of Mar del Plata. This city is located southeast of the province of Buenos Aires, on the coast of the Argentine sea. It is the main city of "General Pueyrredón" district, an important port and seaside resort; and the second most important tourist city at the country level, following the Autonomous City of Buenos Aires, since it can increase its population density by 300% during the summer.

Its main industries are fisheries, tourism and textiles. The fishing activity has been developed in this report in Point **Error! Reference source not found.**.

- Necochea City

The "CAN 114" Area is located more than 400 km from the coast of the City of Necochea, located south of the province of Buenos Aires, on the Atlantic coast. It is the main city of the homonymous district, with wide beaches and an important port located at the mouth of the Quequén Grande River and the Argentine Sea. It is also a tourist center during the summer months, but on a considerably smaller scale than the aforementioned City of Mar del Plata.

In the map below you can see the location of CAN_100-CAN_108 Area and CAN_114 Area in relation to the cities hereinbefore mentioned.

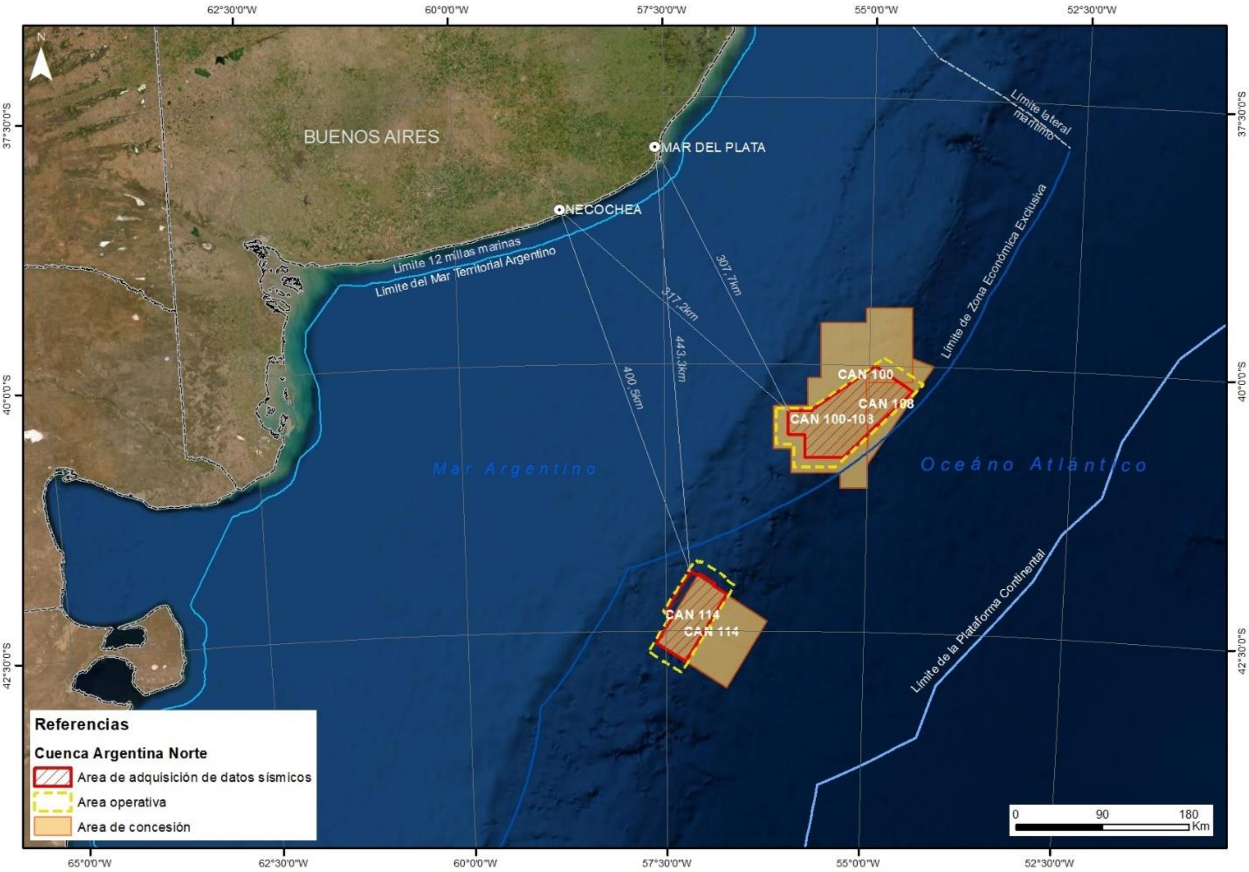


Figure 381. Location of the CAN_100, CAN_108 and CAN_114 Areas in relation to Mar del Plata and Necochea coastal cities. Source: own elaboration.

(Translation of Figure 381: **References.** Argentina North Basin (ANB) (CAN). Seismic Data Acquisition Area. Operative Area. License Area. Atlantic Ocean. Argentine Sea. 12 Nautical Mile-Limit. Argentina Territorial Sea Limit. Continental Shelf Limit. Exclusive Economic Zone Limit. Maritime Lateral Limit. Province of Buenos Aires. Cities of Mar del Plata-Necochea. Can 114- CAN 114- CAN 100-103- CAN 108- CAN 100.)

5.1.3 Port of Mar del Plata

Although the seismic data acquisition areas are located in the maritime zone, the Port of Mar del Plata shall be the land support for very specific activities: crew changes and supplies. It is geographically located on the Argentine Sea at the following coordinates: 38º 01 ′ S; 57º 32 ′ W, 400 km from the city of Buenos Aires, on National Route N ° 2 on the coast of Mar del Plata, head city of the General Pueyrredón Borough, Province of Buenos Aires.

The port administration is in charge of the Mar del Plata Regional Port Consortium, a non-state public entity aimed at managing and exploiting the Port of Mar del Plata. It has legal, financial, accounting and administrative independence and is subject to external audit, through the Administrative Court and the Bodies of the Constitution of the province of Buenos Aires. Its Board of Directors is chaired by a representative of the provincial Executive Power (Province of Buenos Aires) and made up of municipal, private and union representatives (Municipality of General Pueyrredón), (industrial, commercial and union chambers and associations of the port area). On the other hand, the Argentine

Coast Guard, Mar del Plata branch, is in charge of providing security.

This maritime port has two well differentiated sectors: a purely military area that encompasses the properties and facilities surrounding the Mar del Plata Naval Base according to Decree No. 425/78 (under the jurisdiction of the Mar del Plata Coast Guard); and the commercial part°that covers the rest of the port area where the movements of the fishing activity prevail, but it is also registered in the oil, cereal and tourist exploitation areas.

By land, access is through Vertiz and Ortiz de Zarate Avenues, while those of Martínez de Hoz, Juan B. Justo and 12 de Octubre Avenues are reserved for tourism. National road No. 2 should be highlighted to get to the city, which connects it with Greater Buenos Aires and CABA. It is worth mentioning National Road No. 226 and National Road No. 11 and 88 to access other urban centers. All the routes to which reference has been made are paved and in good conditions.

For the maritime access, on the other hand, there is an access channel set at 238º 39 ′. It is 100 meters wide and 11 meters deep in relation to the local zero. Then, it has a secondary access channel set in its line at 216º 20 ′, with the same depth, used in times prior to the periodical dredging of the main access. In order to enhance the security conditions for the entry of large ships to the port, the Mar del Plata Regional Port Consortium has a navigation simulator in order to verify if security conditions are in place[17]. The types of Ships that operate in the Port under study are oil tankers, freezer trawlers, passenger ships and bulk carrier fishing vessels.[18]

The Port provides the following navigation and operation services:

- Trailer Services: towing for canal navigation, docking, approach with a towline or undocking, assistance and rescue of ships that have difficulties with broken moorings, damage to machines or helm, beaching, etc. MDP Port Management SRL and Remolcadores MDP SA are in charge of the operations needed.

- Mooring Services: during stopovers / stays, ships are moored and lengthened. The mooring lines of the ships are placed in the mooring bollards at the dock. Marina Port Service SRL is in charge of rendering the previously mentioned services.

- Stowage Services: The stevedores are especially in charge of loading and unloading ships. Operan los sindicatos The SUPA and the FEDERACION DE COOPERATIVAS DE ACTIVIDADES PORTUARIAS Y AFINES LTDA Unions operate these activities.

- Pilotage Services: The pilot helps the captain to steer a ship to and from a port, roadstead or river. He contributes with his experience at the nautical level (tides, currents, etc.), as well as in terms of entry maneuvers. MDP Port Management SRL is in charge of operations.

[17] https://puertomardelplata.net/arribo-a-puerto/

[18] https://www.mardelplata.com/puerto/

As a result of the arrival of different types of overseas vessels (container carriers, grain carriers, freezer, passengers, etc.), the Security Area, through the Port Facility Protection Officer, ensures strict compliance with the established international security standards in the Ship and Port Facilities Protection Code (ISPS) [19], applying the appropriate procedures for each type of ship upon arrival.

It is worth mentioning that, as reported by the Port authorities on their website, from 07/01/2004 to date, all ships that have called at this port have done so with a level of protection 1, with no recorded incidents.

In addition, in December 2005, the Argentine Coast Guard certified that the Port Facility Consorcio Portuario Regional de Mar del Plata Terminals 2 and 3, has verified compliance with Chapter XI-2 and Part A of the International Code for the Protection of Ships and Port Facilities (ISPS Code), thus obtaining the category of Safe Harbor.

On the other hand, the Port offers the possibility of taking the course on Protection of Ships and Port Facilities about the importance of security and the need to interpret the scope and objectives of the application of the ISPS code in a Port Terminal, intended for personnel who exercises activity, trade or profession in port jurisdiction. It is recognized and approved by the Argentine Coast Guard and is valid in all ports of the Argentine Republic.

The rest of the services provided by the port are hereinbelow listed:

- Shipping agencies
- Customs Officers
- Gastronomy
- Naval Warehouses
- Fuel Provision
- Provision of Drinking Water
- Electric Power Provision
- Naval Workshops
- Diving and Naval Rescue
- Storage Plants
- Integral Suppliers
- Shipyards
- Waste Collection (“Transporte 9 de Julio S.A.” Company)

[19] As of 1 July 2004, the application of the International Ship and Port Facility Security Code (ISPS Code) entered into force, which is a party to the International Convention for the Safety of Life at Sea (SOLAS 74), to which Argentina is a signatory and the Argentine Coast Guard is its implementing authority in National jurisdiction.

Figure 382. South Sector of the Port of Mar del Plata. Fuente: Source: Information Guide - Port of Mar del Plata. Undersecretariat of Port Activities. Provincial Office of Port Planning. November 2016.

Below is a description of the operational sites offered by the Management Consortium of the Port of Mar del Plata on its official website.

TERMINAL N° 1

ESPIGON N° 1

Cuenta con instalaciones de permisionarios afectados a la provisión de combustible, fabrica de hielo, industrialización de pescado y gestión administrativa, y con inmuebles como el Ex-Mercado Nacional de Concentración Pesquera para el remate y trasvase de pescado fresco.

DARSENA DE PESCADORES Y ESPIGON N° 10

Se realizan las operaciones de alistamiento y descarga de embarcaciones de pesca denominadas Rada/Ria y Costeros

TERMINAL N° 2

ESPIGON N° 2

Se encuentran diversas instalaciones destinadas a las tareas de apoyo logístico a la flota pesquera y flota de buques porta-contenedores. Se divide en seis secciones, todas ellas operativas.

ESPIGON N° 3

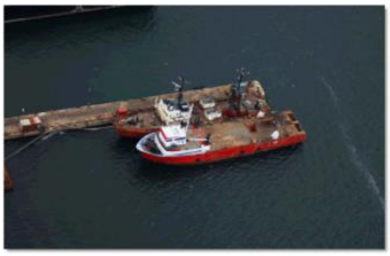
Sobre su frente de atraque existe la galería de embarque de granos que opera por transferencia desde los silos hacia los buques. En el área del Espigon N° y calle B se encuentran las instalaciones de la Ex-Junta Nacional de Granos, actualmente concesionada a la Firma Elevadores Mar del Plata S.A. que acopian un total de 20.000 tns. de granos, pudiendo alcanzar hasta 25.000 tns. en caso de ejecutar los trabajos de reparación necesarios. Existe una galería de embarque con ocho (8) mangas, estimándose la carga en 400 tns. por hora.

Consta de un Muelle de Hormigón de 276 mts. de longitud, dividido en dos Secciones 12da. y 13ra., cuyo frente en un largo de 250 mts. esta concesionado a la sociedad anteriormente citada. Este es utilizado para el atraque de buques de ultramar. Asimismo cuenta con un sector de conexión entre los Espigones n° 2 y n° 3, formado por un frente de 134 mts. de longitud denominado como Sección 11ma., en la que realizan operaciones de descarga y alistamiento embarcaciones pesqueras.

TERMINAL N° 4

ESPIGON N° 7

Este atracadero fue desafectado de las operaciones de combustible utilizándose actualmente para el amarre de embarcaciones inactivas (línea de amarre), remolcadores de puerto y unidades de la Prefectura Naval Argentina.



TERMINAL N° 5

POSTA DE INFLAMABLES

Estas instalaciones permiten la operación de un solo buque para derivar cargas de combustible líquido a los depósitos de las plantas de YPF y la central 9 de Julio.

Delimitación del área que abarca: las áreas que ocupa el Puerto Mar del Plata tanto en su Zona Militar como Comercial, se encuentran definidas con claridad en los Decretos N° 425/78 y 1951/83, que se transcriben parcialmente a continuación.

ZONA PORTUARIA MILITAR

Decreto N° 1951 / Buenos Aires, 2-8-83

Articulo 1 – Sustituyese el inciso a) del articulo 1° del Decreto N 425 de fecha 15 de febrero de 1978 , en el que se determinan los limites de la Zona Portuaria Militar del Puerto de Mar del Plata, por el siguiente:

Zona Portuaria Militar: Por el Norte, la línea exterior del pie de la Escollera Norte; por el Oeste, el cerco existente sobre el costado Este de la Avda. Martínez de Hoz, hasta la prolongación del Costado Norte de la Avda. Juan B. Justo; por el Sur, la prolongación de la línea antes citada hasta llegar a una paralela al eje del Espigon N° 4, situada a doscientos cincuenta metros (250 m) al Sur del Talud Norte de la Dársena E de Hidroaviones, y por esta línea hasta llegar a la laguna siguiendo su borde hacia el Sur hasta llegar a una paralela al Espigon N° 4 que abarque hacia el Sur toda la actual escollera de piedra existente, conforme se señala en el croquis que como Anexo I forma parte integrante del presente decreto.

ZONA PORTUARIA COMERCIAL

Al Norte, el limite Sur de la zona anterior; al Oeste, una línea paralela a cinco metros del Cordón Este de la Avda. Martínez de Hoz y ubicada al Este del mismo, hasta su intersección con el limite Norte de la Parcela 3b de la ex chacra 91, correspondiente al plano de replanteo de la misma, conforme al plano 45-525-46 de la Dirección de Geodesia de la Provincia de Buenos Aires, siguiendo dicho limite por una longitud de 24,57 metros, y luego por el lado Sudeste (según ángulo de 101° 18') de la misma paralela, en una longitud de 61,27 metros. A partir de este punto retomara la línea de cinco metros al Este del Cordón Este de la Avda. Martínez de Hoz, hasta interceptar una paralela al eje del arranque de la Escollera Sur, ubicada a 850 metros del mismo; al Sur, el limite será la paralela al eje del arranque de la Escollera Sur, hasta el mar.

Figure 383. Sites and areas of the Port of Mar del Plata. Taken from: https://puertomardelplata.net/sector-operativo/

It should also be noted that the Port is a tourist destination because it is part of the Buenos Aires seaside resort and the Southern Cone Cruise Association, which designated the port as a terminal station for international cruise ships.

It offers varied recreational, cultural and commercial activities.

- <u>Commercial and Gastronomic Complex:</u> Gastronomy offer based on fish and shellfish, canned products and regional souvenirs.

- <u>Museum of the Man of the Port "Cleto Ciocchini"</u>: It was opened in 1990 with an important collection of photos, documents, bibliography and customs of the first settlers of the area.

- <u>Monument to the Fisherman:</u> Funded by the community of the port of Mar del Plata, it is a work of art made from a single block of stone by the sculptor Capurro. It is close to the “Banquina del Puerto”.

In addition, it has the "Paseo Banquina Pescadores", tourist boats, the sea lion, North and South Breakwaters and the Nautical Club, among others.

Figure 384. Tourist map of the Port of Mar del Plata. Source: https://www.mardelplata.com/puerto/mapa.html

Figure 385. Seals Island. Source: https://www.mardelplata.com/puerto/fotos.html

- Contacts

- Management Consortium of the Port of Mar del Plata
  Address: B/P Marlín 404 and "De los Pescadores" Ave., Mar del Plata, Province of Buenos Aires.
  Phones: +54 0223 480 – 2041
  +54 0223 480 – 2095
  +54 0223 480 – 5261
  Website: http://www.puertomardelplata.net/

- Provincial Office of Port Planning - Undersecretariat of Port Activities
  Address: Giaggino St. and Italia St., Ensenada, Province of Buenos Aires
  Phone: +54 0221 460-1014
  Email: planeamientoportuario@mp.gba.gov.ar

5.1.4 Surface inspection and exploration Licensees

There are other blocks bordering those that involve CAN_100 - 108 and CAN_114 acquisition areas under study, which have also been part of the Offshore International Public Tender No. 1.

Below is a description of the projects identified around the aforementioned areas:

More precisely, CAN_100 block borders to the north with CAN_105 block, to the northeast with CAN_106, CAN_107 block is located to the northwest, CAN_109 block to the southwest and CAN_110 to the south. CAN_108 block borders to the north with CAN_106 block.

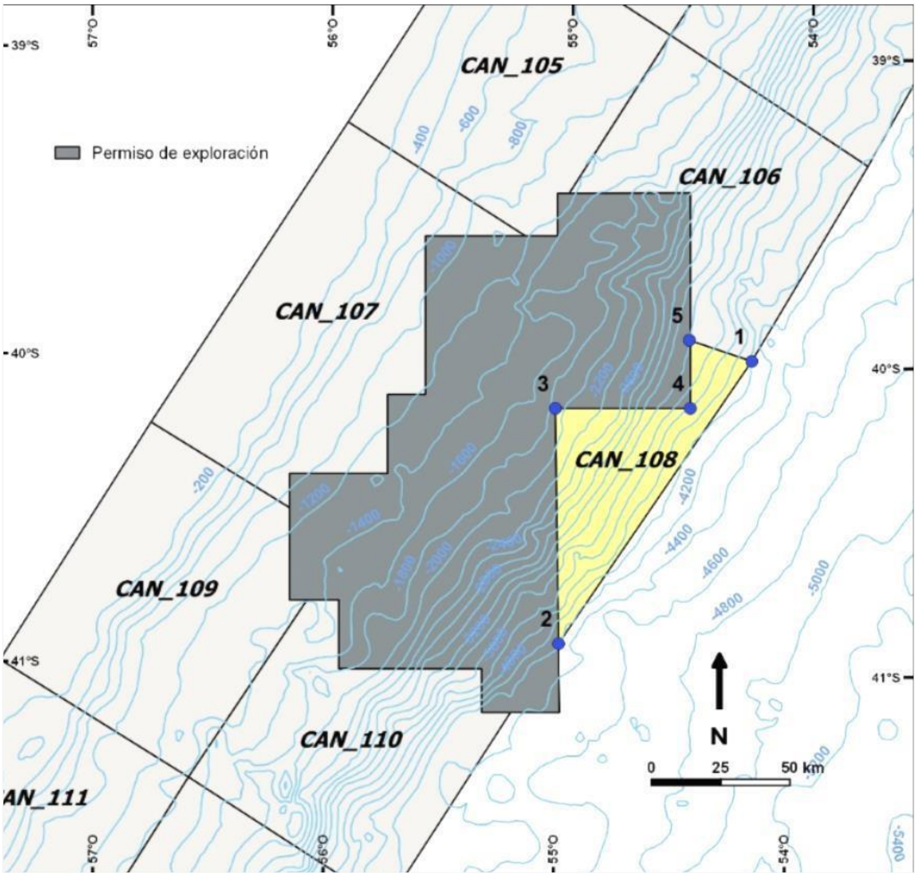


Figure 386. Blocks bordering CAN_108 Area (and CAN_100 in gray) licensed by the Offshore International Public Tender No. 1.

(Translation of Figure 386: Permiso de exploración: Exploration Permit)

CAN_114 block is adjacent to CAN_111, 112 and 113 blocks, limiting in its northeast margin with CAN_112 block, in the northwest margin with CAN_113 block, and finally with CAN_111 block only in its northern angle.

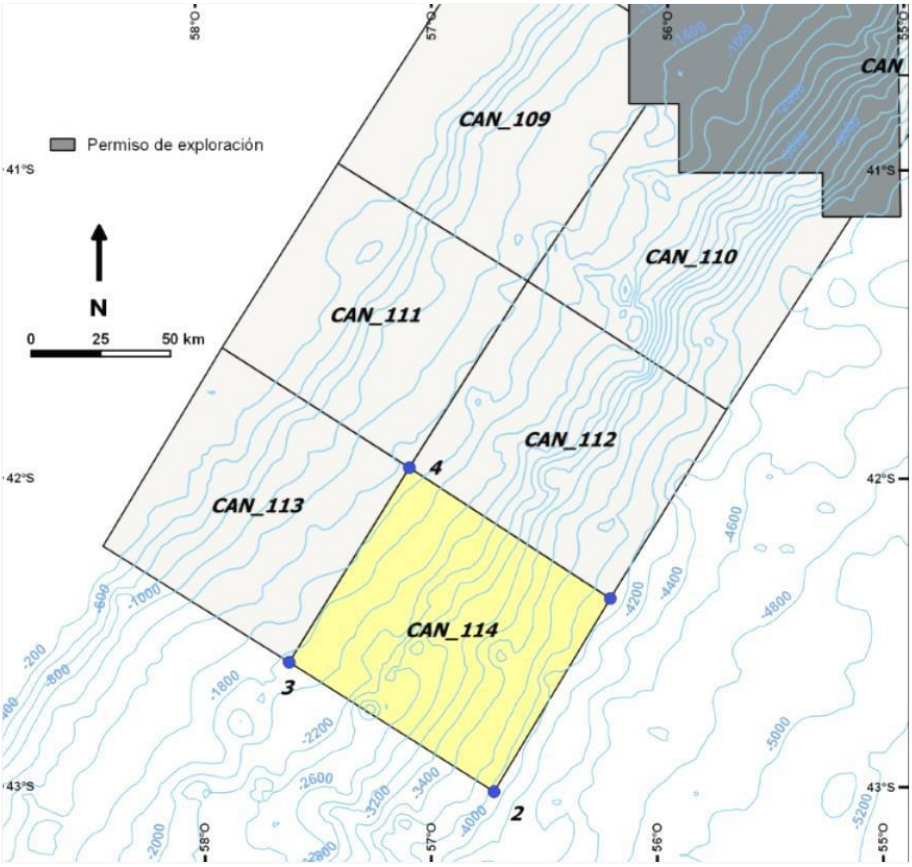


Figure 387. locks bordering CAN_114 area licensed by the Offshore International Public Tender No. 1.

(Translation of Figure 387: Permiso de exploración: Exploration Permit)

According to Resolution 276/2019[20] of the then Secretary of Energy of the Government, CAN_107[21] and CAN_109[22] blocks were licensed to Shell Argentina SA group and Qatar Petroleum International Limited, with the oil company Shell being the operator with 60% share in the consortium. The blocks in question are located on the edge of the continental shelf and cover an area of 8,341 km2 and 7,860km2, respectively. They stretch in areas of shallow and deep waters from 200 to 2,500 meters deep. CAN_107 and CAN_109 blocks border CAN_100 block under study towards its WNW and

[20] Available at: https://costaafuera.energia.gob.ar/docs/RESOLUCION%20276-2019.pdf

[21] Resolution N° 524/2019 (RESOL-2019-524-APN-SGE#MHA)

[22] Resolution N° 525/2019 (RESOL-2019-525-APN-SGE#MHA)

SW, respectively. According to information provided by the Ministry of Environment and Sustainable Development, both Shell company and Spectrum (now TGS) have submitted project notices for seismic exploration activities in these areas[23]. According to communications between Equinor and Shell, operator of the CAN_107 and CAN_109 blocks, the latter aims to start the seismic acquisition in the mentioned blocks in the last quarter of 2021.

CAN_111[24] and 113[25] blocks were granted by means of the aforementioned Resolution to Total Austral SA and BP Exploration Operating Company Limited group, each holding a 50% stake. These are two deep water blocks, embracing an area of 6,320 km2 and 6,573 km2, respectively. The depth of the waters in this basin, located off the coasts of the provinces of Buenos Aires and Río Negro, can reach up to 4,000 meters. As mentioned in the Project Description (Chapter 4) CAN_114 seismic data acquisition area includes a marginal sector of CAN_113. In turn, CAN_114 operational area involves a sector of CAN_111 boundary block where vessels shall make turns, maneuvers, etc. without operating seismic sources. Chapter 4 contains a copy of the authorization by which Total Austral SA authorizes Equinor to carry out the aforementioned operations in CAN_111 and CAN_113 blocks. According to the communications between Equinor and Total, the latter would have planned to carry out the seismic acquisition in CAN_111 and CAN_113 blocks during 2022, so it would not overlap with Equinor's activities planned for the first quarter of 2022.

Finally, according to Resolution 276/2019, the bidding for CAN_105, 106, 110 and 112 blocks was declared void since no offers were received for those areas.

5.1.5 Navigation

The Argentine Republic has an extensive network of ports and waterways that move about 200 million tons of merchandise, through which most of the Argentine foreign trade (87%) and a portion of the national domestic cargo are channeled (4%) (García, 2019).

The water transport system basically comprises three elements:

- Inland waterways: Argentina has an extensive maritime coastline on the Atlantic Ocean and a large-scale navigable river route made up of the De la Plata, Paraná (and its various tributaries), Uruguay and Paraguay rivers. However, many of the accesses to the ports with the highest traffic require extensive dredging work in their entrance channels for the docking of ships, and their administrations must periodically hire dredging services for their nautical accesses.

  For example, the limitations presented by the inland waterway due to the fact that it only allows ships in one direction and the shortage of anchorages, crossing and waiting areas, implying unnecessary delays in navigation (Abramian, 2015). In addition, the importance of this issue from the point of view of safety in navigation, for which it is essential to expand the width of the dock sill of the route that today is 100 m (Deleersnyder, 2013).

- Port terminals: they work as cargo transfer nodes, being the entry and exit doors of the country at the same time.

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[23] Shell for CAN_107 y CAN_109 Areas through EX-2020-17578657- -APN-DNEP#MHA) and Spectrum for the Argentine Basin (EX-2020-25269675- -APN-DNEP#MHA) TGS: CAN_107, CAN_108, CAN_109, CAN_101, CAN_102, CAN_103, CAN_104 (EX-2020-17648170- -APN-DNEP#MHA, EX-2020-17643202- -APN-DNEP#MHA y EX-2020-73992409- -APN-DNEYP#MEC)

[24] Resolución 597/2019 (RESOL-2019-597-APN-SGE#MHA)

[25] Resolución 600/2019 (RESOL-2019-600-APN-SGE#MHA)

- Within the Argentine port system, four large subsystems can be identified according to the navigable route in which they are located and the type of merchandise that is deployed (See Figure 388): the ports of the Río de la Plata, the river ports of the Paraná River, the maritime coastal ports of Buenos Aires and the ports of the Patagonian sea coast.

  In the first place, the river ports of the Paraná River and the Paraguay River play an important role, with approximately 70 terminals that, together, account for more than half of the country's total cargoes. They send goods abroad: solid and liquid bulks, general cargo, chemical products, fruits, containers and vehicles.

  Secondly, there is the fluvio-maritime node of the Rio de la Plata ports of the Autonomous City of Buenos Aires (CABA) and the north of the province of Buenos Aires. It is one of the most important port facilities in the country.

  The third place is made up of the ports of the maritime coast, located in the Southeast and South of the province of Buenos Aires which offer the greatest depths of the national port system. It is integrated by the group of terminals of the ports of Quequén, Coronel Rosales, Bahía Blanca and Mar del Plata. They operate liquid and solid bulk, containers and, in the latter case, also fish products.

  In fourth and last place, the ports of the Patagonian sea coast, encompassing the provinces of Río Negro, Chubut, Santa Cruz and Tierra del Fuego. They have deep water areas and great tidal ranges. The most relevant traffics are liquid bulk (fuel), fishery products and fruits and vegetables from San Antonio Este.

- Transport services: they move goods from one port to another. Maritime lines offer services with pre-established docking schedules, which prevail for the transport of containers, vehicles and cruise ships. In turn, within this type of organization, “trunk” services can be distinguished (normally of intercontinental scope), for which an attempt is made to minimize the number of stops, and “supply” services, on a regional scale, that carry out the transport between the ports served by trunk services and other ports with less activity (Palomar, 2011).

  The transport system consists of contracts in which a vessel with its corresponding crew operates under the requirements of a third party so that he or she can define the goods to be transported and the route to be traveled. They can be made for specific trips (voyage charter) or for long periods of time (time charter), without necessarily specifying the itineraries in advance. Liquid or solid bulk services adopt this method.

  In Argentina, the river and maritime transport service is framed by Decree Law 12,942 / 1944 (**Cabotage Laws**: These apply to merchant ships in most countries that have a costline so as to protect the domestic shipping industry from foreign competition) and its amendments, as well as by Decree 1010/2004.

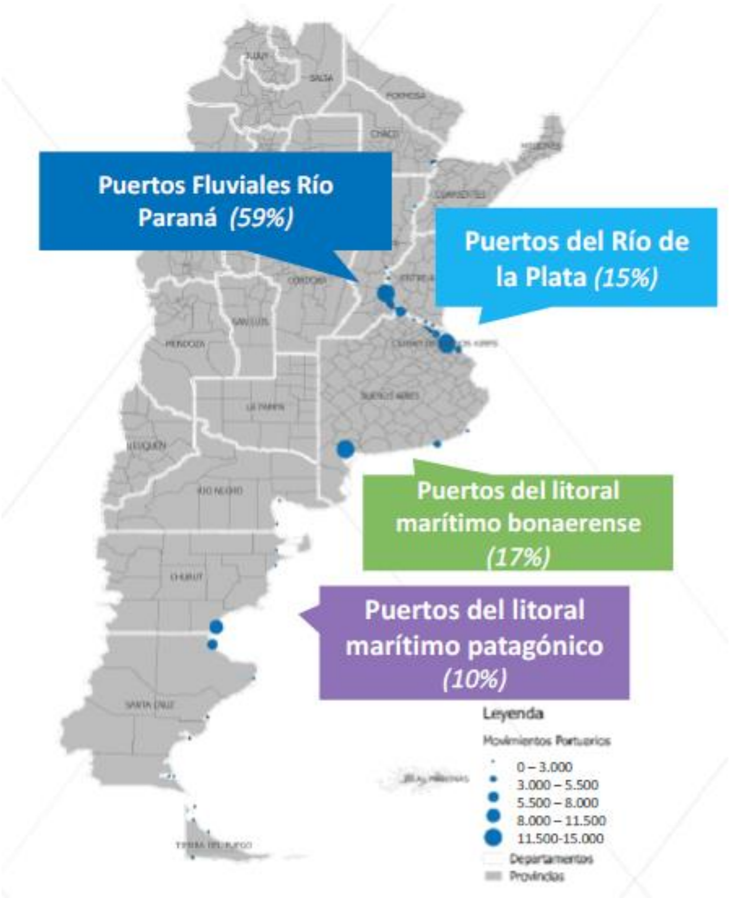

Figure 388. Argentine Port System and participation in the total loads deployed. (2017) Source: García, N. (2019). Planning of water transport in Argentina. Limits and challenges for the coming years based on the General Administration of Ports (AGP), Undersecretariat of Ports, Inland Waterways and Merchant Marine (SSPVNyMM) and former Undersecretariat of Cargo Transportation Planning and Logistics (SSPTCL).

(Translation of Figure 388: Puertos fluviales Rio Paraná: Rio Paraná River Ports. Puertos del Río de la Plata: Ports of Rio de la Plata. Puertos del litoral marítimo bonaerense: Ports of the Buenos Aires maritime coast. Puertos del litoral marítimo patagónico: Ports of the Patagonian maritime coast. Leyenda: Legend. Movimientos Portuarios: Port Movement. Departamentos: Districts. Provincias: Provinces).

Unlike inland waterways where there are usually defined channels through which ships navigate due to the draft they allow, in the case of maritime routes there are other criteria that influence, among which the following stand out: cost of fuel, climatic and oceanographic factors, proximity to intermediate ports, if needed, and legal factors. In this way, the route of each ship is somewhat more independent than in the case of river traffic.

Figure 389 shows the density of the maritime routes in the study area. Regarding the area of the Port of Mar del Plata, the highest intensity value is observed, as is to be expected since it is the place of entry and exit of the ships in the area of seismic data acquisition (and OA of the seismic activity), and a coloring from an orange to reddish tone is observed which belongs to CAN_114, also having a high to moderate density with respect to the density of maritime transport. On the other hand, in the area corresponding to the seismic data acquisition zone (and OA of the seismic activity) of CAN_100-CAN_108, the tones observed are between yellow and red. It should be clarified that the most updated data in this parameter on the website consulted (https://www.marinetraffic.com/) belong to the year 2019.

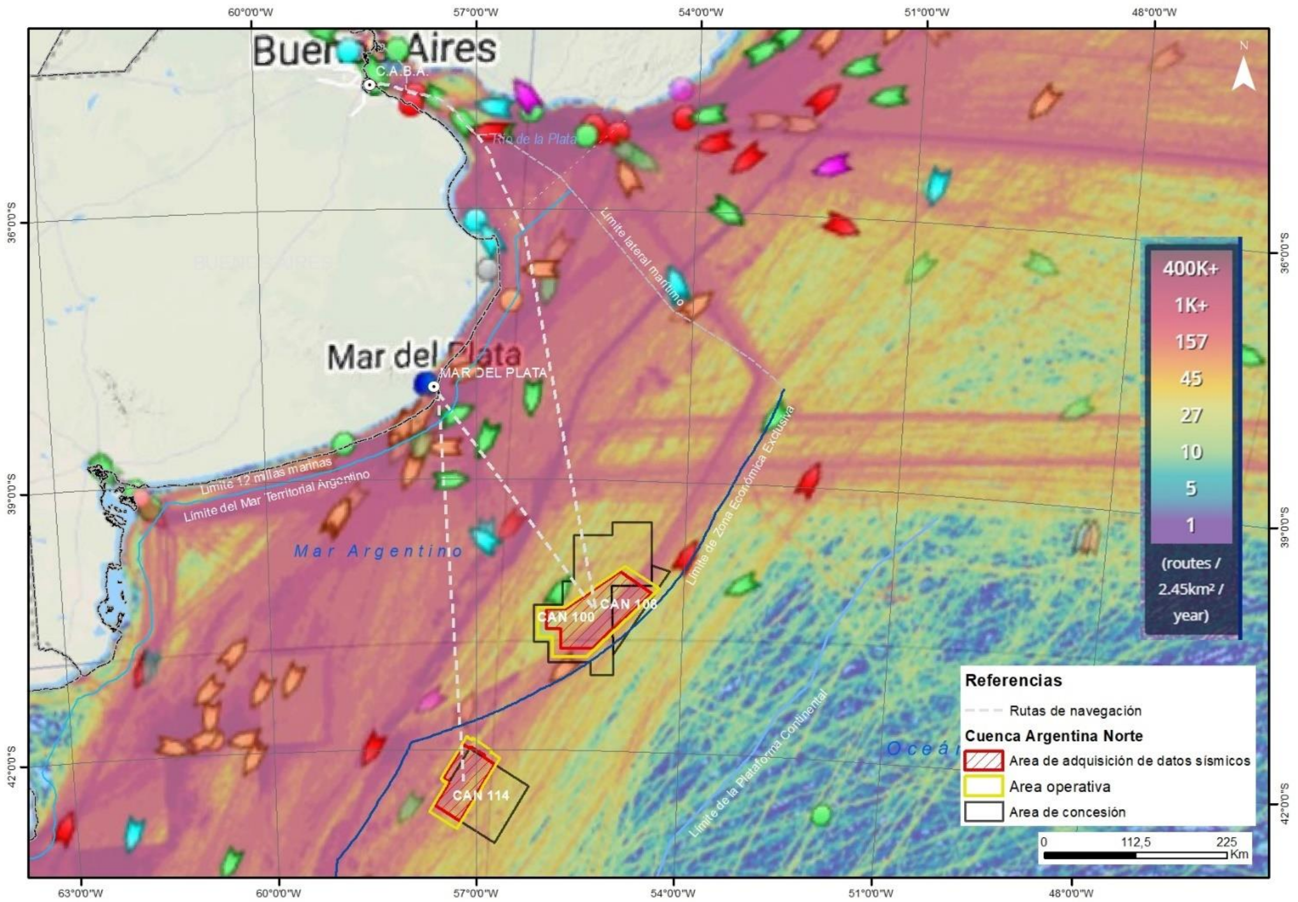

Figure 389. Density of the maritime routes in the study area. Source: https://www.marinetraffic.com/
Note: References: routes / 2,45 km^2 / year.

(Translation of Figure 389: Referencias: References. Rutas de Navegación: Navigation Routes. Cuenca Argentina Norte: North Argentine Basin. Area Operativa: Operative Area. Area de concesión: License Area).

Regarding the type of vessels that can be seen in the navigation routes connecting the Port of Mar del Plata and CAN_100-108 and 114 seismic data acquisition Areas, fishing vessels prevail, followed by tankers and cargo vessels. To a lesser extent, there are also tugs and special craft and pleasure boats, some unspecified ships and passenger vessels only in the location corresponding to the Port of Mar del Plata.[26]

[26] https://www.marinetraffic.com/en/ais/home/centerx:-55.5/centery:-40.1/zoom:6

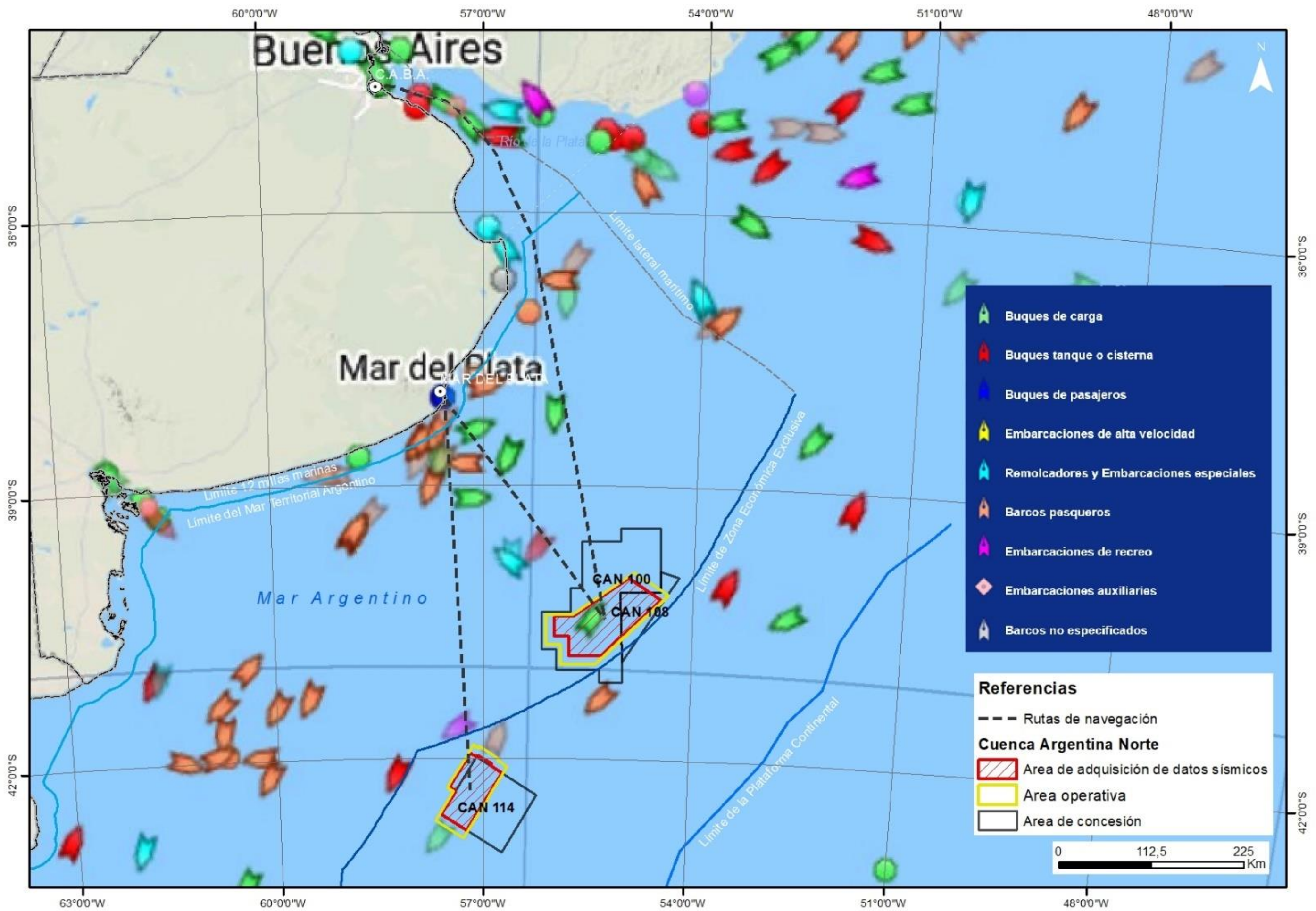

Figure 390. Types of vessels in the navigation routes and the seismic data acquisition zone of CAN_100-108 and 114 Areas. Source: https://www.marinetraffic.com/

(Translation of Figure 390: Blue Reference Box: Cargo Ships. Tankers. Passenger ships. High speed vessels. Tugboats. Fishing vessels. Pleasure boats. Auxiliary vessels. Unspecified boats. White reference box: References: Navigation routes. North Argentine Basin. Seismic data acquisition area. Operative Area. License Area).

Finally, it should be added that information about the operational shipping lines is provided from the page of the Ministry of Transportation of the Argentine Nation.

Table 43. Contact information for the shipping lines. Source: Ministry of Transport.[27]

Shipowner	Maritime Agent	Phone	Email	Website
ALIANCA NAVEGACAO	HAMBURG SUD ARG.	5811-9466/68/77	operations@hamburgsud.com	www.hamburgsud.com
CELEBRITY	NAVIJET S.A.	4325-0778/0756	info@navijetsa.com.ar	www.navijetsa.com.ar
CHINA SHIPPING CONTAINER	CHINA SHIPPING AGENCY	4312-4001/02/03	ops@chinaship.com.ar	
CMA-CGM	A.M. DELFINO S.A.	6320-1000	ops@delfino.com.ar	www.delfino.com.ar
CMSP S.R.L.	ULTRAMAR ARG. S.A.	4310-2400/2300	buenosaires@ocean.com.ar	www.amisa.com.ar
COSCO CONTAINER LINE	COSCO ARG. S.A.	4343-0607/8	ops@coscoarg.com.ar	www.coscoarg.com.ar
COSTA CRUISE LINE	SHIPPING SERVICES ARGENTINA	4315-1444	operations@ssa-shipping.com.ar	www.ssa-shipping.com.ar
CSAV-LIBRA	CSAV ARG.	5355-5700	operaciones.arg@csav.com	www.csavgroup.com.ar
EVER GREEN LINES	MARITIMA HEINLEIN S.A.	5382-7000	ops@heinlein.com.ar	www.heinlein.com.ar
FRED OLSEN CRUISE LINES	J.E.TURNER Y CIA S.A.	5272-4481	info@turner.com.ar	www.turner.com.ar
GEARBULK GALINES	DULCE S.A.	4118-8000/01	operaciones@dulba.com.ar	
GRIMALDI COMPAGINA DI NAV.	GRIMALDI AGENCY S.A.	5353-0940	grimaldi@grimaldi-bue.com.ar	
HAMBURG SUD	HAMBURG SUD ARG.	5811-9466/68/77	operations@hamburgsud.com	www.hamburgsud.com
HAPPAG LLOYD AG	HAPPAG LLOYD ARG.	4323-1032	invertfl@hlag.com	www.hapag-lloyd.com

[27] https://www.argentina.gob.ar/transporte/puerto-ba/buques/informacion-lineas-maritimas

Shipowner	Maritime Agent	Phone	Email	Website
INARI ATLANTICA	GRIMALDI AGENCY S.A.	5353-0940	grimaldi@grimaldi-bue.com.ar	
K LINE	NABSA S.A.	4342-3418/3473	nabsamail@nabsa.com.ar	www.nabsa.com.ar
MAERSK	MAERSK ARG. S.A.	5382-5800	bueapmtops@apm.terminal.com	www.terminal4.com.ar
MARUBA S.C.A.	AG. MARITIMA MARUBA SCA	5279-5640	remolque@maruba.com.ar	www.maruba.com.ar
MEDITERRANEAN SHIPPING SERVICES	MEDITERRANEAN SHIPPING SERVICES	5300-7300/01	info@mscar.mscgva.ch	www.mscgva.ch
MOL-HYUNDAI	ULTRAMAR ARG. S.A.	4310-2400/2300	buenosaires@ocean.com.ar	www.amisa.com.ar
NAVENOR MERIDIAN	MARITIME S.A.	4300-2340	mmsa@meridian.com.ar	www.meridian.com.ar
NIPPON YUSEN KAISHA (NYK)	MULTIMAR S.A.	4328-3111	multimar@multimar.com.ar	www.multimar.com
NIVER LINES	NAVEGACIÓN ATLANTICA	5236-7013/18	nave@nave.com.ar	www.nveatlantica.com.ar
NORWEGIAN	INCHCAPE SHIPPING SER. ARG.	5218-1200	issargentina@iss-shipping.com	www.iss-shipping.com
PETROTANK	MERIDIAN MARITIME S.A.	4300-2340	mmsa@meridian.com.ar	www.meridian.com.ar
ROYAL CARIBEAN	NAVIJET S.A.	4325-0778/0756	info@navijetsa.com.ar	www.navijetsa.com.ar
ZIM INTEGRAD SHIPP.	STAR SHIPPING ARG. S.A.	4312-6868	mktg@starshipping.com.ar.com.ar	www.starshipping.com.ar
ZPMC	INCHCAPE SHIPPING SER. ARG.	5218-1200	issargentina@iss-shipping.com	www.iss-shipping.com

5.1.6 Fishing activity

The fishing activity is of great importance at the regional level in most of the cities located on the Argentine sea coast. Employment opportunities and activity thereof can be highlighted; as well as its exports derived from the foreign exchange.

In the first place, there is an extractive stage of catch (primary sector), then a processing stage of the extracted resources (secondary sector), which can be carried out in processing plants on land or on board freezer vessels; and, finally, the commercialization (tertiary sector) of fishery resources.

Figure 391. Maritime Fishing Chain Scheme. Source: Value Chains Report - Fisheries - September 2019. Undersecretariat for Microeconomic Programming, Secretariat for Economic Policy, Ministry of Finance. Available at: https://www.argentina.gob.ar/sites/default/files/sspmicro_cadenas_de_valor_pesca_0.pdf

Note: The Extractive Stage refers to the Primary Sector (Catches), the Industrial Stage to the Secondary Sector (Processing) and the Final Destination to the Tertiary Sector (Marketing).

The activity by sector is hereinbelow described.

Primary Fishing Sector (catches)

The Argentine maritime space is made up of the sea adjacent to the continental coasts of Argentina and its islands, as well as the bed and subsoil of its marine areas, its living and mineral resources and its marine air space, over which sovereignty is exercised at different degrees.

In accordance with the current Federal Fisheries System, the living resources that populate the interior waters and the Argentine territorial sea adjacent to their coasts are the domain of the provinces with a maritime coastline, up to 12 nautical miles measured from the baselines. While the marine living resources existing in the waters of the Argentine EEZ and on the Argentine continental shelf from 12 miles are over the exclusive domain and jurisdiction of the Nation (Law 24.992 / 1997).

The commercial fishing activity began very incipiently in the province of Buenos Aires at the end of the 19th century, based on beach and boat fishing. The activity presents fluctuations, which originate both in the maximum catches defined by the Federal Fisheries Council for the main fisheries, as well as in the abundance of resources for those species without maximum allowable catch and in international demand.

In the figure below you can see the fishing areas in the Argentine maritime space with the regulations and closures in force as of February 2021. Regarding the CAN_100-108 and CAN_114 seismic data acquisition areas, there are no sectors with restrictions and / or closures in force for fishing. However, according to Resolution 973/1997 of former SAGPyA, the opening to fishing for squid (*Illex argentinus*) north of the 44th parallel is established from May 1 to August 31 of each year, except for conservation reasons the early closure of the fishing season is ordered, with directed fishing of the prohibited species remaining in said sector for the rest of the year.

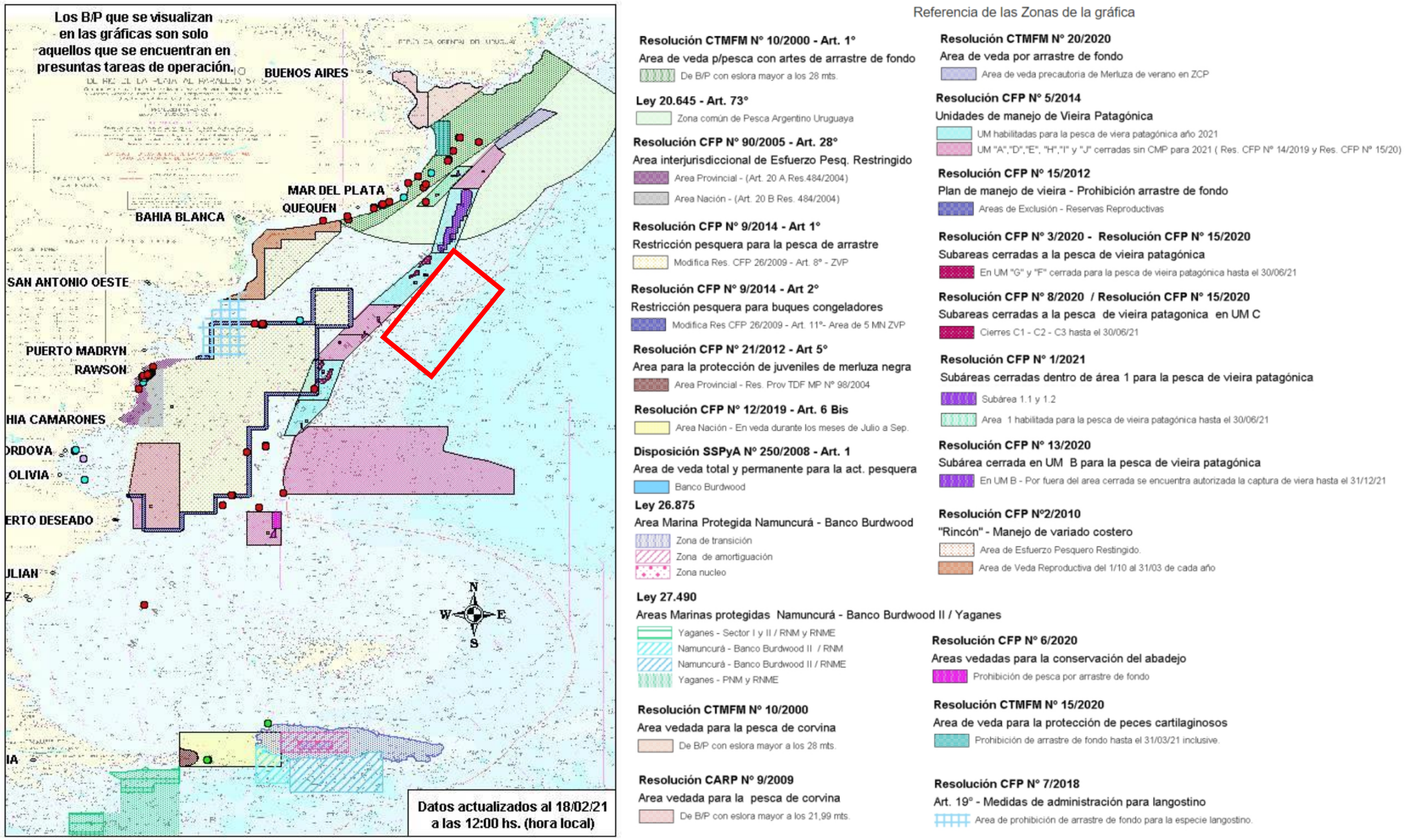

Figura 392. Fishing areas with regulations and closures in force as of February 2021. Consultation date. Source: Ministry of Agro-industry [28]. The red polygon roughly represents the location of CAN_100-108 and CAN_114 seismic data acquisition areas.

[28] Available at: http://www.agroindustria.gob.ar/sitio/areas/pesca_maritima/monitoreo/

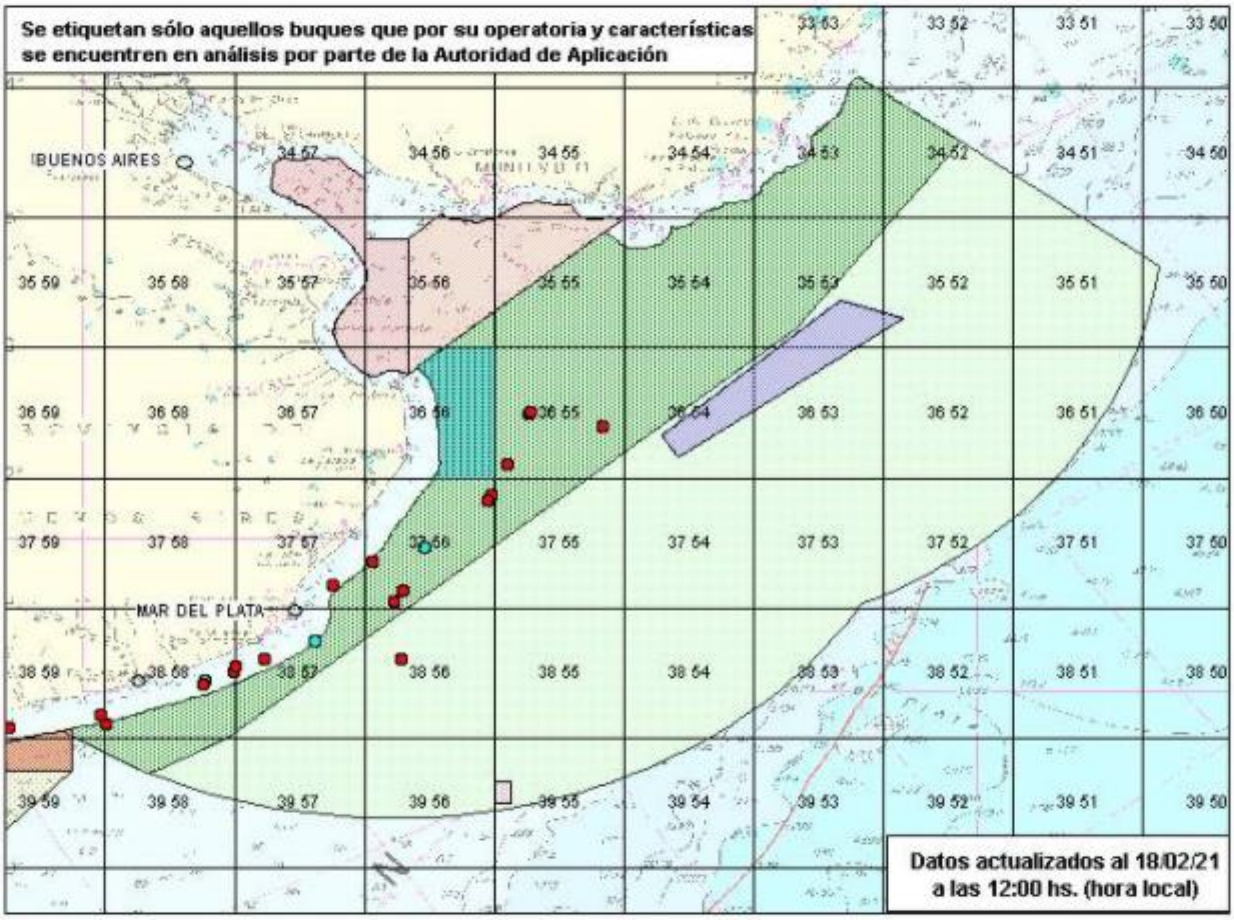

Figure 393. Enlarged view of ZCP (Law 20.645 Treaty of the Río de la Plata and its Maritime Front and subsequent). Graphic representation of the status of the fishing vessels that are reporting to the System. Consultation date: 18/02/2021. Source: Ministry of Agro-industry [29].

(Translation of Figure 393: Se etiquetan solo aquellos buques que por su operatoria y características se encuentren en análisis por parte de la Autoridad de Aplicación: Only those vessels that due to their operation and characteristics are under analysis by the Enforcement Authority are labeled). Datos actualizados al 18/02/21 a las 12.00Hs (hora local): Updated data on 02/18/21 at 12Hs. (local time).

It should be noted that the fishing sector faces overexploitation situations that have demanded some restrictive regulatory measures. As can be seen in Figure 394, after the maximum reached in 1997 (with 1,343 thousand tons) there was an abrupt drop in landings. In 1999, the Fisheries Emergency Law and the Emergency Decree (Law 25.109 and Decree 792/99) were enacted. The possibility of catches has improved in recent years based on the restrictive measures established, the improvement in the operation of the surveillance system (satellite monitoring) and the behavior of the species.

[29] Available at http://www.agroindustria.gob.ar/sitio/areas/pesca_maritima/monitoreo/

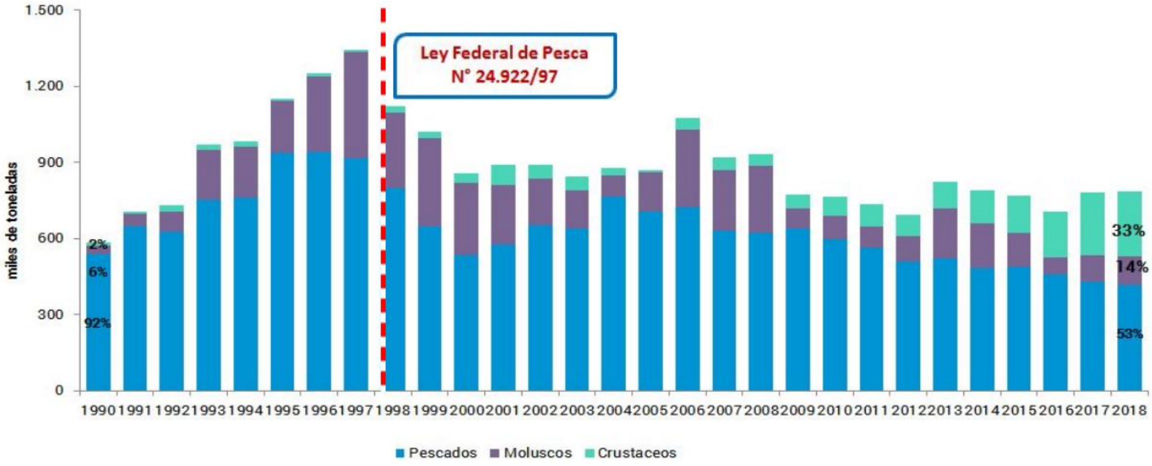

Figure 394. Maritime landings 1990-2018 Period. Source: Undersecretariat of Microeconomic Programming, based on the Undersecretariat of Fisheries and Aquaculture. Available at: https://www.argentina.gob.ar/sites/default/files/sspmicro_cadenas_de_valor_pesca_0.pdf

(Translation of Figure 394: miles de toneladas: thousand tons. Ley Federal de Pesca: Federal Fisheries Law. Pescados. Moluscos. Crustáceos: Fish. Molluscs. Crustaceans).

On the other hand, the production scheme is largely dependent on resources with short life cycles such as squid (*Illex argentinus*), which presents significant annual variations catching possibilities, due to particularities of its life cycles and changes in environmental conditions.

The regulations to guarantee sustainable fishing are the following:

- Set up of minimum catch sizes for the protection of juvenile specimens.
- Protection of areas or seasons of spawning and / or recruitment of juveniles.
- Limitation to the number of licenses or permits by type of fleet.
- Limitations on the total fishing effort, for example, the one applied to common hake by establishing “biological stops” of 50 to 75 days per year for all vessels that catch this species (res. CFP 26/2009).
- Limitations of the total catch allowed, applying Individual Transferable Catch Quotas (Law No. 24,922) for common hake (res. CFP 23/2009); and for Southern hake, toothfish and hoki (res. CFP 20/2009).
- Plans for the conservation of species, such as the National Action Plan for the conservation and management of chondrichthyans (sharks, rays and chimaeras) (res. CFP 06/2009) or the National Action Plan to prevent, discourage and eliminate illegal, unreported, unregulated fishing (res. CFP 1/2008; OPP, 2010).

The characteristics of the fishing fleet were previously described in Point **Error! Reference source not found.**.

Marine catch fisheries account for around 98% of the national fish production. The port in which the highest percentage of landings of maritime catches is concentrated is the Port of Mar del Plata (53%), where an important fresh fleet operates, followed by the following Patagonian Ports: Puerto Madryn (16%), Puerto Deseado (10%) and Ushuaia (6%), where the freezer fleet operates almost exclusively.

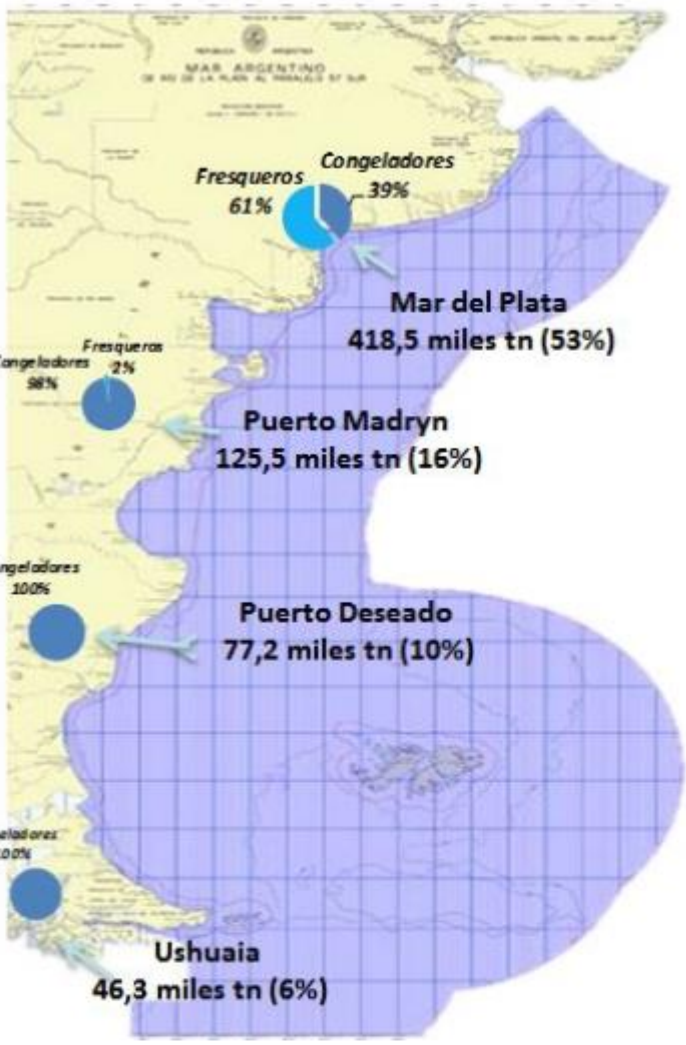

Figure 395. Exclusive Economic Zone of Argentina - Percentages in the different Ports. Source: Undersecretariat of Microeconomic Programming, based on the Undersecretariat of Fisheries and Aquaculture. Available at:
https://www.argentina.gob.ar/sites/default/files/sspmicro_cadenas_de_valor_pesca_0.pdf

(Translation of Figure 395: Congeladores: Freezer trawlers. Fresqueros: Stern Trawlers fleet. Miles tn: Thousand tons).

The following figures display the landings according to groups, main species and ports. A strong predominance of the Port of Mar del Plata is observed in fish and hubbsi hake (74%) and in the group of mollusks where Illex squid stands out (54%).

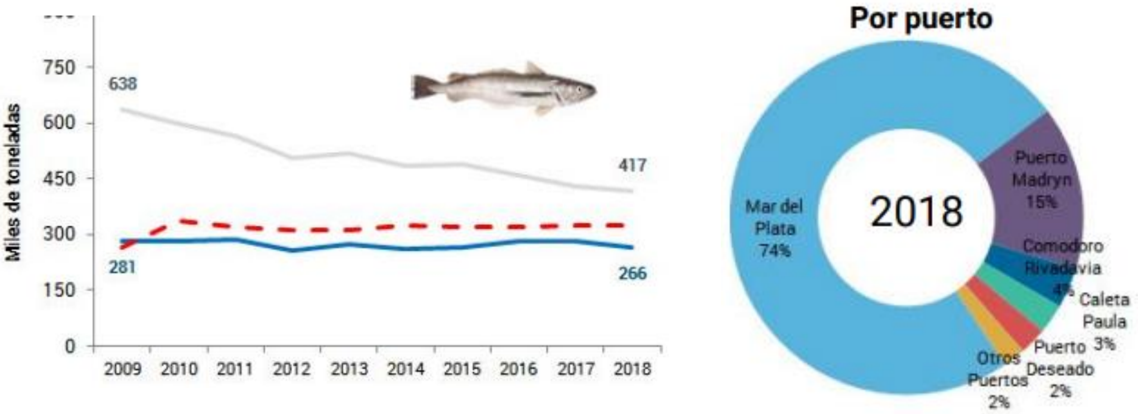

Figure 396. Landings (thousand tons) of total fish and common hake (*Merluccius hubbsi*) per year and per port. Source: Undersecretariat of Microeconomic Programming, based on the Undersecretariat of Fisheries and Aquaculture.

(Translation of Figure 396: Miles de toneladas: Thousand tons. Por Puerto: By port).

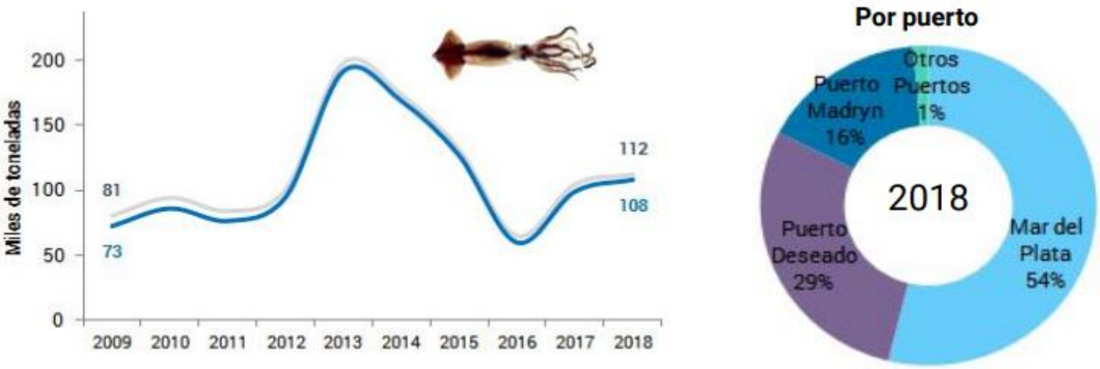

Figure 397. Landings (thousand tons) of total mollusks and squid (*Illex argentinus*) per year and per port. Source: Undersecretariat of Microeconomic Programming, based on the Undersecretariat of Fisheries and Aquaculture.

(Translation of Figure 397: Miles de toneladas: Thousand tons. Por Puerto: By port).

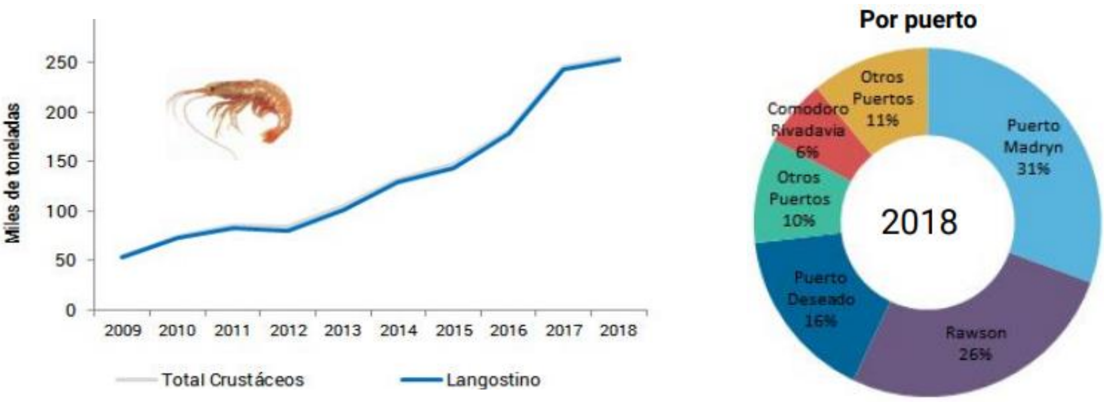

Figure 398. Landings (thousand tons) of shrimp per year and per port. Source: Undersecretariat of Microeconomic Programming, based on the Undersecretariat of Fisheries and Aquaculture.

(Translation of Figure 398: Miles de toneladas: Thousand tons. Por Puerto: By port.Total crustáceos: Total Crustaceans. Langostino: Shrimp).

Secondary Fishing Sector (processing)

There were 140 processing plants and cold storage chambers for fishery products authorized to export to the European Union from Argentina during 2019, which were operated by 127 companies.[30] These onshore facilities offer a wide variety of products. The following industrial processes are carried out for fish and shellfish in General Pueyrredón district: fresh or chilled and frozen, salted, canned and elaboration of fish flour and oils.

The cooling process is carried out by fishing plants that handle and process fish and shellfish (product around 0 ° C); while in the case of the freezing process, a product that has been brought to a temperature of -18 ° C or lower is obtained.

Canned and semi-canned Factories carry out different types of processes to obtain canned and packaged products subjected to a heat treatment and cured in order to increase their conservation.

On the other hand, fish flour factories obtain their product basically by cooking and drying from whole fish, trimmings and residues from filleting and canning; While, by different industrial processes, the part of the fish not used for human consumption is also used to obtain Omega-rich fish oils.[31]

The largest number of factories are located in the province of Buenos Aires, mainly in Mar del Plata (63%) – (Table 44) where most of the landings of the fresh and coastal fleet are carried out (72% up to 2014) to be processed, as well as almost all of the fresh fish products directed to the domestic market.

30 Available at https://www.argentina.gob.ar/sites/default/files/sspmicro_cadenas_de_valor_pesca_0.pdf

31 Chapter "Economy and Employment". Second Report of "Mar del Plata Entre Todos": citizen monitoring: to know which city we want we need to know which city we have. Pagani, Andrea; Gualdoni, Patricia. FCEyS, UNMdP. Page 250.

Table 44. Cold stores and processing plants authorized to export to the European Union. (Year 2015). Fuente: Source: Undersecretariat of Microeconomic Programming, based on SENASA. Available at: https://www.argentina.gob.ar/sites/default/files/sspmicro_cadenas_de_valor_pesca_0.pdf

(Translation of Table 44: Provincia: Province. Ciudad: City. Almacén Frigorífico: cold stores. Planta procesadora: Processing Plant).

Provincia	Ciudad	Almacén frigorífico	Planta Procesadora	Total	% del total
Buenos Aires	*Mar Del Plata*	*6*	*82*	*88*	*63%*
	Batan	*1*	*3*	*4*	*3%*
	Ingeniero White	*1*	*1*	*2*	*1%*
	Vivorata		*1*	*1*	*1%*
	Avellaneda		*1*	*1*	*1%*
	General Lavalle		*1*	*1*	*1%*
Total Buenos Aires		**8**	**89**	**97**	**69%**
Chubut	*Puerto Madryn*	*3*	*11*	*14*	*10%*
	Comodoro Rivadavia		*5*	*5*	*4%*
	Rawson		*5*	*5*	*4%*
	Trelew		*2*	*2*	*1%*
Total Chubut		**3**	**23**	**26**	**19%**
Santa Cruz	*Puerto Deseado*		*7*	*7*	*5%*
	Caleta Olivia	*1*	*1*	*2*	*1%*
	Caleta Paula		*1*	*1*	*1%*
Total Santa Cruz		**1**	**9**	**10**	**7%**
Tierra del Fuego	*Ushuaia*	*1*	*2*	*3*	*2%*
Total Tierra del Fuego		**1**	**2**	**3**	**2%**
Rio Negro	*San Antonio Este*		*2*	*2*	*1%*
Total Rio Negro			**2**	**2**	**1%**
Entre Ríos	*Victoria*		*1*	*1*	*1%*
Total Entre Ríos			**1**	**1**	**1%**
Santa Fe	*Arroyo Seco*		*1*	*1*	*1%*
Total Santa Fe			**1**	**1**	**1%**
Total general		**13**	**127**	**140**	**100%**

Fishing Tertiary Sector (Marketing)

Domestic demand is very limited with production allocated predominantly for export. In 2018, 489 thousand tons of fishery products were exported for a total value of 2,148 million dollars.

External shrimp sales led the chain's exports (61%), followed by squid (13%) and hubbsi hake (9%). There were also significant exports of toothfish and scallops representing 3% each respectively (Ministry of Finance, 2019).

The following figure shows how exports have evolved according to species groups. An important change in economic terms is observed in those groups that mainly land in the Port of Mar del Plata (fish and mollusks). This situation is explained by the increase in demand and price of prawns.

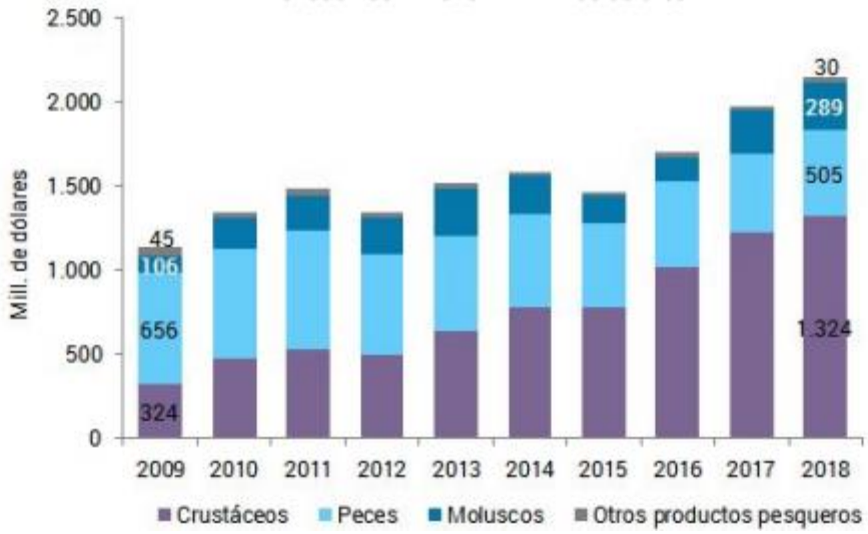

Figure 399. Exports of the value chain by species groups for the 2009-2018 period. Source: Undersecretariat of Microeconomic Programming, based on SENASA. Available at: https://www.argentina.gob.ar/sites/default/files/sspmicro_cadenas_de_valor_pesca_0.pdf.

(Translation of Figure 399: Millones de dólares: Million dollars. Crustáceos: Crustaceans. Peces: Fish. Moluscos: Mollusks. Otros productos pesqueros: Other fishing products).

The main destination markets have kept some stability. The European Union (EU), mainly Spain, has been the main destination for Argentine exports of fishery products followed by China, Brazil, the United States and Japan; shrimp being the main exported product.

In recent years, there has been an exponential growth in sales of crustaceans to China, with a 26% market share in 2018.

As regards fish, Brazil is the most important destination for Hubbsi hake exports, followed by the European Union (EU), for which Argentina is one of the main suppliers.

The Illex Squid exports fall third, whose commercialization is strongly conditioned by the ups and downs of international demand and price ranges. The main destination markets are Spain, China and Thailand (Ministry of Finance, 2019).

The trade balance is structurally positive, with very limited imports related to prepared and canned fish, especially canned tuna and then Chilean salmon.

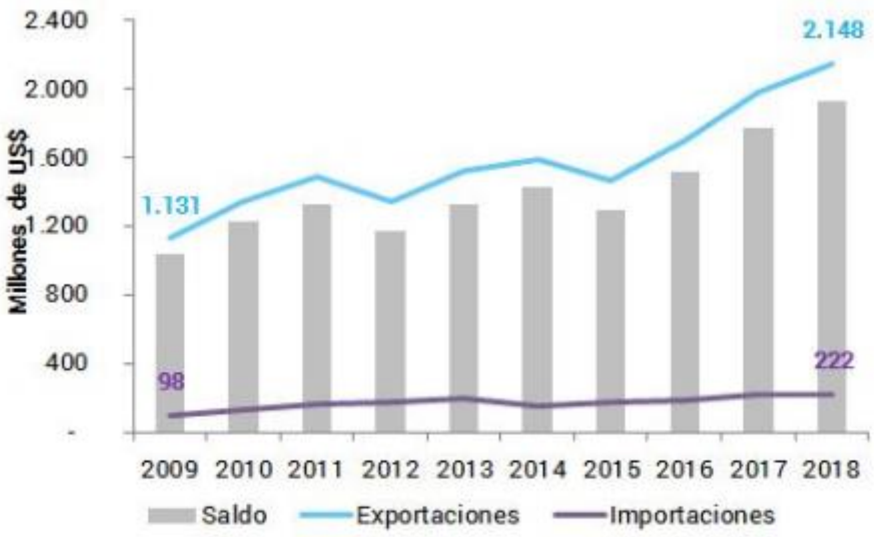

Figure 400. Exports, imports and trade balance of the value chain. 2009 - 2018 Period. In USD million. Source: Undersecretariat of Microeconomic Programming, based on INDEC. Available at: https://www.argentina.gob.ar/sites/default/files/sspmicro_cadenas_de_valor_pesca_0.pdf.

(Translation of Figure 400: Millones de U$S: Million dollars. Saldo: balance. Exportaciones: Exports. Importaciones: Imports).

Local consumption of fishery products is low, around 5-6 kg / person per year, well below the world average (19.2 kg / person) (Ministry of Finance, 2019).

5.1.7 Employmet

The jobs related to sea fishing in 2018 were close to 23,000, where the majority (60%) is concentrated in coastal and deep-sea fishing activities (including in factory vessels), then 40% is linked to the processing industry and 10% to labor contractor services. Most of the workers are men.

Figure 401. Registered jobs in the fishing value chain. Fuente: Source: Undersecretariat of Microeconomic Programming, based on the Employment and Business Dynamics Observatory, Ministry of Labor and Employment. Available at: https://www.argentina.gob.ar/sites/default/files/sspmicro_cadenas_de_valor_pesca_0.pdf

(Translation of Figure 401: Miles de puestos de trabajo: Thousand Jobs. Servicios para la pesca: Services for fishing. Elaboracion de pescado y productos de pescado: Elaboration of fish and its products. Pesca y recolección de productos marinos: Fishing and collection of marine products).

With regard to salaries, workers in the sector are above the average of what is received by registered employees in Argentina. Historically, the salary in the Primary Sector has been higher than in the Secondary Sector, however, the crew do not generally receive a basic salary, but it is established according to the catches of the vessel. In the figure below, it can be seen that for 2018 the difference in the average salary between the two sectors mentioned becomes double.

Figure 402. Average pay of workers registered in the fishing value chain. Source: Undersecretariat of Microeconomic Programming, based on the Employment and Business Dynamics Observatory, Ministry of Labor and Employment. Available at: https://www.argentina.gob.ar/sites/default/files/sspmicro_cadenas_de_valor_pesca_0.pdf.

(Translation of Figure 402: Pesos Corrientes: Current pesos. Pesca y recolección de productos marinos: Fishing and collection of marine products. Servicios para la pesca: Services for fishing. Elaboracion de pescado y productos de pescado: Elaboration of fish and its products).

5.1.8 Hydrocarbon Activity

Argentina has an extensive submarine platform with great potential for hydrocarbon resources; However, the offshore is one of the least explored areas of the territory which, if exploited, would expand the horizon of gas and oil reserves to a global scale.

Initially, offshore activity in Argentina was concentrated in the Colorado and Gulf of San Jorge basins, then it expanded along the Southern Basin and its subdivisions. The period between 1977-1980 has been characterized by the acquisition of YPF's semi-submersible platform, called General Mosconi, enabling exploration activities beyond 200 km offshore as a result of its characteristics, which prevented drilling in areas close to the coast.

In 1981 offshore exploration was intensified by international companies (Esso, Shell and Total), and in 1982, these companies began exploring the Southern Marine Basin; Productivity in the area was consolidated with the discovery of two wells (Carina and Gran Carina) in the early 1990s [32].

The International Offshore Public Tender N°1 permits for the search for hydrocarbons in National Offshore areas is the largest tender in the last 30 years, according to the Ministry of Energy [33].

According to a Report prepared by the Ministry of Energy, called "Energy Scenarios 2030"[34] in Argentina, off-shore production represents approximately 2.3% of total oil production and 17.7% of gas production , based on 2019 production data.

In the aforementioned report, they conclude that oil production in these reservoirs has remained stable in its share of the total, in contrast to gas production, which has practically doubled since 2009.

As for the North Argentine Basin, where CAN_100, CAN_108 and CAN_114 Areas under study are located, operations in ultra-deep waters shall be discussed.

On the website of the Ministry of Energy, you can consult a database of geographic information, linked to basins, areas of exploitation and seismic activity in Argentina. It should be cleared up that, although said database contains enough information about the aforementioned topics, it is not fully updated.

When consulting the information presented on said page, it was observed that the study area does not have the presence of hydrocarbon wells, pipelines or concession areas, beyond the tendered areas (See point **Error! Reference source not found.**).

The aforementioned web page has a record of the existence of 2D exploratory activities. Below you can see a map made based on this information.

However, there is a record of the existence of 2D exploratory activities. Below you can see a map made based on this information.

[32] "History of Exploration in Argentina", based on the presentations made by the IAPG Exploration and Development Commission on December 4, 2007. Mariel S. Palomeque. Petrotecnia. December (2008).

[33] https://www.argentina.gob.ar/produccion/energia/exploracion-costa-afuera

[34]http://www.energia.gob.ar/contenidos/archivos/Reorganizacion/planeamiento/2019-11-14_SsPE-SGE_Documento_Escenarios_Energeticos_2030_ed2019_pub.pdf

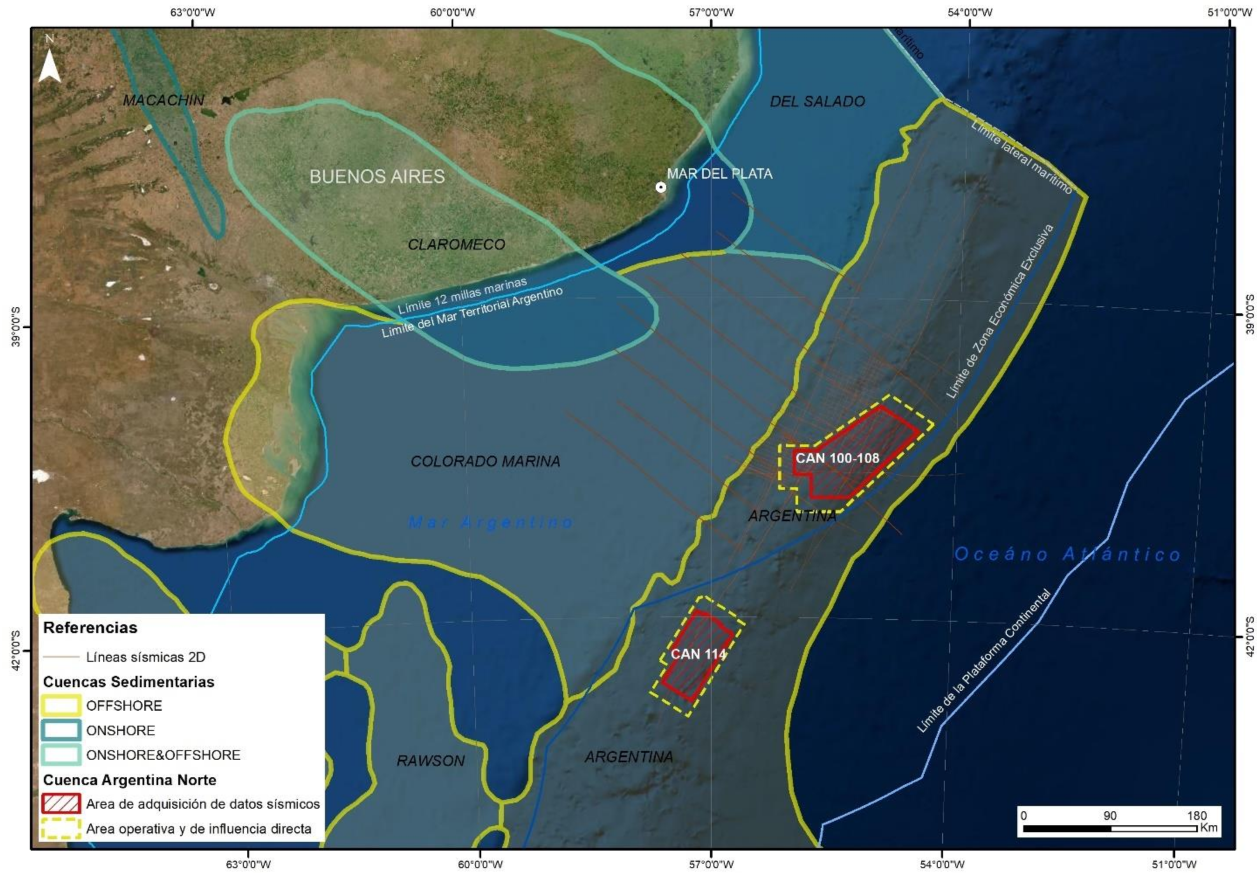

Figure 403. Image showing those sites where 2D seismic activities were carried out in the vicinity of the study area. Source: own elaboration based on SIG of the Ministry of Energy[35].

(Translation of Figure 403: Límite lateral marítimo: Maritime lateral limit. Límite de Zona Económica Exclusiva: Exclusive Economic Zone Limit. Límite 12 millas marinas: 12 Nautical-mile limit. Límite del mar territorial Argentino: Argentine Territorial Sea Limit. Límite de la Plataforma Continental: Continental Shelf Limit. Referencias: References. Líneas sísmicas 2D: 2D Seismic Lines. Cuenca Argentina Norte: North Argentine Basin. Area de adquisición de datos sísmicos: Seismic Data acquisition Area. Area operativa y de influencia directa: Operative and Direct Influence Areas).

However, according to information provided by the EQUINOR company, the following map has been prepared with information corresponding to the latest 2D seismic data acquisition campaigns (Figure 404). They were carried out between 2018 and 2020. The two oldest campaigns are large areas (identified on 5/5/2018 and 9/30/2019. Only the 2018 campaign performed by SPECTRUM ASA SUCURSAL ARGENTINA (now TGS), involves the target seismic acquisition areas of this study.

Of the three following campaigns, which cover smaller areas, the second campaign carried out in 2019 (dated 10/11/2019) is located immediately to the west of the seismic data acquisition area of CAN_100-108 Areas and the first campaign of the year 2020 (dated 1/2/2020) is located northeast of CAN_114 Area.

35 https://www.argentina.gob.ar/produccion/energia/hidrocarburos/mapas-del-sector-de-hidrocarburos

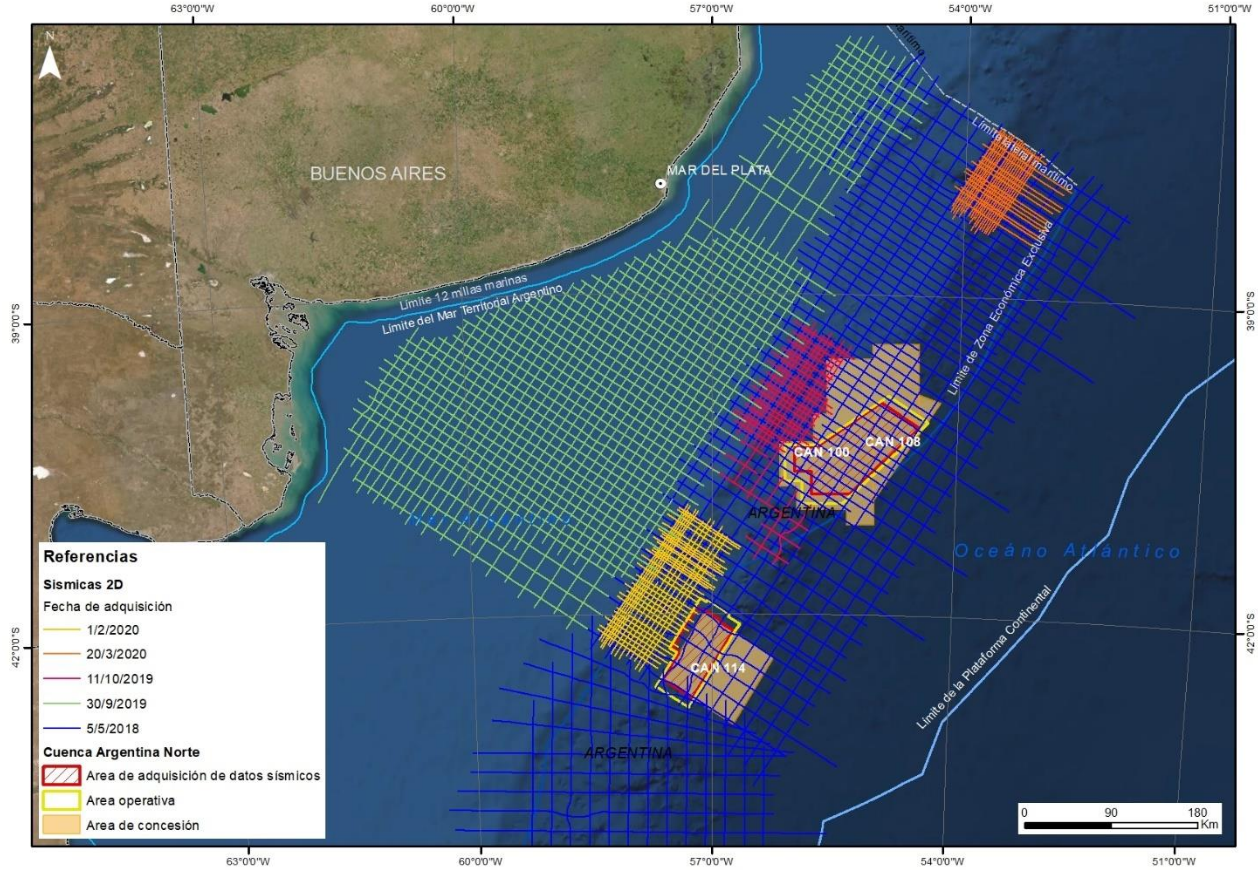

Figure 404. Image showing those sites where 2D seismic activities were carried out in the vicinity of the study area between 2018 and 2019 (Additional information to that consulted on the Ministry of Energy website). Source: own elaboration.

(Translation of Figure 404: Límite lateral marítimo: Maritime lateral limit. Límite de Zona Económica Exclusiva: Exclusive Economic Zone Limit. Límite 12 millas marinas: 12 Nautical-mile limit. Límite del mar Territorial Argentino: Argentine Territorial Sea Limit. Límite de la Plataforma Continental: Continental Shelf Limit. Referencias: References. Sísmicas 2D. 2D Seismic. Cuenca Argentina Norte: North Argentine Basin. Area de adquisición de datos sísmicos: Seismic Data acquisition Area. Area Operativa: Operative Area. Area de concesión: License Area).

5.1.9 Infrastructure

5.1.9.1 Underwater communication cables

Numerous communication cables have been laid on the Argentine sea front, linking Argentina, Uruguay and other worldwide countries. Most of them are located under sediment, although in some cases cables rest on the sea floor.

Currently, eight active cables in the Argentine EEZ can be seen in the cartography: “ARBR”, “Atlantis-2”, “Bicentenario”, “Malbec”, “SAm-1”, “SAC”, “Tannat” and “Unisur”.

In recent years, two of them have recorded breakdowns or cuts attributed to fishing operations in areas where the cables are on the surface of the bed and not under the sediment. These cables ("SAM-1" and "Atlantis-2") lie on the bed of the Atlantic Ocean and enter the continental shelf. They are located under sediment as from 1,000 m deep toward the coast. As a result of the accidents, a series of measures were introduced to avoid interruptions in communications (Maritime Regulation N° 128, 2011). In addition to the standards established in International Agreements (International Convention for the Protection of Submarine Cables, Paris, 1884) in which the precautions to be taken in the vicinity of the cables are established, and the recommended safety zone of 500 m on each side (Art. 60, UNCLOS, 1982), they also prohibit fishing operations around the cables at 1852 m (1 nautical mile) on each side (Marín and others, 2013).

In this case, the operational area of CAN_100-108 is located approximately 400 km south of the underwater cable "Atlantis-2", which as can be seen in the following figure is the southernmost of all the cables present in the area.

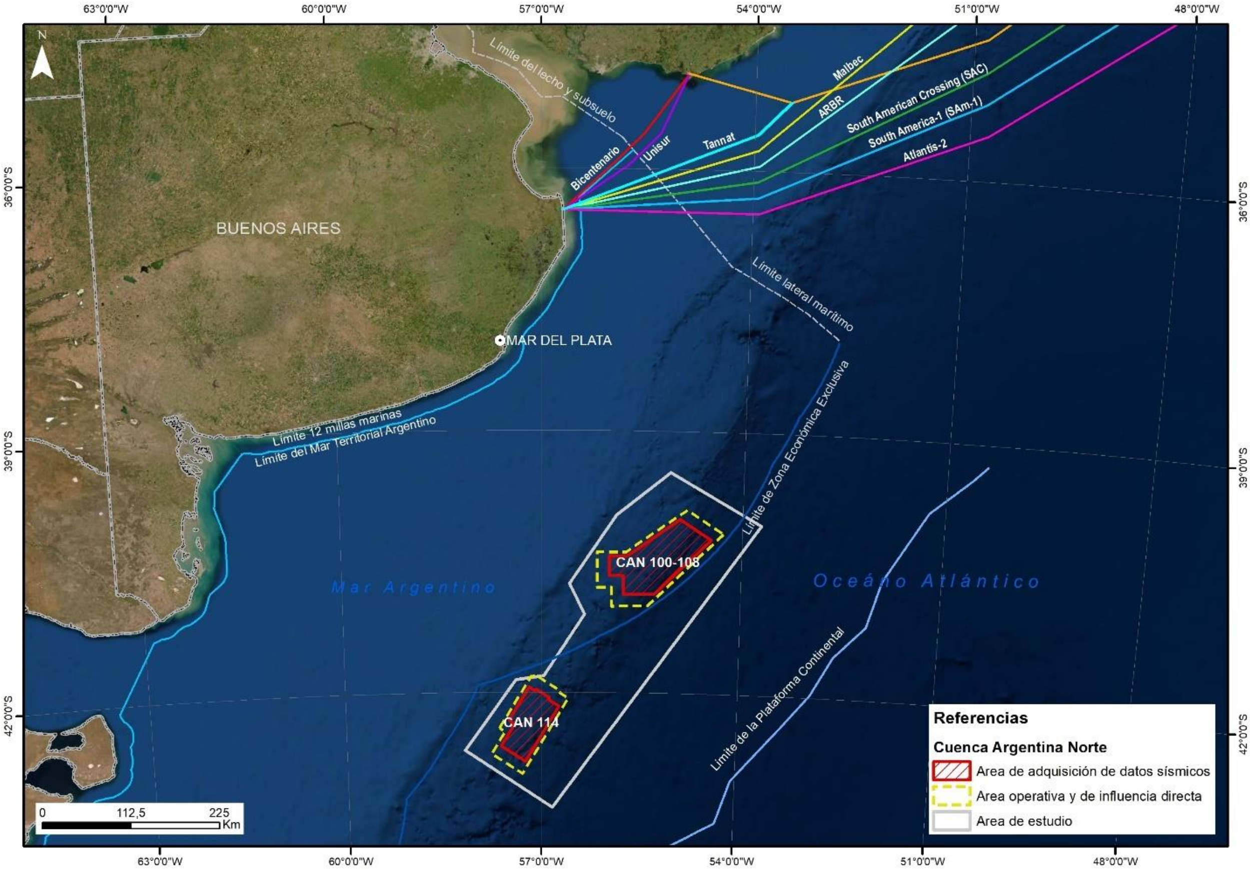

Figure 405. Presence of active submarine communication cables on the Buenos Aires coast of Argentina. Source: Own elaboration from the georeferencing of the image corresponding to the following site: https://www.submarinecablemap.com/#/[37].

(Translation of Figure 405: Límite del lecho y subsuelo: Seabed and Subsoil limit. Límite lateral marítimo: Maritime lateral limit. Límite de Zona Económica Exclusiva: Exclusive Economic Zone Limit. Límite 12 millas marinas: 12 Nautical-mile limit. Límite del mar Territorial Argentino: Argentine Territorial Sea Limit. Límite de

[36] It should be cleared up that, the laying of the traces of the underwater cables in the mentioned link is not exact, so the elaborated map presents the traces in the most approximate way possible.

[37] It should be cleared up that, the laying of the traces of the underwater cables in the mentioned link is not exact, so the elaborated map presents the traces in the most approximate way possible.

la Plataforma Continental: Continental Shelf Limit. Referencias: References. Cuenca Argentina Norte: North Argentine Basin. Area de adquisición de datos sísmicos: Seismic Data acquisition Area. Area operativa y de influencia directa: Operative and Direct Influence Areas. Area de Estudio: Study Area).

5.2 IDENTIFICATION AND STAKEHOLDER INVOLVEMENT PLAN

5.1.1. Introduction and Purpose

Disclosure of information and an open dialogue with potentially affected communities and other impacted interested parties, are key elements in all impact assessment processes undertaken by Equinor.

The main purpose of the stakeholder participation process, including the public hearing that shall be facilitated by the Convening Authority, is to identify the possible environmental and social contributions of the relevant actors and the probable concerns, related to the seismic survey planned by Equinor in the CAN_100, CAN_108 and CAN_114 licenses and, where appropriate, integrate this feedback into the Environmental Impact Assessment (EIA).

Given the timeline with planned operation start-up for the last quarter of 2021, the main focus of this plan shall be on early commitment and consultation with interested parties, prior to the approval of the EIA.

5.1.2. Regulations and Requirements

The regulations as to access to information and the process of citizen participation stand out as rights, although it is also worth considering them as interrelated instruments to promote, as far as this concerns, the sustainable development of the project in the environment (considering the social, economic and cultural fields as an integral part of said project) to obtain the social license.

The **General Environmental Law N° 25,675** sets forth the need to ensure free access of the population to information.

Hence, **Law N° 25,831** was enacted for **free access to environmental information**, understanding that it is the right of all interested citizens to be informed of the state of the environment where they live and the potential changes that could occur.

This standard, which must be applied by all jurisdictions, defines environmental information in this regard as all that linked to the description of the components of the environment, particularities of a project that may alter it and the policies, plans, programs and actions related to environmental management. It establishes the obligation of the competent authorities and / or companies that provide public services to offer the environmental information upon requirement and they can only deny it with due justification, also considering that access to information should be public and free.

As stated by the Secretariat of Environment and Sustainable Development (SAyDS) of the Argentine Nation (2019) in relation to the environmental impact assessment processes to comply with this standard, the EIA must be published and state that “The total or partial denial of access to the information must be well founded and the administrative acts for which it is denied must comply with the reasonable requirements set forth in the regulations of the corresponding jurisdiction.” (SAyDS, 2019. pp 17).

This rule was recently complied with through **Law 27,275** in 2016, which requires the disclosure of information by the State in order to strengthen transparency in management. Although it has not yet been ratified, the **Escazú Agreement** that Argentina signed in 2018 that seeks to guarantee this right together with that of participation and justice should be highlighted.

Regarding citizen participation, Law 25.675 states as one of the objectives of Argentina's environmental policy "... to promote social participation in decision-making processes ..." and at the same time, it states that everyone has the right to give an opinion on the environmental issue. This rule defines that citizen participation is mandatory in Environmental Impact Assessment procedures (art. 21). In addition to the right of access to information and environmental protection, consultation or public hearing is considered as the main way to guarantee these rights from the institutional spheres.

It is worth mentioning that public hearings have a non-binding nature for the enforcement authorities, although in case of sanctioning other than their main result, they must give due public justifications (Art. 20, Law 25.675).

It is important to highlight that these regulations are aimed at promoting access to clear, timely, reliable information and instances of community participation throughout a project cycle beyond the obligations of the State through its institutional bodies that are enforcement authorities.

The Project´s location and the activity provided for it must be taken into account considering Joint Resolution 3/19 of the former Government Secretariats for Energy, Environment and Sustainable Development. This regulation also contemplates the instance of citizen participation in the processing of the approval of the environmental impact assessments, after issuance of the declaration by the environmental portfolio.

In this way, and taking into account that both enforcement authorities have categorized this project as category II.A.1. "2D, 3D and 4D seismic acquisition operations" must be submitted to a public hearing, corresponding therefore the processing of an "ORDINARY ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURE".

Subsequently, the Directorate for Environmental Impact Assessment and Environmental Risk Analysis under the Ministry of Environment and Sustainable Development through the CATEGORIZATION AND SCOPE REPORT OF THE "SEISMIC ACQUISITION CAMPAIGN OFFSHORE ARGENTINA; NORTHERN ARGENTINE BASIN (CAN_108, CAN_100 AND CAN_114 AREAS) "EX-2020-11258246- -APN-DNEP # MHA (IF-2020-43049058-APN-DEIAYARA # MAD of July 6, 2020) established requirements for consultation with the interested parties, those that are integrated into the Environmental Impact Assessment through this Plan.

5.1.3. Stakeholder identification and mapping

Equinor has executed a broad investigation and analysis of potentially interested parties related to the planned offshore seismic programmes in Argentina with the support of ERM Argentina. This research has been carried out through a review of the public domain documentation on the web pages of the different organizations, including statements, information / news and a description of the activities they carry out.

The investigation and analysis of the data collected has had two reasons:

- Identify stakeholders in a global perspective. For the purpose of this investigation, an “interested party” has been defined as “any individual or group who is potentially impacted by the project or can themselves potentially impact the outcome of the project”.

- Based on detailed analysis of the information gathered, identify the key stakeholders with whom Equinor must proactively engage, prior to approval of the EIA.

The investigation has included the following three stages:

1. Development of a comprehensive register identifying interested parties.
2. Identification of nine key categories under which to organise groups of interested parties:
   - Public Administration: some of which fulfill a regulatory function directly applicable to the registration and authorization of projects related to oil and gas.
   - Non-governmental organizations at the local, national and international levels, as well as inter-governmental ones.
   - Professional, business and worker associations, such as trade unions, among others.
   - Academic Scope: Universities that have a role or interest in environmental issues related to hydrocarbons and offshore exploration.
   - Private sector: private companies and industrial groups operating offshore, including other oil and gas companies.
   - Media: including major newspapers, television, radio news channels, and online news sites.
   - Religious organizations that can influence the public perception of the project.
   - Native organisations.
   - Political Parties.
   - Community-based organisations.
3. Identification and analysis of interested parties in terms of:
   - Their supposed level of interest in Equinor’s offshore exploration project.
   - Their supposed level of influence upon the project.
   - Their probable position/attitude towards the project (against, neutral or positive).

Key research findings:

- The main dimensions of groups of interested parties vary across social, political, economic and environmental topics with the largest proportion of organisations having a dimension in “Environment”.

- A large proportion of stakeholders are considered likely to be “neutral” in their position towards Equinor's offshore exploratory operations in the Argentine Sea. They may move towards a more positive or negative position depending on how they are being approached and engaged with.

- The organisations with the greatest degree of influence upon the project fall largely under the “Public Administration” category.

- Some NGOs can influence opinions about seismic surveys, although they do not have the greatest degree of influence.

Degree of involvement:

The appropriate level of consultation and communication within the complete list of interested parties shall differ. During the analysis the model below was used as a tool to group and visualize the interested parties according to their interpreted level of interest and influence. Following the logic of 'the higher the interest and influence, the higher involvement level', the model subsequently suggests a preferred level of involvement for different interested parties ranging from:

- "Close interaction" (upper right quadrant).
- "Keep informed" (lower right quadrant).
- "Monitor" (lower left quadrant).
- "Keep satisfied" (upper left quadrant).

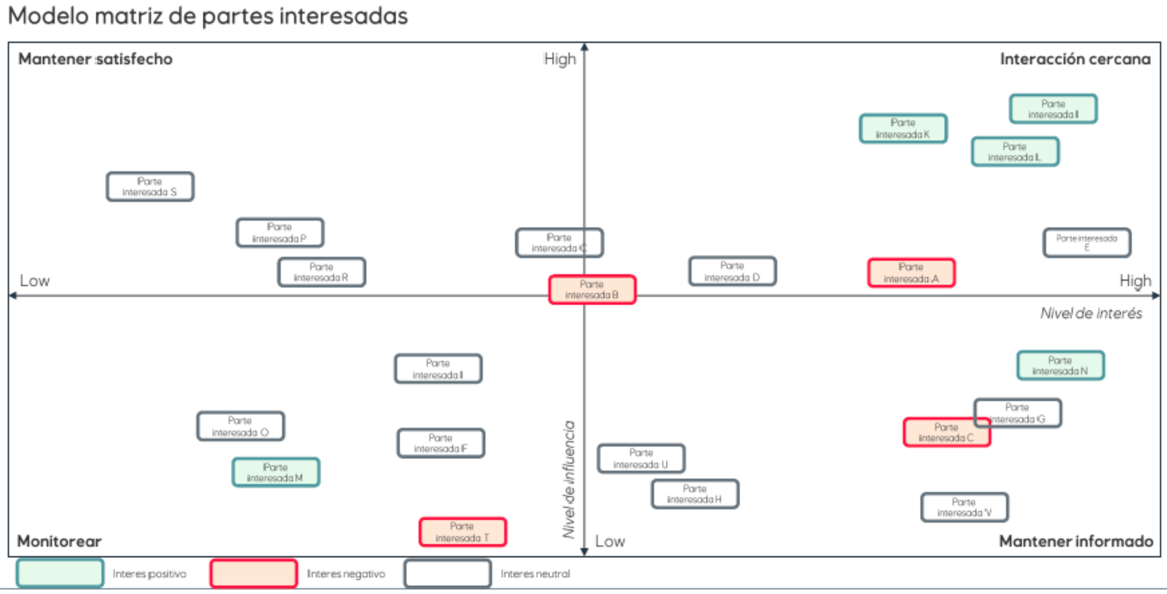

Figure 406. Model used to group and visualize stakeholders according to level of interest and influence.

(Translation of Figure 406: Modelo Matríz de partes interesadas: Matrix model of Interested parties. Mantener satisfecho: keep satisfied. Interacción cercana: Close interaction. Monitorear: Monitoring. Mantener informado: Keep informed. Nivel de Influencia: Influence level. Interes positivo: Positive Interest. Interes negative: Negative Interest. Interes neutral: Neutral Interest. Parte Interesada: Interested Party/Stakeholder).

Such a model shall provide a simplified image and not portrait an exact image of reality conveying all aspects. The stakeholders within each quadrat shall not belong to a homogenous group that requires the same level of involvement. Also, the image shall not be static The actors may shift positions, new ones might enter and the landscape of interested parties needs to be monitored throughout the public participation process.

Key Stakeholders:

The complete list of potential interested parties gathered from the desktop study amounts to more than a hundred. It has served as a database for further analysis and an assessment of which parties should be defined as 'key actors'.

The "Guide to Strengthen Public Participation and Social Impact Assessment" states: "From a broad perspective, the key actors are those people, groups or institutions involved or positively or negatively affected by a project, and whose participation is necessary for the adequate achievement of the purpose and objectives established for the evaluation".

Through the assessment of what interested parties should be defined as key actors, the general principles have been as follows:

- The higher influence upon and interest in the project an interested party has, the higher priority the interested party should have. Following this principle, the ministries involved in the regulatory- and EIA process shall have the highest scores on these criteria.

- Ranking of the interested parties affected by, or with a specific interest in the area of the project as key actors. Such key actors should not only be informed, but also be consulted by proactively asking for their input and potential concerns. A relevant example representing such key actors would be the fishing chambers.

From the perspective of the early consultation that Equinor shall carry out, the company has used the following definition of key actors: "Those people, groups or institutions that are affected by the project activities planned by Equinor or that have a specific interest in the area where these activities shall be carried out".

5.1.4. Stakeholder approach and strategy

Aims:

As stated in the introduction, the primary purpose of the public participation process, including the public hearing, is to identify potential stakeholder comments and concerns on environmental and social issues and, where appropriate, integrate this feedback into the EIA (Environmental Impact Assessment).

Equinor's overall objective is to contribute to a best practice participation process:

- Through the way we inform and involve relevant interested parties.
- By ensuring alignment both with the requirements from MAyDS/SE, and Equinor's principles for impact assessments as a tool for managing environmental and social impacts in project performance.
- By participating and contributing in discussions with other members of the industry in the Offshore Commission in the IAPG and other regular meetings with our peers, to align on a best practice process across the industry.

Safeguard reputation and license to operate:

Second, Equinor aims to safeguard reputation and license to operate by developing relationships with key players involved in our offshore exploration projects in Argentina.

Strategic approach:

The aim is to continuously evaluate our outreach and activities directed towards interested parties, take learnings and implement them in our plans moving forward. Such learnings could be to realise the need to consult with other interested parties that should be defined as key actors or having achieved a deepened understanding of specific input from key actors, and thereby optimise further communication towards interested parties.

Equinor shall:

- Consult with 'key actors' as follows:
  - Proactively reach out to those directly impacted by or with a specific interest in the area of the project, asking for their feedback.
  - Arrange for meetings when relevant.
- Disclose information about the project to all interested parties in a broader perspective by:
  - Establish a designated area on our website with information about the project, including a response option for potential feedback to Equinor.
  - Ensure that the information is accessible and easy to understand by those seeking information on Equinor´s seismic project.
  - Ensure that the information is accessible and easy to understand across interested parties.
- Document directed activities and feedback from interested parties.

Consultation with stakeholders of the initial phase carried out from December 15, 2020 to the beginning of February 2021:

The consultation with key actors started early to analyze their input and enable identification of potential risks and impacts at an early stage to subsequently cater for improvement of mitigating actions.

As described in point **Error! Reference source not found.**, Equinor has done an extensive mapping of potential interested parties related to offshore oil and gas in offshore Argentina. The aim was to get a better understanding of the totality of interested parties as such, and particularly to comprehend whom we should reach out to proactively and consult at an early stage.

After our analysis and alignment with industry peers in Argentina when relevant, the following list of "key players" was defined in point **Error! Reference source not found.**, for the first consultation activity:

Table 45. List of interested parties according to their category.

Stakeholder category		Interested Party
Public Administration	Fishing related	CENADAC
		INIDEP
		Consejo Federal Pesquero
		Subsecretaría de Pesca – Dirección y Planificación de Pesquerías
	Investigation	Proyecto Pampa Azul
		CONICET
	Port related	Puerto de Buenos Aires
		Puerto de Mar del Plata
Professional, Business and Workers' Associations	Fishing chambers	CEPA
		CAPeCA
		CAIPA
		CAPIP
		CAPA
		CAABPA
		AEPC
	Fishing and maritime Unions	SOMU
	Naval chambers	CAENA
		Cámara Naviera Argentina
		FENA
	Non-profit private sector	Instituto Argentino de Energía
		IAPG
		Cluster de energía de Mar del Plata
Non-Governmental Organizations	Environmental	Fundación Ambiente y Medio
		Fundación Biodiversidad
		Fundación CETHUS
		ICB
		Fundación Patagonia Natural
ACADEMIA	Universities	Universidad del Mar del Plata

Due to a challenging Covid-19 context it has proved difficult to reach stakeholders. Many have been working from home making it difficult to reach them by their official phone number and physical meetings have not been an option. Equinor therefore chose to use email as our primary channel. An official mailbox for the project, ARG_sismica_norte@equinor.com, was established to distribute information, allow comments, and collect and enable documentation of mails to and from stakeholders.

During week 51 (12-14-18 / 2020), Equinor distributed information about the project, including a stakeholder consultation to share their comments, potential concerns, and their point of view on which other stakeholders Equinor should contact. See Annex - Point **Error! Reference source not found.** for distributed material and details on disclosure. In the Annex, Point 0 shows the dialogue and when it took place.

By the end of January 2021, Equinor had received response from 8 stakeholders; INIDEP, "Cluster de Energía Mar del Plata", Leviticus Subsea (member of the "Cluster de Energía Mar del Plata"), Antares Naviera (member of CAENA), Argentina Institute of Energy, Mar del Plata Port Management (member of the "Cluster de Energía Mar del Plata"), ICB and CAPeCA. CAPeCA and ICB have provided input, questions and concerns about the project. Their input and Equinor's answers to this is to be found in Annex – Point 0.

See Point 0 of the Annex for an overview of the scope and dialogue with all key stakeholders during this initial consultation phase.

Plans for involvement of interested parties through all phases:

Outreach to and dialogue with interested parties shall be a continuous process with two main phases, each including several sub-stages. As mentioned above, Equinor shall follow a stepwise approach and implement learnings to optimise our plans and activities on a continuous basis.

Phase 1: Consultation of key stakeholders before obtaining final approval of the EIA

In this phase, consultation, evaluation and mitigation shall be the focus through the following stages:

- Early consultation with key stakeholders before submitting the EIA (finalized).
- Communication activities up until the public hearing.
- Communication activities after the public hearing.

Equinor has carried out the first step of this early consultation phase, as described above.

Phase 2: Follow-up and communication with key stakeholders after the approval of the EIA

- Prior to operations. Examples: inform about time and location, define communication protocols with key stakeholders.
- During Operations. Examples: Regular updates on the vessel's operation and location, notification and coordination in case of incidents or emergencies, early identification of potential difficult routes/activities.
- Inform about the end of activities.

Digital Channel:

The company shall make information about the project easily accessible for a wider range of interested parties on the web. The plan is to create a page on the Equinor.com website during the first quarter of 2021. The webpage shall contain content like; a presentation of the project, information about how seismic surveys are being carried out and Q&A documents on key topics and issues related to seismic operations. There shall also be a reply option (ARG_sismica_norte@equinor.com) for those who want to contact Equinor with comments or questions.

5.1.5. Complaints and claims management procedure

EQUINOR shall set up a Complaints and Claims Management Procedure for the seismic survey of the company that covers CAN_100, CAN_108 and CAN_114 licenses, in due time prior to the start of operations. The mechanism shall be effective throughout the operations and for a short period of time after the operations are completed.

The Complaints and Claims Management Procedure is defined as a systematic non-judicial mechanism for the purpose of receiving, investigating, responding and resolving complaints from individuals or communities or their representatives, which are related to the operations of Equinor, its contractors and subcontractor. It shall be designed to resolve grievances in a transparent, systematic and timely manner.

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ANNEX I - CONSULTATION OF THE INITIAL PHASE WITH INTERESTED PARTIES

ANNEX II – COMMUNICATIONS WITH THE INTERESTED PARTIES

This section of the annex documents the contacts Equinor has had with each of the key stakeholders, showing the type of contact, the date and a brief description of the dialogue. In some cases, the disclosure document was sent to organizations representing several members (e.g., fishing chambers) and forwarded to their members. It also specifies the cases in which some members have contacted Equinor individually.

Interested Party	Type of Contact	Date	Dialogue description
CENADAC	Equinor´s email	15-Dec-20	The disclosure document was sent.
INIDEP	Equinor´s email	15-Dec-20	The disclosure document was sent.
	INIDEP´s email	15-Dec-20	INIDEP acknowledged receipt of the document and informed that it would be distributed to the relevant people.
Federal Fisheries Council	Equinor´s email	15-Dec-20	The disclosure document was sent.
Undersecretariat of Fisheries – Fisheries Management and Planning	Equinor´s email	15-Dec-20	The disclosure document was sent.
Pampa Azul Project	Equinor´s email	15-Dec-20	The disclosure document was sent.
CONICET	Equinor´s email	15-Dec-20	The disclosure document was sent.
Port of Buenos Aires	Equinor´s email	15-Dec-20	The disclosure document was sent.
Port of Mar del Plata	Equinor´s email	15-Dec-20	The disclosure document was sent.
CEPA	Equinor´s email	15-Dec-20	The disclosure document was sent.
CAPeCA	Equinor´s email	15-Dec-20	The disclosure document was sent.
	CAPeCA´s email	21-Dec-20	CAPeCA sent a document with specific consultations on the project (see ANNEX I - CONSULTATION OF THE INITIAL PHASE WITH INTERESTED PARTIES).
	Equinor´s email	08-Jan-21	Equinor appreciates the detailed response received and explains that it is currently working on a response (see ANNEX I - CONSULTATION OF THE INITIAL PHASE WITH INTERESTED PARTIES).
	Equinor´s email	10-Mar-21	Equinor responded to the document received (see ANNEX I - CONSULTATION OF THE INITIAL PHASE WITH INTERESTED PARTIES).
CAIPA	Equinor´s email	15-Dec-20	The disclosure document was sent.
CAPIP	Equinor´s email	15-Dec-20	The disclosure document was sent.
CAPA	Equinor´s email	15-Dec-20	The disclosure document was sent.
CAABPA	Equinor´s email	15-Dec-20	The disclosure document was sent.
AEPC	Equinor´s email	16-Dec-20	The disclosure document was sent.
SOMU	Equinor´s email	15-Dec-20	The disclosure document was sent.
CAENA	Equinor´s email	15-Dec-20	The disclosure document was sent.
Antares Naviera (member of CAENA)	Antares Naviera´s email	17-Dec-20	Antares Naviera confirms having received the information and requests more details about the operations offered by its vessels for Equinor's activities.
	Equinor´s email	08-Jan-21	Equinor thanks Antares Naviera for its

			response and explains the strict Bidding process that Equinor follows for its offshore activities and, in particular, for this seismic project. In addition, the seismic operator may outsource some supply/support activities to Argentine companies, but this decision is completely outside Equinor's area of responsibility.
Argentine Marine Chamber	Equinor´s email	15-Dec-20	The disclosure document was sent.
FENA	Equinor´s email	16-Dec-20	The disclosure document was sent.
Argentine Institute of Energy [38]	Equinor´s email	15-Dec-20	The disclosure document was sent.
	IAE email	22-Dec-20	The IAE appreciates the information provided and the willingness of Equinor to explain its activities.
	Equinor´s email	08-Jan-21	Equinor thanks the IAE for its response.
IAPG	Equinor´s email	15-Dec-20	The disclosure document was sent.
Mar del Plata Energy Group (They sent it to: - Universidad Nacional de MdP - INTEMA Argentine Navy)	Equinor´s email	16-Dec-20	The disclosure document was sent.
	Mar del Plata Energy Group´s email	16-Dec-20	The group appreciates the information provided and sends it to its members and other organizations.
	Equinor´s email	08-Jan-21	Equinor thanks the Group for their response and explains that it will continue to inform stakeholders with relevant updates as the project develops.
Leviticus Subsea (Member of Mar del Plata Energy Group MdP)	Levíticus email	16-Dec-21	Leviticus appreciates the information and offers its availability to help and participate in the project.
	Equinor´s email	08-Jan-21	Equinor thanks Leviticus for its response and explains that it will continue to inform stakeholders with relevant updates as the project develops.
	Levíticus email	08-Jan-21	Leviticus responded by saying they are available for what Equinor might need.
Port Management of Mar del Plata (member of the MdP Energy Group)	Mar del Plata Port Management Email	14-Jan-21	MdP's Port Management explains that its headquarters are located in the MdP port that Equinor plans to use. Describe the type of services they can offer and request more details about Equinor's logistics during seismic activities.
	Equinor´s email	20-Jan-21	Equinor thanks the MdP Port Management for its response and explains the strict bidding process that Equinor follows for its offshore activities and, in particular, for this seismic project. In addition, the seismic operator may outsource some supply/support activities to Argentine companies, but this decision is completely outside Equinor's area of responsibility.
Environment and Ambient Foundation	Equinor´s email	15-Dec-20	The disclosure document was sent.

[38] Equinor and the IAE had a meeting on November 17 within the framework of the process prior to the hiring of stakeholders for the Seismic Project planned for MLO_121, AUS_105 and AUS_106. Equinor presented the company, the Argentina Offshore team and the planned Seismic Projects. At the meeting, discussions and information relevant to the present project were dealt with.

Biodiversity Foundation	Equinor´s email	15-Dec-20	The disclosure document was sent.
Fundacion CETHUS	Equinor´s email	15-Dec-20	The disclosure document was sent.
ICB	Equinor´s email	16-Dec-20	The disclosure document was sent.
	ICB email	13-Jan-21	CB appreciated the commitment and sent a document with specific queries and concerns about the project (see ANNEX III - DOCUMENTATION OF THE COMMUNICATIONS WITH INTERESTED PARTIES).
	Equinor´s email	9-Mar-21	Equinor responded to the document with comments received (see ANNEX III –).
Patagonia Natural Foundation	Equinor´s email	16-Dec-20	The disclosure document was sent.
University of Mar del Plata	Equinor´s email	16-Dec-20	The disclosure document was sent.

ANNEX III – DOCUMENTATION OF THE COMMUNICATIONS WITH INTERESTED PARTIES

- **Communications with CAPeCA**

C.A.Pe.C.A.

Cámara de Armadores de Pesqueros y Congeladores de la Argentina

Buenos Aires, 21/12/2020

A la Sra. Nidia Álvarez Crogh

Presidenta Equinor Argentina

S/D

Referencia: Actividad de exploración sísmica 3D en las áreas CAN 100, CAN 108 y CAN 114, Cuenca Argentina Norte.

Me dirijo a usted en relación a la actividad de la referencia, dado que atentamente se ha informado a esta Cámara sobre las características del Proyecto de relevamiento sísmico 3D que se planea llevar a cabo en las áreas CAN 100, CAN 108 y CAN 114 ubicadas en la Cuenca Argentina Norte. Como usted sabe, nuestros representados constituyen un conjunto de empresas pesqueras con intereses ligados a la explotación sustentable de recursos en áreas donde actualmente se proyectan varias prospecciones sísmicas hidrocarburíferas. Debido a ello, y al conocimiento existente sobre el impacto negativo potencial que dicha actividad tiene sobre los recursos fuente de nuestra industria, es que tenemos una serie de interrogantes respecto de los estudios de impacto ambiental y de la posterior actividad sísmica que se proyecta desarrollar. En función de ello, y ante la posibilidad de consulta que amablemente indicó en su presentación, es que decidimos elaborar un cuestionario a los efectos de conocer más acerca del proceso de marras. Este cuestionario es similar a aquel realizado con motivo de la presentación del proyecto de EQUINOR SA en la cuenca sur, particularmente para las áreas MLO_121, AUS_105 y AUS_106.

Preliminarmente, considero oportuno manifestarle que en base a las preguntas formuladas en el documento, cabe destacar que nuestra mayor preocupación, compartida por todo el sector, versa sobre la potencialidad y magnitud del impacto que dicha actividad exploratoria pueda generar, directa o indirectamente, sobre el recurso pesquero en dicha zona.

Como es de su conocimiento, el estudio de impacto ambiental requerido por la normativa vigente, es una de las principales herramientas con la que contamos para identificar, predecir, valorizar, mitigar y en caso de ser necesario, remediar los efectos negativos que pudieran surgir de la exploración sísmica. En ese sentido, estamos interesados en conocer si dicho estudio estará disponible para las partes interesadas con la antelación suficiente para su análisis detallado previo a las instancias de consulta pública.

En virtud de lo expresado, solicitamos amablemente nos informen sobre los siguientes puntos:

-¿Qué variables/aspectos se tienen en cuenta para definir la línea de base del área evaluada? ¿Se basan únicamente en bibliografía o han actualizado determinada información a través de estudios de campo?

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C.A.Pe.C.A.

Cámara de Armadores de Pesqueros y Congeladores de la Argentina

-¿Se han realizado o se están realizando análisis de sensibilidad y resiliencia de los diversos componentes del ecosistema en el cual está emplazado el proyecto?

-¿Qué metodología se aplica para analizar los posibles impactos ambientales del proyecto, considerando la identificación, valoración y evaluación de los mismos?

-¿Cuáles son las actividades impactantes consideradas en forma previa, que potencialmente presenta el proyecto en cada una de sus etapas (construcción, funcionamiento y cierre)?

-Debido a que el estudio de impacto ambiental, junto con otros procedimientos de gestión ambiental, buscan reducir o corregir las consecuencias o efectos ambientales que determinadas acciones del proyecto exploratorio pueden causar, ¿se establecerá algún mecanismo de compensación para la industria pesquera en base a los posibles impactos que puedan ocurrir, se encuentren estos contemplados en el estudio de impacto ambiental realizado, o bien para el caso de que determinado impacto evaluado presente una magnitud diferente a las esperada?

-¿Se ha tomado en consideración la dinámica de los recursos que habitan las zonas a prospectar, particularmente la distribución espacial y las características biológicas de los mismos, de conformidad con el documento titulado "*Estado del conocimiento biológico pesquero de los principales recursos vivos y su ambiente con relación a la explotación hidrocarburífera en la Zona Económica Exclusiva Argentina y adyacencias*" elaborado por el Instituto Nacional de Investigación y Desarrollo Pesquero (INIDEP)?

-Teniendo en cuenta que ya se ha establecido, aunque en forma aproximada, el período de realización de las actividades sísmicas, a iniciarse en el cuarto trimestre de 2021 y con una duración de alrededor de 120 días, ¿se ha considerado la superposición parcial en tiempo y espacio de dicha actividad en relación al área de cría del Calamar argentino (*Illex argentinus*)? ¿Se considera la posibilidad de modificar la fecha y periodo propuesto a fin de minimizar el impacto sobre el recurso?

¿Cuáles son las principales medidas de mitigación contempladas en el EIA? ¿Se establecerá un plan de gestión ambiental que permita contemplar aspectos de importancia que pudieran surgir de la instancia de audiencias públicas? ¿Cuál será el grado de flexibilización del plan de gestión a implementarse?

Por último, consultarle en caso de conocer, ¿Cuándo se estima que se llevará a cabo la etapa de audiencias públicas previas a la aceptación de la Evaluación de Impacto Ambiental por parte de la Autoridad de Aplicación?

Sin otro particular, y agradeciendo su particular interés en informar a todos los genuinos interesados, la saludo con atenta consideración.

Eduardo Román

Gerente C.A.Pe.C.A

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9 de marzo de 2021

Señores,
Cámara de Armadores de Pesqueros y Congeladores de la Argentina - CAPeCA

Atte. Eduardo Román
Gerente - Apoderado

Estimados Señores,

Reciban un cordial saludo en ocasión de agradecerles su atención a los Estudios de Impacto Ambiental que estamos desarrollando para la adquisición sísmica offshore en Argentina, a la vez que manifestamos nuestras disculpas ante el tiempo tomado para responder a las preguntas que nos manifestaran en las correspondencias recibidas.

Hemos recopilado sus comentarios y preguntas y a continuación les brindamos aclaratoria y respuesta a las mismas

1. **Comentario / Pregunta de CAPeCA:** Como saben, el estudio de impacto ambiental que exige la normativa vigente es una de las principales herramientas con las que contamos para identificar, predecir, valorar, mitigar y, si fuera necesario, remediar los efectos negativos que puedan derivarse de la exploración sísmica. Al respecto, nos interesa saber si dicho estudio estará disponible para los interesados con suficiente anticipación para su análisis detallado previo a las instancias de consulta pública, así como algunos de los siguientes temas:

Respuesta de Equinor: De acuerdo al Decreto 1172/03, la Autoridad Convocante deberá publicar durante DOS (2) días la convocatoria a Audiencia Pública, con aviso no menor a los VEINTE (20) días hábiles a la fecha fijada para su realización, en la Gaceta oficial, en al menos DOS (2) diarios de circulación nacional y, en su caso, en la página de Internet de dicha área. Aún no tenemos no sabemos la fecha exacta en que el Estudio de Impacto Ambiental estará disponible, sin embargo, estimamos que durante los 20 días indicados la Autoridad de Aplicación lo hará posible.

2. **Comentario / Pregunta de CAPeCA:** ¿Qué variables / aspectos se utilizan para definir la línea de base del área evaluada? ¿Se basan únicamente en la literatura o se ha actualizado cierta información a través de estudios de campo?

Respuesta de Equinor: Se consideraron los requisitos legales aplicables, la bibliografía y antecedentes a nivel mundial y las normas más actuales que rigen este tipo de estudios. Los estudios de campo no formaron parte del alcance del estudio.

3. **Comentario / Pregunta de CAPeCA:** ¿Se han realizado análisis de sensibilidad y resiliencia de los distintos componentes del ecosistema en el que se ubica el proyecto?

Respuesta de Equinor: Se ha realizado un análisis del proyecto desde una perspectiva ambiental y del entorno con la finalidad de identificar los impactos en este ámbito. Asimismo, han sido evaluadas las interacciones que podrían producirse entre los aspectos ambientales del proyecto y los factores de los ambientes naturales y antrópicos que podrían ser influenciados por tales acciones. Para identificar la susceptibilidad de los factores afectados, se ha realizado un Análisis de Sensibilidad Ambiental con base en el desarrollo de la Línea Base Ambiental. Para evaluar los potenciales impactos ambientales asociados al proyecto en estudio, se siguió la metodología propuesta por Vicente Conesa Fernández - Vitora (1997, Guía Metodológica para la Evaluación de Impacto Ambiental, Matriz de Importancia).

4. **Comentario / Pregunta de CAPeCA:** ¿Cuáles son las actividades de impacto previas que potencialmente presentarían el proyecto en cada una de sus etapas (construcción, operación y cierre)?

Respuesta de Equinor: El estudio incluye la evaluación ambiental de la etapa de adquisición sísmica. Los impactos analizados corresponden a los relacionados con los aspectos más significativos del proyecto en estudio y su impacto potencial sobre los factores ambientales identificados como de mayor sensibilidad. En este sentido, los aspectos ambientales considerados en la evaluación están relacionados principalmente con las actividades que se realizan en las embarcaciones: la acción de generar pulsos sonoros, el movimiento de las embarcaciones y el manejo de sustancias especiales, residuos y combustibles en las embarcaciones.

5. **Comentario / Pregunta de CAPeCA:** Dado que el estudio de impacto ambiental, junto con otros procedimientos de gestión ambiental busca reducir o corregir las consecuencias o efectos ambientales que pudieren ocasionar determinadas acciones del proyecto exploratorio, quién se hará cargo de los posibles impactos no contemplados en el estudio de impacto ambiental realizado, o en el caso de que un impacto evaluado tenga una importancia diferente a la esperada.

Respuesta de Equinor: Todos los impactos identificados se describen en los Estudios de Impacto Ambiental (EIA). Según nuestros criterios de tolerancia, buscamos reducir al máximo los impactos introduciendo acciones mitigadoras. Los grandes impactos no son aceptables. Todas las acciones de mitigación que se describen en el EIA y los planes de manejo ambiental se desarrollan para asegurar que las acciones de mitigación sean llevadas a cabo y verificadas como corresponde.
Todas las medidas de mitigación identificadas también se enumeran en un registro interno de Equinor que se desarrollará una vez finalizado el EIA. Las responsabilidades estarán claramente descriptas en este registro (persona / entidad / empresa), para asegurar la aplicación de las medidas de mitigación.

6. **Comentario / Pregunta de CAPeCA (area sur):** Dado que ya se ha establecido el período de realización de actividades sísmicas, aunque aproximadamente, para comenzar en el cuarto trimestre de 2021 y con una duración aproximada de 150 días, se ha considerado la coincidencia temporal y espacial de dicha actividad con las actividades pesqueras del sur, en particular de la merluza de cola larga? ¿El plan de mitigación establecido considera la posibilidad de cambiar la fecha y el período propuesto para minimizar el impacto sobre el recurso y la interacción con la flota pesquera que opera en la zona?

Respuesta de Equinor: Se considera que la actividad sísmica tendrá una interferencia muy baja en las pesquerías más relevantes que se realizan en la región sur como son la Rosada del Cabo (Genypterus spp.), La Polaca austral (Micromesistius australis), la Merluza de Cola (Macruronus magallanicus) y Merluza austral (Merluccius australis). El análisis de la distribución espacial de las diferentes flotas pesqueras con respecto al área de influencia del proyecto identifica una interacción baja, y solo en el sector noreste, sobre la salida del Estrecho de Magallanes en verano y primavera. En lo que respecta a la Merluza de cola (Macruronus magallanicus) existe efectivamente una baja posibilidad de interacción en el cuarto trimestre ya que la pesquería de esta especie se expande hacia el oeste acercándose a la costa de Tierra del Fuego. Sin embargo, el área de mayor concentración del cardumen está lejos del área de prospección. La zona de reproducción y cría no tiene relación con el área sísmica y, aunque se han encontrado concentraciones importantes de larvas a la salida del Canal de Beagle (no del Estrecho de Magallanes), la interacción con el área sísmica es nula. Al mismo tiempo, cabe indicar que ninguna de las otras especies mencionadas tiene su área de cría o reproducción en el área en cuestión.

En relación al período de ejecución de las actividades sísmicas, Equinor ha evaluado en detalle las posibilidades de operar en las diferentes temporadas. Al respecto, cabe señalar que las operaciones en las condiciones climáticas que prevalecen en la zona en el período otoño-invierno, son con cierta frecuencia riesgosas para la navegación (del buque sísmico y en particular para los buques de apoyo por su menor tamaño), pero especialmente para maniobras de despliegue / recuperación de equipos sísmicos (fuentes de aire comprimido, serpentinas, deflectores, etc.) involucrados en los complejos despliegues sísmicos 3D. De acuerdo con las normas de seguridad aplicables a la industria, estos riesgos son inaceptables en la zona para el período otoño-invierno y limitan la realización de las operaciones 3D exclusivamente al período primavera-verano.

7. **Comentario / Pregunta de CAPeCA (Area norte):** Teniendo en cuenta que ya se ha establecido el plazo para la realización de actividades sísmicas, aunque de forma aproximada, durante el cuarto trimestre de 2021 y con una duración en torno a los 120 días, y que se superpone parcial y temporalmente con la zona de cría del Calamar Argentino (Illex argentinus) ¿Se está considerando la posibilidad de modificar la fecha y el período propuestos para minimizar el impacto sobre el recurso?

Respuesta de Equinor: Efectivamente, se ha considerado la ventana temporal de cría y reproducción del calamar argentino (Illex argentinus) con respecto al área de prospección. El área de cría y reproducción de esta especie no se superpone en la temporada de primavera con el área donde la influencia se puede considerar como directa por el impacto de las ondas sísmicas. El área de reproducción es muy extensa y se desarrolla al oeste en lugar de al este del borde de la plataforma.

8. **Comentario / Pregunta de CAPeCA:** Debido a que el estudio de impacto ambiental, junto con otros procedimientos de gestión ambiental, buscan reducir o corregir las consecuencias o efectos ambientales que puedan ocasionar determinadas acciones del proyecto exploratorio, se establecerá un mecanismo de compensación para la industria pesquera en base a los posibles impactos que puedan ocasionar, ¿están contemplados en el estudio de impacto ambiental realizado, o en el caso de que un determinado impacto evaluado tenga una magnitud diferente a la esperada?

Respuesta de Equinor: Con base en la evaluación ambiental realizada, las medidas de mitigación y los programas de gestión ambiental incluidos en el estudio, no se espera que los impactos del proyecto sean significativos. Equinor establecerá un Procedimiento de gestión de quejas y reclamos durante todas las operaciones y por un corto período de tiempo luego de finalizar mismas. El Procedimiento de gestión de quejas y reclamos se define como un procedimiento no judicial sistemático con el propósito de recibir, investigar, responder y resolver reclamos de individuos o comunidades o sus representantes, que se relacionen con las operaciones de Equinor, sus contratistas y subcontratistas, y el mismo estará diseñado para resolver las quejas de manera transparente, sistemática y oportuna.

9. **Comentario / Pregunta de CAPeCA:** ¿Se ha tomado en consideración la dinámica de los recursos que habitan las áreas a relevar, particularmente su distribución espacial y sus características biológicas, de acuerdo con el documento titulado "Estado del conocimiento pesquero biológico de los principales recursos vivos y su entorno en relación con explotación de hidrocarburos en la Zona Económica Exclusiva Argentina y sus alrededores" elaborado por el Instituto Nacional de Investigación y Desarrollo Pesquero (INIDEP)?

Respuesta de Equinor: Este documento en particular, junto con el resto de la bibliografía específica, se ha considerado para evaluar la distribución espacial y características biológicas de los recursos involucrados en el área de influencia del proyecto.

10. **Comentario / Pregunta de CAPeCA:** ¿Cuáles son las principales medidas de mitigación previstas en el EIA? ¿Se establecerá un plan de gestión ambiental flexible para abordar aspectos importantes que puedan surgir de las audiencias públicas?

Respuesta de Equinor: La incidencia de las actividades de adquisición sísmica aún carece de conclusiones firmes sobre su efecto sobre las capturas. Cualquier posible efecto sobre los peces puede no traducirse necesariamente en efectos a escala poblacional o interrupciones en la pesca. Si bien varios estudios han demostrado que la exposición a emisiones de fuentes sísmicas tiene un impacto en la captura de peces, posiblemente como resultado de respuestas de comportamiento y distribución de peces durante y después de la exposición al sonido, algunos autores sugieren que los efectos sobre la pesca pueden ser transitorios, ocurriendo principalmente durante la exposición al sonido en sí. También existen otros factores ajenos a la actividad sísmica que afectan las capturas (pesca en sí, pesca ilegal, etc.).
En cualquier caso, el área de adquisición sísmica tiene una escasa importancia pesquera o es secundaria para algunas especies de reconocida importancia en la región sur como la Rosada del Cabo (Genypterus spp.), la Polaca Austral (Micromesistius australis), la Merluza de Cola (Macruronus magallanicus) y la Merluza austral (Merluccius australis. Las pesquerías de macro-crustáceos en la zona no son de gran importancia económica.

Dado que el área del proyecto tiene una relación muy marginal con las pesquerías relevantes que se realizan en la región sur, se estima que la prospección sísmica tendrá una interferencia muy baja ya que las actividades pesqueras están muy diseminadas en el área y la densidad es baja.

De acuerdo con la metodología de la Evaluación de Impacto Ambiental aplicada, y considerando la baja sensibilidad de las pesquerías en el área del proyecto, el impacto por actividades sísmicas se evalúa como bajo.

Con respecto al Plan de Manejo Ambiental, sírvase ver nuestra respuesta a la pregunta No. 5. Si se necesitara alguna actualización del EIA posterior a la Audiencia Pública, los impactos, acciones de mitigación y planes de manejo ambiental se actualizarán en consecuencia.

11. **Comentario / Pregunta de CAPeCA:** ¿Cuándo se estima que tendrá lugar la etapa de audiencias públicas previa a la aceptación de la Evaluación de Impacto Ambiental por parte de la autoridad de implementación?

Respuesta de Equinor: La Autoridad de Aplicación ha solicitado algunas aclaraciones sobre el estudio presentado. Se espera que las mismas se presenten a finales de febrero de 2021. De acuerdo con lo establecido por la Autoridad de Aplicación, la revisión de la información adicional requerirá aproximadamente 30 días hábiles después de los cuales se convocará a Audiencia Pública.

Atentamente,

The Offshore Argentina Project Team
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- **Communications with ICB**

8 de enero de 2021

Respuesta del Instituto de Conservación de Ballenas a la comunicación recibida el mes de diciembre de 2020, realizada por Equinor Argentina AS en relación con el "Proyecto de relevamiento sísmico 3D en las áreas CAN 100, CAN 108 y CAN 114 Cuenca Argentina Norte"

Contactos: Mariano Sironi (mariano.sironi@icb.org.ar) y Diego Taboada (diego.taboada@icb.org.ar).

El Instituto de Conservación de Ballenas (ICB) es una asociación civil sin fines de lucro cuya misión es conservar a las ballenas y su medio ambiente mediante la investigación y la educación. Su principal objetivo es monitorear el estado de la población de ballena franca austral que reproduce en Península Valdés, Chubut, para conocer más sobre la biología de las ballenas y proporcionar datos para su manejo y protección a lo largo de todo su hábitat en el Atlántico sur. Para ello, el ICB desarrolla numerosos proyectos de investigación científica en colaboración con investigadores de diversas instituciones nacionales e internacionales.

En tal sentido, el ICB participa del proyecto colaborativo #SiguiendoBallenas (http://siguiendoballenas.org) que se inició en 2014. Tiene por objetivo conocer las rutas migratorias y áreas de alimentación de las ballenas francas australes que se reproducen en los golfos norpatagónicos. En 2019 se equiparon en el Golfo Nuevo, Chubut, 23 ballenas con transmisores satelitales que monitorearon en detalle sus desplazamientos por el Atlántico Sudoccidental entre septiembre de 2019 y abril de 2020.

Los resultados preliminares de este proyecto son particularmente relevantes para la presente consulta. Como muestra la figura, con la ubicación que hemos recibido en la consulta indicando el área de campaña como CAN 100, CAN 108, y CAN 114, la misma se superpone con un área muy relevante para las ballenas francas durante su época de alimentación (primavera y verano) (ver figuras 1 y 2).

(*) Descripcion del Proyecto

***Área de la campaña**: El alcance máximo de la superficie prevista de adquisición sísmica abarca aproximadamente 6000 km² para las áreas CAN 100 y CAN 108 en conjunto, y unos 3500 km² para el área CAN 114, así como extendiéndose ligeramente hacia licencias vecinas.*
***Distancia más cercana a la costa**: Las dos áreas de adquisiciones sísmicas 3D sobre CAN 100-108 y CAN 114, se encuentran mar adentro a más de 300 km al sur-este y 400 km al sur de la ciudad de Mar del Plata, Provincia de Buenos Aires, respectivamente.*
***Número de embarcaciones**: Se utilizará un buque sísmico (que remolcará 10 streamers en paralelo, con una longitud de 8000 m y una separación entre streamers de 150 m), un buque de apoyo y un buque de suministro. Las características de los buques que se utilizarán aún no están claras.*
***Puertos alternativos**: El puerto más probable que se utilizará para los suministros o personal adicional cuando opere en el área de la licencia, será el de Mar del Plata, ubicado en la Provincia de Buenos Aires.*

A continuación, realizamos algunas preguntas puntuales y manifestamos nuestras preocupaciones por los impactos de la actividad propuesta por Equinor sobre las ballenas y su hábitat:

1. Hemos recibido información básica que describe de manera genérica que se realizarán prospecciones sísmicas para la detección de yacimientos de hidrocarburos en el fondo marino. Estas descripciones detallan las áreas donde se realizarán las prospecciones sísmicas solicitadas, y mencionan que las mismas serán realizadas con buques aún no definidos.

Es importante conocer a futuro más detalles de la operatoria prevista. En el texto recibido se comenta que **Equinor Argentina AS** llevará a cabo un Estudio de Impacto Ambiental (EsIA), en tal sentido nos sería de interés conocer las Medidas de Mitigación y Planes de Gestión específicos para evitar, reducir y/o mitigar los impactos potenciales, puntualmente las vinculadas con el impacto sonoro.

2. Tenemos preocupaciones vinculadas al proyecto, en particular debido a la superposición entre los recorridos de los individuos de ballena franca marcados con rastreadores satelitales en 2019 (figuras 1 y 2) y el área propuesta para la prospección. Los mapas destacan que las ballenas hacen un uso muy intensivo de las áreas de interés para esta consulta. Es conocido el impacto que las actividades de exploración y explotación petrolera pueden generar sobre la fauna marina en general, los cetáceos en particular, y sus hábitats. Los cetáceos dependen de la producción y percepción de sonidos para la mayoría de sus funciones vitales, como obtener información de su entorno, detectar presas y predadores, orientarse, comunicarse, y para la reproducción. Por lo tanto, la introducción de ruido de alta intensidad (como el caso de las prospecciones sísmicas) en el medio marino, puede potencialmente afectar a dichas funciones biológicas esenciales y producir efectos negativos tanto físicos y/o fisiológicos, deterioro de la audición, enmascaramiento, y cambios en el comportamiento, todos con posibles impactos asociados. Las actividades propuestas generarán impactos que coadyuvan a la degradación del hábitat, que ya se encuentra afectado por numerosas amenazas como la sobrepesca, el calentamiento global y la contaminación, entre otras.

3. Nuestras recomendaciones están dirigidas a que cualquier actividad que se desarrolle en el Mar Argentino debe abordarse con un enfoque ecosistémico, bajo el principio de precaución, asegurando la conservación de su biodiversidad, bienes y servicios ecosistémicos que brinda. En tal sentido se debe realizar una Planificación Espacio-temporal del Mar Argentino, donde se restrinja la actividad hidrocarburífera, según el caso: Áreas Marinas Protegidas, áreas y épocas con alta sensibilidad, etc.

Deben implementarse, de manera sistemática y estandarizada, medidas de prevención y mitigación de la contaminación acústica marina con los más altos estándares internacionales y de manera obligatoria. Las mismas deben ser implementadas por profesionales idóneos y capacitados. Asimismo es importante establecer un registro unificado y accesible de datos e informes, como insumo para la investigación, y que permitan el control, seguimiento, y un proceso de mejora continua.

A mediano plazo, es imperante diversificar la matriz energética, promoviendo las energías renovables, disminuyendo así la altísima dependencia de combustibles fósiles.

4. Por último, recomendamos que se incluya en las consultas a nuestro referente/asesor en temáticas relacionadas con los impactos de la actividad hidrocarburífera en ambientes marinos y costeros a J. Cristián de Haro (GEPAMA-UBA): delfinaustral2004@yahoo.com.ar / deharocristian@gmail.com

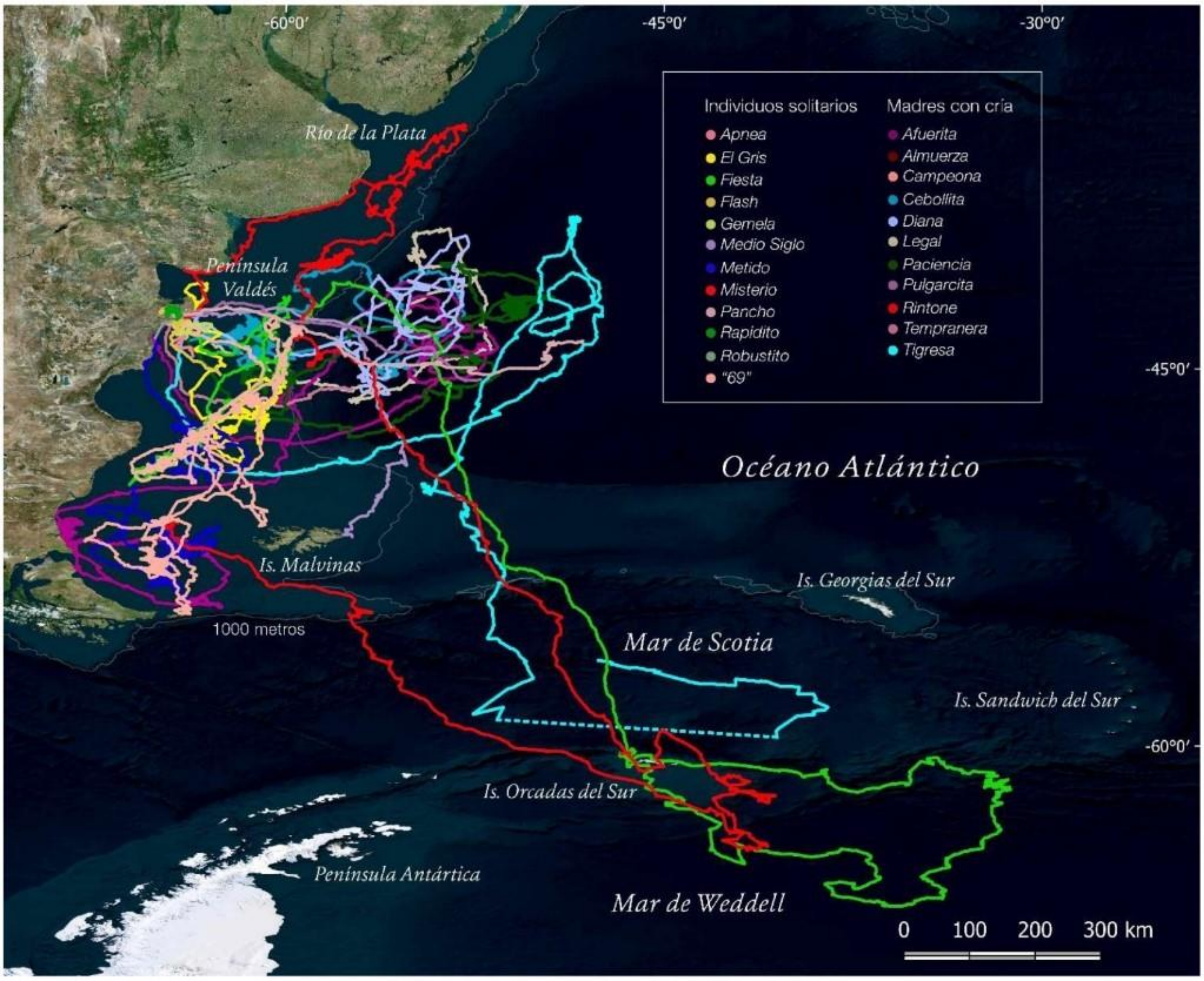

Figura 1. Recorridos completos de 23 ballenas francas marcadas con transmisores satelitales en septiembre de 2019 en el Golfo Nuevo de Península Valdés. Cada color muestra los movimientos registrados para un individuo. Estos recorridos resaltan la importancia que todo el Mar Argentino, el Atlántico Sudoccidental y las aguas subantárticas tienen para las ballenas francas australes. Tomado de: http://siguiendoballenas.org/

(Translation of Figure 1: Complete tours of 23 Southern right whales tagged with satellite transmitters in September 2019 in the Golfo Nuevo of Península Valdes. Each color shows the movements recorded for an individual. These tours highlight the importance that the entire Argentine Sea, the Southwest Atlantic and the Subantarctic Waters have for southern right whales. Taken from: www.siguiendoballenas.org).

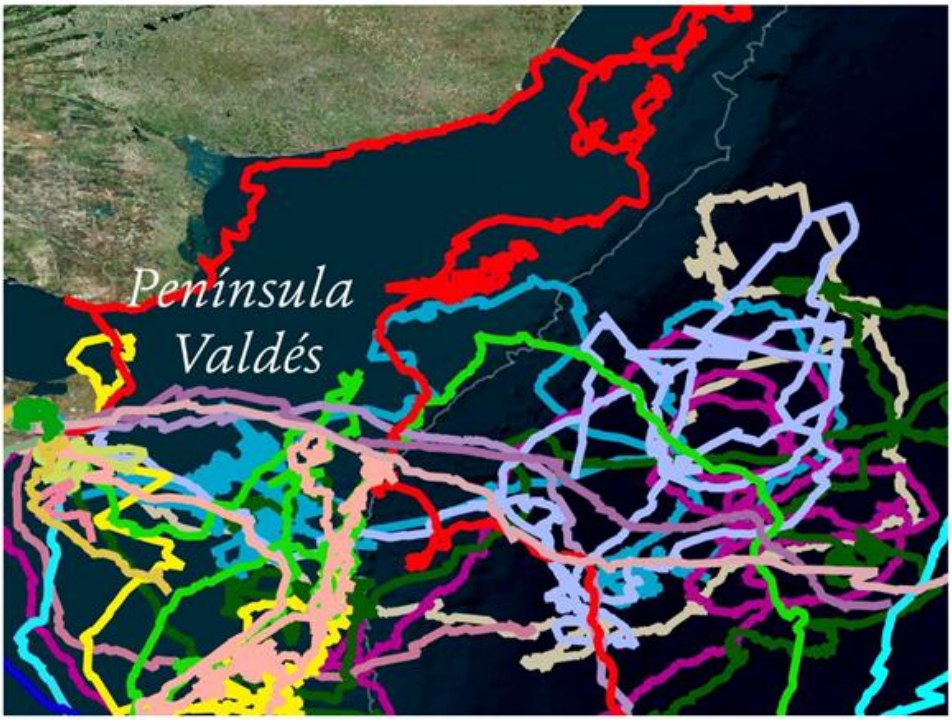

Figura 2. Detalle que muestra la superposición entre el uso de hábitat de las ballenas francas australes con las Áreas CAN_100, CAN_107, CAN_108 y CAN_109. Tomado de: http://siguiendoballenas.org/

(Translation of Figure 2: Detail of the overlap of the Southern right whale habitat with CAN_100,CAN_107, CAN_108, and CAN_109 Areas. Taken from: www.siguiendoballenas.org).

Algunas referencias sobre la temática:

1. Gordon, J., et al. 2004. A Review of the Effects of Seismic Surveys on Marine Mammals. Marine Technology Society Journal. Volume 37, Number 4.
2. A.G. Carroll a, R. Przeslawski a, A. Duncanb, M. Gunning c, B. Bruce d. 2017. A critical review of the potential impacts of marine seismic surveys on fish & invertebrates.
3. C. Erbe et al. 2016. Communication masking in marine mammals: A review and research strategy. Marine Pollution Bulletin 103 (2016) 15–38.
4. Robertson, F. C. et al. 2013. Seismic operations have variable effects on dive-cycle behavior of bowhead whales in the Beaufort Sea. Endang Species Research. **Vol. 21: 143–160, 2013.**
5. Aichinger Dias, L. et al. 2017. Exposure of cetaceans to petroleum products following the Deepwater Horizon oil spill in the Gulf of Mexico. Endang Species Research. Vol. 33: 119–125, 2017.
6. Suggested citation: Graham, L., Hale, C., Maung- Douglass, E., Sempier, T. Skelton, S., Swann, L., and Wilson, M. (2017). Oil spill science: The Deepwater Horizon oil spill's impact on bottlenose dolphins. MASGP-17-002.
7. De Guise, S. et al. 2017. Changes in immune functions in bottlenose dolphins in the northern Gulf of Mexico associated with the *Deepwater Horizon* oil spill. Endang Species Ressearch. Vol. 33: 291–303, 2017.

Buenos Aires, 9 de marzo de 2021

Señores
Instituto de Conservación de Ballenas-ICB

Attn. Diego Taboada

Presidente

Estimados señores,

Reciban un cordial saludo en ocasión de remitirles respuesta a sus preguntas e inquietudes plasmadas en la correspondencia recibida con fecha 8 de enero del año en curso. Al respecto, a continuación, encontrará su comentario y aclaratoria:

1. Hemos recibido información básica que describe de manera genérica que se realizarán prospecciones sísmicas para la detección de yacimientos de hidrocarburos en el fondo marino. Estas descripciones detallan las áreas donde se realizarán las prospecciones sísmicas solicitadas, y mencionan que las mismas serán realizadas con buques aún no definidos.

Es importante conocer a futuro más detalles de la operatoria prevista. En el texto recibido se comenta que Equinor Argentina AS llevará a cabo un Estudio de Impacto Ambiental (EsIA), en tal sentido nos sería de interés conocer las Medidas de Mitigación y Planes de Gestión específicos para evitar, reducir y/o mitigar los impactos potenciales, puntualmente las vinculadas con el impacto sonoro.

Respuesta: En el marco del Decreto 1172/03, previo a la Audiencia Pública, la Autoridad de Aplicación pondrá a disposición el Estudio de Impacto Ambiental realizado. A continuación respondemos a las consultas efectuadas pero confiamos en que una vez que puedan acceder al Estudio de Impacto Ambiental (EsIA) podrán satisfacer mejor cada una de las inquietudes planteadas, que contienen las respuestas desde el punto de vista científico-técnico realizadas por profesionales especialistas.

El EsIA, y en particular las Medidas de Mitigación y programas del Plan de Gestión Ambiental se han integrado con las buenas prácticas más consolidadas y recientes en lo que hace a la actividad sísmica offshore. En particular se han tomado como referencia las buenas prácticas de la Joint Nature Conservation Commission del Reino Unido (JNCC) de agosto 2017[1], junto a otras directrices y guías de buenas prácticas usadas internacionalmente como es el caso de las recomendaciones de Nueva Zelanda, Australia y la Administración Nacional Oceánica y Atmosférica (NOAA, por sus siglas en inglés) de los Estados Unidos.

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Existe una coincidencia entre las directrices en cuanto a contar con observadores calificados a bordo para efectuar las detecciones previas al inicio de cada rumbo de recorrido sísmico, establecimiento de "zonas de exclusión", periodos de vigilancia previos. También plantean mecanismos de "arranque suave" con el fin de alejar a los ejemplares presentes en las proximidades de la zona de trabajo.

2. Tenemos preocupaciones vinculadas al proyecto, en particular debido a la superposición entre los recorridos de los individuos de ballena franca marcados con rastreadores satelitales en 2019 (figuras 1 y 2) y el área propuesta para la prospección. Los mapas destacan que las ballenas hacen un uso muy intensivo de las áreas de interés para esta consulta. Es conocido el impacto que las actividades de exploración y explotación petrolera pueden generar sobre la fauna marina en general, los cetáceos en particular, y sus hábitats. Los cetáceos dependen de la producción y percepción de sonidos para la mayoría de sus funciones vitales, como obtener información de su entorno, detectar presas y predadores, orientarse, comunicarse, y para la reproducción. Por lo tanto, la introducción de ruido de alta intensidad (como el caso de las prospecciones sísmicas) en el medio marino, puede potencialmente afectar a dichas funciones biológicas esenciales y producir efectos negativos tanto físicos y/o fisiológicos, deterioro de la audición, enmascaramiento, y cambios en el comportamiento, todos con posibles impactos asociados. Las actividades propuestas generarán impactos que coadyuvan a la degradación del hábitat, que ya se encuentra afectado por numerosas amenazas como la sobrepesca, el calentamiento global y la contaminación, entre otras.

Respuesta: La información proporcionada en las referidas figuras junto a información de similares características publicada por Zerbini et al., 2018[3] se ha considerado en el EsIA. Allí los registros de marcaciones seguidas satelitalmente dan cuenta que el área del proyecto es utilizada por individuos de ballena franca austral (*Eubalaena australis*).

De acuerdo con toda la bibliografía relevada, y como resultado del Análisis de Sensibilidad incluido en el EsIA, el grupo de mamíferos que se conoce están presentes en el área de proyecto incluye cuatro especies de ballenas (Ballena franca austral, Ballena Sei - *Balaenoptera borealis* -; Ballena azul - *Balaenoptera musculus* - y Ballena fin - *Balaenoptera physalus*) fue clasificado con elevada sensibilidad, en función de criterios biológicos (incluida la sensibilidad auditiva, la actividad estacional y la distribución), ecológicos y de conservación. Si bien la zona de proyecto no es un área de reproducción o cría para los mamíferos marinos más abundantes, la misma tendría una función como área de paso y área de alimentación, por lo que la sensibilidad del área podría considerarse moderada a lo largo de todo el año. En el caso de las cuatro especies de ballenas mencionadas no se identifica un periodo claro de mayor sensibilidad, pero en principio podría considerase más crítico la primavera. En particular, la ballena franca austral es la más frecuente en la zona de estudio, que es un área de alimentación importante también para las otras especies de ballenas.

De acuerdo con la metodología empleada para la evaluación de impactos y aun considerando la condición más desfavorable que se dará cuando las prospecciones se realicen en primavera, la importancia del impacto de la adquisición sísmica sobre los mamíferos marinos resulta moderada, siendo que se trata de un impacto temporal y de corto plazo. La modelación acústica realizada en el marco del estudio establece que los umbrales de daño fisiológicos sobre la audición para este grupo de especies se alcanzan a distancias muy acotadas de la fuente, inferiores a las distancias que se imponen como "área de exclusión". Los controles asociados con el proyecto incluyen el uso de un procedimiento de "arranque suave" que se llevará a cabo cada vez que se active el conjunto de fuentes después de un período de inactividad (superior a 20 minutos) en el que el sonido se va incrementando gradualmente a lo largo de un período de tiempo, y la observación por parte de personal especializado que monitoreará equinor

que no haya presencia de mamíferos en los radios o "área de exclusión" establecida entorno a las fuentes de emisión sonora antes de que la fuente sísmica sea activada procediendo al arranque suave. De este modo, las afectaciones más comunes podrían ser cambios de comportamiento (principalmente desplazamientos espaciales) que se revertirán al finalizar las tareas. A la vez que la afectación se dará en todo caso en solo una porción de un área de importancia de alimentación que tiene una distribución mucho más amplia.

3. Nuestras recomendaciones están dirigidas a que cualquier actividad que se desarrolle en el Mar Argentino debe abordarse con un enfoque ecosistémico, bajo el principio de precaución, asegurando la conservación de su biodiversidad, bienes y servicios ecosistémicos que brinda. En tal sentido se debe realizar una Planificación Espacio-temporal del Mar Argentino, donde se restrinja la actividad hidrocarburífera, según el caso: Áreas Marinas Protegidas, áreas y épocas con alta sensibilidad, etc.

Deben implementarse, de manera sistemática y estandarizada, medidas de prevención y mitigación de la contaminación acústica marina con los más altos estándares internacionales y de manera obligatoria. Las mismas deben ser implementadas por profesionales idóneos y capacitados. Asimismo es importante establecer un registro unificado y accesible de datos e informes, como insumo para la investigación, y que permitan el control, seguimiento, y un proceso de mejora continua.

A mediano plazo, es imperante diversificar la matriz energética, promoviendo las energías renovables, disminuyendo así la altísima dependencia de combustibles fósiles.

Respuesta: Estamos de acuerdo con las afirmaciones realizadas, aunque hay cuestiones de planificación, control y seguimiento (dependen del MAyDS) y de diversificación de la matriz energética (depende de la Secretaría de Energía y políticas de incentivos) que exceden nuestro accionar para el desarrollo del proyecto.

4. Por último, recomendamos que se incluya en las consultas a nuestro referente/asesor en temáticas relacionadas con los impactos de la actividad hidrocarburífera en ambientes marinos ycosteros a J. Cristián de Haro (GEPAMAUBA):
delfinaustral2004@yahoo.com.ar / deharocristian@gmail.com

Respuesta: Gracias por su recomendación. Consideraremos incluir en las consultas a J. Cristián de Haro (GEPAMAUBA).

Atentamente,

The Offshore Argentina Project Team
Equinor

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