Environmental Impact Assessment (EIA) for 2D-3D seismic survey in the Ashrafi-Dan Ulduzu-Aypara (ADUA) Exploration area, Azerbaijan

March 2019

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Acronyms

ACG	Azeri Chirag and Deep Water Guneshli
ADUA	Ashrafi-Dan Ulduzu-Aypara
ALARP	As Low As Reasonably Practicable
BOD	Biological Oxygen Demand
BOEM	Bureau of Ocean Energy Management
BTC	Baku-Tbilisi-Ceyhan
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
BWM Convention	International Convention for the Control and Management of Ships' Ballast Water and Sediments
BWMP	Ballast Water Management Plan
CASPAR	Azerbaijan Caspian Shipping Company
CASPECO	Creation of Special protected Areas for the Caspian Seal
CEP	Caspian Environment Programme
CIPCO	Caspian International Petroleum Company
ES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COP	Conference of the Parties
CSCAP	Caspian Seal Conservation Action Plan
CSIR	Council for Scientific and Industrial Research
CSL	Caspian Sea Level
CST	Centre of Social Technologies
dB	decibels
DCENR	Department of Communications, Climate Action and Environment
DDT	Dichlorodiphenyltrichloroethane
E	Evaporation
ECMWF	European Centre for Medium-Range Weather Forecasts
EEA	European Environment Agency
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessments
EMP	Environmental Management Plan
EN	Endangered
ENP	European Neighborhood Policy
ERM	Environmental Resource Management
ERP	Emergency Response Plan
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GHG	Greenhouse Gas
HFC	Hydrofluorocarbons
HR	High Resolution

HSE	Health, Safety and Environment
HSES	Health, Safety, Environmental and Security
IAGC	International Association of Geophysical Contractors
IBA	Important Bird Areas
IFC	International Finance Corporation
IMO	International Maritime Organization
IOGP	International Association of Oil and Gas Producers
IPIECA	Global oil and gas industry association for environmental and social issues
ISPPC	International Sewage Pollution Prevention Certificate
IUCN	International Union for Conservation of Nature
IUU	Overfishing, and illegal, unreported and unregulated fishing
JNCC	Joint Nature Conservation Committee
KBA	Key Biodiversity Areas
LTD	Limited Company
MARPOL	International Convention for the Prevention of Pollution from Ships
MENR	Ministry of Ecology and Natural Resources
MES	Ministry of Emergency Situations
MGO	Marine Gasoil
MMO	Marine Mammal Observers
MODU	Mobile Offshore Drilling Unit Safety Certificate (appears in EMP)
MPA	Marine Protected Area
MSDS	Material Safety Data Sheets
NA	Not Available
NAVAREA	Geographic areas in which various governments are responsible for navigation and weather warnings
NGO	Non-Governmental Organisations
NOAA	National Oceanic and Atmospheric Administration
NTM	Notice to Mariners
O&G	Oil & Gas
OSCP	Oil Spill Contingency Plan
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
OW	Otariidae
P	Precipitation
PAH	Polycyclic Aromatic Hydrocarbons
PCAD	Population Consequences of Acoustic Disturbance
PCB	Polychlorinated Biphenyl
PER	Precipitation – Evaporation + Runoff
PFC	Perfluorocarbons
POPs	Persistent organic pollutants
PSA	Production Sharing Agreement

PTS	Permanent Threshold Shift
PW	Phocidae
R	Runoff
RSA	Risk Service Agreement
SEE	State Ecological Expertise
SEL	Sound Exposure Level
SOCAR	State Oil Company of the Republic of Azerbaijan
SOPEP	Shipboard Oil Pollution Emergency Plan
SSPA	Seal Special Protected Area
SSS	Side Scan Sonar
SWAP	Shallow Water Absheron Peninsula
TBD	To be defined
TEU	Twenty-foot equivalent unit
TPH	Total Petroleum Hydrocarbons
TTS	temporary threshold shift
UN	United Nations
UNCLOS	The United Nations Convention on the Law of the Sea
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VOCs	Volatile organic compounds
WMP	Waste Management Plan

Executive Summary

This document presents the results of the Environmental Impact Assessment ("EIA") undertaken for the 2 and 3-dimensional ("2D and 3D") marine seismic acquisition survey program (“the Project”), proposed by Statoil Azerbaijan in the the Ashrafi-Dan Ulduzu-Aypara (ADUA) exploration area in Azerbaijan. This document has been prepared by the international sustainability consultancy *Environmental Resources Management Iberia S.A.* ("ERM") in collaboration with the Azeri company CST (Centre of Social Technologies) Synergetics.

The president of Azerbaijan’s state oil company SOCAR and Statoil Azerbaijan (part of the Equinor group) signed a Production Sharing Agreement (PSA) for the Ashrafi-Dan Ulduzu-Aypara (ADUA) exploration area on the 30th of May 2018. The ADUA exploration area is located around 50 kilometres east of Baku, around 14 kilometers to the east of Azerbaijan mainland (Absheron peninsula), and approximately 7 kilometers to the east of Pirallahi Island and Chilov Island in water depths varying between 20 and 225 meters.

As per the PSA, Statoil Azerbaijan will be the operator of these activities and thus responsible for the planning and execution of the 2D-3D seismic survey, which will comprise a minimum of approximately 500 full fold km^2 of 3D seismic data, and a minimum of approximately 800 full fold km^2 of 2D seismic data.

The 2D-3D seismic survey is expected to start during July 2019 (subject to vessel availability) and will have an approximate duration of 42 to 45 days.

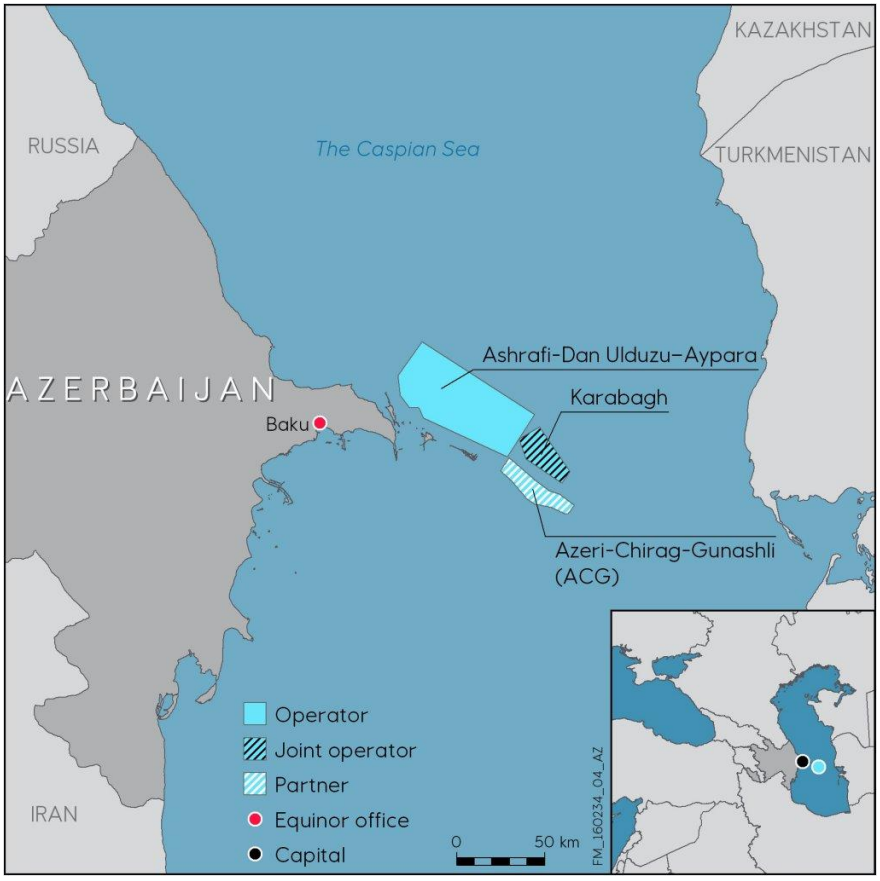


Figure 0.1: Location of ADUA exploration area and Karabakh oilfield in Azerbaijan (Statoil Azerbaijan, 2018)

Regulatory Framework

In Azerbaijan, the Ministry of Ecology and Natural Resources (MENR) is the Central state authority overseeing the environmental protection by controlling the implementation of the environmental protection rules and the adherence to the regulations and standards. The MENR is responsible for the review and approval of the EIA report.

The seismic acquisition Project will be carried out taking into account a number of legal and practice guidelines. These will be taken into account from early stages of the project planning and cover the entire project life-cycle. They can be organized as follows:

- National legislation and policy.
- International conventions and agreements.
- Guidelines and requirements set in the production sharing agreement (PSA) signed between the Ministry of Energy and the Project proponent.

- International standards.

Key regulations, legislation, as well as international conventions and standards relevant to the Project, are summarized in Table 1.

Table 1: Key National Environmental Laws (ERM and Synergetics, 2018)

Subject	Title
General	Law of Azerbaijan Republic on the Protection of the Environment No. 678- IQ.
	Law of Azerbaijan Republic on Ecological Safety No. 677-IQ.
	Law of the Azerbaijan Republic "On environmental impact assessment" of June 12, 2018
	Law of the Azerbaijan Republic "On hydrometeorological activity" № 485-IQ
	Resolution of the Cabinet of Ministers of the Azerbaijan Republic "On approval of the Regulation on the rules of state monitoring of the environment and natural resources" No. 90 of July 1, 2004
Ecosystems	Law of the Azerbaijan Republic on Specially Protected Natural Territories and Objects No. 840-IQ.
	Law of the Azerbaijan Republic "On the protection of green belts" № 957-ICQ
	Law of the Azerbaijan Republic «On fisheries» № 457- İQ
	Law of Azerbaijan Republic on Fauna No. 675-IQ.
Water	Water Code of Azerbaijan Republic (approved by Law No. 418-IQ).
	Rules for Protection of Surface Waters from Waste Water Pollution, State Committee of Ecology Decree No. 1.
Air	Law of Azerbaijan Republic on Air Protection No. 109-IIQ.
	Methodology to Define Facilities' Hazards Categories Subject to Hazardous Substance Emissions Levels and Need to Develop Projects' Maximum Permissible Emissions.
	Decree of the President of the Azerbaijan Republic "On approval of norms of vibration and noise pollution having a negative impact on the environment and human health" No. 381
Waste	Law of Azerbaijan Republic on Industrial and Domestic Waste No. 514-IQ.
	Resolution of the Cabinet of Ministers of the Azerbaijan Republic "On approval of the rules of hazardous waste storage " No. 228
	Resolution of the Cabinet of Ministers of the Azerbaijan Republic "On approval of the procedure for certification of hazardous waste" No. 41
Subsurface	Law of the Azerbaijan Republic on Subsurface Resources No. 439-IQ.
Information	Law of the Azerbaijan Republic on Access to Environmental Information No. 270-IIQ.
Liability	Law on Mandatory Insurances.

Subject	Title
Permitting	Law of Azerbaijan "On licenses and permits" № 176-VQ
International Conventions	Stockholm Convention on Persistent Organic Pollutants
	International Convention for the Prevention of Pollution from Ships/ Vessel (MARPOL), 1973 as amended by the protocol, 1978
	International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990.
	Bern Convention
	Basel Convention on Control of Transboundary Movements of Hazardous Wastes and their Disposals
	Kyoto Protocol, 1997
	UN Convention on Biological Diversity, 1992
	Convention for the Protection of the Archaeological Heritage of Europe
	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
	UN Convention on the Protection of the Ozone Layer (Vienna Convention)
	Montreal Protocol on Substances that Deplete the Ozone Layer, 1987
	United Nations Framework Convention on Climate Change, 1992
Regional Conventions	Convention on the legal status of the Caspian Sea
	Tehran-Caspian FrameworkConvention
	Convention for the Protection of the Marine Environment of the Caspian Sea
	Convention on the Transboundary Effects of Industrial Accidents*
	Protocol on Water and Health*
	Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki Convention)*
	UNECE Geneva Convention on Long-range Transboundary Air Pollution*
	UN Convention on Control of Transboundary Movements of Hazardous Wastes and their Disposals
	International Carriage of Dangerous Goods by Road*
	Aarhus Convention
	Espoo Convention

Project Description

Principles of seismic survey

The marine seismic survey will use a vessel towing underwater acoustic energy sources. These sources generate a low-frequency acoustic signal by releasing compressed air bubbles into the water. This acoustic signal, also known as “seismic wave”, spreads through the water down to the seabed. The acoustic signal emitted in the column of water penetrates the seabed and is then reflected by the rocky layers in the sub-surface. On its return it can be recorded using submarine microphones, known as hydrophones, distributed along a set of lines towed from the vessel, known as streamers.

A seismic acquisition survey can be carried out in two or three dimensions depending on the survey precision sought. The seismic survey proposed by Statoil Azerbaijan will be two and three dimensional (2D and 3D).

The 3D acquisition technique requires at least two seismic sources and several streamers, placed in parallel and separated one from another by several dozen metres. The vessel towing this equipment must travel at regular speed, along predefined, straight lines.

For 2D acquisition the seismic mechanism comprises a single streamer associated with a single source towed by the acquisition vessel. 2D seismic acquisition takes place across an extensive area, using a wide mesh grid.

To make them visible to third parties, each streamer is equipped with a tail buoy. The seismic vessel is supported by a guard vessel, responsible for liaising with third party vessels to reduce the potential for interference between the seismic survey and third party activities.

Schedule

The proposed 2D and 3D seismic exploration survey is tentatively scheduled to start during July 2019 (depending on vessel availability). Depending on the equipment configuration and the weather conditions, the expected duration of the survey is approximately 42-45 days of acquisition (8-9 days for 2D and 34-36 days for the 3D program), running an uninterrupted schedule of 24 hours a day and 7 days per week. A reasonable amount of weather standby and technical downtime has been included in the time estimate, but not the mobilization time which is expected to be 4-7 days. The order of the 2D acquisition and 3D acquisition will be decided once vessel availability is confirmed, taking into account technical, logistical and environmental considerations to ensure minimal impact on the environment.

Operational details on the seismic survey proposed by Statoil

The Project will be conducted following the conventional steps:

- mobilisation of one seismic vessel, one guard vessel and one support/supply vessel to the Project area;
- seismic acquisition campaign including the deployment of the seismic equipment (source and streamers) and data acquisition operations; and
- demobilisation: once the seismic survey is performed, the seismic and support vessels will leave the study area to navigate to their next assignment or back to the port of embarkation. No trace of the survey activity will be left in the study area after demobilisation.

The seismic vessel will navigate at a speed of approximately 4.4 knots, towing seismic sources at a depth of approximately 7 m, generating acoustic signal at an interval yet to be defined. In the case of the 3D acquisition, the seismic vessels will also tow between 4 and 6 streamers of up to approximately 6 km in length separated by 100 m, while in the 2D acquisition only one streamer between 6 and 12 km long will be towed.

Fuel will be loaded prior to mobilization in the port of Baku. Considering the expected duration of the survey (42-45 days) and the operational endurance of a typical seismic vessel, refueling is likely to be required, taking place most likely at sea from the supply vessel. Refueling will be done using dry break couplings between the supply and survey vessels. Detailed procedures of refueling operations during the course of the survey, when the vessel is at sea, will comply with the requirements of the International Association of Geophysical Contractors (IAGC)/International Oil and Gas Producers (IOGP) Guidelines and with the specific mitigation measures defined in this EIA considering the environmental sensitivities of the area.

Description of the Environmental and Social Baseline

Geographical setting

The Caspian Sea is the largest closed water basin in the world with an average depth of 207m, while the deepest area reaches 1,025 m, and is characterized by its regular changes in sea level. Azerbaijan has 850 km of shorelines. The Caspian Sea can be divided into three parts according to physical and geographical features, bottom relief and morphological features of shorelines: Northern Caspian Sea, Middle Caspian Sea and Southern Caspian Sea. The ADUA exploration area is located within the Southern Caspian Sea,

Meteorological Conditions

Climate condition of the ADUA exploration area is distinguished with moderate winter and hot summer months. Mean annual temperatures in the Project area range between 12 and 14°C. The lowest temperatures are expected in January (3-5°C) and the highest in August (35°C).

Average annual rainfall is estimated between 170-230 mm and there are approximately 30-40 days of rain a year on average.

The ADUA area is prone to north winds, being these more prevalent in summer, and average speed is 8.5-9.4 m/sec. Gusty winds mainly blow from north, sometimes reaching 40 m/sec and mainly occur in September.

Hydrological features

The Caspian Sea is the largest closed water basin in the world with an average depth of 207m, while the deepest area reaches 1,025 m, and is characterized by its regular changes in sea level with a fluctuation value estimated within the 15m range during the last 3,000 years. Since 1995 a slow rate of decline has occurred from the 26,7 m below open oceanic levels measured at that moment.

The ADUA exploration area is located within a relatively shallow subsea plateau that gently slopes offshore from the coast to a distance of approximately 70 km offshore. Water depth ranges between 20 to 225 m, with some limited areas reaching 10m.

Water temperature in the Caspian Sea presents large latitudinal changes showing differences of up to 10ºC between the north and south areas. Mean sea water surface temperatures within ADUA exploration area vary from 5ºC in winter to 25ºC in summer.

Similarly, salinity is highly influenced by the influx of fresh waters from rivers resulting in an increase of salinity from the north to the south east of the Caspian Sea. Results of a survey performed in 2017 in the near-by Karabakh field showed that salinity levels in the vicinity of the Project area changed between 11.04 and 12.39 ppt and was higher in lower layers.

Water circulation in the Caspian Sea is mainly formed by wind-drift currents along the western shore from Northern Caspian to the South. These flows move to the Absheron Peninsula, where they divide into two arms. The stronger arm passes the peninsula and enters the southern part before returning North. The second arm moves to the east from Absheron Peninsula and enters the southern shores joining with the main arm. The joined flow results in a cyclic water circulation in the Northern Caspian Sea. Typical current speed value in the Caspian Sea varies in the range from 15-20 cm/sec, whereas this value can reach up to 100cm/sec in certain areas. Current measurements near the ADUA exploration area in 2017 revealed speeds varying between 25 and 102 cm/sec.

The greatest waves in the Caspian are found around Absheron Peninsula and may reach heights of 7,5 - 8,0 m, and during extreme storms 9-10 m. The waves in the ADUA area are mainly brought by north winds and are mainly short, with late extinction after wind drop.

Water and Sediment Quality

Water and sediments analysis carried out in the near-by Karabakh field in 2017 have been considered to analyze water and sediment quality within the ADUA exploration area, provided the vicinity of the two locations. Results reveal that concentrations in the water of metals, total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAH) and BTEX (Benzene, Toluene, Ethylbenzene and xylene) were below the minimum concentrations defined by the analytic methods.

Sediments are mainly formed by silt and sand with low amount of organic substances and high levels of TPH and also of PAH in certain locations, as was the case of metals such as copper (23.167 mg/kg), iron

(20,071.36 mg/kg), nickel (32.5612 mg/kg), lead (10.11264 mg/kg), zinc (44.44 mg/kg), chromium (48.94 mg/kg), manganese (732.66 mg/kg), and barium (1463.84 mg/kg).

Biological Environment

The Caspian Sea is relatively poor in terms of biodiversity compared to other large water bodies. However, because of its isolation, the Caspian Sea includes a high number of endemisms. In total, it is calculated that the Caspian Sea includes around 500 plant and 854 animal species, 79 of which are vertebrate species. Among these vertebrate species it includes a total of 5 species of sturgeon and the Caspian seal. The most relevant elements in the area of interest are the following:

- **Fishes:** The Sturgeons are the most remarkable group of fishes from the Caspian Sea. Four species are found in the region: *Acipenser gueldenstaedtii* (Russian Sturgeon), *Acipenser nudiventris* (Ship Sturgeon), *Acipenser persicus* (Persian Sturgeon) and *Acipenser stellatus* (Stellate Sturgeon). All four species found in the area are anadromous (i.e. they spend most of their life at sea but migrate into river systems for reproduction) and based on the IUCN Red List all are considered as Critically Endangered (CE).

- **Mammals:** The Caspian seal (*Pusa caspica*) is a species belonging to real seals family and is the only marine mammal inhabiting in the Caspian Sea. The species is currently classified as an Endangered (EN). A total population size of about 104,000 was estimated in 2005, though a reduction of 3 to 4% occurs every year. In spring a significant number of seals (up to 500) rests on the islands of the Absheron peninsula (ie Malaya Plita, Bolshaya Plita, Podplitochny, Dardanella, Baklaniy, the Southern Spit and Urunos island, a part of Chilov island), though the amount of seal estimated in nearshore waters in April and May can be of up to 5,000-10,000 individuals. The most sensitive period for seals in the ADUA exploration area is expected to be between April-May and November, where they are either resting or migrating through the area.

- **Seabirds**: The west coast of the Caspian Sea constitutes a migration corridor for many bird species. Migrating species tend to concentrate in a narrow piece of land along the Absheron Peninsula, where the Absheron National Park is located., being the Common Starling (*Sturnus vulgaris*) the most frequently observed species.

- **Protected and other designated areas:** The ADUA exploration area is located relatively far from any protected or designated area, and the closest protected area, the Absheron National Park, which is located some 22.7 km to the west from the ADUA exploration area boundaries. Figure 0.2 shows the location of the protected areas compared to the ADUA exploration area. Currently there are marine reserves in Azerbaijan.

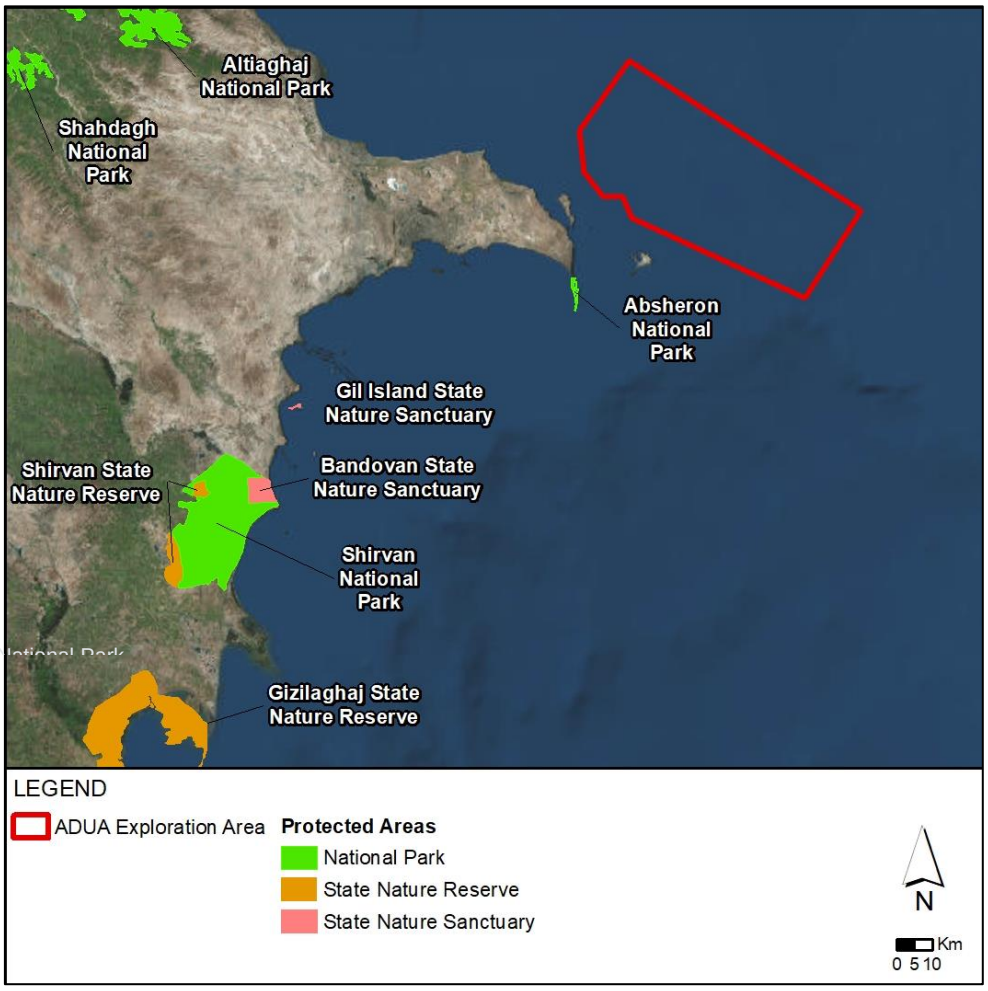


Figure 0.2: Protected Areas in Azerbaijan and ADUA exploration area (ERM, 2018)

Socioeconomic Environment

- **Fisheries**: In Azerbaijan there are some 22 species of fish species with commercial value. The most important species belong to the Acipenseridae, Clupeidae and Cyprinidae families although the large majority of the catches are composed by the species of the Clupeidae family. Fisheries have been traditionally an important commercial activity in Azerbaijan. However, during the last few decades the relevance of this sector has been reduced due to a number of environmental problems, including the appearance of the Comb Jelly, leading to a significant reduction in catches.

- **Maritime Transport**: Maritime transport plays a significant role in the economic development and prosperity of Azerbaijan, Baku being the largest port in the Caspian Sea. Shipping activity in the region combines different types of users from fishing boats to offshore O&G vessels, commercial trade and ferry

services/passenger. The ADUA exploration area lies within some of the main marine traffic routes in the region.

- **O&G:** Oil and Gas industry is currently the most important economic resource and activity in the Caspian Sea and particularly in the Azerbaijan waters. At present, the majority of oil produced in the Azerbaijan Republic (70-95%) is received from the subsea fields.

Impact Assessment and Mitigation

Impact significance categories for potential environmental and social impact are illustrated in Table 2 below.

Table 2: Significance Criteria for Impacts (ERM, 2018)

Impact Significance	Definition
Negligible	When a receptor will not be affected in any way by a particular activity or the predicted effect is deemed “imperceptible”.
Minor	When an effect will be experienced but the impact magnitude is sufficiently small and well within accepted standard, and/or the receptor is of low sensitivity
Moderate	An impact within accepted limits and standards. Moderate impacts may cover a broad range, from a threshold below which the impact is minor to a level that might be just short of breaching the legal limit
Major	An impact where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive receptors. An aim of the EIA is to get to a position where the project does not have any major impacts, certainly not ones that would endure into the long-term or extend over a large area.

Table 3 presents a summary of the significance of residual impact (that is, after the implementation of the mitigation measures), based on the assessment of the activities associated with the 2D and 3D seismic acquisition survey in ADUA exploration area.

Table 3: Evaluation of the Significance of Potential Environmental Impacts associated with the ADUA exploration area seismic survey activities (Routine Activities) (ERM, 2018)

Receptor	Project activity	Impact Description	Residual impact
Air Quality and Climate Change	Routine seismic, guard and support vessel operations	Potential reduction in localised air quality and contribution to greenhouse gases	**Negligible**
Seawater Quality	Routine and operational discharges during the project (i.e. black and grey water, bilge water, ballast, etc.).	Potential localised reduction in water quality, including increased turbidity and BOD Potential introduction of alien invasive species from ballast water discharges	**Negligible**
Seabed and Benthic communities	Seismic survey operations	Generation of noise emissions	**Negligible**
Plankton	Routine and operational discharges during the project (organic liquid/solid discharges)	Potential localised increase in organic matter and reduction in water quality	**Negligible**
Fish	Seismic survey operations and routine discharges	Impacts due to the generation of noise emissions Secondary impacts due to changes in water quality	**Negligible**

Receptor	Project activity	Impact Description	Residual impact
Marine Mammals	Physical presence of the vessels and seismic equipment Seismic survey activities	Disturbance from the presence of Project vessels and equipment; Potential collision risk with Project vessels and/or equipment; Impacts due to the generation of underwater noise emissions Secondary impacts due to changes in water quality	**Negligible to Minor** (physical presence, risk of collision and noise generated by seismic equipment) **Negligible** (secondary impacts due to changes in seawater quality)
Seabirds	Operation of Project vessels	Disturbance from the presence and movements of Project vessels. Secondary impacts due to changes in water quality	**Negligible** (physical presence and secondary impacts due to changes in seawater quality)
Sensitive coastal areas	Operation of Project Vessels (including helicopters)	Potential disturbance to sensitive coastal areas	**Negligible**
Navigation, Traffic and Sea user	Project vessels movements	Impacts to maritime traffic Increase of collision risk	**Minor**
Fisheries	Physical presence and operation of Project vessels Seismic survey activities	Impacts due to the presence of seismic vessel and equipment and associated safety area Impacts due to the generation of underwater noise emissions Secondary impacts due to changes in water quality	**Negligible** (presence of Project vessels) **Negligible** (impacts from underwater noise and from water quality changes)

Receptor	Project activity	Impact Description	Residual impact
Birds, marine mammals, coastal habitats, fish stocks and fisheries	Accidental Diesel Spill	Affection to multiple receptors, including effects such as increased mortality, loss of habitats, contaminated fish and associated reduction in food and economic resources, etc.	**Tolerable if As Low As Reasonably Practical or 'ALARP'**

Seismic surveys are considered a temporary and non-intrusive activity with minor effects on the environment. Conclusions on key identified impacts are summarized here:

- Impacts from noise emissions, physical presence and risk collision on marine mammals (Minor significance): The largest potential impact on the environment from this seismic survey is from the noise produced by the airgun arrays and the risk collision derived of the physical presence of the vessels. Main associated mitigation measures include the implementation of soft start or ramp up procedures together with the implementation of a 500m mitigation zone and the presence of an on-board Marine Mammal Observer. Additionally, a shutdown procedure shall be implemented in case Caspian seals are detected within the mitigation zone.
- Impacts from the presence and movements of project vessels on marine traffic and navigation (Minor significance): The project will notify relevant marine authorities about the development plans, timing and location of activities that together with the direct information through Notice to Mariners will ensure other marine users are aware of the activities. In addition, the implementation of a safety awareness zone of 500 m around the seismic vessel and the towed equipment will be enforced and supervised with the help of the guard vessel for the safety of the equipment and other users of the area. Given the short duration of the survey, the residual impact from the physical presence of the seismic vessel and the presence of the safety awareness zone on the other sea users is considered to be Minor.
- Impacts from an Accidental Spillage (Tolerable if "ALARP"): The seismic acquisition vessel will have a plan and procedures to implement in case of any accidental spillage of hydrocarbons (or other pollutants) at sea (also known as the SOPEP - Shipboard Oil Pollution and Emergency Plan), that meets the demands of the International Marine Organisation. An Oil Spill Contingency Plan (OSCP) and Emergency Response Plan (ERP) will also be in place to minimize the effects of an accidental oil spill by an effective and quick response. Regular maintenance activities and inspections as well as procedures for bunker transfer will contribute to reduce the likelihood of such an event.

Environmental Management Plan

In this EIA, no impacts were identified that could not be avoided or reduced to acceptable levels through the application of the proposed mitigation measures detailed in the impact assessment chapter and further described in the project´s Environmental Management Plan (EMP). The EMP will ensure that all the mitigation measures provided for in the EIA are implemented while the Project is carried out, in accordance with the commitments

made by Statoil Azerbaijan. The EMP is to be considered a dynamic document that may be continuously revised as part of an on-going environmental management and improvement process.

The objectives of the EMP are:

- Providing the mechanism to ensure compliance with Azeri legislation, Equinor Health, Safety, and Environment (HSE) policies, management system and procedures, international law and standards, and good Oil & Gas industry best practices; providing the mechanism for ensuring that all proposed mitigation measures identified in the EIA to mitigate potentially adverse impacts are implemented;
- Providing a framework for mitigating impacts that may be unforeseen or unidentified;
- Evaluating effectiveness or inefficiency of these mitigation measures and, if required, modify them or include new mitigation/preventive measures; and
- Establishing a monitoring programme and record-keeping protocols so that pertinent additional information that was not available during the compilation of the EIA can be collected in order to provide quality assurance for the conclusions of the EIA.

In addition, the EMP serves as a set of contractual clauses and specifications that define the Contractor's environmental and social responsibilities at the tendering stage.

Based on the key identified impacts, specific management plans will be developed for the following environmental and social aspects:

- Waste management plan: establish waste streams, procedures for the storage, packaging and labelling of waste, including liquid and solid waste and hazardous and non-hazardous wastes, define transportation procedures and location for final disposal, and to define the responsibilities associated to waste management activities.
- Ballast Water Management Plan (BWMP): to assist in complying with measures intended to reduce the harmful effects on the marine environment that are spread through aquatic microorganisms transferred from one area to another through ballasting operations, while maintaining safety;
- Emergency Response Plan (ERP): to prepare for and respond quickly and safely to any incident within onshore and offshore operational sites, regardless of incident type and size;
- Oil Spill Contingency Plan (OSCP): will provide a detailed oil spill response and removal plan that addresses controlling, containing, and recovering an oil discharge in quantities that may be harmful to navigable waters or adjoining shorelines, by defining responsibilities and duties as well as capabilities and procedures;
- Shipboard Oil Pollution Emergency Plan (SOPEP): to assist personnel in dealing with unexpected discharge of oil, to set in motion the necessary actions to stop or minimize the discharge, and to mitigate its effects on the marine environment.

The EMP further establishes the procedures and responsibilities set forth to effectively implement all proposed actions, relevant information to be communicated and change management procedures when modifications of the EMP may be warranted.

1 Introduction

1.1 Background

The president of Azerbaijan's state oil company SOCAR and Statoil Azerbaijan (part of the Equinor group) signed a Production Sharing Agreement (PSA) for the Ashrafi, Dan Ulduzu, Aypara (ADUA) exploration area on the 30th of May 2018. The ADUA exploration area is located offshore and is around 50 kilometres east of Baku, around 14 kilometers to the east of Azerbaijan mainland (Absheron peninsula), and approximately 7 kilometers to the east of Pirallahi Island and Chilov Island.

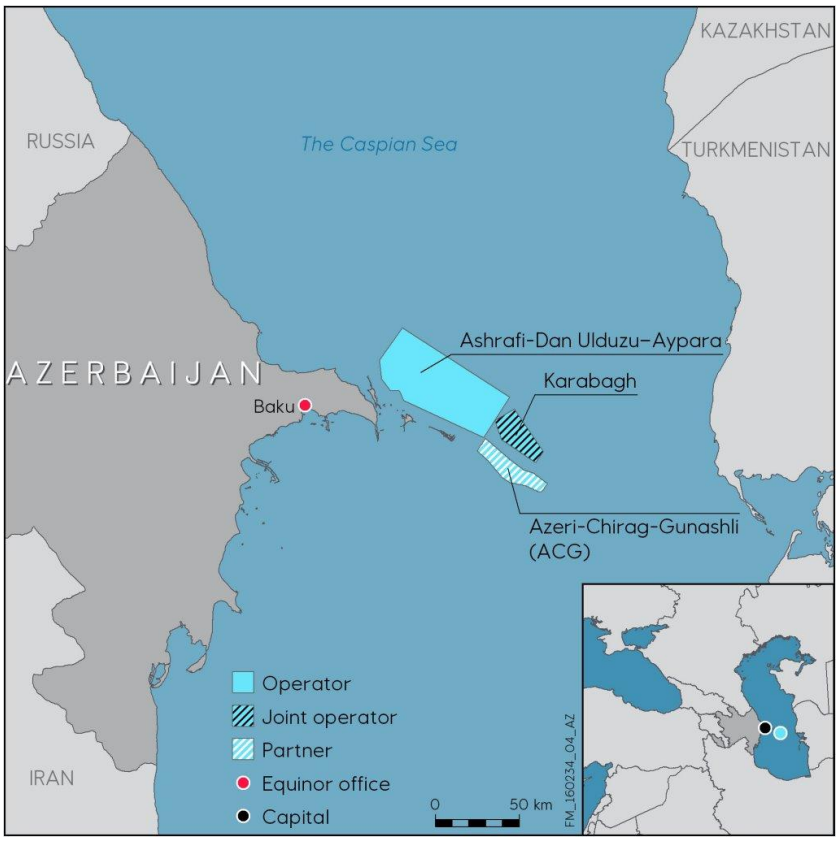


Figure 1.1: Location of ADUA exploration area and Karabakh oilfield in Azerbaijan (Statoil Azerbaijan, 2018)

As a first step, prior to the development of the ADUA exploration area, a seismic acquisition is to be undertaken to further characterise the subsurface geology and potential reservoirs within the ADUA exploration area and the definition of its subsequent development (e.g. location of future production wells).

As per the PSA, Statoil Azerbaijan will be the operator of these activities and thus responsible for the planning and execution of the 2D-3D seismic survey.

1.2 The Project

The main objective of the proposed survey is to obtain 2D and 3D seismic data of the sub-surface geology within the Ashrafi-Dan Ulduzu-Aypara exploration area in Azerbaijan. The proposed survey area lies at a minimum distance of 7 kilometers to the east of Pirallahi Island and Chilov Island in water depths varying between 20 and 140 meters (Figure 1.2). Statoil Azerbaijan intends to acquire a minimum of approximately 500 full fold km^2 of 3D seismic data, and a minimum of approximately 800 full fold km of 2D seismic data.

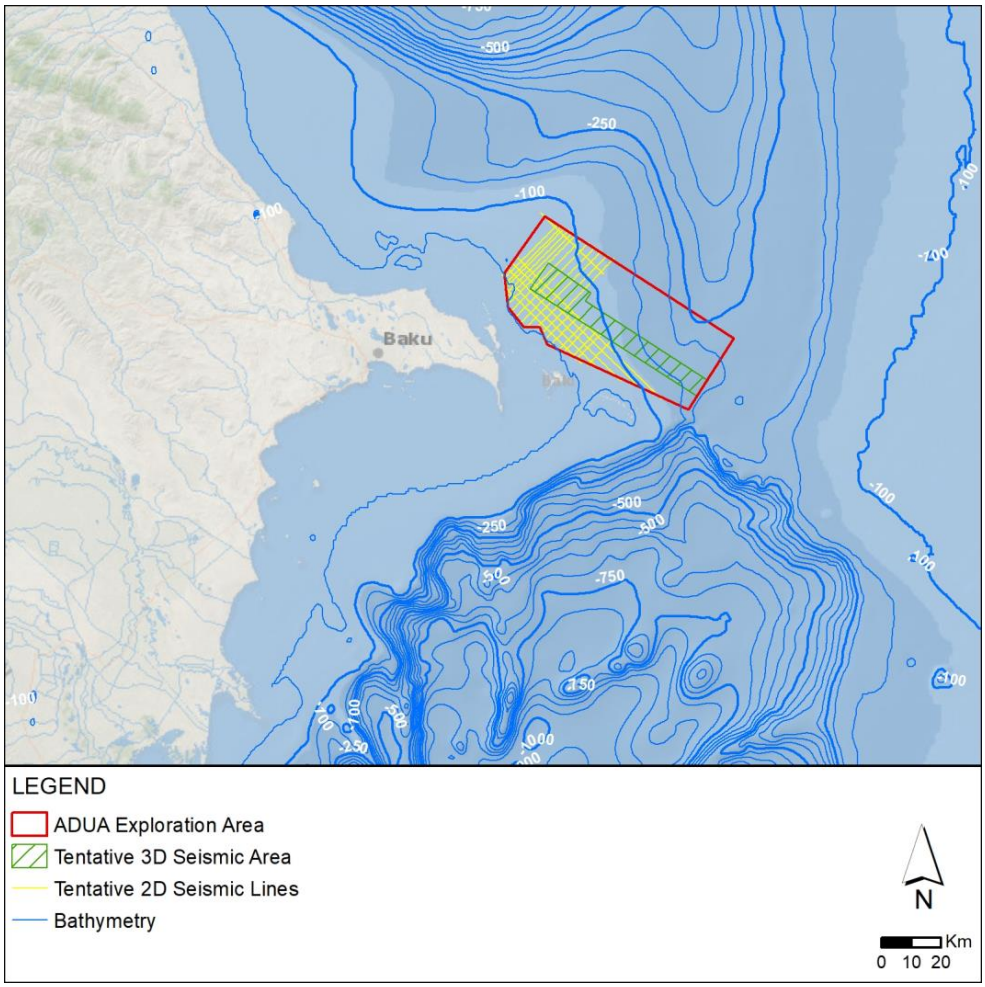


Figure 1.2: Location of Azerbaijan Ashrafi-Dan Ulduzu-Aypara exploration area (ERM, 2018)

The 2D-3D seismic survey is expected to start during July 2019 (subject to vessel availability) and will have an approximate duration of 45 days. It will be undertaken by a single seismic vessel; which will be accompanied by a fleet of guard/support vessels for logistical and technical support, supplies, safety and crew change purposes. The survey activities will be supported from a main onshore base to be sited at Baku port, using existing facilities.

The seismic acquisition will be undertaken across the ADUA exploration area in 2D and 3D modes, with limited overlap between these; where a single seismic vessel will travel along a predefined grid of lines (2D) / area (3D) (refer to Figure 1.2). The 3D program has an estimated duration of 34-36 days. The 2D program is closer to shore and has an estimated duration of approximately 8-9 days. Both time estimates include a reasonable amount of standby and downtime, but do not include mobilization time which is expected to be 4-7 days. The order of the 2D and 3D acquisition will be decided once vessel availability is confirmed, taking into account technical, logistical and environmental considerations to ensure minimal impact on the environment.

1.3 Purpose of this report

This Environmental Impact Assessment (EIA) report covers the activities required for the offshore 2D-3D seismic acquisition survey. This EIA report has been prepared in compliance with legal requirements in Azerbaijan, the conditions set in the PSA and international good practice.

The objective of the EIA is to support the design and management of activities related to the 2D and 3D seismic activities. The overall objectives of this EIA can be summarized as follows:

- Establish and describe the baseline of existing environmental conditions in the ADUA exploration area;
- Assess the potential impacts of the Project and to propose management tools and approaches using internationally accepted standards;
- Ensure that all stages of the proposed activity are compatible with internationally accepted environmental management practices;
- Demonstrate that the Project complies with current Azerbaijan legislation, Equinor's HSES policies, standards and expectations, and relevant international standards.

1.4 Presentation of the Project Proponent

Equinor[1], formerly Statoil, is an international energy company in charge of developing oil, gas, wind and solar energy around the world. Statoil Azerbaijan (part of the Equinor group) has been a partner in Azerbaijan's industrial and economic transition since 1992. Together with the national oil company SOCAR and other international companies, they have worked both industrially and socially to build Azerbaijan's thriving oil and gas market to realise its full potential.

Today Equinor has an interest in the Azeri-Chirag-Gunashli (ACG) oil field, as well as the Baku-Tbilisi-Ceyhan (BTC) pipeline—which runs from the Azerbaijan capital of Baku to the south Turkish port of Ceyhan on the Mediterranean. In September 2017, the 30-year Production Sharing Agreement (PSA) for Azeri Chirag and Deep Water Gunashli (ACG) oil field that was signed in September 1994 was extended for another 25 years, until the end of 2049.

[1] In May 2018, Statoil's Annual General Meeting voted to change the company name to Equinor to better reflect our evolution and identity as a company. The name Equinor is formed by combining "equi", the starting point for words like equal, equality and equilibrium, and "nor", signalling a company proud of its Norwegian origin.

Equinor has a 7.27% interest in the extended ACG PSA and has an 8.71% interest in the BTC project. The BTC pipeline passes Azerbaijan, Georgia and Turkey, connecting the Caspian with the Mediterranean Sea. Baku-Tbilisi-Ceyhan (BTC) oil export pipeline is the main export route for the ACG oil.

1.5 Presentation of the consultancy in charge of the EIA

1.5.1 ERM

The EIA document has been developed by Environmental Resources Management Iberia S.A, which is part of the ERM Group. ERM is an international sustainability consultancy company employing approximately 5,000 people in more than 160 offices across the world.

ERM operates exclusively in the sustainability, environmental, social and health, risks and safety fields and the vast majority of its clients are private industrial clients or public sector clients of an industrial nature.

ERM has extensive experience in Projects in offshore environments in several geographic locations around the world, covering numerous sectors, such as oil and gas, mining and power. The company has an extensive proven track record in delivering Impact Assessments for offshore seismic acquisition projects worldwide.

ERM has significant experience in Azerbaijan and in the Caspian Sea in the O&G sector, including almost all Caspian countries.

1.5.2 Synergetics

CST (Centre of Social Technologies) Synergetics is an Azeri company that specializes in the development of research, consulting and training services for environmental and socio-economic projects carried out by different local and international organizations and has been delivering quality consulting services to clients in different fields of social and environmental development projects since 1998.

CST has completed more than 59 projects which have been funded by different foreign and international organizations as well as major O&G companies and Consultancies, and government institutes of Azerbaijan Republic plans and programs.

The interdisciplinary team of CST Synergetics includes 45 employees, of which 7 are permanent staff. CST is supported by a network of independent consultants with expertise in multiple fields, including environmental and social evaluation and analysis.

1.6 Scope of the Seismic survey EIA

The purpose of the EIA is to provide information to regulators, the public and other stakeholders to aid the decision-making process. The main objectives of the EIA are to identify, reduce and effectively manage potential negative impacts and to maximize positive impacts. Specifically, the following objectives can be mentioned:

- Integrate environmental and socio-economic considerations into the seismic survey design and implementation;
- Ensure that environmental and socio-economic impacts are identified and assessed, and appropriate preventive and mitigation measures proposed;
- Define the appropriate environmental and socio-economic performance standards for planning and implementation;
- Identify and establish the applicable legal, operator and PSA requirements and expectations; with due regard to environmental and socio-economic considerations.

1.7 Report Structure

The contents of the EIA have been organized following the contents presented in Table 1.1.

Table 1.1: Structure and content of the EIA (ERM, 2018)

Chapter	*Contents*
Executive Summary	Provides a summary of the EIA.
Acronyms	A list of the acronyms used in the EIA.
• **Introduction**	Provides a general introduction to the seismic survey EIA, including objectives and EIA structure.
• **Legal Framework**	Outlines the main regulations and legal framework applicable to the project in Azerbaijan. The chapter includes national legislation as well as international standards of reference (which Azerbaijan is a signatory) and key international standards of application to the project.
• **Project Description**	This chapter provides a technical description of the seismic survey activities proposed by Statoil Azerbaijan including operations, location, timings and resources required.
• **Environmental Baseline**	This chapter provides a description of the environmental features of the Ashrafi-Dan Ulduzu-Aypara (ADUA) exploration area.
• **Impact Assessment**	A description of the methodology used for the EIA and assessment of the potential impacts (from routine and accidental events, and cumulative impacts) associated with the seismic survey activities, including mitigation and monitoring.
• **Environmental Management Plan (EMP)**	This chapter provides a description of how the mitigation measures identified in Impact Assessment Chapter will be incorporated into the Project design and subsequently implemented throughout the duration of the seismic survey activities.

Chapter	*Contents*
References	Lists of references and sources used along the EIA.

2 Regulatory Framework

2.1 Introduction

This chapter outlines the main regulations and legal framework applicable to the project in Azerbaijan. This chapter also includes international standards of reference (which Azerbaijan is a signatory) as well as key international standards of application to the project.

The chapter is organized in six sections as follows:

1. National authorities regulating environmental issues;
2. Production sharing agreement (PSA);
3. National environmental legislation and policy;
4. Segment and Regional standards[2].
5. International and regional conventions and agreements ratified by the Azerbaijan government and of relevance for this project;
6. International petroleum industry standards and practices.

This chapter also sets out the responsibilities of relevant regulatory agencies in relation to environmental regulation.

2.2 National Authorities

The Azerbaijan government is responsible for environmental protection in Azerbaijan. Central state authority overseeing the environmental protection is the Ministry of Ecology and Natural Resources (MENR). The MENR is authorized to control the implementation of the environmental protection rules, adherence to the regulations and standards. In addition, the MENR is responsible for the review and approval of the EIA report, which are part of the agreements under the PSA that is signed with the corresponding contractors for O&G exploration and production.

State Land and Cartography Committee oversees the regulation of use of soils, while the registration of immovable property, including the land owners is performed by the State Service for Registration of Real Estate.

Ministry of Emergency Situations (MES) is the responsible organization in management of unexpected natural and industrial accidents. MES is also a state authority controlling the implementation of safety regulations in the construction, mining works and industry.

The Ministry of Health is a state authority overseeing sanitary and epidemiological situation within the country. The Ministry also regulates the health and safety in the production sites.

[2] Taking into account the gradual trend of integration of Azerbaijan national environmental legislation to that of EU directives, at this stage the inclusion of segment and regional standards, though not mandatory, are recommended.

Ministry of Energy is the regulator for oil and gas sector in the country and is in charge of issuing the agreements and contracts for exploration, exploitation, production, processing, storage, transportation, distribution and use of energy materials and products, including oil and natural gas. In addition, it is entitled for the preparation and negotiation of Production Sharing Agreements (PSAs). In this context the State Oil Company of the Republic of Azerbaijan (SOCAR), dependant from the Ministry of Energy plays a key role in the preparation of the PSAs and defining the conditions applicable.

The **State Oil Company of the Republic of Azerbaijan (SOCAR)** is the party to the PSA representing the Republic of Azerbaijan. Hence, the obligations that Statoil Azerbaijan has undertaken in the PSA are effectively owed to SOCAR.

2.3 Production Sharing Agreement (PSA)

Production sharing agreements (PSAs) are the contractual vehicle between the Ministry of Energy and the Contractors engaged in the exploration or development activities. As part of these contracts the Ministry of Energy includes guidance on relevant aspects such as the environmental protection and safety, environmental standards and practices and commitments for operations planned.

The PSA establishes the legal regime for implementation of the Petroleum Operations envisaged in the ADUA exploration area in the Azerbaijan sector of the Caspian Sea (in this case 2D-3D seismic and exploration drilling). The PSA was signed by Statoil Azerbaijan as Contractor and SOCAR in Baku on 30th May 2018, and was later ratified by Parliament in Azerbaijan (Milli Majlis) on 29th June 2018. The 2D-3D Seismic Survey will be managed by Statoil Azerbaijan as the Contractor under the PSA.

The detailed conditions can vary from contract to contract and are negotiated with the corresponding contractor. Nevertheless, unless specific conditions apply, the same principles are applicable to all contracts (i.e. Article 26 of the PSA on Environmental Protection and Safety, and Appendix 9 Environmental Standards and Practices). These can be summarized as follows:

General Environmental and safety requirements:

- Good International Petroleum Industry Practice with their implementation in exploration and production operations in other parts of the world and (ii) existing Azerbaijan safety and environmental legislation.
- Implementation of integrated management systems (covering all health, safety and environmental aspects of the activities carried out).
- Good emergency preparedness including definition of possible scenarios, response plan, coordination with relevant agencies and having the required technical capabilities and means.
- Environmental Protection Strategy shall typically include: (1) an environmental management system; (2) environmental risk assessment; (3) baseline and impact assessment studies, (4) environmental monitoring, (5) emergency response plans, and (6) an environmental work programme.

The environmental work programme to be pursued during Petroleum Operations pursuant to Article 26 of the PSA, in regards to seismic acquisition activities, requires the development of an environmental impact assessment for seismic surveys.

2.4 National Environmental legislation

The Azerbaijan Government has committed to a process to align national environmental legislation with the principles of internationally recognised legislation, based on EU environmental legislation. As this process is on-going, the 2D-3D Seismic Survey will comply with the intent of current national legal requirements where those requirements are consistent with the provisions of the PSA, and do not contradict, or are otherwise incompatible with, international petroleum industry standards and practice.

The framework for national environmental legislation in Azerbaijan is provided by the Law on the Protection of the Environment (1999), which addresses the following issues:

- The rights and responsibilities of the State, the citizens, public associations and local authorities;
- The use of natural resources;
- Monitoring, standardisation and certification;
- Economic regulation of environmental protection;
- State Ecological Expertise (SEE);
- Ecological requirements for economic activities;
- Education, scientific research, statistics and information;
- Ecological emergencies and ecological disaster zones;
- Control of environmental protection;
- Ecological auditing;
- Responsibility for the violation of environmental legislation; and
- International cooperation.

According to Article 54.2 of the Law on Protection of the Environment, EIAs are subject to SEE, which means that the environmental authority (MENR) is responsible for the review and approval of EIA reports submitted by operators. The Law establishes the basis for the SEE procedure, which can be seen as a “stand-alone” check of compliance of the proposed project with the relevant environmental standards (e.g. for pollution levels, discharges and noise). In addition, the law determines that projects cannot be implemented without a positive SEE resolution.

The SEE approach requires state authorities to formally verify all submitted developments for their potential environmental impacts. Current internationally recognized practice emphasizes a proportionate, consultative and publicly accountable approach to assessing impacts.

According to the Law "On EIA "of 12.06.2018 (approved by the Decree of the President of the Azerbaijan Republic, №193, from 13.07.2018), the EIA documentation is developed in accordance with: 1) the requirements of the EIA law, 2) the laws of the Azerbaijan Republic "On environmental protection",3) "On environmental safety " and 3) other legal acts in the field of environmental protection. The list of activities for which EIA is required is

given in Appendix 1 of this Law. According to this Appendix (paragraph 1), the EIA is required for projects related to the prospecting, exploration, development and production of hydrocarbon reserves.

The environmental impact assessment shall identify, describe and assess, as appropriate, in the light of each individual case, the direct and indirect impact of the proposed activity on the following factors:

- atmospheric air;
- surface and ground water;
- bottom surface of basins;
- natural and artificial landscapes;
- soil cover and subsoil;
- fauna and flora;
- state of ecosystems and biodiversity;
- environmentally sensitive areas;
- public health;
- socio-economic sphere (employment, education, health, road transport and other infrastructure); cultural heritage;
- climate change

The environmental impact assessment documentation (report) shall contain at least the following information:

- description, objectives and stages of the planned activities, types of environmental impacts and methods of environmental risk assessment;
- legal and regulatory framework used in the development of the EIA document;
- prospects of socio-economic development of the territory for the implementation of the planned activity;
- assessment of the current environmental status and sensitivity of the proposed activity area;
- forecast of changes and outcomes of the environmental impact of the planned activity and assessment of their scope;
- description of physical characteristics and requirements of land use during the construction and operation stages; description of the main characteristics of technological processes, assessment of the types and quantities of expected waste and emissions (water, air and soil pollution, subsurface pollution, noise, vibration, thermal and radioactive radiation, etc.) resulting from the planned activities;
- comparison of the main alternatives considered (including the option of abandonment of the planned activity) and indication of the main reasons for the choice of an alternative, taking into account the environmental impact;
- description of the current state of those elements of the environment that are likely to be significantly affected by the planned activity, including population, flora, fauna, soil, subsoil, water, air, climatic factors, material values, including architectural and archaeological heritage, landscape and the relationship between the above factors, with the necessary detailing to establish the basic (initial) state of the environment in the area of the planned activity;
- description of the possible types and effects of environmental impacts of the proposed activity and assessment of their scope. The description should include direct effects and any indirect, secondary,

cumulative, short-term, medium-term and long-term, permanent and temporary, positive and negative impacts of the planned activity;

- description of the methods used for the environmental impact assessment;
- description of the measures provided for the prevention, reduction and, where possible, elimination of significant adverse environmental impacts;
- description of measures for prevention and elimination of consequences of the possible extraordinary and emergency situations;
- environmental management plan for all stages of the planned activities;
- environmental monitoring plan;
- plan of site rehabilitation after the expiry of the period of operation of the facility;
- information on public hearings and discussions;
- if the planned activity is related to the use of the earth's interior, the information on geological and hydrogeological justifications should be attached to the EIA document;
- justification of the need for implementation or non – implementation of post – project analysis and in the case of the need for its implementation, the definition of indicators and time frames.

Table 2.1 provides a summary of the key national environmental laws.

Table 2.1: Key National Environmental Laws (ERM and Synergetics, 2018)

Subject	Title	Date	Description / Relevance to ADUA 2D-3D Seismic Survey EIA
General	Law of Azerbaijan Republic on the Protection of the Environment No. 678- IQ.	08/06/1999 (last amendment 30/09/20140)	Establishes the main environmental protection principles and the rights and obligations of the State, public associations and citizens regarding environmental protection (described above).
	Law of Azerbaijan Republic on Ecological Safety No. 677-IQ.	08/06/1999 (last amendment 01/02/2013)	One of two keystone laws of the country's environmental legislation (along with the *Law on the Protection of the Environment*). Its purpose is to establish a legal basis for the protection of life and health, society, the environment, including atmospheric air, space, water bodies, mineral resources, natural landscapes, plants and animals from natural and anthropogenic dangers. The Law assigns the rights and responsibilities of the State, citizens and public associations in ecological safety, including information and liability. The Law also deals with the regulation of economic activity, territorial zoning and the alleviation of the consequences of environmental disasters.
	Law of the Azerbaijan Republic "On environmental impact assessment" of June 12, 2018	Approved by the Decree of the President of Azerbaijan Republic dated 13/07/2018, № 193	The purpose of this law is to create a legal basis for the functioning of the environmental impact assessment mechanism and/or strategic assessment of projects or planned activities (specified in Appendix 1 of the Law) to ensure the prevention or reduction of negative impacts on the environment and public health at the earliest stages. In accordance with the provisions of this Law, the environmental impact assessment is carried out based on the following principles: an integrated environmental, social and economic assessment of the impact of the proposed activity on the environment and human health; ensuring the integrity, transparency and reliability of information about the environmental safety of the proposed activity; the preservation of ecological balance and biodiversity; not to exceed the impacts of the proposed activity on the environment to acceptable standards; forecasting of possible environmental consequences and assessment of the level of environmental risks; ensuring transparency in the EIA, informing the public and taking into account public opinion.
	Law of the Azerbaijan Republic "On hydrometeorological activity" № 485-IQ	17/04/1998 (last amendment 03/04/18)	Defines the legal basis for conducting observations, investigations and works of active impact on atmospheric processes, development, use and protection of information on hydrometeorology and monitoring of the natural environment in the Azerbaijan Republic.

Subject	Title	Date	Description / Relevance to ADUA 2D-3D Seismic Survey EIA
	Resolution of the Cabinet of Ministers of the Azerbaijan Republic "On approval of the Regulation on the rules of state monitoring of the environment and natural resources" No. 90 of July 1, 2004	01.07.2004	Regulates the rules of state monitoring of the environment and natural resources. The state monitoring system for the environment and natural resources is divided into: monitoring of atmospheric air; monitoring of water bodies; monitoring of land; monitoring of mineral resources; monitoring of biological resources; monitoring of atmospheric precipitation (rain, snow); monitoring of radioactivity; monitoring of harmful physical effects on the environment; monitoring of waste; sanitary and epidemiological monitoring.
Ecosystems	Law of the Azerbaijan Republic on Specially Protected Natural Territories and Objects No. 840-IQ.	24/03/2000 (last amendment 06/03/2015)	Determines the legal basis for protected natural areas and objects in Azerbaijan.
	Law of the Azerbaijan Republic "On the protection of green belts" № 957-ICQ	02/05/2014	Regulates relations in connection with the protection of green belts in the Azerbaijan Republic and defines the rights and obligations of the state, municipalities, legal entities and individuals in this area.
	Law of the Azerbaijan Republic «On fisheries» № 457- İQ	27/03/1998 (last amendment 28/10/2014)	Defines the legal basis for the organization and management of fisheries, the increase of fish stocks, their use and protection in the Azerbaijan Republic.
	Law of Azerbaijan Republic on Fauna No. 675-IQ.	04/06/1999 (last amendment 06/03/2015)	Defines the animal world, property rights over fauna and legal relationships between parties. It also describes issues of State inventory and monitoring, and economic and punitive regulations.
	Forest Code of the Azerbaijan Republic (approved by Law No. 424-IQ).	30/12/1997 (last amendment 14/02/2017)	Defines the legal basis for the regulation of forest relations, use of forests, their protection, conservation, reproduction, improvement of ecological and resource potential of forests in the territory of the Azerbaijan Republic.

Subject	Title	Date	Description / Relevance to ADUA 2D-3D Seismic Survey EIA
	Law of the Azerbaijan Republic on Protection of Public Health No. 360-IQ.	26/06/1997 (last amendment 02/02/2015)	Sets out the basic principles of public health protection and the health care system. The Law assigns liability for harmful impact on public health, stipulating that damage to health that results from a polluted environment shall be compensated by the entity or person that caused the damage.
Water	Water Code of Azerbaijan Republic (approved by Law No. 418-IQ).	26/12/1997 (last amendment 06/03/2015)	Regulates the use of water bodies, sets property rights and covers issues of inventory and monitoring. The Code regulates the use of water bodies for drinking and service water and for medical treatment, spas, recreation and sports, agricultural needs, industrial needs and hydro energy, transport, fishing and hunting, discharge of waste water, fire protection and specially protected water bodies. It provides for zoning, maximum allowable concentrations of harmful substances and basic rules of industry conduct.
	Law of Azerbaijan Republic. "On the safety of hydraulic structures "	27/12/2002 (last amendment 18/12/2015)	Regulates the relations related to ensuring the safety of hydraulic structures during their design, construction, operation, reconstruction, restoration, conservation and liquidation, establishes the duties of public authorities, owners of facilities and operators.
	Rules of Referral of Specially Protected Water Objects to Individual Categories, Cabinet of Ministers Decree No. 77.	01/05/2000 (last amendment 10/05/2012)	The Caspian Sea is a specially protected water body. This resolution requires special permits for disposal if there are no other options for wastewater discharge. The resolution allows for restrictions to be placed on the use of specially protected water bodies, and for further development of regulations related to these water bodies. It requires consent from MENR for activities that modify the natural conditions of specially protected water bodies, and includes provisions for permitting of any discharges to water that cannot be avoided. There are also special requirements for the protection of water bodies designated for recreational or sports use (which includes the Caspian).
	Rules for Protection of Surface Waters from Waste Water Pollution, State Committee of Ecology Decree No. 1.	04/01/1994	Under this legislation the *Permitted Norms of Harmful Impact Upon Water Bodies of Importance to Fisheries* require discharges to meet several specified standards for designated water bodies in terms of suspended solids; floating matter; colour, smell and taste; temperature; dissolved oxygen; pH; Biological Oxygen Demand (BOD) and poisonous substances. Limits are based on Soviet era standards and are to be achieved at the boundary of the facility (specific “sanitary protection zone limits”) rather than “end-of-pipe” limits. End of pipe limits are defined in facility-specific “eco-passports” and are established with the intent to ensure compliance with applicable ambient standards.

Subject	Title	Date	Description / Relevance to ADUA 2D-3D Seismic Survey EIA
Air	Law of Azerbaijan Republic on Air Protection No. 109-IIQ.	27/03/2001	Establishes the legal basis for the protection of air, thus implementing the constitutional right of the population to live in a healthy environment. It stipulates the rights and obligations of the authorities, legal and physical persons and non-governmental organizations (NGOs) in this respect, sets general requirements for air protection during economic activities, establishes norms for mitigating physical and chemical impacts to the atmosphere, establishes rules for the State inventory of harmful emissions and their sources and introduces general categories of breaches of the Law that will trigger punitive measures.
	Methodology to Define Facilities' Hazards Categories Subject to Hazardous Substance Emissions Levels and Need to Develop Projects' Maximum Permissible Emissions.	04/09/1990	Under this methodology the maximum permissible concentrations of harmful substances and their hazard classes are provided. Limits are based on Soviet era standards.
	Decree of the President of the Azerbaijan Republic "On approval of norms of vibration and noise pollution having a negative impact on the environment and human health" No. 381	15/02/2011	This decree approved the "Norms of vibration and noise pollution, which have a negative impact on the environment and human health."

Subject	Title	Date	Description / Relevance to ADUA 2D-3D Seismic Survey EIA
Waste	Law of Azerbaijan Republic on Industrial and Domestic Waste No. 514-IQ.	30/06/1998 (last amendment 12/06/2012)	Describes State policy in environmental protection from industrial and household waste including harmful gases, waste water and radioactive waste. It defines the rights and responsibilities of the State and other entities, sets requirements for the design and construction of waste-treatment installations, licensing of waste generating activities, and for the storage and transport of waste (including transboundary transportation). The Law also encourages the introduction of technologies for the minimization of waste generation by industrial enterprises. There is a general description of responses to infringements. This law is specified by Resolutions of the Cabinet of Ministers on the rules of certification of hazardous wastes, state strategy on management of hazardous wastes in Azerbaijan and by Instructions on the Inventorisation Rules and Classification System of the Wastes generated by Industrial Processes and In the Field of Services approved by the MENR.
	Resolution of the Cabinet of Ministers of the Azerbaijan Republic “On approval of the rules of hazardous waste storage" No. 228	14/06/2016	Approves the rules of storage of hazardous industrial waste.
	Resolution of the Cabinet of Ministers of the Azerbaijan Republic “On approval of the procedure for certification of hazardous waste” No. 41	31/03/2003	Approves the procedure for certification of hazardous industrial waste.
	Resolution of the Cabinet of Ministers of the Azerbaijan Republic "On the order of inventory of hazardous waste generated in the production process" No. 13	25/01/2008	Approves the procedure for inventory of hazardous waste generated in the production process.

Subject	Title	Date	Description / Relevance to ADUA 2D-3D Seismic Survey EIA
	Resolution of the Cabinet of Ministers of the Azerbaijan Republic “On approval of the State strategy of hazardous waste management in Azerbaijan” № 117	21/08/2004	Approves the State strategy for hazardous waste management in Azerbaijan.
	Resolution of the Cabinet of Ministers of the Azerbaijan Republic ”On the procedure of transportation of hazardous waste by road " № 167	25/07/2008	Approves the procedure for transportation of hazardous waste by road transport.
Subsurface	Law of the Azerbaijan Republic on Subsurface Resources No. 439-IQ.	13/02/1998 (last amendment 25/12/2007)	Regulates the exploitation, rational use, safety and protection of subsurface resources and the Azerbaijani sector of the Caspian Sea. The Law lays down the principal property rights and responsibilities of users. It puts certain restrictions on the use of mineral resources, based on environmental protection considerations, public health and economic interests.
Information	Law of the Azerbaijan Republic on Access to Environmental Information No. 270-IIQ.	12/03/2002 (last amendment 20/10/2006)	Establishes the classification of environmental information. If information is not explicitly classified “for restricted use” then it is available to the public. Procedures for the application of restrictions are described. Law aims to incorporate the provisions of the Aarhus Convention into Azeri Law.
	Law of the Azerbaijan Republic “On environmental education and public education” No. 401-IIQ.	10/12/2012	Establishes the legal, economic and organizational framework of state policy related to environmental education and public education and regulates relations in this area.
Liability	Law on Mandatory Insurances.	24/06/2011	Identifies requirements for the mandatory insurance of civil liability for damage caused to life, health, property and the environment resulting from accidental environmental pollution.

Subject	Title	Date	Description / Relevance to ADUA 2D-3D Seismic Survey EIA
Permitting	Law of Azerbaijan "On licenses and permits" № 176-VQ	15/03/2016 (last amendment 25/04/2017)	This Law establishes the legal, economic and organizational regulation of the system of licenses and permits in connection with the implementation of business activities (except in the field of financial markets) in Azerbaijan Republic. According to Appendix 1 of the Law, activities related to the disposal and neutralization of hazardous waste are subject to licensing in the manner prescribed by this law.

2.4.1 National EIA Guidance

Guidance on the EIA process in Azerbaijan is provided in the Handbook for the Environmental Impact Assessment Process in Azerbaijan (1996). The Handbook introduces the main principles of the 'western'- type EIA process and details:

- The EIA process, i.e. the sequence of events and the roles and responsibilities of applicants and Government institutions;
- The purpose and scope of the EIA document;
- Public participation in the process;
- Environmental review decision (following its submission to the MENR, the EIA document is reviewed for up to three months by an expert panel); and
- The appeal process.

The approval of an EIA by the MENR establishes the compliance framework, including the environmental and social standards that an organisation should adhere to.

A summary of the guidance provided in the Handbook is given in Table 2.2.

Table 2.2: Summary of Guidance on the EIA Process in Azerbaijan (ERM and Synergetics, 2018)

Screening	The operator is required to submit an Application (containing basic information on the proposal) to MENR to determine whether an EIA is required.
Scoping	Requirement for a Scoping Meeting to be attended by the operator, experts and concerned members of the public, and aimed at reaching a consensus on the scope of the EIA.
Project Description	Full description of technological process and analysis of what is being proposed in terms of planning, pre-feasibility, construction and operation.
Environmental Studies	Requirement to describe fully the baseline environment at the site and elsewhere, if likely to be affected by the proposal. The environment must be described in terms of its various components – physical, ecological and social.
Consideration of Alternatives	Comparison of the main alternatives considered (including the option of abandonment of a planned activity) and indication of the main reasons for the choice of an alternative taking into account the environmental impact.
Impact Assessment and Mitigation	Requirement to identify all impacts (direct and indirect, onsite and offsite, acute and chronic, one-off and cumulative, transient and irreversible). Each impact must be evaluated according to its significance and severity and mitigation measures provided to avoid, reduce, or compensate for these impacts.

Public Participation	Requirement to inform the affected public about the planned activities twice: when the application is submitted to the MENR for the preliminary assessment and during the EIA process. The operator is expected to involve the affected public in discussions on the proposal. Annex A details the public hearing process of the present EIA.
Monitoring	The operator is responsible for continuous compliance with the conditions of the EIA approval through a monitoring programme. The MENR undertakes inspections of the implementation of activities in order to verify the accuracy and reliability of the operator's monitoring data. The operator is responsible for notifying the MENR and taking necessary measures in case the monitoring reveals inconsistencies with the conditions of the EIA approval.

2.5 Segment and regional Standards

2.5.1 European Union

EU relations with Azerbaijan are governed primarily by the EU-Azerbaijan Partnership and Cooperation Agreement (PCA) and the European Neighbourhood Policy (ENP).

The PCA entered into force in 1999. Under Article 43:

"The Republic of Azerbaijan should endeavour to ensure that its legislation will be gradually made compatible with that of the Community".

As part of the PCA an EU assessment of Azerbaijan's environmental legislation against EU Directives identified a number of recommendations for the approximation of national legislation with EU Directives[3]. Based on this, a draft national programme was developed that emphasises a flexible approach to amending national legislation to take account of institutional capacity and cost[4].

Following the enlargement of the European Union, the EU launched the ENP and Azerbaijan became part of this policy in 2004. The current National Indicative Programme for implementing the ENP[5] includes a commitment to support legislative reform in the environmental sector, including:

- Approximation of Azerbaijan's environmental legislation and standards with the EU's;
- Strengthening management capacity through integrated environmental authorisation;
- Improved procedures and structures for environmental impact assessment; and
- Development of sectoral environmental plans (waste and water management, air pollution, etc.).

[3] Mammadov, A. & Apruzzi, F. (2004) Support for the Implementation of the Partnership Cooperation Agreement between EU- Azerbaijan. Scoreboard Report on Environment and Utilisation of Natural Resources. Report prepared for TACIS

[4] SOFRECO (undated) Support for the Implementation of the PCA between EU-Azerbaijan, Draft Programme of legal Approximation.

[5] European Commission, 2007. European Neighbourhood and Partnership Instrument, Azerbaijan National Indicative

2.5.2 Environment for Europe

Environment for Europe[6] is a partnership of member states, including Azerbaijan, and other organisations within the UNECE region. Under the auspices of the Environment for Europe a series of ministerial conferences on the environment have been held that have resulted in the establishment of the UNECE conventions described in *Section 2.6.*

2.6 International and Regional Environmental Conventions

Conventions, agreements, contracts on use of nature and environmental protection ratified by the Azerbaijan Republic are an integral part of the national environmental legislation. Each law of the Azerbaijan Republic has a special chapter or article stating that should international contracts provide for regulations that are different from the national legislation, the regulations of the international instruments shall prevail.

The state and central execution authority shall be appointed by the Resolution of the President of Azerbaijan Republic to address the issues arising from International Conventions. These authorities shall cooperate with the corresponding international organizations in regards to the Conventions, and shall perform the activities pursuant to the decrees of the Cabinet of Ministers of the Azerbaijan Republic, to address issues related to the implementation of the conventions in the country.

Resolution of issues arising from the execution of the responsibilities stipulated in the conventions is, in general, assigned to the concerned executive authorities.

The list of international and regional legislative environmental acts accepted by the Azerbaijan Republic are included in Table 2.3 and Table 2.4.

[6] United Nations Economic Commission for Europe UNECE (2008) Environment for Europe. Available at: http://www.unece.org/env/efe/welcome.html Accessed August 2015

Table 2.3 Summary of International Conventions (ERM and Synergetics, 2018)

Convention	Purpose	Status
Stockholm Convention on Persistent Organic Pollutants	Reduction in releases of dioxins, furans, hexachlorobenzene and PCBs with the aim of minimization or elimination.	**Acceded in 2004.**
International Convention for the Prevention of Pollution from Ships/ Vessel (MARPOL), 1973 as amended by the protocol, 1978	The legislation giving effect to MARPOL 73/78 in Azerbaijan is the Protection of the Sea (Prevention of Pollution from Ships) Act 1983. Preventing and minimizing pollution of the marine environment from ships - both accidental pollution and that from routine operations.	**Acceded in 2004.**
International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990.	Seeks to develop further measures to prevent pollution from ships.	**Acceded in 2004.**
Bern Convention	Conservation of wild flora and fauna and their natural habitats.	**In force since 2002.**
Basel Convention on Control of Transboundary Movements of Hazardous Wastes and their Disposals	Seeks to control and reduce transboundary movements of hazardous wastes, minimize the hazardous wastes generated, ensure environmentally sound waste management and recovery practices and assist developing countries in improving waste management systems.	**Ratified in 2001.**
Kyoto Protocol, 1997	Follow on from the Framework Convention on Climate Change.	**Acceded in 2000.**
UN Convention on Biological Diversity, 1992	Conservation of biological diversity including the sustainable use of its components and the fair and equitable sharing of benefits.	**Party to the Convention in 2000.**
Convention for the Protection of the Archaeological Heritage of Europe	Requires each state party to support archaeological research financially and promote archaeology, using public or private funding.	**Ratified in 2000.**
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Controls trade in selected species of plant and animals.	**In force since 1999.**
UN Convention on the Protection of the Ozone Layer (Vienna Convention)	Framework for directing international effort to protect the ozone layer, including legally binding requirements limiting the production and use of ozone depleting substances as defined in the Montreal Protocol to the Convention. Supported by the Montreal Protocol and amendments	**Acceded in 1996.**

Convention	Purpose	Status
Montreal Protocol on Substances that Deplete the Ozone Layer, 1987	Specific requirements for reductions in emissions of gases that deplete the ozone layer. Amended four times: London 1990, Copenhagen 1992, Montreal 1997 and Beijing 1999.	**Acceded in 1996.**
United Nations Framework Convention on Climate Change, 1992	Seeks to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, within a sufficient time frame to allow ecosystem to adapt naturally, protect food production and enable sustainable economic development.	**Acceded in 1992. Not formally required to meet specific targets.**

Table 2.4: Summary of Regional Conventions (ERM and Synergetics, 2018)

Convention	Purpose	Status
Convention on the legal status of the Caspian Sea	Treaty signed at the Fifth Caspian Summit in Aktau, Kazakhstan, on 12 August 2018 by the presidents of Russia, Kazakhstan, Azerbaijan, Iran and Turkmenistan. The dispute began after the dissolution of the Soviet Union in 1991, as the Soviet Union (and subsequently Russia) and Iran were respecting mutual 1921 and 1940 treaties. However, according to Azerbaijan, Kazakhstan and Turkmenistan, these treaties did not address the exploitation of the seabed, thus a new UNCLOS treaty was found to be necessary.	**Signed August 12, 2018**
Tehran-Caspian FrameworkConvention	Ratified by all five littoral states and entered into force in 2006. Requires member states to take a number of generic measures to control pollution of the Caspian Sea. Three protocols have been adopted and therefore form the basis for national legislation and regulations. One protocol, namely Environment Impact Assessment in a Transboundary Context has been drafted and has not been yet adopted. Convention is ratified and the following protocols have been adopted: • The Protocol Concerning Regional Preparedness, Response and Co- operation in Combating Oil Pollution Incidents ("Aktau Protocol") (August 2011); • The Protocol for the Protection of the Caspian Sea against Pollution from Land-based Sources and Activities ("Moscow Protocol") (December 2012); and • The Protocol for the Conservation of Biological Diversity ("Ashgabat Protocol") (May 2014).	**Signed November 2003 and entered into force on August 2006.**

Convention	Purpose	Status
Convention for the Protection of the Marine Environment of the Caspian Sea	The Convention protects the biological resources of the Caspian Sea and, at the same time, defines the following tasks for Littoral States with regard to the Pollutions: • Development of the national systems and emergency actions plans for contingencies with objective of fight against pollution; • Assurance of the information exchange and dissemination of information; • Urgent operational measures; • Establishment of the joint interest zone; • Reporting based on the pollution results; • Availability of the emergency action plans for vessels, offshore units, sea ports and oil rigs; • Mutual assistance in case of pollution; • Meeting the expenses for assistance; • Assurance environmental safety in the marine navigation.	**Ratified in 2006**
Convention on the Transboundary Effects of Industrial Accidents*	To prevent industrial accidents that may have transboundary effects and to prepare for and respond to such events.	**Acceded in 2004.**
Protocol on Water and Health*	To protect human health and well-being by better water management and by preventing, controlling and reducing water-related diseases.	**Acceded in 2003.**
Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki Convention)*	To prevent, control or reduce transboundary impact resulting from the pollution of transboundary waters by human activity.	**Acceded in 2002.**
UNECE Geneva Convention on Long-range Transboundary Air Pollution*	Provides a framework for controlling and reducing transboundary air pollution. (NOTE: Has been extended by eight protocols, none of which have been ratified by Azerbaijan).	**In force since 2002.**
UN Convention on Control of Transboundary Movements of Hazardous Wastes and their Disposals	Regulates the transboundary movements of hazardous wastes and provides obligations to its Parties to ensure that such wastes are managed and disposed of in an environmentally sound manner.	**Ratified in 2001.**
International Carriage of Dangerous Goods by Road*	Provides requirements for the packaging and labelling of dangerous goods and the construction, equipment and operations of transportation vehicles. Annexes provide detailed technical requirements.	**In force since 2000.**

Convention	Purpose	Status
Aarhus Convention*	To guarantee the rights of access to information, public participation in decision-making and access to justice in environmental matters.	**Acceded in 2000.**
Espoo Convention*	To promote environmentally sound and sustainable development through the application of ESIA, especially as a preventive measure against transboundary environmental degradation (Note: Azerbaijan has not signed related protocol on Strategic Environmental Assessment.)	**Acceded in 1999.**

* Denotes UNECE agreement; Azerbaijan became a member of the UNECE in 1993. The major aim of the UNECE is to promote pan-European integration through the establishment of norms, standards and conventions.

2.7 International Petroleum Industry Standards and Practices

The 2D-3D Seismic Survey related activities are required to comply with national legislation “to the extent that such laws and regulations are no more stringent than those set out in Environmental Standards” (Art. 26.4*)*; described in Part II of Appendix 9 of the ADUA PSA. The safety and environmental protection standards shall be developed by the Contractor jointly with MENR and “shall take account of the specific environmental characteristics of the Caspian Sea and draw, as appropriate, on (i) international Petroleum industry standards and experience with their implementation in exploration and production operations in other parts of the world and (ii) existing Azerbaijan safety and environmental legislation”. Consideration of relevant international industry standards is therefore an important element in determining the applicability of national legislation or otherwise. Industry standards including those of:

- The Joint Nature Conservation Committee (JNCC) 2017 Guidelines for minimising the risk of injury to marine mammals from geophysical surveys.
- The International Association of Oil and Gas Producers (IOGP).
- The global oil and gas industry association for environmental and social issues (IPIECA) and
- The International Association of Geophysical Contractors (IAGC).

3 Project Description

3.1 Introduction

This chapter provides a technical description of the seismic survey proposed by Statoil Azerbaijan and presents the main characteristics of the Project. It presents:

- The geographical limits of the survey;
- The period envisaged for seismic acquisition;
- A description of the seismic acquisition methodology;
- Generic specifications of the type of vessels used;
- Estimated emissions, waste and hazardous materials generated during the survey; and
- Health, safety and environmental management procedures implemented for this Project.

The main objective of the proposed survey is to obtain 2D and 3D seismic data of the sub-surface geology within the Ashrafi, Dan Ulduzu, Aypara exploration area in Azerbaijan. The proposed survey area lies approximately 14 kilometers to the east of Azerbaijan mainland, and approximately 7 kilometers to the east of Pirallahi Island and Chilov Island[7], in water depths varying between 20 and 140 meters, with some very limited areas of shallower depth (Figure 3.1). Statoil Azerbaijan intends to acquire a minimum of approximately 500 full fold km^2 of 3D seismic data, and a minimum of approximately 800 full fold km of 2D seismic data.

[7] The distance from the ADUA exploration area to the Pirallahi and Chilov Islands is approximately 7 km. However, the planned 2D lines will have a run-out of up to 3 km (half streamer length) outside the ADUA area to obtain full-fold data within the ADUA area. The sources will be activated during this run-out. After completing the run-out the seismic vessel will turn with a radius of typically 2-3 km before starting the line in the opposite direction. For the 2D lines acquired in the NE-SW direction, this means that the vessel may be operating closer to the islands than 7 km. The sources will not be activated during the turn.

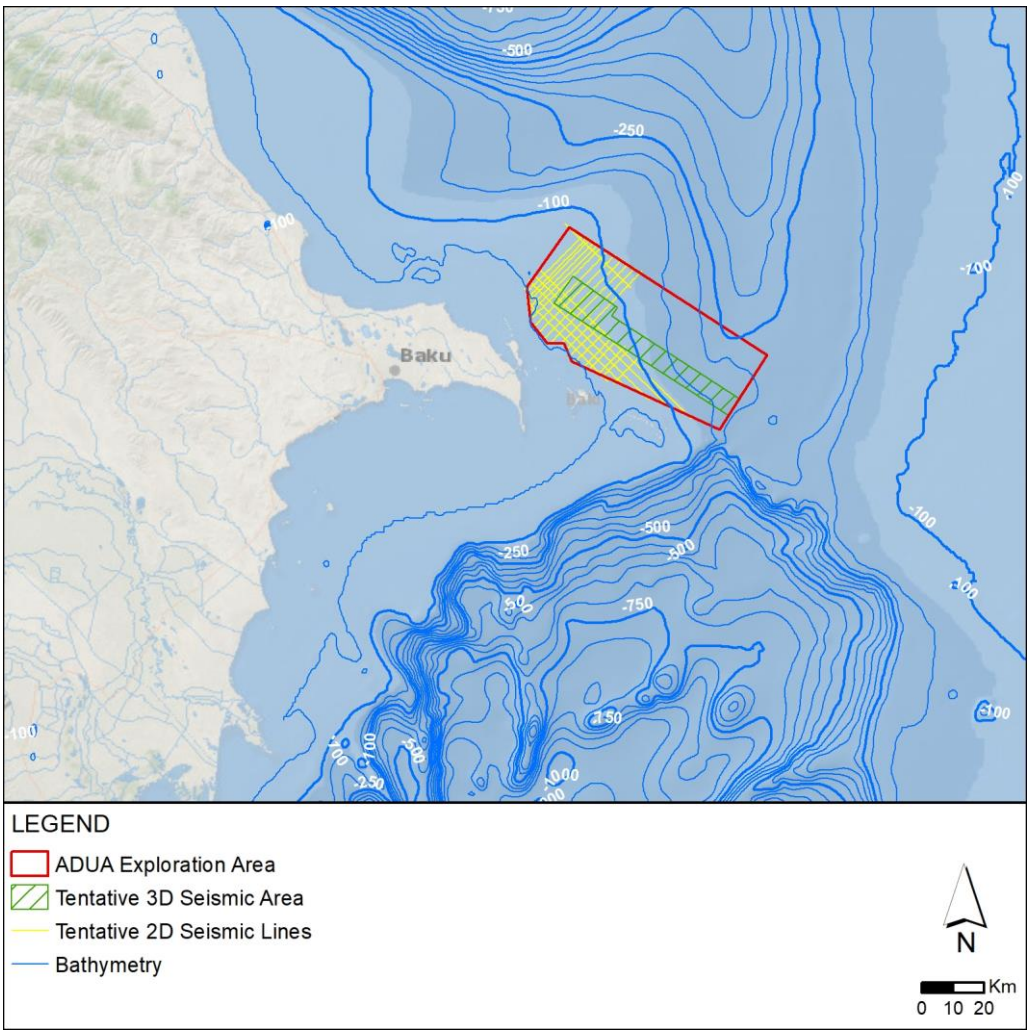


Figure 3.1: Location of Azerbaijan Ashrafi-Dan Ulduzu-Aypara exploration area (ERM, 2018)

3.2 Survey schedule and period

The proposed 2D and 3D seismic exploration survey is tentatively scheduled to begin during July 2019 (depending on vessel availability). Depending on the equipment configuration and the weather conditions, the expected duration of the survey is approximately 42-45 days of acquisition (8-9 days for 2D and 34-36 days for the 3D program), running an uninterrupted schedule of 24 hours a day and 7 days per week. A reasonable amount of weather standby and technical downtime has been included in the time estimate, but not the mobilization time which is expected to be 4-7 days. The order of the 2D acquisition and 3D acquisition will be decided once vessel availability is confirmed, taking into account technical, logistical and environmental considerations to ensure minimal impact on the environment.

3.2.1 Description of the seismic acquisition survey

3.2.2 Principles of acoustic signal emission

Marine seismic acquisition is a geophysical technique that uses acoustic energy and seismology to map the geological structures below the seabed. This technique is used to identify structures in the sub-surface rocks, propitious to the possible discovery of hydrocarbons.

At sea, seismic data is acquired by a vessel that tows a seismic energy source. These seismic energy sources, which will be submerged to a depth of approximately 6-9 m, generate a low frequency acoustic signal by instantaneously releasing compressed air into the water. These air bubbles generate a low frequency acoustic wave, also known as a "seismic wave", which propagates through the water and down to the marine sub-surface.

Seismic energy sources are designed to focus a maximum of energy vertically downwards (thus limiting lateral propagation of the acoustic wave), with a frequency typically between 5 and 300 Hz.

3.2.3 Capturing the acoustic signal / principles of a 3D seismic survey

The acoustic signal emitted in the column of water penetrates the seabed and is then reflected by the rock layers in the sub-surface. On its return it can be recorded using submarine microphones, known as hydrophones (Figure 3.2).

Figure 3.2: Typical streamers. (ERM, 2018)

The hydrophones are placed along a 6 to 12 kilometer length cable known as "streamer" that is towed at a depth of approximately 6-15 m (a single streamer in case of 2D, and 4-6 streamers in case of 3D). To identify the tail of a streamer, the streamer is marked at its end by a floating marker buoy (tail buoy), which is identified by a white strobe light and a radar reflector. Depending on the configuration of the streamers, the total width of exploration equipment, including tail buoys, can be up to 600-700 m.

3.2.4 Difference between 2D and 3D seismic acquisition

A seismic acquisition survey can be carried out in two or three dimensions depending on the survey precision sought (Figure 3.3). The seismic survey proposed by Statoil Azerbaijan will be two and three dimensional (2D and 3D).

For 3D acquisition the aim is to provide a three-dimensional image of the marine sub-surface geology (a "data cube"). This image will be used to establish a model of the submarine geological layers and of the reservoir to be explored. The 3D acquisition technique requires at least two seismic sources and several streamers, placed in parallel and separated one from another by several dozen metres. The vessels towing this equipment must travel at regular speed, along predefined, straight lines.

For 2D acquisition the seismic mechanism comprises a single streamer associated with a single source towed by the acquisition vessel. 2D seismic acquisition takes place across an extensive area, using a wide mesh grid. A 2D image of the surface located just below the line of receptors is thus obtained.

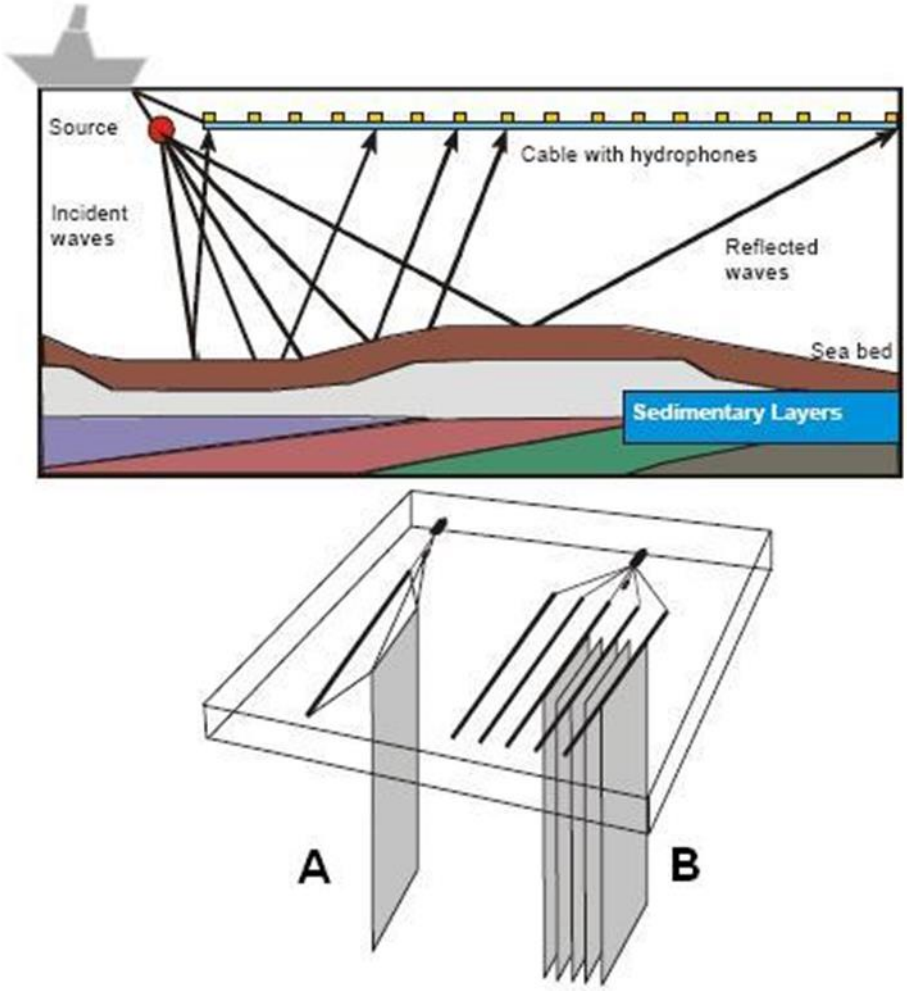


Figure 3.3: Marine seismic acquisition configuration layouts (A:2D seismic; B:3D seismic; The Royal Society of Canada, 2003)

3.2.5 Complementary survey techniques

3.2.5.1 Magnetic and Gravity measurements

Statoil Azerbaijan is considering to acquire magnetic and gravity data as part of the 2D / 3D seismic campaign. The equipment used to record this type of data are purely passive recording devices (i.e. no energy is emitted into the environment). The gravity and magnetic data may be used in combination with the seismic data to provide additional insight into the structure and composition of the subsurface. The following equipment is typically used:

- Magnetometer: A passive recording device attached to a towfish that is approximately 1-1.5 m long and towed in the water a short distance (~50 m) behind the seismic source. The magnetometer measures the variation of the earth's magnetic field.
- Gravimeter: A passive recording device that is placed onboard the seismic vessel itself. It measures the variation in the earth's gravity field along the vessel trajectory.

As the Magnetometer is a very small device and towed inside the seismic spread itself, it can effectively be considered a part of the towed seismic spread. Furthermore, as both the magnetometer and the gravimeter are purely passive recording devices, no further assessment of their use is necessary as their operation will not impact the environment.

3.2.5.2 Marine Current Meter and Echo Sounder

Most seismic vessels are equipped with a current meter that measures the ocean current. The equipment used for this is called Acoustic Doppler Current Profiler (ADCP). The ADCP emits high frequency signal into the water column below the vessel and measures the reflections coming back from the particles in the water. The particles in the water is affected by the current in the water and will move with a velocity relative to the seismic vessel. By processing the measured reflection data from the water particles and exploiting the Doppler effect in the data it is possible to calculate the speed and direction of the current. Knowledge of the current is important in order to operate the vessel with the towed equipment safely.

An echo sounder is a hull mounted sonar system that sends an array of sound pulses in fan shape and returns depth from directly underneath the ship and from either side. Its function is to ascertain water depth and seabed topography. Echo sounders are also widely used for monitoring sea mammals (eg, abundance surveys) including seals, and prey-predator relationship studies. Sounders are electromechanical sources of mid- or high-frequency emissions, with operating frequencies ranging from 2-900 kHz.

Concerns about the potential impact of multibeam echo sounders on marine mammals has focused on the low-frequency systems. Lurton (2016) modelled deep water multibeam systems taking into account their extreme directivity (i.e. in the along-ship direction) and short pulse lengths, having concluded that even for worse-case scenarios (e.g. equipment of up to 12 kHz) "the computation of ranges corresponding to impact thresholds accepted today shows that impacts in terms of injury are negligible for both SPL and SEL; however behavioural response impacts cannot be excluded and should require specific experimentation". Similarly, Deng et al (2014) indicated that the intensity of these signal components are well below injury thresholds. The measured signal levels in this study suggest the potential detection of these lower frequencies by harbour porpoises and harbour seals and thus raises the question on whether behavioural changes should be taken into account when using echo sounders during monitoring and environmental impact studies. Finally, it should be noted that JNCC does not advise on mitigation procedures for multi beam surveys in shallow waters (<200) (JNCC, 2017).

3.3 Seismic survey of Azerbaijan Ashrafi-Dan Ulduzu-Aypara exploration area

3.3.1 Survey fleet

3.3.1.1 Current status of selection

The survey fleet has not been contracted yet. Therefore, this section presents generic technical specifications of the most common seismic survey operations available, based on previous data of existing technical/logistical capabilities in the Caspian Sea. This information has been taken as reference for the activities that are to be performed, and thus allow for the identification of the relevant environmental and social aspects to assess the potential impacts that may be derived from the Project's activities.

3.3.1.2 Seismic fleet

The seismic fleet will be composed of one vessel with seismic sources and streamers, one guard vessel and one support/supply vessel. Further information and generic specifications on each of these vessels is given below. Typically, the seismic vessel will have a maximum crew complement of about 45-50 people, the guard vessel will accommodate a maximum of about 15 personnel and the supply vessel a maximum of 30 personnel.

Generic seismic vessels specifications are summarized in Table 3.1.

Table 3.1: Generic specifications of a seismic vessel (ERM, 2018)

Length	80-100 m
Width	15-30 m
Tonnage (gross)	3,000-6,000
Tonnage (net)	1-2,000
Capacity (accommodation)	40-60 people
Fuel capacity	1,500 m3
Maximum speed	15 knots (transit)
	4.4 knots (operations)
Operational endurance	20-60 days
Fuel consumption (survey speed)	~24-30 m^3 per day ~21.0-27.0 t/d

An example of a seismic vessel is shown in Figure 3.4.

Figure 3.4: Example of typical seismic vessels (Left: Ports & Ships Maritime News, 2009; Right: Shipspotting, 2018)

The seismic vessel will operate 24 hours a day and typically navigate at an average speed ranging from 4 to 5 knots, and the acoustic signals will be generated at regular intervals (50 m each source, 25m flip-flop mode). The seismic vessel will tow 4-6 streamers each 6-12 kilometers long with 100 m separation between each streamer at the front and 100-125 m separation at the tail (fan mode). The seismic sources will be towed at a depth of approximately 6-9 m depth. A tail buoy will be floating at the end of the streamers to enable other ships to identify the seismic array and avoid crossing the streamer's trajectory.

3.3.1.3 Guard vessel

During seismic acquisition operations, a seismic vessel has to sail maintaining a minimum speed of approximately 4 knots and its maneuverability is reduced by the fact that the streamers, several kilometers in length, are deployed in the water and must remain in place relative to each other. To ensure the safety of the seismic acquisition vessel and that of other ships present in the area, and to limit the need for sudden maneuvering of the seismic vessel, a navigational awareness zone will be established. The seismic vessel will be supported by a guard vessel, whose main tasks will be to warn / avoid other ships hindering the progress of the seismic acquisition vessel and the streamers. It will ensure that the awareness zone is maintained, protect the streamers from maritime traffic, help to avoid the streamers getting tangled and keep watch to detect any obstacles that may hinder the survey's progress (fishing nets or floating debris, for example).

The guard vessel will remain close to the seismic acquisition vessel and will travel at variable speed, typically between 4 and 22 knots.

An example of a typical guard vessel is shown in Figure 3.5.

Figure 3.5: Example of typical guard vessel (MarineTraffic, 2018)

Generic specifications for guard vessel are presented in Table 3.2.

Table 3.2: Generic specifications for guard vessel (ERM, 2018)

Length	40-50 m
Width	10-12 m
Tonnage (gross)	500-700
Tonnage (net)	150-300
Capacity (accommodation)	10 to 20 people
Fuel capacity	150-300 m^3

3.3.1.4 Support/Supply vessel

In addition to the guard vessel, the seismic fleet will likely include one support / supply vessel that will contribute to maintain the main seismic vessel at sea during the whole period of the Project by supplying it with everything it may need (fuel, food, staff). As a result, the support/supply vessel will be either close to the seismic vessel or sailing to nearby ports in order to undertake supply activities. The support/supply vessel may also undertake guard vessel duties and viceversa.

Figure 3.6 shows an example of a typical support/supply vessel and Table 3.3 presents generic specifications for support/supply vessels.

Figure 3.6: Example of typical support / supply vessel (MarineTraffic, 2018)

Table 3.3: Generic specifications for support / supply vessel (ERM, 2018)

Length	50-60 m
Width	12-15 m
Tonnage (gross)	1100-1500
Tonnage (net)	350-500
Capacity (accommodation)	30-50 people
Fuel capacity	500-1,000 m^3

3.3.2 Operational details

Table 3.4 shows the main anticipated characteristics of the seismic survey.

Table 3.4: Generic survey operation characteristics (Statoil Azerbaijan, 2018)

Acquisition mode	3D
Type of energy source	Tuned Airgun Arrays
Airgun array towing depth	~7m
Volume of source	~3-4,000 cubic inches
Source/operating pressure	2,000 psi
Number of hydrophone streamers	4-6
Type of streamer [(2)]	Solid (or gel-filled)
Depth of hydrophone streamer cable	TBD (between 6 and 15 m)
Streamer length	Approximately 6,000 m
Streamer separation	100 m (front), 100-125 m (tail)
Sailing orientation	123º / 303º
Acquisition mode	**2D**
Type of energy source	Tuned Airgun Arrays
Airgun array towing depth	~7m
Volume of source	~3- 4,000 cubic inches
Source/operating pressure	2,000 psi
Number of hydrophone streamers	1
Type of streamer [(2)]	Solid (or gel-filled)
Depth of hydrophone streamer cable	TBD (between 6 and 15 m)
Streamer length	Between 6,000 m and 12,000m
Streamer separation	NA
Sailing orientation	NA

Assuming that the seismic survey will be performed using the typical seismic vessel, it is estimated that, the seismic acquisition vessel will carry about 50 people, working 12 hour shifts. In addition to the crew of the seismic acquisition vessel, the guard vessel will have a crew of approximately 15 people and the support/supply vessel a maximum of 30 persons; thus the total seismic fleet personnel is estimated at 95 crew.

Fuel will be loaded prior to mobilization in the port of Baku. Considering the expected duration of the survey (42-45 days) and the operational endurance of a typical seismic vessel, refueling is likely to be required, taking place most likely at sea from the supply vessel. Refueling will be done using dry break couplings between the supply and survey vessels. Fuel transfer will occur via alongside transfer protocols.

Detailed procedures of refueling operations during the course of the survey, when the vessel is at sea, will comply with the requirements of the International Association of Geophysical Contractors (IAGC)/International Oil and Gas Producers (IOGP) Guidelines and with the specific mitigation measures defined in this EIA considering the environmental sensitivities of the area.

Statoil Azerbaijan will review the contractors vessel bunkering procedures and ensure these comply with their internal policies, best international practice and Bridging Documentation between contractor and operator.

The survey and support vessels will operate on a 24-hour basis during the seismic survey. The operational crew will be permanently stationed on both the survey and support vessels. It is expected that the crew will mobilize from the shore and crew changes will typically be completed by either support vessels returning to shore or by helicopter approximately every 4-6 weeks. The frequency of crew change will vary depending on the contractor's requirements, and could be as frequent as every 2-3 weeks.

3.4 Emissions, discharge, waste and handling of hazardous materials

3.4.1 Atmospheric emissions

The main source of emissions into the atmosphere will be the vessels' engines. The fuel used will lead to the emission of sulphur dioxides (SO_x), nitrogen dioxides (NO_x), carbon dioxide (CO_2) and carbon monoxide (CO). Fuel consumption by the seismic vessel can be estimated at approximately 30 tonnes/day during the survey process. Fuel consumption by the support/supply vessel is estimated at 16 tonnes/day and 4-6 tonnes per day for the guard vessel.

Helicopter operations will produce limited emissions and are expected to be dispersed across the entire flight path route and the wider area. Increases in pollutant concentrations will be very small and indistinguishable from existing background concentrations. On-board incineration of some waste materials and the air compressors of the energy sources will also generate occasional, limited emissions.

3.4.2 Liquid discharge

The main effluent discharged into the marine environment will be as follows:

- Treated grey water [8] from sanitary effluent e.g. wash water, and laundry discharges;
- Treated sewage (black water [9]), such as wastewater effluent;
- Treated bilge water [10] used for cleaning out engine rooms and other potentially contaminated sources;
- Deck drainage and run-off rain water; and
- Ballast water.

(8) Grey water is defined as water from cooking activities, washing and laundry facilities and non-oily water that has been used for cleaning.

(9) Blackwater is used to describe wastewater containing faeces, urine, and flushwater from flush toilets along with toilet paper.

(10) Bilge water is water collected in the lower section of the vessel. One of the main contributors to bilge water is the cleaning out of a ship's engine rooms. This water may thus be contaminated by oils and other substances, some of which may be toxic if discharged directly into the marine environment.

The seismic vessel will be equipped with a treatment system. Different types of effluent will be treated considering the following requirements:

- Grey water and sewage (black water) will be treated on-board before being discharged into the sea;
- Discharge of oily waste waters such as bilge water and drainage areas is prohibited within the Caspian Sea, thus all oily waste water will be contained onboard and transported to shore for disposal.;
- Grey water, sewage and bilge water will all be treated and discharged in accordance with the applicable annexes to the MARPOL[11] convention;
- Water used for cooling and surplus water generated by the drinking water generation systems may contain a residual concentration of chlorine (typically less than 1 ppm for drinking water systems); and
- The other effluent discharged during seismic acquisition operations may contain traces of oil, but these volumes will be very low.

All vessels, namely the seismic acquisition vessel, the support/supply vessel and the guard vessels will comply with the requirements of the MARPOL convention.

A summary of liquid discharge, maximum volumes expected and its potential components, together with comments regarding means of elimination and expected volumes, is provided in Table 3.5.

Table 3.5: Summary of expected liquid discharge from seismic, guard and supply vessels (ERM, 2018)

Waste flow	Main sources and Maximum Volume Generated	Main possible components	Comments
Bilge water disposal	Cleaning out of engine rooms. Bilge water generation variable, depending upon vessel characteristics, discharge volume variable. Estimated up to approximately 180 bbl/d.	Hydrocarbons, High Biochemical Oxygen Demand (BOD)	Discharge of oily waste waters such as bilge water and machinery spaces drainage within the Caspian Sea is prohibited. All oily waste water will be contained onboard and transported to shore for disposal. There will be no impact to sea from oily water

([11]) MARPOL 73/78 Annex IV, 1973, 2004 revision.

Waste flow	Main sources and Maximum Volume Generated	Main possible components	Comments
Deck drainage	Run-off of rain water. Deck drainage water generation variable depending on vessel characteristics and rainfall amounts; discharge volumes variable, though expected to be low.	Hydrocarbons, cleaning products.	Same as above.
Grey water	Staff washing, laundry, water from the kitchen. Estimated 220 l per person per day. Total volume: 20.9 m^3 per day (assuming maximum capacity of 95 people within all Project vessels).	High BOD, solids, detergents.	On-board sewage treatment unit to comply with MARPOL 73/78 Annex IV: no floating solids or discoloration of surrounding water; No discharges of treated sewage from vessels within 3 nm of the nearest land. Residual chlorine content <1.0 mg/ l.
Sewage (Black water)	Water effluent from toilets Estimated 100 l per person per day. Total volume: 9.5 m^3 per day (assuming maximum capacity of 95 people within all Project vessels).	Microorganisms, nutrients, suspended solids, organic material, pathogens, chlorine.	On-board sewage treatment unit to comply with MARPOL 73/78 Annex IV: no floating solids or discoloration of surrounding water; No discharges of treated sewage from vessels within 3 nm of the nearest land. Residual chlorine content <1.0 mg/ l.

Waste flow	Main sources and Maximum Volume Generated	Main possible components	Comments
Ballast water	Dependent on vessel characteristics and stabilization needs.	Oil and alien organisms.	The Regional Strategy and Action Plan on Ballast Water Management for the Caspian Sea was developed and reviewed at a workshop, organized by IMO in Baku, Republic of Azerbaijan, from 9 to 11 July 2012. It was endorsed by the COP of the Tehran Convention in Moscow in December 2012.

3.4.3 Non-hazardous and hazardous Solid waste

3.4.3.1 Non-hazardous solid waste

Generally, seismic acquisition vessels generate only a limited amount of waste. Insofar as possible, paper waste, food waste, wood and plastic materials may be incinerated on board; though it is likely that all this waste in addition to other solid waste such as glass, metal and ash from the incinerators will be carried back to land to be disposed of at a licensed facility. Food wastes are generated from galley and food service operations. Food waste, a type of domestic waste, will be ground prior to discharge (i.e., comminuted), in accordance with MARPOL requirements (i.e., for vessels 400 gross tonnage and above). Food waste is typically ground to <25 mm diameter to meet discharge requirements. Food waste discharges are allowed, when ground, if the vessel is 3 nautical miles (5.6 km) or more from land. A summary of the types of solid waste materials anticipated, their main components and means of elimination is presented in Table 3.6.

3.4.3.2 Solid Hazardous waste

Other potentially hazardous materials that may be involved in the survey include fuel and batteries, lubricating oils and fluorescent lights. Appropriate handling procedures will be implemented for all hazardous materials. There will be no discharge of hazardous materials at sea. All hazardous waste will be safely stored and disposed of at licensed/certified waste service providers for final treatment/disposal at facilities that deal with specific waste types in Azerbaijan.

All vessels will have equipment, systems and protocols in place for the prevention of pollution by hydrocarbons, wastewater and general waste, in accordance with Equinor policies, national and international standards and the requirements of certification authorities. Waste management will comply with current Azerbaijan's legislation, the requirements of the MARPOL convention, and with international good practices.

The seismic vessels will have a waste management plan (including disposal options) that will be reviewed in line with company requirements and international applicable standards. This Waste Management Plan (WMP) will meet or exceed MARPOL requirements (MARPOL 73/78, Annex V).

Table 3.6: Summary of expected potential solid waste materials (ERM, 2018)

Waste flow	Main sources	Main possible components	Comments
Food waste	Kitchen	Biodegradable food waste	Ground to a 25 mm particle size and discharge into the sea at locations further than 3 nm from coastline.
Plastics	Various	All solid wastes including plastics in any form	The seismic vessel will be equipped with an on-board incinerator. Some waste materials will be transported back to land.
Domestic wastes	Accommodation spaces of the vessels	Packaging materials, paper, cans, etc.	The seismic vessel will be equipped with an on-board incinerator. Some waste materials will be transported back to land (including metal waste and other waste materials such as glass).
Cooking oil	Kitchen	Any type of edible oil or animal fat	Minor quantities, transferred to shore for supervised disposal by a licensed facility.
Incinerator ashes	Incinerators	Ash and clinkers resulting from the incineration of garbage	Safely stored on board, for subsequent disposal at a licensed facility onshore.
Operational Wastes	Maintenance operations, storage, batteries, drums of paint, greasing oil, etc.	Hydrocarbon soiled equipment or cleaning residues, metals, acids, oil filters, rags, paint residue, glass and empty chemical recipients, batteries, hydrocarbons, heavy metals etc.	Safely stored on board, for subsequent disposal at a licensed facility onshore.
Medical waste	Dressings, clinical and cleaning materials from vessel infirmary	Pathogenic organisms, plastic, glass, drugs, needles	A syringe box will be available on board to collect any medical materials; these will then be disposed of at a licensed facility on land.

In line with Equinor HSES Procedures, the operator will make their best efforts to minimize the quantity of waste generated and will adopt an effective segregation system to guarantee that international good practices will be in place.

A monitoring system to record all waste generated and those fractions that are recycled and/or treated will be implemented during the seismic survey.

3.5 HSES procedures

All survey operations undertaken within the context of this Project will comply with the HSES Policies, documentation and procedures of the vessel responsible for carrying out the survey in addition to HSES Bridging Documentation from contractor and operator, as appropriate. These procedures shall describe in detail the conditions in which all the seismic acquisition operations must take place. Specifically, they describe the intervention plans to be used and the measures to take in the event of an incident such as an oil spill or in the event of a disruption in conditions, including the observation of marine mammals.

These procedures will comply with Equinor requirements in terms of health, security, safety and environmental and social responsibility.

Seismic acquisition contractor will have in place a documented HSES Management System addressing vessel operations. In addition, a specific HSES plan will be prepared before the start of the seismic acquisition programme, comprising at least the following elements:

- Roles and responsibilities;
- Assessment of the risks induced by the activities and associated preventive measures;
- Overview of the main preventive measures concerning safety & environment, including measures to avoid the disturbance of marine mammals (sensitive marine fauna protection procedure);
- Vessel's emergency spill response plan and procedure (Shipboard Oil Pollution Emergency Plan - SOPEP);
- Waste management plan and procedure;
- Procedure for liaison with shipping traffic and fisheries;
- Sub-contractors' management procedure;
- Reporting;
- Staff HSES training procedure; and
- Audit and inspection.

HSES Compliance Requirements will be integrated into the Environmental Management Plan (EMP) derived from this EIA.

4 Environmental and Social Baseline

4.1 Introduction

4.1.1 Project Study Area and regional setting

This baseline chapter focuses on the environmental features of the Ashrafi-Dan Ulduzu-Aypara (ADUA) exploration area. The ADUA exploration area is located about 50km east of Baku (Figure 4.1). The present chapter combines data specific to the ADUA exploration area and general descriptions of the regional setting and local setting depending on the availability of data (i.e. Caspian Sea and Middle Caspian area) for context. Additionally, specific socioeconomic characteristics such as fisheries and maritime/O&G activities in the area have also been described.

Figure 4.1: ADUA exploration area (ERM, 2018)

4.1.2 Sources of information

This baseline has been prepared combining publicly available information, scientific literature and data collected as part of previous studies in the wider ADUA area, in particular the Karabakh EIA prepared by Equinor in April 2018. This EIA included specific data obtained by SOCAR through a number of marine surveys (the Karabakh field is adjacent to the ADUA exploration area, towards southeast; Figure 4.2).

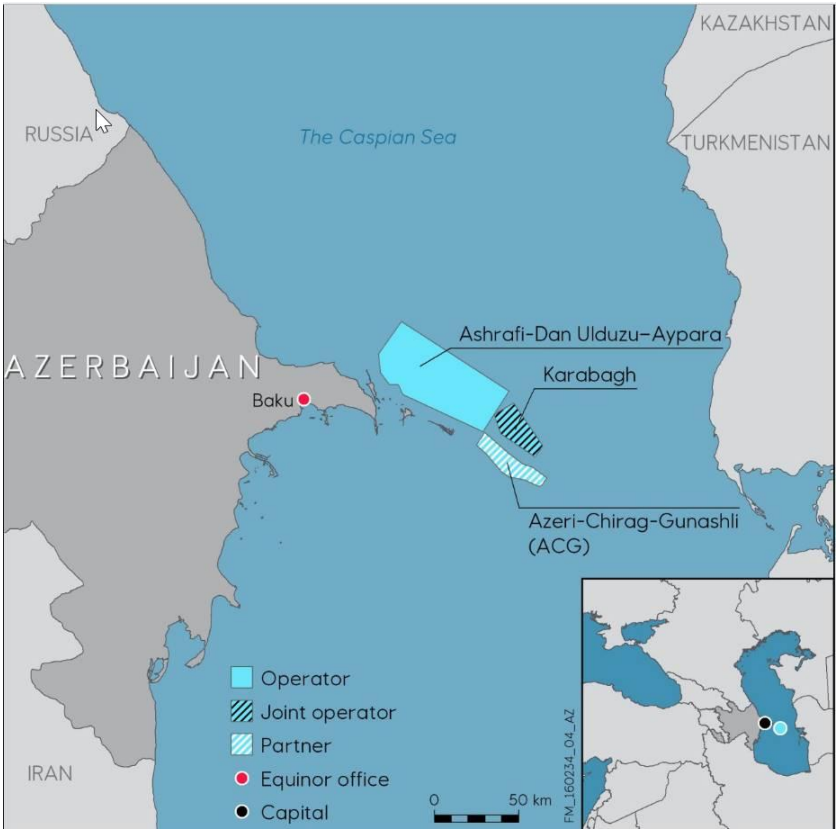


Figure 4.2: Location of Karabakh field in relation to ADUA exploration area (Statoil Azerbaijan, 2018)

The latter surveys comprised water column physical properties measurements on the surface, middle column and near the seabed. Similar measurements were undertaken in 1996 in the Karabakh field within the framework of the CIPCO studies in 1996-1999 (Environment and Resource Technology LTD, 1996). The 2017 results are also compared with the 1996 data to determine any water quality changes over the past 20 years.

4.2 Physical Environment

This section presents the geological, meteorological and climate conditions, hydrological regime, currents, water column chemistry and environment pollution assessments of the ADUA exploration area and its surroundings.

4.2.1 Geographical setting

The Caspian Sea is the largest closed water basin in the world and, contains about 45% of the water in all the world's enclosed water bodies. Its meridional length is 1,200 km, middle length 325 km, area – 392,000 km^2, water volume – 79,000 km^3, and average depth - 207m, while the deepest area reaches 1,025 m (Mekhtiyev and Buniat-Zade, 1980). The most important hydrographical feature of the Caspian Sea is considered to be its regular changes in level; the main reason of changes in the sea level is the changes in the water balance components (Nicholls, 2013). More than 130 rivers flow into this sea, among them Volga River is the first and the most important because of its discharging regime (most of the water balance in the Caspian (80%) is gained from rivers, 85% of which is the water brought by the Volga River), and Kura River is in the second place (Kosarev, 2005).

The Caspian Sea can be divided into three parts according to physical and geographical features, bottom relief and morphological features of shorelines: Northern Caspian Sea, Middle Caspian Sea and Southern Caspian Sea. The Caspian Sea has both sea (large size, hydrometeorological properties, chemical composition of water, etc.) and lake features (no direct contact with oceans).

There are five countries on the Caspian shores: the Republic of Azerbaijan, the Kazakhstan Republic, the Islamic Republic of Iran, the Russian Federation and the Republic of Turkmenistan (Figure 4.3). The shoreline boundaries between the countries are as follows: Azerbaijan – 850 km, Kazakhstan – 2,350 km, Iran – 900 km, Russia – 1,000 km, Turkmenistan – 1,200 km. There are 50 islands in the Caspian Sea with a total area of 2,000 km^2.

Note: Approximate ADUA exploration area shown in red outline

Figure 4.3: Geographic setting of the Caspian Sea, including major river networks (Spangler, 2018)

4.2.2 Meteorological conditions

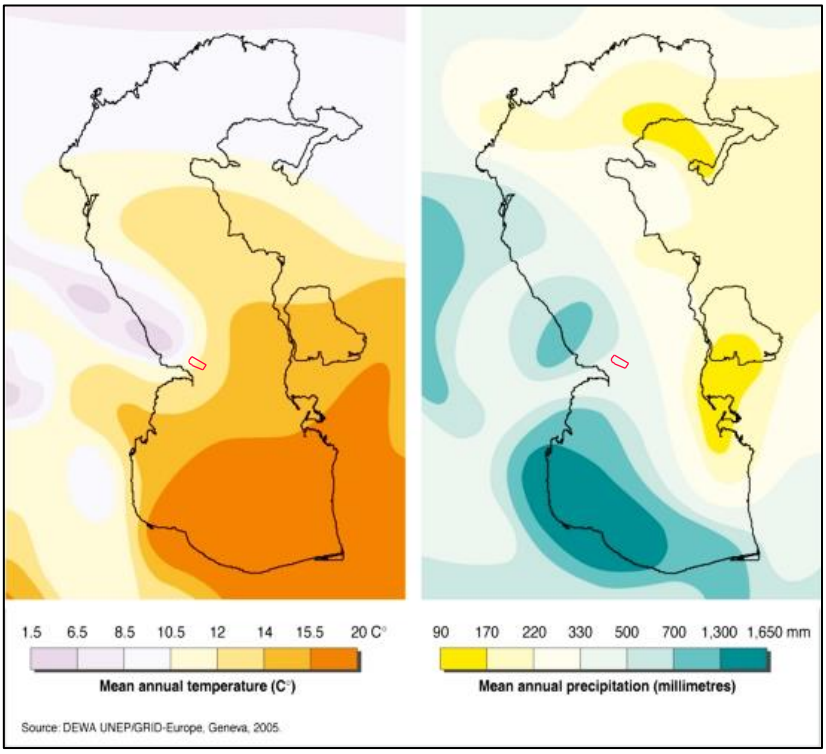
The climate of the Caspian Sea mainly depends on its geographical condition, overall circulation of the atmosphere, shore features, sea depth, impact of surrounding dry areas (i.e. Aral-Caspian lowland in the east, Caucasian Mountains in the west) and water exchange between various areas of the sea (Heydar Aliyev Foundation, 2018).

Lower latitude conditions a higher temperature of the air, which, in in turn, allows accumulation of the heat in the seawater. In winter, the cold Arctic air from the north and from mountainous areas of Iran enters the sea area. These two high-pressure air masses collide creating cyclonic air period in the middle of the sea. Moreover, the cyclones from Mediterranean and Black Seas also affect the Caspian Sea climate. In spring, the Siberian anti-cyclone and Mediterranean cyclone start moving towards east and northeast. As a result, synoptic processes and air currents change frequently (Heydar Aliyev Foundation, 2018).

4.2.2.1 Air temperature, precipitation and humidity

The average annual air temperature above the Caspian Sea changes from 10ºC in the north to 17ºC in the south. (Figure 4.4). The monthly average air temperature in January is -5 - 10°C in the north and near the east coast of the Middle Caspian and is -1 - 5°C in Makhachkala area. The coldest month above the southwestern and central areas of the sea is February. Increase of temperature from March to July occurs uniformly. From the middle of March the temperature of air over eastern and western parts of the sea becomes lower than the temperature over land; in the central deep-water areas of the sea and in the southwest this occurs in April. The largest range of monthly average air temperatures in deep-water areas of the Middle Caspian is 20,5 - 22°C, of the South Caspian it is 18 - 20°C. Above the remaining part of the South Caspian this range also does not exceed 20°C and increases up to 22°C only around the Absheron and Cheleken Peninsulas (Casp Info, 2018).

The amount of precipitation on the Caspian coast depends on the interaction of different air masses with relief of the coast. Distribution of precipitation above water area is extremely uneven. It oscillates from 210 mm (Neft Dashlari) to 1250 mm (Lenkoran zone) of precipitation per year on the southwestern coast (southern Caspian). To the north of Absheron Peninsula, the amount of precipitation is of 400-430 mm. The eastern Caspian coast is distinguished by its dryness, and thus precipitation maximums do not exceed 10-20 mm (Casp Info, 2018).



Note: Approximate ADUA exploration area shown in red outline

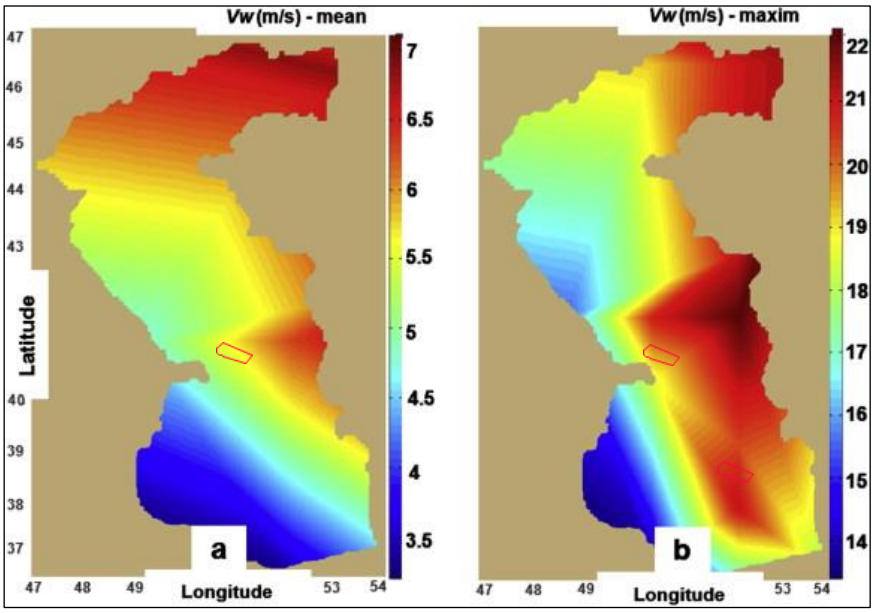
Figure 4.4: Mean annual temperature/precipitation in the Caspian Sea region (UNEP/Grid Arendal, 2007)

The humidity of the air above the Caspian Sea increases from south to north at high sea and from east to west along the shoreline; it also increases towards the high sea. The humidity does not vary markedly during the cold season, reaching 80-87% on western coast and 75-80% on eastern coast. In the high sea it decreases from 90% at the central parts of the Middle Caspian to 85% at the center of the South Caspian area.

4.2.2.2 Winds

Direction and strength of winds over the Caspian are determined by three factors: atmospheric circulation, sea temperature and coastal relief. Despite significant physiographic dissimilarities, the Caspian coastal and offshore areas may be divided into regions with relatively stable regime of a wind direction. General regularity of the wind direction regime is such that the winds of northern (ie northwest, north, and northeast) and southeastern directions dominate above the sea the most part of a year. Northern winds make up on average 41% each year; moreover their probability in the summer is higher (48,7%). All eastern winds make up on average 35,9% per year, and are more often observed in winter (41,3%).

The average wind speed over the sea is 5,7 m/sec. The greatest average speeds are observed in the middle part of the sea and are on average 6-7 m/sec per year. Their values may reach 8-9 m/sec in the Absheron Peninsula, with maximum wind speed being able to reach 40 m/sec. During the cold season (i.e. December-February), when the intensity of atmospheric circulation above Middle and South Caspian increases, the average wind speeds may reach 7-7,5 m/sec.The average wind speeds are sizably lower in the South Caspian, in the central areas being 4-5 m/sec, eastern coast 3,5-4 m/sec, southeast 2,5-3 m/sec. Low speeds (2,2-3 m/sec) are observed along the south-western coast (Figure 4.5).



Note: Approximate ADUA exploration area shown in red outline

Figure 4.5: Spatial distributions of the wind speed (at 80 m) in the Caspian Sea based on the ECMWF data for the time interval January 2001–December 2011 (Rusu and Onea, 2013)

4.2.2.3 Specific meteorological conditions in the ADUA area

Specific climate conditions of the ADUA exploration area are not known since no primary climatic data have been collected in that area as part of this EIA. However, given the proximity of the ADUA exploration area with the Karabakh field, the climatic conditions provided in the Karabakh KPS-4 well EIA (Equinor, 2018) are considered valid also for the ADUA exploration area and are described below.

- **Air Temperature**: moderate winter and hot summer months. Average annual temperature is 12.2°C. The lowest temperatures are expected in January (3-5°C) and the highest in August (35°C). In winter, the temperatures and wind direction in the area often change and strong gusts are observed. Summer is usually accompanied with hot dry weather.
- **Humidity**: it is around 50-70% in October-March and 70-80% in April-September.
- **Precipitation**: they happen mainly in winter and spring with 25-30% frequency. The most rainy month is November and the least precipitations (2.6 mm) occur in summer. Annual amount of precipitations is 170-230 mm and there are approximately 30-40 days of rain a year on average.
- **Visibility**: it depends on the amount of precipitations and dust in the area. The longest visibility distance is 12-15 km with 30% frequency in September - April and 30-40% frequency in May-September.

- **Winds**: this part of the Caspian Sea is subject to north winds. Their frequency is about 43%, which mostly happens in winter and summer months and average speed is 8.5-9.4 m/sec. Gusty winds mainly blow from north, sometimes reaching 40 m/sec and mainly occur in September.

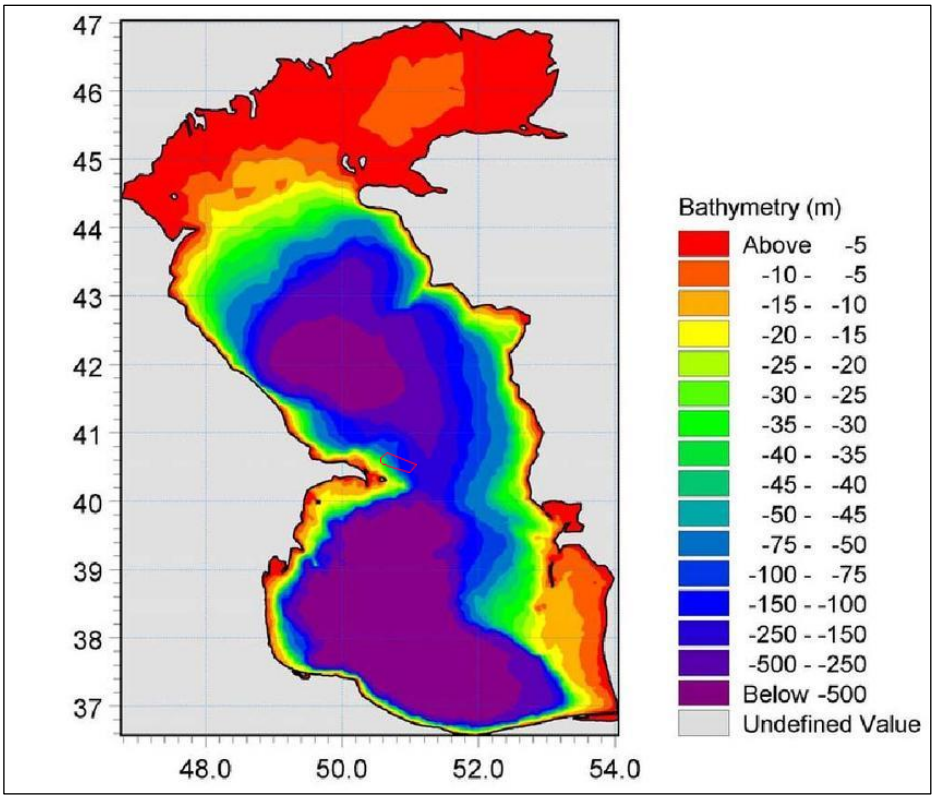
Table 4.1: Frequency of wind origins in the Karabakh area in % (SOCAR, 2017)

North	North-east	East	South-east	South	South-west	West	North-west
43	11	5	6	17	12	3	3

4.2.3 Hydrological features of the Caspian Sea

4.2.3.1 Bathymetry

The Caspian sea consists of three distinct basins, each characterized by different features. The northern basin (91,942 km2) is actually a shallow expanse of water, which never reaches a depth of more than 25 m and is less than 5 m deep over two-thirds of its area. It accounts for nearly a quarter of the total surface area of the sea but only 0.5 percent of the volume. The central and southern basins are deep depressions. The central basin, with a surface area of 137,812 km2, a maximum depth of 788 m, and an average depth of 192 m, contains 33.9 percent of the total volume of water; the southern basin, with a surface area of 148,646 km2, a maximum depth of 1,025 m and an average depth of 345 m, contains 65.6 percent of the volume (Schmitt, 2012). General bathymetry of the Caspian sea is shown in Figure 4.6.



Note: Approximate ADUA exploration area shown in red outline

Figure 4.6: Caspian Sea bathymetric map (Allahdadi et al. 2004)

The Absheron Ridge, which separates the Central and Southern Basins, is a narrow section of relatively shallow water (between 50 to 300m deep) which extends from Absheron Peninsula to the Khazar Peninsula on the east coast of Turkmenistan. The ADUA exploration area is located within the Middle Basin, within a relatively shallow subsea plateau that gently slopes offshore from the coast to a distance of approximately 70 km offshore. Water depth ranges between 20 to 225 m, with some limited areas reaching 10 m (Figure 4.7).

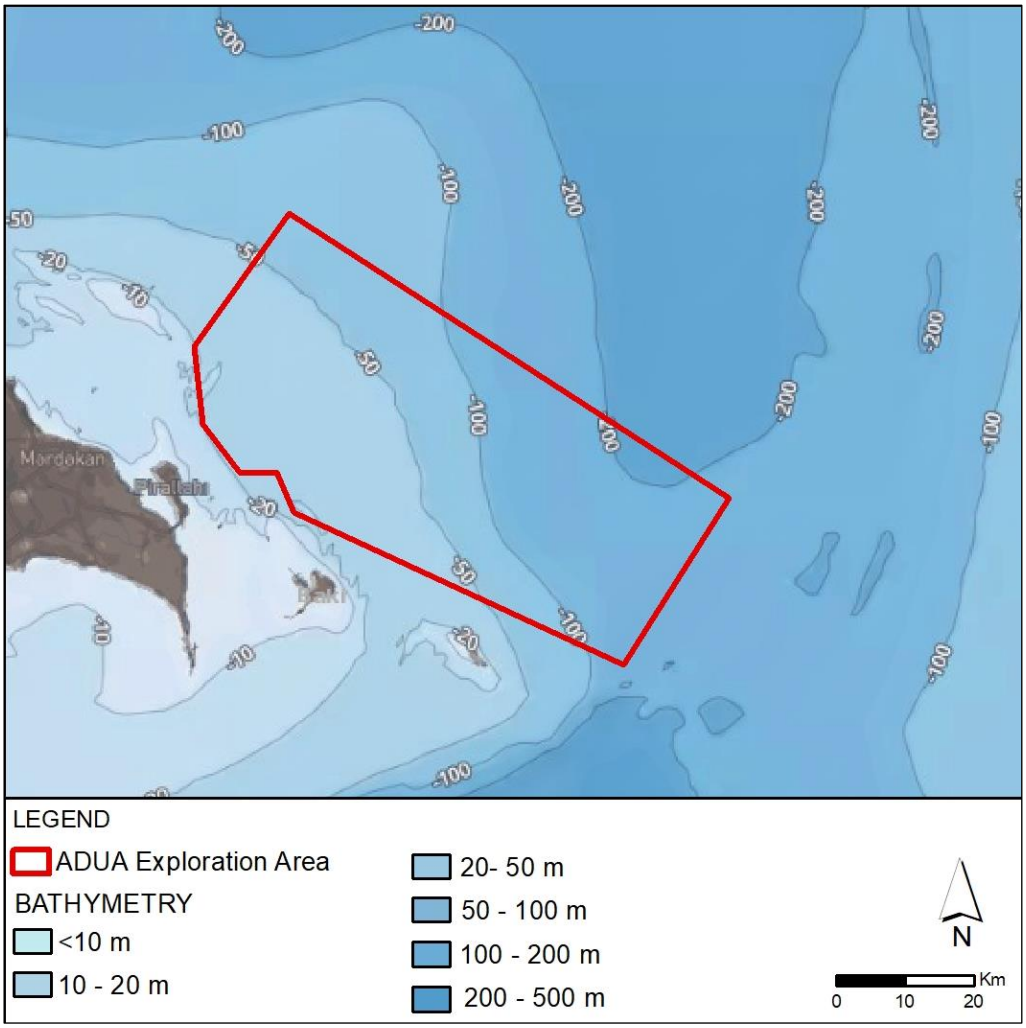


Figure 4.7: ADUA exploration area bathymetric map (ERM, 2018)

4.2.3.2 Sea level

One of the profound features distinguishing Caspian Sea from other large inland basins is the fact of its sea level significant fluctuation. Caspian Sea level fluctuation value is estimated within the 15 m range during the last 3,000 years based on paleo-geographic, archaeological and historical evidences (Heydar Aliyev Foundation, 2018).

The considerable drop in the Caspian Sea Level (CSL) began in 1930. Prior to that the observed water level had been more constant, fluctuating around -26 m for about eight decades. In 1929, the water level stood at 26.1 m below open oceanic levels. This level dropped rapidly by around 1.6 m and reached -27.7 m by 1940. After that the Caspian's sea level continued to decline but at a slower rate, falling by around 1.4 m within 37 years and reaching -29.1 m by 1977. After 1977, the sea level began to rise such that a water level of about -26.7 was

recorded in 1995 showing an increase of 2.6 m over the period 1977 to 1995. Since 1995, a slow rate of decline has occurred (Firoozfar et al. 2012). Chen et al. (2017) conducted a climate model-predicted precipitation (P), evaporation (E), and observed river runoff (R) to reconstruct long-term CSL changes for 1979–2015 and show that PER (P-E + R) flux predictions agree very well with observed CSL changes. They observed rapid CSL increase (about 12.74 cm/yr) and significant drop (~−6.72 cm/yr) during the periods 1979–1995 and 1996–2015 are well accounted for by the integrated PER flux predictions; showing that increased evaporation rates over the Caspian Sea play a dominant role in reversing the increasing trend in CSL during the past 37 years; with an actual long-term decline in CSL expected to continue into the foreseeable future, under global warming scenarios(Figure 4.8).

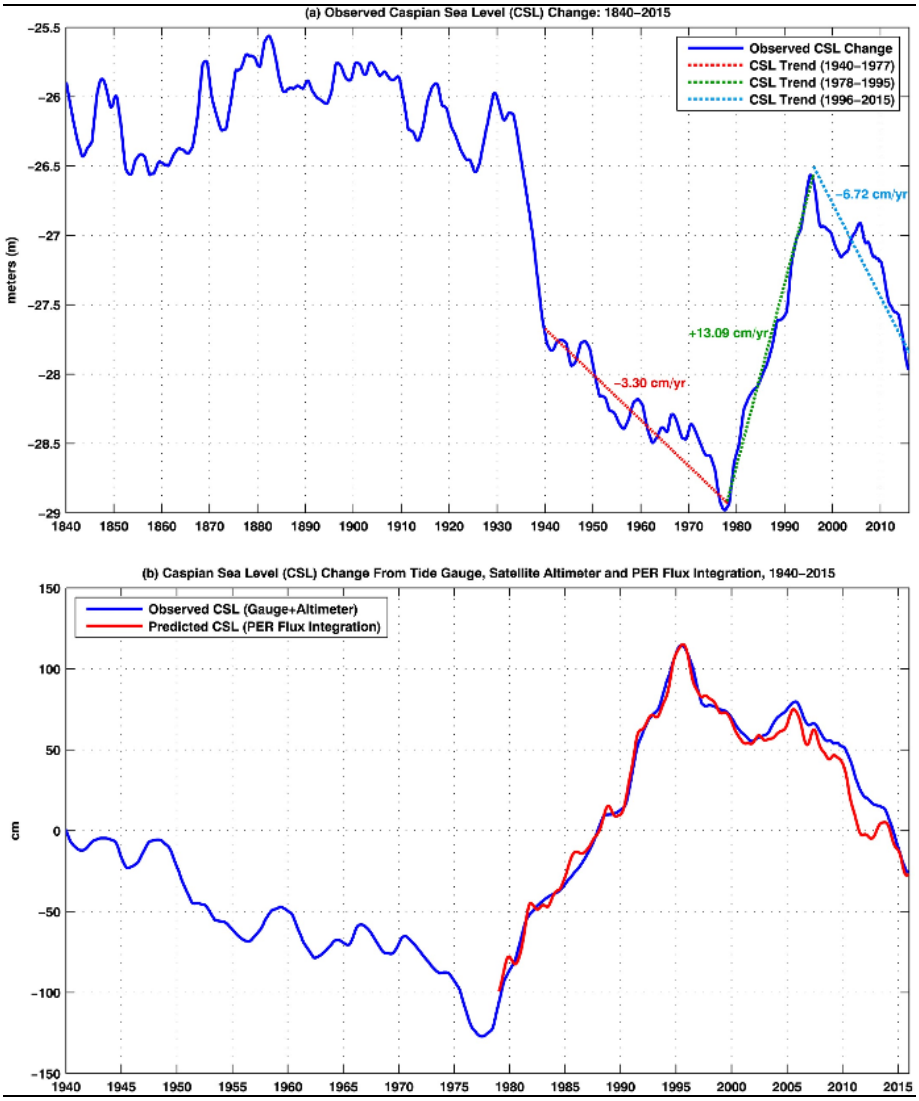


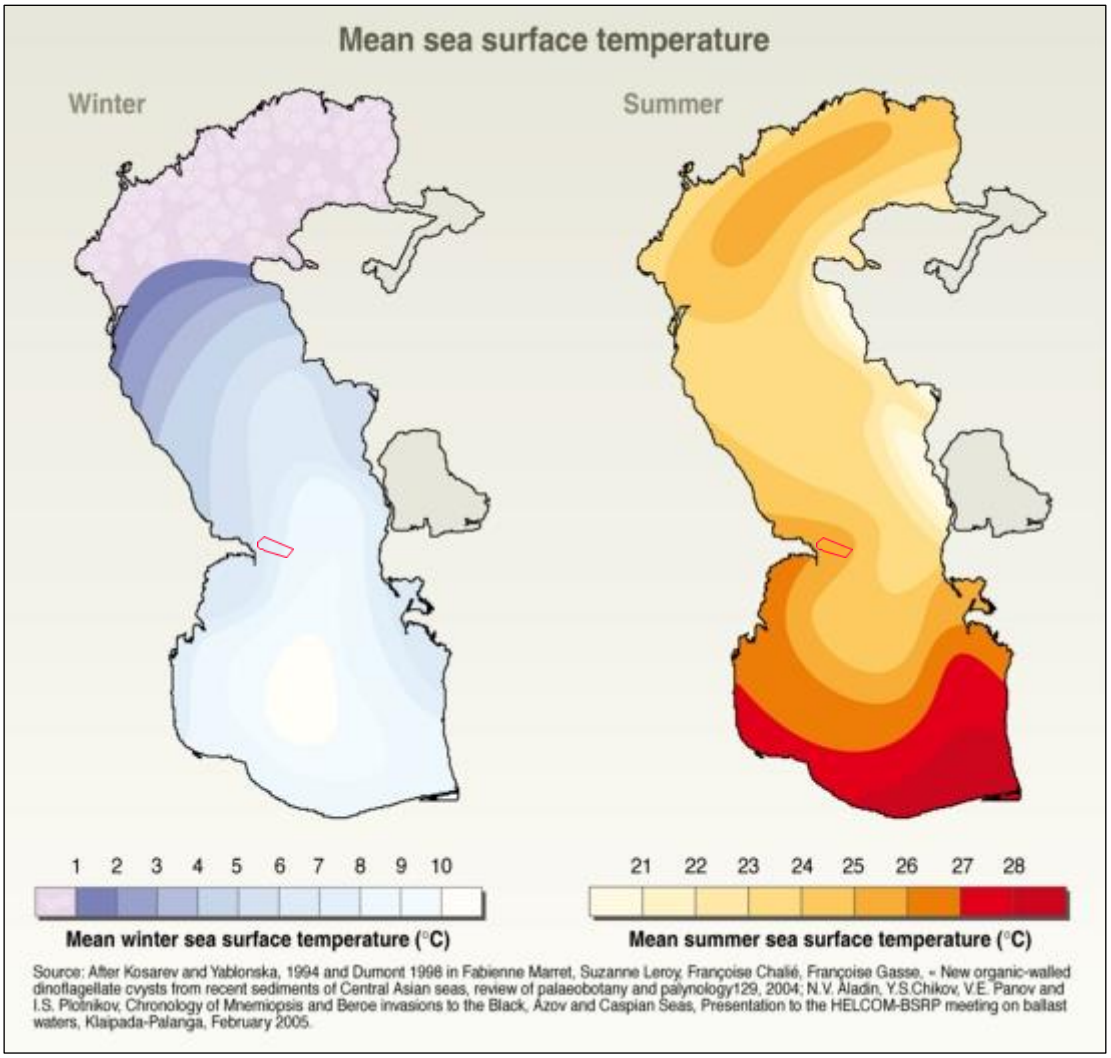
Figure 4.8: Caspian Sea level fluctuations 1840-2015 (Chen et al, 2017)

4.2.3.3 Sea surface temperature (SST)

Due to the considerable extent of the Caspian sea along the meridian, the water temperature is subject to large latitudinal changes, most distinctly expressed in the winter period, when the sea temperature changes from 0-0,5ºC in the north to 10-11ºC in the south (Figure 4.9), a difference of nearly 10ºC. This difference decreases to 1-2ºC in the summer; where water temperature in the north is of 24-25ºC, whilst in the south 25-26ºC. The temperature along the east coast is 1-2ºC lower than on the west coast.

The most general characteristic of seawater temperature is the distribution of the annual average temperature. These values reflect the influence of the Caspian Sea on the climate of the adjoining land, though it is more smoothed with regard to separate seasons. This smoothness is reflected in the form of annual average isotherms. Far from the coast the accumulation of water heating in degrees changes from 11ºC in the areas adjoining the Caspian near steppes to 18ºC on south-eastern tip of the sea. The greatest influence on the form of isotherms is the drain of the rivers: Volga, Terek, Kura, and also prevailing winds. The influence of cold deep waters getting to the surface is greatest in the eastern half of the Caspian.

Annual average differences of water temperature on the surface of up to 20ºC are observed in the northern areas. This is also observed near the east coasts of the South Caspian, but depends on intensive warming up in summer and cooling down of shoals in winter. It is characteristic for central parts of the South Caspian that water temperature changes the least during the year, which corresponds to minor seasonal climatic distinctions. The annual difference of surface temperature decreases to 14-15ºC near western and eastern coasts of the Middle Caspian in upwelling areas.



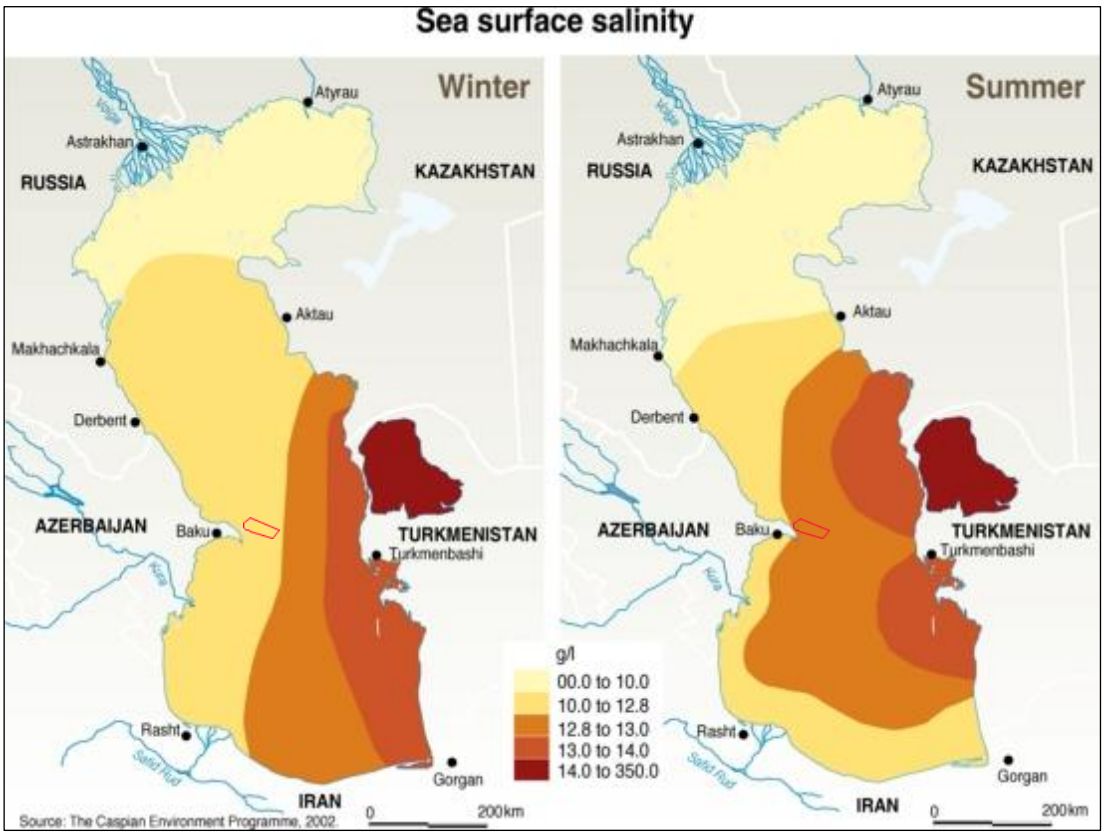
Note: Approximate ADUA exploration area shown in red outline

Figure 4.9: Sea surface temperature in the Caspian Sea (UNEP/Grid Arendal, 2007)

4.2.3.4 Salinity

The salinity of Caspian Sea changes from the north to the south within a range of 1,0 to 13,5 parts per thousand (ppt). This difference is especially marked in the northern Caspian, being less obvious in other areas distinguished by relative homohalinity. The 12,8 ppt bending around the peninsula forms a ledge as more salty water masses move towards the east. This phenomenon is explained by the fresh water influence from rivers draining into the western coast of the Middle Caspian, which is allocated by branches of Main Caspian flow of cyclonic and anticyclonic directions. Practically all the remaining surface waters beyond the 12,9 ppt isohaline is defined by salinity of 13,0-14,0 ppt, due to an almost complete absence of a hydrographic network in the south-east Caspian.

The common increase of the salinity happening in the northern areas is observed in the whole area of the sea in winter months. In other parts of the sea extremes do take place. Like in the Gara-Bogas-Gol Gulf, where the salinity of the water can reach up to 300 ppt.



Note: Approximate ADUA exploration area shown in red outline.

Figure 4.10: Sea surface salinity in the Caspian Sea (UNEP/Grid Arendal, 2007)

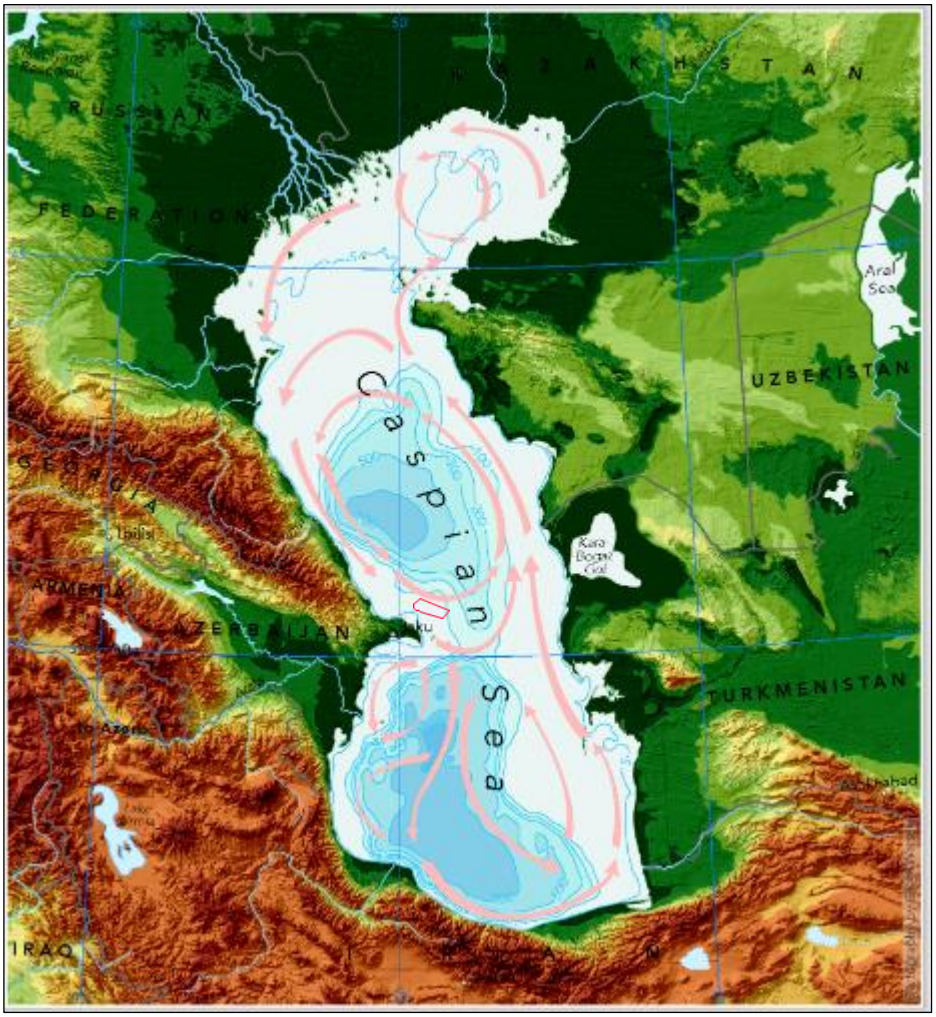
4.2.3.5 Sea Currents

General water circulation in the Caspian Sea is the result of long-term hydrometeorological conditions. In order of importance the causes of the circulation in Caspian waters are (Casp Info, 2018):

- wind conditions;
- bottom relief;
- shape of the coastal line;
- differences in water temperature and
- drain of rivers flowing into the Caspian, especially of the Volga river.

In general, north winds are dominant all year round generating wind-drift currents along the western shore from Northern Caspian to the South. These flows move to the Absheron Peninsula, where they divide into two arms. The stronger arm passes the peninsula and enters the southern part, then moves along the shores of the Southern Caspian and turns left returning back to the Central and Northern Caspian. The second arm moves to the east from Absheron Peninsula and enters the southern shores joining with the main arm. This joined flow enters Mangishlag Peninsula and turns west, thus creating cyclic water circulation in the Northern Caspian (Figure 4.11). There are also local anti-cyclone currents between Absheron Peninsula and Kura River mouth in the southern part of the sea.

Typical current speed value in the Caspian Sea varies in the range from 15-20 cm/sec, whereas this value reaches 100cm/sec in between Chilov Island and Neft Dashlary oilfield (Heydar Aliyev Foundation, 2018). The fastest currents in the North Caspian Sea are the Northeast and Southwest (25 cm/s) currents, while the Northwest and Southeast currents are the slowest (13 cm/s). Direction of winds and currents in the eastern part of the Central Caspian coincide. Wind velocity and, respectively, the current speed increases along the shore from south to north. The south currents (velocity up to 10 cm/sec) dominate around Baku archipelago in the Southern Caspian. The maximum current velocity in this area was 40-50 cm/sec. The south currents dominate along the eastern shores of the South Caspian in April - September. The current velocity is 15-30 cm/sec in moderate wind and 50-60 cm/sec in strong winds. Recurrence frequency of currents with up to 10 cm/sec velocity may reach 60%.



Note: Approximate ADUA exploration area shown in red outline

Figure 4.11: Main surface currents of the Caspian Sea (EEA, 2008)

The results of the Karabakh field current measures carried out in 2017 suggest that in this part of the Caspian currents vary between 25 and 102 cm/sec. Southeast currents dominate over the western shores of the Central Caspian. Within Absheron Peninsula, the strong north-west winds create the currents from the shore to the east due to the impact of the shore, while in open sea the currents flow towards north-west. With exception of south winds between Chilov Island and Neft Dashlari, all other winds create stable southbound currents and their velocity changes between 60-80 cm/sec and sometimes between 100-110 cm/sec.

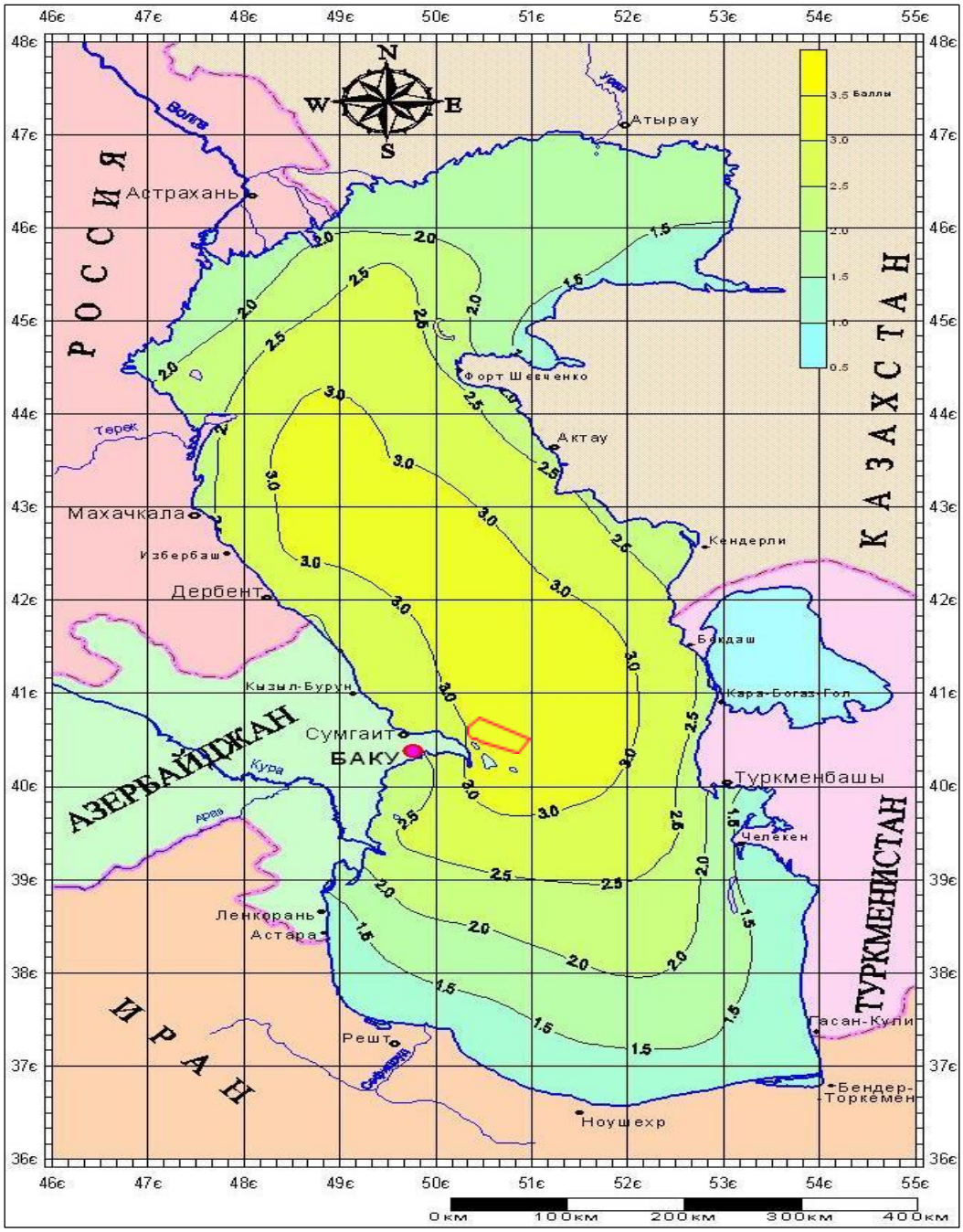
4.2.3.6 Waves

Characteristics of waves in various areas of Caspian Sea strongly differ from each other. The main characteristics of the waves in the Northern Caspian sea are: height - 3m, the period - 10 sec., length - 85m. Wave regime in the southeastern and eastern directions has the largest repeatability in the western part of the Northern Caspian Sea (Figure 4.12). In the northeastern area of the sea the repeatability is biggest in western and eastern directions (Casp Info, 2018).

Wave regime in various areas of Middle and South Caspian is characterized by northern winds, where greatest heights are 2-3 m in the coastal zone of Makhachkala - Derbent region, and are 4-6 m in the offshore section of this area. The average periods and lengths of waves are accordingly 4 sec and 16 m at the coast, 5-7 sec and 20-25 m far from the coast; with wave size increasing from north to south (Casp Info, 2018).

The greatest wave heights are found around Absheron Peninsula. During severe northwestern storms (> 25 m/sec) waves may reach heights of 7,5 - 8,0 m, and during extreme storms 9-10 m. Eastern winds with a speed of 5-9 m/sec cause wave heights up to 1 m. Winds with speeds of 10-15m/sec cause waves of up to 2 m in height. The period of the waves is increased to 3,0 - 4,7 sec (Casp Info, 2018).

With eastern winds of 16 - 20 m/sec, waves may reach heights of 3-3,5 m with a period of 6 sec. The whole southern Caspian Sea has a weak standard wave regime (0,5-1 m) due to the southeastern winds. Strong waves develop in case of northern and western winds on the east coast near the Cheleken region. The height of waves does not exceed 1 m in case of moderate and strong northwest winds (from 5 up to 15 m/sec) in the eastern area of the South Caspian. Storms of 16-20 m/sec may cause waves of 2-3 m, and heavy storms (21-25 m/sec) waves of 3 - 4 m (Casp Info, 2018).



Note: Approximate ADUA exploration area shown in red outline

Figure 4.12: Annual wave regime the Caspian Sea (Casp Info, 2018)

Similarly to what has been described for the meteorological conditions, in the absence of primary data specifically for the ADUA area, the hydrological regime of Karabakh field are considered applicable to the ADUA area given the

proximity between these two. The waves in the ADUA area are mainly brought by north winds and are mainly short, with late extinction after wind drop. Waves influence the wind regime. Wind direction changes are described *in* Table 4.2.

Table 4.2: Wave height frequency and average wind directions in the Karabakh field (SOCAR, 2017)

Wave height	Throughout the year	Directions							
		N.	N.E.	E.	SE	s	SW	W	NW
0,1-0,5	69,7	26,9	55,2	81,7	81,2	83,5	61,3	86,4	81,2
0,6-1,0	19,6	27,7	33,4	16,5	14,3	15,4	30,2	9,7	9
1,1-1,5	5,3	16,5	6,6	1,8	4	1	3,3	3,9	5,2
1,6-2,0	2,8	11,5	3,5	-	0,3	0,1	5	-	2
2,1-2,5	1,4	8,6	1	-	0	-	0,15	-	1,8
2,6-3,0	0,6	4	0,1	-	-	-	0,05	-	0,8
3,1-3,5	0,3	2,6	0,2	-	-	-	.	-	-
3,6-4,0	0,18	1,4	-	-	-	-	-	-	-
4,1-4,5	0,07	0,5	-	_	-	-	-	-	-
4,6-5,0	0,03	0,17	-	-	-	-	-	-	-
5,1-5,5	0,02	0,13	-	-	-	-	_	-	-

4.2.3.7 Water transparency

The transparency of Caspian waters increases from the north to the south (Figure 4.13). The North Caspian Sea has by a small transparency (0,5-1,0 m), which is explained by a big inflow of river waters, containing rich organic and inorganic suspensions, a highly biological productivity of waters and small depths.

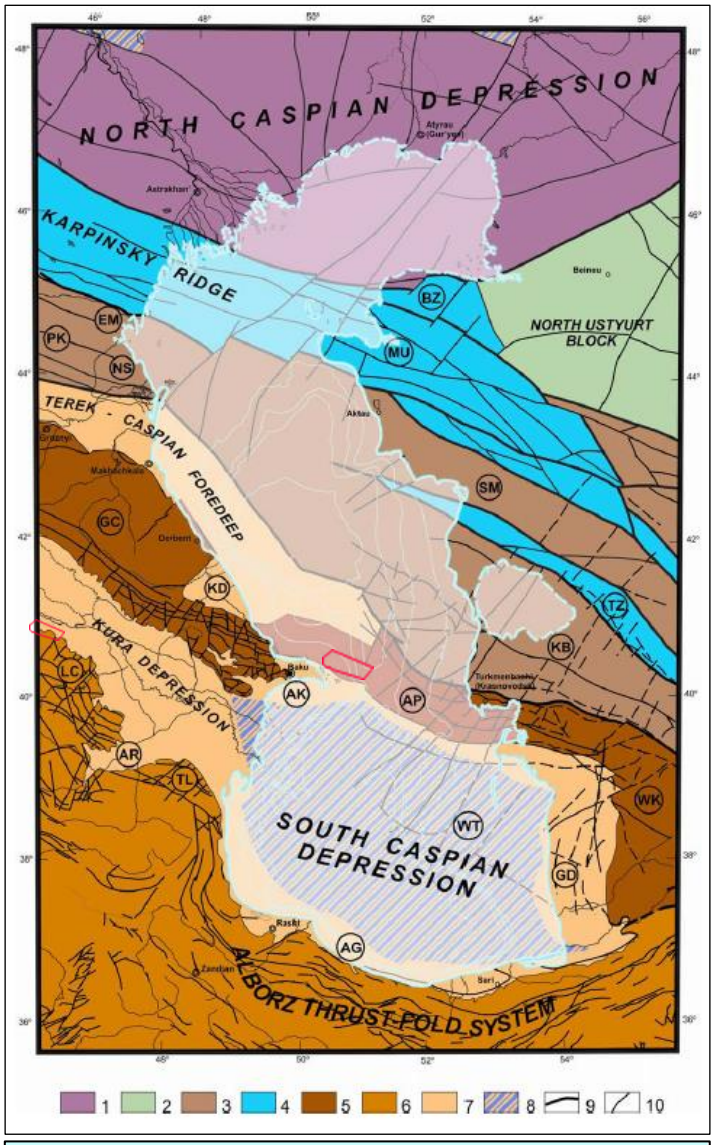
The transparency is not the same in various areas of Middle and South Caspian and increases in deep water. The transparency is about 10-15 m in the central part of the sea almost in all seasons of year, and the maximal value (21 m) was observed in South Caspian.

Note: Approximate ADUA exploration area shown in red outline

Figure 4.13: Water transparency in the Caspian Sea (National Academy of Science, 2010)

4.2.3.8 Geology and Sediments

Various geological structures participated in the formation of the Caspian depression: the Russian Paleozoic platform, Epihercynian Turan platform and Alpine-Himalayan orogenic zone. As a result, the Caspian Sea was separated by three almost independent depressions: the Northern Caspian, the Middle Caspian and the Southern Caspian, which differ in depth, morphological features, geological structure and occupied area. They are separated by sub-latitudinal, underwater risings (Mangyshlak and Absheron). The Middle Caspian Basin is separated from the South Caspian Basin by the Absheron – Balkhash zone of uplifts, which bridge the fold systems of the Greater Caucasus and Kopeh Dagh. It consists of two chains of brachyanticlines, the western of which is located immediately north of the Absheron Peninsula. Eastwards from the seashore there is a poorly traceable arch expression of the structure up to Eocene-Miocene deposits. Cretaceous strata occur here at a depth of approximately 2 km and are locally overlain by Pliocene sediments. This area represents a submerging continuation of the Greater Caucasus axial zone. The latter submerges sharply further eastward with simultaneous increase in the thickness of the lower Pliocene hydrocarbon productive sequence (Russian Academy of Sciences, 2005).



Basement of platform areas (1 – 4): (1) Early Precambrian, (2) Baikalian, (3) Hercynian, (4) Early Cimmerian; Alpine fold – thrust systems (5, 6): (5) Greater Caucasus and Kopeh Dagh, (6) Lesser Caucasus, Talesh, Alborz; (7) Foredeeps and depressions; (8) Depressions with oceanic-type crust; (9) Tectonic lineaments corresponding to boundaries of large structures; (10) other important lineaments. Main structures (letters in circles): (Bz) Buzachi arch, (MU) Mangyshlak – Central Ustyurt, (SM) South Mangyshlak – Ustyurt system of troughs, (TZ) Tuarkyr zone, (KB) Middle Caspian Karabogaz anteclise, (EM) East Manych trough, (PK) Kuma system of uplifts, (NS) Nogai scarp, (GC) Greater Caucasus fold system, (KD) Kusary – Divichi trough, (AP) Apsheron Balkhan zone, (WK) West Kopeh Dagh zone, (LC) Lesser Caucasus fold system, (AR) Lower Araks trough, (TL) Talesh zone, (AG) Alborz – Gorgan foredeep, (WT) West Turkmen trough, (GD) Gograndagh – Okarem zone.

Note: Approximate ADUA exploration area shown in red outline

Figure 4.14: Main structural elements of the Caspian Sea region (Russian Academy of Sciences, 2005)

Regional Geology

Geological data have been obtained from exploration and appraisal wells drilled in the South Caspian Basin and at the Absheron Sill. Seismic interpretation and mapping based on acquired (in 1995-1999) and reprocessed 2D and 3D seismic indicates that the area north of the Naft Dashlari-Chilov Adasi trend is covered by thick Cenozoic sediments.

The Pleistocene aged Absheron Formation is underlain by the Pliocene aged Productive Series sediments. The Absheron Formation comprise grey to green claystones and marls interbedded with minor channelised bodies of siltstones and sandstones.

The Pliocene sequence is characterised by the deposition of fluvial deltaic sandstones and shales of Paleo Volga in a lacustrine basin. Laterally continues sand and shale layers were deposited in a low gradient ramp like delta under great influence of rapid fluctuations of lake level (driven by climate change). The Pliocene interval is characterized by fast deposition and rapid subsidence of the basin. Approximately 8km of sediment was deposited in the South Caspian Basin during five to six million years in Pliocene time. The Pliocene interval is thinning toward the north (Absheron Sill) and progressively onlaps onto an upper Miocene or older unconformity surface across the central Caspian region.

The youngest formation of the Productive Series (Akchagyl Formation) mainly consist of claystone and represents the last connection period between the Caspian Basin and open sea. Below the Akchagyl Formation are the deposits of Surakhany, Sabunchi, Balakhany, Fasila, NKG, NKP, Kirmaky, PK and Kalin Formations.
The older units (Miocene to Paleocene) are poorly known in the offshore area. Only few exploration wells have been drilled down to Cretaceous and limited data is available from these old deep targeted wells.

Tectonic Setting

The South Caspian Basin is bounded by the Alborz Mountains in the south, the Kopet Dagh Mountains in the east and the Azeri Kura Basin in the west. The northern boundary of the South Caspian Basin is the Apsheron Sill, a large structural high that stretches across the Caspian Sea from Turkmenistan to the Greater Caucasus Mountains in Azerbaijan.

The Apsheron Sill marks the boundary of the thick sedimentary package found in the South Caspian Basin and separates the South Caspian Basin from the Central Caspian Basin. At shallow levels, the Apsheron Sill is composed of large anticlines that form giant hydrocarbon fields found in Azerbaijan and Turkmenistan. To the north of the Apsheron Sill, there is a small foreland basin (thick isochore) that is called the Apsheron Depression. The regional tectonic is controlled by the collision between the Arabian and Eurasian plates during late Cenozoic. This north-south converge between the Arabian and Eurasian plates resulted in a large variation in structural styles and kinematics.

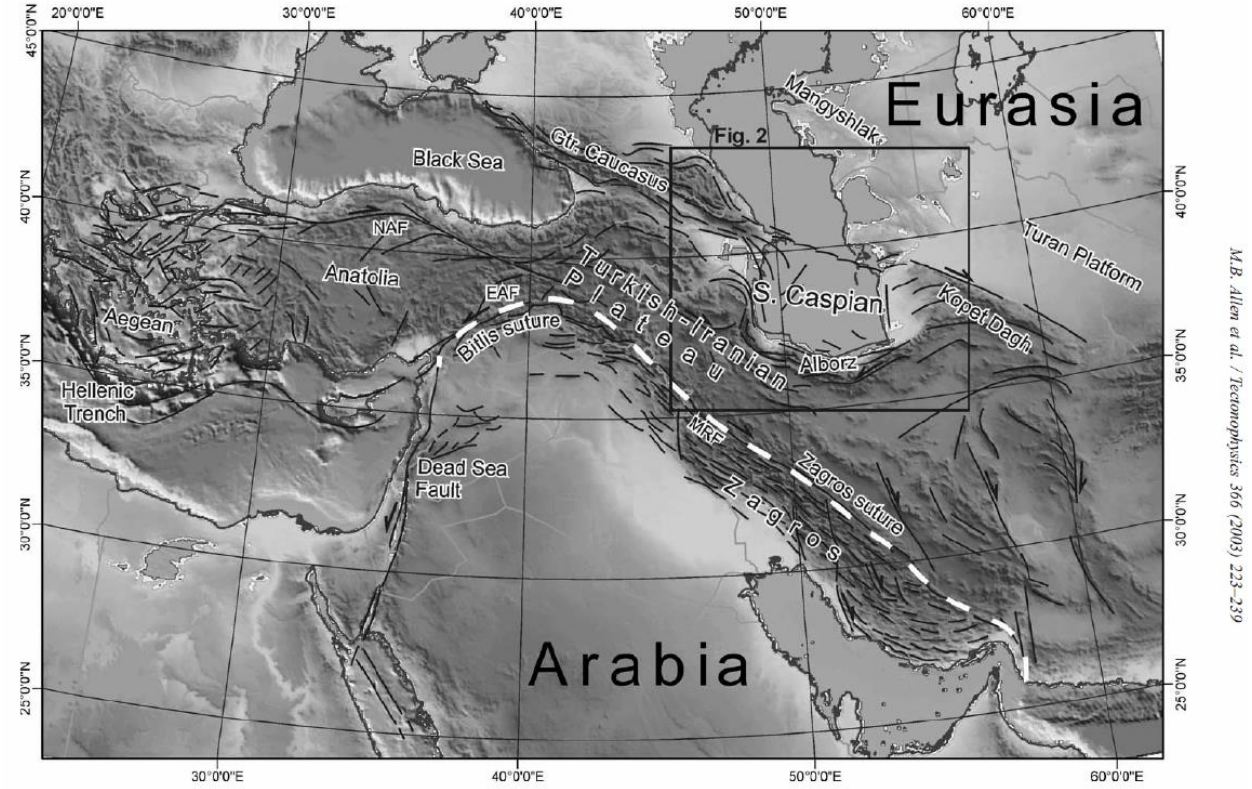


Figure 4.15: Topography and regional structure of the Arabia-Eurasia collision. Principal fault zones and fold trends are highlighted. Elevated regions are principally between the Zagros and the northern side of the Greater Caucasus-Kopet Dagh range. The Arabia-Eurasia convergence has been largely accommodated by crustal shortening in the area between these range fronts. EAF = East Anatolian Fault; MRF= Main Recent Fault; NAF =North Anatolian Fault. (Allen et al 2003)

The basin architecture in the South Caspian Basin is characterized by long wavelength box folds. The folds are detached from the basement by the thick mid-Tertiary Maykop interval. These folds formed during late Pliocene (Akchagyl Formation) and are marked by thickness changes across the folds. In Akchagyl to recent times, the sediments imply deposition during structural growth. Some of the folds within the South Caspian Basin are underlain by basement structures. The Maykop acts as the decollement zone for the box folds.
The northern margin of the South Caspian Basin is marked by the transition towards the Apsheron Sill. The sill trend is interpreted to have developed during Early Cenozoic as the offshore continuation of the Greater Caucasus Mountains. Evidence of structural inversion along faults parallel to the ACG trend suggests that these faults may represent reactivation of earlier normal faults that relate to the formation of the early Cenozoic South Caspian Basin.

The main compressional events occurred during the Late Miocene forming the Greater Caucasus fold and thrust belt and the formation of the folds within the South Caspian during the Pliocene-Pleistocene. Both folding events are linked to the Arabian-Eurasian collision.

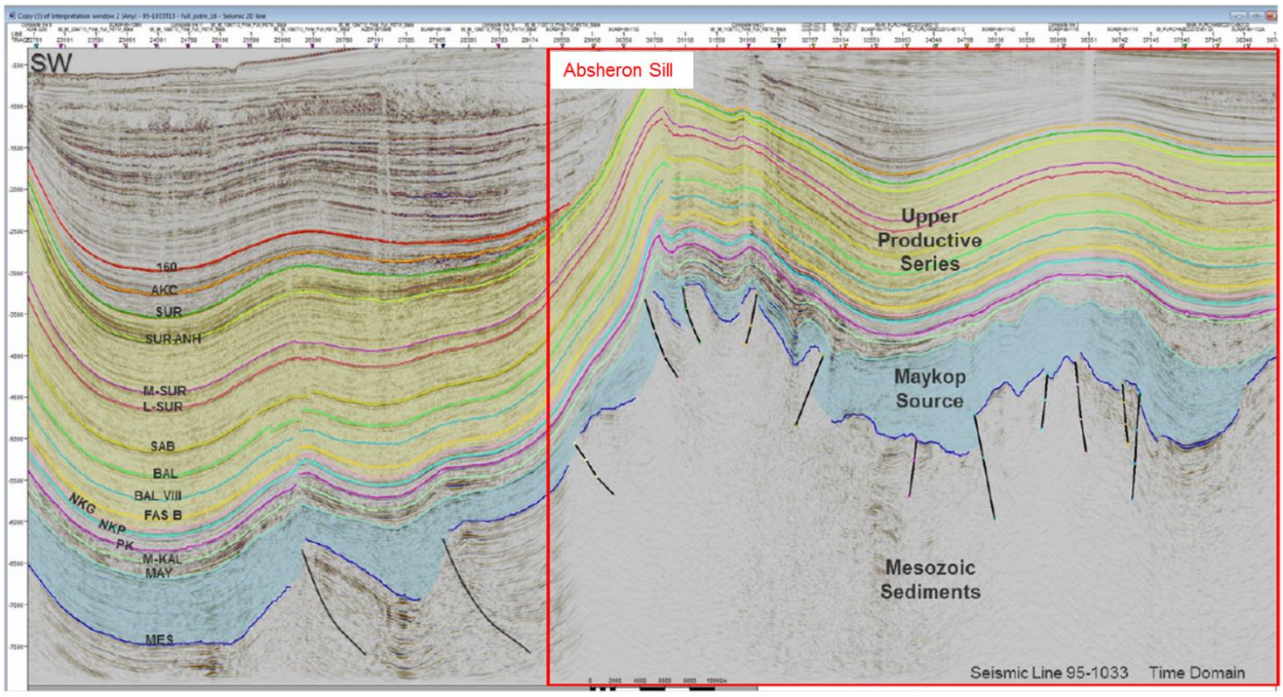


Figure 4.16: South Caspian Basin cross-section. SW-NE cross section across the northern margin of the South Caspian Basin showing the long wavelength folds in the Productive Series. The basement high is the Apsheron Sill that marks the northernmost boundary of the South Caspian Basin.

Seismicity

The regional tectonic of the Caspian region is controlled by the collision between the Arabian and Eurasian plates. The convergent collision between the Arabian and Eurasia continental plates led to the subduction of the Tethys oceanic plate, which lay between the Eurasia plate to the north and the Arabian plate to the south. The convergent plate movements are associated with relatively high levels of seismic activity and earthquakes around the rigid South Caspian Basin.

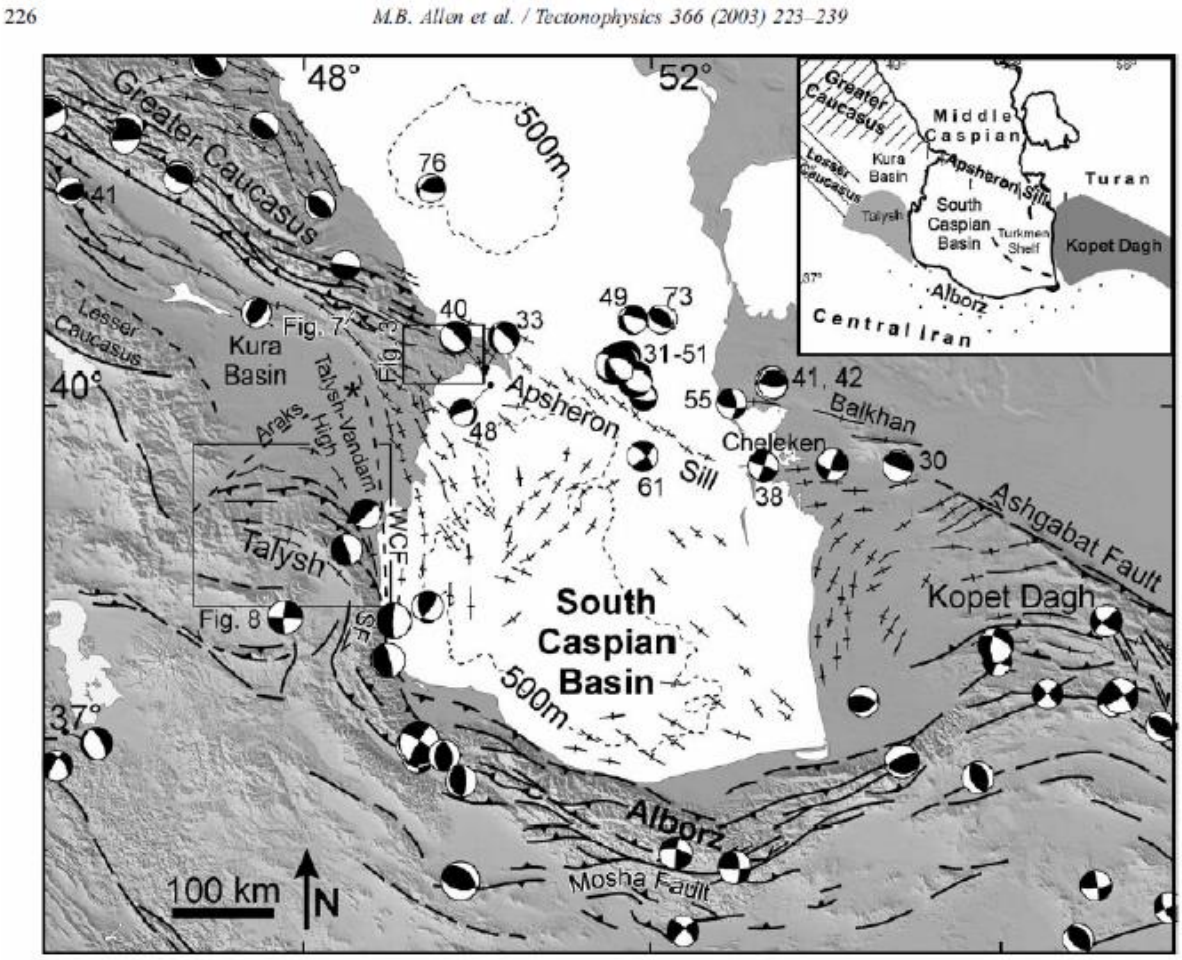


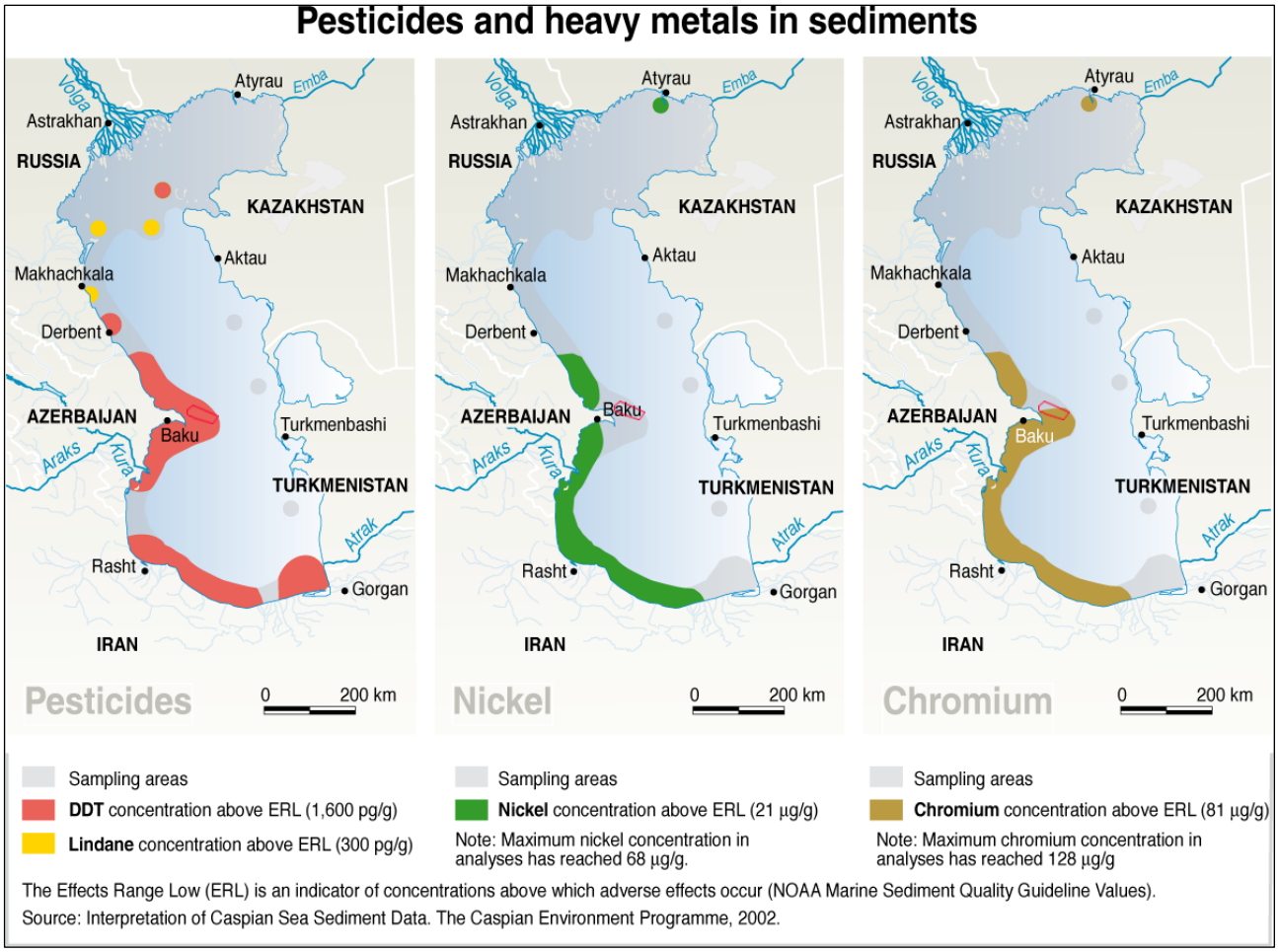
Figure 4.17: Structure and seismicity of the South Caspian region. Modified after Jackson et al. (2002). Centroid depths are only shown for earthquakes deeper than 30 km. SF = Sangevar Fault; WCF=West Caspian Fault. The South Caspian Basin is characterized by thin skinned deformation and is surrounded by compressional thick-skinned fold and thrust belts. (Allen et al., 2003).

Current neotectonic (more recent) tensions are leading to convergent movements between the plates. The Absheron Sill is located to the north of the main deep fault that is associated with several reverse and thrust faults. Figure 3 shows the location of earthquakes deeper than 30 km. Five earthquakes with a magnitude greater than 6.0 on the Richter scale have occurred in Azerbaijan since 1842 with the most recent, measuring 6.5, on 25th November 2000 with an epicenter 30km northeast of Baku.

Sediments

Sampled sediments in the Caspian Sea (Figure 4.18) showed that the accumulation is at its worst in the south and southwestern shores of this inland sea, off the shores of Iran and Azerbaijan. Sampled pollutants presented in this

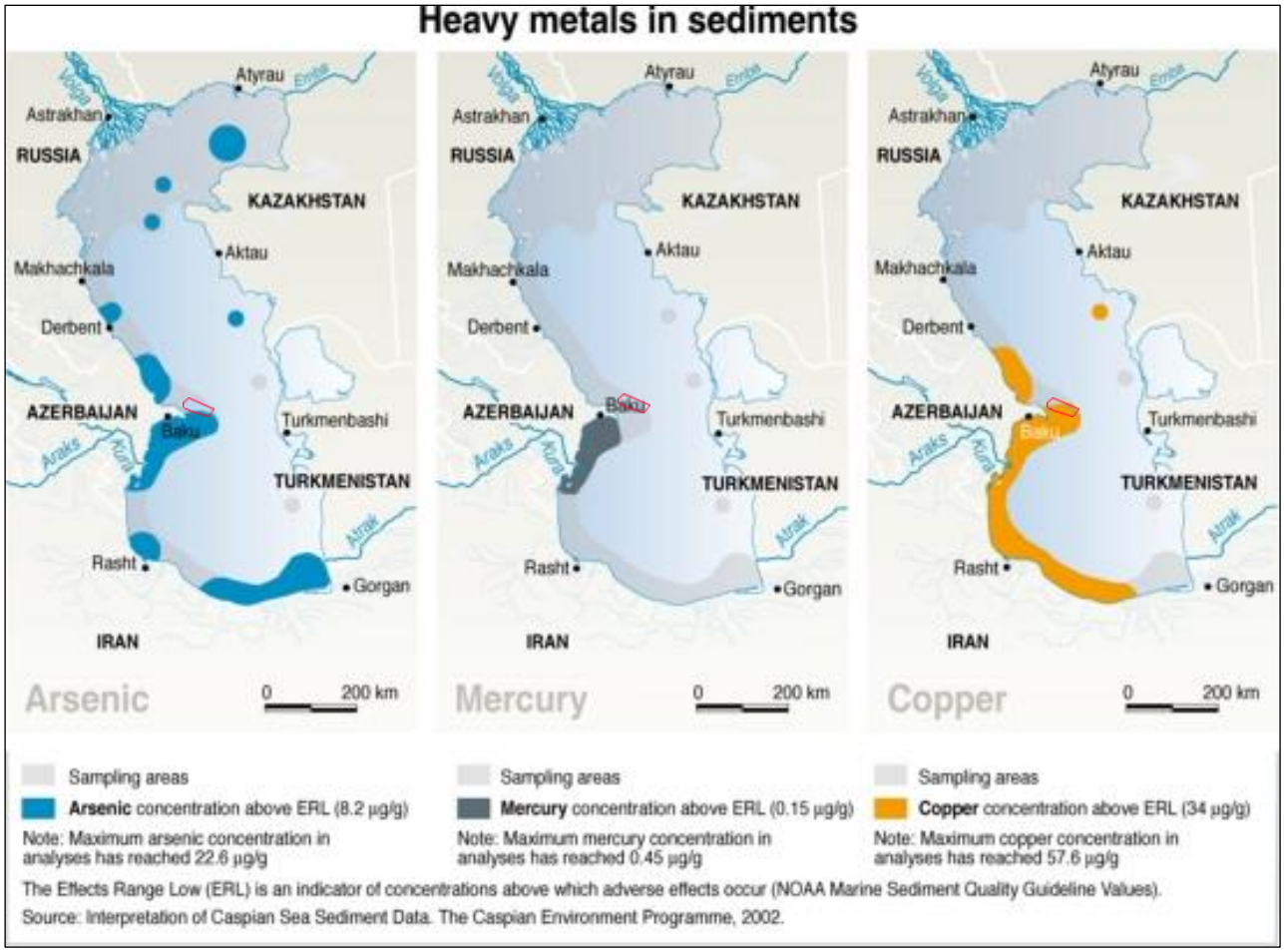
map are pesticides (persistent organic pollutants Lindane and DDT - POPs), and the heavy metals Chromium and Nickel (CEP, 2002).



Note: Approximate ADUA exploration area shown in red outline

Figure 4.18: Pollutants in sediments of the Caspian Sea (pesticides, nickel and chromium) (CEP, 2002)

Other parameters (Figure 4.19) showed that arsenic is spread out at multiple locations, but primarily on the southern and southwest shores of the Sea, on the shores of Iran and Azerbaijan - where also Copper is accumulated in the sediments. Mercury is concentrated on the Absheron Peninsula of Azerbaijan (CEP, 2002).



Note: Approximate ADUA exploration area shown in red outline

Figure 4.19: Heavy metals in sediments of the Caspian Sea (Arsenic, Mercury and Copper) (CEP, 2002)

4.2.4 Specific water column and sediment analysis in the Karabakh area use as reference for the ADUA area

Water column physical properties were measured for the near-by Karabakh field in 2017 on the surface, middle column and seabed. The results are likely to be applicable to the ADUA exploration area as well and are summarized in the sub-sections below. Similar measures were performed in 1996 in the Karabakh field in 1996 within the framework of the CIPCO studies in 1996-1999 (Environment and Resource Technology LTD-1996). The 2017 results are also compared with the 1996 to pinpoint any water analysis changes over the past 20 years.

4.2.4.1 Physical parameters analysis

Temperatures in the upper layers of the samples changed between 18.4 and 19.6° C, and were more than two times lower in middle layers (8.0 to 8.9° C) and lower layers (6.7 to 8.7°C). This indicates the existence of a thermocline, (i.e. sharp decline of temperature) in the area. This was also recorded in previous surveys and seem to occur in the layers below 60 m. Salinity changed between 11.04 and 12.39% and was higher in lower layers. The pH was fairly similar in all samples (8.83 - 9.10).

Results of the 1996 monitoring where found to be comparable with the 2017 surveys.

4.2.4.2 Analysis of biogenic substances in water samples

The 2017 survey included sampling of Nitrates NO_3^-, Nitrites NO_2^-, Ammonium NH_4^+, and Orthophosphates PO_4^{3-} which are the main source of food for phytoplankton and therefore a good ecological indicator.

The amount the nitrate ions was the highest in two samples collected in the middle layer (2.466 and 2.326 mg/l) and were similar in remain sample points (1.024-1.664 mg/l). The amount of nitrites was the highest in the upper level (0.022 -0.027 mg/l) and in some stations on the bottom level (0.018-0.021 mg/l) and were fairly similar in other stations (0.01-0.016 mg/l). The amount of orthophosphates was about the same in all stations (0.039-0.059 mg/l). The amount of ammonium was lower than the minimum defining level of analytical method in most stations (<0.0058 mg/l), and both maximum (0.037 mg/l) and minimum values (0.01 mg/l) were found in the upper level.

The 1996 monitoring campaign highlighted an increase in nitrates towards the deeper areas, which was not the case in 2017. Nitrites and phosphate levels were lower in 1996 than in 2017.

4.2.4.3 Analysis of hydrocarbons in water samples

The 2017 survey included the analysis of hydrocarbon concentrations. Based on the results obtained from the samples, the concentration of total hydrocarbons (TPH) was lower than minimum level defined by the analytic method (<0.05 mg/l). Similarly, the concentration of polycyclic aromatic hydrocarbons (PAH) and n-alkaline was lower than the minimum defining limit of the analytic method (PAH < 2 µg /l, n-alkane <0,001 mg/l).

Concentrations of BTEX (Benzene, Toluene, Ethylbenzene and xylene), of poly-aromatic hydrocarbons (PAH) and of n-alkaline in water samples were lower than the minimum concentrations defined by the analytic methods.

Overall, the levels of total hydrocarbons obtained during the 2017 monitoring are equivalent to the ones obtained in 1996.

4.2.4.4 Analysis of heavy metals in water samples

The concentration of heavy metals (Cd, Cu, Fe, Pb, Zn, Cr, Mn, Ba) in water samples collected during the 2017 monitoring campaign in Karabakh where lower than the standards permissible for waters important for fishing industry, except for the concentrations of mercury (Hg) which were slightly higher. Overall the amounts of heavy metals where similar to indicators from other fields in the Caspian Sea.

4.2.4.5 Sediment analysis

The exact types of seabed sediments that found in the ADUA exploration area cannot be determined at this stage since no specific field campaign was performed in the area. Nonetheless, the 2017 campaign in the nearby Karabakh field highlighted the following results.

- Presence of Modern Caspian Deposits, containing clayey sand, sandstones and seashell, and clay in the deepest parts.
- The granular composition of the sediment samples mainly consisted of silt and sand.
- The amount of organic substances was relatively low and, in general, similar in all sampling locations (between 3.60 mg/l and 10.57 mg/l).
- The carbonate content of seabed deposits was 36.378% throughout the field but variable according to sampled stations (from more than 50% to less than 20%).
- The average value of total phosphorus in sampled stations was 0.123 kg/g.
- The total nitrogen varies significantly in different stations (between 0.0002 g/kg and 0.0066 g/kg), with an average value of 0.0038 g/kg.
- In terms of hydrocarbon concentrations in bottom sediment samples, TPH concentrations were high in all stations, the amount of PAH was above standards in five 5 out of 25 stations, the amount of n-alkanes was higher than standards in most of the stations, and the BTEX amount in most of the stations was below the defining limit of the analytic method (<1 µg /kg).
- In terms of heavy metals in bottom sediment samples, the following average concentrations were recorded: arsenic (18.257 mg/kg), cadmium (0.18 mg/kg), copper (23.167 mg/kg), iron (20,071.36 mg/kg), nickel (32.5612 mg/kg), lead (10.11264 mg/kg), zinc (44.44 mg/kg), mercury (0.024 mg/kg), chromium (48.94 mg/kg), manganese (732.66 mg/kg), and barium (1463.84 mg/kg).

These results are somehow comparable to the results obtained by CIPCO in 1996, main differences between the amount of iron and lead which were relatively lower in 2017 than in 1996. A similar type of seabed is expected to be found in the ADUA exploration area.

4.3 Biological Environment

4.3.1 Introduction

The Caspian Sea is relatively poor in terms of biodiversity compared to other large water bodies. However, because of its isolation, the Caspian Sea includes a high number of endemic species (i.e. species that occur only in the Caspian Sea). In total, it is calculated that the Caspian Sea includes around 500 plants and 854 animal species, 79 of which are vertebrate species. Among harvested fish species, there are seven species and subspecies of sturgeons, Caspian salmon, bream, chub, Shamai, Omul and the Caspian eel. In addition, the Caspian Sea includes the Caspian seal (*Pusa caspica*).

As for the physical environment, no biodiversity surveys were conducted specifically on the ADUA exploration area as part of this study therefore the section is based on literature information and from primary data collected as part of other near-by projects, in particular the Karabakh field survey carried out in 2017.

4.3.2 Plankton

4.3.2.1 Phytoplankton

Production characteristics of the Caspian Sea are determined by receipt allochthonous organic matter, mainly, with river runoffs and eolian precipitation; autochthonous organic matter, i.e. production of organic matter by phytoplankton and higher water plants, development of bacterial biomass and destruction of organic matter in water and ground (Aladin et al. 2006).

The phytoplankton of the Northern Caspian is different from that of the Middle and Southern Caspian with typical features of estuarine plankton, impoverished by marine elements. The phytoplankton of the Northern Caspian in 1986-1994 consisted of 230 species, the Middle and Southern 82 and 83 species, respectively. Currently, specific composition of plankton microalgae only of the Northern Caspian includes more than 400 species (Cyanophyta - 90, Chrysophyta - 1, Bacillariophyta - 149, Pyrrophyta - 58 Euglenophyta - 7, Chlorophyta - 138). However, despite of this diversity, only a few species are predominating. A marine diatom, *Rhizosolenia calcar-avis* makes the basic part of the phytoplankton of the Middle and Southern Caspian. At present, its amount remains the same in the Middle Caspian, but has highly increased in general. In the Middle Caspian, in the 90's, the eastern region was the richest by the number of phytoplankton species and their population. (Aladin et al. 2006).

The phytoplankton of the southern Caspian at the coast of Azerbaijan is represented by 171 species. A leading role belongs to diatoms, which are widespread all over this part of the sea and have the most diverse species composition (75 species of 22 genera). By specific diversity, the genus Chaetoceros - 16 species, varieties and forms is distinguished, of these 3 are endemics of the Caspian Sea. The second by the number of species is the genus Thalassiosira consisting of 11 species, varieties and forms, of which 5 are endemics. On the third place there is the genus Coscinodiscus - 8 species, varieties and forms, ensued by genera Melosira and Nitzschia – up

to 6 species, varieties and forms. Of the genus Coscinodiscus, the species *N. jonesianus* and *N. granii* are the most widespread. It is necessary to note the marine genus Rhizosolenia with 3 species. Such species, as Actinocyclus, Sceletonema, Thalassionema though they are represented by a small number of forms, however their representatives are widely distributed in the Caspian and play an important role in the life of the sea. In the coastal zone, in the vicinity of islands of the Baku archipelago, a special role belongs to benthic-plankton and benthic species, abundantly developing in plankton - Grammatophora, Achnantes, Campylodiscus, etc (Aladin et al. 2006).

During the marine campaign carried out in the Karabakh Field, in addition to physical and chemical parameters samples of plankton were taken. Given the proximity of the Karabakh field with the ADUA exploration area, it is assumed that biological results of the Karabakh survey are likely to be applicable to the ADUA exploration area too.

In terms of phytoplankton, the following taxa were surveys in Karabakh field:

- Cyanophyta: 4 types blue-green.
- Bacillariophyta: 10 diatoms.
- Dinophyta: 4 diatoms.
- Chlorophyta: 2 types of green algae.

The most abundant species in phytoplankton was Bacillariophyta (50%). Cyanophyta and Dinophyta accounted for a 20% of the species and Chlorophyta accounted for 10% of the species.

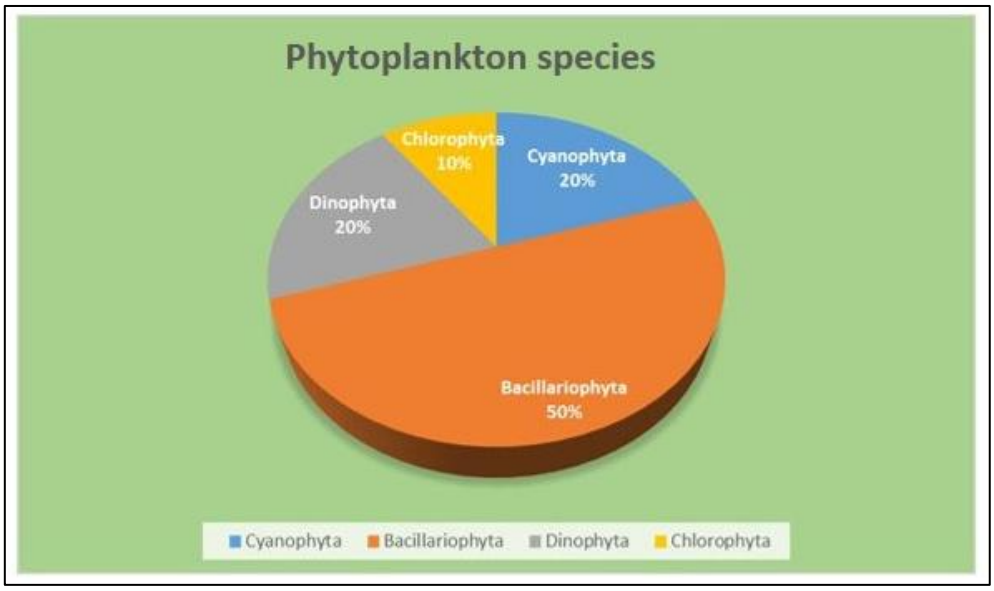


Figure 4.20: Phytoplankton species composition diagram (SOCAR, 2017)

Rhizosolenia calcar-avis (Shults) was the most abundant by number and by weight among the Bacillariophyta composition. *Anabaenopsis tanganyikae* (Müller) was the most abundant among the Cianophyta species. *Prorosentrum cordata* (Ostf) was the most abundant among the Dynophyta species. *Binuclearia lauterbornii* (P-L) was the most abundant among the Chlorophyta species.

Overall, the distribution density and biomass of phytoplankton in the studied area (Karabakh field) was conform to the known information from literature.

4.3.2.2 Zooplankton

Zooplankton of the Caspian Sea includes classes Infusoria, Coelenterata, Rotatoria, Annelida, Mollusca, as well as fish eggs and tadpoles. Zooplankton is the main food source for fish. There are 315 species of zooplankton in the Caspian Sea, including 135 species of infusorias, 2 species of coelenterates, 67 species of rotifers, 54 species of cladoceras, 32 species of copepods, 1 species of ostracods, 6 species of mysids, 5 species of cumaceas, 6 species of amphipod, 1 species of isopods, and 1 species of water fleas.

73 out of the infusoria plankton species of the Caspian Sea live in the North Caspian, 112 in the Central Caspian and 108 in the Southern Caspian. Rotatori mainly live in fresh water areas, i.e. where Volga and Kura Rivers flow to the sea, cladoceras play an important role in the zooplankton of the Caspian Sea. They can be observed in the North Caspian Sea and the Volga River delta. There are several sub-species of copepods in the Caspian Sea (6 Calanoida species, 17 Cyclopoida species, 9 Harpacticoida species). Most numerous species are *Limnocalanus* spp. Mizids, amphipoda and other invertebrate are also important in the Caspian plankton.

Representative species of zooplankton in coastal shallow zone of the Middle and Southern Caspian are *Calanipeda aquaedulcis, Acartia clausi, Heterocope caspia, Podonevadne camptonux*, and *P. angusta*. (Aladin et al. 2006). The presence of larvae of benthic organisms in mass is representative of vernal and summer plankton of coastal zone. Both in the Middle and Southern Caspian, more than 50 % of the total biomass of plankton is formed by the larvae of Balanus in spring, and by the larvae of Mollusca in summer (Bagirov, 1989).

The biomass of zooplankton increases in autumn near the coastal area, while the biomass in the central part of the sea is much lower. The trophic structure of the Caspian zooplankton is the following: Plant feeders are dominant in deep areas, the predators are more important in circular currents while the shallow zones are shared between plant feeders, predators and detritus eaters.

The zooplankton collected in the Karabakh field in October 2017 included 14 species belonging to 4 families:

- Cladocera: 5 species.
- Copepod: 5 species.
- Ctenophora: 1 species.
- Others: 3 species.

The majority of the zooplankton species were Copedoda and Cladocera (36% each), then Ctenophora (7%) and others.

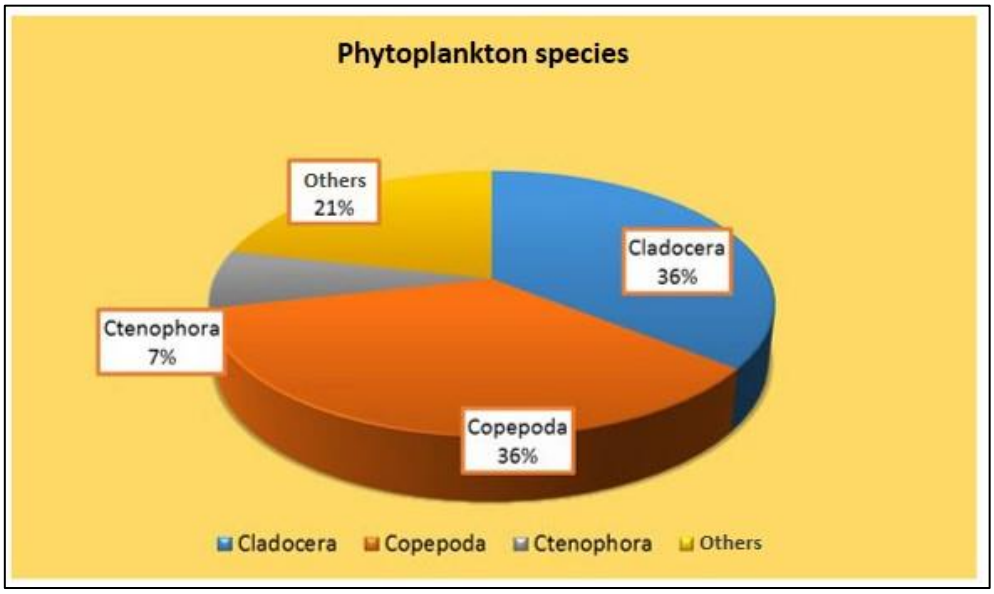
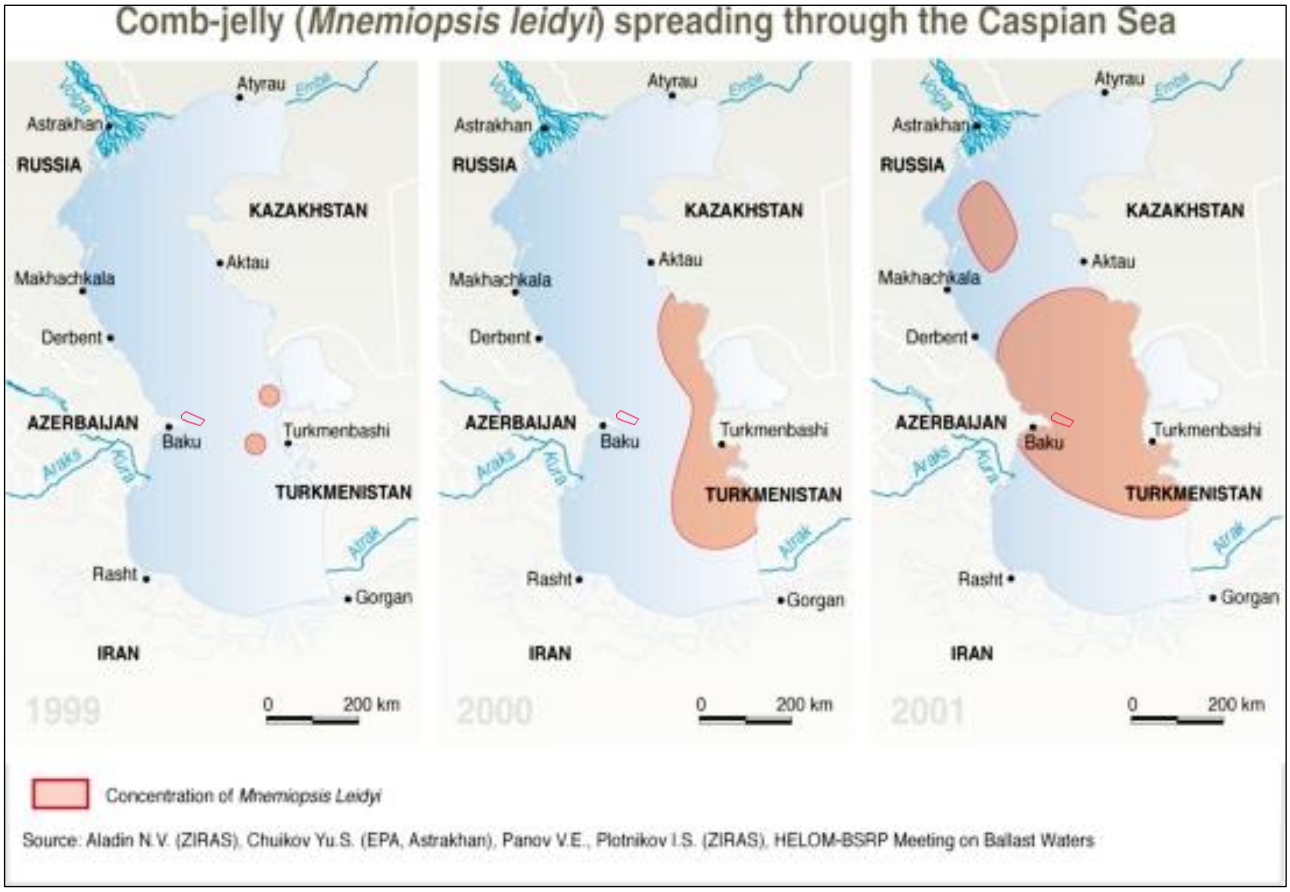


Figure 4.21: Zooplankton species composition diagram (SOCAR, 2017)

Acartia tonsa Dana was the most abundant among the Copedoda species and *Evadne anonyx typica Sar* among Cladocera species. Cthenophora species consisted of comb jelly *Mnemiopsis leidyi (Agassis)*, which had invaded the Caspian in the year 1999 (Bilio and Niermann, 2004).

The plankton-feeding comb jelly *M. leidyi*, has diminished food reserves in the Caspian Sea, consuming large quantities of zooplankton, so that the situation is almost catastrophic for organisms which feed on zooplankton and throughout the food chain (BP, 2015). Roohi et al. (2008) documented changes in the Caspian Sea pelagic ecosystem after the introduction of this ctenophore species; they found that *Mnemiopsis leidyi* and zooplankton abundance where inversely related by season; with M. leidyi abundance was highest in summer and autumn, whereas zooplankton biomass was highest in spring and winter. In the period 2001–2006, following the invasion by *M. leidyi*, the dominance of the calanoid copepod *Acartia tonsa* was striking, whereas the abundance of other large copepods such as *Eurytemora minor* and *Eurytemora grimmi* decreased compared to 1996 (Hossieni et al. 1996) or completely disappeared. Among the cladocerans, only *Podon polyphemoides* seemed to have survived the invasion of *M. leidyi.*



Note: Approximate ADUA exploration area shown in red outline

Figure 4.22: Spread of comb jelly M. leidyi in the Caspian Sea (UNEP/Grid Arendal, 2007)

Zooplankton species also included Mollusca, Balanus and Copepoda larvae, which were dominant in terms of quantity and biomass.

The middle Caspian Sea is characterized by reduced phytoplankton productivity (Pautova et al, 2009), due to the change in dominant diatom species (now dominated by the coccolithophorid *Emiliania huxleyi* and the pennate diatom *Pseudo-nitzschia pseudodelicatissima*) and the increasing role of picoplankton in the primary production of the Caspian Sea ecosystem. This demonstrates that the stability of the pelagic ecosystem in the central Caspian Sea is currently limited. Furthermore, the relatively recent invasion by the comb jelly is thought to have played a major role in the modification of zooplankton distribution and abundance in the Caspian (Roohi et al. 2008), with changes in species composition of some zooplankton groups (e.g. a sharp decrease in the species number of Cladocera, one of the main prey of the comb jelly). A deficiency of phytoplankton results in poor feeding conditions for micro-, meso- and macrozooplankton, and for ichthyoplankton. Phytoplankton, zooplankton and ichthyoplankton abundances in the survey area are thus expected to be relatively low.

4.3.3 Macrophytes

87 species of macrophytes, relating to 5 types, 8 classes, 17 orders, 24 families and 45 genera are known in the Caspian Sea. The quantitative ratio of types of algae is represented in the table. The most diverse with representatives of the family Cladophoraceae (11), and Characeae (11) Ulvaceae (10). The most diverse genus Enteromorpha - 9. The core of the Caspian algoflora is the green alga.

Review of historical data by Karayeva (2003) indicate seagrass beds were present along much of the coastline between Baku and Sangachal as well as in shallow waters surrounding the Shahdili Spit and the lagoons adjacent to Sahil. Data to confirm the presence and density of seagrass in the ADUA area is not available.

4.3.4 Macrozoobenthos

The main part of benthic organisms live on or in the seafloor (i.e. epi and endobenthos). These are usual representatives of periphyton (fouling); sponges (Demospongiae); pearlweed (Bryozoa); worms (Vermes); barnacles (Cirripedia); bivalves (Bivalvia), *Mytilaster*, *Dreissena*, Infusorias (Infusoria), and also nektobenthos (e.g. shrimps (Palaemonidae); opossum shrimps (Mysidacea)) and planktobenthos (e.g. copepods (Copepoda); cladocerans (Cladocera) and rotifers (Rotatoria)).

Factors defining geographical distribution of benthic fauna include:

- Salinity (especially for the Northern Caspian).
- Granulometry and related gas (dissolved oxygen) regime of benthic layer.
- Distribution and population of the major benthos consumers (e.g. benthos eating fishes).

In regards to salinity, 4 ecological groups are distinguished in the benthos of the Caspian Sea (Aladin & Plotnikov, 2004):

- Freshwater forms: freshwater gastropods (Gastropoda) and bivalves (Bivalvia), oligochaetas (Oligochaeta), larvae of chironomids (Chironomidae), spreading within estuaries with the salinity of 0-2 gr/l.
- Coastal and brackish forms: including freshwater by genesis invertebrates (Oligochaeta, Bryozoa, Chironomidae) and representatives of autochthonous Caspian fauna (e.g. higher crustaceans such as ampharetids (Ampharetidae), molluscs *Hypanis vitrea*, *Dreissena polymorpha polymorpha* and crustacean *Pterocuma sowinskyi*). These forms live mainly under the salinity ranging from 0-2 up to 7 gr/l, some of them (higher crustaceans) are euryhaline and can live in a broad range of salinity and depths.
- Exlusively brackish forms: living under salinity from 3-5 to 10-11 gr/l. A mass development of relict Caspian molluscs is typical for this group, which habitat is limited to northern part of the Caspian Sea (*Didacna trigonoides*, *Hypanis angusticostata*, *Dreissena polymorpha andrusovi*, and also amphipods (Amphipoda) and Cumacea.

- Marine forms: includes invertebrates of Mediterranean origins and salt water forms of relict Caspian faunal complex (inhabit mainly in the Middle and Southern Caspian: *Didacna barbotdemarnyi, D. Longipes, Dreissena rostriformis*). Mass development of marine forms is observed under the salinity of above 8-10 gr/l.

At present, about 855 species and sub-species of invertebrate have been recorded in the seabed. 305 of them are infusoria, 52 are nematodes, 118 are molluscs, 74 are amphipods and 46 are hermit crabs. Coastal areas of the sea (0-50 m) have more variety of benthic animals than deep sea areas. Maximum number of benthic species are recorded at a depth of 10-50 m, where *Mytilaster*, *Abra* and *Dreissena* snails dominate the biomass.

Due to the increased salinization of the Caspian Sea in the bays, its benthos has significantly changed, generating completely new biotic community. This phenomenon also includes the migration of organisms from semi-saline waters of the Azov and Black Seas via the Volga-Don Canal. Caspian fauna remained unchanged only in the Kazakhstan bay, where water salinity has not significantly changed.

Mirzoev and Alekperov (2017) studied composition and quantitative distribution of macrozoobenthos in deep zones of the Azerbaijan sector of the Caspian Sea in 2000 - 2012. They found 118 species of zoobenthos belonging to 10 taxonomic groups; among them, 57 species were first discovered in the deep zones. The maximum number of species was observed at depths of 200 - 300 m (118 species), and the minimum one was observed at depths of 900 - 1000 m (6 species).

Macrozoobenthos diversity surveyed in the Karabakh field in 2017 where distributed as follows:

- Crustacean: 29 species.
- Annelida: 8 species.
- Coelenterate: 1 species.
- Other: 1 species.

The most abundant species inventoried in the benthos were Crustaceans (74%), followed by Annelids (20%), Coelenterates and others (3% each).

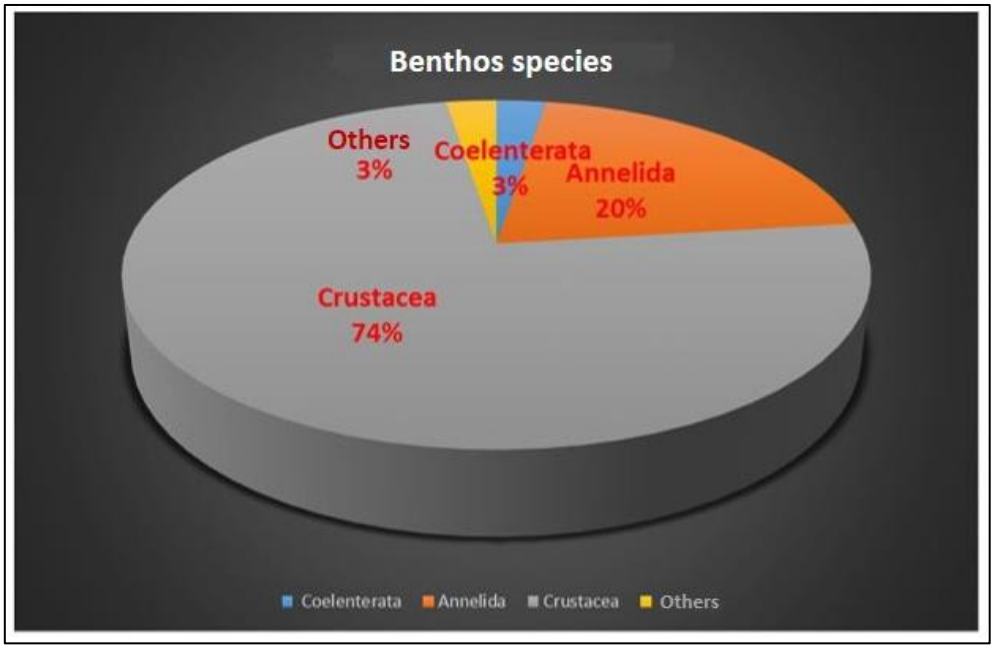


Figure 4.23: Benthos species composition diagram (SOCAR, 2017)

The most abundant Crustacean species was *Gammarus pauxillus* and the most abundant Annelida species was *Stylodrilus cernosvitoviv*.

4.3.5 Fishes

The distinctive feature of the Caspian ichthyofauna is its high endemism, observed from the category of a genus up to the level of a subspecies. Early separation of the Caspian Sea from the World Ocean has ensured a high level of endemism of its ichthyofauna. According to Kazancheyev (1981), the number of endemics at the level of a genus make 8.2 %, species - 43.6 %, subspecies - 100%. In general, the Caspian is inhabited by 4 endemic genera, 31 endemic species and 45 endemic subspecies (Kazancheyev, 1981). The active speciation processes in the Caspian Sea are largely related to special hydrological conditions in geological past and present. Repeated transgressions of the sea, its salinization and desalinization promoted formation of new species and subspecies and as well as various biological and ecological forms and races (Aladin & Plotnikov, 2004).

According to Naseka & Bogutsaya (2009), indigenous fish fauna of the Caspian Sea basin (including drainages of rivers belonging to it) encompass 159 species and subspecies from 60–62 genera (four to six endemic) of 19 families. Ninety-nine species and subspecies (62%) may be considered endemic to the basin. The most numerous family is Cyprinidae (27 genera), followed by Gobiidae (12 genera). Other families where much less numerous (1–3 genera).

The fish species in the Caspian are typically divided into 4 different ecological groups based on criteria of physical habitats and the presence/absence of migrations between them:

- Marine fishes;
- Fluvial (river);
- anadromous; and
- semi-anadromous.

The sturgeons are the most remarkable group of fishes from the Caspian Sea. All four species are anadromous (i.e. they spend most of their life at sea but migrate into river systems for reproduction). These species are highly prized for their meat and unfertilized roe (caviar), traded both legally and illegally. The majority of global trade in caviar is wild-sourced, although trade in caviar from aquaculture operations is increasing. Their IUCN Red List status and population trend is shown Table 4.3 .

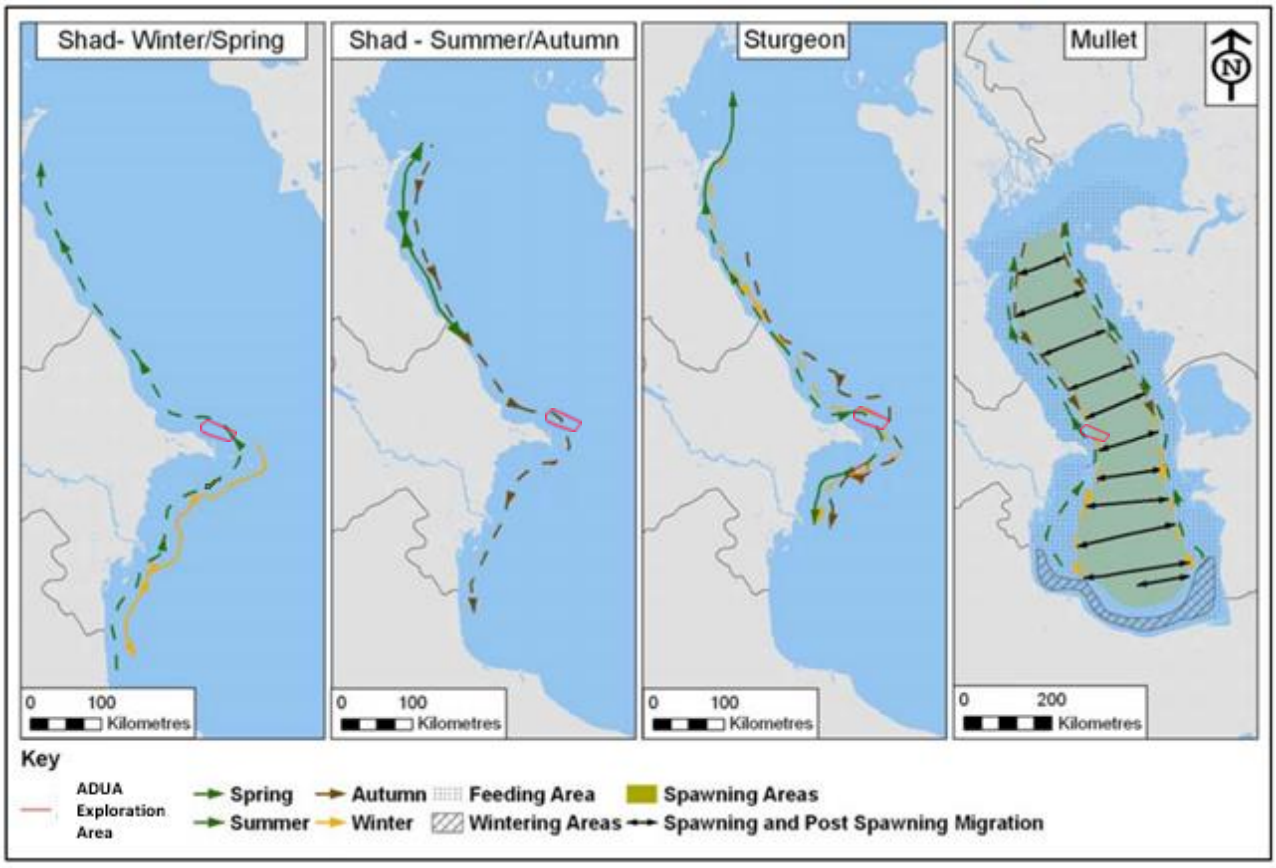
Table 4.3: Sturgeon species present in the Caspian Sea (IUCN, 2018)

Scientifc name	Common name	Status	Population trend
Acipenser gueldenstaedtii	Russian Sturgeon	Critically Endangered	decreasing
Acipenser nudiventris	Ship Sturgeon	Critically Endangered	decreasing
Acipenser persicus	Persian Sturgeon	Critically Endangered	decreasing
Acipenser stellatus	Stellate Sturgeon	Critically Endangered	decreasing

As presented above all sturgeon species are Critically Endangered (CR) according to the IUCN red list. According to the Food and Agriculture Organization of the United Nations (FAO), there are numerous factors that underpin this situation.

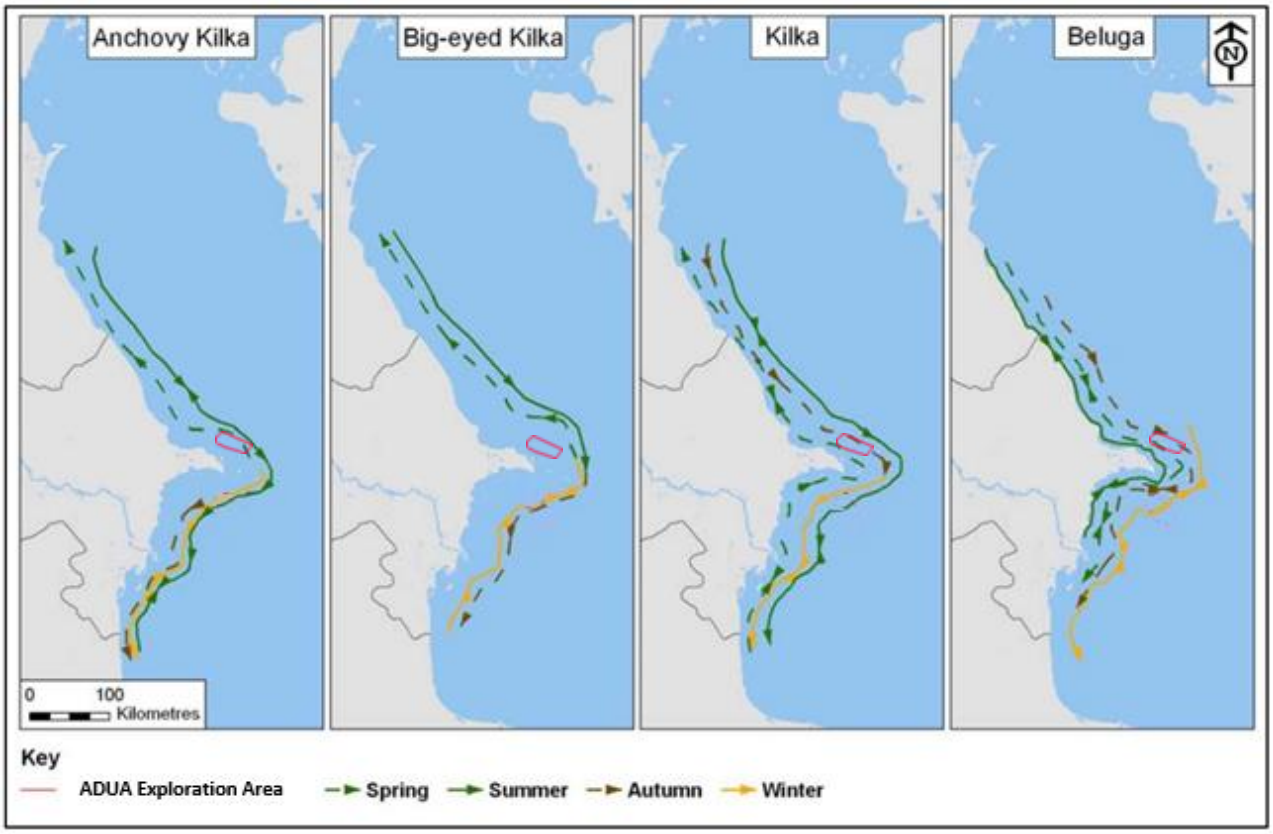
- Overfishing, and illegal, unreported and unregulated (IUU) fishing;
- lack of fishery management;
- deteriorating environmental conditions; and
- the construction of several dams, which have prevented fish from migrating upstream to their natural spawning grounds.

Other species besides the sturgeon such as grey mullet, herring, anchovy kilka, big eyed kilka and beluga migrate across the Southern Caspian region during spring (March-April) and autumn (October-November). During the winter months these species are found wintering near the western shores and southern slopes of the Absheron sill (herring, anchovy and big-eyed kilka). The migration routes and spawning areas of fish species respective to the ADUA exploration area are shown in Figure 4.24.



Note: Approximate ADUA exploration area shown in red outline

Figure 4.24: Shad, Sturgeon and Mullet Migrations Routes (modified from BP, 2015)



Note: Approximate ADUA exploration area shown in red outline

Figure 4.25: Kilka and Beluga Migrations Routes (modified from BP, 2015)

4.3.6 Mammals

The Caspian seal (*Pusa caspica*) is a species belonging to the real seals family and is the only marine mammal known to be present in the Caspian Sea. It is endemic to the Caspian and is considered the smallest seal in the world.

The species is currently classified as endangered (EN) by the IUCN red list (Goodman and Dmitrieva, 2016). According to the IUCN (2018), this is mainly due to the following factors: (1) the species population has faced a decline exceeding 70% over the last three generations; (2) the number of sites used by the species have been reduced (range reduction within the overall geographic range); (3) the current hunting levels are expected to certainly exceed sustainable harvest levels; and (4) there are multiple ongoing negative impacts on the habitat of the Caspian seal.

According to the Seal Conservation Society (2011), seal population is currently reducing by at least 3–4% per year. A total population size of about 104,000 was estimated from the pup production figure of about 21,000 in

2005 (Härkönen et al. 2008). Main causes on seal death are hunting and fishing by-catch, as well as natural mortality, predation on pups by wolves and eagles, contamination of food-chain (especially DDT) and habitat loss. There is a Caspian Seal Conservation Action Plan (CSCAP) agreed in 2007 by all five Caspian countries, but the plan has yet to be implemented on the ground. The species is included in the second edition of the “Red Book” of the Azerbaijan Republic.

Figure 4.26: Caspian seals and colony (Arkive, 2018)

4.3.6.1 Caspian Seal Migration

Seals live in all parts of the Caspian Sea, and mainly in the North. In winter they live on the ice of the North Caspian. In the summer time, seals migrate to the Middle and Southern Caspian for fattening although a portion of the herds remain in the Northern Caspian (some 10-15% of the population is thought to be non-migratory). Their pupping, mating and molting happens on ice *(*Figure 4.27*).*

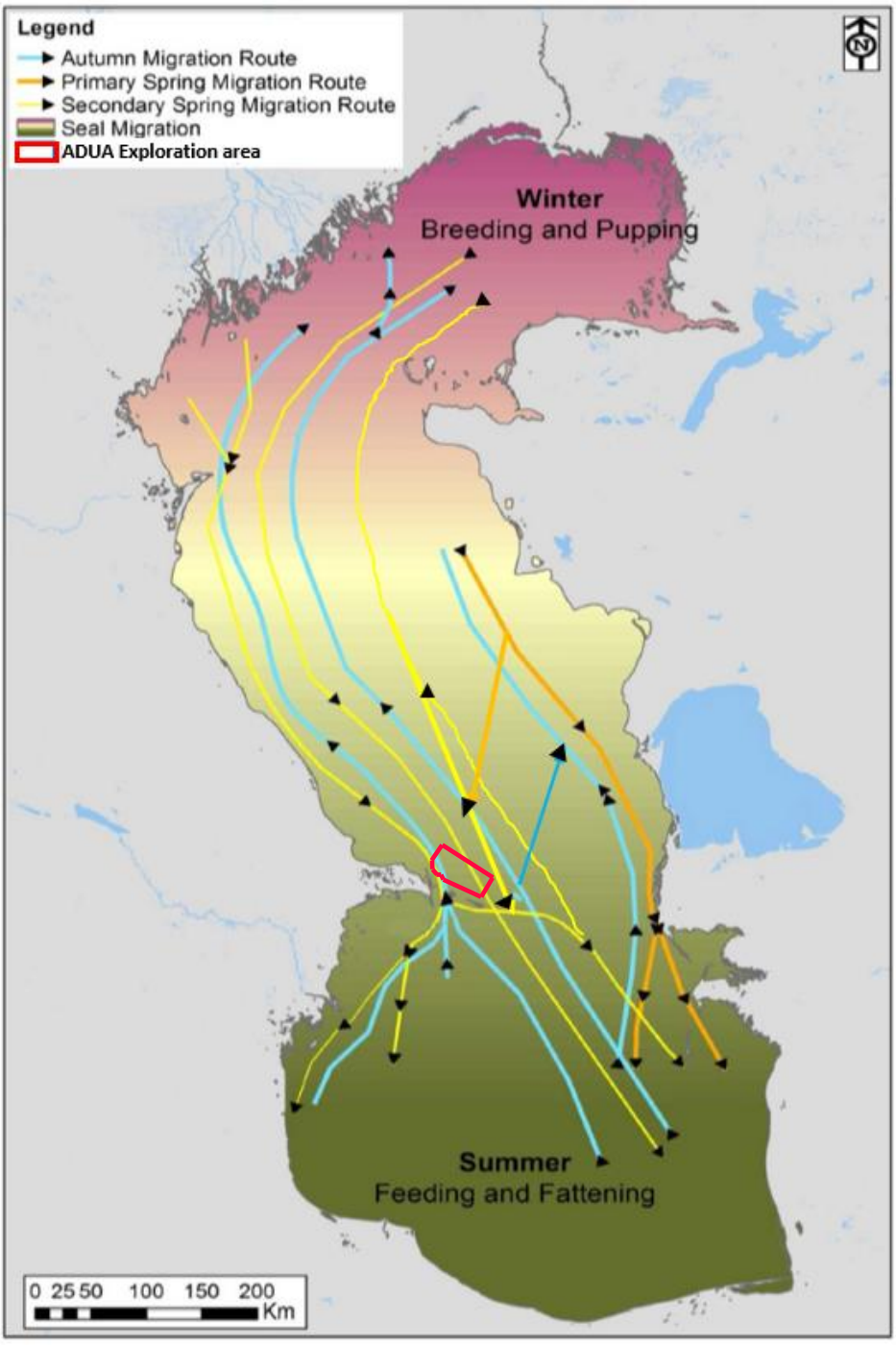
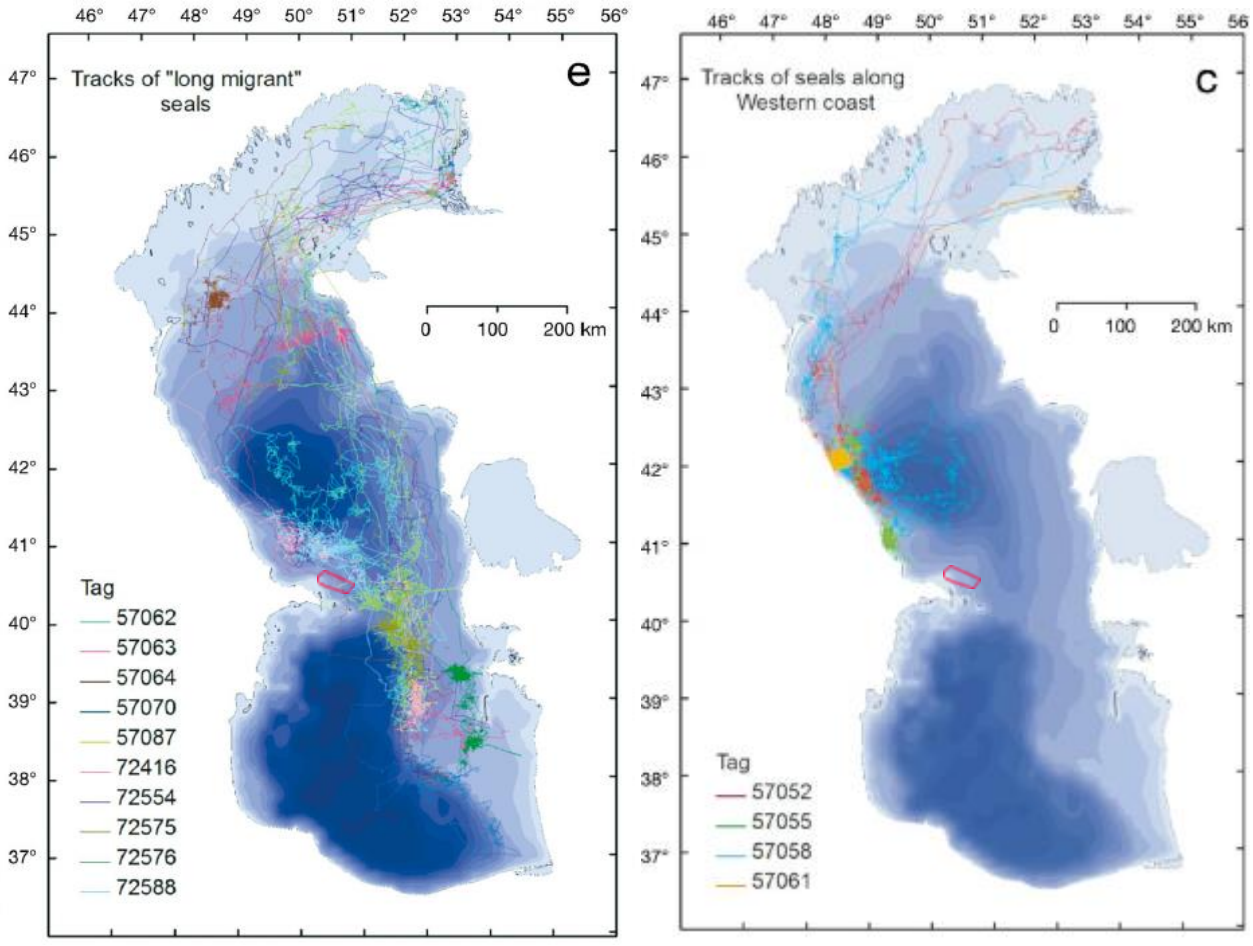


Figure 4.27: Caspian seal migratory routes (modified from Eybatov, 2015 and 2018)

A recent exhaustive study of Caspian seal movement, based on deployments of tags on 75 individuals, spanning 4 consecutive years (2009 to 2012) supported the general historic understanding of population migration (Dmitrieva et al, 2016). However, the results revealed a high degree of individual variation in the timing, destination, and consistency of movement patterns, indicating that migratory movements are much more heterogeneous than previously thought *(*Figure 4.28*);* with north-south spring migration paths also existent along the central part of the Caspian Sea*.* The authors further indicated that timings of spring and autumn movements derived from telemetry data correspond with bi annual peaks of strandings around the Absheron peninsula in Azerbaijan recorded from the 1970s to present (Wilson et al. 2014), suggesting that those peaks in mortality reflected local increases in seal density arising from seasonal migrations.



Note: Approximate ADUA exploration area shown in red outline

Figure 4.28: Movement patterns for Caspian seals tagged in April 2011 that moved to the Southern Caspian Sea (left) and tracked along the western coast (right) (Dmitrieva et al, 2016)

Overall seal distribution in the Caspian can be summarized as follows:

- In summer (June-August): adult seals tend to stay in areas of the middle and South Caspian.
- In autumn (October-November): seals start their migration towards the north where they will wait in the haul-out areas for the ice to form and breed.
- In winter (November-March): the majority of the seal population will be breeding and giving birth in the North Caspian.
- In Spring (April-May): the migration towards the south commences and seals start to appear in the middle and south Caspian shores.

Eybatov (2018) cites Dmitrieva et al. (2016) seal satellite tracking results, that Caspian seals not only migrate during springtime to the Middle and South Caspian through coastal corridors along the eastern and western coasts, but also through the central part of Caspian Sea (periodically shifting from east to west).

According to Eybatov (2015 and 2018) a part of the seal population (5,000-10,000 specimens) stays in the North Caspian. In spring, from April to June, until seals reach Iran, their abundance in Azerbaijan can reach up to 20,000 individuals. In spring a significant number of seals (up to 500) rests on the island of the Absheron peninsula (i.e. Malaya Plita, Bolshaya Plita, Podplitochny, Dardanella, Baklaniy, the Southern Spit and Urunos island, a part of Chilov island).

4.3.6.2 Caspian Seal Haul-out sites

In the past, Azerbaijan had multiple important haul-out areas in the Absheron Peninsula and other locations, south and north of the peninsula. These sites, however, seem to have been largely abandoned as the residential population of the species has effectively disappeared from the Azerbaijan coasts and only migrating individuals are expected to use these sites in their migration. The CASPECO project (Creation of Special protected Areas for the Caspian Seal) identified two offshore areas and 17 coastal sites as potential protected areas (i.e. Seal Special protected Areas or SSPAs), separated in three categories:

- Category 1. An established area of seal habitat currently used fully by seals.
- Category 2. An established area of seal habitat no longer used fully or regularly by seals, or used only by a few animals.
- Category 3. A known area of historical seal habitat not currently used at all by seals.

The relevant sites adjacent to the Absheron peninsula are:

Haul-out site “D” Cat. 1: Zhilhov Island and surrounding islands in Azerbaijan. The Zhilhov archipelago off the Absheron Peninsula in Azerbaijan was used by c. 500 seals in January 1996. 60 seals in July 2007, about 500 seals between October and December 2007 and 2008, and large groups of seals seen in the water at that time. Seal by-catch was reported in December 2007. These islands were also used by large numbers of seals (up to about 500) in the post-moult period of May–June in 2008 and 2009 (though not in 2007). There is anecdotal

information from fishermen to suggest that large numbers of seals are most likely to be present when herring or kilka shoals are also present in the area.

Haul-out site "O" Cat. 3: Shakhova Kosa, Absheron Peninsula, Azerbaijan. This site was regularly used by more than 100 seals at a time, counted on surveys in January 1996, June 1997, 2000, and 2001, and March 2002. However, repeated surveys since autumn 2006 have found zero live seals or signs of seals there, with the exception of a record of a transient seal presence in the Shakhova area, apparently following a herring shoal, at the beginning of May 2009.

To date, the pilot SSPA plan has not proceeded further, since the programme has not had any government support.

Monitoring conducted on the coast of the Absheron peninsula and on the island of the Absheron and Baku archipelagos, showed that since 2005 there were no permanent rookeries. Temporary haul-out sites are only observed during the spring migration from the north to the south (from April till May) and during autumn migration from the south to the north (in October-December). And these temporary haul-out sites are only found on the Southern spit and Urunos on Chilov island, as well as on small islands between Pirallahi and Chilov islands (Malaya Plita, Bolshaya Plita, Podplitochny and Dardanella, Coltush, Baklaniy and so on). There are no haul out sites or rookeries on the Shakhova spit any more. (Eybatov and Rustamova, 2010).

4.3.6.3 Caspian Seal Presence in the Absheron peninsula

Based on the studies commissioned by BP for the Shallow Water Absheron Peninsula (SWAP) seismic 3D Project, findings from Eybatov (2015) are highly relevant, considering the northeastern area of the SWAP is directly adjacent to the ADUA exploration area.

Table 4.4: Observations of Caspian Seal Presence and Activity During spring season the Last 5 Years in the Vicinity of the Absheron Peninsula and up to 40 Km Offshore from the Coast (Eybatov, 2015 and 2018)

Year	Spring season observations	Summer season observations
2010	Seals appeared in the area Pirallahi island - Chilov island - Oil Rocks at the end of April. In this year unusual (diffuse) spring migration was observed. Seals arrived in small groups - 3-5 individuals in a group and distributed evenly in the aquatic area up to Oil Rocks. There were no seal accumulations at the island haul-out sites.	Small groups of seals - 2 to 10 individuals swim along the shores of aquatic area of Azerbaijan, from Yalama to Lenkoran, at approximately 1 km from the shore.
2011	Early migration, 1st April. Concentration of seals again is related to migration of herring.	Small groups of seals (2-3-7 individuals) swim in the area of Oil Rocks between Chilov and

Year	Spring season observations	Summer season observations
	The first large shoal of seals (200 – 400 individuals) was registered on 1 April in the area of Southern spit and islands between Pirallahi island and Chilov (Malaya Plita, Bolshaya Plita, Podplitochny, Dardanella). According to fishermen, at that time mass migration of small herrings took place. At the end of April - beginning of May seals moved to the sea area between Chilov island and Shakhova spit. Small groups of seals were also observed by oilmen at Oil Rocks. The first seals appeared in the Iranian waters in the beginning of June.	Pirallahi islands. Small groups of seals accompany ships that service offshore platforms.
2012	Helicopter pilots informed that seals came to the islands between Pirallahi and Chilov at the end of April, and disappeared one week later. In some places occasionally individual seals can be seen. Migration of seals was related to migration of kilka, then migration of Black sea roach (small kutum) began, and only now - migration of gray mullet. Diffuse migration in the beginning of May.	Seals are distributed evenly as small groups all across the aquatic area of Azerbaijan.
2013	Migration began in mid-April. Significant accumulations were observed westward from Chilov island. Large group of seals swam in waters of Lebyazhi island, which seals usually do not visit	Small groups of seals swam to the south from Shakhova spit and in the east between Chilov island and Oil Rocks
2014	1st April - early migration was observed. Namely, seals appeared in the Azerbaijan waters, in the area of Yalama seashore at the end of March. Usually one week prior to appearance on the islands of Absheron archipelago. In the recent years migration of seals in the first place was related to migration	Seals are distributed evenly, as small groups in the aquatic area, at significant distance from the coast - 1-2 km. Groups of 7-15 seals periodically appeared in the area of Oil Rocks. In dark hours also small groups of seals swam around the brightly illuminated ships.

Year	Spring season observations	Summer season observations
	of shoals of herring. Fishermen complain that seals eat out fish in the nets.	
2015	Mass spring migration in the area between Pirallahi and Chilov islands was observed on 19-20 April. The largest number of seals was observed near Baklaniy and Urunos islands	Seals are evenly distributed in small groups within the waters at a considerable distance from the shore. Small seal groups of 2-3 individuals on Chilov and other islands located between Pirrallahi and Chilov islands
2016	For the first time in many years there was no mass spring migration of seals. The ice melted earlier in the northern Caspian Sea and small groups of seals started migration to the southern regions in March. Aggregations of seals on the islands of the Absheron archipelago were observed in the spring. Fishermen also noted that there were no spring herring migrations in this region. Also on the north coast of the Absheron peninsula there were no seal corpses washed up onto the coast, commonly observed here each year	During summer months, seals were not observed. Dramatically reduced number of corpses, washed up onto the coast in the summer.

Eybatov (2015) further indicated that the expected total amount of seals that may be found along the eastern waters of the Islands of Absheron archipelago during spring (April and May) can be of up to 5,000-10,000 individuals; with another estimated 5-10 thousand individuals that may swim further eastwards offshore. The backward migration towards the North usually occurs in November (autumn migration), and seal numbers are comparable to that of spring.

June to October is a period of active feeding. During the period seals will migrate through the Contract Area in small groups. The total number of seals in the Absheron archipelago islands would not exceed 300-500 specimens. Most of them (estimated at some 2-3 thousand individuals) would be found far away from the shore and in the deep water (3-70 km distance) (Eybatov, 2018).

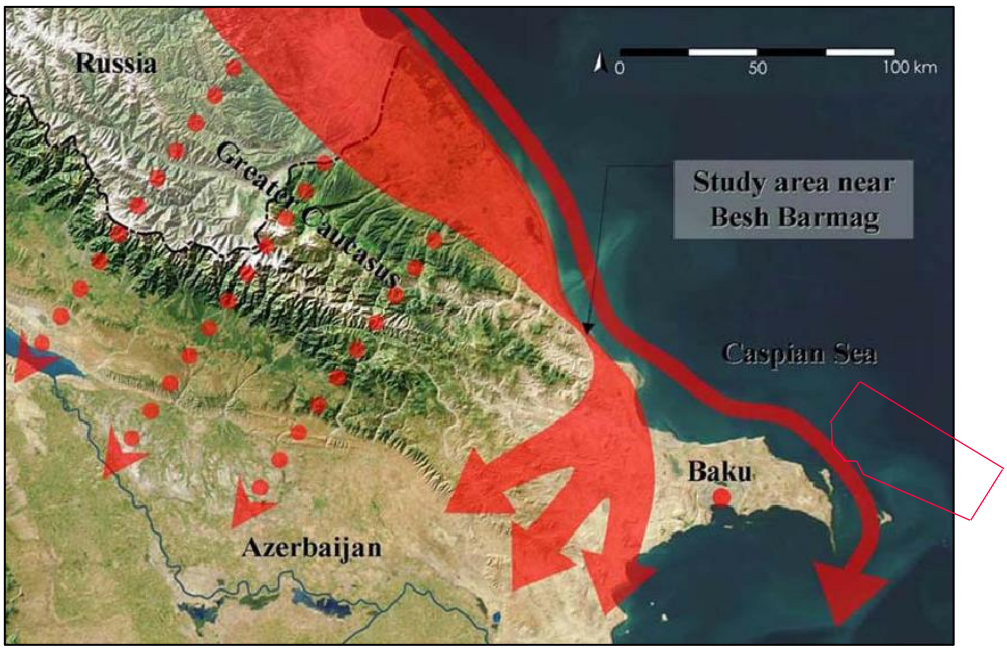
On the other hand, the period of lowest abundance of seals is January to March; small groups (1-3 specimens) may be seen on the islands on the Absheron archipelago, with small groups of young seals also be found far from the shore in the deep-water part of the Azerbaijani sector of the Caspian.

Based on the above, the most sensitive period for seals in the ADUA exploration area is expected to be between April-May and November as this is the period where seals may be most abundant in this part of the Caspian Sea coinciding with their spring and autumn migration respectively.

4.3.7 Seabirds

According to BirdLife International Azerbaijan includes some 300 migratory bird species, 31 seabird species and 124 waterbird species.

The west coast of the Caspian Sea constitutes a migration corridor for many bird species. Different species may follow slightly different routes along a wider corridor and use the landscape features differently. However, most species tend to travel close to the coastal areas and use specific areas (e.g. inland or coastal wetlands) as stopovers (for eating and resting) on their routes north or south. In Azerbaijan, the presence of the mountains of the Caucasus and the Caspian Sea create a natural bottleneck (ie *Besh Barmag bottleneck*) which forces many migrating species to concentrate in a narrow piece of land along the Absheron Peninsula, where the Absheron National Park is located. Heiss and Gauger (2011) indicated from observations during a one month survey in 2007 that the most common migrating species was the Common Starling (*Sturnus vulgaris*); noting that in general passerine migration was restricted to the coastal plain, whilst along the coastline strong migration of terns, gulls and ducks was observed (Figure 4.29).



Note: Approximate ADUA exploration area shown in red outline

Figure 4.29: Important bird migration routes along the Caspian shore of Azerbaijan. Dotted line = weak migration route through the Greater Caucasus, broad line = main migration route through the lowland, narrow line = coastal waterbird migration route. (Heiss and Gauger, 2011)

The distance between the ADUA exploration area and the Chilov Island, on the East of the Absheron Peninsula is around 7 km, thus relatively far from the main route along the coast.

In general, even seabirds that can travel to offshore areas tend to stay relatively close to the shores because the best, most productive, feeding grounds are usually located on shallower areas (0-15 km approx.). Consequently, the ADUA exploration area, especially its westernmost part (closer to the coast) may be considered quite sensitive from an ornithological perspective. It is expected that birds would be found in small numbers as they cross the area, and in some cases may be attracted by vessels and offshore infrastructures such as platforms as these are often attracting fish as well. In addition, old oil platforms in the sea are considered to be important places for breeding of different species of birds (Birdlife, 2018a,b).

4.3.8 Sensitive marine habitats

Mud volcanoes and seepages at the Caspian Sea bottom have been known about for a long time. The largest number of mud volcanoes (more than 300) and the biggest ones are concentrated at the north-western edge of the South-Caspian Depression. The majority of South-Caspian Depression mud volcanoes are in the seepage stage of their lifecycle and discharge mud, water, gas and oil. Intensification of activity of the underwater volcanoes and seepages results in contamination of the sea surface by oil and mud patches (Mityagina and Lavrova, 2016). There are more than 170 mud volcanoes located within the Caspian Sea. The mud volcanoes are formed as a results of over pressure buildup in a thick mud dominated sequence (Maykop Formation), caused by rapid subsidence and deposition. The only currently known mud volcano at seabed is located to the northwest of Karabakh and south of Ashrafi structure, outside the 3D survey. The shallow seismic interpretation and mapping reveals the presence of a flowing mud features close to and at the seabed. The feature is characterized by very low seismic velocity and strong seismic amplitude dimming beneath. No other mud volcanoes have been seen on 2D seismic data covering the ADUA contract area.

4.3.9 Protected and other designated areas

The ADUA exploration area is located relatively far from any protected or designated area. Figure 4.30 shows the ADUA area and the closest protected area, the Absheron National Park, which is located some 22.7 km to the west from the ADUA exploration area boundaries.

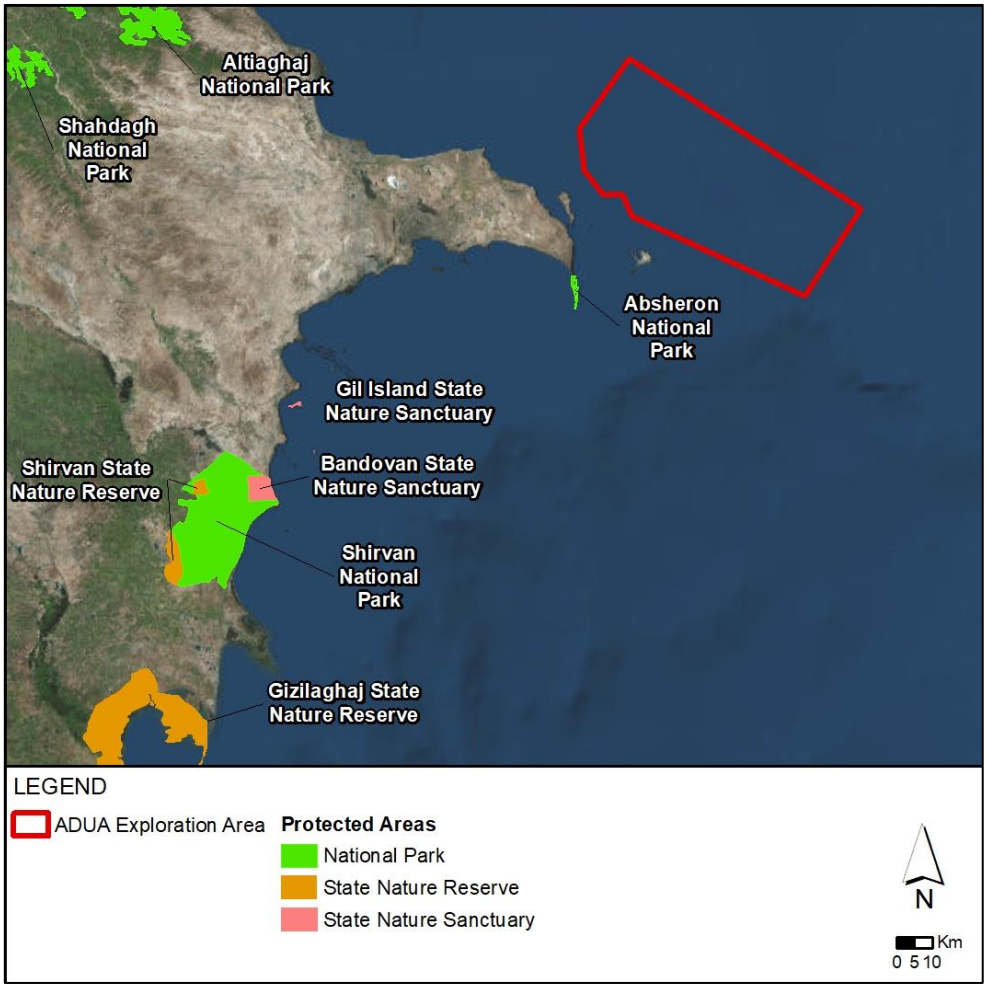


Figure 4.30: Protected Areas in Azerbaijan and ADUA exploration area (ERM, 2018)

The Absheron National Park was established in the basis of Absheron State Nature Sanctuary in 783 ha area of administrative territory of Baku city Azizbayov district with the decree of the President of the Republic of Azerbaijan dated February 8, 2005. The main reason for its establishment is protection and rehabilitation of the natural complexes and entities, threatened rare species of fauna (e.g. Caspian seal, crested diver, silver gull, green-head duck, etc.), development of ecotourism, implementation of ecological monitoring and ecological education of the population. In the National Park, the area of application of legal regime of special protection (protection regime) is 381 ha, and that of tourism and recreation is 402 ha.

The National Park is situated in the south-eastern end of Absheron peninsula in the Shah Dili territory. The climate of the area is semi-arid, specific to semi-desert and dry steppe. Types and phytomass of flora is poor, with plant biodiversity varying respective of water and saltiness regime of the area. Nearly 25 plant species and more than

50 bird and animal species are encountered in Absheron National Park. The Absheron National Park is the closest natural monument to the capital Baku, and considered a key area for ecotourism, the site holding the most pure water and the clearest air in Absheron beach (Heydar Aliyev Foundation, 2018).

Currently there are no marine reserves in Azerbaijan, however based on a recent news published by IUCN on 14th February 2018: "*Azerbaijan is upgrading and expanding the Gizilaghaj State Reserve to become a National Park and will include the first Marine Protected Area (MPA) in the Caspian Sea, the largest inland body of water on the planet. The new MPA will seek to protect six significant marine species on the brink of extinction, including the Beluga sturgeon and the Caspian salmon"*. This area, which is also designated as a Ramsar site, is located more than 200 km to the south-west of the ADUA exploration area.

In addition to the above, in Azerbaijan there are a number of internationally recognized areas designated by BirdLife International and IUCN designated as *Important Bird Areas* (IBA) and *Key Biodiversity Areas* (KBA) respectively (Figure 4.31). The closest IBA/KBA is the Absheron archipelago (north) and Pirallahi bay[12] located on the islands around the Absheron Peninsula, this is Chilov (or Jilov) and Pirallahy islands, as well as some small islands like Boyuk and Kichik Tava, Yal, Koltish, Gu, Garabatdag and a scores of small islands (Birdlife, 2018a).This IBA/KBA (and in particular the Chilov island) is located about 6.5 km to the southwest of the ADUA exploration area

Additonally Shahdidi Spit is at the easternmost edge of the peninsula. It is notable for passage and wintering Pelecaniformes and Ciconiiformes. At least 20,000 ducks and 40,000 *Fulica atra* migrate through the area. It is possible to find 100-200 individuals of Caspian seals in any season of the year (Birdlife, 2018b).

Breeding birds in this archipelago include *Tadorna ferruginea*, *Porphyrio porphyrio*, *Larus cachinnans*, *Sterna hirundo* and (unconfirmed) *S. sandvicensis*. It is a wintering area for 2,000-3,000 wildfowl, notably *Cygnus cygnus*, and also *Aythya fuligula*, *A. marila*, *A. ferina*, *Bucephala clangula* and *Fulica atra*. Species of global conservation concern that do not meet IBA criteria include *Circus macrourus* and *Phalacrocorax pygmeus*.

[12] http://datazone.birdlife.org/site/factsheet/absheron-archipelago-(north)-and-pirallahi-bay-iba-azerbaijan

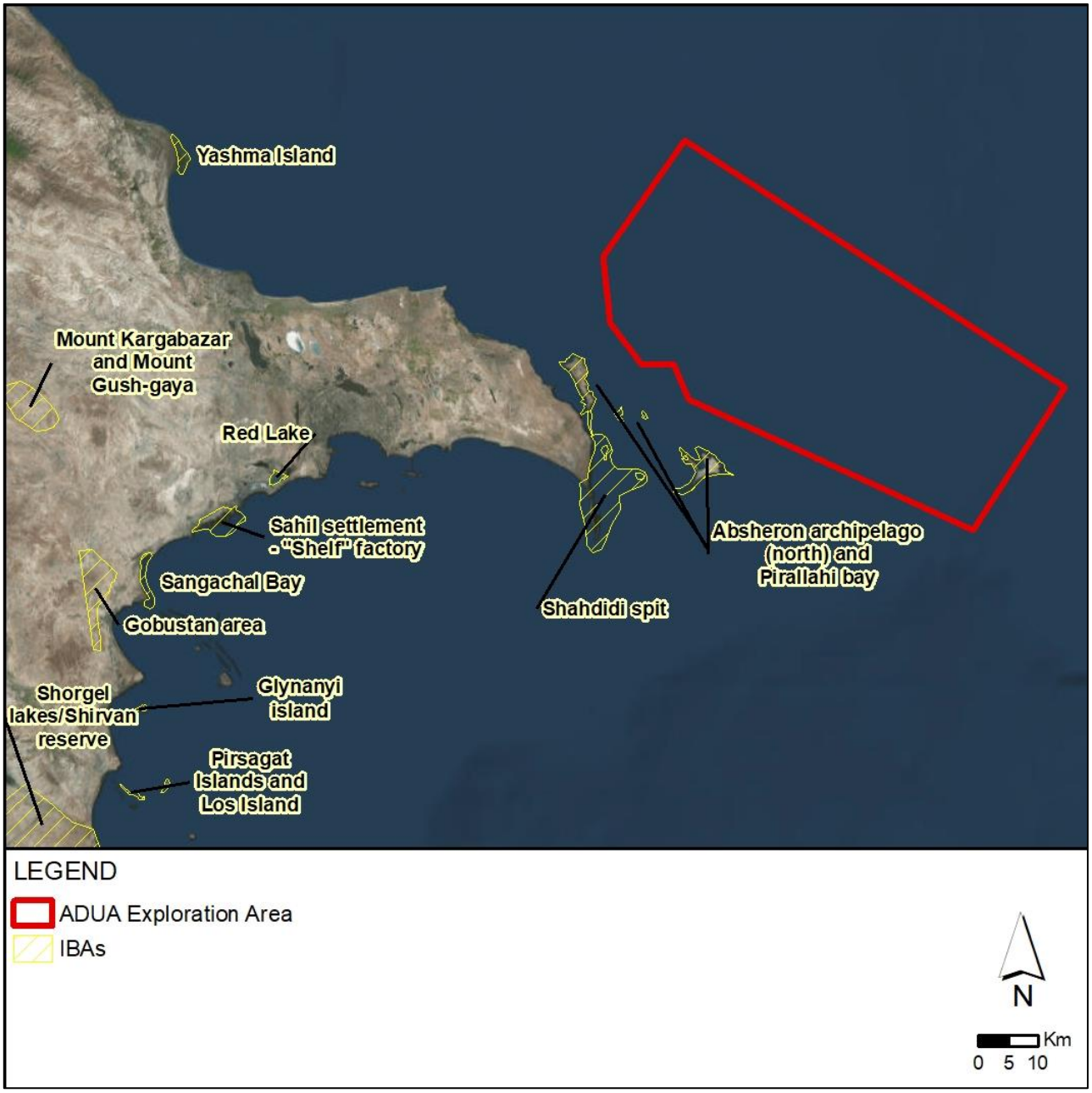


Figure 4.31: Location of closest IBAs and KBAs to the ADUA exploration area (ERM, 2018)

4.4 Socioeconomic Environment

4.4.1 Fisheries

In Azerbaijan, there are some 22 species of fish species with commercial value. Table 4.5 lists these species and their families. The most important species in terms of fisheries belong to the Clupeidae family, followed by Acipenseridae and Cyprinidae (Salmanov et al, 2013).

Table 4.5: Species of commercial value in Azerbaijan (Salmanov et al., 2013)

Family	Scientific name	Common name
Acipenseridae	*Acipenser gueldenstaedtii*	Russian sturgeon
Acipenseridae	*Acipenser persicus*	Persian sturgeon
Acipenseridae	*Acipenser stellatus*	Stellate sturgeon
Acipenseridae	*Acipenser nudiventris*	Fringebarbel sturgeon
Acipenseridae	*Huso huso*	Beluga sturgeon
Clupeidae	*Clupeonella cultriventris*	Kilka
Cyprinidae	*Abramis brama*	Bream
Cyprinidae	*Cyrpinus carpio*	European carp /common carp
Cyprinidae	*Hypophthalmichthys molitrix*	Silver carp
Cyprinidae	*Ctenopharyngodon idella*	Grass carp
Cyprinidae	*Rutilus rutilus*	Roach
Cyprinidae	*Rutilus frisii*	Kutum
Cyprinidae	*Aspius aspius*	Asp
Cyprinidae	*Vimba vimba*	Vimba
Cyprinidae	*Chalcalburnus chalcoides*	Shemaya
Esocidae	*Esox Lucius*	Pike
Mugilidae	*Liza auratus*	Golden grey mullet
Mugilidae	*Liza saliens*	Leaping grey mullet
Persidae	*Sander lucioperca*	Pike-perch
Persidae	*Perca fluviatilis*	Perch
Salmonidae	*Salmo trutto caspiensis*	Caspian salmon
Siluridae	*Silurus glanis*	Wels catfish

Fisheries have been traditionally an important commercial activity in Azerbaijan. However, during the last few decades the relevance of this sector has been reduced due to a number of environmental problems, such as water pollution, introduction of alien species, overfishing, etc. This reduction in catches has been accompanied by a significant reduction in fishing fleets. With the appearance of the Comb Jelly (*Mnemiopsis leidyi*) in the Caspian Sea, kilka reserves have dramatically reduced, with volumes of caught fish overall in the Caspian basin reduced from 271 thousand tonnes in 1999 to 54 thousand tonnes in 2003 (i.e. a 5-fold decline).

Table 4.6 shows the fishing fleet's composition over three years and shows that the vast majority of fishing boats belong to small artisanal boats (less than 6 m length) which are mainly used for Cyprinidae fishes, caught about 1.6–3.2 km off the coast.

Table 4.6: Fishery fleet composition in Azerbaijan (Source: FAO, 2013)

Fishery fleet composition												
Length	**< 6 m**			**24–30 m**			**45–60 m**			**> 60 m**		
Year	2007	2008	2009	2007	2008	2009	2007	2008	2009	2007	2008	2009
Number	563	624	633	34	28	22	4	4	2	1	-	-
Total waterway tonnage (tonnes)	-	-	-	3,112	2,596	2,082	2,890	2,890	1,545	1,115	-	-
Power kW)	-	-	-	4,945	4,109	3,515	3,408	3,408	1,704	852	-	-

At present, there are 5 heavy-tonnage vessels engaged in sprat fishing in the Azerbaijan sector of the Caspian Sea. Of these, 4 vessels are located in the south of Azerbaijan - in the Lankaran port, from there they sail and fish near the water border with Iran. The 5th vessel, owned by "Caspian Fish" (LTRV-50 "Shahriyar" vessel), berths near the Pirallahi Island, and sails from there. According to the fishing license, the vessel with a crew of 6 persons has an annual quota for sprat fishing in the amount of 25 tons. Fishing is carried out between the banks Korinov, Pavlov and Karagedov located approximately at a distance of 50-100 km to the south from the ADUA area. Fishing is carried out only at night using cone-shaped nets and electric lighting.

On the other hand, coastal small-scale fishery is carried out by fishing crews mainly using small-sized (up to 5 m long, 2 m wide) motor boats in the coastal zone of the Caspian Sea. Fishing is done on the basis of the license of MENR, which specifies the composition of the crew, areas of fishing, quotas on fishing, species of fish, the catching of which is permitted. As a rule, the small-scale fishing is carried out at a distance of 2-3 nautical miles. For catching mainly floating and plug-in (insertable) nets, fixed seines and nets in the form of traps are used. Plug-in nets and seines are mainly installed at a depth of 2-3 m, and nets at a depth of 5 -8 m. Fixed seines are installed at a depth of 1.5-2.5 m, start from the shore and have a length of not more than 1 km from the coast.

Detailed and reliable statistics on current artisanal and commercial fisheries distribution, seasonality, fishing grounds and catches are not available. However, a summary of seasonal changes in commercial and coastal small-scale fisheries in the Azerbaijan sector of the Caspian Sea:

- from December to February – due to adverse weather conditions, fishing intensity ranges from average to low levels. As a rule, during this period the fishing is carried out by commercial fishermen, who use 50% or less of their fleet;
- from March to April - due to the predominance of cloudy weather, the fish attracting method using electric lighting is most effective, for this reason this season is considered as a high demand season;

- from May to June is a season with low intensity when Clupeid fish migrate to the northern and southern Caspian Sea for spawning;
- from July to August - due to clear weather is a season with medium-low fishing indicators;
- from September to November - due to the predominance of overcast and cloudy weather, fish attracting method is most effective and thus a high demand season.

According to previous studies conducted at sea, some sturgeon species migrate along the routes indicated on the maps from March to April and again from September to November (see Section 4.3.5 on fish migrations). The expected presence of fishing boats in the ADUA exploration area in the spring (especially from February to April) is likely within a distance of 4-6 km from the shore. According to the Fish and Fishing Review Report from BP (2015), the most relevant areas for fishing near and to the south of Absheron Peninsula are in most cases within 0-50 km from the shores (see Figure 4.32). Nonetheless, fishing grounds can be located up to 70-80 km offshore. The closest known fishing ground is Oil rocks, located about 9 km south from the ADUA exploration area boundaries.

Figure 4.32: Areas of importance for the Fishing Industry (modified from BP, 2013)

Commercial fishing methods exclude trawling (the latter only performed for scientific purposes). Methods currently used include cone-shaped purse nets, centrifugal fish pumps and airlift.

Within the Caspian context the shallow northern part of the sea is of high importance as a region of reproduction of marine species, development on early stages of their life and a feeding ground of adult fishes (e.g. common sprat, Dolginka shad, Caspian shad and big-eyed shad). The Azerbaijan sector of the Caspian, the Cis-Kura region, Kyzyl-Agaj gulf and Lenkoran coast are important for fish species of the Southern Caspian and areas with water depths of 10-50 m with silty-sandy, sandy-silty and silty-shelly grounds are considered as the most populated with benthic fodder organisms.

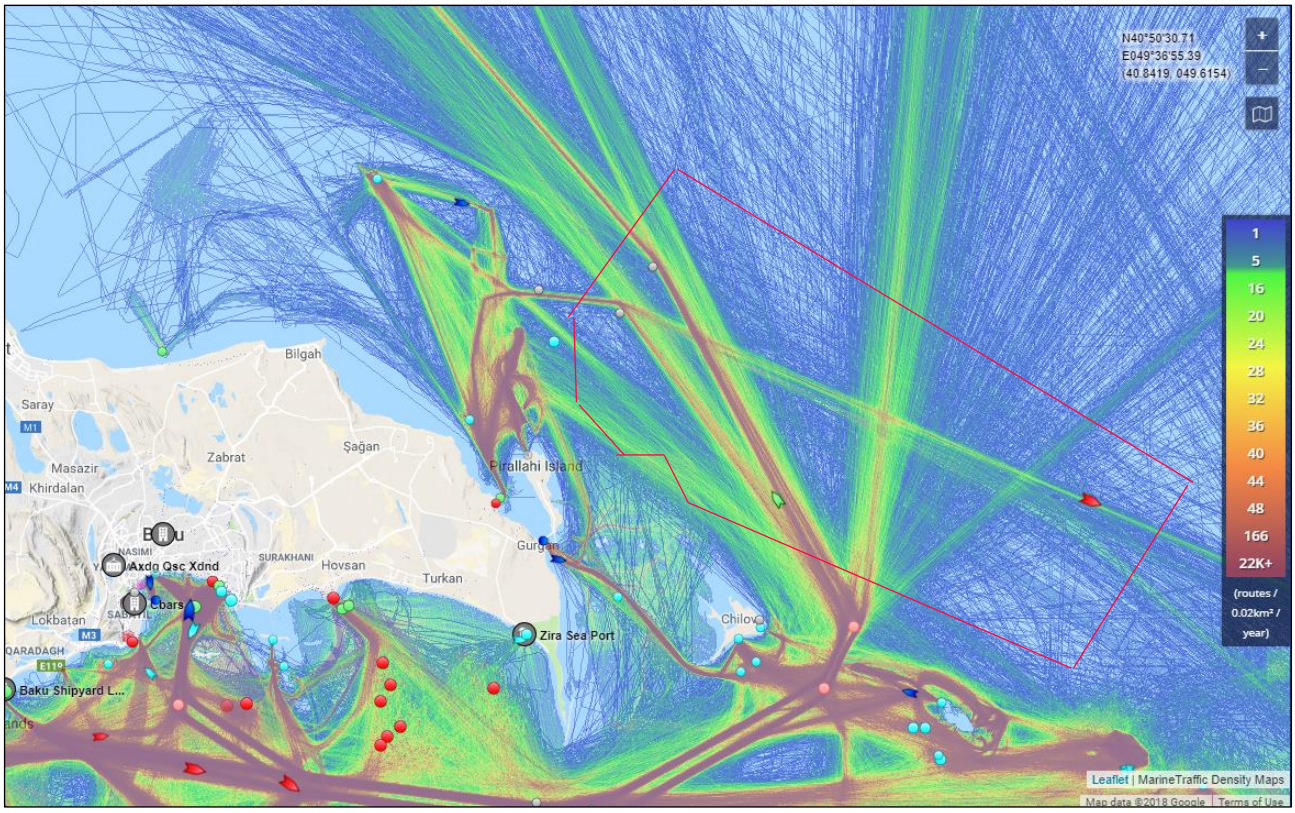
Wintering and feeding grounds of sturgeons on marine pastures at the depths of 10-40 m are located in the regions of western coast of the Middle and Southern Caspian. Therefore, the whole western coast of the Middle and Southern Caspian can be considered as a sensitive fish habitat.

Caspian sturgeon stocks have also suffered a very important reduction. Natural reproduction of sturgeons was dramatically reduced as a result of sturgeon habitat destruction and limited access to breeding grounds, which are located along rivers that have been largely modified and dammed.

4.4.2 Maritime Transport

Maritime transport plays a significant role in the economic development and prosperity of Azerbaijan. Azerbaijan has vast potential in maritime transport in the Caspian Sea. Baku has the largest seaport in the Caspian Sea. Azerbaijan's Caspian Sea Shipping Company is among the major ship owning companies in the Caspian basin and its main activity is cargo transportation, predominantly in oil and oil products, in the Caspian, Black, Mediterranean, and Marmara Seas. Until recently, Azerbaijan's state-owned Caspian Shipping Company (CASPAR) had remained a monopolist in the maritime transportation on the Caspian Sea, though there is increasing competition (Azernews, 2015).

The Baku International Sea Trade Port ferry terminal in Alat, 40 miles south of Baku, was recently commissioned in 2014, while the Baku Sea Port was upgraded and was commissioned later the same year. The estimated transshipment volume for the new port complex is up to 10 million tons of cargo and 40,000 TEU containers at the first stage, up to 17 million tons of cargo and 150,000 TEU containers at the second stage, and up to 25 million tons of cargo, and 1 million TEU containers at the third stage of the project. In addition to the logistics center, a free economic zone is planned for this area in the future. Around 3.1 million metric tons of cargo was transported by ships during January-May 2015, according to the Statistics Committee. All cargo accounted for international operations. The volume of goods handled in Azerbaijani ports amounted to 4.2 million metric tons. Some 71.2 percent of cargo shipping fell to oil and oil products, while 28.8 percent on dry cargo. The volume of international transit cargo handled in the ports hit 94.5 percent. As of June 1, 2015, around 56,800 metric tons of import cargo left in the ports for transportation. A map showing maritime traffic density for years 2016-2017 show large density of ingoing-outgoing traffic, mostly related to nearby O&G fields (Figure 4.33).

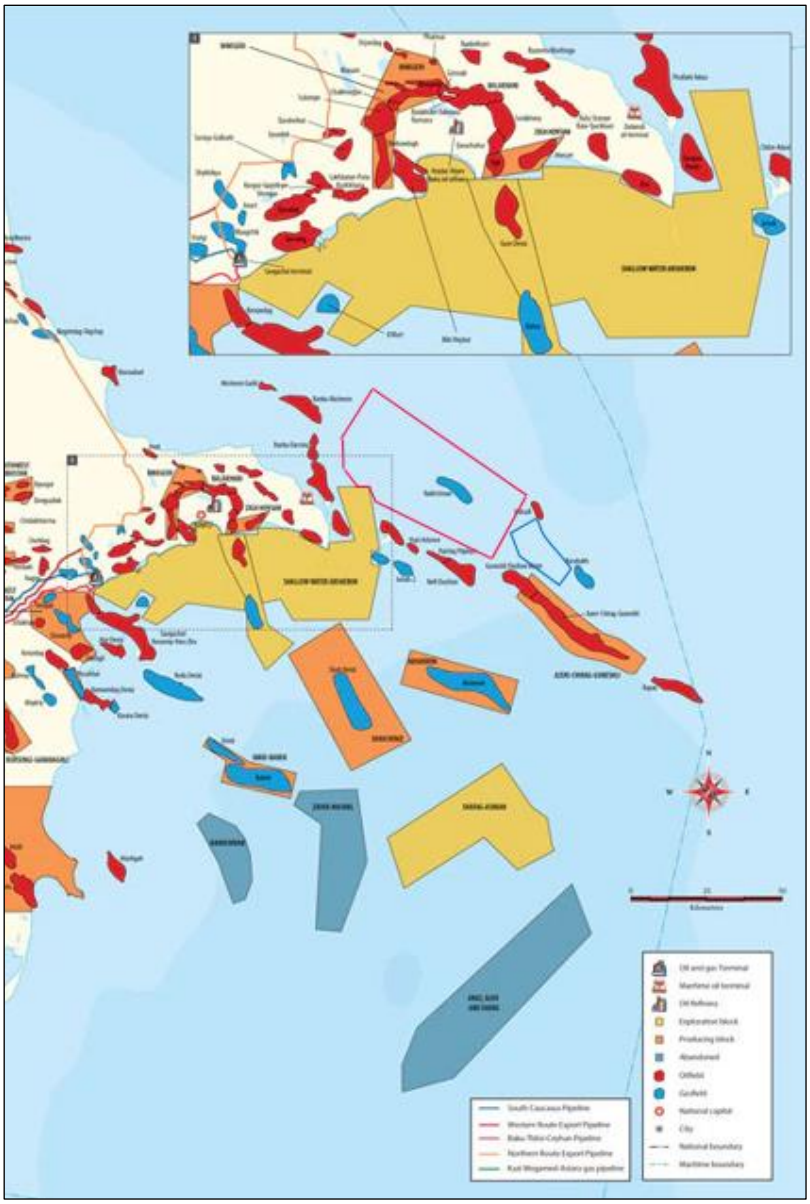


Note: Approximate ADUA exploration area shown in red outline

Figure 4.33: Marine traffic density map (2016-2017) in the main Baku ports (Marine Traffic, 2018)

4.4.3 O&G Activities

Oil and Gas industry is currently the most important economic resource and activity in the Caspian Sea. At present, the majority of oil produced in the Azerbaijan Republic (70-95%) is received from the subsea fields. Geological exploration works in the region discovered a number of large oil and gas fields in the sea and adjacent areas. Thanks to its hydrocarbon potential, the Caspian Sea is the world second oil and gas source after the Persian Gulf. Recent map on O&G infrastructure and hydrocarbon blocks in the vicinity of the Absheron Peninsula is shown in Figure 4.34.



Note: Approximate ADUA exploration area and Karabakh field shown in red and blue outline respectively

Figure 4.34: O&G infrastructure and blocks in Azerbaijan (The Oil and Gas Year, 2016)

5 Impact assessment

5.1 Introduction

This chapter provides an assessment of potential impacts from the planned 2D-3D seismic acquisition survey in the ADUA exploration area to be undertaken by Equinor. The assessment considers how the Project has the potential to impact upon receptors in the physical, biological, and socio-economic environment[13] within the Project area.

5.2 Methodology

This section presents the methodology for assessment of the Project impacts.

The key stages in the impact assessment are as follows:

- identification of potential environmental and social receptors (baseline chapter);
- identification of the activities of the proposed seismic acquisition with the potential to contribute to or cause impacts to environmental and social receptors;
- development of mitigation measures to be applied to reduce potential impacts; and
- assessment of the likely magnitude of the residual impact (depending on its intensity, its duration, its scale, etc.), and the sensitivity of the receiving environment to impacts, to determine its importance.

5.2.1 Impact Significance

Significance of potential impacts is obtained through a combination of the following:

- the predicted magnitude of an impact, taking into consideration all the mitigation measures; and
- the sensitivity of the receptor.

In addition to the impacts generated by routine activities, the impact of unforeseen or accidental events has also been assessed. In these cases, the probability of the event has also been considered.

5.2.1.1 Impact Magnitude

The magnitude describes the degree of change that impact is likely to bring to a component of the environment (receptor). The evaluation criteria are presented in Figure 5.1 below.

[13] Only selected receptors have been considered in this EIA, mainly fisheries and shipping /O&G activities in the Project area.

1. Nature of Impact

- **Negative** – an impact that is considered to represent an adverse change from the baseline
- **Positive** – an impact that is considered to represent an improvement to the baseline

2. Type of Impact

- **Direct** – impacts that result from a direct interaction between a planned project activity and the receiving environment.
- **Indirect** – impacts that result from other activities that are encouraged to happen as a consequence of the project
- **Cumulative** – impacts that act together with other to affect the same receptors as the project.

3. Frequency of the impact

Degree of disturbance experienced by the receiving environment.

4. Duration of Impact

- **Short-term**: impacts that are predicted to last only for an intermittent /occasional period of time.
- **Medium**-term: impacts that are limited in time, ceasing once the activity is over.
- **Long-term**: impacts that will continue over an extended period.
- **Permanent**: impacts that endure substantially beyond the project lifetime.

4. Extent of Impact

- **Local:** impacts that affect locally important environmental receptors or are restricted to a single habitat/biotope, a single (local) administrative area, a single community.
- **Regional:** impacts that affect regionally important environmental receptors or are experienced at a regional scale as determined by administrative boundaries, habitat type/ecosystem.
- **National:** impacts that affect nationally important environmental receptors affect an area that is nationally important/protected or have macro-economic consequences.
- **International:** impacts that affect internationally important receptors such as areas protected by International Conventions.
- **Transboundary:** impacts that are experienced in one country as a result of activities in another.

Figure 5.1: Evaluation criteria

An assessment of the overall magnitude of an impact is provided by taking into account all the dimensions of the impact described above to determine whether an impact is of negligible, small, medium or large magnitude; examples can be found below.

Table 5.1: Magnitude Criteria for Environmental Impacts

Magnitude	Physical Receptors (e.g. air, water, sediments)	Biological receptors
Negligible	Immeasurable, undetectable or within the range of normal natural variation.	Immeasurable, undetectable or within the range of normal natural variation.
Small	Minimal disturbance. Slight change in water quality expected over a limited area with water quality returning to background levels within a few meters. Discharges are well within benchmark effluent discharge limits.	Affects a specific group of localized individuals within a population over a short time period (one generation or less), but does not affect other trophic levels or the population itself.
Medium	Localized and/or short-term disturbance of seabed. Temporary or localized change in water quality with water quality returning to background levels thereafter. Occasional exceedance of benchmark effluent discharge limits.	Affects a portion of a population and may bring about a change in abundance and/ or distribution over one or more generations, but does not threaten the integrity of that population or any population dependent on it.
Large	Widespread and/or long-term disturbance or permanent change to the seabed. Change in water quality over a large area that lasts over the course of several months with quality likely to cause secondary impacts on marine ecology. Routine exceedance of benchmark effluent discharge limits.	Affects an entire population or species in sufficient magnitude to cause a decline in abundance and/ or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations.

5.2.1.2 Receptor sensitivity

The significance of the impacts resulting from an impact of a given magnitude will depend on the sensitivity (terms and definitions of vulnerability and importance may also be used when defining sensitivity) of receptors to that impact, i.e. the extent to which the receptor will undergo a change – negative or positive – as a result of the Project (e.g. nature of the impact).

The quality or importance of a receptor will be judged taking into account, for example, national or international designation, its importance to the local or wider community, its ecosystem function or its economic value.

Table 5.2: Sensitivity Criteria for Environmental Receptors

Sensitivity	Physical Receptors (e.g. air, water, sediments)	Biological receptors
Low	Existing airshed/water/seabed quality is good and the ecological resources that it supports are not sensitive to disturbance.	Ecological receptors are abundant, common or widely distributed and are generally adaptable to changing environments Species are not endangered or protected.
Medium	Existing airshed/water/seabed quality shows some signs of stress and/ or supports ecological resources that could be sensitive to change in quality or physical disturbance (secondary ecological impacts are possible).	Some ecological receptors have low abundance, restricted ranges, are currently under pressure or are slow to adapt to changing environments. Species are valued locally / regionally and may be endemic, endangered or protected.
High	Airshed/water/seabed quality is already under stress and/ or the ecological resources it supports are very sensitive to change (secondary ecological impacts are likely).	Some ecological receptors in the area are rare or endemic, under significant pressure and / or highly sensitive to changing environments. Species are valued nationally /globally and are listed as endangered or protected.

5.2.1.3 Evaluation of significance

Magnitude and receptor sensitivity are looked at in combination to evaluate whether an impact is, or is not, significant and if so its degree of significance (defined in terms of Negligible, Minor, Moderate or Major). This principle is illustrated schematically in Table 5.3. The definitions for the four categories of impact significances are the following.

- **Negligible impact** is where a receptor will not be affected in any way by a particular activity or the predicted effect is deemed “imperceptible”.
- **Minor impact** is where an effect will be experienced, but the impact magnitude is sufficiently small and well within accepted standards, and/or the receptor is of low sensitivity.
- **Moderate impact** is an impact within accepted limits and standards. Moderate impacts may cover a broad range, from a threshold below which the impact is minor up to a level that might be just short of breaching the legal limit.
- **Major impact** is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive receptors. An aim of EIA is to get to a position where the project does

not have any major impacts, certainly not ones that would endure into the long-term or extend over a large area.

Table 5.3: Overall Significance Criteria for Impacts in the EIA

		Sensitivity Importance of the Receptor		
		Low	**Medium**	**High**
Magnitude of Impact	**Negligible**	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

5.2.2 Developing Mitigation Measures

One of the key objectives of an EIA is to identify and define environmentally/socially acceptable, technically feasible and cost-effective mitigation measures. Mitigation measures are developed to reduce the significant negative impacts identified during the EIA process to a point where they have no adverse effects, and to create or enhance positive impacts such as environmental and social benefits.

Mitigation measures are often established through industry standards and may include the following.

- Changes to the design of the project during the design process (*e.g.* changing the development approach or selection of more energy efficient power generating equipment).
- Engineering controls and other physical measures applied (*e.g.* use of effluent treatment equipment or spill prevention technology).
- Operational plans and procedures (*e.g.* notification to other marine users, navigation safety plans or waste management plans).

In this context the term “mitigation measures” includes operational controls as well as management actions. Where a significant impact is identified, a hierarchy of options for mitigation is explored as follows.

Avoidance at source
Develop the project such that the characteristic causing an impact is eliminated at the design stage (elimination of waste materials flow, for example).

Reducing at source
Modify the design of the project or of operational procedures to reduce the impact. For example, measures used to process effluent and waste materials fall into this category – this is also the case of soft-start procedures when seismic survey phases begin.

Reducing at receptor level
If an impact cannot be reduced on site, measures can be implemented off site – this is the case for example with the use of a guard vessel to help to control the level of interference with fishing activities.

Repairing or correcting
Some impacts imply damage to a receptor that is unavoidable. Repair mainly involves restoration and re-establishment type measures.

Compensation in kind
When other mitigation methods are either not possible or are not entirely efficient, compensation can be adapted, to a certain extent, to losses

Figure 5.2: Mitigation hierarchy

To facilitate the comprehension of the report, mitigation measures are provided at the end of the impact assessment chapter in a tabular form, both for routine events (Table 5.8) and unforeseen events (Table 5.9).

The proposed EIA process will undertake the assessment of potential impacts considering the inclusion of the mitigation measures. The final remaining “mitigated” impacts are termed “residual” impacts. Where significant residual impacts remain, monitoring may be necessary to investigate the effectiveness of the mitigation measures.

5.2.3 Uncertainty

The prediction methods used are mainly qualitative evaluations based, to the extent possible, on specific indicators such as timings, volumes of resources/effluents, etc. This approach allows a reasonable degree of accuracy in predicting changes to the existing baseline and making comparisons with relevant standards. Where assumptions have been made, the nature of any uncertainty that stems from the ‘prediction’ process is explained. If appropriate, a ‘worst case’ approach has been adopted with mitigation measures developed accordingly.

5.3 Impact identification

The first step in impact identification is to identify the various types of activities associated with the project, together with their associated emissions and discharges where appropriate. At a high level, the main sources of impact of a seismic survey are:

- physical disturbance from underwater noise emissions;
- physical presence of vessels and seismic equipment
- discharges to the sea;
- generation of wastes; and
- accidental events.

Accidental events can potentially lead to significant impacts, for example in the event of an oil spill. However, they are clearly not a part of the intended activity and their potential occurrence has a likelihood associated with it.

The impact identification matrix provided in Table 5.4 identifies and scopes the predicted interactions between Project activities and environmental/socio-economic receptors. Each marked cell on the impacts matrix represents a potential interaction between a project activity and an environmental/socioeconomic receptor (i.e., potential impact). The cells are marked by using an associated code (e.g., for Air Quality Impacts, A). Blanks in the matrix indicate no potentially significant impacts are expected.

The specific impacts presented in the sections below have been defined based on a receptor potentially being impacted by the activities. Grouping all the individual impacts (marked cells) in one single impact allows a comprehensive analysis of the project activities that would interact with each environmental and socioeconomic receptor, also considering potential synergistic processes.

Table 5.4: Impact identification matrix

			Air Quality and Climate Change	Sea water Quality	Marine Flora/Plankton	Benthic communities	Pelagic Fish and Invertebrates	Marine Mammals	Seabirds	Protected Areas	Navigation, traffic and sea users	Fisheries
Sources of Potential impact	Seismic Survey Acquisition Campaign Routine Events	Atmospheric emissions from Project vessels	A1									
		Liquid discharges from project vessels		W1	P1		FA1	FA1	FA1	PA1		
		Solid discharges from project vessels		W1	P1		FA1	FA1	FA1	PA1		
		Underwater noise emissions			P2	B1	F1	M1	SB1			FS2
		Physical presence of Project vessels and equipment						M2			NT1	FS1
		Artificial illumination			IL1		IL1	IL1	IL1			
	Accidental Events	Accidental hydrocarbon spillage/discharge	AE1	AE1	AE1	AE1	AE1	AE1	AE1	AE1	AE1	AE1

A1	*Impacts on air quality and climate change due to the release of air pollutants*	***FA1***	*Impacts on fauna due to the change of seawater quality due to effluents and waste to the sea*
W1	*Impacts on seawater quality due to the discharge of effluents and waste to the sea*	***M2***	*Impacts on marine mammals due to presence of the vessels and seismic acquisition equipment*
P1	*Impacts on plankton due to the change of seawater quality due to effluents and waste to the sea*	***IL1***	*Impacts on fauna due to artificial lighting*
P2	*Impacts on plankton due to the generation of underwater noise emissions*	***PA1***	*Impacts on protected areas due to the Project activities*
B1	*Impacts on benthic communities derived from the generation of underwater noise emissions*	***FS1***	*Impacts on Fisheries due to presence of the vessels and seismic acquisition equipment*
F1	*Impacts on fish due to the generation of underwater noise emissions*	***FS2***	*Impacts on Fisheries due to the generation of underwater noise emissions*
M1	*Impacts on marine mammals due to the generation of underwater noise emissions*	***NT1***	*Impacts on Navigation and Traffic / Sea users*
SB1	*Impacts on seabirds due to the generation of underwater noise emissions*	***AE1***	*Impacts due to potential accidental events (hydrocarbon spills)*

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5.4 Impacts to the Physical Environment

5.4.1 A1: Impacts on Air Quality and Climate Change

5.4.1.1 Impacts on air quality due to the release of air pollutants

The major sources of atmospheric emissions will result from the seismic and guard/support vessel engines and power generation exhausts. Other emissions to air from point and non-point sources may occur throughout the Project (e.g. helicopter and incineration). However, these would be very small in the worst-case scenario, and their occurrence will be mitigated via proper maintenance protocols.

The release of gaseous pollutants to the atmosphere has the potential to affect local air quality, the source of emissions will range from a few kilometres to about 50 km from the coastline given the location of the seismic survey area. Emissions will also be released by guard/support vessels along the route between the port and the survey area and as such will be of a diffuse nature, which will assist dispersion of pollutants and lessen potential impacts. On-board incineration of some waste materials may also generate occasional-limited emissions. The dispersion rate of atmospheric emissions is expected to be high, due to the project's offshore location and the fact that all sources are practically mobile.

Effects on air quality will be localised and temporary at the vessels location. In addition, background levels of pollutant concentrations are expected to be reached within tens of metres from the sources and are not expected to reach any onshore receptors.

In summary, no significant impacts to air quality from Project-related emissions are expected, given the extent of emissions from vessel engines and other power generation sources, the high level of dispersion that will occur in offshore locations from moving vessels and the human receptors in the immediate vicinity of the vessels).

5.4.1.2 Mitigation measures

Project-embedded measures to limit atmospheric emissions during the Project operations will include:

- advanced planning to ensure efficient operations;
- appropriate maintenance policies and procedures of equipment and generators will be followed, and its implementation audited by an Equinor representative;
- regular monitoring of fuel consumption;
- equipment will be switched off when not in use;
- use of low-sulphur marine fuel (i.e. <0.4% S by weight), and

- compliance with Tier II of revised MARPOL 73/78 Annex VI which sets limits on sulphur dioxide and nitrogen oxide emissions from ship exhausts and prohibits deliberate emissions of ozone depleting substances.

Taking into consideration the implementation of Project mitigation measures and embedded controls inherent in the project design, together with the localised nature of emissions, the sensitivity of the offshore environment and the expected dispersion rate, the resulting residual impact on air quality is assessed as **Negligible**.

5.4.1.3 Impacts on climate change due to the release of air pollutants

Context

In September 2015, just before the 21st Conference of the Parties to be held in Paris (COP 21) of the United Nations Framework Convention on Climate Change (UNFCCC), Azerbaijan submitted its new climate action plan that included the country's Intended Nationally Determined Contribution (INDC) in relation to the fight against climate change. This action plan targets a 35% reduction in the level of greenhouse gas (GHG) emissions compared to 1990 base year as its contribution to the global climate change efforts, by 2030. In practical terms, the INDC aims a total annual emission of 25,666 tonnes of CO_2, compared to the 73,331 tonnes emitted in 1990.

With regards to the oil and gas sector specifically, the INDC included the following measures:

- application of new and modern environmental-friendly technologies in the oil and gas processing,
- production of fuel in line with EURO-5 standards in a new refinery complex by 2019 and strengthening the capacity of the staff;
- modernization of gas pipelines, gas distribution system and other measures to decrease losses up to 1% by 2020 and ensure the volume of reduction in compliance with international standards by 2050; and
- based on adopted strategy, accumulation of gases emitted to the atmosphere during oil-gas production, prevention of gas leakages during oil-gas processing and at distribution networks.

The analyses of impacts related to Project's greenhouse gas emissions are limited to the Project itself (seismic survey activities) but not to GHG emissions related to future phases of oil exploitation (e.g. related to possible exploitation of resources, processing, distribution and consumption of products are not taken into account in this study as they are outside the scope of the current seismic survey EIA). GHG included in the assessment are those considered by the Kyoto Protocol, namely carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), fluorinated hydrocarbons (HFC -PFC - SF6).

Emissions related to the consumption of fossil energy for the operation of ships

As detailed in the Project Description (Chapter 3), air emissions sources, estimated hours of operation, and type of fuel to be used associated to the Project are shown in Table 5.5:

Table 5.5: Estimated fuel consumption (Equinor and ERM, 2018)

Vessel	Activity	Average speed (knots)	Average fuel consumption (tonnes/day/vessel)	Fuel consumption (tonnes)
1 Seismic vessel	Seismic acquisition (assuming 45 days)	4	27	1,215
1 Guard vessel	Guard seismic vessel (assuming 45 days)	4	6	270
1 Support/ Supply vessel	Supply activities between base port and survey area (assuming 45 days)	4	16	720
Total				**2,205**

Estimation of the predicted associated emissions has been calculated using emission factors based on methodology proposed by the International Association of Oil and Gas Producers (IOGP) (former E&P Forum/ UNEP, 1997) is shown in Table 5.6.

Table 5.6: Total air emission estimates (Tonnes emission / tonne fuel. OGP (Former E&P Forum, 1994). Methods for Estimating Emissions from E&P Operations. Report 2.59/197. Table 4.11)

Emission Gas	Emissions Factors (Sea transport)	Gas Emitted (tonnes)*	Global Warming Potential (t CO_2e)
CO_2	3.2	7,056	7,056
CO	0.008	17.64	n.a
NO_x	0.059	130	n.a.
SO_2	2xS(1)	17.64	n.a.
CH_4	0.00027	0.63	26
VOCs	0.024	52.92	n.a

*: tonnes emitted from fuel consumption during a 45 day seismic survey.

Note: S(1) Assumes a sulphur content for marine diesel of 0.4% by weight.

According to the emission estimate provided before, the seismic acquisition activities will generate 7,082 tonnes of CO_2 in total. Compared to the country emissions target of 25.7 Mn tons/year of CO_2, the Project impacts on GHG emissions is considered to be **Negligible.**

5.4.1.4 Descriptors and residual impact

Impact descriptors for air quality and climate change impacts

Type	Duration	Frequency	Extent	Magnitude	Sensitivity	Significance
Direct	Temporary	Occasional	Local	SMALL	LOW	**Negligible**

Taking into consideration the implementation of Project mitigation measures and embedded controls inherent in the project design, together with the localized nature of emissions, the sensitivity of the offshore environment and the expected dispersion rate, the resulting residual impact on air quality and the potential for climate change is assessed as **negligible**.

5.4.2 W1: Impacts on seawater quality due to effluents and waste to the sea

Operational discharges may locally affect water quality and can be grouped into:

- liquid wastes; and
- solid wastes (hazardous and non-hazardous).

Liquid wastes

Liquid wastes include sanitary wastewater ('black water' from toilet facilities) and domestic wastewater ("grey water" from showers, sinks, laundries and galleys, as well as from safety shower and eye-wash stations). In some cases, grey water can include some solid or semi-solid food. These streams will introduce microorganisms, small quantities of nutrients, suspended solids, organic material with chemical and biological oxygen demand and residual chlorine from sewage treatment to well-mixed, well-oxygenated surface open waters.

As described in the Project Description, it is estimated that one person will generate 100 l/day of sanitary wastewater and 220 l/day of domestic wastewater. Since about 95 persons would be involved in the seismic acquisition activities, the estimated daily volumes result to be 20,900 liters of wastewater a day, which corresponds to 20.9 m^3 / day.

Liquid wastes also include drainage water from the drains and bilges of the seismic vessel and auxiliary vessels (one guard vessel and one support/supply vessel). Drainage is likely to become contaminated with low levels of hydrocarbons and other chemicals. Unmanaged discharge of this water to the sea represents a potential impact on local water quality. All oily waste water will be contained onboard and transported to shore for disposal. The amount of drainage water depends on the frequency of wash-downs and rainfall. In general, considering the seismic survey duration (about 45 days), it is expected that the generated volume of drainage water will be small.

The last type of liquid waste considered are ballast waters. Ballast water is taken on-board to maintain safe operation and manoeuvring of vessels. Depending on where it is taken on-board, it may contain harmful

microorganisms, marine organisms from other locations (potentially invasive species) and contaminated sediments in suspension. Any ballasting operations will be logged. In addition, the Project will comply with IMO regulations and standards and guidelines for ballasting management based on the International Convention for the Control and Management of Ship's Ballast Waste and Sediments (BWM Convention).

All discharges of liquid wastes to the sea will be carried out in accordance with a Waste Management Plan and in full compliance with relevant national legislation, as well as MARPOL requirements and provisions specified in its Annex IV – Sewage. Moreover, liquid wastes that may be discharged are expected to dilute and disperse quickly in the offshore environment resulting only in a temporary and localised reduction of water quality.

Solid wastes

Solid wastes include maintenance products (e.g., lube oil and other greases), packaging waste (e.g., paper, card, wood, sacks, drums and grease/paint cans), scrap metal, and empty chemical drums. As described in the Project Description, any solid waste will be sorted, transported to shore and disposed according to the Waste Management Plan (although wastes that are appropriate to burn at sea may be incinerated). No solid waste other than food waste will be discharged into the marine environment, in accordance to MARPOL 73/78 Annex V regulations.

As described in the Project Description, any chemical waste will be managed according to the Waste Management Plan, including storage in sealed containers/drums with clear labelling and accompanied with copies of the relevant Material Safety Data Sheets (MSDS). Chemical wastes will be sorted, transported to shore and disposed according to the Waste Management Plan. Therefore, no impacts to water quality is expected from the generation of chemical wastes during project activities. The only potential negative impact is potentially linked to accidental events, described in *Section 5.7*.

5.4.2.1 Mitigation measures

- The vessels will be equipped with a sewage treatment unit compliant with MARPOL Annex IV regulations, with International Sewage Pollution Prevention Certificate ("ISPPC");
- Discharges will comply with MARPOL Annex IV and the Azerbaijani law;
- Bilge and drainage oily wastewater will be contained onboard and transported to shore for disposal ;
- Maintenance of an Oil Record book and a vessel's logbook.
- All Ballasting activities will comply with the International Convention for the Control and Management of Ship's Ballast Waste and Sediments (BWM Convention);
- Food waste discharges will comply with MARPOL Annex V requirements (discharges of comminuted waste always more than 3 nm from the coast and while navigating).

5.4.2.2 Descriptors and residual impact

Impact descriptors for water quality

Type	Duration	Frequency	Extent	Magnitude	Sensitivity	Significance
Direct	Temporary	Occasional	Local	SMALL	LOW	**Negligible**

Taking into consideration the implementation of Project mitigation measures and embedded controls inherent in the project design, together with the localized nature of liquid/solid discharges, the sensitivity of the offshore environment and the expected dispersion rate, the resulting residual impact on water quality is assessed as **negligible**.

5.5 Impacts to the Biological Environment

5.5.1 P1: Impacts on plankton due to the change of seawater quality due to effluents and waste to the sea

The discharge of routine waste effluents from the seismic survey fleet may result in a temporal increase in organic matter in the surroundings of the vessels as well as along the sites traversed by them. Considering the maximum personnel requirements of 95 people and assuming an average daily production of 100 L/day/person of sanitary wastewater and 220 L/day of domestic wastewater, expected volumes of effluents should not exceed 30.4 m^3/day.

Considering these limited volumes, the constant movement of survey vessels throughout the survey area and the adherence to MARPOL requirements, an increase in organic matter is considered not significant as it is not expected to disrupt natural phytoplankton cycles in the area and will be limited to a temporary increase in plankton communities along a limited surface.

Regarding ballast waters, should any of the project vessels not be sourced locally and come from other marine areas, it could result in the introduction of invasive or alien species into the Caspian Sea. Alien species have the potential to create changes to ecosystem by modifying the trophic chain and even lead to the local extinction of certain species, presenting therefore a threat to biodiversity. To reduce this possibility, Statoil Azerbaijan and its contractors will adhere to IMO Guidelines for the Control and Management of Ship's Ballast Waste and Sediments (BWM Convention) which will be communicated to contractors supporting the Project as part of their contractual obligations.

5.5.1.1 Descriptors and Residual impacts

Impact descriptors for plankton

Type	Duration	Frequency	Extent	Magnitude	Sensitivity	Significance
Direct	Temporary	Occasional	Local	SMALL	LOW	**Negligible**

Due to the embedded controls for the Project, including adherence to IMO guidelines, the impact of liquid discharges (including ballast water discharge) in general, is predicted to be **Negligible**.

5.5.2 Noise impacts on Marine Fauna

This section analyses underwater noise impacts generated by the Project. Noise-generating activities include the mobilization and operation of Project vessels and seismic survey activities from the use of underwater airguns.

Seismic surveys have the potential to create underwater sonic disturbance to marine fauna due to acoustic levels associated with the seismic energy sources. Some characteristics of these sources are described in Chapter 3.

The most important characteristic in terms of effects on marine biodiversity, is that most emitted energy is low frequency, between 10-120 Hz; especially for deep surveys. Pulses also contain some higher frequency energy up to 500-1,000 Hz. These latter components are weak when compared to the low frequency energy, but strong when compared to ambient noise levels. As pulses propagate horizontally in shallow water, low frequencies attenuate rapidly, leaving only the high frequency energy (Richardson et al. 2013).

This characteristic determines the mode and range of potential effects, and to which species it could affect more preferentially. The low frequency component of the sound spectrum propagates with slower attenuation than at high frequencies, for which the level of sound drops off quite rapidly to levels similar to those of ambient noise or normal background noise.

Table 5.7 shows noise sources and sound levels likely to be associated with Project activities. Underwater sound besides that generated from the seismic source will be generated by the vessels engines, as well as navigational, operational and safety equipment on board the vessels, such as echo sounders, sonar systems and current meters. The exact noise levels expected to be generated by the Project equipment is still not known, nonetheless the underwater noise produced by the airgun array is considered the most significant source of noise produced by the survey activities, thus the assessment is based on known noise levels generated by a typical seismic survey airgun array (especially those recently performed in the Caspian Sea). This information forms the basis of the assessment of noise impacts on receptors including fish and marine mammals (i.e. the Caspian Seal).

Table 5.7 Typical Underwater Noise Levels and Frequencies (Urick, 1983; Richardson et al., 1995; Equinor and ERM, 2018)

Source	Noise Level (dB re 1µPa)	Noise Frequency (Hz)
Ambient noise		
Calm Seas	45-60	Broadband
Moderate waves/surf	80-120	Broadband
Project-related noise		
Seismic vessel engines (acquisition speed)	150-170	5-500
Guard/Supply vessels engines (general)	170-180	20-1000
Multi-beam depth sounder	213	12 kHz to 455 kHz
Seismic source (specific to this Project)	**255**	**100-250**

*Noise pressure is expressed on a decibel scale (dB) and referenced to 1 micro Pascal at 1 m from the source (dB re 1 µPa @ 1m).
*Noise frequency is expressed in Hertz. Only the approximate range of peak frequencies is presented, frequencies outside this range are likely to exist but be lower in sound level.

Based on available scientific literature, the potential effects of underwater noise resulting from seismic sources ultimately depends on the perceived sound intensity and the particular hearing capabilities of different marine fauna. In general, the types of effects can be summarised in the following categories (mainly for marine megafauna), in preliminary order of received acoustic level which could produce these effects.

- Irreversible effects on auditory structures from exposure to significant levels of noise (dependent on species) or associated pressure effects to nearby organisms, tissue damage or permanent auditory trauma; the latter is commonly referred to as Permanent Threshold Shift: PTS[14]. These effects may potentially lead to lethal damage.
- Reversible effects on auditory structures (referred to as Temporal Threshold Shift: TTS[15]) from exposure to specific threshold levels (dependent on species) of noise or associated pressure effects to nearby organisms.
- Behavioural disturbance with potential ecological implications such as disruption to feeding, mating, breeding or nursery activities.
- Interference with the use of acoustic communication signals, or naturally produced cues used by marine animals (i.e. auditory masking).
- Indirect effects, such as changes in the abundance or behaviour of prey animals for marine mammals, seabirds and fish.

[14] A permanent loss of hearing caused by some kind of acoustic trauma. PTS results in irreversible damage to the sensory hair cells of the ear, and thus a permanent loss of hearing (Hastings and Popper, 2007).

[15] Temporary loss of hearing as a result of exposure to sound over time. Exposure to high levels of sound over relatively short time periods will cause the same amount of TTS as exposure to lower levels of sound over longer time periods. The mechanisms underlying TTS are not well understood, but there may be some temporary damage to the sensory hair cells. The duration of TTS varies depending on the nature of the stimulus, but there is generally recovery of full hearing over time (Hastings and Popper, 2007).

The following paragraphs will analyse the potential effects of the expected noise levels on the different receptors.

5.5.2.1 P2: Impacts on plankton derived from the generation of noise emissions during seismic acquisition activities

The movement of phytoplankton and zooplankton is largely limited by currents. As they are not able to actively avoid the seismic survey sound source, they are thus likely to come into close contact with the sound sources.

Studies such as those of Kostyuchenko (1971) have shown that a 1.4x104 kilo Pascals (142.7 kilograms per square centimetre) noise level discharged by an airgun caused damage to larval planktonic species within a range of five metres. It has also been estimated that the wake from passing ship propellers and bow waves from routine maritime traffic will cause a similar if not greater volumetric effect to that of noise disturbance from seismic operations (Swan et al., 1994).

Thus, except for larvae, fish eggs and other planktonic organisms (e.g. zooplankton, icthyoplankton, fish eggs) within a few metres of a seismic source, no planktonic organism populations are likely to be significantly affected by seismic array discharges. For a large seismic array, injuries and mortality to eggs and larvae are highest at close range, within 2 m of the source, and decrease rapidly with distance from the seismic sources. Outside a range of 5 m, no effects are demonstrated. Furthermore, mortality of fish larvae in the plankton is considered to be insignificant compared with stochastic factors that cause natural mortality to fish larvae (McCauley, 1994).

Descriptors and Residual impacts

Impact descriptors for plankton

Type	Duration	Frequency	Extent	Magnitude	Sensitivity	Significance
Direct	Temporary	Often	Local	NEGLIGIBLE	LOW	**Negligible**

Potential impacts on plankton populations are considered **negligible**. No mitigation measures are recommended.

5.5.2.2 B1: Impacts on benthic communities derived from the generation of noise emissions during seismic acquisition activities

Most marine benthic invertebrates have poorly developed mechano-sensory systems and would not be expected to be affected by the sound generated during the seismic acquisition activities.

Research on underwater noise effects on benthic communities have focused on species of commercial importance. Different experiments have been unable to show significant effects on prawn catch rates before,

during and after seismic surveys. Data on the impacts of seismic sound on macro invertebrates (scallop, sea urchins, mussels, periwinkles, shrimp, gastropods, cephalopods) show no significant increase in mortality below sound levels of 220 dB re 1µPa@1m. Some show no mortality at 230 dB re 1µPa@1m (Royal Society of Canada, 2004). However, Carroll et al. (2017) noted that limited investigations on the physiological responses of marine invertebrates to seismic noise are available; such as those of Day et al. (2016) where rock lobsters where exposed to acoustic sources having found damage in statocyst hair cells and low haemolymph counts; in the case of exposed scallops, Day et al. (2016) also found lower haemolymph counts. No specific mitigation measures are in place to reduce the potential effects of seismic surveys on benthic invertebrates; however, based on the information above, any effects on these are predicted to be highly localised and no population effects anticipated.

Descriptors and Residual impacts

Impact descriptors for invertebrates

Type	Duration	Frequency	Extent	Magnitude	Sensitivity	Significance
Direct	Temporary	Rare	Local	NEGLIGIBLE	LOW	**Negligible**

The proposed seismic surveys will be conducted over an area where water depth broadly ranges from 20 to 250 meters (with a limited area on the north-western side of the ADUA being shallower, of up to 10m depth). Disturbance to benthic fauna from the proposed seismic surveys is unlikely. Thus the potential impact on marine invertebrates related to the proposed seismic program is considered to be **negligible**, with no mitigation measures recommended.

5.5.2.3 F1: Impacts on fish due to the generation of noise emissions during the seismic acquisition activities

All fish species hear with varying degrees of sensitivity within the frequency range of sound produced by seismic sound sources (Hawkins, 1973; Popper and Fay, 1973; Tavolga et al., 1981; Fay, 1988; Popper and Fay, 1993; Fay, 2000). The effects of anthropogenic sound on fish have been summarised by several authors, including Popper (2003), Hastings (2008), Popper and Hastings (2009a, b), Slabbekoorn et al. (2010), Popper and Hawkins (2012), Halvorsen et al. (2013) and Popper et al. (2014). The best hearing range for most fish is believed to be in the frequency range of 100 to 1,000 Hz (Fay, 1988). Available data indicate that fish cannot hear sounds above approximately 3 to 4 kHz, with the majority of species able to detect sounds only to 1 kHz or below. Studies have demonstrated that some species can detect sounds below 50 Hz (i.e., infrasound), but it remains unclear whether these sounds are sensed by the ear or via the lateral line (Karlsen, 1992; Knudsen et al., 1994; Popper, 2012).

General effects of seismic noise on marine fish may be grouped as follows.

- **Physical Injury:** Available literature regarding the potential for fish injury and fatality as a result of acoustic impacts and associated pressure effects indicates that direct injuries to fish, are predicted to occur only when the fish are within a few metres of the operating seismic sources. Significant numbers can only be affected in situations where the survey line passes directly over aggregations in shallow waters where large numbers exist.

  The physical injury effects are most pronounced on fish with a swim bladder because the organ is unable to adapt quickly enough to the high intensity seismic pressure waves. If the received sound vibrations are too intense the bladder may be damaged or destroyed, the fish may become stunned and disorientated, or trauma may occur to fish hearing (McCauley, 1994). This type of physical damage; however is only likely to occur within a few metres of the noise source, as studies on the effects of seismic noise on fish have previously indicated that fish injury occurs at noise levels in excess of 220 dB re 1µPa (McCauley et al., 2000).

  There is no evidence of fish mortality resulting from seismic surveys, and there are no data available on the noise intensity that would result in mortality or other pathological effects. Except at very close range, the effects of seismic sound sources on fish are thought to be transitory, mainly evoking a startle response (i.e., movement away from the source of the noise) and changes in schooling behaviour.

- **Auditory trauma:** There is a wide range of susceptibility among fish; for example those with a swim bladder will be more susceptible than those without this organ (McCauley, 1994). Most pelagic fish are expected to swim away when seismic noise reaches levels which might cause pathological effects; however, previous anecdotal reports of open sea fish near operating vessels suggest that some of these species are less susceptible to impacts from sound. Fish with large, thin walled swim bladders connected to their inner ear with a resonant frequency near to 100 Hz will be most susceptible to physical damage or trauma from seismic shots (Hawkins, 2011). The most sensitive fish species are those which have a link or form of connection between the swim bladder and the inner ear. Such species are therefore deemed to be of moderate sensitivity to anthropogenic noise sources.

  McCauley et al. (2000, 2003) conducted trials with captive fish, which showed a common fish “alarm” response of swimming faster, swimming to the bottom, tightening school structure, or all three at an estimated 2 to 5 km from a seismic source. Captive fish exposed to short-range seismic pulses were seen to have some damaged hearing structures, but showed no evidence of increased stress. Ears of fish exposed to the close proximity of an operating seismic sound source (i.e. within a few metres) sustained extensive damage to the sensory epithelia, which was apparent as ablated hair cells.

- **Auditory Masking:** Noise from marine seismic surveys also may have the potential to mask the sounds normally used by fish in their usual acoustic behaviours (Popper and Clarke, 1976; Ha, 1985).

- **Behavioural:** Noise induced behavioural effects have been found to result in decreased catchability even though no direct mortality may result (Dalen and Knutsen, 1986; Pearson et al., 1992; Engås et al., 1993;

Løkkeberg and Soldal, 1993). Fish with specialised hearing abilities (such as those with swim bladders mechanically linked to the ear) will be more likely to exhibit behavioural responses to distant seismic survey operations than those fish with relatively poor hearing (McCauley, 1994).

Numerous studies have reported no significant effect on the behaviour of various fish species, even in very close proximity (1.5 metres) to the seismic source (Pickett et al., 1994; Wardle et al., 1998). Wardle et al. (2001) for example used a video system to examine the behaviours of fish and invertebrates on a coral reef in response to emissions from seismic air guns that were carefully calibrated and measured to have a peak level of 210 dB re 1 µPa at 16 metres from the source (noise levels which are comparable to those expected from the proposed survey) and 195 dB re 1 µPa at 109 metres from the source. They found no permanent changes in the behaviour of the fish or invertebrates on the reef throughout the course of the study, and no animals appeared to leave the reef. There was no indication of any observed damage to the animals (Wardle et al., 2001).

To avoid the sound, adult fish generally swim away from the sound source. Review work by Turnpenny & Nedwell (1994) indicates that there are two different types of fish avoidance towards seismic sound; demersal fish will dive towards the bottom or into deeper waters and pelagic fish will swim horizontally away from the sound source. Demersal fish may also display a secondary horizontal movement in their diving reaction.

Habituation of fish to noise is suggested by the fact that behavioural changes are observed to cease during the exposure period, sometimes within minutes of commencement of surveying (Løkkeberg and Soldal, 1993). Turnpenny & Nedwell (1994) have concluded that during seismic survey operations, fish tend to avoid the area from between 200 and 2,000 metres of the source.

There is a concern that any behavioural changes, as described above, might alter the volume of catches of commercially exploited fish species (Brand & Wilson, 1996). Engås et al. (1996) and Engås and Løkkeborg (2002) looked at the effects of seismic exploration on fishing success for haddock (*Melanogrammus aeglefinus*) and Atlantic cod (*Gadus morhua*). They found that, compared to pre -seismic catches, there was a significant decline in the long -line catch rate during and after the seismic study. The catch rate did not return to normal for at least five days after the end of the seismic study. More recently, the same group used sonar to observe the behaviour of blue whiting and Norwegian spring spawning herring during a seismic operation and observed that fish would dive from the seismic source and not return until after the activity had stopped (Slotte et al., 2004).

Noise emissions generated by seismic operations have the potential to affect the behaviour of some species of Caspian fish species that are sensitive to sound, especially those regarded as ‘hearing specialists’ (in the Caspian, typical species are the shad (genus *Alosa*) and kilka (genus *Clupeonella*). Shad and kilka are expected to migrate along the Absheron peninsula coastline (shad in spring and autumn and kilka in spring, summer and winter). The survey schedule will avoid part of their main migration period; however should they be found present, they are expected to be passing through and would only be likely to be in the vicinity of the survey vessel for a very short period of time. They are also highly mobile and able to avoid any underwater sound that could cause lethal effects.

Among the fish species of conservation value in the Caspian Sea there are four species of sturgeon (Russian Sturgeon, Ship Sturgeon, Persian Sturgeon and Stellate Sturgeon). Sturgeon are anadromous fish, thus they migrate to river systems for reproduction and therefore are not expected to be impacted by the Project during their reproductive period (March to April / September to November). Sturgeon species also have moderate hearing sensitivity since in comparison to hearing specialists.

With regards to potential auditory trauma, according to Popper (2014), the threshold for recoverable injury for hearing specialists is of more than 207 dB Peak re 1 µPa/ or 203 dB re 1 μPa^2s SEL cum, based on recent underwater noise modelling data from similar projects in the Caspian sea (e.g. BP SWAP 2D ESIA; BP Shah-Deniz 3D ESIA), such levels would be attained within 50-80 m for SPL values and up to 200 m for SEL In addition, the continuous nature of noise produced by the vessels and seismic source would reduce the chances of startle reactions in fish. The adoption of the soft start procedures as recommended by the JNCC (2017) would also contribute to avoid the presence of fish in the vicinity of the source giving them time to swim away from the noise source as the levels increase progressively.

Mitigation measures

No measures are recommended specifically to mitigate the potential impacts of seismic sound sources on fishes, though it is considered they may benefit from soft-start procedures implemented for marine mammals. Only fish in the immediate vicinity of the seismic sources (i.e. less than 100 m for most species,) on commencement of the firing would be expected to suffer any notable injury, while those located beyond this distance from the source may show altered behaviours. Impacts to fish are therefore expected to be limited to the duration of activities and localised in the vicinity of the seismic source.

Descriptors and Residual impacts

Impact descriptors for marine fish

Type	Duration	Frequency	Extent	Magnitude	Sensitivity	Significance
Direct	Temporary	Often	Local	SMALL	LOW	**Negligible**

It is considered that an approaching sound source, the implementation of the JNCC recommendations for marine mammals (e.g. the ‘soft start’ procedure) and the movement of the vessel is sufficient to provide an opportunity for fishes to be driven away from the area before the seismic source reaches full power. The potential impact of the proposed seismic program on marine fishes is considered **negligible.**

5.5.2.4 *M1: Impacts on marine mammals due to the generation of noise emissions during seismic acquisition activities*

Potential impacts of seismic surveys on marine mammals have been reviewed extensively by BOEM (2012a,b); Clark (1990); Croll et al. (1999); Davis et al. (1998); Gordon et al. (1998); McCauley et al. (2000); Richardson et al. (1995); Southall et al. (2007 & 2012) and Stone (2003). According to these studies, the list of general effects of seismic noise on marine mammals may be grouped as follows.

- **Lethal or sub-lethal effects.** A series of incidents in Greece, the Bahamas, Madeira, and the Canary Islands (Southall et al, 2007) have served to establish that military sonar can cause cetaceans, in most cases beaked whales, to strand, but there have been no documented instances with conclusive evidence of deaths and/or stranding's of marine mammals directly related to seismic surveys.

- **Auditory trauma:** There is a permanent threshold shift (PTS) that could derive in potential or permanent auditory trauma, which could occur within a range of tens to hundreds of metres of a typical seismic sound source. This range depends on a variety of factors, including the size and configuration of the array, water depth, receiver depth, seafloor characteristics, density structure of the water column and receiving animal depth and behaviour. These characteristics and the specific distances at which these effects can be expected in this case are described further in detail in this subsection.

  The reversible mode of this effect (TTS) is from exposure to moderate levels of noise which could, in principle, affect organisms at longer distances from the source. In both cases, given the mobility of marine mammals, it is reasonably expected that they would move away from the source to avoid these effects. This combined situation is what derives the design and implementation of specific operational mitigation, so as to ensure no animal is affected by irreversible auditory trauma.

- **Behavioural effects:** Behavioural responses from marine mammals to seismic operations have been observed in some instances, primarily in baleen whales. However, the ecological consequences of such behavioural responses to underwater noise has not been determined (Southall et al., 2007 & 2012). This is due to the very variable range of identified behavioural responses: from no observable response, low ecological consequence responses (Increased alertness; vocal modifications, temporary avoidance behaviour, modification of group structure or activity state), to the very rare and particular cases where potentially significant effects have been observed, such as cessation of feeding or social interaction and or habitat abandonment. The Population Consequences of Acoustic Disturbance (PCAD) framework was developed by the US National Academies of Sciences National Resource Council in 2005 to evaluate how changes in behaviour caused by acoustic disturbance, may result in population effects by affecting the critical life functions of marine mammals. Its main premise is that basically, any form of disturbance, not just acoustic, could lead to population changes by reducing for example, the time mothers spent preparing their bodies to nurse a future pup by feeding at sea.

- **Auditory masking:** Auditory masking results from the spectral, temporal, and/or spatial overlap between a noise source and a marine mammal, whether a sender or receiver, and causes a reduction in the ability of the marine mammal to effectively communicate, detect predator, prey, and/or conspecific signals, and/or properly determine its spatial orientation. Auditory masking occurs when sound signals important to a marine mammal (e.g., sounds associated with echolocation, communication, and environmental sounds cues) are blocked or interfered with (Richardson et al., 1995).

Auditory trauma and Mortality

Both PTS and TTS[16] represent actual changes in the ability of an animal to hear, usually at a particular frequency, whereby it is less sensitive at one or more frequencies as a result of exposure to sound (Nowacek et al. 2007). Southall et al. (2007) proposed a dual criterion for assessing injury from noise based on the peak sound pressure level (SPL) and sound exposure level (SEL) (a measure of injury that incorporates the sound pressure level and duration), with the one that is exceeded first used as the operative injury criterion. For a pulsed sound source such as that generated during seismic surveys, the levels for PTS are 218 dB re 1µPa (peak) and 186 re 1µPa2-s for SPL and SEL respectively. There is thus a range at which permanent or temporary hearing damage might occur, although some hearing damage may already occur when received levels exceed 183dB re 1µPa2-s SEL. The latest NOAA (2018 criteria) makes a distinction among Otariid and Phocid pinnipeds (Caspian seal being the latter) with SPL levels being the same, but SEL levels 1 dB lower (i.e. 185 re 1µPa2-s).

The physiological effects of loud low frequency sounds on seals are not well documented, but include cochlear lesions following rapid rise time explosive blasts (Bohne et al. 1985; 1986, in McCauley 1994), temporary threshold shifts (TTS) following exposure to octave-band noise (frequencies ranged from 100Hz to 2 000Hz, octave-band exposure levels were approximately 60-75dB, while noise-exposure periods lasted a total of 20-22 min) with recovery to baseline threshold levels within 24 hours of noise exposure (Kastak et al. 1999).

Reichmuth et al. (2016) performed laboratory measurements in trained spotted (*Phoca largha*) and ringed seals (*Pusa hispida*); where they observed a lack of observed auditory responses at noise levels predicted to cause TTS, indicating that initial predictions based on extrapolations (e.g. from those of Southall et al., 2007) were sufficiently precautionary. The relatively low-magnitude behavioural responses observed during noise exposures indicated that individual animals can learn to tolerate loud, impulsive sounds, but do not imply that similar sounds would not elicit stronger behavioural responses in wild seal individuals. These findings suggest that the auditory systems of Arctic seals may be relatively resistant to impulse noise exposure at low frequencies. It is expected Caspian seals are less likely to be affected by the seismic noise, being highly mobile creatures, and thus they would be able to avoid severe sound sources at levels below those at which discomfort occurs but may still be subject to TTS effects.

[16] Temporary Threshold Shift (TTS) is also an effect of sound, but is considered auditory fatigue rather than an injury.

Behavioural Disturbance

The factors that affect the response of marine mammals to sounds in their environment include the sound level and other properties of the sound, the physical and behavioural state of the animal and its prevailing acoustic characteristics, and the ecological features of the environment in which the animal encounters the sound. The speed of sound increases with increasing temperature, salinity and pressure (Richardson et al. 1995) and stratification in the water column affects the rate of propagation loss of sounds produced by an airgun array. As sound travels, acoustic shadow and convergence zones may be generated as sound is refracted towards areas of slower sound speed. These can lead to areas of high and low noise intensity (shadow zones) so that exposure to different pulse components at distances of 1-13 km from the seismic source does not necessarily lessen (attenuate) with increasing range. In some cases this can lead to received levels at 12 km being as high as those at 2 km (Madsen et al. 2006). Depending on the propagation conditions of the water column, animals may need to move closer to the sound source or apply vertical rather than horizontal displacement to reduce their exposure, thus making overall avoidance of the sound source difficult. Although such movement may reduce received levels in the short-term it may prolong the overall exposure time and accumulated sound exposure level (SEL) (Madsen et al. 2006).

Information on the behavioural response of fur seals to seismic exploration noise is lacking (Richardson et al. 1995; Gordon et al. 2004). Reports of studies conducted with Harbour and Grey seals include initial startle reaction to airgun arrays, and range from partial avoidance of the area close to the vessel (within 150 m) (Harris et al. 2001) to fright response (dramatic reduction in heart rate), followed by a clear change in behaviour, with shorter erratic dives, rapid movement away from the noise source and a complete disruption of foraging behaviour (Gordon et al. 2004). In most cases, however, individuals quickly reverted back to normal behaviour once the seismic shooting ceased and did not appear to avoid the survey area.

Seals seem to show adaptive responses by moving away from airguns and reducing the risk of sustaining hearing damage. Potential for long-term habitat exclusion and foraging disruption over longer periods of exposure (i.e. during full-scale surveys conducted over extended periods) is however a concern. During seismic operations off southern California in 1995, California sea lions showed mixed reactions, some moving away from the source, others coming closer, while others showed no response (Arnold, 1996). Similar information was obtained during seismic operations in the Beaufort Sea in 1996 and 2001 (Harris et al., 2001).

Thompson et al. (1998) found a change in short-term behaviour of harbour seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*) exposed to noise from seismic sources. Harbour seals responded variably, some avoiding the seismic zone, whereas others showed no reaction even from a distance of 500 m from the sound source. As for grey seals, when they were exposed to a single seismic source of 10 cu in., they had an avoidance reaction, moving away from the sound source, swimming faster and/or making longer dives; with most observed individuals returning to the area after the seismic operations.

There are also reports of Cape fur seals approaching seismic survey operations and individuals biting hydrophone streamers (CSIR 1998). This may be related to their relative insensitivity to sound below 1 kHz and their tendency

to swim at or near the surface, exposing them to reduced sound levels. It has also been suggested that this attraction is a learned response to towed fishing gear being an available food supply

Masking of Environmental or Biological Sounds

Potential interference of seismic emissions with acoustic communication in cetaceans includes direct masking of the communication signal, temporary or permanent reduction in the hearing capability of the animal through exposure to high sound levels or limited communication due to behavioural changes in response to the seismic sound source. Masking can both reduce the range over which the signals can be heard and the quality of the signal's information (Weilgart et al. 2007). However, the length of seismic pulses increases with distance from the source, thereby increasing the potential to cause masking at range (Gordon et al. 2004). High frequency sound is released as a byproduct of airgun firing and this can extend into the mid- and high-frequency range (up to 22 kHz) and travelling up to at least 8 km (Goold and Fish 1998). Seals produce underwater sounds over a wide frequency range, including low frequency components.

Sensitivity of the Caspian Seal.

The only species of marine mammal present in the ADUA exploration area is the Caspian seal (*Pusa caspica*) which rely on sound for echolocation, detection of predators and prey, and communication within or between social groups.

Pinnipeds have functional hearing both above and below the water, although they have broader functional hearing ranges in water (Kastak and Schusterman, 1998). Southall et al. (2007) estimated functional hearing across all pinnipeds as extending between 75 Hz and 75 kHz under water and between 75 Hz and 30 kHz in air. However, they also noted that there appears to be a segregation in functional hearing within pinniped taxa, with phocids (seals lacking external ear pinnae that are less mobile on land, such as harbour seals and *Pusa caspica*) extending to much higher frequencies, especially in water, than otariids (lion seals and fur seals that have distinct external ear pinnae and are more agile on land). The most recent NOAA (2018) revised technical guidance made a distinction of pinnipeds into PW (Phocidae) and OW (Otariidae) hearing groups; based on a review of the literature, phocid species had consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range (Hemilä et al. 2006; Kastelein et al. 2009a; Reichmuth et al. 2013).

Seals produce underwater sounds over a wide frequency range, including low frequency components. Babushina (1997) provided audiogram data for the Caspian seal (0.5–20 kHz (behavioural, air) and 1–40 kHz (behavioural, water)). Sills et al. (2015) assessed that ringed seals (*Pusa hispidus*) possess hearing abilities comparable to those of spotted seals (*Phoca largha*) and harbor seals (*Phoca vitulina*); with best sensitivity being 49 dB re. 1 µPa (12.8 kHz) in water, and −12 dB re. 20 µPa (4.5 kHz) in air, rivalling the acute hearing abilities of some fully aquatic and terrestrial species in their respective media. Critical ratio measurements ranged from 14 dB at 0.1 kHz to 31 dB at 25.6 kHz, suggesting that ringed seals– can efficiently extract signals from background noise across a broad range of frequencies.

Typical sound source level for this seismic survey is expected to be of approximately 255 dB re 1 µPa 1m (peak), which exceed the sources levels required for hearing damage (PTS). Comparable seismic surveys undertaken in the Caspian Sea have used airgun arrays producing between 240-253 dB re 1 µPa 1m (peak) (e.g. BP SWAP 2D ESIA 2013; BP Shah-Deniz 3D ESIA 2015). Considering the 218 dB threshold the estimated distances at where PTS could occur was in the order of tens of metres (50-90 m). In case of accumulated sound levels (SEL), estimated distances varied on a range of 250-600 m.

Impact magnitude

Given the expected timeframe and location of the seismic survey (to start during July) the Caspian seal may likely be present during the prospective survey period, considering it is an active feeding period after the end of the spring migration. The estimated number of seals that may be present in the Absheron peninsula and eastern offshore waters may peak at 2-3 thousand individuals from June to September.

The potential impact of physiological injury as a result of exposure to high-amplitude seismic sounds is deemed to be limited/localised to the immediate vicinity of the operating airguns within the survey area. As mentioned previously, existing noise modelling on comparable operational scenarios have indicated that the noise levels produced during the proposed seismic survey will not exceed injury criteria beyond 100 m of the airgun itself.

In terms of behavioural effects, due to acoustic exposure, as explained previously, they are generally more variable, context -dependent and less predictable than the effects of noise exposure on hearing or physiology. This is because behavioural responses to anthropogenic sound are dependent upon operational and environmental variables, and on the physiological, sensory and psychological characteristics of exposed animals. It is important to note that the animal variables may differ (considerably in some cases) among individuals, of a species and even within individuals depending on various factors (e.g. sex, age, previous history of exposure, season, and animal activity). The survey location is deemed to overlap with the wide spring-autumn migration route (along east coast and central Caspian), where feeding groups of Caspian seals are expected to be found, and behavioural avoidance of seismic noise in the proposed survey area is expected to be likely.

The potential impact of physiological injury to seals from seismic noise is deemed to be low and would be limited to the survey area, although the sounds would be audible beyond the survey area, causing any sort of behavioural reactions. As with other vertebrates, the assessment of indirect effects of seismic surveys on Caspian seal is limited by the complexity of trophic pathways in the marine environment. The impacts are difficult to determine and would depend on the diet make-up of the species (and the flexibility of the diet), and the effect of seismic surveys on the diet species. The broad ranges of fish prey species (in relation to the avoidance patterns of seismic surveys of such prey species) and the foraging ranges of Caspian seals suggest that indirect impacts due to effects on predators or prey would be low.

The Caspian seal is considered a sensitive species given its conservation status, it is estimated that approximately some 2-3 thousand individuals may be present along the Absheron peninsula coastal waters and eastern offshore

surroundings; thus the receptor sensitivity is considered medium. Given the impact magnitude discussed above, the species is expected to be relatively highly sensitive to underwater noise (but significantly less compared to that of cetaceans).

Mitigation measures

In order to avoid potential effects on marine mammals, adherence to the mitigation measures set out in the UK-JNCC (Joint Nature Conservation Committee) 2017 Guidelines for minimising the risk of injury to marine mammals from geophysical surveys will be undertaken. These guidelines are the most commonly adopted by operators in regions without statutory guidelines

Important operational procedures from this guideline are as follows:

- The order of the 2D acquisition and 3D acquisition will be decided once vessel availability is confirmed, taking into account technical, logistical and environmental considerations to ensure minimal impact on the environment (i.e. avoidance of sensitive Caspian seal feeding/resting areas adjacent to the coast to the extent possible).
- Implementation of the Joint Nature Conservation Commission (JNCC), guidelines (see details below).
- Irrespective of Caspian Seal migrating/feeding seasons and/or sensitive areas, and their relation to the survey timing/location, Statoil Azerbaijan will implement a “shutdown procedure” should seals be detected within 500 m radius mitigation zone around the seismic source.
- Use of a dedicated Marine Mammal Observer (MMO) aboard the survey vessel. The MMO’s role will be:
    - To provide advice on the application of the JNCC Guidelines;
    - To monitor adherence to the Guidelines during seismic source operations;
    - To keep watch for Caspian Seals during daylight/night hours; and
    - To record and report sightings.
- MMO will be provided with special field equipment for distance measurement to seals and automated logging of position and distance and with devices allowing observations at night.
- Visual monitoring (Pre-shooting): at least 30 minutes before commencement of any use of the seismic sources, MMO’s will make a visual check to see if there are any marine mammals within 500 meters (mitigation zone). If marine mammals are present, the start of the seismic sources should be delayed until they have moved away, allowing adequate time after the last sighting (at least 20 minutes for marine mammals to move well out of range).
- Use of “soft-start” procedures: seismic operators are advised to increase the power to seismic sources over a 20 minute period and not exceeding 40 minutes. This is typically done by first turning on the

smallest seismic source and then progressively adding additional sources until the whole array is operational, even if no marine mammals have been seen (particularly at night).

Descriptors and residual impact

Impact descriptors for marine mammals

Type	Duration	Frequency	Extent	Magnitude	Sensitivity	Significance
Direct	Temporary	Often	Local	SMALL	MEDIUM	**Negligible to Minor**

It is widely accepted that mammals are able to avoid either the vessel or an operating seismic array because of their swimming abilities. In light of the proposed mitigation measures being the combined implementation of soft-start, mitigation zone and shutdown procedure, it is considered unlikely that marine mammals will be exposed to levels that may lead to pathological or significant permanent auditory disruption. Most likely effects expected are related to Temporary Threshold shifts (TTS) and potential behavioral effects; which may be experienced at varying distances from the airgun source, thus the potential impact for these effects is considered to range between **Negligible to Minor.**

5.5.2.5 SB1: Impacts on seabirds due to the generation of noise emissions during seismic acquisition activities

There are no documented observations of injuries/mortalities on seabirds related to seismic source operations. Research on the effects of seismic sources on marine birds is very limited. Stemp (1985) made some opportunistic observations on the effects of seismic acquisition in marine birds, with no conclusion on whether seismic activities affected the distribution or abundance of marine birds. Lacroix et al. (2003) investigated the effects of seismic activities on long tailed ducks in Alaska's northern slope, where aerial and radio tracking sampling techniques indicated that the proportion of ducks that remained close to the survey area was not affected by the seismic operations, furthermore, no significant change in diving behaviour was found during airgun operations.

Marine birds that may be at relatively increased risk are those that dive for food (either plunge divers or surface divers) though most of their time is spent in the air and resting on the water surface. These species would likely be unaffected by the seismic pressure waves generated below the surface (considering the seismic sources will be close to 7 m underwater). Local distribution of species that forage on pelagic fish species may be indirectly

affected if prey species are redistributed out of the area due to behavioural avoidance of the disturbance, but such potential impacts are expected to be temporary and not significant.

Descriptors and residual impact

Impact descriptors for seabirds

Type	Duration	Frequency	Extent	Magnitude	Sensitivity	Significance
Direct	Temporary	Rare	Local	NEGLIGIBLE	LOW	**Negligible**

The potential impact of the seismic surveys on pelagic bird species is therefore expected to be **negligible.** No mitigation measures are recommended for seabirds.

5.5.3 FA1: Impacts on marine fauna due to the change of seawater quality due to discharge of effluents and waste

The discharge of effluents from seismic fleet may lead to temporary changes on the distribution of fish species due to opportunistic feeders being attracted to organic discharges as a potential source of food. Any change derived from this is considered to be small and within natural variation given the limited amount of the organic content introduced and the expected absence of significant changes in planktonic communities. Other effects on fish could be related to toxicity from the depletion of oxygen as the biological demand increases, from the residual chlorine content from black waters or from any hydrocarbon content from treated deck drainage and bilge waters.

However, given the mitigation and control measures for discharges, the relatively small volumes discharged, their rapid dilution and dispersion in the marine environment (leading to predicted significance of negligible impacts on water quality), and the ability of mobile fish/mammal species to avoid polluted waters, the impact is considered **Negligible**.

5.5.3.1 *Descriptors and residual impact*

Impact descriptors for waste on marine fauna

Type	Duration	Frequency	Extent	Magnitude	Sensitivity	Significance
Direct	Temporary	Occasional	Local	SMALL	LOW	**Negligible**

Resulting impacts on marine water quality and marine flora will be negligible. Similarly, impacts on marine fauna are likely to be **negligible.**

5.5.4 *M2: Impacts on marine mammals linked to the physical presence of the seismic fleet and towed equipment*

In addition to the impacts linked to underwater noise emissions (see Section 5.5.2), the physical presence of the vessels and towed equipment can have potential impacts on the Caspian seal.

Impacts related to physical presence are expected to occur primarily in the offshore environment. It is anticipated that activities will last for approximately 45 days and will involve the seismic vessels, towed equipment and guard/support vessels. Support vessels will be involved in the ship-to-shore transfer of waste/supplies/crew, extending the impact into the near-shore and coastal environment.

The potential behavioural modifications exhibited by marine mammals that are close to physical structures in or near their habitat may include:

- Movement away from the area.
- Avoidance of the area and/or obstruction of normal movement patterns.
- Mother/pup separation.
- Interrupted feeding.

Given the broad movement ranges and mobility of the Caspian seals, it is expected that they may be somewhat habituated to the presence of vessels. In addition, with the mitigation measures applied by the Project disturbance to Caspian seals is not expected to be significant.

The movement of vessels implies also an increased risk of collision. The consequence of a vessel collision with a seal may range from minor disturbance or injury to a worst case of fatality. This risk is considered limited given the relatively low volume of Project related traffic and the speed that Project vessels are expected to move at (typically less than 5 knots), though supply vessel may move faster (e.g. 10-14 knots) while in transit to/from survey area

during resupply operations. In fact, both behavioural effects and risk of collisions are usually most profound in the case of small fast-moving vessels which frequently change direction, in contrast to the large and relatively slow moving seismic/support vessels associated to the Project. CarbonNet (2017) indicated that vessel interaction reports during the period for either the Australian or New Zealand fur seal. There have been incidents of seals being injured by boat propellers, however all indications are rather than 'boat strike' these can be attributed to be the seal interacting/playing with a boat, with a number of experts indicating the incidence of boat strike for seals is very low.

5.5.4.1 Mitigation measures

Measures to be implemented by the Project to mitigate disturbance impacts and reduce the risk of Project vessels collision with marine mammals include:

- Seismic vessel operator should maintain a visual monitoring of marine mammals during day/night to reduce the risk of collision;
- Guard vessel travelling in association with the seismic vessel will assist in visual observations if practical;
- Support vessel will maintain a watch for marine mammals during its transit to and from the survey area; and
- Support vessel travelling to and from port will observe slow speeds (<14 knots).

5.5.4.2 Descriptors and Residual impact

Impact descriptors for physical presence of vessels

Type	Duration	Frequency	Extent	Magnitude	Sensitivity	Significance
Direct	Temporary	Often	Local	SMALL	MEDIUM	**Minor**

Given the expected timeframe and location of the seismic survey (starting during July) the Caspian seal is likely to be present during the prospective survey period, though in reduced numbers. Considering that potentially present seals may be exhausted from migration and actively searching for food in the area, the potential impact from a vessel/seismic equipment strike may be probable but will be reduced through the avoidance of seal feeding/resting areas adjacent to the coast to the extent possible, hence impact magnitude is assessed as small. Overall, the receptor sensitivity is considered medium and the significance of the impact is thus assessed as **Minor.**

5.5.5 IL11: Impacts on fauna due to artificial lighting.

The presence and movement of the seismic fleet in the Project may have behavioural impacts on marine fauna, causing them to avoid or to be attracted to the area. This impact will occur primarily in the offshore environment, but may extend to the near shore and coastal environment due to the movements of the support vessel involved.

In particular, there may be impacts on pelagic fish species which are known to be attracted by light (Castro Hernández, 1991); Kilka fisheries in the southern Caspian use a funnel net with light during night-time hours to attract fish (Kideys, 2001). Therefore, nocturnal activity that includes lightning may attract shoals of these species towards the vessels if they are stationary or very slow moving. This attraction effect also applies to seabirds.

Birds typically migrate at night and are attracted to artificial light during their migrations. Nocturnally migrating birds have been known to die or deplete their energy reserves during migration as a result of encountering artificial light sources (Poot, 2008). The level of impact, however, is dependent on the location of offshore lighting, time of year, and weather conditions. For example, birds tend to be attracted to offshore lighting during poor weather, i.e. overcast nights (OSPAR 2009b).

Light emissions from the vessels involved in the Project during the night may be visible at considerable distances, depending on weather and sea conditions. Birds that are attracted to the light will expend energy reaching the vessels, but this will only cause a small increase in overall energy expenditure to the individual. As this type of behaviour is usually seen during nights with fog and/or >80% cloud cover (Van de Laar, 2007) the frequency and duration of periods when this impact may occur may be significant.

Supply vessels passing through and near coastal areas may disturb individual or groups of birds in sensitive coastal habitats such as stopover areas where feeding, resting and breeding takes place. The “Shahdidi spit” important bird and biodiversity area (IBA), is located about 15 km from the western boundaries of the ADUA exploration area and has a considerable number of seabird trigger species. It is expected birds may be found in small numbers as they cross the area and, in some cases, may be attracted by vessels and offshore infrastructures such as platforms as these are often attracting fish as well.

5.5.5.1 Descriptors and Residual impact

Impact descriptors for artificial lighting

Type	Duration	Frequency	Extent	Magnitude	Sensitivity	Significance
Direct	Temporary	Often	Local	NEGLIGIBLE	MEDIUM	**Negligible**

The sensitivity of the seabirds is considered to be medium. The magnitude of the impact on the seabirds is considered to be negligible, taking into account that the disturbance will be very localised, only affecting a small number of birds offshore, and will be short term, occurring periodically throughout the Project. The resulting impact significance is considered to be **negligible.**

5.5.6 PA1: Impacts on sensitive coastal areas due to the support operation from coastal facilities

Support operations (supply vessel/ helicopter transport) to Project will be conducted from an existing shore base in Baku. Base location is still to be determined but no base construction activity is planned.

The closest protected area is the Absheron National Park, which is located some 22.7 km to the west from the ADUA exploration area boundaries. Likewise, the Absheron archipelago and Pirallahi bay IBA Shadidi spit IBAs, though not officially protected are located about 6.5 and 15 km from the ADUA exploration area respectively. The main sensitivity of these internationally recognised areas are the avifauna, thus prospective helicopter flight paths routes will be defined in accordance with relevant authorities to avoid to the extent possible sensitive areas where birds are known to aggregate. Other project impacts on birds have been discussed in the lighting impact section (Section 5.5.5).

5.5.6.1 Descriptors and Residual impact

Impact descriptors for protected areas

Type	Duration	Frequency	Extent	Magnitude	Sensitivity	Significance
Indirect	Temporary	One-off	Local	NEGLIGIBLE	MEDIUM	**Negligible**

Considering that the Project will not exert any significant impact on the biodiversity values for which the protected areas where designated the impact is assessed as **negligible**.

5.5.7 FS1: Impacts on Fisheries due to the presence and operation of the seismic fleet

Project activities that may result in potential impacts of significance on commercial fishing include:

- Physical presence and movement of Project vessels and the towed array;
- Unplanned events (discussed in Section 5.8).

The potential effect of the proposed activities related to disruption of offshore fishing activities due to the passage of the vessels and seismic array involved in the seismic surveys include:

- Temporary disruption or loss of access to fishing grounds;
- Temporary fishery stock displacement; and
- Risk of interference of the array with industrial fishing.

Artisanal fishing is restricted to coastal areas (and at no more than 25 m depth), and thus may have limited impact by the operations. Commercial fishing is known to extend mainly in the offshore, several kilometres from the shoreline, where target species (mainly pelagic fish) are found.

Following the deployment of equipment, a safety awareness zone will be established around the survey vessel and the towed array. The safety awareness zone will apply to fishing vessels that may be in the area and it therefore has the potential to temporarily prevent them from reaching fishing grounds should they occur within the survey area. In this instance, fishing vessels would have to move to other areas with potential implications on fishing effort and success. This could lead to lost fishing time for any displaced fishing vessels.

The closest important area for the fishing industry is named Oil rocks and is located about 9 km south of the ADUA exploration area boundaries. Fishing fleet interaction may span from vessel/vessel interactions, as well as interaction with fishing gear. In terms of fishery activities, increased vessel traffic as a result of Project development increases the risk of maritime accidents involving commercial fishing. Considering that seismic fleet movements will be continuous; a safety awareness area of 500 m around the seismic vessel and equipment will be established for safety and security reasons.

5.5.7.1 Descriptors and Residual impact

Impact descriptors for artificial lighting

Type	Duration	Frequency	Extent	Magnitude	Sensitivity	Significance
Direct	Temporary	Often	Local	MEDIUM	LOW	**Minor**

Considering the location of the survey, it is expected that artisanal/commercial fishing vessels have the potential to occur on the Project area thus receptor sensitivity is considered medium, on the other hand the magnitude of the impact is considered to be low given the limited length of the project (45 days). The significance of the impact if thus assessed as **Minor.**

5.5.8 FS2: Impacts on Fisheries due to the generation of noise emissions during the seismic survey activities

Any Project-related reduction in the fish stock in the area as a result of Project activities is considered very unlikely, though temporary displacement of pelagic shoals may occur in the vicinity of the seismic source. The main area of potential impact is generally related to interactions with fishing and shipping boats, including

entanglement with streamers. This is the area of focus for mitigation. In summary, the Project is unlikely to significantly affect fishing activities in the wider Project area. This impact is linked to impact F1 on fish, considered of **Negligible** importance (see Section 5.5.2).

5.5.9 NT1: Impacts on Navigation, Traffic and Sea users

The movement of the vessels involved in the seismic survey activities will increase maritime traffic in the area, which could increase the risk of collision between vessels. The presence of the survey vessel may also potentially interfere with shipping and navigation, due to the presence of its 500 m safety awareness zone.

Maritime transport plays a significant role in the economic development and prosperity of Azerbaijan and Baku is the biggest seaport in the Caspian Sea. The ADUA exploration area is located in an area of intense maritime traffic due to the connection routes between Azerbaijan and neighbouring countries (especially Turkmenistan). The intense maritime traffic is mainly linked to oil and gas vessels, but also to fishing boats, commercial trade and ferry services/ passenger. Potential disruption or interference with these all these sea users may occur during project activities.

During the Project, movements of the survey fleet will span a major part of the ADUA exploration area. The potential impacts on other sea users are expected to be limited, given the short duration of the Project (45 days) and the limited number of vessels compared to the existing cumulative traffic conditions. To reduce the potential for this impact, the following mitigation measures will be implemented:

- Notification to relevant marine authorities and advanced notice to mariners prior to commencement of the seismic survey program including notification of the establishment of the safety zone.
- Vessels will use designated and relevant navigation channels where applicable and comply with designated safety zones.
- Navigational marks and lights on the project vessels.
- Safety awareness zone will be monitored for the safety of the facility and other users of the area.
- Ensure that vessels are equipped with collision risk reducing devices i.e. navigational lights and beacons, marker buoys, etc.

5.5.9.1 Descriptors and Residual impact

Impact descriptors for maritime navigation

Type	Duration	Frequenc	Extent	Magnitude	Sensitivity	Significance
Direct	Temporary	Often	Local	SMALL	MEDIUM	**Minor**

Considering the maritime traffic intensity in the Project area, the relative mobility of the survey vessels and the temporary duration of the Project (45 days) together with the mitigation measures described, the potential Project impacts to maritime traffic during the survey are assessed as **Minor.**

5.6 Summary of Impacts from Routine Events

The evaluation of impacts associated with routine events is presented in Table 5.8.

Table 5.8 Evaluation of the Significance of Potential Environmental Impacts associated with the ADUA exploration area seismic survey activities (Routine Activities)

Receptor	Project activity	Impact Description	Mitigation and Control Measures	Residual impact
Air Quality and Climate Change	Routine seismic, guard and support vessel operations	Potential reduction in localised air quality and contribution to greenhouse gases	• Advanced planning to ensure efficient operations, including the planning of vessels trip to acquire supplies; • Ensure vessels have valid Engine International Air Pollution Prevention Certificate in place (marine diesel engines >130kW). • Appropriate maintenance policies and procedures of equipment and generators will be followed, and its implementation audited by an Equinor representative; • Regular monitoring of fuel consumption; • Engines and equipment will be switched off when not in use; • Use of low-sulphur marine fuel where possible; and Compliance with Tier II of revised MARPOL 73/78 Annex VI which sets limits on sulphur dioxide and nitrogen oxide emissions from ship exhausts and prohibits deliberate emissions of ozone depleting substances.	**Negligible**
Seawater Quality	Routine and operational discharges during the project (i.e. black and grey water, bilge water, ballast, etc.).	Potential localised reduction in water quality, including increased turbidity and BOD Potential introduction of alien invasive species from ballast water discharges	• The vessels will be equipped with a sewage treatment unit compliant with MARPOL Annex IV regulations, with International Sewage Pollution Prevention Certificate (“ISPPC “); • Discharges will comply with MARPOL Annex IV and the Azerbaijani law; • Bilge and drainage water will be contained onboard and transported to shore for disposal; • Maintenance of an Oil Record book and a vessel’s logbook. • All Ballasting activities will comply with the International Convention for the Control and Management of Ship’s Ballast Waste and Sediments (BWM Convention), including:	**Negligible**

Receptor	Project activity	Impact Description	Mitigation and Control Measures	Residual impact
			○ all ballast water will be stored in specifically designated tanks to avoid cross contamination and remain free of oil; ○ ballast water discharges will be continuously monitored for oil sheen and in case of visibly oil contaminated ballast water discharges will be stopped; ○ ballast water exchange will take place at least 200 nautical miles from nearest land and at depths over 200 m; ○ any ballasting operations will be logged in a record book; and ○ the vessels will have a Ballast Water Management Plan (BWMP) in place. • Food waste discharges will comply with MARPOL Annex V requirements (discharges of comminuted waste always more than 3 nm from the coast and while navigating).	
Seabed and Benthic communities	Seismic survey operations	Generation of noise emissions	No measures required.	**Negligible**
Plankton	Routine and operational discharges during the project (organic liquid/solid discharges)	Potential localised increase in organic matter and reduction in water quality	Applicable embedded measures related to water quality will apply.	**Negligible**
Fish	Seismic survey operations and routine discharges	Impacts due to the generation of noise emissions Secondary impacts due to changes in water quality	• Applicable embedded measures related to Noise generation will apply (see summary of impacts on marine mammals); • Applicable embedded measures related to water quality will apply	**Negligible**

Receptor	Project activity	Impact Description	Mitigation and Control Measures	Residual impact
Marine Mammals	Physical presence of the vessels and seismic equipment Seismic survey activities	Disturbance from the presence of Project vessels and equipment; Potential collision risk with Project vessels and/or equipment; Impacts due to the generation of underwater noise emissions Secondary impacts due to changes in water quality	Embedded measures related to Noise generation: • Implementation of soft start or ramp up procedure, a 500m mitigation zone and have on-board a Marine Mammal Observer with specialized equipment as recommended by the Joint Nature Conservation Committee (JNCC, 2017) guidelines, during seismic survey activities. • Implementation of an airgun shutdown procedure, should seals be detected within the above described 500 m mitigation zone. • Good maintenance procedures on vessel engines. • The order of the 2D acquisition and 3D acquisition will be decided once vessel availability is confirmed, taking into account technical, logistical and environmental considerations to ensure minimal impact on the environment. Measures related to rest of impacts: • Vessels will use designated and relevant speed and wake restrictions where possible.	**Negligible to Minor** (physical presence, risk of collision and noise generated by seismic equipment) **Negligible** (secondary impacts due to changes in seawater quality)

Receptor	Project activity	Impact Description	Mitigation and Control Measures	Residual impact
			• A Marine Mammal Observer on-board the seismic/guard vessel will maintain watch for Caspian seal. • Supply vessel operators should maintain a watch for marine mammals, and take avoidance action if a collision seems likely, if safe to do so; • Statoil Azerbaijan will limit the transit of supply vessels in coastal waters at night hours to the extent possible, and in case this is not possible, speeds at coastal waters will be reduced at night-time; • Documentation and sharing of relevant and applicable marine environmental data and opportunistic sightings of marine fauna. • Vessels will not be allowed to intentionally approach marine fauna, such as Caspian seals, and, where practicable, will alter course or reduce speed to further limit the potential for disturbance. • Maintain a record of Caspian seals observed during the seismic survey to gain a better understanding of their presence in the area. Applicable embedded measures related to water quality will apply.	
Seabirds	Operation of Project vessels	Disturbance from the presence and movements of Project vessels. Secondary impacts due to changes in water quality	• Project vessels to avoid sailing through areas with large aggregations of seabirds where possible. • Applicable embedded measures related to water quality will apply.	**Negligible** (physical presence and secondary impacts due to changes in seawater quality)

Receptor	Project activity	Impact Description	Mitigation and Control Measures	Residual impact
Sensitive coastal areas	Operation of Project vessels	Potential disturbance to sensitive coastal areas	• Applicable embedded measures related to water quality will apply. • Should helicopter operations be required, the flight paths routes will be defined in accordance with relevant authorities and avoiding, to the extent possible, sensitive coastal areas and islands around the Absheron peninsula.	**Negligible**
Navigation, Traffic and Sea user	Project vessels movements	Impacts to maritime traffic Increase of collision risk	• A safety awareness zone of 500 m around the seismic vessel and equipment will be enforced to ensure safety distance with other sea users such as fishing boats. • Notification to relevant marine authorities and advanced notice to mariners prior to commencement of the seismic survey program including notification of the establishment of the safety awareness zone; • Vessels will use designated and relevant navigation channels where applicable and comply with designated awareness zones; • Navigational marks and lights on the seismic/guard/supply vessel; • Ensure that vessels are equipped with collision risk reducing devices i.e. navigational lights and beacons, marker buoys, etc.	**Minor**
Fisheries	Physical presence and operation of Project vessels Seismic survey activities	Impacts due to the presence of seismic vessel and equipment and associated safety area Impacts due to the generation of underwater noise emissions	• Each project vessel will have an individual (Azeri and English -speaker) who will be able to communicate with any fishing vessels or other navigators that are	**Negligible** (presence of Project vessels) **Negligible** (impacts from underwater noise and from water

Receptor	Project activity	Impact Description	Mitigation and Control Measures	Residual impact
		Secondary impacts due to changes in water quality	present in the vicinity of the safety awareness zone around the survey vessel, ensuring that such vessels are able to alter their course in complete safety; • Applicable embedded measures related to Noise generation will apply (see summary of impacts on marine mammals); • Applicable embedded measures related to water quality will apply; • Compliance with MARPOL requirements and good industry practice; and • Operational controls contained in Waste Management Plan. • Mitigation measures are expected to be the same as those described for water quality (see Impact W1). • To reduce impacts to commercially exploited species derived from physical presence of project vessels and light emissions, the Project will control and reduce overall light intensity to the extent practicable, without adversely affecting maritime or operational safety. • Notify relevant authorities, fishing associations and industrial fishermen of seismic survey activities, dates, location, and safety awareness zone. • Ensure procedures are in place for dealing with claims in the event of damaged fishing gear.	quality changes)

5.7 Cumulative Impacts

Cumulative impacts are the result of the combined effect of a number of individual impacts, which may be of no significance when on the scale of a single occurrence.

The potential for the Project to have cumulative impacts with other activities and with known or committed developments taking place in the area at the same time has been considered. This Section presents the assessment of the cumulative impact risk associated with the main receptors studied in the previous sections.

Activities in the vicinity of the ADUA exploration area have the potential to cause cumulative impacts. The activities considered in assessing offshore cumulative impacts may include:

- The oil and gas exploration activities in the vicinity of the ADUA exploration area; and
- The shipping and fishing related traffic in the ADUA area.

5.7.1 Interference with shipping and navigation of other sea users

The vessels taking part in the Project activities will increase shipping traffic in the area, which could increase the risk of collision between vessels. Though no other similar seismic projects are envisaged to occur simultaneously in the area, considerable O&G related traffic is expected. However, the limited number of vessels involved in the survey (up to 4 vessels), the limited duration of the Project and the relatively low density of shipping traffic in the area is not expected to result in a significant increase in the shipping activity in the area and therefore the impact due to the interference with other sea users will remain as Minor. No particular mitigation measures in addition to those already reflected in Section 5.5.9 are required.

5.7.2 Noise disturbance to marine fauna

Cumulative impacts linked to submarine engine noise generated by other sea users together with the one generated by Project seismic activities could potentially be significant if there was a large amount of shipping traffic in the Project area, or if multiple seismic acquisition surveys were taking place in neighbouring blocks/areas over the same period.

To reduce cumulative impacts of anthropogenic sound from seismic vessels and related impacts on marine mammals, the industry accepted best practice is to have a 40 km separation distance between simultaneously operating deep penetration seismic surveys to limit the creation of large areas with high noise levels at the same time (BOEM, 2012).

For the current Project, no seismic surveys are known to be planned in nearby Blocks at the same time. Seismic surveys in Blocks D230 and ACG field, north and southeast of the ADUA exploration area respectively are

envisaged to be developed after the present survey so there is no requirement to have a minimum distance of 40 km between different survey vessels to minimise potential cumulative noise impacts.

In addition, with the safety awareness zone in place around the seismic vessel and streamers, the interaction of underwater noise with those noises generated by other vessels is unlikely to result in significant cumulative impact because of the transitory and temporary nature of the other various activities. Impact descriptors for cumulative impact (noise disturbance). As a result, cumulative impacts from noise disturbance are considered to be **negligible**.

5.7.3 Atmospheric emissions

Atmospheric emissions result from the combustion of diesel fuel by the various vessels taking part in the Project. Taken cumulatively, these emissions are small, intermittent and localised and are not expected to constitute any significant deterioration of the air quality in the Project area (see Section 5.4.1). Other possible contributors to air emissions are the other vessels crossing the area, especially those related to O&G activities. However, the cumulative impact of emissions generated by all shipping traffic in the area should not lead to any significant deterioration of the air quality, though there may be potentially localized exceedances in areas where traffic is most intense; and no particular mitigation or management measures (beyond those already in place for Project activities detailed in previous sections i.e. Section 5.4.1) are required to address this cumulative impact which is assessed as **negligible**.

5.7.4 Waste generation and effluent discharge

The Project's waste generation (including both liquid and solid waste, whether hazardous or not) will be localised, of small scale, and limited in time. No other significant waste generators have been identified in the vicinity of the Project area and the cumulative impacts linked to the generation and management of waste by other sea users is considered to be **negligible**.

5.8 Accidental Events: Oil Spills

Accidental events occur under abnormal operations and present non-routine and unplanned environmental risks. Prevention is the primary emphasis in any discussion of the potential environmental impacts of accidental events and it is important to consider the likelihood of an event as a key factor.

The key potential accidental events that may occur include a loss of part or the entire vessel fuel inventory to sea as a consequence of re-fuelling activities, loss of containment on-board or a vessel collision. Nonetheless, the most likely situation may be an accidental spillage as a result of a leaking hydraulic hose, leaking oil drums, etc. Such spills are either entirely contained on the vessel, or if they do reach the sea, are typically less than 50 litres.

The largest possible spill would be a consequence of an unforeseen loss of part or the entire vessel fuel inventory following rupture of the vessel's tanks, in the very unlikely event of a failure of the vessel fuel tanks (i.e. complete rupture). The maximum spill size possible could be, therefore, of several hundred tonnes, which is the current case for the 1500 m^3 fuel storage capacity of the seismic vessel.

Spills from these sources are extremely rare due to the navigational systems on-board, and the environmental procedures in place on the vessels. In addition, valves connecting the fuel tanks would minimise the amount of material lost if one of the tanks was ruptured.

The seismic vessel will mainly use Diesel (MGO), a light petroleum distillate. In the open waters where the proposed surveys will be carried out, spilled fuel, after creating a slick on the water surface, would be subject to rapid dispersion, weathering, evaporative losses and dilution in the water column. It is estimated that within 24 hours more than 90% of a diesel spill would be dispersed or have evaporated. Consequently, diesel slicks are likely to break up and disperse in a short period of time.

It undergoes dispersion and evaporation in the marine environment when subjected to wave action, winds, currents; and photo-oxidation and bio degradation form light, and bacteria. The remaining material can then be recovered according the ship SOPEP. However, a larger spill has the potential to affect fish, seabirds and marine mammals. If this were to occur close to shore, coastal habitats and communities could also be affected.

The potential hydrocarbon type spills could have a detrimental effect on water quality, marine flora and fauna including plankton, benthic invertebrates, fish, seabirds and marine mammals that may come into direct contact with an area of a spill. The potential impacts arising from hydrocarbon pollution on fauna are presented below.

5.8.1 Impacts on Plankton

Conclusive effects of oil spills are difficult to evaluate due to the natural variability and high turnover of plankton communities. Many studies of oil spills have not demonstrated any major effects on phytoplankton.

Abundance of phytoplankton may increase after an oil spill due to increased nutrient availability; Tkalich et al. (1999) documented blooms of certain kinds of phytoplankton species at low concentrations of oil under suitable conditions. Oil spills may however lead to lethal and sub -lethal effects on fish larvae and juveniles due to toxicity in the water column, and therefore can affect the food chain of other fish species.

The effect of an oil spill on plankton is dependent on the structure of the plankton community, the natural environmental conditions e.g. sea temperature, and relationships between plankton types that may conceal contaminant effects.

5.8.2 Impacts on Birds

Seabirds rafting on the surface of the water are vulnerable to the effects of a hydrocarbon spill as the oil clings to their feathers thereby reducing the insulating properties of their plumage which may subsequently lead to hypothermia and possibly eventually mortality. Birds are also vulnerable to the toxic effects of hydrocarbons through ingestion of contaminated prey.

Seabird population is highest in the coastal and near shore Azerbaijani waters, offshore species can potentially be present in the seismic survey area feeding on fish and other marine fauna, considering the proximity of the ADUA area to the coast they can be impacted in the event of a large oil spill, though the number of birds affected would be expected to be small because of the short time the oil is on the water surface

5.8.3 Impacts on Fish

There is evidence that fish have the ability to detect oil contaminated waters through olfactory (smell) or gustatory (taste) systems (DCENR, 2011) and therefore avoid them. This may however disrupt migration or spawning corridors for some fish species by altering their routes through avoiding contaminated areas. Evidence suggests that juveniles and larvae are more susceptible to oil spills as they often lack the ability to actively move away from the spill (DCENR, 2011). However, as spawning and nursery grounds are predominantly located closer to the coast where major rivers reach the sea (e.g. Kural river south of the Absheron peninsula), it is not anticipated that an offshore diesel spill would significantly impact fish populations on a wider scale.

5.8.4 Impacts on Marine Mammals

Marine mammals are generally less sensitive to oil spills than seabirds as they will tend to avoid and move away from affected areas and avoid any breaching or feeding behaviours, thus reducing direct physiological impacts, and returning as the environment recovers. However, marine mammals are still sensitive to impacts from oil spills, and in particular from the hydrocarbons and chemicals that evaporate from the oil, particularly in the first days following a spill event. Fumes from diesel can be inhaled by seals affecting their respiratory system, gut, cornea and mucus membranes and if absorbed can cause liver, kidney and brain damage. In this context, acute narcotic effects could be therefore caused by sustained exposure to dissolved compounds, especially the soluble aromatics. Dilution and biodegradation will typically reduce these concentrations to sub-lethal levels within days. However, even at sub-lethal levels, impacts may occur due to chronic impacts from prolonged exposure to these dissolved concentrations.

5.8.5 Impacts on Socio-economic Activities

Spills can cause direct damage to fishing resources through toxic effects and tainting, and by disrupting normal fishing activities (e.g. fouling of nets, vessels). Direct economic losses to the fishing industry due to a hydrocarbon

spill can be significant and have both long-term and short-term effects. Hydrocarbon spills can have four main impacts on fisheries resources and fishing activity.

- Direct mortality of fish stocks.
- Exclusion from the fishing grounds.
- Fouling of fishing gear.
- Potential decline in market value due to concerns about tainting.

A large oil spill can adversely affect the fishing industry through the creation of exclusion zones around the pollution source, thus limiting the access of fishing vessels. Fishing would likely resume days after the spill; however, there may be a potential decline in market value due to concerns about tainting. In a worst-case scenario, a relatively large area of the coastline and sea may be affected.

5.8.6 Proposed mitigations measures

Section 5.5.9 has described measures related to avoidance of collisions between vessels that may lead to loss of fuel. Project vessels will have in place Shipboard Oil Pollution and Emergency Plans (SOPEPs). MARPOL requires vessels to have a system in place that deals with any actual or probable discharge of oil spilled into the marine environment. The SOPEP contains the necessary reporting procedures, actions required to control discharge, and the steps necessary to initiate an external response for any oil- related discharges, or in the case of a maritime accident / collision that results in an oil spill. The existing SOPEP on board contracted vessels (seismic, guard and supply vessels) will be reviewed.

Mitigation measures include:

- Ensure all vessels meet international requirements through contract requirements, and audit the vessels prior to the beginning of the seismic survey;
- All vessels engaged on the survey will maintain an Oil Record Book as required under MARPOL 73/78;
- Oil and grease will be stored in designated containment areas on board the survey vessel and no oily discharges will be allowed;
- Lube and hydraulic oil will be stored in tanks or sealed drums to reduce risk of spillage. These drums or tanks will be well secured in bunded areas, all of which will be properly maintained and inspected;
- A guard vessel will be patrolling the area to detect and to alert other vessels in the area so as to maintain the integrity of the safety awareness zone around the seismic survey vessel and therefore protect the towed array from any entanglement or rupture;
- Availability of sufficient spill response equipment on the vessels, approved containers for storage and shipment of spill wastes, disposable bags, gloves/goggles etc. as per international standards and practices

- Sorbent materials will be used to clean up any minor spill on board the survey vessel upon observation. Stocks of absorbent materials will be checked and replenished as needed prior to the survey;
- Regular spill drills, as per SOPEP requirements, to be conducted on vessels engaged in the survey to ensure an efficient response in case such an event occurs;
- A Vessel bunkering Procedure will be in place;
- Dry-break fittings will be required for any vessels when refuelling;
- Non-return valves will be installed on fuel transfer hoses;
- Re-fuelling will be undertaken in safe working weather conditions and good lighting;
  - Any re-fuelling operation will be supervised at all times from both the supply vessel and the seismic vessel;
  - Ongoing checks of equipment integrity will be performed (in particular bunkering hoses, bunds, storage tanks, valves, etc.);
  - Alarm systems are expected to be fitted to fuel oil tanks to warn of high levels;
  - Other ships and any relevant marine authority will be informed through NTM (Notice to Mariners) and NAVAREAs (warnings and radio announcements) about vessel mobilization and activities;
  - Spills will be reported to the Azerbaijan authorities, together with the response action taken; and
  - The position of the seismic vessels will be broadcasted via the appropriate communication channels.

5.8.7 Residual Risk

The risks of these individual activities may affect the biophysical and human environment in various ways, but are expected to be ‘Tolerable if ALARP’ (i.e. As Low As Reasonably Practicable)” on the basis that:

- the most likely spills associated with the project would be small scale;
- these likely spills can be mitigated via the project oil spill response measures and likely contained on-board; and
- large oil spills are highly unlikely to occur.

5.9 Summary of Impacts from Accidental Events

The evaluation of impacts associated with accidental events is presented in Table 5.9.

Table 5.9 Evaluation of the Significance of Potential Environmental Impacts associated with the ADUA exploration area seismic survey activities (Accidental Events).

Receptor	Project activity	Impact Description	Mitigation and Control Measures	Residual Impact
Seabirds and Coastal Birds	Diesel Spill	• Stains of oil on the plumage may destroy the insulating and water repelling properties which may ultimately cause the death of the bird. • Toxic effects after the ingestion of oil during preening, ingestion of oiled prey, inhalation of oil fumes or absorption of oil through skin or eggs may also lead to death. • Indirect effects may result from destruction of bird habitats or food resources.	• Vessels will comply with IMO codes for prevention of oil pollution and have on-board Shipboard Oil Pollution Emergency Plans (SOPEPs) • Audits of the vessels • Oil spill response equipment installed in supply vessel and at shore base (in case of port spills) • Regular maintenance and inspection of equipment and high spill risk points • Oil Spill Contingency Plan (OSCP) and Emergency Response Plan (ERP) • Procedures in place for bunker transfer to reduce the risk of spillage • Use of bulk handling methods and non-return valves for diesel • Lube and hydraulic oil will be stored in tanks or sealed drums and will be well secured and stored in bunded areas. • Approach procedures and poor weather operational restrictions	**Tolerable if 'ALARP'**

Receptor	Project activity	Impact Description	Mitigation and Control Measures	Residual Impact
Marine Mammals (Caspian Seal)	Diesel Spill	• Symptoms of acute exposure to hydrocarbons and chemicals from oil spills include irritation to the eyes and lungs, lethargy, poor coordination and difficulty with breathing. Individuals may then drown as a result of these symptoms. • Long persistence time of the oil effects may be encountered.	• Reporting of any spill to Azerbaijan authorities together with response action taken.	**Tolerable if 'ALARP'**
Coastal Habitats	Diesel Spill	• Destruction of sensitive coastal habitats, including the Absheron National Park and the Absheron archipelago and Pirallahi bay and Shadidi spit IBAs.		**Tolerable if 'ALARP'**
Fish Stocks	Diesel Spill	• Fish exposed to elevated concentrations of hydrocarbons absorb contaminants though their gills, accumulating it within their internal organs which can lead to long-term, sub-lethal effects. • Smothering of fish eggs and larvae		**Tolerable if 'ALARP'**
Fisheries	Diesel Spill	• Loss of revenue from fishing bans • Damage to fishing vessels and equipment • Reduction in both food and economic resources		**Tolerable if 'ALARP'**

6 Environmental Management Plan

6.1 Introduction

This chapter provides a description of how the mitigation measures identified in Chapter 5 Impact Assessment will be incorporated into the Project design and subsequently implemented throughout the duration of the offshore seismic acquisition.

The Environmental Management Plan (EMP) identifies actions required, assigns responsibilities and sets timings for completion. The plan will be incorporated into the overall environmental management of the project and will be incorporated into the corresponding contract agreements (e.g. seismic vessel contractor). The plan will act as a "live" document to track progress through to completion of the seismic survey. The plan also provides a mechanism for monitoring the environmental performance of the contractor, and where required instigating further remedial action as required.

The mitigations measures and the parties responsible for their implementation are summarised below and presented in Table 6.1.

6.2 EMP Objectives

The EMP is designed to serve as the connection between the mitigation and management measures identified in this EIA and the seismic survey execution with the following main objectives:

- Providing the mechanism to ensure compliance with Azeri legislation, Equinor Health, Safety, and Environment (HSE) policies, management system and procedures, international law and standards, and good Oil & Gas industry best practices; providing the mechanism for ensuring that all proposed mitigation measures identified in the EIA to mitigate potentially adverse impacts are implemented;
- Providing a framework for mitigating impacts that may be unforeseen or unidentified;
- Evaluating effectiveness or inefficiency of these mitigation measures and, if required, modify them or include new mitigation/preventive measures; and
- Establishing a monitoring programme and record-keeping protocols so that pertinent additional information that was not available during the compilation of the EIA can be collected in order to provide quality assurance for the conclusions of the EIA.

The EMP is an integral part of the system that also has the longer-term objectives of:

- Ensuring that health, safety, social and environmental issues are integrated into the business risk management and decision-making process;

- Rationalising and streamlining health, social and environmental activities throughout the lifetime of the Project to add value and efficiency;
- Encouraging and achieving the highest environmental performance and response from all employees and contractors;
- Providing the standards for overall planning, operation and review; and
- Enabling management to establish environmental priorities.

In addition, the EMP serves as a set of contractual clauses and specifications that define the Contractor's environmental and social responsibilities at the tendering stage.

6.3 Environmental Management Framework

Statoil Azerbaijan will have an overall and ultimate responsibility for the proposed operations.

The environmental management of the proposed seismic survey will be conducted within a framework comprising the HSE policies of Equinor and HSE Management System which provides a framework through which health, safety and environmental priorities, responsibilities, and risks are systematically managed.

6.3.1 Equinor standards

The sustainability issues that Equinor prioritises reflect Equinor's value chain, the business context faced and Equinor's pursued strategy: "Always safe, High value, Low carbon". Safe and secure operations, empowered people, and stakeholder engagement have been defined as key enablers for Equinor's strategy, along with technology and innovation. Climate change considerations have also been further embedded in the corporate strategy.

Equinor key values are:

- Responding to climate change;
- Health, safety & security;
- Managing our environmental impact;
- Value for society;
- Respecting human rights;
- Transparency and integrity.

Equinor sustainability strategy aims to enable cost effective environmental and social performance that protects and creates value for Equinor and communities, to effectively address the climate change challenge and to respect human rights.

Equinor aims to avoid causing significant harm to the local or regional environment. Equinor takes a precautionary approach and apply a combination of corporate requirements and risk-based local solutions to manage the environmental performance. We strive to adhere to high standards of emissions to air (monitoring of CO_2, nitrogen oxide (NOx), non-methane volatile organic compounds and SOx emissions), waste management and impact on ecosystems—wherever it works. This includes integrating environmental and social risk management into planning and decision-making processes, at all levels in the organisation.

Equinor works closely with the suppliers to qualify and implement new technology to improve the cleansing of produced water, and is concerned with valuing and protecting biodiversity and the ecosystem. Equinor follows precautionary rules and regulations to minimise the potential negative effects of its activities, especially during seismic data acquisition. Equinor also supports research programmes to increase knowledge about ecosystems and biodiversity.

Equinor continues to be an active participant in a joint Biodiversity Working Group of IPIECA and the International Oil and Gas Producers Association (IOGP). This cooperation has resulted in the development of specific tools and recommendations for industry best practice. Equinor also supports the maintenance and development of the World Database on Protected Areas and other GIS-based databases containing information on high-value biodiversity areas. Equinor uses these databases actively in environmental risk and impact evaluations.

Finally, Equinor safety and security strategy aims to enable safe and secure operations through efficient operations where zero harm to people, assets and environment can be achieved.

6.3.2 Other Standards, Guidelines and International Conventions

Statoil Azerbaijan will comply with the requirements of applicable international, regional and national maritime law and will follow best industry standards such as those promulgated by the International Marine Organisation (IMO), the International Association of Oil and Gas Producers (IOGP) as well as the Azeri Authorities.

In addition to the international conventions listed above, Statoil Azerbaijan will also consider, where appropriate, adhering to international standards including International Finance Corporation (IFC) guidelines, World Bank Environmental, Health and Safety (EHS) guidelines, IPIECA guidelines, Joint Nature Conservation Committee (JNCC) guidelines; and topic-specific conventions that are not restricted to a specific geography or ratified by Azerbaijan, such as the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM, 2004).

6.3.3 Consultation and notifications

It is important that the seismic contractor maintains regular communication with the relevant regulatory authorities as well as relevant stakeholders such as the Ministry of Ecology and Natural Resources (MENR), the Ministry of Energy, the State Oil Company of the Republic of Azerbaijan (SOCAR), maritime and port authorities, fisheries, shipping and other sea users.

Prior to the commencement of the seismic survey, notification of survey vessels details will be sent to MENR. This organisation will inform the relevant regional agencies and sub-departments concerned.

All appropriate environmental permits and any attached conditions will be obtained from MENR. Statoil Azerbaijan will provide the seismic contractor with details on the environmental sensitivities within the project area and the procedures and mitigation measures to be applied while operating in these waters.

6.3.4 Mitigation Framework

The mitigation measures and the parties responsible for their implementation are summarized below and presented in Table 6.1.

All crew members, including any support craft, will be made aware of the standards and controls applicable to the conduct of the seismic survey before operations commence.

All equipment (including engines, compressors, generators, solids separation equipment, sewage treatment plant, oily water separators) will be regularly checked and maintained in accordance with manufacturer's guidelines in order to maximize efficiency and minimize malfunctions and unnecessary discharges to the environment during the survey.

Wastes will be minimized, appropriately segregated and stored onboard prior to disposal at authorized and adequately equipped port reception facilities.

Clear lines of communication and operational procedures will be established between the seismic vessel and accompanying vessels before the start of the survey.

6.4 Potential impacts and mitigation measures

6.4.1 Overview of impacts considered

The EIA considered the following potential impacts from the proposed Project activities:

- Potential reduction in localized air quality and contribution to greenhouse gases as a result of emissions from operation of the seismic survey fleet (i.e. seismic, guard and supply vessels);
- Degradation of water quality as a result of routine and operational discharges of effluents and wastes to the sea (i.e. black and grey water, bilge water, ballast, etc.);
- Impacts on plankton due to the change of seawater quality resulting from effluents and waste discharges to the sea as well as potential introduction of invasive or alien species into Azeri waters;

- Impacts on marine fauna such as benthos, fish, seabirds and marine mammals (Caspian Seal) resulting from the noise emissions generated during seismic activities; change of seawater quality due to the discharge of effluents and waste to the sea and vessel lighting;
- Impacts on sensitive coastal areas resulting from the operation of the onshore facilities and supply vessel transit;
- Impacts on other sea users, potential increase of collision risk and disturbance of marine traffic resulting from project vessel movements;
- Impacts on fisheries, commercial and artisanal fishing activities resulting from the presence and operation of Project vessels and associated exclusion area for fisheries, the generation of underwater noise emissions and changes in water quality;
- Damage to receptors and resources as a result of accidental events – impacts resulting from accidental events including fuel spills from vessels.

6.4.2 Issue Specific Management Plans and procedures

In support of the seismic survey operations and as per the standard practice in the offshore O&G industry, a number of management plans and procedures will be develop prior to the start of the activities. These will serve to address key areas of potential environmental/social impact requirement and therefore are being mentioned along the relevant sections of the EMP.

This section summarizes the requirements for these issue specific management plans[17]:

- Waste Management Plan (WMP).
- Ballast Water Management Plan (BWMP).
- Emergency Response Plan (ERP).
- Oil Spill Contingency Plan (OSCP).
- Shipboard Oil Pollution Emergency Plan (SOPEP).

summary of the objectives and contents of the plans are summarized in the following sections.

6.4.2.1 Waste Management Plan (WMP)

A Waste Management Plan (WMP) will be developed for the Project to establish waste streams, procedures for the storage, packaging and labelling of waste, including liquid and solid waste and hazardous and non-hazardous wastes, define transportation procedures for final disposal, and to define the responsibilities associated to waste management activities.

[17] It should be noted that these plans are not part of the EIA Report but management plans that need to be in place prior to the start of the operations.

The following activities are developed in the waste management plan:

- Waste generation at the seismic, guard and supply vessels, and onshore logistics base.
- Temporary waste storage at the seismic, guard and supply vessels, and onshore logistics base.
- Waste transportation from offshore to the onshore base.
- Waste unloading at the onshore base.
- Waste transportation from the onshore base to the final destination of the waste.
- Supervision of the contractors that will be in charge of waste treatment and management.

The final onshore destination for disposal of the waste will be included in the plan. Good international practice requires a commitment to adopt the various measures aimed at preventing inappropriate discharges of wastes at sea. These measures must be put into practice on the project vessels and onshore support facilities. As so, the project's waste management first reference will be the Azeri legislation, international legislation and Equinor Standards.

6.4.2.2 Ballast Water Management Plan (BWMP)

The discharge of ballast water into the marine environment is controlled by the International Convention for the Control and Management of Ship's Ballast Water and Sediments. Even though Azerbaijan is not signatory of this convention, the use of an onshore base in a mainland port, the seismic, guard and support vessels involved in the Project will undertake ballast operations in accordance with this convention. As so each Project vessel will have a Ballast Water Management Plan.

The function of the Ballast Water Management Plan is to assist in complying with measures intended to reduce the harmful effects on the marine environment that are spread through aquatic microorganisms transferred from one area to another through ballasting operations, while maintaining safety.

The BWMP will include the following elements:

- A description of the ballast water management system on each vessel, and how it operates.
- Procedures for monitoring and reporting.
- Operational along with the method to be used for ballasting as well as safety aspects.
- The locations at different coastal water for ballast exchange.
- Sampling point and treatment method.
- Roles and responsibilities of the personnel on board for carrying out ballast operation.

6.4.2.3 Emergency Response Plan (ERP)

The purpose of the ERP is to assist the Equinor Incident Management Team to prepare for and respond quickly and safely to any incident within onshore and offshore operational sites, regardless of incident type and size.

The specific objectives of the ERP are the following:

- Define notification, activation and mobilization procedures of the Incident Management Teams to be followed when an incident or threat of an incident occurs.
- Describe positions on the Incident Management Teams and define the roles and responsibilities of team members, including organizational structure and lines of responsibility to be adhered to during an incident response.

This plan shall contain procedures applicable to foreseeable incident scenarios for the seismic survey activities. The plan shall define the emergency response organization, the incident notification procedure, the assessment process of an incident, the emergency team activation process, the response planning, the incident stand-down as well as training and emergency exercises requirements and objectives.

6.4.2.4 Oil Spill Contingency Plan (OSCP)

Specific to the emergency scenario of an oil spill risk, an Oil Spill Contingency Plan will be developed, as per relevant best practice guidelines.

The oil spill contingency plan will provide a detailed oil spill response and removal plan that addresses controlling, containing, and recovering an oil discharge in quantities that may be harmful to navigable waters or adjoining shorelines.

It will include:

- A definition of the authorities, responsibilities, and duties of all entities involved in oil removal operations.
- Procedures for early detection and timely notification of an oil discharge.
- Assurance that full resource capability is known and can be committed following a discharge.
- Actions for after discovery and notification of a discharge.
- Procedures to facilitate recovery of damages and enforcement measures.

With regards to Statoil Azerbaijan's oil spill response strategy, it adopts the internationally recognised Tiered response system for assessing the severity of an oil spill. The purpose of the three levels is to establish, as soon as possible, what is the correct level response to combat the spill. The severity of the spill depends on the size of the spill, the complexity of the response, and the potential consequences for people and for the environment.

6.4.2.5 Shipboard oil Pollution Emergency Plan (SOPEP)

Regulation 37 of MARPOL Annex I requires that all ships of 400 gross tonnage and above carry an approved Shipboard Oil Pollution Emergency Plan (SOPEP). The purpose of a SOPEP is to assist personnel in dealing with unexpected discharge of oil, to set in motion the necessary actions to stop or minimize the discharge, and to mitigate its effects on the marine environment. This regulation requires the SOPEP to include the following as a minimum:

- The procedure to be followed by the master or other persons in charge of the ship to report an oil pollution incident, as required in article 8 and Protocol I of the MARPOL Convention, based on the guidelines developed by the IMO.
- The list of authorities or persons to be contacted in the event of an oil pollution incident.
- A detailed description of the action to be taken immediately by persons on board to reduce or control the discharge of oil following the incident; and
- The procedures and point of contact on the ship for coordinating shipboard action with national and local authorities in combating the pollution.

Each vessel used by the Project, will have a SOPEP that is suitable to respond to its own specific risk inventory.

6.5 Responsibilities

6.5.1 Statoil Azerbaijans's Role and Responsibility

Statoil Azerbaijan will ensure that the project is carried out in accordance with Global Equinor HSE policies and in line with the Equinor HSE Management System. Although contractors will carry out most of the HSE critical activities Statoil Azerbaijan will retain the overall responsibility and accountability for managing the Contract, including HSE (Health, Safety and Environment).

The different roles within Statoil Azerbaijan organization are explained below.

6.5.2 Statoil Azerbaijan Geophysical Operations Project Manager (Onshore based)

The Statoil Azerbaijan Geophysical Operations Project Manager will be responsible for providing expertise on safety issues that may arise during the conduct of emergency response operations as well as for relevant environmental matters. He / she will be responsible for reviewing the seismic contractor's HSE management plans for acceptability and ensuring compliance with the Project's EMP, reviewing environmental audits to ensure compliance with the agreed environmental performance objectives and providing advice in the event of an oil spill or other environmental incidents. He/she will be supported by the Equinor Baku office.

6.5.3 Statoil Azerbaijan Seismic Vessel HSE Supervisor (Vessel based)

The HSE Supervisor located at the seismic vessel will be responsible for:

- Provide analysis tracking of HSE hazards as part of Pre-Start Safety Reviews, Mechanical Integrity & Critical Equipment inspections, and Incident investigation processes. Review and follow up.
- Liaise with Contractors HSE representatives.
- Assure that all Personnel have completed the required HSE training prior to work onsite. Record Personnel onsite along with required records and documentation for regulatory compliance.
- Participate as the Onsite Safety Advisor as part of the Emergency Management Plan.
- Support field execution of contractors Health Safety and Environment program. Assist with implementation of Contractor HSE bridging document requirements.
- Advising seismic vessel and shore base supervisors and personnel on safety, health, and environmental related issues.
- Conduct worksite inspections, coaching and mentoring to ensure compliance with safe working practices and in particular all applicable regulations and requirements.
- Conduct Health, Safety, and Environment inspections as stated in Statoil Azerbaijan and local regulations.
- Assist in conducting emergency training exercises as needed.
- Ensure reporting of contractor incident, accident, and safety indicators.

6.5.4 Seismic Contractor Requirements

The EMP will be the overarching contractual document for all environmental and social management requirements to which all contractor and subcontractor plans and documents will be aligned. It will be provided to all relevant contractors for the project, who will be required to include the following provisions to ensure that the EMP is effective:

- Clearly defined roles and responsibilities for the execution of the EMP.
- Ensure that all crew and supply base staff or contractors are familiar with Equinor's global standards.
- Appropriate reporting and remedial action procedures to ensure that any incidents are reported promptly and dealt with effectively.
- Review, assessment and revision of the EMP as required.

All contractor documentation used to bridge to the main EMP, and hence facilitate the implementation of its requirements, will be subject to review and approval by Statoil Azerbaijan.

6.6 Reporting

In addition to daily survey progress reporting required by Statoil Azerbaijan, it is recommended that the seismic contractor carries out the following reporting/documentation:

- Daily contact with the relevant port in the survey area to update on survey progress and vessel position.
- Logging of all sightings and contacts with other vessels (e.g. fishing or cargo vessels).
- Logging of all health, safety and environmental accidents and incidents, including any incidents involving cargo or fishing vessels in Azeri waters.
- End of survey programme report to include the final HSE report with details of HSE accidents and incidents and environmental performance, and fishing equipment removed as described above.

In case of any HSE incidents, Statoil Azerbaijan will conduct a proper incident investigation and prepare a respective report detailing the events and corrective and preventative measures implemented. All incidents where local regulatory standards are exceeded will be reported to the authorities in Azerbaijan.

6.7 Management of change

In an operation with this dimension and duration there are uncertainties and changes that need to be addressed in a structured and transparent manner.

As a result, Statoil Azerbaijan will implement a clear and transparent management of change procedure, in order to identify gaps, evaluate risks and uncertainties and to take them into account. This procedure will be applied in case of changes from the original scope of work (e.g. equipment, operating procedures, materials and operating conditions) which would require to develop additional/ amended programs and/or add cost form the original estimated expenditure. Whenever these changes are planned or if they occur out of operational necessity, the Management of Change procedure will be implemented prior to the change.

6.8 Summary of mitigation to be implemented as part of the Project

A summary of the EMP with its corresponding recommended measures is presented in Table 6.1 below.
This section and Table 6.1 is intended to be read in conjunction with the full text of the accompanying EIA document, which provides important context and background, as well as describing the impacts which the listed measures aim to mitigate or manage, and the residual impact which may remain.

Table 6.1: Summary of mitigation and monitoring measures to be implemented as part of the EMP

N°	Receptor	Project Activity	Impact Description	Mitigation and Control Measures	Responsibility	Monitoring / Recordkeeping Requirement	Reporting Requirements	Frequency / Timing
Routine events								
1	Air Quality and Climate Change	Routine seismic fleet operation	Potential reduction in localized air quality and contribution to greenhouse gases	• Advanced planning to ensure efficient operations, including the planning of vessels trip to acquire supplies; • Ensure vessels has valid Engine International Air Pollution Prevention Certificate in place (marine diesel engines >130kW). • Appropriate maintenance policies and procedures of equipment and generators will be followed and its implementation audited by an Equinor representative; • Regular monitoring of fuel consumption; • Engines and equipment will be switched off when not in use; • Use of low-sulphur marine fuel (<0,4% S by weight); and • Compliance with Tier II of revised MARPOL 73/78 Annex VI which sets limits on sulphur dioxide and nitrogen oxide emissions from ship exhausts and prohibits deliberate emissions of ozone depleting substances.	Seismic contractor; guard and supply vessels contractors	• Monitor and record fuel consumption weekly • Maintenance record – as required • Verification of maintenance of equipment • Record of Low sulphur fuel use	N/A	Weekly when vessels are active. Vessels HSE review prior to operations to verify all relevant systems Prior to start of activities
2	Seawater Quality	Routine and operational discharges	Potential localized reduction in water quality, including	• Vessels will be equipped with a sewage treatment unit compliant with MARPOL	Seismic contractor; guard and supply	• Maintain an Oil Record Book and	N/A	At all times when vessels are active.

N°	Receptor	Project Activity	Impact Description	Mitigation and Control Measures	Responsibility	Monitoring / Recordkeeping Requirement	Reporting Requirements	Frequency / Timing
		during the project (i.e. black and grey water, bilge water, ballast, etc.).	increased turbidity and BOD. Potential introduction of alien invasive species from ballast water discharges	Annex IV regulations, with an International Sewage Pollution Prevention Certificate ("ISPPC "); • Discharges will comply with MARPOL Annex IV and the Azerbaijani law; • Bilge and drainage water will be contained onboard and transported to shore for disposal; • Maintenance of an Oil Record book and a vessel's logbook; • Maintenance of an Oil Record book and a vessel's logbook. • All Ballasting activities will comply with the International Convention for the Control and Management of Ship's Ballast Waste and Sediments (BWM Convention), including: ○ all ballast water will be stored in specifically designated tanks to avoid cross contamination and remain free of oil; ○ ballast water discharges will be continuously monitored for oil sheen and in case of visibly oil contaminated ballast water discharges will be stopped; ○ ballast water exchange will take place at least 200 nautical miles from nearest land and at depths over 200 m;	vessels contractors	a vessel's logbook • Record or estimate volume of sewage discharge – daily • Record /consignment note of liquid/solid wastes transferred to shore • Record estimates of food waste generation – daily • Daily visual inspection of discharge point to ensure absence of floating solids and discoloration of the water • Detailed Ballast Water Logbook – as required. • Ballast Water Management Plan for each Project vessel		

N°	Receptor	Project Activity	Impact Description	Mitigation and Control Measures	Responsibility	Monitoring / Recordkeeping Requirement	Reporting Requirements	Frequency / Timing
				○ any ballasting operations will be logged in a record book; and ○ the vessels will have a Ballast Water Management Plan (BWMP) in place. • Food waste discharges will comply with MARPOL Annex V requirements (discharges of comminuted waste always more than 3 nm from the coast and while navigating).				
3	Seabed and Benthic communities	Seismic survey operations	Generation of noise emissions	• No measures required.	N/A	N/A	N/A	N/A
4	Plankton	Routine and operational discharges during the project (organic liquid/solid discharges)	Potential localized increase in organic matter and reduction in water quality	• Applicable embedded measures related to water quality will apply.	Seismic contractor; guard and supply vessels contractors	See monitoring requirements specified under N°2	N/A	At all times when vessels are active
5	Fish	Routine operation of seismic fleet. Seismic survey activities.	Impacts due to the generation of noise emissions Secondary impacts due to changes in water quality	• Applicable embedded measures related to Noise generation will apply (see summary of impacts on marine mammals); • Applicable embedded measures related to water quality will apply	Seismic contractor; guard and supply vessels contractors	See monitoring requirements specified under N°6	N/A	At all times when vessels are active
6	Marine Mammals	Physical presence of seismic fleet	Disturbance from the presence of Project vessels;	Embedded measures related to Noise generation:	Seismic contractor; guard and supply	• Monitoring requirements specified under	Sharing data of marine environmental	At all times when vessels are active

N°	Receptor	Project Activity	Impact Description	Mitigation and Control Measures	Responsibility	Monitoring / Recordkeeping Requirement	Reporting Requirements	Frequency / Timing
		Seismic survey activities.	Potential collision risk with Project vessels; Impacts due to the generation of underwater noise emissions Secondary impacts due to changes in water quality	• Implementation of soft start or ramp up procedure, implementation of a 500m mitigation zone and have onboard a Marine Fauna Observer with specialized equipment as recommended by the Joint Nature Conservation Committee (JNCC, 2017) guidelines, during seismic survey activities; • Implement of an airgun shutdown procedure should seals be detected within the above described 500 m mitigation zone. • Good maintenance procedures on vessel engines • The order of the 2D acquisition and 3D acquisition will be decided once vessel availability is confirmed, taking into account technical, logistical and environmental considerations to ensure minimal impact on the environment Measures related to rest of impacts • Vessels will use designated and relevant speed and wake restrictions where possible; • A Marine Fauna Observer onboard the seismic/guard vessels will maintain watch for Caspian seals; • Supply vessel operators should maintain a watch for marine mammals, and take avoidance action if a collision seems likely, if safe to do so;	vessels contractors	N°2 relative to water quality also apply • Record of marine fauna observations during seismic activities • Maintenance record – as required	data including marine fauna observations with relevant Azeri authorities	

N°	Receptor	Project Activity	Impact Description	Mitigation and Control Measures	Responsibility	Monitoring / Recordkeeping Requirement	Reporting Requirements	Frequency / Timing
				• Statoil Azerbaijan will limit the transit of supply vessels in coastal waters at night hours to the extent possible, and in case this is not possible, speeds at coastal waters will be reduced at nighttime; • Documentation and sharing of relevant and applicable marine environmental data and opportunistic sightings of marine fauna. • Vessels will not be allowed to intentionally approach marine fauna, such as Caspian seals, and, where practicable, will alter course or reduce speed to further limit the potential for disturbance. • Maintain a record of Caspian seals observed during the seismic survey activities to gain a better understanding of their presence in the area. Applicable embedded measures related to water quality will apply.				
7	Seabirds	Operation of Project vessels	Disturbance from the presence and movements of Project vessels. Secondary impacts due to changes in water quality	• Project vessels to avoid sailing through areas with large aggregations of seabirds where possible. • Applicable embedded measures related to water quality will apply.	Supply vessels contractors	• Monitoring requirements specified under N°2 relative to water quality also apply.	N/A	At all times when vessels are active

N°	Receptor	Project Activity	Impact Description	Mitigation and Control Measures	Responsibility	Monitoring / Recordkeeping Requirement	Reporting Requirements	Frequency / Timing
8	Sensitive coastal areas	Operation of Project Vessels and helicopters.	Disturbance to sensitive coastal areas from onshore activities	• Should helicopters be required the flight paths routes will be defined in accordance with relevant authorities and avoiding, as much as possible, coastal areas and islands around the Absheron peninsula . • Applicable embedded measures related to water quality will apply.	Helicopter contractor Statoil Azerbaijan	• Verification of flight path. • Verification of maintenance of equipment.	N/A	Whenever a flight needs to be planed Prior to Project activities and in line with emergency response planning
9	Navigation, Traffic and Sea user	Project vessels movements	Impacts to maritime traffic Increase of collision risk	• A safety awareness zone of 500 m around the seismic vessel will be enforced to ensure safety distance with other sea users such as fishing boats; • Notification to relevant marine authorities and advanced notice to mariners prior to commencement of the seismic survey program including notification of the establishment of the safety awareness zone; • Vessels will use designated and relevant navigation channels where applicable and comply with designated safety awareness zone; • Navigational marks and lights on the project vessels. • Ensure that vessels are equipped with collision risk reducing devices i.e. navigational lights and beacons, marker buoys, etc.	Seismic contractor; guard and supply vessels contractors	• Monitoring of safety awareness zone • Bridge logs (date, time, location) of encounters with vessels. • Records of vessel inspections • Records of incidents and near miss events	Contractor notifies Statoil Azerbaijan in case of incident	Prior to the start of the seismic survey program At all times when vessels are active

N°	Receptor	Project Activity	Impact Description	Mitigation and Control Measures	Responsibility	Monitoring / Recordkeeping Requirement	Reporting Requirements	Frequency / Timing
10	Fisheries	Seismic survey activities Physical presence and operation of Project vessels	Impacts due to the presence of seismic fleet and associated exclusion area for fisheries Impacts due to the generation of underwater noise emissions Secondary impacts due to changes in water quality	• Each project vessel will have an individual (Azeri and English -speaker) who will be able to communicate with any fishing vessels or other navigators that are present in the vicinity of the safety awareness zone around the survey vessel, ensuring that such vessels are able to alter their course in complete safety; • Applicable embedded measures related to Noise generation will apply (see summary of impacts on marine mammals); • Applicable embedded measures related to water quality will apply; • Compliance with MARPOL requirements and good industry practice; and • Operational controls contained in Waste Management Plan. • Mitigation measures are expected to be the same as those described for water quality (see Nº2). • In order to minimise impacts to commercially exploited species derived from physical presence of project vessels and light emissions, the Project will control and reduce overall light intensity to the extent practicable, without adversely affecting maritime or operational safety. • Notify relevant authorities, fishing associations and industrial fishermen of	Seismic contractor; guard and supply vessels contractors	• Keep logs (date, time, location) of encounters with fishing vessels. • Records of grievances / complaints received, actions taken, and responses provided	N/A	Prior to the start of the seismic survey program At all time when vessels are active Recording of grievances ongoing

N°	Receptor	Project Activity	Impact Description	Mitigation and Control Measures	Responsibility	Monitoring / Recordkeeping Requirement	Reporting Requirements	Frequency / Timing
				seismic survey activities, dates, location and safety awareness zone. • Ensure procedures are in place for dealing with claims in the event of damaged fishing gear.				
Accidental events								
11	Seabirds and Coastal Birds Marine Mammals Coastal Habitats Fish Stocks Fisheries	Crude Oil or Diesel Spill	• Symptoms of acute exposure to hydrocarbons and chemicals from oil spills • Impact on coastal habitats ecosystem • Loss of revenue from fishing bans • Damage to fishing vessels and equipment • Reduction in both food and economic resources	• Vessels will comply with IMO codes for prevention of oil pollution and have on-board Shipboard Oil Pollution Emergency Plans (SOPEPs) • Audits of the vessels • Oil spill response equipment installed in supply vessel and at shore base (in case of port spills) • Regular maintenance and inspection of equipment and high spill risk points • Oil Spill Contingency Plan (OSCP) and Emergency Response Plan (ERP) • Procedures in place for bunker transfer to reduce the risk of spillage • Use of bulk handling methods and non-return valves for diesel • Lube and hydraulic oil will be stored in tanks or sealed drums and will be well secured and stored in bunded areas. • Approach procedures and poor weather operational restrictions • Reporting of any spill to Azerbaijan authorities together with response action taken.	Seismic contractor, guard and supply vessels contractors	N/A	Incident Report Notification to competent authority in line with spill reporting requirements	In case of spill.

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Annex A

Public hearing process of the Environmental Impact Assessment (EIA) study for 2D-3D seismic activity in the Aypara-Dan Ulduzu-Ashrafi (ADUA) exploration area.

A.1 Description of the public hearing process

The following section provides details on the chronology of the public hearing process, actions implemented by Equinor and prospective activities to be undertaken once the official public meeting concludes.

- A draft version of the Environmental Impact Assessment (EIA) was finalized in December 2018.
- Advertising of the hearing process was announced in the “Respublika” and “Xalq” newspapers and websites, and Trend news agency’s website on 18 December 2018 .
  The EIA was posted on Equinor’s website (link below) together with a Hearing letter to the public, see Section A.1.1.

  https://www.equinor.com/content/dam/statoil/documents/impact-assessment/azerbaijan/equinor-adua-azerbaijan-environmental-impact-assessment.pdf

- Deadline for commenting on the EIA was 21st January 2019.
- Comments where received from several institutions and have been responded on, see Section A.2.
- Updates of the EIA, according to relevantcomments have been implemented and a final version of the EIA has been developed in both English and Azeri.
- A public meeting will be arranged in Baku 12th March 2019.
- A separate letter with a summary of the public meeting and comments that may require updates of the EIA will be sent to MENR shortly after the meeting.

A.1.1 Letter to public

Date:17-12-2018
Ref. No.: EQAZ 2018-12-17 410

Proposal for the Public Hearing for an Environmental Impact Assessment (EIA) study for 2D-3D seismic activity in the Aypara-Dan Ulduzu-Ashrafi (ADUA) exploration area

Equinor is considering acquiring 2D-3D seismic data in the ADUA area. The purpose of this letter is to announce that a draft EIA document has been produced for planned 2D-3D seismic data acquisition as part of Equinor's work obligation and is available for public review and comment.

The document examines the potential environmental impact of the project and describes recommended mitigation measures.

Copies of these documents have been placed at the following locations for public review:

* M.F. Akhundov Central Public Library, 29 Khagani street
* Scientific Library of the National Academy of Sciences, 31 H.Javid Avenue.
* Aarhus Environmental Information Center, MENR, 100 B. Agayev Street
* The Azerbaijan State Oil Academy library, 20 Azadlig Avenue
* Equinor Absheron, at the reception of Marine Plaza, U. Hacibeyli Street. 62
* Pirallahi settlement, Public Library branch 2 in the Cultural Center n.a. V. Mustafazade. S. Baghirov str. 3.
* Oily Rocks settlement, Public Library, Oil Rocks Cultural Center
* Chilov settlement, secondary school No 131. 1D. Kisilyov str.

Comments on the document should be addressed to Aynur Rzayeva in Equinor by the 21st of January 2019.

Contact details:

Telephone: (994 12) 497 73 40/ 050 225 95 56 Email:konsekvensutredning@equinor.com

Address: Equinor Azerbaijan. Marine Plaza Business Center. 62 U. Hacibeyli street, Baku Az1010

A.2 Summary of comments/feedback received and response from Equinor.

Table below lists a summary of the comments received to the EIA throughout the public hearing process, along with the relevant A.2 subsections where the official letters are presented and a summary of Equinor´s response.

From	Date	Comments	Equinor's response
Ministry of Ecology and Natural Resources (MENR)	27.12.18	See Section A.2.1	Appointed contact person has been contacted, the first meeting is held. Comments from this meeting to be found in Section A.2.5
Ministry of Health – Center for Hygiene and Epidemiology	04.02.19	See Section A.2.2	The comments are considered not to be included in the EIA. Working environment and health risk analyses for personnel involved in the Seismic acquisition will be included in the HSE program.
Ministry of Defense	17.12.18	See Section A.2.3	Feedback is given to Ministry of Defense. No changes have been done in the EIA.
Institute of Geology and Geophysics	18.12.18	See Section A.2.4	The EIA is updated according to the comments
Verbal comments from MENR	04.02.19	See Section A.2.5	Some changes have been done in the EIA Item 2 & 3 is covered in Sections A.2.2 and A.2.3

A.2.1 Official letter with comments from Ministry of Ecology and Natural Resources (MENR)

AZƏRBAYCAN RESPUBLİKASININ
EKOLOGİYA VƏ TƏBİİ SƏRVƏTLƏR NAZİRLİYİ

Az1073 Bakı şəhəri,B.Ağayev küç.100A
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№ 4/2487-08-22. «24» 12 2018 il

"Equinor Absheron AS" şirkətinin
ölkə üzrə meneceri
cənab Favad Quraişiyə

"Əşrəfi-Dan Ulduzu-Aypara" (ƏDUA) kontrakt sahəsində aparılacaq 2Ö-3Ö seysmik kəşfiyyat işlərinə başlanmadan öncə hazırlanacaq Ətraf Mühtə Təsirin Qiymətləndirilməsi (ƏMTQ) layihə sənədinin hazırlanması prosesində ETSN-nin nümayəndəsinin təyin edilməsi ilə bağlı müraciətinə tərəfimizdən baxılmışdır.

"Əşrəfi - Dan Ulduzu - Aypara sahəsinin kəşfiyyatı, işlənməsi və hasilatın pay bölgüsü haqqında" Sazişinə əsasən "Ətraf mühitin mühafizəsi və təhlükəsizlik" Maddə 26 və "Ətraf müihitin mühafizəsi standartları və metodları" Əlavə 9-un tələblərinə uyğun olaraq qeyd edilən yataqlarda aparılması nəzərdə tutulan seysmik işlərin həcmini və ətraf mühitə potensial təsirlərini nəzərə alaraq ətraf mühit ilə bağlı məsələlər və "Azərbaycandakı Əşrəfi-Dan Ulduzu-Aypara" kəşfiyyat sahəsində 2-3 ölçülü seysmik tədqiqatlar üçün hazırlanmış ƏMTQ hesabatının hazırlanması üzrə məsləhətçi qrupun tərkibində ETSN-nin Ətraf mühitin mühafizəsi departamentinin direktor müavini əvəzi Mirsalam Qənbərovun və Dövlət ekspertiza idarəsinin Təbii ehtiyatlardan istifadənin tənzimlənməsi üzrə ekspertiza sektorunun məsləhətçisi Könül Əhmədovanın iştirakının təmin edilməsi məqsədəuyğun hesab edilir.

"Azərbaycandakı Əşrəfi-Dan Ulduzu-Aypara" kəşfiyyat sahəsində 2-3 ölçülü seysmik tədqiqatlar üçün hazırlanacaq ƏMTQ-nin qısa xülasəsinin müzakirə olunaraq müvafiq düzəlişlər edildikdən sonra yenidən baxılması təmin ediləcəkdir.

Nəzərə almağınız xahiş olunur.

Hörmətlə,
Nazir müavini Firdovsi Əliyev

Translated letter from MENR

From the MENR

Letter No: 4/2787-02-22

Date: 27.12.2018

You request on appointing representatives of MENR for participation in drafting of the EIA document prior 2D-3D seismic study works in Ashrafi-Dan Ulduzu-Aypara (ADUA) contract area has been reviewed from our side.

According to the requirements set in the *Article 26 "Environmental Protection and Safety"* and *Appendix 9 "Environmental Standards and Practices"* of the ADUA PSA, and considering the volume of the seismic works in the mentioned areas and potential impact on the environment, it was decided to ensure participation of MENR's *Acting Deputy Director of the Environmental Protection department,* ***Mr Mirsalam Qanbarov*** and the *Adviser of the expertise sector in the Sector of Use from Environment and Natural Resources,* ***Ms. Kenul Ahmadova*** of the State Expertise Office as members of the advisory group for environmental issues and EIA report preparation.

Short summary of the EIA document shall be discussed and reviewed again after necessary changes are applied.

Please take this into consideration.

Respectfully,

Deputy Minister

Firdovsi Aliyev

A.2.2 Official letter with comments from Ministry of Health – Center for Hygiene and epidemiology

MINISTRY OF HEALTH OF THE REPUBLIC OF AZERBAIJAN

CENTER FOR HYGIENE AND EPIDEMIOLOGY ON WATER TRANSPORT

Address: Block 501, House 12, Mikayil Mushfig street

Phone : (+994 12) 539-45-07; Fax: 510-21-40 **E-mail: sn_gem@esehiyye.az**

Date: 04 February 2019 Ref#:02-25

To: Fawad Quraishi, Country Manager, Azerbaijan, "Equinor" Absheron AS

Dear Sir,

Your letter Ref. #EQAZ 2019-01-28427 dated 28.01.2019 and enclosed detailed written description of proposed environmental measures have been reviewed.

The points reflected in Environmental Impact Assessment (EIA) document in relation to activities intended for prevention of contamination incidents and protection of environment in the Caspian Sea as part of 2D-3D seismic survey in the Ashrafi-Dan Ulduzu-Aypara (ADUA) exploration area in Azerbaijan are well appreciated.

One of the tasks of Center for Hygiene and Epidemiology on Water Transport is to organize preventive measures and implement current hygienic control in order to assess workplace sanitary and hygiene conditions for people working on Offshore installations (vessels, mobile offshore drilling units, oil and gas extraction platforms) and eliminate harmful impacts of production factors to people that form as a result of poor working conditions.

In this connection relevant measures should be taken by employees of Center for Hygiene and Epidemiology on Water Transport on the vessels engaged in the survey.

Governed by Law No. 371 on "Sanitary and Epidemiologic Wellbeing" of the Azerbaijan Republic it is instructed to ensure compliance with the following requirements on the vessels of research fleet.

1. It is recommended to use special structural means and shock absorbers at the source of noise to isolate the noise. When this is impossible, acoustic screens should be used covered with noise absorbents. To protect personnel from noise impact it is important to provide employees with proper food and B1 and C1 vitamins.
2. In order to eliminate vibration at vibration sources for prevention of functional diseases in persons impacted by long-term vibration on vessel it is important to use appropriate means such as rubber shock absorbers, couplings, elastic pipes, rubber or plastic material seals. To damp vibration forming at noise range frequencies, vibrating metal surfaces should be covered with dampers. The following can be stated as efficient preventive measures: to reduce impact time of long-term continuous vibration on an employee, to ensure efficient work and rest mode, full value vitaminized nutrition (provision of B1 and C1 vitamins).
3. The electromagnetic zones present on vessels are expected to expand due to operation of post installed seismic equipment. In this connection to reduce electromagnetic radiation impact the following hygienic measures should be taken:
   a) The electromagnetic radiation parts present on vessel decks shall be provided with warning signs.
   b) The persons not working in electromagnetic radiation sources must not be allowed to enter such areas.
   c) Feeding lines of high frequency generators should be securely screened.
   d) Remote controls should be used.

e) Employees contacting with electromagnetic radiation sources should be provided with special PPE made of metal-coated material.

4. In order to identify higher volume of production factors (toxic chemicals vapours, hydrocarbon gases etc.) ingress during work process posing risk to human organisms, working areas shall be fitted with alarmed gas analysers.
5. Subcontractors directly involved in survey shall be registered for sanitary at Center for Hygiene and Epidemiology on Water Transport.

In addition, “Equinor” Absheron AS should submit names of vessels involved in seismic survey to Center for Hygiene and Epidemiology on Water Transport and appropriate conditions should be created for specialists of the Center on vessels for carrying out sanitary and hygienic inspections.

Truly Yours,
O.G, Veliyev,
Acting Director
Prepared by: F. Mirzayev

A.2.3 Official letter with comments from Ministry of Defense

MINISTRY OF DEFENSE OF THE REPUBLIC OF AZERBAIJAN

3, Parliament Ave, Baku AZ1073 Tel.:(+99412) 539 29 15, Fax: (+99412) 510 59 02
www.mod.gov.az

Date: 17 December 2018 Ref #: 16/5113

To: Fawad Quraishi, Country Manager,
Equinor Apsheron AS

Dear Mr. Fawad Quraishi,

Please be advised that our appropriate division has reviewed your letter Ref # EQAZ 2018-11-29 399 dated 29 November 2018 regarding Providing Conclusion on the EIA document for 2D/3D seismic survey in the Ashrafi-Dan Ulduzu-Aypara Exploration Area based on PSA signed between SOCAR and Statoil Azerbaijan Ashrafi Dan Ulduzu Aypara BV.

Ashrafi-Dan Ulduzu-Aypara Exploration Area mentioned in the Project intersect with the following special regime areas and recommended routes:

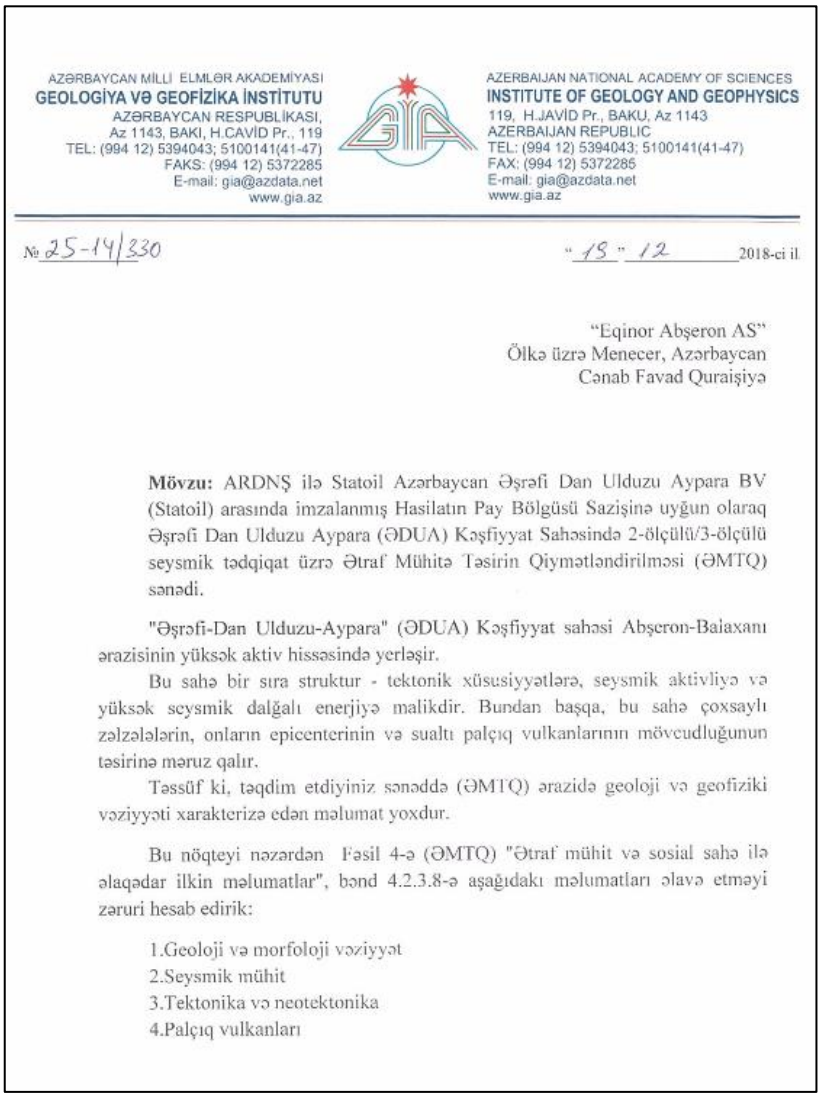
- Area # 46 (Pirshagi village to the North – Tarta Cape) prohibited for anchoring, fishing with ground angling gear, carrying out subsea and dredging activities and sailing with deployed anchor chain;
- Area # 139 (Sangachal – Oil Rocks) prohibited for anchoring, fishing with ground angling gear, carrying out subsea and dredging activities and sailing with deployed anchor chain;
- Special regime navigation Area # 242 (Oil Rocks to the North);
- Recommended route# 3 (Baku harbor to Astrakhan roadstead);
- Recommended route# 4 (Baku harbor to Absheron harbor (eastern passage));
- Recommended route# 5 (Baku harbor to Absheron harbor (northern passage));
- Recommended route# 6 (Baku harbor to Makhachkala harbor);
- Recommended route# 7 (Baku harbor to Astrakhan roadstead);
- Recommended route# 29 (Absheron harbor to Aktau harbor);
- Recommended route# 31 (Turkmenbashi harbor to Absheron harbor).

Pursuant to Clause 5 (Coordination and Interaction at Sea) of the Azerbaijan Republic Marine Safety Strategy approved by Decree No. 3130 dated 11 September 2013 of the President of the Azerbaijan Republic, please take into account compliance with requirements of Navigation Regime in the Caspian Sea, as well as sending a copy of technical reports on details of commencing and completion of planned activities to Navigation and Mapping Office of the Operations Head Office in the course of conducting seismic survey in the above-stated special regime areas and recommended routes.

Best Regards,

Ayaz Hasanov
Lieutenant General

A.2.4 Official letter with comments from Institute of Geology and Geophysics



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№ 25-14/330 "19" 12 2018-ci il

"Eqinor Abşeron AS"
Ölkə üzrə Menecer, Azərbaycan
Cənab Favad Quraişiyə

Mövzu: ARDNŞ ilə Statoil Azərbaycan Əşrəfi Dan Ulduzu Aypara BV (Statoil) arasında imzalanmış Hasilatın Pay Bölgüsü Sazişinə uyğun olaraq Əşrəfi Dan Ulduzu Aypara (ƏDUA) Kəşfiyyat Sahəsində 2-ölçülü/3-ölçülü seysmik tədqiqat üzrə Ətraf Mühitə Təsirin Qiymətləndirilməsi (ƏMTQ) sənədi.

"Əşrəfi-Dan Ulduzu-Aypara" (ƏDUA) Kəşfiyyat sahəsi Abşeron-Balaxanı ərazisinin yüksək aktiv hissəsində yerləşir.

Bu sahə bir sıra struktur - tektonik xüsusiyyətlərə, seysmik aktivliyə və yüksək seysmik dalğalı enerjiyə malikdir. Bundan başqa, bu sahə çoxsaylı zəlzələlərin, onların epicenterinin və sualtı palçıq vulkanlarının mövcudluğunun təsirinə məruz qalır.

Təssüf ki, təqdim etdiyiniz sənəddə (ƏMTQ) ərazidə geoloji və geofiziki vəziyyəti xarakterizə edən məlumat yoxdur.

Bu nöqteyi nəzərdən Fəsil 4-ə (ƏMTQ) "Ətraf mühit və sosial sahə ilə əlaqədar ilkin məlumatlar", bənd 4.2.3.8-ə aşağıdakı məlumatları əlavə etməyi zəruri hesab edirik:

1.Geoloji və morfoloji vəziyyət
2.Seysmik mühit
3.Tektonika və neotektonika
4.Palçıq vulkanları

Bu məlumatları əldə etdikdən sonra, "Eqinor" şirkəti tərəfindən nəzərdə tutduğunuz seysmik tədqiqatlar zamanı pnevmatik silahlardan istifadə edərək, ətraf mühitə onların mümkün olan potensial təsirini müəyyən etmək üçün (2 ölçülü / 3ölçülü), elmi ekspertiza aparmaq və bununla bağlı AMEA Geologiya və Geofizika İnstitutu ilə razılığa gəlinməlidir.

AMEA Geologiya və Geofizika İnstitutunun direktoru, akademik Ak.A.Əlizadə

Translated letter from Institute of Geology and Geophysics

From the Institute of Geology and Geophysics

Letter No: 25-14/330

Date: 19.12.2018

Subject: EIA document for 2D-3D seismic activity in ADUA exploration area

ADUA exploration area is located in the high active part of Absheron-Balakhani zone.

This area has several structural tectonic specifics, seismic activity and high seismic wave energy. In addition, this area is affected by numerous earthquakes, their epicenters and underwater mud volcanos.

Unfortunately, the EIA document provided by you does not include information characterizing the geological and geophysical condition of the area.

From this point of view, we find it important to include the following data in the EIA's Chapter 4 "Environmental and Social Baseline", clause 4.2.3.8:

1. Geological and morphological conditions
2. Seismic conditions
3. Tectonics and neotectonics
4. Mud volcanos

Once this information is obtained, pneumatic weapons should be used during seismic study planned by Equinor, and - in order to determine their potential impact on the environment (2D/3D) it is required to have a scientific expertise and to achieve an agreement with the Institute.

ANAS Geology and Geophysics Institute

Director

Academic A. Alizada

A.2.5 Additional verbal comments from the MENR

On 21 January 2019, Equinor received additional comments to the EIA, *these* and their response are listed below:

1. Need more relevant info on seals migration. This should also include data from Azerbaijan Fisheries Research Institute re seals season migration especially in the time of the year when our activities are going to happen.
    - The EIA for the 2D-3D seismic survey in the ADUA exploration area discusses the latest results of Caspian Seal monitoring (i.e Eybatov 2015 and 2018; Dmitrieva et al. 2016) that is relevant to the survey area and prospective survey period.

2. Need feedback from the Institute of Geology and the Epidemiology Center.
    - Equinor has received official letters from: i) Institute of Geology and Geophysics and ii) Ministry of Health – Center for Hygiene and Epidemiology. Requirements of the former have been included in the EIA, while requirements from the latter have been assessed as not relevant to include in the EIA but rather in Equinor's HSE plans.

3. Need feedback/approval on the planned activities from the Azerbaijan Navy Forces
    - Equinor has received a letter from the Ministry of Defense in regard to shipping routes and navigational areas, these have been discussed directly with them and no relevant edits where needed in the EIA contents.

4. More data is needed on the seabed in that area.
    - Data included in the EIA is related to SOCAR *in situ* investigations in the Karabakh area which is adjacent to the east of the ADUA exploration area; this information is considered fit for purpose and may be extrapolated to similar areas of the ADUA where most part of the survey is to be conducted.

5. Need info on other activities that are going in the area (by BP or others)
    - To Equinor`s knowledge there is no other O&G activity currently occurring within the ADUA exploration area (beyond normal shipping traffic which has already been described in the EIA); and no other O&G activity is foreseen during the survey period. Equinor will take the necessary measures to communicate its activities to other sea users in the area during the seismic acquisition activities.

6. More info on impact on Absheron National Park.
    - Additional relevant details on the Absheron National Park have been included in the EIA.