

EQUINOR CANADA LTD.

ENVIRONMENTAL SEABED SURVEY PROGRAM 2023 REPORT

MARCH 14, 2024



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ENVIRONMENTAL SEABED SURVEY PROGRAM

2023 REPORT

EQUINOR CANADA LTD.

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ABBREVIATIONS

AUV	Autonomous underwater vehicle
C-NLOPB	Canada-Newfoundland & Labrador Offshore Petroleum Board
CPT	Cone Penetrating Test
DFO	Fisheries and Oceans Canada
ECCC	Environment and Climate Change Canada
EIS	Environmental impact statement
EL	Exploration license
EPA	Eastern Project Area
ESRI	Environmental Systems Research Institute
GIS	Geographic Information System
HD	High definition
IAAC	Impact Assessment Agency of Canada
NAD 83	North American Datum 1983
NAFO	Northwest Atlantic Fisheries Organization
PNET	Predicted-no-effect threshold
ROV	Remotely operated vehicle
SBM	Synthetic-based mud
sp.	Species
Stdev.	Standard deviation
UTM	Universal Transverse Mercator
VME	Vulnerable Marine Ecosystems
WBM	Water-based mud

Units

%	percent
cm	centimeters
ind.	individual
km	kilometers
m	meters
mm	millimeters
n	number

1 INTRODUCTION

Equinor Canada Ltd. (herein referred to as Equinor) undertook a pre-drill seabed survey in the Flemish Pass area offshore Newfoundland and Labrador (NL) in June of 2023. This Environmental Seabed Survey Program Report outlines the survey methodology and results for two survey areas.

The purpose of the program was to collect baseline data in support of potential exploration activities in the Flemish Pass area. This report presents information at two proposed wellsites on a) coral and sponge aggregation presence (including abundance, densities, and condition) and b) fish and fish habitats (marine taxa presence and surficial substrate coverage).

1.1 PROJECT LOCATION

The Project Area is approximately 500 km east of St. Johns in the Flemish Pass with the wellsite locations (marked with an X in Figure 1-1) in approximately 900 m of water depth.

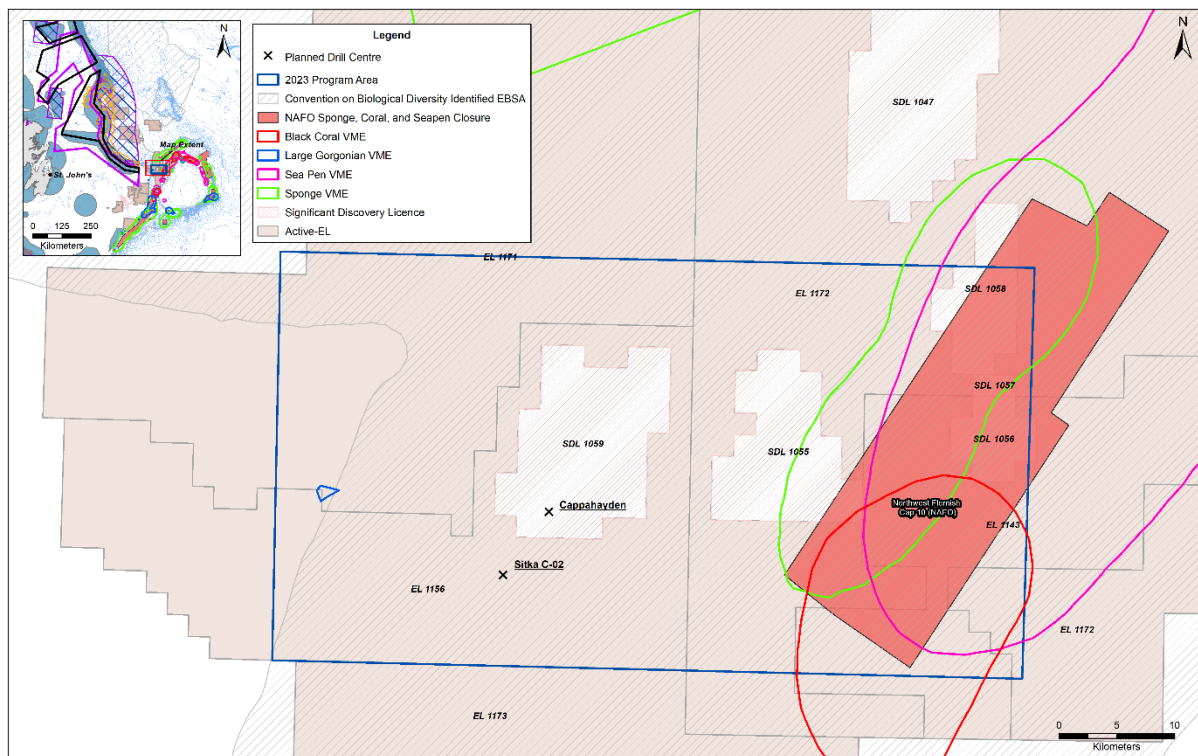


Figure 1-1 2023 survey area polygon, wellsite areas, and special areas (including 2019 VME delineation).

1.2 PREVIOUS SURVEYS

Equinor has previously conducted seabed surveys in the Flemish Pass in 2018, 2019, and 2021. These surveys utilized both autonomous underwater vehicles (AUV) and remotely operated vehicles (ROV).

- 2018 Bay du Nord AUV/ROV Seabed Surveys (Equinor 2020a, Wood 2020c),

- 2019 Exploration Drilling ROV Surveys (Wood 2019b, Wood 2020a, b),
- 2019 Geotechnical Program ROV Seabed Inspection (Fugro 2020).
- 2021 Coral, Sponge, and Fish Habitat Survey (Wood 2022 a, b).

These previous reports identified several coral and sponge taxa within the Project Area (Equinor 2020a, Wood 2020b). Coral taxa typically observed included sea pens (mainly *Pennatula* sp.), large gorgonians, small gorgonians (mainly *Acanella* sp.), and soft corals. Corals rarely observed in the survey area included black corals and solitary stony corals. Various sponges were also observed including encrusting sponges, papillate sponges (round with projections), and globular sponges. The abundance of coral and sponge taxa varied per site and some distributions were influenced by surficial substrate present. Some species of corals and sponges only occur on large grain hard substrates.

In addition to corals and sponges, several taxa of fish and marine invertebrates were also observed. Commonly observed fish species included grenadiers, blue hake, and longnose eels. Echinoderms such as sea stars, brittle stars, and sea urchins were the most frequently observed marine invertebrates (excluding corals and sponges).

1.3 ENVIRONMENTAL SEABED SURVEY SCOPE

The scope of work for the 2023 program included two pre-drill clearance surveys:

- a) the Sitka C-02 wellsite, and
- b) the Cappahayden C-85 wellsite.

These surveys were completed using site-specific plan based on the potential activities at each location (Equinor 2023). The plan was developed in consultation with Fisheries and Oceans Canada (DFO) and the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB).

These surveys were conducted as described in the following environmental assessment decision statements:

- Flemish Pass Exploration Drilling Project Decision Statement (ECCC 2019) per Condition 3.6, Fish and Fish Habitat

Table 1-1 lists the conditions from the applicable Decision Statements.

Table 1-1 EA Decision Statements applicable to the 2023 survey scopes

Condition	Condition Details
Flemish Pass Exploration Drilling Project	
3.6	The Proponent shall develop and conduct, in consultation with Fisheries and Oceans Canada and the Board, a coral and sponge survey to confirm the presence or absence of any aggregations of habitat-forming corals or sponges or any other environmentally sensitive features. The equipment used to conduct the surveys shall be operated by a qualified individual. Survey transect length and pattern around well sites shall be based on applicable drill cutting dispersion model results. Transects around anchor sites should extend at least 50 metres from the extent of the anchor pattern.

1.4 REGULATORY GUIDANCE

The regulatory guidance to mitigate potential effects from exploration drilling activities on cold-water corals and sponges was recently updated. The 2023 surveys followed the updated guidance titled: *Regional Guidance on Measures to Protect Corals and Sponges During Exploratory Drilling in the Canada-Newfoundland and Labrador Offshore Area* drafted in August 2022 by DFO (here within referred to as the Guidance).

Under the Guidance, proponents must follow the conditions of project-specific EAs and consult with the C-NLOPB and DFO to develop and conduct a seabed survey prior to any drilling activities. The seabed surveys will be used to determine the presence of aggregations of habitat-forming corals and sponges or any other environmentally sensitive features around each proposed wellsite. Aggregations of habitat-forming corals or sponges are defined as “aggregations of corals or sponges that are known or observed to support fish (IAAC 2021)”. This definition does not include a numerical value. Similarly, the DFO Guidance also does not have a numerical value to denote habitat-forming coral and sponge aggregations (i.e., by a density threshold) therefore, the distributions of the abundances and densities for each functional group will be reported. The wellsite seabed surveys were also designed in reference to applicable drill cuttings dispersion model results and meet the requirements described in Section 2.3.2 of the Guidance (DFO 2022).

1.5 DRILL CUTTINGS DISPERSION MODELLING

As per the Guidance, the survey was designed around the drill cutting dispersion model described in the Flemish Pass Exploration Drilling Program - Environmental Impact Statement (Statoil 2017). The

Eastern Project Area (EPA) dispersion model was chosen to inform the survey designs due to its proximity to the proposed drilling locations (Sitka and Cappahayden sites) and similar depth range (model: 1,100 m water depth, potential wellsites: ~900 m).

The EPA drill cutting model included the combined deposition distribution of both water-based mud (WBM) and synthetic-based mud (SBM) discharges. To capture the seasonal variation in ocean currents experienced over the course of a year, modelling was conducted for four different 'scenarios' (for March, June, September, and December). Drilling activities in the Newfoundland offshore typically occurs over the late spring to early fall timeframe. To represent the most conservative scenario, the drill cuttings model used in this plan consists of the maximum depositional value and spatial extent from the four seasonal models combined.

To assess the potential effects of drill cuttings on benthic fauna, a threshold of 1.5 mm predicted no effect threshold (PNET) was applied to the model results (Kjeilen-Eilertsen et al. 2004, DFO 2022). Potential effects from sedimentation thresholds of 1.5 mm and 6.5 mm (combined WBM and SBM accumulations) were also considered in the EIS (Statoil 2017). Studies on the effects of sedimentation and burial from drill cuttings on benthic invertebrates have found the effects to be mainly localized to the vicinity of the cuttings pile (Neff et al. 2000, Gates and Jones 2012). The PNET for non-toxic sedimentation (based on benthic invertebrate species burial tolerances) is an average burial depth of 6.5 mm (Kjeilen-Eilertsen et al. 2004, Smit et al. 2006). However, burial tolerance can vary between species and a burial threshold of 1.5 mm has been suggested as a conservative threshold to assess drill cutting burials (Kjeilen-Eilertsen et al. 2004). Areas below the 1.5 mm PNET are predicted to have no adverse effect to benthic fauna.

Table 1-2 summarizes the accumulations of drill cuttings with proximity to the wellsite based on the PNET levels stated in the EIS. Table 1-3 summarizes the percent of depositional area each thickness category covers. Figure 1-2 visually depicts the predicted distribution of drill cuttings and the proposed wellsite survey design.

Table 1-2 Percent Drill Cuttings Material Settled by Distance (adapted from Statoil 2017).

Eastern Project Area Model		Distance from Well Site									
		<10m	10-100m	100-200m	200-500m	500-1km	1-2 km	2-4 km	4-5 km	5-31 km	>31 km
Cuttings Type		Cuttings Thickness (mm)									
March											
WBM	Mean	41	10	1	1	-	-	-	-	-	-
	Maximum	58	88 ¹	4	1	-	-	-	-	-	-
SBM	Mean	-	<0.01	0.01	0.02	0.03	0.02	-	-	0.01	0.03
	Maximum	-	<0.01	0.04	0.1	0.1	0.1	-	-	0.05	0.3
June											
WBM	Mean	20	8	3	1	-	-	-	-	-	-
	Maximum	35	97 ²	28	1	-	-	-	-	-	-
SBM	Mean	-	-	-	<0.01	0.01	0.02	-	-	-	-
	Maximum	-	-	-	0.01	0.1	0.12	-	-	-	-
September											
WBM	Mean	10	6	6	1	-	-	-	-	-	-
	Maximum	25	80 ³	40	9	-	-	-	-	-	-
SBM	Mean	<0.01	0.03	0.05	0.02	<0.01	<0.01	-	-	0.03	-
	Maximum	0.01	0.13	0.19	0.15	0.06	0.02	-	-	0.4	-
December											
WBM	Mean	17	12	2	1	-	-	-	-	-	-
	Maximum	37	116 ⁴	17	2	-	-	-	-	-	-
SBM	Mean	<0.01	<0.01	<0.01	0.02	0.02	<0.01	-	-	0.06	-
	Maximum	<0.01	0.02	0.06	0.10	0.10	0.05	-	-	0.4	-
¹ maximum located (at 0.02 km, 0°), ² at (0.02 km, 292°), ³ at (0.05 km, 35°), ⁴ at (0.06 km, 151°)											

Table 1-3 Distribution of Drill Cutting Thickness by Distance Summary (adapted from Statoil 2017).

Drill Cutting Thicknesses	Depositional Area (%)	
	Within 500 m	Drill Cuttings Footprint
0 mm (outside of footprint)	39.4	-
0 < x < 1.5 mm (Below PNET)	53.2	87.6
1.5 < x < 6.5 mm (PNET range)	2.7	4.4
6.5 < x < 10 mm (Above PNET)	0.8	1.3
10 mm < x (Above PNET)	4.0	6.6

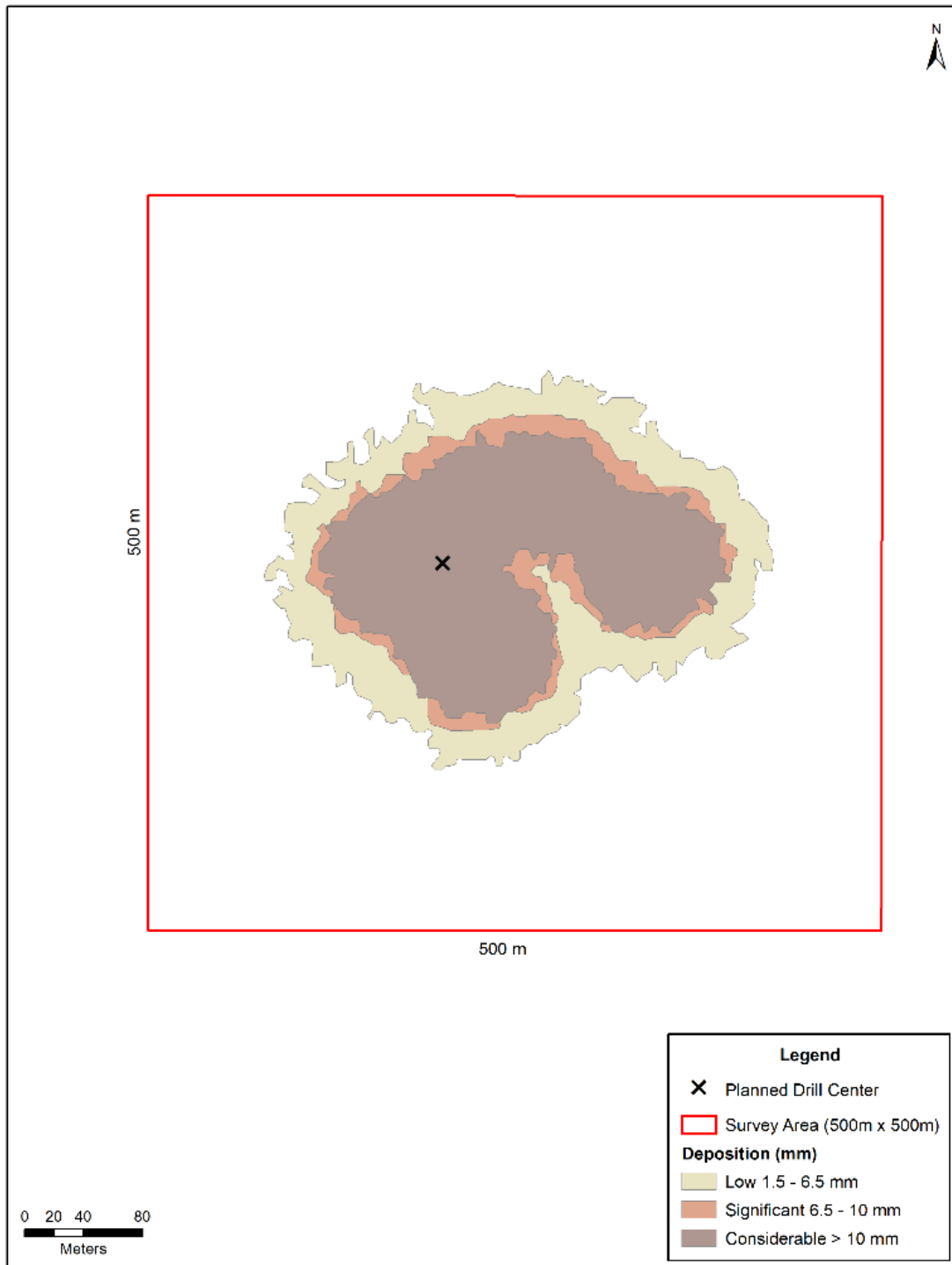


Figure 1-2 Combined predicted drill cutting footprint (WBM and SBM) for exploratory wellsites.

2 METHODOLOGY

2.1 FIELD SURVEY

The 2023 program survey was conducted between June 13th and June 17th, 2023, aboard the *Horizon Arctic* (operated by Horizon Maritime). Video and still imagery were collected using an ROV operated by Bourbon Offshore. Geo-referencing services were provided by Fugro GeoSurveys Inc. WSP provided onboard biologists to offer direction related to collecting appropriate data as described in the survey plan. Equinor was responsible for chartering the vessel and hiring the subcontractors.

2.1.1 VEHICLE AND DATA COLLECTION

To locate possible aggregations and characterize the benthic habitat, imagery of the seabed was collected using a Schilling HD ROV (See Appendix C). The ROV followed site-specific patterns described below. Geo-tagged HD video and still imagery was collected of the seafloor along the entirety of each transect. To capture appropriate imagery, the ROV travelled less than 1 m above the seabed and at speeds of less than 1 km/hr. The altitude recorded in the overlay during the survey was not accurate thus the ROV was flown at a height appropriate for identifying taxa (> 5 cm in size) and objects. Close-up images of representative coral and sponge taxa were taken opportunistically and included images of polyps (corals only), body, and attachment point.

2.2 SURVEY PATTERNS

WELLSITE SURVEYS

Due to the exploratory nature of drilling, some survey patterns had to be adapted after the plan was submitted but prior to the execution of the survey. For example, a focused pattern was conducted at the Sitka wellsite as its specific location was known at the time the plan was submitted (Figure 2-1). However, a broad scope survey pattern was used at the Cappahayden survey area as the specific drilling location was not determined at the time the plan was approved and the survey was conducted (Figure 2-2). Both survey patterns were developed in consideration of the Guidance and EPA drill cuttings dispersion model predictions and encompass the modelled distribution of drill cuttings above 1.5 mm PNET (as described in Section 1.5).

The Sitka wellsite survey pattern consisted of:

- a 500-m x 500-m grid centered on the drill cutting dispersion footprint for the planned drill centre, transects spaced 25-m apart (as per Section 2.3.2 in the Guidance),
- Six 500-m long additional transects spaced 100-m apart outside of the survey grid (three north of the grid and three south of the grid),
- Six 100-m long additional transects spaced 100-m apart extending outside of the survey grid (three east of the grid and three west of the grid),
- Two reference areas (one downstream and one upstream) (as per Section 2.3.2 in the Guidance).

The Cappahayden wellsite survey pattern consisted of:

- a trapezoid grid centered on the preferred drilling area,

- 37 transects spaced 25-m apart and varied in length from 50 m (Transect 37) to 1,200 m (Transect 1)

The survey area identifies the area where the potential wellsite was expected to go before the execution of the plan. The survey boundary is the buffer for the potential wellsite within the survey area.

Table 2-1 Proposed wellsite and polygon coordinates for each site.

Site	Coordinates
Sitka Wellsite	368125.19 E/5301559.31 N (proposed wellsite)
Cappahayden Wellsite	371965.1 E/ 5306982.1 N (proposed wellsite)
	1) 371379 E/5307242 N
	2) 371652 E/ 5307394 N
	3) 372826 E/ 5307099 N
	4) 371829 E/ 5306444 N
All coordinates listed are in NAD 83 Zone 23 N.	

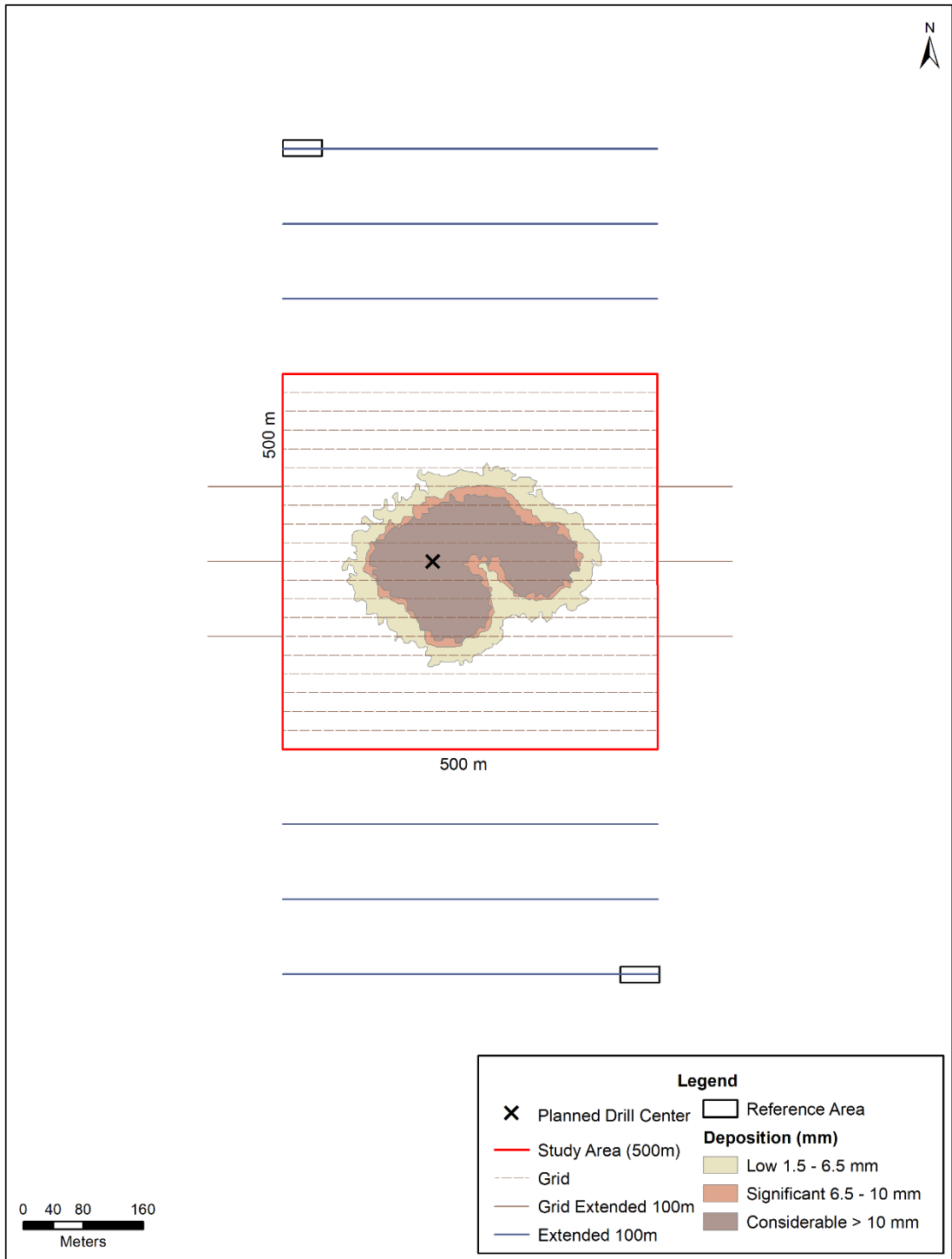


Figure 2-1 Sitka Wellsite survey pattern (2023).

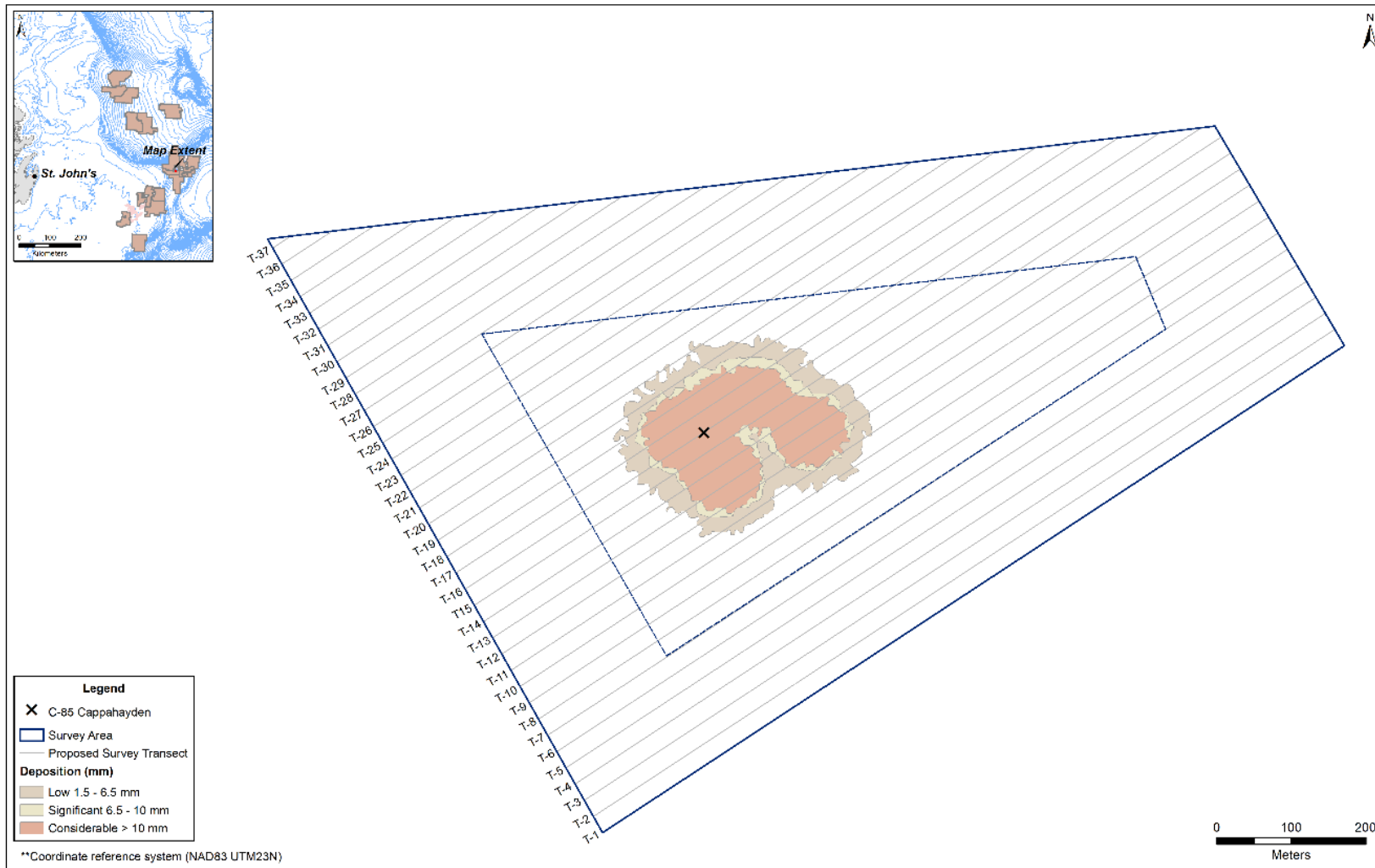


Figure 2-2 Cappahayden Wellsite Survey Pattern (2023)

2.3 POST-SURVEY ANALYSIS

Equinor will use the results of the surveys for additional baseline habitat data to further inform drilling locations and subsea infrastructure planning. The survey fulfilled EA conditions for the Flemish Pass Exploration Drilling Project (Condition 3.6) (see Table 1-). For the post-survey analysis, transects were binned into 50 m sections. Post-survey, biologists were responsible for reviewing the acquired imagery and documenting the following:

- Surficial Substrate Description (see below Section 2.3.1),
- Functional/Morphological Groups of corals and sponges (as per the draft Guidance see Section 2.3.2),
- Coral and Sponge Aggregations (see above Section 1.4),
- Coral and Sponge Condition (as per the draft Guidance see Section 2.3.2).
- General observations of marine fish and invertebrates (see below Section 2.3.3),
- Species at Risk,
- Other observations (e.g., evidence of trawl fishing).

2.3.1 SURFICIAL SUBSTRATE

Surficial substrate was described per transect using the definitions described in Table 2-2. Surficial substrates present (percent coverage of primary and secondary substrates) were described per transect sub-section. The largest substrate class present in each section was mapped.

Table 2-2 Surficial substrate categories used to categorize benthic environment (Wentworth 1922).

Substrate Class	Substrate Type	Definition
Bedrock		Continuous solid bedrock
Coarse	Boulder	Rocks greater than 250 mm
	Rubble	Rocks ranging from 130 mm to 250 mm
Medium	Cobble	Rocks ranging from 30 mm to 130 mm
	Gravel	Granule size or coarser, 2 mm to 30 mm
Fine	Sand	Fine deposits ranging from 0.06 mm to 2 mm
	Mud	Material encompassing both silt and clay < 0.06 mm
Organic/Detritus		A soft material containing 85 percent or more organic materials
Shells		Calcareous remains of shellfish or invertebrates containing shells

2.3.2 CORAL AND SPONGE IDENTIFICATION AND CONDITION

Corals and sponges were identified visually using a Northwest Atlantic Fisheries Organization (NAFO) area guide (Kenchington et al. 2015) (Table 2-3) and put into functional groups based on the DFO guidance (DFO 2022). The abundance (individuals) and density (ind./m²) of each coral and sponge

functional group was mapped per transect section. Coral and sponge conditions were also assessed during the post-survey analysis using the condition categories described in the approved plan (Table 2-4). Conditions noted include if individuals are alive or dead, have visible damage (e.g., broken skeletons, polyps are missing, or pieces of the sponge body are missing), and if they have visible layers of sediment or drill cuttings. In the Guidance, habitat-forming coral and sponge aggregations are not defined (i.e., by a density threshold) therefore, the distribution of each functional groups abundances and densities will be discussed.

Table 2-3 Summary table of coral and sponge functional groups (Annex A of DFO 2022).

Functional Groups	Example Taxa
<i>Habitat-Forming</i>	
Black Corals	<i>Stauropathes</i> sp.
Small Gorgonians	<i>Acanella</i> sp.
Large Gorgonians	<i>Paragorgia</i> sp.
Sea Pens	<i>Anthoptilum</i> sp.
Sponges	Calcarea, Hexactinellida, Demosphongiae
<i>Other Groups</i>	
Other (Soft corals, Hard Corals, Hydrocorals)	<i>Duva</i> sp., <i>Desmophyllum dianthus</i>

Table 2-4 Coral and sponge condition categories with descriptions (Annex C of DFO 2022).

Coral Condition		Sponge Condition	
Condition	Description	Condition	Description
Good (G)	<ul style="list-style-type: none"> — Coral is oriented upright (or expected orientation for species), with no breakage, — No polyp loss, — No discoloration, — No visual signs of parasitic or mucus covering the colony or hydroids covering parts of the colony, — No visual sedimentation. 	Good (G)	<ul style="list-style-type: none"> — No signs of dislodgement, usually clean surface (i.e., no visual signs of sedimentation) and a tight shape.
Damaged (Dm)	<ul style="list-style-type: none"> — Partially covered/visible layer of sediment/drill cuttings, — A portion of the coral is bent or has breakage of branches/polyps, some polyps missing, — Skeleton partially exposed, partial necrosis, — Lack of tissue/tissue destroyed, — Some visible discoloration, — Presence of parasites such as zoanths or hydroids overgrowing the colony, 	Poor/Damaged	<ul style="list-style-type: none"> — Broken, exposed tissue, fragmented, or tipped/flipped over, — Partially covered/visible layer of sediment/drill cuttings, — Branched sponge laying on the seafloor, — Evidence necrosis, — Presence of white mats covering parts of the sponge, — Sponge appears deflated, losing its firmness, — Sponge looks to be disintegrating,

Coral Condition		Sponge Condition	
Condition	Description	Condition	Description
	<ul style="list-style-type: none"> — Mucus clearly visible on surface of coral. 		<ul style="list-style-type: none"> — Surface appears fuzzy, — Discoloration, many times appearing brown.
Dead (D)	<ul style="list-style-type: none"> — Dead, partially dead, or broke. Some indications may include: toppled, dislodged, skeleton visible with little to no living tissue, or coral skeleton with few or no polyps, — Tipped colony with growth re-oriented upwards-most of the colony dead, — Loss of color. 	Unable to determine if a sponge is dead with visual survey alone.	

2.3.3 FISH, OTHER INVERTEBRATES, SPECIES AT RISK, AND OTHER OBSERVATIONS

The most common invertebrates and fish observed during the survey were noted. Fish were identified to functional group as described in Ollerhead et al. (2017). While the survey was not specifically designed to assess the presence of Species at Risk (SAR), they were also be identified whenever possible. Representative photos of taxa groups observed during the survey were taken opportunistically. Any other observations of objects on the seafloor such as trawl marks or debris were also noted.

Table 2-5 Summary table of fish functional groups.

Functional Groups	Example Taxa
Benthivore	Wolffish, grenadiers
Piscivore	Greenland halibut
Planktivore	Lanternfish
Plank-piscivore	Redfish
Unknown Fish	Fish unable to be identified to a particular functional group
Note: Functional groups are based on Table 7 of Ollerhead et al. 2017	

2.3.4 MAPPING

All datasets (transect positioning, and survey observations) were plotted using GIS software ArcGIS (ESRI 2020) in NAD83 UTM datum zone 23. Mapping primary substrates alone do not show the full extend of substrates present as fine-grained substrates are the primary substrate for a majority of the seafloor in the area. Thus, to depict the distribution of any hard substrates present, the largest substrate observed with the highest percent coverage for each transect section was mapped. Coral

and sponge data (abundance, density, and condition) were mapped per each transect section. Percent condition for coral and sponge functional groups were mapped by percent 'Damaged (Poor)/Dead' present.

3 RESULTS

3.1 GENERAL TRENDS

A total of 14,100 m of seafloor (linear distance) was examined at the Sitka wellsite location and 31,000 m at the Cappahayden wellsite location. The seafloor was mainly fine-grained substrates with sporadic larger hard substrates. The most commonly observed coral functional groups were sea pens (mainly *Pennatula* spp.) at both survey areas. Sponges were relatively rare at both sites. At both sites, corals and sponges appeared to be in mainly good condition. The Cappahayden site showed signs of trawling activity throughout the surveyed area.

3.2 SITKA WELLSITE SURVEY

The Sitka wellsite area survey covered 14,100 m of seafloor in approximately 850-m water depth. The surficial geology and taxa present are described as such:

- The primary substrate class observed was fine with sporadic coarse and medium substrates (Figure 3-3).
- A total of 68,841 individual corals were observed from three functional groups sea pens, small gorgonian, and other corals (e.g., soft and hard corals). Sea pens (consisting mainly of *Pennatula* spp.) occurred in the highest total abundance ($n = 67,418$). Small gorgonians (mainly *Acanella* sp.) were also present ($n=1,337$) as were soft and hard corals ($n= 83$ and $n=3$, respectively) (Table 3-1, Figure 3-1).
- No large gorgonians or black corals were observed within the survey area.
- The highest abundance/density of sea pens were observed to the east of the proposed wellsite (Figure 3-4, Figure 3-5). The lowest densities were observed in the northwest section of the survey area (500 m boundary). Small gorgonians were observed at similar densities throughout the survey area with the lowest occurring to the west and northwest of the wellsite (Figure 3-6, Figure 3-7). Other corals were observed mainly to the south of the wellsite with the highest densities occurring on transect 20 and 21 (Figure 3-8, Figure 3-9). Less than three percent of the total corals observed were deemed to be in 'Damaged' or 'Dead' condition (Figure 3-10).
- Sponges were rarely observed in the survey area with a total of 20 individuals observed (Figure 3-11, Figure 3-12). The overall condition of these sponges was deemed 'Good'.
- Sponge densities are low within the predicted drill cuttings dispersion area. Coral densities are similar throughout the survey area with a few sections of relatively higher densities (7.53 to 14.253 ind./m²) to the east of the wellsite.
- All four fish functional groups (benthivores, piscivores, plank-piscivores, and planktivores) were present within the survey area (Table 3-2). Benthivores (mainly grenadiers) were most

commonly observed. Two redfish and two wolffish were also observed within the survey area (Figure 3-2).

- Other invertebrates observed during the survey included cnidarians (anemones), echinoderms (urchins and sea stars), and molluscs (squid) (Table 3-3).
- While no trawl marks were present in this area, there was some debris (e.g., a bottle).

Table 3-1 Summary for corals and sponges for the Sitka survey area.

Functional Groups	Total	Density (individuals per m ²)				
		Mean	Standard Deviation	Median	Minimum	Maximum
Sea Pens	67418	2.75	2.20	2.17	0.41	14.26
Small Gorgonians	1337	0.05	0.06	0.03	0	0.48
Other Corals	86	0.004	0.03	0	0	0.44
Large Gorgonian	-	-	-	-	-	-
Black Coral	-	-	-	-	-	-
Sponges	20	<0.001	0.003	0	0	0.22
Field-of-view: 1.74 m, Area per 50 m bin: 87 m ²						
“- “indicates this faunal group was not observed						

Table 3-2 Summary for fish functional groups for the Sitka survey area.

Functional Groups	Total	Density (individuals per m ²)				
		Mean	Standard Deviation	Median	Minimum	Maximum
Benthivore	1445	5.12	3.11	4	0	20
Piscivore	5	0.02	0.13	0	0	1
Planktivore	2	0.01	0.08	0	0	1
Plank-piscivore	2	0.01	0.08	0	0	1
Unknown Fish	80	0.28	0.64	0	0	4
Field-of-view: 1.74 m, Area per 50 m bin: 87 m ²						
“- “indicates this faunal group was not observed						

Table 3-3 Summary for other invertebrate groups for the Sitka survey area.

Functional Groups	Total	Density (individuals per m ²)				
		Mean	Standard Deviation	Median	Minimum	Maximum
Echinodermata	8,377	29.71	13.06	28	4	81
Cnidaria	410	1.45	1.76	1	0	9
Mollusca	242	0.86	1.10	1	0	6
Arthropoda	63	0.22	0.52	0	0	2
Annelida	4	0.01	0.15	0	0	2
Field-of-view: 1.74 m, Area per 50 m bin: 87 m ²						
“- “indicates this faunal group was not observed						
Cnidaria other than corals						

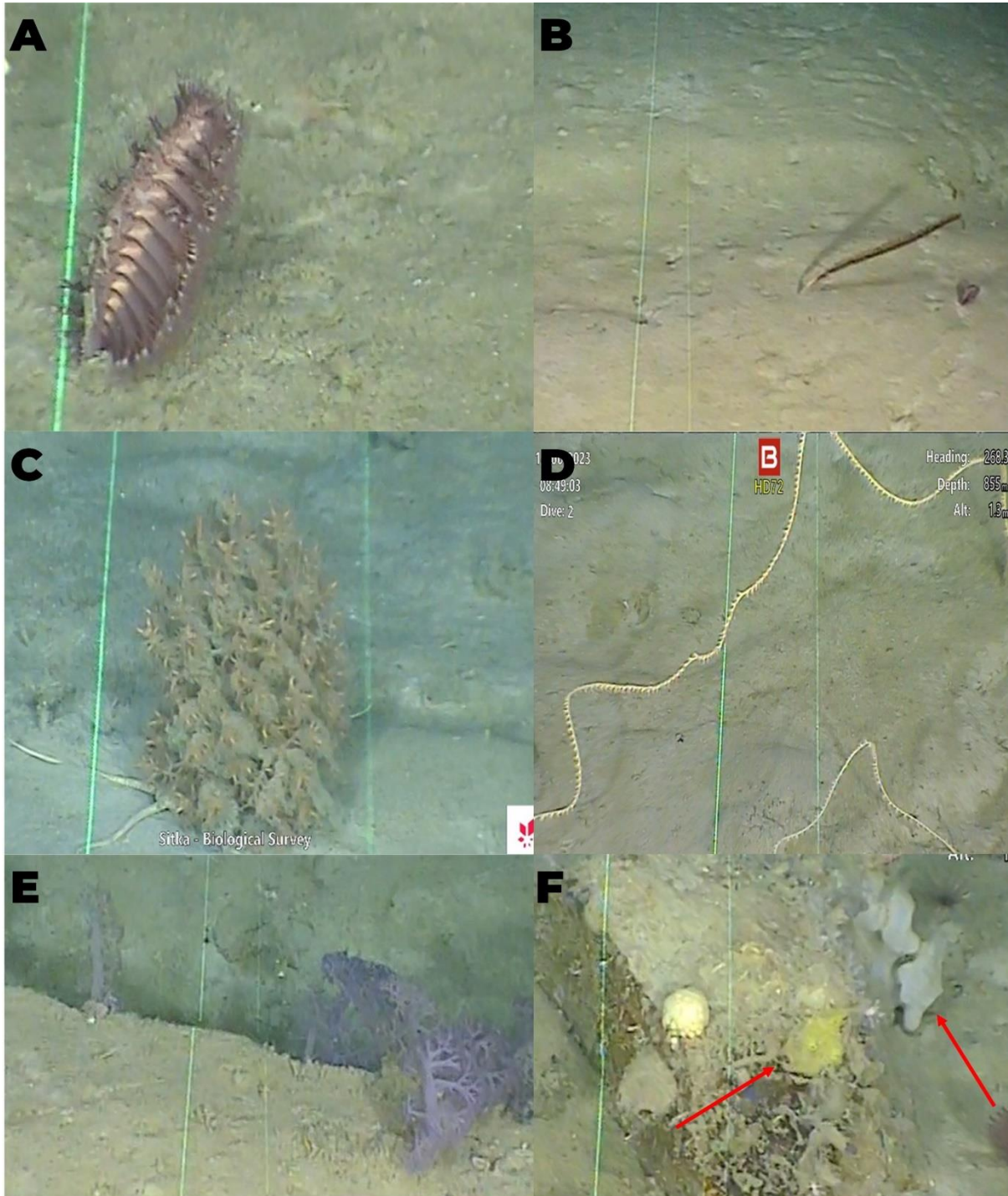


Figure 3-1 Representative photos of coral and sponge functional groups observed. A) Sea pen (*Pennatula* sp., condition 'Good'), B) Sea pen (*Balticina* sp.), C) Small gorgonian (*Acanella* sp., condition 'Damaged'), D) Small gorgonian (*Radicipes* sp.), E) Other coral (soft corals), F) Sponges (red arrows). Green lasers are 10 cm apart.

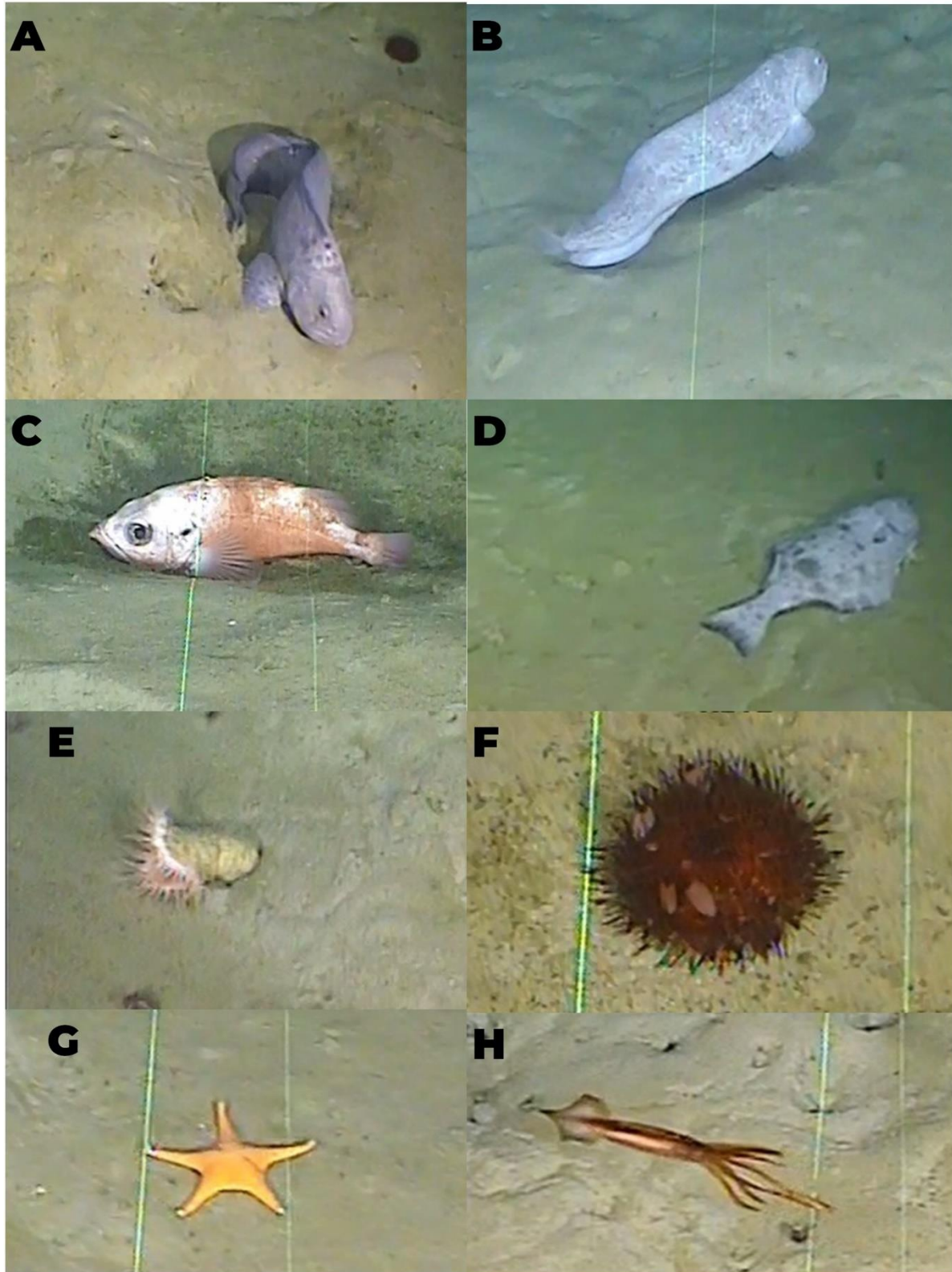


Figure 3-2 Representative photos of other taxa and observations. A) Benthivore (Spotted Wolffish sp., B) Benthivore (Atlantic Wolffish sp.), C) Plank-piscivore (Redfish), D) Piscivore (halibut), E) Cnidaria (anemone), F) Echinoderm (sea urchin), G) Echinoderm (sea star), H) Mollusc (squid). Green lasers are 10 cm apart.

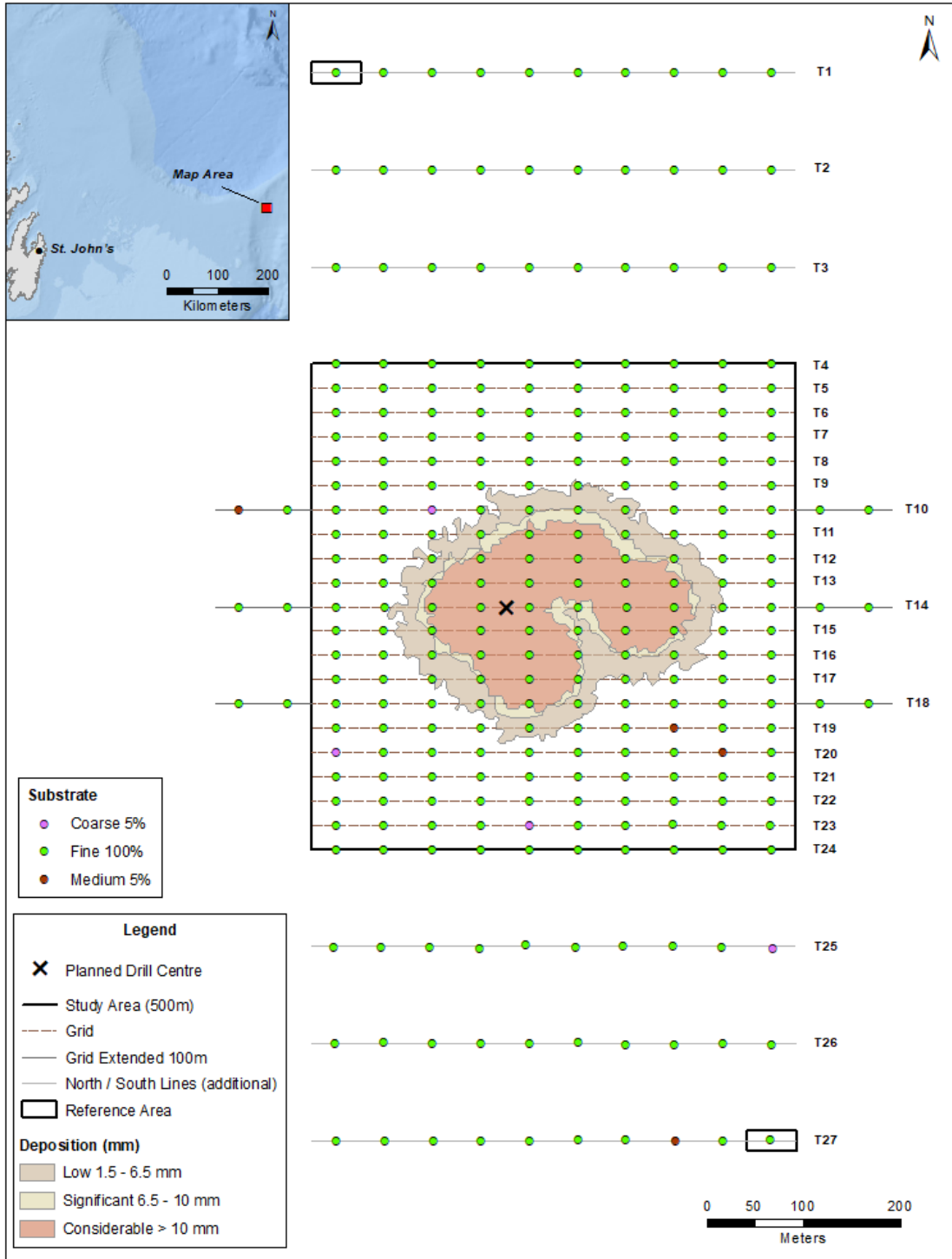


Figure 3-3 Largest grain size percent present for the Sitka wellsite area (by section)

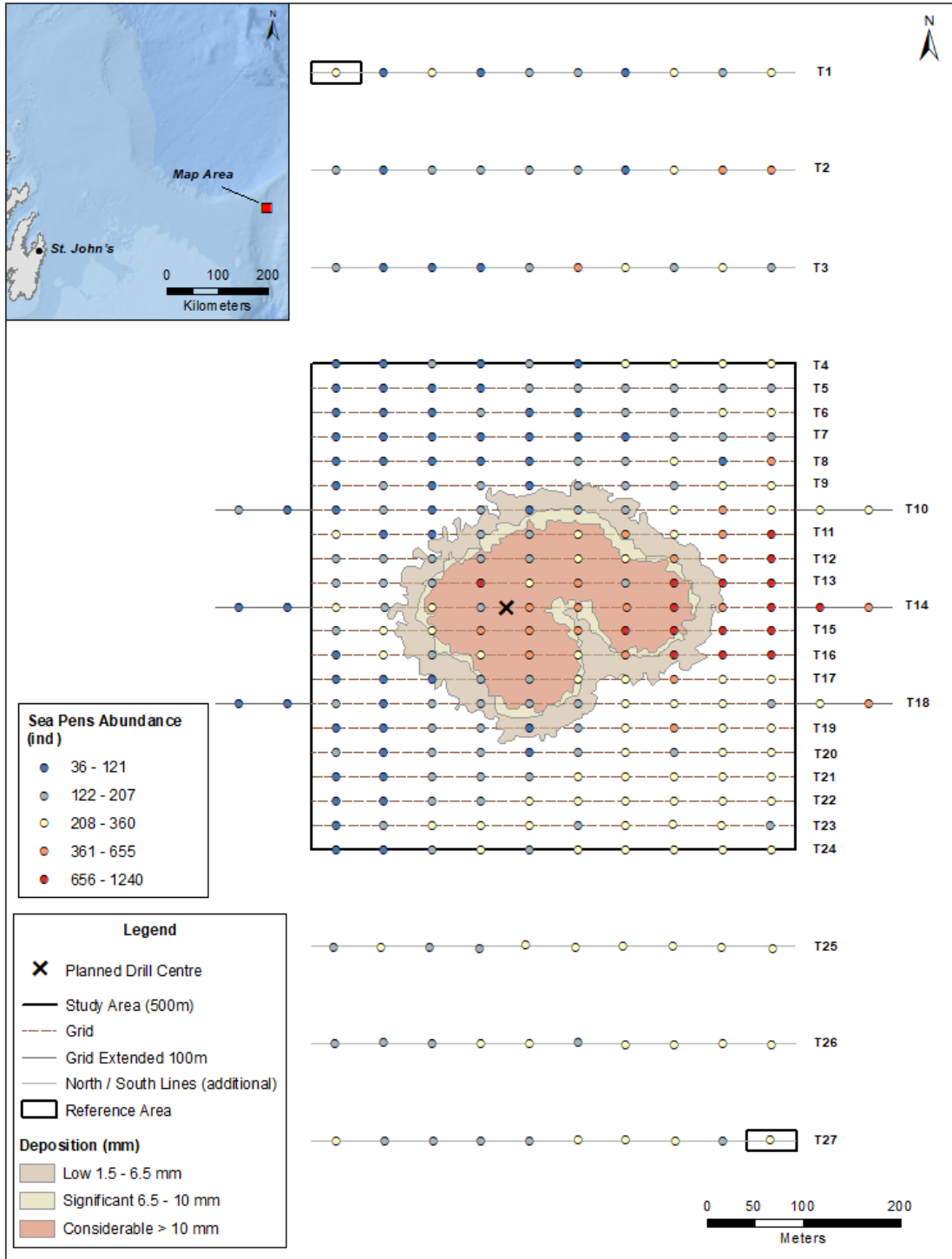


Figure 3-4 Sea pen abundance for the Sitka wellsite area (by section)

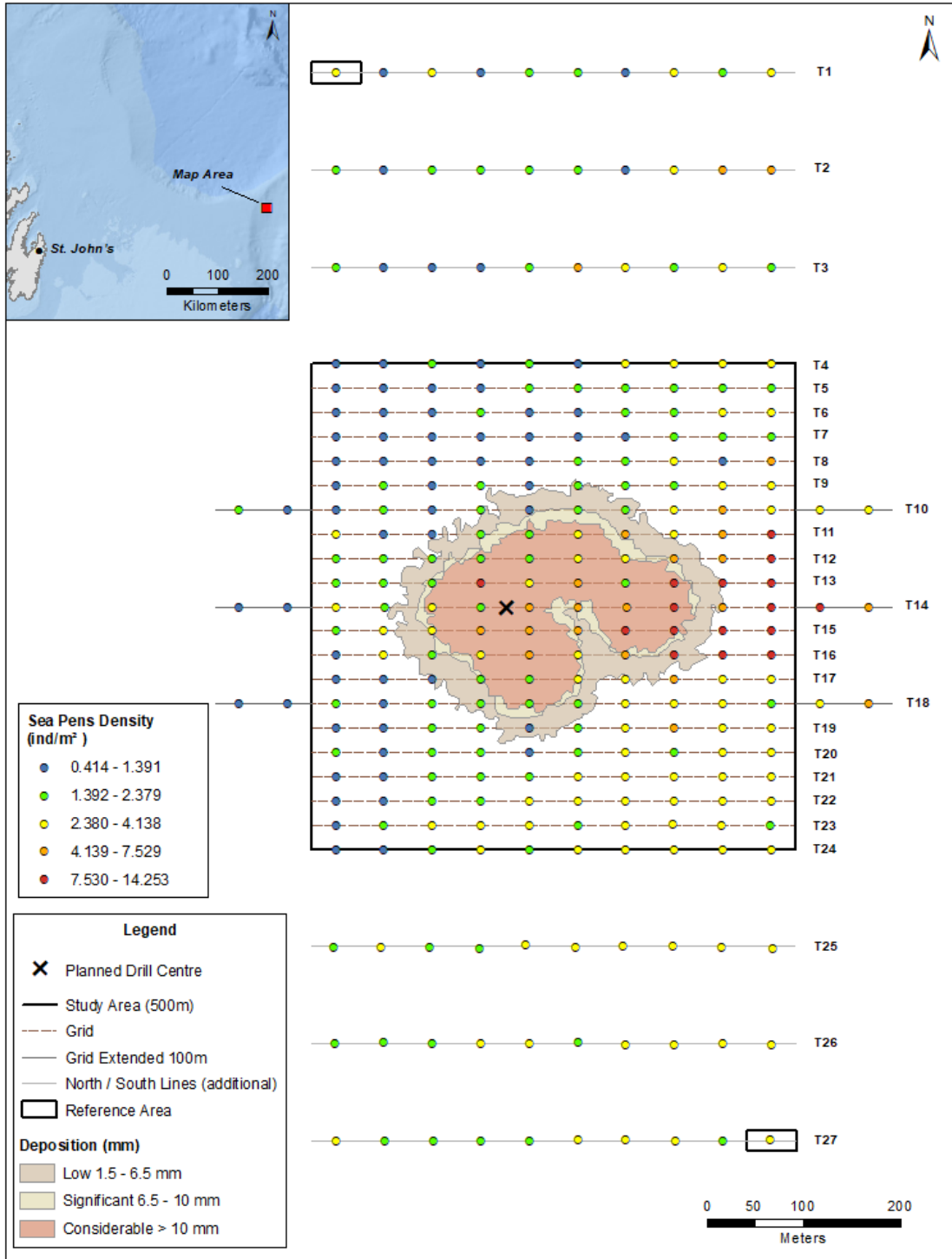


Figure 3-5 Sea pen density for the Sitka wellsite area (by section)

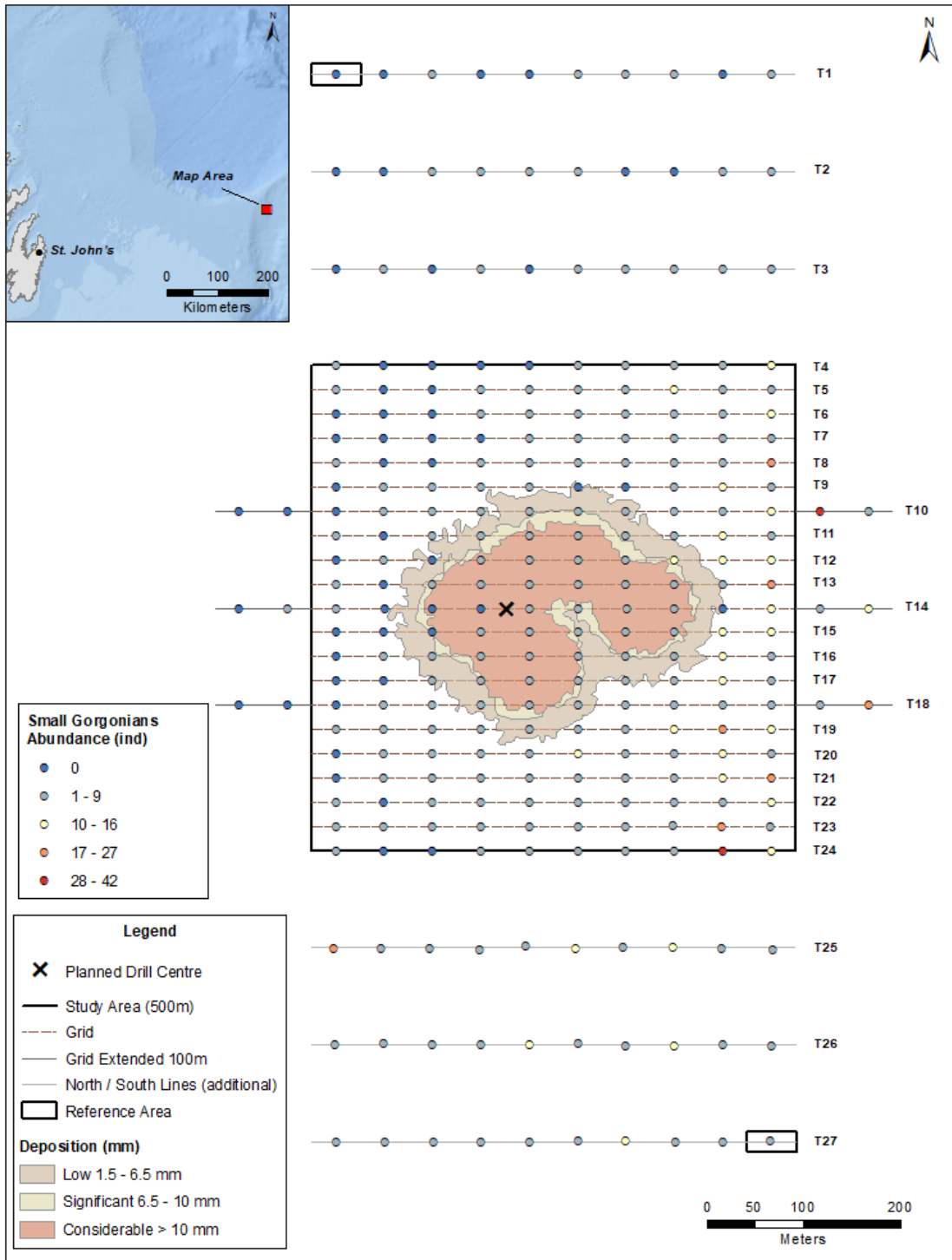


Figure 3-6 Small gorgonian abundance for the Sitka wellsite area (by section)

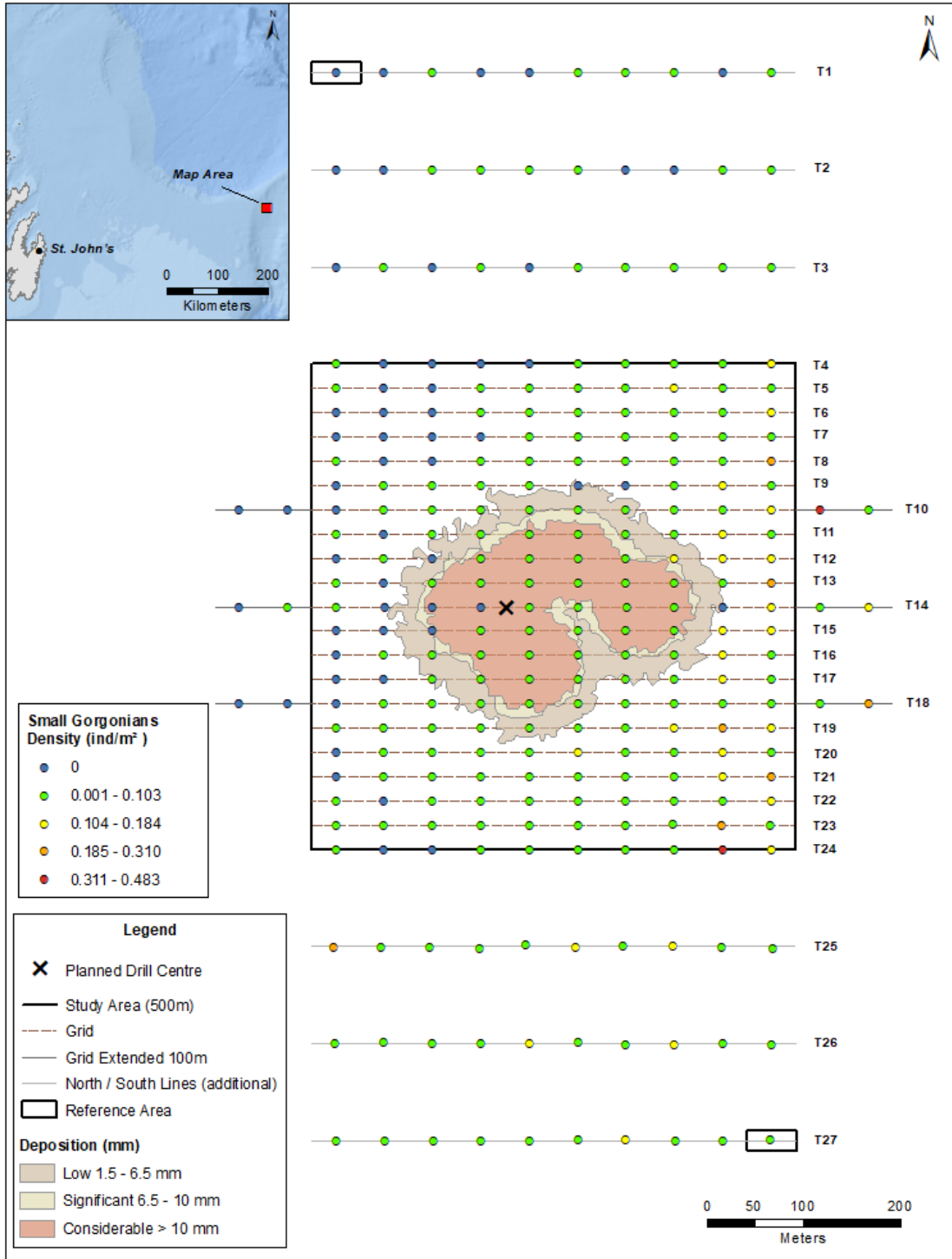


Figure 3-7 Small gorgonian density for the Sitka wellsite area (by section)

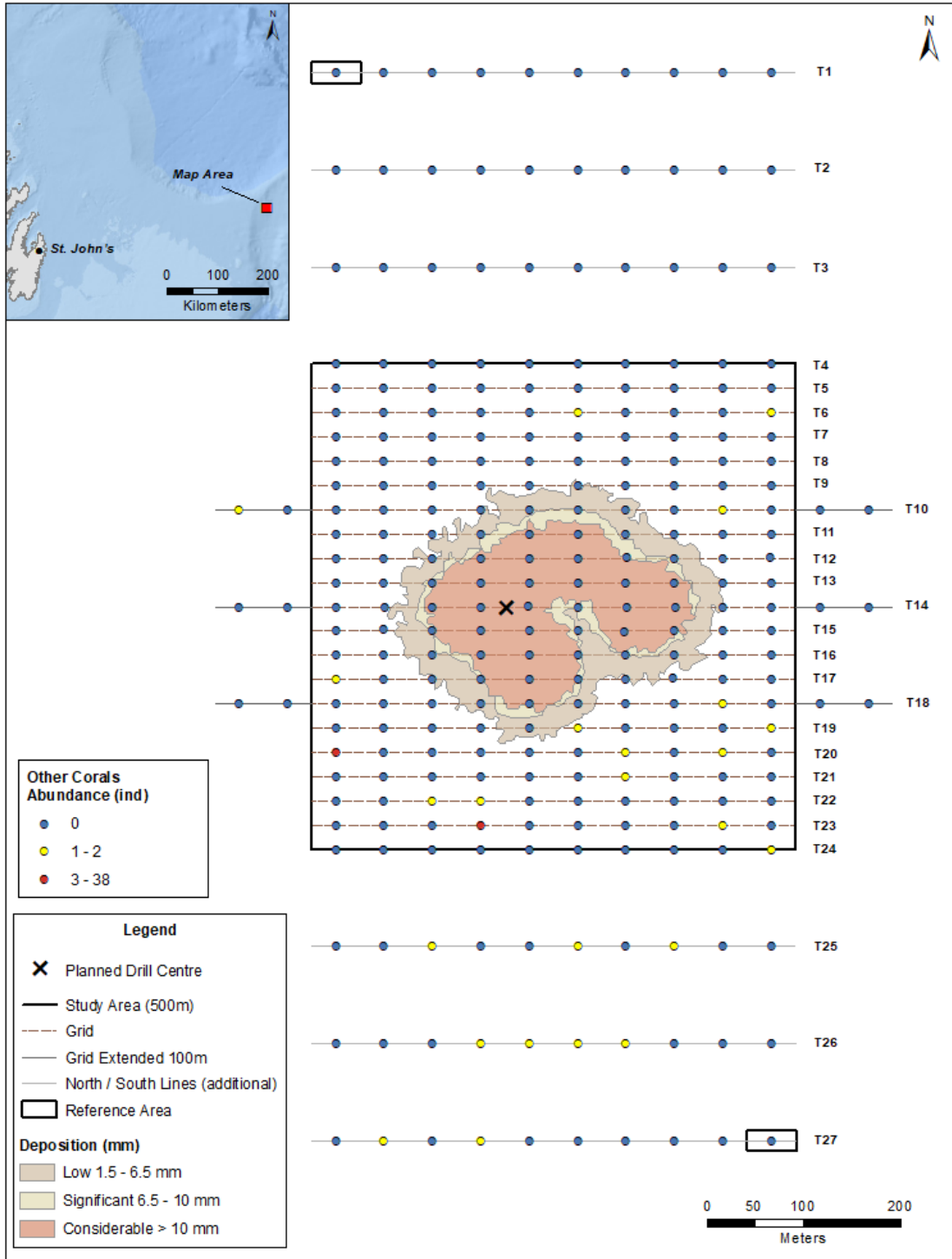


Figure 3-8 Other corals abundance for the Sitka wellsite area (by section)

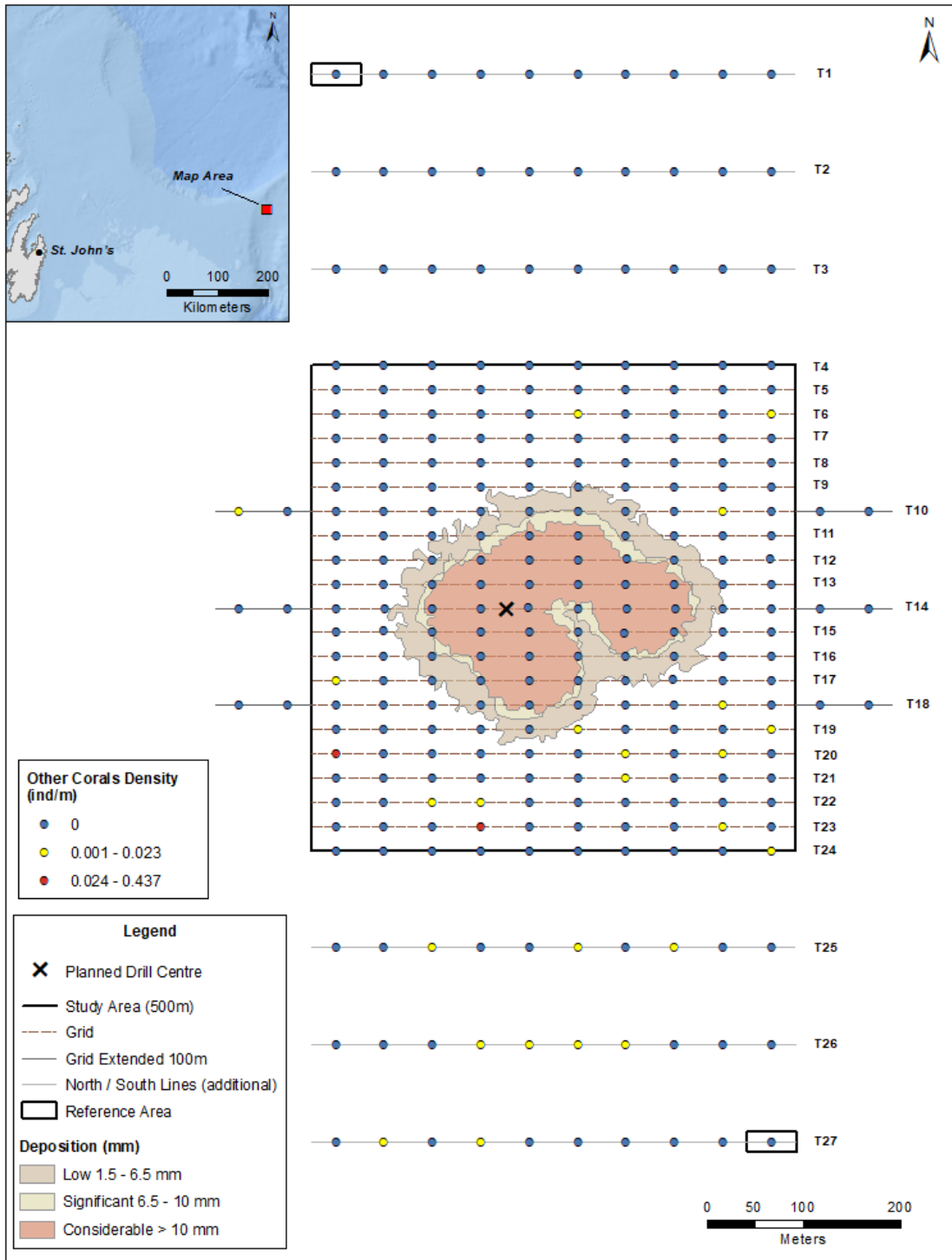


Figure 3-9 Other corals density for the Sitka wellsite area (by section)

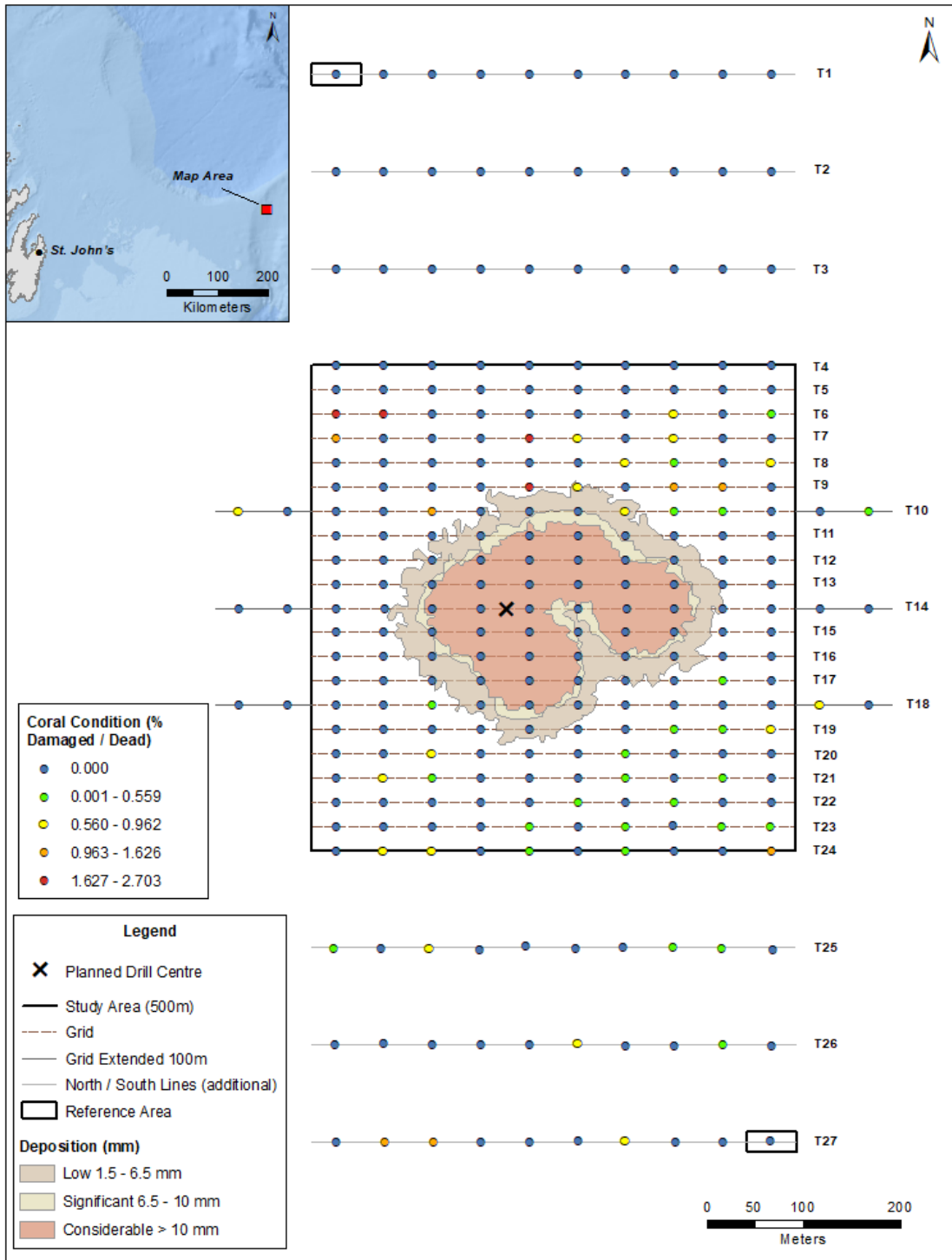


Figure 3-10 Coral condition (% Damaged or Dead) for the Sitka wellsite area (by section)

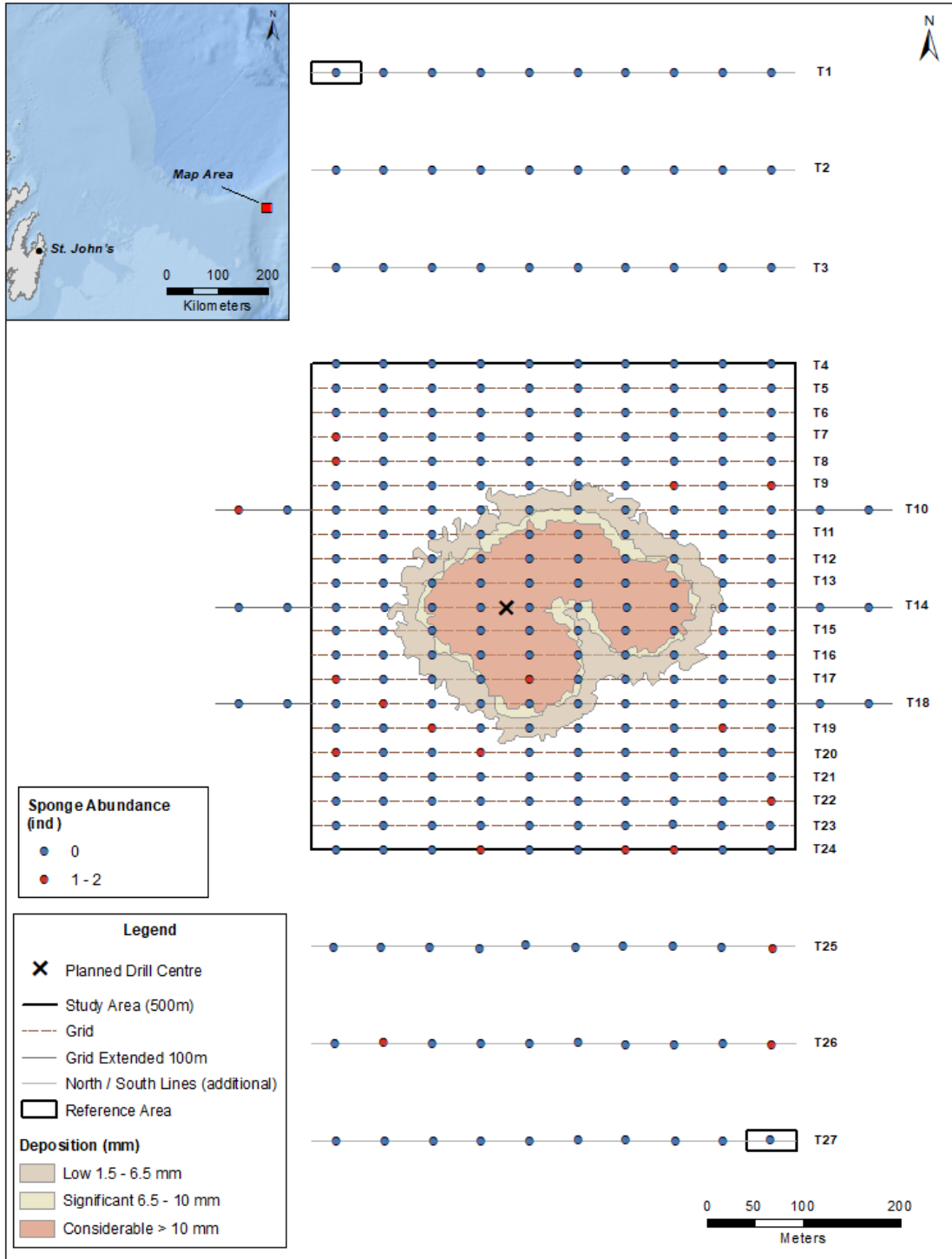


Figure 3-11 Sponge abundance for the Sitka wellsite area (by section)

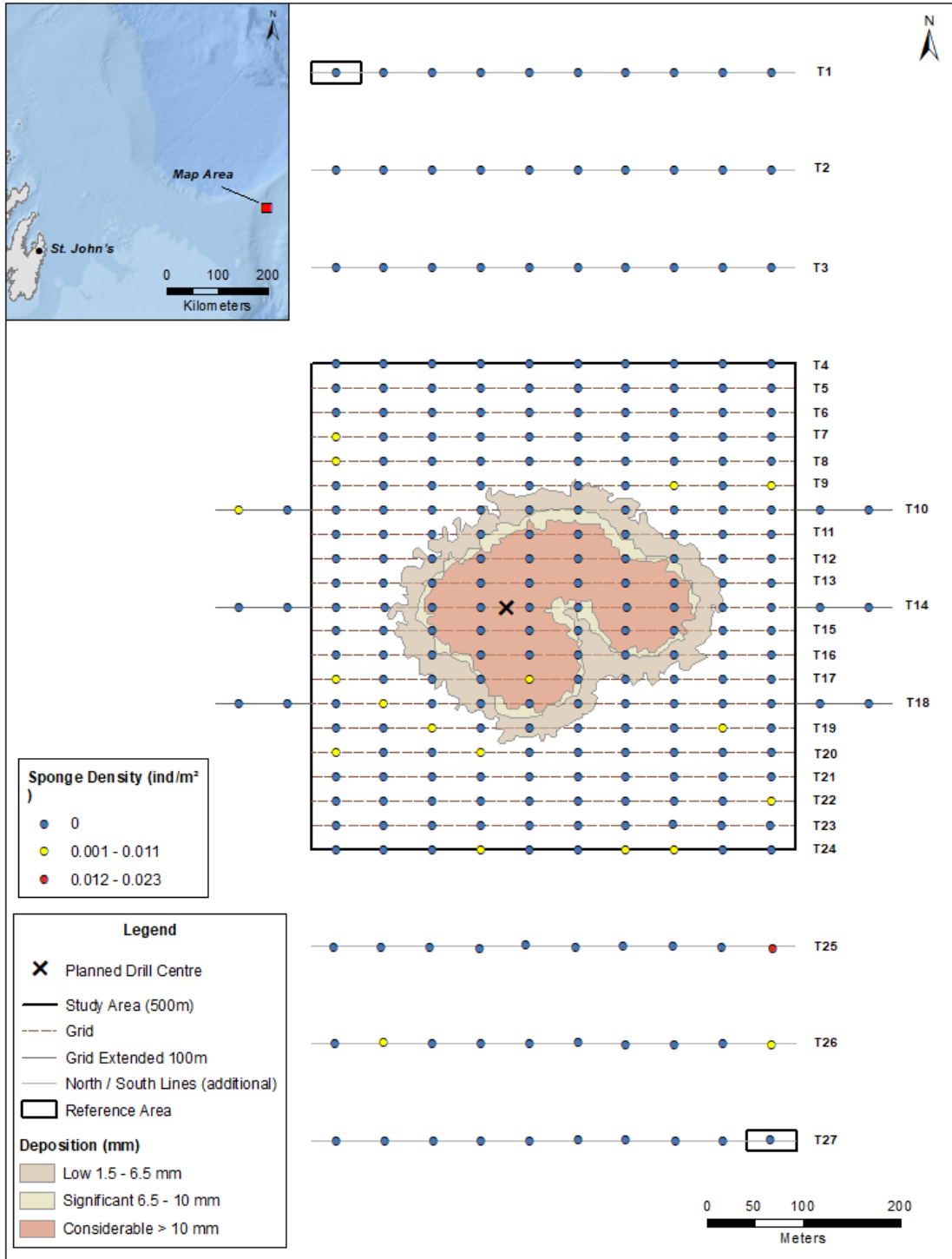


Figure 3-12 Sponge density for the Sitka wellsite area (by section)

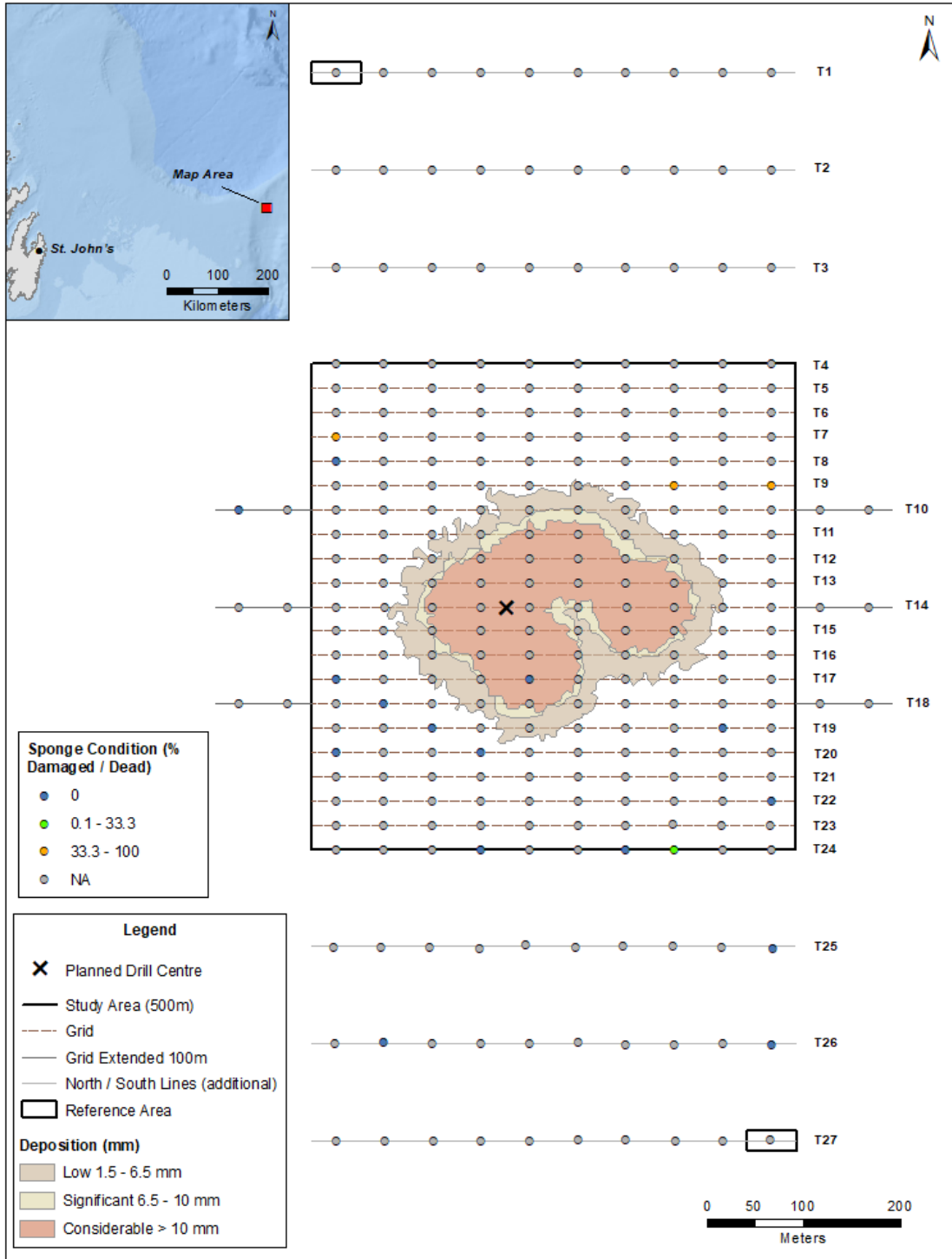


Figure 3-13 Sponge condition (% Poor/Damaged) for the Sitka wellsite area (by section)

3.3 CAPPAHAYDEN WELLSITE SURVEY

The Cappahayden wellsite area survey covered 31,000 m of seafloor in approximately 900 m water depth. The surficial geology and taxa present are described as such:

- The primary substrate class observed was fine with sporadic coarse and medium substrates (Figure 3-17).
- The coral functional groups sea pens, small gorgonian, and other corals (e.g., soft and hard corals) were present (Table 3-4). Sea pens occurred in the highest abundance (n = 76,980 ind.) and consisted mainly of *Pennatula* spp. (Figure 3-14). Other sea pen species observed included the whip-like species *Balticina* sp. and *Distichoptilum gracile*. Small gorgonians (*Acanella* sp. and *Radicipes* sp.) were also present (n=183) as were soft and hard corals (n=115 and n=15, respectively). Approximately three percent of the total corals observed were deemed to be in the Damaged or Dead condition (Figure 3-24).
- No large gorgonians or black corals were observed with in the survey area.
- The highest abundance/density of sea pens were observed towards the northwest and southwest corners of the survey area with the lowest occurring in the eastern portions of the survey area (Figure 3-18, Figure 3-19). Small gorgonians were sparsely distributed and observed throughout the survey area (Figure 3-20, Figure 3-21). Other corals were also sparsely distributed and observed throughout the survey area (Figure 3-22, Figure 3-23).
- Sponges were rarely observed in the survey area with a total of 15 individuals observed (Figure 3-25, Figure 3-26). The overall condition of these sponges was good with 33% deemed in Poor/Damaged condition (Figure 3-27).
- All four fish functional groups were also present within the Cappahayden survey area. Benthivores (mainly grenadiers) were most commonly observed (Table 3-5). Four wolffish (two spotted and two Atlantic) and three redfish were also observed within the survey area (Figure 3-15).
- Other invertebrates observed during the survey included echinoderms (sea urchins), arthropods (crab), and molluscs (octopus) (Table 3-6).
- Trawl marks were present throughout the area. In total 413 of 617 sections had the presence of trawling. There was also scattered debris present as well as a whale vertebra (Figure 3-16).

Table 3-4 Summary for corals and sponges for the Cappahayden survey area.

Functional Groups	Total	Density (individuals per m ²)				
		Mean	Standard Deviation	Median	Minimum	Maximum
Sea Pens	76980	1.46	0.66	1.37	0.08	5.05
Small Gorgonians	183	0.003	0.008	0	0	0.07
Other Corals	130	0.002	0.01	0	0	0.22
Large Gorgonians	-	-	-	-	-	-
Black Corals	-	-	-	-	-	-
Sponges	15	<0.001	0.003	0	0	0.06
Field-of-view: 1.72 m, Area per 50 m bin: 86 m ²						
“- “indicates this faunal group was not observed						

Table 3-5 Summary for fish functional groups for the Cappahayden survey area.

Functional Groups	Total	Density (individuals per m ²)				
		Mean	Standard Deviation	Median	Minimum	Maximum
Benthivore	2212	0.04	0.02	0.03	0	0.13
Piscivore	14	<0.01	<0.01	0	0	0.01
Planktivore	50	<0.01	<0.01	0	0	0.03
Plank-piscivore	3	<0.01	<0.01	0	0	0.01
Unknown Fish	196	<0.01	0.01	0	0	0.05
Field-of-view: 1.72 m, Area per 50 m bin: 86 m ² “- “indicates this faunal group was not observed						

Table 3-6 Summary for other invertebrate groups for the Cappahayden survey area.

Functional Groups	Total	Density (individuals per m ²)				
		Mean	Standard Deviation	Median	Minimum	Maximum
Echinodermata	18,196	0.34	0.15	0.35	0.03	0.85
Cnidaria	3,219	0.06	0.05	0.05	0	0.36
Mollusca	820	0.02	0.01	0.01	0	0.07
Arthropoda	237	<0.01	0.01	0	0	0.05
Annelida	20	<0.01	<0.01	0	0	0.02
Field-of-view: 1.72 m, Area per 50 m bin: 86 m ² “- “indicates this faunal group was not observed Cnidaria other than corals						

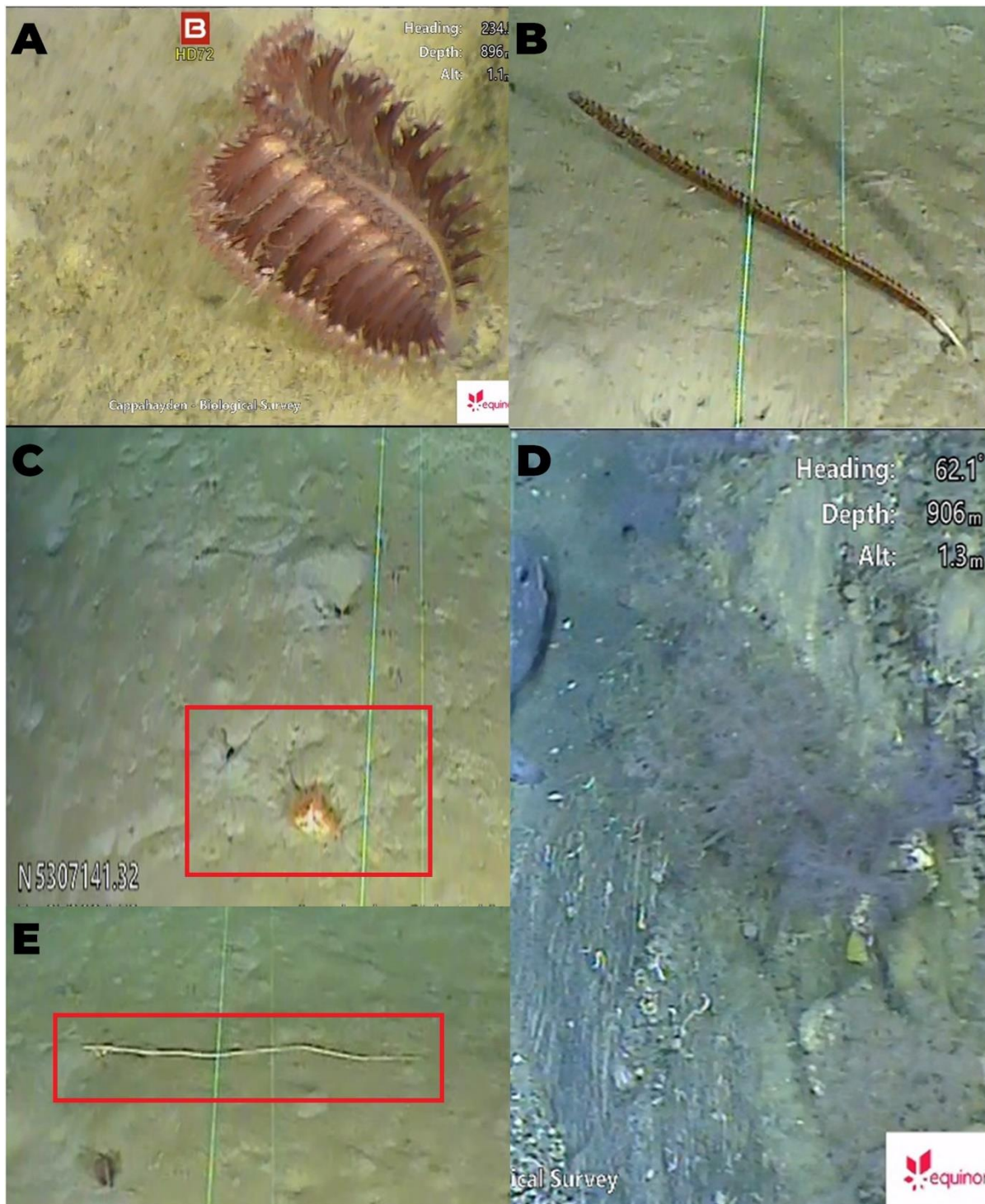


Figure 3-14 Representative photos of coral and sponge functional groups observed. A) Sea pen (*Pennatula* sp.), B) Sea pen (*Balticina* sp., condition Good), C) Other coral (hard coral in red box), D) Other coral (soft coral), E) Example of a coral with the condition Dead (in red box). Green lasers are 10 cm apart.

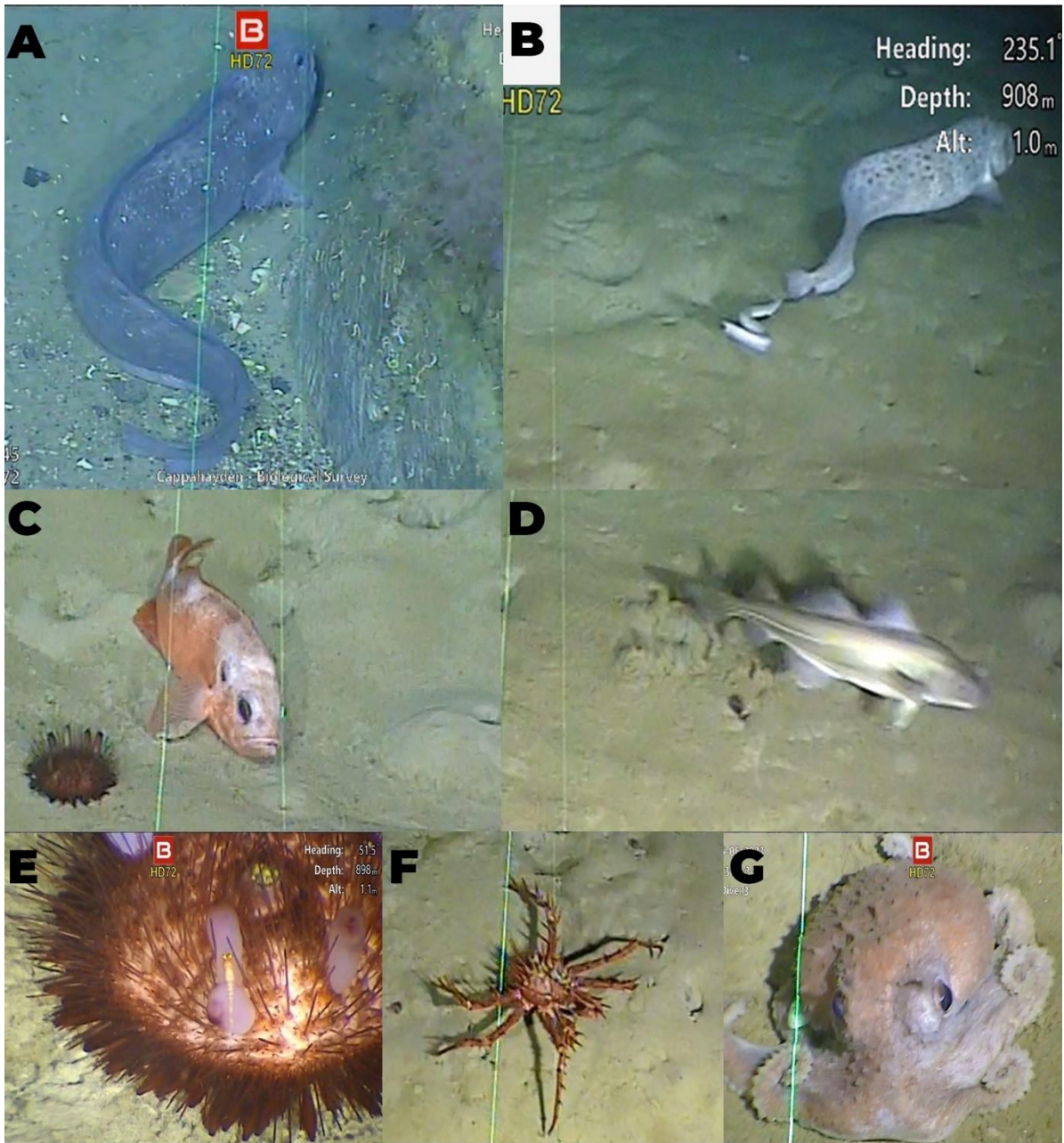


Figure 3-15 Representative photos of other taxa. A) Benthivore (Atlantic Wolffish), B) Benthivore (Spotted Wolffish), C) Plank-piscivore (Redfish), D) Piscivore (Atlantic Cod), E) Echinoderm (sea urchin), F) Arthropod (crab), G) Mollusc (octopus). Green lasers are 10 cm apart.

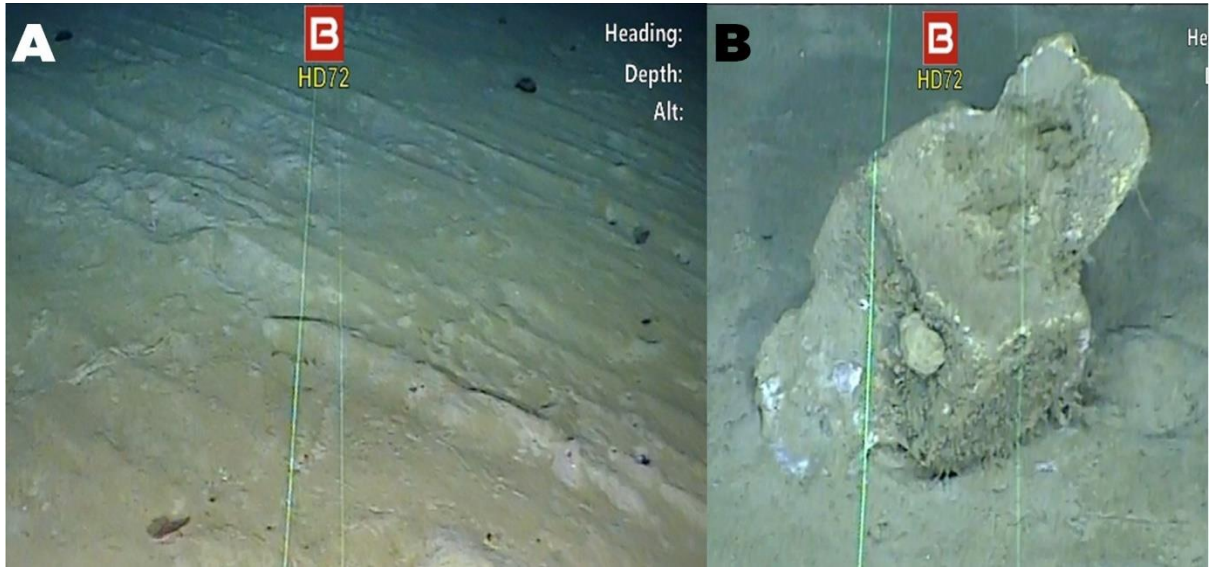


Figure 3-16 A) Representative photo of trawl marks and B) a whale vertebra. Green lasers are 10 cm apart.

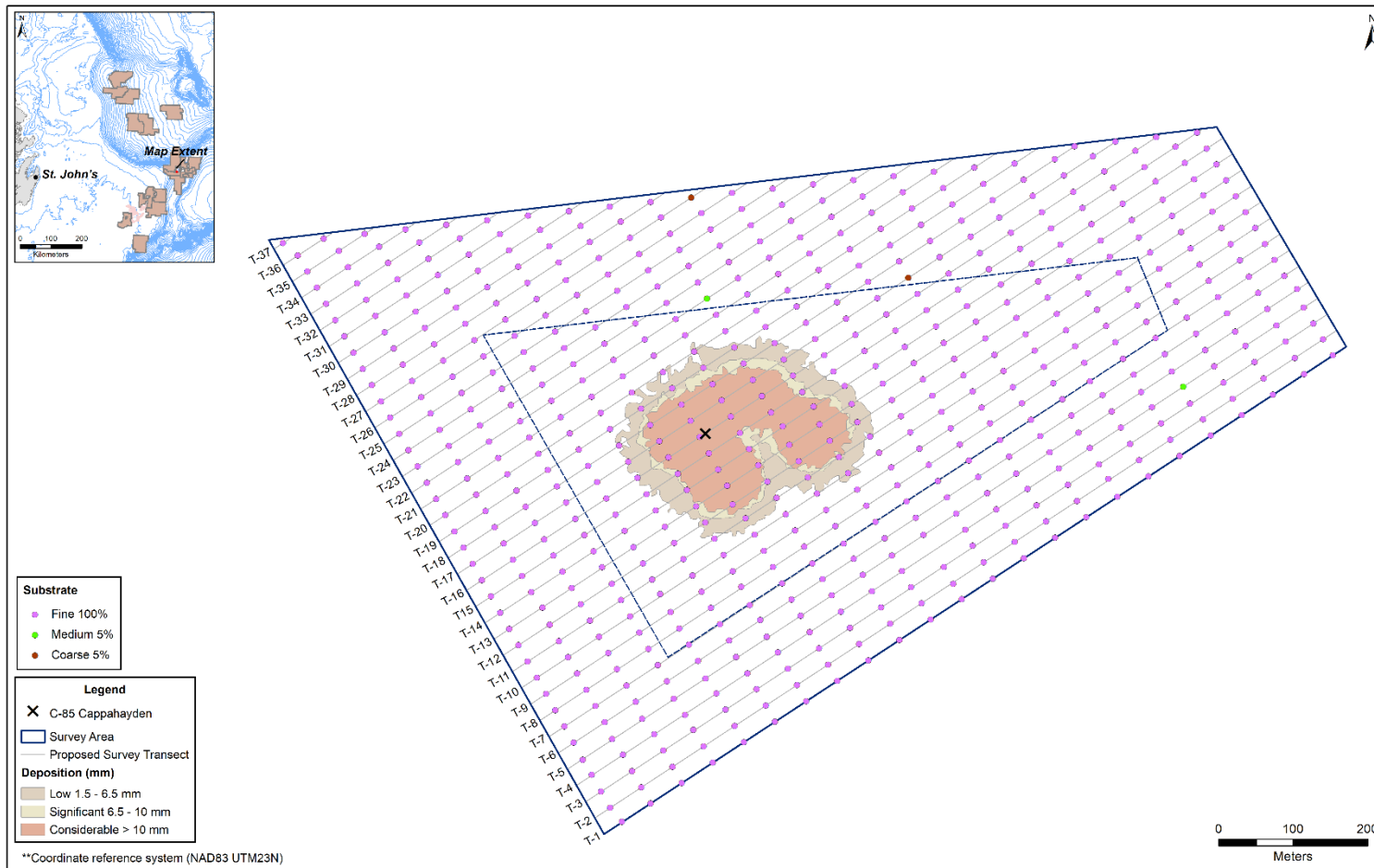


Figure 3-17 Largest grain size percent present for the Cappahayden wellsite area (by section)

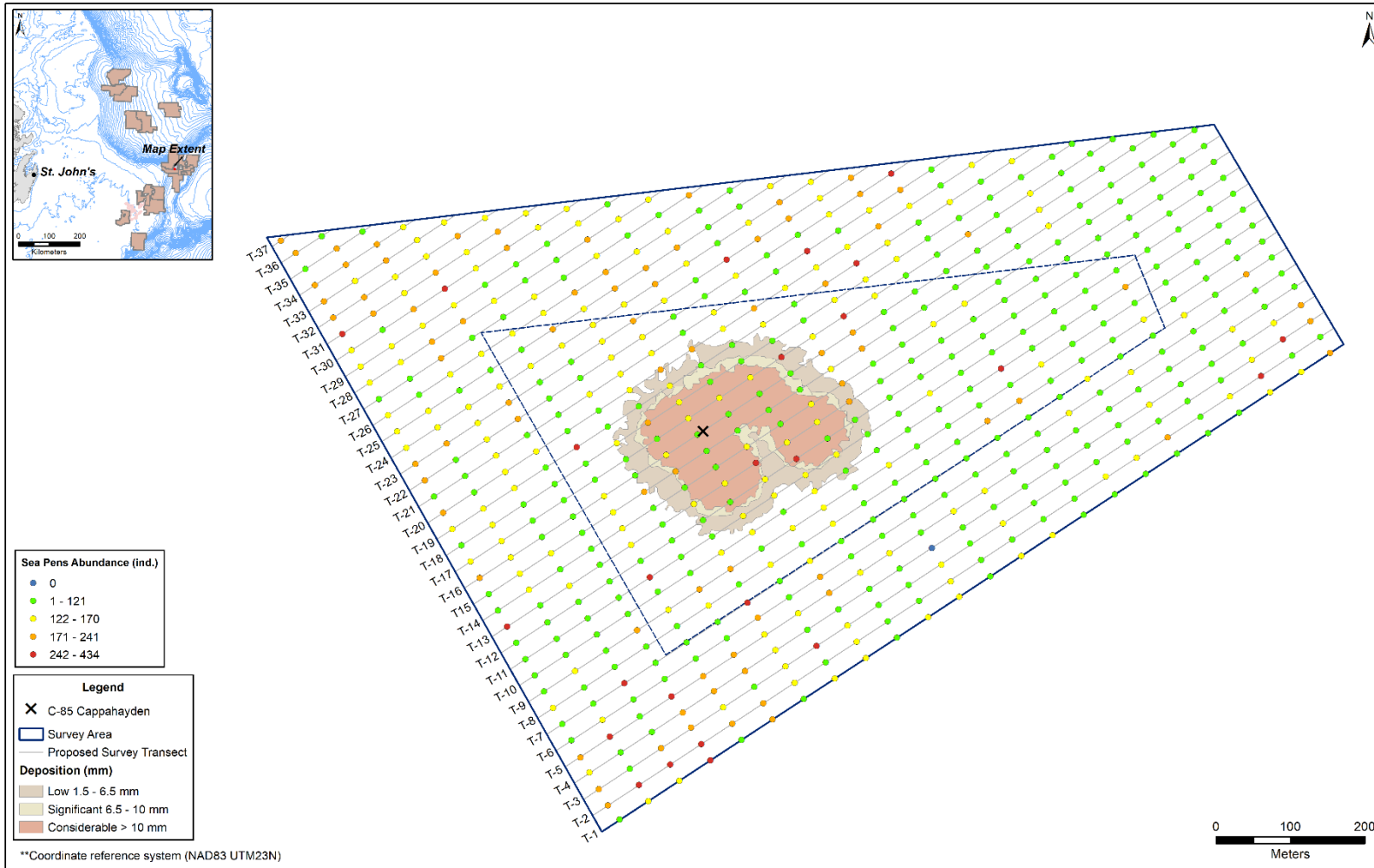


Figure 3-18 Sea pen abundance for the Cappahayden wellsite area (by section)

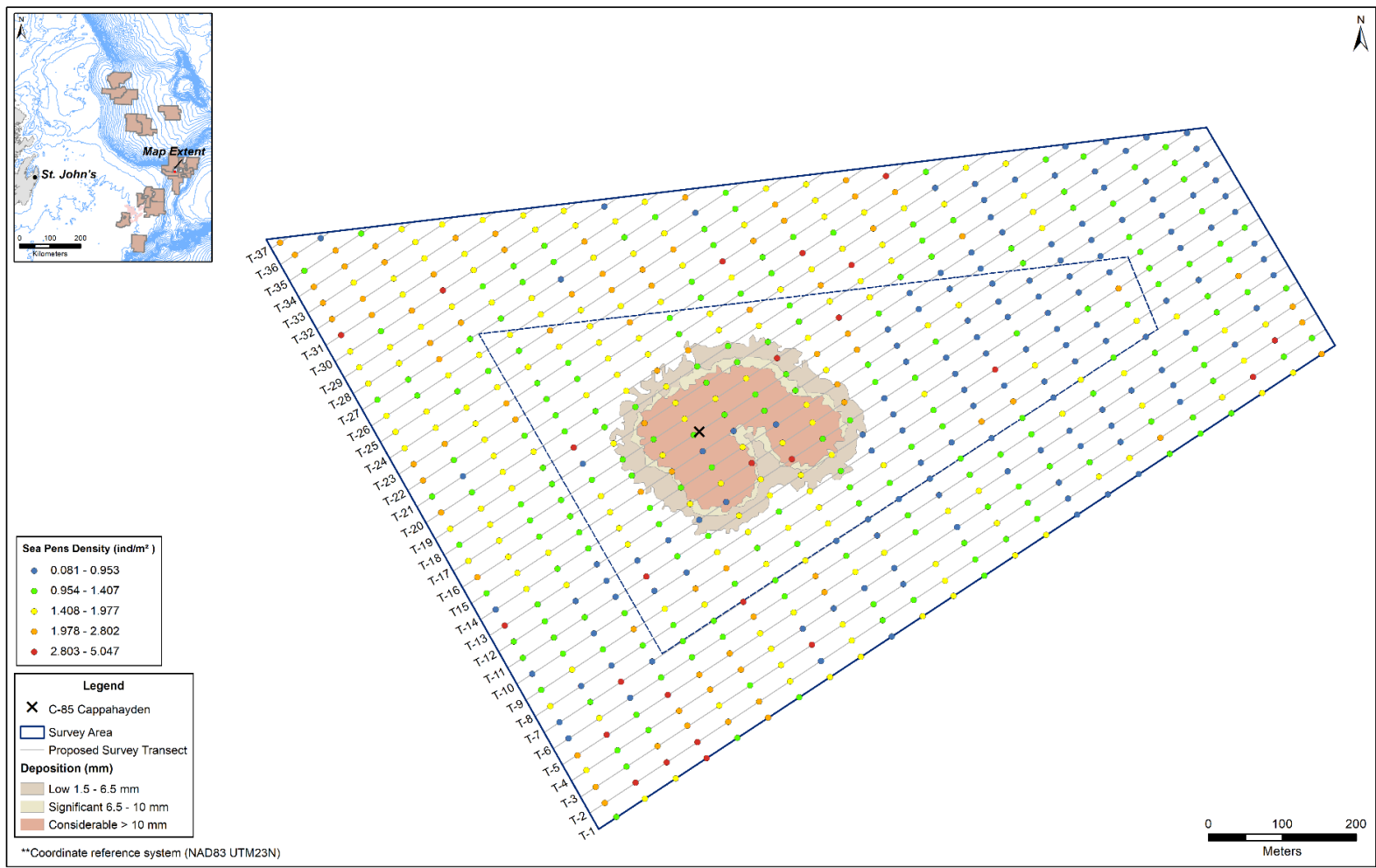


Figure 3-19 Sea pen density for the Cappahayden wellsite area (by section)

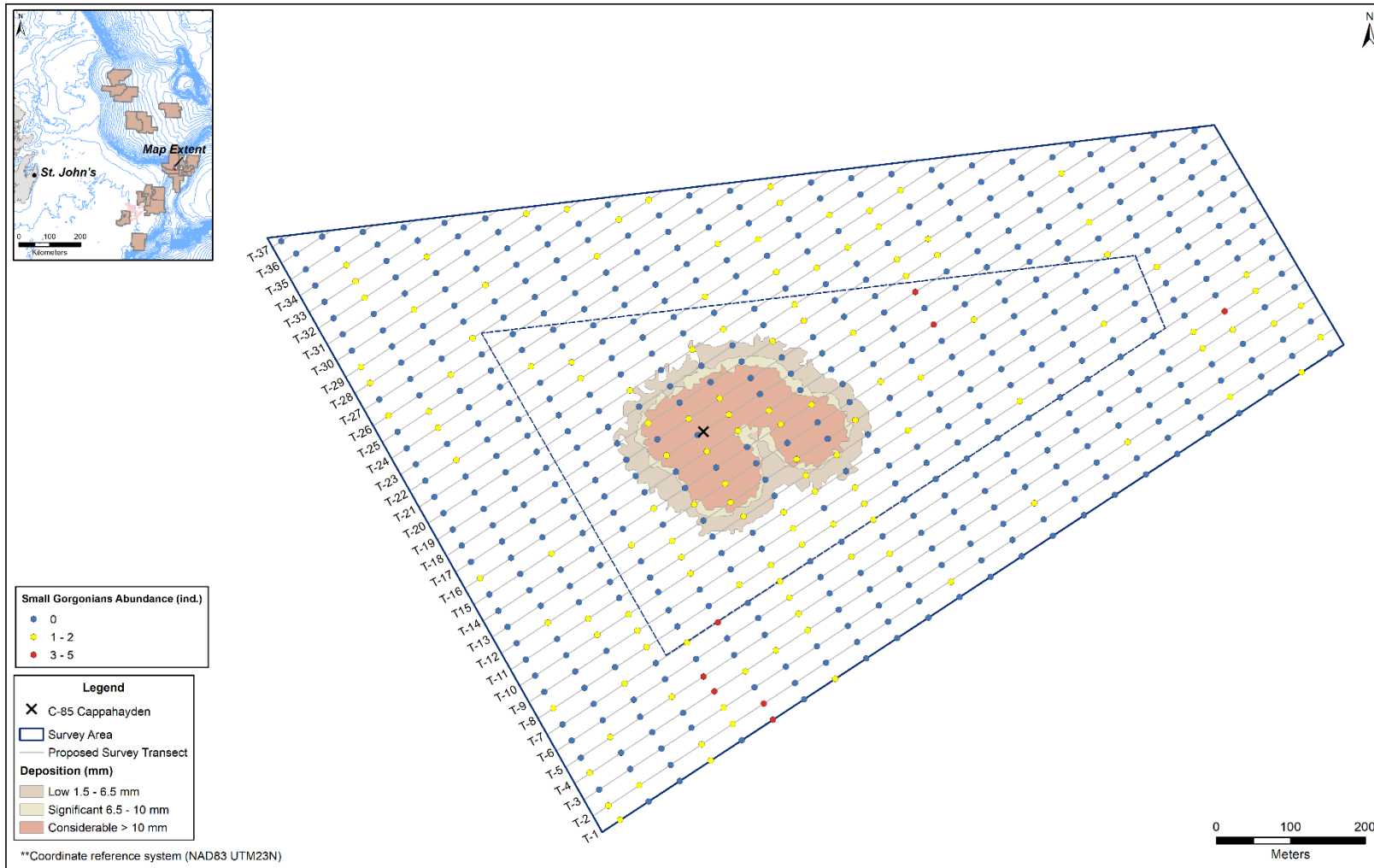


Figure 3-20 Small gorgonian abundance for the Cappahayden wellsite area (by section)

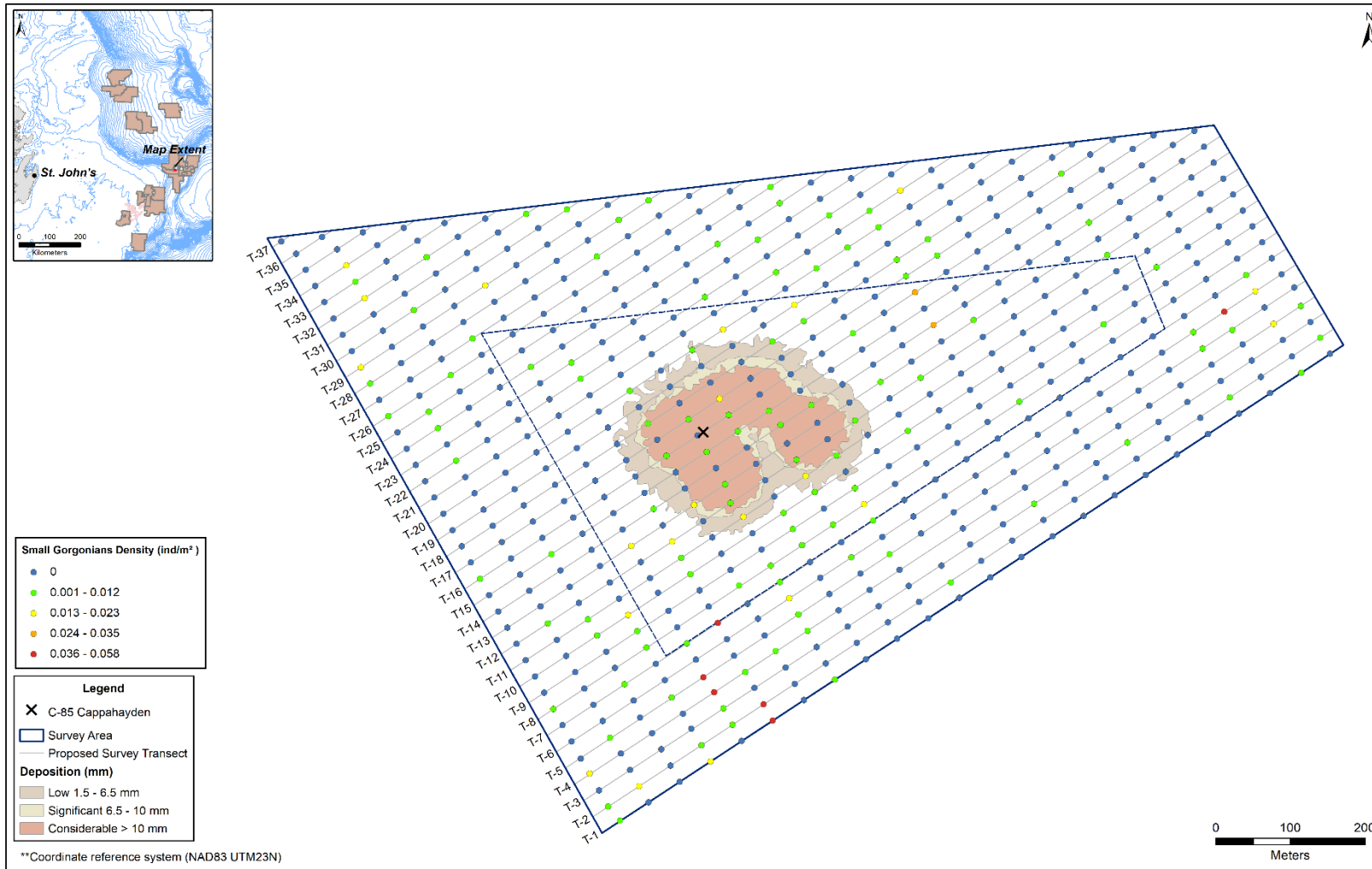


Figure 3-21 Small gorgonian density for the Cappahayden wellsite area (by section)

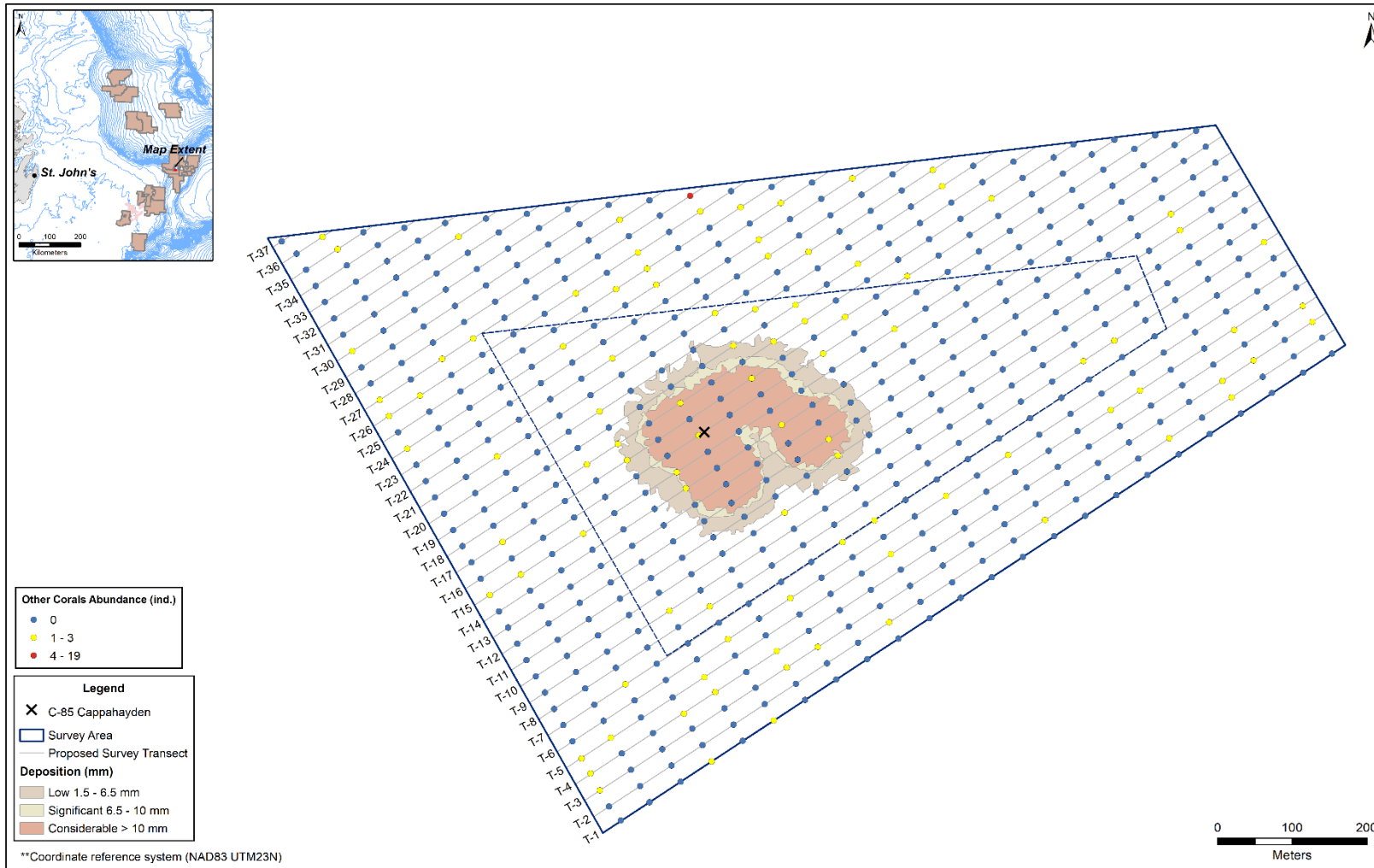


Figure 3-22 Other corals abundance for the Cappahayden wellsite area (by section)

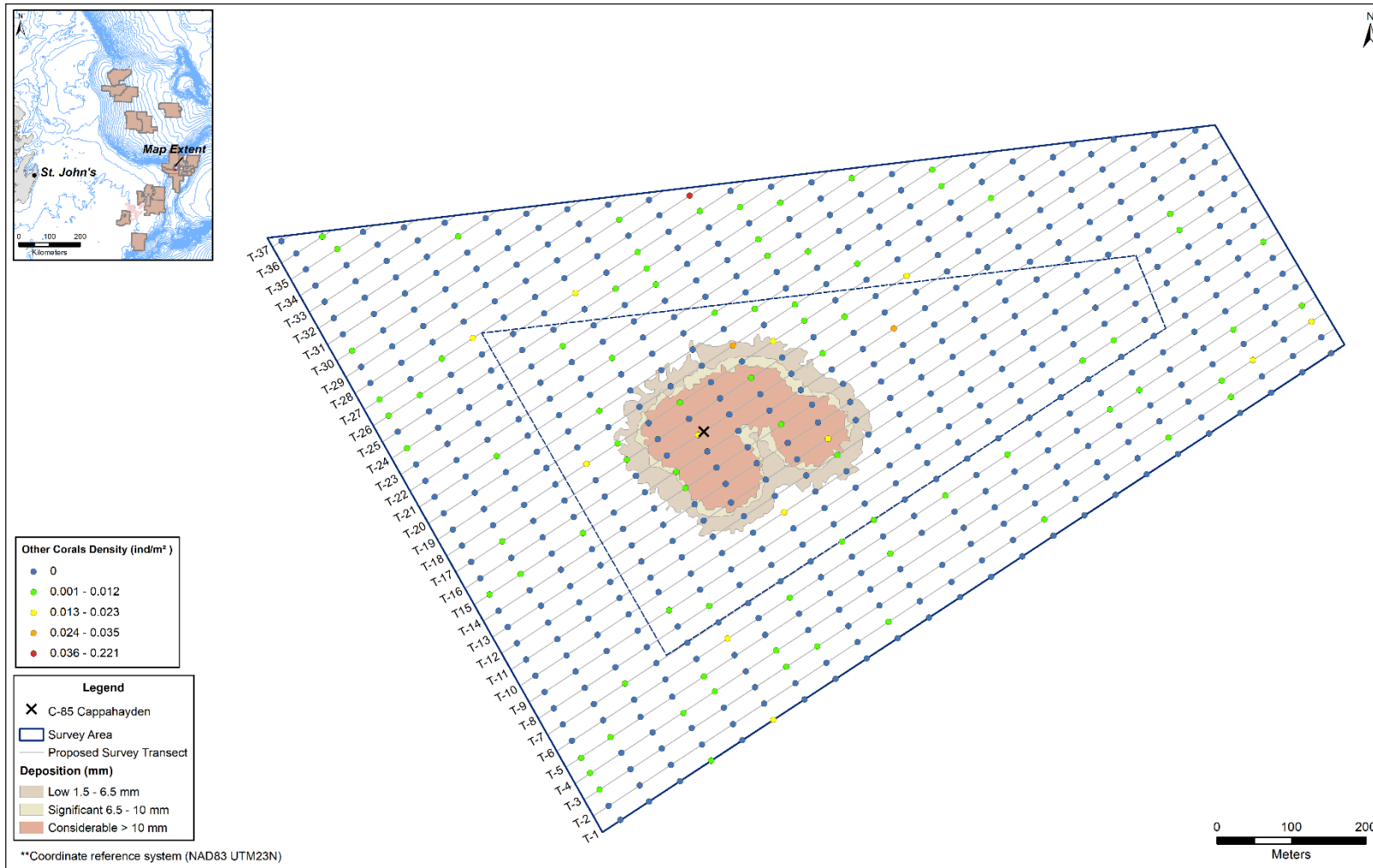


Figure 3-23 Other corals density for the Cappahayden wellsite area (by section)

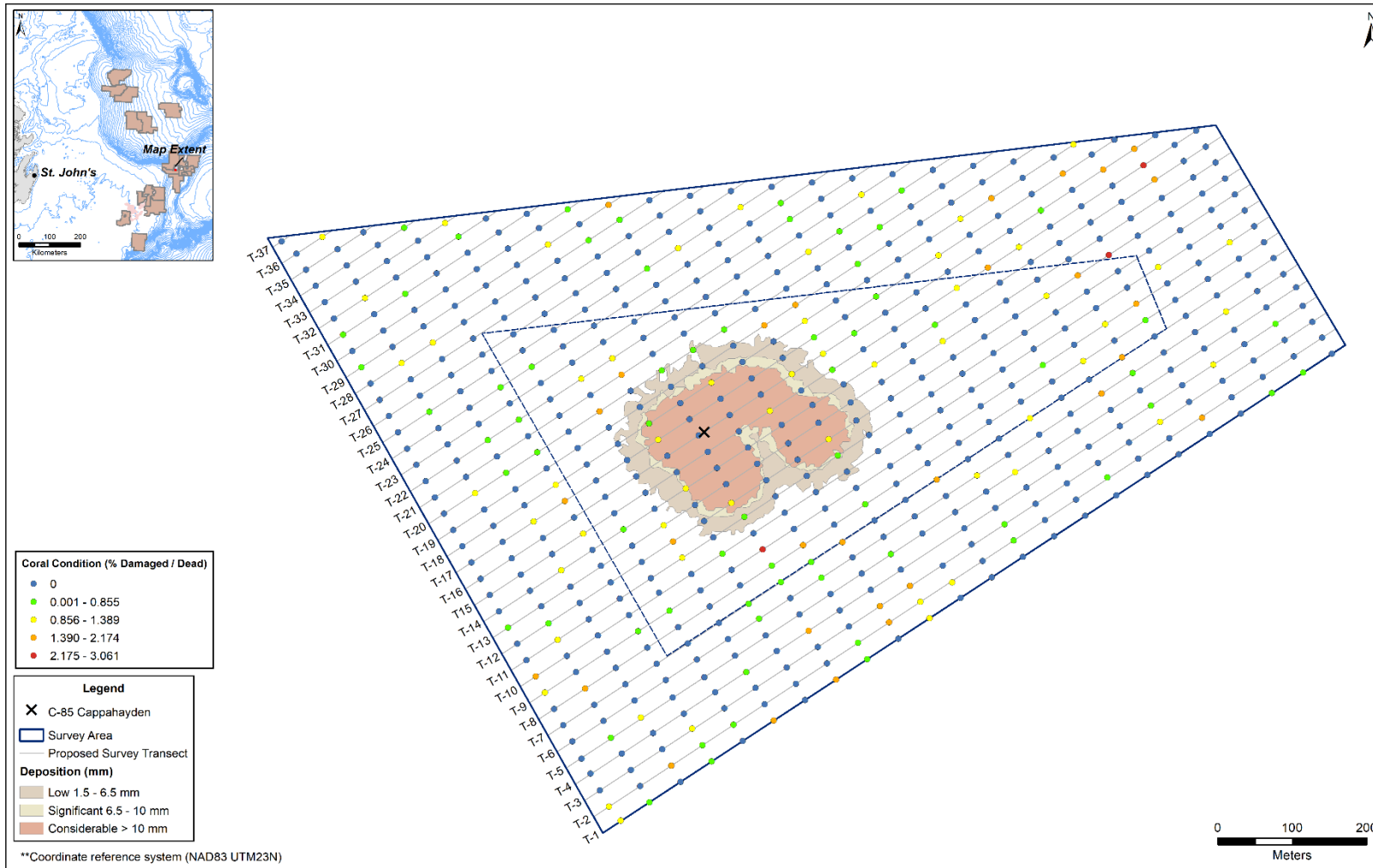


Figure 3-24 Coral condition (% Damaged or Dead) for the Cappahayden wellsite area (by section)

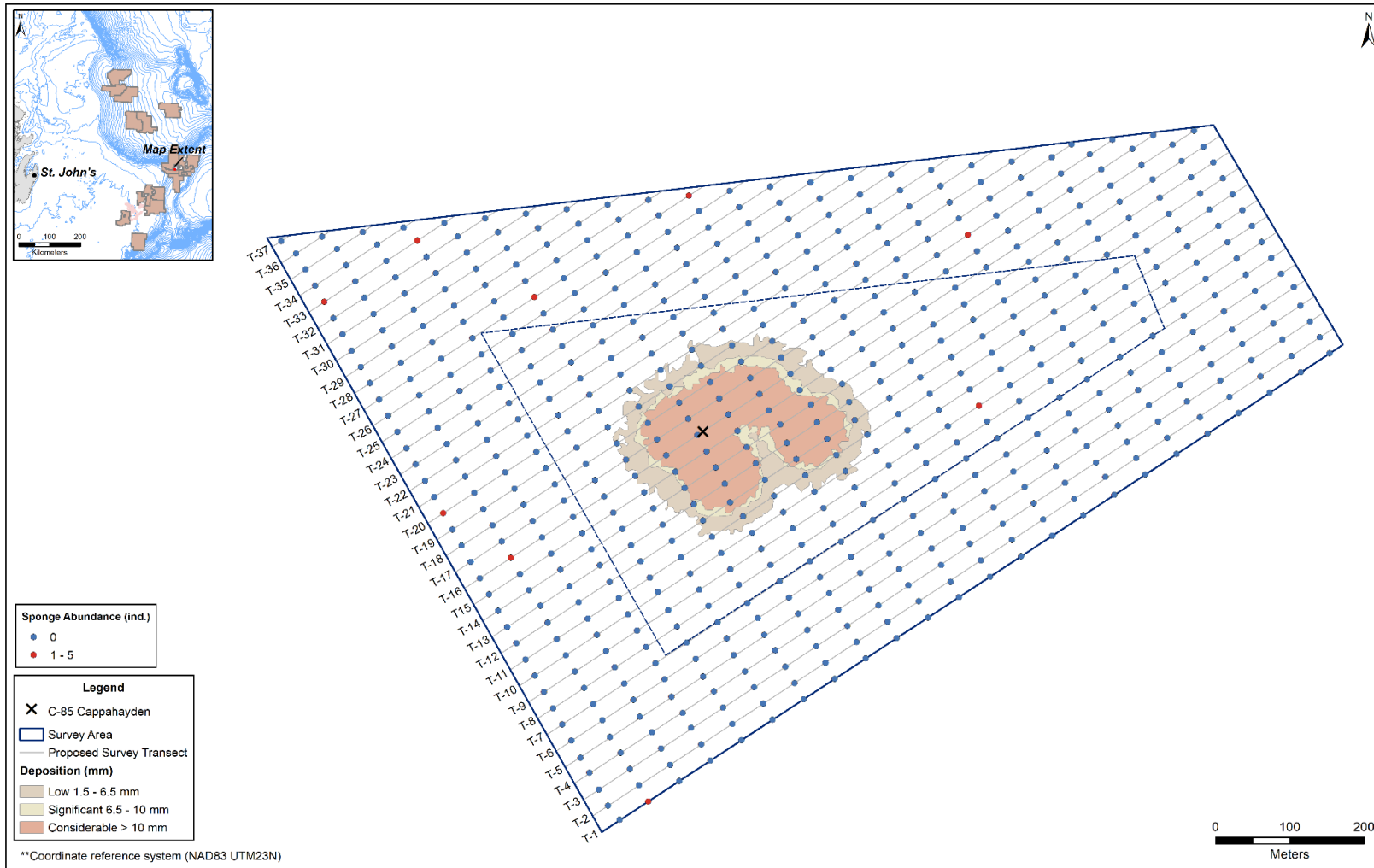


Figure 3-25 Sponge abundance for the Cappahayden wellsite area (by section)

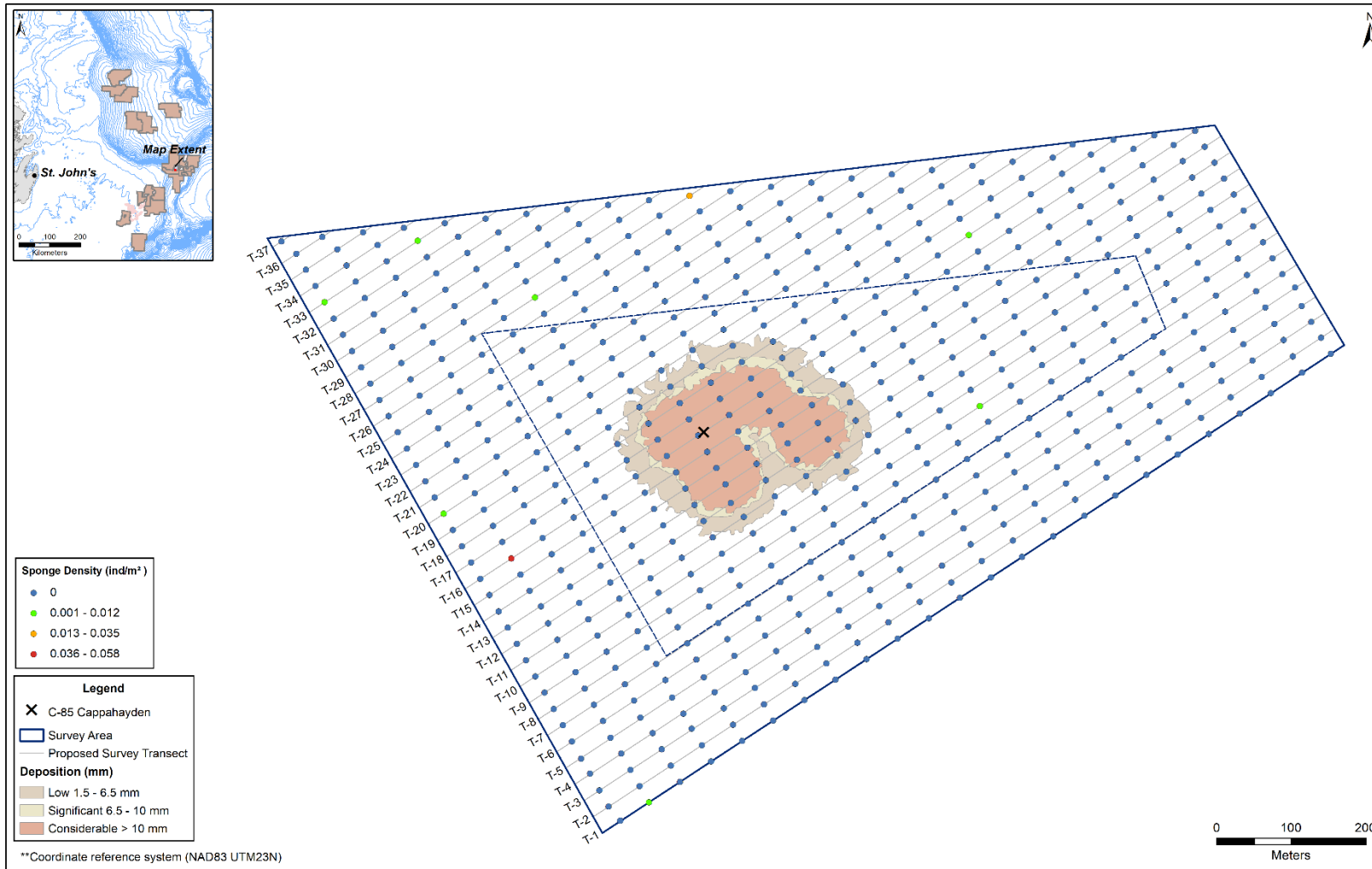


Figure 3-26 Sponge density for the Cappahayden wellsite area (by section)

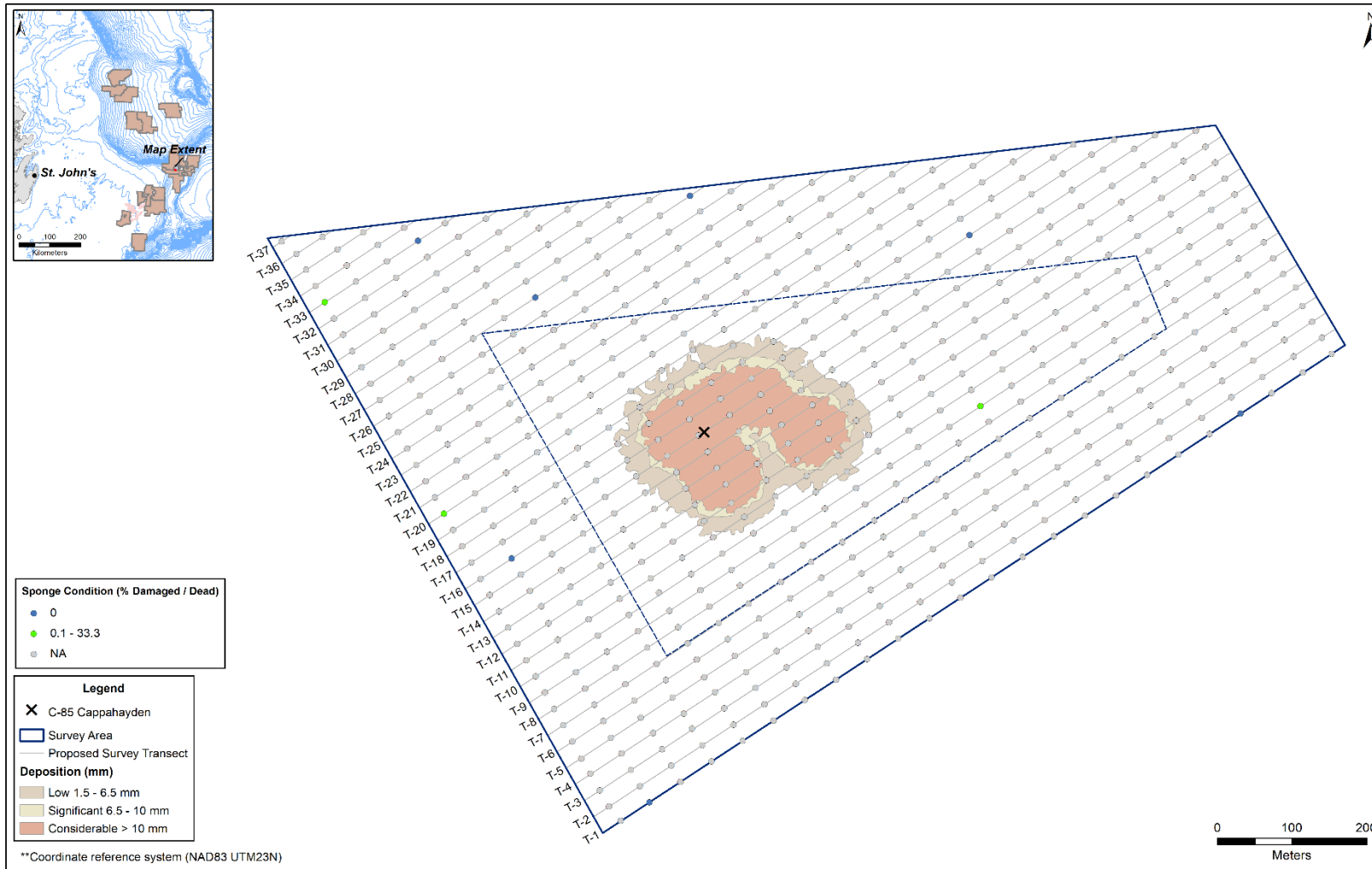


Figure 3-27 Sponge condition (% Poor/Damaged) for the Cappahayden wellsite area (by section). NA indicates sections with no sponges present.

4 CLOSURE

This report has been prepared for the exclusive use by Equinor. This scope of work was conducted using standard practices by qualified personnel and in accordance with verbal and written requests from the client.

Within the Sitka wellsite survey area, sea pens were the most abundant coral functional group. The sea pen median density for the survey area was 2.17 ind./m² with a few transect sections with higher densities occurring to the east of the proposed drill centre. Drilling is projected to occur during the summer and early fall timeframe. Cutting depositions during this timeframe (June and September models) will mainly occur within 200 m of the drill centre. The combined cutting deposition model predicts a majority of the cuttings will settle within 200 m of the drill centre.

Sea pens were also the most abundant coral functional group present (median density of 1.37 ind./m²) within the Cappahayden wellsite survey area. The highest densities of sea pens mainly occurred to the north, south and west of the wellsite and were largely outside of the cutting deposition model.

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APPENDIX

A

SITKA DATASHEETS



APPENDIX

B

CAPPAHAYDEN DATASHEETS



Wellsite	Date	Line	Section	Time_Start_UTM	Time_End_UTM	Easting_m_Start	Northing_m_Start	Easting_m_End	Northing_m_End	Depth (m)	ROV	Area (m ²)	Core	Medium	Organic Detritus	Shell	Core Condition_Good	Core Condition_Damaged	Sponge Condition_Good	Sponge Condition_Poor	Trawl Marks	Substrate_Designation	Core Condition_Percent Damaged/Dead	Sponge Condition_Percent Damaged/Dead	Echinoderms_Abundance	Gorgonians_Abundance	Chitina_Abundance	Crustacea_Abundance	Arthropods_Abundance	Annelids_Abundance	Small Gorgonians_Abundance	Sea Pen_Abundance	Other Corals_Abundance	Benthos_Abundance	Benthos_Pictures_Abundance	Planktivores_Abundance	Planktivores_Pictures_Abundance	Planktivores_Den (ind./m ²)	Unknown_Fish_Den (ind./m ²)	Comment											
Capahayden	6/15/2023	Transect 25	T25-9	16:16:36	16:19:51	371866.58	5307188.62	371909.83	5307213.74	905	0	1.72	86	0	0	100	0	203	1	0	0	0	1	Fine 100%	0.49	NA	44	6	4	0	0	203	1	0	5	0	0	1	0.51	0.07	0.05	0.00	0.00	2.36	0.01	0.00	0.06	0.00	0.00	0.00	0.01
Capahayden	6/15/2023	Transect 25	T25-10	16:19:51	16:23:30	371869.83	5307213.74	371952.05	5307242.05	905	0	1.72	86	0	0	100	0	207	0	0	0	0	1	Fine 100%	0.96	NA	31	6	0	0	0	209	0	0	0	0	0	0	0.47	0.07	0.00	0.00	0.00	2.43	0.00	0.00	0.08	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 25	T25-11	16:23:30	16:27:43	371925.05	5307242.05	371992.54	5307271.45	905	0	1.72	86	0	0	100	0	206	0	0	0	0	1	Fine 100%	0.00	NA	40	11	2	0	0	109	0	0	0	0	0	0	0.47	0.13	0.03	0.00	0.00	1.27	0.00	0.00	0.09	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 25	T25-12	16:27:43	16:32:19	371992.64	5307271.45	372037.1	5307295.51	905	0	1.72	86	0	0	100	0	207	0	0	0	0	1	Fine 100%	0.93	NA	56	7	2	1	0	105	1	0	3	0	0	0	0.65	0.08	0.02	0.00	0.00	1.22	0.01	0.00	0.03	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 25	T25-13	16:32:19	16:35:40	372037.1	5307295.51	372078.23	5307325.98	905	0	1.72	86	0	0	100	0	207	0	0	0	0	1	Fine 100%	0.00	NA	48	5	2	0	0	146	0	0	5	0	0	0	0.56	0.06	0.02	0.00	0.00	1.70	0.00	0.00	0.06	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 24	T24-1	16:53:20	16:58:09	372130.57	5307332.28	372085.96	5307309.31	905	0	1.72	86	0	0	100	0	137	0	0	0	0	1	Fine 100%	0.00	NA	21	12	1	0	0	131	0	0	0	0	0	0	0.24	0.14	0.01	0.00	0.00	1.52	0.00	0.00	0.03	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 24	T24-2	16:58:09	17:02:42	372085.96	5307309.31	372046.99	5307274.69	905	0	1.72	86	0	0	100	0	126	1	0	0	0	1	Fine 100%	0.44	NA	24	10	1	0	0	125	1	0	5	0	0	0	1.00	0.12	0.01	0.00	0.00	2.62	0.01	0.00	0.06	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 24	T24-3	17:02:42	17:06:42	372046.99	5307274.69	372007.00	5307250.02	905	0	1.72	86	0	0	100	0	125	0	0	0	0	1	Fine 100%	0.00	NA	38	16	2	0	0	123	0	0	0	0	0	0	0.43	0.19	0.02	0.00	0.00	1.45	0.00	0.00	0.02	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 24	T24-4	17:06:42	17:10:43	372007.00	5307250.02	371962.78	5307222.72	905	0	1.72	86	0	0	100	0	108	0	0	0	0	1	Fine 100%	0.00	NA	33	14	2	0	0	107	0	0	0	0	0	0	0.38	0.16	0.02	0.00	0.00	1.24	0.00	0.00	0.03	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 24	T24-5	17:10:43	17:14:53	371962.78	5307222.72	371922.5	5307202.78	905	0	1.72	86	0	0	100	0	156	0	0	0	0	1	Fine 100%	0.00	NA	58	2	2	0	0	156	0	0	0	0	0	0	0.67	0.09	0.03	0.00	0.00	1.81	0.00	0.00	0.07	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 24	T24-6	17:14:53	17:20:54	371922.5	5307202.78	371880.18	5307164.72	905	0	1.72	86	0	0	100	0	222	0	0	0	0	1	Fine 100%	0.00	NA	61	9	2	0	0	221	1	0	0	0	0	0	0.71	0.10	0.02	0.00	0.00	2.57	0.01	0.00	0.03	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 24	T24-7	17:20:54	17:23:34	371880.18	5307164.72	371839.25	5307139.54	905	0	1.72	86	0	0	100	0	129	0	0	0	0	1	Fine 100%	0.00	NA	26	15	0	0	0	129	0	0	0	0	0	0	1.30	0.17	0.00	0.00	0.00	1.50	0.00	0.00	0.03	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 24	T24-8	17:23:34	17:27:33	371839.25	5307139.54	371797.32	5307110.71	905	0	1.72	86	0	0	100	0	160	0	0	0	0	1	Fine 100%	0.00	NA	32	13	0	0	0	160	0	0	0	0	0	0	0.37	0.15	0.00	0.00	0.00	1.86	0.00	0.00	0.03	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 24	T24-9	17:27:33	17:31:31	371797.32	5307110.71	371755.72	5307085.14	905	0	1.72	86	0	0	100	0	158	0	0	0	0	1	Fine 100%	0.00	NA	27	9	0	0	0	157	1	0	0	0	0	0	0.31	0.10	0.00	0.00	0.00	1.83	0.01	0.00	0.03	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 24	T24-10	17:31:31	17:35:17	371755.72	5307085.14	371713.35	5307058.23	905	0	1.72	86	0	0	100	0	149	1	0	0	0	1	Fine 100%	0.67	NA	42	12	3	0	0	148	0	0	0	0	0	0	0.49	0.14	0.03	0.00	0.00	1.72	0.00	0.00	0.09	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 24	T24-11	17:35:17	17:39:13	371713.35	5307058.23	371670.65	5307030.12	905	0	1.72	86	0	0	100	0	131	1	0	0	0	1	Fine 100%	0.76	NA	46	10	2	0	0	132	0	0	0	0	0	0	0.53	0.12	0.02	0.00	0.00	1.53	0.00	0.00	0.07	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 24	T24-12	17:39:13	17:43:26	371670.65	5307030.12	371629.94	5307000.48	905	0	1.72	86	0	0	100	0	154	0	0	0	0	1	Fine 100%	0.00	NA	51	14	0	0	0	154	0	0	0	0	0	0	0.59	0.16	0.00	0.00	0.00	1.79	0.00	0.00	0.12	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 24	T24-13	17:43:26	17:47:24	371629.94	5307000.48	371589.22	5306972.92	905	0	1.72	86	0	0	100	0	139	0	0	0	0	1	Fine 100%	0.00	NA	42	10	0	0	0	138	0	0	0	0	0	0	0.53	0.12	0.01	0.00	0.00	1.60	0.00	0.00	0.07	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 24	T24-14	17:47:24	17:51:55	371589.22	5306972.92	371544.56	5306946.08	905	0	1.72	86	0	0	100	0	154	0	0	0	0	1	Fine 100%	0.00	NA	46	10	3	1	0	153	0	0	0	0	0	0	0.49	0.13	0.03	0.00	0.00	1.78	0.01	0.00	0.02	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 23	T23-1	18:04:50	18:11:35	371554.85	5306923.91	371600.28	5306953.59	905	0	1.72	86	0	0	100	0	193	0	0	0	0	1	Fine 100%	0.00	NA	71	11	0	1	0	193	0	0	0	0	0	0	0.83	0.10	0.03	0.00	0.00	2.24	0.00	0.00	0.12	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 23	T23-2	18:11:35	18:16:10	371600.28	5306953.59	371642.39	5306979.53	905	0	1.72	86	0	0	100	0	188	0	0	0	0	1	Fine 100%	0.00	NA	41	7	1	0	0	188	0	0	0	0	0	0	0.48	0.08	0.01	0.00	0.00	2.19	0.00	0.00	0.03	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 23	T23-3	18:16:10	18:20:36	371642.39	5306979.53	371682.48	5307004.95	905	0	1.72	86	0	0	100	0	157	0	0	0	0	1	Fine 100%	0.00	NA	48	8	1	0	0	157	0	0	0	0	0	0	0.56	0.09	0.01	0.00	0.00	1.83	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 23	T23-4	18:20:36	18:25:02	371682.48	5307004.95	371725.48	5307033.92	905	0	1.72	86	0	0	100	0	228	0	0	0	0	1	Fine 100%	0.00	NA	40	6	5	0	0	228	0	0	0	0	0	0	0.47	0.07	0.06	0.00	0.00	2.65	0.00	0.00	0.05	0.00	0.00	0.00	0.00
Capahayden	6/15/2023	Transect 23	T23-5	18:25:02	18:29:42	371725.48	5307033.92	371767.83	5307060.51	905	0	1.72	86	0	0	100	0	85	0	0	0	0	1	Fine 100%	0.00	NA	43	1	3	0	0	85	0	0	0	0	0	0	0.50	0.03	0.03	0.00	0.00	0.99	0.00						

Website	Date	Line	Section	Time Start_LUTC	Time End_LUTC	Easting_m_Start	Northing_m_Start	Easting_m_End	Northing_m_End	Depth (m)	Length	ROV	Area (m ²)	Core	Medium	Fine	Organic Detritus	Shell	Coral Condition_Good	Coral Condition_Damaged	Coral Condition_Dead	Sponge Condition_Good	Sponge Condition_Poor	Trawl Marks	Substrate_Designation	Coral Condition_Percent Damaged/Dead	Sponge Condition_Percent Damaged/Dead	Echinoderms_Abundance	Cnidaria_Abundance	Molluscs_Abundance	Arthropods_Abundance	Annelids_Abundance	Small Gorgonians_Abundance	Sea Pens_Abundance	Other Corals_Abundance	Sponges_Abundance	Benthivores_Abundance	Piscivores_Abundance	Planktivores_Abundance	Plank_piscivore_Abundance	Unknown Fish_Abundance	Echinoderms_Den (ind./m ²)	Cnidaria_Den (ind./m ²)	Molluscs_Den (ind./m ²)	Arthropods_Den (ind./m ²)	Annelids_Den (ind./m ²)	Small Gorgonians_Den (ind./m ²)	Sea Pens_Den (ind./m ²)	Other Corals_Den (ind./m ²)	Sponge_Den (ind./m ²)	Benthivores_Den (ind./m ²)	Piscivores_Den (ind./m ²)	Planktivores_Den (ind./m ²)	Plank_piscivore_Den (ind./m ²)	Unknown_Fish_Den (ind./m ²)	Comment			
Cappahayden	6/17/2023	Transect 1	T1-12	07:31:00	07:35:18	372285.29	5306747.17	372329.91	5306773.95	905	50	1.72	86	0	0	100	0	0	135	0	0	0	0	1	Fine 100%	0.00	NA	21	5	5	1	0	0	135	0	0	3	0	0	0	0	0	0.24	0.06	0.06	0.01	0.00	0.00	1.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
Cappahayden	6/17/2023	Transect 1	T1-13	07:35:00	07:39:21	372329.91	5306773.95	372371.98	5306799.05	905	50	1.72	86	0	0	100	0	0	99	0	0	0	0	1	Fine 100%	0.00	NA	9	7	1	0	0	0	99	0	0	4	0	0	0	0	0	0.10	0.08	0.01	0.00	0.00	0.00	1.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
Cappahayden	6/17/2023	Transect 1	T1-14	07:39:00	07:43:03	372371.98	5306799.05	372414.54	5306826.64	905	50	1.72	86	0	0	100	0	0	123	0	0	0	0	1	Fine 100%	0.00	NA	12	8	0	0	1	0	123	0	0	6	0	0	0	0	0.14	0.09	0.00	0.00	0.01	0.00	1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
Cappahayden	6/17/2023	Transect 1	T1-15	07:43:00	07:47:09	372414.54	5306826.64	372455.4	5306856.74	905	50	1.72	86	0	0	100	0	0	130	0	0	0	0	1	Fine 100%	0.00	NA	14	7	0	0	0	0	130	0	0	8	0	0	0	0	0	0.16	0.08	0.00	0.00	0.00	0.00	1.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
Cappahayden	6/17/2023	Transect 1	T1-16	07:47:00	07:51:33	372455.4	5306856.74	372499.11	5306886.58	905	50	1.72	86	0	0	100	0	0	73	0	0	0	0	1	Fine 100%	0.00	NA	15	4	0	1	0	0	73	0	0	5	0	0	0	0	0	0.17	0.05	0.00	0.01	0.00	0.00	0.85	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00		
Cappahayden	6/17/2023	Transect 1	T1-17	07:51:00	07:55:25	372499.11	5306886.58	372538.86	5306911.34	905	50	1.72	86	0	0	100	0	0	55	0	0	0	0	1	Fine 100%	0.00	NA	17	8	2	0	0	0	55	0	0	4	0	0	0	0	0	0.20	0.09	0.02	0.00	0.00	0.00	0.64	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.01	
Cappahayden	6/17/2023	Transect 1	T1-18	07:55:00	07:59:25	372538.86	5306911.34	372582.18	5306938.58	905	50	1.72	86	0	0	100	0	0	77	0	0	0	0	1	Fine 100%	0.00	NA	11	3	0	0	0	0	77	0	0	3	0	0	0	0	0	0.13	0.03	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00		
Cappahayden	6/17/2023	Transect 1	T1-19	07:59:00	08:03:47	372582.18	5306938.58	372624.69	5306968.04	905	50	1.72	86	0	0	100	0	0	96	0	0	0	0	1	Fine 100%	0.00	NA	28	8	0	2	1	0	96	0	0	3	0	0	0	0	0	0.33	0.09	0.00	0.02	0.01	0.00	1.12	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00		
Cappahayden	6/17/2023	Transect 1	T1-20	08:03:00	08:07:50	372624.69	5306968.04	372665.03	5306992.29	905	50	1.72	86	0	0	100	0	0	107	0	0	0	0	1	Fine 100%	0.00	NA	32	4	0	1	0	0	107	0	0	4	0	0	0	0	0	0.37	0.05	0.00	0.01	0.00	0.00	1.24	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00		
Cappahayden	6/17/2023	Transect 1	T1-21	08:07:00	08:11:47	372665.03	5306992.29	372704.37	5307021.02	905	50	1.72	86	0	0	100	0	0	114	0	0	0	0	1	Fine 100%	0.00	0.00	35	3	1	1	0	0	114	0	0	1	0	0	0	0	0	0.41	0.03	0.01	0.01	0.00	0.00	1.33	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00		
Cappahayden	6/17/2023	Transect 1	T1-22	08:11:00	08:16:22	372704.37	5307021.02	372749.57	5307047.24	905	50	1.72	86	0	0	100	0	0	132	1	0	0	0	1	Fine 100%	0.75	NA	27	6	0	0	0	0	133	0	0	0	0	0	0	0	0	0.31	0.07	0.00	0.00	0.00	0.00	1.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Cappahayden	6/17/2023	Transect 1	T1-23	08:16:00	08:21:11	372749.57	5307047.24	372792.88	5307075.33	905	50	1.72	86	0	0	100	0	0	142	0	1	0	0	1	Fine 100%	0.70	NA	33	3	1	0	0	1	143	0	0	0	0	0	0	0	0	0.38	0.03	0.01	0.00	0.00	0.01	1.64	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00		
Cappahayden	6/17/2023	Transect 1	T1-24	08:21:00	08:25:08	372792.88	5307075.33	372832.27	5307104.15	905	50	1.72	86	0	0	100	0	0	234	0	0	0	0	1	Fine 100%	0.00	NA	28	6	0	0	0	0	234	0	0	1	0	0	0	0	0	0.33	0.07	0.00	0.00	0.00	0.00	2.72	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	

APPENDIX

C

ROV
SPECIFICATIONS





HD WROV SYSTEM

Class III Remotely Operated Vehicle

Innovative features in the frame design and modular subsystems produce a high performance vehicle suitable for IMR, drill support, and construction operations, while maintaining a compact system footprint.

HD WROV SYSTEM



150HP OF HYDRAULIC POWER

- Separate hydraulic circuits: main for propulsion and manipulators, auxiliary for tooling
- Automatic heading, depth, altitude, attitude, auto-tuning, and StationKeep
- AutoTrack utility to control vehicle through survey coordinates
- Digital Telemetry System: serial, video, Ethernet through Gigabit backbone
- Optional 1080i FULL-HD video capability on multiple cameras
- New-generation FMC Schilling "Hammerhead" operating system

GENERAL SPECIFICATIONS

Depth rating (msw):	3000
Dimensions (L x W x H - m):	2.5 x 1.7 x 1.9
Weight in air (Ton):	3.4
Through-frame lift (Ton):	up to 3.0

PERFORMANCE

Power (hp):	150
Thrusters (horizontal/vertical):	4 x SA380 / 3 x SA380
Forward, Aft, Lateral bollard (Kgf):	750
Vertical down/up bollard (Kgf):	750 / 720
Forward, aft speed (knots):	3.0
Lateral, vertical speed (knots):	2.2

AUTO FUNCTION CONTROL

Auto heading (deg):	± 2
Auto depth (cm):	± 15
Auto altitude (cm):	± 15
Station keep (m):	± 0.3
Displacement (m):	± 0.15

SENSORS

Fibre optic gyro heading sensor:	CDL TOGS 0.5 deg accuracy 0.1 deg RMS pitch / roll
Depth Sensor:	Digiquartz 8000 1 x 10-8 resolution
DVL:	1200KHz Workhorse ±0.2% bottom velocity
Sonar:	Tritech Super Seaking

CAMERAS AND LIGHTS

First Pan & Tilt unit:	1 x electric FMC Schilling
Second Pan & Tilt unit:	Optional
Low light B/W:	1
Color CCD zoom:	1
Color CCD fixed focus:	1
Titan 4 wrist camera:	Optional
LED lights:	8

HYDRAULIC SPECIFICATIONS

Maximum main/aux pressure (bar):	207 / 207
Maximum main/aux flow (lpm):	240 / 80
8-F valve packs:	2 x Sub-Atlantic GFV*
8-F valve packs max flow (lpm):	12
8-F valve packs max pressure (bar):	207
3-F manifold:	1 x FMC Schilling
3-F manifold max flow (bar):	160**
3-F manifold max pressure (bar):	207

*5 functions are reserved for Rig-Master movements

**Limited by aux circuit flow

MANIPULATORS

7 functions:	FMC Schilling Titan 4
5 functions grabber:	FMC Schilling Rig-Master

TELEMETRY SYSTEM

Standard channel types*:	10 / 100 Ethernet, RS232, PAL video, 1080p HD-video
Subsea power outputs:	110VAC, 48VDC, 24VDC
Gigabit multiplexer:	Optional

*Setup and quantity may be reconfigured

TOP HAT TETHER MANAGEMENT SYSTEM

Dimensions (Ø x H - m)*:	1.9 x 2.2 / 2.3 x 2.2
Weight in air (Ton):	3.0 / 3.1
Tether length max capacity (m)*:	425 / 850
Pan & Tilt:	1 x electric Schilling
Depth Sensor:	Digiquartz 8000
Color CCD Zoom Camera:	2
HID lights:	2

*Actual specifications may vary depending on ROV unit

CONTROL VAN, WORKSHOP AND STORAGE

2 x ISO 20' containers + 1 x 10' container

TELESCOPIC LAUNCH & RECOVERY SYSTEM

Telescoping A-Frame (L x W x H - m):	8.3 x 2.5 x 3.1
A-frame maximum height (m):	9.6
A-Frame weight (Ton):	22
Winch (L x W x H - m):	3.8 x 2.2 x 3.0
Winch weight (Ton):	22
Levelwind (L x W x H - m):	3.8 x 2.2 x 2.0
Levelwind weight (Ton):	7
Levelwind + winch (L x W x H - m):	3.8 x 2.2 x 5.0*
Levelwind + winch weight (Ton):	29*
Winch max umbilical capacity (m):	3300
HPU (L x W x H - m):	1.4 x 2.4 x 2.4
HPU weight (Ton):	4.2

*Not meant to be lifted as a single piece. Figures to be used for deck layout only.

STANDARD OPERATIONAL LIMITS

Beaufort:	6
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ELECTRICAL REQUIREMENTS

ROV, control van:	380 / 480 VAC, 50 / 60Hz, 3PH, 630A
LARS:	440 VAC ±10%, 60Hz, 3PH, 400A

ROAD TRANSPORTATION

Number of trucks:	5 (approximately)
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