Open

ENERGINET - MARINE ENVIRONMENTAL STUDIES

Kriegers Flak II Benthic Ecology, Technical Report

Energinet Eltransmission A/S

Report no.: 2024-2175, Rev. 01
Date: 2024-11-27

Open

Project name:	Energinet - Marine Environmental Studies	DNV Denmark A/S Energy Systems
Report title:	Kriegers Flak II Benthic Ecology, Technical Report	Risk Management-1330-DK
Customer:	Energinet Eltransmission A/S,	Tuborg Parkvej
	Tonne Kjærsvej 65	DK 2900
	7000 Fredericia	Denmark
	Denmark	Tel: +45 39 45 48 00
Customer contact:	Amalie Rasmussen	DK89832314
Date of issue:	2024-11-27	
Project no.:	10443476	
Organization unit:	Risk Management-1330-DK	
Report no.:	2024-2175, Rev. 01	

Applicable contract(s) governing the provision of this Report:

Objective:

This document summarizes marine benthic environmental baseline data from Kriegers Flak II planned offshore wind farm areas (North and South), including export cable corridor to shore.

Prepared by:	Verified by:	Approved by:
Øyvind Fjukmoen Principal Consultant	Kjersti Myhre Senior Principal Consultant	Digitalt signeret af Lyager, Kristian Placering: Esbjerg, Denmark Dato: 2024.11.27 15:49:40+01'00' Kristian Lyager KAM Energinet
Lars Ulvestad Senior Consultant		
Annecken Nøland Consultant		
Emma Åslein Høgh Consultant		

Keywords: Offshore wind, benthic ecology, Kriegers Flak II

Rev. no.	Date	Reason for issue	Prepared by	Verified by	Approved by
A	2024-10-25	First draft	FJUKM; LUVES, ANCEN, EMMASL	MYHRE	
0	2024-11-25	Final version	FJUKM; LUVES, ANCEN, EMMASL	MYHRE	LYAGER
01	2024-11-27	Minor corrections	FJUKM; LUVES, ANCEN, EMMASL	MYHRE	LYAGER

Table of contents

ABBREVATIONS

Abbreviation	Explanation
AMBI index	AZTI Marine Biotic Index (AMBI), was designed to establish the ecological quality of European coasts. The index examines the response of soft-bottom benthic communities to natural and man-induced disturbances in coastal and estuarine environments.
CTD	Conductivity-Temperature-Density
DCE	Danish Centre for Environment and Energy
DKI	The Danish Quality Index for benthic infauna used for assessment of infauna condition
DW	Dry weight
ECC	Export Cable Corridors.
EEA	European Environment Agency
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency (Miljøstyrelsen, MST)
EQS	Environmental Quality Standards
GEUS	De Nationale Geologiske Undersøgelser for Danmark og Grønland
GIS	Geographic Information System
GW	Giga Watt
HAPS	Sediment core sampler. Samples a cylinder of sediment in soft to loose seabed sediments
Landfall	Is where the cable transfers from sea to land
MDS	Multidimensional Scaling
NEQS	National Environmental Quality Standards
NOVANA	Nationale Overvågningsprogram for Vandmiljø og Natur
OWF	Offshore Wind Farm
PAH	Polycyclic aromatic hydrocarbon
PSU	Practical salinity unit
ROV	Remotely Operated Vehicle
Shannon-Wiener index	The Shannon-Wiener Index gives a measure of the diversity of species in a community
SIMPER analysis	Similarity Percentage Analysis, calculates the contribution of each variable to the dissimilarity observed between two groups
TOC	Total Organic carbon given as % of DW

1 SUMMARY

DNV on behalf of Energinet Eltransmission A/S (Energinet) has carried out benthic baseline surveys in the planned offshore wind farm areas Kriegers Flak II North and Kriegers Flak II South in Danish waters, including export cable corridor to shore.

The document is a technical report on marine benthic environmental baseline data for the planned the planned Kriegers Flak II North and South Offshore Wind Farm (OWF) area and its export cable corridor (ECC) to Rødvig on the south east coast of Zealand, Denmark.

The technical report provides a comprehensive overview of the marine benthic environmental baseline data collected in 2024 for the planned Kriegers Flak II North and South OWF and its export cable corridor (ECC). This includes details on hydrography, sediment composition, sediment chemistry, infauna, megafauna, and macroalgae. Also, results from previous studies in the area are shortly summarized.

The survey area includes the planned Kriegers Flak II North and South OWF area at depths of 10-50 meters and the 48 km long ECC making landfall near Rødvig. The fieldwork was carried out in April 2024 and involved sediment sampling, visual mapping with ROVs, and hydrography measurements. An additional nearshore sampling was performed in June 2024.

Analyses of the sediment samples from the planned Kriegers Flak II North and South OWF area were characterized by a mixture of sand and silt, with clay present in the deeper layers also, with some rocks and black patches in the sediment on one station. The CTD profiles show the variation in salinity, temperature and oxygen vertically in the water column from the sea surface to approximately 1 meter above the sea bottom.

A total of 44 stations were sampled for infauna analyses, with a total of 34165 individuals distributed among 63 different taxa were recorded (juveniles excluded). The benthic infauna was dominated by polychaetes, with the highest diversity recorded at deeper stations. The fauna composition indicates healthy communities with a mix of filter feeders, suspension feeders, and carnivores.

A total of 19 km of seabed in the planned Kriegers Flak II North and South OWF areas and ECCs was surveyed by use of ROV. A total of 49 species of benthic megafauna and macroalgae were registered at the planned Kriegers Flak II North and South OWF areas and ECC, in addition, 16 fish species were encountered during the survey. The invasive fish, Round goby (*Neogobius melanostomus*) was registered in transects from Kriegers Flak II North and in the main ECC to shore. Apart from Round goby, no macrofauna or macroalgae species considered as alien species to Danish waters were registered in the visual surveys.

WSP has modelled substrate types in the planned Kriegers Flak II OWF and ECC areas according to the Danish classification system. Identified infauna communities registered are mud/silt, sand, mixed substrate with 1-10% rocky bottom, mixed substrate 10-25% rocks and stony reef more than 25% rocks

The biomass measurements from samples retrieved at the planned Kriegers Flak OWF and ECC areas. Mollusca contributed most to the biomass in some stations, but echinoderms also ranked high in total biomass in several stations. Phoronids that were also commonly dominating the fauna occurrences numerically were also among the top five species contributing to the overall biomass.

Mollusca contributed most to the biomass in some stations, particularly in Kriegers Flak II South where blue mussels accounted for most of the biomass. Polychaeta attributed to much of the biomass in shallower stations. Echinoderms were practically absent from all stations.

2 INTRODUCTION

2.1 Background

In order to accelerate the expansion of Danish offshore wind production, it was decided with the agreement on the Finance Act for 2022 to offer an additional 2 GW of offshore wind for establishment before the end of 2030. In addition, the parties behind the Climate Agreement on Green Power and Heat 2022 of 25 June 2022 (hereinafter Climate Agreement 2022) decided), that areas that can accommodate an additional 4 GW of offshore wind must be offered for establishment before the end of 2030. Most recently, a political agreement was concluded on 30 May 2023, which establishes the framework for the Climate Agreement 2022 with the development of 9 GW of offshore wind, which potentially can be increased to 14 GW or more if the concession winners – i.e. the tenderers who will set up the offshore wind turbines – use the freedom included in the agreement to establish capacity in addition to the tendered minimum capacity of 1 GW per tendered area.

To enable the realization of the political agreements on significantly more energy production from offshore wind before the end of 2030, the Danish Energy Agency has drawn up a plan for the establishment of offshore wind farms (OWF) in three areas in the North Sea, the Kattegat and the Baltic Sea respectively. The planned Kriegers Flak II North and South OWF areas in the Baltic Sea are stipulated to generate 1 GW of electricity.

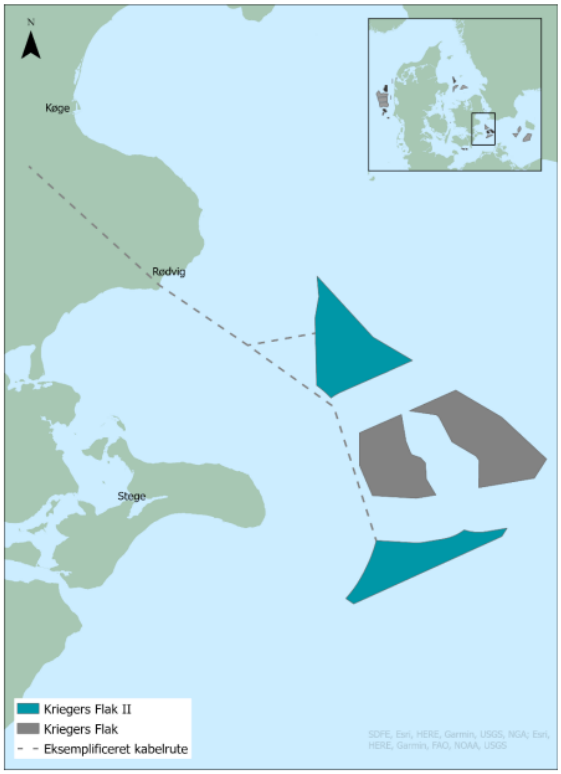


Figure 2-1 *Map showing the planned Kriegers Flak II North and South OWF areas and cable corridor to shore. Shown is also the existing Kriegers Flak wind farm areas. Source: Energistyrelsen.*

The offshore areas for Kriegers Flak II OWF (Figure 2-1) consist of two wind farm areas (North and South) and an export cable corridor to Zealand. The wind farm areas are located approximately 15 km off the south coast of Zealand. The area for the Kriegers Flak II North OWF is 99 km^2 and Kriegers Flak II South is 76 km^2. Kriegers Flak II will be connected to land via subsea cables making landfall close to Rødvig at the southeast coast of Zealand. The ECC from Kriegers Flak II South to junction with Kriegers Falk II North is approximately 32 km, ECC from Kriegers Flak North to junction is approximately 9 km, and the common ECC from junction to shore is approximately 15 km.

2.2 Objective

The objective of this benthic ecology baseline report is to present an overview of existing knowledge and baseline data collected in 2024 regarding hydrography, sediment composition, sediment chemistry, infauna and megafauna and macroalgae in the areas for the planned Kriegers Flak II North and South OWF areas and ECC.

2.3 Report structure

The report is initiated with a description of the methodology used in the offshore benthic survey performed in April 2024 and the survey close to shore (shallow water) performed in June 2024. The chapter elaborates on the parameters analysed, the methodology for sampling of the seabed and finally the methodology for the visual transect survey.

To give a background for placements of stations and parameters chosen, the next chapter gives a sum up of the existing information from previous studies in the area. Further details of existing data can be found in Benthic Ecology – Scope Report (DNV,2023).

Finally, Chapter 5 give a detailed description of the survey results for the offshore and shallow water surveys performed in 2024. The chapter includes a section with sediment characteristics and a description of the benthic communities.

3 METHODOLOGY

The following section describes survey area, sampling program, cruise information, equipment and methodology as well as data analyses performed in the planned Kriegers Flak II North and South OWF areas and ECC in 2024. Details regarding the cruise are given in a separate cruise report (DNV, 2024b).

3.1 Survey area

The area for the planned Kriegers Flak II North and South OWF areas and export cable corridor (Figure 3-1) is the survey area relevant for this report. The area is situated in the western parts of the Baltic Sea at depths of 10-50 meters.

The export cable corridor is 48 km long, with water depths of 0-35 meter and makes landfall near Rødvig and the Natura 2000 area Stevns rev at the east coast of Zealand.

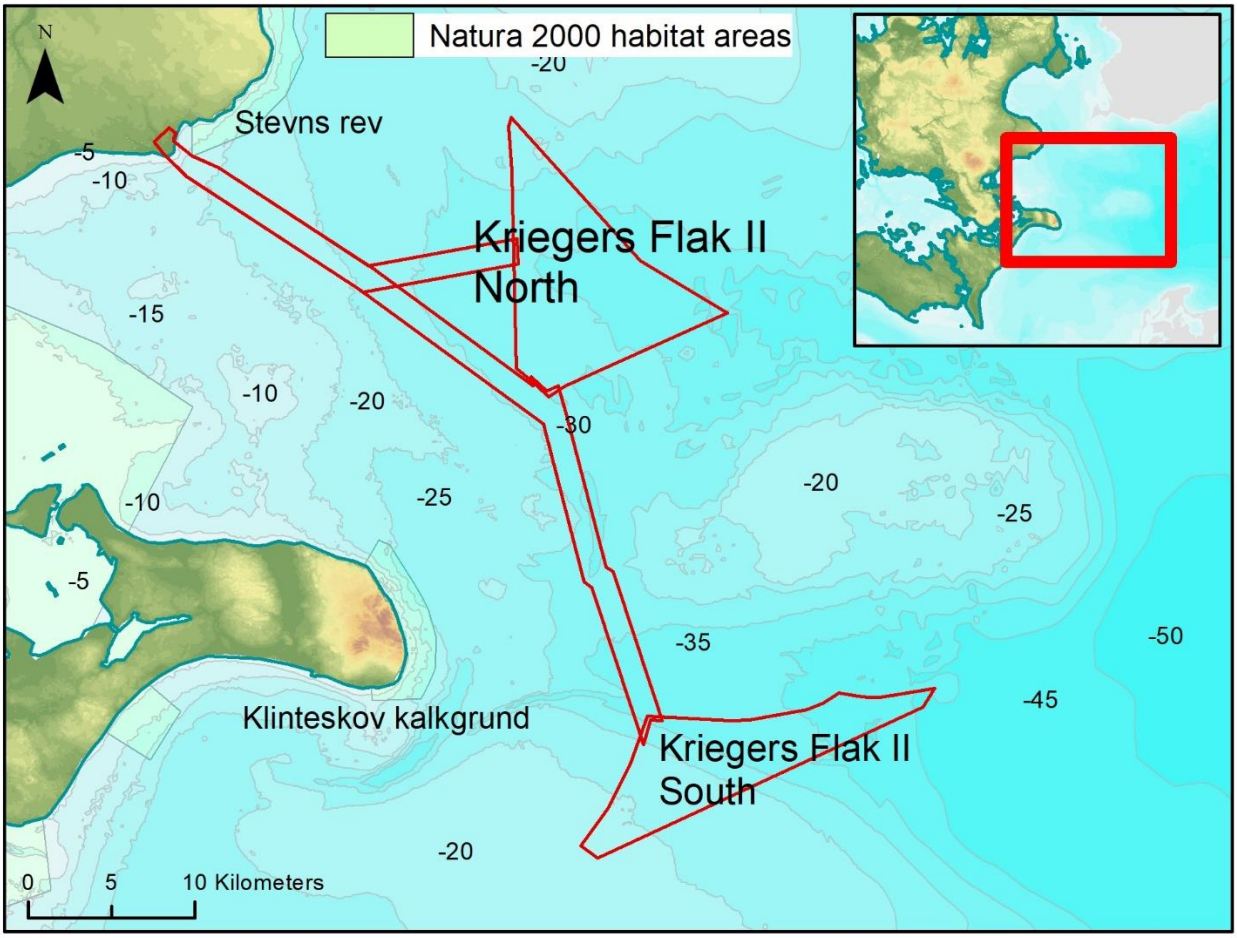


Figure 3-1 *The planned Kriegers Flak II North and South OWF areas and export cable route. Bathy data: GEUS.*

3.2 Sampling program

Work was performed according to program developed by DNV in agreement with Energinet (DNV, 2024a).

The environmental survey scope included sampling of:

- Sediment data: benthic macrofauna (infauna) and sediment grain composition and chemistry.
- Visual mapping data of seabed habitats, fauna and flora (ROV)
- Hydrography (salinity, temperature, oxygen content in the water masses)

Overview of sampling program is given in Table 3-1 and Table 3-2. A map with the sampling locations and the locations of the visual survey transects is given in Figure 3-2, Figure 3-3 and Figure 3-4.

Sediment samples were collected from environmental stations within the two main areas, planned Kriegers Flak II North and South OWF areas and ECC. In total 48 stations were sampled, and 23 visual survey transects corresponding to a total of 19 km were filmed using ROV. Environmental stations were evenly distributed within the areas and were placed so that main substrate types were sampled and so that the range of variability was covered. Details regarding sediment stations are given in Appendix 1.

Visual survey transects were placed in such a manner that both dominant seabed substrate types were covered in addition to areas of particular interest e.g. such as stony reefs. Transects were evenly distributed over the areas, covering the depth gradient and different substrate types.

Two or three hydrographical stations were sampled for each area to obtain baseline data regarding salinity, temperature and oxygen content in the water masses and will serve as supporting parameters for the infauna analyses.

Table 3-1. *Table showing number of sediment stations, hydrography stations and visual survey transects. Numbers in parentheses indicate number of shallow water stations in each area (separate cruise with smaller vessel).*

Area	No. environmental stations sediment sampling	No. of hydrography stations	No. transects for visual mapping
Kriegers Flak II North OWF	10	2	4
Kriegers Flak II North ECC	4	1	2
Kriegers Flak II South OWF	10	2	4
Kriegers Flak II South ECC	20 (2)	5	13 (2)
Total	**44**	**10**	**23**

Table 3-2. *Table showing performed sampling in the planned Kriegers Flak II North and South OWF areas and cable corridors.*

Area	Stations	Hydrography	Bio	Grain	TOC	Metals	PAH	Phthalates	Phenols
Kriegers Flak II North OWF	10	2	40	10	10	5	5	5	5
Kriegers Flak II North ECC	4	1	16	4	4	2	2	2	2
Kriegers Flak II South OWF	10	2	40	10	10	5	5	5	5
Kriegers Flak II South ECC	20	5	73	20	20	10	10	10	10
SUM	**44**	**10**	**169**	**44**	**44**	**22**	**22**	**22**	**22**

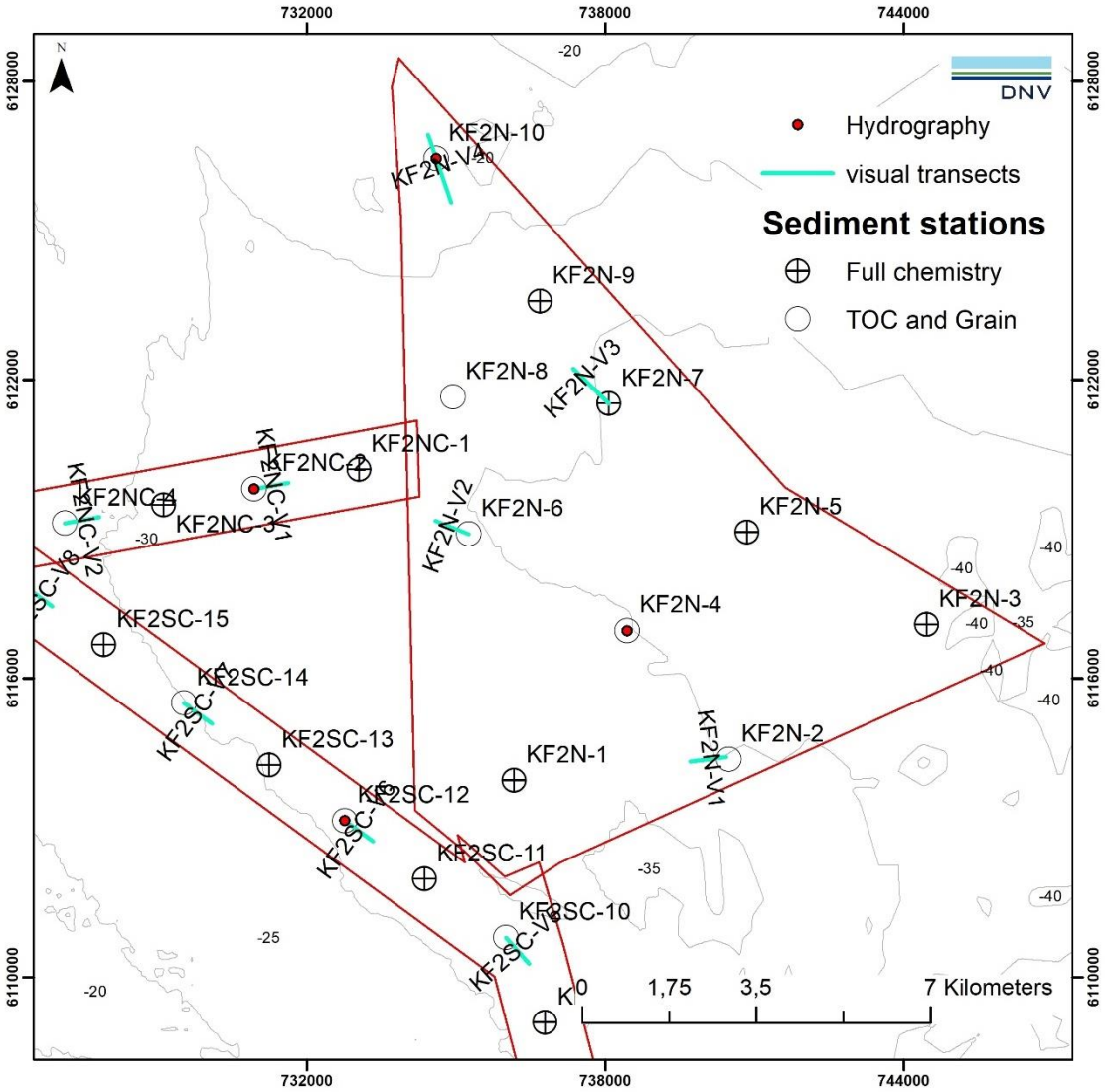


Figure 3-2 *Map showing sediment sampling stations, hydrography stations and visual survey transects in the area for the planned Kriegers Flak II North OWF and Kriegers Flak II North ECC.*

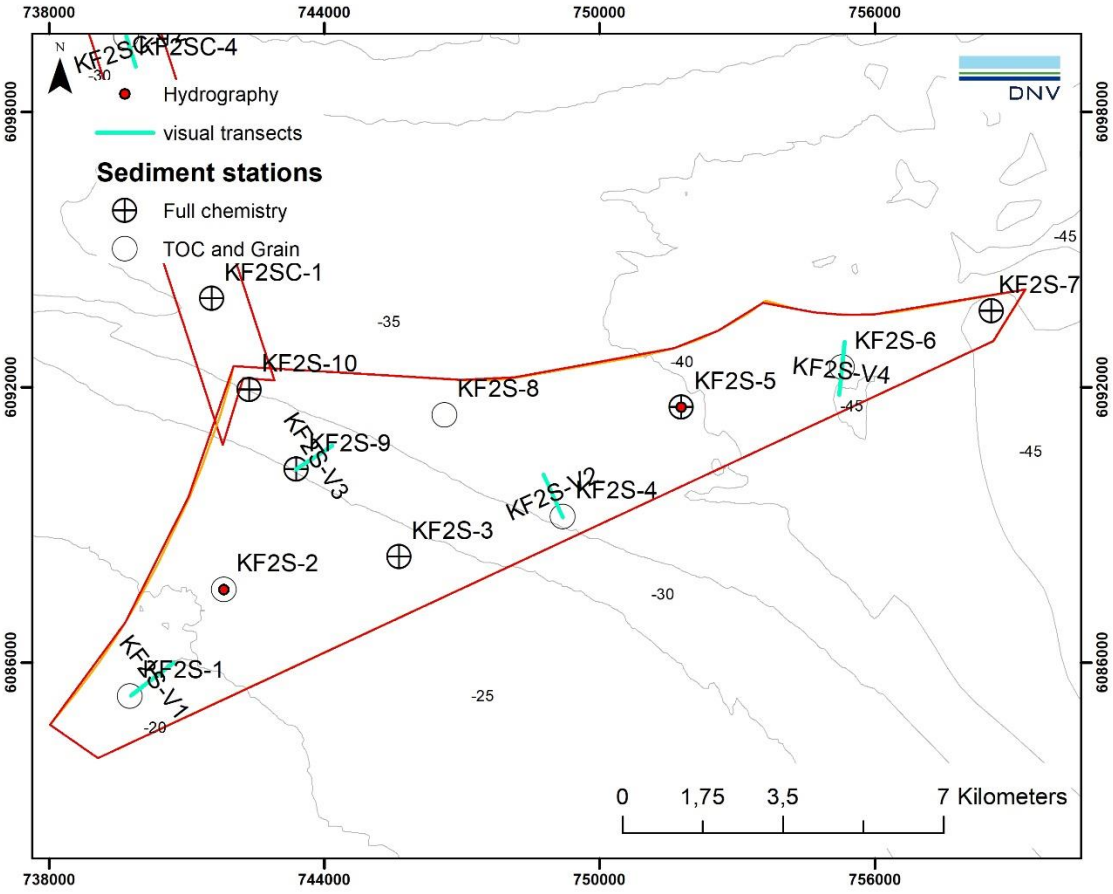


Figure 3-3. *Map showing sediment sampling stations, hydrography stations and visual survey transects in the planned Kriegers Flak II South OWF.*

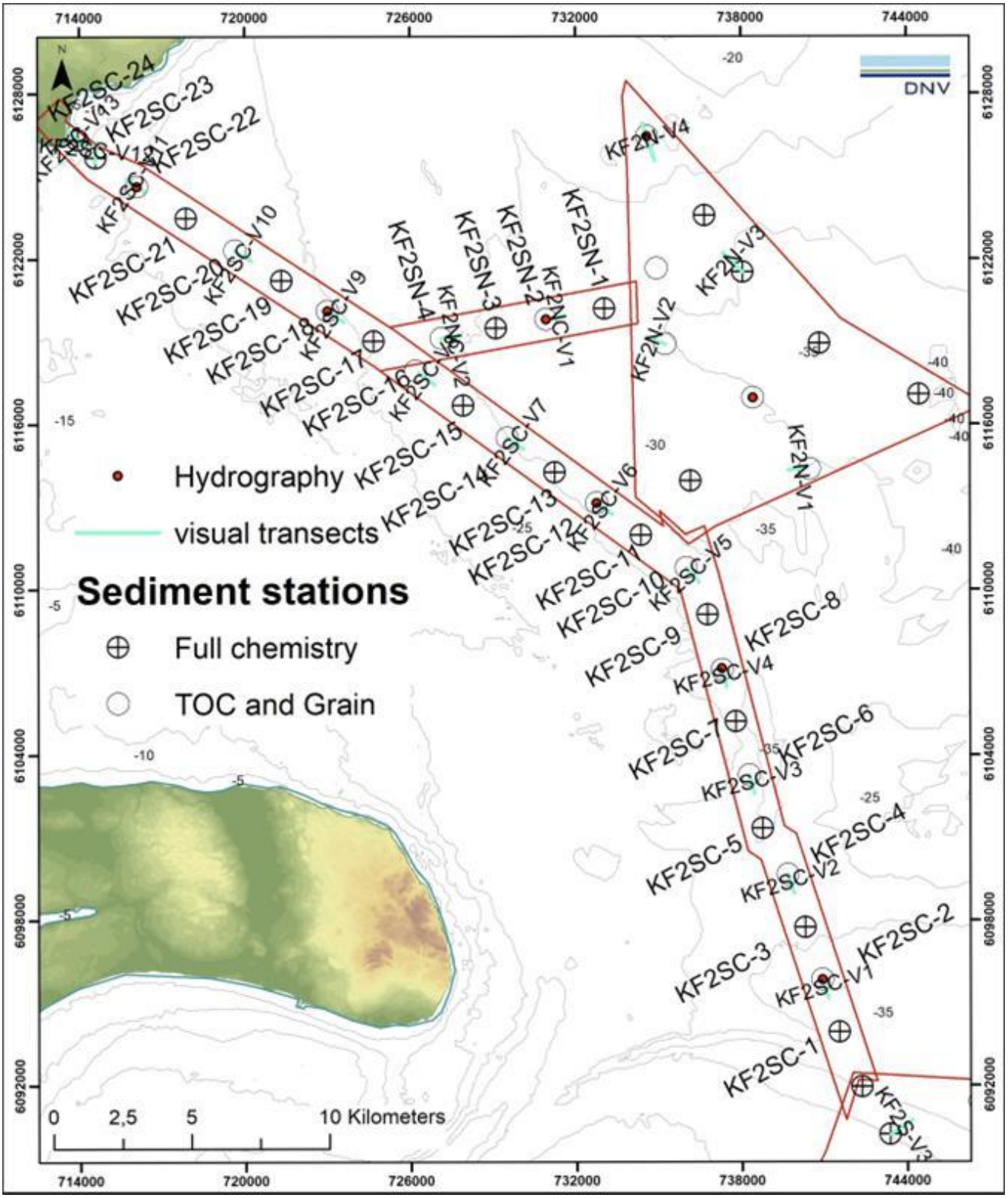


Figure 3-4 *Map showing sediment sampling stations, hydrography stations and visual survey transects in the planned Kriegers Flak II South ECC.*

3.3 Methods and equipment

3.3.1 Cruise information

Offshore fieldwork was carried out 4-8 April 2024 from the vessel Esvagt Server (Figure 3-5). The fieldwork was done in conjunction with a larger environmental baseline cruise where the areas for the planned Kattegat and Hesselø OWF areas and export cable corridors were also surveyed. Nearshore/ shallow water stations were inspected and sampled 11-14 June 2024 in collaboration with WSP, by use of WSP's vessel "Sephia".

In total 19 km of visual survey transects were visually mapped (23 ROV transects) and 169 grab samples from 44 stations were obtained for analyses of infauna and chemistry in the planned Kriegers Flak II North and South OWF areas and ECC.

Figure 3-5 *Esvagt Server (L) and WSP's SEPHIA (R).*

3.3.2 Sediment sampling and analysis

A summary of sediment sampling and analyses performed is given in Table 3-3 .

Macrobenthic fauna living in the sediments (infauna) are traditionally included in offshore environmental monitoring. The reason for this is that the study of benthic communities can give an indication of the effects of pollution from activities, while chemical monitoring of sediments is aimed at assessing the dispersion and concentration levels of pollutants in the seabed sediments. It is important to obtain baseline data on both benthic infauna communities as well as chemical and physical characteristics of the sediments before activities take place in the planned Kriegers Flak II North and South OWF areas and ECC. The baseline will be used in the Environmental Impact Assessment (EIA) for the Kriegers Flak II project.

The benthic fauna is a suitable biological parameter for monitoring the general environmental status and effects of pollution or disturbances since most of the species have limited mobility and changes in species composition and densities of individuals can therefore easily be identified. The distribution of the fauna can be related to natural variations in environmental parameters such as depth and type of sediment, but also anthropogenic factors such as sedimentation, pollution and organic enrichment.

The sediment sampling carried out is standard for this type of investigation. The following equipment was used (see Figure 3-6):

- Combi grab – modified van Veen (0.15 m^2 surface area, takes chemistry and biology samples in the same cut)
- Reception table in stainless steel
- Measuring cylinder
- Washing table
- Sieves (5 mm and 1.0 mm round holes)
- Winch with Spectron rope

Each environmental station was spatially limited to an area with a radius of 25 meters where sediment sampling took place.

Each station was sampled with 4 replicates for fauna analyses. Pooled samples for chemistry and sediment composition were prepared for each station. An overview of sampled stations and grabs is given in Appendix 1.

During sampling, the sediment samples for infauna analyses were sieved on 1 mm sieves and fixated and stored for analysis in the accredited taxonomical laboratory. Procedures are described in DNV's Biolaboratory's quality system: "Sampling of marine sediment and soft bottom analyses". A flow chart showing the different steps in the preparation of macrofauna is shown in Figure 3-7.

The sampling was carried out in accordance with accredited procedures described in *Handbook for the Biology laboratory quality system; sampling of marine sediment and soft bottom analyses*. The sediment was sampled so that the surface in the samples was undisturbed, and the washing/sieving of the fauna samples was carried out gently. Animals were fixed in formalin (4 % neutralized with hexamine), added pink Bengal and stored in plastic buckets. Sediment samples for chemical analyses and sediment characteristics were stored in rilsan bags or plastic cups. Freezers were utilized for storage of chemical samples. All samples were double-labeled and packed in solid boxes to avoid damage to the sample packing. Sampling was performed in accordance with the standards NS-EN ISO 16665, NS-EN ISO 5667-19, NS-EN ISO 16665.

Measurements of infauna biomass was made on wet weight basis for each station. Biomass for different species / taxa at each station was calculated as wet weight per 1 m^2. Each taxa / species was weighed with an accuracy of 0.1 mg after conservation liquid was drain off on filter paper. Species or taxa with less weight than this was set to 0.1 mg.

Analysis of grain size composition and content of organic matter were performed as supporting parameters for the infauna analyses. Chemical analyses were performed to fulfil parameters requested by The Water Framework Directive (from coast to 12 nautical mile) and The Marine Strategy Framework Directive (outside 12 nautical mile). The national and EU's environmental quality requirements (EQS, Environmental Quality Standards) are used to assess the substance analysis results. Lab analyses of sediment samples were carried out by Eurofins and DCE (Phthalates and phenols).

Table 3-3 *Overview of sediment sampling in the areas for the planned Kriegers Flak II North and South OWF areas and ECC. Sediment layer sampled is specified for the different analyses of chemistry and grain sizes. Bio refers to grab samples.*

Kriegers Flak North OWF	Station depth (m)		Grain	TOC	Metals	PAH	Phthalates	Phenols
		Bio	0-5 cm	0-1 cm				
KF2N-1	30	4	1	1	1	1	1	1
KF2N-2	31	4	1	1				
KF2N-3	36	4	1	1	1	1	1	1
KF2N-4	31	4	1	1				
KF2N-5	34	4	1	1	1	1	1	1
KF2N-6	31	4	1	1				
KF2N-7	32	4	1	1	1	1	1	1
KF2N-8	24	4	1	1				
KF2N-9	31	4	1	1	1	1	1	1
KF2N-10	26	4	1	1				
SUM		**40**	**10**	**10**	**5**	**5**	**5**	**5**
Kriegers Flak II North ECC								
KF2NC-1	28	4	1	1	1	1	1	1
KF2NC-2	23	4	1	1				
KF2NC-3	27	4	1	1	1	1	1	1
KF2NC-4	25	4	1	1				
SUM		**16**	**4**	**4**	**2**	**2**	**2**	**2**
Kriegers Flak II South OWF								
KF2S-1	21	4	1	1				
KF2S-2	22	4	1	1				
KF2S-3	23	4	1	1	1	1	1	1
KF2S-4	33	4	1	1				
KF2S-5	36	4	1	1	1	1	1	1
KF2S-6	42	4	1	1				
KF2S-7	44	4	1	1	1	1	1	1
KF2S-8	35	4	1	1				
KF2S-9	26	4	1	1	1	1	1	1
KF2S-10	31	4	1	1	1	1	1	1
SUM		**40**	**10**	**10**	**5**	**5**	**5**	**5**
Kriegers Flak II South ECC								
KF2SC-1	34	4	1	1	1	1	1	1
KF2SC-2	33	4	1	1				
KF2SC-3	31	4	1	1	1	1	1	1
KF2SC-4	30	4	1	1				
KF2SC-5	32	4	1	1	1	1	1	1
KF2SC-6	29	4	1	1				
KF2SC-8	29	4	1	1				
KF2SC-9	29	4	1	1	1	1	1	1
KF2SC-10	30	4	1	1				
KF2SC-11	29	4	1	1	1	1	1	1
KF2SC-12	27	4	1	1				
KF2SC-13	27	1	1	1	1	1	1	1
KF2SC-14	26	4	1	1				
KF2SC-15	24	4	1	1	1	1	1	1
KF2SC-18	21	4	1	1				
KF2SC-19	20	4	1	1	1	1	1	1
KF2SC-20	20	4	1	1				
KF2SC-21	18	4	1	1	1	1	1	1
KF2SC-22	17	4	1	1				
KF2SC-23*	13		1	1	1	1	1	1
SUM		**73**	**20**	**20**	**10**	**10**	**10**	**10**
Overall SUM		169	44	44	22	22	22	22
*: Shallow water station sampled from smaller vessel								

Figure 3-6. *Grab sampling. Grab type used, a Van Veen type grab (collects sediments for 0.1 m^2 samples of macrofauna and 0.05 m^2 for sediment chemistry and grain size analyses.*

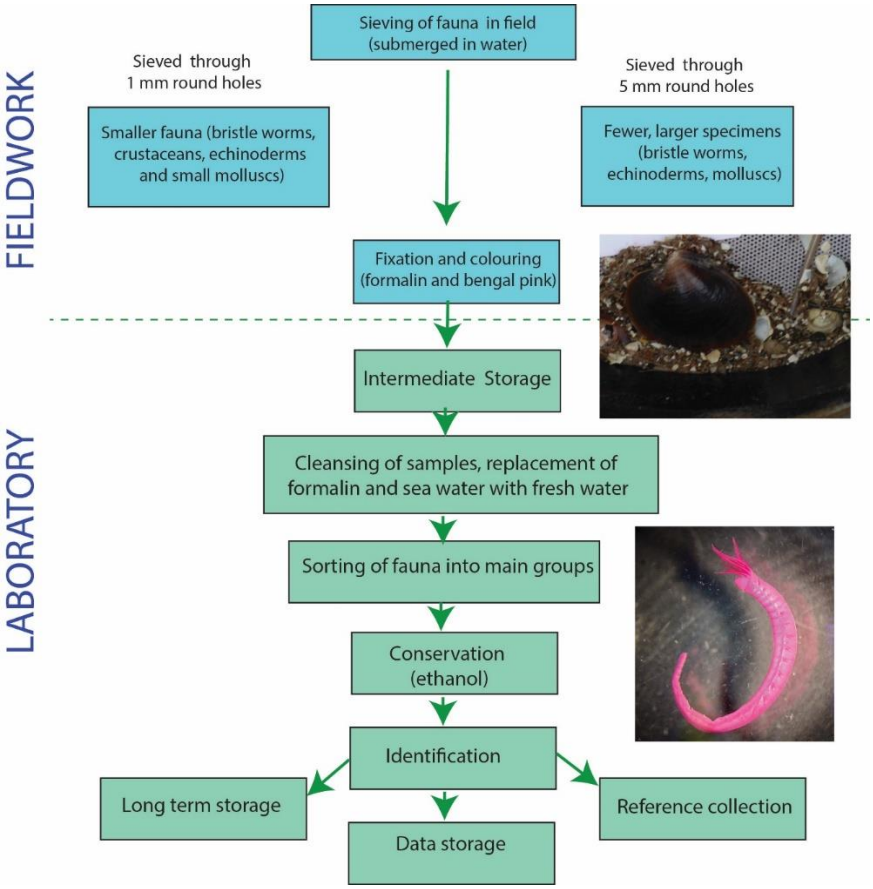


Figure 3-7. *Flow chart showing preparation and analyses of sediment macrofauna samples*.

3.3.2.1 Data analysis

Results that are reported from infauna analyses includes species present, number of species, abundance, biomass, biodiversity (Shannon-Wiener), Evenness (pileou), AMBI (AZTI's Marine Biotic Index) and the Danish DKI index (Danish Quality Index). Results are presented aided by multivariate statistics such as cluster analyses (dendrograms and multidimensional scaling plots), principal components analyses and SIMPER analyses, also including results from analyses of sediment chemistry and physical parameters.

3.3.3 Visual mapping

Summary of visual survey transects performed are given in Table 3-4 and Figure 3-8. A total of 19 km spread over 23 visual transects were filmed and 1800 still images were captured.

Visual mapping was conducted with an observation class ROV (Remotely Operated Vehicle). DNV's ROV "Chimaera", of the type "SPERRE 15K" (Figure 3-9). The ROV was fitted with HD camera, still camera, laser for size calculations and sonar for scanning of the seafloor. Underwater navigation was obtained by transponder (Kongsberg cNode beacon) communicating with the vessels USBL system (Kongsberg Hipap 500). The navigational system onboard worked well with the cNode beacon and navigational data was clean and accurate. See Figure 3-8 . The visual mapping was carried out according to requirements in the standard EN 16260:2012. The ROV generally flew 1- 1,5 meters above the seabed along the transects and field of view was generally 1-2 meter. High resolution still photos were captured every 20-30 meters along the survey transects.

Shallow water visual transects were performed by WSP and by use of their BlueROV.

Table 3-4 *Overview of visual survey transects. Positions in ETRS89 UTM32N.*

Area	Name	Depth interval (m)	Length (m)	Transect centerpoint	
				Easting	Northing
Kriegers Flak II North OWF	KF2N-V1	27-28	725	740065	6114370
	KF2N-V2	24-28	720	734916	6119040
	KF2N-V3	23-26	1008	737714	6121870
	KF2N-V4	19-25	1441	734665	6126240
Kriegers Flak II North ECC	KF2NC-V1	22-26	700	731280	6119870
	KF2NC-V2	18-24	700	727483	6119180
Kriegers Flak II South OWF	KF2S-V1	17-20	1176	740245	6085640
	KF2S-V2	28-32	1010	748995	6089630
	KF2S-V3	24-27	943	743779	6090470
	KF2S-V4	35-39	1162	755288	6092410
Kriegers Flak II South ECC	KF2SC-V1	30-31	695	741032	6095500
	KF2SC-V2	25-28	698	739784	6099320
	KF2SC-V3	24-27	700	738382	6102930
	KF2SC-V4	24-27	696	737381	6106800
	KF2SC-V5	26-28	702	736235	6110530
	KF2SC-V6	23-26	701	733045	6112940
	KF2SC-V7	21-24	700	729815	6115300
	KF2SC-V8	18-22	701	726600	6117650
	KF2SC-V9	16-19	700	723303	6119920
	KF2SC-V10	15-18	703	719944	6122120
	KF2SC-V11	12-15	800	716036	6124700
	KF2SC-V12*	9-13	731	714618	6125880
	KF2SC-V13*	1-10	968	713928	6126360

*: Shallow water transects performed with small ROV.

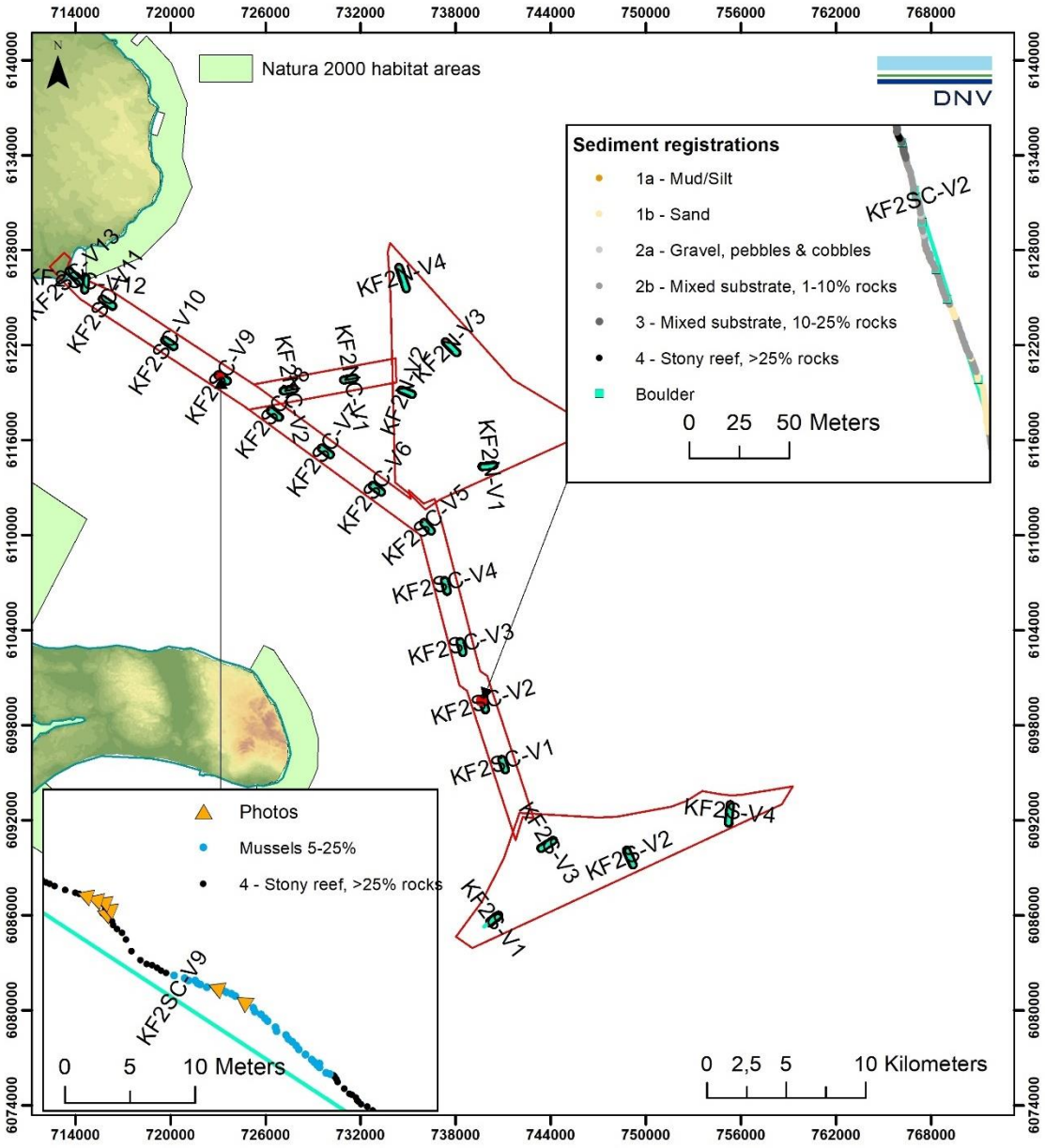


Figure 3-8 *Map showing overview of visual survey transects visually inspected by DNV in the areas for the planned Kriegers Flak II North and South OWF areas and ECC in April 2024. Example of ROV navigational data and georeferenced registrations of sediment (according to the Danish sediment classification system) and fauna coverage are shown for two transects (zoomed in for sections of KF2SC-V2 sediment, and KF2SC-V9 - fauna registrations).*

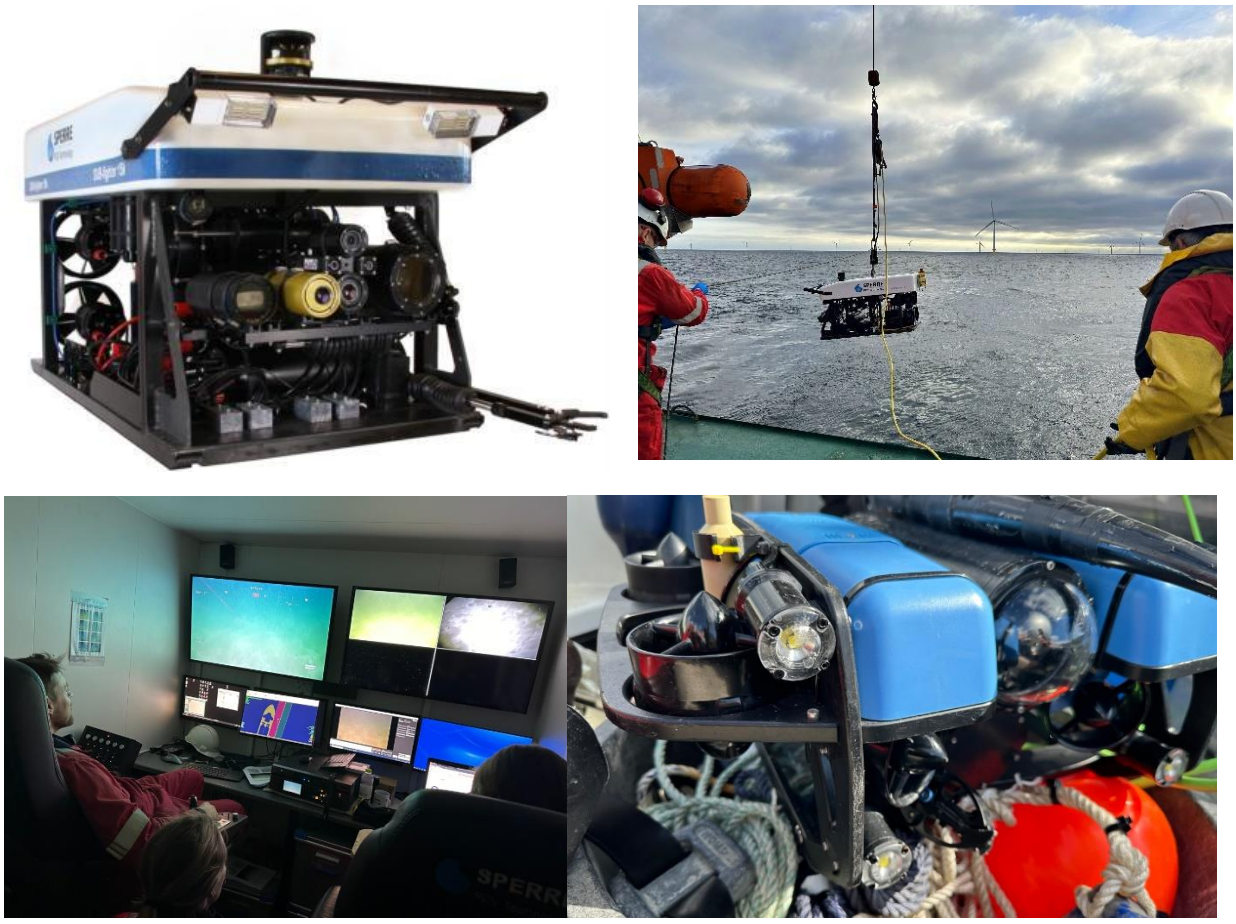


Figure 3-9 *DNV's ROV "Chimaera". A SPERRE Subfighter 15K. and WSPs BlueROV (bottom right) used for shallow water surveys.*

3.3.3.1 Data logging system

Logging of findings was made by use of DNV's video logger software ensuring that findings are georeferenced. The log included date, time, type of seabed substratum, megafauna, and any special observations (e.g., debris or fish). ROV position was recorded every second in a navigation log. By merging these two logs all registrations from the video material were given a coordinate to be used in preparation of maps. Still images were also georeferenced for presentations in GIS system. Species encountered, substrate types and distribution of fauna in general was registered along the visual survey transect, and findings were georeferenced for presentations in maps, together with species lists. Seabed classifications followed the Danish substrate classification method (next section).

3.3.3.2 Substrate and fauna registrations

Registrations of substrate and fauna were made according to DS-EN-16260.

Substrate classifications were made according to the Danish classification system as described in Raw material statutory order no.1680 of 17-12-2018. Summarized in Table 3-5 (with reference to WSP, 2022). Note that WSP is preparing modelled distribution of substrate types according to the same classification system for planned Kriegers Flak II North and South OWF areas and ECC in 2024.

All megafauna species and habitat types encountered during the surveys were registered. In addition to species registration by review of the video material, the species lists are based on identification from still photos. The abundance of each species was logged using the SACFOR scale, which is a relative six-graded abundance scale, changing with animal size (Table 3-6)

In instances where fauna could not be identified to species, identifications were made to higher taxonomical levels, or "video species" were introduced in instances where the same type of unidentified fauna was encountered over several transects.

The video registrations of sponges were categorised into two groups; "soft bottom sponges" and "hard bottom sponges"

Survey transects to be covered during visual mapping often constitute several km of seabed. Counting individual sponges in images or calculating percent coverage can be quite time-consuming and generally cannot be applied to the whole length of the survey transect. Semi-quantitative density estimates provide an efficient way of assessing spatial patterns on the seabed. The method requires trained experts in order to keep results reliable and methods replicable. DNV uses the following semi-quantitative scale when logging sponges: "No sponges", "single individual", "scattered", "common" and" high". Sponge individuals were logged as single when there was about 10 m or more between individuals (i.e., a couple of viewing frames in video between individuals). For illustrative purposes, single individuals and no sponges are shown as a combined group in this report, so that seabed sponge cover classification in maps and figures are represented by four semi-quantitative groups.

Sea pens, sea feathers and soft corals/carnation corals were classified as following (ind./ 25m^2): "Rare": <5, "Scattered": 6-10, "Common": 11-15, "High": >15.

Table 3-5: *Sediment characterization according to the Danish classification system (WSP, 2022).*

Main type	Description	Sub type
Type 1 – Sand and soft sediments	Areas that consist of soft sediments as gyttja, silt or mud, to hard sediments of sand (0.06 – 2.0 mm) and gravel fraction grain size, with a variation of bed forms (often dynamical). sediments), Coverage of boulders (>100 mm) is less than 1%.	1a (gyttja or silty soft bottom, loose
		1b (firm bed type of sandy loose sediment)
		1c (clayish firm sediments).
Type 2 – Sand, gravel and small rocks with a few larger rocks (area coverage 1-10%)	Composed chiefly of sand or fine-grained matrix but with varying amounts of gravel (2-20mm) and pebbles/small cobbles (20-100 mm). The substrate may contain some (1-10%) scattered boulders (>100mm). This is further divided into the sub-divisions of type 2a and 2b.	2a is a bed type consisting of a variety of gravel, pebbles and cobbles with less than 1% area coverage of larger rocks (>100 mm).
		2b is a bed type with a varying sediment content of gravel, pebbles and cobbles and a spread of larger rocks of cobble to boulder grain sizes with an area coverage of 1-10% (>100 mm).
Type 3 – Sand, gravel, small rocks and several larger rocks (area coverage 10-25%)	Areas consisting of mixed marine sediment types dominated by sand, gravel and smaller rocks. This sediment type consists of a spread of larger rocks (>100 mm) with an area coverage of 10-25% and can be associated with rocky reefs when spatial connection to substrate type 4	
Type 4 – Rocky areas (reefs), consisting of many larger rocks (area coverage >25%)	Dense spreading of larger rocks or rock reefs (stone reefs) with forming of cavities / rock shelters and can have a bathymetric anomaly due to the high ground of large rocks compared to the adjacent sediment.	

Table 3-6 *The SACFOR scale used for logging species abundances at Kriegers Flak II. (From http://jncc.defra.gov.uk).*

% cover scale	Growth form		Size of individuals/colonies				Density scale	
	Crust/meadow	Massive/Turf	<1cm	1-3 cm	3-15 cm	>15 cm		
>80%	S		S				**>1/0.001 m^2 (1x1 cm)**	**>10,000 / m^2**
40-79%	A	S	A	S			**1-9/0.001 m^2**	**1000-9999 / m^2**
20-39%	C	A	C	A	S		**1-9 / 0.01 m^2 (10 x 10 cm)**	**100-999 / m^2**
10-19%	F	C	F	C	A	S	**1-9 / 0.1 m^2**	**10-99 / m^2**
5-9%	O	F	O	F	C	A	**1-9 / m^2**	
1-5% or density	R	O	R	O	F	C	**1-9 / 10m^2 (3.16 x 3.16 m)**	
<1% or density		R		R	O	F	**1-9 / 100 m^2 (10 x 10 m)**	
					R	O	**1-9 / 1000 m^2 (31.6 x 31.6 m)**	
						R	**<1/1000 m^2**	

S	A	C	F	O	R	P
super-abundant	abundant	common	frequent	occasional	rare	present

4 EXISTING DATA

In this chapter the existing data and knowledge is presented. The purpose of this is to provide an overview of previous work done in the area which also will support the baseline information of the benthic ecology in the planned Kriegers Flak II North and South OWF and ECC areas.

4.1 Kriegers Flak II North

4.1.1 Sampling stations

4.1.1.1 NOVANA

An overview of NOVANA benthic monitoring stations in the vicinity of the Kriegers Flak II North area, monitored in the period 1st of January 2020 to 1st of August 2023 is shown in Figure 4-1. There are no monitoring stations inside, or close to the survey area for Kriegers Flak II North, however, one monitoring station is close to the ECC landfall (station name Lund, eelgrass) (Table 4-1).

Figure 4-1. *NOVANA benthic monitoring stations in the vicinity of the Kriegers Flak II North project area conducted in the period 1st of January 2020 to 1st of August 2023. Source: Miljøgis, 2023.*

Table 4-1. *An overview of NOVANA benthic monitoring stations close to the landfall of the ECC for Kriegers Flak II North sampled in the period 1st of January 2020 to 1st of August 2023. Source: Miljøgis, 2023.*

Station name	Parameter	No. of surveillance	First surveillance	Last surveillance
Fakse Ladeplads	Eelgrass	14	19-09-2005	17-08-2022
Lund	Eelgrass	13	19-09-2005	17-08-2022

An overview of all registered NOVANA benthic monitoring stations in the vicinity of Kriegers Flak II North project area is given in Figure 4-2.

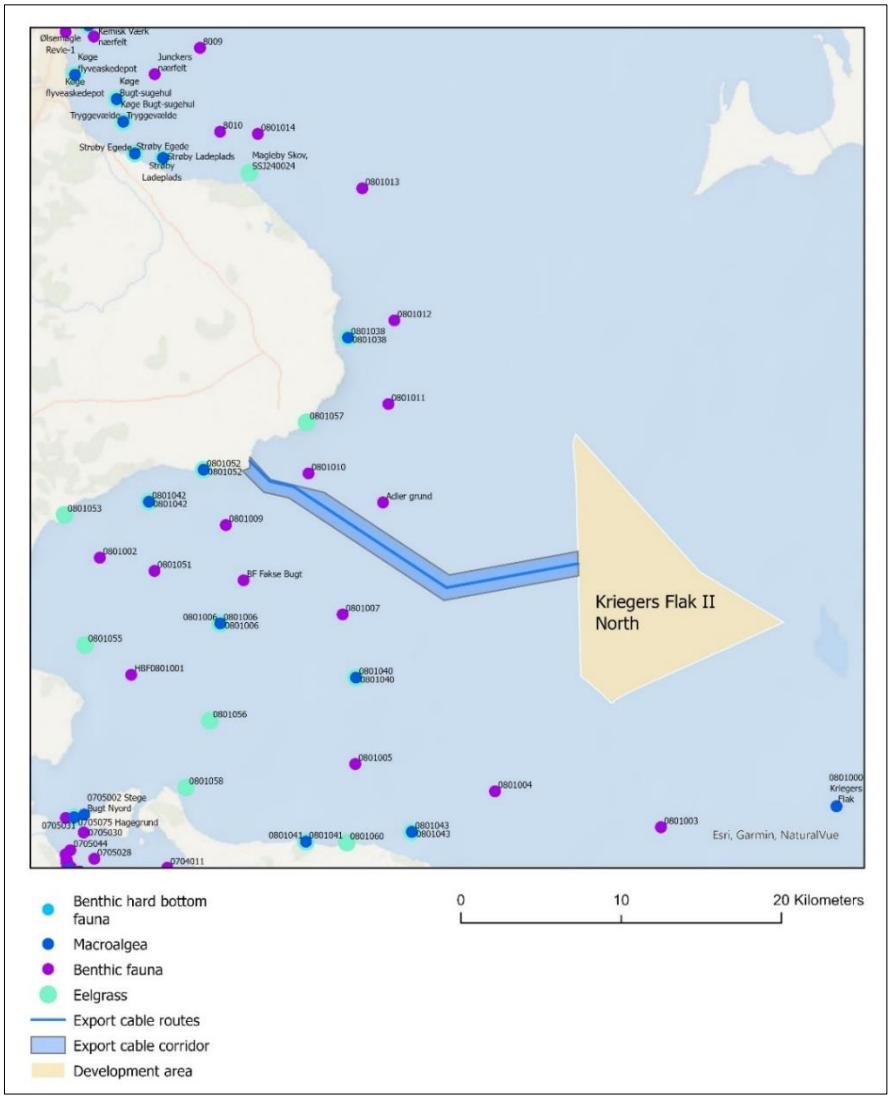


Figure 4-2. *Registered NOVANA benthic monitoring stations in the vicinity of Kriegers Flak II North project area. Please see Appendix 1 for more information about the monitoring stations. Source: Miljøgis, 2023.*

4.1.1.2 Natura 2000

There are no Natura 2000 sites within the Kriegers Flak II North area, however, there is a site *Stevns Rev* adjacent to the planned landfall (Figure 4-3). The basis for the protection of *Stevns Rev* is the presence of sand banks and reefs in the area. There is one monitoring station in *Stevns Rev* where monitoring of hard bottom fauna takes place (Miljøstyrelsen, 2022).

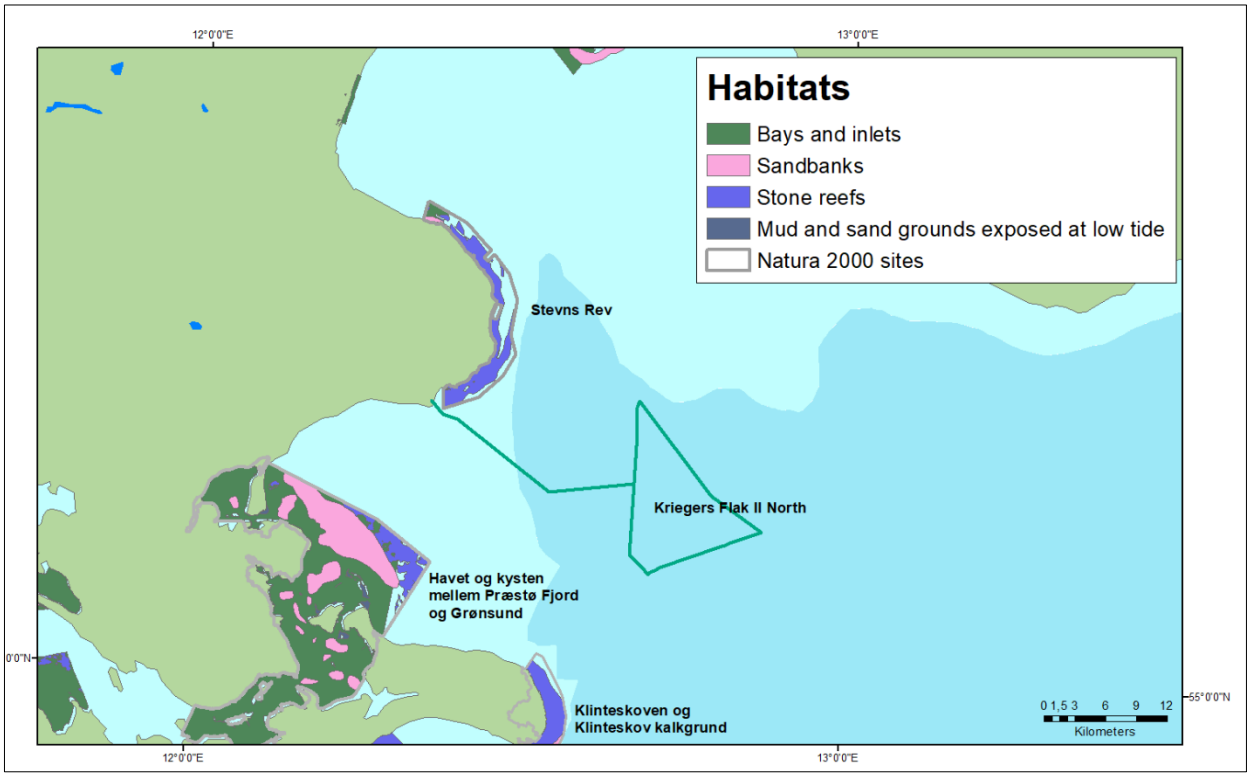


Figure 4-3. *Natura 2000 sites in the vicinity of Kriegers Flak II North project area. Source: Miljøgis, 2023.*

4.1.1.3 Kriegers Flak (existing) Offshore Wind Farm

Baseline investigations for the Kriegers Flak Offshore Wind Farm and export cable corridor were undertaken in May 2013 (Berg et al., 2015). . The investigations included grab sampling, underwater video recording and diving (Figure 4-4 till Figure 4-10). Based on the obtained data and supplemented with data from e.g., the geophysical surveys, benthic habitats were mapped throughout the study area (Niras & MariLim, 2015).

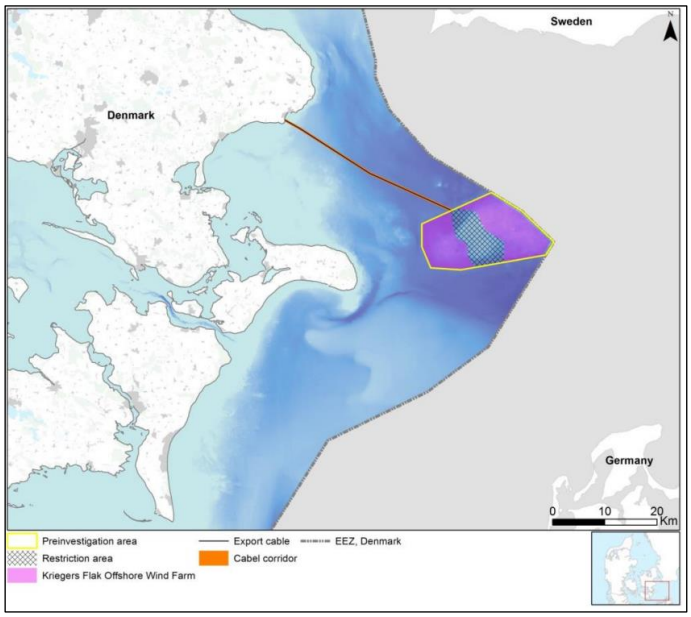


Figure 4-4. *Map from Niras & MariLim (2015) showing the planned location of Kriegers Flak offshore wind farm in the Danish territory. Approximately in the middle of the pre-investigation area an area (approximately 28 km^2) is reserved for sand extraction with no permission for technical OWF components to be installed (hatched area). Source: Niras & MariLim, 2015.*

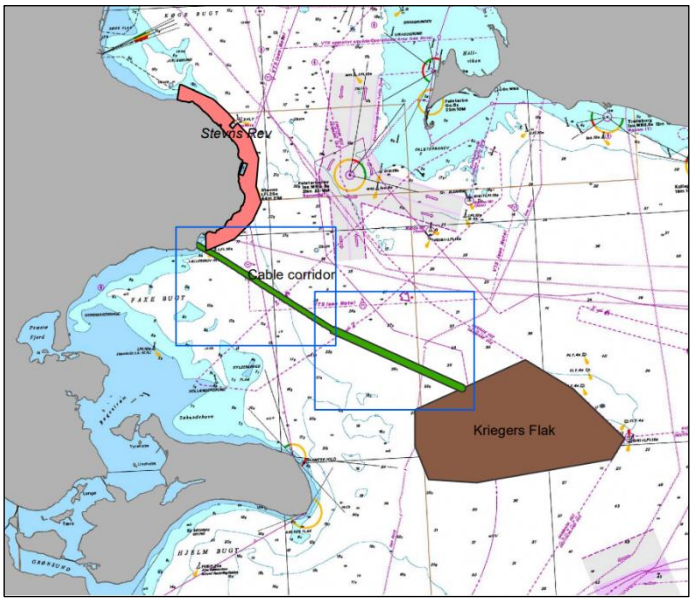


Figure 4-5. *Outline of the investigation area including the offshore wind area, Kriegers Flak, and cable corridor. Source: Niras & MariLim, 2015.*

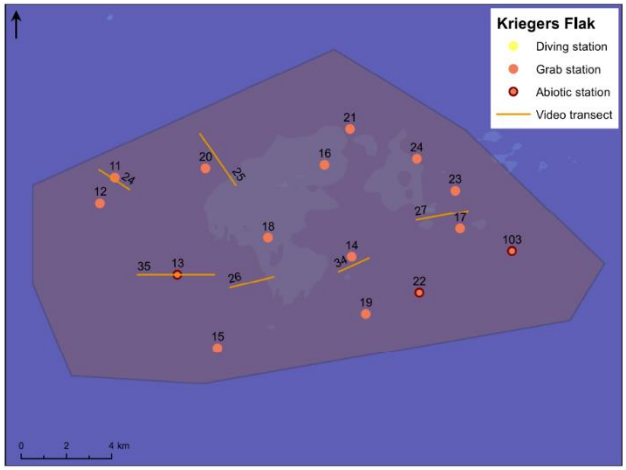


Figure 4-6. *Sampling program at Kriegers Flak subarea in 2013. Source: Niras & MariLim, 2015.*

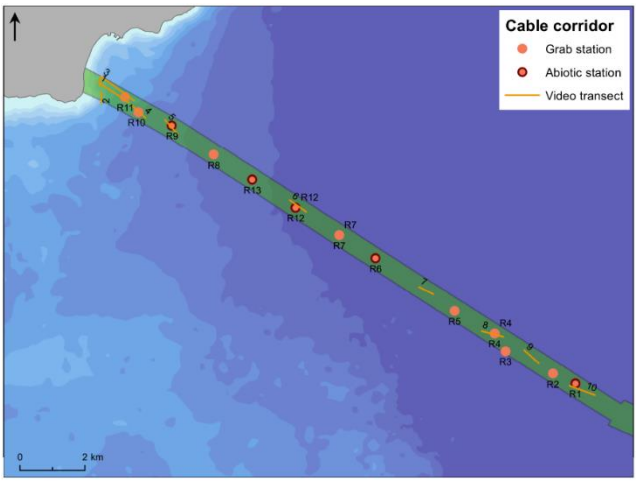


Figure 4-7. *Sampling program at the western part of the cable corridor in 2014. Source: Niras & MariLim, 2015.*

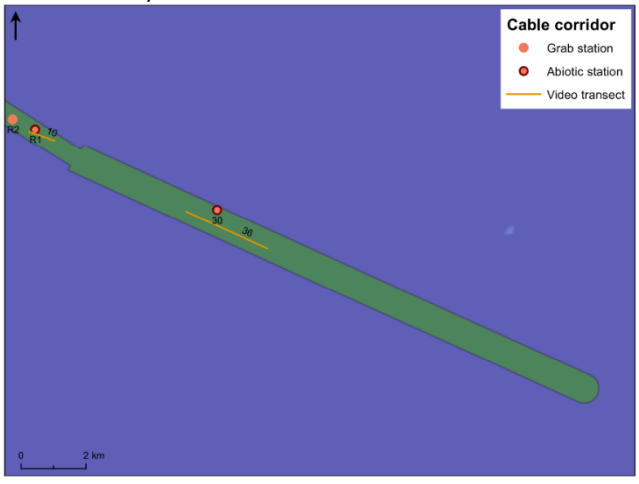


Figure 4-8. *Sampling program at the eastern part of the cable corridor in 2013. Source: Niras & MariLim, 2015.*

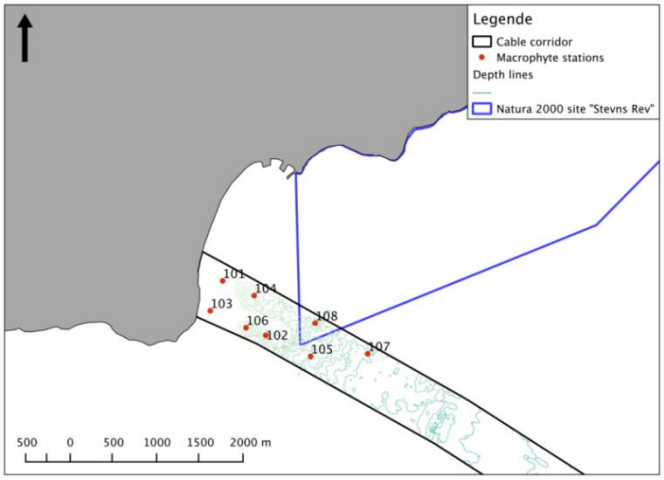


Figure 4-9. *Sampling program for macrophytes at the landfall area near Rødvig in 2014. Source: Niras & MariLim, 2015*.

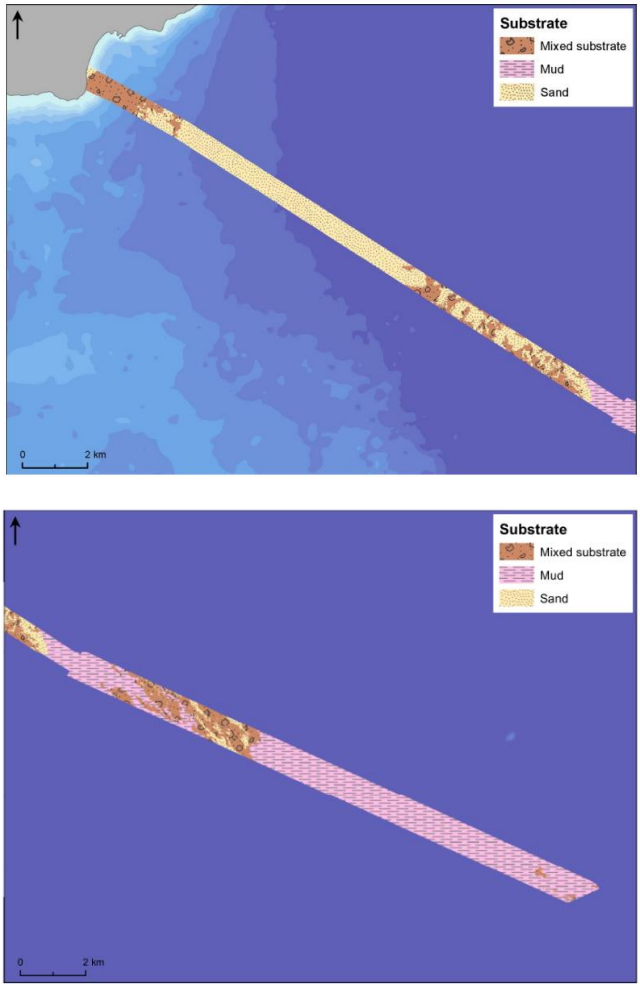


Figure 4-10 *Substrate distribution at the cable corridor based on side scan data. Source: Niras & MariLim, 2015.*

4.1.2 Benthic habitat description

Large parts of Kriegers Flak II North area are covered by muddy sand (Figure 4-11). In this area, as in the rest of the western Baltic Sea, in the contemporary protected basin areas, there is normally only a weak flow through the basins, and marine muddy sand has been deposited over the last 5,000 years (Naturstyrelsen, 2014). The salinity in the area is relatively low, which i.e., is reflected in the occurrence of smaller marine species and a generally low species diversity (COWI, 2022b).

A large area in the western part of Kriegers Flak II North consists of till (mixed sediment type of glacial origin, often covered by a thin layer of sand, gravel, boulder and/or sandy mud washed out of the till) / diamicton (contains particles ranging in size from clay to boulders). These areas are often seen with populations of blue mussels covering stones (Vejdirektoratet, 2017). Blue mussels are more scattered in the area and are generally smaller than in more saline localities. The algal vegetation consists of a few dominant species, and it is often the filamentous algae that occur in greatest quantity.

Landfall for the ECC is in the eastern part of Zealand. The export cable corridor will cross areas of till/diamicton, muddy sand, sand and gravel and coarse sand (Figure 4-11). The export cable corridor will cross an area of sedimentary rock near the coast in in Faxe Bugt.

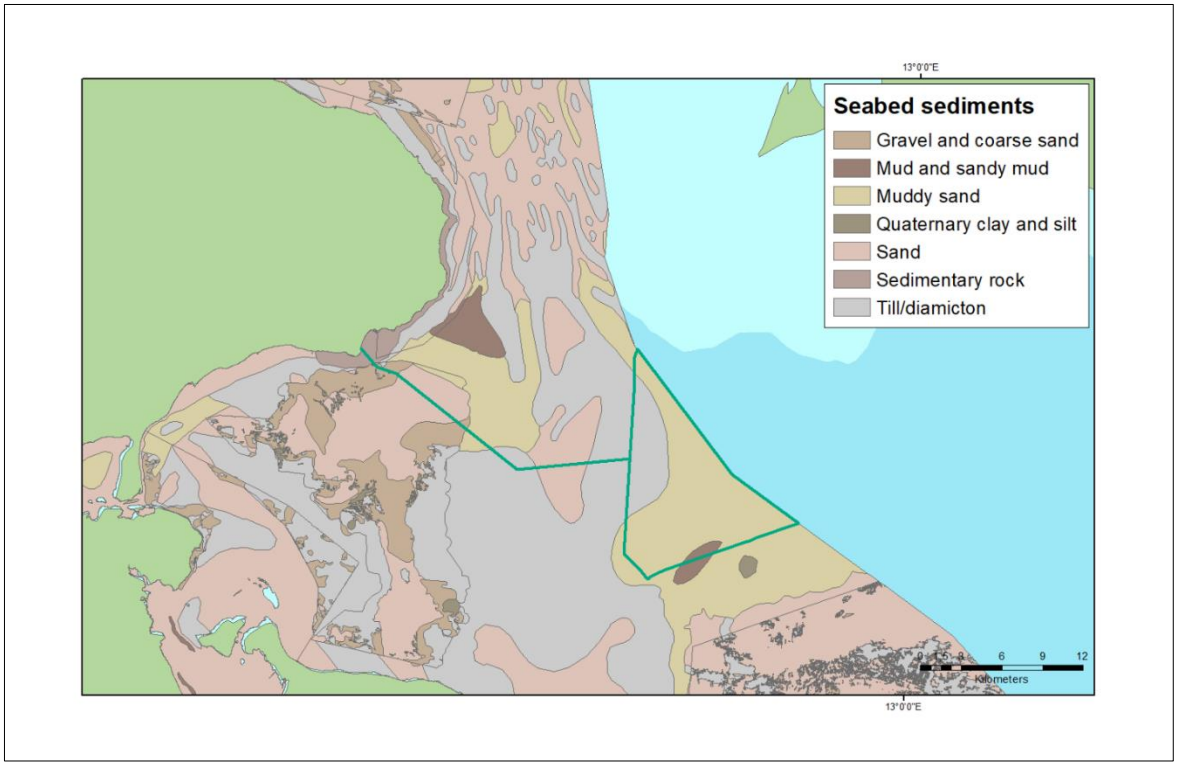


Figure 4-11 *Seabed sediments in the Kriegers Flak II North OWF area and in the ECC. Source: GEUS, 2023*.

4.1.2.1 Kriegers Flak

In the existing Kriegers Flak OWF, three benthic habitats have been identified (Berg et al., 2015). The dominant habitat is “Sand with infauna” where the bivalves *Macoma balthica* and *Mya arenaria* contribute with over 50 % of the fauna biomass. “Mixed substrate with infauna” is less dominant and includes areas with boulders and other hard substrates. Benthic vegetation is, however, scarce and the Blue mussel *Mytilus edulis* is dominating the biomass of this habitat. The north-western corner of Kriegers Flak is “Mud dominated by *Macoma balthica*” and characterises the transition to areas surrounding Kriegers Flak and

having greater water depths and more fine-grained sediments. Accordingly, “Mud dominated by *Macoma balthica*” is the predominant benthic habitat along the deeper part of the cable corridor (up to around 26 m water depth). The shallower part of the cable corridor up to the 15 m depth contour is largely dominated by the habitat “Sand with infauna”, followed by “Mixed substrate with infauna”. Macrophyte communities only occur in the nearshore region within the habitat complex “Reef”.

4.1.3 Summary

An overview of sampling stations within or in close distance to the Kriegers Flak II OWF area and ECC is given in Table 4-2.

Table 4-2. *An overview of sampling stations in or close to the Kriegers Flak II North project area; NOVANA stations examined in the period 1st of January 2020 to 1st of August 2023, monitoring stations in connection to the Kriegers Flak II project area, and monitoring stations in the Natura 2000 site Stevns Rev.*

Kriegers Flak II North	**No. of NOVANA monitoring stations with results < 3 years**	**No. of Kriegers Flak II stations sampled in 2013/2014**	**No. of Natura 2000 monitoring stations *Stevns Rev***
Array area	0	0	-
Corridor & landfall	1 Eelgrass	8 macrophyte 11 video transects. 9 grab stations	1

4.2 Kriegers Flak II South

4.2.1 Sampling stations

4.2.1.1 NOVANA

An overview of NOVANA benthic monitoring stations monitored in the period 1st of January 2020 to 1st of August 2023 is given in Figure 4-12. There are not registered any stations inside or close to the planned Kriegers Flak II South OWF area.

An overview of all registered NOVANA benthic monitoring stations is shown in Figure 4-13.

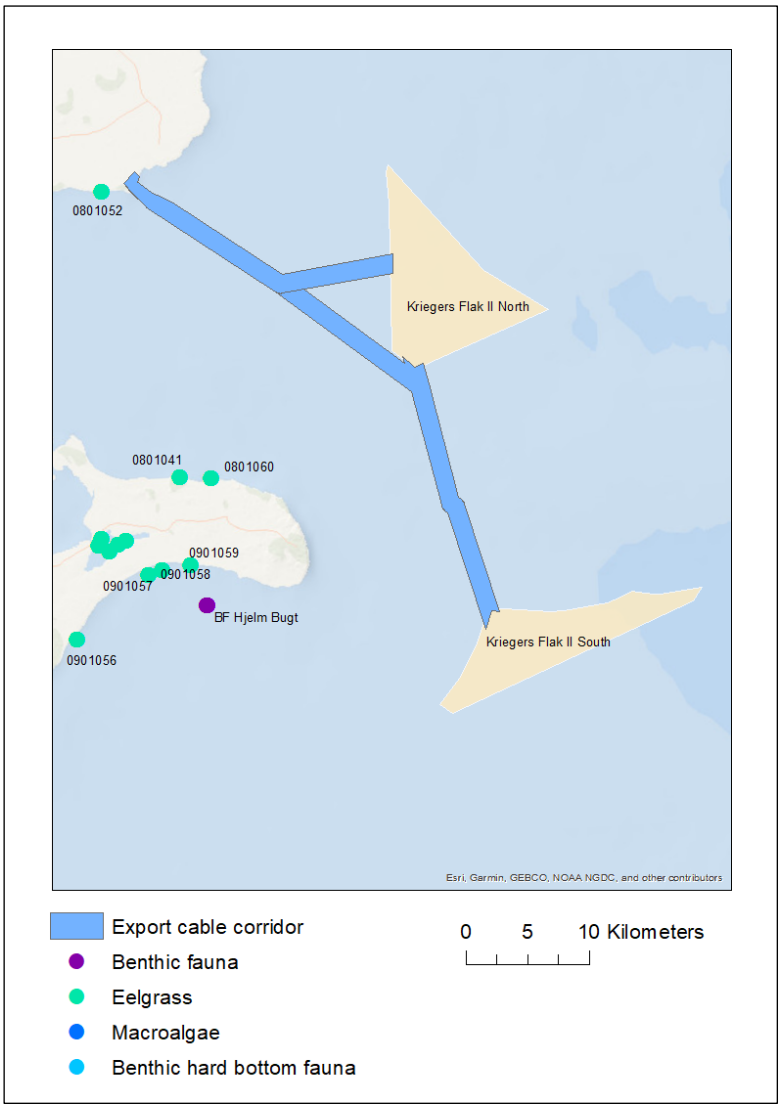


Figure 4-12. *NOVANA benthic monitoring stations in the Kriegers Flak II South project area sampled in the period 1st of January 2020 to 1st of August 2023. Source: Miljøgis, 2023.*

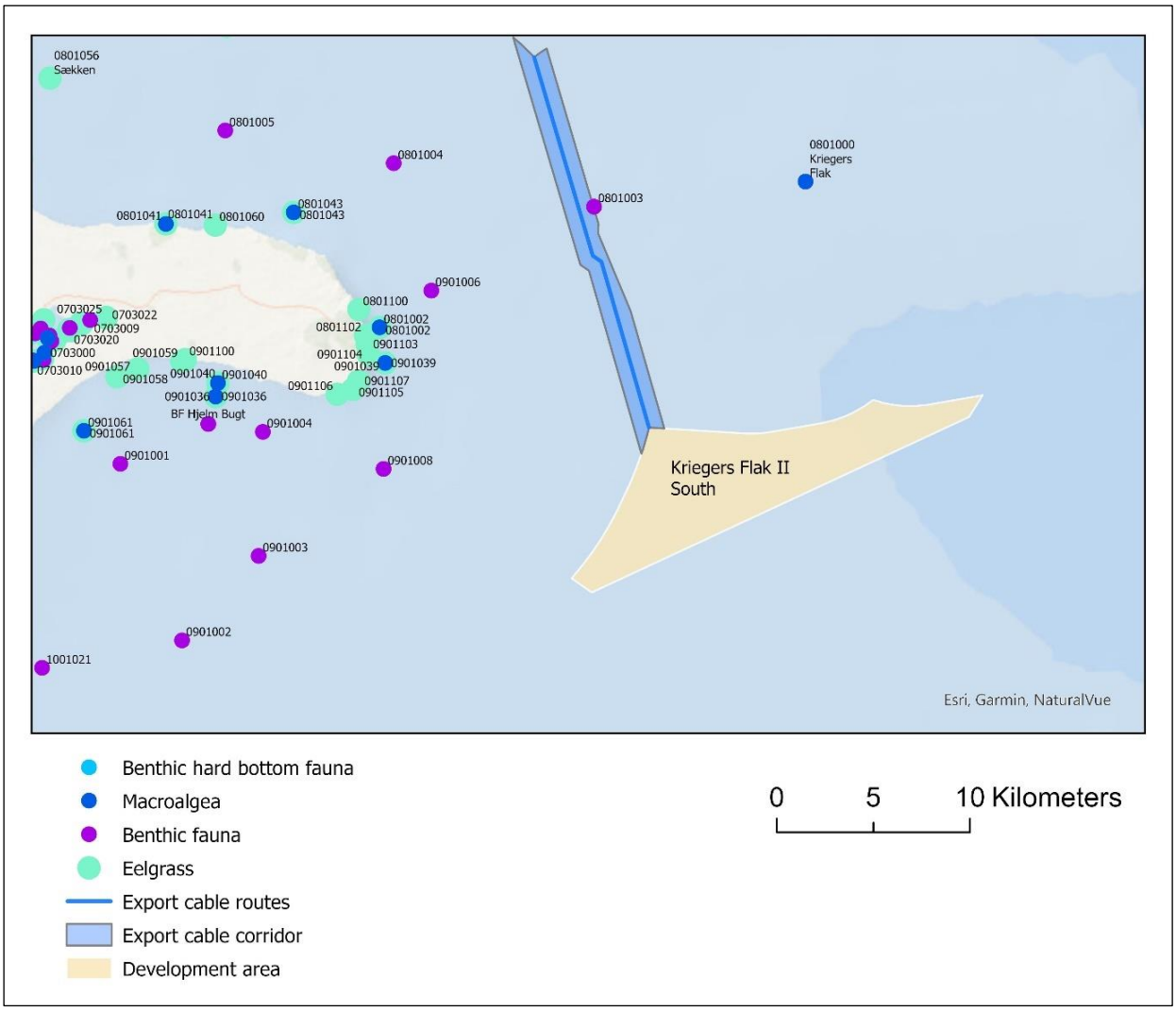


Figure 4-13. *Registered NOVANA benthic monitoring stations in the Kriegers Flak II South project area. Source: Miljøgis, 2023.*

4.2.1.2 Natura 2000 sites

There are no Natura 2000 sites within the Kriegers Flak II South area. The Natura 2000 site *Klinteskoven og Klinteskov kalkgrund* with sandbanks and reefs, is located approximately 10 km from the ECC and approximately 15 km from the planned Kriegers Flak II South OWF area (Figure 4-14). There are one hard bottom fauna monitoring stations in this Natura 2000 site (Miljøstyrelsen, 2022).

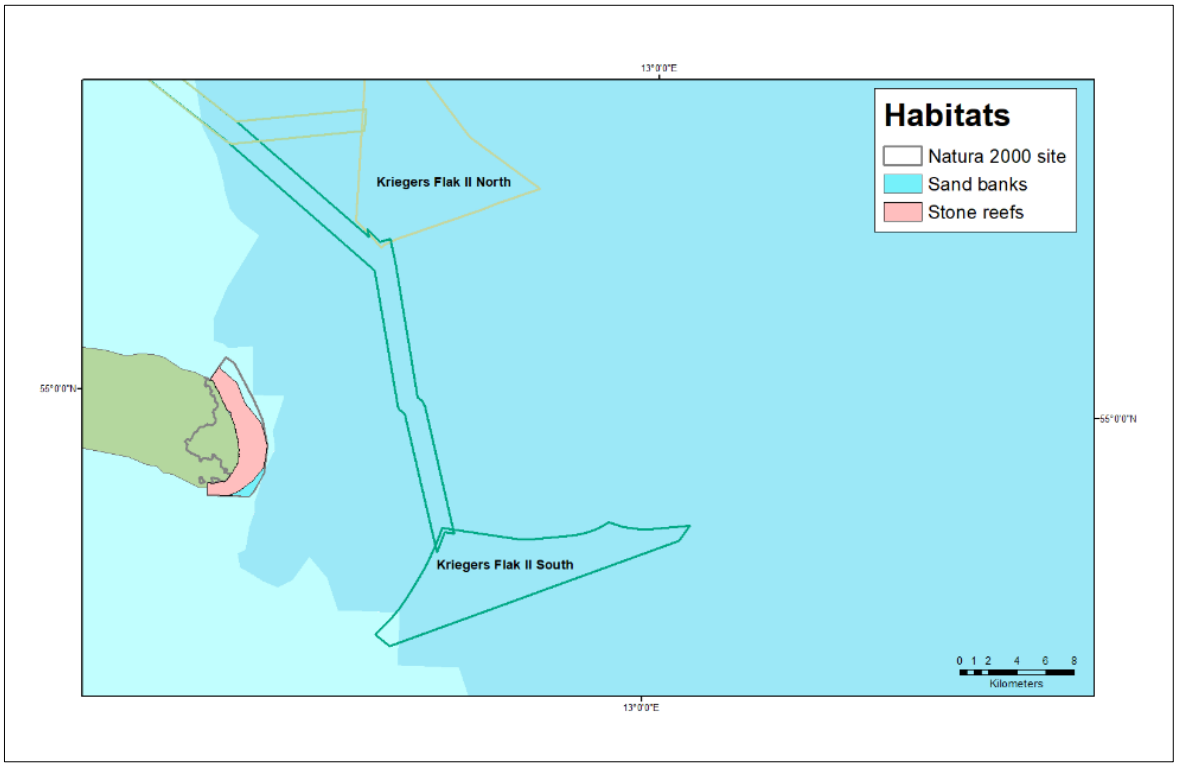


Figure 4-14. *The location of the Natura 2000 site Klinteskoven og Klinteskov kalkgrund and the Kriegers Flak II South project area. Source: Miljøgis, 2023.*

4.2.2 Benthic habitat description

The eastern part of Kriegers Flak II South is covered by muddy sand (Figure 4-15). There are no recent benthic fauna surveys from the area, but according to older sources, the benthic fauna in the area can be characterized as a Macoma community (Thorson, 1979 in Cowi, 2022a). (There are no lists of species available for this study)

In connection to the preparation of the Kriegers Flak OWF environmental impact assessment, a benthic fauna study was carried out in a potential cable export corridor in a nearby area with a muddy sand bottom. The seabed in this area was described as mud dominated by Baltic Sea mussels (NIRAS & MariLim, 2015).

The western and central part of Kriegers Flak II South is covered by sand. Previous studies in the Kriegers Flak area have shown that the benthic fauna in the area is characterized as a *Macoma* community with species such as e.g., Baltic Sea mussel (*Macoma balthica*), blue mussel (*Mytilus edulis*), sand gapers (*Mya arenaria*) and the bristle worms *Pygospio elegans*, *Scoloplos armiger* and *Hediste diversicolor* (MariLim, 2015). On Kriegers Flak itself, there are many blue mussels that form biogenic reefs. There is no information available on the occurrence of blue mussels in the southern part of the Kriegers Flak II South area (Energistyrelsen, 2022).

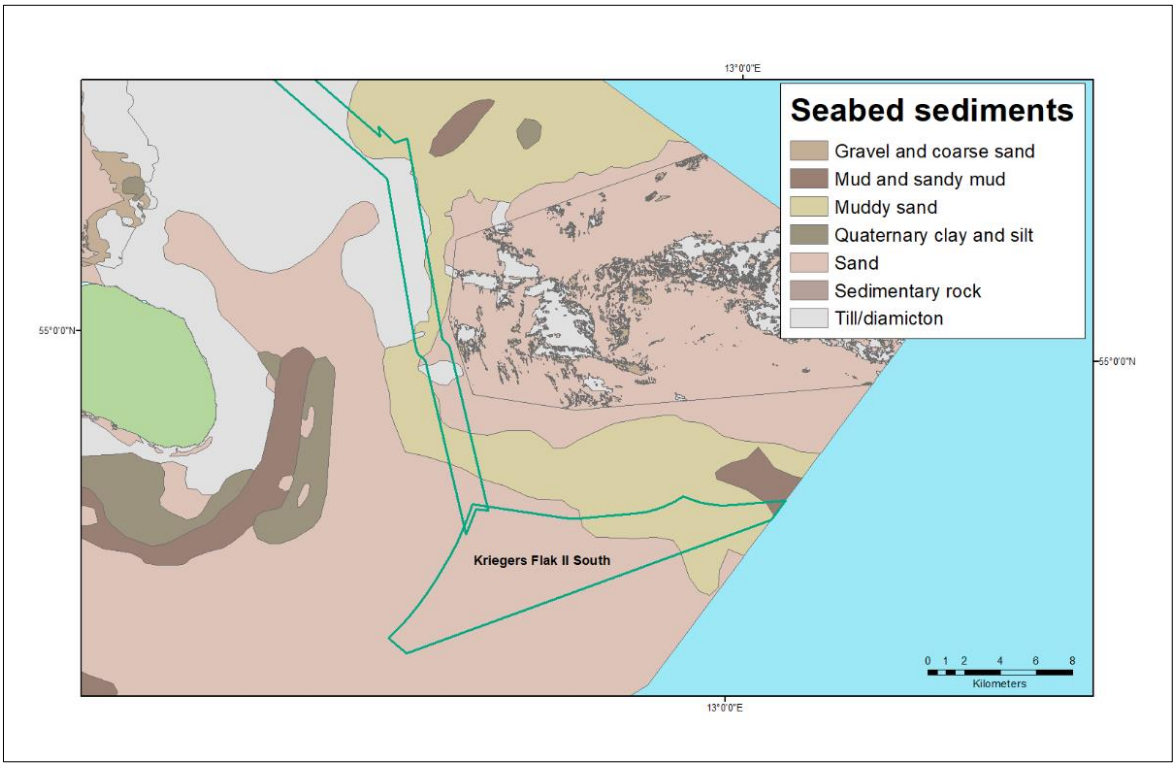


Figure 4-15. *Seabed sediments in the Kriegers Flak II South project area. Source: GEUS, 2023.*

4.2.3 Summary

An overview of sampling stations within or in close distance to the Kriegers Flak II South area and ECC is given in Table 4-3.

Table 4-3 *An overview of sampling stations in or close to the Kriegers Flak II South area; NOVANA stations examined in the period 1st of January 2020 to 1st of August 2023, monitoring stations in connection to the Kriegers Flak II area, and monitoring stations in the Natura 2000 site Klinteskoven og Klinteskov kalkgrund.*

Kriegers Flak II South	**No. of NOVANA monitoring stations with results < 3 years**	**No. of Kriegers Flak II stations sampled in 2013/2014**	**No. of Natura 2000 monitoring stations *Klinteskoven og Klinteskov kalkgrund***
Array area	0	0	-
Corridor	0	0	-

4.3 Abiotic data

Physical parameters such as depth, salinity, and oxygen concentration are determining factors for the living conditions and habitat types available for benthic fauna and flora. Salinity, temperature, and oxygen profiles are measured in the water column using a CTDO. The Kriegers Flak II areas are located 22 and 45 km southeast of Rødvig on Zealand, Denmark, and is a part of the western Baltic Sea region, which connects to the larger body of the Baltic Sea. It is also influenced by Kattegat, where water exchange between the Baltic and North Seas occurs. The Baltic Sea is a semi-enclosed area, surrounded almost entirely by land and connected to Kattegat through narrow passages. The water region at Kriegers Flak II lies close to the coast and is relatively shallow, ranging from 16 to 35 meters (Energinet, 2015).

Previous data show that the hydrography at Kriegers Flak varies seasonally. Typically, the oxygen concentrations remain relatively stable but can be influenced by seasonal variations in temperature and water stratification. Dissolved oxygen is necessary for healthy marine ecosystems, making oxygen deficiency of particular concern. Well-oxygenated bottom water is important for the survival of benthic fauna. Oxygen deficiency (hypoxia) can be caused by eutrophication; and excessive enrichment of marine water with nutrients, which may lead to extreme algal blooms. The Baltic Sea is one of the largest hypoxic areas worldwide, partly due to its natural geographical setup as a semi-enclosed water body with limited water exchange, but also due to excess human-induced nutrient input (Meier et al., 2019; Phiel et al., 2023). Eutrophication is a significant threat in the Baltic Sea, as bacterial decomposition of the organic material from algal blooms can cause oxygen depletion and disturb the overall water quality (Phiel et al., 2023).

The European water areas are most likely to experience oxygen depletion from July to October due to higher water temperatures (EEA, 2024). Thus, the European Environment Agency measured the dissolved oxygen (DO) concentration in European marine waters from July to October based on a four-class system: Good: >6 mg/l, Moderate: 4-6 mg/l, Poor: 2-4 mg/l, Very Poor: <2 mg/l (EEA, 2024). Oxygen concentrations above 6 mg/l are considered to support marine life with minimal problems, whilst concentrations below 2 mg/l can cause severe problems (hypoxia) (Levin et al., 2009). The deep-water oxygen concentrations in the water region at Kriegers Flak II are not as badly affected by reduced oxygen concentrations compared to the rest of the Baltic Sea. The average oxygen concentration for the years 2011-2022 was above >6 mg/l, which is considered to be of ‘Good’ quality (EEA, 2024).

The water temperature in the Baltic Sea varies seasonally as increased solar radiation during summer will heat surface waters, and it is characterised by a vertical salinity stratification (halocline) due to limited exchange with the salty North Sea and freshwater input from land (Phiel et al., 2023). Environmental data collected at Kriegers Flak in the past show evidence of a non-existing to weak halocline over the shallow bank, with salinity concentrations ranging from 7.7-8.1 PSU in October (Axe & Lindow, 2005).

5 2024 SURVEY RESULTS

5.1 Abiotic data (Hydrography)

Abiotic data refers to the environment's non-living chemical and physical parts that affect living organisms and ecosystem functioning. This includes factors such as temperature, oxygen, salinity, and other non-biological influences that contribute to the conditions and habitat types available for organisms. In the context of environmental studies, abiotic data is crucial for understanding the habitat and living conditions of species like benthic fauna and flora.

CTD profiles of salinity, temperature and oxygen concentrations were collected at ten stations in the Kriegers flak area. Six stations are located along the cable route north to south (KF2SC-22, KF2SC-18, KF2NC-2, KF2SC-12, KF2SC-8, KF2SC-2) (Figure 5-1), two in the northern area (KF2N-10, KF2N-4) (Figure 5-2) and two in the southern area (KF2S-5, KF2S-2) (Figure 5-2). The CTD profiles show the variation in salinity, temperature and oxygen vertically in the water column from the sea surface to approximately 1 meter above the sea bottom, to avoid collision with the seabed and damaging the instrument. The maximum depth for the ten stations in the Kriegers flak area varied between 13 and 31 meters, with KF2SC-22 being the shallowest station (Figure 5-1 and Figure 5-2).

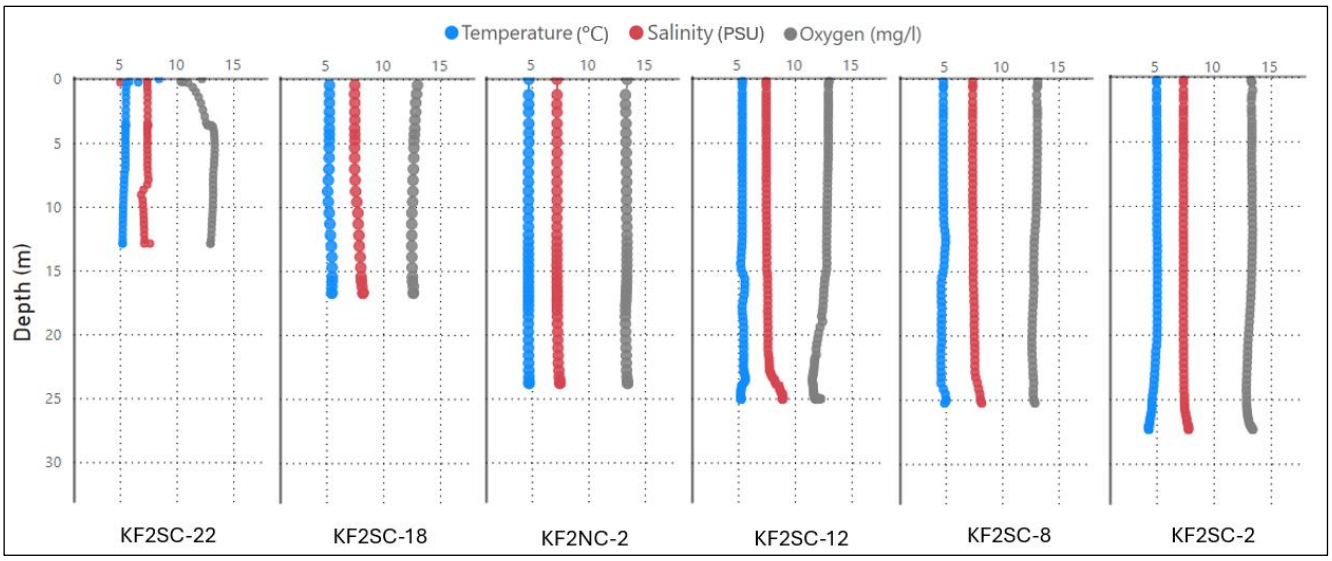


Figure 5-1 *CTD profiles of salinity, temperature and oxygen for the stations along the Kriegers Flak II cable route (KF2SC-22, KF2SC-18, KF2NC-2, KF2SC-12, KF2SC-8, KF2SC-2).*

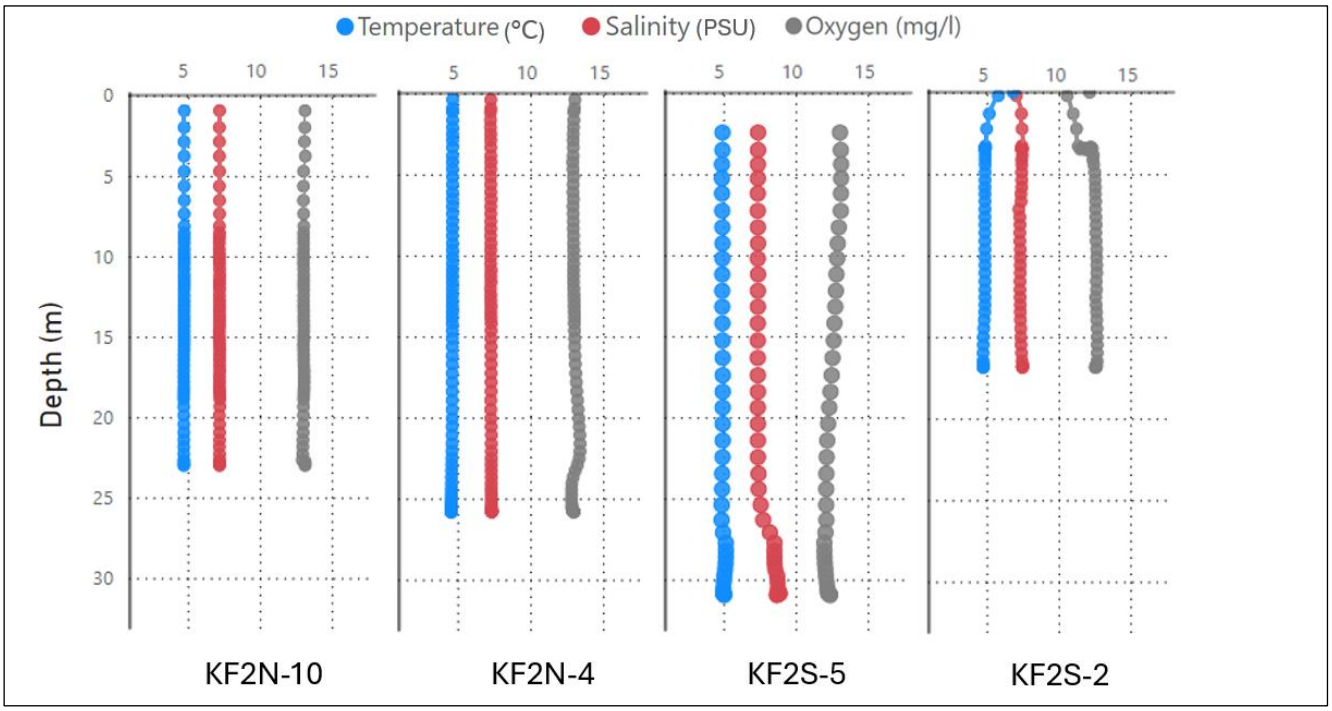


Figure 5-2 *CTD profiles of salinity, temperature and oxygen for the stations in the Kriegers Flak North (KF2N-10 and KF2N-4) and South (KF2S-5 and KF2S-2) area.*

The salinity, temperature and oxygen concentrations remain relatively constant downwards in the water column. The temperature has an average value of ~5°C at all stations, except for KF2SC-22 with a slightly higher average value due to higher surface temperatures (8,46°C). No distinct thermocline (sharp change in temperature with depth) was observed at any of the stations. This can be explained by the fact that the CTDO measurements were taken in April when winter cooling and wind-driven mixing were still dominant, and surface waters may not have warmed sufficiently to create significant temperature gradients between surface - and deeper waters.

Most of the salinity concentrations from the Kriegers Flak area lie between 7-8 PSU and stay consistent throughout the depth of the water column. Some of the stations have a small increase in salinity at the seabed (KF2S-5, KF2SC-12, KF2SC-18, KF2SC-2, KF2SC-8). The low salinity is caused by the limited water exchange with the saltier North Sea waters in Kattegat and the significant freshwater input from rivers/rainfall. No distinct halocline (sharp change in salinity with depth) was observed at any of the stations, which can be explained by its shallow depth and frequent wind-driven mixing, which prevents the formation of distinct temperature or salinity layers.

The oxygen concentrations remain constant throughout the water column for most of the stations, with concentrations varying between 12-13.5 mg/L. The exception is KF2S-2 and KF2SC-22 where there is a gradual increase in oxygen concentrations in the upper water layers. KF2S-2 has surface concentrations of 10.6 mg/L that increase rapidly at 3.4 meters depth and reach a concentration of 12.7 ml/L at the seabed, whilst the oxygen concentration at station KF2SC-22 starts at 10.4 mg/L at the sea surface and increases gradually to 13.4 mg/L at 5 meters depth and decreasing to 13 mg/L at the seabed. The oxygen concentrations are classified as ‘Good’ (>6 mg/l) for all stations, which have been observed in previous research (EEA, 2024). The data did not show any signs of oxygen depletion in the deeper waters.

5.2 Seabed sediment characteristics

5.2.1 Sediment samples

The colour and characteristics (clay, silt, sand, gravel etc.) of the sediments collected in the grab samples were described during sampling. In Kriegers Flak II North OWF, the sediment was characterized by a grey/brown colour, typically with a thin layer of brown sediment on the surface and a more grey/brown colour throughout the rest of the sample (Figure 5-3, top images). The sediment composition at these stations was predominantly a mixture of sand and silt, with clay present in the deeper layers. KF2N-9 also had rocks and black patches (probably organic matter) in the sediment.

Kriegers Flak II North ECC has similar sediment characteristics, but without a defined thin brown layer at the top and more grey colored sediments (Figure 5-3, bottom images).

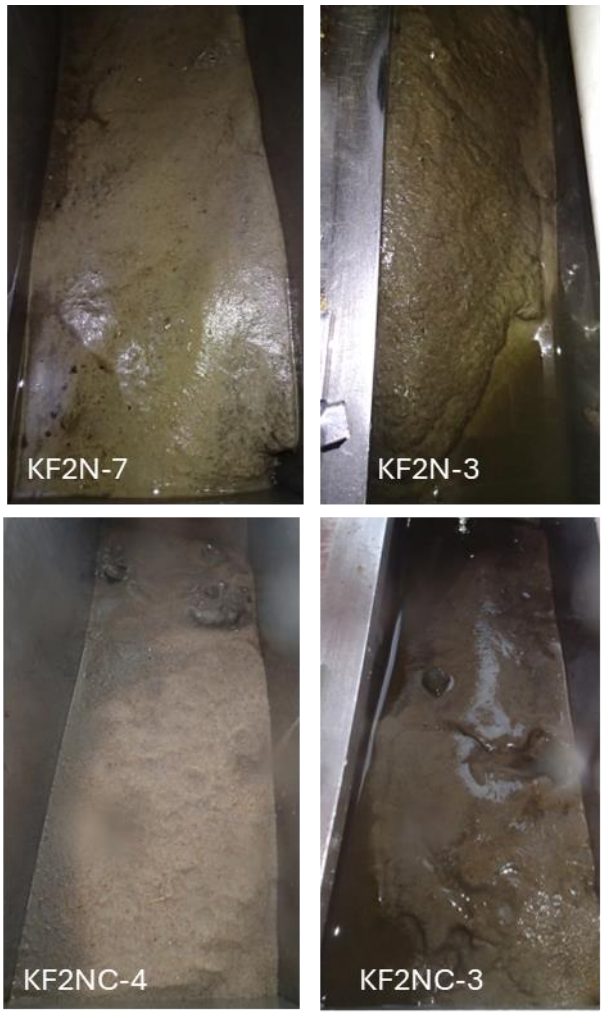


Figure 5-3 *Sediment colour and characteristics in a selection from Kriegers Flak II North OWF (KF2N) and ECC (KF2NC).*

In Kriegers Flak II South, the sediment featured olive coloured top, transitioning to a brown/grey color further down (Figure 5-4). The sediment at these stations was mostly sand, with clay present in the deeper layers. Other findings include pieces of blue mussels (KF2S-4) and an odor of H_2S (KF2S-7), indicating poor oxygen levels.

Figure 5-4 *Sediment colour and characteristics in a selection from Kriegers Flak II South OWF (KF2S).*

The sediments at Kriegers Flak II South ECC varied a lot between stations, from larger rocks to coarse sand, to fine sand and then to silt with a brown top and deeper layers of clay (Figure 5-5). More rocky areas, such as KF2SC-6 and KF2SC-13 resulted in up to 12 misses during sampling, but most of the areas consisted of sandy sediments. The colour of the sediment varied from olive, to grey and brown.

Figure 5-5 *Sediment colour and characteristics in a selection from Kriegers Flak II South ECC (KF2SC).*

5.2.1.1 Physical parameters

Physical and chemical sediment samples were collected from the sediment as supporting parameters for the statistical analysis. The physical parameters total organic content (TOC) and grain size in the sediments determine the oxygen conditions. From the grain size distribution, the fraction of silt and clay fraction (particles < 0.063 mm) was determined, as well as the median particle size in the sediment (D50). D50 is the particle size where 50 % of the particles are bigger and 50 % of the particles are smaller than this size.

Kriegers Flak II North

For Kriegers Flak II North OWF, the TOC content does not show a consistent trend with depth. The D50 values generally decrease with depth, indicating finer sediment particles at greater depths. Still, at the two most shallow stations (KF2N-8 and -10) there is a lower TOC content, a higher D50 value and a much lower silt and clay fraction than at the two deepest stations (KF2N-3 and -5). This indicates fine grained sediments with higher TOC content in the deeper areas and more coarse sediments with lower TOC content in the shallower areas. For silt and clay the lowest fraction is 9.6% (KF2N-10) and the highest being 80.4% (KF2N-5), resulting in a mean fraction of approximately 41.7%.

Table 5-1 *Physical conditions in the sediment surface at Kriegers Flak II North OWF. TOC = total organic carbon, D50 = median particle size. Silt and clay are all particles <0.063 mm*

Station	Depth [m]	TOC [% of DW]	D50 [mm]	Silt and Clay fraction (%)
KF2N-1	30	1.4	0.063	66.6
KF2N-2	31	0.65	0.097	20
KF2N-3	36	1.2	0.063	79.1
KF2N-4	31	0.87	0.063	47
KF2N-5	34	0.67	0.063	80.4
KF2N-6	31	0.74	0.081	41.9
KF2N-7	32	0.36	0.108	18.4
KF2N-8	24	0.52	0.101	29.1
KF2N-9	31	0.62	0.119	27.3
KF2N-10	26	0.29	0.175	9.6

At Kriegers Flak II North ECC, there were only 4 stations. Across the different depths, the TOC content and D50 values fluctuate without a clear trend. For example, at 28 meters (KF2NC-1), the D50 is 0.232 mm, while at 23 meters (KF2NC-2), it is 0.103 mm. Still, where the TOC content is the highest the D50 is the lowest, also showing the highest fraction of the silt and clay (KF2NC-3). This shows that areas with fine particles hold a greater TOC content. The opposite pattern is evident at KF2NC-4. For silt and clay the lowest fraction is 0.7% and the highest is 31.6%, resulting in a mean fraction of approximately 16%.

Overall, these findings highlight the variability and complexity of sediment characteristics across different stations in the Kriegers Flak region, with Kriegers Flak II North OWF showing a more pronounced trend in D50 values and silt and clay fractions compared to Kriegers Flak II North ECC.

Table 5-2 *Physical conditions in the sediment surface at Kriegers Flak II North ECC. TOC = total organic carbon, D50 = median particle size. Silt and clay are all particles <0,063 mm*

Station	Depth [m]	TOC [% of DW]	D50 [mm]	Silt and Clay fraction (%)
KF2NC-1	28	0.32	0.232	10
KF2NC-2	23	0.51	0.103	21.7
KF2NC-3	27	1	0.092	31.6
KF2NC-4	25	<0.2	0.370	0.7

Kriegers Flak II South

At Kriegers Flak II South OWF, the TOC content increased and the D50 decreased with depth. The stations corresponding to a greater depth show a higher TOC content, a lower D50 value and a high silt and clay fraction, compared to the shallower locations. This indicates finer sediment particles at greater depths, with more organic content. The lowest silt and clay fraction is 1.1% (KF2S-1) and the highest is 76.3% (KF2S-7), resulting in a mean fraction of approximately 20.7%.

Table 5-3 *Physical conditions in the sediment surface at Kriegers Flak II South OWF. TOC = total organic carbon, D50 = median particle size. Silt and clay are all particles <0,063 mm*

Station	Depth [m]	TOC [% of DW]	D50 [mm]	Silt and Clay fraction (%)
KF2S-1	21	<0.2	0.156	1.1
KF2S-2	22	<0.2	0.170	3.5
KF2S-3	23	<0.2	0.143	1.5
KF2S-4	33	0.29	0.063	50.6
KF2S-5	36	0.31	0.147	6.7
KF2S-6	42	0.73	0.090	37
KF2S-7	44	3.2	0.063	76.3
KF2S-8	35	0.47	0.106	16.7
KF2S-9	26	<0.2	0.120	3
KF2S-10	31	<0.2	0.115	7.2

On the other hand, for Kriegers Flak II South ECC**,** the TOC content fluctuates without a consistent trend. For example, at the greatest and smallest depth (34 and 13 m), the TOC content is less than 0.2%, and the TOC content is highest (3%) at 29 meters depth (KF2SC-11). The D50 values also show significant variation without a clear trend. The silt and clay fraction does not exhibit a consistent trend either, with the lowest fraction being 0.7% (KF2SC-15), 34.2% at 30 meters (KF2SC-10), and the highest being 34.2% (KF2SC-10), resulting in a mean fraction of approximately 14.1%.

Table 5-4 *Physical conditions in the sediment surface at Kriegers Flak II South ECC. TOC = total organic carbon, D50 = median particle size. Silt and clay are all particles <0,063 mm*

Station	Depth [m]	TOC [% of DW]	D50 [mm]	Silt and Clay fraction (%)
KF2SC-1	34	<0.2	0.107	17.6
KF2SC-2	33	0.59	0.129	13
KF2SC-3	31	0.59	0.207	5.2
KF2SC-4	30	0.65	0.901	2
KF2SC-5	32	0.25	0.175	11.4
KF2SC-6	29	<0.2	0.420	5
KF2SC-8	29	0.68	0.285	9.8
KF2SC-9	29	0.4	0.161	23.8
KF2SC-10	30	0.97	0.084	34.2
KF2SC-11	29	3	0.091	34
KF2SC-12	27	1.9	0.287	3.9
KF2SC-13	27	1.4	0.400	3
KF2SC-14	26	0.21	0.099	28.3
KF2SC-15	24	0.25	0.329	0.7
KF2SC-18	21	1	0.263	1.1
KF2SC-19	20	0.71	0.118	20.2
KF2SC-20	20	<0.2	0.127	18.1
KF2SC-21	18	0.23	0.149	4.6
KF2SC-22	17	<0.2	0.125	4.1
KF2SC-23	13	<0.2	0.167	8

In general, the deeper areas typically exhibit high organic content and fine grain sizes, while the shallow stations typically display larger grain sizes and lower organic content. Overall, these findings highlight the variability and complexity of sediment

characteristics across different stations in the Kriegers Flak region, with Kriegers Flak II South OWF showing a more pronounced trend compared to Kriegers Flak II South ECC.

Comparing Kriegers Flak II North with Kriegers Flak II South shows a more consistent pattern in sediment characteristics in the northern areas than in the southern areas. Kriegers Flak II North areas exhibit a lower D50 value and a higher silt and clay fraction, especially in the OWF, indicating a finer grain size. Meanwhile, Kriegers Flak II South has the highest content of TOC.

5.2.1.2 Chemical parameters

Classification of environmental quality status in the sampled sediments is made according to the threshold criteria in Table 5-5, listed in the order of importance.

Table 5-5 *Threshold values for the parameters analysed. NEQS = National Environmental Quality Standards (Miljøstyrelsen, n.d.), Danish EPA. EQS = Environmental Quality Standards (HELCOM, 2017), EU. ERL = Effect Range Low (OSPAR Commission, 2021), US EPA. LAL = Lower Action Level (Miljøstyrelsen, 2008), Danish Dredging Manual/Klapvejledningen.*

Parameter		Thresholds			
		NEQS	EQS	ERL	LAL
Heavy metals	Arsenic (As)	0.4		8.2*	20
	Barium (Ba)				
	Lead (Pb)	163	120	47*	40
	Cadmium (Cd)	3.8	2.3	1.2*	
	Chromium (Cr)	9.2		81*	
	Copper (Cu)			34*	20
	Mercury (Hg)			0.15*	
	Nickel (Ni)	6.8		21*	30
	Silver (Ag)	13			
	Zinc (Zn)			150*	
PAH	Naphthalene	0.138		0.160**	
	Acenaphthylene				
	Acenaphthene	0.048***			
	Fluorene				
	Anthracene	0.024***	0.024***	0.085**	0.085
	Fluoranthene	3.5***		0.600**	
	Pyrene	0.42***		0.665**	
	Chrysene/ Triphenylene	0.0231***		0.384**	
	Benzo(b+j+k)fluoranthene				
	Benzo(e)pyrene				
	Indeno(1,2,3-cd)pyrene			0.240**	
	Benzo(g,h,i)perylene			0.085**	
	1-Methylnaphthalene	0.478 x fOC			
	2-Methylnaphthalene	0.478 x fOC		0.070**	
	Dimethylnaphthalenes, sum	0.478 * fOC			
	Trimethylnaphthalenes, sum	0.478 * fOC			
Phthtalates	Dibutyl phthalate (DBP)				
	Benzylbutylphthalate (BBP)	0.4***			
	Di(2-ethylhexyl)adipat (DEHA)				
	Di(2-ethylhexyl)phthalate (DEHP)	0.53***			
	Di-n-octylphthalate (DNOP)				
	Diisononylphthalate (DNP)				
	Diisodecylphthalat (DIDP)				
Phenols	4-t-octylphenol	0.2***			
	4-n-octylphenol				
	4-n-nonylphenol				
	Nonylphenols, sum				
	Nonylphenol-monoethoxylater (NP1EO)				
	Nonylphenol-diethoxylater (NP2EO)				
	Dibenzothiophene			0.190**	

* 5% Al
** 2.5 % TOC
*** 5% OC

Kriegers Flak II North

The analysis of the samples collected from Kriegers Flak II North OWF and ECC shows that most of the chemical parameters are within their threshold values. Still, the NEQS threshold values for arsenic were exceeded at all stations at both locations (Table 5-6 and Table 5-7). In the OWF, KF2N-1, KF2N-3 and KF2N-5 also exceeded the NEQS threshold values for chromium and nickel. Additionally, KF2N-1 and KF2N-5 exceeded the NEQS values for crysene/triphenylene. In the ECC, only one more threshold was exceeded, which was the NEQS for arsenic, at both stations (KF2NC-1 and KF2NC-3).

Table 5-6 *Chemical conditions in the sediment surface at Kriegers Flak II North. Unit = mg/kg. Chemical parameters (heavy metals, PAH-compounds, phthalates, phenols, and dibenzothiophene). Red numbers represent exceeded threshold values (see Table 5-5). Heavy metals, PAH and dibenzothiophene are analysed by Eurofins, and phthalates and phenols are analysed by DCE.*

Parameter		Station and depth (m)				
		KF2N-1	KF2N-3	KF2N-5	KF2N-7	KF2N-9
		30	36	34	32	31
Heavy metals	Arsenic (As)	2.3	3.3	2.5	1.1	1.2
	Barium (Ba)	24	19	22	6.6	6.6
	Lead (Pb)	20	15	16	5.4	4.9
	Cadmium (Cd)	0.16	0.18	0.18	0.054	0.064
	Chromium (Cr)	13	10	11	3.2	3.2
	Copper (Cu)	9.7	6.6	7.8	1.6	3.2
	Mercury (Hg)	0.056	0.072	0.046	0.0053	0.0053
	Nickel (Ni)	10	7	8.1	2	2
	Silver (Ag)	<0.15	<0.15	<0.15	<0.15	<0.15
	Zinc (Zn)	39	29	32	7.7	8.8
PAH	Naphthalene	0.0044	0.0016	0.0058	<0.0008	0.0024
	Acenaphthylene	0.0036	0.0013	0.0058	<0.0005	0.0029
	Acenaphthene	0.0013	<0.0005	0.0037	<0.0005	<0.0009
	Fluorene	0.0018	0.0007	0.0038	<0.0005	0.0024
	Anthracene	0.0065	0.0024	0.0096	0.0011	0.0058
	Fluoranthene	0.058	0.02	0.082	0.012	0.052
	Pyrene	0.043	0.013	0.061	0.0073	0.036
	Chrysene/ Triphenylene	0.027	0.0081	0.037	0.0047	0.016
	Benzo(b+j+k)fluoranthene	0.061	0.021	0.068	0.013	0.04
	Benzo(e)pyrene	0.018	0.0064	0.021	0.0039	0.012
	Indeno(1,2,3-cd)pyrene	0.019	0.0066	0.021	0.0043	0.013
	Benzo(g,h,i)perylene	0.022	0.0075	0.022	0.0046	0.015
	1-Methylnaphthalene	<0.0025	<0.0007	<0.004	<0.0005	<0.0008
	2-Methylnaphthalene	0.0042	0.0017	0.0053	<0.001	0.0019
	Dimethylnaphthalenes. sum	0.012	0.0054	0.016	<0.003	0.011
	Trimethylnaphthalenes. sum	0.0055	0.003	0.0088	0.0011	0.0034
Phthalates	Dibutylphthalate (DBP)	0.007	0.0011	0.002	0.009	0.007
	Benzylbutylphthalate (BBP)	0.002	0.002	<0.001	<0.001	<0.001
	Di(2-ethylhexyl)adipat (DEHA)	0.002	<0.001	0.001	0.002	0.001
	Di(2-ethylhexyl)phthalate (DEHP)	0.040	0.029	0.013	0.018	0.039
	Di-n-octylphthalate (DNOP)	<0.001	<0.001	<0.001	<0.001	<0.001
	Diisononylphthalate (DNP)	0.040	0.029	0.009	<0.005	0.008
	Diisodecylphthalat (DIDP)	0.042	0.031	0.011	0.008	0.010
Phenols	4-t-octylphenol	0.0017	<0.001	<0.001	<0.001	<0.001
	4-n-octylphenol	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	4-n-nonylphenol	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Nonylphenols, sum	0.0057	0.0043	0.0012	<0.001	<0.001
	Nonylphenol-monoethoxylater (NP1EO)	0.0092	<0.001	<0.001	<0.001	<0.001
	Nonylphenol-diethoxylater (NP2EO)	<0.001	<0.001	<0.001	<0.001	<0.001
	Dibenzothiophene	0.0014	<0.001	0.0023	<0.001	0.0026

Table 5-7 *Chemical conditions in the sediment surface at Kriegers Flak II North ECC. Unit = mg/kg. Chemical parameters (heavy metals, PAH-compounds, phthalates, phenols, and dibenzothiophene). Red numbers represent exceeded threshold values (see Table 5-5). Heavy metals, PAH and dibenzothiophene are analysed by Eurofins, and phthalates and phenols are analysed by DCE.*

Parameter		Station and depth (m)	
		KF2NC-1	KF2NC-3
		28	27
Heavy metals	Arsenic (As)	1	1.6
	Barium (Ba)	3.4	15
	Lead (Pb)	4	12
	Cadmium (Cd)	<0.03	0.075
	Chromium (Cr)	1.6	8.6
	Copper (Cu)	0.73	5.8
	Mercury (Hg)	<0.005	0.023
	Nickel (Ni)	0.93	6.3
	Silver (Ag)	<0.15	<0.15
	Zinc (Zn)	4.6	23
PAH	Naphthalene	0.0009	0.0027
	Acenaphthylene	0.0008	0.0009
	Acenaphthene	<0.0005	<0.0007
	Fluorene	0.0005	0.0009
	Anthracene	0.0026	0.0026
	Fluoranthene	0.013	0.018
	Pyrene	0.011	0.012
	Chrysene/ Triphenylene	0.0086	0.0069
	Benzo(b+j+k)fluoranthene	0.016	0.022
	Benzo(e)pyrene	0.0048	0.0065
	Indeno(1,2,3-cd)pyrene	0.0053	0.0075
	Benzo(g,h,i)perylene	0.0056	0.0081
	1-Methylnaphthalene	<0.0005	<0.0015
	2-Methylnaphthalene	0.0011	0.0027
	Dimethylnaphthalenes. sum	0.0036	0.0084
	Trimethylnaphthalenes. sum	0.0017	0.0037
Phthalates	Dibutylphthalate (DBP)	<0.001	0.001
	Benzylbutylphthalate (BBP)	0.003	<0.001
	Di(2-ethylhexyl)adipat (DEHA)	0.001	0.001
	Di(2-ethylhexyl)phthalate (DEHP)	0.0058	0.0025
	Di-n-octylphthalate (DNOP)	<0.001	<0.001
	Diisononylphthalate (DNP)	0.005	0.0055
	Diisodecylphthalat (DIDP)	0.005	0.0067
Phenols	4-t-octylphenol	<0.001	<0.001
	4-n-octylphenol	<0.0005	<0.0005
	4-n-nonylphenol	<0.0005	0.0006
	Nonylphenols, sum	<0.001	0.0023
	Nonylphenol-monoethoxylater (NP1EO)	<0.001	0.004,4
	Nonylphenol-diethoxylater (NP2EO)	<0.001	<0.001
	Dibenzothiophene	<0.001	<0.001

Kriegers Flak II South

The analysis of the samples collected from Kriegers Flak II South OWF and ECC shows that most of the chemical parameters are within their threshold values. Still, the NEQS threshold values for arsenic were exceeded at all stations at both locations (Table 5-8 and Table 5-9). In the OWF, KF2S-7 exceeded the NEQS threshold values for chromium, nickel, and chrysene/triphenylene. In the ECC, KF2SC-9 and KF2SC-11 exceeded the same parameters, except for chrysene/triphenylene.

Table 5-8 *Chemical conditions in the sediment surface at Kriegers Flak II South OWF. Unit = mg/kg. Chemical parameters (heavy metals, PAH-compounds, phthalates, phenols, and dibenzothiophene). Red numbers represent exceeded threshold values (see Table 5-5). Heavy metals, PAH and dibenzothiophene are analysed by Eurofins, and phthalates and phenols are analysed by DCE.*

Parameter		Station and depth (m)				
		KF2S-3	KF2S-5	KF2S-7	KF2S-9	KF2S-10
		23	36	44	26	31
Heavy metals	Arsenic (As)	1.1	1.4	5.9	0.75	0.93
	Barium (Ba)	2.3	5	36	3.2	3.5
	Lead (Pb)	3.2	6	35	3.6	3.5
	Cadmium (Cd)	0.04	0.031	0.36	0.031	0.041
	Chromium (Cr)	1.4	2.7	22	2.2	2.2
	Copper (Cu)	0.35	1.4	18	0.71	0.83
	Mercury (Hg)	<0.005	<0.005	0.12	<0.005	<0.005
	Nickel (Ni)	0.68	1.9	17	1.5	1.3
	Silver (Ag)	<0.15	<0.15	0.49	<0.15	<0.15
	Zinc (Zn)	2.9	8.1	71	4.3	4.8
PAH	Naphthalene	<0.0008	<0.0008	0.012	<0.0008	<0.0008
	Acenaphthylene	<0.0005	<0.0005	0.0068	<0.0005	<0.0005
	Acenaphthene	<0.0005	<0.0005	0.0025	<0.0005	<0.0005
	Fluorene	<0.0005	<0.0005	0.0051	<0.0005	<0.0005
	Anthracene	<0.0005	0.0007	0.015	<0.0005	<0.0005
	Fluoranthene	<0.003	0.0056	0.095	<0.003	0.005
	Pyrene	<0.003	0.0039	0.07	<0.003	<0.003
	Chrysene/ Triphenylene	<0.001	0.0029	0.04	<0.001	0.0018
	Benzo(b+j+k)fluoranthene	<0.0015	0.011	0.12	<0.0015	0.005
	Benzo(e)pyrene	<0.001	0.0033	0.035	<0.001	0.0014
	Indeno(1,2,3-cd)pyrene	<0.002	<0.005	0.039	<0.002	<0.002
	Benzo(g,h,i)perylene	<0.001	0.0046	0.043	<0.001	0.0018
	1-Methylnaphthalene	<0.0005	<0.0005	<0.006	<0.0005	<0.0005
	2-Methylnaphthalene	<0.001	<0.001	0.008	<0.001	<0.001
	Dimethylnaphthalenes. sum	<0.003	<0.003	0.026	<0.003	<0.003
	Trimethylnaphthalenes. sum	<0.001	<0.001	0.011	<0.001	<0.001
Phthalates	Dibutylphthalate (DBP)	0.005	0.005	0.008	0.008	<0.001
	Benzylbutylphthalate (BBP)	0.004	0.003	0.002	<0.001	0.001
	Di(2-ethylhexyl)adipat (DEHA)	0.006	0.002	0.005	0.011	0.007
	Di(2-ethylhexyl)phthalate (DEHP)	0.044	0.017	0.047	0.014	0.008
	Di-n-octylphthalate (DNOP)	<0.001	<0.001	0.002	<0.001	<0.001
	Diisononylphthalate (DNP)	<0.005	<0.005	0.136	<0.005	0.0024
	Diisodecylphthalat (DIDP)	0.004	0.013	0.202	0.008	0.011
Phenols	4-t-octylphenol	<0.001	<0.001	0.0026	<0.001	<0.001
	4-n-octylphenol	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	4-n-nonylphenol	<0.0005	<0.0005	0.0014	<0.0005	<0.0005
	Nonylphenols, sum	<0.001	<0.001	<0.001	<0.001	<0.001
	Nonylphenol-monoethoxylater (NP1EO)	<0.001	<0.001	0.0217	<0.001	<0.001
	Nonylphenol-diethoxylater (NP2EO)	<0.001	<0.001	0.0026	<0.001	<0.001
	Dibenzothiophene	<0.001	<0.001	0.0041	<0.001	<0.001

Table 5-9 *Chemical conditions in the sediment surface at Kriegers Flak II South ECC. Unit = mg/kg. Chemical parameters (heavy metals, PAH compounds, phthalates, phenols, and dibenzothiophene). Red numbers represent exceeded threshold values (see Table 5-5). Heavy metals, PAH and dibenzothiophene are analysed by Eurofins, and those values marked with an asterisk (*). Phthalates and phenols are analysed by DCE.*

Parameter		Station and depth (m)									
		KF2SC-1	KF2SC-3	KF2SC-5	KF2SC-9	KF2SC-11	KF2SC-13	KF2SC-15	KF2SC-19	KF2SC-21	KF2SC-23
		34	31	32	29	29	27	24	20	18	
Heavy metals	Arsenic (As)	1.8	1.3	1.2	2.5	1.8	0.7	1.2	1.3	0.85	0.72
	Barium (Ba)	7.2	7.1	5.4	17	20	3.1	2.9	5.8	4.2	1.4
	Lead (Pb)	6.7	7.4	5.1	15	17	2.5	2.9	3.5	3	1.4
	Cadmium (Cd)	0.066	<0.03	0.051	0.15	0.1	0.032	<0.03	0.092	0.04	0.038
	Chromium (Cr)	4.5	4.1	3.2	9.8	11	1.6	1.4	2.7	2.1	0.63
	Copper (Cu)	2	2.5	1.7	7.4	7.4	0.57	0.33	1.2	1	0.27
	Mercury (Hg)	0.0093	<0.005	0.026	0.05	<0.005	0.0058	<0.005	<0.005	0.0077	0.0074
	Nickel (Ni)	2.7	2.9	2.2	8.2	8.3	0.77	0.55	1.7	1.4	0.57
	Silver (Ag)	<0.15	<0.15	<0.15	0.18	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Zinc (Zn)	11	11	9.5	31	30	4.7	5.1	6.8	5.5	2.3
PAH	Naphthalene	0.0015	<0.0009	0.0027	0.0067	0.0052	<0.0009	<0.0008	0.0043	0.0008	<0.0015
	Acenaphthylene	0.001	<0.0005	0.0022	0.0041	0.003	<0.0005	<0.0005	0.0007	<0.0005	<0.0005
	Acenaphthene	0.0005	<0.0005	0.0011	<0.0025	<0.0015	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Fluorene	0.0013	<0.0005	0.002	0.0053	0.0031	<0.0005	<0.0005	0.0009	<0.0005	<0.0005
	Anthracene	0.0017	0.0007	0.003	0.0075	0.0056	0.0005	<0.0005	0.0016	<0.0005	<0.0005
	Fluoranthene	0.015	0.0062	0.028	0.059	0.039	0.0045	<0.003	0.011	<0.003	<0.003
	Pyrene	0.013	0.005	0.027	0.055	0.036	0.0039	<0.003	0.0076	<0.003	<0.003
	Chrysene/ Triphenylene	0.012	0.0049	0.02	0.048	0.029	0.0038	<0.001	0.005	<0.001	<0.001
	Benzo(b+j+k)fluor-anthene	0.022	0.011	0.044	0.063	0.052	0.0076	0.002	0.012	0.0028	<0.0015
	Benzo(e)pyrene	0.0072	0.0036	0.013	0.021	0.016	0.0026	<0.001	0.0031	<0.001	<0.001
	Indeno(1,2,3-cd)pyrene	0.0081	0.0049	0.016	0.024	0.018	0.0036	<0.002	0.0041	<0.002	<0.002
	Benzo(g,h,i)perylene	0.0084	0.0044	0.02	0.027	0.023	0.0037	<0.001	0.0043	<0.001	<0.001
	1-Methylnaphthalene	<0.0015	<0.0008	0.0012	0.0033	<0.003	<0.0007	<0.0005	<0.0005	<0.0005	<0.0005
	2-Methylnaphthalene	0.0016	<0.001	0.0021	0.0055	0.004	<0.001	<0.001	0.0011	<0.001	<0.001
	Dimethy-lnaphthalenes. sum	0.0043	<0.003	0.0061	0.023	0.012	<0.003	<0.003	0.0039	<0.003	<0.003
	Trimethyl-naphthalenes. sum	0.0018	<0.001	0.0028	0.0067	0.0048	<0.001	<0.001	0.0015	<0.001	<0.001
Phthalates	Dibutylphthalate (DBP)	<0.001	0.010	0.059	0.097	0.013	0.056	0.004	0.032	0.003	<0.01*
	Benzylbutylphthalate (BBP)	<0.001	<0.001	0.002	0.004	0.003	0.004	0.003	<0.001	0.001	-
	Di(2-ethylhexyl)adipat (DEHA)	0.008	0.011	0.012	0.040	0.005	0.018	0.002	0.024	0.002	<0.01*
	Di(2-ethylhexyl)phthalate (DEHP)	0.012	0.016	0.155	0.351	0.139	0.126	0.006	0.106	0.020	<0.01*
	Di-n-octylphthalate (DNOP)	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01*
	Diisononylphthalate (DNP)	0.024	0.011	0.045	0.123	0.078	0.009	0.010	0.016	<0.005	<0.02*
	Diisodecylphthalat (DIDP)	0.037	0.017	0.050	0.172	0.103	0.012	0.003	0.025	0.010	-
Phenols	4-t-octylphenol	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005*
	4-n-octylphenol	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.1*
	4-n-nonylphenol	<0.0005	<0.0005	<0.0005	0.0006	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005*
	Nonylphenols, sum	0.0063	0.0013	0.0029	<0.001	0.0073	<0.001	<0.001	0.0022	<0.001	<0.1*
	Nonylphenol-monoethoxylater (NP1EO)	0.0104	0.0030	0.0022	0.0200	0.0118	<0.001	<0.001	<0.001	<0.001	-
	Nonylphenol-diethoxylater (NP2EO)	0.0029	0.0014	<0.001	0.0038	0.0054	<0.001	<0.001	<0.001	<0.001	-
	Dibenzothiophene	<0.001	<0.001	<0.001	0.0026	0.0015	<0.001	<0.001	<0.001	<0.001	<0.001

5.2.2 Visual registrations of sediment type (ROV)

A total of 19 km of seabed in the planned Kriegers Flak II North and South OWF areas and ECCs was surveyed by use of ROV in April 2024, and registrations of substrate type according to the Danish classification system were made along the survey transects. A map summarising substrate registration in each survey transect is shown in Figure 5-6. Detailed maps of substrate registrations for each visual survey transect are given in Appendix 2. An example of substrate registrations along a visual transect is shown in Figure 5-7.

Substrate type encountered in the different transects varied substantially in relation to location and depth. The cable corridor to shore had most transects being comprised of harder substrates such as substrate types 2a, 2b, 3 and 4. Stony reef (category 4) occurred in several transects and particularly the transects closest to shore. Large flat plains of seabed consisting of sand and mud/silt in deeper parts were evident in some transects. Transects from Kriegers Flak II North had relatively high amount of type 1b – sand along the transect lines, but with portions of mixed substrates in between. Transects from Kriegers Flak II South were dominated by either sand or mud/silt and no harder substrates. Note that portions of the transect closest top shore (KF2SC-13) were comprised of limestone reef structures, evident as layered white formations on the seabed (heavily overgrown by algae).

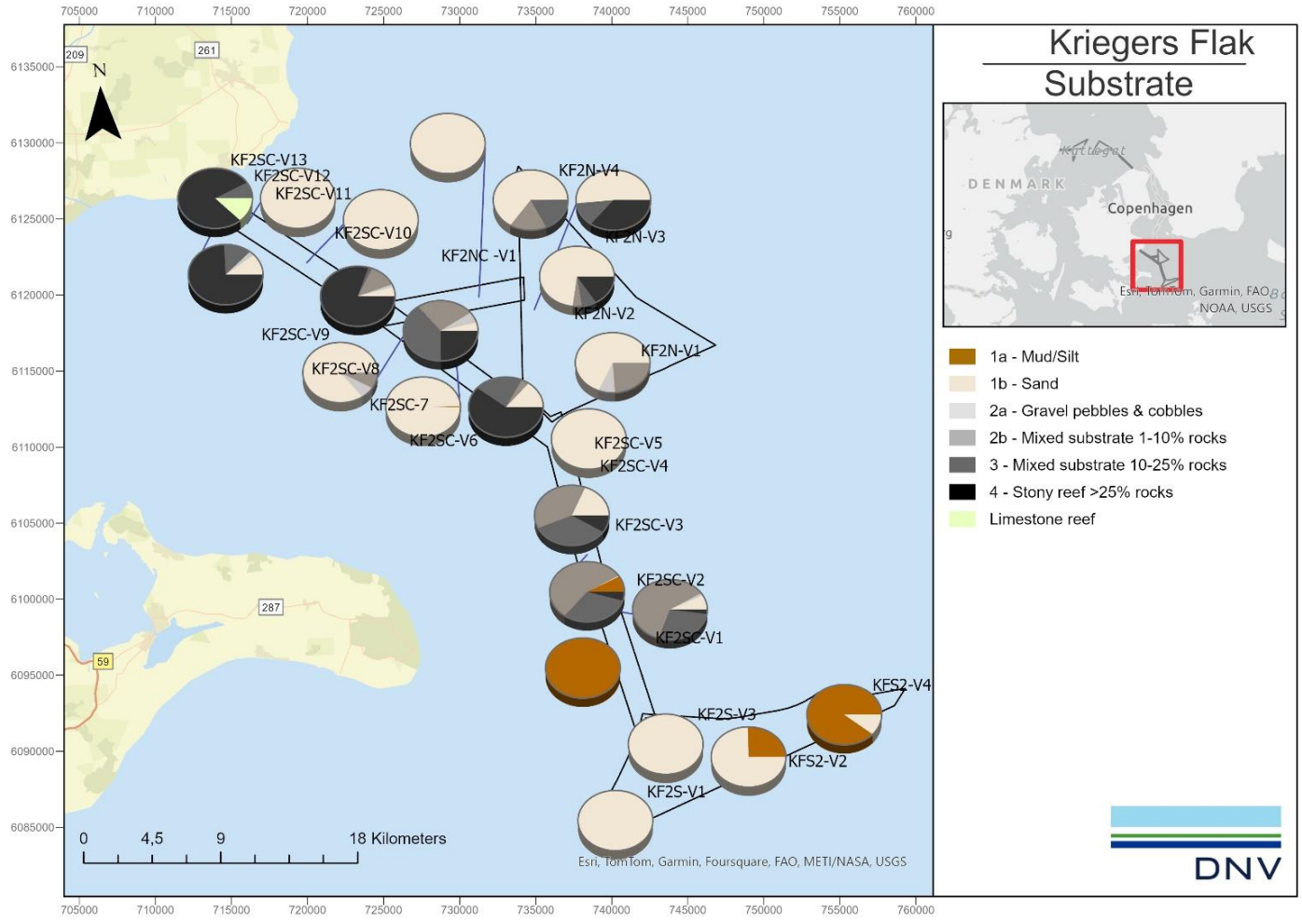


Figure 5-6 *Map summarising relative amounts of registrations of substrate types according to the Danish classification scheme in visual survey transects from the planned Kriegers Flak II North and South OWF areas and ECC.*

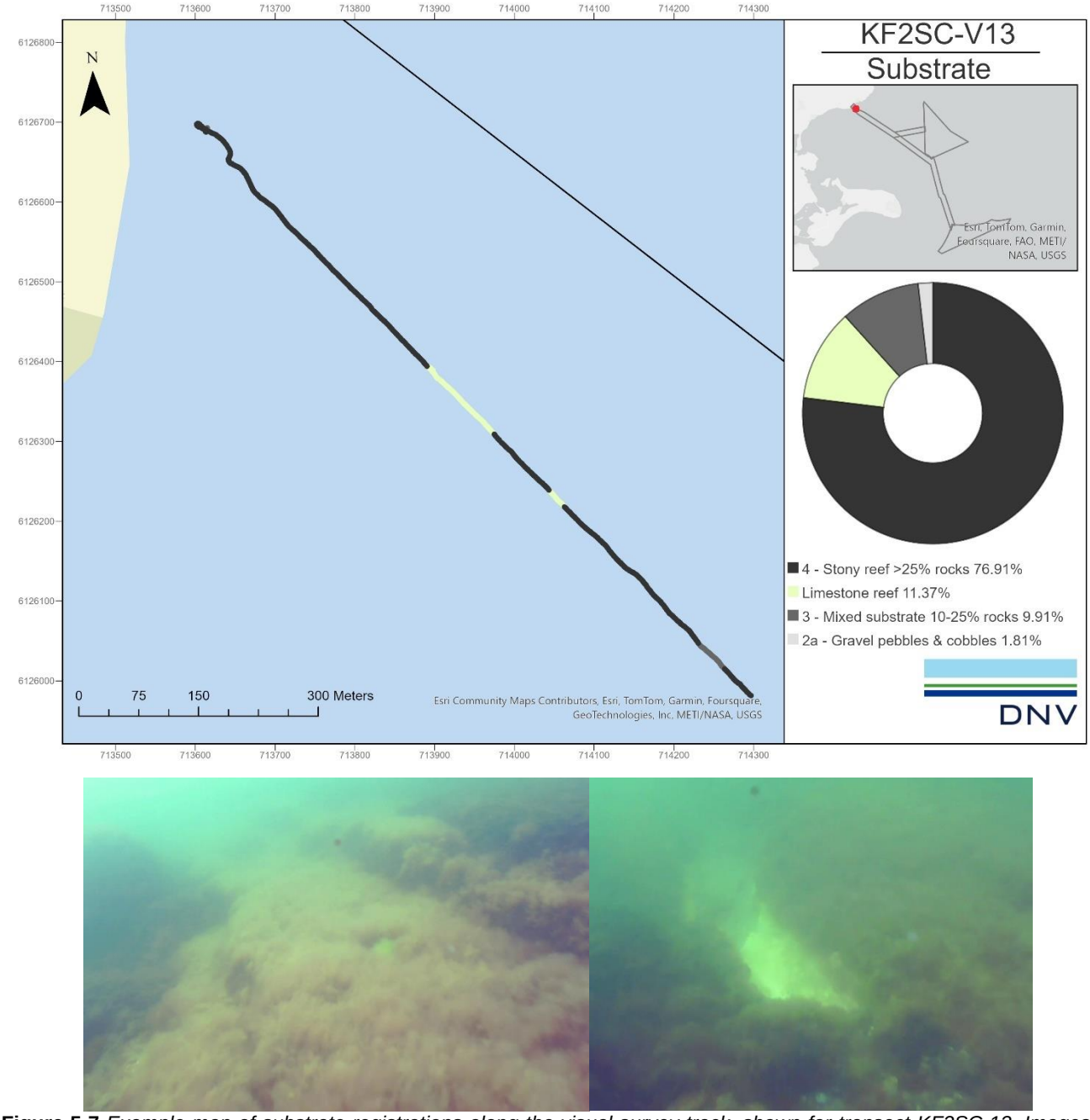


Figure 5-7 *Example map of substrate registrations along the visual survey track, shown for transect KF2SC-13. Images at bottom show example of limestone reef formations (4-7 meters depth).*

5.3 Benthic communities (nature types)

5.3.1 Benthic megafauna and macroalgae (ROV)

5.3.1.1 General overview

A total of 19 km with visual transects were surveyed in detail, and registrations were made of dominating fauna and flora types along the survey tracks. A species list was produced for each survey transect. A map summarizing main registrations flora types in each visual transect is given in Figure 5-9. A detailed map of fauna and flora registrations along the seabed for each visual survey transect is given in Appendix 3. An example map of detailed registrations of flora and fauna along visual survey transects are given in Figure 5-10. The species list for the visual survey is given in Appendix 4. Example images of seabed fauna and flora are given in Figure 5-11. Example images from landfall/ shoreline are given in Figure 5-12.

A total of 49 species of benthic megafauna and macroalgae were registered at the planned Kriegers Flak II North and South OWF areas and ECC, in addition, 16 fish species were encountered during the survey.

Table 5-10 gives a summary of the distribution of species within taxonomical groups, shown as histograms in Figure 5-8.

Dominating fauna and flora types varied according to depth and substrate type. At Kriegers Flak II there were relatively high densities of blue mussels (*Mytulis edulis*) on the seabed, creating dense aggregations over larges stretches. Closer to shore, and in transects dominated by harder substrates algae turf and macro algae were dominating. Relatively high densities of eelgrass (*Zostera marina* were recorded in the transect closest to shore; KF2SC-13).

Table 5-10 *Table summarising number of species of megafauna and macro algae in each taxonomical group in the visual survey transects at Kriegers Flak North and South OWF and ECC.*

AREA	STATION	GROUP								
		Porifera	Polychaeta	Varia	Crustacea	Mollusca	Echinodermata	Cnidaria	Pisces	Plantae
	KF2N-V1		1		2	2			4	3
	KF2N-V2	2	1		2	1	2	1	4	3
	KF2N-V3		1	1	1	1		1	3	2
	KF2N-V4		1		2	2	2	1	5	5
	KF2NC-V1		1						3	2
	KF2NC-V2		1			1			3	2
	No. Species	2	1	1	3	3	2	1	12	6
	KF2S-V1					1			1	1
	KF2S-V2		1			2	2		3	2
	KF2S-V3		1		1	1			3	3
	KF2S-V4		1		1		2		4	3
	No. Species		1		2	2	2		6	5
	KF2SC-V1		1		1	2	1		4	2
	KF2SC-V2	1	1			1	2	1	3	1
	KF2SC-V3	1	1			1	2	1	4	1
	KF2SC-V4		1		2	2		1	2	3
	KF2SC-V5		1		1				1	
	KF2SC-V6	1			2	1	1	1	2	5
	KF2SC-V7		1						2	
	KF2SC-V8		2		1	1		1	4	4
	KF2SC-V9		1		1	1	1		2	6
	KF2SC-V10		1						3	2
	KF2SC-V11		1			1			3	2
	KF2SC-V12		1	3	3	1	1	1	1	6
	KF2SC-V13		1	3	2	1	1	1	1	24
	No. Species	2	2	3	3	2	2	1	10	28

TOTAL	4	2	3	4	3	2	1	16	30

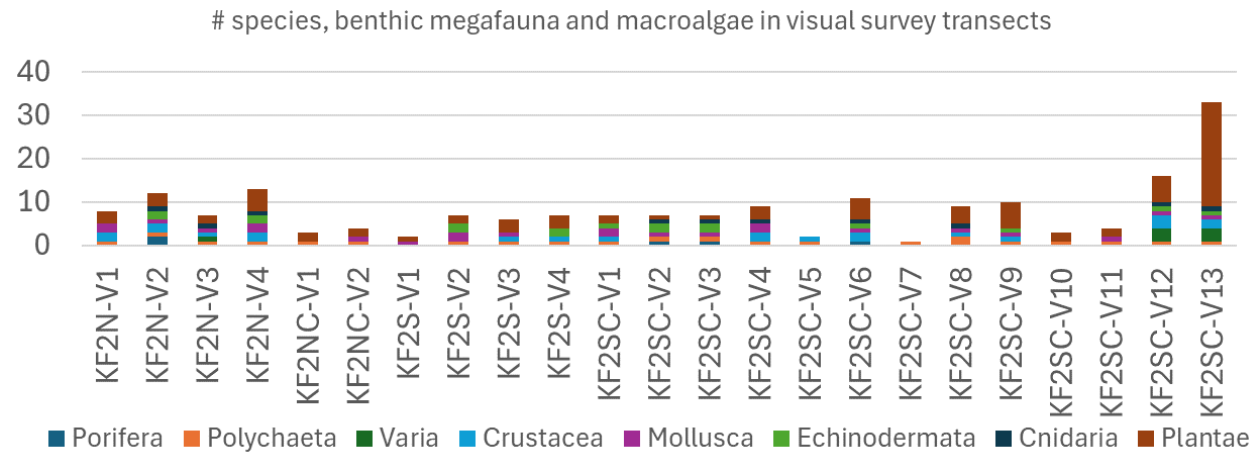


Figure 5-8 *Histogram showing number of species within different taxonomical groups of benthic megafauna and macroalgae registered in visual survey transects from the planned Kriegers Flak II North and South OWF areas and ECC.*

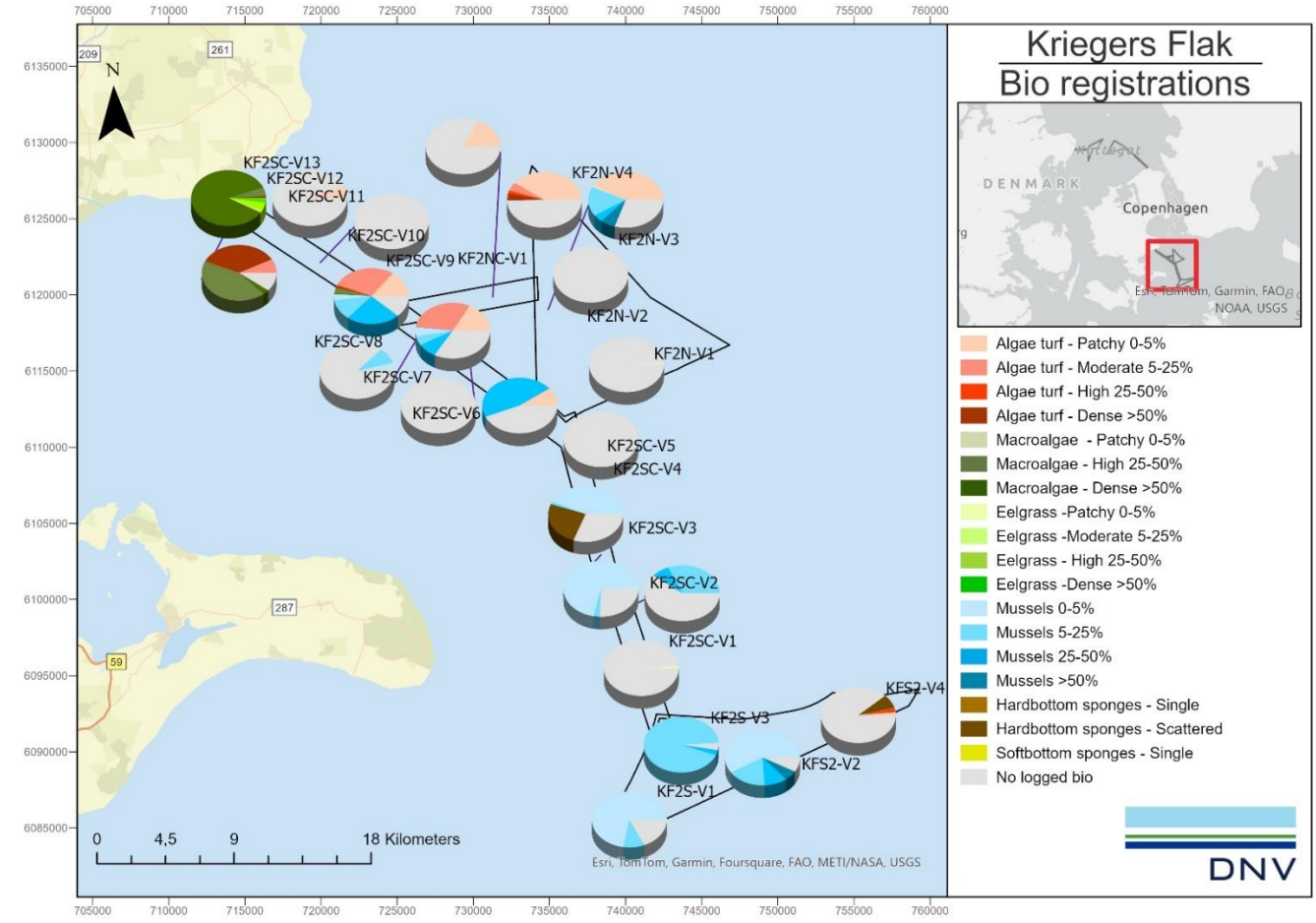


Figure 5-9 *Map summarising relative amounts of main findings of fauna and flora coverage types in visual survey transects at the planned Kriegers Flak II North and South OWF areas and ECC.*

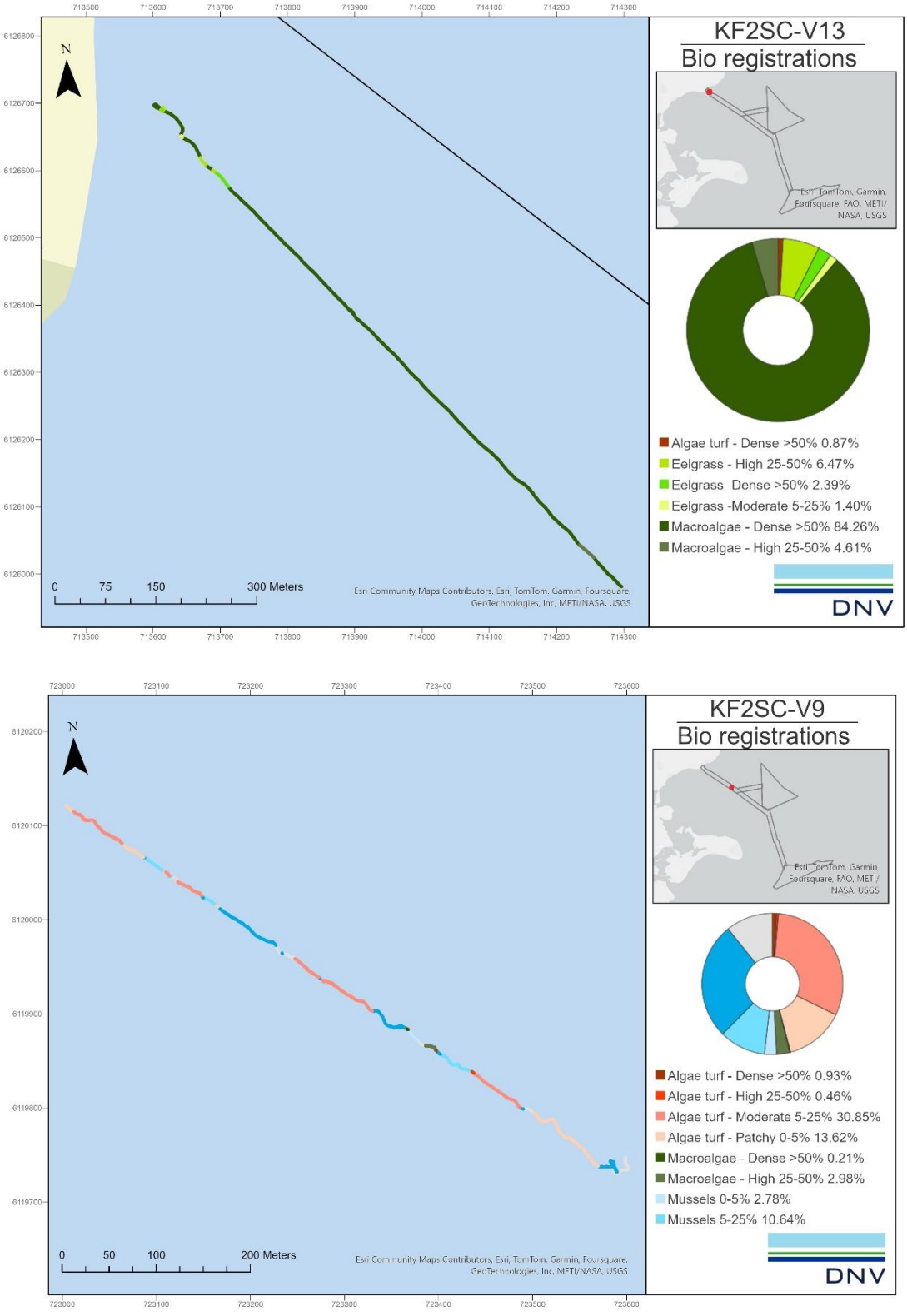


Figure 5-10 *Example maps showing registrations of megafauna and macroalgae along the visual survey tracks for visual survey transects KF2SC-13 and KF2SC-9.*

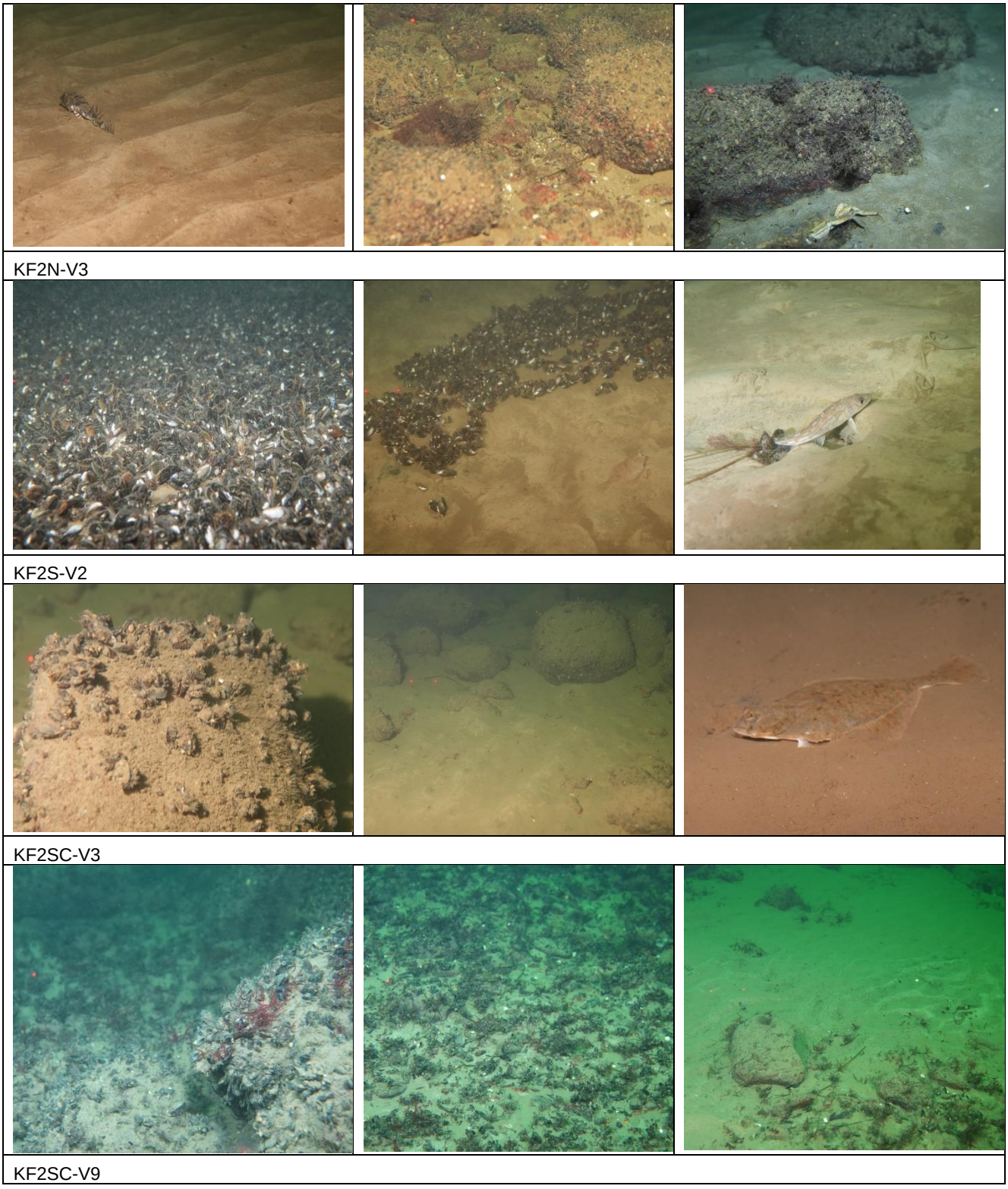


Figure 5-11 *Example images from selected visual survey transects: KF2N-V3, KF2S-V2, KF2SC-V3, KF2SC-V9*.

Figure 5-12 *Example images from landfall at the planned Kriegers Flak II ECC, bottom images show seabed at 1- and 5-meters depth. Eelgrass (Zostera marina) and Fucus serratus (L) and various filamentous algae (Pilayella, Ceramium, Vertebrata and Polyides rotunda) (R).*

5.3.1.2 Red-listed or vulnerable species and nature types

No red listed species were encountered in the visual survey transects.

Stony reefs supporting increased levels of biodiversity of hard bottom fauna and flora were registered in relatively high coverage in transects KF2N-V2, KF2SC-V6, KF2SC-V9, KF2SC-V12 and KF2SC-V13 (see Figure 5-6).

Eelgrass communities (*Zostera marina*) were registered near shore in transect KF2NSC-13, comprising ~10 % of the visual survey transect coverage categories (moderate to high occurrences, i.e. 5% - > 50% coverage at each assessment point along the survey transect). Eelgrass communities are generally considered to be important habitats under pressure from eutrophication or anthropogenic activities. The species *Zostera marina* is however classified as LC (least concern) in the Helcom Red list for species.

5.3.1.3 Introduced species

The invasive fish, Round goby (*Neogobius melanostomus*) was registered in transects from Kriegers Flak II North and in the Kriegers Flak II ECC to shore. The species main area of habitation is reported to be in the waters south of Zealand (see Jensen et al., 2023).

Apart from Round goby, no macrofauna or macroalgae species considered as invasive species to Danish waters were registered in the visual surveys at the planned Kriegers Flak II North and South OWF areas and ECC areas.

5.3.1.4 Multivariate analyses, visual data

Similarity analyses based on relative abundances of species in visual survey transects were performed. Resulting cluster diagram (dendrogram) is shown in Figure 5-13. The analyses show that the visual transects can be separated in 3 main groups at 30% similarity (Groups KF2SC-V13, Group 1 and Group 2). Main reason for grouping is given in Table 5-11. Transects mainly group together according to amounts of blue mussels and algae turf (dominating in group 1), or amounts of sandy sediments (Group 2). KF2SC-13 is in a separate group dominated by shallow water algae and eelgrass.

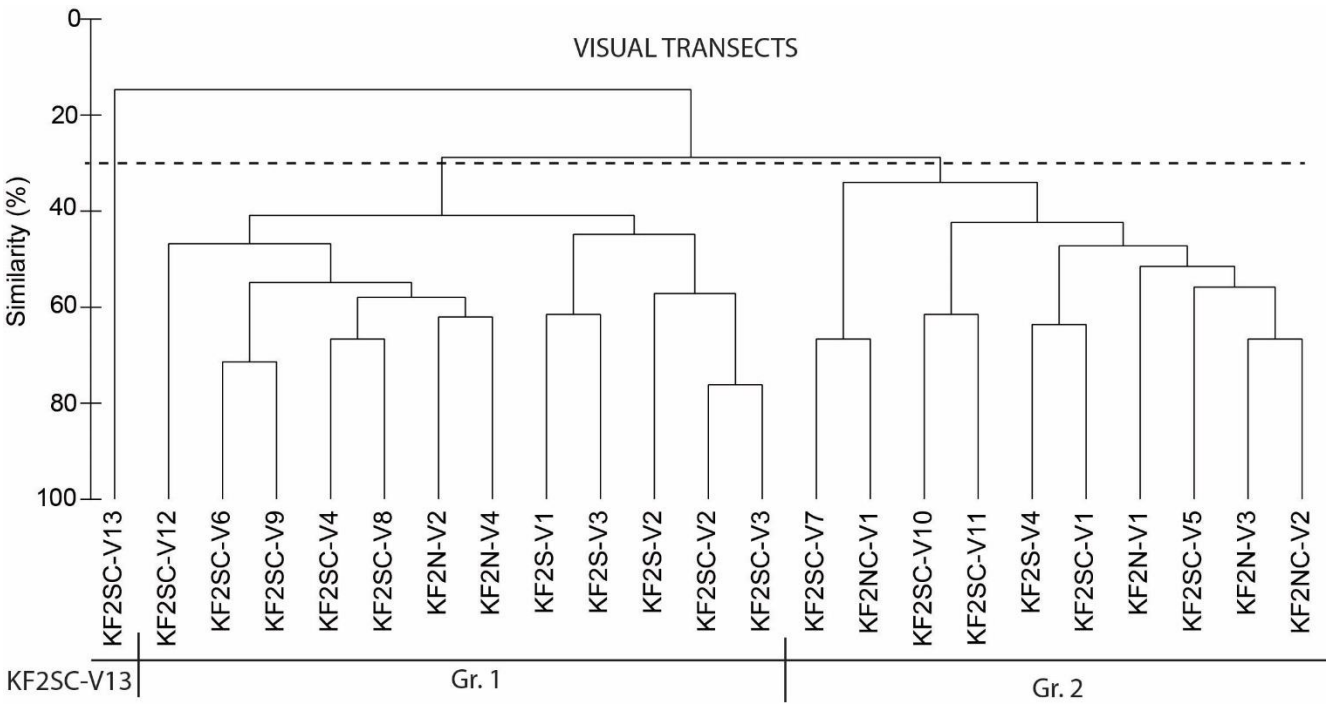


Figure 5-13 *Dendrogram resulting from similarity analyses of relative abundances of species of megafauna and macroalgae in visual survey transects at the planned Kriegers Flak II North and South OWF areas and ECC.*

Table 5-11 *Table showing main reason for grouping of stations according to similarities in megafauna and macroalgae registered in visual transects.*

Group	Transects	General description	Main reason for grouping
KF2SC-V13	KF2SC-V13	Shallowest transect closest to shore, rocky	Dominated by eelgrass and macroalgae *Zostera marina, Eudesme virecens, Fucus serratus, Cladophora rupestris* and *Pilayella.*
1	KF2SC-V12, KF2SC-V9, KF2SC-V8, KF2SC-V6, KF2N-V2, KF2N-V4, KF2S-V1, KF2S-V, KF2S-V3, KF2SC-V2, KF2SC-V3	Mixed and hard sediments and most stations from Kriegers Flak II South (softer sediments but high amounts of blue mussels)	Dominated by blue mussels *(Mytilus edulis),* barnacles *(Semibalanus),* algae such as *Polyides rotunda, Ceramium, Hildenbrandia rubra*
2	KF2S-V4, KF2SC-V1, KF2SC-V5, KF2SC-V7, KF2SC-V10, KF2SC-V11, KF2N-V1, KF2N-V3, KF2NC-V1, KF2NC-V2	Transects dominated by sand	Few species. More sandworm *Arenicola marina* than other groups.

5.3.2 Benthic infauna (sediment samples)

A total of 169 sediment samples were analyzed from 44 different stations at Kriegers Flak North and South OWF and ECC. Four grab samples (0.1 m^2 surface area) were analyzed for each environmental station. The samples were analyzed for benthic infauna species occurrences and abundances. Biomass of each infauna species at each sediment station was calculated for 1 m^2 of seabed.

5.3.2.1 Diversity and dominant species

Table 5-12 shows the distribution of individuals and taxa for infauna sampled at Kriegers Flak North and South OWF and ECC. Species list from the survey is given in Appendix 5. A total of 34165 individuals distributed among 63 different taxa were recorded (juveniles excluded). Polychaeta dominated in terms of number of individuals and number of species in all areas. No echinoderms were sampled in any stations (1 juvenile specimen was collected). Clearly, echinoderms did not have preferences towards the low salinity water in this geographical area. Total number of species is low compared to areas north of Zealand, e.g. Kattegat and Hesselø areas. The lower number of species and lower biodiversity is generally expected in areas with low salinity.

Number of species, individuals, and the diversity indexes H, J and ES100, AMBI and DKI for the different environmental stations sampled is given in Table 5-13. Relative distribution of species in relation to ecological AMBI group is given in Figure 5-14. Highest number of individuals were recorded at station KF2S-10, Lowest number of individuals were registered at station KF2S-7 (and KF2SC-13 where only one grab was analysed). Highest number of species was registered at KF2S-10, KF2SC-1 and KF2SC-3 having 27 species recorded.

Table 5-12 *Distribution of individuals and taxa of infauna within the main taxonomic groups for the planned Kriegers Flak II North and south OWF areas and ECC (juveniles excluded).*

	Total				N OWF (& N ECC)				S OWF				S ECC			
Faunal groups	**Ind.**		**Taxa**		**Ind.**		**Taxa**		**Ind.**		**Taxa**		**Ind.**		**Taxa**	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Varia	1495	4.4	7	11.1	438	3.6	5	11.1	418	4.8	3	8.1	639	4.8	6	11.5
Polychaeta	23302	68.2	29	46.0	8759	72.2	18	40.0	4864	55.5	15	40.5	9679	73.0	26	50.0
Crustacea	2873	8.4	19	30.2	1377	11.3	15	33.3	522	6.0	12	32.4	974	7.3	12	23.1
Echinodermata	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Mollusca	6495	19.0	8	12.7	1563	12.9	7	15.6	2957	33.8	7	18.9	1975	14.9	8	15.4
Total	**34165**	**100.0**	**63**	**100.0**	**12137**	**100.0**	**45**	**100.0**	**8761**	**100.0**	**37**	**100.0**	**13267**	**100.0**	**52**	**100.0**

Shannon-Wiener diversity (H') varied between 1.9 and 3.7, stations KF2SC-8 and KF2NC-4 respectively, and are considered low to moderate. AMBI scores are relatively low and indicate good status (slightly disturbed class) for most stations, but with 3 stations being classified as moderate ecological status (AMBI>3.3). The distribution of fauna within ecological AMBI groups (Figure 5-14) reflect a mix of infauna groups with various feeding preferences and sensitivity. Pollution/ organic enrichment indicator species are present in most of the stations, with fewest generally being found in stations from Kriegers Flak II North OWF (with the exception of 2 stations). The DKI index is relatively high for most stations, indicating moderate to good conditions, relative to the salinity and expected diversity scores. Due to the low salinity the diversity indexes are relatively low, but the DKI index takes into consideration the salinity and adjust for this.

The ten most common species at each station is shown in Table 5-13. Distribution of dominant species were relatively homogenous for the whole survey. Dominating species, common for most stations are the bristle worms *Scoloplos armiger, Pygospio varians* and nereididae and the molluscs *Peringia ulvae* and *Limecola baltica.* In some stations there was high dominance of blue mussels, *Mytilus edulis.*

Table 5-13 Univariate indexes calculated based on infauna samples The number of species (S) and individuals (N) per 0.4 m^2, Shannon Wiener's diversity index (H'), ES100 and evenness (J') AMBI and DKI. Results are presented station wise, average values calculated on 0.1 m^2 (grab) basis. Juveniles excluded.

Station	S	N	J'	ES(100)	H'(log2)	AMBI	DKI
KF2N-1	19	893	0.60	11.82	2.54	2.77	0.91
KF2N-2	18	1021	0.52	9.73	2.16	2.74	0.86
KF2N-3	17	969	0.58	8.95	2.38	2.78	0.89
KF2N-4	18	831	0.57	10.90	2.38	2.86	0.87
KF2N-5	20	991	0.56	9.96	2.42	2.83	0.88
KF2N-6	22	569	0.44	12.56	1.97	2.84	0.78
KF2N-7	18	667	0.54	9.35	2.24	3.04	0.82
KF2N-8	19	1158	0.59	10.32	2.49	2.82	0.90
KF2N-9	25	1453	0.63	11.49	2.92	3.59	0.87
KF2N-10	15	713	0.63	9.54	2.45	3.48	0.84
KF2NC-1	26	661	0.70	16.83	3.30	2.59	0.97
KF2NC-2	23	949	0.57	12.80	2.60	2.78	0.91
KF2NC-3	21	787	0.60	11.49	2.62	2.79	0.92
KF2NC-4	24	475	0.82	17.73	3.74	2.44	0.98
KF2S-1	13	953	0.53	7.38	1.96	3.09	0.78
KF2S-2	15	491	0.74	11.47	2.89	2.79	0.91
KF2S-3	17	504	0.74	12.27	3.04	3.12	0.88
KF2S-4	20	1221	0.55	11.59	2.39	2.93	0.79
KF2S-5	20	746	0.74	13.50	3.20	2.47	0.97
KF2S-6	24	984	0.56	10.91	2.58	2.51	0.89
KF2S-7	12	271	0.72	9.28	2.56	2.10	0.85
KF2S-8	18	800	0.68	11.27	2.84	2.54	0.97
KF2S-9	13	493	0.66	9.06	2.44	3.27	0.84
KF2S-10	27	2298	0.52	11.51	2.46	3.03	0.87
KF2SC-1	27	865	0.59	12.64	2.79	2.69	0.96
KF2SC-2	25	833	0.65	13.20	3.00	2.53	0.98
KF2SC-3	27	964	0.59	15.32	2.81	2.55	0.97
KF2SC-4	20	622	0.75	14.62	3.26	3.08	0.94
KF2SC-5	20	427	0.64	12.28	2.76	2.84	0.92
KF2SC-6	23	729	0.63	13.35	2.84	2.87	0.85
KF2SC-8	19	1023	0.45	9.80	1.91	3.11	0.76
KF2SC-9	17	1453	0.49	7.17	2.02	2.86	0.79
KF2SC-10	17	623	0.54	10.23	2.23	2.72	0.82
KF2SC-11	18	461	0.60	11.64	2.49	2.76	0.84
KF2SC-12	15	561	0.61	10.69	2.39	2.64	0.85
KF2SC-13*	12	68	0.66	12.00	2.38	2.82	0.85
KF2SC-14	16	440	0.58	10.86	2.32	2.88	0.81
KF2SC-15	21	316	0.63	16.17	2.75	2.81	0.89
KF2SC-18	18	323	0.77	14.76	3.20	3.20	0.90
KF2SC-19	17	1370	0.56	10.66	2.30	3.09	0.81
KF2SC-20	16	570	0.56	9.57	2.24	3.11	0.80
KF2SC-21	13	807	0.62	9.96	2.29	3.08	0.83
KF2SC-22	12	812	0.54	7.86	1.92	3.07	0.75
Min.	12	68	0.44	7.17	1.91	2.10	0.75
Max.	27	2298	0.82	17.73	3.74	3.59	0.98

* Only 1 grab

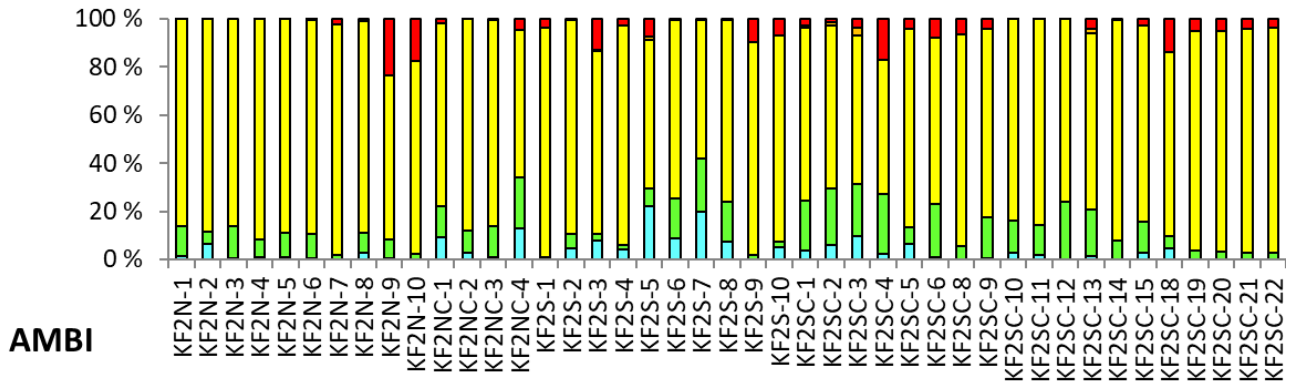


Figure 5-14 *Relative amounts of individuals of macrofauna in various ecological AMBI groups at the different stations. Explanation: ● Gr. I - sensitive species; ● Gr. II – neutral species; ● Gr.III – tolerant species; ● Gr.IV – opportunistic species; ● Gr.V – pollution indicators*

Table 5-14 *Ten most dominant taxa at each station (juveniles included), planned Kriegers Flak II North and south OWF areas and ECC 2024.*

KF2N-1	No.ind	%	Cum%
Scoloplos armiger	313	35	35
Nereididae	284	31	66
Limecola balthica	135	15	81
Pygospio elegans	32	3	85
Aricidea (Strelzovia) suecica	22	2	88
Ampharete lindstroemi kompleks	20	2	90
Parajassa pelagica	17	1	92
Terebellides	16	1	93
Calathura brachiata	12	1	95
Mya arenaria	12	1	96
Number of taxa 19			

KF2N-2	N	%	C
Scoloplos armiger	5	5	5
Pygospio elegans	1	1	7
Limecola balthica	7	7	8
Ampharete lindstroemi	7	7	8
Nereididae	6	6	9
Terebellides	1	1	9
Halicryptus spinulosus	1	1	9
Parajassa pelagica	8	0	9
Aricidea (Strelzovia) suecica	8	0	9
Pyrgiscus jeffreysii	6	0	9
Number of taxa 18			

KF2N-3	No.ind	%	Cum%
Scoloplos armiger	435	44	44
Nereididae	177	18	63
Pygospio elegans	138	14	77
Limecola balthica	94	9	87
Ampharete lindstroemi kompleks	65	6	93
Parajassa pelagica	25	2	96
Mya arenaria	8	0	97
Terebellides	7	0	97
Calathura brachiata	4	0	98
Aricidea (Strelzovia) suecica	4	0	98
Number of taxa 17			

KF2N-4	N	%	C
Scoloplos armiger	4	4	4
Pygospio elegans	1	1	6
Limecola balthica	9	1	7
Nereididae	8	1	8
Ampharete lindstroemi	1	1	9
Pyrgiscus jeffreysii	1	1	9
Terebellides	1	1	9
Mya arenaria	1	1	9
Aricidea (Strelzovia) suecica	9	1	9
Pseudocuma	8	0	9
Number of taxa 18			

KF2N-5	No.ind	%	Cum%
Scoloplos armiger	428	43	43
Nereididae	227	22	66
Limecola balthica	131	13	79
Ampharete lindstroemi kompleks	75	7	86
Pygospio elegans	64	6	93
Terebellides	12	1	94
Calathura brachiata	11	1	95
Crassicorophium crassicorne	9	0	96

KF2N-6	N	%	C
Scoloplos armiger	3	6	6
Limecola balthica	3	6	7
Nereididae	2	4	8
Pygospio elegans	2	4	8
Crassicorophium crassicorne	2	3	8
Oligochaeta	1	1	9
Parajassa pelagica	9	1	9
Capitella capitata	8	1	9

Mytilus edulis	7	0	97
Pseudocuma	7	0	97
Number of taxa 20			

Pyrgiscus jeffreysii	8	1	9
Halicryptus spinulosus	5	0	9
Number of taxa 22			

KF2N-7	No.ind	%	Cum%
Crassicorophium crassicorne	318	47	47
Scoloplos armiger	138	20	68
Nereididae	108	16	84
Limecola balthica	46	6	91
Ampharete lindstroemi kompleks	18	2	94
Aricidea (Strelzovia) suecica	11	1	95
Parajassa pelagica	6	0	96
Pygospio elegans	4	0	97
Mya arenaria	4	0	97
Oligochaeta	2	0	98
Number of taxa 18			

KF2N-8	N	%	C
Scoloplos armiger	4	3	3
Crassicorophium crassicorne	3	2	6
Oligochaeta	1	1	7
Nereididae	9	7	8
Capitella capitata	5	4	9
Limecola balthica	3	2	9
Parajassa pelagica	2	1	9
Ampharete lindstroemi	1	1	9
Mytilus edulis	8	0	9
Leptostylis	5	0	9
Number of taxa 19			

KF2N-9	No.ind	%	Cum%
Nereididae	437	30	30
Limecola balthica	276	18	49
Oligochaeta	254	17	66
Pygospio elegans	151	10	76
Scoloplos armiger	90	6	83
Capitella capitata	88	6	89
Peringia ulvae	51	3	92
Parajassa pelagica	40	2	95
Crassicorophium crassicorne	15	1	96
Mytilus edulis	14	0	97
Number of taxa 25			

KF2N-10	N	%	C
Scoloplos armiger	2	3	3
Nereididae	2	3	6
Pygospio elegans	1	1	8
Crassicorophium crassicorne	5	7	8
Mya arenaria	4	5	9
Peringia ulvae	1	1	9
Aricidea (Strelzovia) suecica	1	1	9
Aricidea (Aricidea) minuta	8	1	9
Calathura brachiata	5	0	9
Oligochaeta	4	0	9
Number of taxa 15			

KF2NC-1	No.ind	%	Cum%
Scoloplos armiger	197	29	29
Nereididae	137	20	50
Pygospio elegans	68	10	60
Crassicorophium crassicorne	59	8	69
Mya arenaria	42	6	76
Peringia ulvae	25	3	79
Aricidea (Strelzovia) suecica	22	3	83
Aricidea (Aricidea) minuta	19	2	86
Calathura brachiata	19	2	88
Oligochaeta	8	1	90
Number of taxa 26			

KF2NC-2	N	%	C
Scoloplos armiger	3	4	4
Nereididae	2	2	6
Pygospio elegans	1	1	7
Limecola balthica	4	4	8
Parajassa pelagica	2	2	8
Peringia ulvae	2	2	8
Ampharete lindstroemi	1	1	9
Terebellides	1	1	9
Calathura brachiata	1	1	9
Diastyloides serratus	1	1	9
Number of taxa 23			

KF2NC-3	No.ind	%	Cum%
Scoloplos armiger	268	34	34
Nereididae	212	26	60
Pygospio elegans	149	18	79
Calathura brachiata	36	4	84
Ampharete lindstroemi kompleks	29	3	88
Limecola balthica	25	3	91
Parajassa pelagica	20	2	93
Crassicorophium crassicorne	12	1	95
Mya arenaria	9	1	96
Aricidea (Strelzovia) suecica	4	0	97
Number of taxa 21			

KF2NC-4	N	%	C
Peringia ulvae	8	1	1
Pygospio elegans	7	1	3
Spio	4	8	4
Harpinia laevis	4	8	5
Mya arenaria	3	7	5
Ampharete lindstroemi	3	6	6
Nereididae	3	6	7
Crassicorophium crassicorne	2	4	7
Oligochaeta	2	4	8
Calathura brachiata	1	4	8
Number of taxa 24			

KF2S-1	No.ind	%	Cum%
Peringia ulvae	494	51	51
Pygospio elegans	222	23	75
Scoloplos armiger	141	14	89
Oligochaeta	33	3	93
Nereididae	33	3	96
Limecola balthica	9	0	97
Cerastoderma glaucum	8	0	98
Parajassa pelagica	5	0	99
Mytilus edulis	4	0	99
Dipolydora	1	0	99
Number of taxa 13			

KF2S-2	N	o	C
Mytilus edulis	1	2	2
Scoloplos armiger	1	2	4
Peringia ulvae	9	2	6
Pygospio elegans	4	9	7
Parajassa pelagica	2	4	8
Nereididae	2	4	8
Cerastoderma glaucum	1	3	9
Jaera	1	3	9
Limecola balthica	1	2	9
Microdeutopus	7	1	9
Number of taxa 15			

KF2S-3	No.ind	%	Cum%
Scoloplos armiger	141	27	27
Pygospio elegans	89	17	45
Mytilus edulis	67	13	58
Oligochaeta	64	12	71
Nereididae	49	9	81
Jaera	32	6	87
Limecola balthica	15	2	90
Crassicorophium crassicorne	11	2	92
Parajassa pelagica	11	2	95
Gammaridae	7	1	96
Number of taxa 17			

KF2S-4	N	o	C
Scoloplos armiger	6	5	5
Mytilus edulis	1	1	6
Nereididae	1	1	7
Limecola balthica	6	5	8
Pygospio elegans	4	3	8
Gammaridae	3	2	9
Oligochaeta	2	2	9
Aricidea (Strelzovia) suecica	1	1	9
Peringia ulvae	1	1	9
Parajassa pelagica	1	0	9
Number of taxa 20			

KF2S-5	No.ind	%	Cum%
Pygospio elegans	185	24	24
Scoloplos armiger	171	22	47
Harpinia laevis	93	12	60
Crassicorophium crassicorne	55	7	67
Oligochaeta	54	7	74
Aricidea (Strelzovia) suecica	44	5	80
Limecola balthica	32	4	84
Astarte montagui	25	3	88
Terebellides	24	3	91
Parajassa pelagica	17	2	93
Number of taxa 20			

KF2S-6	N	o	C
Scoloplos armiger	3	3	3
Pygospio elegans	2	2	6
Ampharete lindstroemi	1	1	7
Limecola balthica	8	8	8
Aricidea (Strelzovia) suecica	7	7	9
Parajassa pelagica	1	1	9
Aricidea (Aricidea) minuta	1	1	9
Mya arenaria	8	0	9
Pseudocuma	5	0	9
Nephtys hombergii	4	0	9
Number of taxa 24			

KF2S-7	No.ind	%	Cum%
Scoloplos armiger	74	27	27
Limecola balthica	73	26	54
Aricidea (Strelzovia) suecica	53	19	73
Ampharete lindstroemi kompleks	33	12	85
Parajassa pelagica	18	6	92
Terebellides	8	2	95
Halicryptus spinulosus	4	1	97
Nereididae	3	1	98
Capitella capitata	2	0	98
Nemertea	1	0	99
Number of taxa 12			

KF2S-8	N	o	C
Scoloplos armiger	2	3	3
Limecola balthica	1	1	5
Pygospio elegans	1	1	6
Terebellides	7	9	7
Aricidea (Strelzovia) suecica	5	6	8
Nereididae	4	5	8
Ampharete lindstroemi	3	4	9
Peringia ulvae	1	2	9
Parajassa pelagica	1	1	9
Astarte montagui	8	1	9
Number of taxa 18			

KF2S-9	No.ind	%	Cum%
Scoloplos armiger	222	45	45

KF2S-10	N	o	C
Mytilus edulis	1	4	4

Nereididae	91	18	63
Oligochaeta	48	9	73
Pygospio elegans	46	9	82
Crassicorophium crassicorne	33	6	89
Limecola balthica	26	5	94
Peringia ulvae	15	3	97
Mya arenaria	4	0	98
Ampharete lindstroemi kompleks	2	0	98
Parajassa pelagica	2	0	99
Number of taxa 13			

Scoloplos armiger	41	16	6
Limecola balthica	2	8	7
Oligochaeta	1	6	8
Pygospio elegans	1	5	8
Aricidea (Strelzovia) suecica	6	2	9
Jaera	3	1	9
Nemertea	2	0	9
Ampharete lindstroemi	1	0	9
Capitella capitata	1	0	9
Number of taxa 27			

KF2SC-1	No.ind	%	Cum%
Scoloplos armiger	290	33	33
Limecola balthica	192	22	55
Ampharete lindstroemi kompleks	138	15	71
Pygospio elegans	115	13	84
Aricidea (Strelzovia) suecica	28	3	88
Oligochaeta	18	2	90
Mya arenaria	16	1	92
Retusa obtusa	14	1	93
Capitella capitata	8	0	94
Nereididae	8	0	95
Number of taxa 27			

KF2SC-2	N	o	C
Pygospio elegans	2	2	2
Scoloplos armiger	2	2	5
Terebellides	1	1	6
Limecola balthica	7	9	7
Ampharete lindstroemi	7	9	8
Aricidea (Strelzovia) suecica	4	5	8
Peringia ulvae	2	2	9
Dipolydora	1	1	9
Halicryptus spinulosus	7	0	9
Capitella capitata	7	0	9
Number of taxa 25			

KF2SC-3	No.ind	%	Cum%
Pygospio elegans	455	47	47
Ampharete lindstroemi kompleks	166	17	64
Scoloplos armiger	81	8	72
Aricidea (Strelzovia) suecica	40	4	76
Harpinia laevis	36	3	80
Oligochaeta	34	3	84
Dipolydora	30	3	87
Astarte montagui	15	1	88
Limecola balthica	15	1	90
Parajassa pelagica	13	1	91
Number of taxa 27			

KF2SC-4	N	o	C
Pygospio elegans	1	2	2
Oligochaeta	1	1	4
Scoloplos armiger	6	1	5
Calathura brachiata	6	1	6
Nemertea	4	6	7
Ampharete lindstroemi	3	5	7
Mytilus edulis	3	5	8
Terebellides	2	3	8
Cirripedia	2	3	9
Peringia ulvae	1	1	9
Number of taxa 20			

KF2SC-5	No.ind	%	Cum%
Pygospio elegans	132	30	30
Scoloplos armiger	123	28	59
Nereididae	64	14	74
Limecola balthica	26	6	80
Aricidea (Strelzovia) suecica	23	5	86
Oligochaeta	16	3	89
Ampharete lindstroemi kompleks	14	3	93
Parajassa pelagica	6	1	94
Aricidea (Aricidea) minuta	4	0	95
Terebellides	4	0	96
Number of taxa 20			

KF2SC-6	N	o	C
Pygospio elegans	2	3	3
Scoloplos armiger	1	2	6
Parajassa pelagica	7	1	7
Oligochaeta	5	7	7
Ampharete lindstroemi	3	5	8
Terebellides	2	2	8
Calathura brachiata	2	2	8
Limecola balthica	1	2	9
Mytilus edulis	1	2	9
Nemertea	8	1	9
Number of taxa 23			

KF2SC-8	No.ind	%	Cum%
Scoloplos armiger	575	56	56
Limecola balthica	287	28	84
Oligochaeta	58	5	89
Pseudocuma	18	1	91

KF2SC-9	N	o	C
Scoloplos armiger	7	5	5
Limecola balthica	2	1	6
Pseudocuma	2	1	8
Nereididae	1	7	9

Ampharete lindstroemi kompleks	14	1	93
Parajassa pelagica	12	1	94
Priapulus caudatus	10	0	95
Capitella capitata	8	0	95
Terebellides	8	0	96
Nereididae	7	0	97
Number of taxa 19			

Oligochaeta	6	4	9
Parajassa pelagica	1	0	9
Pygospio elegans	6	0	9
Ampharete lindstroemi	5	0	9
Aricidea (Strelzovia) suecica	3	0	9
Mya arenaria	3	0	9
Number of taxa 17			

KF2SC-10	No.ind	%	Cum%
Scoloplos armiger	307	49	49
Nereididae	160	25	74
Pseudocuma	53	8	83
Pygospio elegans	38	6	89
Aricidea (Strelzovia) suecica	18	2	92
Ampharete lindstroemi kompleks	10	1	94
Limecola balthica	9	1	95
Calathura brachiata	5	0	96
Terebellides	4	0	96
Parajassa pelagica	4	0	97
Number of taxa 17			

KF2SC-11	N	o	C
Scoloplos armiger	1	3	3
Nereididae	1	3	7
Peringia ulvae	3	7	7
Parajassa pelagica	2	4	8
Pygospio elegans	2	4	8
Pseudocuma	1	3	9
Aricidea (Strelzovia) suecica	9	1	9
Limecola balthica	6	1	9
Ampharete lindstroemi	4	0	9
Diastylis rathkei	4	0	9
Number of taxa 18			

KF2SC-12	No.ind	%	Cum%
Scoloplos armiger	304	54	54
Nereididae	61	10	65
Parajassa pelagica	46	8	73
Limecola balthica	38	6	80
Ampharete lindstroemi kompleks	37	6	86
Pseudocuma	23	4	90
Calathura brachiata	20	3	94
Pygospio elegans	9	1	95
Mytilus edulis	9	1	97
Mya arenaria	5	0	98
Number of taxa 15			

KF2SC-13	N	o	C
Scoloplos armiger	3	5	5
Parajassa pelagica	1	1	6
Nereididae	8	1	7
Pygospio elegans	3	4	8
Oligochaeta	2	2	8
Calathura brachiata	2	2	8
Limecola balthica	2	2	9
Heteromastus filiformis	1	1	9
Capitella capitata	1	1	9
Aricidea (Strelzovia) suecica	1	1	9
Number of taxa 12			

KF2SC-14	No.ind	%	Cum%
Scoloplos armiger	186	42	42
Nereididae	146	33	75
Peringia ulvae	28	6	81
Limecola balthica	21	4	86
Calathura brachiata	13	2	89
Mya arenaria	12	2	92
Pygospio elegans	10	2	94
Mytilus edulis	7	1	96
Ampharete lindstroemi kompleks	4	0	97
Cerastoderma glaucum	4	0	97
Number of taxa 16			

KF2SC-15	N	o	C
Peringia ulvae	1	5	5
Nereididae	2	7	6
Calathura brachiata	1	5	6
Scoloplos armiger	1	4	7
Pygospio elegans	1	4	7
Parajassa pelagica	1	4	8
Limecola balthica	1	4	8
Oligochaeta	8	2	8
Fabricia	7	2	8
Pyrgiscus jeffreysii	6	1	9
Number of taxa 21			

KF2SC-18	No.ind	%	Cum%
Scoloplos armiger	94	29	29
Pygospio elegans	64	19	48
Oligochaeta	38	11	60
Nereididae	26	8	68
Limecola balthica	22	6	75
Spio	16	4	80
Travisia forbesii	14	4	84

KF2SC-19	N	o	C
Scoloplos armiger	6	4	4
Nereididae	4	2	7
Oligochaeta	6	4	8
Peringia ulvae	6	4	8
Limecola balthica	6	4	8
Crassicorophium crassicorne	4	2	9
Pygospio elegans	2	1	9

Ampharete lindstroemi kompleks	12	3	88
Crassicorophium crassicorne	7	2	90
Capitella capitata	6	1	92
Number of taxa 18			

Calathura brachiata	1	1	9
Streblospio shrubsolii	1	1	9
Mya arenaria	1	1	9
Number of taxa 17			

KF2SC-20	No.ind	%	Cum%
Scoloplos armiger	224	39	39
Nereididae	207	36	75
Peringia ulvae	44	7	83
Limecola balthica	30	5	88
Oligochaeta	28	4	93
Pseudocuma	10	1	95
Streblospio shrubsolii	7	1	96
Pygospio elegans	4	0	97
Mya arenaria	4	0	97
Arenicola marina	3	0	98
Number of taxa 16			

KF2SC-21	N	%	C
Scoloplos armiger	3	4	4
Nereididae	2	2	7
Peringia ulvae	6	7	8
Oligochaeta	3	3	8
Pygospio elegans	2	2	8
Cerastoderma glaucum	2	2	9
Limecola balthica	1	2	9
Mya arenaria	1	2	9
Crassicorophium crassicorne	1	1	9
Streblospio shrubsolii	1	1	9
Number of taxa 13			

KF2SC-22	No.ind	%	Cum%
Scoloplos armiger	469	57	57
Nereididae	137	16	74
Peringia ulvae	116	14	88
Oligochaeta	29	3	92
Limecola balthica	19	2	94
Pygospio elegans	16	1	96
Parajassa pelagica	15	1	98
Mya arenaria	4	0	99
Cerastoderma glaucum	3	0	99
Retusa obtusa	2	0	99
Number of taxa 12			

5.3.2.2 Multivariate analyses

Cluster diagram and MDS plot resulting from similarity analyses of species composition at the different stations are shown in Figure 5-15. The analyses show that stations can be grouped into five main groups at 50 % similarity (group A, B and stations KF2SC-13, KF2S-7 and KF2S-10 each in separate groups). A general description and main reason for groupings are given in Table 5-15.

The groupings are mainly according to grain sizes and depths, with most species and individuals registered in Group A comprising most of the deeper stations with relatively homogenous infauna composition.

BIOENV analysis show best correlation (0.4) between the observed similarities and the environmental variable % silt and clay. The relatively low correlation indicates that there are no strong correlations between fauna composition and the environmental variables included in the analysis.

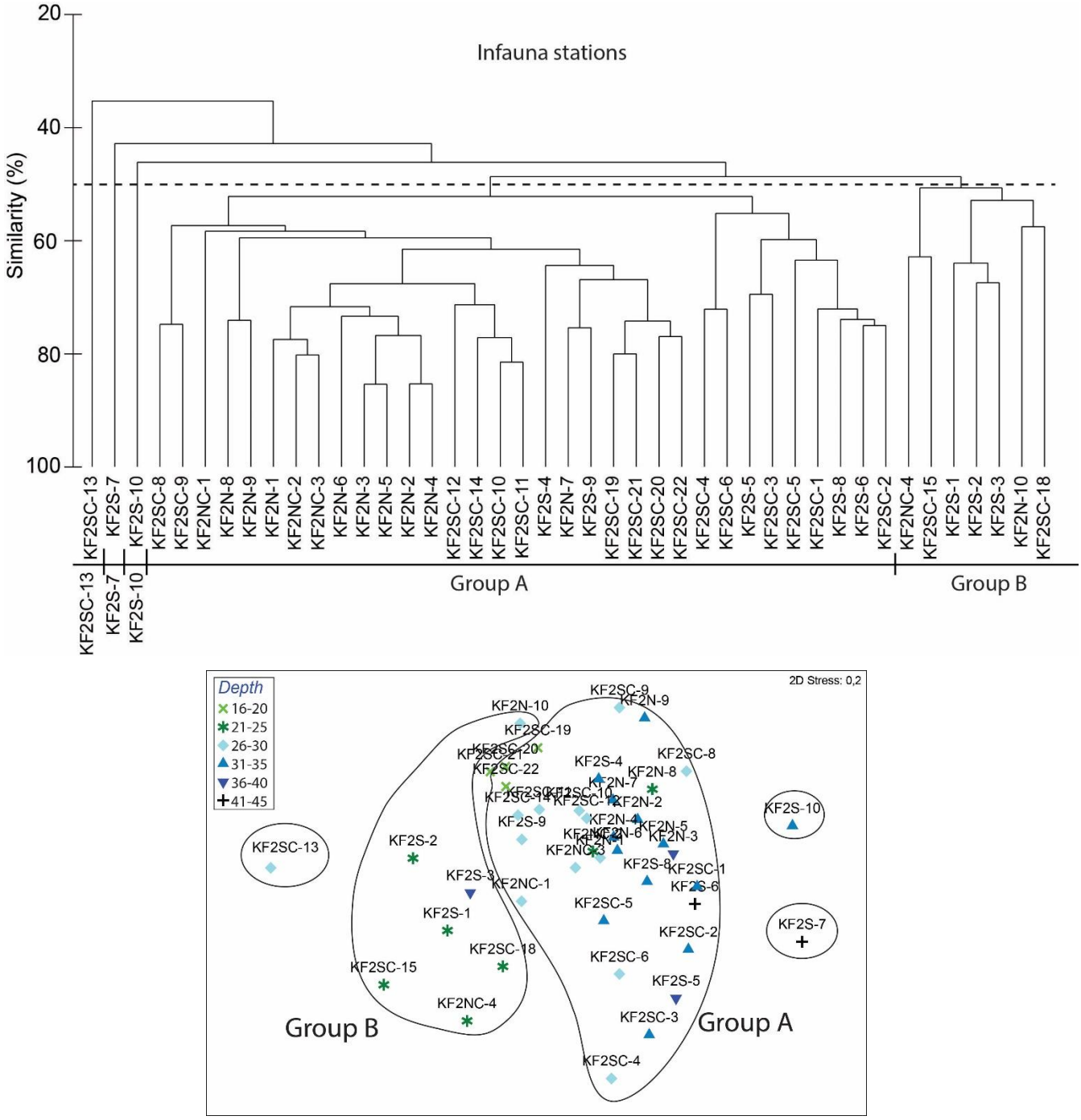


Figure 5-15 *Cluster diagram (top) and MDS plot (bottom) resulting from similarity analyses of species composition of infauna in sediment samples from the planned Kriegers Flak II North and South OWF areas and ECC. Depth interval for environmental stations is shown in the MDS as colour coded symbols.*

Table 5-15 *Table showing main reason for grouping of stations according to infauna species similarities.*

Group	Stations	Main reason for grouping
A	KF2N-1, KF2N-2, KF2N-3, KF2N-4, KF2N-5, KF2N-6, KF2N-7, KF2N-8, KF2N-9, KF2NC-1, KF2NC-2, KF2NC-3, KF2S-4, KF2S-5, KF2S-6, KF2S-8, KF2S-9, KF2SC-1, KF2SC-2, KF2SC-3, KF2SC-4, KF2SC-5, KF2SC-6, KF2SC-8, KF2SC-9, KF2SC-10, KF2SC-11, KF2SC-12, KF2SC-14, KF2SC-19, KF2SC-20, KF2SC-21, KF2SC-22	Dominated by the polychaeta *Scoloplos armiger, nereididae, Pygospio elegans, Ampharete lindstroemi* and the mussel *Limicola balthica.*
B	KF2S-1, KF2S-2, KF2S-3, KF2N-10, KF2NC-4, KF2SC-15, KF2SC-18	Dominated by the mollusc *Peringia ulvae,* more blue mussel *M. Edulis* than group A
KF2SC-13	KF2SC-13	Rocky area, (only one grab). Few species and individuals.
KF2S-7	KF2S-7	Deepest station. Dominated by the polychaete *Aricidea suecica*. Very few blue mussels, *M. edulis.*
KF2S-10	KF2S-10	High dominance of blue mussels*, M. edulis*. More *S. armiger* and *Limicola balthica* than group A.

Sampling effort for infauna analyses in the current study is relatively high compared to earlier studies in the area, mainly because of equipment used (Van Veen grab instead of HAPS corer), but also because of replicate samples at each environmental station. A species accumulation plot is given in Figure 5-16. The figure indicates that the species richness in the area is relatively well-captured with the chosen sampling regime (the saturation curve flattens out with increased sampling effort).

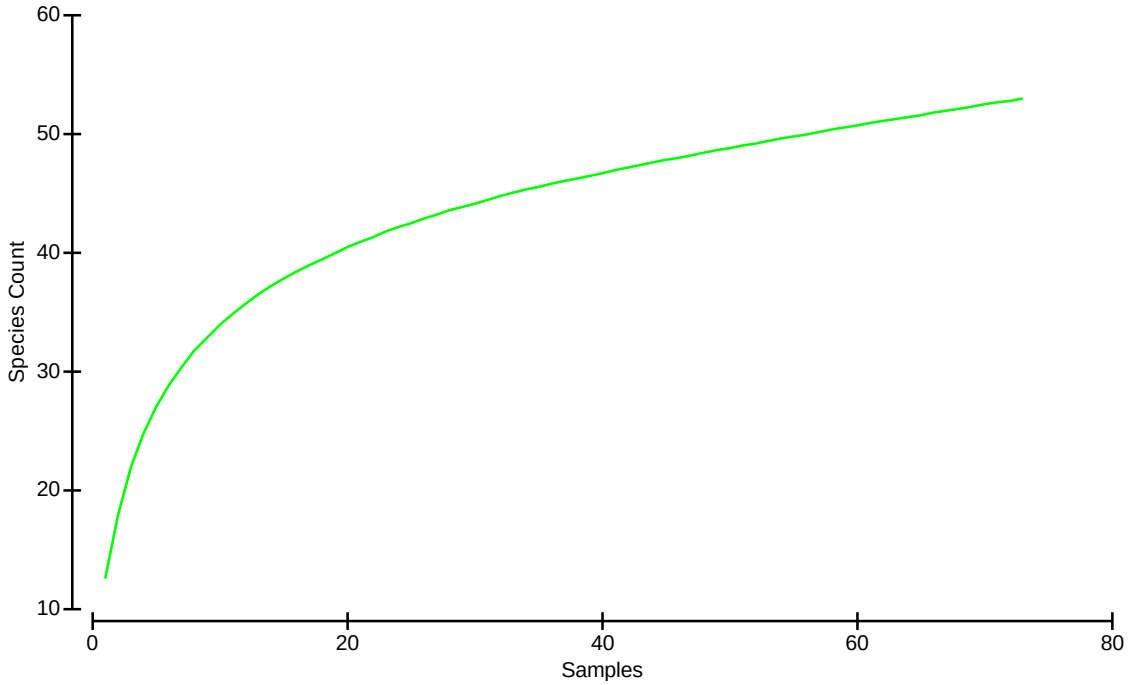


Figure 5-16 *Species accumulation plot showing number of species in relation to sampling effort, - grab samples (each grab sampling 0.1 m^2 surface area) at planned Kriegers Flak II North and South OWF areas and ECC combined.*

5.3.2.3 Infauna and modelled substrate type

WSP has modelled substrate types in the planned Kriegers Flak II North and south OWF areas and ECC according to the Danish classification system (Figure 5-17). Infauna communities identified in grab samples are shown in Table 5-16. Grouping of stations according to species similarities (previous section) is not according to modelled substrate types at each of the stations, and no clear fauna types are found to be associated to each of the modelled substrate types..

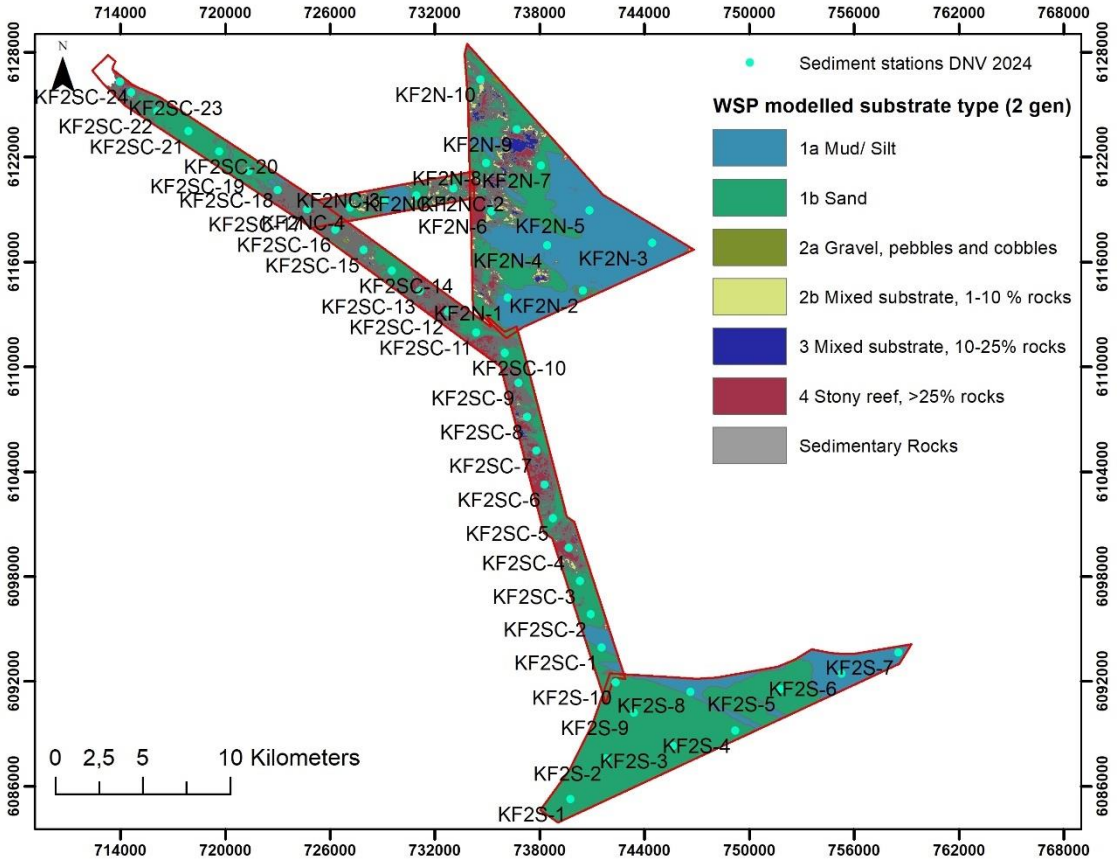


Figure 5-17 *Modelled substrate types in the planned Kriegers Flak II N and S OWF and ECC (WSP, 2024) and sediment stations sampled for infauna in 2024.*

Table 5-16 ***I****nfauna communities dominating in modelled substrate types.*

Substrate type	**Fauna**
1a Mud/silt	*Domionated by Scoloplos armiger, Ampharete liundstroemi,*
1b Sand	*Dominated by Nereididae, Peringia ulvae, Crassicorophium crassicorne*
2b Mixed substrate, 1-10% rocks	*More Aricidea suecica, Calathura brachiata han other groups*
3 Mixed substrate, 10-25% rocks	*More Pygospio elegans, Mytilus edulis and oligochaeta compared to other groups*
4 Stony reef, >25% rocks	*High occurrences of Limecola balthica, Parajassa pelagica, Pseudocuma*

5.3.2.4 Biomass registrations

Summary of biomass measurements at the planned Kriegers Flak II North and South OWF and ECC is given in Table 5-17 and Table 5-18. A map showing biomass registrations in relation to taxonomical group is shown in Figure 5-18. Mollusca contributed most to the biomass in some stations, particularly in Kriegers Flak II South where blue mussels accounted for most of the biomass. Polychaeta attributed to much of the biomass in shallower stations, particularly due to the species *Scoloplos armiger* and members of the family Nereididae. Echinoderms were practically absent from all stations. The reason for "Varia" sccounting for large parts of the biomass in station KF2SC-8 is to occurrence of the large sized *Priapulus caudatus*.

See Figure 5-19 for overview of contribution to biomass at different stations from four species contributing most to the biomass.

Table 5-17 *Table summarising biomass measurements at each station at Kriegers Flak II North OWF and ECC (wet weight (g) per m2) for different taxonomical groups*

Station	Varia	Polychaeta	Mollusca	Echinodermata	Crustacea	Total biomass
KF2N-1	0.00	8.61	0.40	0.00	0.44	9.45
KF2N-2	0.00	9.34	3.40	0.00	0.39	13.14
KF2N-3	0.88	9.62	7.95	0.00	0.11	18.56
KF2N-4	0.00	7.30	3.00	0.00	0.30	10.60
KF2N-5	0.17	4.89	7.58	0.00	0.16	12.79
KF2N-6	0.03	8.15	0.77	0.00	0.90	9.85
KF2N-7	0.26	5.19	7.72	0.00	0.44	13.61
KF2N-8	0.00	6.36	2.29	0.00	5.79	14.45
KF2N-9	0.35	8.55	7.84	0.00	3.32	20.06
KF2N-10	0.08	5.90	6.20	0.00	0.11	12.28
KF2NC-1	0.13	1.88	4.04	0.00	1.18	7.23
KF2NC-2	0.00	6.66	11.40	0.00	0.46	18.52
KF2NC-3	0.00	7.90	3.82	0.00	0.95	12.66
KF2NC-4	0.01	0.83	1.38	0.00	0.55	2.78

Table 5-18 *Table summarising biomass measurements at each station at Kriegers Flak South OWF and ECC (wet weight g per m2) for different taxonomical groups*

Station	Varia	Polychaeta	Mollusca	Echinodermata	Crustacea	Total biomass
KF2S-1	0.01	2.17	15.22	0.00	0.02	17.43
KF2S-2	0.00	2.25	141.63	0.00	0.36	144.25
KF2S-3	0.06	3.83	59.15	0.00	0.36	63.41
KF2S-4	0.03	7.09	339.88	0.00	0.89	347.89
KF2S-5	0.06	1.57	45.83	0.00	0.55	48.01
KF2S-6	0.14	8.11	52.33	0.00	0.16	60.75
KF2S-7	0.06	0.86	20.82	0.00	0.07	21.81
KF2S-8	0.00	4.20	41.89	0.00	0.11	46.20
KF2S-9	0.03	4.43	0.71	0.00	2.11	7.28
KF2S-10	0.72	7.14	402.24	0.04	0.43	410.57
KF2SC-1	3.49	14.92	13.22	0.00	0.13	31.75
KF2SC-2	1.72	15.75	17.99	0.00	0.06	35.52
KF2SC-3	0.29	8.68	18.78	0.00	0.60	28.35
KF2SC-4	1.32	2.75	48.72	0.00	0.44	53.23
KF2SC-5	0.02	25.14	12.11	0.00	0.03	37.31
KF2SC-6	1.90	7.02	8.25	0.00	0.50	17.68
KF2SC-8	17.13	14.63	43.93	0.00	0.12	75.80
KF2SC-9	1.94	23.41	10.55	0.00	0.41	36.31
KF2SC-10	0.00	20.07	0.54	0.00	0.36	20.98
KF2SC-11	0.00	15.22	7.86	0.00	0.43	23.51
KF2SC-12	0.00	7.11	8.23	0.00	0.90	16.24
KF2SC-14	0.00	26.82	5.32	0.00	0.19	32.34
KF2SC-15	0.03	5.89	12.04	0.00	0.22	18.18
KF2SC-18	0.20	6.72	14.42	0.00	0.14	21.48
KF2SC-19	0.15	30.00	52.80	0.00	0.98	83.93
KF2SC-20	0.10	19.51	28.85	0.00	0.03	48.49
KF2SC-21	0.06	10.27	38.25	0.00	0.32	48.90
KF2SC-22	0.02	16.80	6.43	0.00	0.06	23.30

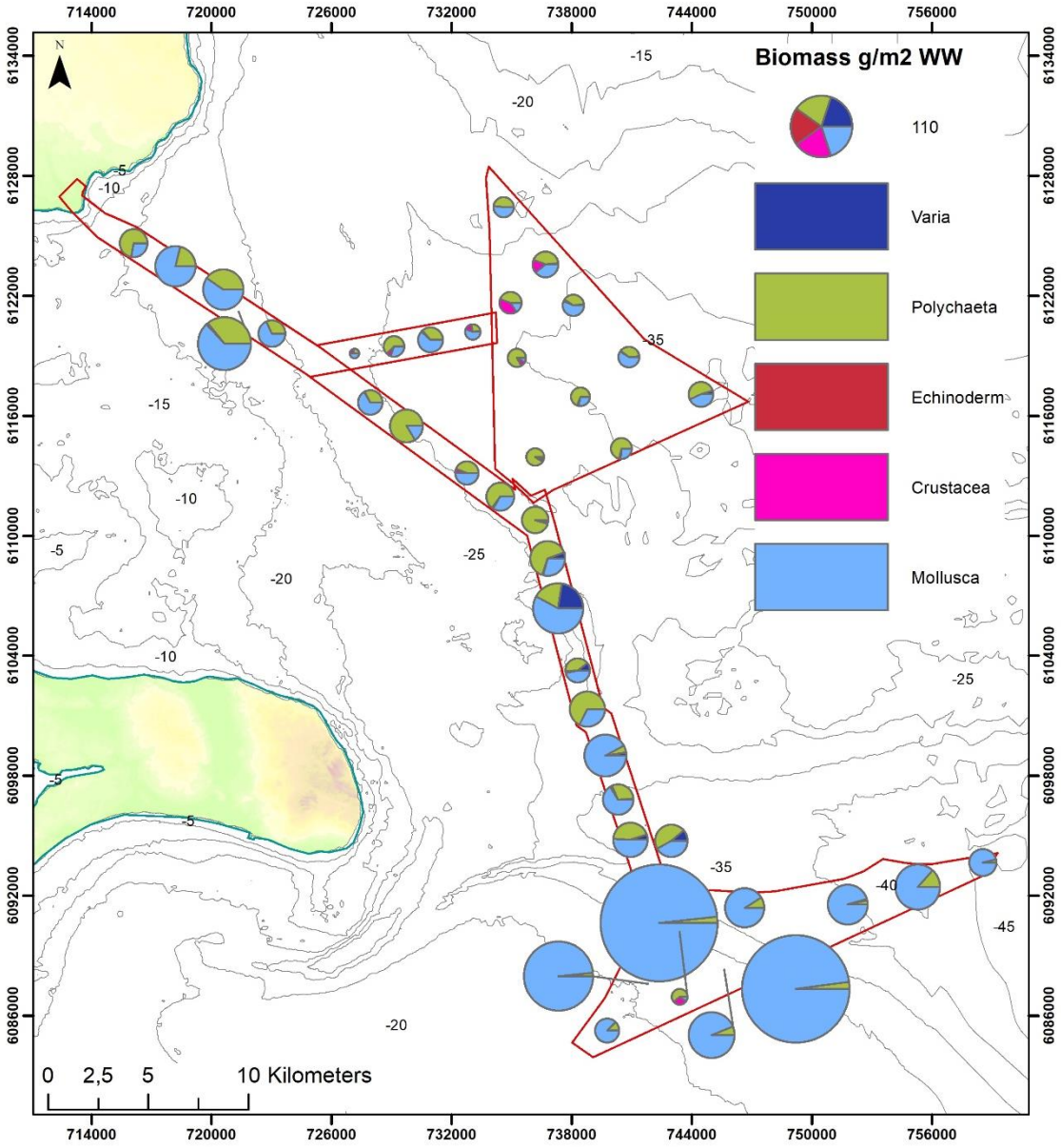


Figure 5-18 *Map showing biomass registrations at Kriegers Flak II North and South OWF and ECC. Pie charts show relative contribution to the total biomass from different taxonomical groups. Size of each cake diagram corresponds to total biomass at each station. Note the relatively big contribution molluscs (blue mussel) has on total biomass in Kriegers Flak II south.*

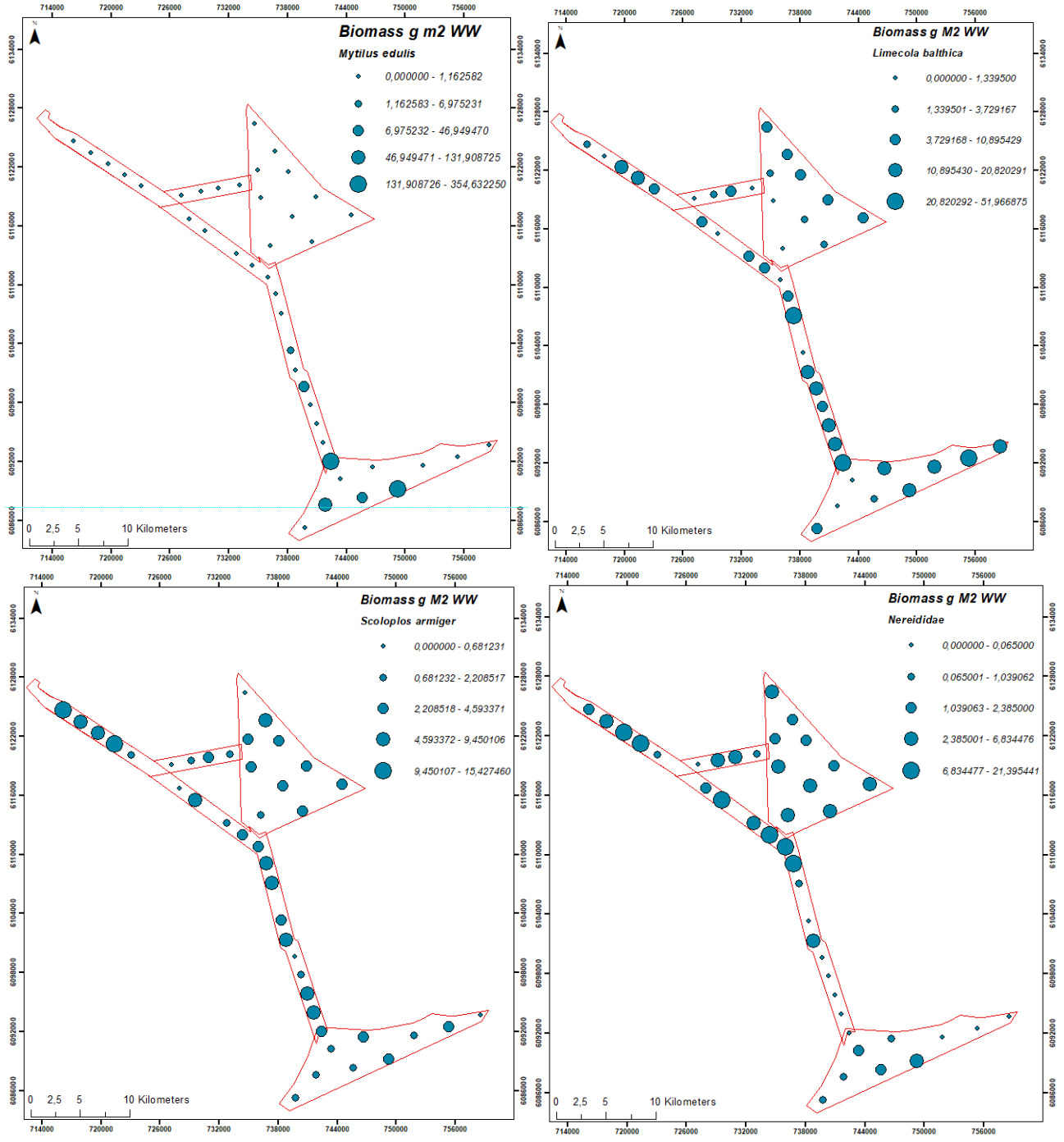


Figure 5-19 *Map showing biomass measurements of selected species contributing most to the biomass at Kriegers Flak II North and South OWF and ECC.*

6 CONCLUSIONS

The survey area includes the planned Kriegers Flak II North and South OWF area at depths of 10-50 meters and the 48 km long ECC making landfall near Rødvig. The fieldwork was carried out in April 2024 and involved sediment sampling, visual mapping with ROVs, and hydrography measurements. An additional nearshore sampling was performed in June 2024.

Analyses of the sediment samples from the planned Kriegers Flak II North and South OWF area were characterized by a mixture of sand and silt, with clay present in the deeper layers also, with some rocks and black patches in the sediment on one station. The CTD profiles show the variation in salinity, temperature and oxygen vertically in the water column from the sea surface to approximately 1 meter above the sea bottom.

A total of 44 stations were sampled for infauna analyses, with a total of 34165 individuals distributed among 63 different taxa were recorded (juveniles excluded). The benthic infauna was dominated by polychaetes, with the highest diversity recorded at deeper stations. The fauna composition indicates healthy communities with a mix of filter feeders, suspension feeders, and carnivores.

A total of 19 km of seabed in the planned Kriegers Flak II North and South OWF areas and ECCs was surveyed by use of ROV. A total of 49 species of benthic megafauna and macroalgae were registered at the planned Kriegers Flak II North and South OWF areas and ECC, in addition, 16 fish species were encountered during the survey. The invasive fish, Round goby (*Neogobius melanostomus*) was registered in transects from Kriegers Flak II North and in the main ECC to shore. Apart from Round goby, no macrofauna or macroalgae species considered as alien species to Danish waters were registered in the visual surveys.

WSP has modelled substrate types in the planned Kriegers Flak II OWF and ECC areas according to the Danish classification system. Identified infauna communities registered are mud/silt, sand, mixed substrate with 1-10% rocky bottom, mixed substrate 10-25% rocks and stony reef more than 25% rocks

The biomass measurements from samples retrieved at the planned Kriegers Flak OWF and ECC areas. Mollusca contributed most to the biomass in some stations, but echinoderms also ranked high in total biomass in several stations. Phoronids that were also commonly dominating the fauna occurrences numerically were also among the top five species contributing to the overall biomass.

Mollusca contributed most to the biomass in some stations, particularly in Kriegers Flak II South where blue mussels accounted for most of the biomass. Polychaeta attributed to much of the biomass in shallower stations. Echinoderms were practically absent from all stations.

REFERENCES

Axe, P., & Lindow, H. (2005). *Hydrographic Conditions Around Offshore Banks*. SMHI.

Berg T., Fürhaupter K., Wilken H., Meyer T., 2015. Kriegers Flak Offshore Wind Farm. Benthic Flora, Fauna and Habitats EIA - Technical Report June 2015. The report is prepared by MariLim in collaboration with NIRAS. https://ens.dk/ansvarsomraader/vindmoeller-paa-hav/etablerede-havvindmoelleparker

Cowi, 2022a. Opdatering af dele af finscreeningen fra 2020 samt finscreeningen af nyt havareal til etablering af havvindmølleparker. 1-0 finscreening av havarealer til etablering af nye havmølleparker med direkte forbindelse til land. Udgivelsesdato 18-02-2022.

Cowi, 2022b. Opdatering af dele af finscreeningen fra 2020 samt finscreeningen af nyt havareal til etablering af havvindmølleparker.1-2 Miljø- og planmæssige forhold for Nordsjøen 1, Hesselø, Kattegat 2 og Kriegers Flak 2. Doc.no. A235631-1-2. Date: 21-01-2022. A132994-1-1 Miljø-og planmæssige forhold for Nordsøen I, Hesselø og Kriegers Flak II (ens.dk)

DNV, 2023. Benthic Ecology – Scope report. DNV report 2023-4108, Rev 0

DNV. 2024a. WP B Phase 2 Benthic Ecology, Fieldwork. Scope Of Work. DNV report 2024-3061.

DNV. 2024b. WP B Phase 2 Benthic Ecology, Cruise report. DNV report nr: 2024-3061. Rev. 1.

Energistyrelsen og Naturstyrelsen, 2015. Kriegers Flak Havmøllepark. VVM redegørelse. Del 3 Det marine miljø.

EnergiNet, 2015. Kriegers Flak Offshore Wind Farm Technical Project Description for the large-scale offshore wind farm (600 MW) at Kriegers Flak.

European Environment Agency (EEA), 2024. Oxygen concentrations in Europe's coastal and marine waters. Retrieved from https://www.eea.europa.eu/en/analysis/indicators/oxygen-concentrations-in-coastal-and?activeAccordion=546a7c35-9188-4d23-94ee-005d97c26f2b&_sm_au_=iVVJZSP04ZSLL4tQ [09.09.2024].

GEUS, 2018. GEUS kort over havbundssedimenter. http://data.geus.dk/geusmap.

GEUS, 2023. Mapdata downloaded from: Geus webshop

Hansen J.W. & Høgslund S., 2023. Marine områder 2021. NOVANA. Aarhus Universitet, DCE – Nationalt Center for Miljø og Energi, 220 s. - Videnskabelig rapport fra DCE nr. 529. http://dce2.au.dk/pub/SR529.pdf.

HELCOM. 2017. The integrated assessment of hazardous substances: Supplementary report, first version. Retrieved from http://stateofthebalticsea.helcom.fi/wp-content/uploads/2017/07/HELCOM_The_integrated_assessment_of_hazardous_substances_supplementary_report_first_version_2017.pdf

Jensen, K.R.; Andersen, P.; Andersen, N.R.; Bruhn, A.; Buur, H.; Carl, H.; Jakobsen, H.; Jaspers, C.; Lundgreen, K.; Nielsen, R.; et al. 2023. Reviewing Introduction Histories, Pathways, Invasiveness, and Impact of Non-Indigenous Species in Danish Marine Waters. Diversity 2023, 15, 434. https://doi.org/10.3390/d15030434

Joint Nature Conservation Committee, JNCC - Adviser to Government on Nature Conservation (sacfor.pdf).

Levin L, Ekau W, Gooday AJ, et al (2009) Effects of natural and human-induced hypoxia on coastal benthos. Biogeosciences 2063–2098. https://doi.org/10.5194/bgd-6-3563-2009.

Meier, H. E. M., Eilola, K., Almroth-Rosell, E., et al. (2019). Disentangling the impact of nutrient load and climate changes on Baltic Sea hypoxia and eutrophication since 1850. Climate Dynamics, 53, 1145–1166. https://doi.org/10.1007/s00382-018-4296-y

Miljøstyrelsen. 2008. "Klapvejledningen" - Vejledning fra By- og Landskabsstyrelsen, Dumpning af optaget havbundsmateriale – klapning. https://naturstyrelsen.dk/media/nst/Attachments/Klapvejledning.pdf.

Miljøstyrelsen, 2017. NOVANA Det nationale overvågningsprogram for vandmiljø og natur 2017-21 Programbeskrivelse

Miljøstyrelsen, 2022. GAP-analyse af behov for supplerende biologiske data i de overordnende habitattyper. Project no.: 3622100230 Miljøstyrelsen. Date: 30-05-2022.

Miljøstyrelsen. Kvalitetskriterier for miljøfarlige forurenende stoffer i vandmiljøet. Retrieved from https://mst.dk/erhverv/sikker-kemi/kemikalier/graensevaerdier-og-kvalitetskriterier/kvalitetskriterier-for-miljoefarlige-forurenende-stoffer-i-vandmiljoeet [10.17.2024]

Naturstyrelsen, 2014. Marin habitatkortlægning i de indre danske farvande 2014. Naturstyrelsen.

Niras & MariLim, 2015. Kriegers Flak Offshore Wind Farm Benthic Flora, Fauna and Habitats EIA - Technical Report June 2015.

OSPAR. 2009. Background Document for Ocean quahog Arctica islandica.

OSPAR 2010. Background document for Deep Sea Sponge Aggregations. OSPAR Commision biodiversity series Publication Number: 485/2010.

OSPAR Commission. 2021. Agreement on CEMP assessment criteria. Retrieved from https://www.ospar.org/documents?v=46271 [10.17.2024]

Piehl, S., Friedland, R., Heyden, B. Leujak, W., Neumann, T. & Schernewski, G. Modeling of Water Quality Indicators in the Western Baltic Sea: Seasonal Oxygen Deficiency. *Environ Model Assess* **28**, 429–446 (2023). https://doi.org/10.1007/s10666-022-09866-x

Vejdirektoratet, 2017. Ansøgning om indvindingstilladelse på Kriegers Flak

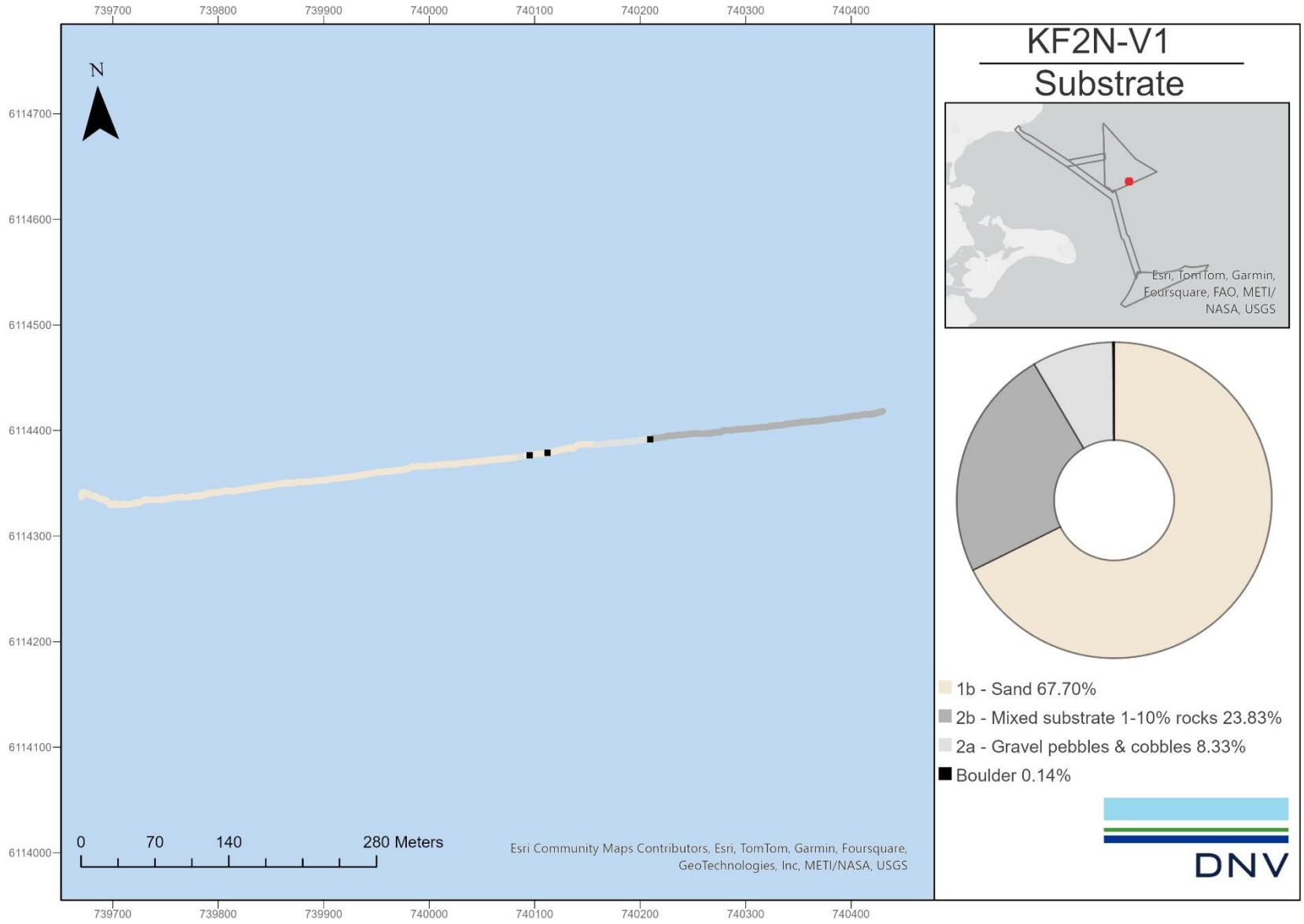
WSP. 2022. The Danish Substrate Classification Method. Report to Offshore Windmill Farm pre-investigations. Rev. 1

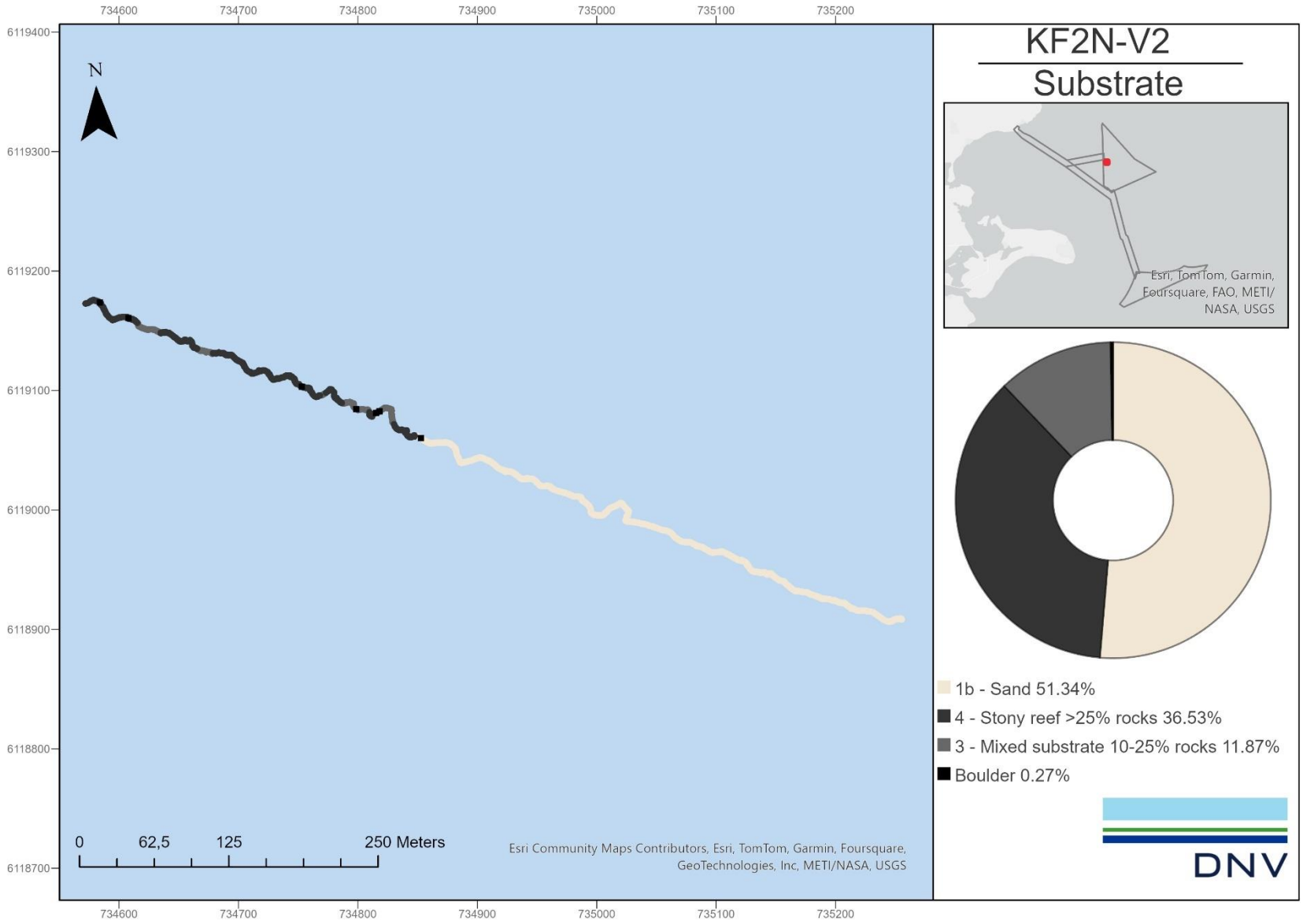
WSP. 2023. Energy Islands Bornholm. Technical report – sediment, benhic flora and fauna. WSP project 3622100110 for Energinet.

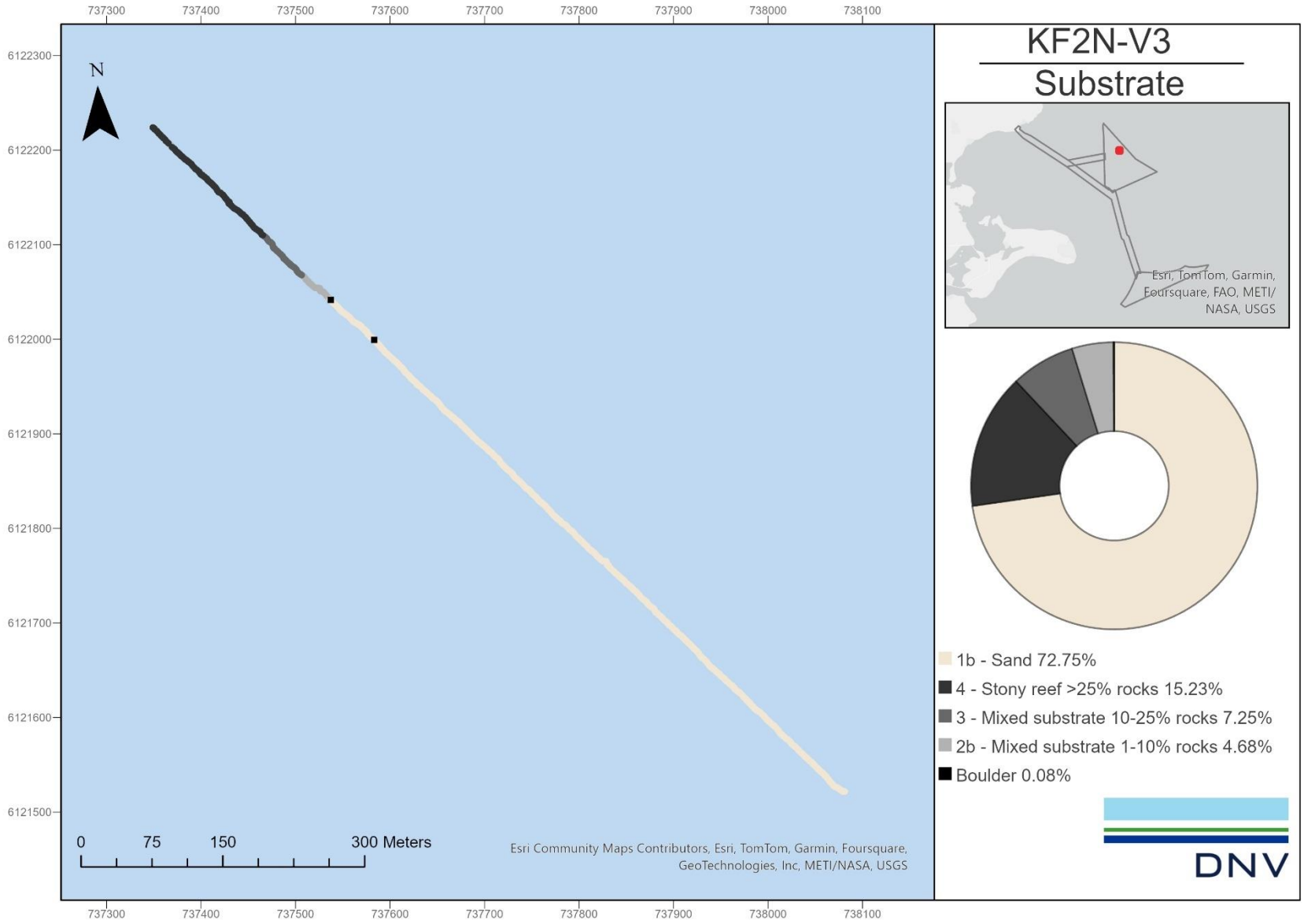
APPENDIX 1 STATION LOG, SEDIMENT SAMPLING

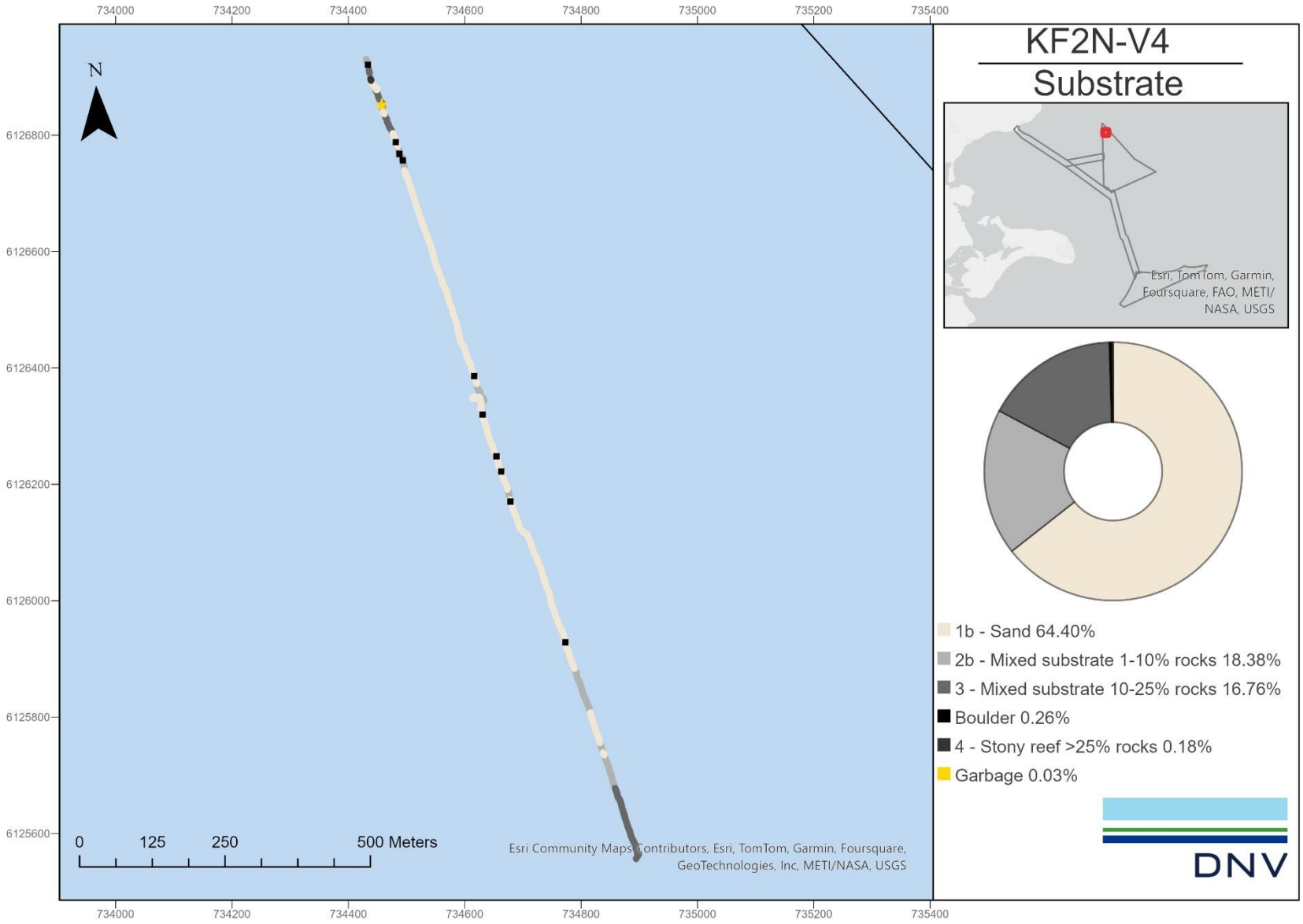
ETRS 89 UTM 32N				Deviation from program: samples not taken due to rocks																				
*Shallow water stations			#														Chemistry		Bio					
	East	North	st.	CTD	Bio	Grain	TOC	Metal	PAH	Phthalates	Phenols	Depth	Date	Start	Stop	Time	Blend sample	#1	#2	#3	#4	GrabbID	Misses	Description	Comments
Kriegers Flak II North																									
KF2N-1	736167	6113945	1		4	1	1	1	1	1	1	30	06.apr	06:38	07:01	00:23	x	12	11	13	10	B25	0	Grey brown soft clay	
KF2N-2	740486	6114367	1		4	1	1					31	06.apr	05:47	06:13	00:26	x	12	11	12	12	B25	0	Brown top sandy clay	
KF2N-3	744459	6117082	1		4	1	1	1	1	1	1	36	06.apr	04:46	05:20	00:34	x	20	13	14	15	B25	0	Brown top soft silty clay	
KF2N-4	738437	6116956	1	1	4	1	1					31	06.apr	02:42	03:21	00:39	x	14	14	14	14	B25	0	Brown top, sandy clay	
KF2N-5	740854	6118938	1		4	1	1	1	1	1	1	34	06.apr	03:43	04:17	00:34	x	12	12	11	11	B25	0	Brown top, sandy clay	
KF2N-6	735255	6118901	1		4	1	1					31	06.apr	01:42	02:16	00:34	x	13	17	11	14	B25	2	Brown top dark brown silty clay	
KF2N-7	738077	6121522	1		4	1	1	1	1	1	1	32	06.apr	00:40	01:14	00:34	x	10	9	9	6	B25	2	Brown top , grey sandy clay	
KF2N-8	734942	6121653	1		4	1	1					24	05.apr	21:44	22:03	00:19	x	13	8	11	10	B25	0	Grey brown silty clay	Rocks and black patches
KF2N-9	736690	6123579	1		4	1	1	1	1	1	1	31	05.apr	23:37	00:14	00:39	x	12	8	11	11	B25	4	Grey brown soft clay	
KF2N-10	734598	6126441	1	1	4	1	1					26	05.apr	22:40	23:05	00:25	x	9	9	7	10	B25	0	Grey brown silty clay	
			10	**2**	**40**	**10**	**10**	**5**	**5**	**5**	**5**														
Kriegers Flak II North Corridor																									
KF2NC-1	733051	6120198	1		4	1	1	1	1	1	1	28	05.apr	21:08	21:31	00:23	x	8	11	10	12	B25	0	Grey brown sandy clay	
KF2NC-2	730936	6119807	1	1	4	1	1					23	05.apr	20:23	20:50	00:27	x	12	13	12	12	B25	0	Grey brown silty clay	
KF2NC-3	729120	6119479	1		4	1	1	1	1	1	1	27	05.apr	19:45	20:08	00:23	x	12	12	14	12	B25	0	Grey brown silt	
KF2NC-4	727135	6119117	1		4	1	1					25	05.apr	18:55	19:20	00:25	x	10	10	9	12	B25	0	Grey brown sand	
			4	**1**	**16**	**4**	**4**	**2**	**2**	**2**	**2**														
Kriegers Flak II South																									
KF2S-1	739767	6085266	1		4	1	1					21	05.apr	01:40	02:14	00:34	x	8	7	8	7	B25	0	Olive brown fine sand	
KF2S-2	741811	6087595	1	1	4	1	1					22	04.apr	23:50	01:14	00:24	x	7	6	7	8	B25	0	Olive brown fine sand	
KF2S-3	745630	6088312	1		4	1	1	1	1	1	1	23	04.apr	23:05	23:29	00:24	x	7	8	8	7	B25	0	Olive brown fine sand	
KF2S-4	749205	6089178	1		4	1	1					33	04.apr	22:22	22:45	00:23	x	11	10	11	8	B25	0	Grey brown silty clay	Blue mussels
KF2S-5	751789	6091569	1	1	4	1	1	1	1	1	1	36	04.apr	21:28	22:00	00:32	x	8	8	7	5	B25	0	Olive brown sandy	
KF2S-6	755291	6092437	1		4	1	1					42	04.apr	20:30	21:04	00:34	x	15	15	17	16	B25	1	Greybrown sandy clay	
KF2S-7	758548	6093662	1		4	1	1	1	1	1	1	44	04.apr	19:00	20:00	01:00	x	23	20	16	22	B25	0	Grey/black soft clay	H2S smell
KF2S-8	746626	6091397	1		4	1	1					35	05.apr	03:02	03:41	00:39	x	8	9	12	12	B25	0	Brown top dark grey silty clay	
KF2S-9	743390	6090213	1		4	1	1	1	1	1	1	26	05.apr	04:05	04:37	00:32	x	7	9	9	7	B25	0	Olive brown, sandy	
KF2S-10	742365	6091949	1		4	1	1	1	1	1	1	31	04.apr	04:57	05:28	00:31	x	8	9	8	7	B25	0	Olive top, grey bottom, Sand	
			10	**2**	**40**	**10**	**10**	**5**	**5**	**5**	**5**														
Kriegers Flak II South ECC																									
KF2SC-1	741550	6093935	1		4	1	1	1	1	1	1	34	04.apr	13:50	14:20	00:30	x	10	10	11	10	B25	0	Brown top dark grey sandy clay	
KF2SC-2	740925	6095845	1	1	4	1	1					33	04.apr	12:57	13:30	00:33	x	13	12	12	10	B25	0	Brown top dark grey sandy clay	
KF2SC-3	740318	6097733	1		4	1	1	1	1	1	1	31	04.apr	12:13	12:37	00:24	x	8	9	8	10	B25	0	Brown top dark grey sandy clay	
KF2SC-4	739680	6099647	1		4	1	1					30	04.apr	11:29	11:55	00:26	x	5	5	7	5	B25	5	Grey sandy gravel	
KF2SC-5	738776	6101327	1		4	1	1	1	1	1	1	32	04.apr	10:56	11:14	00:18	x	15	13	15	14	B25	0	Grey brown silty clay	
KF2SC-6	738293	6103267	1		4	1	1					29	04.apr	10:11	10:37	00:26	x	7	7	5	5	B25	7	Grey sand / gravel	
KF2SC-7	737810	6105208											04.apr	08:48	09:58	01:10						B25	0		
KF2SC-8	737312	6107089	1	1	4	1	1					29	04.apr	07:40	08:31	00:51	x	14	9	10	9	B25	4	Grey brown sandy soft clay	
KF2SC-9	736788	6109083	1		4	1	1	1	1	1	1	29	04.apr	07:04	07:20	00:16	x	16	15	16	19	B25	0	Grey brown sandy soft clay	
KF2SC-10	736001	6110789	1		4	1	1					30	04.apr	06:26	06:45	00:19	x	14	14	16	20	B25	0	Grey brown clay	
KF2SC-11	734372	6111964	1		4	1	1	1	1	1	1	29	04.apr	05:40	06:08	00:28	x	15	14	15	12	B25	0	Brown top silty clay	
KF2SC-12	732762	6113139	1	1	4	1	1					27	04.apr	03:56	05:30	01:34	x	14	11	14	15	B25	2	Brown top sand/ silty clay	
KF2SC-13	731245	6114253	1			1	1	1	1	1	1	27	04.apr	01:40	02:36	00:56	x	na	na	na	na	B25	12	Olive brown sandy	
KF2SC-14	729532	6115502	1		4	1	1					26	04.apr	00:46	01:15	00:29	x	15	13	16	16	B25	0	Brown top sand/ silty clay	
KF2SC-15	727926	6116677	1		4	1	1	1	1	1	1	24	04.apr	23:49	00:35	00:46	x	6	9	11	12	B25	0	Olive grown fine sand	
KF2SC-16	726203	6117942											04.apr	22:35	23:25	00:50						B25	0		
KF2SC-17	724683	6119013											04.apr	21:35	22:15	00:40						B25	0		
KF2SC-18	723007	6120116	1	1	4	1	1					21	04.apr	20:55	21:15	00:20	x	7	7	6	6	B25	0	Olive brown fine sand	
KF2SC-19	721343	6121207	1		4	1	1	1	1	1	1	20	04.apr	20:21	20:49	00:28	x	12	9	9	10	B25	0	Grey brown sandy soft clay	
KF2SC-20	719650	6122317	1		4	1	1					20	04.apr	19:51	20:06	00:15	x	7	6	10	9	B25	0	Black/grey soft clay	
KF2SC-21	717885	6123475	1		4	1	1	1	1	1	1	18	04.apr	19:19	19:34	00:15	x	7	7	5	6	B25	0	Grey brown silty sand	
KF2SC-22	716099	6124637	1	1	4	1	1					17	04.apr	18:43	19:04	00:21	x	6	6	6	6	B25	0	Olive brown fine sand	
KF2SC-23*	714585	6125526	1			1	1	1	1	1	1	13	19.jun	10:50	11:16	00:26	x					mini		Fine sand	
KF2SC-24*	713963	6126323																							
			20	**5**	**72**	**20**	**20**	**10**	**10**	**10**	**10**														
Sum analyses																									
			44	**10**	**168**	**44**	**44**	**22**	**22**	**22**	**22**														

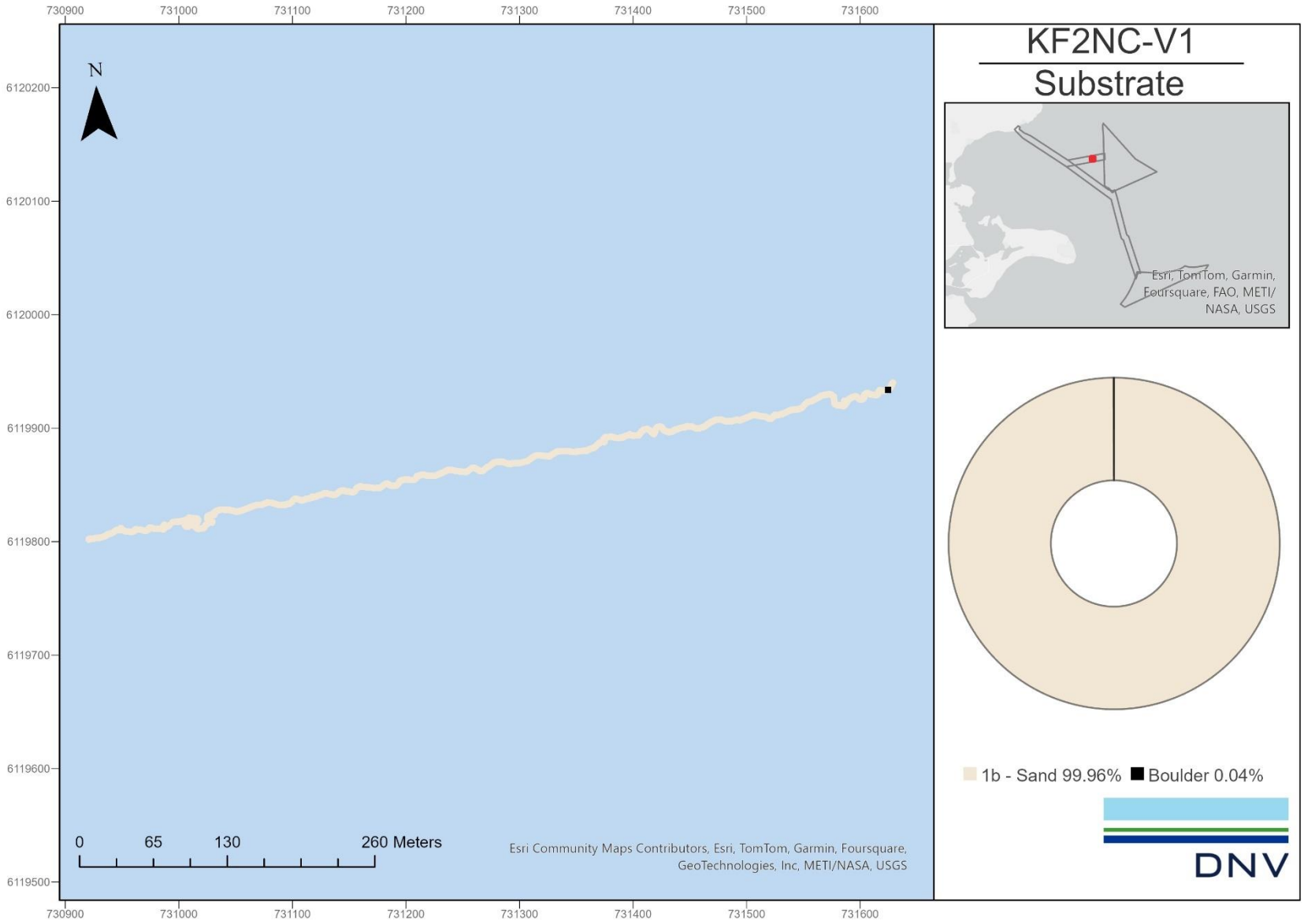
APPENDIX 2 MAPS OF SUBSTRATE REGISTRATIONS IN VISUAL SURVEY TRANSECTS

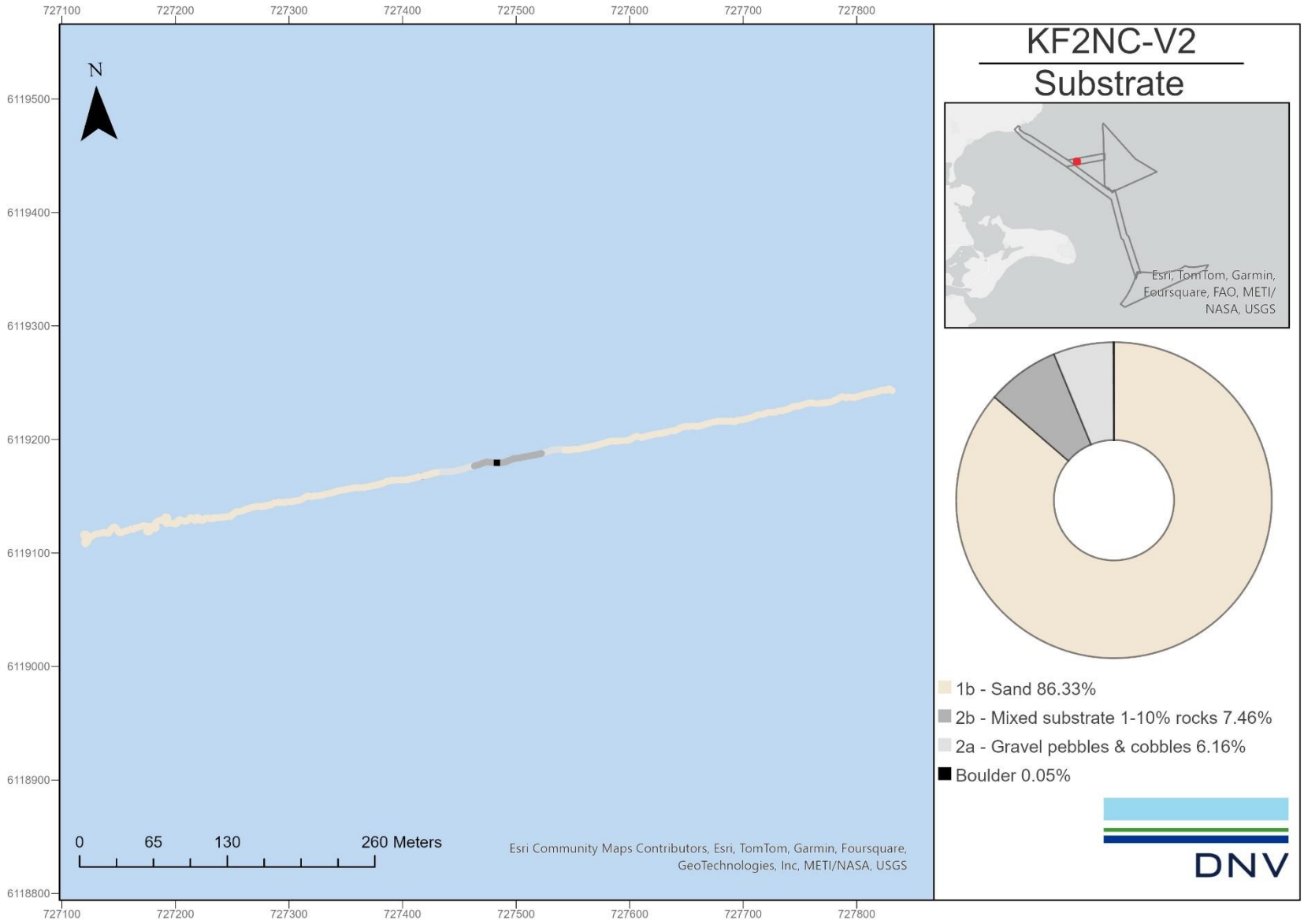

739700
739800
739900
740000
740100
740200
740300
740400
N
6114700
6114600
6114500
6114400
6114300
6114200
6114100
6114000
0
70
140
280 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2N-V1
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
1b - Sand 67.70%
2b - Mixed substrate 1-10% rocks 23.83%
2a - Gravel pebbles & cobbles 8.33%
Boulder 0.14%
DNV

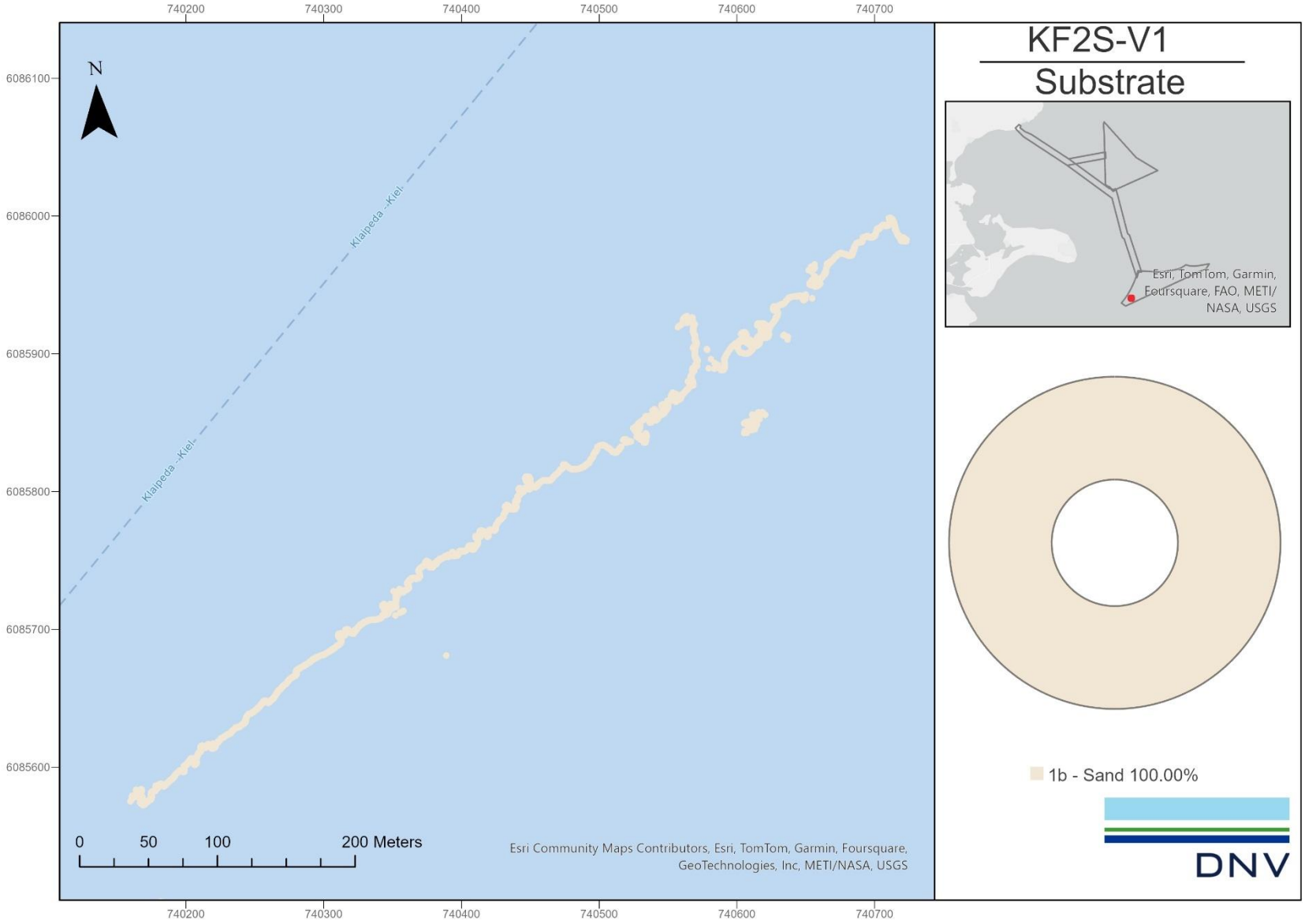

734600
734700
734800
734900
735000
735100
735200
6119400
6119300
6119200
6119100
6119000
6118900
6118800
6118700
N
0
62,5
125
250 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2N-V2
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
1b - Sand 51.34%
4 - Stony reef >25% rocks 36.53%
3 - Mixed substrate 10-25% rocks 11.87%
Boulder 0.27%
DNV

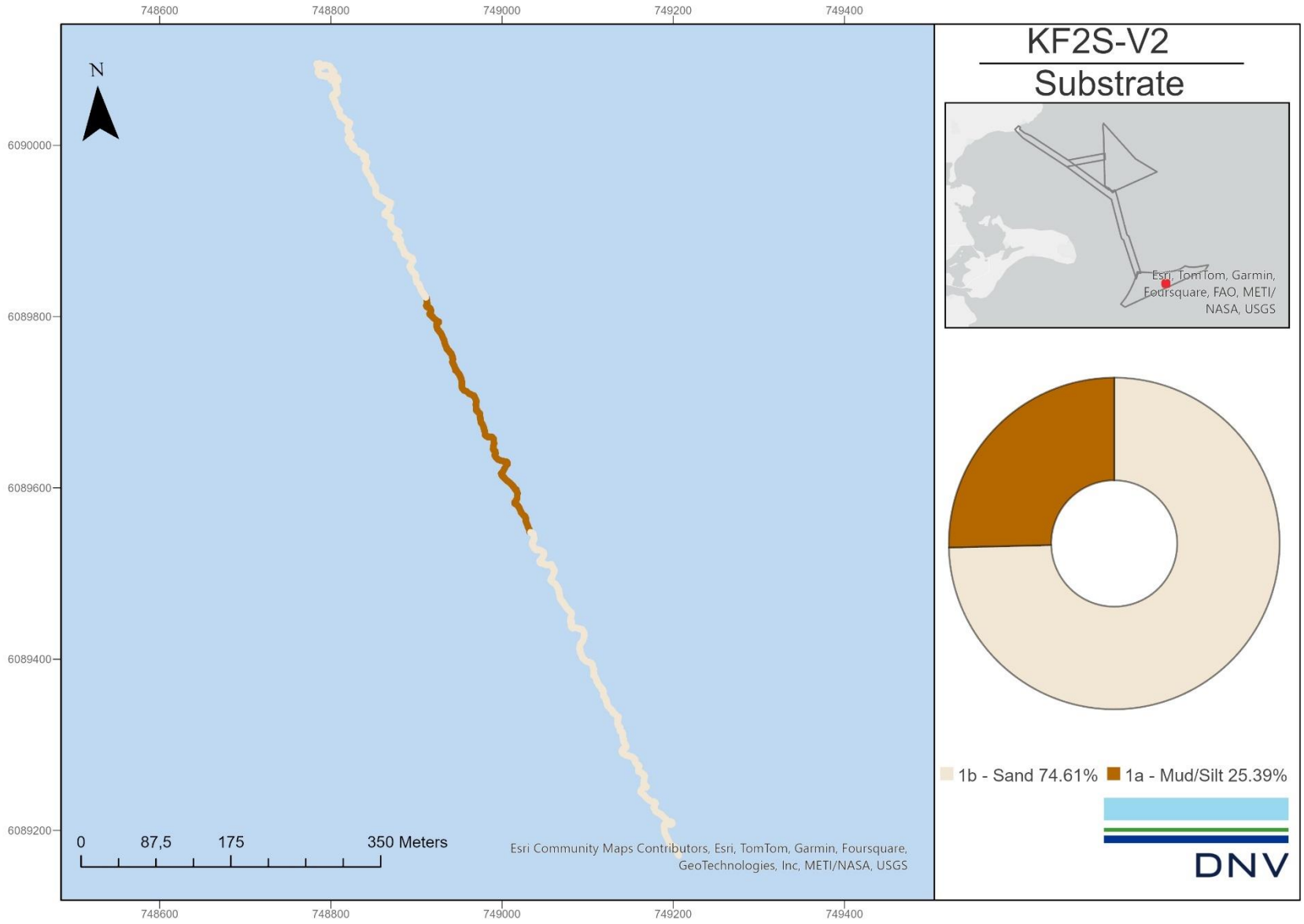

737300
737400
737500
737600
737700
737800
737900
738000
738100
6122300
6122200
6122100
6122000
6121900
6121800
6121700
6121600
6121500
N
0
75
150
300 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2N-V3
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
1b - Sand 72.75%
4 - Stony reef >25% rocks 15.23%
3 - Mixed substrate 10-25% rocks 7.25%
2b - Mixed substrate 1-10% rocks 4.68%
Boulder 0.08%
DNV

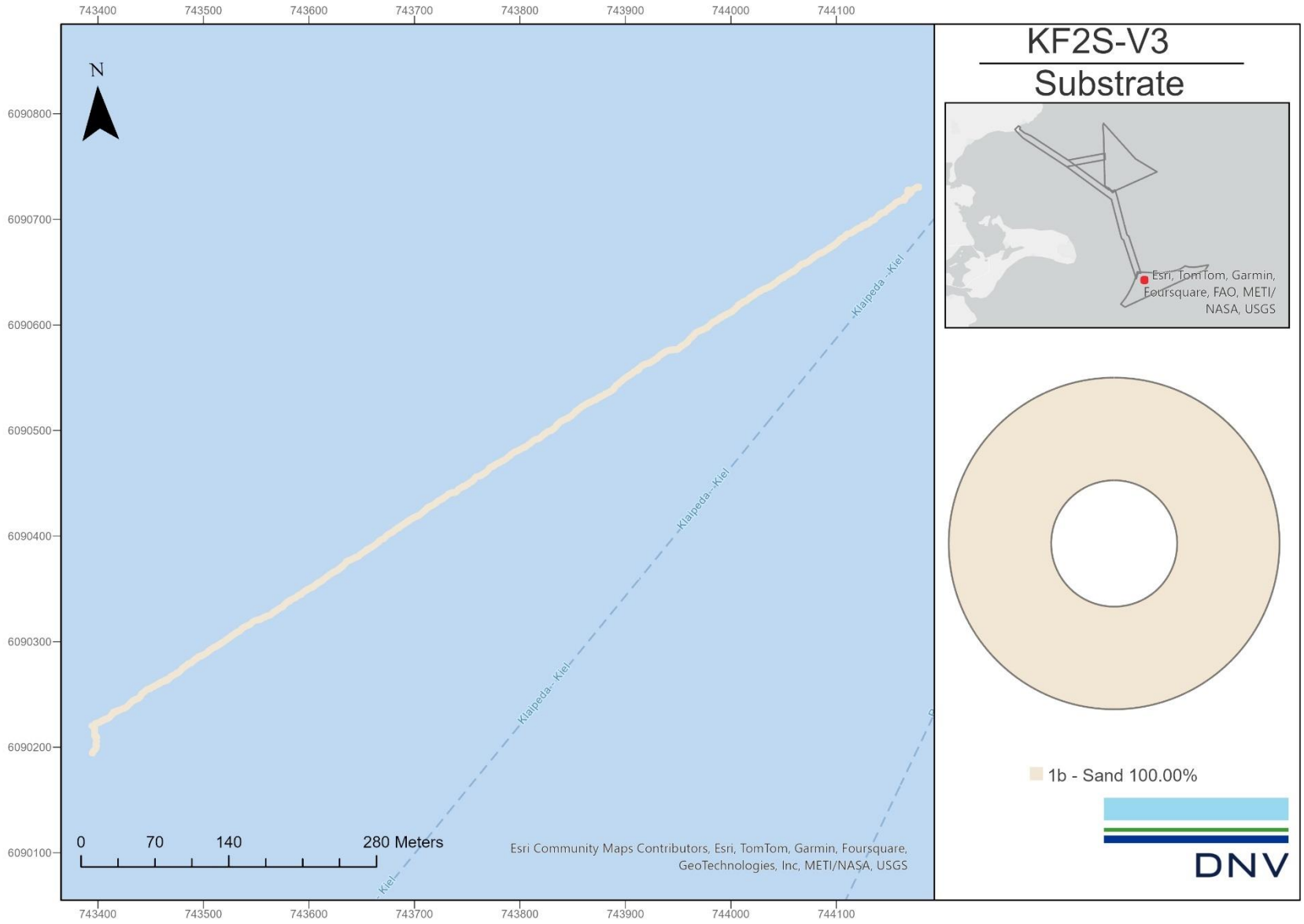

734000
734200
734400
734600
734800
735000
735200
735400
N
6126800
6126600
6126400
6126200
6126000
6125800
6125600
0
125
250
500 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2N-V4
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
1b - Sand 64.40%
2b - Mixed substrate 1-10% rocks 18.38%
3 - Mixed substrate 10-25% rocks 16.76%
Boulder 0.26%
4 - Stony reef >25% rocks 0.18%
Garbage 0.03%
DNV

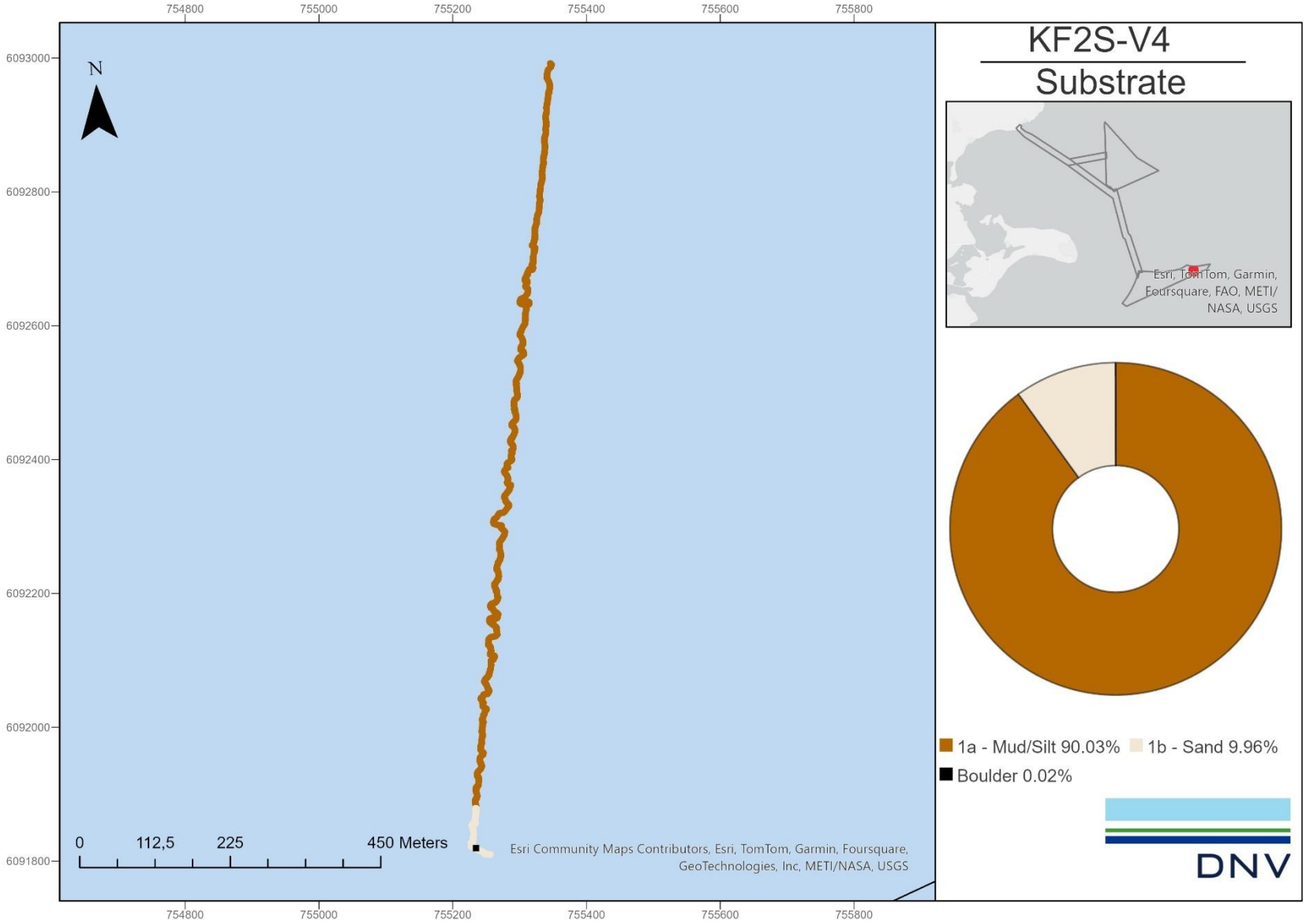

730900
731000
731100
731200
731300
731400
731500
731600
6120200
6120100
6120000
6119900
6119800
6119700
6119600
6119500
N
0
65
130
260 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2NC-V1
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
1b - Sand 99.96%
Boulder 0.04%
DNV

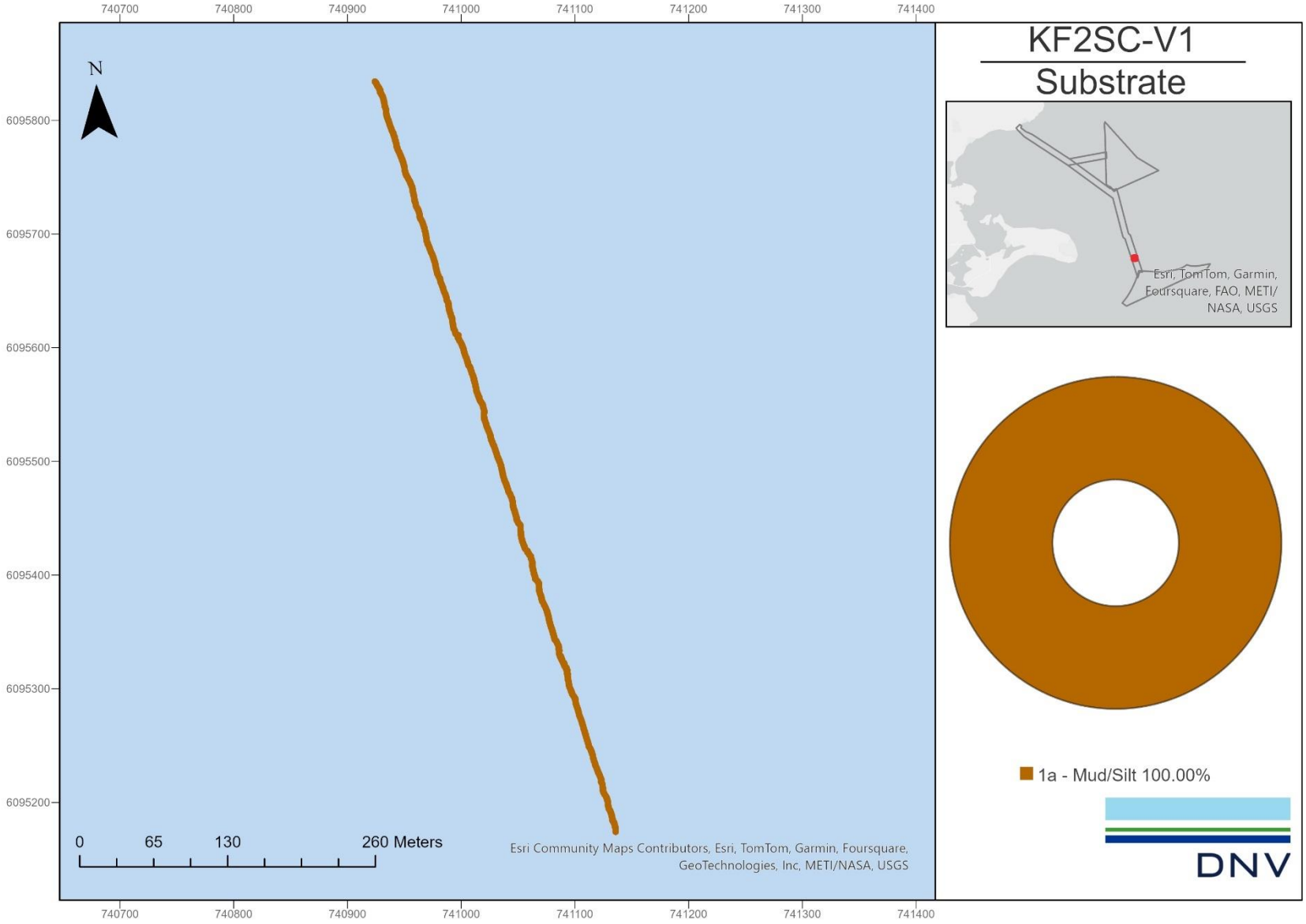

727100
727200
727300
727400
727500
727600
727700
727800
6119500
6119400
6119300
6119200
6119100
6119000
6118900
6118800
N
0
65
130
260 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2NC-V2
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
1b - Sand 86.33%
2b - Mixed substrate 1-10% rocks 7.46%
2a - Gravel pebbles & cobbles 6.16%
Boulder 0.05%
DNV

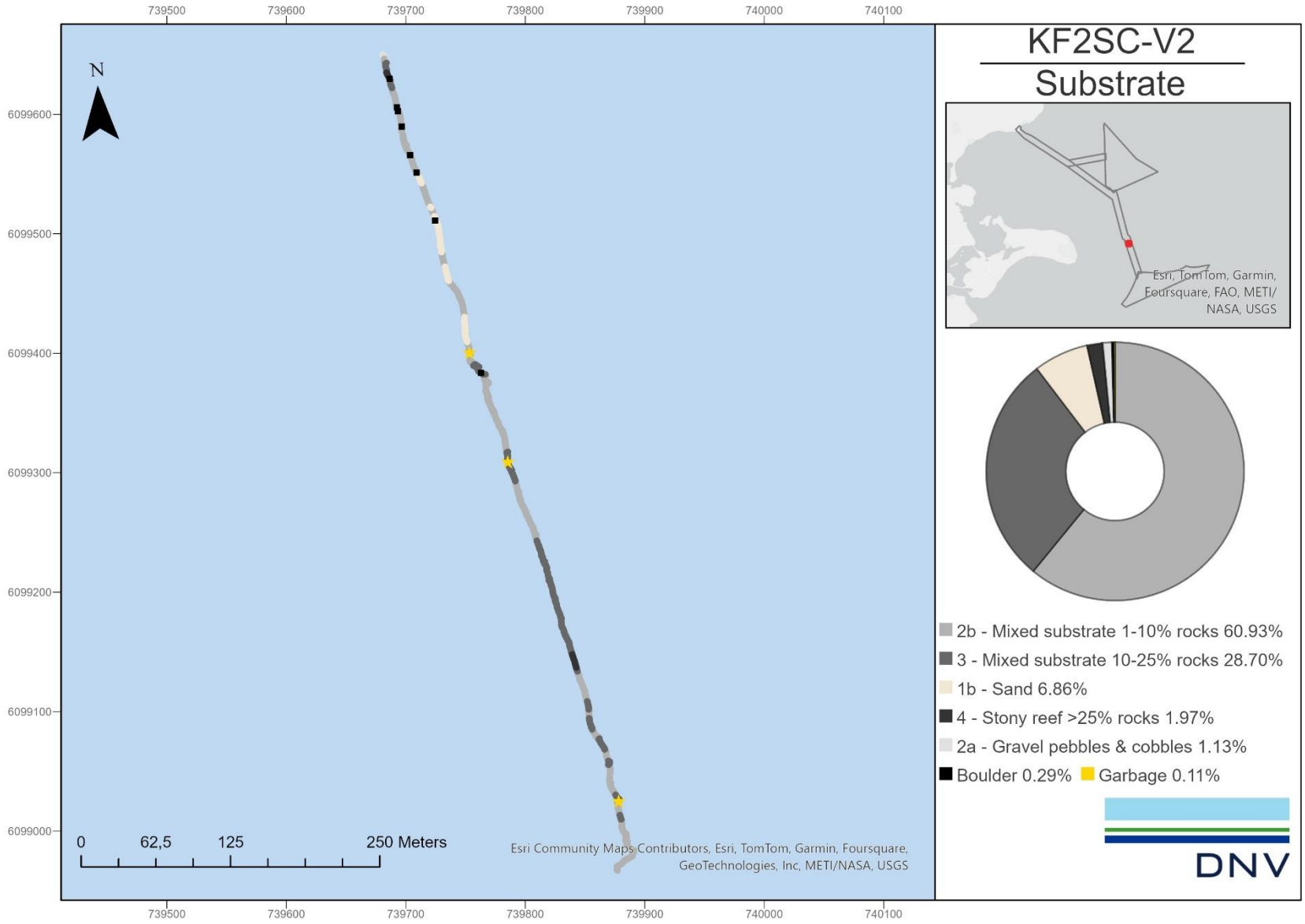

740200
740300
740400
740500
740600
740700
6086100
6086000
6085900
6085800
6085700
6085600
N
Klaipeda - Kiel
Klaipeda - Kiel
0
50
100
200 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2S-V1
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
1b - Sand 100.00%
DNV

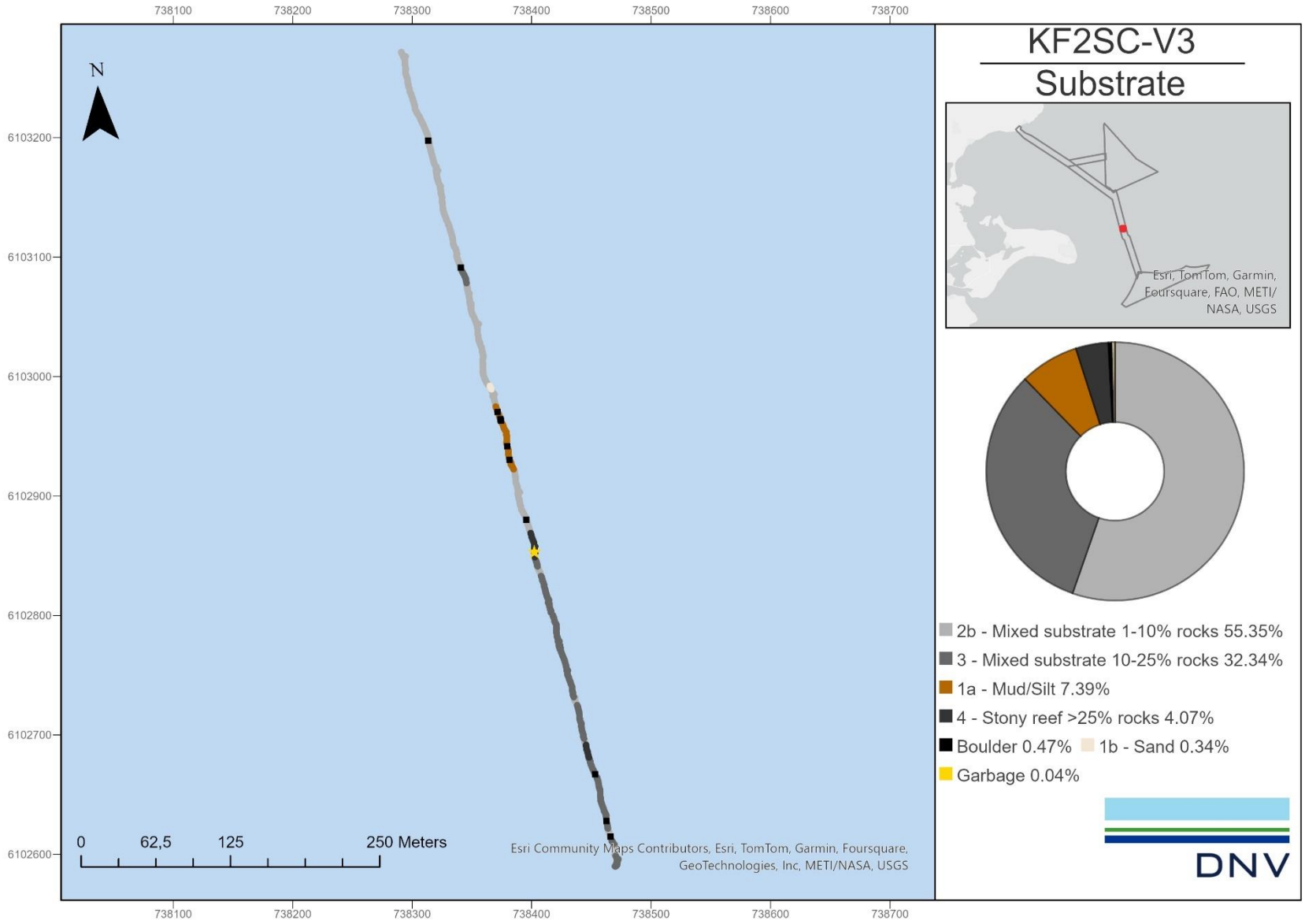

748600
748800
749000
749200
749400
N
6090000
6089800
6089600
6089400
6089200
0
87,5
175
350 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2S-V2
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
1b - Sand 74.61%
1a - Mud/Silt 25.39%
DNV

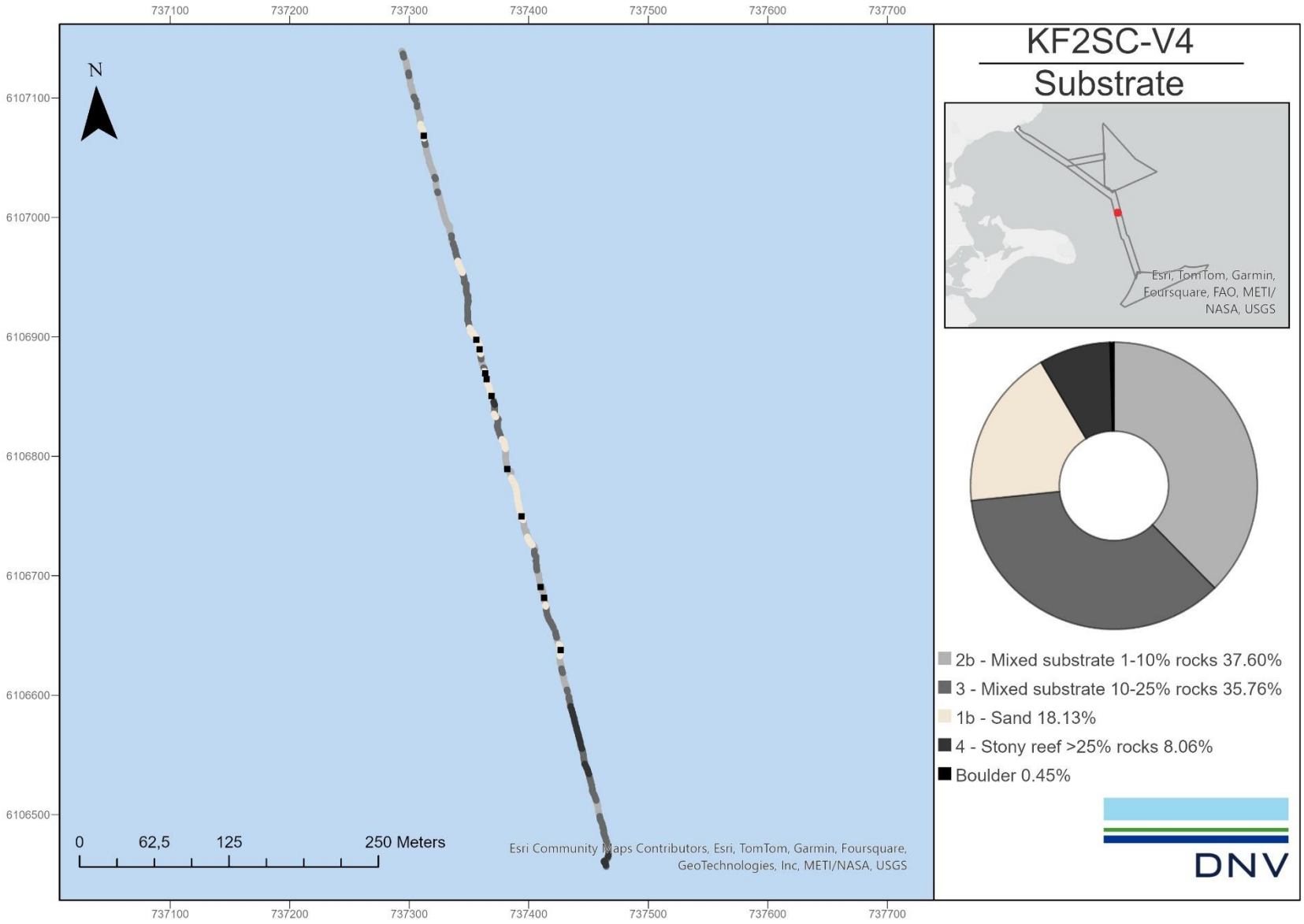

743400
743500
743600
743700
743800
743900
744000
744100
6090800
6090700
6090600
6090500
6090400
6090300
6090200
6090100
N
Klaipeda - Kiel
Klaipeda - Kiel
Klaipeda - Kiel
0
70
140
280 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2S-V3
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
1b - Sand 100.00%
DNV

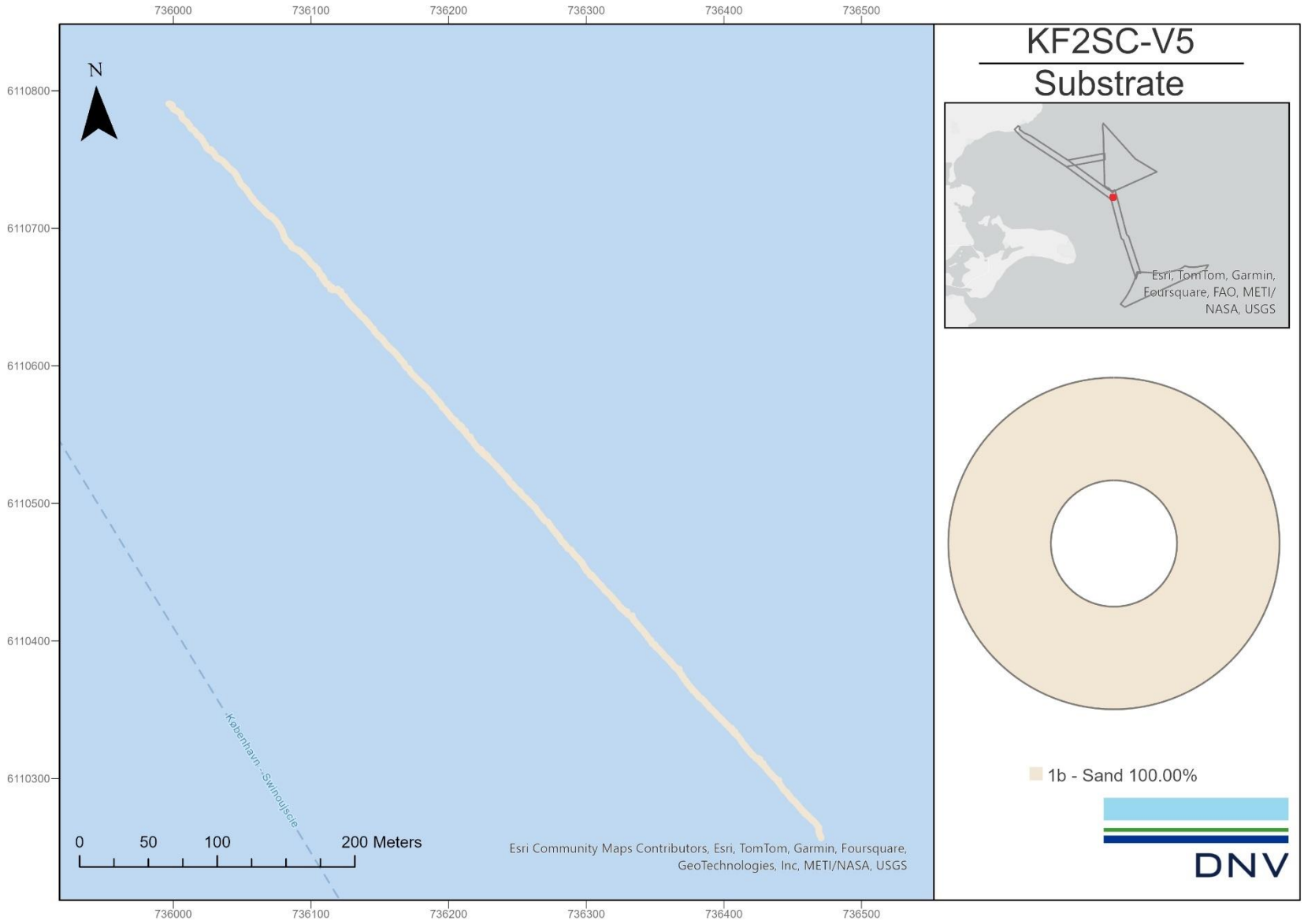

754800
755000
755200
755400
755600
755800
6093000
6092800
6092600
6092400
6092200
6092000
6091800
N
0
112,5
225
450 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2S-V4
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
1a - Mud/Silt 90.03%
1b - Sand 9.96%
Boulder 0.02%
DNV

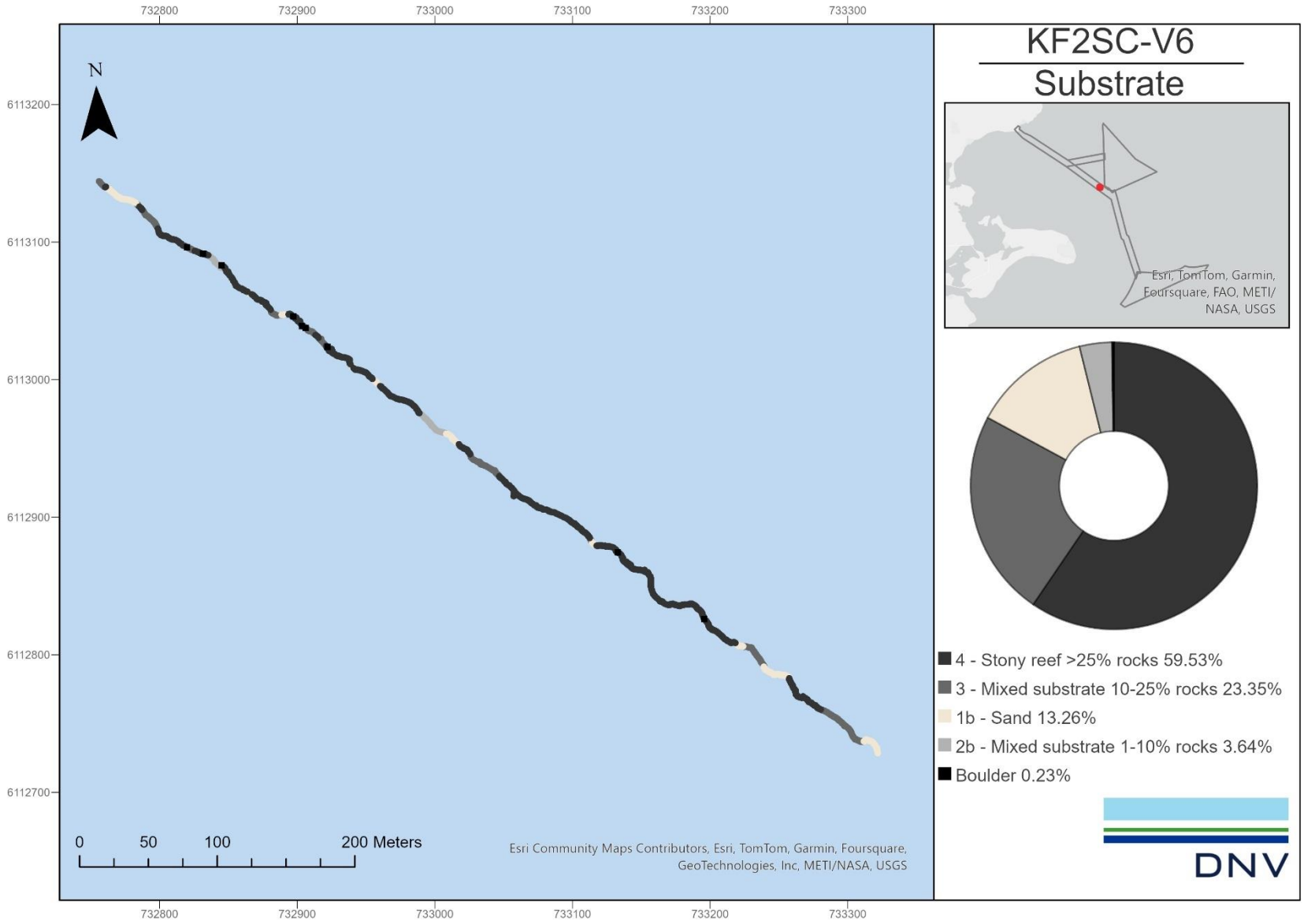

740700
740800
740900
741000
741100
741200
741300
741400
6095800
6095700
6095600
6095500
6095400
6095300
6095200
N
0
65
130
260 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V1
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
1a - Mud/Silt 100.00%
DNV

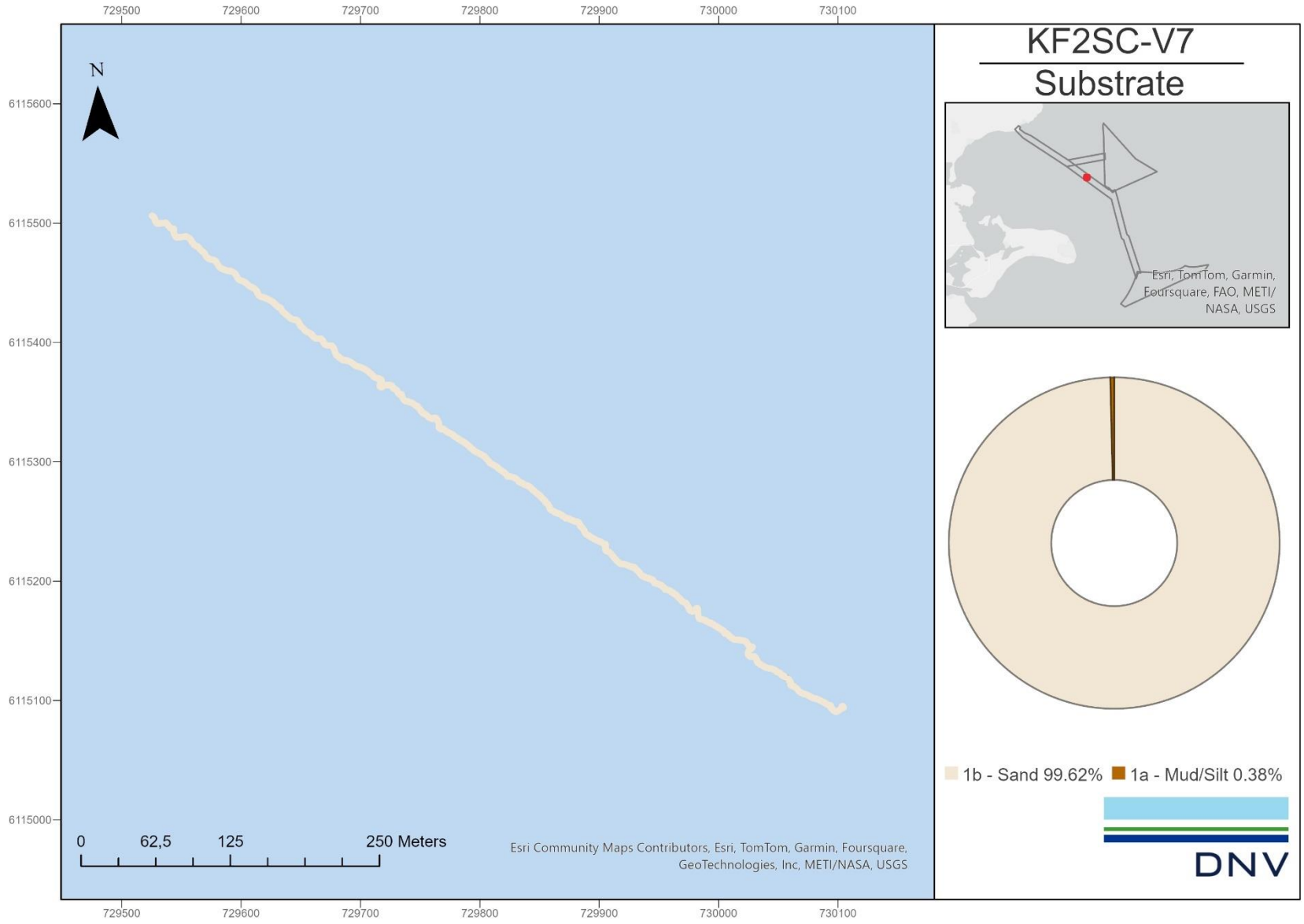

739500
739600
739700
739800
739900
740000
740100
6099600
6099500
6099400
6099300
6099200
6099100
6099000
N
0
62,5
125
250 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V2
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
2b - Mixed substrate 1-10% rocks 60.93%
3 - Mixed substrate 10-25% rocks 28.70%
1b - Sand 6.86%
4 - Stony reef >25% rocks 1.97%
2a - Gravel pebbles & cobbles 1.13%
Boulder 0.29%
Garbage 0.11%
DNV

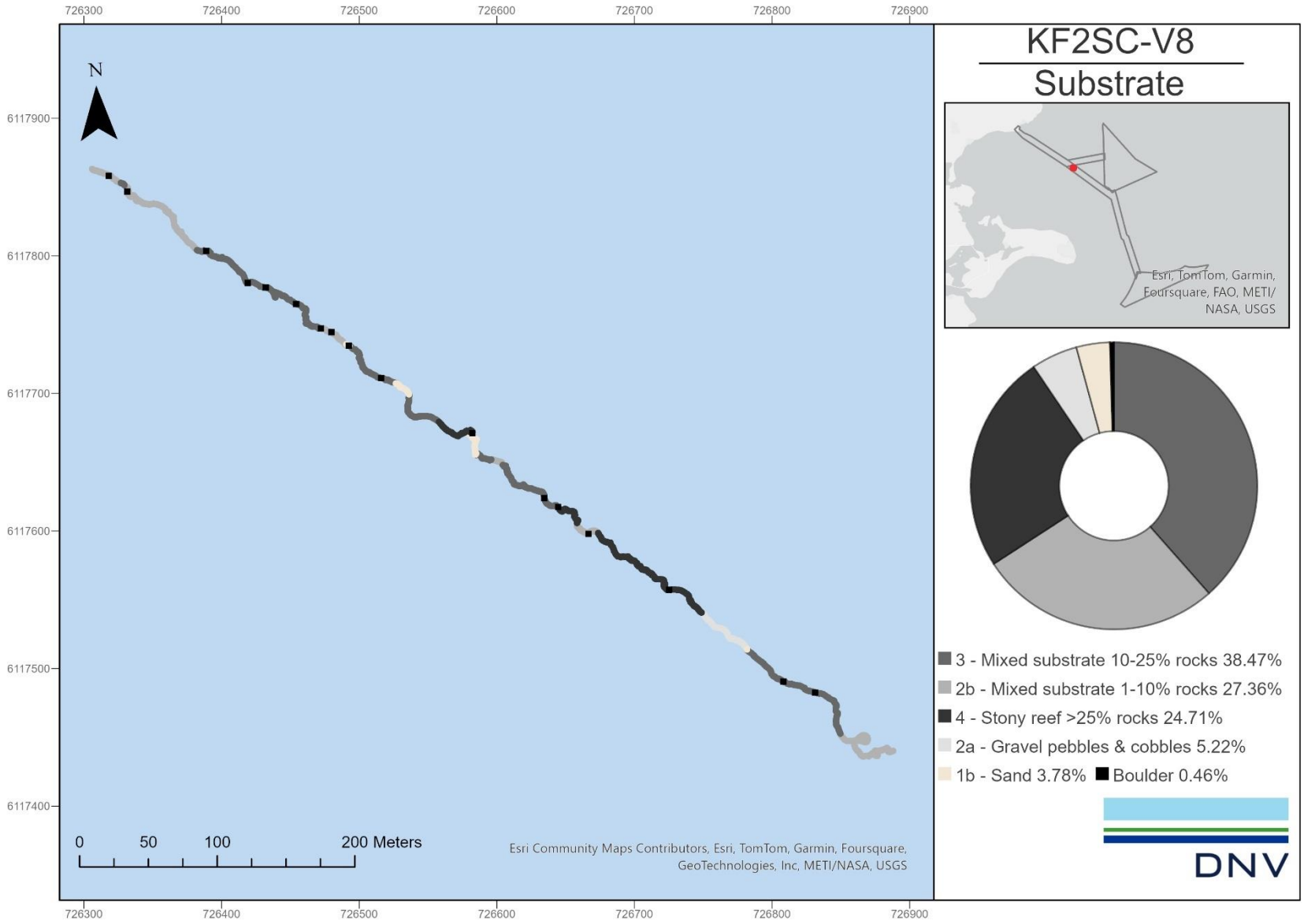

738100
738200
738300
738400
738500
738600
738700
N
6103200
6103100
6103000
6102900
6102800
6102700
6102600
0
62,5
125
250 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V3
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
2b - Mixed substrate 1-10% rocks 55.35%
3 - Mixed substrate 10-25% rocks 32.34%
1a - Mud/Silt 7.39%
4 - Stony reef >25% rocks 4.07%
Boulder 0.47%
1b - Sand 0.34%
Garbage 0.04%
DNV

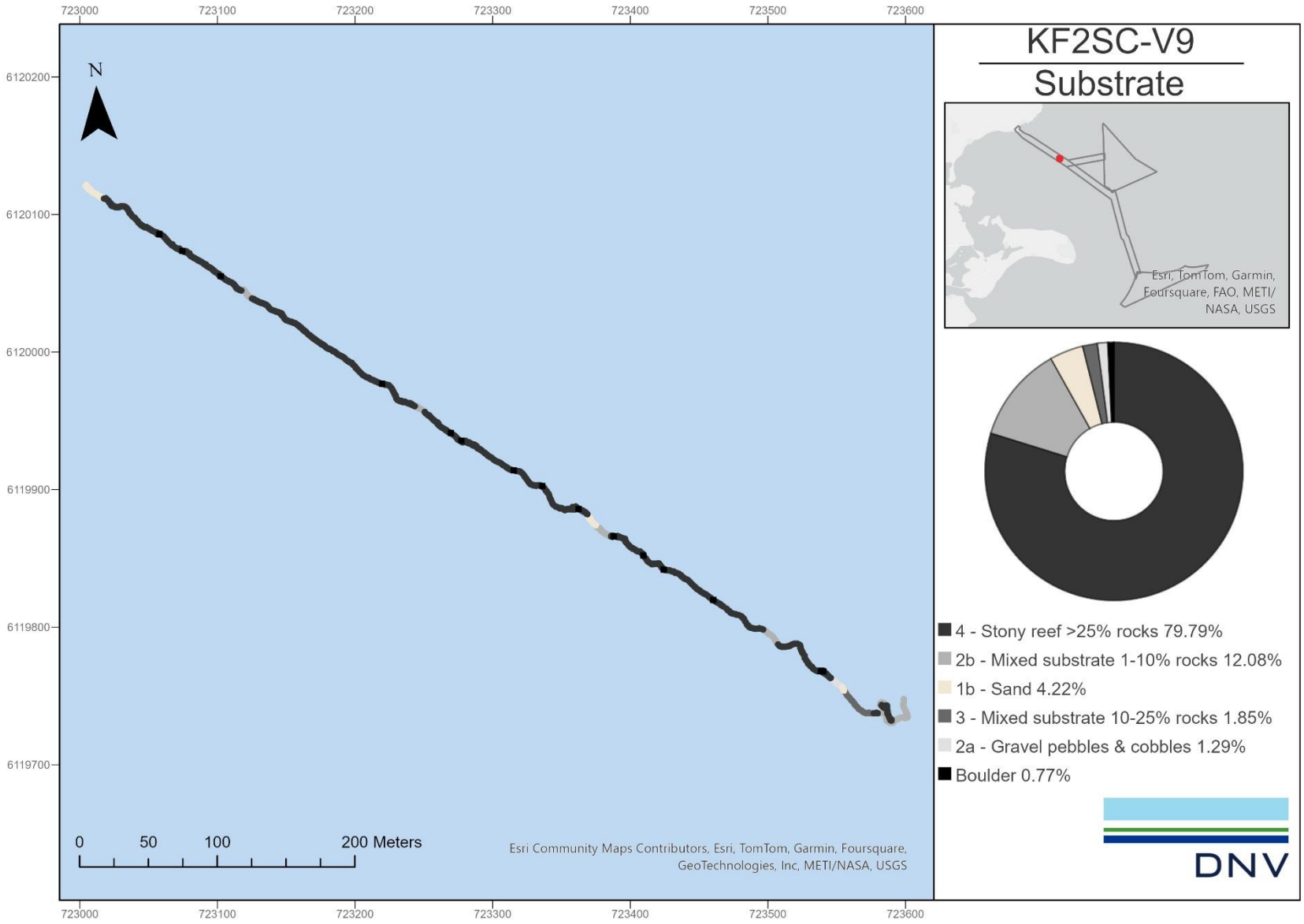

737100
737200
737300
737400
737500
737600
737700
N
6107100
6107000
6106900
6106800
6106700
6106600
6106500
0
62,5
125
250 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V4
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
2b - Mixed substrate 1-10% rocks 37.60%
3 - Mixed substrate 10-25% rocks 35.76%
1b - Sand 18.13%
4 - Stony reef >25% rocks 8.06%
Boulder 0.45%
DNV

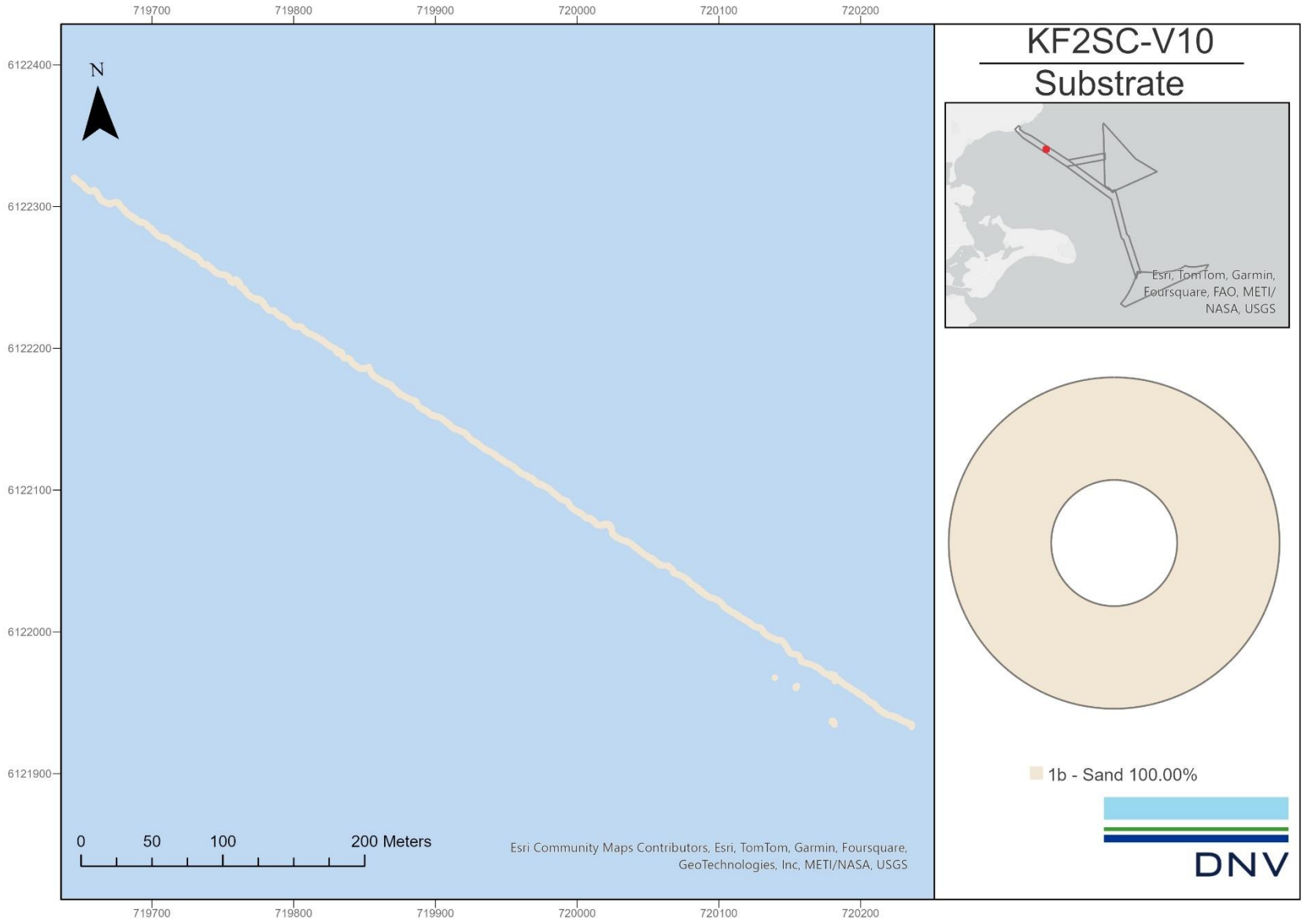

736000
736100
736200
736300
736400
736500
6110800
6110700
6110600
6110500
6110400
6110300
N
KF2SC-V5
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
København - Swinoujscie
0
50
100
200 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
1b - Sand 100.00%
DNV

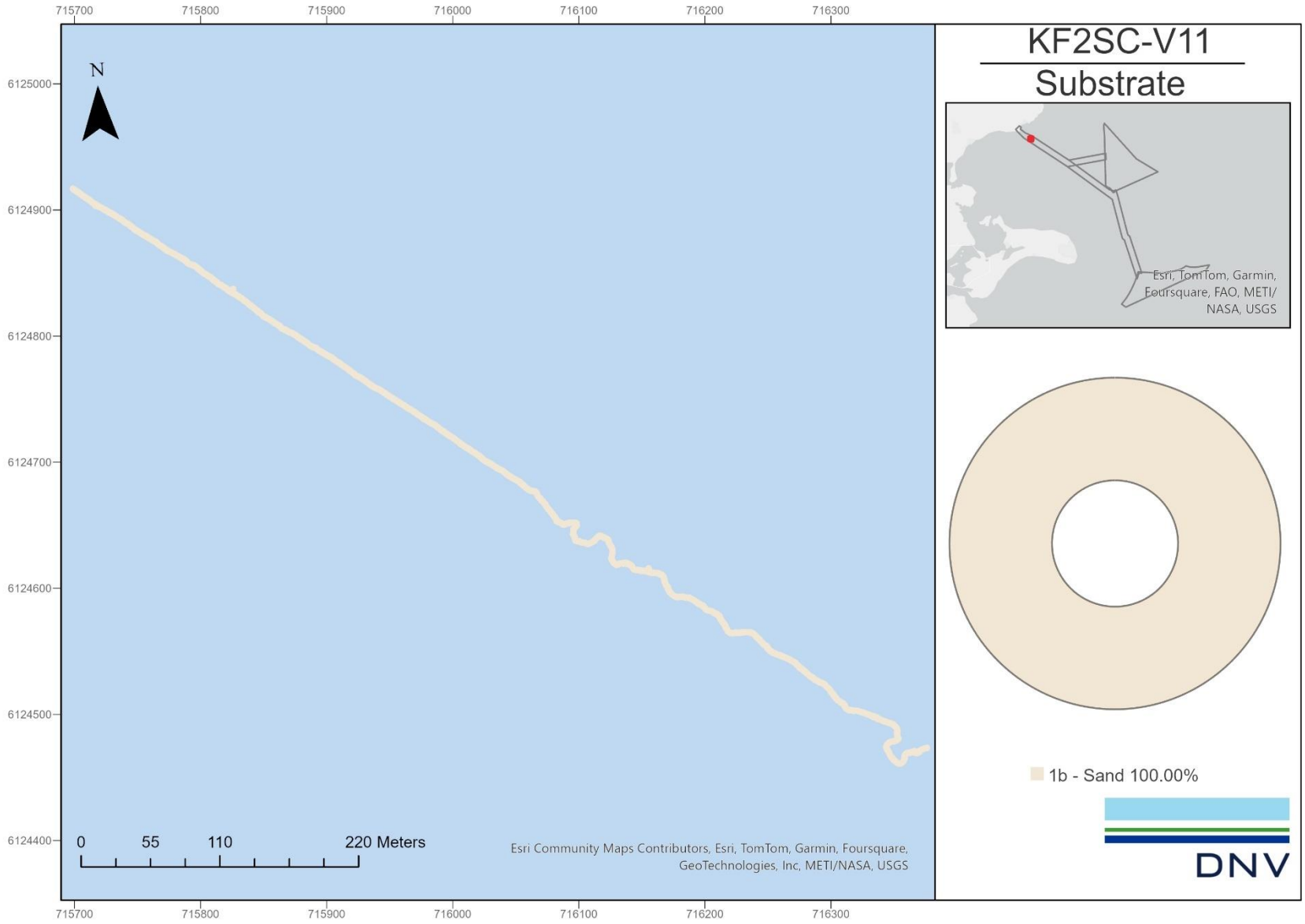

732800
732900
733000
733100
733200
733300
N
6113200
6113100
6113000
6112900
6112800
6112700
0
50
100
200 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V6
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
4 - Stony reef >25% rocks 59.53%
3 - Mixed substrate 10-25% rocks 23.35%
1b - Sand 13.26%
2b - Mixed substrate 1-10% rocks 3.64%
Boulder 0.23%
DNV

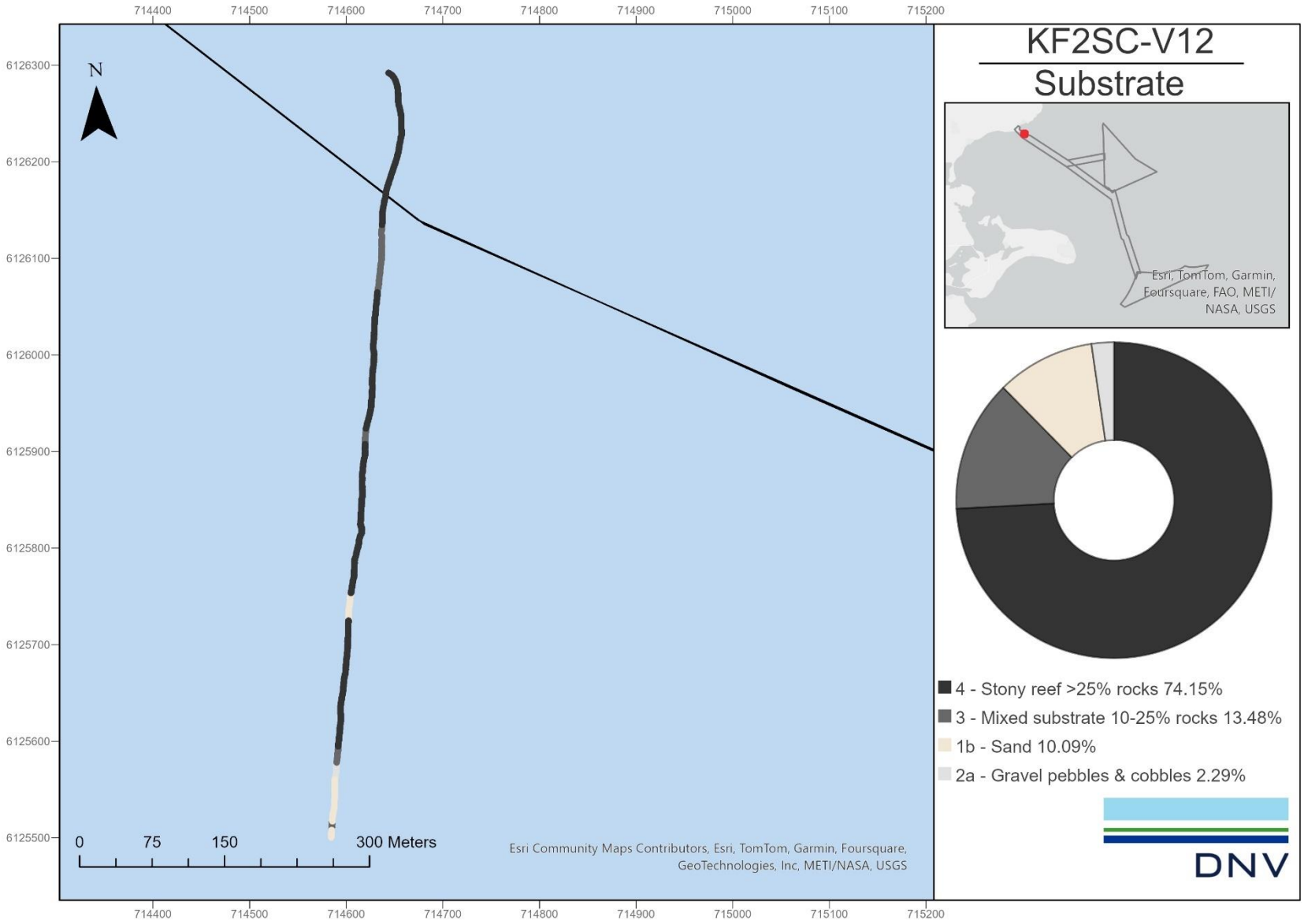

729500
729600
729700
729800
729900
730000
730100
N
6115600
6115500
6115400
6115300
6115200
6115100
6115000
0
62,5
125
250 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V7
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
1b - Sand 99.62%
1a - Mud/Silt 0.38%
DNV

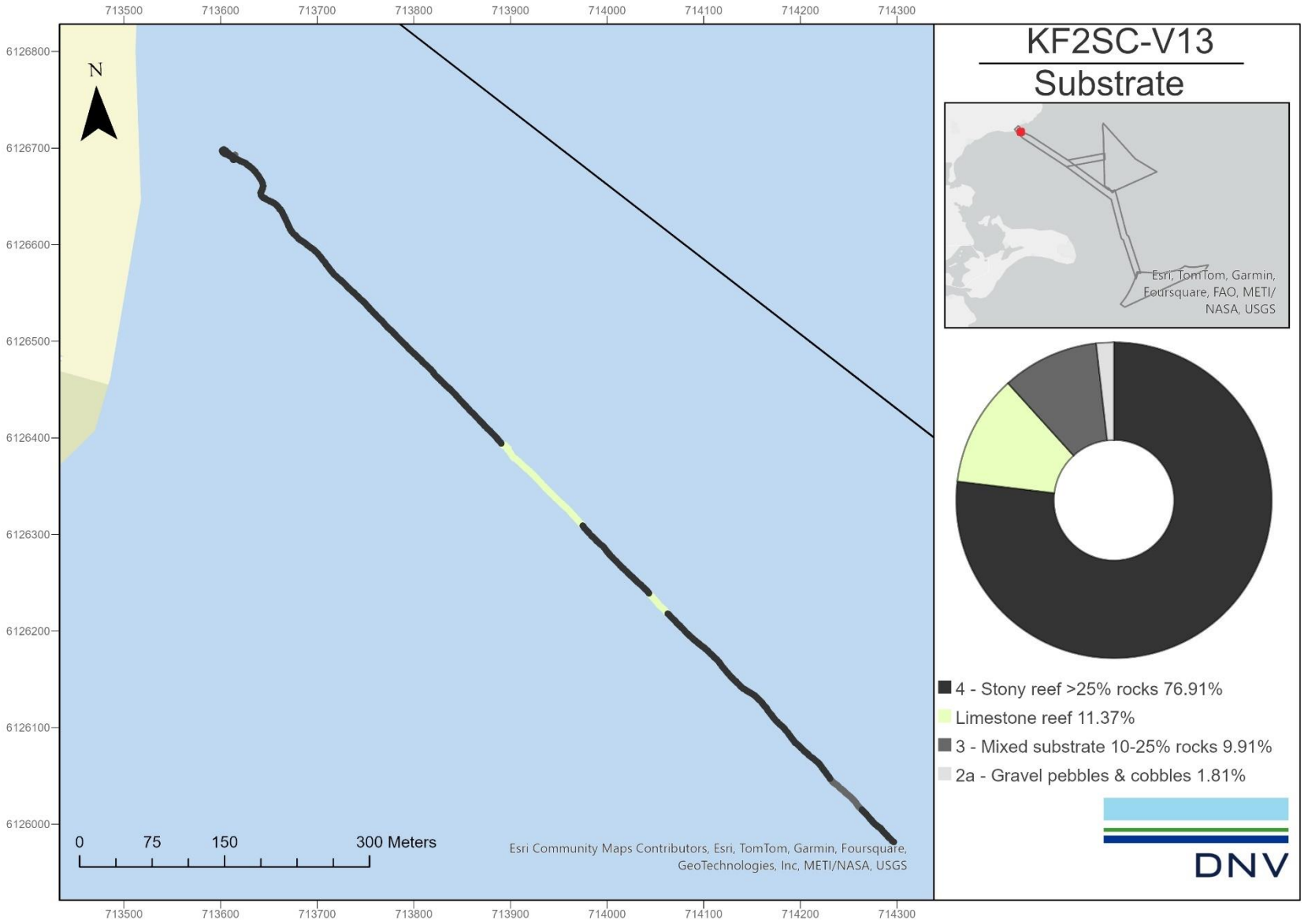

726300
726400
726500
726600
726700
726800
726900
6117900
6117800
6117700
6117600
6117500
6117400
N
0
50
100
200 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V8
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
3 - Mixed substrate 10-25% rocks 38.47%
2b - Mixed substrate 1-10% rocks 27.36%
4 - Stony reef >25% rocks 24.71%
2a - Gravel pebbles & cobbles 5.22%
1b - Sand 3.78%
Boulder 0.46%
DNV


723000
723100
723200
723300
723400
723500
723600
6120200
6120100
6120000
6119900
6119800
6119700
N
0
50
100
200 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V9
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
4 - Stony reef >25% rocks 79.79%
2b - Mixed substrate 1-10% rocks 12.08%
1b - Sand 4.22%
3 - Mixed substrate 10-25% rocks 1.85%
2a - Gravel pebbles & cobbles 1.29%
Boulder 0.77%
DNV

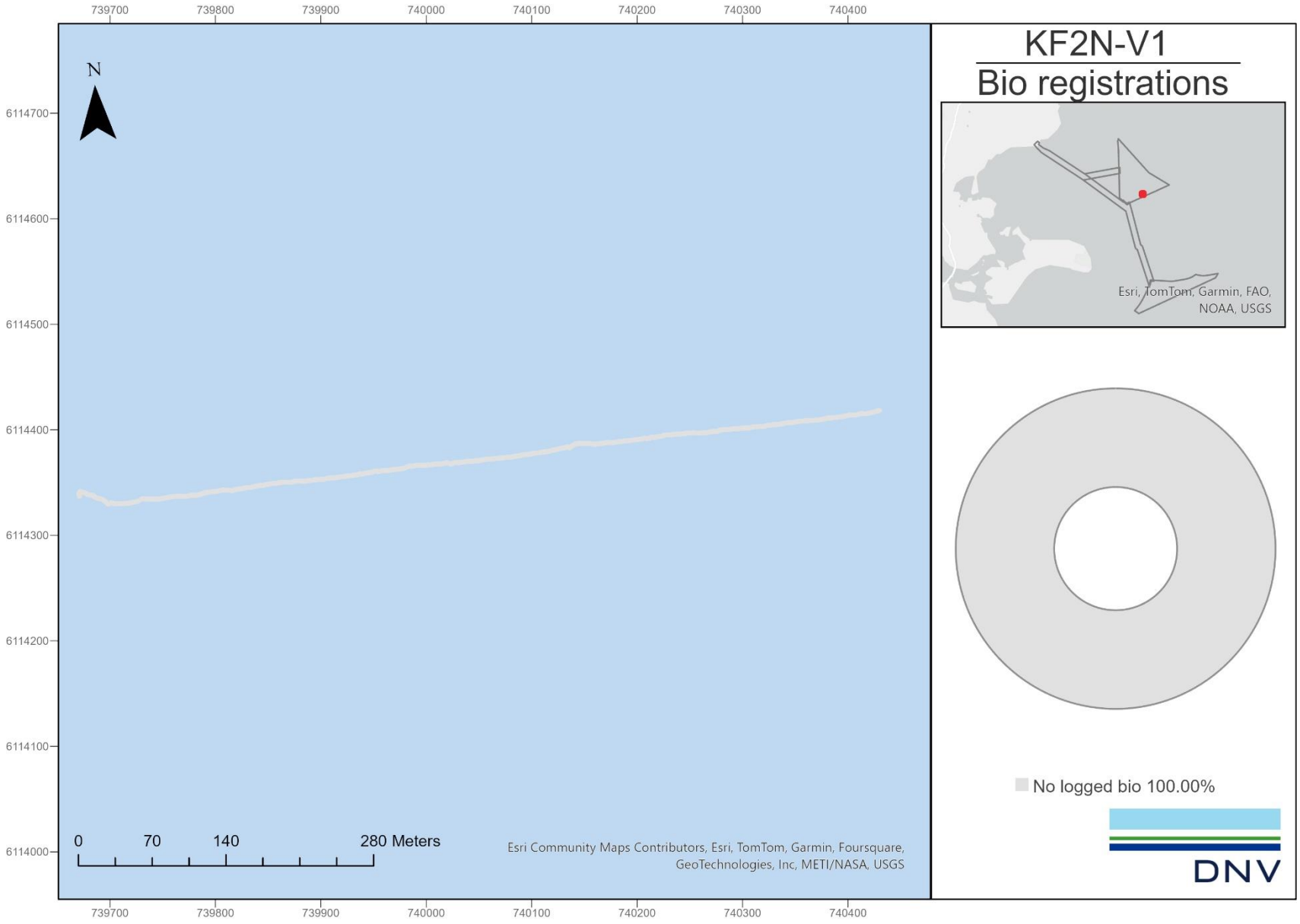

719700
719800
719900
720000
720100
720200
6122400
6122300
6122200
6122100
6122000
6121900
N
0
50
100
200 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V10
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
1b - Sand 100.00%
DNV

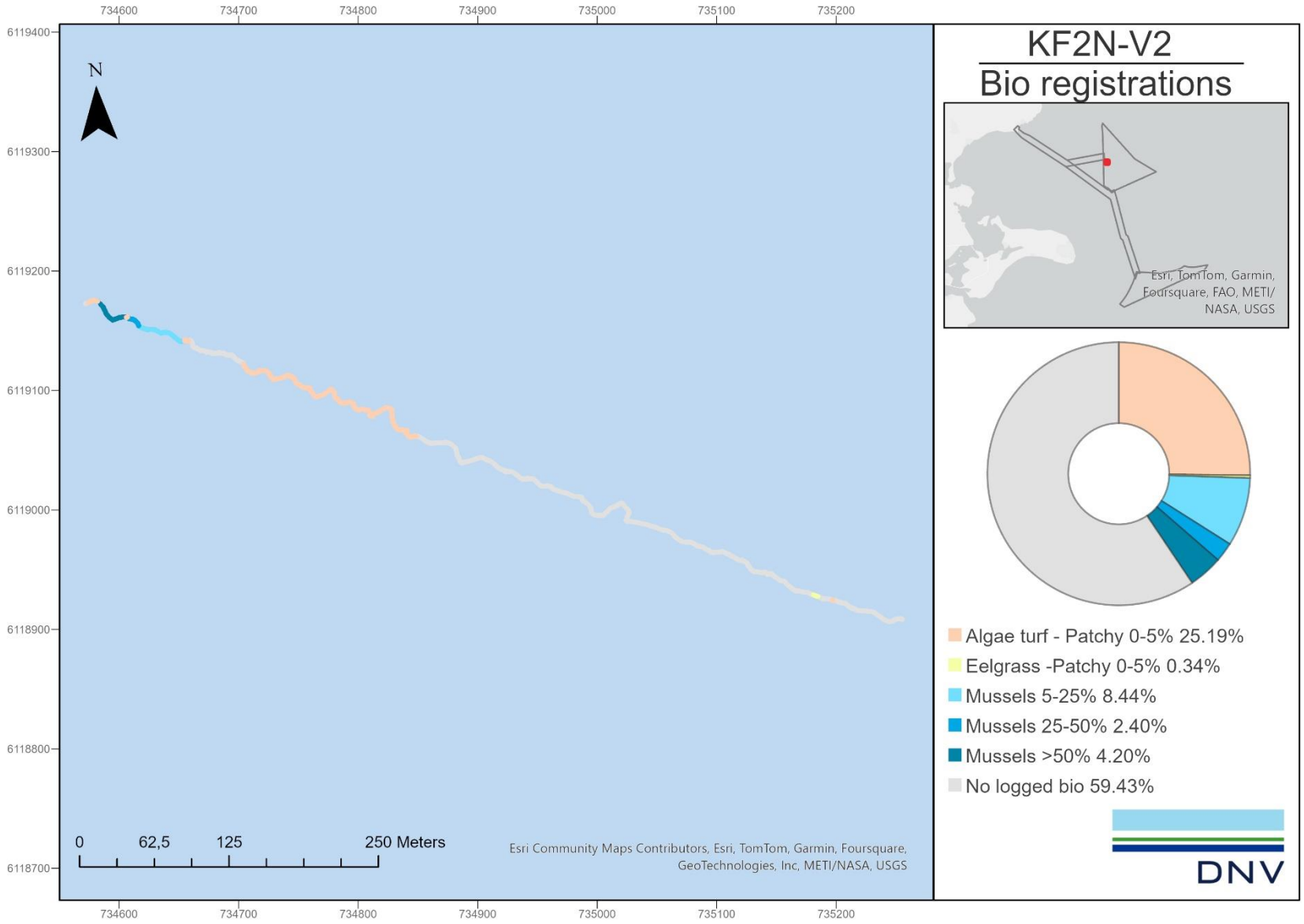

715700
715800
715900
716000
716100
716200
716300
6125000
6124900
6124800
6124700
6124600
6124500
6124400
N
0
55
110
220 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V11
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
1b - Sand 100.00%
DNV

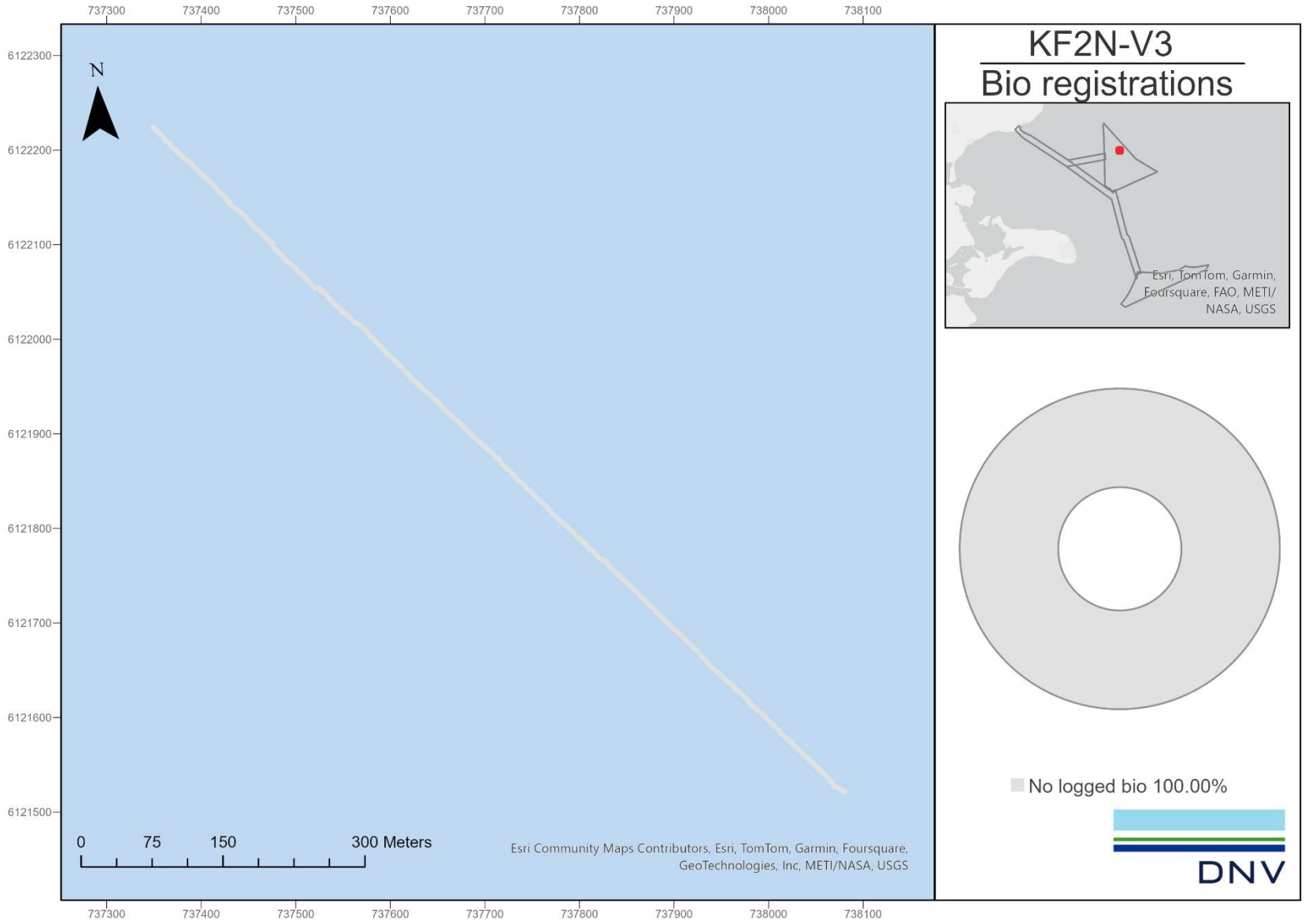

714400
714500
714600
714700
714800
714900
715000
715100
715200
6126300
6126200
6126100
6126000
6125900
6125800
6125700
6125600
6125500
N
0
75
150
300 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V12
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
4 - Stony reef >25% rocks 74.15%
3 - Mixed substrate 10-25% rocks 13.48%
1b - Sand 10.09%
2a - Gravel pebbles & cobbles 2.29%
DNV

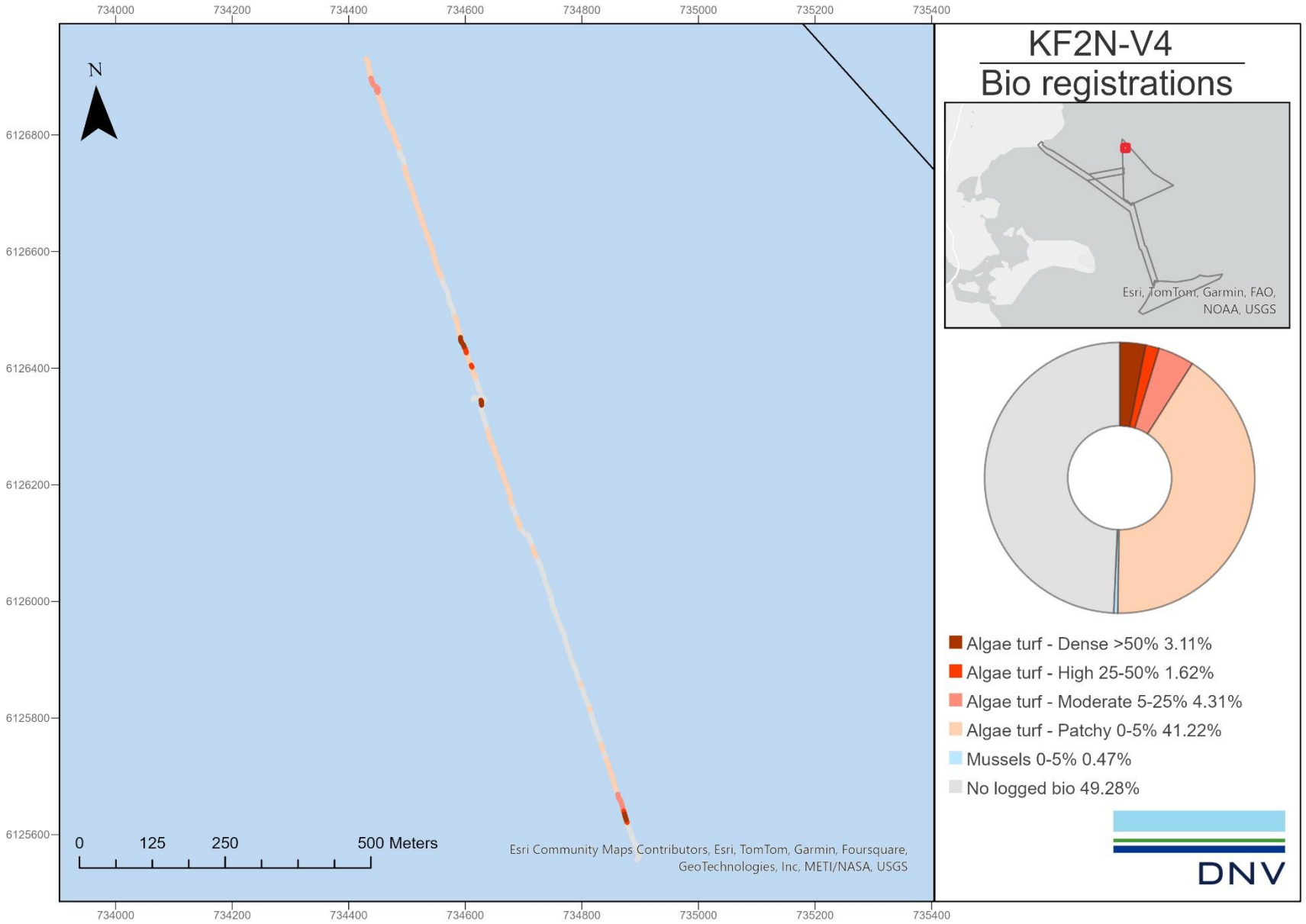

713500
713600
713700
713800
713900
714000
714100
714200
714300
6126800
6126700
6126600
6126500
6126400
6126300
6126200
6126100
6126000
N
0
75
150
300 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V13
Substrate
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
4 - Stony reef >25% rocks 76.91%
Limestone reef 11.37%
3 - Mixed substrate 10-25% rocks 9.91%
2a - Gravel pebbles & cobbles 1.81%
DNV

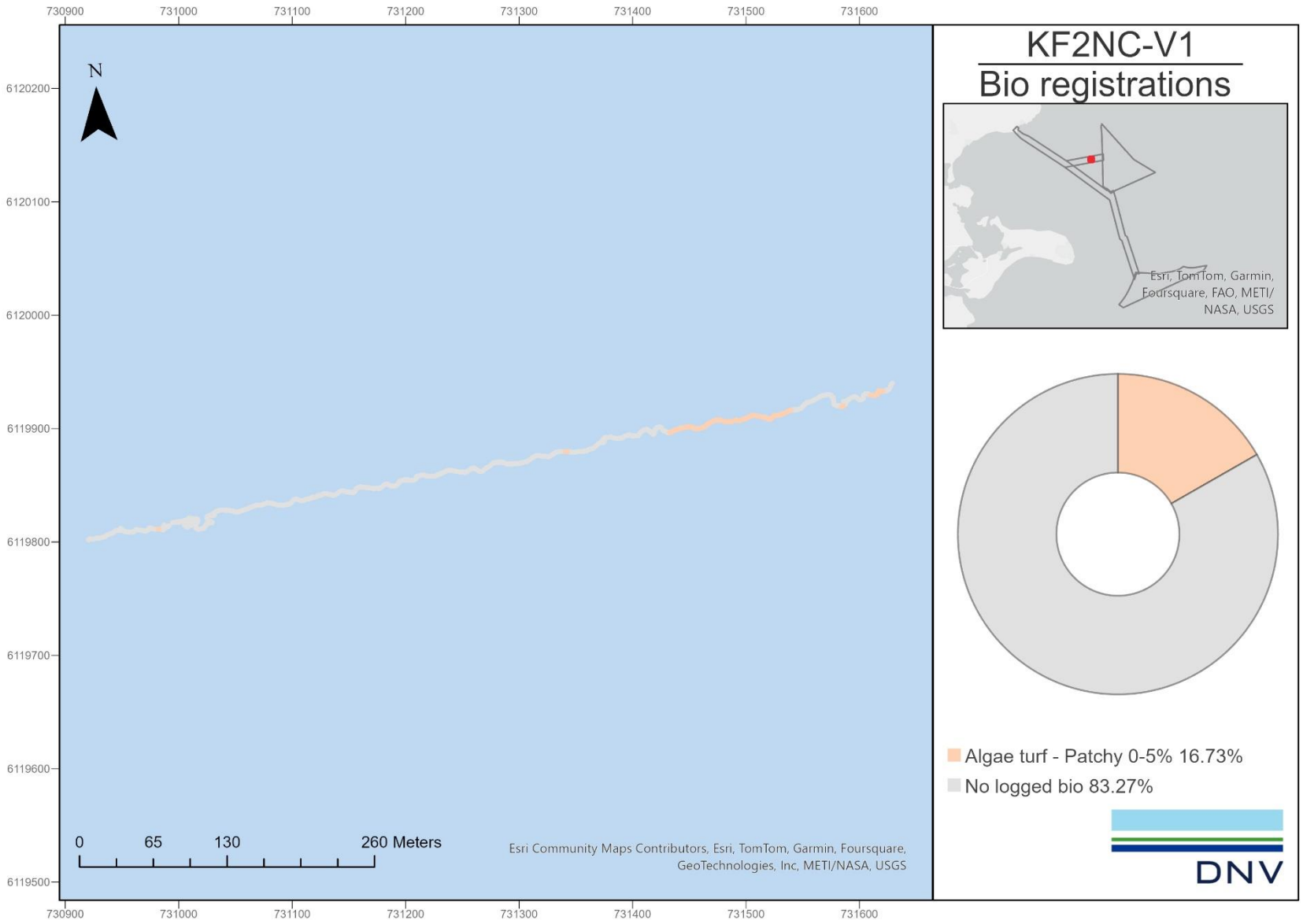
APPENDIX 3 MAPS OF FAUNA AND FLORA REGISTRATIONS IN VISUAL SURVEY TRANSECTS

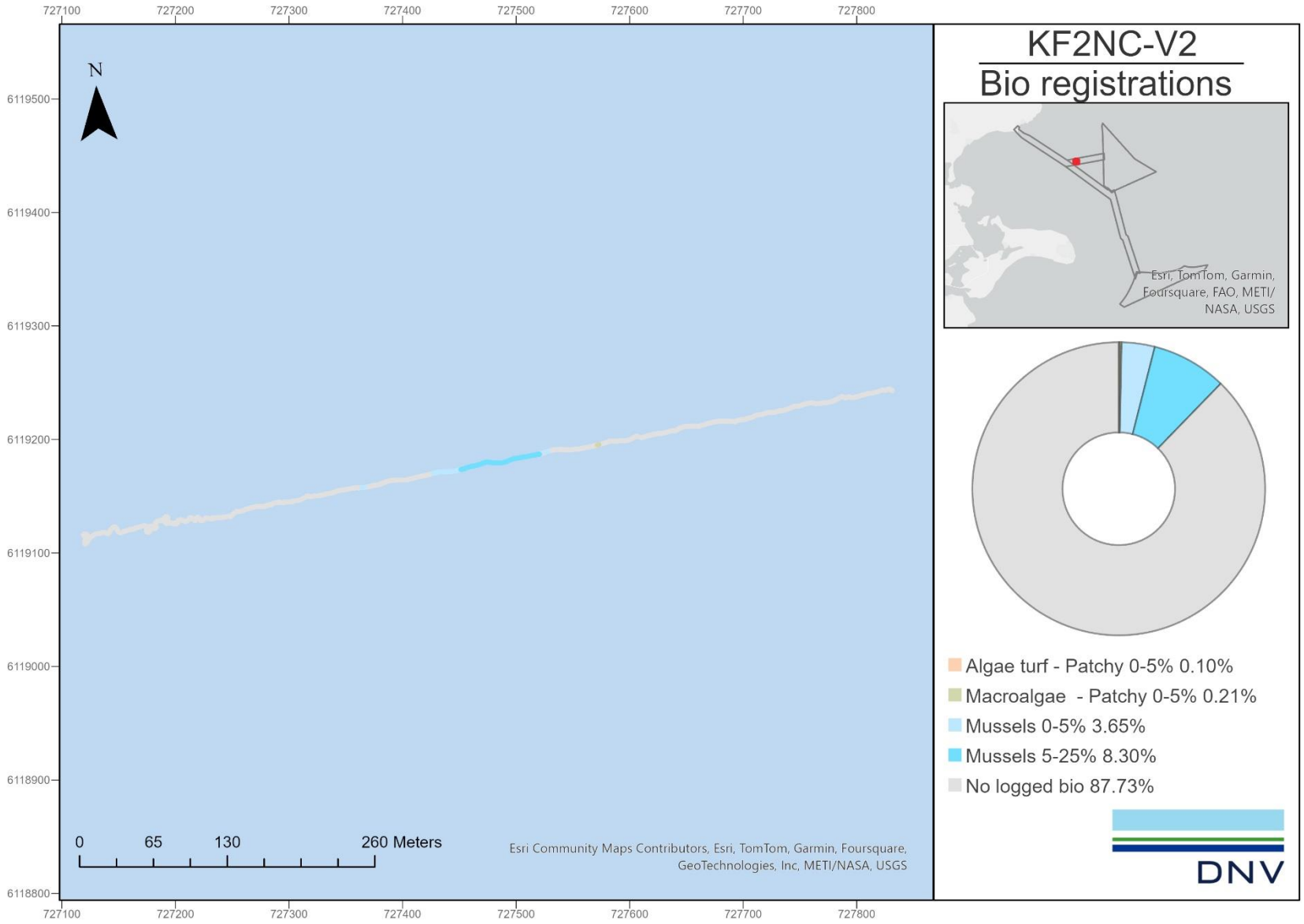

739700
739800
739900
740000
740100
740200
740300
740400
N
6114700
6114600
6114500
6114400
6114300
6114200
6114100
6114000
0
70
140
280 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2N-V1
Bio registrations
Esri, TomTom, Garmin, FAO, NOAA, USGS
No logged bio 100.00%
DNV

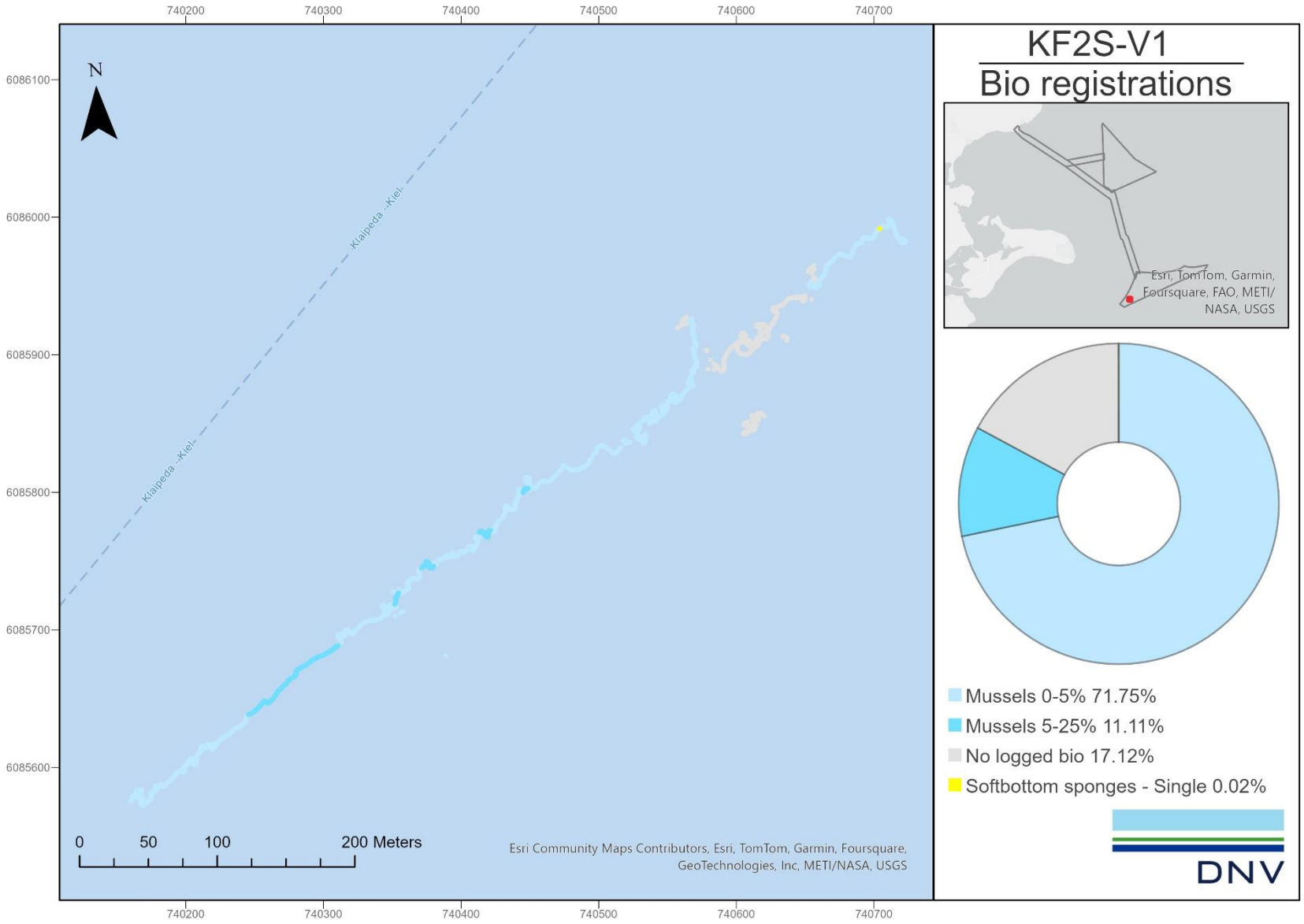

734600
734700
734800
734900
735000
735100
735200
6119400
6119300
6119200
6119100
6119000
6118900
6118800
6118700
N
0
62,5
125
250 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2N-V2
Bio registrations
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
Algae turf - Patchy 0-5% 25.19%
Eelgrass -Patchy 0-5% 0.34%
Mussels 5-25% 8.44%
Mussels 25-50% 2.40%
Mussels >50% 4.20%
No logged bio 59.43%
DNV

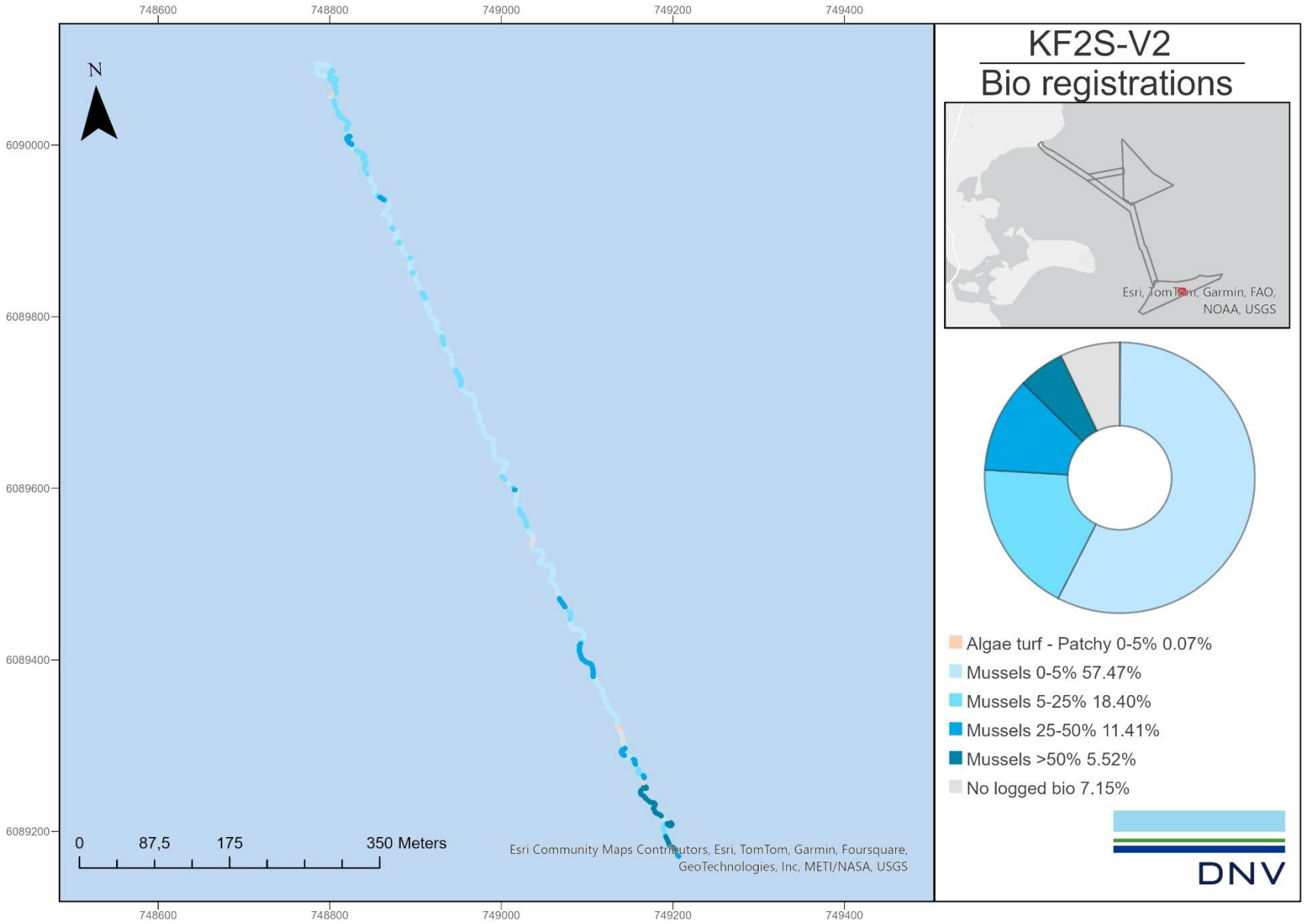

737300
737400
737500
737600
737700
737800
737900
738000
738100
6122300
6122200
6122100
6122000
6121900
6121800
6121700
6121600
6121500
N
0
75
150
300 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2N-V3
Bio registrations
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
No logged bio 100.00%
DNV

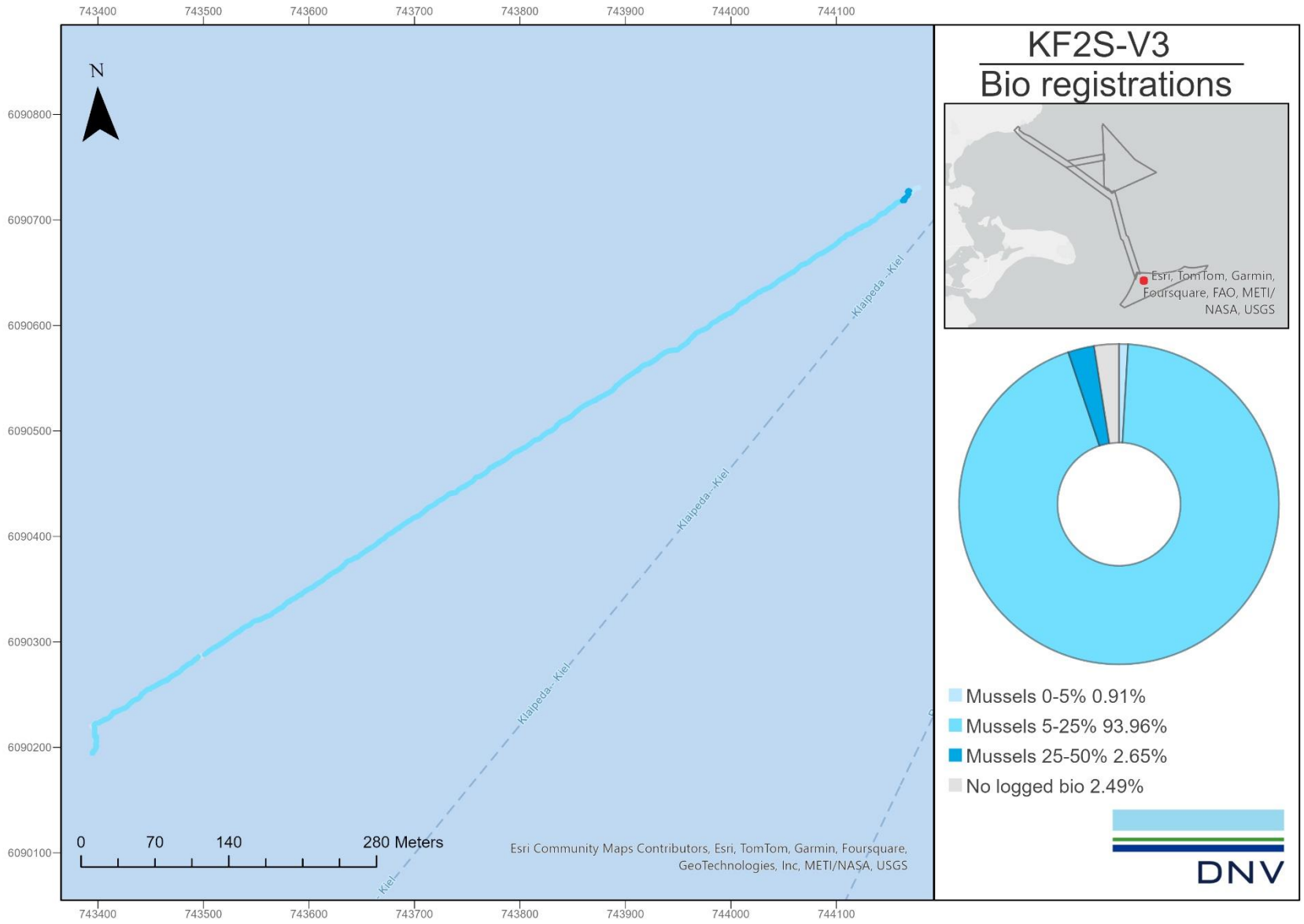

734000
734200
734400
734600
734800
735000
735200
735400
N
6126800
6126600
6126400
6126200
6126000
6125800
6125600
0
125
250
500 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2N-V4
Bio registrations
Esri, TomTom, Garmin, FAO, NOAA, USGS
Algae turf - Dense >50% 3.11%
Algae turf - High 25-50% 1.62%
Algae turf - Moderate 5-25% 4.31%
Algae turf - Patchy 0-5% 41.22%
Mussels 0-5% 0.47%
No logged bio 49.28%
DNV

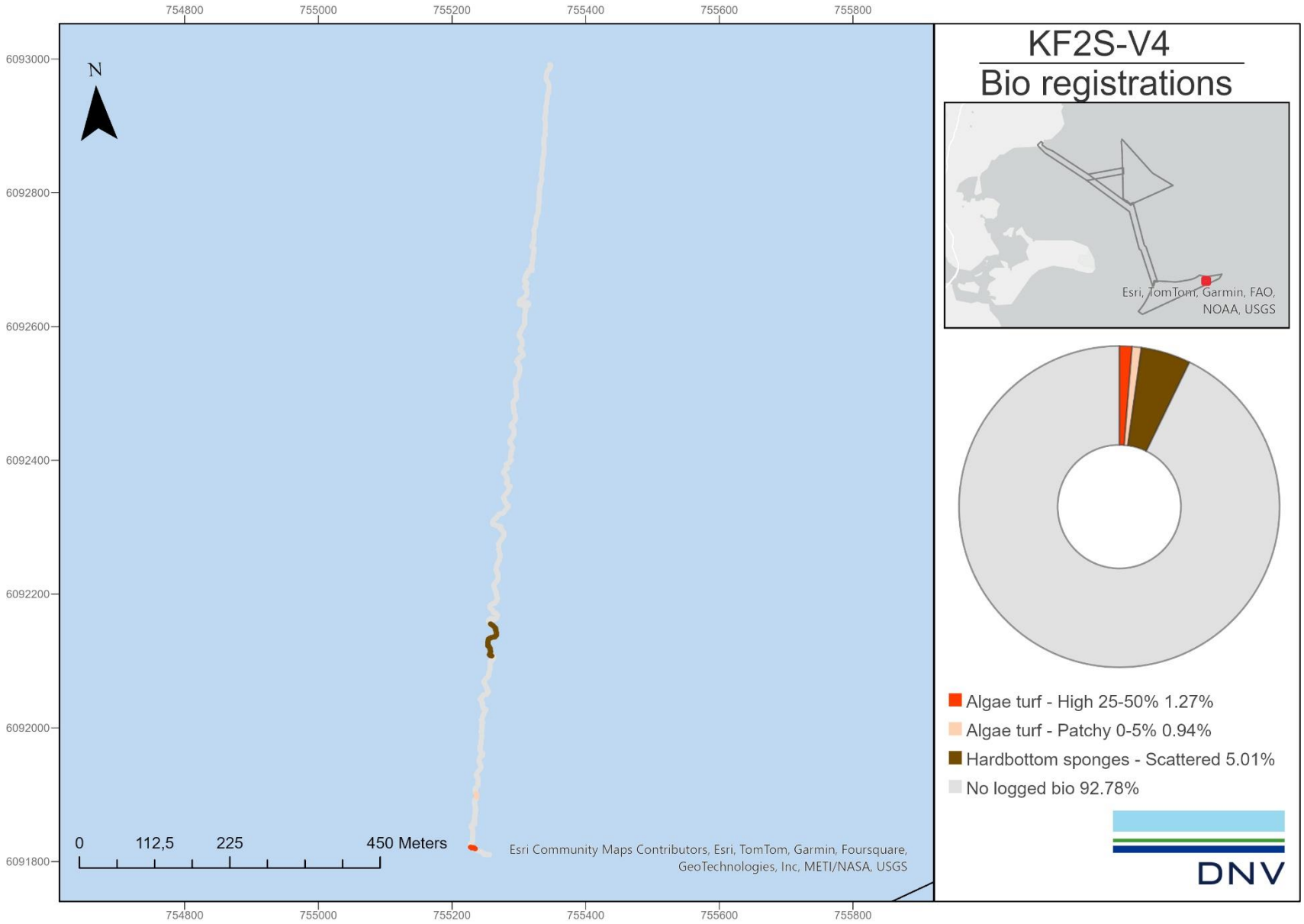

730900
731000
731100
731200
731300
731400
731500
731600
6120200
6120100
6120000
6119900
6119800
6119700
6119600
6119500
N
0
65
130
260 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2NC-V1
Bio registrations
Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
Algae turf - Patchy 0-5% 16.73%
No logged bio 83.27%
DNV

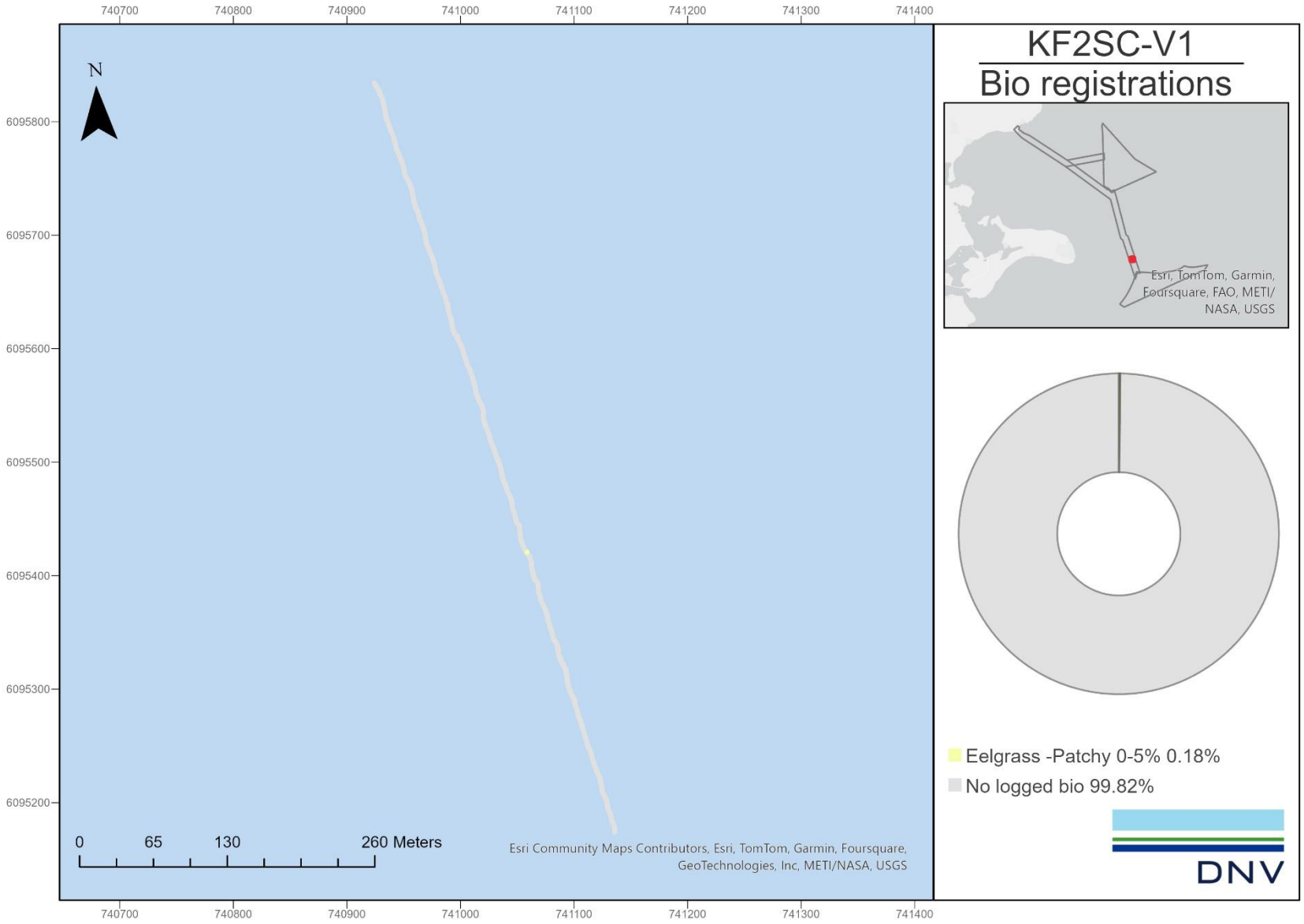

727100
727200
727300
727400
727500
727600
727700
727800
6119500
6119400
6119300
6119200
6119100
6119000
6118900
6118800
N
0
65
130
260 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2NC-V2
Bio registrations
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
Algae turf - Patchy 0-5% 0.10%
Macroalgae - Patchy 0-5% 0.21%
Mussels 0-5% 3.65%
Mussels 5-25% 8.30%
No logged bio 87.73%
DNV

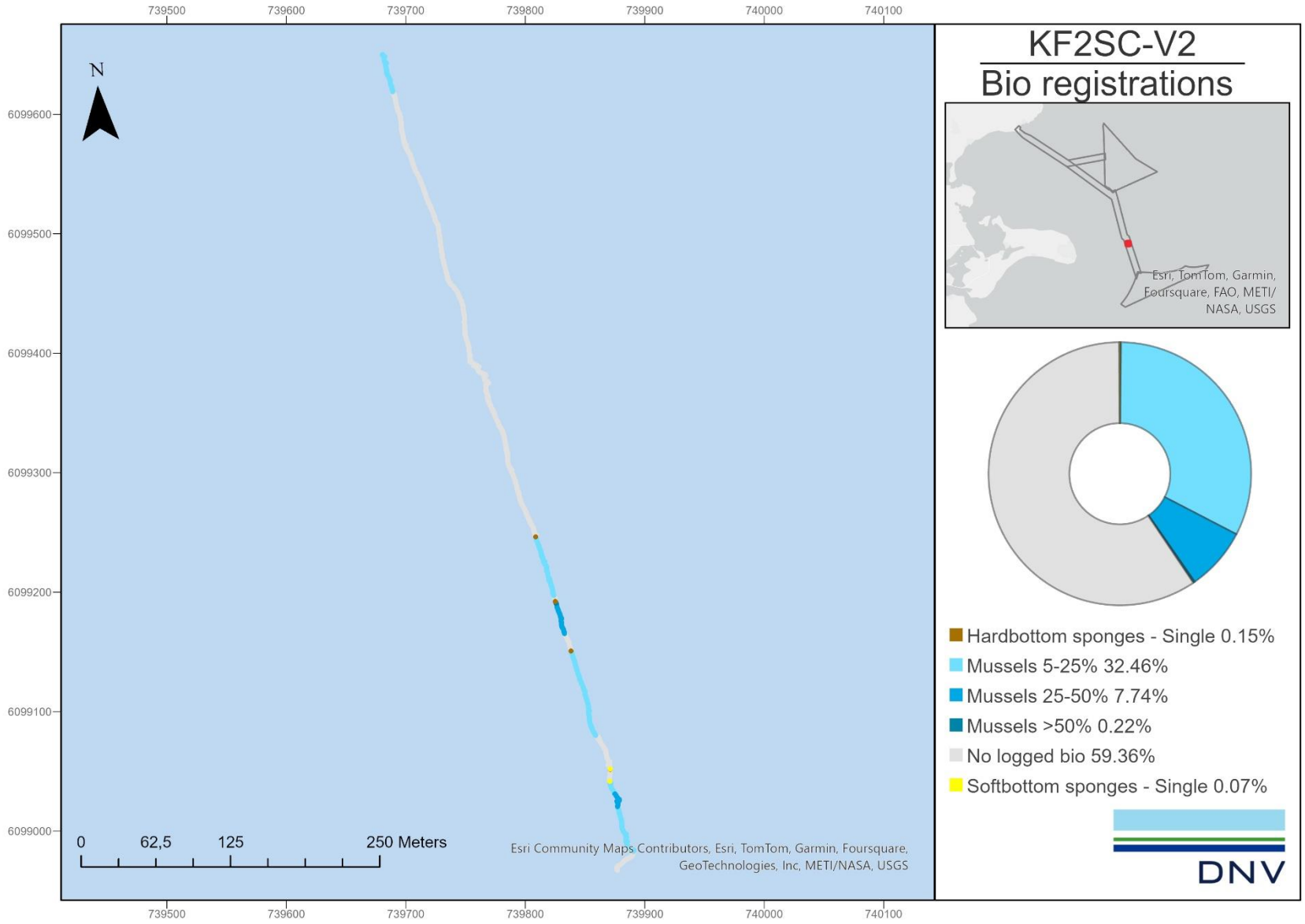

740200
740300
740400
740500
740600
740700
6086100
6086000
6085900
6085800
6085700
6085600
N
Klaipeda - Kiel
Klaipeda - Kiel
0
50
100
200 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2S-V1
Bio registrations
Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
Mussels 0-5% 71.75%
Mussels 5-25% 11.11%
No logged bio 17.12%
Softbottom sponges - Single 0.02%
DNV

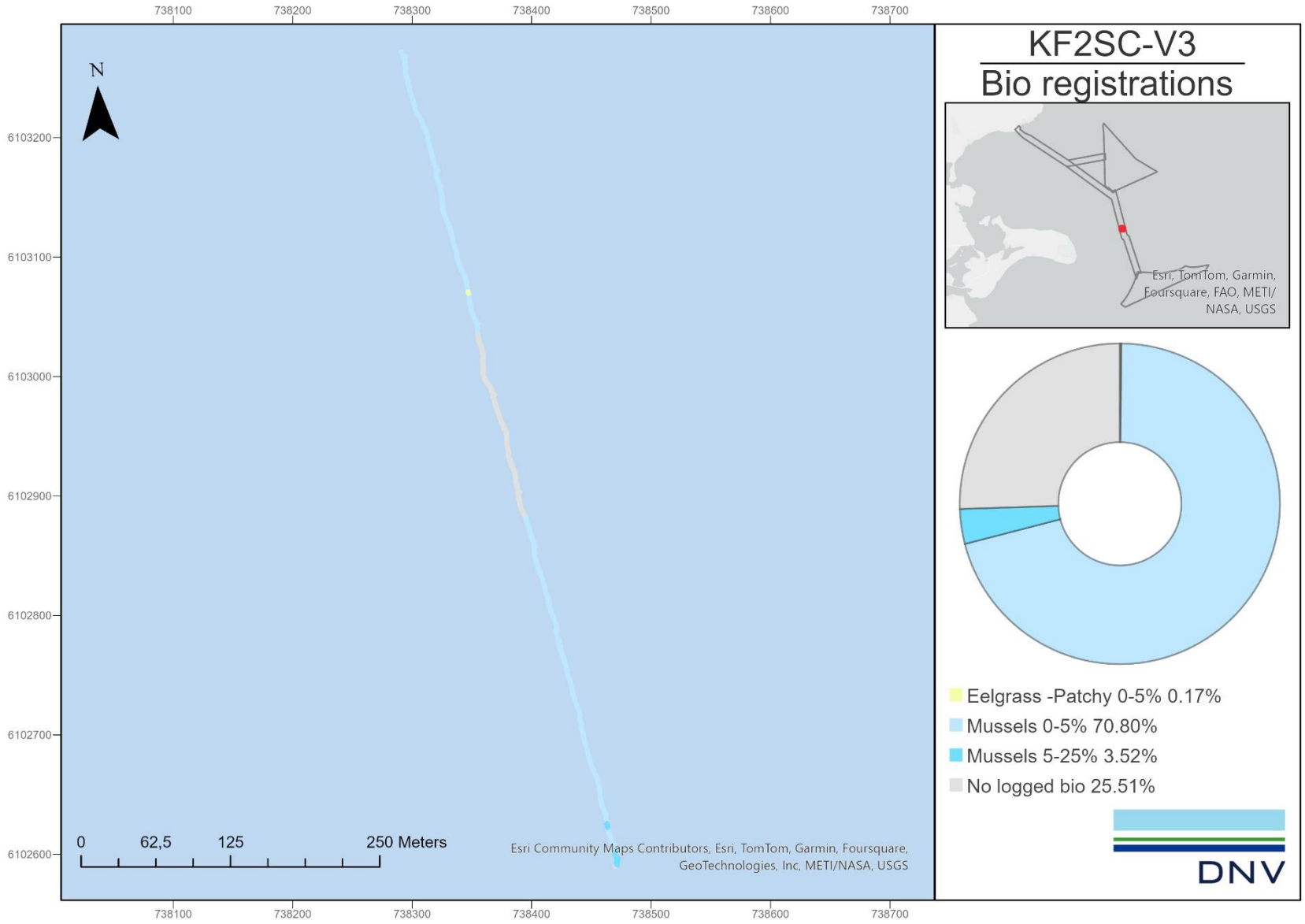

748600
748800
749000
749200
749400
N
6090000
6089800
6089600
6089400
6089200
0
87,5
175
350 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2S-V2
Bio registrations
Esri, TomTom, Garmin, FAO, NOAA, USGS
Algae turf - Patchy 0-5% 0.07%
Mussels 0-5% 57.47%
Mussels 5-25% 18.40%
Mussels 25-50% 11.41%
Mussels >50% 5.52%
No logged bio 7.15%
DNV

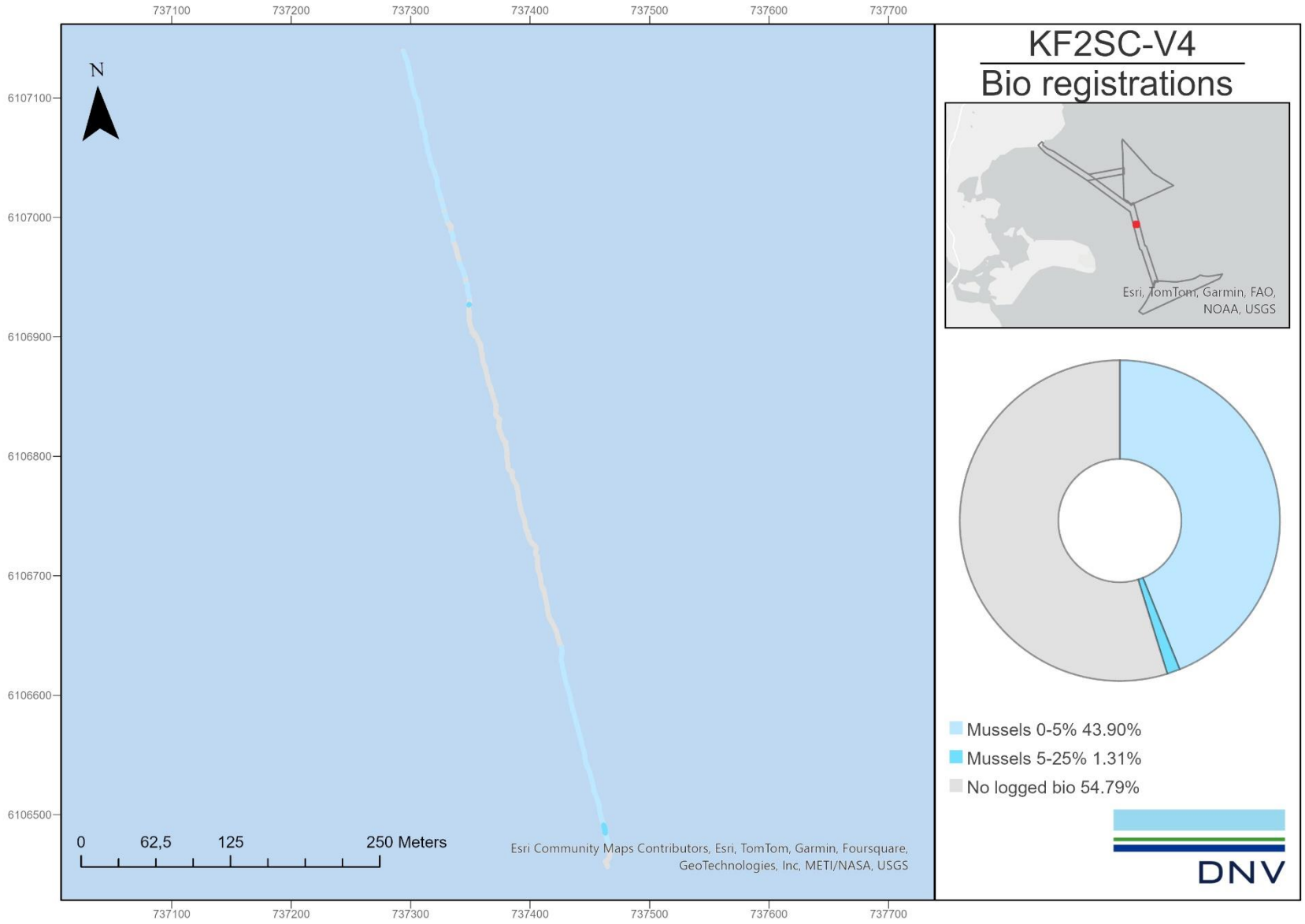

743400
743500
743600
743700
743800
743900
744000
744100
N
6090800
6090700
6090600
6090500
6090400
6090300
6090200
6090100
Klaipeda - Kiel
Klaipeda - Kiel
Klaipeda - Kiel
0
70
140
280 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2S-V3
Bio registrations
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
Mussels 0-5% 0.91%
Mussels 5-25% 93.96%
Mussels 25-50% 2.65%
No logged bio 2.49%
DNV

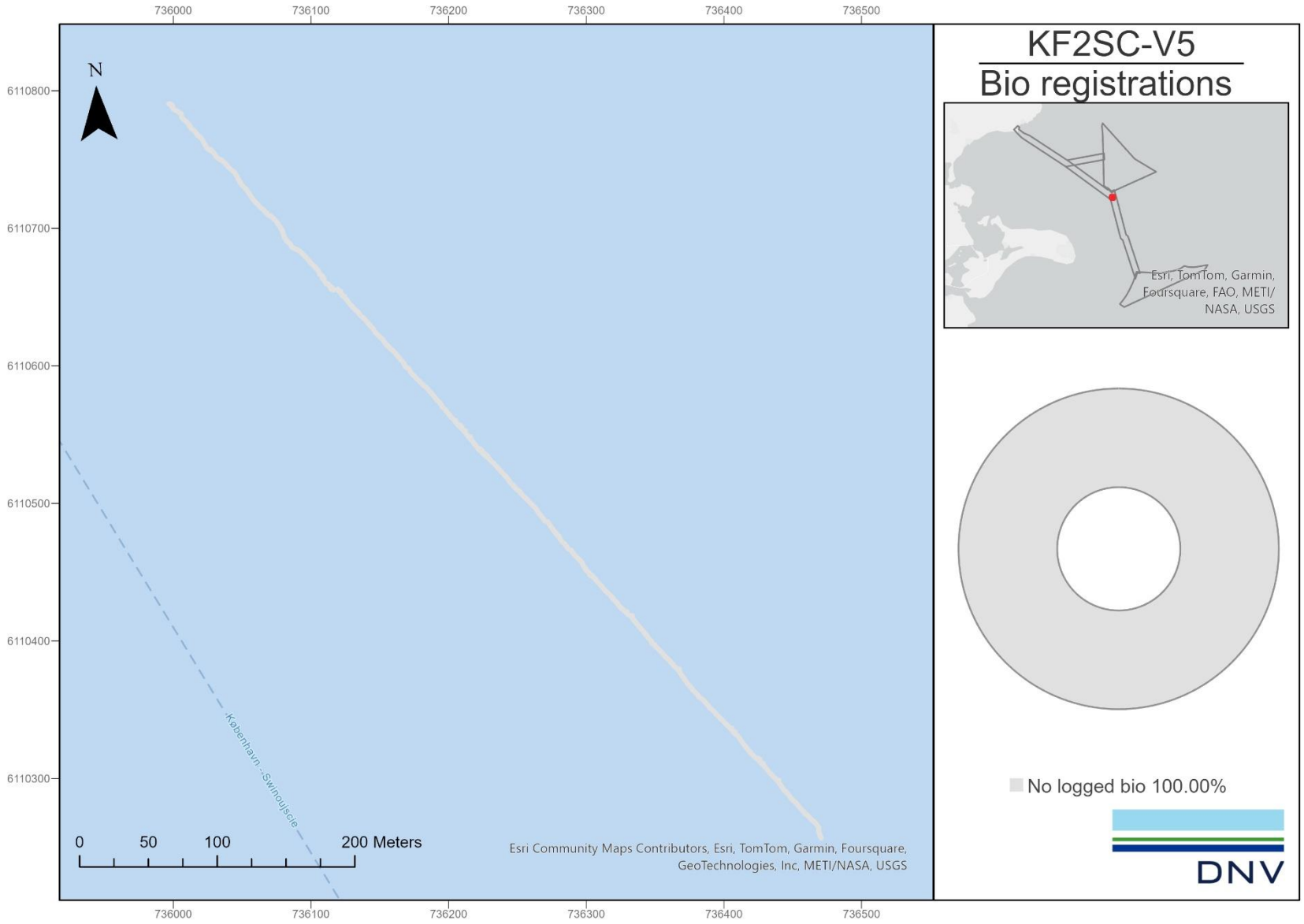

754800
755000
755200
755400
755600
755800
6093000
6092800
6092600
6092400
6092200
6092000
6091800
N
0
112,5
225
450 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2S-V4
Bio registrations
Esri, TomTom, Garmin, FAO, NOAA, USGS
Algae turf - High 25-50% 1.27%
Algae turf - Patchy 0-5% 0.94%
Hardbottom sponges - Scattered 5.01%
No logged bio 92.78%
DNV

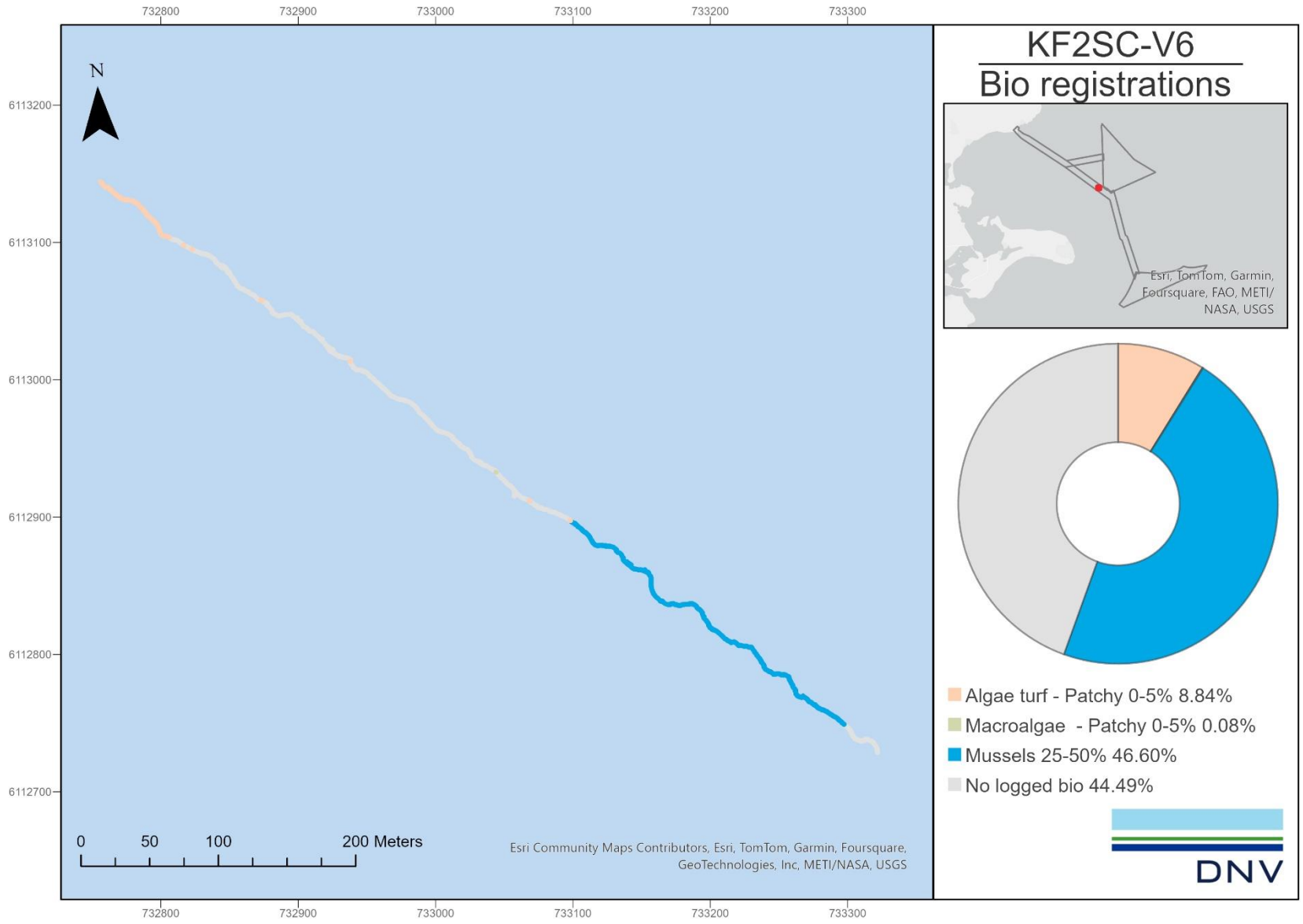

740700
740800
740900
741000
741100
741200
741300
741400
N
6095800
6095700
6095600
6095500
6095400
6095300
6095200
0
65
130
260 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V1
Bio registrations
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
Eelgrass -Patchy 0-5% 0.18%
No logged bio 99.82%
DNV

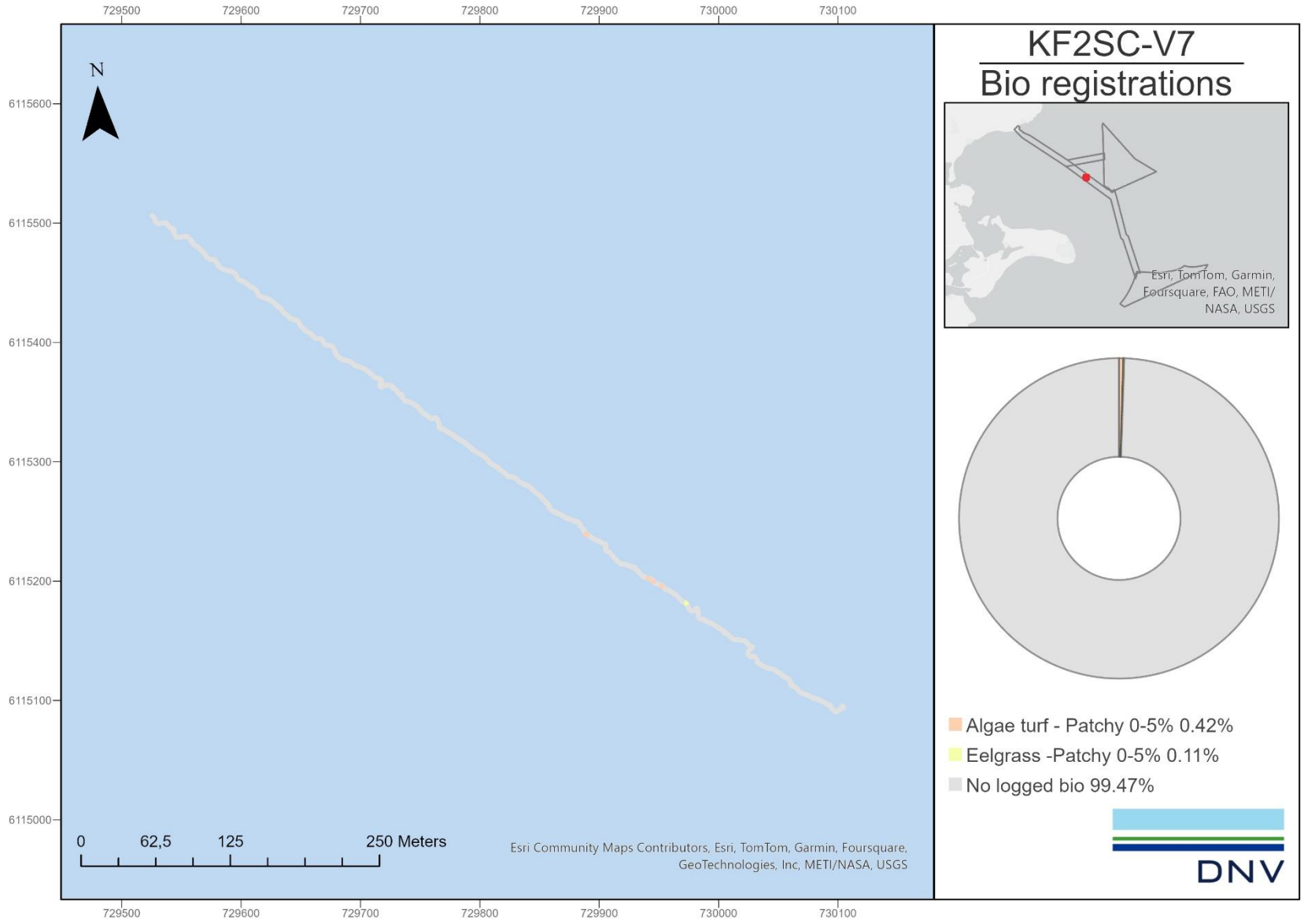

739500
739600
739700
739800
739900
740000
740100
6099600
6099500
6099400
6099300
6099200
6099100
6099000
N
0
62,5
125
250 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V2
Bio registrations
Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
Hardbottom sponges - Single 0.15%
Mussels 5-25% 32.46%
Mussels 25-50% 7.74%
Mussels >50% 0.22%
No logged bio 59.36%
Softbottom sponges - Single 0.07%
DNV

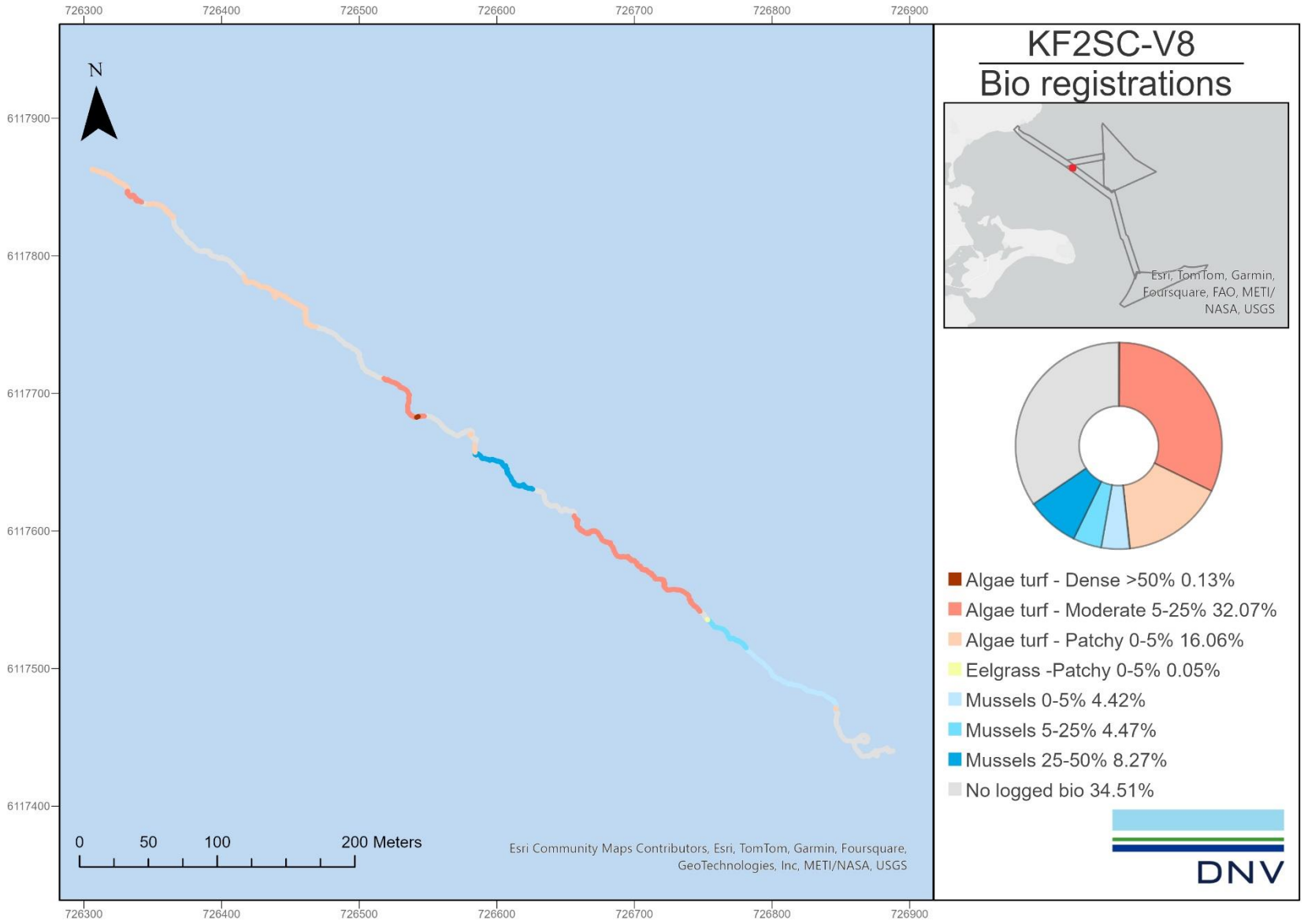

738100
738200
738300
738400
738500
738600
738700
N
6103200
6103100
6103000
6102900
6102800
6102700
6102600
0
62,5
125
250 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V3
Bio registrations
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
Eelgrass -Patchy 0-5% 0.17%
Mussels 0-5% 70.80%
Mussels 5-25% 3.52%
No logged bio 25.51%
DNV

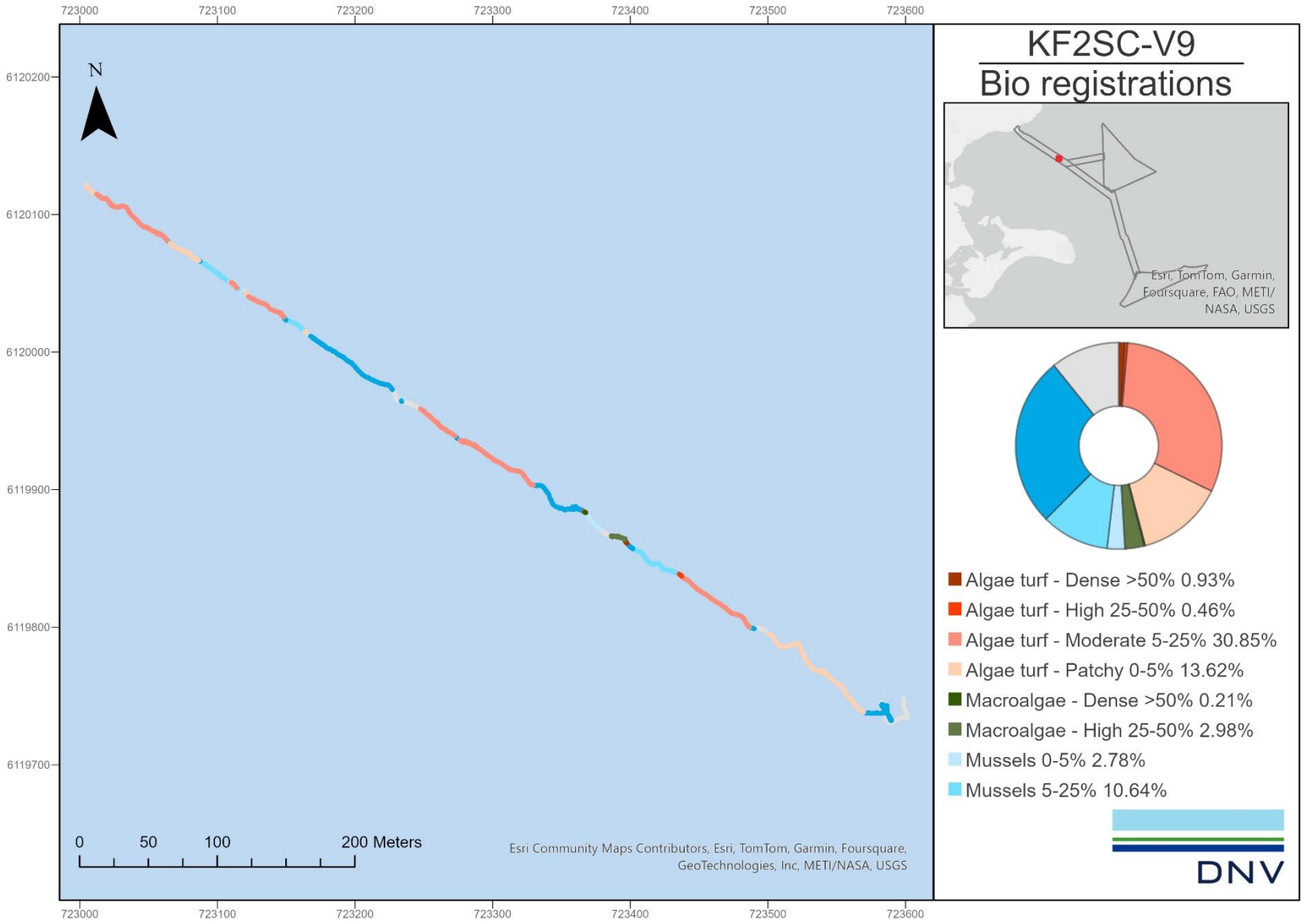

737100
737200
737300
737400
737500
737600
737700
6107100
6107000
6106900
6106800
6106700
6106600
6106500
N
0
62,5
125
250 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V4
Bio registrations
Esri, TomTom, Garmin, FAO, NOAA, USGS
Mussels 0-5% 43.90%
Mussels 5-25% 1.31%
No logged bio 54.79%
DNV

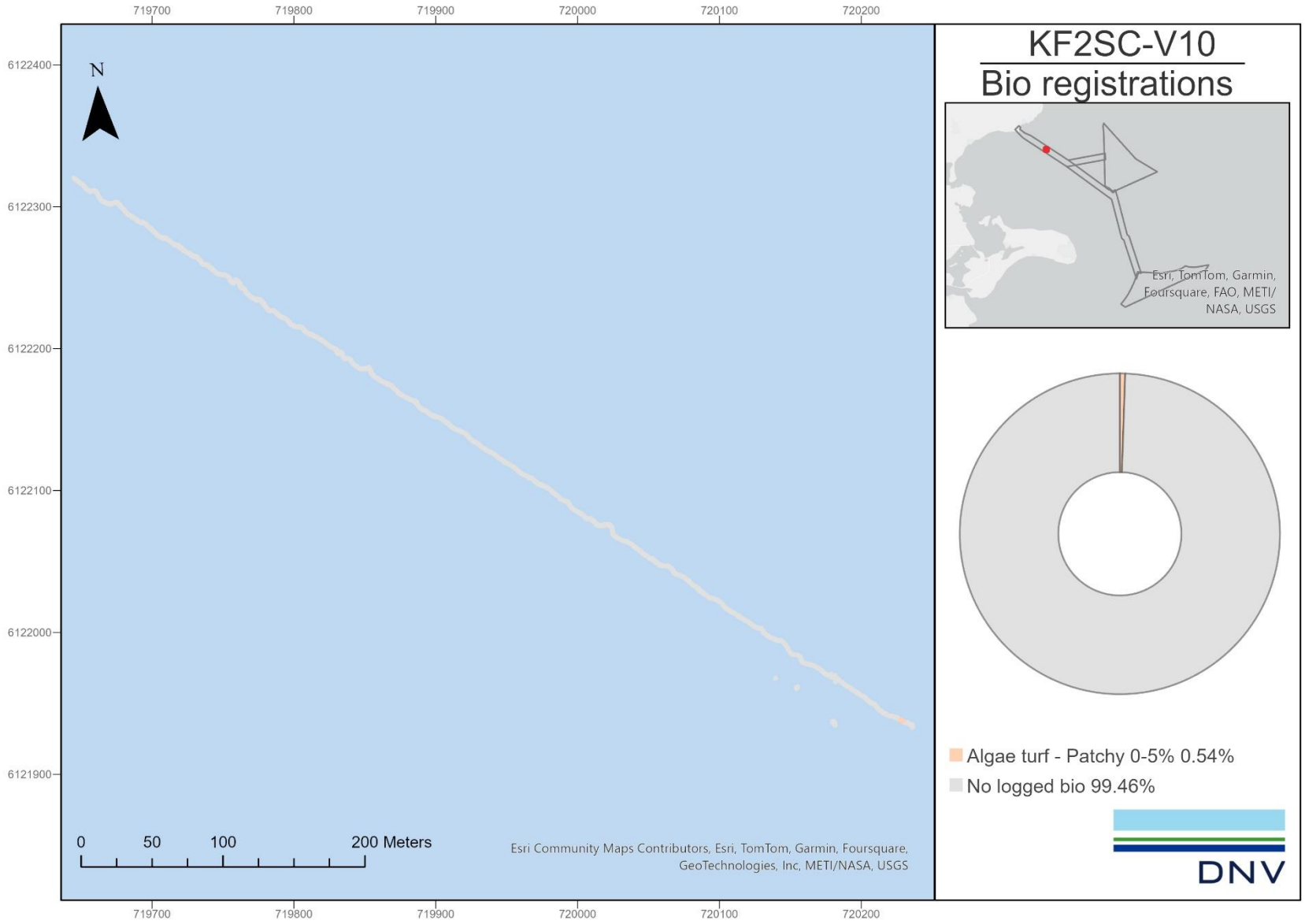

736000
736100
736200
736300
736400
736500
6110800
6110700
6110600
6110500
6110400
6110300
N
KF2SC-V5
Bio registrations
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
København - Swinoujscie
0
50
100
200 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
No logged bio 100.00%
DNV

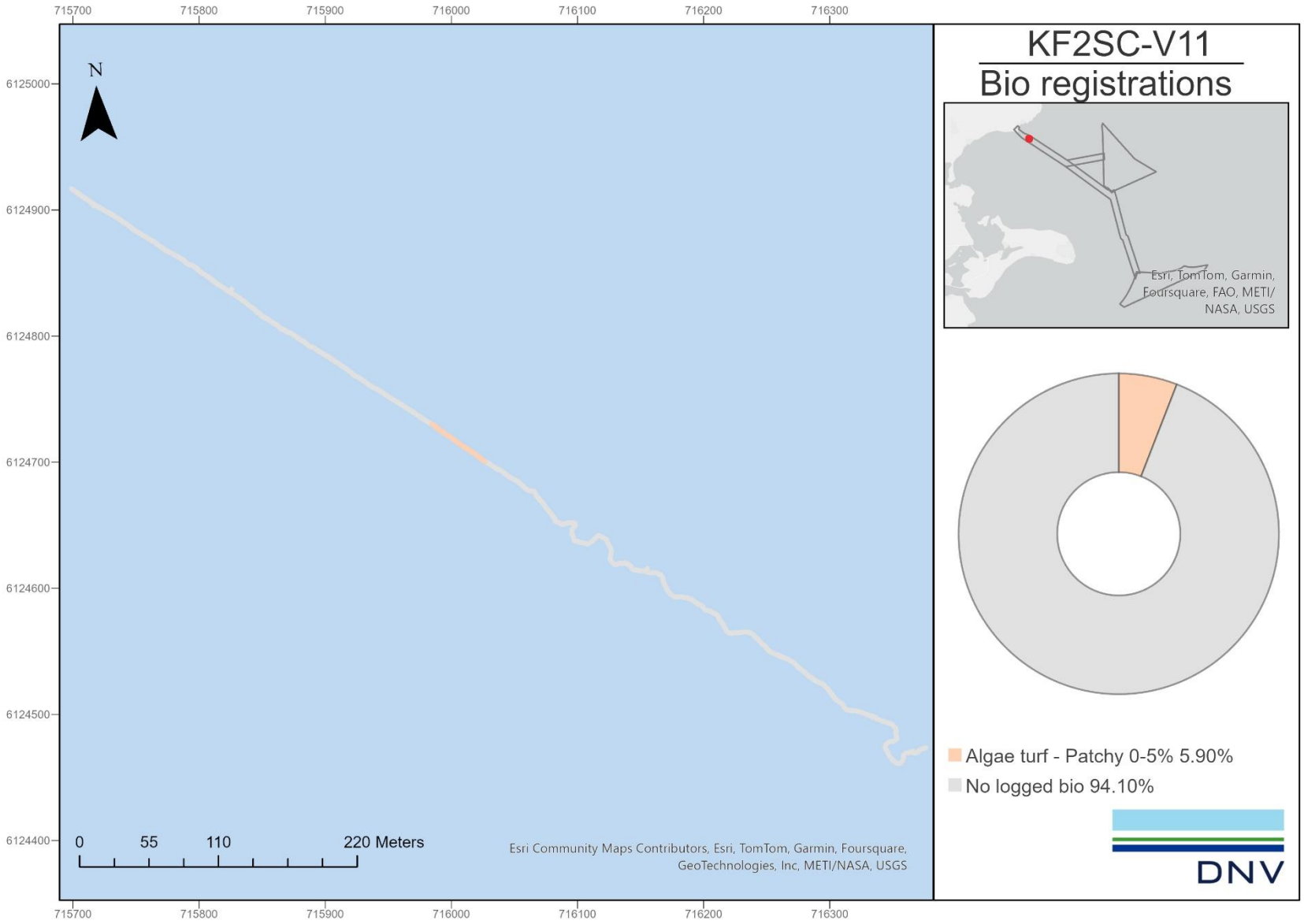

732800
732900
733000
733100
733200
733300
N
6113200
6113100
6113000
6112900
6112800
6112700
0
50
100
200 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V6
Bio registrations
Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
Algae turf - Patchy 0-5% 8.84%
Macroalgae - Patchy 0-5% 0.08%
Mussels 25-50% 46.60%
No logged bio 44.49%
DNV

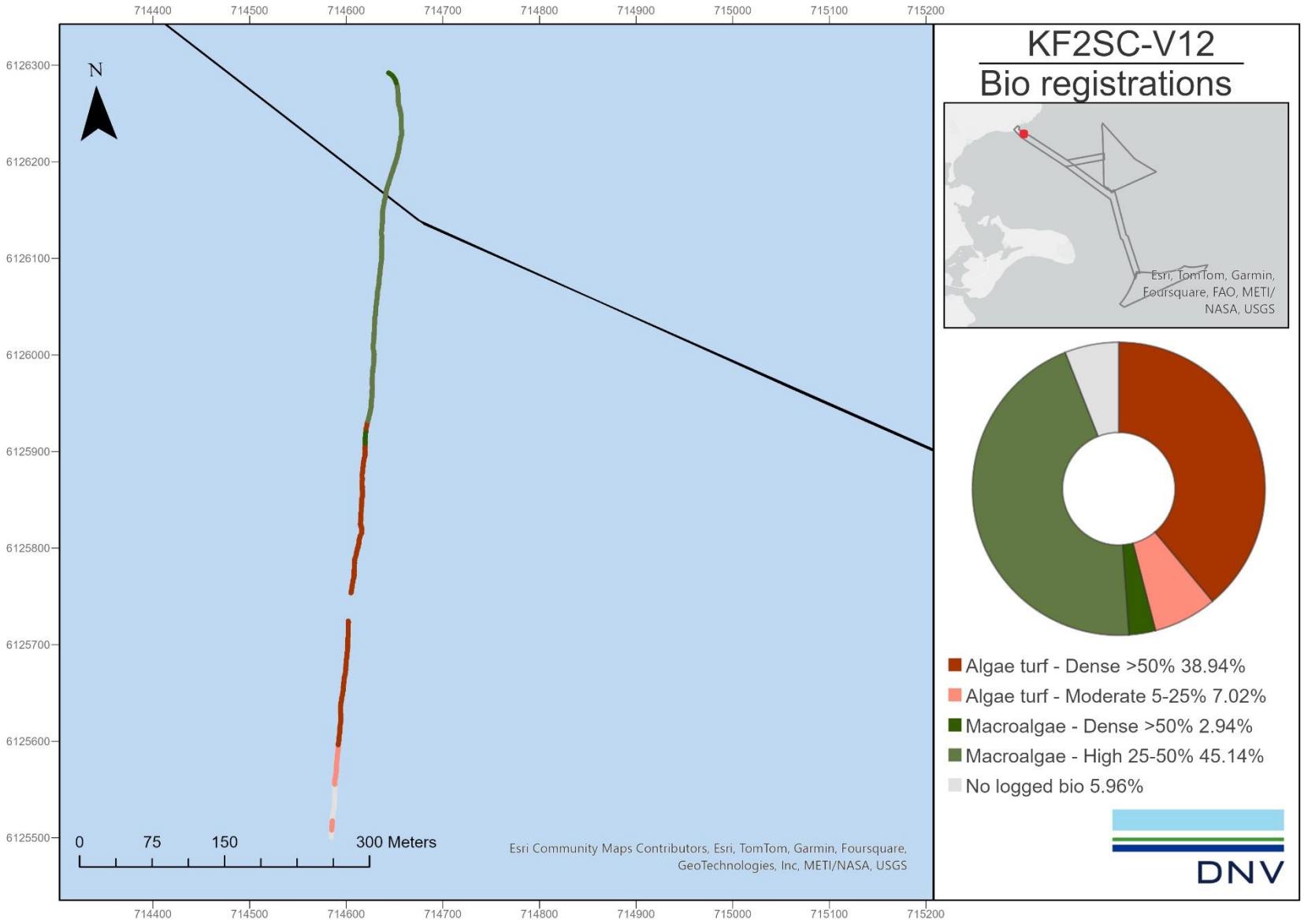

729500
729600
729700
729800
729900
730000
730100
N
6115600
6115500
6115400
6115300
6115200
6115100
6115000
0
62,5
125
250 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V7
Bio registrations
Esri, TomTom, Garmin, Foursquare, FAO, METI/ NASA, USGS
Algae turf - Patchy 0-5% 0.42%
Eelgrass -Patchy 0-5% 0.11%
No logged bio 99.47%
DNV

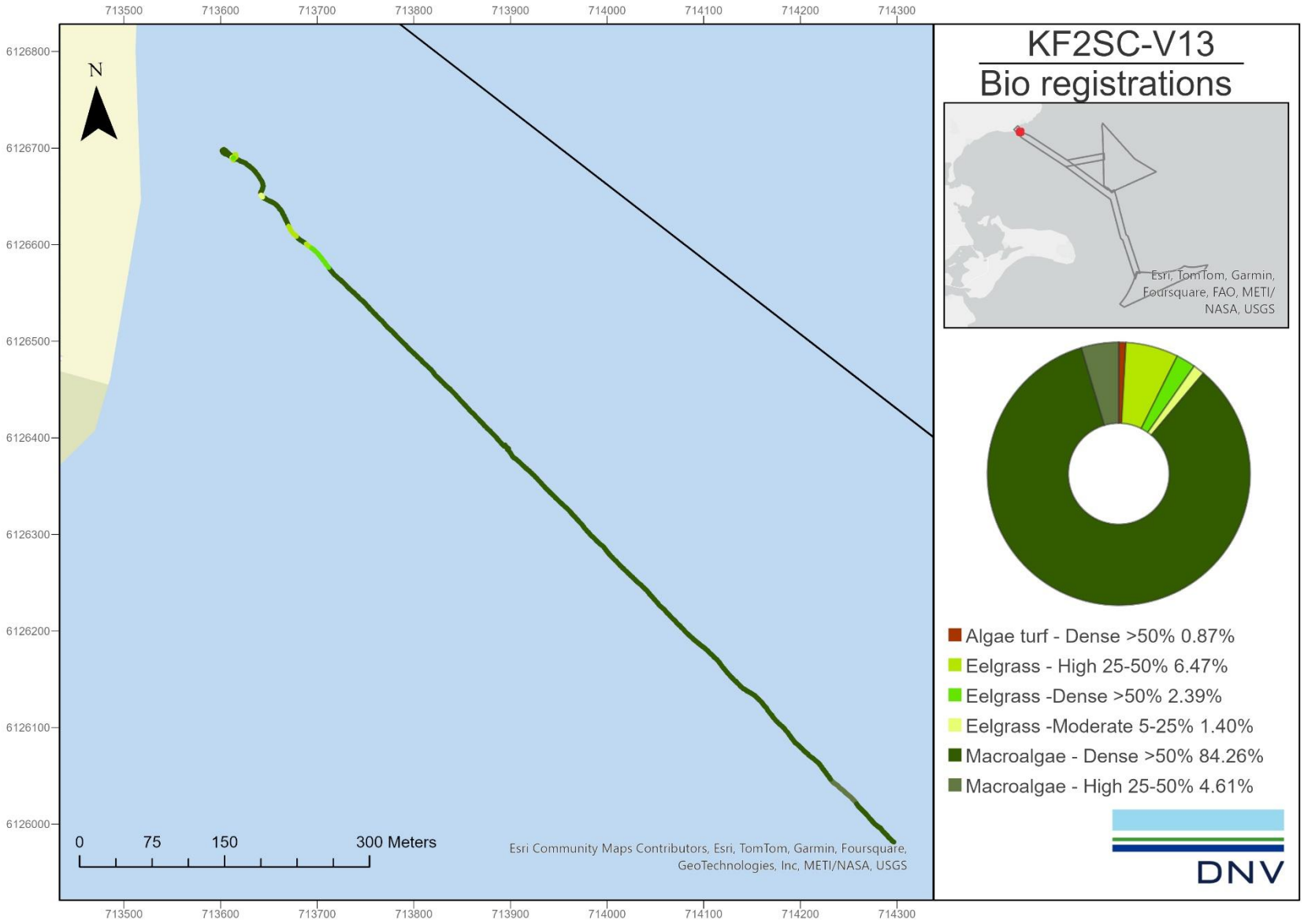

726300
726400
726500
726600
726700
726800
726900
6117900
6117800
6117700
6117600
6117500
6117400
N
0
50
100
200 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V8
Bio registrations
Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
Algae turf - Dense >50% 0.13%
Algae turf - Moderate 5-25% 32.07%
Algae turf - Patchy 0-5% 16.06%
Eelgrass -Patchy 0-5% 0.05%
Mussels 0-5% 4.42%
Mussels 5-25% 4.47%
Mussels 25-50% 8.27%
No logged bio 34.51%
DNV


723000
723100
723200
723300
723400
723500
723600
6120200
6120100
6120000
6119900
6119800
6119700
N
0
50
100
200 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V9
Bio registrations
Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
Algae turf - Dense >50% 0.93%
Algae turf - High 25-50% 0.46%
Algae turf - Moderate 5-25% 30.85%
Algae turf - Patchy 0-5% 13.62%
Macroalgae - Dense >50% 0.21%
Macroalgae - High 25-50% 2.98%
Mussels 0-5% 2.78%
Mussels 5-25% 10.64%
DNV


719700
719800
719900
720000
720100
720200
6122400
6122300
6122200
6122100
6122000
6121900
N
0
50
100
200 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V10
Bio registrations
Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
Algae turf - Patchy 0-5% 0.54%
No logged bio 99.46%
DNV


715700
715800
715900
716000
716100
716200
716300
6125000
6124900
6124800
6124700
6124600
6124500
6124400
N
0
55
110
220 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V11
Bio registrations
Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
Algae turf - Patchy 0-5% 5.90%
No logged bio 94.10%
DNV


714400
714500
714600
714700
714800
714900
715000
715100
715200
6126300
6126200
6126100
6126000
6125900
6125800
6125700
6125600
6125500
N
0
75
150
300 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V12
Bio registrations
Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
Algae turf - Dense >50% 38.94%
Algae turf - Moderate 5-25% 7.02%
Macroalgae - Dense >50% 2.94%
Macroalgae - High 25-50% 45.14%
No logged bio 5.96%
DNV


713500
713600
713700
713800
713900
714000
714100
714200
714300
6126800
6126700
6126600
6126500
6126400
6126300
6126200
6126100
6126000
N
0
75
150
300 Meters
Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
KF2SC-V13
Bio registrations
Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
Algae turf - Dense >50% 0.87%
Eelgrass - High 25-50% 6.47%
Eelgrass -Dense >50% 2.39%
Eelgrass -Moderate 5-25% 1.40%
Macroalgae - Dense >50% 84.26%
Macroalgae - High 25-50% 4.61%
DNV

APPENDIX 4 SPECIES LIST VISUAL TRANSECTS

Species	KF2S-V1	KF2S-V2	KF2S-V3	KF2S-V4	KF2SC-V1	KF2SC-V2	KF2SC-V3	KF2SC-V4	KF2SC-V5	KF2SC-V6	KF2SC-V7	KF2SC-V8	KF2SC-V9	KF2SC-V10	KF2SC-V11	KF2SC-V12	KF2SC-V13	KF2N-V1	KF2N-V2	KF2N-V3	KF2N-V4	KF2NC-V1	KF2NC-V2
PORIFERA																							
Hymedesmia spp.						1	1																
cf. Halichondria panicea																			1				
Cf. pachymatisma johnstonia																			1				
Porifera indet										1													
Arenicola marina		4	1	3	3	1	2	1	2		1	1	1	4	3	3	1	2	1	2	2	1	2
Sabellidae indet												1											
VARIA																							
Bryozoa indet																1	2			1			
Electra pilosa																1	2						
Membranipora membranacea																1	2						
CRUSTACEA																							
Cancer pagurus																		1					
Carcinus maenas				1	1			1	1	1			1			2	2	1	1	1	1		
Hyas spp.																1							
Semibalanus balanoides			1					2		1		1				1	2		1		1		
MOLLUSCA																							
Buccinum undatum																		1					
Cardiidae indet		1			1			1							1			1			1		
Mytilus edulis	3	5	4		1	3	3	2		5		1	4			4	4		2	1	1		1
ECHINODERMATA																							
Asterias rubens		1		4	1	1	1			1			1			1	1		1		1		
Asteroidea indet		1		2		1	1												2		1		
CNIDARIA																							
Hydroidea indet						3	1	1		1		1				1	1		1	1	1		
PISCES																							
Actinopterygii indet		2			1			1					1		1								

Agonus cataphractus			1																		1		
Agonus cataphractus																			1				
Gadus morhua		2	1	1		1	1			1	1	1	1					1	1		1	1	1
Gobiidae sp.					2				1	1	1	1		1	1			1		1	1		
Limanda limanda																						1	
Lumpenus lampretaeformis				1				1															
Melanogrammus aeglefinus							1											1					
Myoxocephalus scorpius																				1			
Neogobius melanostomus																1	1				1		
Platichthys flesus						1	1												1				
Pleuronectes platessa	1	3	1	2	1	1	1					1		1				1	1	1		1	1
Pleuronectidae indet					1										1								
Pomatoschistus minutus												1		1									
Pomatoschistus sp.																							1
Zoarces viviparus				1																	1		
PLANTAE																							
Ceramium shuttleworthianium																	2						
Ceramium sp.		1	1	1	1	1		1		1		1	1	1		2	1	1	1	1	2	1	1
Ceramium tenuicorne																2	2						
Ceramium virgatum																2	4						
Chorda filum																	2						
Cladophora rupestris																	3						
Cladophora sericea																	2						
Delesseria sanguinea				1																			
Ectocarpus spp.																	2						
Eudesme virescens																	5						
Fucus serratus																	4						

Fucus vesiculosus																	1						
Furcellaria lumbricalis										1		1	1	1	1	1	1				1		
Halidrys siliquisa																	2						
Halosiphon tomentosus																	2						
Hildenbrandia rubra								1		1		1	1			2	3		1	1	3		
Laminaria digitata													1										
Membranoptera cf. alata		1	1																				
Phymatolithon lenormandii																	1						
cf. Phyllophora crispa				1	1		1	1		1		2	1										
Polyides rotunda															2	3	4				1		
Pylaiella littoralis																	3						
Rhodophyta indet													1					1					
Rhodomela cf. confervoides	1		1							1													
Sphacelaria cirrosa																	2						
Spongonema tomentosum																	3						
Ulva intestinalis																	2						
Vertebrata fucoides																	2						
Vertebrata spp.																	3						
Zostera marina																	4						

APPENDIX 5 SPECIES LIST INFAUNA

Kriegers Flak II North	KF2N-1	KF2N-2	KF2N-3	KF2N-4	KF2N-5	KF2N-6	KF2N-7	KF2N-8	KF2N-9	KF2N-10
Oligochaeta		2					11	5	254	111
Nemertea					1	2			2	
Halicryptus spinulosus			8		2		2			
Ampharete lindstroemi kompleks	16	12	94	13	64	24	1	51	40	1
Arenicola marina			1			2	2	4	9	
Capitella capitata	1				2	1	4	4	90	13
Nereididae	284	166	65	152	75	36	108	141	151	234
Scoloplos armiger	313	577	435	404	428	396	318	326	437	41
Aricidea (Strelzovia) suecica	12	62	4	8	7	3		33		
Bylgides			2					1	1	
Dipolydora				1		1				
Pygospio elegans	135	73	177	96	227	20	46	12	5	50
Terebellides	32	8	25	11	11	11	2	3		
Autonoe longipes		1							1	
Microdeutopus									1	
Crassicorophium crassicorne			2	2		8	18	444	276	5
Diastylis rathkei	1	2	2	3	2	4	1	2	3	
Leptostylis	4	5		1	3	2	1	3	14	3
Leptostylis longimana						1				
Gammaridae		1			1				1	1
Idotea granulosa									1	
Parajassa pelagica	6	11	7	13	3	4	6	22	51	8
Calathura brachiata	17	8		9	1	9		4	2	1
Pontoporeia femorata							1			
Pseudocuma	20	5	2	2	7	5			1	
Cerastoderma glaucum	2	2	2	3	1	1		2	1	
Peringia ulvae	3								5	12
Mya arenaria	12	6	1	12	9	1	2	8	2	

Mytilus edulis	3			7		8	2		15	4
Retusa obtusa	2				4			2	2	3
Limecola balthica	8	78	138	89	131	28	138	91	88	226
Pyrgiscus jeffreysii	22	2	4	5	12	2	4			

Kriegers Flak II North ECC	**KF2NC-1**	**KF2NC-2**	**KF2NC-3**	**KF2NC-4**
Oligochaeta	8		3	22
Edwardsia	2			
Nemertea		1		
Phoronis	2			
Ampharete lindstroemi kompleks	8	18	29	33
Arenicola marina	1			
Capitella capitata	3		1	
Heteromastus filiformis		1		
Fabricia	6	1		
Nereididae	137	249	212	33
Ophelia rathkei				8
Scoloplos armiger	197	396	268	11
Aricidea (Aricidea) minuta	19	4	3	4
Aricidea (Strelzovia) suecica	22	10	4	1
Eteone				1
Bylgides		1		
Polynoidae			1	
Dipolydora	1			1
Pygospio elegans	68	108	149	74
Spio				42
Travisia forbesii				4
Terebellides		15		
Microdeutopus	4	1		
Crassicorophium crassicorne	59	7	12	23

Diastylis rathkei		1	2	
Diastyloides serratus	4	11	2	2
Ischyrocerus megacheir	7			
Parajassa pelagica		23	20	9
Calathura brachiata	19	15	36	19
Harpinia laevis	4			42
Pseudocuma	1	2	3	4
Cerastoderma glaucum	4	5	1	4
Peringia ulvae	25	23	2	89
Mya arenaria	42	6	9	35
Mytilus edulis	4		3	3
Retusa obtusa	6	5	2	1
Limecola balthica	8	46	25	10

Kriegers Flak II South	**KF2S-1**	**KF2S-2**	**KF2S-3**	**KF2S-4**	**KF2S-5**	**KF2S-6**	**KF2S-7**	**KF2S-8**	**KF2S-9**	**KF2S-10**
Oligochaeta	33	2	64	27	54	2		1	48	149
Nemertea				1	1		1			21
Halicryptus spinulosus						3	4			7
Ampharete lindstroemi kompleks				3	12	126	33	34	2	15
Arenicola marina			1			1				2
Capitella capitata			2	6	1	4	2	1		12
Heteromastus filiformis										3
Nephtys hombergii						4	1			
Nereididae	33	21	49	143	1	4	3	45	91	2
Scoloplos armiger	141	116	141	641	171	351	74	282	222	447
Aricidea (Aricidea) minuta					2	10				
Aricidea (Strelzovia) suecica				15	44	70	53	51		65
Bylgides						1				
Polynoidae juv.				1	1					
Dipolydora	1		1		10					

Marenzelleria			2							
Pygospio elegans	222	49	89	40	185	276		125	46	122
Spio					15	1		1		
Terebellides		1		3	24	4	8	76		9
Cirripedia										12
Microdeutopus		7		3						6
Crassicorophium crassicorne	1		11	8	55	1			33	3
Diastylis rathkei		2		5	1	2	1	1	1	1
Leptostylis					2					1
Dulichia										1
Gammaridae			7	31						12
Parajassa pelagica	5	24	11	12	17	15	18	13	2	12
Jaera		15	32							34
Harpinia laevis					93					1
Pontoporeia femorata						1		2		1
Pseudocuma				1		5				
Asteroidae juv.										1
Astarte montagui					25	4		8		
Cerastoderma glaucum	8	17	4	3				4		10
Peringia ulvae	494	99	7	14		4		19	15	5
Mya arenaria	1	3		6	1	8		5	4	
Mytilus edulis	4	121	67	191		2			2	1139
Retusa obtusa	1	2	1					2	1	
Limecola balthica	9	12	15	68	32	85	73	130	26	206

Kriegers Flak II South ECC	KF2SC-1	KF2SC-2	KF2SC-3	KF2SC-4	KF2SC-5	KF2SC-6	KF2SC-8	KF2SC-9	KF2SC-10	KF2SC-11	KF2SC-12	KF2SC-13	KF2SC-14	KF2SC-15	KF2SC-18	KF2SC-19	KF2SC-20	KF2SC-21	KF2SC-22
Oligochaeta	18	3	34	107	16	54	58	62				2		8	38	67	28	32	29
Chironomidae	1						5	1											

Halicryptus spinulosus	1	7			1														
Priapulus caudatus	2	1				1	10												
Edwardsia				2															
Nemertea	2			41		8													
Ampharete lindstroemi kompleks	138	75	166	33	14	38	14	5	10	4	37		4	3	12	3			
Arenicola marina		2			2	2	1							1	3	2	3		1
Capitella capitata	8	7	2		2	2	8				1	1		1	6		2		
Heteromastus filiformis									1	1		1	2						
Chaetozone setosa kompleks	1		1																
Fabricia		2	10											7					
Nephtys juv.	1																		
Nephtys caeca	4	1																	
Nephtys hombergii					1														
Nereididae	8	4	10		64	3	7	111	160	145	61	8	146	24	26	406	207	236	137
Scoloplos armiger	290	201	81	64	123	154	575	777	307	183	304	35	186	15	94	630	224	365	469
Aricidea (Aricidea) minuta		7	1		4									3					
Aricidea (Strelzovia) suecica	28	42	40	8	23	7	2	3	18	9		1	1						
Bylgides					1														
Polynoidae	1	4			1			1							1				
Chone				1															
Dipolydora	6	14	30																
Prionospio fallax					1														
Pygospio elegans	115	238	455	182	132	288	5	6	38	21	9	3	10	14	64	21	4	23	16
Spio	1		5											5	16				
Streblospio shrubsolii															5	17	7	12	1
Syllidae			5	4		6								2	1				
Amphitrite				2															
Polycirrus			1																
Terebellidae	1																		
Travisia forbesii														4	14				
Terebellides	3	107	7	22	4	21	8	2	4	3	1		1						
Cirripedia				20		1													

Autonoe longipes			1			1													
Crassicorophium crassicorne			12	1		1			1					2	7	41	1	16	
Diastylis rathkei	2	1	3			1	1		3	4	1		1						
Diastyloides serratus		1																	
Leptostylis				5	2		1		1	1					2	5	1		
Gammaridae																		1	
Parajassa pelagica	5	4	13	6	6	75	12	13	4	23	46	11	2	13			3		15
Calathura brachiata			7	64		20			5	4	20	2	13	16	3	19		3	
Harpinia laevis			36	4										2					
Liocarcinus pusillus								1											
Pseudocuma						2	18	229	53	17	23		2			8	10		
Astarte montagui	1	1	15																
Cerastoderma glaucum	5	6						1		1			4	1	4	5	1	23	3
Peringia ulvae	1	24		12		6	6	1	4	34	3	1	28	171	5	64	44	60	116
Mya arenaria	16	4	4		1		2	3	4	3	5		12			17	4	17	4
Mytilus edulis	1	1	8	32	3	17	3		1		9	1	7	5		3			
Retusa obtusa	14		1					1		1	3					1		1	2
Limecola balthica	192	76	15	12	26	19	287	236	9	6	38	2	21	13	22	61	30	18	19
Pyrgiscus jeffreysii			1			2				1				6			1		

APPENDIX 6 BIOMASS RESULTS

Kriegers Flak II North OWF area

Group	Species	KF2N-1	KF2N-2	KF2N-3	KF2N-4	KF2N-5	KF2N-6	KF2N-7	KF2N-8	KF2N-9	KF2N-10
Varia	Oligochaeta		0,00325					0,00605	0,0025	0,3365096	0,078
Varia	Nemertea					0,0106875	0,0315			0,01125	
Varia	Halicryptus spinulosus			0,8786667		0,1545		0,2525			
Polychaeta	Ampharete lindstroemi complex	0,0075556	0,0096	0,1924063	0,0054167	0,0844444	0,064	0,00399	1,275	0,1075	0,0005
Polychaeta	Arenicola marina			0,0660781			0,1455	0,17	0,1415	0,6406875	
Polychaeta	Capitella capitata	0,00075				0,002	0,0014555	0,02	0,006	0,0322159	0,001625
Polychaeta	Nereididae	6,3566515	4,8993056	5,4338587	3,6561429	1,6427885	3,568	1,995618	2,186381	1,7811136	5,1585625
Polychaeta	Scoloplos armiger	1,6313939	4,2360371	3,1765966	3,2675078	2,7810093	4,18176	2,92774	2,507324	5,9687805	0,6812308
Polychaeta	Aricidea (Strelzovia) suecica	0,0405	0,1051304	0,006	0,0304	0,0240625	0,00761		0,046588		
Polychaeta	Bylgides			0,115					0,16175	0,01225	
Polychaeta	Dipolydora				0,00125		0,00125				
Polychaeta	Pygospio elegans	0,1073864	0,0680227	0,3336689	0,2097391	0,3036125	0,0274972	0,043536	0,016498	0,0090625	0,0552632
Polychaeta	Terebellides	0,4625455	0,024	0,2958333	0,1258125	0,048125	0,154	0,026	0,022875		
Mollusca	Cerastoderma glaucum	0,0045	0,008	0,05025	0,075375	0,025125	0,07975		0,029	0,025125	
Mollusca	Limecola balthica	0,0176	2,61625	7,80275	1,9841196	7,1695208	0,548625	7,60495	2,170829	7,2147059	5,9956908
Mollusca	Mya arenaria	0,251	0,774	0,08925	0,898	0,313875	0,01675	0,100005	0,068667	0,051625	
Mollusca	Mytilus edulis	0,006			0,02065		0,11652	0,01125		0,4875	0,119
Mollusca	Peringia ulvae	0,007875								0,0163542	0,047
Mollusca	Pyrgiscus jeffreysii	0,092125	0,0035	0,0055	0,0195833	0,0555	0,0057847	0,006			
Mollusca	Retusa obtusa	0,0215				0,0135			0,024938	0,044	0,04125
Crustacea	Calathura brachiata	0,3329167	0,1713333		0,147375	0,0225	0,1791		0,1305	0,042	0,01925
Crustacea	Autonoe longipes		0,00025							0,00025	
Crustacea	Microdeutopus									0,00025	
Crustacea	Crassicorophium crassicorne			0,012	0,066		0,15	0,4095	5,531336	2,9902091	0,0609375
Crustacea	Diastylis rathkei	0,0345	0,1725	0,09	0,0525	0,106	0,54	0,0145	0,07375	0,138	
Crustacea	Leptostylis	0,008	0,01		0,002	0,006	0,004	0,002	0,006	0,028	0,006
Crustacea	Gammaridae		0,003			0,00075				0,00175	0,00175
Crustacea	Idotea granulosa									0,00025	
Crustacea	Parajassa pelagica	0,0140417	0,0257431	0,007	0,0304236	0,0070208	0,0093611	0,014042	0,051486	0,1193542	0,0187222
Crustacea	Pontoporeia femorata							0,00025			
Crustacea	Pseudocuma	0,055	0,009375	0,0055	0,0055	0,01925	0,01375			0,00275	

Kriegers Flak II North ECC area

Group	Species	KF2NC-1	KF2NC-2	KF2NC-3	KFNC-4
Varia	Oligochaeta	0,0074286		0,0020491	0,009625
Varia	Edwardsia	0,0202462			
Varia	Nemertea		0,0039444		
Varia	Phoronis	0,1000819			
Polychaeta	Ampharete lindstroemi complex	0,015	0,045	0,0135938	0,023375
Polychaeta	Arenicola marina	0,138			
Polychaeta	Capitella capitata	0,00225		0,00075	
Polychaeta	Heteromastus filiformis		0,00225		
Polychaeta	Fabricia	0,0075	0,00025		
Polychaeta	Nereididae	0,5156014	3,8954472	6,8344762	0,0495
Polychaeta	Ophelia rathkei				0,126
Polychaeta	Scoloplos armiger	1,1168464	2,412	0,8818875	0,0458333
Polychaeta	Aricidea (Aricidea) minuta	0,0149286	0,021	0,0077857	0,007
Polychaeta	Aricidea (Strelzovia) suecica	0,0256667	0,0166667	0,024	0,00125
Polychaeta	Eteone				0,00725
Polychaeta	Bylgides		0,11375		
Polychaeta	Polynoidae			0,00025	
Polychaeta	Dipolydora	0,002			0,002
Polychaeta	Pygospio elegans	0,0396667	0,0891818	0,1351225	0,0274074
Polychaeta	Spio				0,121625
Polychaeta	Travisia forbesii				0,423
Polychaeta	Terebellides		0,0675		
Mollusca	Cerastoderma glaucum	1,0243333	0,115625	0,00125	0,3739444
Mollusca	Limecola balthica	0,025	10,895429	3,7291667	0,285
Mollusca	Mya arenaria	2,6610938	0,1485	0,0405	0,2865625
Mollusca	Mytilus edulis	0,038		0,00375	0,028875
Mollusca	Peringia ulvae	0,19375	0,14375	0,004	0,3877857
Mollusca	Retusa obtusa	0,096	0,091875	0,03675	0,02075
Crustacea	Calathura brachiata	0,2318	0,2165625	0,6583846	0,34675
Crustacea	Microdeutopus	0,0005	0,00025		
Crustacea	Crassicorophium crassicorne	0,9418929	0,1561875	0,16875	0,039675
Crustacea	Diastylis rathkei		0,0505	0,0725	

Kriegers Flak II South OWF area

Group	Species	KF2S-1	KF2S-2	KF2S-3	KF2S-4	KF2S-5	KF2S-6	KF2S-7	KF2S-8	KF2S-9	KF2S-10
Varia	Oligochaeta	0,0144375	0,00225	0,0647273	0,0126	0,0585	0,008986		0,004493	0,03375	0,1785189
Varia	Nemertea				0,02075	0,003		0,02525			0,2549531
Varia	Halicryptus spinulosus						0,1335	0,033			0,2858333
Polychaeta	Ampharete lindstroemi complex				0,0075	0,01275	0,133636	0,1909286	0,0378636	0,005	0,015
Polychaeta	Arenicola marina			0,09075			3,77				3,86075
Polychaeta	Capitella capitata			0,0022333	0,0045	0,00075	0,008	0,0022333	0,0015		0,007
Polychaeta	Heteromastus filiformis										0,02475
Polychaeta	Nephtys hombergii						0,8925	0,1485			
Polychaeta	Nereididae	0,49425	0,669375	2,314025	3,9758125	0,00025	0,018	0,00025	0,4171154	2,1571875	0,0055
Polychaeta	Scoloplos armiger	1,3566214	1,4926471	1,2318947	2,9860158	1,10295	2,513077	0,3216154	2,5437945	2,2085172	2,9811732
Polychaeta	Aricidea (Aricidea) minuta					0,002	0,010625				
Polychaeta	Aricidea (Strelzovia) suecica				0,0140625	0,035444	0,147656	0,0695625	0,136425		0,1233088
Polychaeta	Bylgides						0,0315				
Polychaeta	Polynoidae juv.				0,0285	0,0285					
Polychaeta	Dipolydora	0,003		0,0015417		0,000833					
Polychaeta	Marenzelleria			0,057							
Polychaeta	Pygospio elegans	0,3200106	0,0844605	0,1335	0,03	0,243535	0,570818		0,3565341	0,0583846	0,0737083
Polychaeta	Spio					0,009375	0,000625		0,000625		
Polychaeta	Terebellides		0,0035		0,045	0,132	0,018	0,128	0,7048095		0,0489375
Mollusca	Astarte montagui					34,55313	0,326		27,52		
Mollusca	Cerastoderma glaucum	4,019	8,7465	8,918	0,01875				0,117		0,575
Mollusca	Limecola balthica	8,125875	0,546	3,2314286	13,743438	11,27106	51,96688	20,820291	13,46735	0,6267857	47,022529
Mollusca	Mya arenaria	0,04375	0,30675		0,016	0,0095	0,020667		0,595625	0,011	
Mollusca	Mytilus edulis	0,003	131,90873	46,94947	326,05918		0,011			0,002	354,63225
Mollusca	Peringia ulvae	2,9985455	0,0622742	0,0215833	0,042		0,01		0,1209423	0,0351562	0,01375
Mollusca	Retusa obtusa	0,03225	0,0645	0,03225					0,0645	0,03225	
Echinodermata	Asteroidae juv.										0,038
Crustacea	Microdeutopus		0,2333333		0,00025						0,2
Crustacea	Crassicorophium crassicorne	0,01375		0,075625	0,0746667	0,378125	0,006875			2,0735	0,020625
Crustacea	Diastylis rathkei		0,06125		0,00025	0,0325	0,096	0,029	0,04	0,031	0,02875
Crustacea	Leptostylis					0,0005					0,00025
Crustacea	Gammaridae			0,22875	0,785333						0,095
Crustacea	Parajassa pelagica	0,0104167	0,05	0,0229167	0,025	0,031682	0,03125	0,0375	0,0270833	0,0041667	0,025

Group	Species	KF2S-1	KF2S-2	KF2S-3	KF2S-4	KF2S-5	KF2S-6	KF2S-7	KF2S-8	KF2S-9	KF2S-10
Crustacea	Jaera		0,017125	0,0365333							0,0387813
Crustacea	Harpinia laevis					0,106078					0,0011406
Crustacea	Dulichia										0,00025
Crustacea	Pontoporeia femorata						0,0205		0,041		0,0205
Crustacea	Pseudocuma				0,00025		0,00125				

Kriegers Flak II South ECC area

Group	Species	KF2SC-1	KF2SC-2	KF2SC-3	KF2SC-4	KF2SC-5	KF2SC-6	KF2SC-8	KF2SC-9	KF2SC-10	KF2SC-11	KF2SC-12	KF2SC-14	KF2SC-15	KF2SC-18	KF2SC-19	KF2SC-20	KF2SC-21	KF2SC-22
Varia	Oligochaeta	0,045	0,0075	0,2907895	0,7639183	0,018333	0,160809	0,0503472	1,9375					0,025	0,1973077	0,149075	0,1015	0,06	0,024167
Varia	Chironomidae	0,0090625						0,0625	0,005625										
Varia	Halicryptus spinulosus	0,0075	0,0109375			0,004531													
Varia	Priapulus caudatus	3,4029167	1,7014583				1,701458	17,014583											
Varia	Edwardsia				0,0301584														
Varia	Nemertea	0,025			0,5210417		0,035												
Polychaeta	Ampharete lindstroemi complex	1,0479375	0,2773438	0,8530556	0,21175	0,265417	0,0475	0,02125	0,0078125	0,0104167	0,0075	0,270385	0,0175	0,0168183	0,1905	0,005625			
Polychaeta	Arenicola marina		0,115			12,74125	3,480446	5,145625						1,7402232	0,016875	0,1825	1,3659375		0,055625
Polychaeta	Capitella capitata	0,01	0,030625	0,005		0,0075	0,006806	0,01				0,004375		0,0025	0,03		0,01125		
Polychaeta	Heteromastus filiformis									0,1553125	0,1553125		0,310625						
Polychaeta	Chaetozone setosa complex	0,00375		0,00375															
Polychaeta	Fabricia		0,00025	0,0104167										0,0021875					
Polychaeta	Nephtys juv.	0,029375																	
Polychaeta	Nephtys caeca	4,650625	1,87875																
Polychaeta	Nephtys hombergii					1,351875													
Polychaeta	Nereididae	0,065	0,0275	0,05		3,769524	0,009375	1,0390625	13,85347	15,134694	11,928935	5,047326	21,39544	2,385	0,3425	14,377244	11,702557	3,941938	2,200257
Polychaeta	Scoloplos armiger	6,5968287	6,5235268	2,019375	0,44	5,128125	2,358822	8,1223776	9,4501058	4,5933712	2,7712109	1,739082	5,049979	0,5015625	1,6170238	15,42746	6,4140206	6,236488	14,37132
Polychaeta	Aricidea (Aricidea) minuta		0,0240625	0,000625		0,0425								0,0084375					
Polychaeta	Aricidea (Strelzovia) suecica	0,09625	0,4305	0,1777778	0,025	0,149141	0,015313	0,0082523	0,0123784	0,0385714	0,0084375		0,004126						
Polychaeta	Bylgides					0,275													
Polychaeta	Polynoidae	0,009375	0,0375			0,009375			0,009375						0,009375				
Polychaeta	Chone				0,0273611														
Polychaeta	Dipolydora	0,016875	0,44625	0,21375															
Polychaeta	Prionospio fallax					0,002316													
Polychaeta	Pygospio elegans	2,343125	2,168775	5,1072601	0,3270313	1,2606	0,39913	0,0235069	0,00375	0,0475	0,06125	0,0135	0,009375	0,0175	0,157037	0,005625	0,0075	0,076667	0,161111
Polychaeta	Spio	0,0096181		0,078125										0,01875	0,1516667				
Polychaeta	Streblospio shrubsolii														0,00625		0,0058333	0,015	0,008125
Polychaeta	Syllidae			0,0109375	0,00875		0,02625							0,000625	0,001875				
Polychaeta	Amphitrite				0,923125														
Polychaeta	Polycirrus			0,0924063															
Polychaeta	Terebellidae	0,0046875																	
Polychaeta	Travisia forbesii													1,1985	4,19475				
Polychaeta	Terebellides	0,035625	3,7922059	0,056875	0,7913889	0,137103	0,679875	0,26	0,0685513	0,0941667	0,283125	0,034276	0,034276						
Mollusca	Astarte montagui	0,4111964	0,1135	10,633393															
Mollusca	Cerastoderma glaucum	0,05375	3,1135688						0,01225		0,00025		3,2145	0,394	5,373	2,34625	0,0395	31,97359	2,17875
Mollusca	Limecola balthica	12,205714	14,404375	7,531875	11,7498	12,0432	1,2464	42,662364	10,490838	0,11175	6,9165	7,689154	0,777	9,8011875	9,0279444	13,010792	17,134375	1,3395	2,6258
Mollusca	Mya arenaria	0,124	0,027	0,16		0,0555		0,6119014	0,0225	0,1675	0,9178521	0,105833	1,1085			36,365833	11,426	4,2619	0,6085
Mollusca	Mytilus edulis	0,232516	0,232516	0,434	36,90965	0,0135	6,975231	0,625875		0,232516		0,407625	0,0085	1,162582		0,697549			
Mollusca	Peringia ulvae	0,0035	0,099429		0,06525		0,0225	0,0265	0,00518	0,0315	0,0085	0,00525	0,212154	0,651021	0,0225	0,38	0,24475	0,643269	0,982947
Mollusca	Pyrgiscus jeffreysii			0,0054167			0,010833				0,0054167			0,0325			0,0054167		
Mollusca	Retusa obtusa	0,1855		0,014625					0,014625		0,0155	0,020625				0,00375		0,03375	0,02925
Crustacea	Calathura brachiata			0,1615833	0,364		0,064286			0,1129167	0,131	0,515	0,144625	0,1526667	0,035625	0,3598125		0,017063	
Crustacea	Autonoe longipes			0,00025			0,00025												
Crustacea	Crassicorophium crassicorne			0,17625	0,0146875		0,014688			0,0146875				0,029375	0,1028125	0,6021875	0,004	0,303	
Crustacea	Diastylis rathkei	0,1	0,036	0,135			0,03675	0,028		0,10125	0,159	0,03475	0,03675						
Crustacea	Diastyloides serratus		0,00025																
Crustacea	Leptostylis				0,00025	0,0005		0,00025		0,00025	0,00025				0,0005	0,00125	0,00025		
Crustacea	Gammaridae																	0,00025	
Crustacea	Parajassa pelagica	0,0254545	0,0203636	0,0661818	0,0305455	0,030545	0,381818	0,0610909	0,0442	0,0203636	0,1170909	0,234182	0,010182	0,03315			0,0152727		0,055938
Crustacea	Harpinia laevis			0,061	0,031									0,0033889					
Crustacea	Pseudocuma						0,003076	0,0276875	0,3522465	0,1145179	0,025925	0,1196	0,003076			0,0123056	0,0153819		
Crustacea	Liocarcinus pusillus								0,01625										

About DNV

DNV is the independent expert in risk management and assurance, operating in more than 100 countries. Through its broad experience and deep expertise NV advances safety and sustainable performance, sets industry benchmarks, and inspires and invents solutions.

Whether assessing a new ship design, optimizing the performance of a wind farm, analyzing sensor data from a gas pipeline or certifying a food company's supply chain, DNV enables its customers and their stakeholders to make critical decisions with confidence.

Driven by its purpose, to safeguard life, property, and the environment, DNV helps tackle the challenges and global transformations facing its customers and the world today and is a trusted voice for many of the world's most successful and forward-thinking companies.