

BSAC West Midlands Regional Expedition Scheme

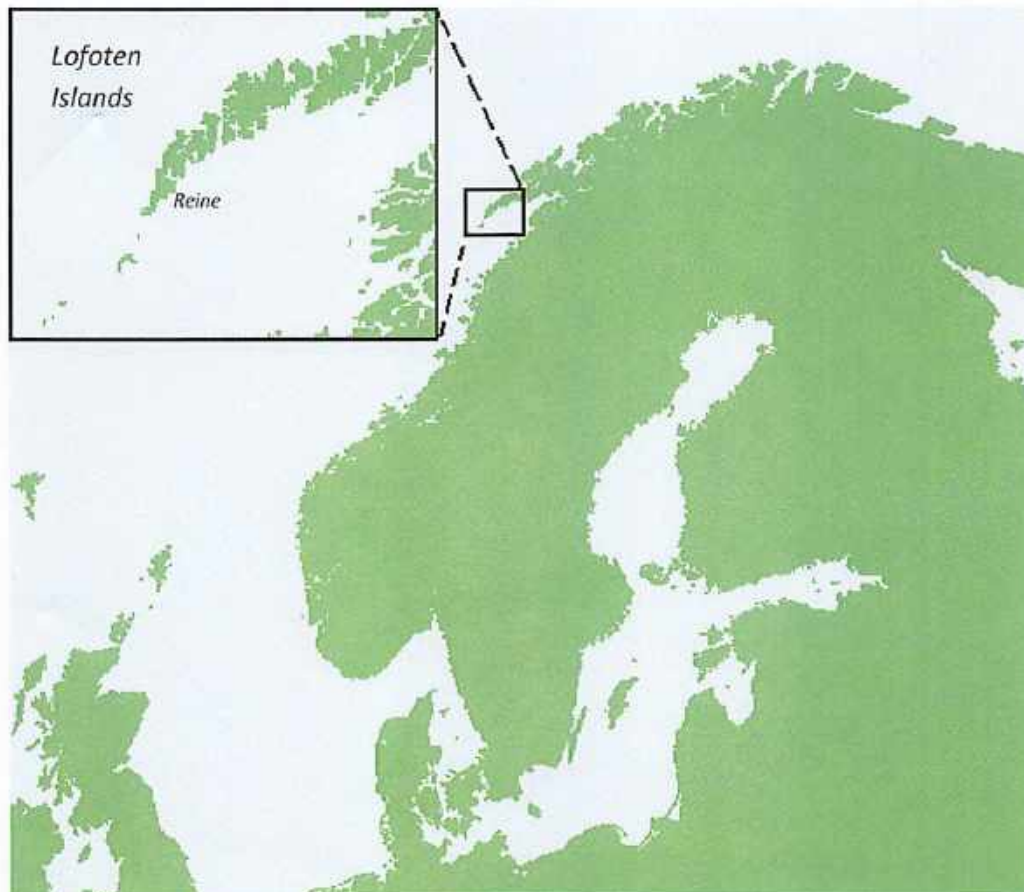
Lofoten Islands Expedition

Reine, Norway

19th September – 3rd October 2013

“A Moment In Time”

(100 miles inside the Arctic Circle)



Expedition Aims

The project aim was to survey the marine life and wrecks around the base of operation to "Capture a moment in time" and to generate a baseline against which changes in the marine environment can be monitored in future years. It provided several different types of diving (boat, drift, wall and wreck) and on one trip allow a glimpse of large marine mammals (orca). The location is surrounded by great natural scenery and wildlife.



The project also offered opportunities for participants to develop individual diving and dive management skills, and was open to anyone qualified to BSAC Sports Diver and above (or equivalent). The expedition consisted of 14 diving places of which two were reserved for a Marine Biologist and Wreck Recording Advisor. The expedition divers held qualifications ranging from BSAC Sports Diver to First Class Diver, and had ages ranging from 22 to 75. During the expedition 109 dives were carried out amounting to approximately 70 hours underwater. Two 24-hour breaks were factored in after each set of multiple days diving, and no incidents were reported.



The Lofoten Islands are a ridge of islands that protrude in to the Norwegian Sea by 60 miles. They are in the path of the North Atlantic Current (part of the Gulf Stream current). Some scientists believe that global warming may affect the direction of the Gulf Stream or lower its temperature at some point of time in the future, and that this could have a dramatic effect on



the marine environment. The objective of the project was to record the marine environment in terms of depth, habitat, biodiversity, location and time. Wreck sites where diving was permitted were also surveyed, both as objects and habitat. Any reports, images or videos taken during the expedition are available freely to interested parties for the purpose of education and promotion.



Base of Operations

The expedition's base of operations was Reine at the southern end of the Lofoten Islands. Accommodation was self-catering in three apartments. There was sufficient space in one of these for all twenty members of the project team to eat together, and this apartment was also used as a meeting room and for survey dry runs.

Aqua Lofoten diving centre at Reine provided gas (air), cylinders and weights. The centre also provided support for equipment failure, a boat (12m RIB) and local knowledge (which was essential as there are no diving guides or detailed charts of the area). The RIB carried maximum 10 divers and their equipment, so participants enjoyed a mixture of shore and boat diving.

All travel costs were borne by individual expedition participants. The ferry between Bodø and the Lofoten Isles was running a restricted winter service which determined the timing of both the outward and return journeys.

A people carrier was hired for the duration of the project and provided local travel for food shopping and for sightseeing, and for transport of participants and their equipment to shore dive sites.



Diving

Due to the remoteness of the sites from recompression facilities (800 miles) and other factors indicated in the risk assessment, the maximum diving depth was limited to 35m.

Consideration was also given to the choice of thermal clothing required above and below the water. Average water temperature was expected to be 10°C. Average air temperature was expected to be 12°C, plus wind chill.

Team Members

Mark Callaghan (Expedition Leader)
Victoria Billings (Marine Biologist)
Jane Maddocks (Wreck Recording Advisor)
Matt Drage
Chris Jackson
Sarah Jepson
Kerry MacKay
David Oliver
Simon Pilsworth
Harold Sach
Jim Seymour
Andy Sharp
Adam Stevens
Brenda Wilson
Eric Yassine



Non-diving Activities



During surface intervals in-between dives, time was spent looking at the local ship museums at the small inlet. There was a wealth of information on the types of local fishing-related industries and vessels.

One rest day was spent visiting the Lofotr Viking Museum with its replica of a long house and Viking boats.



The second rest day was used for a RIB safari to the cave of Refsvika, the oldest known human site in Lofoten containing cave paintings believed to be over 3000 years old.



Acknowledgements

The expedition leader would like to gratefully acknowledge the contributions of the following to the success of the expedition:

- Vicki Billings – for organisation and reporting of the marine biodiversity surveys
- Jane Maddocks – for organisation and reporting of the wreck surveys, and for general advice and guidance throughout the expedition
- Therese and Lars Larsen (Aqualofoten Dive Centre) – for local advice, diving support and wonderful hospitality
- The expedition team members – for their hard work and support, and for their photographs, videos and sketches collected during the expedition

Expedition Report

The expedition report is presented as two sections: a) marine life biodiversity survey and b) wreck sites survey.

BIODIVERSITY SURVEY REPORT

Vicki Billings



Biodiversity Survey

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Introduction

This survey was carried out by recreational divers as part of the BSAC West Midlands Regional Expedition Scheme Lofoten Islands expedition. The aims were to record species diversity and to estimate the abundance of the commoner species of marine flora and fauna found in a variety of habitats in the area around the town of Reine. It is anticipated that this will form a baseline survey against which future surveys can be compared in order to assess the possible effects of climate change.

The Lofotens form a chain of mountainous islands on the north-west coast of Norway, between Bodø and Narvik. They extend into the Norwegian Sea in a SW direction. Glaciation in the past has resulted in steep-sided mountains, deep fjords and majestic scenery.



Figure 1. The Lofoten islands showing the study area

The islands lie just north of the Arctic Circle, but water temperatures are anomalously high for the latitude due to the influence of the Gulf Stream. The tidal range here is about 3m at spring tides and about 1.5m at neap tides. No strong currents were experienced, though the well-known 'maelstrom' occurs nearby. Temperatures of about 12°C were recorded at the surface, dropping to about 6°C below about 20m within the fjords.

The underwater visibility was generally very good, ranging from about 12m to 15m. Visibility measurements were made using an improvised Secchi disc and readings were taken at Angel Point on a very dull day. Vertical measurements averaged about 13m, and horizontal readings (taken at 10m, 20m and 30m) also averaged about 13m showing very little variation with depth.

Since the season was early autumn, some die-back of seaweeds was evident. Kelp forest was commonly found at sites on the open coast. Forest kelp and sugar kelp were found to occur down to 27m which is surprisingly deep at this latitude. Forest kelp stipes were usually bare, and only occasionally bore epiphytic red algae. Pink encrusting alga was found at all

sites and it was still much in evidence at 30m (maximum diving depth) and could be seen to extend to greater depths at some sites.

Observations were recorded at every dive site visited over the 2 week period. Twelve different sites were visited, some on more than one occasion. Two distinct environments were present: a) within the shelter of the fjords, and b) on the open coastline, exposed to the SE.

At each site, the topography was noted, different habitats assessed and plant and animal species were recorded using underwater slates and digital photography. Records were then transferred onto UK Seasearch forms for later analysis. Some seaweed samples were collected for identification purposes and digital images were created using a USB microscope.



Figure 2. Showing part of the village of Reine and Reine harbour with fjords beyond

Outline of dive sites

- 1. Forsfjorden, 2-boat wrecks:** an extremely sheltered site with an E-facing rocky slope shaded by mountains all around; beneath a waterfall; wrecks of two small boats lie at 27m and 30m. Special interest: large mounds formed by pink calcareous alga below 20m.
- 2. Angel Point (Engelsneset):** steep rocky slope on the point between two fjords. Special interest: large anemones at depth, numerous nudibranchs were seen at this site.
- 3. Djupfjorden:** a small enclosed fjord south of Reine; very deep in the middle (>100m), the dive site was on the north side. Special interest: large mounds of pink calcareous alga similar to (1).
- 4. Anstabviken:** a semi-enclosed bay surrounded by steep cliffs to the W and steeply sloping rocks on the NE side; a steep slope underwater with some boulders and sediment, vertical walls and over-hangs at shallower depths. Special interest: patches of bright yellow sponge beneath kelp forest, Norway red fish present.

5. Seaward side of entrance to Djupfjorden: large rocky pinnacles with gullies between, sandy seabed at about 18 m; dense kelp forest on top of rocks. Special interest: large number of sea hares, and an angler fish was seen here.

6. Reine Rocks: shore dive close to dive centre, SE-facing smooth rocky shore near to break-water, kelp forest to 12 m, boulders and sandy seabed below. Special interest: small white nudibranchs, stalked jelly fish, school of saithe.

7. Sheep's Island (Lamholmen): boat dive, rocky island on opposite side of channel to site 6, the sheltered W side was dived, kelp forest extended to a sandy sea bed which sloped gradually to S and W. Special interest: large edible crabs excavating hollows in the sand.

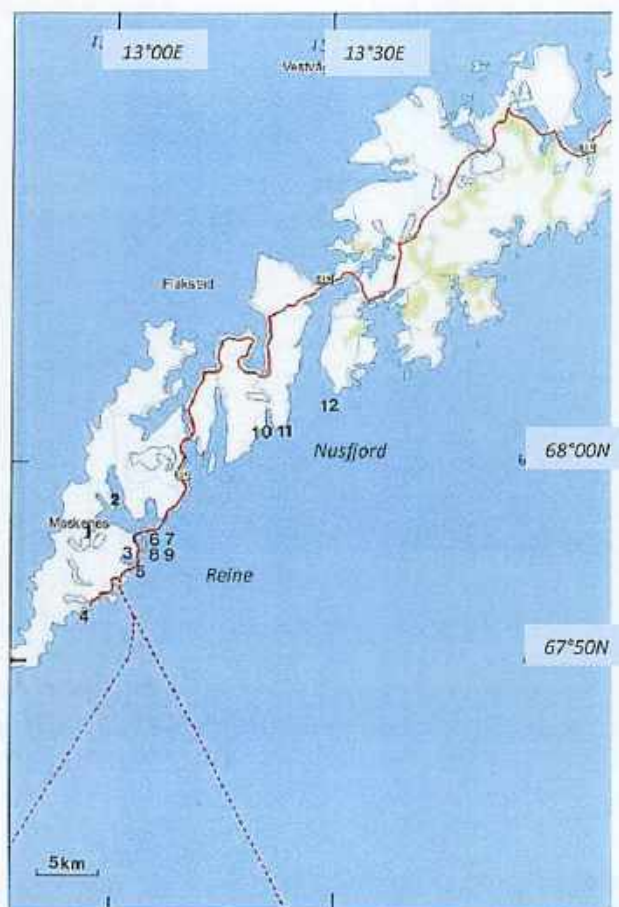


Figure 3. Map of study area around Reine showing position of dive sites

8. Reine Harbour: shallow shore dive starting near the pontoon, heading north around harbour edge. Special interest: many hermit crabs, some carrying parasitic anemones.

9. Reine Inner Harbour, Muddy Hollow: a dive with a difference, rocky slope with large boulders and plenty of life, muddy slope with bristle worms, flocculent black mud below 18 m devoid of life apparent. Special interest: large orange sea squirts on the rocks.

10. Nusfjord, Hyshola: a small inlet to E of Nusfjord harbour entrance, some wreckage including propeller and boiler, tunnel swim-through leading to a wall on the seaward side. Notable for a great variety of starfish and fish species.

11. Nusfjord, Lighthouse: start of dive is a narrow gully with steep rocky walls and sand at base, leading around vertical rock face dropping to >30m. Special interest: a covering of white bacterial filaments over some seaweeds and rocks, an octopus was seen here.

12. Wreck of Karlshorst: wreck 75m in length, lying upside down on seabed at 21m, top of hull in 14m covered with dense growth of filamentous brown seaweed. Special interest: propeller has varied fauna attached: plumose anemones, deadmans fingers, and sea squirts.

About this report

For each site there is an annotated diagram to illustrate the topography, substrate types, habitats and communities. In each case the location is shown on a chart (extracted from www.oceangrafix.com). Images are included to aid site description and to show some of the species present.

Where possible common names for animals and plants have been used in the text but where no common name exists, scientific names (often just the genus) are given. For the purposes of this report, some additional common names have been introduced such as:

Psammechinus miliaris – small urchin; *Strongylocentrotus droebachiensis* – northern urchin; *Ciona intestinalis* - yellow-edged sea squirt; *Desmarestia aculeata* – prickly weed. The latter refers to the winter growth form of this brown seaweed which had already lost its summer foliage by September, leaving small projections along the filaments. *Bonnemasonia hamifera* (trailliella phase, a red algal layer covering rocks at many sites, is referred to as fine filamentous red algal ‘fluff’, or ‘fuzz’.

At the end of the report there is a species list where common names can be related to scientific names. All the species recorded are listed here together with the sites at which each species was found, together with an estimation of abundance.

Identification of most animal species has been carried out using the book entitled ‘Marine Fish and Invertebrates of Northern Europe’ by Frank Emil Moen and Erling Svensen, from which most of the nomenclature has been taken.

Acknowledgements

Thanks are due to Mark Callaghan for organising the expedition, to Therese and Lars of Aqualofoten Dive Centre in Reine for providing excellent diving facilities, invaluable local knowledge and for taking the group to a good variety of dive sites. Thanks are also due to all expedition members who helped to gather the information upon which this report is based.

Some of the images in this report are credited to expedition members Adam Stevens (AS) and Harold Sachs (HS), whilst all other images were taken by the author using a Fuji Finepix f50 compact camera in an underwater housing.

On returning to the UK, images of red seaweeds were sent to Christine Maggs who kindly identified the species. Identification of a dried red seaweed specimen (*Fimbrifolium dichotomum*) was effected by Mike Guiry, confirmed by Juliet Brodie and coordinated by Francis Bunker. Advice was also sought from Erling Svensen with regard to identification of

the Norway redfish, and Lin Baldock with reference to nudibranchs and sponges. Thanks are due to all these people for their assistance.

UK Seasearch techniques were employed for recording observations underwater and Seasearch forms were used for recording information after each dive.

Description of the dive sites

1. Forsfjorden, 2-boats wreck

Location: 67°56.50'N 12°58.57'E

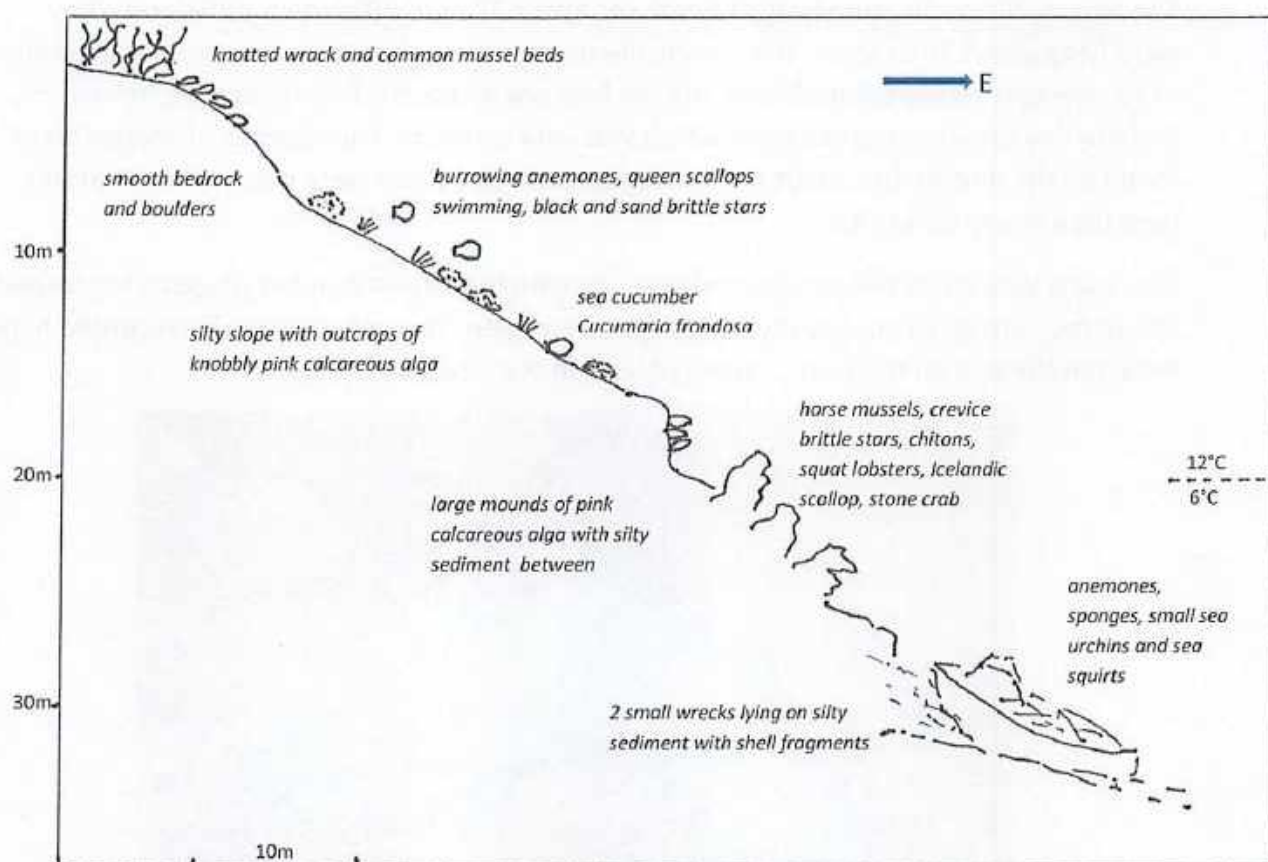


Figure 4. Forsfjorden, 2-boats wreck habitat diagram

This is an extremely sheltered site which is at the end of Forsfjorden and is surrounded by steep mountains. There is a small waterfall above the dive site. Water clarity was good with visibility of about 12 m. Water temperature was about 12 C in surface layers, but there was a distinct thermocline at about 20m below which the temperature dropped quite suddenly to about 6C.

The shallow water habitat was of smooth rocks and boulders with scattered patches of the brown sea weed, knotted wrack and clumps of common mussels.

Moving down the slope there was a band of silty sediment between scattered outcrops of rock and lumps of knobbly pink calcareous alga. Sand brittle stars were present on the surface of the sediment. Black brittle stars, northern urchins and small urchins were common here. There were queen scallops on the surface of the sediment and they were seen swimming actively as divers approached. Clumps of horse mussels occurred on rocky surfaces and burrowing anemones were living in the sediment.

Between about 20m and 27m there was a zone of massive pink calcareous algal structures, some as high as 0.5 m with a hard lumpy pink exterior. Where one mound had been broken, a network of white calcareous 'skeleton' could be seen. This habitat provided living space

for a variety of invertebrate species such as crevice brittle stars and Icelandic scallops and one enormous stone crab. The large sea cucumber *Cucumaria* was occasionally seen perched on top of algal mounds, sometimes with the tentacles expanded.

The two small wrecks were lying at depths of about 27 m to 30 m, on a silty slope. They were lying about 20 m apart. The marine life on the wrecks was quite sparse, but anemones of several species were found here: the sea loch anemone, the large anemone *Hormathia*, and the tiny proliferating anemone which was very common. Four species of sponge were found on the wrecks and whilst they were not common, there were more sponge species here than at any other site.

This was a very interesting and varied dive site with the largest number of species recorded compared with other sites, but very few fish were seen. The only fish species recorded here were the Norwegian top knot, 2-spot gobies and one dragonet.

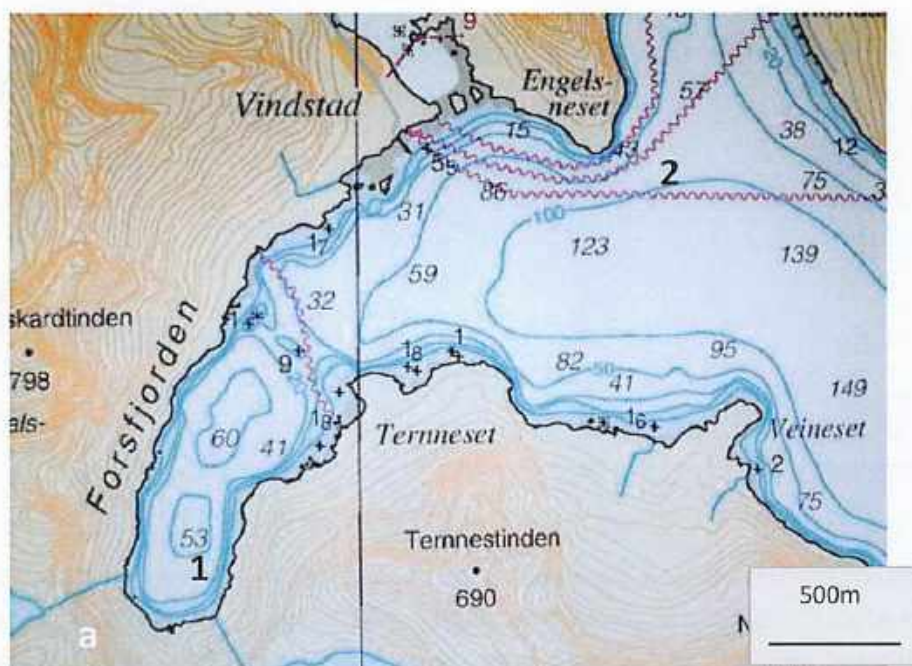


Fig 5. a) Chart to show location of Forsfjorden (1) and Engelsneset (2) dive sites. b) The waterfall above Forsfjorden dive site. c) Shallow water community showing a bed of common mussels, knotted wrack and a common star fish feeding on the mussels.

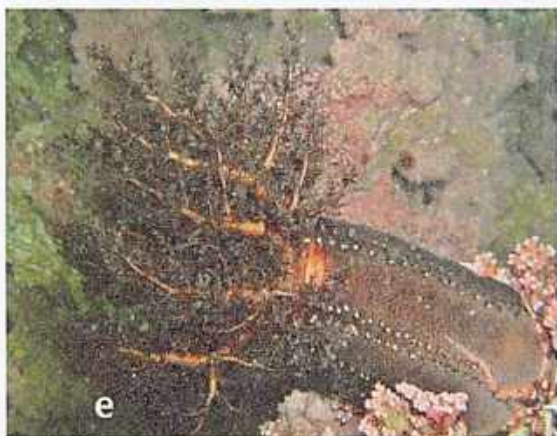
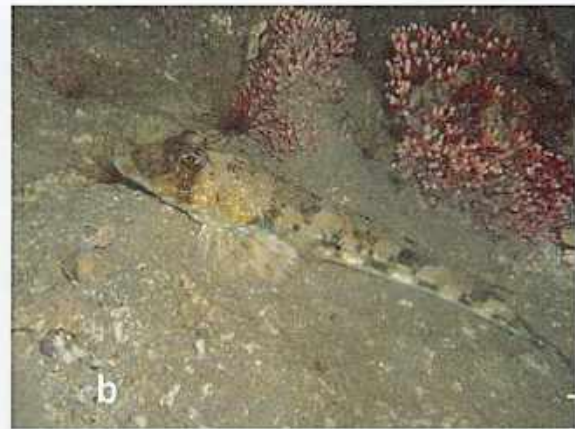
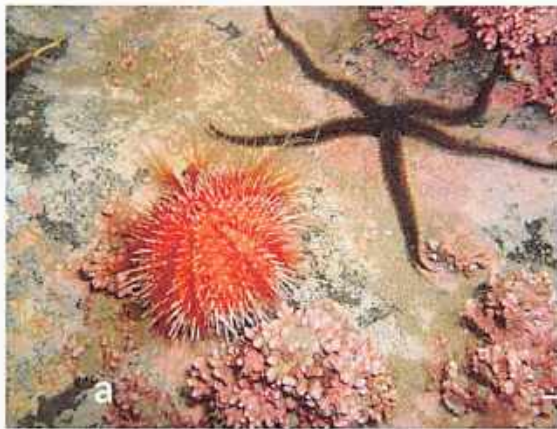




Fig 6. Forsfjorden flora and fauna. a) black brittle star and common urchin, b) dragonet, c) queen scallop and northern sea urchin with outcrops of pink calcareous alga, d) burrowing anemones, e) sea cucumber *Cucumaria*, f) sponge *Haliclona*, g) sea loch anemone and saddle oysters, h) large anemone, *Hormathia*, i) red sea squirts, *Ascidia*, with small proliferating anemones attached, j) Norwegian topknot, k) bloody henry star fish, l) large stone crab, m) proliferating anemones also showing the siphon of purple sponge, n) sand brittle star and annelid worm *Ophiodromus*. Images taken on the wrecks are as follows: f, g, h, i, k and m. Unfortunately, there are no images of the large pink calcareous algal structures because more sophisticated camera equipment would be required. (White lines indicate approx. 10 mm scale).

2. Angel Point (Engelsneset)

Location: 67°57.45'N 13°01.53'E

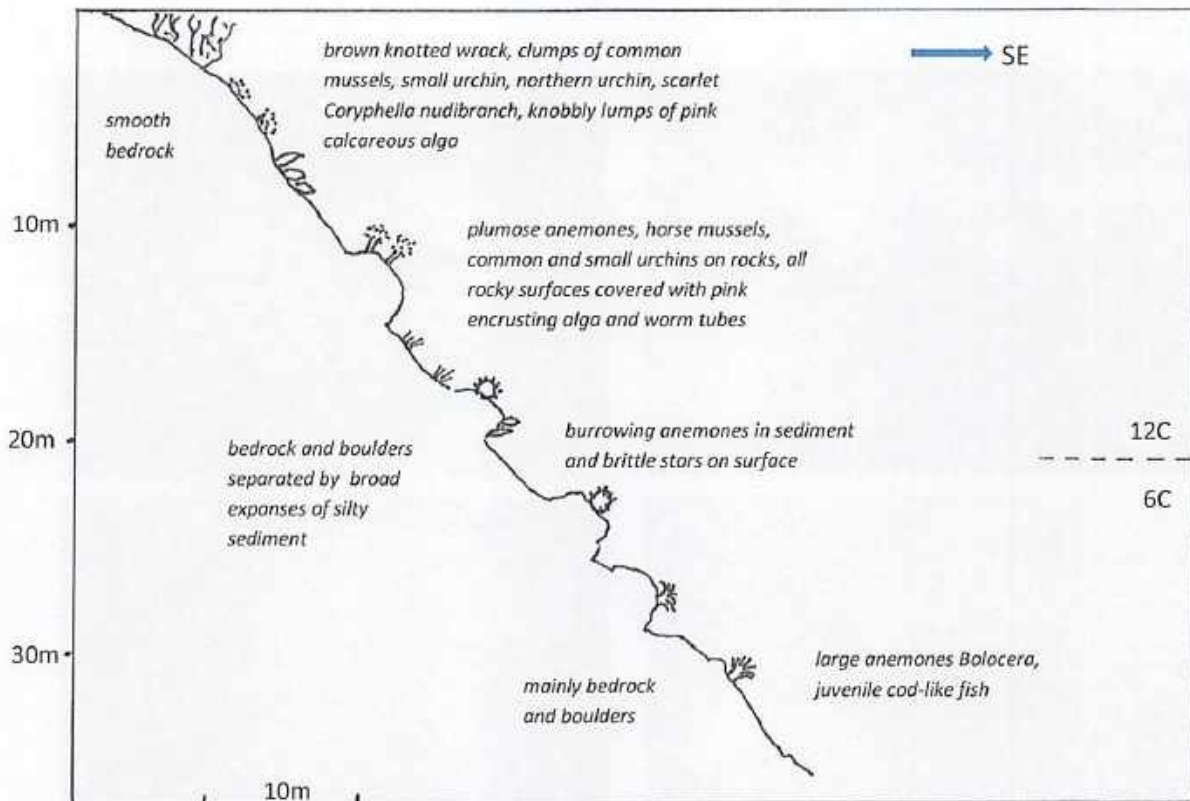


Fig 7. Angel Point profile showing different habitats and communities

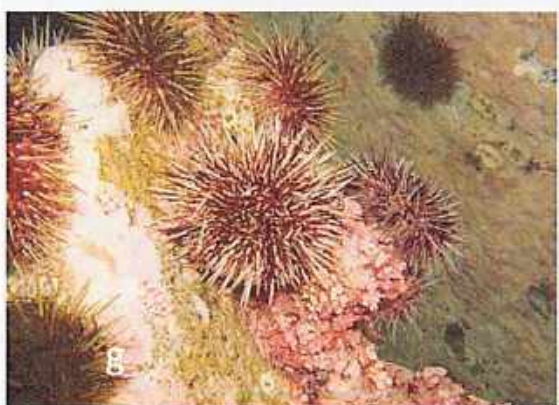
This is a sheltered site at the point where 2 fjords meet, but it is more exposed to wind and weather than the Forsfjorden site (1) which is deeper within the fjords.

At shallow depths the substrate was smooth bedrock with scattered lumps of knobby pink calcareous alga. The brown seaweed knotted wrack was present in the first few meters, with colonies of common mussels. Horse mussels were also found here, as were common star fish, common periwinkle, common urchins and smaller dark-coloured northern urchins. Large numbers of scarlet nudibranchs, *Coryphella*, were seen apparently feeding on a dead compass jelly fish together with northern urchins and common whelks. The rocks were covered with pink encrusting alga and worm tubes at all depths.

Further down the slope, large expanses of silty sediment were present between outcrops of bedrock and boulders. Here deadmen's fingers were seen in shady places and colonies of plumose anemones were growing on the rocks. Small urchins and crevice brittle stars were common. Colonies of horse mussels grew attached to hard substrates and burrowing anemones were common in the areas of sediment.

Below about 20m, individuals of the large anemone *Bolocera* were found attached to rock outcrops and boulders. Also at these depths, the small foliose red alga, *Turnerella* was present.

Very few fish were seen at this site, the only ones recorded were 2-spot gobies found at shallow depths, and a few juvenile cod-like fish (probably either cod or pollack).



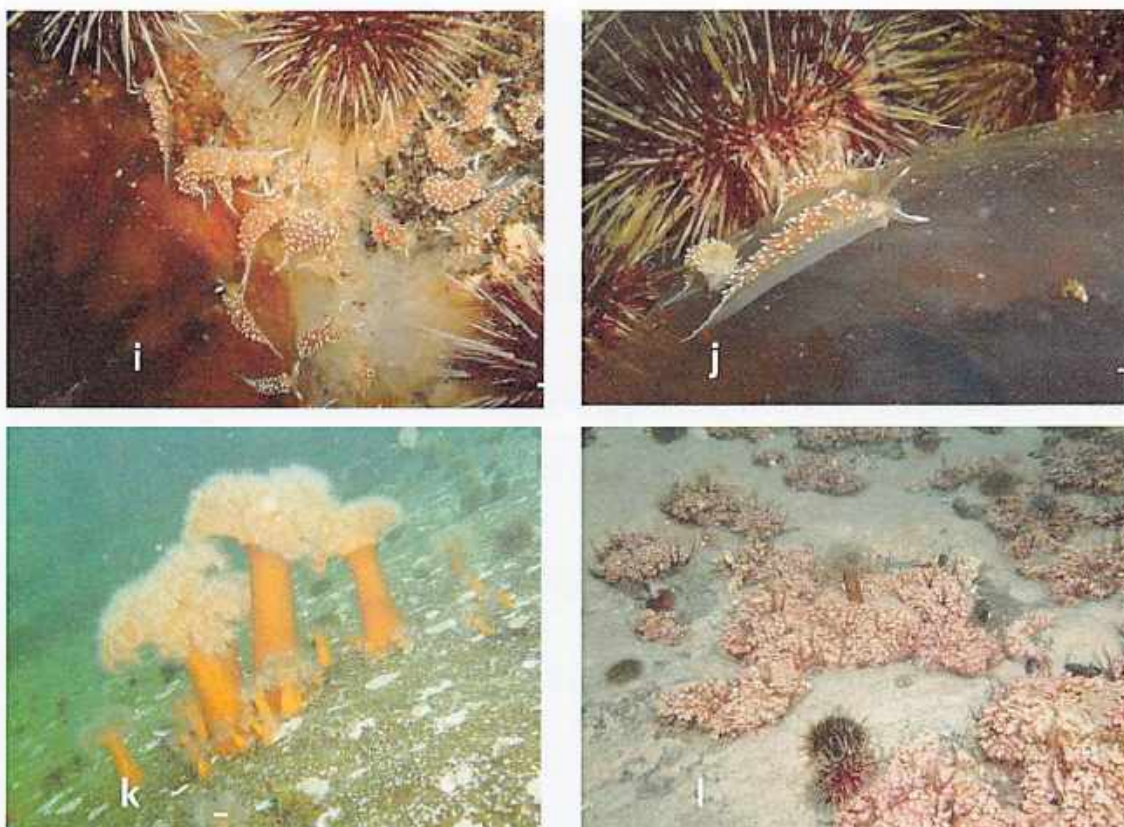


Fig 8. Engelsneset flora and fauna. a) small urchin covered with shells and debris, limpet *Tectura*, b) clump of small urchins with horse mussel, c) elegant anemone *Bolocera* e) lumps of knobbly pink calcareous alga on rock outcrop, f) purple sunstar with northern urchin, part of a bootlace worm can be seen top left, g) northern urchins, h) horse mussel colony, i) scarlet *Coryphella nudibranch*, feeding on a dead compass jellyfish, j) *Coryphella nudibranch* with northern urchins on compass jellyfish, k) colony of plumose anemones on smooth rock surface, l) pink calcareous algal 'garden' with northern urchins, a plumose anemone and crevice brittle star arms projecting into the water. (White lines indicate about 10mm scale).

3. Djupfjorden

Site location: 67°55.25'N 13°03.40'E

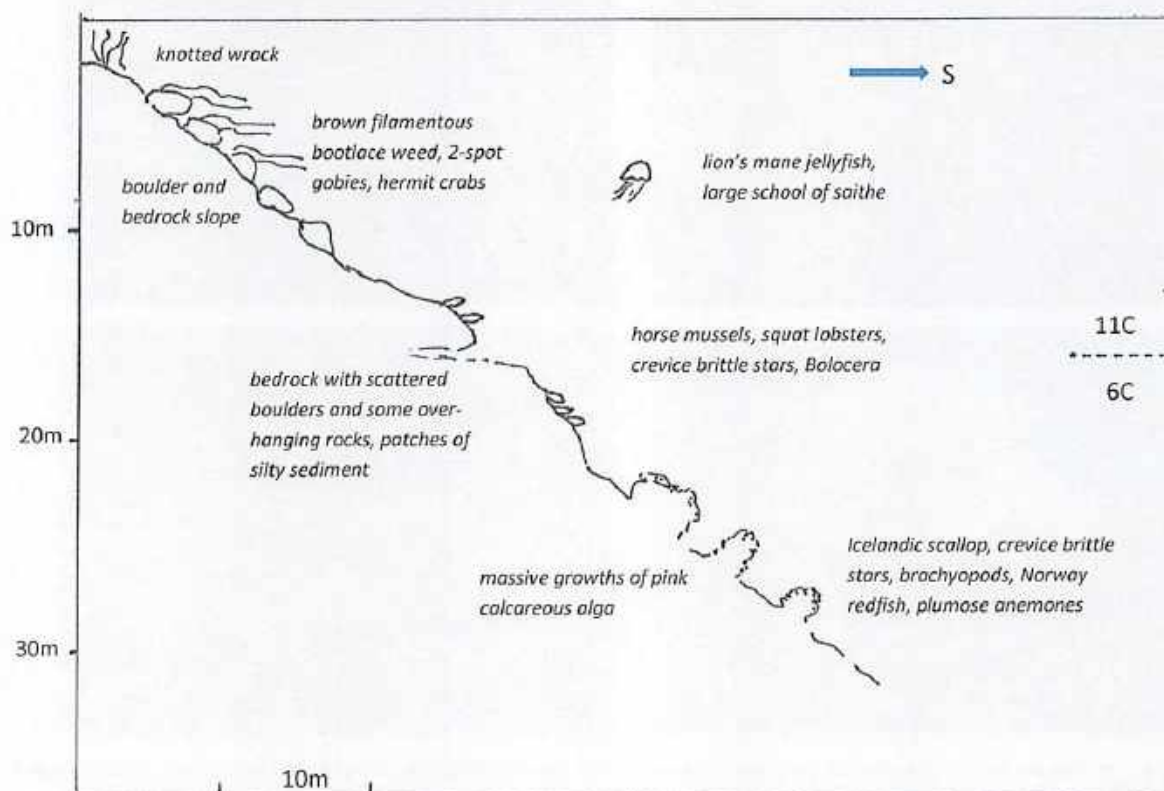


Fig 9. Profile of Djupfjorden dive site illustrating habitats and communities.

Djupfjorden is a small enclosed fjord surrounded by high mountains and opening to the sea through a narrow channel. It is more than 100m deep in the middle (hence the name meaning Deep Fjord in Norwegian). The dive site was on the north side of the fjord.

From the surface down to about 10m the slope was of bedrock and boulders covered with brown alga including knotted wrack, and long filaments of the bootlace weed which bore fluffy tufts of a small epiphytic brown alga. In amongst the alga there was an abundance of juvenile 2-spot gobies, painted gobies and hermit crabs.

In the water column the lion's mane jelly fish were seen and a large school of saithe swam past down the slope.

Below about 10m the slope turned more to bedrock with scattered boulders, and the rocks were under-cut in some places. Beneath one over-hanging rock the large anemone *Bolocera* was seen. Hermit crabs and colonies of horse mussel were common, and in the cracks and crevices squat lobsters and arms of the crevice brittle star were frequently present. Rock surfaces were covered by pink encrusting alga, often with a fluffy layer of red filamentous alga over the top. Keel worms were commonly encrusted onto the rocks together with another tube worm (*Hydroides*). Chitons were well-camouflaged against the pink rocks and may have been more common than was apparent.

Below 20m, and down to below 30m, were massive growths of pink calcareous alga with a knobbly outer surface, similar to those seen at Forsfjorden (site 1). A group of brachiopods

was recorded at about 30m. Squat lobsters, crevice brittle stars and Icelandic scallops were found here. The small urchin was frequently seen here and at all depths at this site. Norway redfish were recorded at about 30m, together with plumose anemones.

Two unidentified sponges were recorded at this site: one orange encrusting sponge with channels visible on the surface, the other beige in colour with a granular appearance.

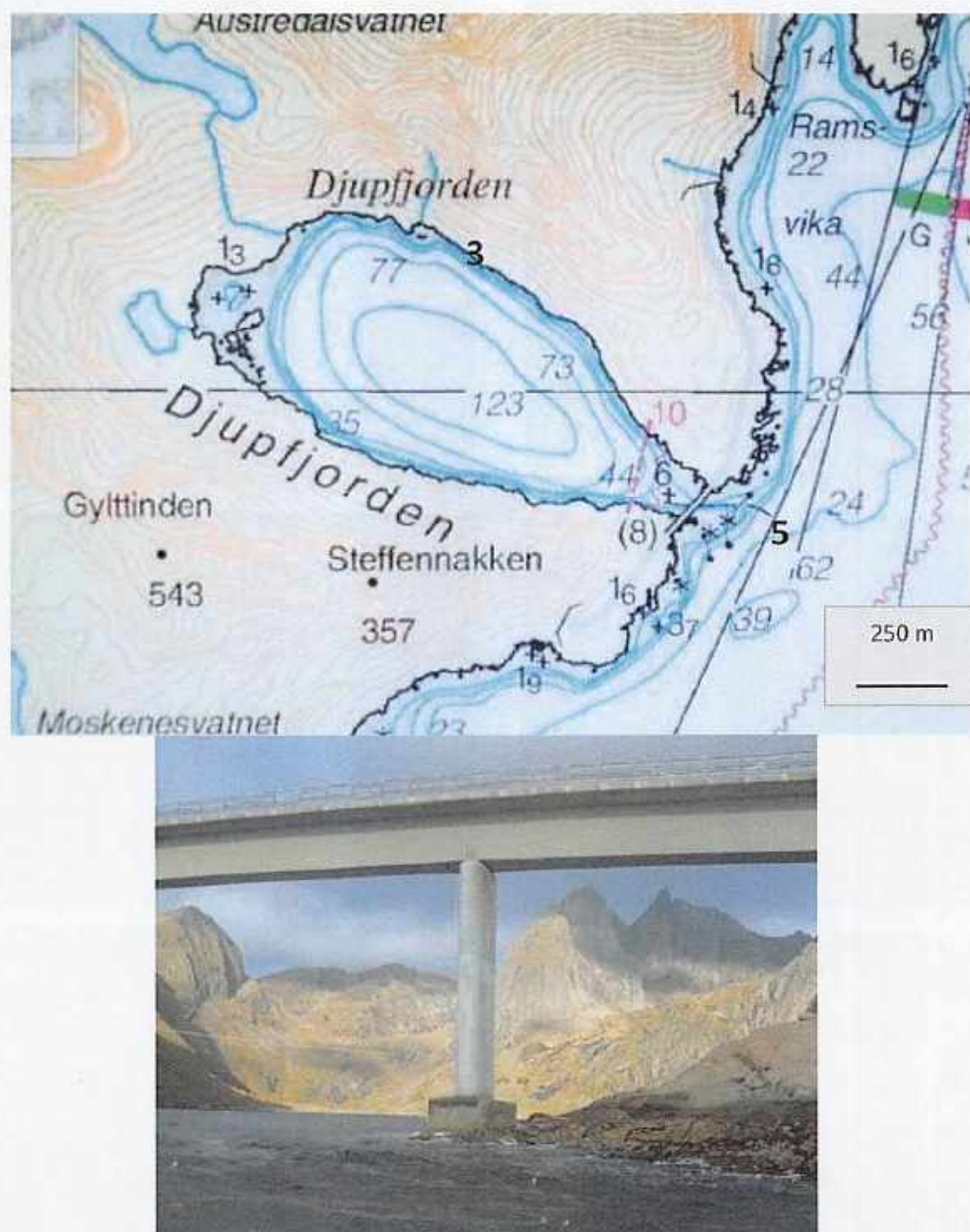


Fig 10. Chart showing Djupfjorden dive site (3) and site on seaward side of entrance to fjord (5). Mountainous backdrop to Djupfjorden seen from seaward side of the road bridge.



Fig 11. a) two-spot goby amongst bootlace weed, b) keel worms with calcareous tubes; crown of tentacles visible, c) Neptune whelk, d) Icelandic clam with barnacle attached, e) chiton on pink encrusting alga, f) large anemone *Urtecina eques*, g) unidentified sponge, h) spider crab molesting *Bolocera* anemone. (White lines indicate approx. 10mm scale).

4. Anstabviken

Dive A 'White Stripes' 67° 52.65'N 12° 58.33'E

Dive B Wall dive 67° 52.67'N 12° 58.20'E

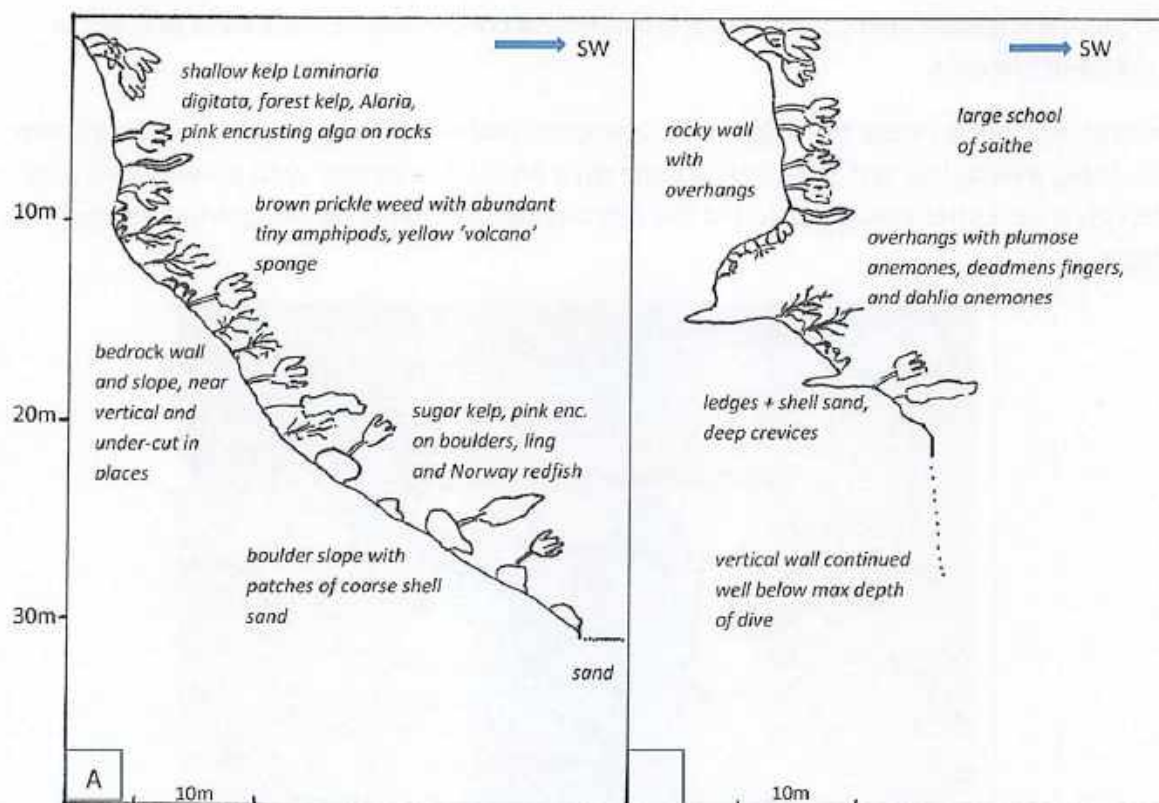


Fig 12. Profiles of the two dive sites at Anstabviken showing habitats and communities.

Anstabviken Bay opens towards the S and is exposed to weather from this direction but it is protected by a shallow area near the entrance with rocks that may break the surface. The bay is encircled by steep cliffs to the W and by a steep rock shore to the NE. The centre of the bay has a sandy sea bed at about 30m. Water temperature was about 12C and visibility of about 15 m was excellent. The first dive site is called 'White Stripes' because of two quartz seams which are clearly seen above water level.

Kelp forest occurred at both sites, with *Laminaria digitata* in shallow water, and a dense covering of forest kelp with some *Alaria* present down to about 10m. Below this the filamentous brown prickly weed was abundant, and covered with large numbers of tiny amphipods *Iphimedia*. In late September the kelp was showing signs of dying back and the fronds were covered with bryozoan sea mat, upon which many white and yellow nudibranchs (*Polycera*, and *Limacea*) were feeding, together with the small chink shell. Forest kelp and sugar kelp were found down to 27m at this site, which is surprisingly deep for this latitude. All rocky surfaces were 'painted' with pink encrusting alga which often had a layer of fluffy red filamentous alga growing over it.

Between about 10m and 15m just beneath the kelp forest, there was a zone where discrete patches of a yellow sponge occurred. This became known as the 'yellow volcano sponge' because of its distinctive colour and shape (identified as *Myxilla incrustans*).

At the second dive site in particular, the rocks were often under-cut, providing another habitat for species such as deadmans fingers, plumose anemones and dahlia anemones.

Many rock surfaces were encrusted with keel worms and common urchins and common star fish were frequently seen. Small squat lobsters and crevice brittle stars were present in cracks and crevices.

Several fish species were recorded here: a large school of saithe swam past heading down the slope, a large ling was seen hiding beneath a boulder, together with prawns guarding the entrance. Other species included the Norway redfish, lump sucker, goldsinney and pogge.



Fig 13. Chart showing the bay at Anstabviken and the two dive sites 4A and 4B.

View of 'White Stripes' showing the quartz seams; to the left is the inlet shown on the chart.



Fig 14. a) Ling with prawns *Lebbeus polaris*, b) Norway redfish, encrusting pink alga on rocks, c) amphipod *Iphimedia* on brown prickly weed, d) chink shell on kelp frond, e) nudibranch *Limacea* feeding on sea mat on kelp frond, f) lump sucker, g) yellow volcano sponge. (White lines indicate approx. 10mm scale)

5. Djupfjorden, seaward side of entrance

Position: 67°54.80'N 13°04.70'E

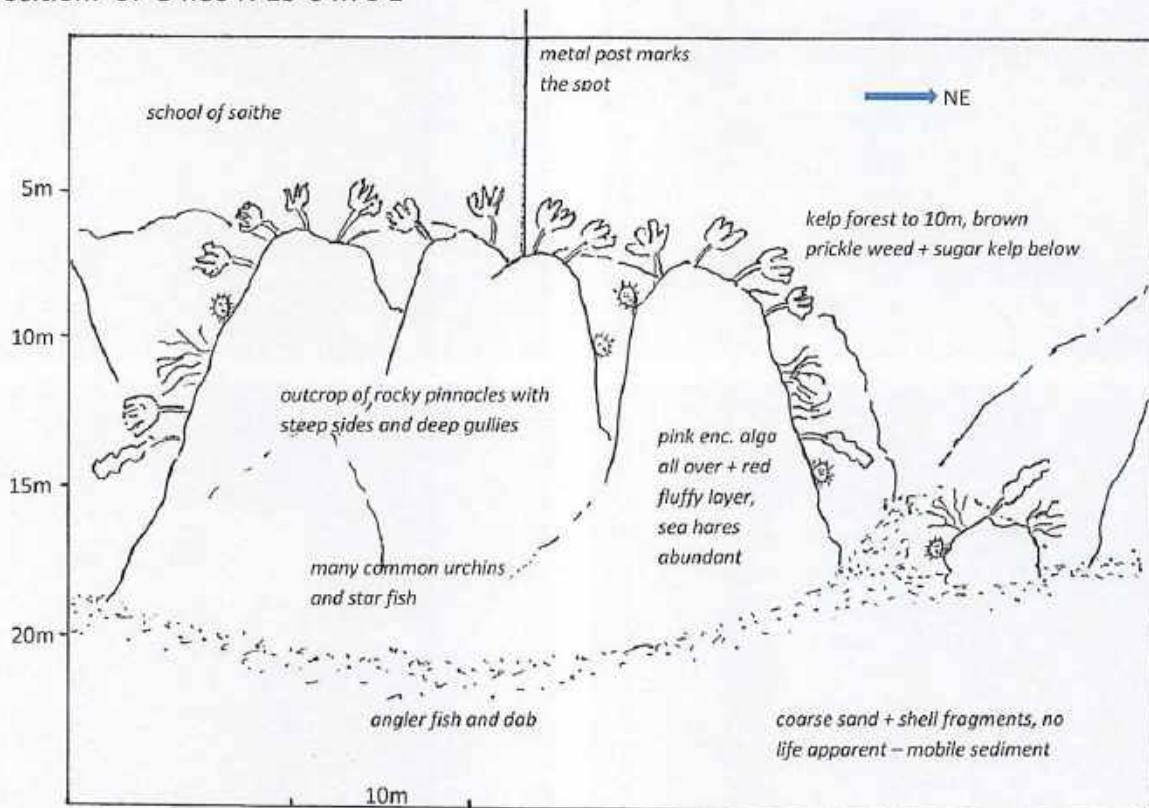


Fig 15. Diagram to illustrate dive site at the entrance to Djupfjorden, on the seaward side.

This site is on the open coast, exposed to weather from the S and E. Being situated near the entrance to Djupfjorden, the site would be subjected to tidal flow at certain times. There is a metal post marking the site, which makes it easy to find. There are 3 posts, which can be seen marked on the chart, and the dive began at the middle one at a depth of 6m. Dense kelp forest grew over the top of the rocks which were steep-sided pinnacles clustered together and separated by deep gullies. Vertical walls surrounded the outcrop, and dropped down to a sandy sea bed at about 18m. On the walls, forest kelp gave way to brown prickly weed and sugar kelp from about 10 m. The vertical walls were plastered with pink encrusting alga, often growing over keel worm tubes and with a covering of fluffy filamentous red alga. Sea hares seemed to be everywhere, and common urchins, hermit crabs and common starfish were frequently seen.

The sediment sea bed was of coarse sand with many shell fragments. There was no burrowing life apparent since the sand was probably quite mobile, but a few fish were seen here: an angler fish at the base of the rock, a dab on the sand, also some juvenile cod-like fish, and a school of saithe in the water column.

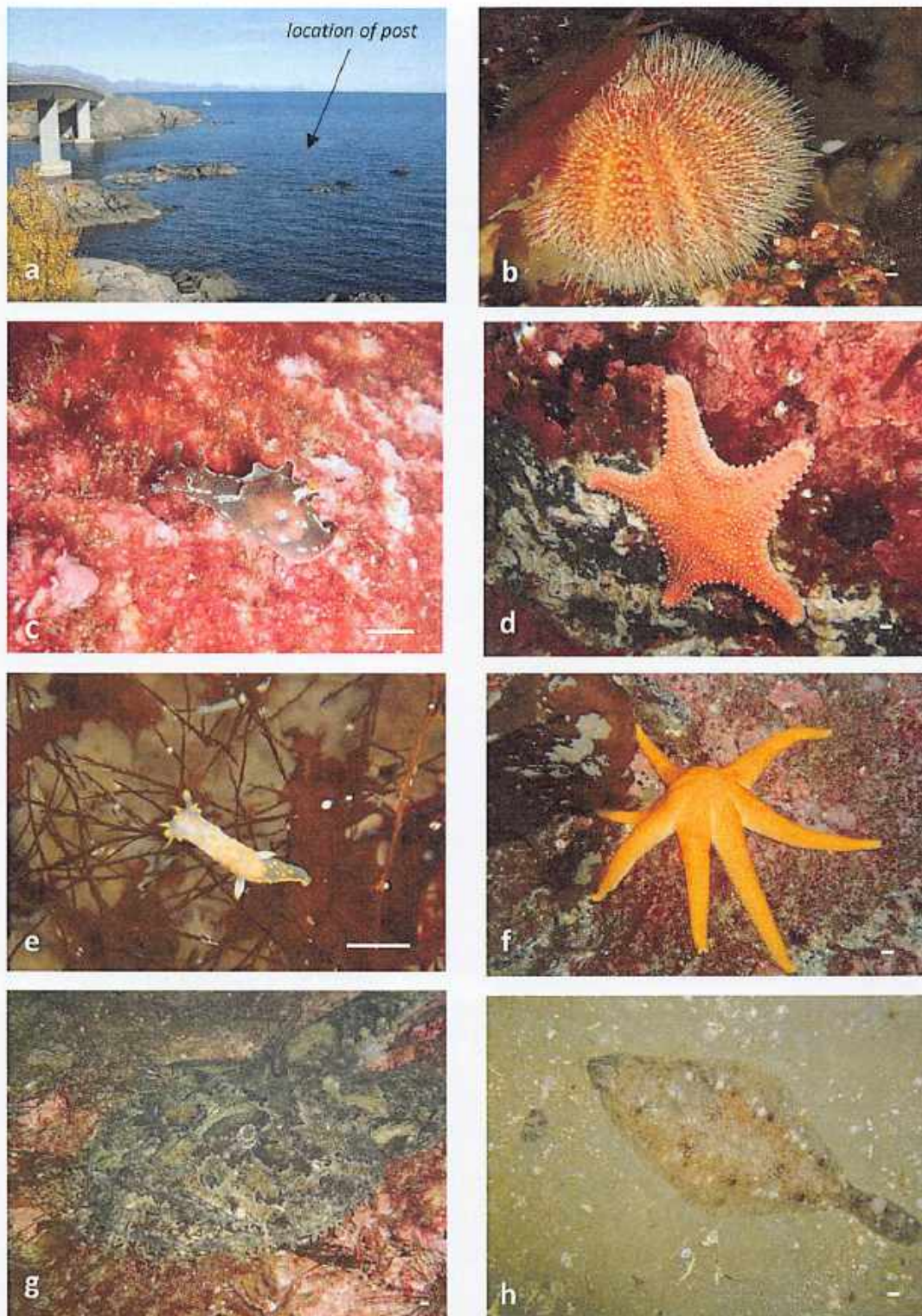
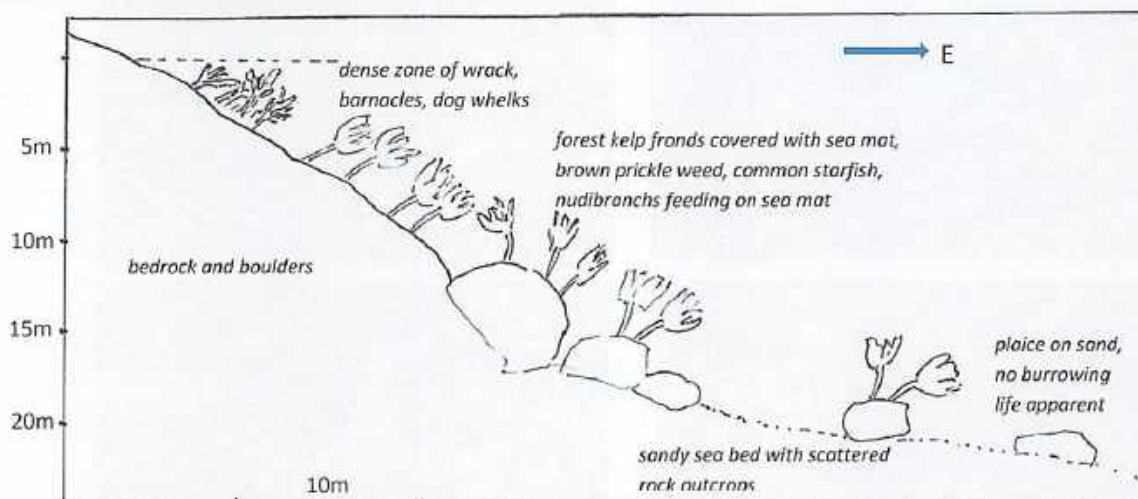


Fig 16. a) entrance to Djupfjorden showing position of post marking start of dive, b) common urchin beneath kelp fronds, c) sea hare on rocks encrusted with pink alga and covered by fine red filamentous alga, d) cushion star *Hippasteria*, e) nudibranch *Polycera* on brown prickly weed (careful observation reveals the 'prickles') f) orange form of 'purple' sunstar, g) angler fish, h) dab on shelly sand. (White line indicates approx. 10mm scale)

6. Reine Rocks

Location: 67°56.00'N 13°05.74'E



7. Lamholmen (Sheep Island)

Location: 67°55.67'N 13°06.27'E

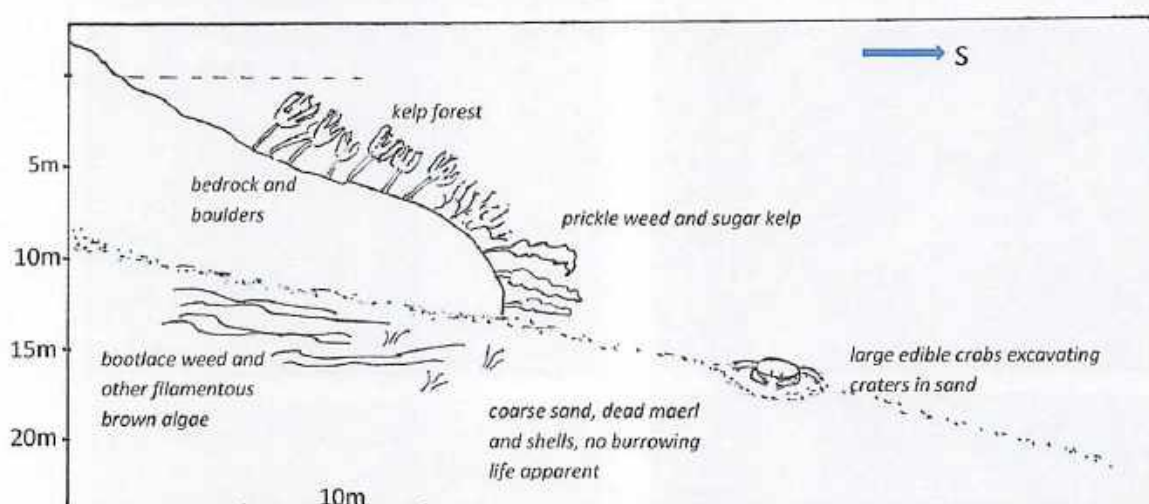


Fig 17. Diagrams illustrating the features of Reine Rocks and Lamholmen.

These two sites were about 500m apart, on either side of a sandy channel. Reine Rocks was dived as a shore dive entering over the rocky shore, Lamholmen was a boat dive. Both sites were similar in character and therefore will be dealt with together.

In the intertidal zone at Reine Rocks, the wrack *Fucus* was abundant, and barnacles and dog whelks were common. Both sites had bedrock dropping down to boulders, covered with dense kelp forest to about 10m, then intermixed with brown prickly weed and sugar kelp. Kelp fronds were encrusted with bryozoan sea mat on which many small white nudibranchs were feeding, (*Onchidoris* and *Adalaria*, probably both species), together with the white and yellow nudibranchs *Polycera* and *Limacea*. The stalked jelly fish was present, also the small chink shell and some sea hares. Beneath the kelp, the rocks were covered with pink encrusting alga, keel worms and a fine 'fluff' of filamentous red alga. The brown prickly weed was encrusted with the hairy sea mat *Electra* and in amongst the filaments was an

abundance of the tiny amphipod *Iphimedia*. Other species seen here included the common starfish, hermit crabs and the common urchin.

On the sand at Lamholmen, bootlace weed was growing, together with other unidentified filamentous brown algae. The sand was coarse and mobile, with no burrowing life apparent. It contained many shell fragments, pieces of dead maerl and entire shells: razor shells, mussel shells and those of the Icelandic cyprina. Large edible crabs were seen digging actively in the sand, revealing a layer of finer sand beneath the surface coarse layer.

Fish species recorded here included a school of saithe, pollack, 2-spot gobies, plaice and other flat-fish, juvenile lump suckers, and small unidentified gobies on the sand.

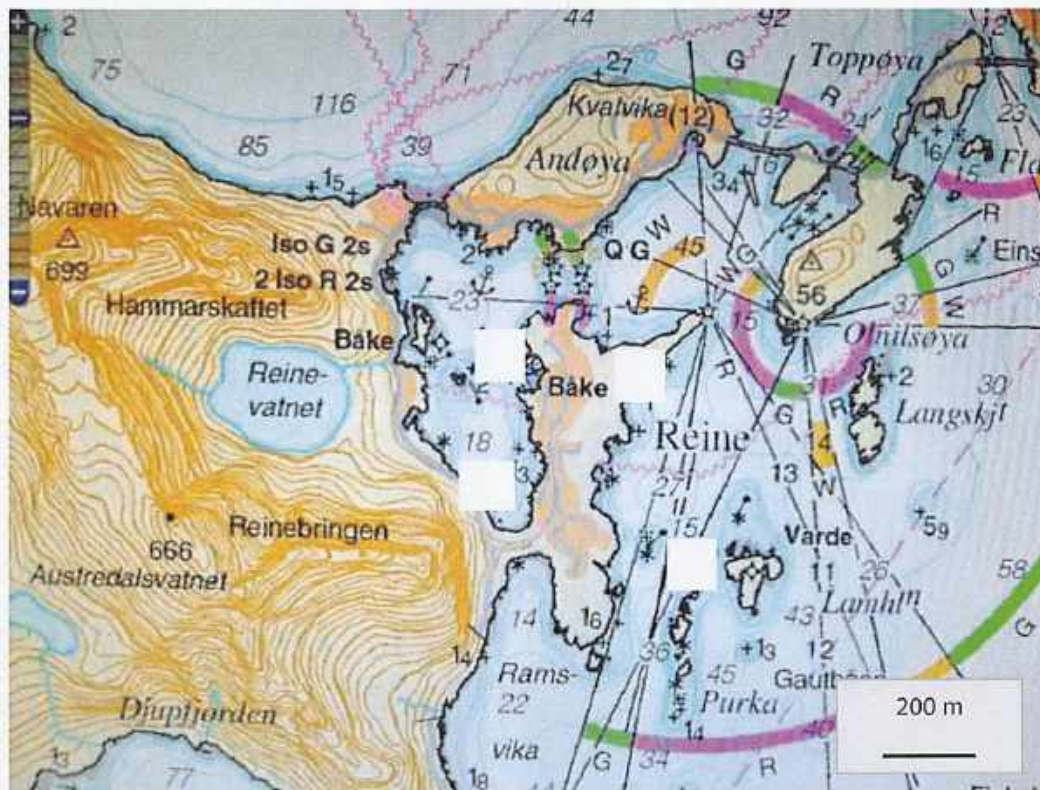


Fig 18. Chart showing location of the four dive sites in the Reine area. Entry point for shore dive at Reine Rocks over smooth bedrock and boulders.



Fig 19. a) edible crab in sand hollow, b) brown prickly weed, c) purple sunstar, d) spider crab, e) barnacles and dog whelks, f) stalked jellyfish on kelp frond, g) nudibranch *Onchidoris* feeding on sea mat, h) top shell and hydroid *Obelia* on kelp frond. (White lines indicate approx. 10mm scale)

8. Reine Harbour

Location: 67°56.07'N 13°05.20'E

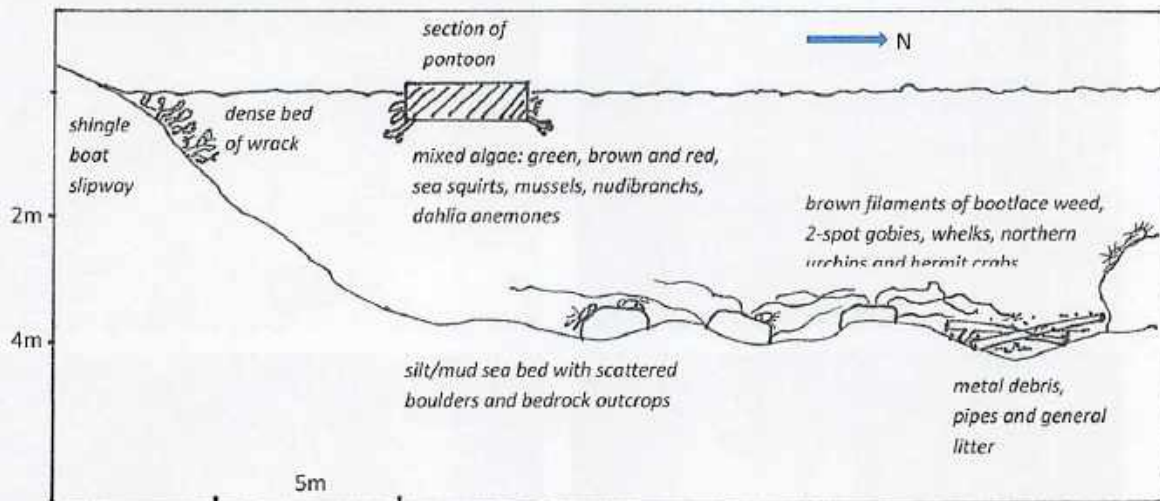


Fig 20. Harbour profile showing shallow sea bed and section through pontoon.

This is a very shallow dive but with plenty of interest. Entry can be from the pontoon or via the boat slipway in the corner of the bay.

Life on the pontoon was rich and varied. Seaweeds present included green and red filamentous algae, and brown seaweeds including wrack and sugar kelp. Transparent yellow-edged sea squirts, dahlia anemones, two species of nudibranchs (*Coryphella* and *Dendronotus*), and common mussels could all be seen on the pontoon, also a small juvenile lump sucker. This habitat is easily observed from on top of the pontoon or by snorkelling.

Heading in a northerly direction, round the boat jetties and harbour wall, the sea bed was undulating with boulders, bedrock outcrops and a soft muddy sediment. Much litter and debris was in evidence. Visibility was good, given the location, and was reported to be about 8m. Long brown filaments of the bootlace weed were common draped over rocks and across the sea bed and burrowing in the sediment were eyelash worms. Pink encrusting alga was present on hard surfaces, and the northern urchin was common on rocks and boulders, as were hermit crabs and common whelks. Some of the hermit crabs were carrying parasitic anemones and hydroids on their shells.



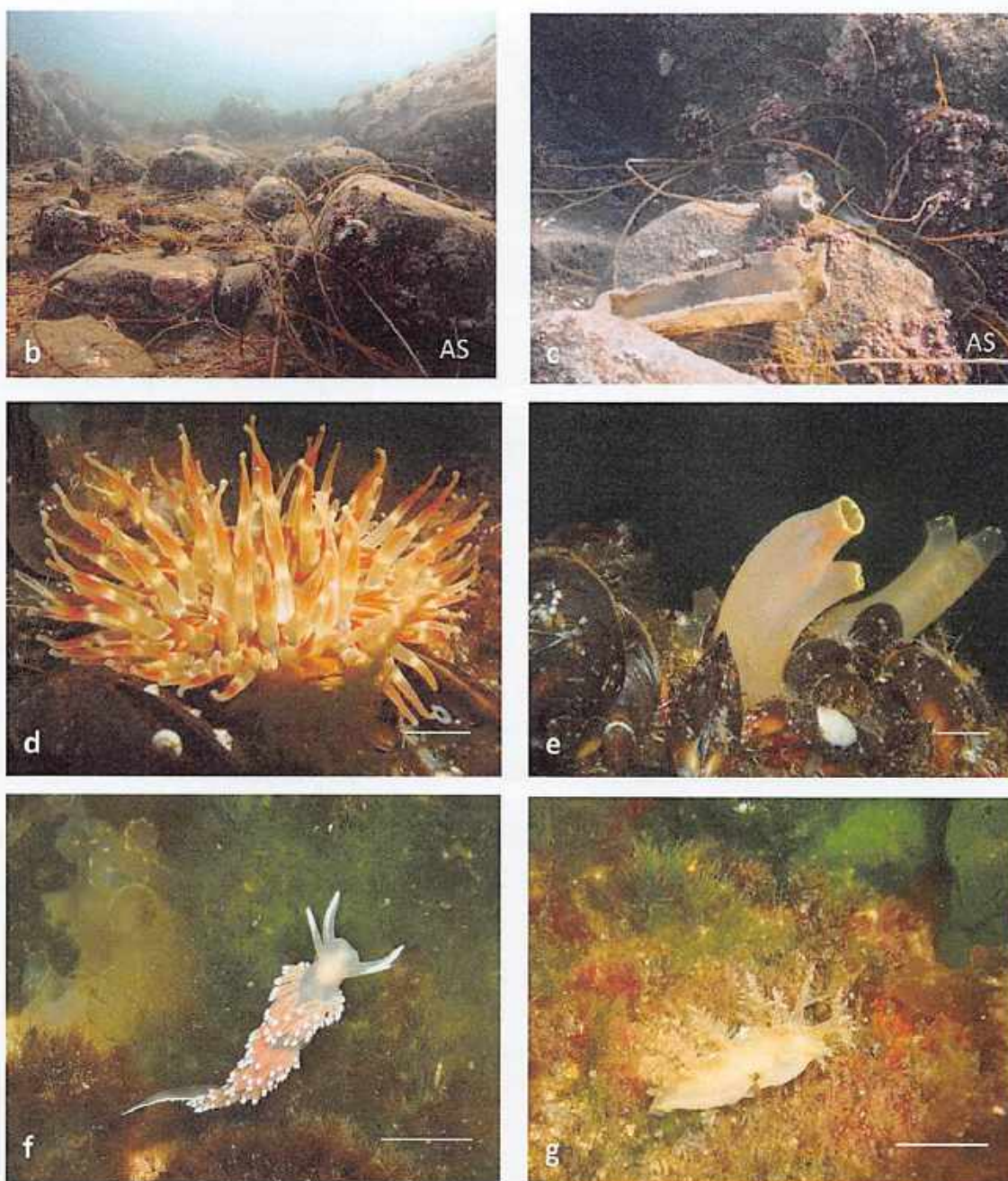


Fig 21. a) View of Reine Harbour looking north, b) harbour seabed with rock outcrops, soft sediment, bootlace weed and hermit crabs, c) hermit crab with parasitic anemones, bootlace weed, knobbly pink calcareous alga and plastic debris. On pontoon: d) dahlia anemone, e) yellow-edged sea squirt and common mussels, f) *Coryphella nudibranch* on green seaweed, g) *Dendronotus nudibranch*. (White lines indicate approx 10mm scale).

9. Reine Inner Harbour, Muddy Hollow

Location: 67°55.77'N 13°04.97'E

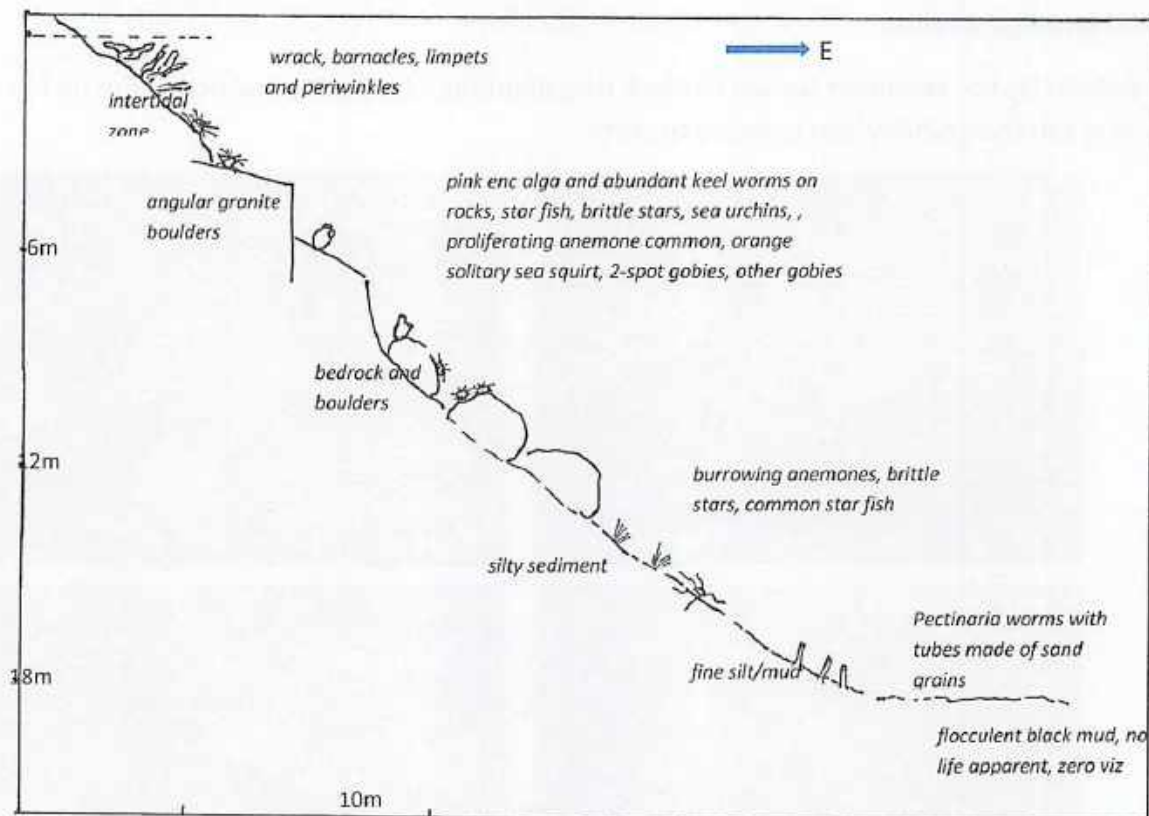


Fig 22. Sketch profile of Muddy Hollow showing habitats and communities.

This is a good dive site in rough weather as it is a very sheltered location within the harbour. Some items of litter and debris were seen at this site, but biodiversity was surprisingly high. Fifty five species were recorded here which was second only to Forsfjorden, site 1.

The intertidal zone consists of bedrock and boulders, including large angular blocks of granite which were probably brought in when work was done on the road nearby. There were dense patches of the brown seaweeds wrack and knotted wrack. Barnacles covered the rocks, and limpets and periwinkles were common.

The bedrock and boulders below the intertidal zone were covered with pink encrusting alga and this zone was very species rich. Chitons, hermit crabs, proliferating anemones and 2-spot gobies were commonly seen and there was an abundance of keel worms attached to the rock. The small urchin and northern urchin were present on the rocks and several large orange solitary sea squirts (*Halocynthia*) were seen here which was interesting because only one individual of this species had been seen elsewhere, at Forsfjorden. Other species included the small starfish *Leptasterias* and the worm, *Alentia* which appeared transparent and jelly-like.

Below the rocky area, the fine silty sediment was home to burrowing anemones and the burrowing eyelash worm, *Myxicola* sp. Other annelid worms seen here were the long thin worm *Phyllodoce*, the small brown white-striped worm *Ophiodromus*, and several unidentified species.

At a depth approaching 18m the sediment became very fine muddy silt and the bristle worm *Pectinaria*, living in tubes constructed from sand grains, was common together with other unidentified worms.

Below this the sediment turned to black flocculent mud (probably anoxic) where no life was seen and the visibility was reduced to zero.



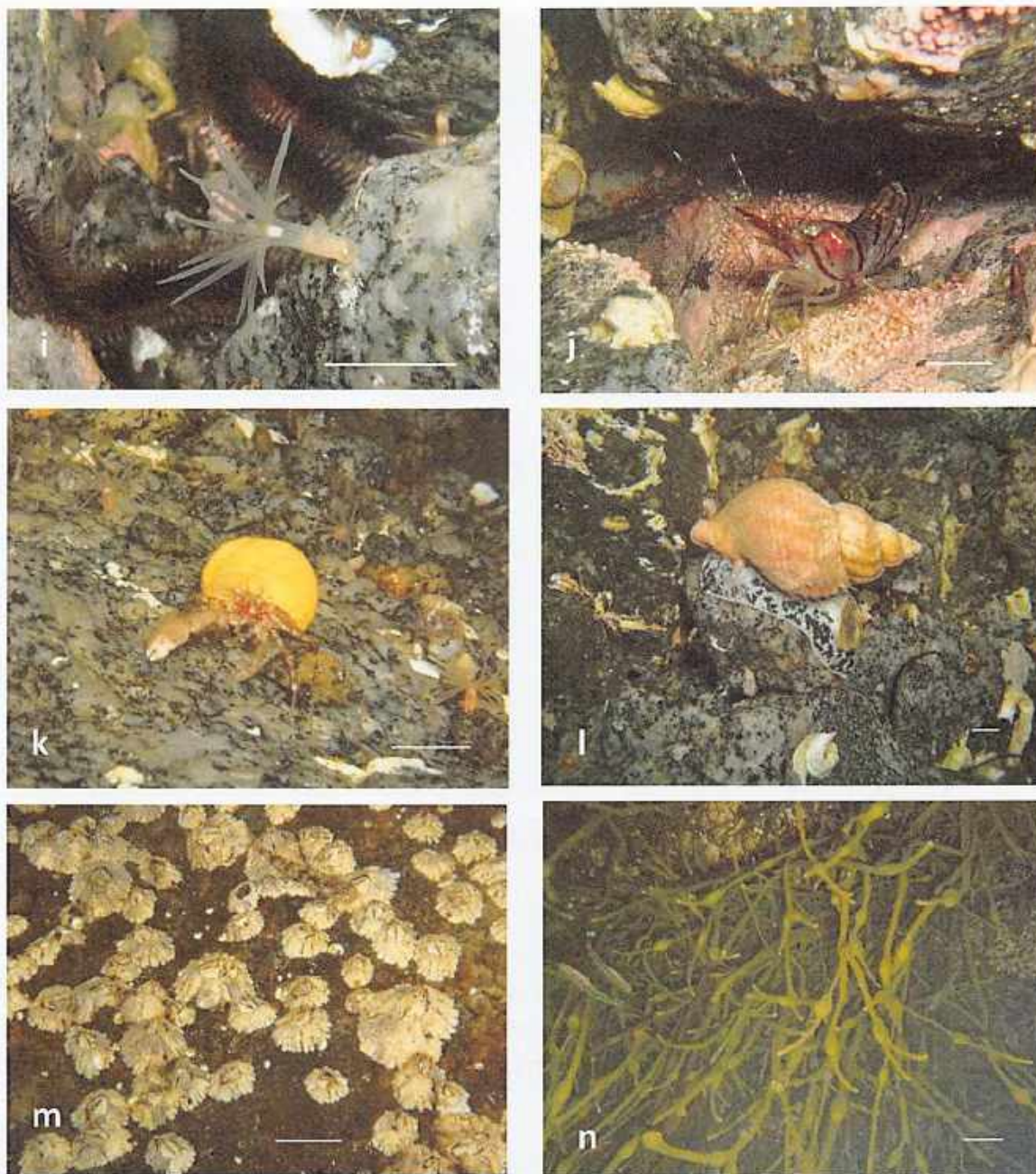


Fig 23. a) common and northern urchins, b) small urchin well-camouflaged by shells, bristle worm tube and other debris, c) bristle worms in fine silty sediment, d) jelly worm with starfish *Leptasterias*, e) sand brittle stars, eyelash worm to left, long thin *Phyllodoce* worm at bottom, f) periwinkle on pink encrusting alga, g) painted goby, h) orange solitary sea squirt, i) proliferating anemone, arms of black brittle star, j) northern prawn, k) hermit crab in shell of flat periwinkle, l) common whelk, and keel worms on rocks, m) intertidal barnacles, tiny goby near top of image, n) knotted wrack. (White lines indicate approx. 10mm scale)

10. Hyshola, Nusfjord: Tunnel dive

Location: 68°01.72'N 13°22.51'E

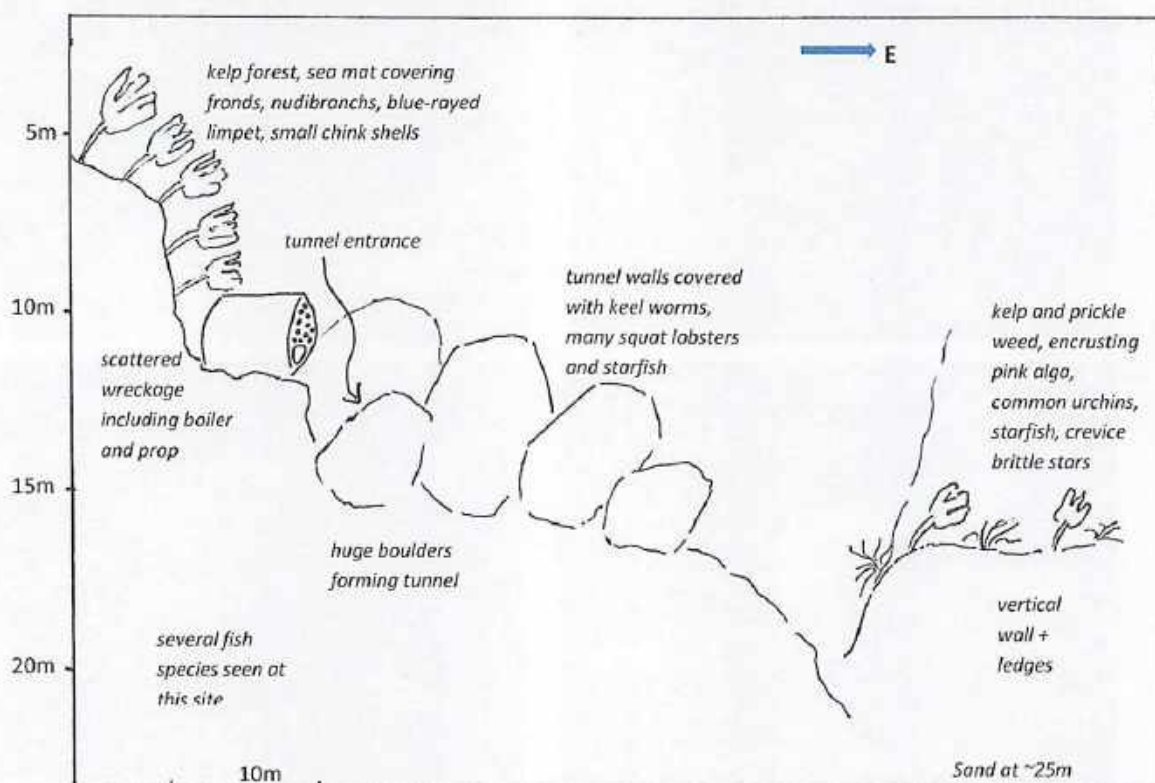


Fig 24. Diagram to illustrate main features of the tunnel dive

The dive starts at the head of this small bay to the west of the entrance to Nusfjord harbour, dropping into kelp forest at about 6m. This site was very rich in species, especially echinoderms, molluscs, crustaceans and fish. The kelp fronds were covered with sea mat and feeding on this were nudibranchs (*Polycera*, *Limacea*, *Onchidoris*) and the chink shell. Stalked jelly fish and blue-rayed limpet were seen attached to the kelp fronds, and juvenile lump suckers were observed. Squat lobsters, the keel worm and common star fish were present throughout the dive.

Some pieces of wreckage were lying in amongst the kelp, notably a propeller and a boiler, the tubes of which were home to many squat lobsters. The tunnel is formed by huge boulders arched together. It starts at about 12m, and continues to about 18m where it opens onto a vertical wall with ledges, and rock outcrops.

Within the tunnel the walls were covered with calcareous worm tubes, mainly the keel worm and *Hydroides*. Starfish seen in the tunnel included the common and purple sunstars, and the cushion star *Hippasteria*. Other creatures found in the tunnel included squat lobsters, edible crabs, dahlia anemones, scorpion fish and Norwegian topknot.

Beyond the tunnel, the walls and ledges were covered with forest kelp, prickly weed and encrusting pink alga. Another starfish species, *Stichastrella*, was observed on the wall and common urchins were present here. Fish species recorded included butterfish, scorpionfish, pogge and Norway redfish. In fact, of all the sites dived, the largest number of fish species

was recorded at this site (eleven species). The wall dropped away to a sandy sea bed at about 25m.

This site was full of interest because of the topography and varied marine life. The return route could be back through the tunnel, or over the top of the boulders.

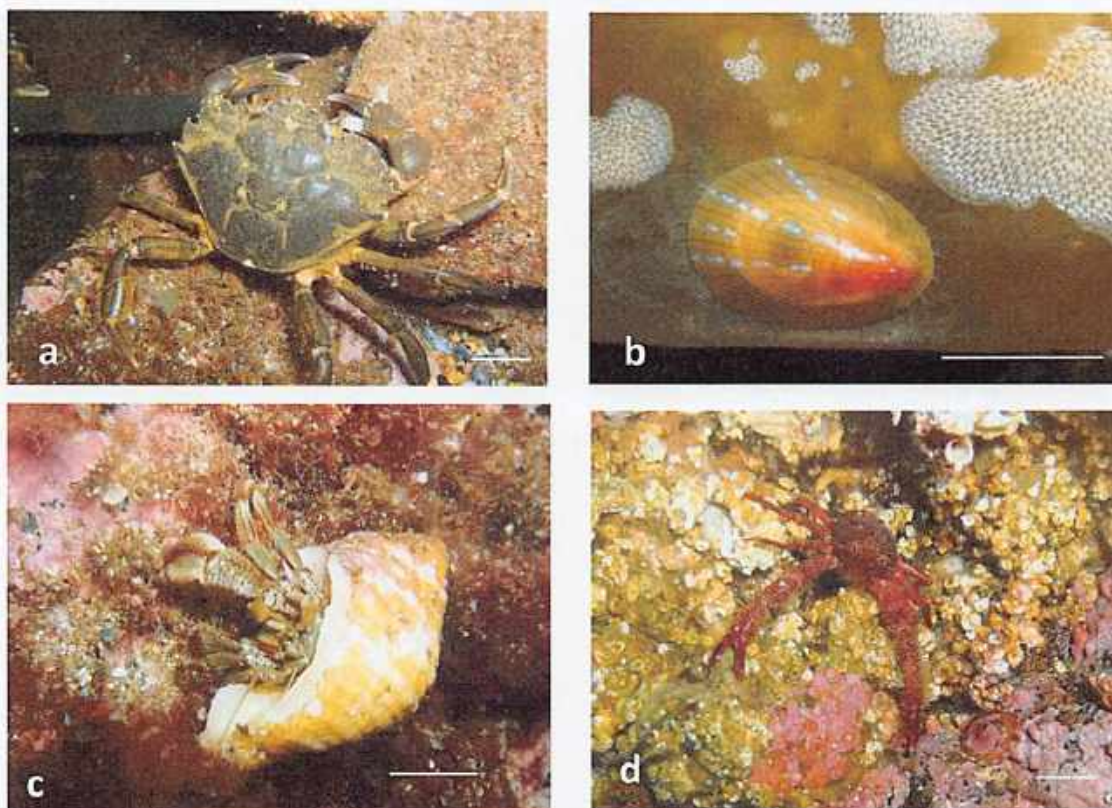


Fig 25. Chart to show location of sites near Nusfjord, and the wreck of the Karlshorst. a) shore crab, b) blue-rayed limpet on kelp frond, c) hermit crab in dog whelk shell, d) squat lobster.

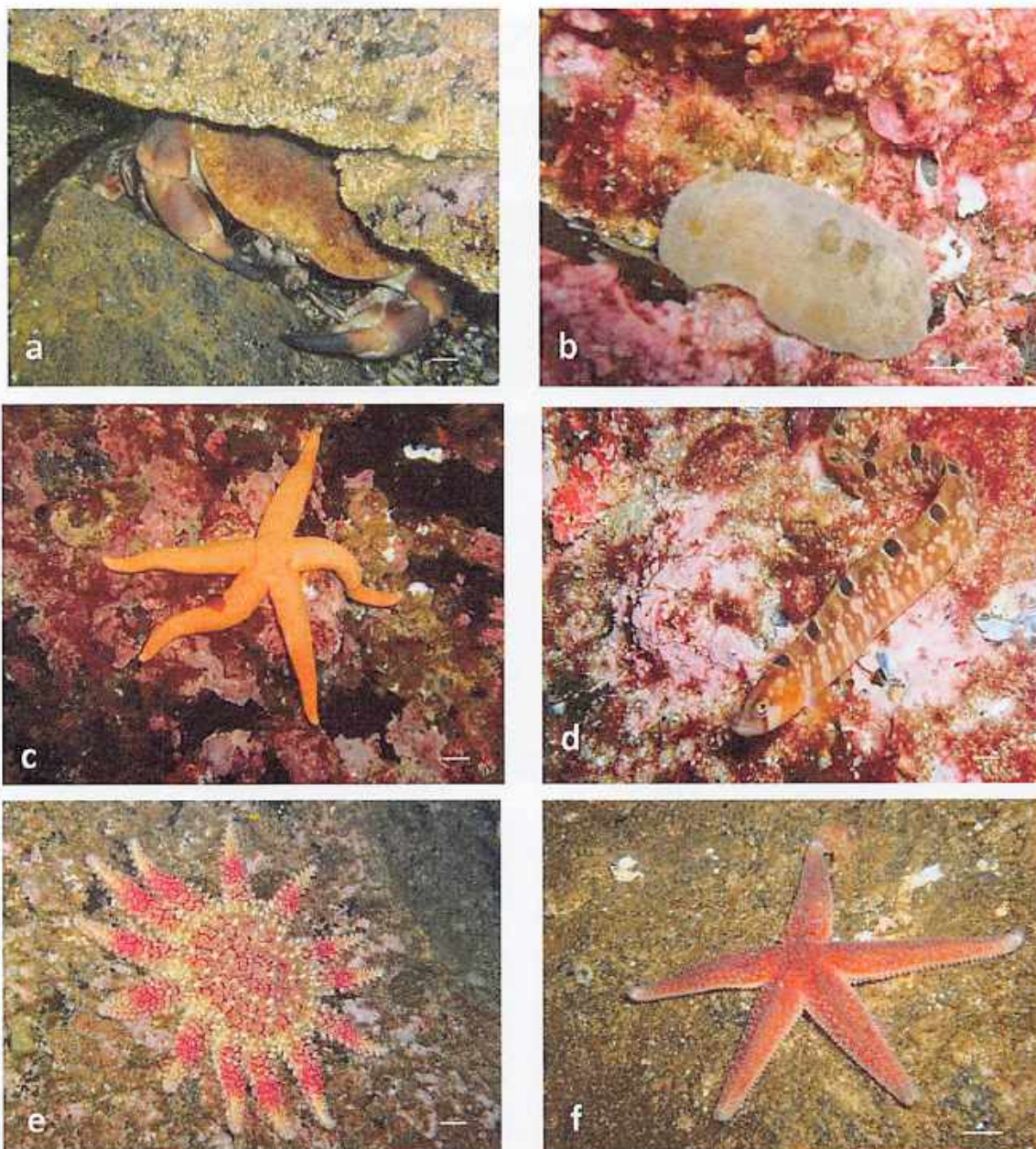


Fig 26. a) edible crab, b) nudibranch: sea lemon, c) *Stichastrella rosea*, d) butterflyfish, e) common sunstar, f) common starfish. (White lines indicate approx. 10 mm scale)

11. Lighthouse, Nusfjord

Location: 68°01.74'N 13°22.05'E

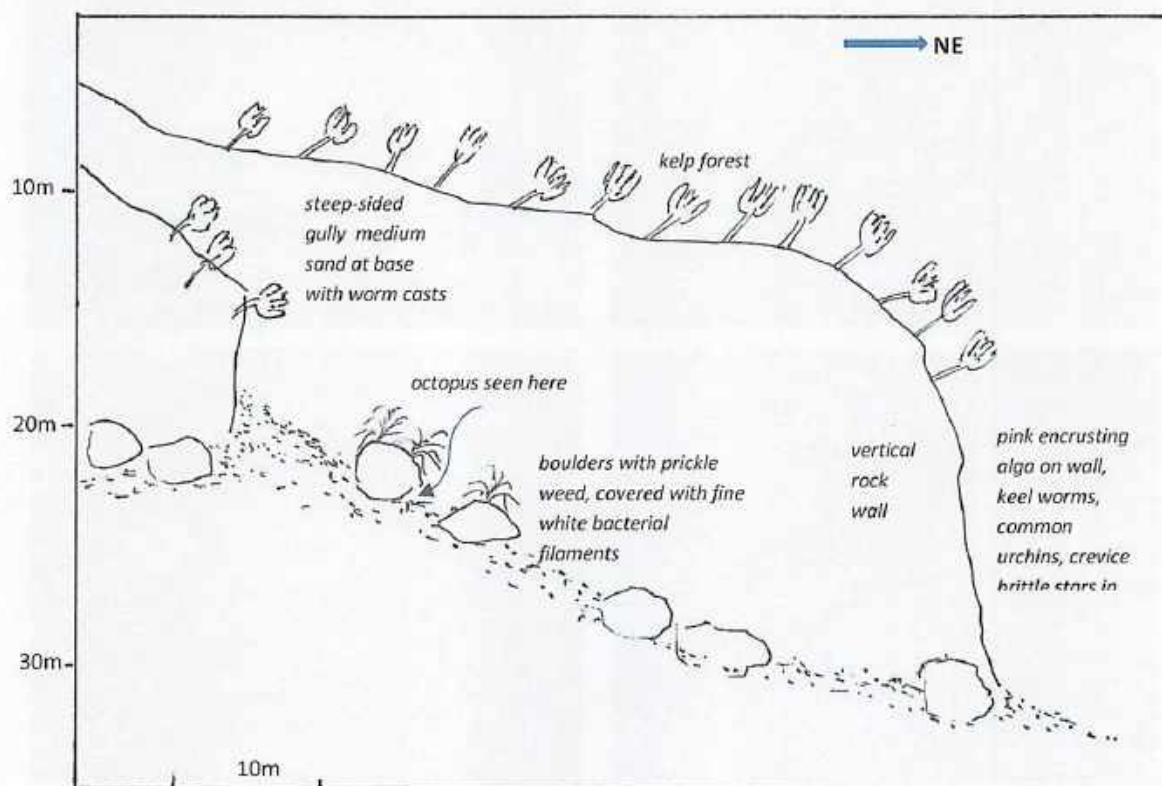


Fig 27. Diagram to illustrate profile and habitats of the lighthouse dive site.

The dive started in a narrow gully with steep sides, dropping to sand with worm casts at the base. Kelp forest was present over the rocks to about 15m. Emerging from the gully, the seabed sloped away around a rocky promontory with near vertical walls.

At the base of the wall was a sandy slope and large boulders with prickly weed growing on them. At this point much of the brown alga and rock surface was covered with a network of fine white bacterial filaments. An octopus was spotted in about 18m, hiding in amongst small boulders. The vertical wall was, as usual, covered with pink encrusting alga growing over aggregations of keel worms and rock surfaces were frequently over-grown by a layer of fine red algal 'fuzz'. Common sea urchins were on the rocks and the arms of crevice brittle stars emerged from cracks in the wall. The edible crab and spider crab were recorded and two species of fish were seen here: short-spined scorpionfish and pogge.

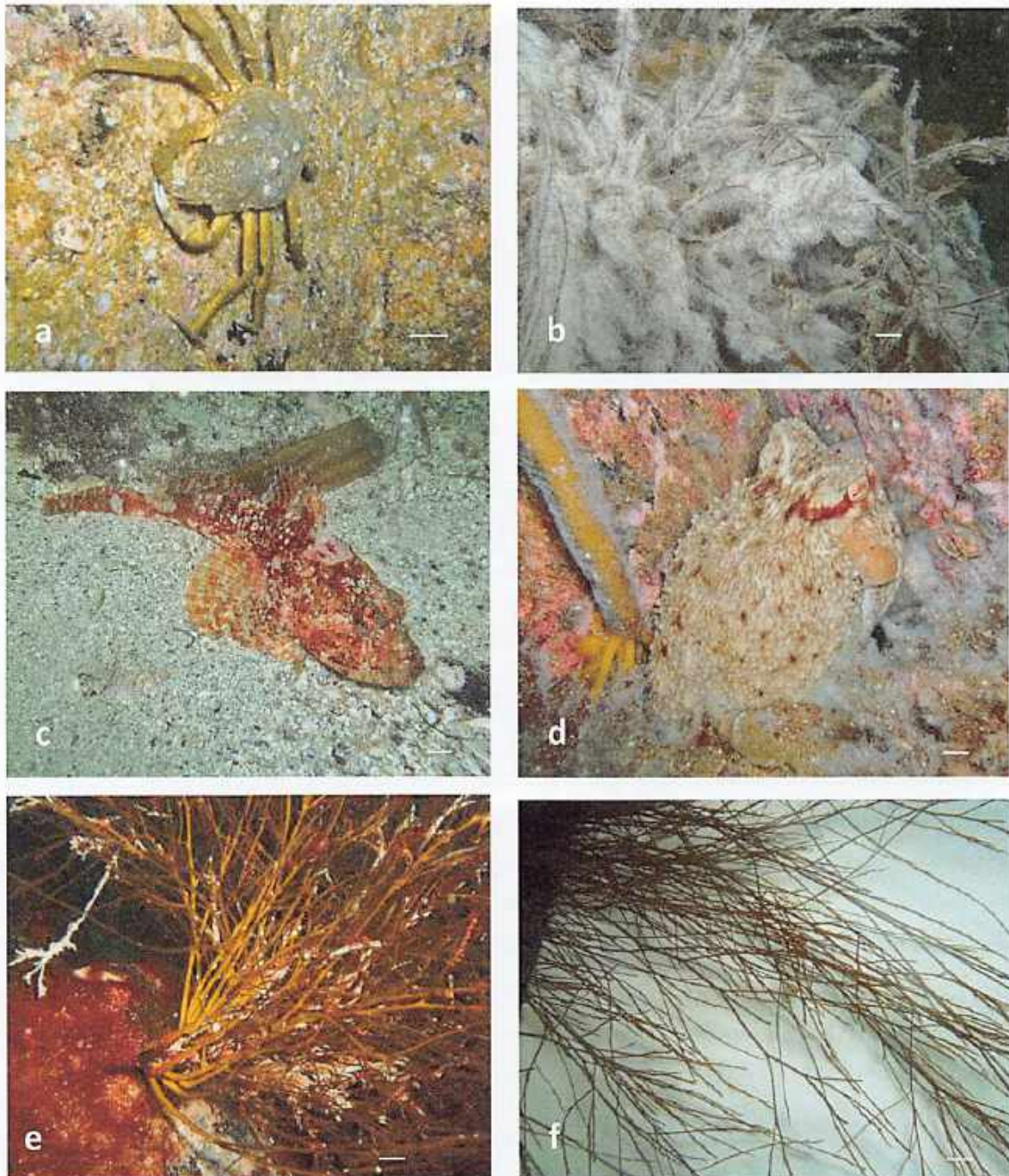


Fig 28. a) spider crab, b) bacterial filaments growing on prickly weed, c) short-spined scorpionfish, d) octopus, some bacterial growth evident on kelp stipe and rocks, e) prickly weed attached to rock covered with fine red algal 'fuzz', white patches on some filaments are encrusting hairy sea mat, *Electra*, f) prickly weed photographed against white slate to show structure of filaments.

12. Wreck of Karlshorst

Location: 68°02.22'N 13°29.30'E

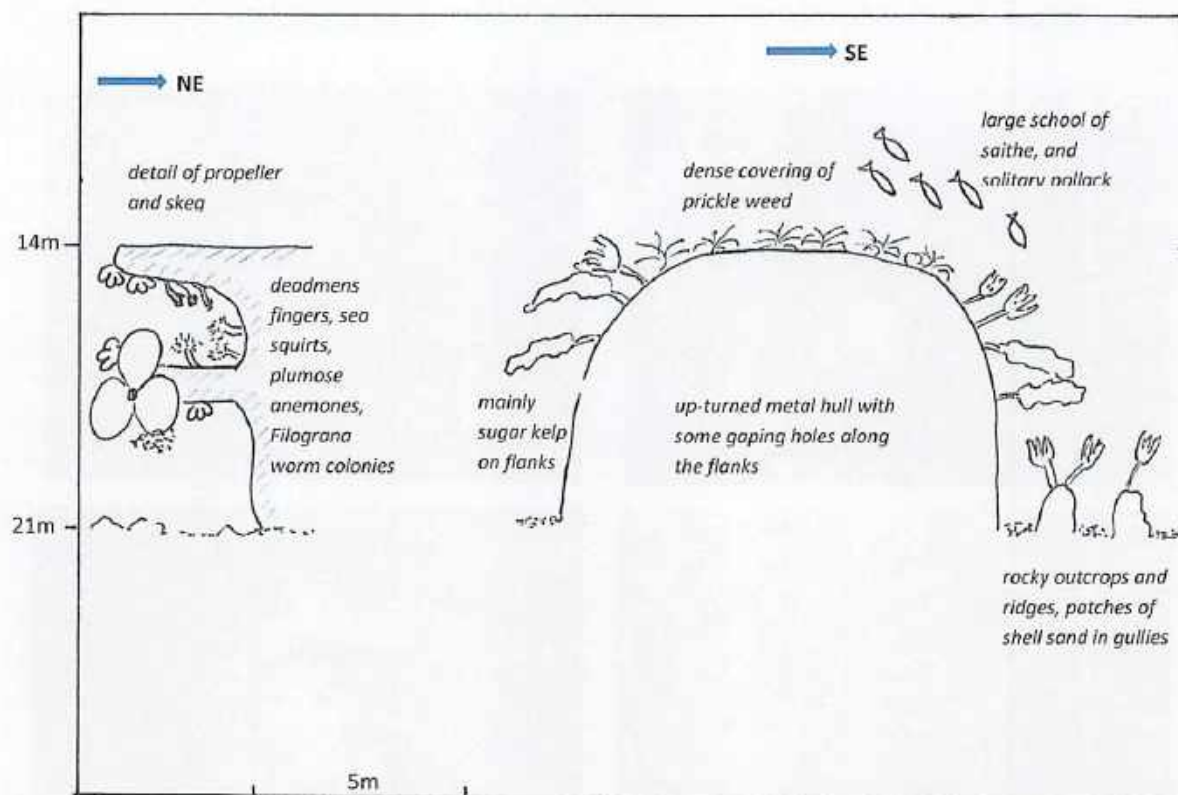


Fig 29. Section of wreck showing upside down hull, and detail of stern.

The wreck lies inverted in about 21m near the rocky island of Roholmen. The sea bed surrounding the wreck was of rocky ridges and gullies with patches of shelly sand including some small pieces of maerl. The top of the hull was covered by a dense forest of prickly weed and in amongst the weed were many 2-spot gobies and an abundance of the tiny amphipod *Iphimedia*. Small nodules of encrusting bryozoan were growing on the weed filaments which were also encrusted with the hairy sea mat. Sea hares were present and there were many *Polycera* nudibranchs together with their egg masses. A large school of saithe swam past and solitary pollack hovered over the wreck. Other fish seen around the wreck included the Norway redfish and one wolf fish.

Dropping down the sides of the hull, kelp plants were present, and sugar kelp was on the vertical sides. The hydroid *Obelia* was growing on many of the kelp fronds. Life was especially rich around the stern where the propeller was still in place. Here there were colonies of yellow-edged sea-squirt, dead men's fingers, large plumose anemones and colonies of the small tube worm *Filograna*. The red sea squirt *Ascidia* was frequently seen on the flanks of the hull and the nudibranch *Tritonia* was recorded. The common star fish was present on the wreck and surrounding sea bed.

Pink encrusting alga was all over the wreck, beneath the brown seaweed cover. The foliose red alga, sea beech was recorded on the side of the hull.

On the rocky sea bed, kelp and sugar kelp were common, as was the ever-present pink encrusting alga. Kelp fronds bore the hydroid *Obelia* and the bryozoan sea mat. Feeding on

these were *Polycera nudibranchs* with ribbons of eggs, *Onchidoris* and the chink shell. Common urchins and the protruding arms of crevice brittle stars were recorded here.

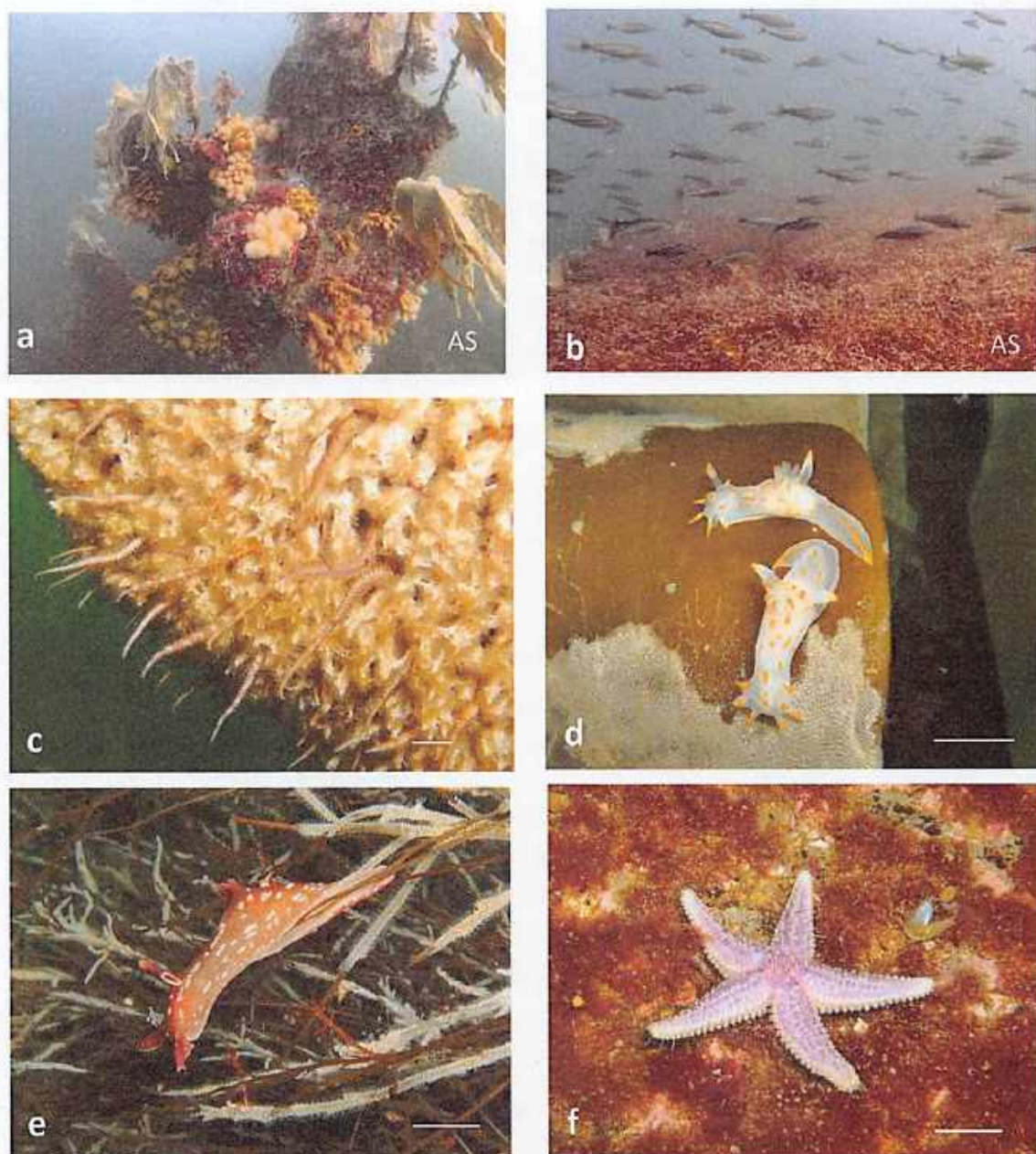


Fig 30. a) ship's propeller covered with life: forest kelp, dead mens fingers and plumose anemones, b) school of saithe swimming over dense forest of prickle weed on top of hull, c) colony of Filograna worms in calcareous tubes, arms of crevice brittle stars protruding, d) *Polycera nudibranchs* feeding on sea mat on kelp frond, e) sea hare on prickle weed encrusted with hairy sea mat, two ghost shrimps can be seen, f) the small starfish *Leptasterias* on a bed of red algal 'fuzz'.

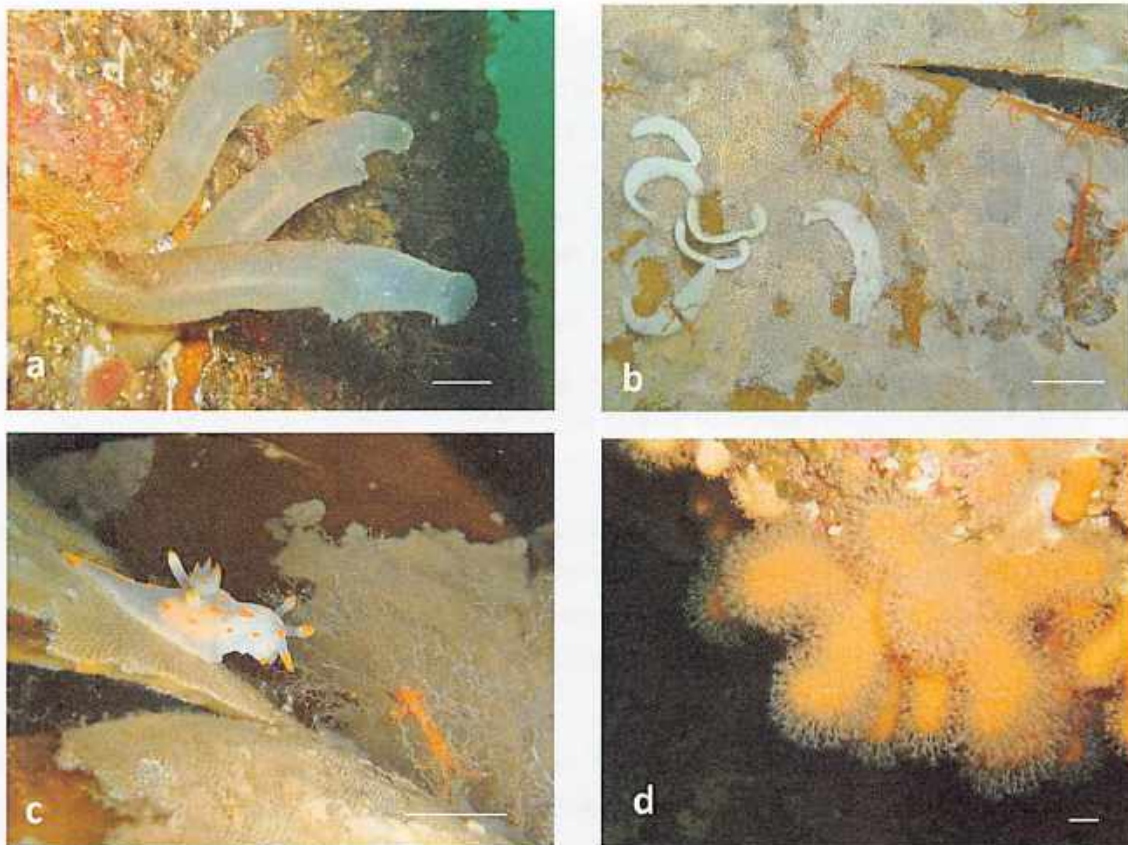


Fig 31. a) yellow-edged sea squirts (with no yellow edge apparent in this case) on side of wreck, b) kelp frond over-grown by sea mat where *Polycera* egg ribbons have been laid, ghost shrimps hang on with their back legs and fish for plankton with their large front claws, c) *Polycera nudibranch*, sea mat and ghost shrimp, d) colony of deadmens fingers.

Survey Review

The SW Lofotens proved to be a fascinating area to dive and to survey. During the course of the expedition a variety of different ecosystems was visited: from Reine harbour and sheltered steep-sided fjords to rocky sites on the open coast, kelp forests, sandy sediment, two wreck sites and one site that extended down to mud. This provided a broad over-view of the marine life in the vicinity of Reine and Nusfjord.

The level of biodiversity was generally good, though some groups were poorly represented.

As a group **Sponges** were not well-represented and they were only recorded at 4 different sites. Only 5 species were identified and of those, *Myxilla incrustans* was found to be common at just one site.

Members of the **Cnidaria** (20 species) were found at most sites but none of the species was especially wide-spread or common. The burrowing anemone was often recorded at sites with fine sediment, the tiny proliferating anemone was found to be common at 2 sites, plumose anemones and *Bolocera* were recorded at 4 or 5 sites. Deadmen's fingers were also found at 5 sites.

10 species of **Annelid worms** were recorded, with other species unidentified. Annelids were particularly well-represented at one site, Muddy Hollow (site 9) where 9 species were found. Keel worms were very common or abundant at most sites. Other worms, the **Nemerteans** were present and may have been more common than records indicate.

Crustaceans (13 species) were present at all sites, with hermit crabs and squat lobsters being widely distributed. Edible crabs were often seen and amphipods were abundant at 2 sites.

The **Molluscs** (32 species) were the best represented of all the groups though no single species was very wide-spread. The horse mussel was frequently seen, but the yellow and white nudibranch *Polycera* was often recorded.

Bryozoa (9 species) were well-represented by the sea mat *Membranipora* which was abundant and wide-spread on kelp fronds, and the hairy sea mat *Electra* was also quite common encrusting on seaweeds. However, other bryozoans were only rarely seen.

As a group the **Echinoderms** (17 species) were very wide-spread, with crevice brittle stars, common starfish, common urchins, small urchins and northern urchins being recorded most frequently. Echinoderm species were present at all sites.

Tunicates (5 species) were poorly represented, and they were mainly found on man-made structures such as the wrecks and the harbour pontoon.

Several **fish species** (20 species) were recorded overall, but at some sites, very few were seen. 2-spot gobies were the most wide-spread species, frequently in shallow water. Large schools of saithe were seen at some sites.

Green seaweeds were only seen on the harbour pontoon. But **brown seaweeds** were very common. Within the fjords only knotted wrack and bootlace weed were found, but on the

open coast, kelp forest was abundant in shallow waters and down to 12m or more. Forest kelp was the commonest species, but sugar kelp was frequent and prickly weed was abundant in places. Kelp stipes were largely free from epiphytic red algae.

Red seaweeds were especially interesting. Encrusting pink alga was present in abundance at most sites, and it occurred with different growth forms. Within the fjords, small knobbly (fist-sized) growths were found on rocks at all 3 sites, but at the 2 most sheltered sites, (Forsfjorden and Djupfjorden) calcareous alga formed large outcrops below about 20m. The growth rate of these structures must be very slow, and they are probably extremely old. Another common species was found as a soft red covering on rocks and sometimes growing over the pink encrusting alga (*Bonnemasonia hamifera*, *trilliella* phase). A few other red algal species were recorded but for the most part they were few and far between.

Of the sites visited, the largest number of species was recorded at Forsfjorden (site 1) with 65 species. Following on from this, more than 50 species were recorded at Muddy Hollow (site 9), Anstabviken (site 4) and Hyshola (site 10). All of these sites had a variety of different habitats identified which may have some bearing on the numbers of species recorded.

The expedition took place in the autumn and it is not known how much of a seasonal effect there may have been. There was some evidence of die-back of seaweeds. It would be interesting to carry out further surveys at different times of year and to compare the results. The area deserves further study and this should only be considered as a preliminary survey.

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Species List

This table lists all the species recorded at each dive site together with estimated abundance. The abundance scale used is Abundant, Common, Frequent, Occasional, Rare. For the first 3 categories, the table contains A, C or F, but for any species that was occasional, rare, or simply present at a particular site, a dot is shown.

Bearing in mind that a site usually has more than one habitat and that the abundance of a particular species may only relate to one of those habitats, a species assigned a C for example, may have only been common in one of the habitats identified at that site. Referring back to the relevant site description should help to provide habitat information if required.

For ease of reference, here is a list of the numbered dive sites and number of species recorded:

The fjords:

- 1 Forsfjorden (65 species)
- 2 Engelsneset (Angel Point) (38 species)
- 3 Djupfjorden (43 species)

Coastal sites SW of Reine:

- 4 Anstabviken (53 species)
- 5 Seaward side of Dupfjorden entrance (24 species)

Sites in the vicinity of Reine:

- 6 Reine Rocks (25 species)
- 7 Lamholmen (29 species)
- 8 Reine Harbour (24 species)
- 9 Muddy Hollow, Inner Harbour (55 species)

Sites accessed from Nusfjord:

- 10 Hyshola, Tunnel dive (52 species)
- 11 Lighthouse (19 species)
- 12 Wreck of Karlshorst (44 species)

Total number of species recorded (some to genus level only): 131 animals, 18 algae

Unidentified: 6 animals, 8 algae (including the various forms of pink encrusting alga, which may or may not be different species), 1 bacterium.

Lofotens Species List

	Site number:	1	2	3	4	5	6	7	8	9	10	11	12
Porifera	Sponges												
Clathrina sp		•			•								
Leucosolenia sp		•											
Sycon quadrangulatum		•											•
Haliclona urceoleus		•											
Myxilla incrustans	Yellow volcano sponge			•	C								
orange encrusting (unidentified)				•									
beige encrusting (unidentified)				•									
Ctenophora	Comb jellies												
Pleurobrachia pileus	Sea gooseberry									•			
Cnidaria	Jelly fish, hydroids, soft corals, anemones												
Cyanea capillata	Lion's mane jellyfish			•	•	•							
Chrysaora hysoscella	Compass jellyfish		•										
Schiphystoma larvae	Moon jelly sessile phase	•											
Halicystis sp	Stalked jellyfish				•		•				•		
Obelia geniculata							C						F
Eudendrium rameum			•	•		•							•
Hydroid (unidentified)				•						•			
Tubularia larynx													•
Hydractinia echinata									•				
Alcyonium digitatum	Deadmans fingers	•	•		F						•		•
A. coralloides	Pink fingers				•								
Protanthia simplex	Sea loch anemone	F	•										
Hormathia digitata		•											
Metridium senile	Plumose anemone	•	F	•	•								•
Gonactinia prolifera	Proliferating anemone	C								C			
Sagartia elegans	Elegant anemone		F							•			•
Urticina felina	Dahlia anemone		•		•				•		•		
U. eques				•									
Bolocera tuediae		•	•	•	•								
Cerianthus lloydii	Burrowing anemone	C	F							C			
Calliactis or Hormathia	Parasitic anemone								•				
Annelida	Segmented worms												
Pomatoceros triqueter	Keel worm	C	A	A	F	C	C	C		A	A	F	C
Hydroides norvegica		•	•	F	•			F		•	F		•
Spirorbis spirorbis		•			C		C	C		C	F		
Pectinaria sp	Bristle worm								•	C			
Ophiodromus flexuosus		•								F			

	Site number:	1	2	3	4	5	6	7	8	9	10	11	12
Phyllodoce sp										•			
Alentia gelatinosa	Jelly worm									•			
Myxicola sp	Eyelash worm			•					C	•			
Terebellid										•			
Filograna implexa													•
Unidentified annelid worms									•	•			
Worm casts in sediment												•	
Nemertea	Ribbon worms												
Lineus longissimus	Bootlace worm		•	•									
unidentified nemertean		•		•									
Crustacea													
Semibalanus balanoides	Barnacles		F				A			A			
Balanus sp	Barnacles	•											
Mysids	Mysid shrimps				•								
Iphimedia obesa	Amphipod				A		•	A					C
Caprella linearis	Ghost shrimp												F
Panadulus montagui	Northern prawn	•			•					•			
Lebbius polaris				•	•								
Pagurus sp	Hermit crabs	•	F	C		C		F		C	F		
Hyas areneus	Spider crab	•		•	•		•				•	•	
Carcinus maenas	Shore crab								•		•		
Cancer pagurus	Edible crab			•	•			•	•		F	•	
Lithodes maja	Stone crab	•											
Galathea sp	Squat lobster	•		F	F		•			•	C		F
Mollusca	Snails, nudibranchs, bivalves and cephalopods												
Chiton		•		F	•					C	•		•
Ansates pellucida	Blue rayed limpet				•			•			•		
Patella vulgata	Common limpet		F				C			F			
Tectura testudinalis		•	•	•				•		•			
Littorina littorea	Common periwinkle	•	C							F			
Littorina obtusata (shells)	Flat periwinkle									•			
Gibbula cinerea	Grey top shell			•			F	F		F	•		
Nucella lapillus	Dog whelk	F					C			•			
Lacuna vincta	Chink shell				C			•			C	•	•
Buccinum undatum	Common whelk		F						C	•			
Neptuna antiqua		•	•										
N. despecta				•									
Aplysia punctata	Sea hare				•	A		•			F		•
Polycera quadrilineata					F	F		F			F	•	C
P. quadrilineata eggs											•		F

	Site number:	1	2	3	4	5	6	7	8	9	10	11	12
<i>Limacea clavigera</i>					•						•		
<i>Archidoris pseudoargus</i>	Sea lemon										•		
<i>Onchidoris muricata</i>							F				•	•	•
<i>Adalaria proxima</i>							F						
<i>Cadlina laevis</i>								•					
<i>Coryphella</i> sp			C						•	F			
<i>Dendronotus frondosus</i>		•							•				
<i>Tritonia hombergi</i>													•
<i>Pododesmus patelliformis</i>	Saddle oyster	•	•										
<i>Mytilus edulis</i>	Common mussel	F							•				
<i>Modiolus modiolus</i>	Horse mussel	F	C	F						F	•		
<i>Aequipecten opercularis</i>	Queen scallop	C							•	F	•		
<i>Chlamys islandica</i>	Icelandic scallop	•	•	•									
<i>Dosinia lupinus</i> (shell)	Smooth Artemis							•					
<i>Acanthocardia echinata</i>	Spiny cockle		•							•			
<i>Ensis ensis</i> (shells)	Razor shell							•					
<i>Arctica islandica</i> (shells)	Icelandic cyprina	•						•					
<i>Mya arenaria</i> (shells)	Sand gaper	•								•			
<i>Eledone cirrhosa</i>	Octopus											•	
Bryozoa	Sea mats												
<i>Tubulipora</i> sp (encrusting nodules on <i>D. aculeata</i>)													F
<i>Membranipora membranacea</i>	Sea mat				A	A	A	A			A	C	C
<i>Electra pilosa</i>	Hairy sea mat				C	C	F	C			C	•	C
<i>Parasmatina trispinosa</i>					•						•		
<i>Schizomavella linearis</i>					•						•		
<i>Caberea ellisi</i>		•											
<i>Scrupocellaria reptans</i>					•								
<i>Crissia</i> sp		•											
<i>Securiflustra securifrons</i>											•		
Brachiopoda													
<i>Crania anomala</i>				•									
Echinodermata	Brittle stars, star fish, urchins, sea cucumbers												
<i>Ophiopholis aculeata</i>	Crevice brittlestar	C	F	F	•					•	F	•	•
<i>Ophiura ophiura</i>	Sand brittle star	•							•	F			
<i>Ophiura albida</i>	Sand brittle star	F								F			
<i>Ophiocoma niger</i>	Black brittle star	F								F			
<i>Asterias rubens</i>	Common starfish	F	•		F	F	C	•	•	F	F		F
<i>Henricia</i> sp	Bloody Henry	•											
<i>Solaster endeca</i>	Purple sunstar	•	•		•	•				•	•		•
<i>Crossaster papposus</i>	Common Sunstar									•	•		

	Site number:	1	2	3	4	5	6	7	8	9	10	11	12
<i>Leptasterias muelleri</i>		•								•			•
<i>Porania pulvillus</i>	Red cushion star				•								
<i>Hippasteria phrygiana</i>	Cushion star				•						•		
<i>Stichasterella rosea</i>											•		
<i>Echinus esculentus</i>	Common urchin	•	•		F	C	•	•		•	C	•	•
<i>Psammechinus miliaris</i>	Small urchin	C	C	F	•					F	•		
<i>Strongylocentrotus droebachiensis</i>	Northern urchin	C	C						C	F			
<i>Spatangus purpurea</i>	Purple heart urchin	•											
<i>Cucumaria frondosa</i>		•											
burrowing cucumber		•											
Tunicates	Sea squirts												
<i>Ascidia mentula</i>	Red sea squirt	F											F
<i>Halocynthia pyriformis</i>	Orange sea squirt	•								F			
<i>Ciona intestinalis</i>	Yellow-edged sea squirt								•	•			F
<i>Ascidella aspersa</i>		•											•
Fish													
<i>Pollachius pollachius</i>	Pollack				•						•		F
<i>P. virens</i>	Saithe			F	C	C	C			•			C
<i>Gadus morhua</i> (juv)	Cod		•		•	•		•		•			
<i>Molva molva</i>	Ling				•								
<i>Lophius piscatorius</i>	Angler fish					•					•		
<i>Myoxocephalus scorpius</i>	Short-spined sea scorpion			•							•	•	
<i>Taurulus bubalis</i>	Long-spined sea scorpion			•							•		
<i>Sebastes viviparus</i>	Norway redfish			•	•						•		•
<i>Agonus cataphractus</i>	Pogge				•						•	•	
<i>Cyclopterus lumpus</i>	Lumpsucker				•						•		
<i>C. lumpus</i> juvenile									•		•		
<i>Ctenolabrus rupestris</i>	Goldsinney				•								
<i>Pholis gunnellus</i>	Butterfish										•		
<i>Anarhichas lupus</i>	Wolf fish												•
<i>Pomatoschistus pictus</i>	Painted goby			•						F			
<i>Pomatoschistus</i> sp	Sand/common goby			•				F		•			
<i>Gobiusculus flavescens</i>	2-spot goby	•	•	C			•		C	F	F		F
<i>Callionymus lyra</i>	Dragonet	•											
<i>Phrynorhombus norvegicus</i>	Norwegian topknot	•								•	•		
<i>Limanda limanda</i>	Dab	•				•							
<i>Pleuronectes platessa</i>	Plaice						•	•			•		
Seaweeds													
Green													
<i>Cladophora</i> sp									C				

	Site number:	1	2	3	4	5	6	7	8	9	10	11	12
Ulva sp	Sea lettuce								•				
Brown													
Fucus sp	Wrack		F							A			
Ascophyllum nodosum	Knotted wrack	C	F	C						•			
Chorda filum	Bootlace weed			A				C	C				
Laminaria digitata					F								
Laminaria hyperborea	Forest kelp				A	A	A	C			A	C	C
Saccharina latissima	Sugar kelp				C	F		A	•				F
Desmarestia aculeata	Prickle weed			•	A	A	F	C			C	C	A
Alaria esculenta						•							•
Filamentous epiphytic on C.filum				C									
Filamentous unidentified								•					
Red													
Delesseria sanguinea	Sea beech			•	F								F
Dilsea carnosa	Red rags						•						
Odonthalia dentata					•						•		
Ptilota (serrata)	*				•	•							
Polysiphonia (stricta)	*				•								
Euthora cristata	*	•											
Turnerella pennyi	*	•	•										
Bonnemasonia hamifera	(Trailliella Phase) *			F	C	A		F				F	C
Pink encrusting		A	A	C	A	A	A	F	•	A	C	C	C
Pink calcareous (lumps)		A	C	F						F			
Pink calcareous (massive)		A		A									
Maerl													•
Corallina type		•	•										
Fimbrifolium dichotomum	**					•		•					
* identified by Christine Maggs from digital images (probable species in brackets)													
** Identified by Mike Guiry and Juliet Brodle from dried specimen													
Bacterial filaments											•	C	

WRECK SURVEY REPORT

Jane Maddocks



Lofoten Wrecks

Originally we had wanted to do some serious wreck surveys. When we got to Reine it became obvious that the most exciting part of the diving was going to be the marine life. Metal and wood would take second place to some extraordinary creatures.

We did have four targets to look at: in Forsfjorden, near to the centre there were two deliberately scuttled small motor fishing boats, and out at Nusfjord the much more majestic SS Karlshorst out in the bay, with the remains of a vessel, possibly the Nero in the bay itself.

Forsfjorden

The first dives were on the two deliberately sunk wrecks in Forsfjorden. Site location was straightforward as the wrecks were almost directly under the large waterfall pouring cold fresh water into the fjord. The fresh water meant that the boats were in a good state of preservation. It also meant the water was very cold at 3°C on the bottom at 30 metres. This restricted the time that divers could stay down, as well as affecting the quality of recording techniques. We decided that recording would be by sketch plan and by photograph. The time taken to draw with full archaeological techniques was too long.

3°C also meant that one or two divers finally understood what we meant when we recommended drysuits. Fortunately the dive centre did have spare suits for hire.

The two boats had been deliberately scuttled at the end of their working lives. It is against Norwegian law to scuttle worn out boats but it still happens, usually at night and in secret.

The larger boat sat on a slope at 30metres, virtually intact with a prominent wheelhouse and most of her features visible. The overall dimensions recorded by Simon and Matt were:

Length overall 16m

Depth from keel to main deck 4.3m

Height of wheelhouse 3.4m

Life on the wreck recorded by Adam Stevens included brittle stars, starfish, scallops, hermit crabs, various species of anemone, mussels, and spiny urchins.

The smaller vessel lies close to the larger one. This was a small motorised fishing boat. She was open, with internal structure visible, lying on her port side. The port side disappeared into thick sediment and the frames on that side were damaged.

Parts of the engine were visible, indicating a simple Petter type engine. Pipe work and cables were evident as were the propeller and rudder. She is more lightly built than the larger vessel and is quite fragile. Her frames are showing evidence of deterioration.



The large fishing vessel © Adam Stevens 2013.

REDS ARCHAEOLOGICAL RECORD SHEET
Lofoten 2013

Name: ADAM STEVENS	Date: 21/11/13 envirn: 1400-1500h	Number: 2	Site: 1400-1500h
GPS:	Area:		Continued from:
Survey item:			Page: 1 of 1
UW drawing ref:		Photo ref:	Video ref:
Dive duration: 30	UW vis: 10-15m	UW tide: n/a	
Diving Equipment: SCUBA			
Tools/ Equipment: CMCRA			

Other constraints: ☒ Cold ☐ Tide ☐ swell ☐ access ☐ low light ☐ other

Task/ objectives: **SURVEY WRECK, COUNT SPECIES**

Outcome/ procedures: **AS ABOVE**

Sketch

Species in surroundings:

- Little shrimps - abundant
- Starfish - frequent
- Scallops - abundant
- Hermit crabs - common
- Murex sp. - abundant
- Murex - common

Specimens on beach:

- Various sp. crabs - common
- Sea urchins - common
- Serpentines



Smaller fishing vessel showing damaged frames © Harold Sach 2013

The overall dimensions of the smaller vessel:

Length 10m 70cm

Width 4m 70men frames visible.

The bow looked similar in style of the 1930s.

[illegible]

These two small boats were interesting. There was a distinct difference in the level of preservation, probably resulting from the more robust structure of the larger vessel in deeper and colder water. They were also the product of a wish to get rid of the boats at the end of their working lives, irrespective of a law that did not allow scuttling of old fishing boats (Therese Amelie Holten Larsen pers. comm).

It was also a useful introduction to diving in cold water, the use of tapes when only 3mm gloves had been brought, and how 12°C could feel really warm after 30 minutes at 3°C. The boats were small enough to survey properly in 3-4 dives, and large enough to give some challenges about how to record when time was limited. The use of mini video cameras was really useful and has provided good footage for the records.

Nero at Nusfjord

The Nero's remains consist of a boiler, propeller shaft, and scattered structure in a rocky, kelpy background.



Divers measuring the boiler © Jim Seymour 2013

This wreck was scattered, however it was possible to see the remains as part of a vessel. It has been tentatively identified as the Nero. More work can be done establishing the identity of the vessel, and perhaps a diver trail would help divers get more out of this wreck.

The boiler dimensions are 2m 11 cm wide and 2m 44cm long. The extant propeller blade needs careful measuring. Once these measurements have been taken it should be possible to work out how big she was. This will help with final identification.

MV Karlshorst

The MV Karlshorst was a German cargo ship, built in 1967 by Neptune Werft A.G. Rostock. She had a single diesel engine, single screw and a speed of 12kn. She was 92.93m long, 14m wide and had a hold depth of 7m.

On 27th October 1977 she was lost off the Lofoten islands *en route* to Rostock from Archangel as her cargo of 3829 tons of wood shifted in bad weather and suddenly increasing seas. The crew were rescued, but the salvage tug Atlas was lost because of damage sustained during the tow. The tug has not yet been located.

The vessel was extensively salvaged and is now an empty hull. The vessel is upside down and all traces of the bridge have disappeared.



MV Hellerau. Sister ship of MV Karlshorst © Wrecksite Eu.

The wreck is accessible, and offered a good opportunity to try out some different survey techniques, and to see how salvage was carried out in the late 70s.

The log sheets show the kind of records that divers new to survey could achieve in less than optimal conditions and the individual approaches of the team... The drawings and measurements were taken underwater then transferred to the record sheets at the end of the day. There was little evidence of deck or bridge, most of the material has disappeared.

REDS ARCHAEOLOGICAL RECORD SHEET
Lofoten 2013

Name Jim Seymour	Date 29/9/2013 am/pm	Number	Site MS KARLSHOLST
GPS	Area	Continued from	
Survey files		Page of	
UAV drawing ref		Photo ref	Video ref

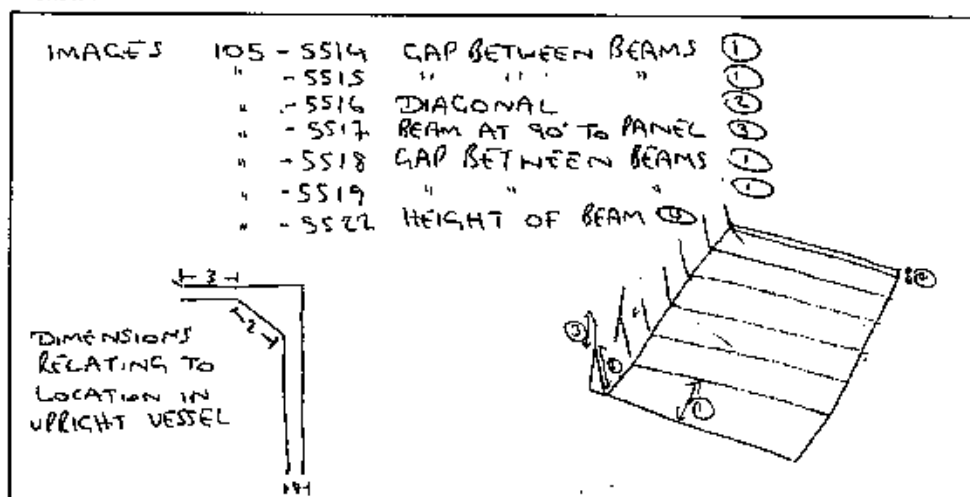
Dive duration 33	UW vis c. 15 m	UW tide SLIGHT
Diving Equipment SCUBA		
Tools/ Equipment MEASURING TAPE & ROD, CAMERA		

Other constraints

Cold Tide swell access low light other

Task/objectives: MEASUREMENTS OF DETACHED PANELS - SEE HAROLD SACH'S LOGSHEET FOR DIMENSIONS PLUS IMAGES OF PLATES
Outcome/ procedures: IMAGE NUMBERS BELOW RELATE TO PHOTOGRAPHS OF PLATES WITH MEASURING ROD FOR REFERENCE

Sketch



REDS ARCHAEOLOGICAL RECORD SHEET
Lofoten 2013

Name ADAM STEVENS	Date 29.9.13 am/pm AM	Number	Site KARLSHOLMST
GPS	Area	Continued from	
Survey files		Page	of
UW drawing ref		Photo ref	Video ref:

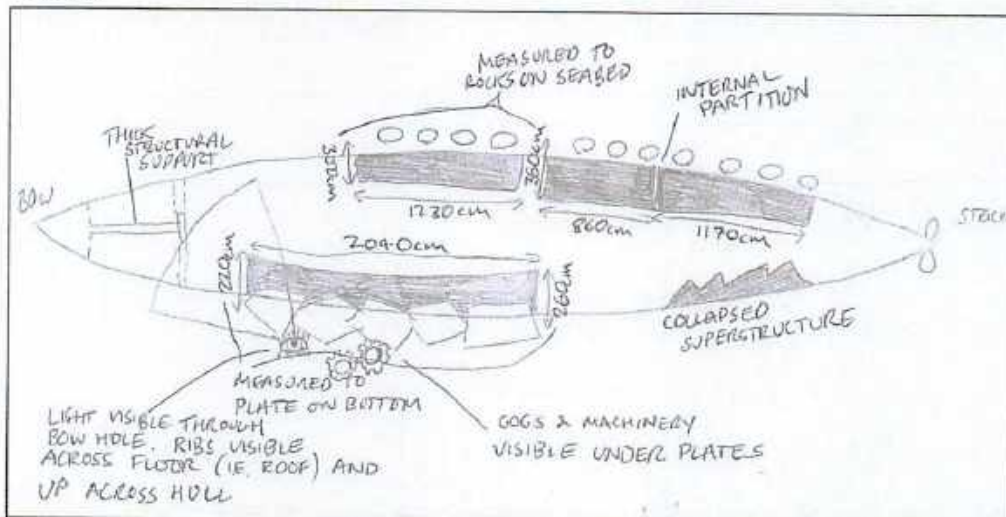
Dive duration 32min	UW vis 20m	UW tide -
Diving Equipment SCUBA		
Tools/ Equipment TAPE (30m)		

Other constraints
☒ Cold ☐ Tide ☐ swell ☐ access ☐ low light ☐ other

Task/ objectives: MEASURE SALVAGE HOLES, ASSESS INTERNAL STRUCTURE

Outcome/ procedures: SALVAGE HOLES MEASURED, SWAM THROUGH INTERIOR AT BOW

Sketch



REDS ARCHAEOLOGICAL RECORD SHEET
Lofoten 2013

Name HAROLD SACH	Date 29/09/13 (am/pm) 9:51	Number	Site MS KARLS HORST
GPS	Area	Continued from	
Survey files		Page	of
UW drawing ref		Photo ref	Video ref:

Dive duration 33 mins	UW vis FAIR	UW tide
Diving Equipment STD DIVING + OSMB		
Tools/ Equipment TAPE MEASURE		

Other constraints
Cold Tide swell access low light other

Task/objectives: SURVEY TWO HOLES AND PLATES REMOVED AS PART OF THE SALVAGE. MEASURE PLATES/HULL SECTIONS CUT OUT
Outcome/procedures: HULL SECTIONS MEASURED BUT FIRST CUT OUT ON REAR PORT SIDE IDENTIFIED AS TWO PANELS.
MEASUREMENTS + DEPTHS RECORDED

Sketch

REAR PORT SIDE

Depth 20.6m 12m 80cm (15 Beams across)

Depth 19.9m 4 beam stands

Note: Plate 1b is over plate 1a hence 1a must cut first and 1b after
Can see through wreck to other side

REDS ARCHAEOLOGICAL RECORD SHEET
Lofoten 2013

Name <u>KERRY MACKAY & DAVID OLIVER</u>	Date <u>am/pm</u>	Number	Site <u>KARLS HORST</u>
GPS	Area	Continued from	
Survey files		Page of	
UW drawing ref		Photo ref	Video ref:

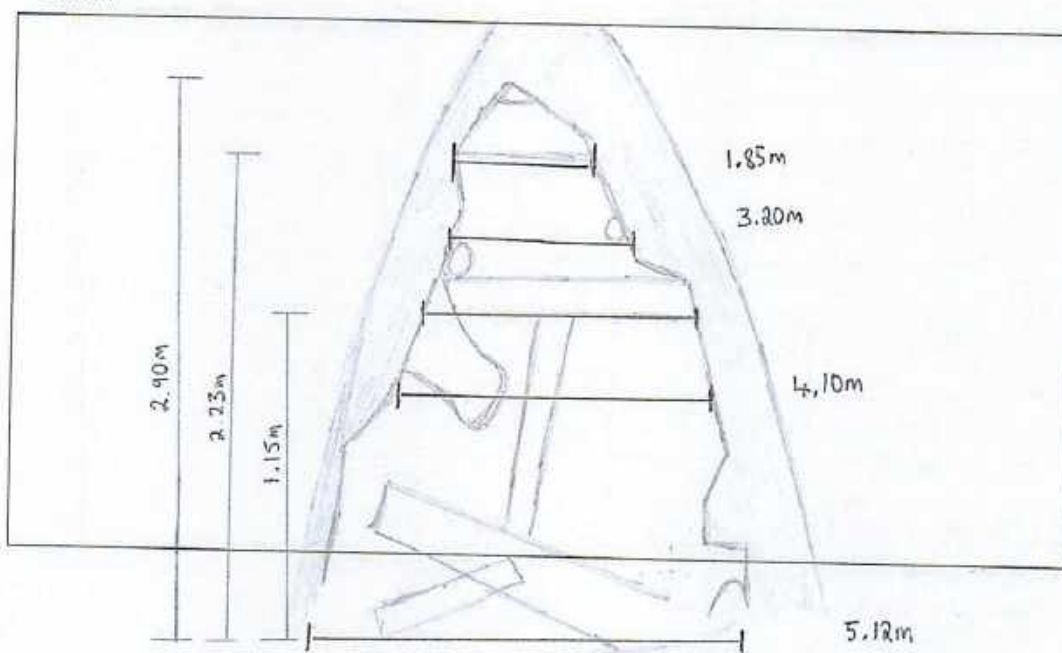
Dive duration <u>37 mins</u>	UW vis <u>15m +</u>	UW tide <u>None</u>
Diving Equipment <u>FULL SCUBA</u>		
Tools/ Equipment <u>Tape measure</u>		

Other constraints

Cold ☒ Tide ☐ swell ☐ access ☐ low light ☐ other ☐

Task/objectives:	<u>SKETCH AND MEASURE THE EXTENT OF THE DAMAGE TO THE BOW AREA</u>
Outcome/procedures:	<u>ROUGH SKETCH OF BOW. MEASUREMENTS WERE TAKEN OF THE OPEN AREA AT THE SEA BED AND AT POINTS UP THE DAMAGED/ OPEN AREA AT POINTS WHICH COULD BE IDENTIFIED. A FINAL MEASUREMENT WAS TAKEN OF THE HEIGHT OF THE OPENING.</u>

Sketch



Summary of survey on MV Karlshorst

MV Karlshorst has a remarkably intact outer hull. She still conforms generally to the dimensions of 93 m long by 14 m wide and 7m depth of hold. What has changed is the evidence of the removal by salvage of all the top hamper, cargo and internal fittings. Evidence of the salvage of the cargo is shown by large rectangular holes cut underwater to allow the machinery to be taken out of the hull. She also has large, professionally cut holes elsewhere on the deck, indicating the removal of material for recycling or to get access to cargo and metals such as copper and brass used in her construction.

It is clear that proper cutting equipment has been used to access the hull. The damage is not the sort that would happen if the holes had been caused by hitting the rocks. The team were briefed not to go inside the wreck. There was quite a lot of noise from plates and structure working inside the hull, so we stayed on the outside.

The visibility was good, and at 21m depth it was possible to stay down for some time. Marine life on the wreck tended to be short 'turf' and there were lots of fish using the wreck as a reef.



Recording structure on MV Karlshorst © Jim Seymour 2013

Summary of the wreck diving interlude

The wrecks that we looked at were all modern 20th century vessels. It was useful to record their current condition because it gave members of the team experience of wreck survey and completing record sheets. The two wrecks in the fjord near Reine were an interesting example of a pragmatic answer to disposing of old boats that had outlived their usefulness.

The wreck of the Nero gave some useful practise in finding wreck by looking for straight lines on a sea bed. In comfortable conditions it enabled the group to get to grips with recording boilers.

The MV Karlshorst in shallow water was useful because it was easy to understand the structure of the metal wreck, and divers could be encouraged to identify frames, plates,

welds and other features. As the wreck was so very modern it also probably meant that most divers were really pleased to get back to the colourful and varied marine life dives.