Sachs Harbour Benthic Community Survey Summary of Results 1999-2000

T.D. Siferd

Fisheries & Oceans Canada
Freshwater Institute
501 University Crescent
Winnipeg, Manitoba R3T 2N6

2001

Canadian Technical Report of Fisheries and Aquatic Sciences 2366

Fisheries and Oceans   Pêches et Océans

Canada

Canadian Technical Report of
Fisheries and Aquatic Sciences 2366

2001

SACHS HARBOUR MARINE BENTHIC COMMUNITY SURVEY SUMMARY OF RESULTS 1999-2000

by

T.D. Siferd

Fisheries & Oceans Canada
Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6
e-mail: siferdt@dfo-mpo.gc.ca

Cat. No Fs 97-6/2366E ISSN 1488-5379

Correct citation for this publication:

Siferd, T.D. 2001. Sachs Harbour marine benthic community survey. Summary of results 1999-2000. Can. Tech. Rep. Fish. Aquat. Sci. 2366: vii + 47 p.

This report is available online at:
inter01.dfo-mpo.gc.ca/wavesdocs/waves_mainmenu.html

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

Siferd, T.D. 2001. Sachs Harbour marine benthic community survey. Summary of results 1999-2000. Can. Tech. Rep. Fish. Aquat. Sci. 2366: vii + 47 p.

At the request of the hamlet of Sachs Harbour, Northwest Territories and the Inuvialuit Fisheries Joint Management Committee a survey was conducted to look at possible benthic resources in the area near the community. The report summarizes the results from the field seasons of 1999 and 2000. The benthos was sampled using photographic methods, longlines and crab traps. Brittle stars were numerically dominant. Toad crabs, *Hyas coarctatus alutaceus*, softshell clams, *Mya* sp., and cockles, *Serripes groenlandicus* and *Clinocardium ciliatum*, were also found but in low abundance. Samples from the eastern portion of the Sachs River estuary were found to be anoxic below about 15m.

Key words: benthic survey, photographic methods, Hyas coarctatus alutaceus, Mya, Serripes, Clinocardium, brittle star.

RÉSUMÉ

Siferd, T.D. 2001. Sachs Harbour marine benthic community survey. Summary of results 1999-2000. Can. Tech. Rep. Fish. Aquat. Sci. 2366: vii + 47 p.

À la demande de la collectivité de Sachs Harbour (Territoires du Nord-Ouest) et du Comité conjoint de gestion des pêches des Inuvialuit, on a procédé à une étude visant à établir la présence de ressources benthiques dans les environs de la collectivité. Le rapport fait état des résultats obtenus lors des saisons de recherche sur le terrain de 1999 et de 2000. On a échantillonné le benthos au moyen de photographies, de palangres et de casiers à crabe. Les ophiures dominaient en nombre. Le crabe-araignée*, Hyas coarctatus alutaceus*, les myes, famille des Mya, les coques du Groenland, *Serripes groenlandicus*, et les coques d'Islande, *Clinocardium ciliatum,* se retrouvaient également, mais en nombre peu important. Les échantillons prélevés dans la partie est de l'estuaire de la rivière Sachs étaient anoxiques en dessous d'une quinzaine de mètres.

Mots-clés : relevé du benthos, méthodes photographiques, Hyas coarctatus alutaceus, Mya, Serripes, Clinocardium, ophiure.

INTRODUCTION

In 1996 the Hunters and Trappers Committee and the community of Sachs Harbour, Northwest Territories approached Fisheries and Oceans Canada to conduct a survey for shellfish in the waters near their community. The request was prompted by local hunters reporting large numbers of bearded seals (*Erignathus barbatus*) with stomachs containing large numbers of shellfish in Sea Otter Harbour and by a request from southern interests for a commercial shellfish harvest in the area.

The marine benthic community of southwestern Banks Island has received very little scientific attention. The objectives of the surveys were to: 1) identify and estimate the abundance of the major macrobenthos community in the Sachs Harbour area; 2) produce a seabed habitat map of the area and 3) determine the bathymetry of the Sachs Harbour and the Sachs River estuary. Results of the surveys conducted in 1999 and 2000 are summarized here.

MATERIAL AND METHODS

Study Area

The survey was conducted in the waters near the community of Sachs Harbour, Northwest Territories (71°59'N 125°14'W)(Fig. 1). This included Sachs Harbour proper, the Sachs River estuary and Thesiger Bay out to the 175m contour approximately 25km offshore. Two significantly widened basins in the Sachs River were named to identify features in which we were working. The basins were named as lakes as is the practice on some rivers in the south near Winnipeg. The western basin was named Fred Lake after Fred Raddi who worked with me on the survey in 2000. The eastern basin was named Bev Lake after Bev Esau, Fred's significant other.

Field Sampling

Two vessels were used for sampling, Murphi I (7m length) in 1999 and the Plover (8m length; Fig. 2) in 2000.

Benthic habitat sampling was conducted using the acoustic based QTC View seabed classification system. The system includes the QTC View, Knudsen 320B/P echosounder and Ashtech Reliance differential global positioning system (DGPS) base station and rover (Fig. 2). This system digitizes, normalizes and records the return signals from an echo sounder. A second program, QTC IMPACT, clusters the normalized returns into statistically similar groups. The clusters can then be groundtruthed to determine their characteristics. At Sachs Harbour, Ponar grab samples and benthic photographs were used. Ship tracks were selected non-systematically to gain coverage of the waterway. Bathymetric contours were derived using the kriging function in Surfer (Golden Software Inc. Golden, CO) after removing depths shallower than 0.5 m (minimum depth recorded by QTC View). The digital coastline was set to 0 m and added to the depth data set for contouring.

Photographic samples were collected along transects extending from shore. Transects were not selected systematically but were to sample the depths encountered in the area. Since there was no previous knowledge of the area, the transects can be considered random. Samples were stratified by depth.

Photographs were taken with a Benthos Model 3782 Minicamera illuminated with dual flashes (one Ikelite Substrobe M and one Ikelite Substrobe MS) to reduce shadowing (Fig. 2). The camera was mounted in an aluminum frame such that the camera hung vertically in the water. Ektachrome 100 ASA Professional slide film was used.

Photograph sampling was controlled by an Osprey OE 1321 video camera mounted beside the Minicamera. A thin cable attached a small round weight of known diameter so that it hung below the cameras at the focal length of the Minicamera and was visible by both cameras. The weight provided a size reference to account for changes in the camera height above the bottom and to calculate the area sampled. The camera frame was lowered slowly to the bottom and the Minicamera was triggered manually from the boat when the weight contacted the bottom as seen in the video display. A Knudsen 320B/P Echosounder was used to record the depth and DGPS position (submeter accuracy) of each photograph taken.

Crabs were collected by baited crab traps or divers. In 1999, inverted open bottom shrimp traps were used. Arctic char and Greenland cod were used as bait. In 2000, west-coast crab traps were used. Openings to the traps measured 8cm X 16cm. A plastic jar punched with small holes and tied to the center of the trap held bait of either sardines or discarded arctic char parts. Captured crabs were returned to shore where carapace length was measured using digital calipers and weighed using a spring scale. Carapace length was defined as the length between the tip of the rostral horn and the posterior margin. Crabs were blotted dry before weighing.

A longline with 68 hooks with crab and shrimp pots attached at either end was deployed in 175m of water in Thesiger Bay. Hooks and traps were baited with discarded arctic char parts. The line was allowed to soak for 2 days before it was retrieved.

Analysis of Photographs

Photographic sample films were processed and placed onto Kodak Photo CDs. Digital images were viewed in Photoshop (Adobe Systems Inc., San Jose, CA). The visible fauna was identified to the lowest possible taxon. Clams were classed to species using the methods of Siferd and Welch (1992). Identification references included: Scott and Scott (1988) and Hart (1973) for fish; D'yakonov

(1950, 1954), Grainger (1966), Mortensen (1977), Serafy and Fell (1985), Messing and Dearborn (1990) and Gagnon and Gilkinson (1994) for echinoderms; Squires (1990) for decapods; Barr and Barr (1983) for various groups. The size reference and area counted in each photograph was measured using SigmaScan (SPSS Inc. Chicago, IL) and exact sample areas calculated.

RESULTS

Seabed Classification and Bathymetry

Vessel tracks for the collection of benthic habitat and bathymetry data in Sachs Harbour and the Sachs River during the two study seasons are shown in Figure 3. A sounder problem in 1999 and a software malfunction in 2000 prevented the data collected from being used for habitat classification. However the data was used to map the bathymetry of the study area (Fig. 4). The Sachs River estuary out to the mouth of Sachs Harbour is a series of 4 deep basins (>35m) with very shallow sills (1-2m) between each basin. This greatly affects the circulation and distribution of animals in the area (see below). Bev Lake was the deepest basin recorded in the area at 57m, this was followed by 46.7m in the inner basin of Sachs Harbour, then the outer basin of Sachs Harbour at 37.1m and finally 36.6m in Fred Lake.

Photographic Survey

Sampling between 16 August and 1 September 2000, 687 photographs were taken. Figure 5 shows the distribution of these samples. Of these photographs, 497 yielded useable frames for counting. Forty-five species and or groups of flora and animals were identified from the photographs (Table 1). The sample sites formed 46 clusters from which average abundance could be calculated. See Table 2 for the statistics of each cluster.

Molluscs (Bivalves and Snails)

The softshell clam (*Mya* sp. Fig. 6A,B,D) was found in low numbers in Sachs Harbour and Thesiger Bay (Fig. 7). The maximum abundance recorded was $11.4m^{-2}$ on the south side of the outer basin of Sachs Harbour.

Two cockles, the Greenland cockle *Serripes groenlandicus* (Fig. 6A,B,C) and the hairy cockle *Clinocardium ciliatum* (Fig. 6B) were found while diving. But since their siphons cannot be distinguished in photographs reliably, they are combined in the population estimates. Diver collections suggested that the hairy cockle represent about 10-20% of the total cockle population. Cockles were present in low numbers throughout the study area (Fig. 8). The maximum abundance found was $13.2m^{-2}$ in Thesiger Bay.

Three other bivalves, the arctic hiatella *Hiatella arctica* (Fig. 6E,F), mussel *Musculus* sp. (an example of *Musculus* from Resolute, Nunavut is seen in Fig. 6 G,H) and Greenland scallop *Delectopecten greenlandicus* (Fig. 6J) were rare (Fig. 9). Another bivalve, the chalky macoma *Macoma calcarea* (Fig. 6I), was identified in the area through shells seen on top of the sediment in Bev Lake. Normally *Macoma* are buried in the sediment and are usually not visible in photographs. At Bev Lake many shells were found near the mouth of the lake. This area is likely used by eider ducks for feeding.

Two species of snail, the whelk *Buccinum* sp. (Fig. 10A) and the moon snail *Natica clausa* (Fig. 10C) were identified. A third unidentified species was also found. These species that were distributed in Sachs Harbour and Thesiger Bay (Fig. 11), but abundance was low.

Echinoderms (Urchins and Stars)

Brittle stars (Fig. 12A, 13B, 13C) are by far the most common group of invertebrates in the Sachs Harbour area (Fig. 14). Two species, *Ophiopleura borealis* and *Ophiacantha bidentata*, were positively identified because they were collected through other means. There could be as many as 4 or 5 other species of brittle star common in the area given the number of color variations seen in the photographs. Brittle stars were absent in shallow water (<10m) and east of Sachs Harbour. Their numbers increased with increasing depth. The maximum mean abundance was 549.8 m^{-2} recorded at 29.4m in Thesiger Bay.

The sea star *Pontaster tenuispinus* (Fig. 13A) was not recorded in the photographs because the flash flooded after the first picture (Fig. 12A) and the remaining film was therefore not exposed properly. However, it was observed in the video images during filming at 71.858352°N 125.699858°W in 128m of water. Most of the bottom seen was densely covered with brittle stars similar to Figure 8A. Occasionally there was a larger sea star amongst the brittle stars. A circle around each sea star, about twice its arm diameter, was completely devoid of brittle stars. It was obvious that the brittle stars were avoiding the sea star. Presumably the brittle stars are preyed upon by the sea star.

Two sea urchins, the pale sea urchin *Strongylocentrotus pallidus* (Fig. 12C) and green sea urchin *S. droebachiensis*, have been identified in the area. However they are so similar they can not be distinguished accurately in sample photographs. They are therefore combined here. Urchins were nonexistent east of and rare in Sachs Harbour (Fig. 15). Although still not very common, more sea urchins were found in Thesiger Bay where there are more rocky areas.

Sand dollars *Echinarachnius parma* (Fig. 12B,E) are more common than the closely related sea urchins (Fig. 15). However, they are only found outside of Sachs Harbour. Sand dollars have a habit of burying themselves in sand making them hard or impossible to see in a photograph. Therefore population estimates may be low for this species. They appeared to be limited to waters less than 20m deep. Diving observations suggested they might be the most abundant echinoderms in the 10-20m-depth range.

The only feather star (*Heliometra glacialis* Fig. 12A) photographed came from the 128m station. A population estimate was not possible but the video pictures and its collection in the longline suggest that it is a fairly common species in the offshore environment.

Crustaceans (Crabs, Shrimp etc.)

Toad crabs *Hyas coarctatus alutaceus* (Fig. 16) were fairly common and found throughout the study area (Fig. 17). The highest mean abundance was 6.4m^{-2} on the south side of Sachs Harbour. The crabs photographed for the most part were small (<35mm) as seen in Figure 12E not the size of crabs caught in traps.

Other members of the crustacean group, amphipods, isopods, mysids and shrimp were present but uncommon (Fig. 18).

Polychaetes (Worms)

Two types of polychaetes are found in the area, sedentary and errant polychaetes. Polychaetes are common throughout the study area (Fig. 19).

Errant polychaetes are free roaming and usually seen on the surface of the sediment. Only one species was identified as *Lumbrineris* sp. This polychaete was uncommon.

As the name implies, sedentary polychaetes do not move on the sediment. They form tubes that they live in for their entire lives. Sedentary polychaetes are very common throughout the study area. Unfortunately they could not be identified from the photographs. Two different types were seen in the photographs. The first type lives in a translucent tube that is held vertically in the sediment. The exposed end extents several centimeters above the surface. The polychaete feeds by extending its arms that appear like feather dusters out the end of the tube and waits until food contacts the arms. The arms are white. This species forms dense mats of tubes in several areas. The problem of determining abundance is that only polychaetes that were actively feeding could be counted. The abundance values reported here most likely represent a small fraction of the actual abundance.

The second type of sedentary polychaete was found only in Bev Lake. This species forms a tube of small pebbles and mud that lay horizontally on the bottom. The polychaete extends itself part way out of the tube to feed on detritus that settles on the bottom. Tubes can become very abundant in some areas but very few animals are every visible. Grab samples in these areas yielded many tubes but no polychaetes were found inside the tubes.

Cnidaria (Sea Anemones)

Four species of sea anemone were photographed in the study area (Fig. 20). All species are burrowing sea anemones; that is, they bury themselves in the sediment extending feeding arms above the surface. *Pachycerianthus fimbriatus* (Fig. 20A) was a fairly common species found throughout the study area (Fig. 21). The maximum abundance, $11.8m^{-2}$, occurred in the outer basin of Sachs Harbour. *Cerianthus borealis* (Fig. 20D) had a very localized distribution limited to the outer basin of Sachs Harbour. But here they reach a maximum abundance of $24.6m^{-2}$. This is a rather large sea anemone extending about 15-20cm above the bottom. Their extended arms cover 30-40% of the surface area. The other 2 species *Halcampa* sp. (Fig. 20B) and an unidentified sea anemone (Fig. 20C) were not very common and mainly limited to the two basins of Sachs Harbour.

Other Groups

Kelp *Laminaria solidungula* (Fig. 22A), seaweed *Fucus* sp. (Fig. 22B) and a red algae (species not identified) were seen rarely in the photographs. The main concentration of these plants was found near the boat launch. The soft sediment of the harbour would not support large quantities of these plants, as they require rocks for their holdfast. Most of the rock substrate found is in very shallow water in the annual ice scour zone. The kelp observed also appeared to be unhealthy. Many plants had large areas of frond rotting off.

Bryozoans are common in the 5 to 10m depth range. Their filamentous nature does not lend itself to quantification by the methods used in this study.

Two species of fish (sculpin *Icelus* sp., Fig. 22B and stout eelblenny *Lumpenus medius*) and one unidentified species of fish were found in low numbers (Fig. 23). Sculpin were seen in and outside of Sachs Harbour. The stout eelblenny was found in Sachs Harbour and Bev Lake.

Brachiopods, echiuroids (Fig. 22C) and tunicates were found in Sachs Harbour and Thesiger Bay in very low numbers (Fig. 24).

Toad Crab Growth

Male and female toad crabs (*Hyas coarctatus alutaceus*) have very different body shapes (Fig. 16). Males grow much larger and are more robust than the females. Males were generally a dark tan color. Females were very dark in coloration (almost black). Females also appeared to be less abundant than males. Only 12.3% of the crabs collected were female.

Toad crabs collected in traps or by divers were measured for carapace length and wet weight determined. Only males were collected in sufficient numbers to calculate a growth curve. A significant ($P<0.0001$) logarithmic growth curve was produced relating wet weight and carapace length (Fig. 25).

Longline

When the longline was retrieved the vast majority (>90%) of the hooks were bare. All the bait had been removed. No fish were collected. Brittle stars, *Ophiopleura borealis* (Fig. 13C) and *Ophiacantha bidentata* (Fig. 13B) and 2 feather stars *Heliometra glacialis* (Fig. 12A) had attached themselves to the line and were retrieved.

The baited crab traps produced one male toad crab (Fig. 16B). The male had a very soft carapace, which was much lighter in coloration compared to the crab encountered in Sachs Harbour. The sea star *Pontaster tenuispinus* (Fig. 13A) was collected also inside the trap. They appear to be too large to fit through the mesh and are assumed to have crawled in the entrance. Brittle stars *Ophiopleura borealis* (Fig. 13C) and a basket star *Gorgonocephalus* sp. (Fig. 12D) were collected from the outside of the trap.

The bait jars from the traps were opened. Most of the bait had been eaten by many small amphipods (*Onisimus* sp.). Several hundred individuals were found in each jar.

Fred and Bev Lakes

The photographic sampling showed that there was no life in the basins of Bev and Fred Lakes below approximately 15m. When lowered in these basins, the cameras would pass through the clear surface waters and then below about 15m the weight would become increasing more difficult to see. At the bottom even with extra light provided by the underwater lamp the weight was almost invisible. The photographs showed a black layer covering the sediment. Photographs above approximately 10m showed little difference with similar depths in Sachs Harbour itself. In the transition zone of 12-15m the abundance of organisms was reduced and only more mobile species such as fish were seen.

Water samples from various depths were taken at Bev Lake in about 50m of water. The samples collected were lost in shipment and could not be analyzed. Observations in the field showed that the bottom water was much more saline that the surface waters. Samples 20m and below tasted increasingly saltier with depth and emitted an ever stronger sulfur smell.

Miscellaneous

Mrs. Carpenter collected a fish from the stomach of an arctic char caught in the Sachs River. The fish was identified as a slender eelblenny (*Lumpenus fabricii*). Another fish was collected in grab samples taken in Sachs Harbour and Bev Lake. It was identified as a stout eelblenny (*Lumpenus medius*).

DISCUSSION

Photographic Survey

The benthos around Sachs Harbour can be best described as sparse. Much of the bottom is devoid of macroinvertebrates. In the area surveyed, brittle stars are the only group that can be considered abundant. Other groups such as toad crabs and sand dollars are common but, again, not overly abundant.

The main focus of the survey was to determine shellfish abundance. Shellfish here are defined as bivalves, crab and shrimp. Humans consider five of the nine species of shellfish identified in the area as food items. These are the softshell clam (*Mya* sp.), Greenland cockle (*Serripes groenlandicus*), hairy cockle (*Clinocardium ciliatum*), toad crab (*Hyas coarctatus alutaceus*) and shrimp. Shrimp will not be considered as their abundance is near zero ($0.01m^{-2}$). The overall mean abundance for softshell clams, cockles and crab are $0.6\pm1.7m^{-2}$, $0.7\pm2.1m^{-2}$ and $1.1\pm1.8m^{-2}$, respectively. Bivalve population levels are low compared to other areas in the arctic. Carey (1984) reported a mean abundance for Greenland cockle of $4.6m^{-2}$ and for the softshell clam of $1.6m^{-2}$ from the 0-

25m depth range in the Beaufort Sea north of Alaska. Both the Beaufort Sea and Sachs Harbour numbers are in turn much smaller than estimates from the Eastern Arctic using similar methods. Welch et al. (1992) reports mean population levels of $40.8m^{-2}$ for the softshell clam and $1.7m^{-2}$ for the Greenland cockle in the 0-100m depth range near Resolute. Peak abundance for the softshell clam was $140m^{-2}$ at 15m. Near Broughton Island, Nunavut, southeast Baffin Island, softshell clams had a mean abundance of $29.4m^{-2}$ and for cockles $11.5m^{-2}$ over 0-100m (Siferd 1997). The maximum abundance recorded at Broughton Island was $250m^{-2}$ divided almost equally between softshell clams and cockles. No references could be found to relate crab population abundance.

Low bivalve abundance may be related to the abundance of toad crabs in the area. Crabs are known to prey on settling bivalve larvae (Nadeau and Cliché 1998). Red rock crab (*Cancer productus*) off the west coast of Canada can excavate buried soft-shell clams (*Mya arenaria*) very similar to the soft-shell clams of Sachs Harbour (Smith et al. 1999). Whether toad crabs can also do this is unknown but may be a factor limiting the abundance of clams.

The clam, cockle and crab may be abundant enough to support a limited personal harvest. But none of these groups are sufficiently abundant to support commercial harvest. Certainly any type of intense harvest would threaten the stock. Outside the survey area there may be areas found that support higher densities of these species.

Bev and Fred Lakes

It was apparent from the water samples and the black surface layer on the sediment that Fred and Bev Lakes were devoid of oxygen and completely inhospitable to organisms above bacteria. There is no cause for concern as this is a natural phenomenon. Given the topography of these basins, they have probably been this way for many hundreds of years.

Salt water exists in the Sachs River estuary from its inlet into Bev Lake out to Thesiger Bay. Being salt water, when it freezes the ice excludes the salts as brine. Brine is much denser than the surrounding seawater. This denser water naturally sinks through the less dense surface water until it either reaches the bottom or encounters a more dense water layer. In this case it reaches bottom. The shallow sills at the entrance and exit of the lakes form what is essentially a bowl. The brine accumulates in the basin year after year. The basins in 2000 were filled to near the 15m mark. The depth of this transition zone between the oxygenated surface layer and the anoxic layer probably varies slightly from year to year depending on the severity of storm winds encountered during the year.

The only way to displace the deep salty waters is through tidal or wind/storm driven circulation. But the shallow sills and narrow channels restrict the circulation of seawater. Since the basins cannot be circulated they are sealed off. The oxygen is quickly used up and the basin bottom becomes anoxic.

The deep basins in Sachs Harbour are also surrounded by shallow sills but did not show signs of anoxia. This is probably due to the harbour's relatively wide mouth and close proximity to open seas. There is enough energy at least in the open water season to circulate these basins. It is possible that in the winter when the ice restricts the water flow that the deepest parts of the basin may also go anoxic on occasion.

Again this is a natural phenomenon that occurs in other areas. I have seen the same thing in Barlow Inlet on Cornwallis Island near Resolute. This inlet too has a narrow opening and very shallow sill (1m). The water was so anoxic and corrosive that it turned metal immediately black upon contact. Resolute Bay itself is not anoxic but each winter some small depressions in the bottom fill with brine excluded from the freezing sea ice (Kvitek et al. 1998; personal observation).

Figure 26 shows such an area where clams, snails and kelp that could not escape have died.

Toad Crabs

The growth of male toad crabs exhibited a very significant relationship between carapace length and wet weight. However, crabs too small to be retained by the traps were not collected and therefore could not be included in the curve. Their inclusion may affect the overall shape of the curve.

Crabs appear to have an asynchronous period of molt. The crab collected offshore in 175m of water appeared to have only recently molted as the shell was very clean and light in color. The shell was also soft and easily broken with the slightest pressure. Male crabs in Sachs Harbour and from 20m in Thesiger Bay were much darker than the offshore crab. This would suggest that the shedding of the carapace be related to food consumption rather than period of the year. Only after an individual has consumed enough food can it molt. The food supply is probably quite different at 175m than in the shallow in Sachs Harbour, therefore accounting for the asynchronous molt.

An interesting note from our crab trapping was the feeding preference of toad crabs. In increasing order of preference were Greenland cod, sardines and arctic char. Char was by far more appealing than the other two. Crab seemed unable to rip apart whole cod but had no such problem with char. Apparently the skin of the cod is too tough for the feeble claws of the toad crab.

Longline

The lack of fish caught and the missing bait of the longline would suggest that animals other than fish caused the cleaning of the hooks. The large number of scavenging amphipods caught in the bait jars and abundance of brittle stars at 175m would suggest that they were responsible for the removal of the bait.

ACKNOWLEDGEMENTS

I thank Fred Raddi, Tony Lucas and Jeremy Stewart for their assistance in the field. I also thank Floyd Lennie and other workers at the Sachs Harbour Hamlet Shop for their help in resolving many of the repair/maintenance problems encountered. I would also like to thank Kathleen Martin for her support from Winnipeg. Martin Curtis identified the echinoderms. I also thank Susan Cosens and John Babaluk for reviewing the manuscripts and suggesting improvements. The Inuvialuit Fisheries Joint Management Committee and Fisheries & Oceans Canada provided funding for this project.

REFERENCES

Barr, L. and N. Barr. 1983. Under Alaskan Seas. Alaska Northwest Publishing Company, Anchorage, AK 208 p.

Carey, A.G., Jr. 1984. Distributional ecology of shallow southwestern Beaufort Sea (Arctic Ocean) bivalve Mollusca. Mar. Ecol. Prog. Ser. 17: 125-135.

D'yakonov, A.M. 1950. Sea Stars (Asteroids) of the USSR Seas. Keys to the Fauna of the USSR No. 34. (Translated from Russian by the Israel Program for Scientific Translations, 1968).

D'yakonov, A.M. 1954. Ophiuroids of the USSR Seas. Keys to the Fauna of the USSR No. 55. (Translated from Russian by the Israel Program for Scientific Translations, 1967).

Gagnon, J.-M. and K.D. Gilkinson. 1994. Discrimination and distribution of the sea urchins *Strongylocentrotus droebachiensis* (O.F. Muller) and *S. pallidus* (G.O. Sars) in the Northwest Atlantic. Sarsia 79: 1-11.

Grainger, E.H. 1966. Sea stars (Echinodermata: Asteroidea) of arctic North America. Bull. Fish. Res. Bd. Can. 152: 70 p.

Hart, J.L. 1973. Pacific Fishes of Canada. Fish. Res. Bd. Canada Bull. 180: 740p.

Kvitek, R.G., K.E. Conlan and P.J. Iampietro. 1998. Black pools of death: hypoxic, brine-filled ice gouge depressions become lethal traps for benthic organisms in a shallow Arctic embayment. Mar. Ecol. Prog. Ser. 162: 1-10.

Messing, C.G. and J.H. Dearborn. 1990. Marine flora and fauna of the northeastern United States. Echinodermata: Crinoidea. NOAA Tech. Rep. NMFS 91: 30 p.

Mortensen, T. 1977. Handbook of the Echinoderms of the British Isles. Dr. W. Backhuys Publisher, Rotterdam. 471 p. (Reprint of original from 1927).

Nadeau, M. and G. Cliché. 1998. Predation of juvenile sea scallops (*Placopecten magellanicus*) by crabs (*Cancer irroratus* and *Hyas* sp.) and starfish (*Asterias vulgaris*, *Leptasteria polaris*, and *Crossaster papposus*). J. Shellfish Res. 17: 1273.

Scott, W.B. and M.G. Scott. 1988. Atlantic fishes of Canada. Can. Bull. Fish. Aquat. Sci. 219:731p.

Serafy, D.K. and F.J. Fell. 1985. Marine flora and fauna of the northeastern United States. Echinodermata: Echinoidea. NOAA Tech. Rep. NMFS 33: 27 p.

Siferd, T. 1997. Broughton Island clam survey 1997. Unpublished report to the Broughton Island HTO.

Siferd, T. and H.E. Welch. 1992. Identification of in situ Canadian Arctic bivalves using underwater photographs and diver observation. Polar Biol. 12: 673-677.

Smith, T.E., R.C. Ydenberg and R.W. Elner. 1999. Foraging behaviour of an excavating predator, the red rock crab (*Cancer productus* Randall) on soft-shell clam (*Mya arenaria* L.). J. Exper. Mar. Biol. Ecol. 238: 185-197.

Squires, H.J. 1990. Decapod Crustacea of the Atlantic coast of Canada. Can. Bull. Fish. Aquat. Sci. 221: 532 p.

Welch, H.E., M.A. Bergmann, T.S. Siferd, K.A. Martin, M.F. Curtis, R.E. Crawford, R.E. Conover and H. Hop. 1992. Energy flow through the marine ecosystem of the Lancaster Sound region, Arctic Canada. Arctic 45: 343-357.

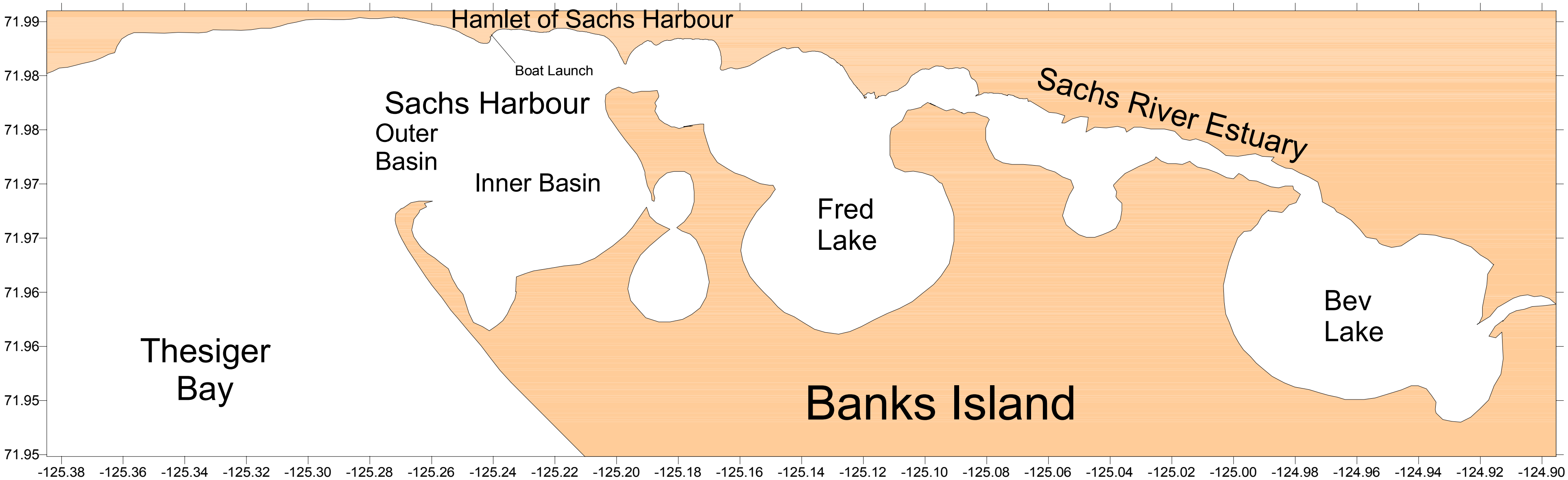

Figure 1: Map of Sachs Harbour study area.

Figure 2: Scientific gear used in the survey: Research vessel Plover, photographic sampling gear and the QTC View seabed classification system.

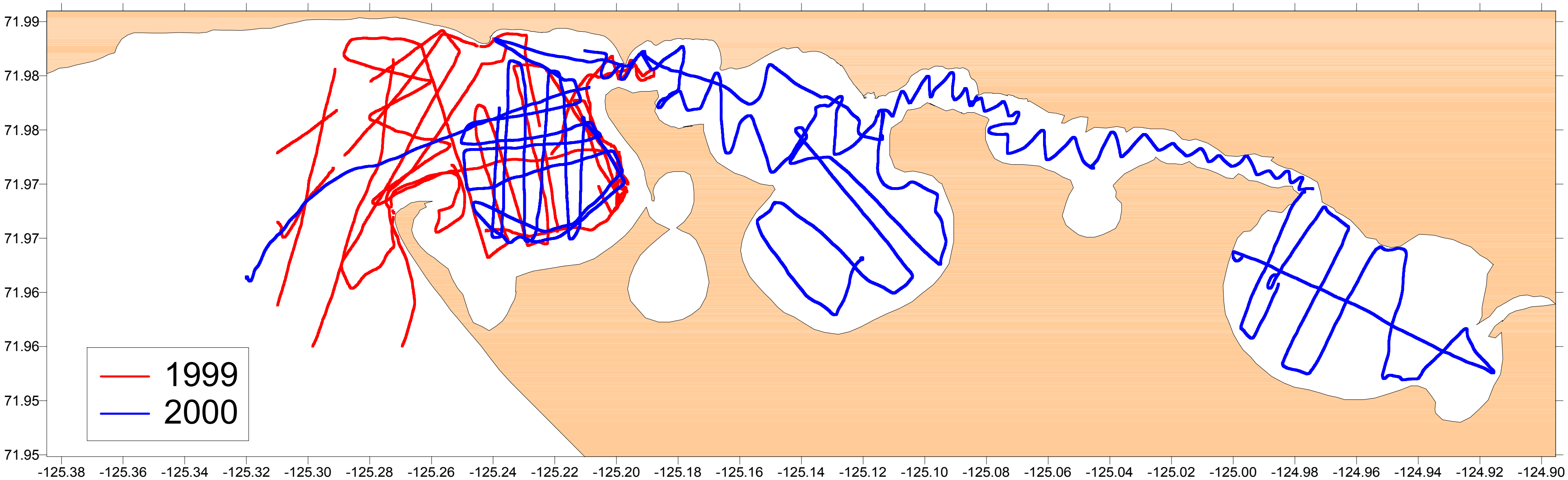

Figure 3: Vessel track plot of sounder surveys for habitat and bathymetry mapping.

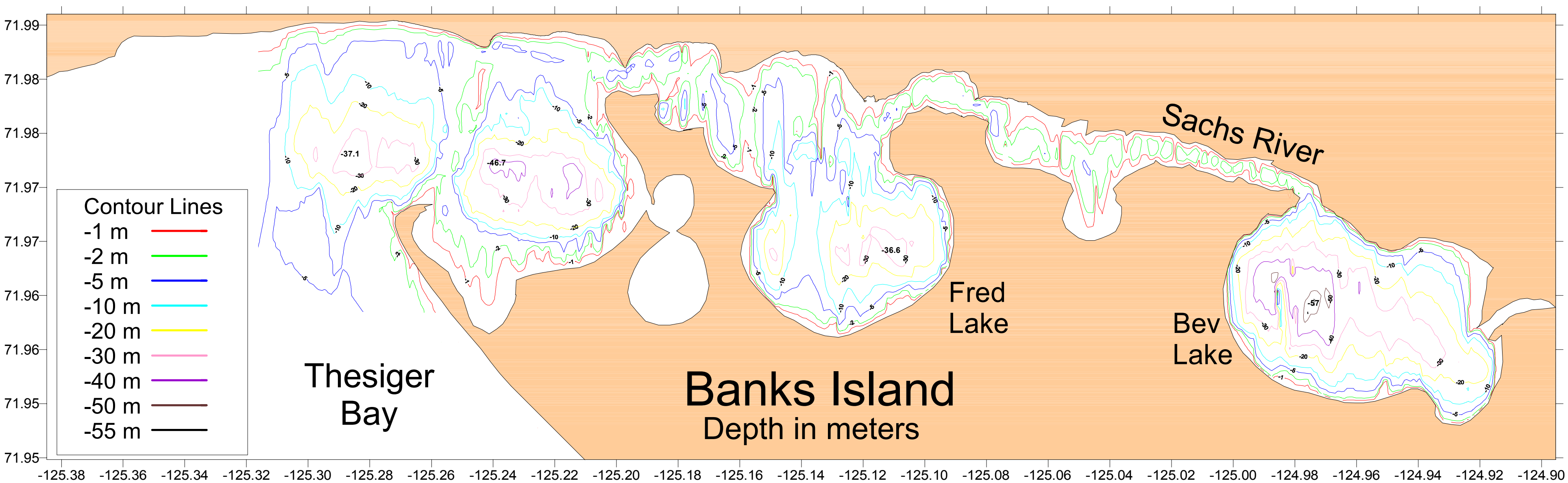

Figure 4: Map of bathymetry in Sachs Harbour and Sachs River estuary.

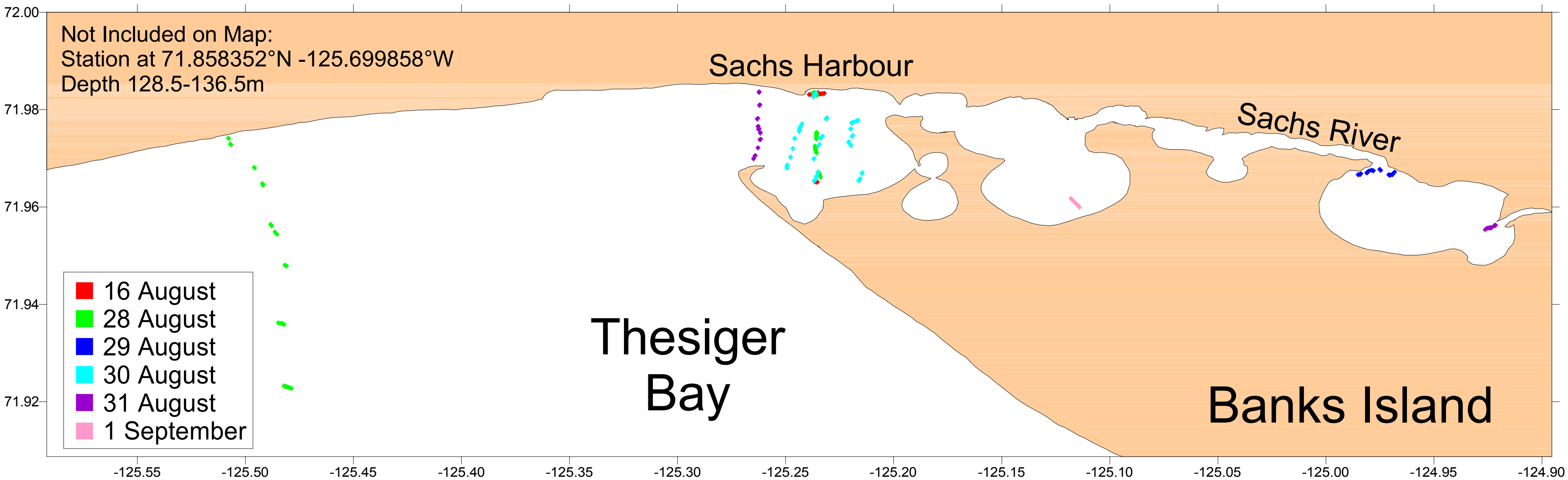

Figure 5: Location of photographic samples collected in Sachs Harbour during August/September 2000.

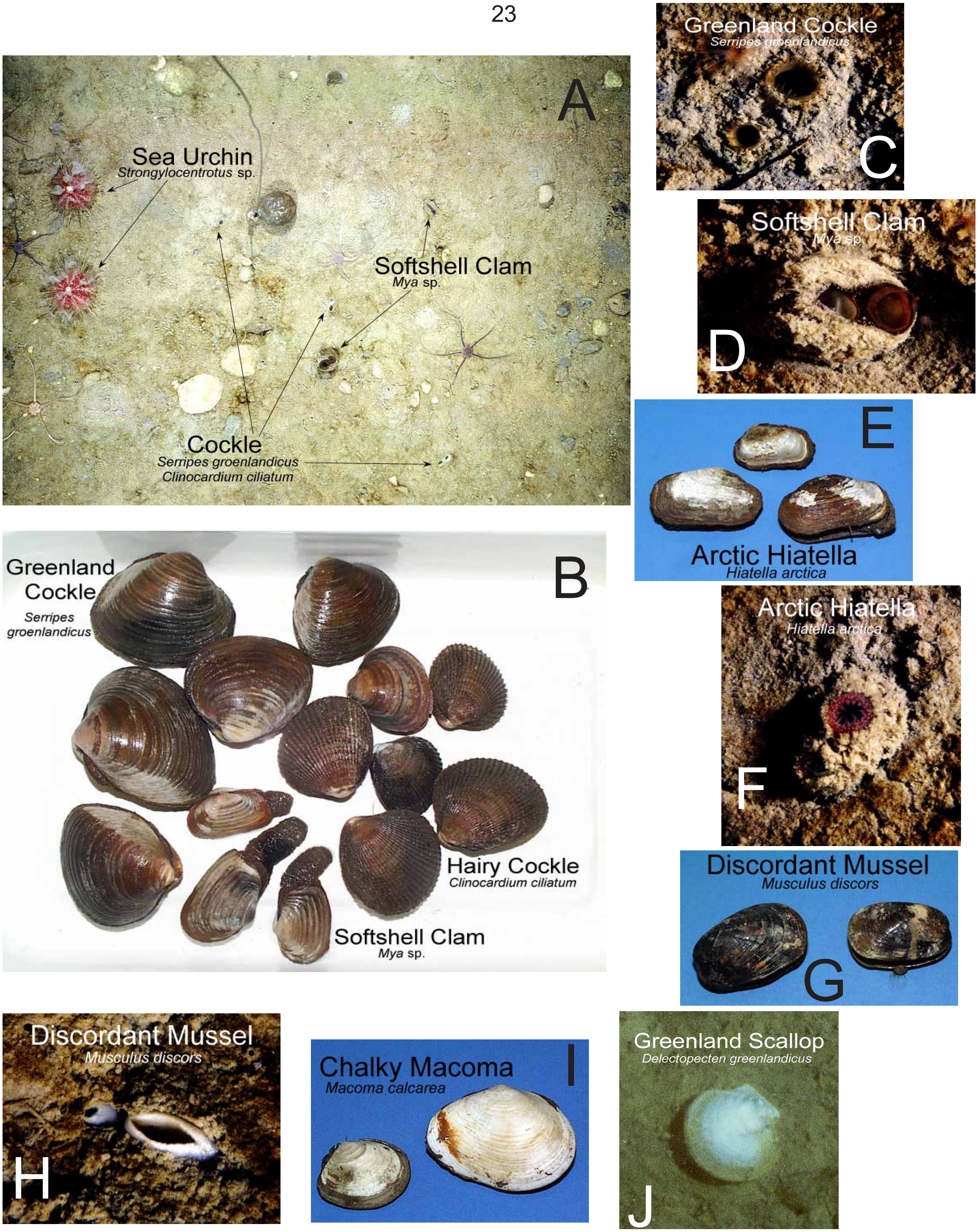

Figure 6: Photographs of plants and animals identified in the Sachs Harbour area. A. Typical photographic sample showing softshell clams and cockle siphons and sea urchins, B. Three main clam species in area, C. Close up of siphon opening of a Greenland cockle, D. Close up of siphon opening of a softshell clam, E. arctic hiatella, F. Close up of siphon opening of an arctic hiatella, G. discordant mussel, H. Close up of siphon opening of discordant mussel, I. chalky macoma, J. Greenland scallop.

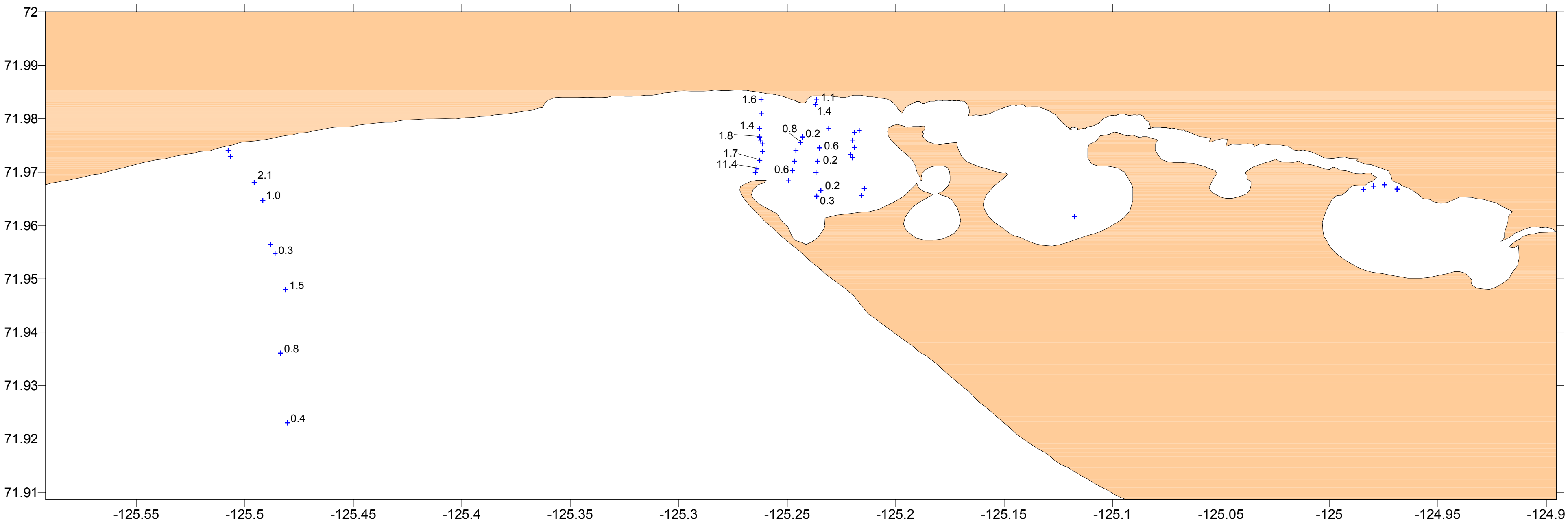

Figure 7: Mean abundance (number$\cdot$m^{-2}) of the softshell clam in August/ September 2000. Stations without number=0.

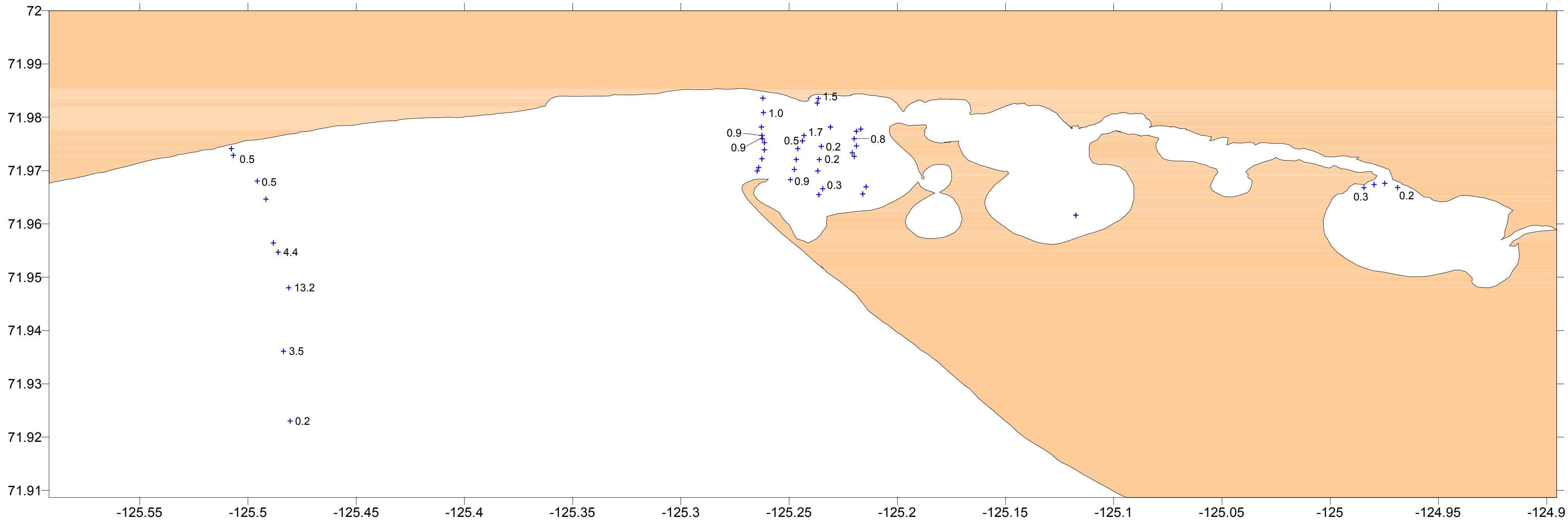

Figure 8: Mean abundance (number$\cdot$m^{-2}) of Greenland and hairy cockles combined in August/ September 2000. Stations without number=0.

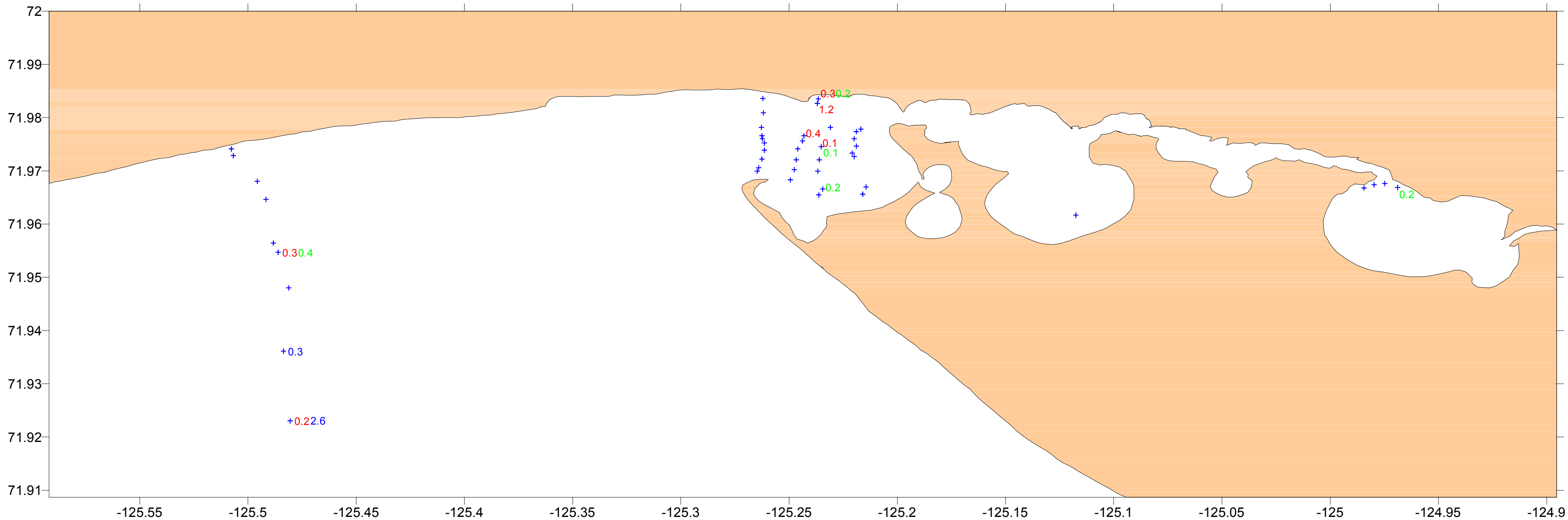

Figure 9: Mean abundance (number$\cdot$m^{-2}) of arctic hiatella (red), mussels (green) and Greenland scallops (blue) in August/ September 2000. Stations without number=0.

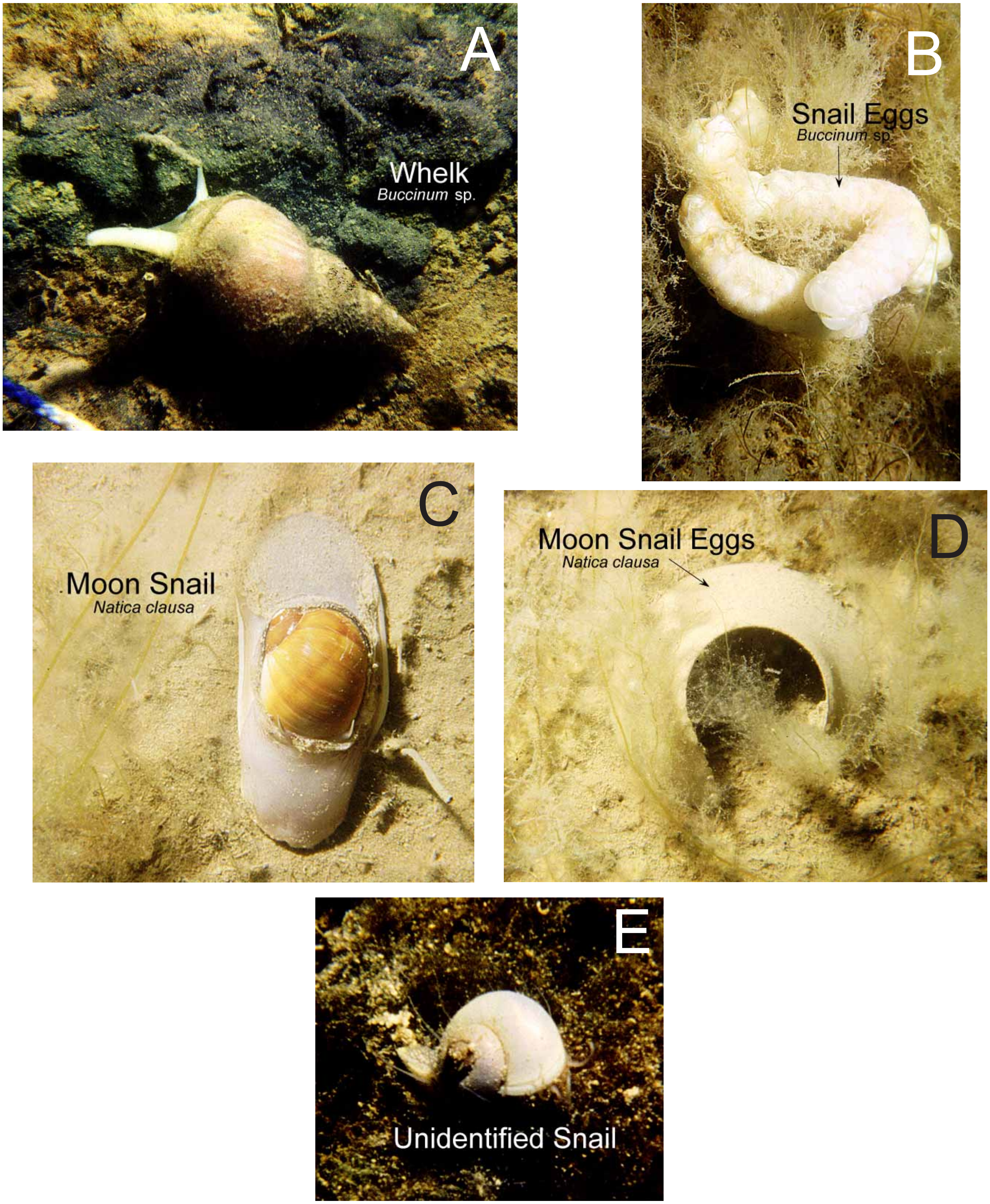

Figure 10: Photographs of plants and animals identified in the Sachs Harbour area. A. whelk, B. egg mass laid by the whelk, C. moon snail, D. egg mass laid by the moon snail, E. unidentified snail

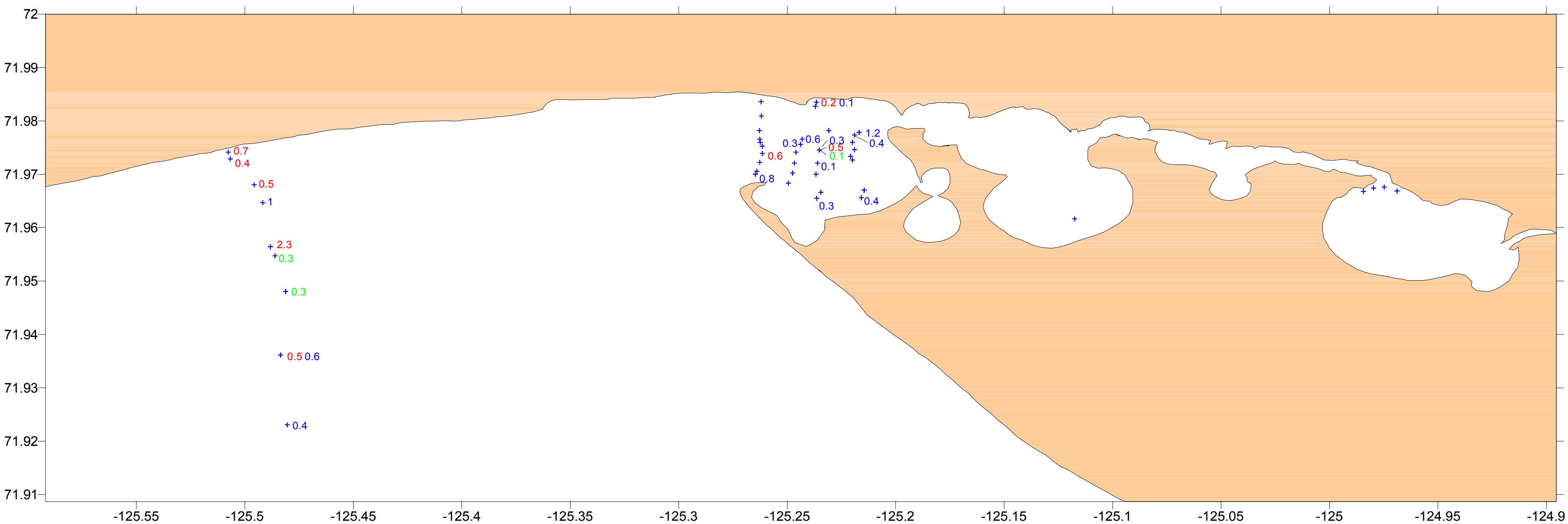

Figure 11: Mean abundance (number·m^{-2}) of moon snail (red), whelk (green) and unidentified snails (blue) in August/ September 2000. Stations without number=0.

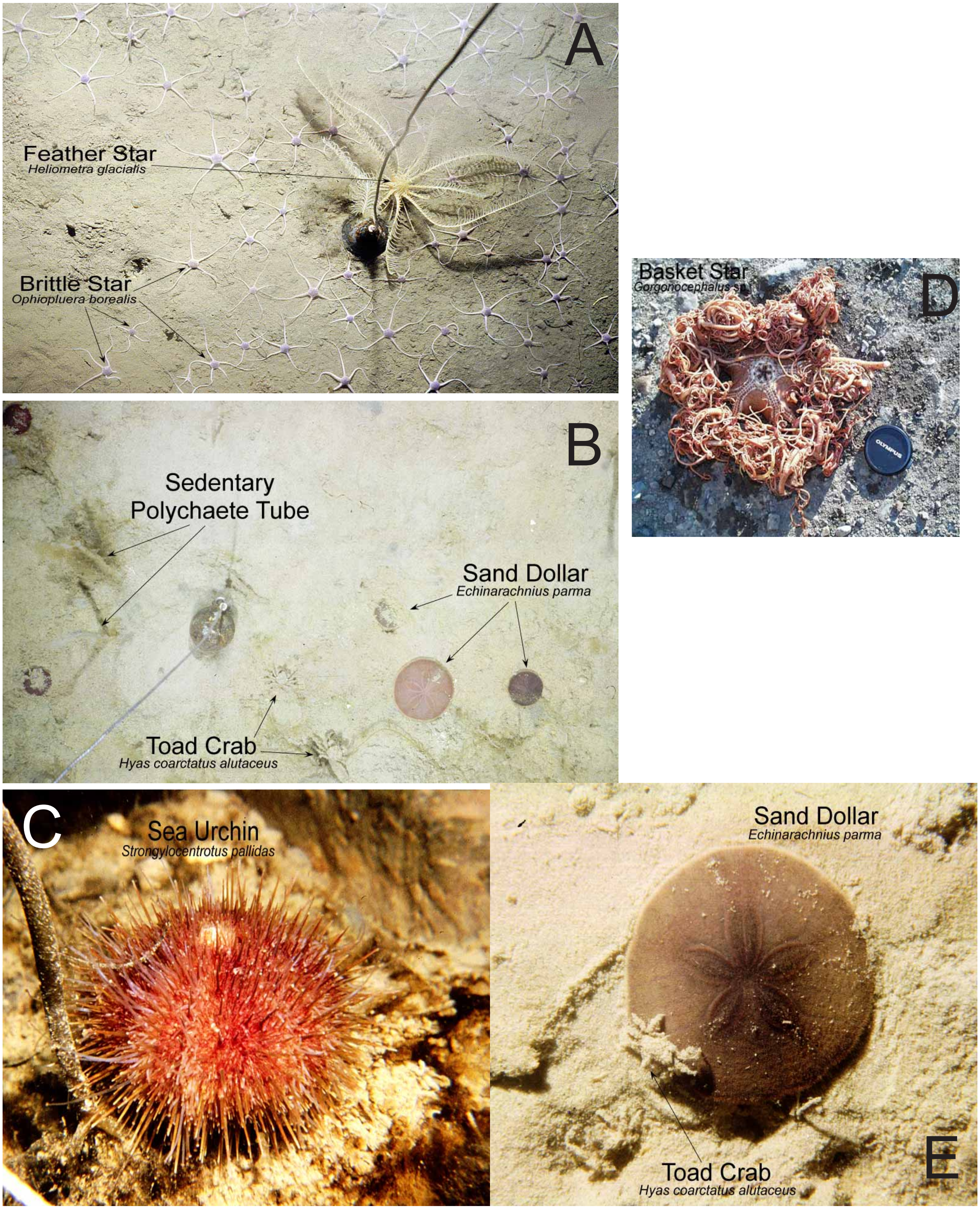

Figure 12: Photographs of plants and animals identified in the Sachs Harbour area.
A. sample photograph from 128m showing the feather star and brittle star,
B. sample photograph showing sand dollar, toad crab and sedentary polychaetes tubes, C. sea urchin, D. basket star from 175m, E. close up of the sand dollar.

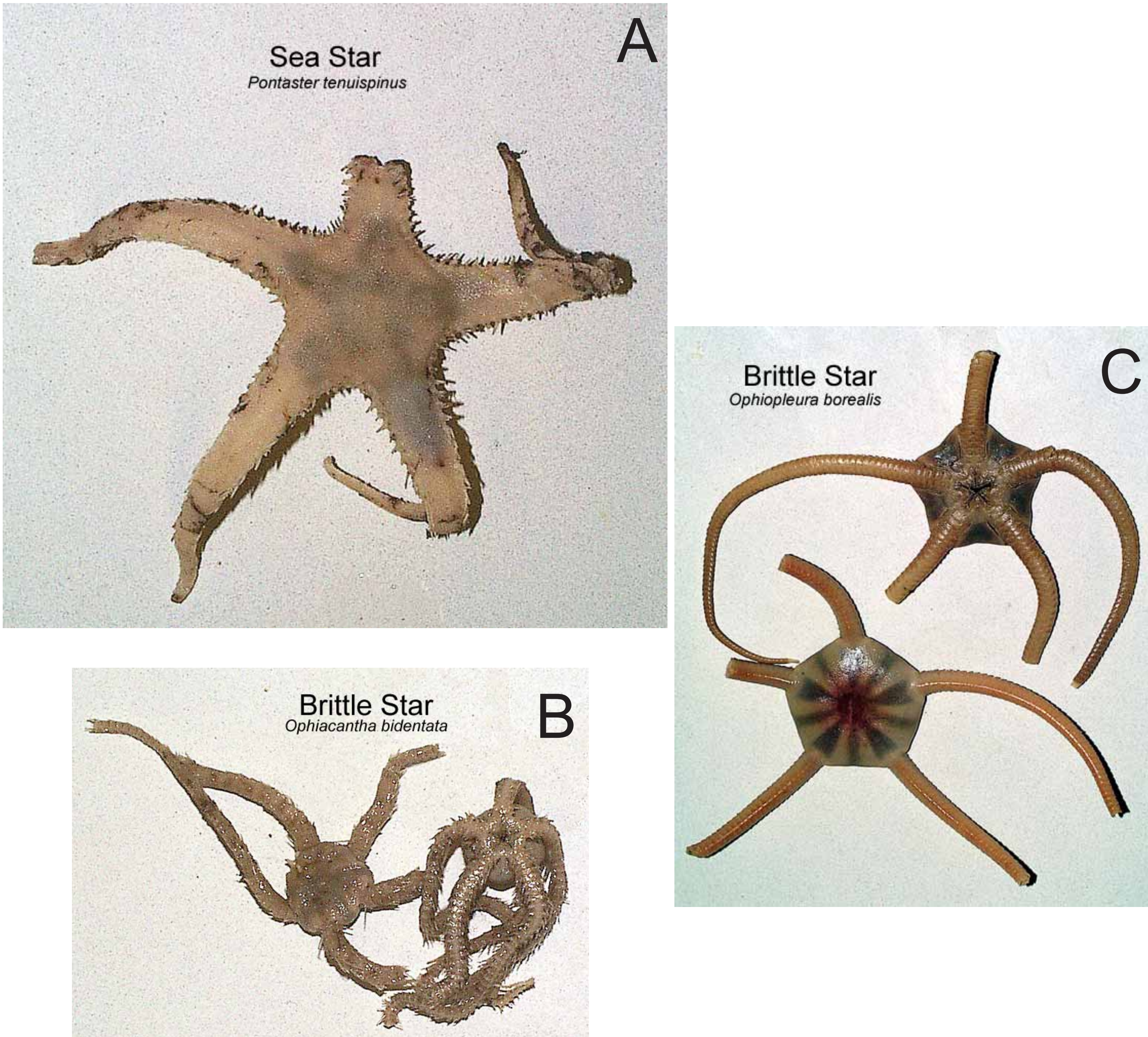

Figure 13: Photographs of plants and animals identified in the Sachs Harbour area. A. sea star, B. brittle star *Ophiacantha bidentata*, C.brittle star *Ophiopleura borealis*.

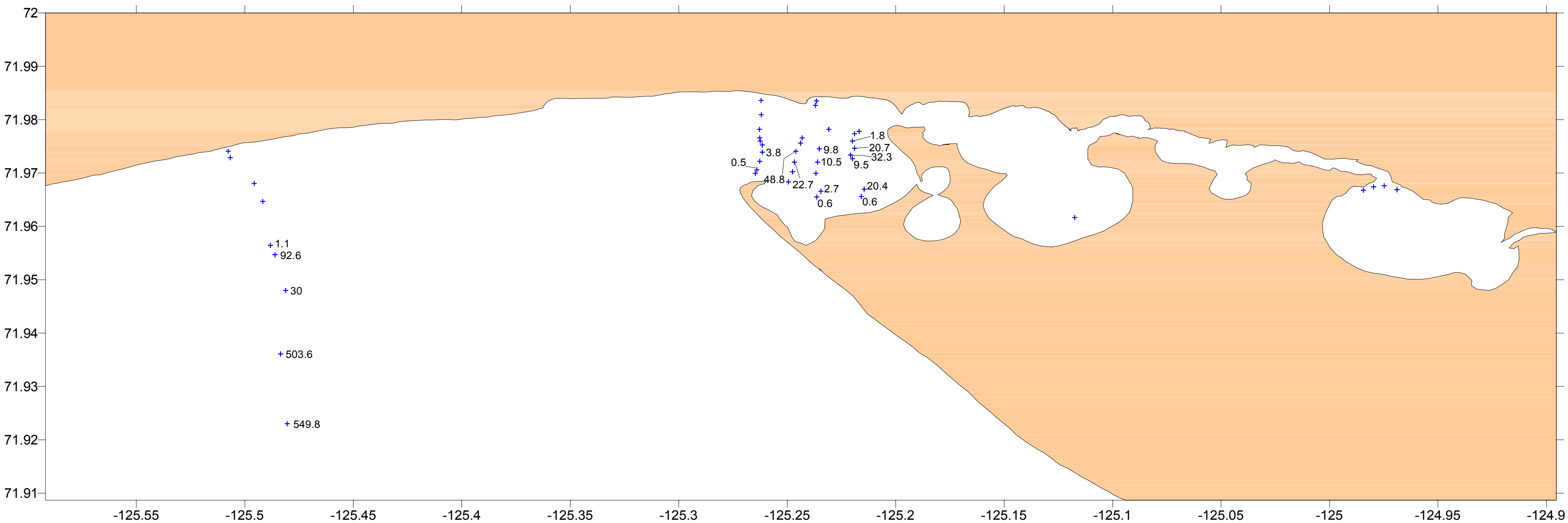

Figure 14: Mean abundance (number·m^{-2}) of brittle stars in August/ September 2000.
Stations without number=0.

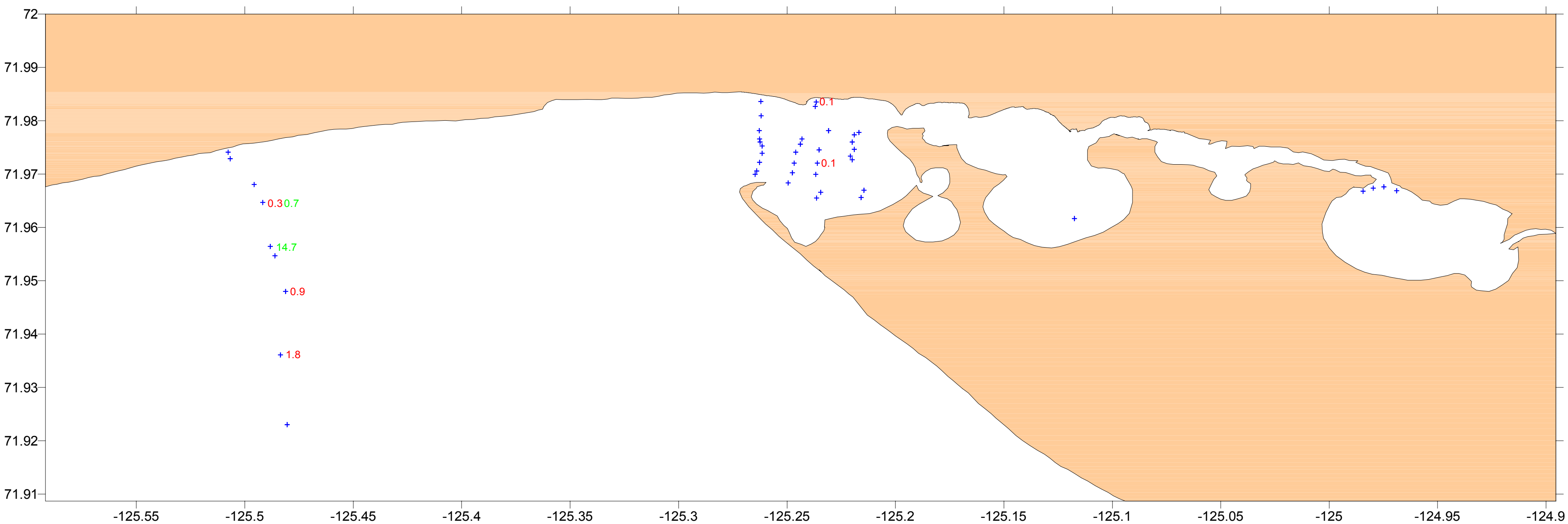

Figure 15: Mean abundance (number·m^{-2}) of the sea urchins (red) and sand dollars (green) in August/ September 2000. Stations without number=0.

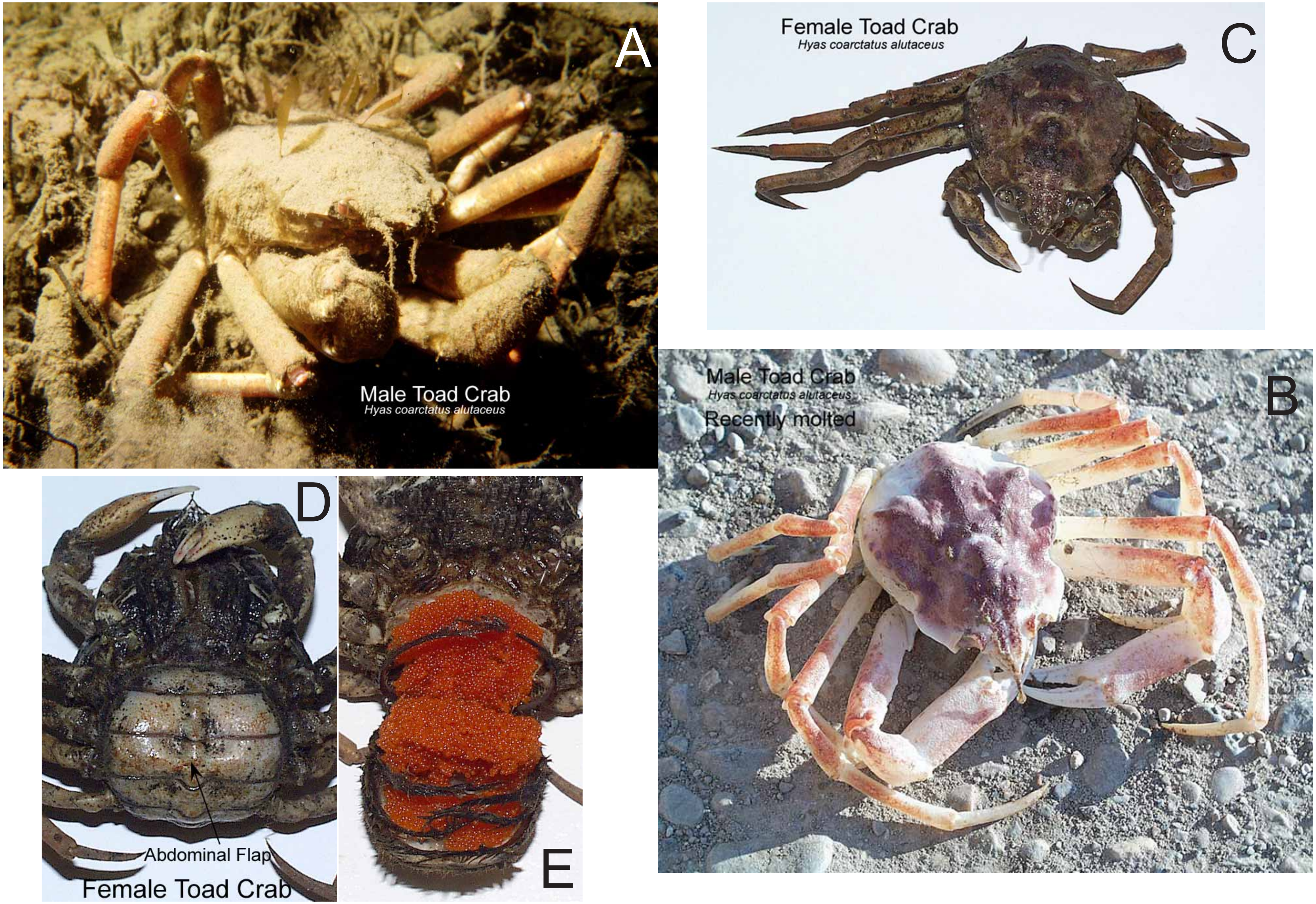

Figure 16: Photographs of plants and animals identified in the Sachs Harbour area. A. male toad crab from inner harbour, B. male toad crab from 175m having recently molted (note light coloration), C. female taod crab, D. closed abdominal flap of female toad crab, E. open abdominal flap showing the eggs carried by the female.

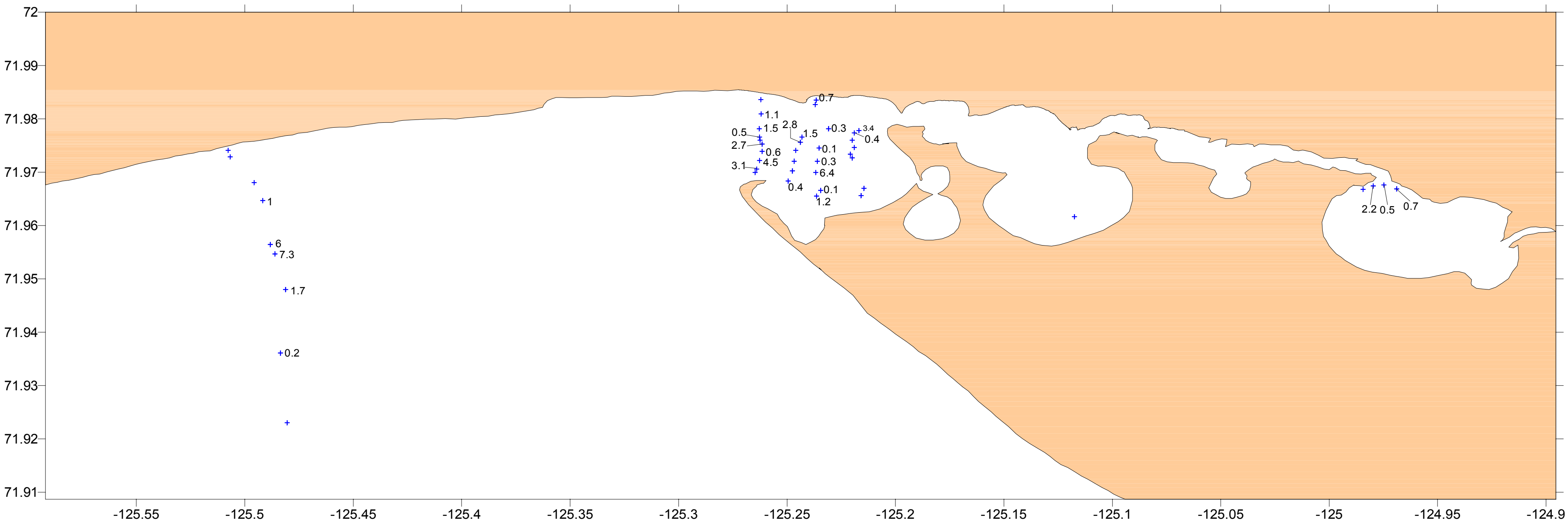

Figure 17: Mean abundance (number·m^{-2}) of toad crabs in August/ September 2000. Stations without number=0.

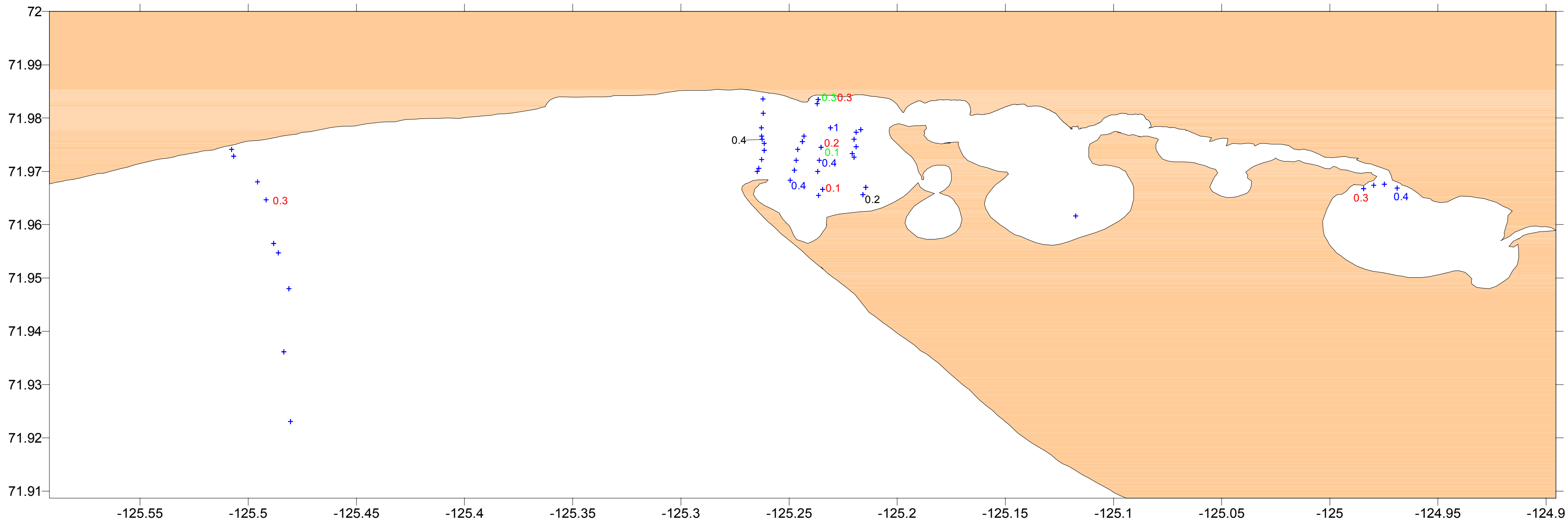

Figure 18: Mean abundance (number·m^{-2}) of amphipods (red), isopods (green), mysids (blue) and shrimp (black) in August/ September 2000. Stations without number=0.

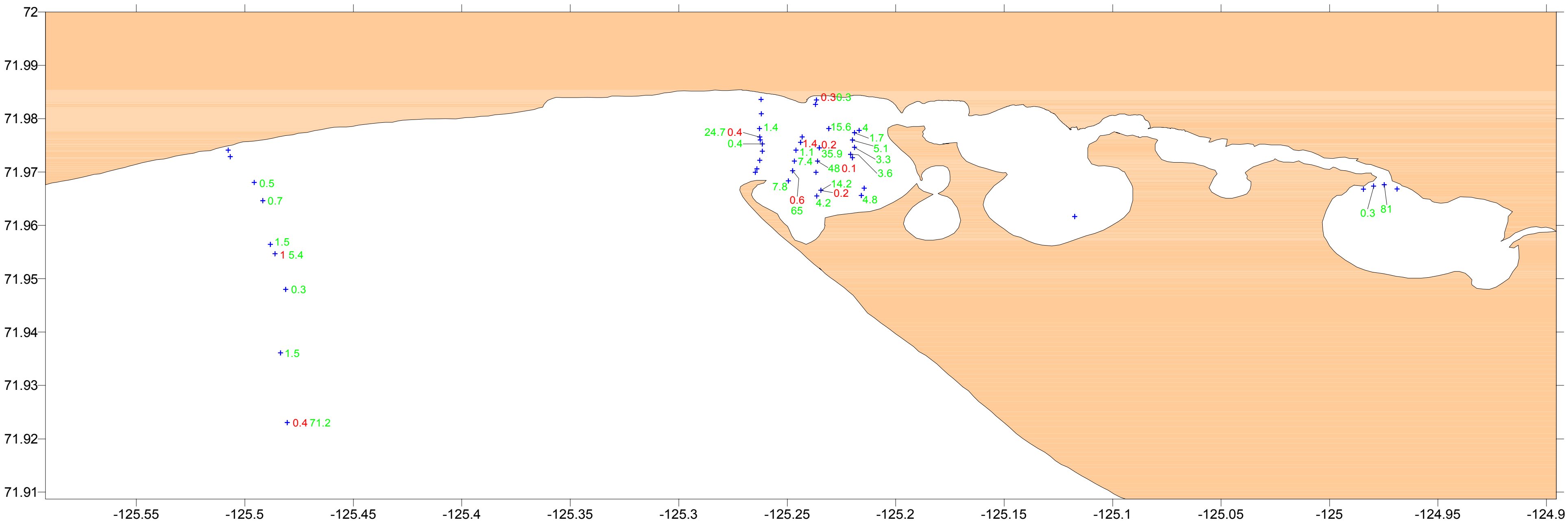

Figure 19: Mean abundance (number·m^{-2}) of errant (red) and sedentary polychaetes (green) in August/ September 2000. Stations without number=0.

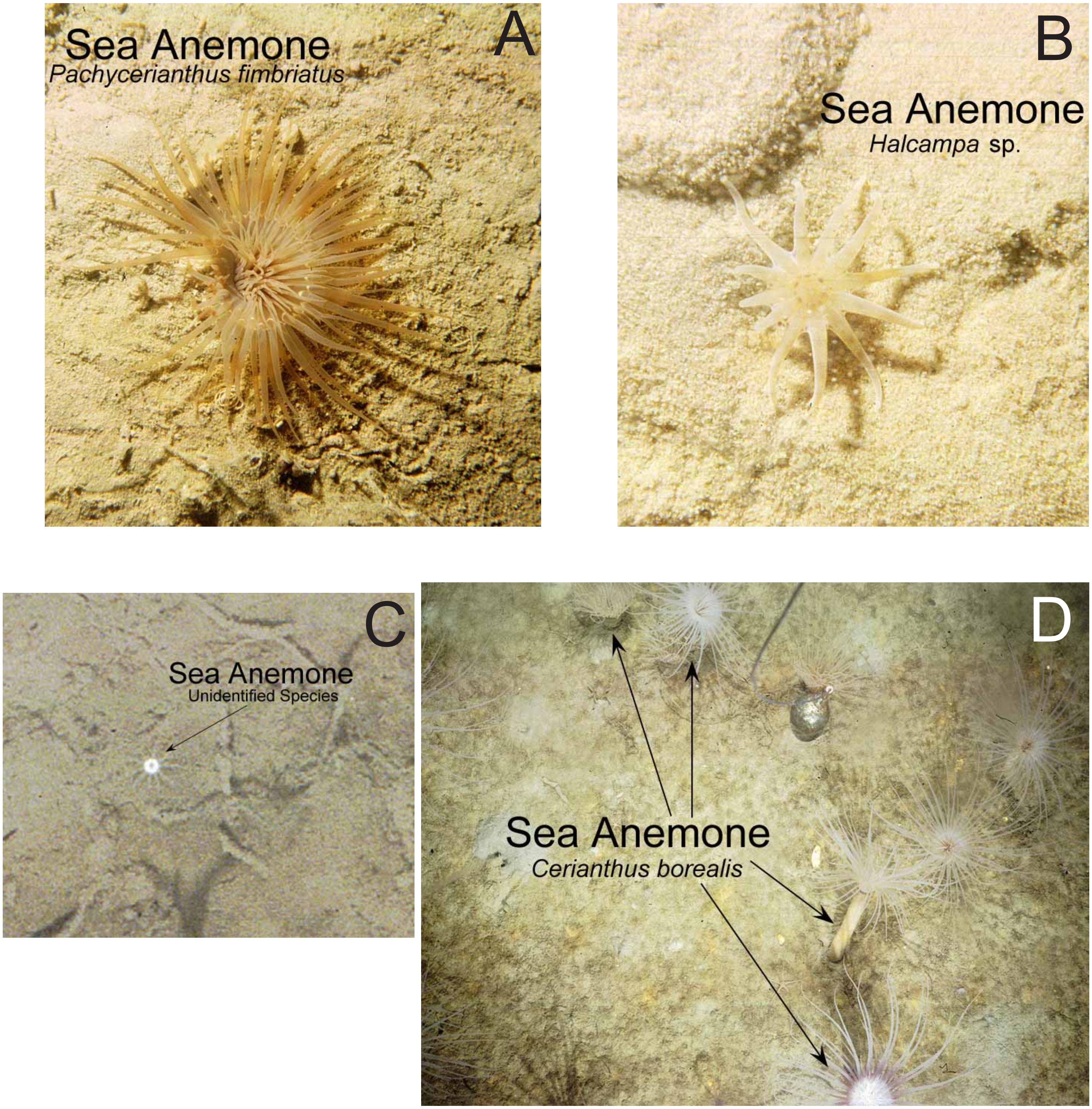

Figure 20: Photographs of plants and animals identified in the Sachs Harbour area.
A. sea anemone *Pachycerianthus fimbriatus*, B. sea anemone *Halcampa* sp.
C. unidentified sea anemone, D. sea anemone *Cerianthus borealis*.

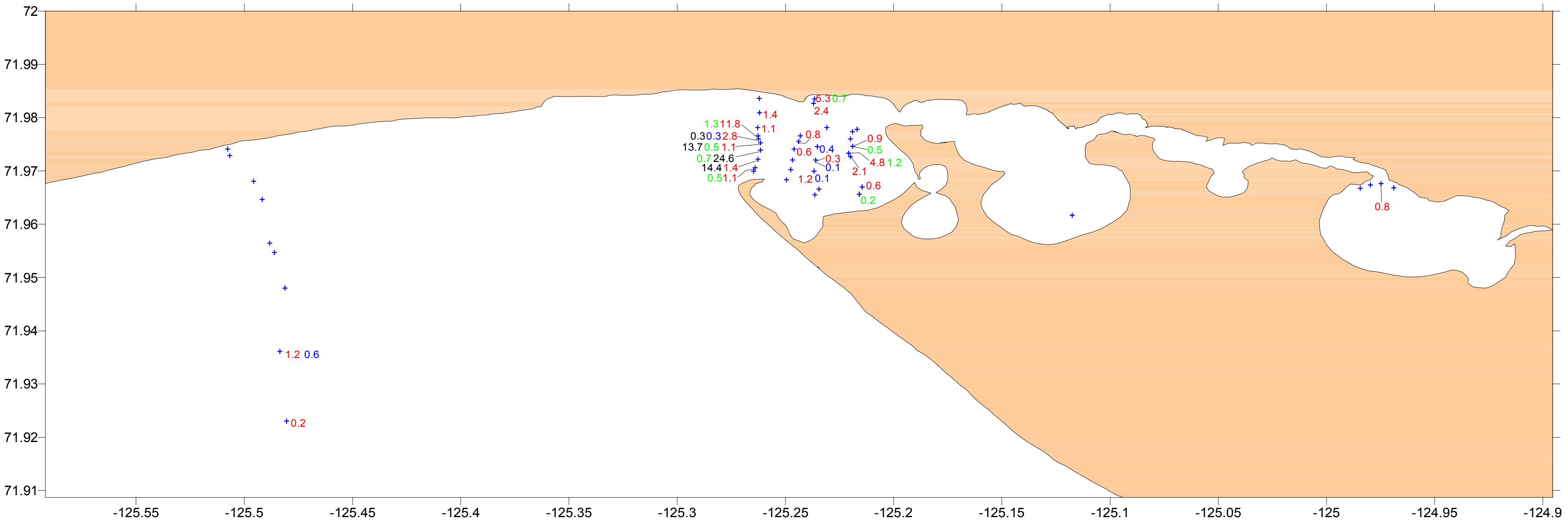

Figure 21: Mean abundance (number·m^{-2}) of sea anemones *Pachycerianthus fimbriatus* (red), *Halcampa* sp. (green), unidentified sea anemone (blue) and *Cerianthus borealis* (black) in August/ September 2000. Stations without number=0.

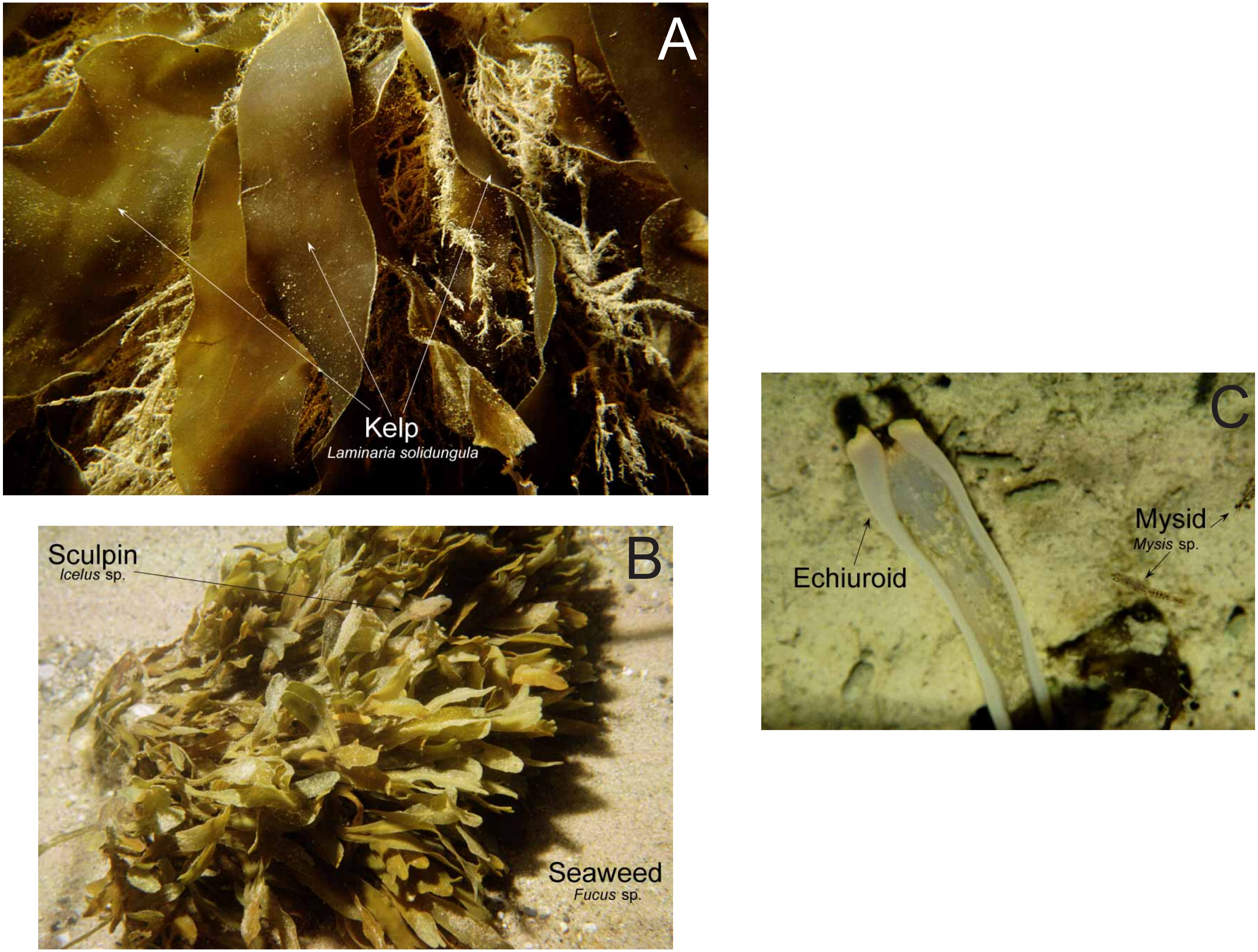

Figure 22. Close up photographs of plants and animals identified in Sachs Harbour area.
A. kelp, B. seaweed with sculpin, C. echiuroid and mysid.

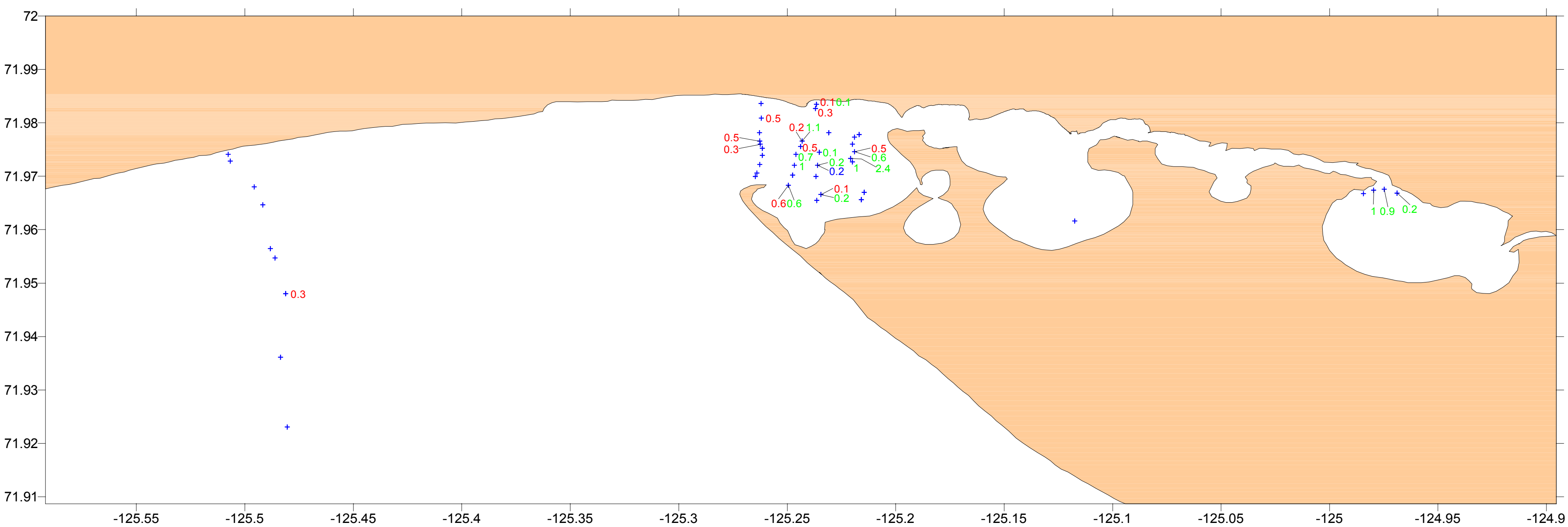

Figure 23: Mean abundance (number·m^{-2}) of the sculpins (red), stout eelblenny (green) and unidentified fish (blue) in August/ September 2000. Stations without number=0.

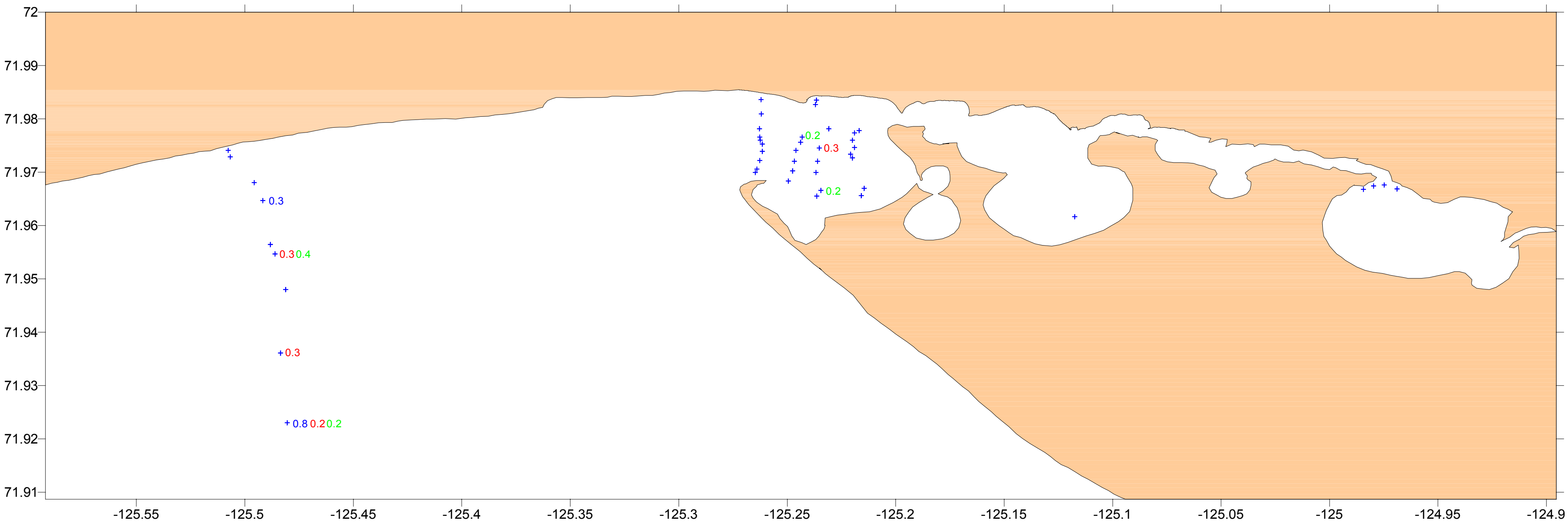

Figure 24: Mean abundance (number·m^{-2}) of the brachiopods (red) and echiuroids (green) and tunicates (blue) in August/ September 2000. Stations without number=0.

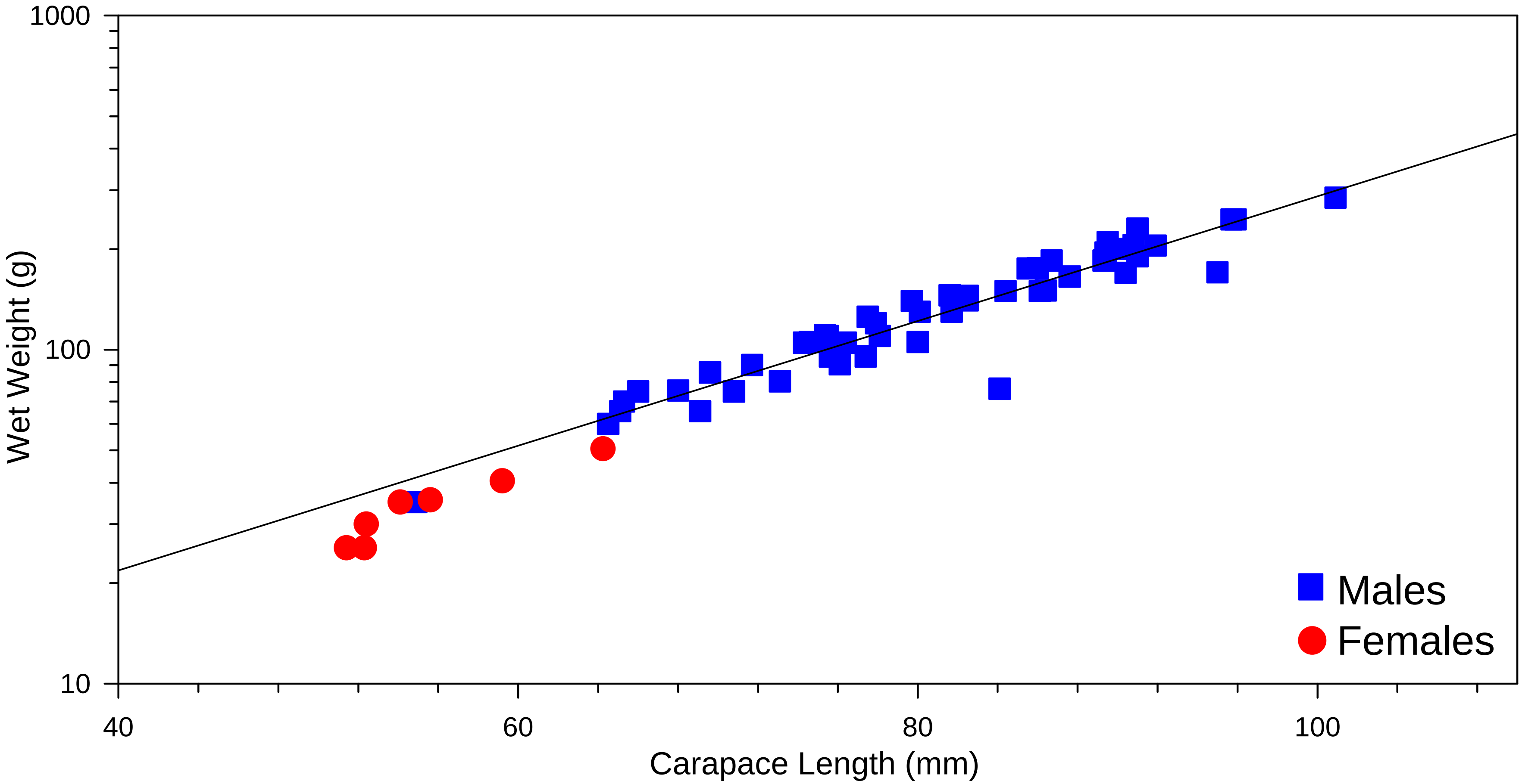

Figure 25: Growth curve of male and female toad crabs collected by trap or by diver.

Figure 26. Arctic dead zone caused by the accumulation of brine excluded from freezing sea ice in a small depression in the sea bottom.

Table 1: List of species identified in photographs or collected near Sachs Harbour in 1999-2000.

Plants:
Kelp *Laminaria solidungula*
Red Algae unidentified species
Seaweed *Fucus* sp.

Animals:
Cnidaria:
- Hydrozoa:
  - Unidentified species
- Anthozoa:
  - Burrowing Sea Anemone *Cerianthus borealis*
  - Burrowing Sea Anemone *Pachycerianthus fimbriatus*.
  - Burrowing Sea Anemone *Halcampa* sp.
  - Unidentified Burrowing Sea Anemone

Mollusca:
- Gastropoda:
  - Whelk *Buccinum* sp.
  - Moon Snail *Natica clausa*
  - Unidentified snail
- Bivalvia:
  - Softshell Clam *Mya* sp.
  - Greenland Cockle *Serripes groenlandicus*
  - Arctic Hiatella *Hiatella arctica*
  - Hairy Cockle *Clinocardium ciliatum*
  - Mussel *Musculus* sp.
  - Greenland Scallop *Delectopecten greenlandicus*
  - Chalky Macoma *Macoma calcarea*

Annelida:
- Polychaeta:
  - Errantia:
    - *Lumbrineris* sp.
  - Sedentaria:
    - 2 unidentified species

Echiura:
- Unidentified species

Table 1 (continued): List of species identified in photographs or collected near Sachs Harbour in 1999-2000.

Crustacea:
- Amphipoda:
  - *Rhachotropis* sp.
  - *Stegocephalus inflatus*
  - *Onisimus* sp.
  - Unidentified species
- Isopoda:
  - *Mesidotea* sp.
- Decapoda:
  - Toad Crab *Hyas coarctatus alutaceus*
  - Mysid *Mysis* sp.
  - Shrimp unidentified species

Bryozoa:
- Unidentified species

Brachiopoda:
- Unidentified species

Echinodermata:
- Crinoidea:
  - Feather Star *Heliometra glacialis*
- Asteroidea:
  - Sea Star *Pontaster tenuispinus*
- Ophiuroidea:
  - Brittle Star *Ophiacantha bidentata*
  - Brittle Star *Ophiopleura borealis*
  - Brittle Star *Ophiopleura* sp.
  - Basket Star *Gorgonocephalus* sp.
- Echinoidea:
  - Green Sea Urchin *Strongylocentrotus droebachiensis*
  - Pale Sea Urchin *Strongylocentrotus pallidus*
  - Sand Dollar *Echinarachnius parma*

Chordata:
- Ascidiacea:
  - Sea Squirt unidentified species
- Fish:
  - Sculpin *Icelus* sp.
  - Stout Eelblenny *Lumpenus medius*
  - Slender Eelblenny *Lumpenus fabricii*
  - Unidentified species

Table 2: Mean abundance of benthic species identified in photographic samples taken at Sachs Harbour August/September 2000.

					Mean Abundance (m^{-2}) Standard deviation brackets.															
					Molluscs															
				Number of	Bivalves					Snails			Echinoderms			Crustaceans				
Group	Longitude	Latitude	Depth (m)	Samples	Softshell Clam	Cockles	Hiatella	Musculus	Delectopecten	Buccinum	Natica	Other Snails	Brittle Star	Sea Urchin	Sand Dollar	Toad Crab	Amphipod	Mesidatia	Mysid	Shrimp
1	-125.507723	71.9741056	-3.6 (0.1)	5	0	0	0	0	0	0.7 (1.5)	0	0	0	0	0	0	0	0	0	0
2	-125.506779	71.9728638	-5.5 (0.1)	7	0	0.5 (1.2)	0	0	0	0.4 (1.2)	0	0	0	0	0	0	0	0	0	0
3	-125.495726	71.9680429	-10 (0.2)	6	2.1 (2.5)	0.5 (1.3)	0	0	0	0.5 (1.3)	0	0	0	0	0	0	0	0	0	0
4	-125.491727	71.9646554	-15.7 (0.2)	10	1 (1.6)	0	0	0	0	0	0	1 (2.2)	0	0.3 (1)	0.7 (1.4)	1 (1.6)	0.3 (1.1)	0	0	0
5	-125.488222	71.9564561	-19.9 (0.1)	3	0	0	0	0	0	2.3 (3.9)	0	0	1.1 (2)	0	14.7 (7.1)	6 (2.9)	0	0	0	0
6	-125.48611	71.9546848	-22.2 (0.2)	11	0.3 (1)	4.4 (4.6)	0.3 (0.9)	0.4 (1.3)	0	0	0.3 (1)	0	92.6 (49.7)	0	0	7.3 (5.1)	0	0	0	0
7	-125.481168	71.9480103	-23.8 (0.1)	10	1.5 (2.2)	13.2 (8.7)	0	0	0	0.3 (1)	0	0	30 (17.5)	0.9 (2.1)	0	1.7 (2.5)	0	0	0	0
8	-125.483549	71.9361314	-29.4 (0.2)	12	0.8 (2.2)	3.5 (5.2)	0	0	0.3 (0.9)	0.5 (1.3)	0	0.6 (1.4)	503.6 (70.7)	1.8 (4.2)	0	0.2 (0.8)	0	0	0	0
9	-125.26212	71.9836014	-4.3 (0.1)	4	1.6 (1.8)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	-125.261895	71.9809262	-5.9 (0.1)	6	0	1 (2.5)	0	0	0	0	0	0	0	0	0	1.1 (1.7)	0	0	0	0
11	-125.262839	71.9781596	-9.3 (0.7)	6	1.4 (3.5)	0	0	0	0	0	0	0	0	0	0	1.5 (2.5)	0	0	0	0
12	-125.262614	71.97658	-17.3 (0.1)	7	1.8 (4.8)	0.9 (1.5)	0	0	0	0	0	0	0	0	0	0.5 (1.2)	0	0	0	0
13	-125.262389	71.9760139	-20 (0.3)	9	0	0.9 (1.4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4 (1.1)
14	-125.261446	71.9752469	-21.2 (0.7)	7	0	0	0	0	0	0	0	0	0	0	0	2.7 (5.7)	0	0	0	0
15	-125.261446	71.9739138	-24 (0.7)	5	0	0	0	0	0	0.6 (1.4)	0	0	3.8 (5)	0	0	0.6 (1.4)	0	0	0	0
16	-125.262614	71.9721973	-25.7 (0.1)	5	1.7 (3.7)	0	0	0	0	0	0	0	0	0	0	4.5 (1.8)	0	0	0	0
17	-125.264007	71.970572	-11.5 (0.3)	6	11.4 (6.8)	0	0	0	0	0	0	0	0.5 (1.3)	0	0	3.1 (3.4)	0	0	0	0
18	-125.264726	71.9699512	-3.5 (0.2)	8	0	0	0	0	0	0	0	0.8 (1.4)	0	0	0	0	0	0	0	0
19	-125.243113	71.97658	-4.7 (1.2)	6	0.2 (0.7)	1.7 (3)	0.4 (1.7)	0	0	0	0	0.6 (1.3)	0	0	0	1.5 (2.5)	0	0	0	0
20	-125.243832	71.9755847	-6.1 (0.3)	12	0.8 (1.5)	0.5 (1.2)	0	0	0	0	0	0.3 (1)	0	0	0	2.8 (3.9)	0	0	0	0
21	-125.245944	71.9741056	-9.7 (0.1)	5	0	0	0	0	0	0	0	0	48.8 (14.7)	0	0	0	0	0	0	0
22	-125.246663	71.9720512	-16.9 (0.1)	7	0	0	0	0	0	0	0	0	22.7 (9.4)	0	0	0	0	0	0	0
23	-125.247562	71.9702433	-22.6 (0.1)	6	0.6 (1.4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	-125.249449	71.968335	-10.1 (2.2)	15	0	0.9 (2)	0	0	0	0	0	0	0	0	0	0.4 (1.1)	0	0	0.4 (1.1)	0
25	-125.236553	71.983501	-4.8 (1.3)	24	1.1 (3)	1.5 (2.4)	0.3 (1)	0.2 (0.8)	0	0.2 (0.8)	0	0.1 (0.7)	0	0.1 (0.7)	0	0.7 (1.4)	0.3 (0.9)	0.3 (1)	0	0
26	-125.237002	71.9826884	-2.4 (0.7)	10	1.4 (3.4)	0	1.2 (2)	0	0	0	0	0	0	0	0	0	0	0	0	0
27	-125.230892	71.9781596	-7.9 (1.8)	10	0	0	0	0	0	0	0	0	0	0	0	0.3 (1.1)	0	0	1 (2.2)	0
28	-125.23516	71.9745347	-17.3 (4.4)	41	0.6 (1.3)	0.2 (0.8)	0.1 (0.5)	0.1 (0.5)	0	0.5 (1.2)	0.1 (0.6)	0.3 (1.1)	9.8 (9.8)	0	0	0.1 (0.5)	0.2 (0.8)	0.1 (0.5)	0	0
29	-125.236059	71.9720512	-38.5 (2.1)	39	0.2 (0.7)	0.2 (0.8)	0	0	0	0	0	0.1 (0.5)	10.5 (12.5)	0.1 (0.5)	0	0.3 (1.1)	0	0	0.4 (1.5)	0
30	-125.236778	71.9699512	-31.4 (0.3)	4	0	0	0	0	0	0	0	0	0	0	0	6.4 (4.7)	0	0	0	0
31	-125.234441	71.9666094	-16.6 (6)	40	0.2 (0.7)	0.3 (1.3)	0	0.2 (1.1)	0	0	0	0	2.7 (4.4)	0	0	0.1 (0.5)	0.1 (0.6)	0	0	0
32	-125.236328	71.9655137	-4.4 (1.1)	9	0.3 (1)	0	0	0	0	0	0	0.3 (1.1)	0.6 (2)	0	0	1.2 (2.6)	0	0	0	0
33	-125.216828	71.9778217	-4.9 (1.1)	6	0	0	0	0	0	0	0	1.2 (2.9)	0	0	0	3.4 (4)	0	0	0	0
34	-125.218939	71.977347	-10.9 (1.5)	9	0	0	0	0	0	0	0	0.4 (1.2)	0	0	0	0.4 (1.3)	0	0	0	0
35	-125.219883	71.9760139	-17.3 (0.9)	5	0	0.8 (1.8)	0	0	0	0	0	0	1.8 (2.7)	0	0	0	0	0	0	0
36	-125.218939	71.974626	-25 (0.7)	6	0	0	0	0	0	0	0	0	20.7 (14.2)	0	0	0	0	0	0	0
37	-125.220827	71.9733386	-24.7 (0.7)	6	0	0	0	0	0	0	0	0	32.3 (16.6)	0	0	0	0	0	0	0
38	-125.219883	71.9726721	-35.9 (0.1)	6	0	0	0	0	0	0	0	0	9.5 (8.4)	0	0	0	0	0	0	0
39	-125.214491	71.9669928	-25.1 (0.2)	5	0	0	0	0	0	0	0	0	20.4 (9.2)	0	0	0	0	0	0	0
40	-125.215884	71.9656141	-11.3 (2.4)	15	0	0	0	0	0	0	0	0.4 (1)	0.6 (1.7)	0	0	0	0	0	0	0.2 (0.8)
41	-124.974774	71.9676137	-4.4 (0.6)	8	0	0	0	0	0	0	0	0	0	0	0	0.5 (1.4)	0	0	0	0
42	-124.979717	71.9673763	-10.1 (3.9)	14	0	0	0	0	0	0	0	0	0	0	0	2.2 (4.6)	0	0	0	0
43	-124.98439	71.9667554	-12.4 (0.8)	11	0	0.3 (1)	0	0	0	0	0	0	0	0	0	0	0.3 (1)	0	0	0
44	-124.968888	71.9668559	-12.2 (2.3)	17	0	0.2 (0.9)	0	0.2 (0.8)	0	0	0	0	0	0	0	0.7 (2.2)	0	0	0.4 (1.9)	0
45	-125.480494	71.9230563	-35.5 (0.4)	8	0.4 (1.1)	0.2 (0.8)	0.2 (0.8)	0	2.6 (2.9)	0	0	0.4 (1.1)	549.8 (146.9)	0	0	0	0	0	0	0
46	-125.117526	71.9616514	-12.3 (1.3)	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2 (continued): Mean abundance of benthic species identified in photographic samples taken at Sachs Harbour August/September 2000.

					Mean Abundance (m^{-2}) Standard deviation in brackets.											
				Number of	Polychaetes		Cnidaria (Sea Anenomes)				Fish					
Group	Longitude	Latitude	Depth (m)	Samples	Errant	Sedentary	Pachycericanthus	Halcampa	Unidentified	Cerianthus	Icelus	Eelblenny	Other Fish	Brachiopod	Echuroid	Tunicate
1	-125.507723	71.9741056	-3.6 (0.1)	5	0	0	0	0	0	0	0	0	0	0	0	0
2	-125.506779	71.9728638	-5.5 (0.1)	7	0	0	0	0	0	0	0	0	0	0	0	0
3	-125.495726	71.9680429	-10 (0.2)	6	0	0.5 (1.3)	0	0	0	0	0	0	0	0	0	0
4	-125.491727	71.9646554	-15.7 (0.2)	10	0	0.7 (1.4)	0	0	0	0	0	0	0	0	0	0.3 (1)
5	-125.488222	71.9564561	-19.9 (0.1)	3	0	1.5 (2.6)	0	0	0	0	0	0	0	0	0	0
6	-125.48611	71.9546848	-22.2 (0.2)	11	1 (1.7)	5.4 (9.9)	0	0	0	0	0	0	0	0.3 (1)	0.4 (1.2)	0
7	-125.481168	71.9480103	-23.8 (0.1)	10	0	0.3 (1)	0	0	0	0	0.3 (1)	0	0	0	0	0
8	-125.483549	71.9361314	-29.4 (0.2)	12	0	1.5 (2.4)	1.2 (1.7)	0	0.6 (1.3)	0	0	0	0	0.3 (1)	0	0
9	-125.26212	71.9836014	-4.3 (0.1)	4	0	0	0	0	0	0	0	0	0	0	0	0
10	-125.261895	71.9809262	-5.9 (0.1)	6	0	0	1.4 (3.4)	0	0	0	0.5 (1.1)	0	0	0	0	0
11	-125.262839	71.9781596	-9.3 (0.7)	6	0	1.4 (3.5)	1.1 (1.6)	0	0	0	0	0	0	0	0	0
12	-125.262614	71.97658	-17.3 (0.1)	7	0.4 (1.2)	24.7 (65.4)	11.8 (8.7)	1.3 (1.7)	0	0	0.5 (1.2)	0	0	0	0	0
13	-125.262389	71.9760139	-20 (0.3)	9	0	0	2.8 (4.7)	0	0.3 (0.9)	0.3 (1)	0.3 (1)	0	0	0	0	0
14	-125.261446	71.9752469	-21.2 (0.7)	7	0	0.4 (1)	1.1 (2.9)	0.5 (1.3)	0	13.7 (12.8)	0	0	0	0	0	0
15	-125.261446	71.9739138	-24 (0.7)	5	0	0	0	0.7 (1.5)	0	24.6 (13)	0	0	0	0	0	0
16	-125.262614	71.9721973	-25.7 (0.1)	5	0	0	1.4 (3.1)	0	0	14.4 (10.8)	0	0	0	0	0	0
17	-125.264007	71.970572	-11.5 (0.3)	6	0	0	1.1 (1.6)	0.5 (1.3)	0	0	0	0	0	0	0	0
18	-125.264726	71.9699512	-3.5 (0.2)	8	0	0	0	0	0	0	0	0	0	0	0	0
19	-125.243113	71.97658	-4.7 (1.2)	6	0	0	0	0	0	0	0.2 (0.8)	1.1 (2.1)	0	0	0.2 (0.7)	0
20	-125.243832	71.9755847	-6.1 (0.3)	12	0	1.4 (3)	0.8 (1.4)	0	0	0	0.5 (1.2)	0	0	0	0	0
21	-125.245944	71.9741056	-9.7 (0.1)	5	0	1.1 (2.5)	0.6 (1.2)	0	0	0	0	0.7 (1.5)	0	0	0	0
22	-125.246663	71.9720512	-16.9 (0.1)	7	0	7.4 (12)	0	0	0	0	0	1 (2.6)	0	0	0	0
23	-125.247562	71.9702433	-22.6 (0.1)	6	0.6 (1.5)	65 (53.6)	0	0	0	0	0	0	0	0	0	0
24	-125.249449	71.968335	-10.1 (2.2)	15	0	7.8 (19.2)	0	0	0	0	0.6 (1.3)	0.6 (1.7)	0	0	0	0
25	-125.236553	71.983501	-4.8 (1.3)	24	0.3 (1.6)	0.3 (1)	5.3 (6.9)	0.7 (0.1)	0	0	0.1 (0.6)	0.1 (0.6)	0	0	0	0
26	-125.237002	71.9826884	-2.4 (0.7)	10	0	0	2.4 (5.3)	0	0	0	0.3 (1)	0	0	0	0	0
27	-125.230892	71.9781596	-7.9 (1.8)	10	0	15.6 (19.5)	0	0	0	0	0	0	0	0	0	0
28	-125.23516	71.9745347	-17.3 (4.4)	41	0.2 (1)	35.9 (42.5)	0	0	0.4 (1.1)	0	0	0.1 (0.6)	0	0.3 (0.9)	0	0
29	-125.236059	71.9720512	-38.5 (2.1)	39	0.1 (0.5)	48 (47.7)	0.3 (1.5)	0	0.1 (0.5)	0	0	0.2 (0.9)	0.2 (0.8)	0	0	0
30	-125.236778	71.9699512	-31.4 (0.3)	4	0	0	0	0	0	0	0	0	0	0	0	0
31	-125.234441	71.9666094	-16.6 (6)	40	0.2 (0.8)	14.2 (33)	1.2 (2)	0	0.1 (0.5)	0	0.1 (0.5)	0.2 (0.8)	0	0	0.2 (0.8)	0
32	-125.236328	71.9655137	-4.4 (1.1)	9	0	4.2 (8)	0	0	0	0	0	0	0	0	0	0
33	-125.216828	71.9778217	-4.9 (1.1)	6	0	4 (8.2)	0	0	0	0	0	0	0	0	0	0
34	-125.218939	71.977347	-10.9 (1.5)	9	0	1.7 (3.3)	0	0	0	0	0	0	0	0	0	0
35	-125.219883	71.9760139	-17.3 (0.9)	5	0	5.1 (6.1)	0	0	0	0	0	0	0	0	0	0
36	-125.218939	71.974626	-25 (0.7)	6	0	3.3 (8.8)	0.9 (2.5)	0.5 (1.2)	0	0	0.5 (1.4)	0.6 (1.5)	0	0	0	0
37	-125.220827	71.9733386	-24.7 (0.7)	6	0	3.6 (5.8)	4.8 (5.1)	1.2 (2.9)	0	0	0	2.4 (2.9)	0	0	0	0
38	-125.219883	71.9726721	-35.9 (0.1)	6	0	0	2.1 (2.4)	0	0	0	0	1 (1.6)	0	0	0	0
39	-125.214491	71.9669928	-25.1 (0.2)	5	0	0	0.6 (1.3)	0	0	0	0	0	0	0	0	0
40	-125.215884	71.9656141	-11.3 (2.4)	15	0	4.8 (7.1)	0	0	0.2 (0.8)	0	0	0	0	0	0	0
41	-124.974774	71.9676137	-4.4 (0.6)	8	0	81 (112.4)	0.8 (2.3)	0	0	0	0.9 (1.7)	0	0	0	0	0
42	-124.979717	71.9673763	-10.1 (3.9)	14	0	0.3 (1.1)	0	0	0	0	0	1 (2.1)	0	0	0	0
43	-124.98439	71.9667554	-12.4 (0.8)	11	0	0	0	0	0	0	0	0.9 (1.6)	0	0	0	0
44	-124.968888	71.9668559	-12.2 (2.3)	17	0	0	0	0	0	0	0	0.2 (0.9)	0	0	0	0
45	-125.480494	71.9230563	-35.5 (0.4)	8	0.4 (1.1)	71.2 (34.4)	0	0.2 (0.8)	0	0	0	0	0	0.2 (0.7)	0.2 (0.8)	0.8 (2.5)
46	-125.117526	71.9616514	-12.3 (1.3)	2	0	0	0	0	0	0	0	0	0	0	0	0