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MBBR 4 Errata

Due to high costs associated with the provision of an inter-operable CD-ROM, the CD-ROM referred to in section 3.4 of this report is not available.

The spatial extent and nature of the bryozoan communities at Separation Point, Tasman Bay

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EXECUTIVE SUMMARY

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1) An area of about 146 km^2 of sea floor off Separation Point, Tasman Bay, was closed to commercial fishing using "power-fishing" methods (trawling, Danish seineing, and dredging) in 1980 to conserve ecologically associated commercial fish species. At that time no survey was undertaken on the extent of the bryozoan communities, although a limited number of dive samples showed the bryozoans within the area were dominated by *Celleporaria agglutinans* and *Hippomenella vellicata*. A dredge sample in 1980 from the northeast portion of Tasman Bay contained 94 species of bryozoans, confirming the biodiversity significance of this type of habitat.

2) During January and February 2002, side-scan sonar techniques were used to map the seafloor over as much of the Separation Point protected area as possible. Transects were positioned using Omni-Star DGPS and then electronically stitched together to form a mosaic. It was clear from the results that several acoustically different targets were recognisable and these formed the basis for selection of further samples to define the major benthic communities present. Benthic communities were identified using a remote-operated vehicle (ROV) fitted with a high-resolution video camera. ROV samples were positioned using GPS and the video images were recorded on the vessel using Digital-8 technology. Twenty ROV stations were completed, stratified according to the acoustic reflections identified in the side-scan results.

3) Bryozoan mounds containing multi-species assemblages were recorded from 16 of the 20 ROV stations, covering an estimated 55 km^2, or about 38% of the protected area. In addition, the side-scan sonar results suggested that bryozoan-dominated communities also occurred outside the protected area,

4) To minimise unnecessary damage to the bryozoan communities, a single small dredge sample was collected, using a 1.5 m wide scallop dredge fitted with 90 mm mesh and towed for about 100 m. A total of 37 species of bryozoans and 39 other invertebrate species from a range of taxa was recorded from this sample.

1. INTRODUCTION

Areas of seafloor colonised by habitat-forming bryozoans are relatively widespread around the New Zealand coast and continental slope, being reported from Spirits Bay (Cryer et al. 2000), the Otago Shelf (Batson & Probert 2000), Stewart Island (Willan 1981), Fiordland (Grange et al. 1981) and Tasman Bay/Golden Bay (Bradstock & Gordon 1983). These bryozoan-dominated habitats are considered to be ecologically and commercially important (see references above) because they can enhance biodiversity through habitat complexity (Probert et al. 1979) and may act as nursery areas for fished species (Vooren 1975).

The bryozoan beds at Separation Point, between Tasman Bay and Golden Bay, are the only ones in New Zealand that are formally protected from trawling/dredging. Saxton (1980a) provided an historical account of fishing practices in the area of Separation Point by summarising interviews from 24 fishers. Included in his report are two charts, delineating the area of "coral" (hard bryozoans) at Separation Point from 1945 and 1980, based on information supplied by the fishers.

Before 1956, Separation Point was not trawled because trawl nets were made from cotton and the foul ground associated with the bryozoans ripped the nets. Synthetic netting became available in 1956 and there was some attempt to trawl over foul ground. At that time three bryozoan beds were known from Tasman Bay. Areas off Torrent Bay contained "paper coral", probably dominated by the more fragile bryozoan *Hippomenella vellicata*. An area off the eastern side of D'Urville Island had been reported to contain bryozoans (Saxton 1980a), but the dominant species composition was unknown. The Separation Point bryozoan bed was dominated by a more physically robust bryozoan, the so-called "hard coral", *Celleporaria agglutinans*. The use of synthetic nets allowed fishers to trawl and subsequently break down the fragile *Hippomenella* bed off Torrent Bay, but the Separation Point bed was not trawled until 1972–74, when pair trawling began. Pair trawling does not require the use of heavy otter boards, so the gear can be "flown" slightly above the seafloor, helping to prevent large volumes of bryozoan and sponge material from entering the net, which increased sorting time but also physically damaged the catch. The subsequent increase in trawling in the area coincided with a decline in the scallop fishery, and by 1979 there was concern among fishers that the bryozoan bed would be destroyed.

According to Saxton (1980a), the catch on the bryozoan beds was dominated by juvenile fish, mainly tarakihi and snapper, and as the Torrent Bay bed was impacted, the proportion of juvenile fish declined. The fishers were therefore supportive of a closure to protect the Separation Point bed because of its apparent importance to recruitment (Saxton 1980b). The area was closed under Fisheries Regulations in December 1980 to all power-fishing methods, including trawl nets, Danish seine nets, and dredges.

The area of Separation Point known to contain bryozoan beds was delineated by Saxton (1980a) after asking fishers to record on charts where they considered the beds to lie. These areas are reproduced in Figure 1, along with the area closed in 1980. In 1945, the bryozoans covered an area of about 213 km^2, but this had reduced to 118 km^2 by 1980. The area protected in 1980 covers 146 km^2.

Bradstock & Gordon (1983) described the species composition of the Separation Point bryozoan beds soon after the area was protected. That study was based on diving observations, but no information was presented on the number or position of dive stations. No attempt was made to define the extent of bryozoans within the protected area and although 94 species of bryozoans were listed, these were collected from a dredge station from the northeastern side of Tasman Bay, near D'Urville Island, from a depth of 75 m. It is unclear, therefore, as to the extent or condition of the bryozoan beds at the time of protection. However, it is clear that the dominant species was *Celleporaria agglutinans*, reported to cover up to 50% of the seabed in places. Individual colonies were up to 0.5 m high. The area was also characterised by turbid water with very low light penetration and strong tidal currents.

2. OBJECTIVES

2.1 Overall objective

To determine the spatial extent and nature of the bryozoan colonies around Separation Point.

2.2 Specific objectives

1. To assess the present state and extent of bryozoan communities around Separation Point.
2. To characterise the bryozoan communities around Separation Point.

3. METHODS

A two-phase approach was taken to achieve both specific objectives; a survey using side-scan sonar, followed by a visual survey using a remote-operated vehicle.

3.1 Side-scan sonar survey

The seabed within the protected area was mapped using C-MAX side-scan sonar, operated at either 100 or 325 kHz, which produced a sonograph swath of about 200 or 100 m, respectively, either side of the tow-body. Vessel speed was kept below 6 knots throughout the side-scan survey and all tracks were positioned using Omni-Star DGPS, with a layback to the tow-body calculated.

The sonograph was stored digitally onboard the vessel, along with the DGPS data. The sonograph was post-processed by digitally stitching each track together to produce a mosaic of the seabed, using CODA mosaic software. Different image types or features of interest were then assessed as likely biological habitats and used as the basis for the visual survey.

3.2 Visual verification

The Separation Point protected area covers about 146 km^2, and depths are greater than 45 m along the outer boundary. In addition, the area is swept by tidal currents of up to 0.7 knots during spring tides (Bradstock & Gordon 1983). These factors prevented the use of scuba and diver-held video to verify the sonograph targets. Video verification was therefore completed using a VideoRay remote-operated vehicle (ROV), equipped with a high-resolution colour video camera.

A total of 20 positions was selected (Table 1), expected to cover all habitat types that were identified from the side-scan mosaic. At each station, the vessel was anchored and the ROV lowered to the seabed and "flown" around for about 5 min. The direction of flight varied to cover as much area as possible, but at most places the strong tidal currents meant that the ROV had to be kept facing the current. An area of 10–25 m^2 was covered at each ROV station, estimated by the amount of cable laid out and the video footage. The video signal from the ROV was recorded on the vessel on to Digital-8 tape for later analysis. All ROV station positions were recorded by GPS.

3.3 Biological sampling

A single dredge sample was collected from near the centre of the protected area at 173° 12.27' E; 40° 44.42' S. The dredge used was a standard recreational scallop dredge with a mouth width of 1.5 m and a mesh size of 90 mm. The dredge was towed for only 100 m (as measured by GPS) to minimise unnecessary damage to bryozoan colonies. Once on board, the contents of the dredge were listed and a small subsample was taken for bryozoan taxonomy.

3.4 CD-ROM production

Bitmap files (TIFF format) were clipped from the digital side-scan sonographs at each ROV station, and movie files (MPEG format) were generated from the Digital-8 video footage. The digital video was captured using a Canopus DV Storm SE video capture card and Storm Edit software used to edit and save footage as small movie files. An interactive CD-ROM has been produced as an aid to interpretation, a copy of which is available on request from Communications Team, Ministry of Fisheries, P.O. Box 1020, Wellington.

4. RESULTS

4.1 Side-scan results

Due to time constraints and weather, it was not possible to cover the entire 146 km^2 of the protected area. Instead, side-scan transects were concentrated in the strata that showed complex seabed features. Approximately 450 km of side-scan tracks were completed, covering a total area of over 90 km^2, or 60% of the protected area. A mosaic of the sonographs was produced, and 5 different seabed types could be distinguished.

- The first was highly reflective features within 20–50 m of the shoreline, which represented nearshore reefs.
- The second covered much of the east and southeast portion of the area and was characterised by relatively featureless and weak sonar reflections. This type of reflection is characteristic of soft mud and silt.
- A third was recorded at a small, isolated patch centred on 173° 2.19E'; 40° 48.44'S. This feature was more reflective and clearly emergent from the surrounding seabed and was interpreted as a rock outcrop about 100 m in diameter.
- The fourth and fifth were similar in appearance, consisting of small reflective, dark patches on a mud surface. At some places, mainly within 1.5–2 km of the coast, the reflective targets were small and covered a large proportion of the seabed. Further offshore, between 2 and 5 km from shore, the reflective targets were larger, more irregular, and scattered. The biological habitats associated with these two seabed types could not be interpreted without "ground-truthing" (see Section 4.3 below).

Examples of side-scan sonographs (covering 200 x 200 m of seabed) depicting each of the seabed types 2–5 above are shown in Figure 2.

4.2 Bathymetry

Accurate bathymetric data were not collected as part of the survey, but depth contours are available from the NIWA coastal digital bathymetry database (Figure 3). An echo-sounder was operated during the side-scan sonar transects and the ROV recorded depths at each station on to the videotape. From the shore, depths rapidly dropped to 20 m near the base of the nearshore reefs. From there the slope of the seafloor was less, and depths of 30 m were reached 1.5–2.0 km from shore. More than 2 km from shore, the seafloor gently sloped to the boundary of the protected area, which lay in depths of 44–45 m at the time of sampling (about 40 m below chart datum – see Figure 3).

4.3 Visual verification

The side-scan sonar results were used to stratify the area according to the different seabed types, which could then be visually sampled using the ROV. No visual interpretation was attempted for the reef along the shoreline because it was unlikely this would be part of the bryozoan community of interest in this study. The ROV sampling was therefore undertaken within each stratum as follows:

- featureless mud – 6 stations (numbered 5–9; 14 on Figure 3);
- isolated rock outcrop – 1 station (numbered 17 on Figure 3);
- reflective irregular targets – 13 stations (numbered 1–4; 10–16; 18–20 on Figure 3).

This gave a total of 20 ROV stations used to ground-truth the side-scan mosaic. The positions of the each of these stations are shown in Figure 3 and listed in Table 1 along with depths and qualitative habitat descriptions.

Video footage from the ROV confirmed the seabed types identified in the side-scan sonographs. Different biological habitats were clearly defined and related closely to depth contours.

a. The sand/dead shell habitat. This was the shallowest habitat (other than the nearshore reefs) and occurred in depths of 20–30 m, at Stations 10, 11, 16, 18–20 (Figure 3). This habitat corresponded to one of the seabed types that showed small, reflective dark patches in the sonographs. This habitat was dominated by sand and silt with large quantities of dead shell material, mainly from bivalve species, including *Glycycmeris laticostata, Dosina zelandica,* and *Atrina zelandica.* The dead shells provided attachment surfaces for hydroids, sponges, and small colonies of bryozoans. Examples of still images from the video footage from this habitat are shown in Figure 4. Juvenile fish, including blue cod, tarakihi, and leatherjackets were also common in this habitat.

b. The soft mud/silt habitat. This was the deepest and most widespread habitat, occurring in depths greater than 40 m. Stations that made up this habitat included 5–9, and 14 (see Figure 3). Underwater visibility was poor and tidal currents were strong. The sediment was soft featureless mud that was easily disturbed. There were few indications of infaunal species present and the only epifauna recorded by the video were hermit crabs in *Struthiolaria* shells and a single *Alcithoe* sp. Examples of still images from the video footage from this habitat are shown in Figure 5A–D.

c. Isolated rock outcrop. A large rock outcrop was apparent from the side-scan sonographs near the southern boundary of the protected area, about 2 km from shore (Station 17, Figure 3). This outcrop is not marked on Hydrographic Chart NZ614 and was not referred to by Saxton (1980a). Several echo-sounding transects were run across the outcrop, which showed it to be about 100 m in diameter. The shallowest point recorded was 19 m, rising from the surrounding muddy seafloor at 32 m depth. The outcrop was heavily colonised by a diverse range of fauna, dominated by ascidians (*Cnemidocarpa, Didemnum*), sponges (e.g., *Callyspongia, Anchorina*), brachiopods (*Liothyrella, Magasella*), bivalves (e.g., *Barbatia, Ostrea, Perna, Limaria, Atrina*), coral (*Culicea*), and a variety of small bryozoan colonies. Fish recorded included barracouta, tarakihi, and leatherjacket. Examples of still images from the video footage from this habitat are shown in Figure 5E–F.

d. The silt/bryozoan habitat. This appeared to be restricted to depths between 30 and 40 m, although occasional bryozoan colonies were recorded shallower than 30 m. Stations that occurred within this habitat were 1–4; 12, 13, and 15 (see Figure 3). This habitat corresponded to sonographs with larger, irregular, and scattered reflective targets. The seafloor was dominated by mud and silt and the reflective targets were confirmed as bryozoan mounds by the ROV. The bryozoans were dominated by *Celleporaria agglutinans*, which formed mounds up to 40 cm tall and 50 cm wide. These mounds were associated with many other bryozoan species as well as brachiopods (*Liothyrella neozelanica*), sponges (e.g., *Callyspongia*), hydroids, and horse mussels. Examples of still images from the video footage from this habitat are shown in Figure 6.

Using the information from the side-scan mosaic and the ROV stations, a habitat map has been constructed (Figure 7) that shows the approximate boundaries of each of the habitats described above. Featureless mud occupies about 85 km^2, or 58% of the protected area, and although relatively dense bryozoan mounds cover about 51 km^2, isolated mounds occur throughout the shallower sand/dead shell habitat as well, increasing the area containing bryozoan habitat to 55 km^2. In addition, the side-scan mosaic indicated that potential bryozoan habitat occurred along the northern boundary of the protected area and may have extended outside it.

4.4 Biological sampling

The dredge sample was taken from a depth of 39 m using a standard recreational scallop dredge. The coarse mesh (90 mm opening) resulted in only large species being collected, so grossly underestimated the total biodiversity present. When recovered, the dredge was completely filled with material, dominated by living and dead bryozoan colonies and dead oyster shells.

Thirty-seven species of bryozoans were identified from the dredge sample, dominated by large mounds of the habitat-forming species *Celleporaria agglutinans* and smaller mounds of *Hippomenella vellicata*. Table 2 lists the bryozoan species identified from the dredge sample. The appearance of the bryozoan colonies was different from those seen on the ROV video footage because the silt had been washed away exposing the natural pink of *C. agglutinans* and *H. vellicata*. The species listed in Table 2 all appeared to be either living or recently dead when collected. However, large portions of many of the *C. agglutinans* colonies did not contain living tissue (identified by the flesh pink coloration), suggesting these parts had been buried in the sediment. It is not unusual for the basal portions of large colonies to be dead, even on deep reefs without sedimentation, such as in Fiordland (K. Grange, pers. obs), but the general condition of the mounds from both the video footage and the dredge sample indicated that live tissue was more or less restricted to the upper, distal portions. It was possible to confirm whether colonies were alive only from the dredge sample, but the video footage also showed clear demarcation between living and dead tissue (e.g., Figures 6A and 6D).

There were many other invertebrate species associated with the bryozoan colonies, from a range of taxa. The most abundant were the brachiopods *Magasella sanguinea* and *Liothyrella neozelanica*, hermit crabs (*Pagurus* sp.), the sea star *Coscinasterias muricata*, the brittle star *Ophiopsammus maculata*, bivalves (*Nemocardium pulchellum* and *Limaria orientalis*), and the large volute *Alcithoe swainsoni*. A full list of invertebrate species other than bryozoans recorded from the dredge sample is given in Table 3.

5. DISCUSSION

This study is the first to characterise both the extent and condition of the bryozoan communities of Separation Point. Before this study, it was not known whether the protection afforded in 1980 had been effective. The bryozoan beds of Separation Point are unusual. Batson & Probert (2000) listed the environmental parameters at seven New Zealand locations where bryozoan-dominated sediments have been recorded. All locations are characterised by biogenic or carbonate sediments in strong tidal currents and high-energy environments, which suggests low sedimentation rates. The same characteristics have been recorded from the more recently discovered bryozoan communities of Spirits Bay (Cryer et al. 2000). Although tidal currents are reasonably strong at Separation Point, the seafloor is characterised by soft mud and silt, suggesting that sedimentation rates may be high. In addition, the fine sediments are easily disturbed (as shown in the ROV footage). Sediment disturbance by tidal currents and storms could adversely affect bryozoan colonies. It is unknown whether the bryozoan mounds originally colonised coarser sediments that may have been present historically, for instance, before land clearance. It seems likely, though, that if considerable damage had occurred to the main habitat-forming mounds before protection, they may not have been able to recolonise on the soft mud that is present in the area today.

The community dominated by bryozoan colonies at present covers 55 km^2 of the protected area and is most common in depths of 30–40 m, where large (over 50 cm tall) multispecies mounds occur, dominated by *Celleporaria* and brachiopods (e.g., *Liothyrella*). Shallower than 30 m, the benthic habitat is dominated by coarse shell gravel with infaunal bivalves (e.g., *Glycymeris*), epifaunal bivalves (e.g., *Atrina*) and gastropods (e.g., *Maoricolpus*). This coarse shell habitat often supports bryozoan communities elsewhere (Batson & Probert 2000), and although colonies do occur in this habitat at Separation Point, they tend to be small (under 20 cm high), widely dispersed, and dominated by *Hornera* rather than *Celleporaria*, as recorded by the ROV video. It is possible that large storms may disturb the seabed in these depths sufficiently to prevent large multispecies bryozoan mounds forming. The epifauna recorded by the ROV on the large rock outcrop supports this assumption. Brachiopods, sponges, and bivalves dominated the rock outcrop; very few bryozoans were recorded. Deeper than 40 m, the sediment is very soft, easily disturbed mud and silt, with reduced tidal currents, a habitat unsuitable for the establishment of bryozoan communities.

The appearance of the bryozoan mounds, as shown by ROV footage, is also unusual. The mounds are often covered in silt and in many instances it appeared as though only the distal portions of the mounds supported living colonies (e.g., Figure 6A) or the colonies were overgrown with other species, including sponges, hydroids, and brachiopods (e.g., Figure 6F). Despite the apparent siltation, however, the dredge sample confirmed that a very diverse community was associated with the bryozoan mounds and surrounding sea floor.

Two other bryozoan communities have been reported from Tasman Bay. The Torrent Bay beds were apparently dominated by the more fragile bryozoan *Hippomenella* and were broken up by trawling and dredging before 1974. Recent sampling within the Tonga Island Marine Reserve using the same methodology as in this study has identified only scattered, small bryozoan mounds, indicating that recovery has not occurred. Another bed off D'Urville Island has been reported (Saxton 1980a) but never sampled, other than the single dredge station reported by Bradstock & Gordon (1983). It is unknown whether this bed still exists.

The Separation Point colonies appear to be growing on older bryozoan mounds rather than directly on the mud sediments. This suggests that the protection was put in place before trawling broke up the frame-building mounds. The lack of recovery within the Torrent Bay bed reinforces the assumption that once the frame-building mounds are broken up, they cannot recover on soft mud sediments. No evidence of trawl marks was found during the ROV survey within the protected area and the extensive area of mud seaward of the dense bryozoan habitat provides an effective buffer against the direct effects of trawling or dredging, and the indirect effects of sediment disturbance.

One of the major reasons for commercial fishers supporting the protection of the Separation Point bryozoan beds was to protect juvenile fish nursery areas. Juvenile fish, including tarakihi, blue cod, and leatherjackets were observed by the ROV during this study, but only in depths less than 30 m. The poor visibility in deeper water prevented observations further than 1–2 m from the camera, making it unlikely that fish would be seen, even though the ROV has proved to be an excellent tool for filming fish elsewhere without the presence of divers.

Further research is suggested, based on the results of this study. It is clear that the bryozoan beds have benefited from protection, but it is unclear whether the values of the area as a nursery for commercial fish species remain. This could be addressed through the use of baited video and the ROV. This method has proved particularly effective in determining the species of fish present within and adjacent to mussel farms in the Marlborough Sounds (authors' unpublished results) where underwater visibility is also poor. The bryozoan community at Separation Point is unusual because it occurs on soft mud sediments. The dull appearance of many colonies, except on the growing distal portions, and the veneer of silt that is evident on many mounds, suggests that the community is potentially stressed by sedimentation. The relative lack of sedimentation in the northeast portion of Tasman Bay, near D'Urville Island, provides an opportunity to compare the Separation Point beds with those previously reported from that area (if they still exist), in terms of extent, condition, biodiversity, and commercial fishery values.

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Table 1: Position, depths, and general habitat description of each ROV station, Separation Point.

Station no.	Depth (m)	GPS location °E	°S	Site Description from ROV images
1	38.8	173° 01.450'	40° 44.750'	mud, shell fragments, medium density bryozoans (some large), hydriods, *Maoricolpus*
2	39.6	173° 01.586'	40° 45.059'	mud, shell fragments, small isolated bryozoans
3	42.9	173° 02.811'	40° 45.166'	mud, shell fragments, small, medium-density bryozoans
4	37.2	172° 59.638'	40° 45.703'	sand/mud, small isolated bryozoans, hydroids, small mud mounds
5	43.9	173° 02.370'	40° 43.763'	mud
6	43.3	173° 01.657'	40° 41.968'	mud
7	41.3	172° 59.876'	40° 42.476'	mud
8	40.4	173° 00.494'	40° 43.439'	mud
9	37.7	172° 59.942'	40° 44.928'	mud
10	35.1	172° 58.870'	40° 46.310'	sand/mud, small amount shell fragments, hydroids
11	18.9	172° 58.852'	40° 46.760'	sand/mud, large isolated bryozoans, sponge
12	39.5	173° 00.757'	40° 45.637'	mud, medium-high density bryozoans (some large), brachiopods, hydroids, sediment-covered shells
13	39.1	173° 02.015'	40° 46.059'	mud, shell fragments, small medium-density bryozoans
14	42.8	173° 04.789'	40° 47.337'	mud, sediment-covered shells, small isolated bryozoans
15	36.2	173° 01.142'	40° 46.996'	mud, medium to high density bryozoans (some large), small shell fragments, horse mussels
16	26.2	173° 00.537'	40° 47.596'	mud, small isolated bryozoans, large shell fragments, *Maoricolpus*, brachiopods, hydroids
17	32.1	173° 02.207'	40° 48.465'	large rock outcrop, dense shell fragments, many brachiopods, horse mussels, large bryozoans covering whole rock
18	21.4	172° 59.167'	40° 46.600'	sand, silt, dead shell, isolated small bryozoans
19	33.4	172° 59.539'	40° 46.263'	fine sand, dead shell, *Maoricolpus*, *Glycymeris*, isolated bryozoan colonies
20	20.8	172° 59.672'	40° 46.668'	shell gravel, *Dosina*, *Glycymeris*, *Maoricolpus*, hydroids

Table 2: Species of Bryozoa recorded from a single dredge sample, Separation Point.

		Family	Genus	Species
Class Stenolaemata	Order Tubuliporina	Diaperoeciidae	*Diaperocia*	*purpurascens*
		Horneridae	*Hornera*	*robusta*
		Lichenoporidae	*Disporella*	*pristis*
Class Gymnolaemata	Order Cheilostomata	Aeteidae	*Aetea*	*ligulata*
		Aeteidae	*Aetea*	*truncata*
		Calloporidae	*Crassimarginatella*	*fossa*
		Calloporidae	*Odontionella*	*cyclops*
		Chaperiidae	*Chaperia*	*granulosa*
		Flustridae	*Gregarinidra*	*serrata*
		Beaniidae	*Beania*	*discodermiae*
		Beaniidae	*Beania*	*plurispinosa*
		Microporidae	*Opaeophora*	*monopia*
		Steginoporellidae	*Steginoporella*	*magnifica*
		Cellariidae	*Cellaria*	*immersa*
		Cellariidae	*Cellaria*	*tenuirostris*
		Cribrilinidae	*Figularia*	*huttoni*
		Hippothoidae	*Hippothoa*	*flagellum*
		Arachnopusiidae	*Arachnopusia*	*unicornis*
		Lepraliellidae	*Celleporaria*	*agglutinans*
		Schizoporellidae	*Hippomenella*	*vellicata*
		Romancheinidae	*Exochella*	*conjuncta*
		Bitectiporidae	*Bitectipora*	*mucronifera*
		Bitectiporidae	*Bitectipora*	*rostrata*
		Smittinidae	*Hemismittina*	*hexaspinosa*
		Smittinidae	*Parasmittina*	*delicatula*
		Smittinidae	*Smittina*	*torques*
		Smittinidae	*Smittoidea*	*maunganuiensis*
		Petraliellidae	*Mobunula*	*bicuspis*
		Microporellidae	*Fenestrulina*	*incompta*
		Microporellidae	*Fenestrulina*	*reticulata*
		Microporellidae	*Microporella*	*agonistes*
		Lacernidae	*Phonicosia*	*circinata*
		Crepidacanthidae	*Crepidacantha*	*crinispina*
		Celleporidae	*Buffonellaria*	*turbula*
		Celleporidae	*Celleporina*	*sinuata*
		Celleporidae	*Galeopsis*	*porcellanicus*
		Phidoloporidae	*Stephanollona*	*longispinata*

Table 3: Invertebrate species associated with bryozoan clumps, as recorded from a single dredge sample, Separation Point.

			Family	Genus	Species
Phylum Mollusca	Class Gastropoda	Order Neogastropoda	Buccinidae	*Austrofusus*	*glans*
			Buccinidae	*Penion*	*sulcatus*
			Volutidae	*Alcithoe*	*swainsoni*
			Muricidae	*Poirieria*	*zelandica*
			Olividae	*Amalda*	*mucronata*
		Order Mesogastropoda	Calyptraeidae	*Sigapatella*	*novaezealandiae*
			Turritellidae	*Maoricolpus*	*roseus*
			Cymatiidae	*Septa*	*parthenopea*
	Class Bivalvia	Order Veneroida	Caridiidae	*Nemocardium*	*pulchellum*
			Veneridae	*Dosina*	*zelandica*
		Order Pterioida	Pectenidae	*Chlamys*	*zealandiae*
		Order Arcoida	Arcidae	*Barbatia*	*novaezelandiae*
		Order Mytiloida	Mytilidae	*Modiolus*	*areolatus*
		Order Pterioida	Limidae	*Limaria*	*orientalis*
			Pectenidae	*Pecten*	*novaezealandiae*
			Ostreidea	*Tiostrea*	*lutaria*
		Order Myoida	Hiatellidae	*Hiatella*	*arctica*
	Class Amphineura	Order Neoloricata		unidentified chiton	
Phylum Brachiopoda	Class Articulata	Order Terebratulida	Terebratellidae	*Magasella*	*sanguinea*
			Terebratulidae	*Liothyrella*	*neozelandica*
Phylum Echinodermata	Class Ophiuroidea	Order Ophiurida	Ophionereididae	*Ophionereis*	*fasciata*
			Ophiodermatidae	*Ophiopsammus*	*maculata*
		Order Ophiomyxida	Ophiomyxidae	*Ophiomyxa*	*brevirima*
	Class Asteriodea	Order Valvatida	Goniasteridae	*Coscinasterias*	*muricata*
Phylum Porifera	Class Demospongiae	Order Haplosclerida	Callyspongiidae	*Callyspongia*	*ramosa*
			Callyspongiidae	*Callyspongia*	sp
		Order Hadromerida	Clionidae	*Cliona*	*celata*
Phylum Chordata	Class Ascidiacea	Order Stolidobranchia	Styelidae	*Cnemidocarpa*	*bicornuata*
			Styelidae	*Asterocarpa*	*caeruleus*
				unidentified (compound)	

Phylum Arthropoda	Class Crustacea	Order Decapoda	Paguridae	*Pagurus*	sp
			Porcellanidae	*Petrolisthes*	*novaezelandiae*
			Dromiidae	*Petalomera*	*wilsoni*
			Majidae	*Notomithrax*	*peronii*
			Galatheidae	*Munida*	*gregaria*
Phylum Cnidaria	Class Hydrozoa	Order Hydroida	Halocordylidae	*Pennaria*	sp
Phylum Annelida	Class Polychaeta	Order Eunicida	Eunicidae		
			Oenonidae		
		Order Phyllodocida	Polynoidae	*Lepidonotus*	*polychroma*

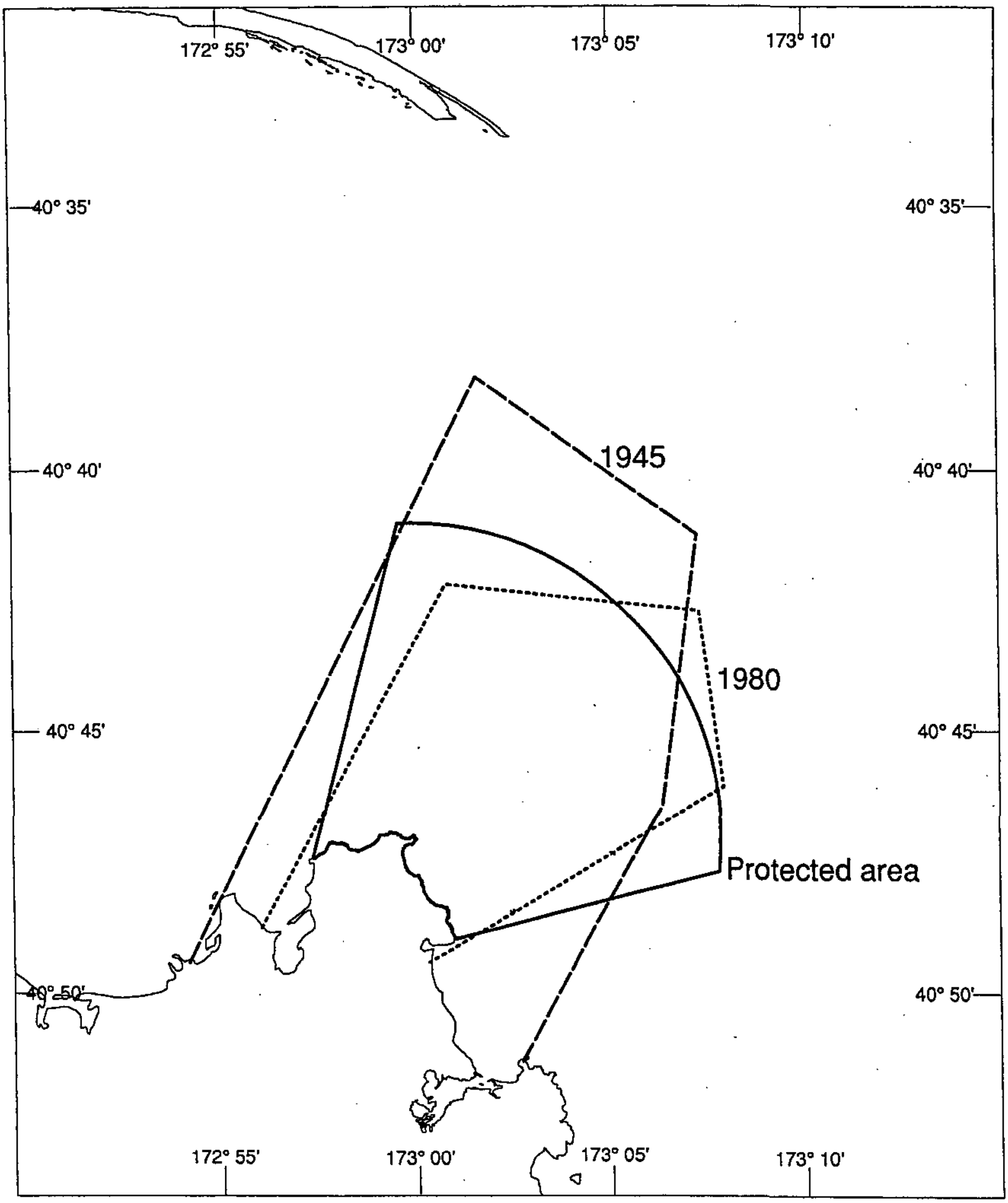

Figure 1: Separation Point, showing the historical extent of bryozoan beds in 1945 and 1980, as detailed by Saxton (1980a), along with the area protected in 1980 from power fishing methods.

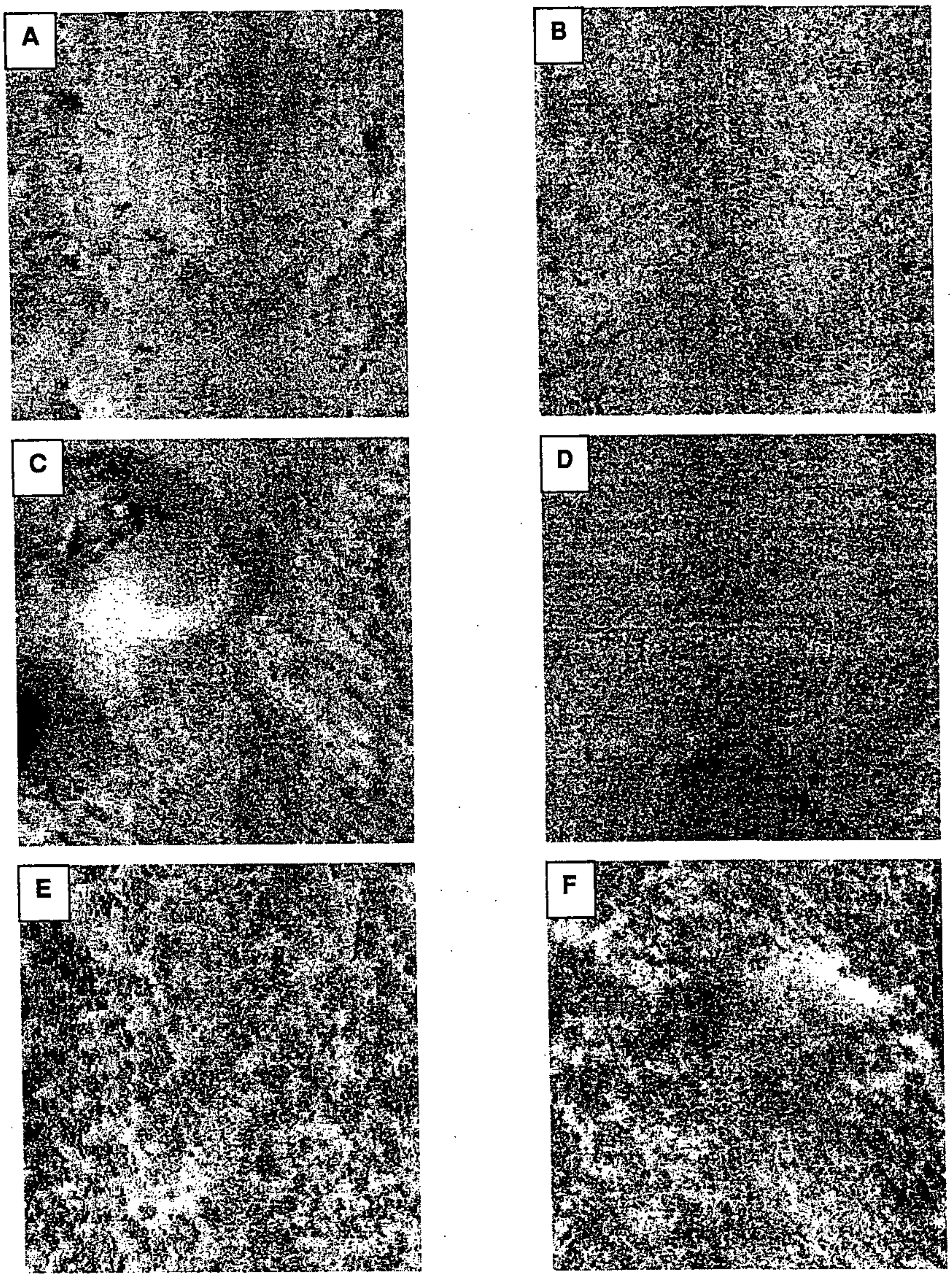

Figure 2: Examples of sonographs showing 200 x 200 m areas of seabed, Separation Point. A & B, poorly reflective seabed typical of mud; C, a large rock outcrop in the left of the sonograph; D, finely mottled seabed typical of sand in shallow areas close to shore; E & F, irregular, highly reflective targets, typical of bryozoan mounds, on mud.

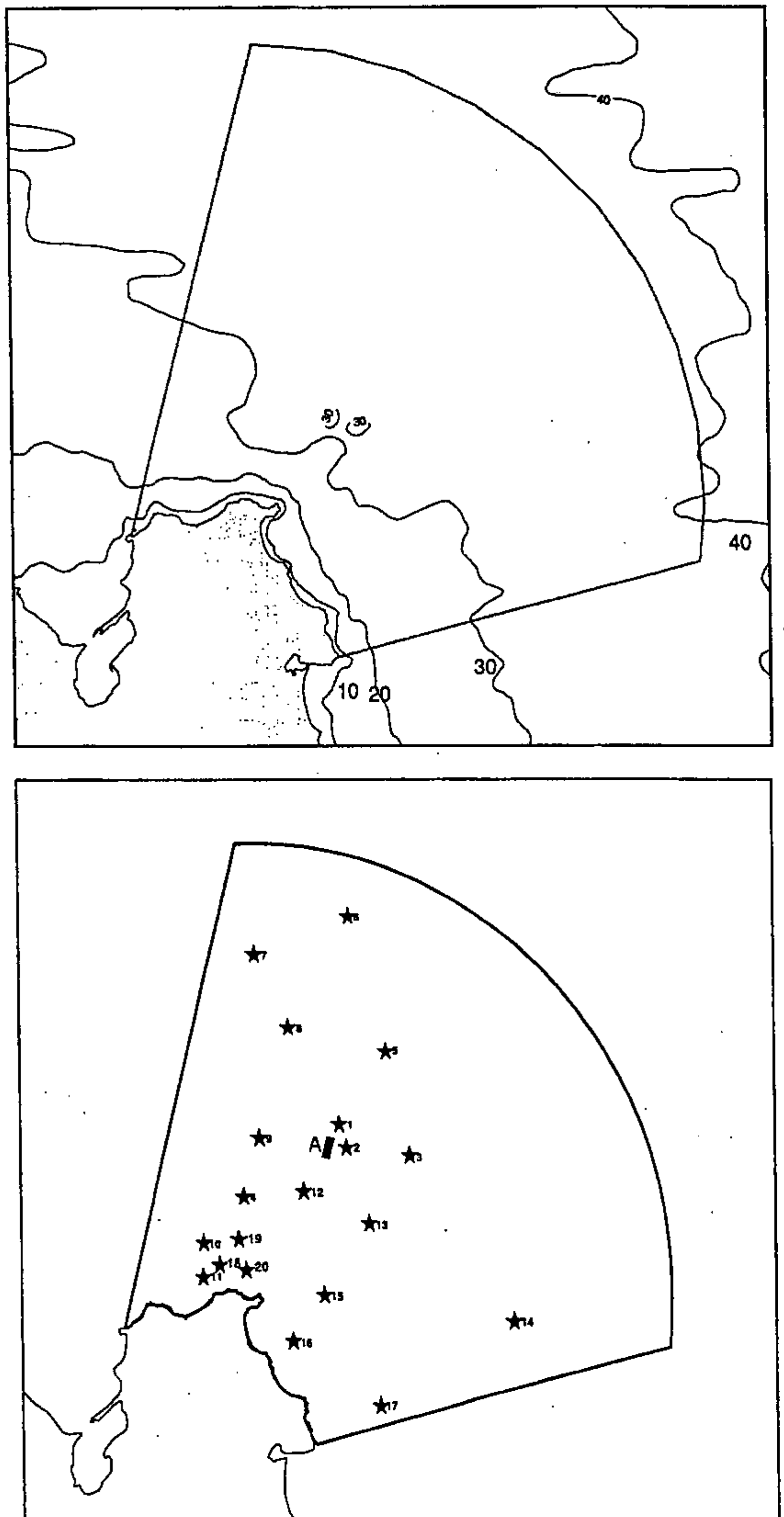

Figure 3: Separation Point protected area. Top. Bathymetry at 10-m depth intervals. Note all depths on this figure are adjusted to chart datum. Bottom. ROV stations (1–20) and dredge station (A) sampled in January-February 2002.

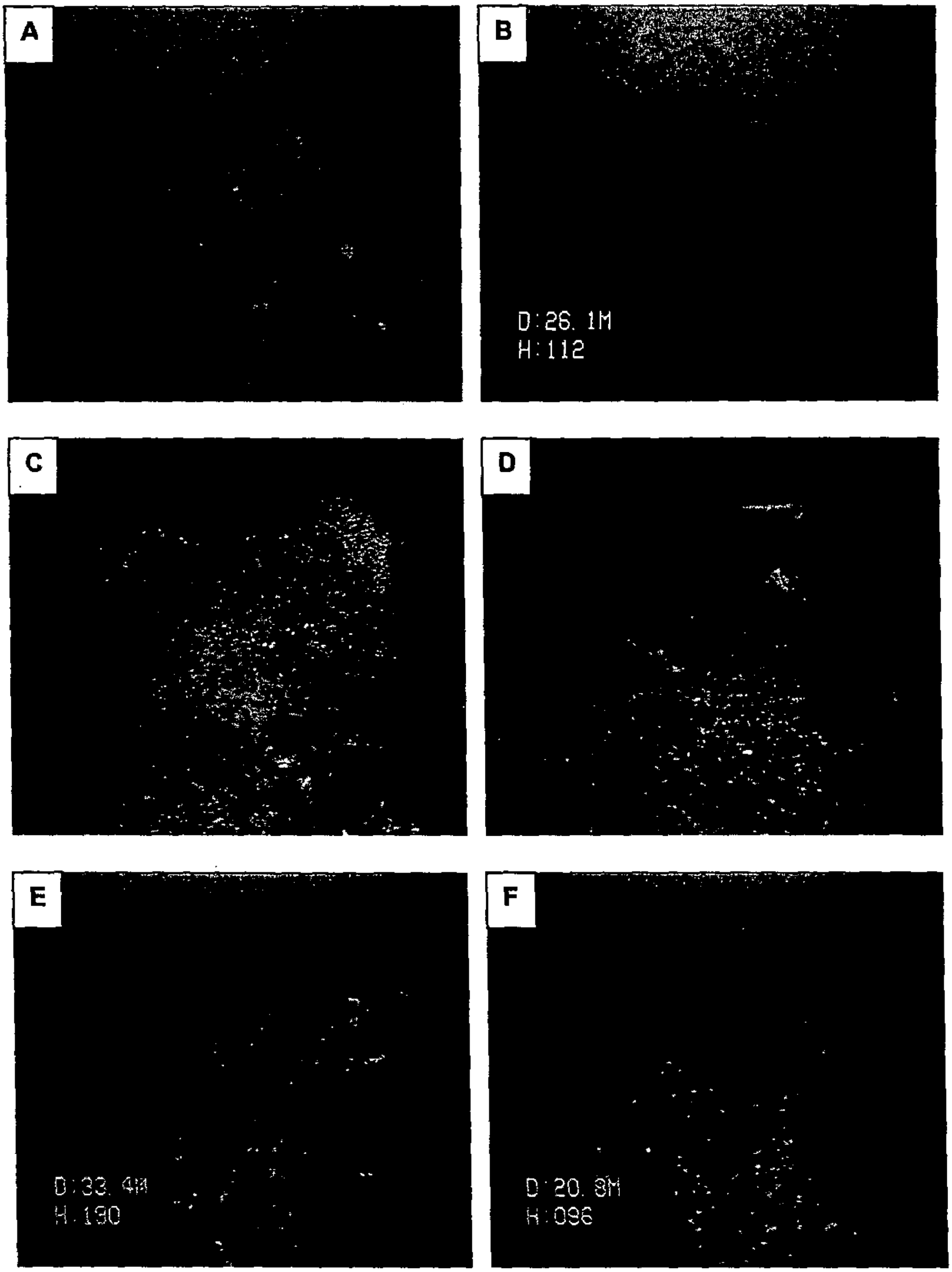

Figure 4: Video frames from the sand/dead shell habitat (see text). A, Stn 10. Dead shells, sponges, on fine sand; B & C, Stn 16. Horse mussel with sponges and brachiopods; hydroid colony; D & E, Stn 18. Juvenile blue cod and turret shells, dead shells; F; Stn 20. Juvenile leatherjacket, hydroids, turret shells, and shell debris (see Figure 3 for positions).

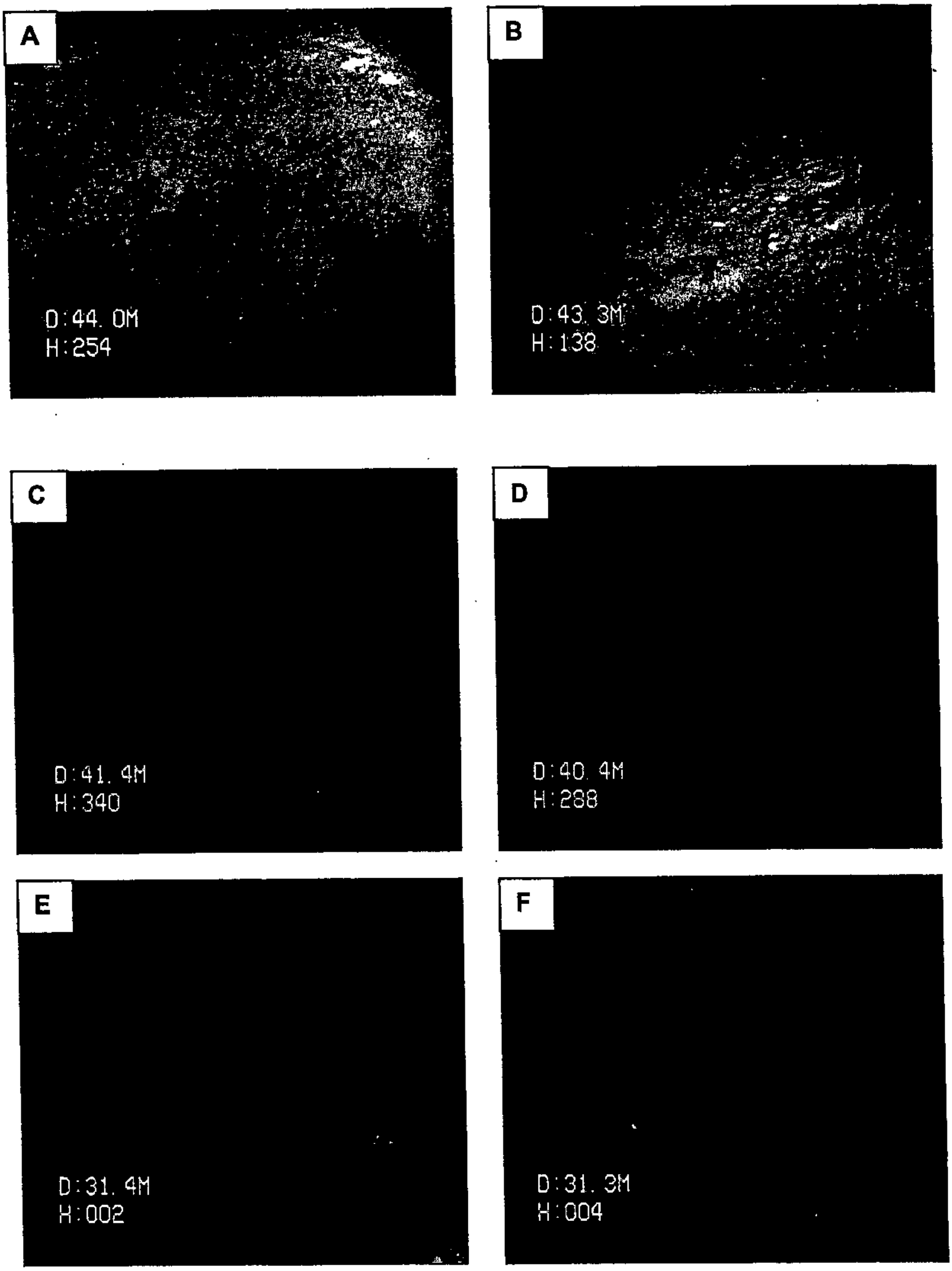

Figure 5: Video frames from the mud/silt habitat (A–D) and the rock outcrop (E–F) (see text). A, Stn 5; B, Stn 6; C, Stn 7; D, Stn 8; E & F, Stn 17. Sponges, brachiopods, hydroids (see Figure 3 for positions).

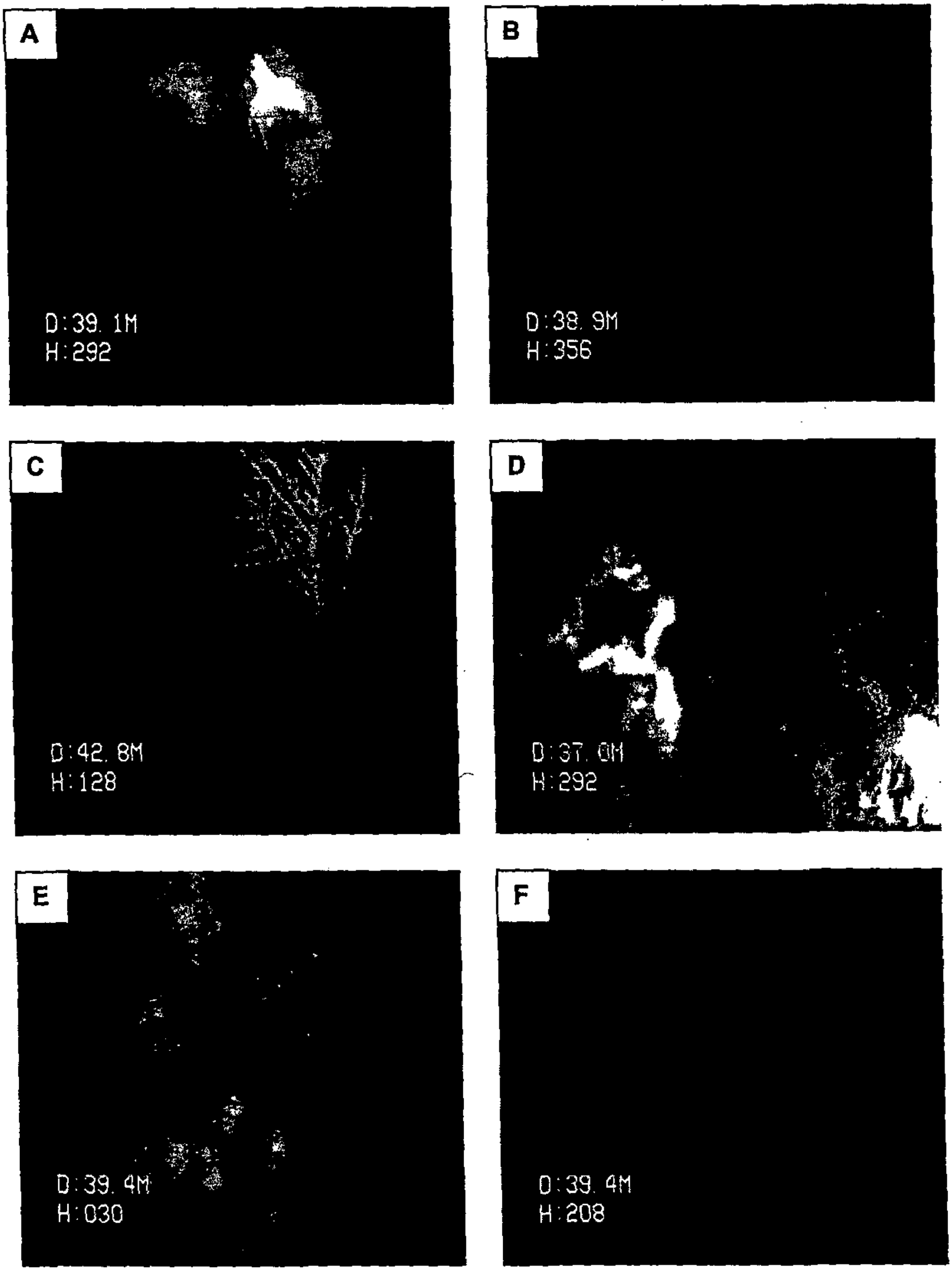

Figure 6: Video frames from the mud/bryozoan habitat (see text). A, Stn 1. Bryozoan (*Celleporaria*), hydroids; B, Stn 1. Bryozoan (*Hippomenella*) and encrusting fauna; C, Stn 3. Hydroids (*Solanderia*); D, Stn 4. Hydroids and sponges; E, Stn 12. Bryozoan colony (*Celleporaria*); F, Stn 12. Brachiopods (*Liothyrella*) on bryozoan colonies (see Figure 3 for positions).

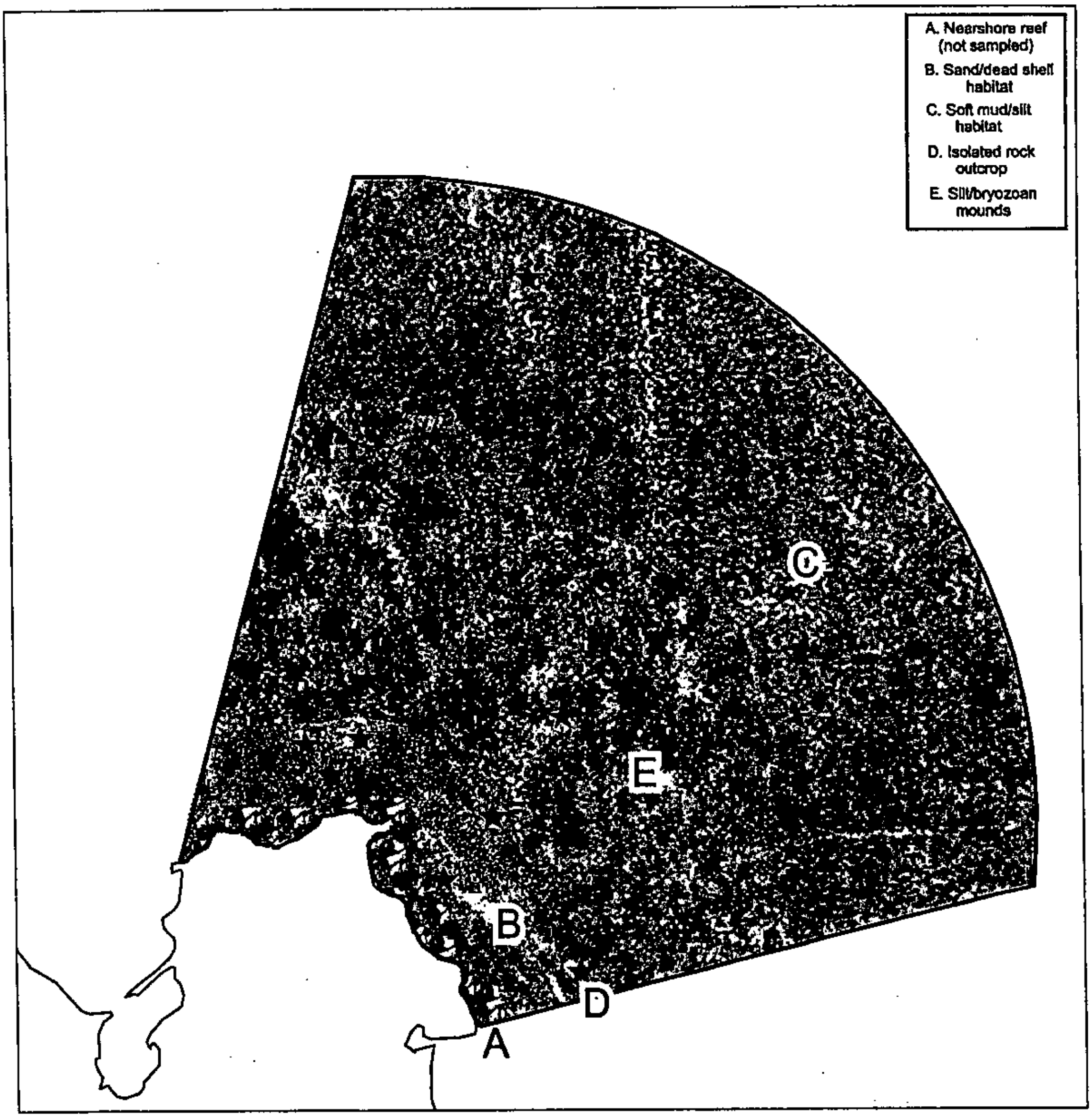

Figure 7: Habitat map, Separation Point protected area, based on side-scan mosaic and ROV stations. Examples of side-scan sonographs are used to represent the appearance of each habitat (except A).