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TASMAN COASTAL AND MARINE ENVIRONMENTS: HISTORICAL DATA

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Prepared for Tasman District Council

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EXECUTIVE SUMMARY

Tasman District Council (TDC) and Nelson City Council (NCC) are currently reviewing their regional coastal plans (RCPs). As part of this process, the councils are required to review the provisions that protect sites of significant indigenous biodiversity within the coastal environment. To support the RCP reviews and to give effect to Policy 11 and other policies in the New Zealand Coastal Policy Statement 2010 (NZCPS; Department of Conservation 2010), NCC and TDC want to gather information regarding the indigenous biodiversity values of the coastal environment and the effects of activities on those values, as well as develop a policy response for the RCPs. To this end, NCC and TDC have initiated a marine and coastal indigenous biodiversity project, with four stages (Stage 1: Literature and data review, Stage 2: Assessment, Stage 3: Management, and Stage 4: Maintenance).

Cawthron Institute (Cawthron) and three collaborators (Salt Ecology, National Institute of Water and Atmospheric Research [NIWA], and Davidson Environmental Ltd) were contracted to carry out Stage 1. This report is one of five (relating to seven topics) that represent the outputs from Stage 1:

- Bathymetry (Report 1)
- Hydrosystems (Report 1)
- Habitats (Report 2a)
- Indigenous biodiversity (Report 2a)
- Historical data (Report 2b, TDC only)
- Publicly available sites of significance to iwi (Report 3, TDC only)
- Effects of activities (Report 4, TDC only).

The current report considers historical indigenous biodiversity data for the Tasman Region. In summary, the scope was to collate historical information found during a literature and data search into a spatial data inventory as geographic information system (GIS) layers where available. The information was assessed (in general terms at this stage) against the criteria of Policy 14 of the NZCPS (‘Restoration of natural character’).

Key details for mapped data relating to historical indigenous biodiversity data for the Tasman Regions are presented. This includes data format, description and source reference. Where data were available for inclusion in a spatial data inventory, layer names are also provided.

Little historical data on marine habitats were recorded before the 1960s, with earlier information limited to newspaper reports. Shellfish and finfish fisheries surveys that followed provided evidence of diverse biogenic habitats, including shellfish (e.g. green-lipped mussels, dredge oysters, scallops), bryozoans (Tasman Bay ‘coral’), sponges and algal beds. These habitats were present in overlapping and widespread distributions across much of Golden Bay / Mohua and Tasman Bay / Te Tai-o-Aorere. The contributory cause of loss of some of those habitats was recorded in early fisheries articles and surveys.

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1. INTRODUCTION

1.1. Context

Tasman District Council (TDC) and Nelson City Council (NCC) are currently reviewing their regional coastal plans (RCPs). As part of this process, the councils are required to review the provisions that protect sites of significant indigenous biodiversity within the coastal environment.

To support the RCP reviews and to give effect to Policy 11 and other policies in the New Zealand Coastal Policy Statement 2010 (NZCPS; Department of Conservation 2010), NCC and TDC want to gather information regarding the indigenous biodiversity values of the coastal environment and the effects of activities on those values, as well as develop a policy response for the RCPs. To this end, NCC and TDC have initiated a marine and coastal indigenous biodiversity project, with the following four stages.

Stage 1: Literature and data review – collate existing marine and coastal indigenous biodiversity information, including spatial data; categorise the existing literature and data against the requirements of Policy 11 (NZCPS); and prepare reports based on the gathered data. The scope of the project includes assessing the quality of the literature and data and identifying any gaps in information. As part of the review, some information relevant only to TDC is reported and mapped for use in separate NZCPS work streams.

Stage 2: Assessment – determine the assessment criteria to identify sites of significance and assess the sites against these criteria, with the assistance of an expert panel and an iwi working group established by NCC and TDC. Field investigations may be required as part of this stage.

Stage 3: Management – determine locations for management, activities significantly affecting the sites of significance, and methods of protection.

Stage 4: Maintenance – add and assess new information as it becomes available. The project will continue and evolve beyond Stages 1–3.

Cawthron Institute (Cawthron) and three collaborators (Salt Ecology, National Institute of Water and Atmospheric Research [NIWA], and Davidson Environmental Ltd) were contracted to carry out Stage 1. This report is one of five that represent the outputs from Stage 1. We understand that Stages 2, 3 and 4 will follow on from this.

1.2. Stage 1 reports

The Stage 1 literature and data review is organised into seven topics and the results are presented in five reports:

- Bathymetry (Report 1)
- Hydrosystems (Report 1)
- Habitats (Report 2a)
- Indigenous biodiversity (Report 2a)
- Historical data (Report 2b; TDC only)
- Publicly available sites of significance to iwi (Report 3; TDC only)
- Effects of activities (Report 4, TDC only).

Key reference information for data sources, reports and publications is provided in each of the above reports.

1.3. This report and its associated spatial layers

This report, 2b in the series, considers the topic of historical indigenous biodiversity data. The report reviews information on the distribution and composition of habitats and biodiversity, such as bryozoan beds and mussel reefs, that historically occurred within the Tasman District Council (TDC) coastal region but are no longer present. The data included are considered important but of sufficient age that their validity cannot be relied on. Where available, geographic information system (GIS) layers on the historical distribution and composition of habitats and biodiversity have been collated into a spatial data inventory and provided as an output of the overall project (Appendix 1). Key reference information for data is provided in the Data sources section (Section 2) and References section (Section 5).

Historical information on where species and habitats used to occur can support the identification of potential restoration sites. The information is assessed (in general terms at this stage) against the criteria of Policy 14 of the NZCPS (‘Restoration of natural character’).

2. DATA SOURCES

Data sources are provided in the text below. Data available for mapping are tabulated in white (i.e. no coloured background), and were obtained and collated into the spatial data inventory (Appendix 1). Data unavailable for mapping that could not be obtained in a spatial or digitised format are tabulated in grey, and restricted access data are in orange. In some cases, where very little information was known, unavailable data were just referenced in the report text rather than tabulated.

2.1. Shellfish beds

Loss of large bivalve species can have catastrophic impacts on ecosystem function and environmental health (Handley and Brown 2012; Anderson et al. 2019). The greatest ecological change in Golden Bay / Mohua (hereafter Golden Bay) and Tasman Bay / Te Tai-o-Aorere (hereafter Tasman Bay) since the 1960s is thought to have been the removal of filter-feeding animals such as green-lipped mussels (*Perna canaliculus*), dredge oysters (*Ostrea chilensis*) and scallops (*Pecten novaezelandiae*), as well as other invertebrates (Michael et al. 2015). This removal has greatly reduced filtration capacity, the ability to remove sediment and phytoplankton (and thereby nutrients) from the water of the bays. The functions shellfish provide increase water clarity to allow light to reach the seabed, and they also transfer nutrients to the seafloor, which enhance the growth of plants (e.g. microalgal diatoms, red algae and seagrass) and support healthy biogeochemical processes. These and other benthic animals change the structure of sediments by providing rugosity, shell and carbonate, thereby decreasing the likelihood of fine sediment being resuspended by tidal currents (Handley et al. 2014, 2020).

Some of the earliest benthic surveys in Tasman Bay were designed to assess scallop biomass during the 1960s (Choat 1960; Tunbridge 1962a; Table 3). Scallop abundance began to decline following the start of commercial fishing in the 1960s (Tunbridge 1968, Table 5), although shellfish, including mussels and oysters, had been exploited since the 1800s (Handley and Brown 2012). Early surveys depict overlapping species distributions (scallops; green-lipped mussels; dredge oysters; horse mussels, *Atrina zelandica*) (Tunbridge 1962b, 1968; Choat and Ayling 1987) (Figures 2–5, Table 4). Historical distribution of oysters and larval densities in the water column of Golden and Tasman Bays is shown in Figure 1 and Table 2 (Cranfield and Michael 1989). Interpolations of catch rates from pre-fishing stock assessment surveys between 1994 and 2012 are shown in Figure 2 and Table 1 (Handley et al. 2018).

Table 1. Key details for data (unavailable for mapping in our study) relating to data-driven bioregionalisation to underpin shellfish fisheries restoration (2018). Included are data source and format, description and relevance to Policy 14.

Data source and format	Handley SJ, Dunn A, Hadfield M. 2018. A data driven bioregionalization to underpin shellfish fisheries restoration, Nelson Bays, New Zealand. New Zealand Aquatic Environment and Biodiversity Report 205. Wellington: Fisheries New Zealand. See figure 2 'Krig interpolations of historic biomass estimates collected between 1994 and 2012: A, scallops, B, dredge oysters, and C, green lipped mussels. The data are: commercially sensitive, Krig interpolations in GIS, high quality.
Data description	Data-driven bioregionalisation to underpin shellfish fisheries restoration.
Relevance to NZCPS	Policy 14(a)–(c).

Table 2. Key details for data (unavailable for mapping in our study) relating to larvae of the incubatory oyster *Tiostrea chilensis* (Bivalvia: Ostreidae) in the plankton of central and southern New Zealand. Included are data source and format, description and relevance to Policy 14.

Data source and format	Cranfield H, Michael K. 1989. Larvae of the incubatory oyster *Tiostrea chilensis* (Bivalvia: Ostreidae) in the plankton of central and southern New Zealand. New Zealand Journal of Marine and Freshwater Research. 23(1):51–60. Early map of oyster and larval distributions (Figure 1).
Data description	Data relating to larvae of the incubatory oyster *Tiostrea chilensis* (Bivalvia: Ostreidae) in the plankton of central and southern New Zealand.
Relevance to NZCPS	Now rare, habitat-forming species, cultural / commercial significance Policy 14(a)–(c).

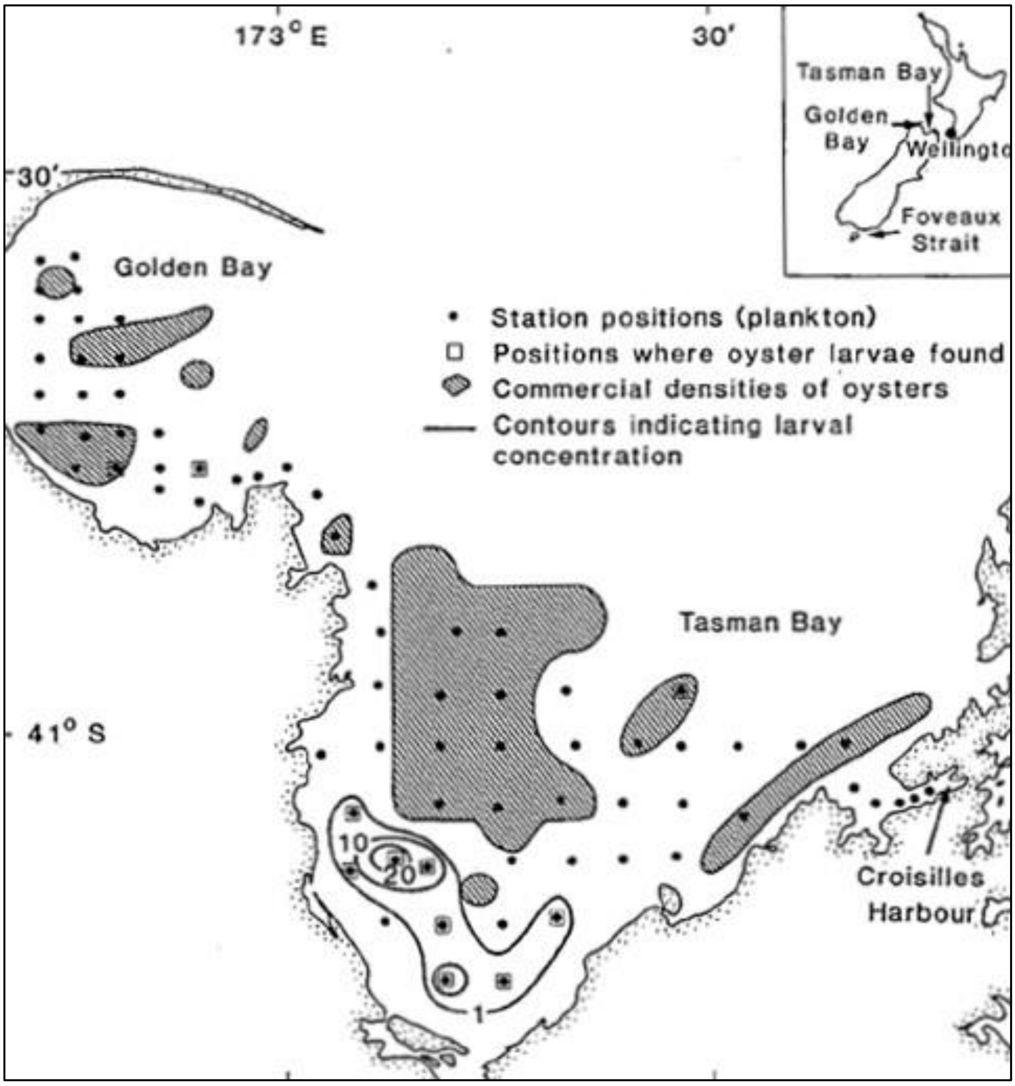


Figure 1. Detailed map of Tasman and Golden Bays showing plankton-sampling stations, stations at which planktonic *Tiostrea chilensis* larvae were caught, contours indicating patches of larval concentrations, and the distribution of commercial beds of oysters. Source: Cranfield and Michael (1989).

Table 3. Key details for data (unavailable for mapping in our study) relating to scallop investigation, Tasman Bay, 1959–60. Included are data source and format, description and relevance to Policy 14.

Data source and format	Choat JH. 1960. Scallop investigation, Tasman Bay 1959–60. Fisheries Technical Report 2. Wellington: Ministry of Agriculture and Fisheries Undigitised map (georeferenced in ArcGIS) (Figure 2).
Data description	Scallop investigation, Tasman Bay 1959–60.
Relevance to NZCPS	Now rare, habitat-forming species, cultural / commercial significance. Potential for restoration. Policy 14(a)–(c).

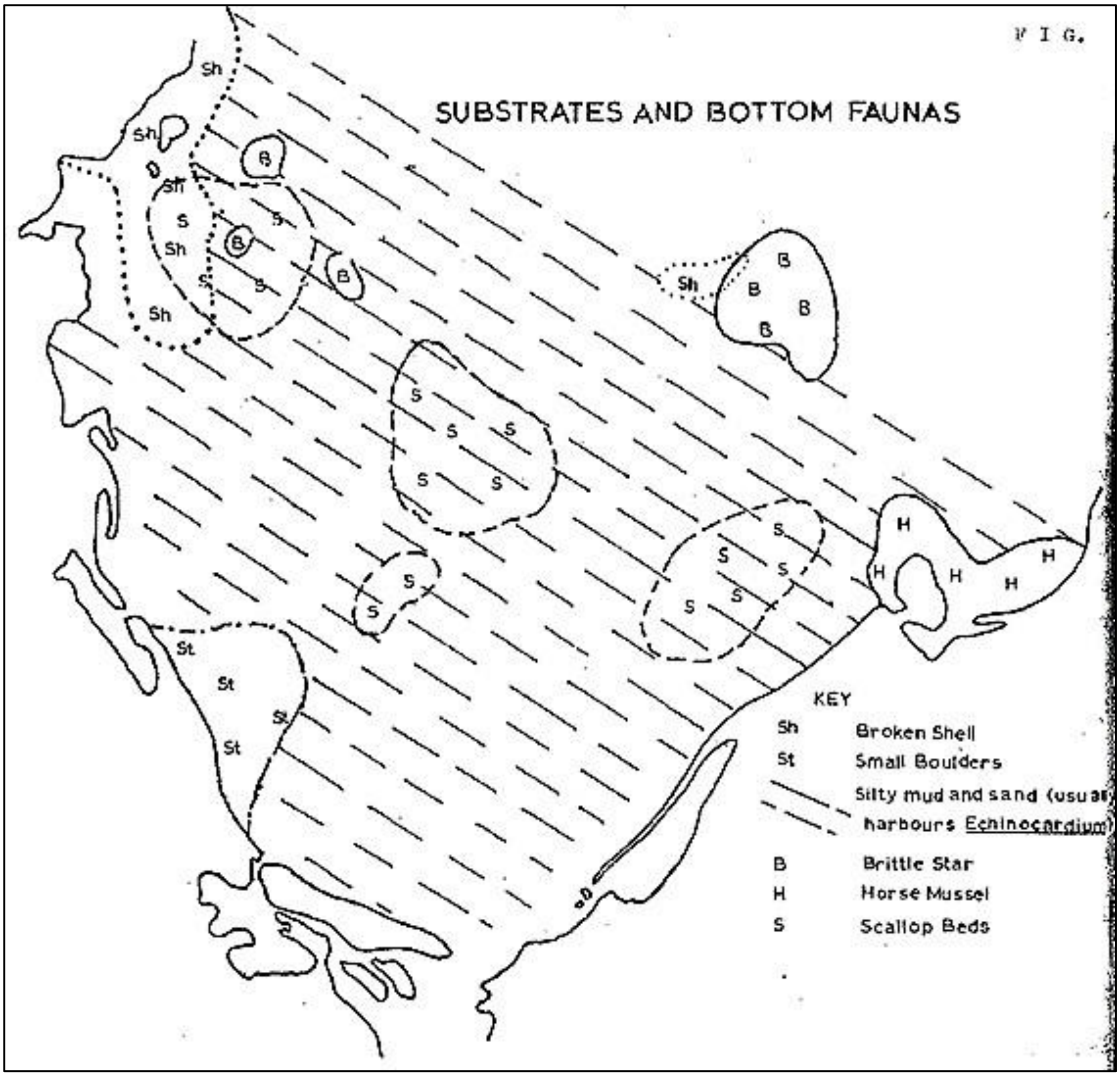


Figure 2. Invertebrates and bottom faunas of Tasman Bay. Source: Choat (1960).

Table 4. Key details for data (unavailable for mapping in our study) relating to occurrence and distribution of the dredge oyster (*Ostrea sinuata*) in Tasman and Golden Bays. Included are data source and format, description and relevance to Policy 14.

Data source and format	Tunbridge BR. 1962b. Occurrence and distribution of the dredge oyster (*Ostrea sinuata*) in Tasman and Golden Bays. Fisheries Technical Report 6. Wellington: Ministry of Agriculture and Fisheries. Undigitised map (georeferenced in ArcGIS) (Figure 3).
Data description	Occurrence and distribution of the dredge oyster (*Ostrea sinuata*) in Tasman and Golden Bays.
Relevance to NZCPS	Now rare, habitat-forming species, cultural / commercial significance. Potential for restoration. Policy 14(a)–(c).

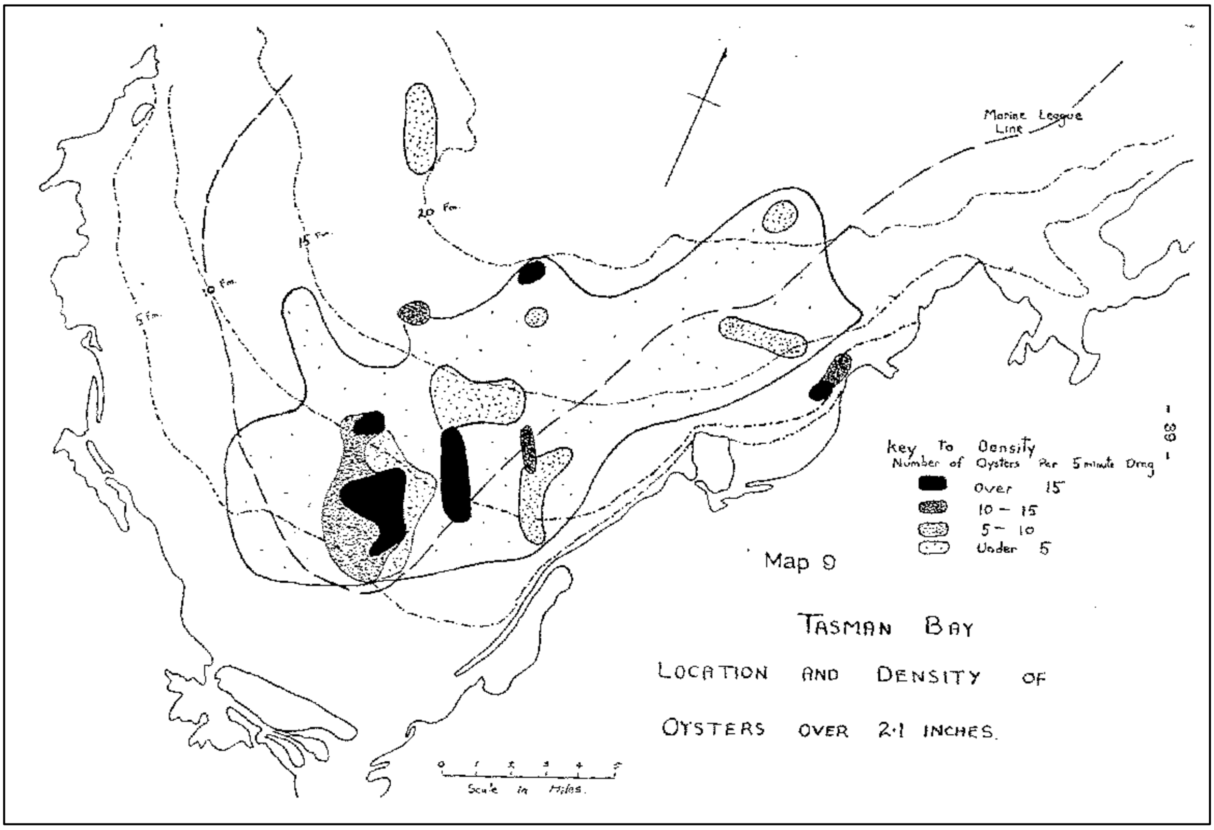


Figure 3. Tasman Bay oyster densities. Source: Tunbridge (1962a).

Table 5. Key details for data (unavailable for mapping in our study) relating to the Tasman Bay scallop fishery. Included are data source and format, description and relevance to Policy 14.

Data source and format	Tunbridge BR. 1968. The Tasman Bay scallop fishery. Fisheries Technical Report 18. Wellington: Ministry of Agriculture and Fisheries. Undigitised map (georeferenced in ArcGIS). Figures 4 and 5.
Data description	The Tasman Bay scallop fishery. Location of commercial shellfish beds, survey towers, and shellfish beds in Tasman Bay, March 1995.
Relevance to NZCPS	Now rare, habitat-forming species, cultural / commercial significance Potential for restoration. Policy 14(a)–(c).

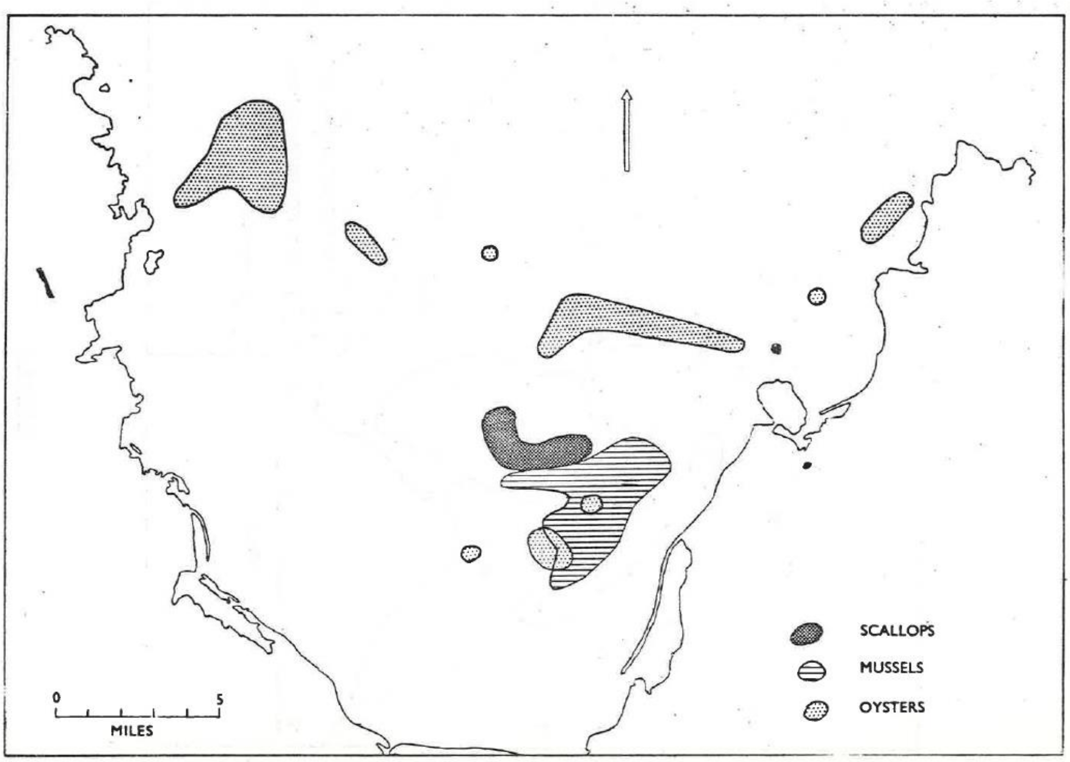


Figure 4. Location of commercial shellfish beds in Tasman Bay, March 1995. Source: Tunbridge (1968).

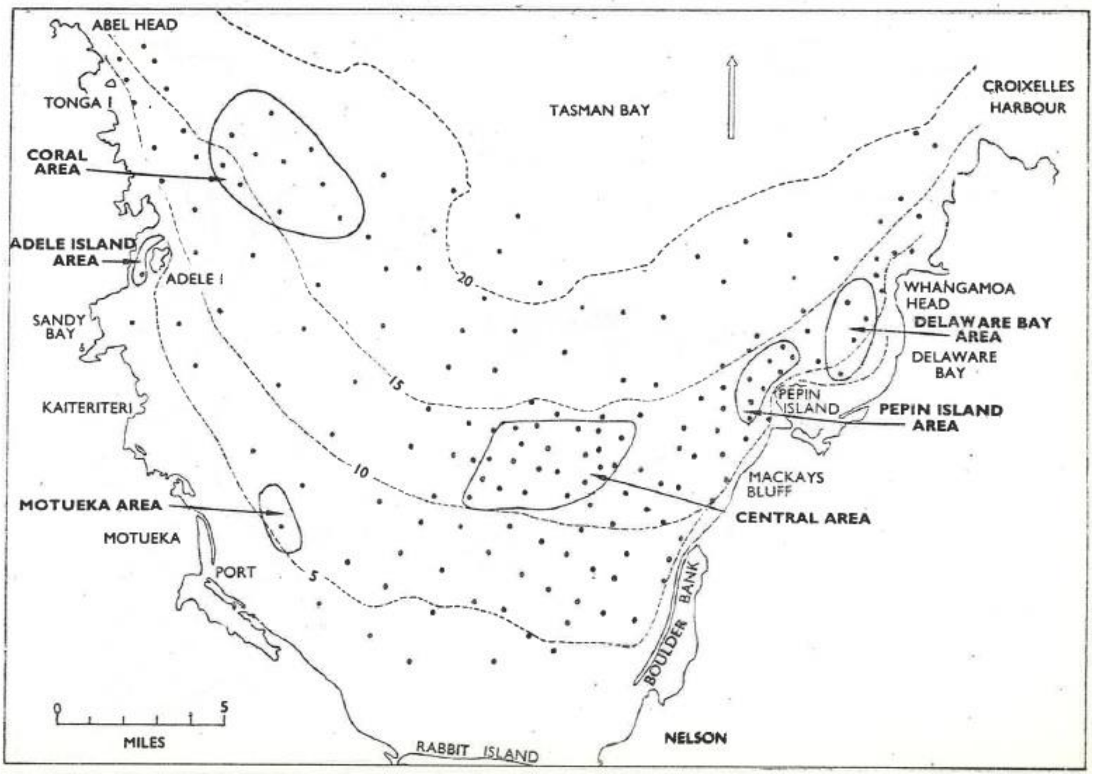


Figure 5. Location of survey tows and shellfish beds in Tasman Bay. Source: Tunbridge (1968).

2.2. Biogenic habitats

Biogenic (or living) habitats are 'habitats created or brought about by living organisms (i.e. trees, coral reefs, kelp forests, etc.) that support other animals, plants and organisms' (*Oxford English Dictionary*) (Anderson et al. 2019) (Table 6). Early shellfish surveys also mapped the distribution of non-target habitat-forming species, including horse mussels and bryozoan or 'coral' beds (Figures 2, 5, 10). Data on biogenic habitats, including bryozoans and shellfish, have also been compiled for the Ministry for the Environment from national datasets and museum records (Anderson et al. 2019). Shellfish included are scallops, green-lipped mussels, horse mussels and dog cockles (*Tucetona laticostata*) (Figure 6).

Table 6. Key details for data relating to the Tasman Bay Horse mussels / *Atrina*; Other bivalves; Bryozoans. Included are data source and format, description and relevance to Policy 14. These data were available for mapping in our study and therefore included in the spatial data inventory (Appendix 1).

Layer names	BIVALVES_Atrina, BIVALVES_compilation, BRYOZOANS_Compliation
Data source and format	Anderson T, Morrison M, MacDiarmid A, Clark M, D'Archino R, Tracey D, Gordon D, Read G, Kettles H, Morrisey D. 2019. Review of New Zealand's key biogenic habitats. Wellington: National Institute of Water and Atmospheric Research. NIWA Client Report No. 2018139WN. Prepared for the Ministry for the Environment.
Data description	Data used in review of key biogenic habitats (Anderson et al. 2019). Compilation of data on habitat-forming species that support high diversity of associated species, including juveniles of commercially important fish. Highly vulnerable to disturbance, particularly bottom-contact fishing methods, which have eliminated this habitat in some parts of the region, and recovery likely to be on decadal scale. Georeferenced data from OBIS (http://www.iobis.org), Te Papa Natural History Collection, NIWA Invertebrate Collection, NIWA Vulnerable Marine Ecosystem dataset, bryozoan dataset for New Zealand compiled by Wood et al. (2013), bivalves from MPI trawl and scallop databases. Layers are sub-set for: a) *Atrina*, b) other bivalves and c) bryozoans. Note that many were submitted in the 1960s, but there are some more recent records.
Relevance to NZCPS	Now rare, habitat-forming species, cultural / commercial significance Potential for restoration. Policy 14(a)–(c).

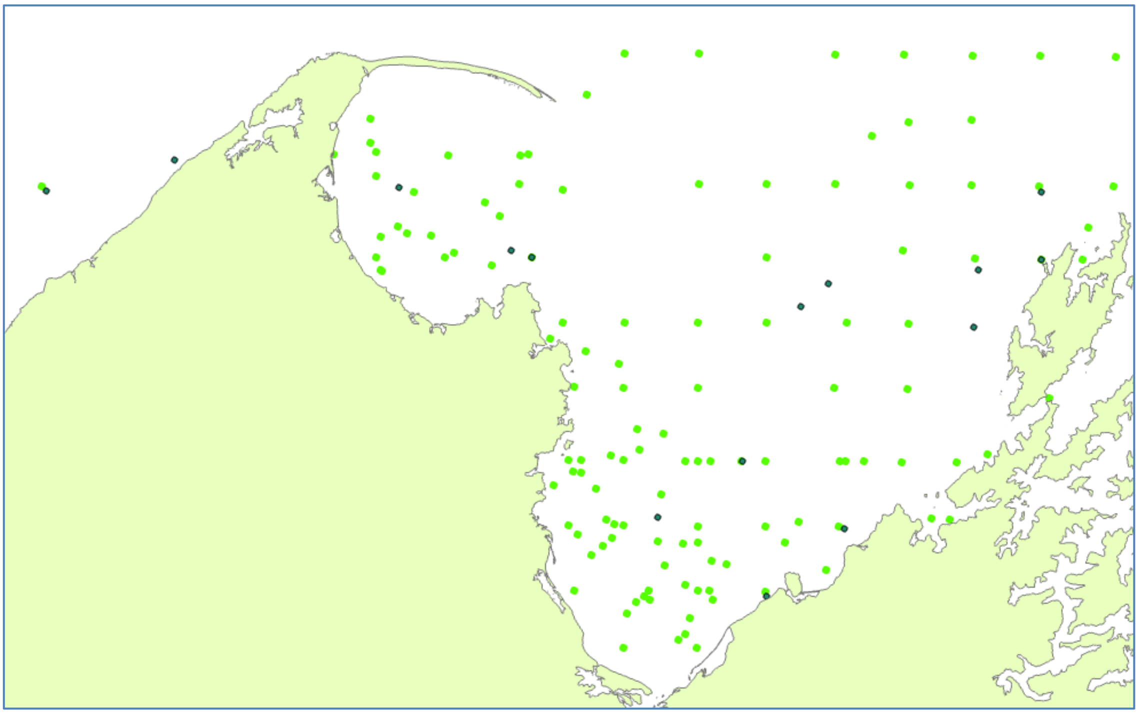


Figure 6. Historical shellfish (light green) and bryozoan (dark green) habitats captured in Anderson et al. (2019).

2.3. Bryozoans

Soon after commercial trawling began in 1946, it became known that large areas of the bottom of Golden and Tasman Bays comprised foul ground unsuitable for trawling as they were a hazard to the lightly constructed cotton trawl nets used in the early days of the fishery (Scientist warning… 1971; Saxton 1980a). Two of the main habitat-forming species in Tasman Bay were the robust bryozoan *Celleporaria agglutinans* and the more delicate 'paper coral' *Hippomenella vellicata*. *Celleporaria* became known as the Tasman Bay 'coral' as it formed large mound-like structures that emerged c. 0.5 m above the seabed (Figure 7). The Rākauroa / Torrent Bay (hereafter Torrent Bay) and Separation Point / Te Matau (hereafter Separation Point) beds were the densest (Figures 7–8, 10). The 'coral' beds were known nurseries for juvenile snapper (*Pagrus auratus*) and tarakihi (*Cheilodactylus macropterus*), among other species (Vooren 1975).

A study between 1963 and 1972 of tarakihi nursery grounds reported dense and varied epibenthic (emergent) invertebrate fauna dominated by sponges and small corals, mostly centred to the northwest and west of Separation Point (Vooren 1975) (Figure 9). Tasman Bay 'corals' were reported as a nursery as they contained an extremely rich benthic epifauna of sponges and small corals (e.g. Scientist warning… 1971; Figures 8–9). In the northeastern part of Tasman Bay, where a minor concentration of young tarakihi was found in 1970, a small area of 'coral' was also said to exist. The trawl net of the research vessel *James Cook* brought up large quantities of this material at most stations where young tarakihi were abundant, especially in the centre of the nursery ground. The young tarakihi in Tasman Bay are evidently closely associated with areas of a rich benthic epifauna of the type mentioned.

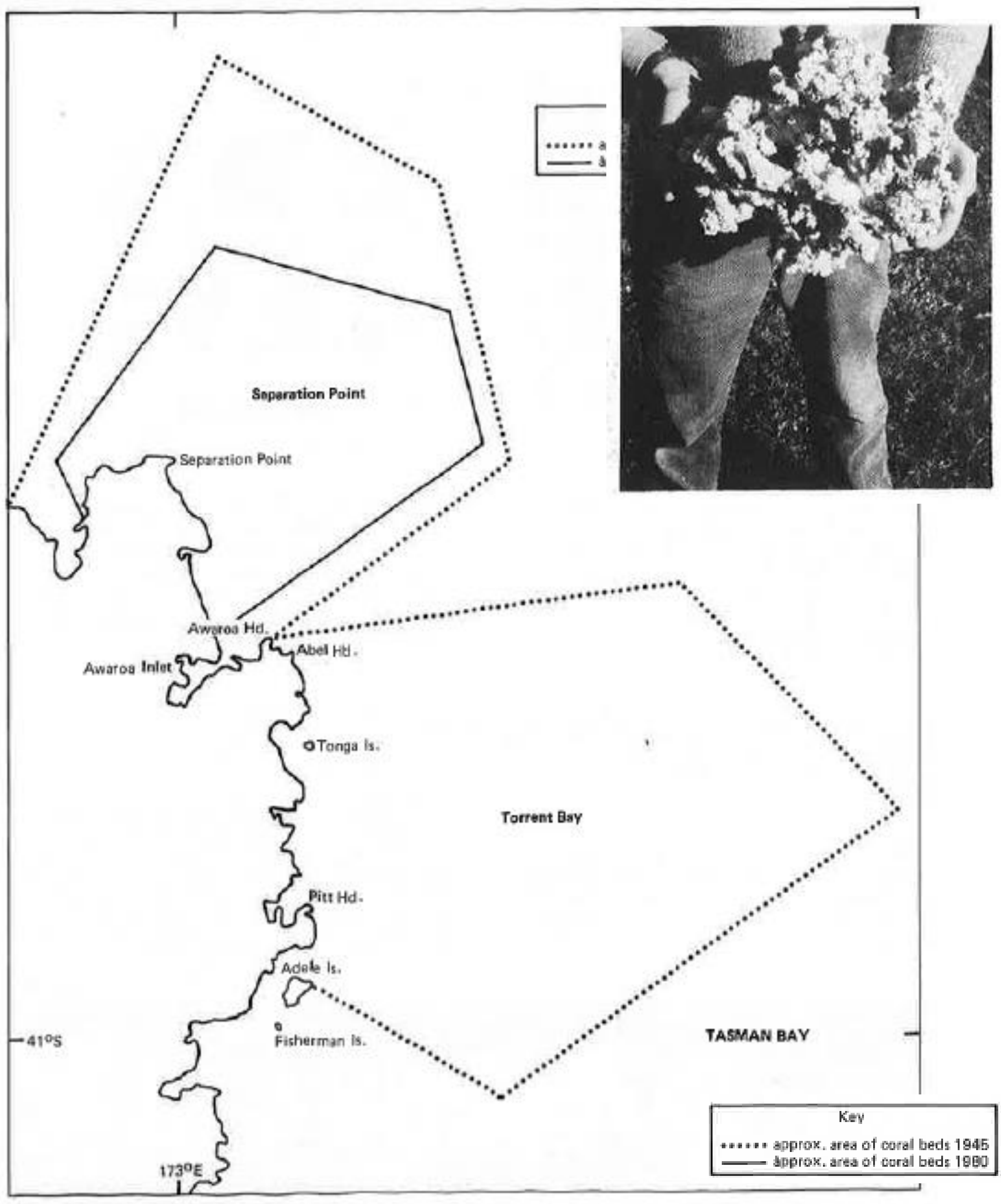


Figure 7. Historical extents of Tasman Bay ‘corals’ (bryozoans) in 1945 and 1980. Inset photo of a sample of the ‘coral’ from the beds in Tasman Bay. Source: Saxton (1980a).

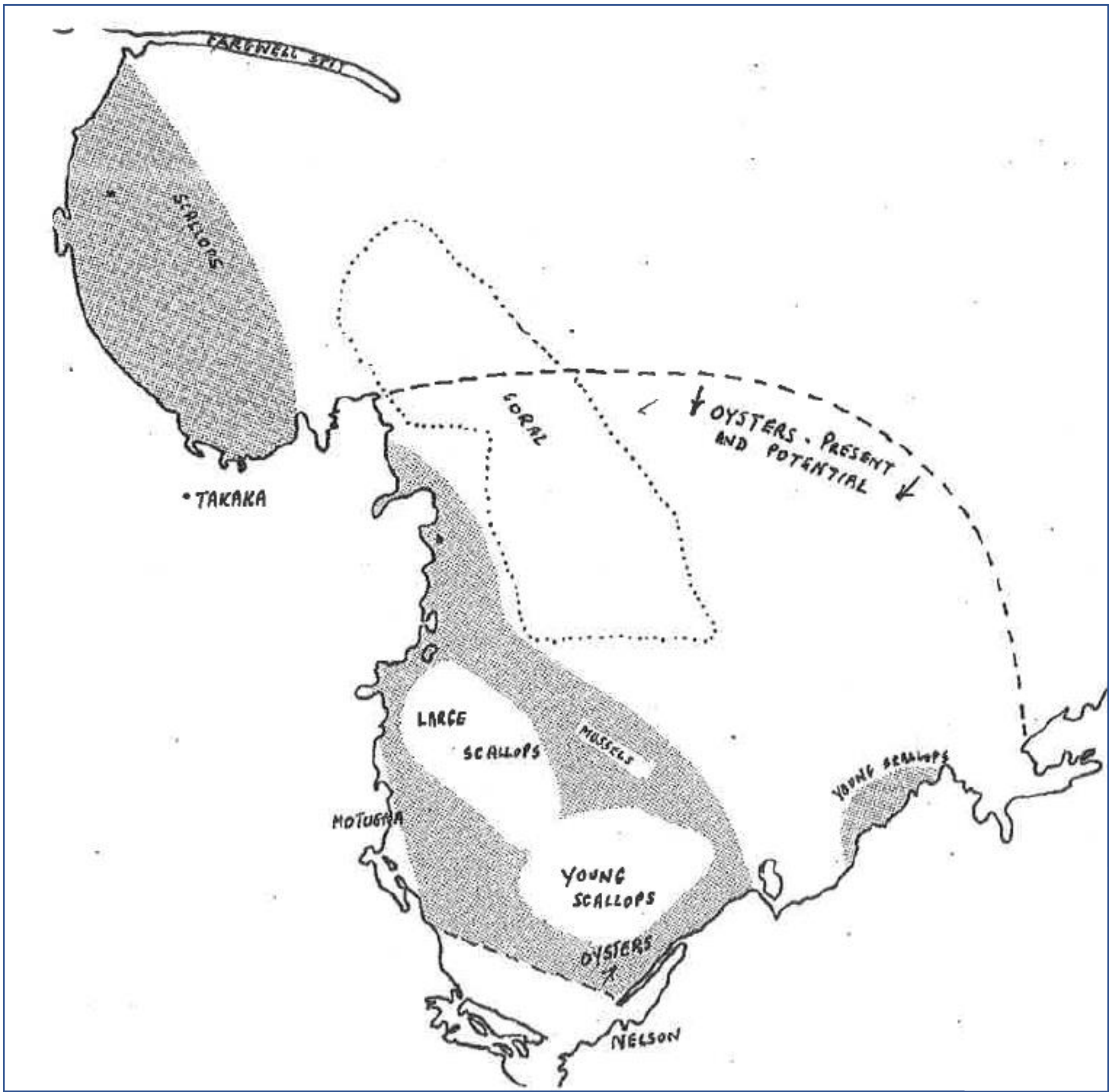


Figure 8. Historical distribution of shellfish beds and 'coral' in Tasman and Golden Bays, recorded from trawlers by Dr Struik in a report for the Nelson Catchment Board. Source: Scientist warning… (1971).

Except for a report on commercially important molluscs (Tunbridge 1962b), there are no contemporary publications on the benthic epifauna of Tasman Bay before or during the early trawl and dredge fisheries. In a 1970 study of nursery grounds of tarakihi, fish found in the Separation Point bryozoan beds included tarakihi, red gurnard (*Chelidonichthys kumu*), leatherjacket (*Meuschenia scaber*) and snapper. Snapper was the dominant fish species in terms of kilograms caught per hour of the 33 species recorded (see Vooren 1975, appendix 7) (Figure 9, Table 7).

> The catches of red cod (*Pseudophycis bachus*) and blue cod (*Parapercis colias*) consisted mainly of small specimens, and the scaly gurnard is a small fish, so that

these species, although common, contributed little to the volume of the catches on the nursery ground. The catches of the other 19 fish species were small both in numbers and in weight. The 1963 and 1970 surveys showed very similar patterns in the species composition of the wetfish catches. The pattern was similar in 1963, although snapper was then the dominant species on the nursery ground, due to the occurrence of an unusually strong year class represented at the time by small (20–25 cm) fish (LJ Paul, Fisheries Research Division, pers. comm.). The leatherjacket were much more abundant on the nursery ground than elsewhere and were clearly associated with the same 'coral' habitat as the young tarakihi.

Except for the differences in the abundance of tarakihi and leatherjacket, the fish faunas of the nursery ground and the remainder of Tasman Bay were similar: the two areas had 33 species in common. The dominant species outside the nursery ground was the red gurnard, followed by leatherjacket, snapper and scaly gurnard, while 23 other demersal species were caught in low numbers and small quantities. (Vooren 1975)

Table 7. Key details for data (unavailable for mapping in our study) relating to the Nelson Bays tarakihi nursery grounds. Included are data source and format, description and relevance to Policy 14.

Data source and format	Vooren CM. 1975. Nursery grounds of Tarakihi (Teleostei: Cheilodactylidae) around New Zealand. New Zealand Journal of Marine and Freshwater Research. 9(2):121–158.
Data description	Catch rates of tarakihi and other fishes from Tasman Bay trawl surveys in 1963 and 1970. The survey indicated nursery grounds associated with biogenic habitats including bryozoans.
Relevance to NZCPS	Now rare, habitat-forming species, cultural / commercial significance Potential for restoration. Policy 14(a)–(c).

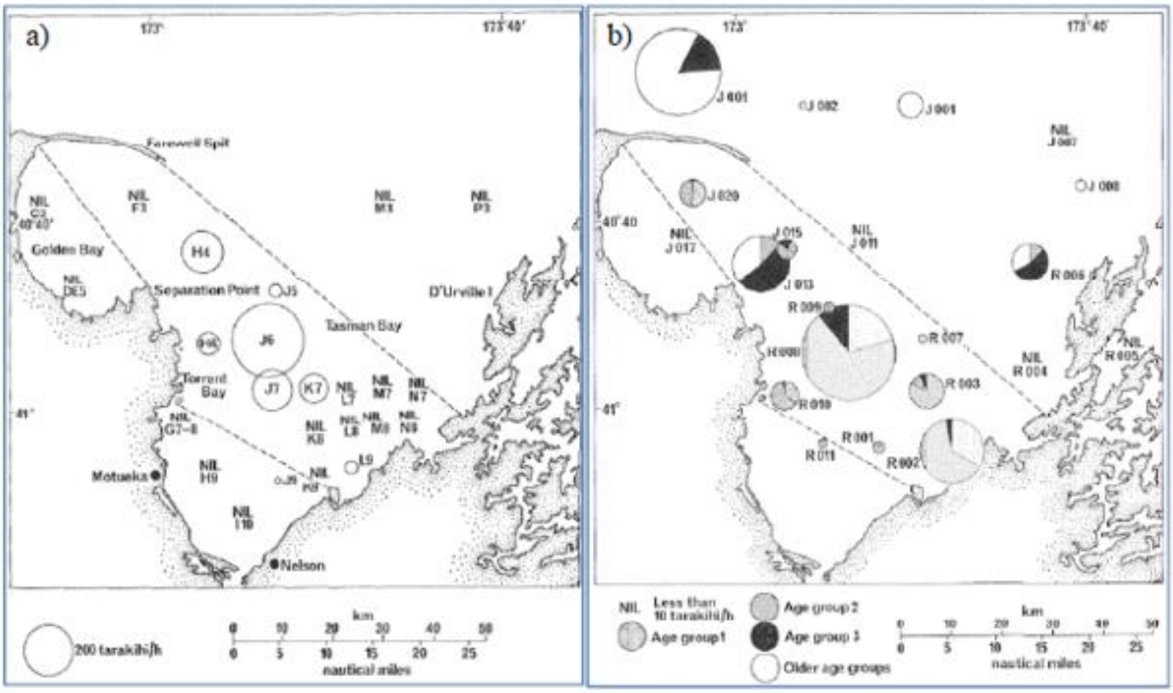


Figure 9. Catch rates of tarakihi from Tasman Bay trawl surveys in a) 1963, and b) 1970. The broken lines denote the estimated nursery area extent. Source: Vooren (1975).

Prior to 1956, the use of nets made of natural material (mostly cotton) provided some protection for the ‘coral’ beds until the development of synthetic trawl nets:

> New Zealand trawlers are mostly small (15–25 m overall length, 150–250 bhp) and use light trawl gear. They tend to avoid tarakihi nursery grounds, partly on account of the occurrence of much ‘coral’ and sponge there, and if they do fish these grounds, then the trawl gear is rigged so as to touch the bottom lightly in order to avoid gear damage and large catches of debris. Therefore, the New Zealand trawl fleet does no serious damage to the habitat of the young tarakihi at present. (Vooren 1975)

However, fishermen learnt to protect their nets with the use of cow hide under the cod-end, sledges and floats to keep the nets above the coral, or leading tickle chains to break up the coral and let it settle before the net passed over (Saxton 1980a).

> In the winter of 1977 trawling on this coral bed [Separation Point] became common with four boats consistently working the area. Huge bags of small unmarketable tarakihi and snapper were commonly taken and laboriously sorted through to find marketable-size fish; the rest were discarded overboard with little chance of survival. Often the nets would be seriously damaged, adding their toll to the profits of the operation. The ‘large bags of juvenile fish’ were sold for ‘about 4 cents a kilogram’ for rock lobster bait. (Saxton 1980a)

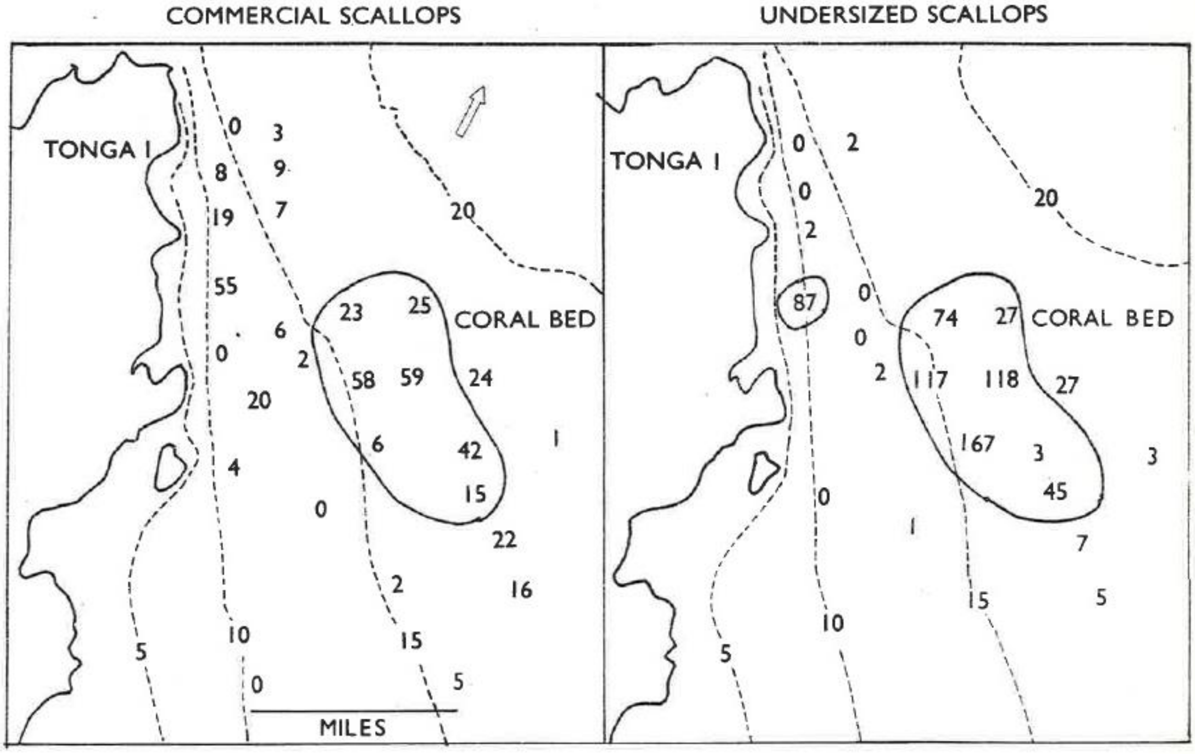


Figure 10. Coral area. Number of commercial and undersized scallops per survey tow – March 1965. Source: Tunbridge (1968, table 4).

The Torrent Bay beds (Figure 10, Table 4) were apparently dominated by the more fragile bryozoan *Hippomenella* and were broken up by trawling and dredging before 1974. According to Saxton (1980a), 'By the early 1960s however, the Torrent Bay coral was in an advanced state of decay after experiencing 15 years of trawling.' It also overlapped in distribution with known scallop beds in the area.

In December 1980, a 146 km^2 area of seabed from Separation Point was protected from commercial contact fishing methods to form the Separation Point Power Fishing Exclusion Zone (Figure 11). The primary rationale for creating the exclusion zone was to protect an area of habitat-forming bryozoans (*Celleporaria agglutinans* and *Hippomenella vellicata*), perceived to be important recruitment habitat for fishes (Mace 1981; Bradstock and Gordon 1983).

By 2003 (23 years later), a survey of Separation Point observed that many bryozoan colonies were covered by a film of silt and growing only from the distal tips, suggesting sedimentation stress (Grange et al. 2003). It is highly likely that the historical fisheries functions (e.g. provision of habitat, refugia, associated mobile and sessile invertebrates as food) of Tasman Bay and Golden Bay bryozoan beds have declined heavily into the present day (Morrison et al. 2014a).

A survey within the Tonga Island Marine Reserve using the same methodology as Grange et al. (2003) identified only scattered, small bryozoan mounds, indicating that recovery has not occurred (Morrison et al. 2014a). Another bed off Rangitoto ki te Tonga / D'Urville Island (hereafter D'Urville Island) reported by Saxton (1980b) (Figure 11) and a single dredge station reported by Bradstock and Gordon (1983) was further surveyed by Jones et al. (2018), confirming 'a seafloor of dead shells (dog cockles, geoducks) and coarse sands, grading into cobbles' with sparse epifauna, including 'sponges, encrusting bryozoan *Celleporaria*, ophiuroids, starfish, and sea-cucumbers'.

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. However, small colonies of *Celleporaria* found attached to bivalve shells from sediment cores collected inside and outside the Separation Point Power Fishing Exclusion Zone (Handley et al. 2020) indicate that dead shells can provide habitat for colony formation.

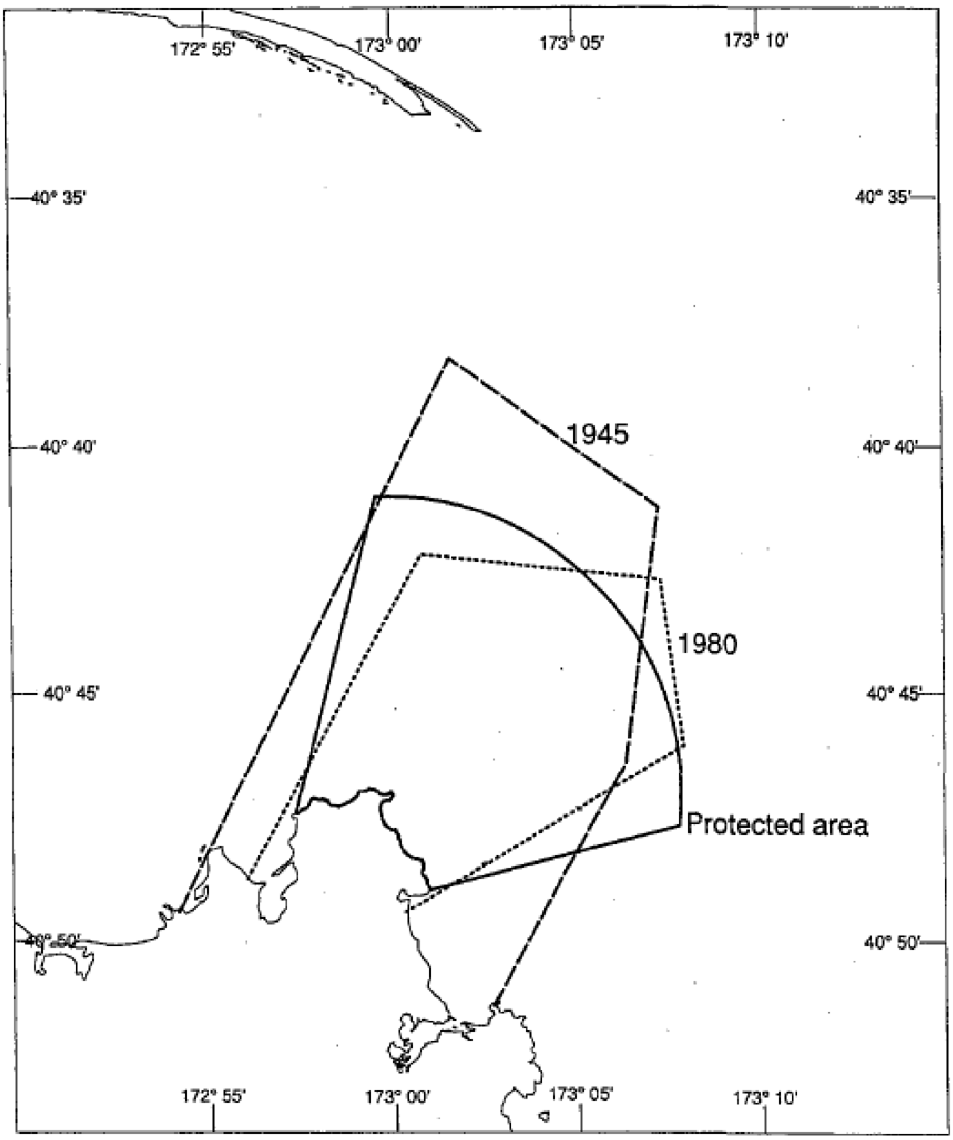


Figure 11. Separation Point, showing the historical extent of bryozoan beds in 1945 and 1980, as detailed by Saxton (1980b), along with the area protected in 1980 from power fishing methods. Source: Grange et al. (2003).

2.4. Rhodolith beds

Rhodoliths (known as maërl in Europe) are free-living, calcified red algae that may start growing around a fragment of shell or rock, or they can be composed entirely of coralline algae (Nelson 2009; Anderson et al. 2019). Rhodoliths have been recorded in high-current areas in Te Aumiti / French Pass, Admiralty Bay and the eastern side of D'Urville Island (Davidson et al. 2011); Tonga Island Marine Reserve in Tasman Bay (Davidson and Freeman 2013); and Ōkiwi Bay in Croisilles Harbour, Nelson (Figure 12, Table 8). As rhodoliths are not attached to the bottom, they can roll and move with waves and currents, and this movement results in their different shapes and forms (e.g. spheroidal, ellipsoidal, branching). The branching or rounded thalli collectively create a fragile, structured biogenic matrix over coarse or fine carbonate sediments.

Rhodolith beds have also been recorded by Davidson (1992) and Davidson et al. (2014, 2016, 2017). Given they relate to habitats and indigenous biodiversity, refer to that report for key details for the mapped data relating to layer name, data source and format, and description. The relevance to Policy 14 is (a)–(c).

Table 8. Key details for data relating to rhodolith beds. Included are data source and format, description and relevance to Policy 14. These data were available for mapping in our study and therefore included in the spatial data inventory (Appendix 1).

Layer name	RhodolithBed_NelsonBaysEcosystemsMap
Data source and format	Davidson RJ, Freeman D. 2013. Trial indicators for an ecological integrity assessment (EIA), Abel Tasman coast. Nelson: Davidson Environmental Ltd. Survey and Monitoring Report 772. Prepared for Department of Conservation, Wellington. Davidson RJ, Duffy CAJ, Gaze P, Baxter A, DuFresne S, Courtney S, Hamill P. 2011. Ecologically significant marine sites in Marlborough, New Zealand. Blenheim: Marlborough District Council. Coordinated by Davidson Environmental Limited for Marlborough District Council and Department of Conservation.
Data description	Rhodolith bed polygons extracted from the Nelson Bays Ecosystems Map. Abel Tasman polygons based on beds described by Davidson and Freeman (2013). Mapped with video sled, drop camera and diving. Areas of reef were excluded from Clark’s shapefile. D’Urville polygons based on description in Davidson et al. (2011). Descriptions provided by Rob Davidson: The Abel Tasman beds are the only rhodolith beds known from the coastal areas of Tasman and Golden Bays. The Onetahuti bed is the only one known to be located within a marine reserve in NZ. The Tōtaranui bed is probably the largest bed in the South Island. Part of the Tōtaranui bed is protected from commercial fishing within the Separation Point closed area but the whole bed is vulnerable to recreational fishing. Onetahuti (southwest of Tonga Island MR): 20 ha, high-density rhodolith bed. Offshore of Tōtaranui (Abel Tasman NP): 246 ha. Rhodolith beds around D’Urville Island (Coppermine and Ponganui bays), estimated total area 22 ha. Found at depths of 6 – 26 m and covered up to 100% of the silt and dead shells on the seafloor. Habitat with restricted distribution in the bays, vulnerable to modification and that may support relatively high biodiversity and productivity.
Relevance to NZCPS	Now rare, habitat-forming species, cultural / commercial significance Potential for restoration. Policy 14(a)–(c).

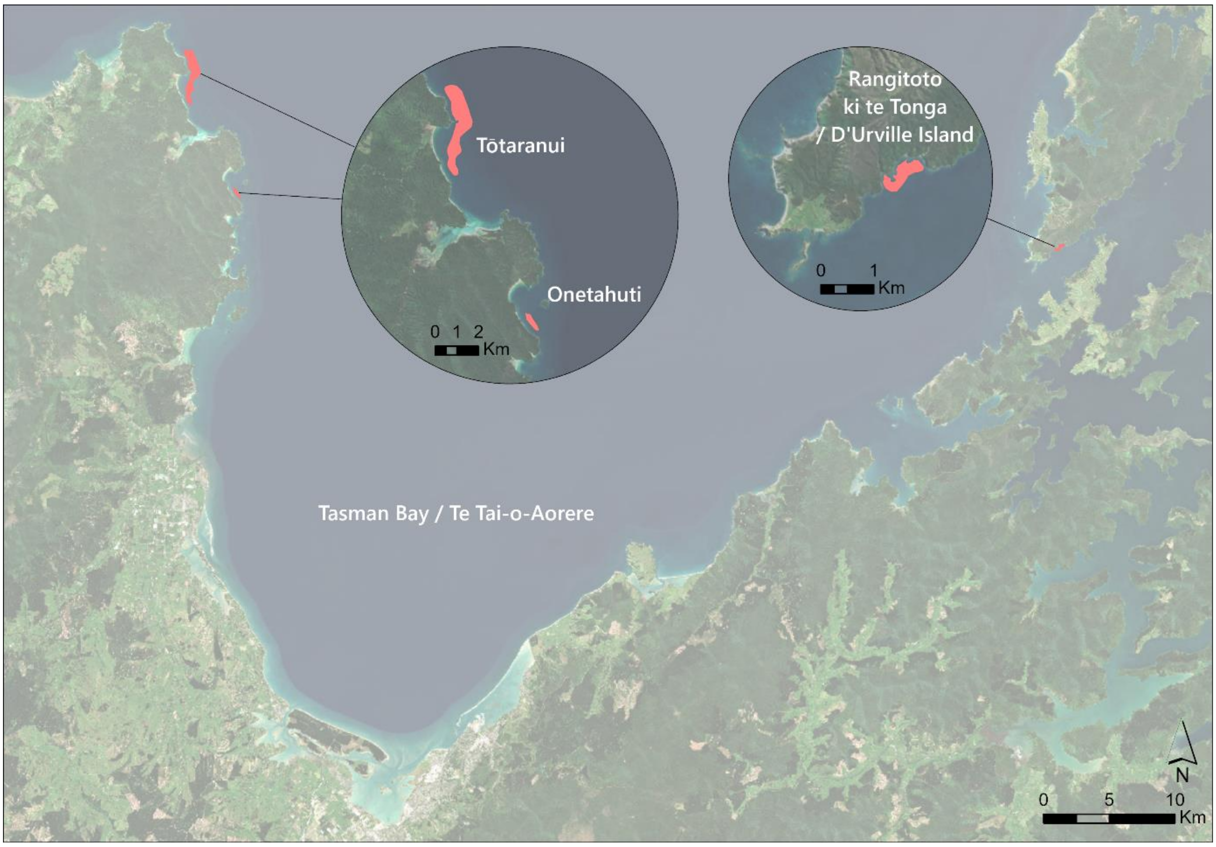


Figure 12. Remnant rhodolith beds. Data sourced from Davidson and Freeman (2013) and Davidson et al. (2011). Background aerial imagery is credited to the NZ Imagery map service (Eagle Technology, Land Information New Zealand).

2.5. Macroalgal beds

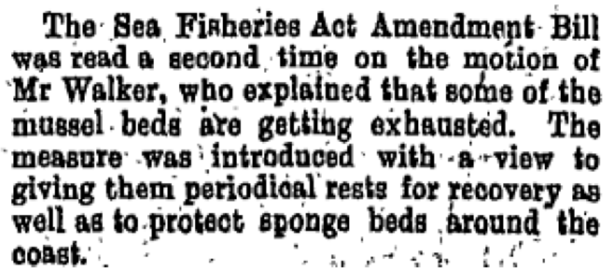
Red macroalgae were recorded from bycatch in the early shellfish dredge fisheries (Tunbridge 1962a, 1968), and may have provided settlement substrata in the early life stages of byssal-attaching bivalves, including scallops, horse mussels and green-lipped mussels (e.g. Bull 1976; Buchanan and Babcock 1997). Macroalgae also provide important habitat for juvenile fishes (Anderson 1995; Taylor 1998; Anderson et al. 2019).

2.6. Dead shell

Hewitt et al. (2005) sampled dead shell drifts in the Tonga Island Marine Reserve (Tasman Bay), finding significantly higher diversity than in adjacent bare substrates, and concluded that shell debris increased and maintained biodiversity. They emphasised the need to reduce disturbance regimes and actively manage seafloor habitats in areas previously largely ignored.

2.7. Sponge gardens

Sponge gardens have been a bycatch of benthic fisheries since early European colonisation (Figure 13).



The Sea Fisheries Act Amendment Bill was read a second time on the motion of Mr Walker, who explained that some of the mussel beds are getting exhausted. The measure was introduced with a view to giving them periodical rests for recovery as well as to protect sponge beds around the coast.

Figure 13. *Nelson Evening Mail*, 3 July 1896. Source: Handley and Brown (2012).

Sponges are often attached to hard substrata (e.g. shells, bryozoans, horse mussels, reef) but some species can live solely on soft sediment (Handley, pers. obs.). They provide important ecosystem services, including filtration, forming biogenic habitats and refugia due to their emergent, massive and complex structures (Morrison et al. 2014b; Jones et al. 2018; Anderson et al. 2019). Little has been reported on the extent of historical sponge beds, although there is information of sponges recorded as bycatch from shellfish fisheries and biomass surveys.

3. APPENDICES

Appendix 1. Tasman and Nelson coastal marine environments: spatial data inventory

Spatial data layers for the overall project (including those relevant to historical data) are supplied as part of an ArcGIS Pro project package (spatial data inventory, TasmanNelsonCoastalEnvironment_SpatialData.ppkx).

Datasets available in spatial format (shapefiles, file geodatabase feature classes, rasters) were imported to an ArcGIS Pro (version 3.0.1) project (.apr) and presented in the Habitats and biodiversity map. In the map's contents panel (shown in Figure A.1), group layers and sub-groups can be expanded to view and turn on or off individual data layers. Key details for mapped data are outlined in Tables 6 and 8 in the report text and are appended to data layers as metadata, accessible through layer properties. These include group and individual layer names (as they appear in the spatial data inventory), data format, details, description and source reference.

Data layers collated for the other reports in this overall project are also included in the spatial data inventory and are presented in a series maps associated with each report (Berthelsen et al. 2023a, 2023b, 2023c; Handley et al. 2023). The ArcGIS Pro project was packaged to form the project package (TasmanNelsonCoastalEnvironment_SpatialData.ppkx) and its associated geodatabases, which include all the data layers.

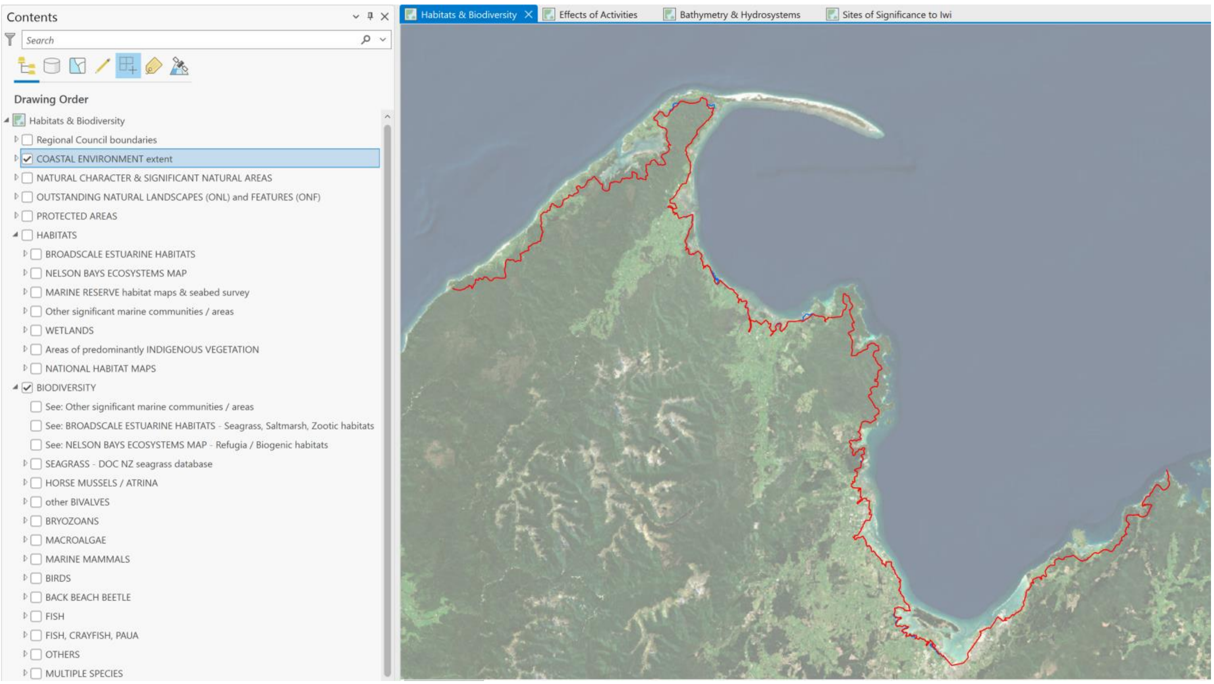


Figure A.1. Screenshot of our ArcGIS Pro project package demonstrating the layout to package users.

4. ACKNOWLEDGEMENTS

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