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ABSTRACT

Adkins, B. E., A. P. Stefanson. 1979. North Coast abalone survey in harvested areas, November 1978. Fish. Mar. Serv. MS Rep. 1500: 15 p.

A survey was made of abalone populations in 13 sites in the Banks Island area, where harvesting had occurred in 1977 and 1978. The standard methods described in Breen and Adkins (1979) were used. Size frequencies, density measurements and site descriptions are presented.

Key words: Abalone, Haliotis, population structure, algal communities.

RÉSUMÉ

Adkins, B. E., A. P. Stefanson. 1979. North Coast abalone survey in harvested areas, November 1978. Fish. Mar. Serv. MS Rep. 1500: 15 p.

Nous avons fait un relevé des populations d'Ormeaux dans 13 stations des parages de l'île Banks, récoltés en 1977 et 1978. À cette fin, nous avons utilisé les méthodes normalisées décrites par Breen et Adkins (1979). Nous présentons des données portant sur la fréquence des tailles et la densité des populations ainsi qu'une description des stations.

Mots clés: Ormeau, Haliotis, structure de la population, communauté d'algues.

INTRODUCTION

The survey described in this report is one of a series conducted to estimate abalone abundance in harvested areas on the northern British Columbia coast. Previous surveys have been carried out on the east coast of Moresby Island, the west coast of Banks Island and the Estevan Group between 1976 and 1978 (Adkins and Stefanson 1977; Adkins 1978; Breen et al. 1978; and Breen and Adkins 1979). The areas examined have been those where harvesting has been most intense as shown in records provided by abalone fishermen.

The purpose of this survey was to measure the remaining abundance of abalone, using a standard method, so that it could be compared with other areas and so that past and future comparisons could be made. As well, we measured population size structure for use in estimating production of legal abalone.

In this survey we examined 13 sites from the south end of Lotbiniere Island in the Estevan Group, north along the west coast of Banks Island to Griffith Harbour. Some of these sites were examined in the spring of 1978 (Breen et al. 1978). These areas were very heavily harvested in both 1977 and 1978 where close to 230,000 lbs of abalone were taken each year.

The results of this survey and previous surveys will be presented in a later publication (Breen, in prep.).

METHODS

The fisheries patrol vessel SOOKE POST was used as a diving base during the period November 14-19, 1978. Three divers and a boat tender worked from a small inflatable boat. The methods used are described in full detail in Breen and Adkins (1979).

Abalone were counted in 16 1 m^2 quadrats arranged in four transects. The transects were placed 4 m apart, running parallel to each other (usually up and down the slope, if one was present). The transects comprised four quadrat measurements with the quadrats spaced 1 m apart. This covered an area measuring $7 \times 17 \text{ m}$ at each site. All abalone that could be seen without turning over rocks were counted in 16 1 m^2 quadrats at each site; and all the abalone seen were collected and measured.

At each site we described the algal communities; using visual identifications only. Some algae, e.g. Laminaria spp., were identified only to genus because visual identification to species was impossible. The term "lithothamnion" refers to all the pink encrusting algae we encountered. We noted slope, substrate type, sea urchin (Strongylocentrotus franciscanus unless otherwise noted) distribution and abundance, and other major invertebrates present at each site.

This was recorded on underwater paper during the dive, then transcribed onto a standard form (Breen and Adkins 1979) on the boat after the day's diving was completed.

RESULTS

A composite size frequency of abalone from all sites is shown in Fig. 1. Figs. 2 and 3 show the general location of the 13 sampling sites.

Following are descriptions of each sampling site. These include: mean density, variance, % legal and legal density of abalone for each population. The exact location of each site is given in degrees, minutes, and seconds of latitude and longitude; general locations are shown in parentheses. All depths are in metres below chart datum.

A brief fishing history is provided in a short summary at the end of each description.

STATION 1 52 59 40 N; 129 33 10 W

SOUTH END OF LOTBINIERE ISLAND (ESTEVAN GROUP)

The MEAN DENSITY was 4.86/m² (variance 12.11). Of the abalone collected from 16 quadrats, 60% were legal sized; the LEGAL DENSITY was 2.94/m².

The SUBSTRATE was small boulders and cobbles on top of coarse gravel. This formed an extensive shoal with almost no slope at a depth of about 2 m. A light CANOPY of Nereocystis leutkeana produced up to 10% cover in small patches over this area; a light (10%) understory of Laminaria sp., and Cymathere triplicata occurred beneath. The exposed rock surfaces were encrusted by a mixture of 80% pink lithothamnion and 20% red Hildenbrandia. SEA URCHINS were scattered among the kelps; we estimated their density to be less than 1/m². Green sea urchins (S. droebachiensis) were the major grazer in this area. They occurred at a density of approximately 20/m² and covered 100% of the substrate in some of the more dense patches. We also noted Tegula pulligo, Pycnopodia helianthoides and Solaster stimpsoni at this site.

COMMENTS - During 1977, only 4,000 lbs of abalone were recorded taken from the large bay at the south end of Lotbiniere Island. In 1978 about 40,000 lbs were recorded from the same area.

We found a high commercial density at this site. This density appeared to be fairly consistent over the large shoal-like area.

STATION 2 52 59 30 N; 129 33 12 W

SOUTH END OF LOTBINIERE ISLAND (ESTEVAN GROUP)

The MEAN DENSITY was $0.63/m^2$ (variance 0.78). Distribution appeared to be fairly even. Of the abalone we collected from 16 quadrats, 60% were legal sized; the LEGAL DENSITY was $0.36/m^2$. About 40% of the abalone collected were juveniles.

All our transects were placed in the kelp zone, at about datum. The SUBSTRATE was boulders, cobbles and pebbles on a level sand floor. ALGAE were: Nereocystis forming a light canopy which produced about 10% cover at the surface; a light (10% cover) understory of Laminaria sp.; and pink lithothamnion and red Hildenbrandia encrusting most of the exposed substrate. SEA URCHINS were present; we estimated their density to be less than $1/m^2$ under the kelp canopy. S. droebachiensis were also present at a similar density. We also noted Tegula pulligo here.

COMMENTS - For fishing history of this area see Station 1. We recorded only a low commercial density here; however, it appeared to increase somewhat as we swam out of the kelp zone into slightly deeper water.

STATION 3 52 59 54 N; 129 31 55 W

SHOAL ON THE WEST SIDE OF HICKEY ISLAND (ESTEVAN GROUP)

The MEAN DENSITY was $0.58/m^2$ (variance 0.81). Distribution was fairly even. Of the abalone collected from 12 quadrats, 86% were legal sized; the LEGAL DENSITY was $0.50/m^2$. We noted no juvenile abalone at this site.

All transects were placed at depths around 7 m.

The SUBSTRATE was solid bedrock sloping steeply to a level boulder, cobble and pebble floor at around 8 m. There was no CANOPY. Agarum cribrosum produced a 20% cover at this depth. Almost all of the exposed rock surfaces were covered with a mixture of pink lithothamnion and red Hildenbrandia. SEA URCHINS were present; we estimated their density to be around $3/m^2$. We also noted S. stimpsoni, Pychopodia and Dermasterias imbricata at this site.

COMMENTS - For fishing history in this area, see Station 1. We found a commercial density of abalone here. We swam a considerable distance along the west side of Hickey Island. The bottom was mainly bedrock patches on a predominantly sandy floor. Dense canopies of Nereocystis, arising from the bedrock, were visible on the surface. Abalone density was too low to measure in these areas.

The substrate gradually changed to boulders, cobbles, and pebbles as we swam into deeper water further to the north. Abalone appeared to be more abundant on this type of substrate.

STATION 4 53 21 07 N; 130 11 07 W

WRECK ISLANDS (BANKS ISLAND)

No collection was made here. We examined only a short distance along this shore. The SUBSTRATE was large rocky reefs with level sandy patches in between. The depth ranged from datum to 3 m. The ALGAE were dominated by Agarum cribrosum and Laminaria sp., which produced a 40% cover on the rocks to 3 m. There was a 10% turf of erect corallines and polysiphonious reds beneath these. All the exposed rock surfaces were covered with a mixture of pink lithothamnion and Hildenbrandia. A 30% cover of Zostera sp., occurred on the sandy patches.

We saw no SEA URCHINS at this site. Tunicates and sponges were present on some of the vertical rock walls.

COMMENTS - About 17,000 lbs of abalone were taken from the area around the Wreck Islands in 1978. We found this site to be unsuitable abalone habitat, probably because it was too sheltered.

STATION 5 53 21 18 N; 130 12 18 W

WRECK ISLANDS (BANKS ISLAND)

The MEAN DENSITY was 2.69/m² (variance 10.10). Distribution was highly patchy with small pockets of abalone located all along the shore of this area; mainly where Nereocystis was visible on the surface. Of the abalone collected, 30% were legal sized; the LEGAL DENSITY was 0.81/m². No juveniles were noted. Transects were made at depths between 1 m above datum and 1 m; however abalone were most abundant at the kelp-sea urchin interface on the cobble and boulder substrate near datum.

The SUBSTRATE was solid bedrock sloping at 15° to 1 m where cobbles and boulders began and the slope approached 0°. ALGAE were Nereocystis, producing a light (10%) canopy with a 10% understory of Laminaria sp., and Phyllospadix beneath. On the solid bedrock was a 50% turf of erect corallines and an 80% cover of lithothamnion and Hildenbrandia. These occurred to a depth of 1 m. Intertidally was a thick 60% cover of Alaria and Hedophyllum, indicating a fairly exposed habitat. SEA URCHINS began at 1 m above datum at a density of up to 10/m², but decreased in density with depth.

COMMENTS - In 1978, about 17,000 lbs of abalone were removed from the area including Survey Bay, Wreck Islands and Foul Bay.

We found a good commercial density of abalone at this site. The size of this population was quite small and appeared to be localized in a small (50 m) indentation in the shore, beneath a Nereocystis canopy. Pockets such as this dotted the shoreline in this area. We found no abundance of abalone in the areas between these pockets. Often abalone concentrations could be spotted from the small patches of Nereocystis visible on the surface along the shore.

STATION 6 53 21 24 N; 130 12 42 W

SHORE OPPOSITE WRECK ISLANDS (BANKS ISLAND)

The MEAN DENSITY was $5.07/m^2$ (variance 9.61). Of the abalone collected in 14 quadrats, 35% were legal size; the LEGAL DENSITY was $1.77/m^2$. Some juveniles were present on the surface of the larger cobbles and boulders. All the transects were made at 1 m on the cobble and boulder substrate beneath the Nereocystis canopy.

The SUBSTRATE was solid bedrock sloping at 20° to datum where cobbles and boulders began and the slope approached 0° . The CANOPY was a sparse (10%) cover of Nereocystis with a 10% understory of Laminaria sp. and Cymathere. Erect corallines formed a 10% turf on the solid substrate, and 100% of the rock surface was covered with a mixture of lithothamnion and Hildenbrandia. SEA URCHINS began at 2 m at a density of $5/m^2$.

COMMENTS - For fishing history in this area see Station 5.

This site contains a small concentration of abalone similar to that seen at Station 5 and at other locations along this shore. We observed a high commercial density here.

STATION 7 53 29 43 N; 130 27 12 W

ANTLE ISLANDS (KINGKOWN INLET)

The MEAN DENSITY was $2.19/m^2$ (variance 4.43). Of 53 abalone collected, 9.8% were legal sized for a LEGAL DENSITY of $0.31/m^2$. About 11% of the abalone were juveniles; all of these were on the exposed surface of the rocks. All the transects were placed at depths around 2 m.

The SUBSTRATE was a mixture of small boulders and cobbles on a mixture of pebbles and sand. The bottom sloped very gradually at about 5%. There was no CANOPY. Lithothamnion and Hildenbrandia were the only algae present; these covered all of the exposed substrate. SEA URCHINS were present at a density of about $2/m^2$. We noted Acmaea mitra, Pycnopodia and Diodora aspera at this site.

COMMENTS - During the 1977 and 1978 abalone fisheries, about 44,000 lbs of abalone were harvested from the mouth of Kingkown Inlet. We found only a moderate commercial density at this site.

STATION 8 52 29 50 N; 130 27 14 W

GOERING REEFS (KINGKOWN INLET)

The MEAN DENSITY was $2.31/m^2$ (variance 4.90). Abalone were most abundant near the kelp-sea urchin zone interface. Of the abalone collected, 70% were legal size; the LEGAL DENSITY was $1.61/m^2$. No juveniles were noted. All transects were placed near the bottom edge of the kelp zone at 1 m above datum.

The SUBSTRATE was a mixture of boulders and cobbles on a pebble floor which was almost level. A strong tidal current was present. A thick (40%) CANOPY of Nereocystis extended from the shore to 1 m above datum. An understory of 40% Laminaria sp., and 15% Phyllospadix occurred beneath. Beneath these was a 60% turf of erect corallines and a 5% cover of Codium setchellii on the rock surfaces. Hildenbrandia and lithothamnion covered all of the exposed substrate. SEA URCHINS began at 1 m above datum; we estimated the density to be about 20/m². We also noted the grazer Calliostoma ligatum at this site.

COMMENTS - For fishing history in this area, see Station 7. We found a high commercial density of abalone here.

STATION 9 53 30 18 N; 130 27 55 W

GOERING REEFS (KINGKOWN INLET)

The MEAN DENSITY was 2.81/m² (variance 6.00). Abalone were most abundant at the kelp-sea urchin zone interface. Of the abalone collected, 42% were legal sized for a LEGAL DENSITY of 1.17/m². We noted no juveniles at this site.

All transects were placed near the kelp-sea urchin zone interface at 1 m.

The SUBSTRATE was solid bedrock changing to boulders, cobbles, and pebbles along a 5° slope. A CANOPY of 30% Nereocystis and 10% Macrocystis integrifolia formed a 10 m wide band along the edge of the reef. Laminaria sp. produced a 20% cover in the understory. This was mixed with a 5% cover of Desmarestia sp., and Cymathera and 60% cover of Phyllospadix at lesser depths. Erect corallines produced a 50% turf on the rocks beneath the kelp canopy and about a 20% cover in the sea urchin zone. Almost all exposed substrate was covered with a mixture of pink lithothamnion and Hildenbrandia. SEA URCHINS were present, beginning at 1 m at a density of about 10/m². We also noted Tegula pulligo, Calliostoma ligatum, Dermasterias and Pycnopodia at this site.

COMMENTS - For fishing history in this area, see Station 7. We found a high commercial density of abalone here.

STATION 10 53 30 12 N; 130 27 29 W

GOERING REEFS (KINGKOWN INLET)

The MEAN DENSITY was 2.13/m² (variance 7.27). Of the abalone collected, 44% were legal size; the LEGAL DENSITY was 0.94/m². Only 9% of the abalone collected were juvenile. These were found mainly in crevices between the boulders and cobbles. All transects were placed beneath the canopy at 3 m.

The SUBSTRATE was boulders and cobbles on a level floor of pebbles and sand. There was a strong tidal current present here. We noted a 10% CANOPY of Nereocystis with no understory beneath. There was a light turf of 10% ulvoids and 5% erect corallines on the larger rocks. A mixture of pink lithothamnion and Hildenbrandia covered almost all the exposed

substrate. SEA URCHINS were present but distribution was highly patchy; they occurred mainly on the larger rocks. We estimated their density to be less than $5/m^2$ over all. We also noted Parastichopus californicus and Pycnopodia at this site.

COMMENTS - For fishing history in this area, see Station 7. We found a good commercial density of abalone at this site.

STATION 11 53 35 03 N; 130 32 48 W

GRIFFITH HARBOUR (BANKS ISLAND)

The MEAN DENSITY was $1.50/m^2$ (variance 3.20). Of the abalone collected, 58% were legal sized; the LEGAL DENSITY was $0.87/m^2$. No juveniles were noted at this site.

The SUBSTRATE was solid bedrock sloping steeply to 2 m where cobbles and boulders began. At this depth the slope became more gradual approaching 0° at 4 m where the cobbles and boulders gave way to sand. A CANOPY of Nereocystis produced a 20% cover to 1 m above datum; a 10% cover of Alaria occurred beneath. Agarum cribrosum began at 1 m and extended down to the lower edge of the cobble and boulder floor at 4m. SEA URCHINS began at 1 m above datum; their density was $3/m^2$.

All the transects were placed between the bottom edge of the kelp zone at 1 m above datum and 4 m where abalone appeared to be most abundant.

COMMENTS - In 1977 16,000 lbs of abalone were removed from Griffith Harbour. Only 2,000 lbs were recorded taken from this area in 1978. We found a high commercial density of abalone at this site.

STATION 12 53 35 54 N; 130 33 48 W

GRIFFITH HARBOUR (BANKS ISLAND)

The MEAN DENSITY was $0.88/m^2$ (variance 2.38). About 59% of the abalone collected were legal sized; the LEGAL DENSITY was $0.52/m^2$. We noted no juveniles at this site.

The SUBSTRATE was solid bedrock sloping steeply to a level cobble and boulder floor at 1.5 m. A light GANOPY of Nereocystis produced a 10% cover to 1.5 m above datum. Laminaria sp., and Alaria sp., produced up to 20% cover in the understory beneath. There was a light (2%) turf of ulvoides on the cobble and boulder floor and all the exposed rock was encrusted with pink lithothamnion and Hildenbrandia. SEA URCHINS began at 1.5 m above datum at a density of about $5/m^2$. We also noted Acmaea mitra, Tonicella lineata and Solaster stimpsoni at this site.

All the transects were placed below the kelp canopy on the cobble and boulder floor at 2 m.

COMMENTS - For fishing history in this area, see Station 11. We found a good commercial density of abalone at this site.

STATION 13 53 36 00 N; 130 36 00 W

GRIFFITH HARBOUR (BANKS ISLAND)

The MEAN DENSITY was $2.06/m^2$; distribution was highly patchy (variance 17.53). Of the abalone collected, 59% were legal sized; the LEGAL DENSITY was $1.21/m^2$. Only 6% were juveniles. All the abalone were collected from depths between +1 m and datum, beneath the kelp canopy.

The SUBSTRATE was solid bedrock sloping at about 5° . Cobbles and boulders began near datum and continued down to a sand floor at 3 m. A canopy of Nereocystis produced a 10% cover to +1 m; Laminaria sp., and Gymathere produced up to 15% cover in the understory beneath. Patches of Zostera sp., occurred throughout the area. We noted a dense turf of erect corallines on the solid substrate. All the exposed rock was encrusted with lithothamnion and Hildenbrandia. SEA URCHINS began at near datum; we estimated their density to be about $5/m^2$.

COMMENTS - For fishing history in this area, see Station 11. We found a high commercial density of abalone at this site.

ACKNOWLEDGEMENTS

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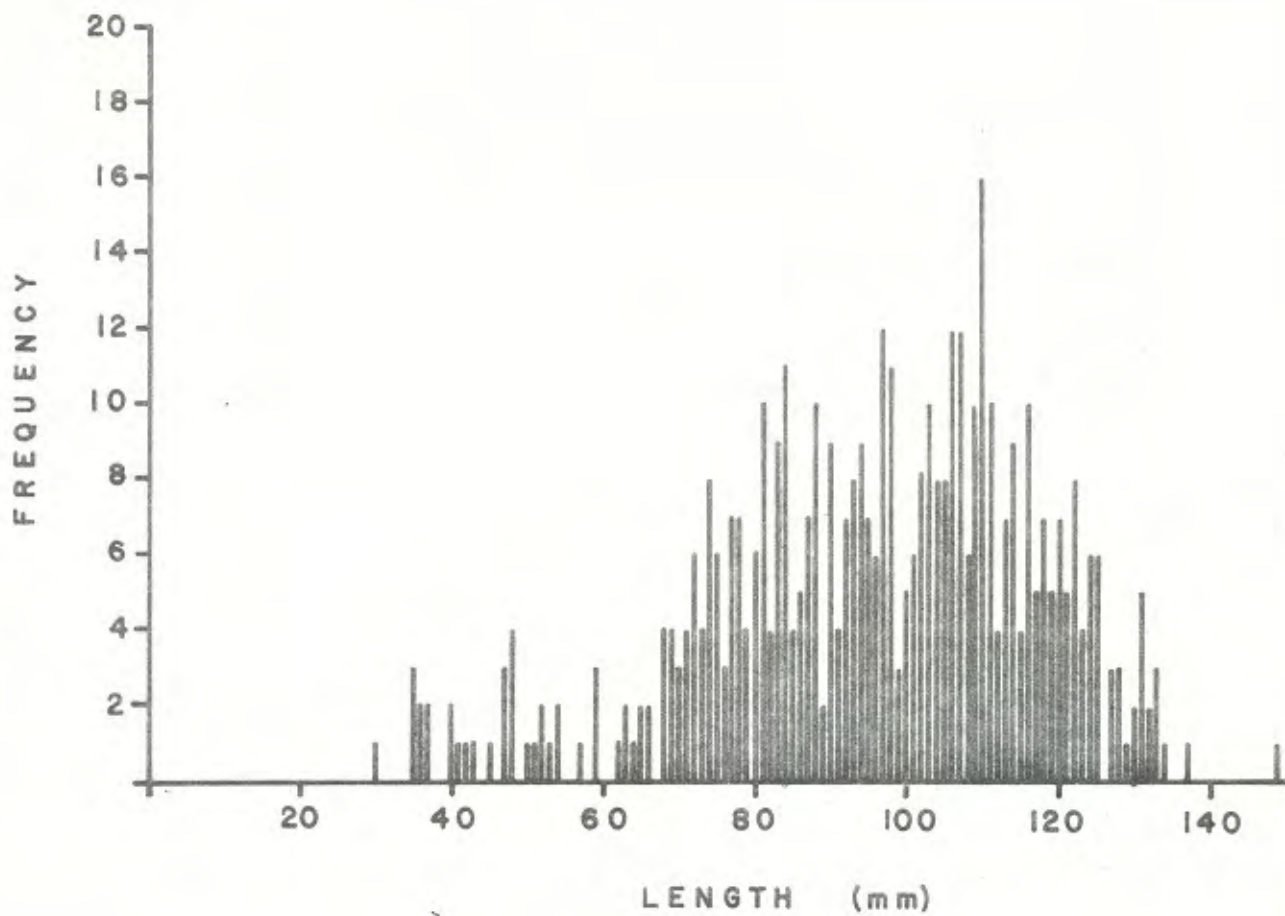


Fig. 1. A composite diagram of abalone population structure from all sites sampled.

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Fig. 2. Dive sites 1-3. Estevan Group.

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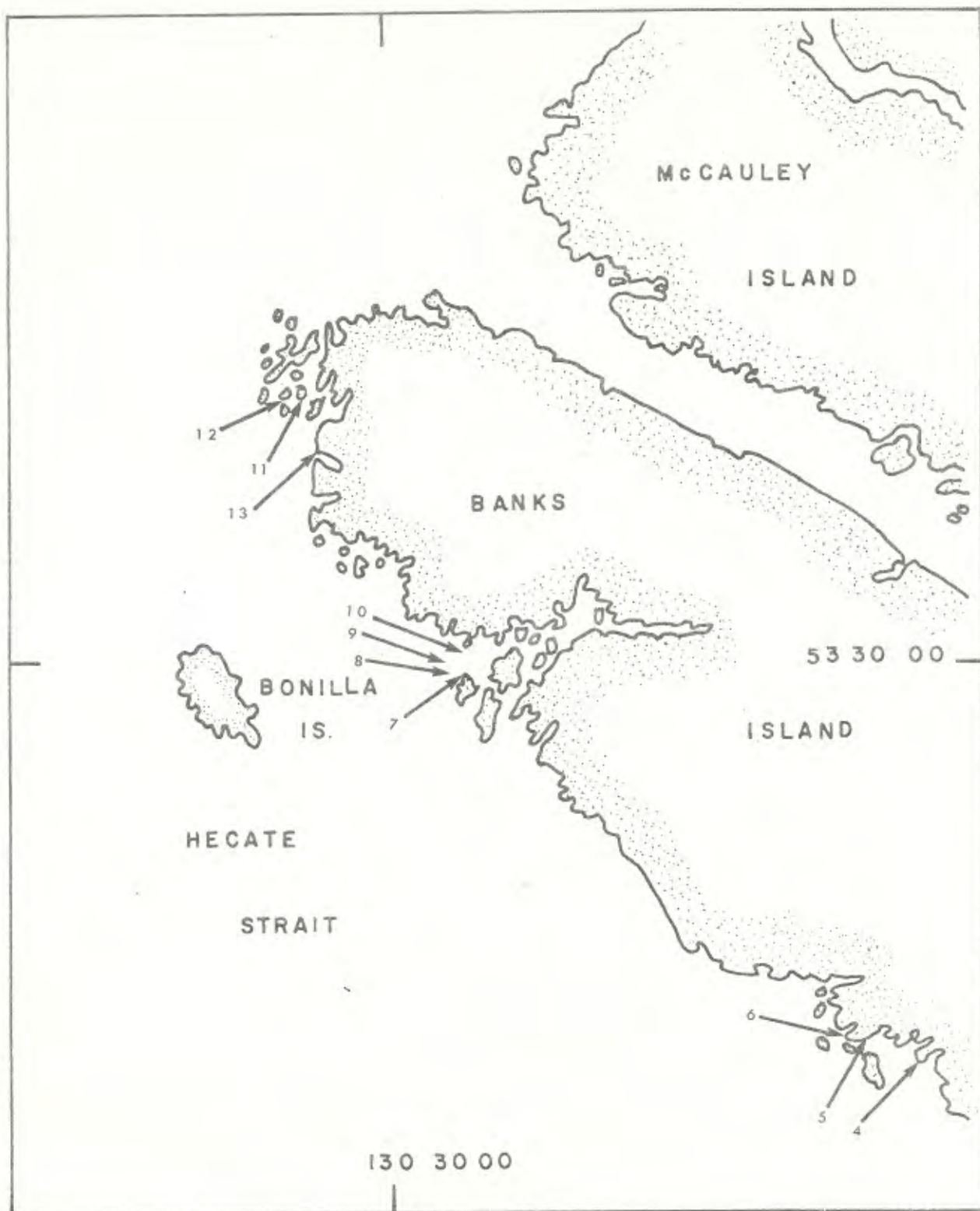


Fig. 3. Dive sites 4-13. Banks Island.