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Assessment of the B.C. Sea Otter Transplants, 1978;
including data on stocks of invertebrates and macrophytic algae

by

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Introduction:

In July of 1969, 1970 and 1972 sea otters (Enhydra lutris) from Alaskan waters were transplanted to the Bunsby Islands in Checleset Bay on the west coast of Vancouver Island (Bigg and McAskie, 1978) (See Figures 1 and 2). A total of 89 otters were released through co-operative action by the Alaskan Department of Fish and Game, the British Columbia Fish and Wildlife Branch, and the Arctic Biological Station of Fisheries and Environment Canada.

The sea otter had been virtually extinct the length of the British Columbia coast since the early 1900's, the result of steady exploitation by the fur trade established along the west coast of North America in the 18th century. The transplants were to determine whether this marine mammal, highly specialized to exist in exposed coastal waters within the 30-fathom curve, could be reintroduced to the previously occupied habitat.

An aerial survey by the Pacific Biological Station in September of 1977 located 70 otters at two locations; 55 at Checleset Bay, and 15 at Bajo Reef near Nootka Sound. Previously, a May, 1977 aerial survey had located several individuals--two at the Cuttle Islets, three at the Bunsby Islands, one at the southern tip of the Brooks Peninsula and a mother with pup at Kyuquot Sound (Figures 1, 2, and 3).

In June and July, 1978, the first intensive investigation of the Checleset Bay sea otters and their behaviour was carried out by marine biologists from the University of Victoria, and the Ecological Reserves Unit of the B.C. Department of the Environment. The investigation, which included population censuses, habitat assessments and behaviour studies was conducted adjacent to the Checleset Bay original

Bunsby Island release sites, and throughout the Checleset Bay area. Checleset Bay comprises B.C. Ecological Reserve Proposal #279, the primary objective of which is the protection of the sea otters and their habitat. Two observers, R. Morris and B. Emerson, were maintained at a Checkaklis Island basecamp (Figure 3) from June 1-July 4 and July 12-August 2. They were joined by additional observers from interested government agencies. From June 18-26, Scuba surveys of kelp beds and the associated invertebrate fauna adjacent to the Bunsby Islands were conducted by the Marine Resources Branch of the B.C. Department of the Environment.

This report provides summarised data to support future assessments and a paper being prepared for professional journal publication. It encompasses population and behavioural data on the otters, and relevant data on the environment, and stocks of invertebrates and algae.

Procedures and Logistics:

Initial observations (June 1-3) of otters were carried out at locations in Checleset Bay (Figure 3), using 4.6 m. Canova and 3.6 m. Avon inflatable boats (outboard motor powered) and the University of Victoria 17 meter oceanographic vessel, the MSSV John Strickland.

It was not known how otters would react to approach by boat, and the initial mobile surveys proved to disturb the animals, e.g. on the second day of preliminary reconnaissance of Checleset Bay, the John Strickland moved inadvertently to within 100 metres of a raft, causing a dispersal of the otters. The vessel was subsequently used only to transport scientists and inflatables to the perimeter of the observation areas. Observation from inflatable boat was restricted to no closer than 100 metres to avoid dispersal of otters, and thus was rendered difficult by wave motion and low angle of observation. Consequently, the strategy of landing on exposed reefs and islets from a 4.0 m aluminum skiff was adopted, especially near the main rafting areas at Gull Island and Humpback Island. Observations at a third main rafting area, Farout Reefs, and the Open Water Position (Figure

which prevented safe landing on these furthest seaward and more exposed reefs. When rough weather made inflatable travel to outlying observation areas hazardous, observations of the inner reef areas (i.e., Gull and Burial Cave Islands, and (when visibility was good), Mid Rocks and Humpback Island areas) were made by spotting scope from lookout points on Cautious and Checkaklis Islands (Figure 3) accessible by boat and overland. An over-nighting blind was constructed on Gull Island which enabled repeated observations of otters at dawn and dusk in July.

Observations were initially spaced irregularly through the day, but were subsequently narrowed to mainly the early morning to noon and evening periods of increased otter activity, and concentrated at locations where such activity was repeatedly observed. Observation equipment included 25X spotting scope, 10X50 binoculars and 35 mm camera equipped with 400 mm telescopic lens.

Inflatable boat surveys for otters covered Checleset Bay including the south coast of the Brooks Peninsula south west to Quineex Reef, the Cuttle Islets, the Bunsby Islands, the Mission Group, the Barrier Islands and the coast of Vancouver Island between the Bunsbys and the Mission Group (Figure 2).

An aerial survey for sea otters by the Pacific Biological Station, Nanaimo, on June 14 covered Checleset Bay and the coastline of Vancouver Island southeast of Nootka Sound.

Two SCUBA dive surveys (B. Emerson, R. Morris) assessed invertebrate food stocks at the southeast side of Gull Island, and the south side of Dozing Rock (Figure 3). Both dives were along transects approx. 3 m - 14 m depth. A 1 m² quadrat was placed randomly along the transects, and invertebrate fauna within the quadrat recorded on underwater slates. These locations were sampled by similar methods in 1972 by the Pacific Biological Station. In

June, two divers from B.C. Marine Resources, S. Norton and K. Spence, did SCUBA inventories (June 18-26) of kelp beds (Nereocystis luetkeana and Macrocystis integrifolia) in the Bunsby Islands and the outlying reefs to the south and south west, including Gull Island, Humpback Island, and Burial Cave Islands. They also recorded invertebrate fauna associated with the kelp beds. Transect lines (25m) were laid through eight kelp beds (Figure 6), and five quadrats (1 m^2) were sampled along each transect. All fauna and flora within the transect was collected, identified, counted and weighed.

On June 15, at two locations (Humpback Island and Gull Island) snorkeling gear was used to approach rafts and make surface and subsurface observations of sea otter behaviour from approximately 10 m.

On February 19, 1979, an aerial survey by the B.C. Fish and Wildlife Branch, Nanaimo, covered Checleset Bay, including the Bunsby Islands, the Cuttle Islets, and the Barrier Islands, as well as Bajo Reef. This survey was to observe possible local winter movements by the Checleset Bay and Bajo Reef sea otters.

Assistance was received from a number of participating agencies and scientists, and these are listed in Appendix 1.

Results:

The results of sea otter investigations and the algal inventory are recorded in tabular form and accompanying figures. Each table and figure has explanatory notes following.

Table 1. Population assessments

Otters frequented certain locales repeatedly and in varying numbers. Larger rafts (>10 otters) aggregated at the southeast corner of Gull Island (Figure 3) for overnight periods, and during the days of a storm period, June 6-13 (See Table 8, Weather Conditions). A maximum count of 45 otters was recorded on June 12 at Gull Island. Occasionally, individuals and pairs were recorded at Gull Island during the day in July. Larger rafts were also observed consistently at the east side of Humpback Island, and the north side of Farout Reefs with the adjacent Open Water Position (Figure 3), with maximum raft counts at these locations of 38 (June 20, 21), and 40-50 (June 13) respectively. Smaller rafts (<10 otters), pairs and individuals were also observed frequently during the day near these three main rafting locations, plus other locations recorded in Table 1 and shown in Figure 3. Gull Island is 1.5 km seaward from the Bunsby Islands, with surrounding reefs, shallows, and abundant kelp beds. Humpback Is. and Farout Reefs are further seaward (3.5 km and 6 km from the Bunsby Islands respectively) and are more exposed to wind and wave action, particularly the latter location. Both had kelp beds adjacent in June and July 1978.

The boat surveys located no sea otters along the south coast of the Brooks Peninsula as far southwest as Quineex Reef, in the Barrier Islands, or the Mission group. An individual otter was observed east of Acous Island, (Figure 3).

The aerial survey on June 14 censused 51 otters--27 at Farout Reefs and the Open Water Position and 24 at Humpback Island. In addition, 16 individuals were located at Bajo Reef. An aerial survey on February 19, 1979, located 15 individuals midway between Gull and Cautious Islands. None were sighted at Bajo Reef.

Table 2. Raft breakdowns according to head colouration

As an aid to age structure assessment in rafts, rafts from which a head colouration count could be made are shown in Table 2. The combined totals for these 18 raft counts are 29 white, 115 grey, 99 brown heads, yielding an approximate ratio of one white head: four grey heads: three brown heads per raft. These raft counts were made on separate days, but would include otters counted more than once because of the animals' repeated use of and mobility between rafting areas. Of the grey-head total, 44 were mothers with young. Using the whitening of the pelage as an indication of ageing in otters (see Kenyon, 1969), the above ratio indicates nearly equal proportions of the subadult (slim-bodied animals, brown pelage) and adult females (grey-headed animals, many with young) age classes with fewer older adult females (white-headed) in the Checleset Bay rafts. A maximum count of ten breeding females seven with pups, three with dependent young was recorded at Gull Island on June 12 (Table 1). A maximum subadult count of ten individuals was recorded on June 9 also at Gull Island. On June 20, a maximum of five white headed adults (one with pup) was recorded.

Solitary adult males were regularly recorded at Burial Cave Island (1) Cautious Island (1) and Deer Island (2) (Figure 3). Individual adult males were also occasionally seen in the vicinity of rafting areas. Separate identity of males was not obtained through individual colouration, as much as by their frequenting of these habitual locations.

Table 3. Behaviour Logged Against Time

All behaviour was recorded and is tabulated against time and location under six categories of behaviour in Table 3.

Resting: Otters were seen resting individually and in rafts at the locations recorded in Table 3, at all times of day. Early morning (0530-0600) observations at both SE Gull and Humpback Islands within 15 minutes (July 24, 25) revealed otters rested at both locales. Although Farout Reef was not observed in early morning, it is assumed that otters remained there overnight also. Rest was the main activity in rafts, was often punctuated with grooming bouts, and usually took place among, or near, kelp plants (Nereocystis luetkeana and Macrocystis integrifolia.) Otters invariably rested with head oriented up into any existing wind and rafts were often more closely packed and rest sessions longer during strong winds and choppy sea conditions. This was particularly evidenced when otters rested at Gull Is. through the day during a stormy period (June 6-13). No hauling-out onto land was observed. Some timing of rest periods is recorded in Table 6, Extended Behavioural Observations of Sea Otters.

Feeding: Individuals, pairs or small groups of otters departed raft locations to feed, although feeding occasionally took place only several metres away from a raft. Instances of mothers nursing, or passing food to young were observed.

Feeding activities observed are detailed and quantified in Table 5, Feeding Activity Logged Against Time; Figure 5, Diurnal Feeding Activity; and Table 7, Timing of Food Dives.

Grooming: Grooming of the pelage occurred at all times of day, especially after feeding activity and travel swimming, before and after resting sessions, and was most vigorous at nightfall and daybreak.

Some timing of grooming sessions are recorded in Table 3, (July 28, July 31, and August 1), and in Table 6, Extended Behavioural Observations of Specific Otters.

Swimming: Swimming behaviour was either flight (escape) or travel. Rafts dispersed by the sight, sound or smell of a disturbance (e.g. boats, the observers, floating logs, noise) often swam off short distances or escaped underwater to shelter of nearby reefs and then returned, or left areas completely. Females with dependents were especially prone to disturbance, but solitary males were less so and seemed unwilling to leave habitual areas.

The consistent and repetitious occurrence of otters performing behaviours within a roughly triangular area (9 km^2), apices at Farout Reefs, Humpback Island, and Gull Island (Figure 3), indicates the area was functioning as a home range in June and July. The predominance of females with dependent young and pups and subadults within this home range and several solitary (adult) male animals habituating areas peripheral to the range, reflects a segregation of the sexes well documented for the sea otter (See Kenyon, 1969).

Table 4. Travel Logged Versus Time

Individuals, pairs, and small groups of otters, arrived and departed rafting areas and feeding locations at all times of day, but travel was concentrated in early morning (0530-0800) and late evening (2000-2200) time periods. Particularly at Gull Island otters consistently arrived at dusk and departed at following dawn. On June 25 and July 2 decreases in raft totals at Gull Island occurred between dusk (2200) and following dawn (0530). On July 15, 17, 18, 24, and 30 increases in Gull Island raft totals occurred between these two times. This indicates movement to and from the Gull Island raft area during the darkness hours. Repeated use of travel paths within the home range area is shown in Figure 4, Diurnal Travel.

Table 5. Feeding Activity Logged Versus Time

Feeding activity was observed in the home range area at all times of day, but appeared to occur mainly in the 0500-0800 (early morning) and 2000-2200 (late evening) time periods. The prevalent food item sea otters retrieved by diving was a large white clam, tentatively identified through the spotting scope as the butterclam, Saxidomus giganteus), with other benthic invertebrates also being taken. Clams were pounded open against a stone or another clam held on the chest as an anvil.

Repeated utilization of feeding locations is shown in Figure 5, Diurnal Feeding Activity. All locations occur within the 20 fathom curve, the majority in less than 6 fathoms.

Table 6. Extended Behavioural Observations of Specific Otters

On July 20 three otters (male and female with dependent young) were observed at Gull Island for a full daylight period (0600-2117), and exhibited a wide range of behaviour. Similarly, on July 31 (0715-1315), and August 1 (1020-1645), observations were made of two (male and female) and three otters (male and female with dependent young), respectively.

Table 7. Timing of Food Dives

Durations of food dives and intervals on the surface between dives were recorded during several feeding sessions (Table 7). The longest feeding session recorded was two hours on white clams, in an area NE of Gull Island (depth: 5-13 fathoms). The longest food dive recorded was 127 seconds; the shortest, 45 seconds. Longest interval between food dives was 180 seconds.

Table 8. Weather Conditions During Observation Periods

Atmospheric and sea surface conditions were recorded during each observation period and are shown in Table 8. In general, fair weather,

with prevailing west to northwest winds persisted for the duration of the otter survey. A significant exception to this weather was June 6-13, when high SE winds, choppy seas, and rain occurred.

Table 9. SCUBA Dive Surveys of Invertebrates

Two areas surveyed within the home range area, the southeast side of Gull Island, and the south side of Dozing Rock (Figure 3) notably lacked an invertebrate macro-fauna (Table 9). These two areas had been surveyed by the Pacific Biological Station (Miller, 1972). Concentrations of urchins and abalone were then recorded. None of the predominant food items (Table 5) were recorded in the diver surveys. However, otters were seen feeding adjacent to both these depauperated locations on the predominant food item, the white clam, and occasionally, on sea urchins (Table 5 and Figure 5).

Table 10. Algal Inventory Transect Data

Algal inventory divers recorded algal growth and invertebrate fauna located along sampling transects (See Table 10; Figure 6). In general, little macrobenthos was found. Abundances of topsnails (Tegula spp and Turbo spp) on kelp plants were recorded.

In general, large beds of Macrocystis integrifolia occurred in the more sheltered waters in the Bunsby Islands and at Gull and Burial Cave Islands. Otters utilized these Macrocystis spp. beds for rafting. Beds of new annual growth of Nereocystis luetkeana were not present in the areas inventoried. Sea otters used small beds of N. luetkeana in June near Humpback Island and Farout Reefs which were second year growth, as were larger beds near Gull Island. M. integrifolia was used by rafting otters at Gull, Cautious, Burial Cave and Deer Islands. There was an increase in growth and extent of N. luetkeana beds observed in July due to new annual growth (R. Morris,

field notes). The aerial survey on February 19, 1979 revealed most of the kelp beds noted above were still intact, although Humpback Island and Farout Reef beds appeared reduced in size relative to July, 1978.

Additional Results:

Predation: No predation on otters was observed. Potential predators were seen near rafting areas--a killer whale (Orcinus orca) circled Gull Island on June 15 (see Appendix 2), and bald eagles (Haliaeetus leucocephalus) were seen individually perched on Mid Rocks, on a reef to the south of Farout Reefs and flying over Humpback Island. A sea lion (Eumetopias stelleri) was sighted 400 m south of Humpback Island. Two sea lion haulouts are located near to otter rafting areas (3 km to the southeast of Farout Reefs and 6 km to the northwest of Humpback Island). Sea lions will predate on fur seal pups in the Pribilof Islands (Gentry and Johnson, 1976). The possibility of predation on sea otters exists.

Mortality: One mortality--an abandoned female pup--was recorded on June 27 (See Appendix 3). On June 26 (approx. 1530 hr) it was found waterlogged, screaming, and with congested breathing, east of Deer Island. No mother was evident after $\frac{1}{2}$ hr. observation. At basecamp it took small quantities of warm milk from an eyedropper. It issued cries through the night, was voiding black, tarry faeces the next morning, and died at approximately 0830.

Summary and Conclusions:

1. Approximately 50 sea otters were censused near the Bunsby Islands in Checleset Bay during June and July, 1978. An aerial census on June 14 located 51 sea otters in Checleset Bay, and 16 at Bajo Reef. On February 19, 1979, an aerial census located 15 individuals in Checleset Bay.
2. Raft aggregations contained adult females, mothers with dependent young or pups, and subadults (both sexes). These rafts occupied a home range area of approximately 9 km² in reefs to the southwest of the Bunsby Islands. Solitary adult males habituated locales on the periphery of the home range and closer inshore to the Bunsby Islands.
3. Three main rafting areas in kelp beds east of Humpback Island, southeast of Gull Island, and north of Farout Reefs were used. Travel to and from raft locales was recorded, generally in the early to mid-morning and evening. Rafts rested at Humpback Island and Farout Reefs during the day, and apparently at night also, but usually formed at Gull Island for overnight periods only. There was evidence of nocturnal travel to and from Gull Island.
4. A brief storm period resulted in large rafts resting at Gull Island during the day. Movement inshore to more sheltered reefs and kelp beds may represent a response to storm activity in the summer, but more particularly to winter storms. Similarly, persistently fair weather in June and July, 1978, may have enabled otters to use more exposed rafting areas (i.e. Humpback Island and Farout Reefs). The movements of otters inshore to more sheltered waters in response to storms has been reported in Alaska (Kenyon, 1967) and California (Shimek and Monk, 1977).

5. The winter aerial survey (February 19, 1979) located 15 individuals, all midway between Gull and Cautious Islands (approx. 1430 h). None of the approximately 35 remaining otters were located by this brief survey. Scagel (1947) reports extensive reduction of annual Nereocystis luetkeana and perennial Macrocystis integrifolia kelp beds due to winter storm activity at Vancouver Island, but as of February, kelp beds utilized by rafting sea otters in June and July, 1978, appeared largely intact with the exception of reductions in N. luetkeana beds at Humpback Island and Farout Reefs. Possibly these, and further, reductions over the winter may also induce movement inshore to kelp beds in more sheltered locations.
6. Mating activity was observed. This activity and the recording of mothers with young in rafts indicates the Bunsby population is breeding. This is an indication of transplant success.
7. The 1978 census total is an apparent decrease from the transplanted total (89 individuals), and there does not appear to have been the 10% annual population increase reported for Alaskan sea otters in newly occupied habitat (see Kenyon, 1969) for 1977 or 1978. Breeding females and subadults are predominantly in the population currently. Possibly this breeding is not yet counter-balancing mortality in the largely adult stock originally introduced and the annual rate of increase may vary until a normal age distribution develops and eliminates any effect from these adult animals (Bigg and McAskie, 1978). The large portion of subadults may be contributing to a low productivity in the population.
8. Foraging activity was generally during early-mid morning and evening and on the predominant food item, a white clam. The apparent reductions in urchin and abalone concentrations since 1972 are probably due largely to commercial urchin and abalone harvests at the Bunsby Islands around 1975

(Dave Smith, B.C. Marine Resources Branch, personal communication). Most foraging activity observed was in less than 10 fathoms depth. Since sea otters are known to forage to 30 fathoms depth in California and Alaska (see Kenyon, 1969), this indicates that full use of the Bunsby habitat is not occurring.

9. The concentration of the small Bunsby population in the home range area makes it particularly vulnerable to catastrophic loss (e.g. oil spillage, a known hazard on the west coast of B.C.) and local disturbance. There is increasing local disturbance in the form of tourist and fishing boat traffic, and also proposed log-booming operations. Protection of this population, its habitat and food stocks (particularly in light of previous commercial harvest in the area) while it increases, and attains a normal age distribution, is strongly recommended. Ecological Reserve status in Checleset Bay would provide a necessary protection and delineate further habitat for a spreading population. Also, additional transplants of sea otters to B.C. would reduce the likelihood of a total loss of stock through catastrophic disturbance.

References Cited

- Kenyon, K.W. 1969. The sea otter in the Eastern Pacific Ocean. U.S. Bureau Sportfish and Wildlife, No. Amer. Fauna, 68: 352 pp.
- Miller, D. Manuscript. 1972. Urchin and abalone survey, Bunsby Islands. Pacific Biological Station. Unpublished report. 13 pp.
- Scagel, R.F., 1947. An Investigation of Marine Plants, B.C. Dept. of Fisheries Publications, No. 1. Victoria, B.C.
- Shimek, S.J. and A. Monk, 1977. The daily activity of the sea otter off the Monterey Peninsula, California, J. Wildl. Management. 41: 277-283.

Appendix 1

List of Participating Scientists

APPENDIX 1List of Participating Scientists

<u>Name</u>	<u>Agency</u>
R. Morris	B. C. Ecological Reserves
B. Emerson	B. C. Ecological Reserves
D. Ellis	University of Victoria
B. Foster	B. C. Ecological Reserves
T. Carson	B. C. Ecological Reserves
M. Bigg	Pacific Biological Station Fisheries and Environment Canada
I. McAskie	Pacific Biological Station Fisheries and Environment Canada
G. Ellis	Pacific Biological Station Fisheries and Environment Canada
G. Smith	B. C. Fish and Wildlife Branch
D. Hebert	B. C. Fish and Wildlife Branch
S. Norton	B. C. Marine Resources (Algal Inventory)
K. Spence	B. C. Marine Resources (Algal Inventory)

Appendix 2

Notes and Observations

Checleset Bay Ecological Reserve Proposal #279

June 13-16, July 25-26 , 1978

T. Carson

Notes and Observations Checleset Bay Ecological Reserve Proposal

#279 June 13-16, July 25-26, 1978

Sea-Otters

June 13th - 2100 hours - Dusk

Fourteen sea otters were spotted rafting near kelp off the east side of "Gull Island". As we approached the otters with the zodiac most of the otters dispersed eastward away from the island; however, one subadult approached our boat within 20 metres of the boat--he swam on his back, vertically "bobbed" in the water, looking in our direction, then rejoined the sea-otters in the kelp. Three sea-otters remained in the kelp bed while 10 otters swam eastward 20 metres off the rock off southeast Gull Island and maintained this distance.

At Clara Reef one otter was seen swimming near a rock about 18 metres away.

June 14th - partially cloudy - breezy

During the census flight with Graham Ellis, Bud Smith, Trudy Carson and Bristol Foster, a total of 67 sea-otters were counted. The location and size of groups is marked on Figure 2 Marine Chart #'s 3666 and 3683. Fifteen sea-otters were counted in the vicinity of Bajo Reef and 52 were counted all together in the Checleset Bay area.

Hauled-out Northern sea-lions were photographed for census purposes. Graham Ellis of Nanaimo Fisheries Office has the results of this work.

At 1700 hours Graham Ellis, Bob, Bristol and myself landed on a small rock in Clara Reef. The otters were observed and photographed from this point. Three sea-otters were observed eating shellfish and sea urchin. The otters were swimming on their backs, handling the food with their forepaws and passing the food between themselves. Much contact between the otters was observed. Occasionally the otters would become alert and bob up, then would dive. The otters would dive for 45 seconds to 2 minutes, then surface again. We observed this feeding routine for 20 minutes until the otters were out of sight.

Two mothers with pups clasped to their stomach were seen about 30 metres east off Clara Reef. Then 6 more otters were observed swimming in a northeasterly direction through the shallow reef waters. Sometimes the otters were in pairs, sometimes in threes. They appeared to be feeding on chitons (*Katharina tunicata*), urchin, and small abalone (*Haliotis kamtchatkana*). In one instance two sea-otters were feeding while 2 to 6 Gulls "mobbed" and dove at the otters trying for scraps of food.

June 15th - partially cloudy, breezy from north, tide rising
0615 hours

On this morning we took the Zodiac out to Gull Island dressed in wet suits prepared to snorkel with the sea-otters. East of Gull Island three sea-otters were observed swimming on their backs, 15 metres from me. Two otters were also seen southeast off Gull Island. I entered the ocean quietly, draped with kelp. Two subadult otters approached me, apparently curious. One other otter approached from the south. He bobbed in the water, looking in my direction, rose, then porpoised and descended 15 feet away from me. The otter was seen swimming below me. This group of otters moved away from me and I swam to the north end of the island. Bristol entered the water and I saw him with two otters, fairly close to him. From a distance he appeared to resemble a seal, except for the orange snorkel tip. The otters stayed with him for 10 minutes, then as I rejoined him, the otters disappeared. We decided to walk west across the island to look for otters by starting from a cove on the north-east of Gull Rock. As we swam for the cove, Bristol dove ahead and I watched for otters. Then, 6 metres behind me, I spotted a large black dorsal fin. Unbelieving, I looked again and saw a Killer Whale surface closer to me. I swam rapidly for shore. Reaching shore, I looked for Bristol. The whale or Bristol could not be seen for 30 seconds. Bristol surfaced, the Killer Whale 3 metres behind him. I shouted and pointed. Bristol turned around looking for otters and saw the whale instead. He lowered his head underwater for a better view. The whale moved away to Bristol's right. Bristol swam furiously towards shore. Once Bristol was ashore, the whale surfaced close behind him showing his white, then swam off in a northwest direction. We walked across the inlet and observed the whale continuing his shoreline circle around the island.

We took the boat to Clara Reef and there were 2 sea-otters outside the Reef. Three otters were seen on the inside of the reef. We tied the boat and swam through tumultuous surges and shallows in the Reef. The otters were west about 100-200 metres away. Bristol filmed the otters. I swam towards an otter, and at 12 metres it bobbed and submerged; another otter was seen and exhibited the same behaviour. I came ashore on the rock. While sitting at the surf line, a sea-otter surfaced only 3 metres away, saw us, and dove down in alarm. Two more otters were observed 12 metres off shore to the east.

Bristol and I both entered the water and swam towards a group of 6 otters, including 2 mothers with largish pups. The swell was increasing and the otters didn't seem to notice our approach. They swam on their backs, unalarmed, grooming and "muzzling" each other. As we came closer the otters saw us and swam with just their heads out of water. After about 5 minutes of observation the otters began dispersing. Four adults swam out to the southeast. An adult female clasped her pup to her chest and swam directly beneath us. The others stayed approximately 100 metres offshore for some time, then swam off.

June 16th, clear, sunny

Only 1 sea-otter was seen off Checkaklis Island at 2130 hours. None were seen in our exploration of the area northwest of Bunsby Island during the day.

Again a raft of approximately 20 sea-otters were seen at Gull Island at dusk.

July 25th - 2200 hours

While camping at Gull Island we saw 2 sea-otters rafted in the kelp.

July 26th 0630 hours

Only 1 sea-otter was observed in the kelp at Gull Island.

At 0900 hours we boated to Clara Reef and filmed 5-6 otters, swimming and grooming.

At 1000 hours 4 sea-otters were observed.

Additional Observations - while diving with sea-otters

June 15th

- Otters were fairly curious of us, but reasonably "cautious".
- It seemed as though the otters would allow us to approach closer when they were in groups of 2 or 3 than when alone.
- Juveniles seemed more curious of us than mothers with pups.
- The otters were not feeding when observed from 0615 - 1100 hours.

Underwater Observations - while snorkeling July 15th morning, Gull Island.

- No sea urchins or abalone at this site.
- Entire rocky bottom covered with various species of algae.
- Particularly abundant was an unknown brown sheet algae (Desmarestia toliacea)
- Some Iridaea sp, Ulva lactuca and Codium fragile was observed.
- Large (3 metres) Phyllospadi scouleri with small dots? were seen.
- Katharina tunicata were seen in crevices but were not abundant (perhaps every 100 metre area).
- Corallina vancouverensis was observed.
- Many small fishes, including needlefish observed.
- The water was very shallow (3-4 metres deep) and fairly turbid.
- Only the white gravelly bottom was free from vegetation
- With the exception of Starfish, Chitons, Mussels, Barnacles and Tunicates, very few invertebrates were seen.

Clara Reef

- Very similar to Gull Island habitat except that there was abundance of small turbans (Tegula funebris) top shells (Calliostoma ligatum?)
- Katharina tunicata and Corallina was more abundant here.
- More yellow (unknown) sponges.

North Sea-Lions

Sea-lions were photographed and censused during the July 14th flight. Locations of sightings are marked on Figure 1. The Pacific Biological Station has the results of the census.

On July 16th we visited the O'Leary Inlets. Over 40 sea-lions were counted. All sea-lions could not be seen from our vantage point.

No pups were seen but it appears that the O'Leary Islets are a major sea-lion haul out site.

Sea-Bird Colonies

Significant marine-bird nesting colonies exist on:

- a) Thomas Island Leach's Storm Petrel and Fork Tailed Storm Petrel and Pigeon Guillemot. This area is nearing final stages of Ecological Reserve Status for its significance as a sea-bird nest site.
- b) Gull Island Glaucous Winged Gull and Black-Oyster Catcher.
- c) O'Leary Islets Pelagic Cormorants and Glaucous Winged Gulls.

Further documentation of these colonies is written up in the Provincial Museum Sea-bird Record File.

Appendix 3. Veterinarian's Verbal Report on Sea Otter Pup Mortality

Autopsy performed on July 13, 1978, by Drs. James and Judith McBain, Veterinarians, Nanaimo, B. C.

Pup was thin, with very little body fat. Lungs were congested, but no transudate in the bronchioles. The liver showed some cloudy swelling; probably due to malnutrition. Congested appearance of lungs was probably due to blood pooling after death. Pup died as a result of losing its mother.

Otherwise everything appeared normal--the pup was a female, 2.9 kg. standard length 65.4 cm.

Table 1. Population Assessments

TABLE 1 (Page 1)

DATE	LOCATION OF OTHERS	TIME PDI	MAXIMUM \$ OF OTHERS
UNIDENTIFIED	S D U B S F E M A L E S	D E P E N D E N T S	M O T H E R S
SEX AND AGE CLASSES			
POPULATION ASSESSMENTS			

TABLE 1 (Page 2)

DATE	LOCATION OF OTHERS	TIME FDT	MAXIMUM # OF OTHERS	SEX AND AGE CLASSES	IDENTIFICATION
				S U B P E N M O T	S U B A D D I T I A L L E D

TABLE 1 (Page 7)

POPULATION ASSESSMENTS

SEX AND AGE CLASSES

DATE	LOCATION OF OTTERS	TIME PDT	MAXIMUM # OF OTTERS	M	H	T	E	N	L	L	E	E	D	D	S	E	U	P	B	F	N	N	E	U	I	I	D	D	E	U	I	I	N	U
July 27	N Deer Is	1950	1																															
	SE Gull Is	2100 - 2145	2																															
28	SE Gull Is	0500 - 0730	3																															
	SE Gull Is	2100	1																															
29	Between Farout Reef & E Humpback Is	1100	2																															
	Mid Rocks	1230	2																															
	Acous Peninsula	2000 - 2115	0																															
30	SE Gull Is	1930 - 2200	2																															
31	SE Gull Is	0545 - 0615	15																															
Aug 1	SE Gull Is	0545 - 0615	10																															
	E Humpback Is	0625 - 0700	10																															
	Cautious Triangle	0850 - 1645	3																															

TABLE 1 NOTES. (PART 1)

POPULATION ASSESSMENTS

1. TIME (PDT)
- Time periods show extended observations; single times are for sightings of otters; overlapping times represent an observation at 2nd or 3rd location during extended observation of a first local; (Pacific Daylight Time).
2. MAXIMUM # OF OTTERS
- This is the maximum number of otters counted for the time recorded. The abbreviation R.P. is Raft Present (but no count obtained). Approximations (App.) if distance, weather or surf conditions precluded counts.
3. MOTHERS
- Identified by constant accompaniment of a dependent young pup. Mammaries were frequently visible, as were nursing young. Numbers of mothers corresponds to number of pups or dependent young observed. More mothers with dependent young in a raft were often not readily detectable because of separation of a mother to young pair, or the observation being obscured by kelp, wave action, distance, etc.
4. PUPS
- Small, with fuzzy, usually light brown pelage. Usually rid on mother's chest, and nursing, unable to swim or dive confident or retrieve food. Totally dependent on mother for well-being.
5. DEPENDENTS
- Refers to dependent young, or larger, darker pups. The distinction between dependent young and pups was recorded in field and is retained in this report. The term "young" used in report refers to any animal(s) still in care of the mother. Start to acquire an adult pelage, still obviously associated and dependent on mother, but she frequently discourages its chest riding and attempts to nurse, eat food items retrieved through diving by s and mother.
6. SUB-ADULTS
- Adult build, but slimmer, usually with dark brown pelage of sub-adults were observed within rafts, containing families males. No sexual activity observed.
7. FEMALES
- Could be definitely identified in adult and sub-adult stages only by the presence of the two lower abdominal mammaries. Mammaries not in view adult sized animals were tentatively identified as females by a slimmer build through the head and neck than adult males plus pelage coloration (See Table 2, Notes).
8. MALES
- Could be definitely identified in sub-adult and adult stages presence of a penile ridge on the lower abdomen. If penile ridge in view, adult males were tentatively identified as such by pel colouration, and a thicker heavier build through the head and neck region than adult females.

TABLE 1. NOTES (PART 2) - continued

POPULATION ASSESSMENTS

9. UNIDENTIFIED

- Wave action, dim lighting, or distance frequently prevented the identification of the sex or age class of otters. In these cases, only a total count of otters was possible.

TABLE 2

POPULATION AGE STRUCTURE ACCORDING TO HEAD COLORATION

DATE	LOCATION	TIME	WHITE	GREY	BROWN
June 20	Humpback Is	1030 - 1200	5(1)	16(6)	9(1)
June 21	Humpback Is	1010 - 1050	3(1)	14(5)	3
June 25	Humpback Is	0625 - 0645	2(1)	9(5)	3
June 26	Gull Is	2115 - 2200	1	5	5
June 27	Gull Is	0750 - 0830	1	2	4
June 28	Gull Is	2050 - 2150	3(1)	8(3)	9(1)
June 29	Humpback Is	1030 - 1045	3(1)	8(2)	8(1)
		1915 - 2120	1	5(3)	2
June 30	Humpback Is	2105 - 2145	1	2	3(1)
	Gull Is	2005 - 2020	1	4(1)	5
July 1	Humpback Is	0900 - 1215	3(1)	7(2)	12(2)
	Humpback Is	1935 - 2010	0	3(1)	3
	Gull Is	2030 - 2105	1	4(2)	3
July 2	Humpback Is	1045 - 1145	0	8(5)	8
July 3	Humpback Is	0555 - 0800	2(1)	7(4)	8(1)
July 17	Humpback Is	0945 - 1045	1	6(3)	6
July 24	Humpback Is	0615 - 1130	1(1)	5(1)	5(1)
July 26	Humpback Is	0815 - 1100	<u>0</u>	<u>2(1)</u>	<u>3(1)</u>
			29	115	99
	Totals				

Bracketed figures indicate females with pups.

NOTES ON TABLE 2

RAFT BREAKDOWNS ACCORDING TO HEAD COLOURATION

1. Pelage colouration and relative body size was noted during field observations as a tentative indication of age, and sex in rafts. Both sexes tend to become white-headed with age. Lighter coloured heads among juveniles are usually males, and this difference tends to prevail in older animals (Kenyon, 1969).
2. White - refers to a head predominantly, and obviously white, or silvery.
3. Grey - refers to a head with mixed white and brown, neither predominant.
4. Brown - refers to a head, dark brown, or sometimes (when wet) almost black, with very little or no white showing.

Bracketed numbers within the table are females with young. Otherwise animals were assumed to be independent within the raft aggregation.

NOTE ON RECOGNITION OF INDIVIDUALS

Over the 60 day observation period, several individuals were recognizable in the field on repeated occasions because of colouration or marking in their pelage, or their association with other otters.

"White-haired Grandmother" - a large, mature-looking female with a white head, and white through her pelage. Absence of a dependent young, lack of prominent mammaries (and penile bulge), led to identification as an older female.

"Silver-haired Mother" (and pup) - a slim female with prominent mammaries, a white-silver pelage (head and body). Accompanied always by a small, dark brown nursing pup.

"The Trio" - an association of 3 animals which were consistently seen together in July. The Trio was comprised of:

- a medium-sized male with a brown head and body. Concluded to be a young male.
- a medium-sized female, grey-headed, with black ears.
- a larger tan-brown coloured pup, nursing, but able to food dive and retrieve food for itself.

"The Male-Female Pair" - seen consistently together through the month of July. The female had a dark brown patch in the back of her head; the male was brown, with a gold-yellow tint through the pelage.

Table 3. Behaviours Logged Against Time.

TABLE 3 (Page 1)

33.

TABLE OF BEHAVIOURS LOGGED AGAINST TIME

DATE	LOCATION	TIME OBSERVED ¹	TOTAL ²	RESTING ³	FEEDING ⁴	GROOMING ⁵	SWIMMING ⁶	INTERACTION ⁷	BEHAVIOUR UNKNOWN ⁸
1	SE Burial Cave Is	1715	2	In kelp					
2	SE Gull Is	1025	3						Brief sighting
	E Humpback Is	1145 - 1610	35	Majority prior to dispersal	Mo/D Mo passes food to D	Many	Dispersal to N from noise of approaching vessel. Regrouped		
	Farout Reef	1315	25	Majority prior to dispersal			Flight from noise of approaching vessel		
3	E Gull Is	0920	2						Brief sighting
	E Humpback Is	1000 - 1400	15	Majority prior to dispersal			Dispersal into reefs by sight of approaching Zodiac. Re-grouping over 2 hr.		
	SE Burial Cave Is	2130	2						In kelp Brief sighting
4	E Humpback Is	1220 - 1320	R.P.	In kelp			Dispersal by sight of Zodiac, then re-rafterd		
	Cautious Triangle	1430	1						Brief Sighting
	SE Burial Cave Is	2200	2	In kelp					

TABLE 3 (Page 2)

TABLE OF BEHAVIOURS LOGGED AGAINST TIME

DATE	LOCATION	TIME OBSERVED ¹	TOTAL ²	RESTING ³	FEEDING ⁴	GROOMING ⁵	SWIMMING ⁶	INTERACTION ⁷	BEHAVIOUR UNKNOWN ⁸
5	E Humpback Is	1030 - 1350	15	In kelp		Majority	Scent of observers upwind causes dispersal into reefs. Re-raftering after 1 hr.		
	SW Humpback Is	1220	2				2 travel southeast		
	E Burial Cave Is	1950	1	In kelp					
	SE Gull Is	2000	2	Both		Both			
6	E Humpback Is	1030 - 1130	19	Majority in tightly packed raft	2 P Nursing	Some			
	Midway Cautious Triangle & Humpback Is	1200	1						Brief Sighting
	SE Burial Cave Is	1710	1	In kelp					
	SE Gull Is	1745 - 1830	10	In kelp, in tightly packed raft					
	E Humpback Is	1745 - 1830	R.P.						Distance of observation obscured count
7	Midway Deer & Thomas Is	1145	1						Brief Sighting

TABLE OF BEHAVIOURS LOGGED AGAINST TIME

DATE	LOCATION	TIME OBSERVED ¹	TOTAL ²	RESTING ³	FEEDING ⁴	GROOMING ⁵	SWIMMING ⁶	INTERACTION ⁷	BEHAVIOUR UNKNOWN ⁸
7	SE Gull Is	1510	R.P.	In kelp					Due to distance of observation
	E Humpback Is	1510	R.P.						Due to distance, wave action, vision obscured
	SE Gull Is	1920 - 2140	12	Majority		Some	Travel - 2 Ho/P pairs		
	Cautious Triangle	1920 - 2140	7	2	Ho/P - Ho passes food to P				
8	Cautious Triangle	0830	1	In kelp					
	N Bozing Rock	0940	1		Individual foraging				
	N Burial Cave Is	1755	1	Sleeping in kelp					
9	Cautious Triangle	1905 - 2040	1			In kelp			
	E Humpback Is	1925 - 2040	3						Wave Action obscured
	SE Gull Is	1925 - 2040	26	In kelp		Some		Play - 2 SA play diving, rolling	
10	E Humpback Is	1450 - 1510	6	In kelp			Flight north 100m upon sighting observer's boat		

TABLE 3 (Page 4)

TABLE OF BEHAVIOURS LOGGED AGAINST TIME

DATE	LOCATION	TIME OBSERVED ¹	TOTAL ²	RESTING ³	FEEDING ⁴	GROOMING ⁵	SWIMMING ⁶	INTERACTION ⁷	BEHAVIOUR UNKNOWN ⁸
10	SE Gull Is	1635 - 1730	28	Majority in kelp	Individual, adjacent to raft	Several			
	E Humpback Is	1730	R.P.						Vision obscured by wave action, distance
11	Cautious Triangle	1230	3	In kelp		No grooms self & P			
	SE Gull Is	1230 - 1340	20	In kelp			Travel		
12	SE Gull Is	1510	3						View obscured by wave action, distance
	E of Acous Peninsula	1530	1						Due to distance of observation
	SE Gull Is	1910 - 2105	45	Majority, wrapped in kelp, sleeping	9 feeding on mussels adjacent to raft. No feeding D. 2 nursing P	Many	2 downwind catch scent of observers, Travel to raft	Play - 2 SA rolling, chasing	
	SE Burial Cave Is	2120	1	In kelp					
	NE Burial Cave Is	2125	2	In kelp					

TABLE OF BEHAVIOURS LOGGED AGAINST TIME

	LOCATION	TIME OBSERVED ¹	TOTAL ²	RESTING ³	FEEDING ⁴	GROOMING ⁵	SWIMMING ⁶	INTERACTION ⁷	BEHAVIOUR UNKNOWN ⁸
13	100 meters SE of Gull Is	1030	App. 35						Brief sighting from distance
	E Humpback Is	1040 - 1130	14	In kelp					
	Open Water Pos	1305	App. 50				Up and out sniffing, then dispersal towards Farout Reefs, on and below surface		Wave action enabled only an estimate of numbers
	SE Gull Is	2100	14	In kelp					Indirect report
14	E Humpback Is	1600 - 1800	14	Several in kelp	1 in reefs adjacent to Humpback Is		H approached Zodiac up and out scenting all the way. Flight - 2 Mo/P pairs to Mid Rocks on approach of vessel		
15	SE Gull Is	0700	15				Flight into reefs due to presence of predator (killer whale)		Indirect report
	S Humpback Is	1400 - 1700	22	Majority		3 Mo/P pairs especially Mo grooms P on chest	Flight upon near approach (10m) of observers in snorkel gear		

TABLE 3 (Page 6)

TABLE OF BEHAVIOURS LOGGED AGAINST TIME

	LOCATION	TIME OBSERVED ¹	TOTAL ²	RESTING ³	FEEDING ⁴	GROOMING ⁵	SWIMMING ⁶	INTERACTION ⁷	BEHAVIOUR UNKNOWN ⁸
16	SE Gull Is	2030 - 2100	25						Indirect observation
	SE Burial Cave Is	2200	2	In kelp					
17	SE Gull Is	0900	0						Indirect observation
	E Humpback Is	0910	R.P.						
18	NE Burial Cave Is	0550	1	In kelp					Brief Sighting
	SE Gull Is	0600	1						Wave action obscured sighting
	E Humpback Is	0630	5						
	SE Gull Is	2015 - 2120	12			Grooming on arrival as raft forms	Travel around S end Gull Is		
	Cautious Triangle	2015 - 2120	2			H, F groom after copulation		Copulation (possibly attempted, intromission not observed)	
19	SE Gull Is	0610 - 0735	9	In kelp	4 - Upon awakening app. 50m from raft position		Travel around S end of Gull Is		
	Cautious Triangle	0630 - 1115	2	Following copulation		Following copulation		Copulation (possibly attempted, H bites F nose, underneath F)	
	E Humpback Is	0940	App. 15						Distance obscured close observation

TABLE OF BEHAVIOURS LOGGED AGAINST TIME

IE	LOCATION	TIME OBSERVED ¹	TOTAL ²	RESTING ³	FEEDING ⁴	GROOMING ⁵	SWIMMING ⁶	INTERACTION ⁷	BEHAVIOUR UNKNOWN ⁸
	Cautious Triangle	2230	2	In kelp					
20	Cautious Triangle	0645 - 1000	2		In kelp	Occasional			
	SE Gull Is	0700	0						
	SE Gull Is	0915	2				2 Travel		
	Cautious Triangle	1930	2	In kelp	2 S of Dozing Rock		Flight to SE when observers scented upwind		
	E Humpback Is	1030 - 1200	38	Majority in and out of kelp. Tightly packed raft in kelp		Increase in grooming activity appeared induced by rise of strong NW wind	Travel - westward toward reefs		
21	SE Gull Is	0745 - 0815	4	In kelp		Occasional			
	Midway Farout Reefs & Humpback Is	0745	4				Travel		
	E Humpback Is	0905 - 1000	38	Majority		Occasional	Flight - dispersal apparently due to log drifting into midst of raft. Raft regrouped, but 5 travelled SE	Mo rolls small P off her chest swim slowly in ahead of P - perhaps a swimming lesson. P progressed slowly on chest	

TABLE 3 (Page 8)

TABLE OF BEHAVIOURS LOGGED AGAINST TIME

IA	LOCATION	TIME OBSERVED ¹	TOTAL ²	RESTING ³	FEEDING ⁴	GROOMING ⁵	SWIMMING ⁶	INTERACTION ⁷	BEHAVIOUR UNKNOWN ⁸
June 21	SE Gull Is	2030 - 2145	8	In kelp		On arrival in raft	Travel to Gull Is forming raft		
	Cautious Triangle	2200	2	In kelp					
	E Burial Cave Is	2215	1	In kelp					
22	SE Burial Cave Is	0555	1	In kelp					
	SE Gull Is	0555 - 0730	0				Travel away from raft area		
	Midway Gull Is & Dozing Rock	0555 - 0730	2		M and F food diving			M and F pair - brief bouts of tumbling and biting before feeding	
	Cautious Triangle	0740	1	In kelp					
	E Humpback Is	1130 - 1300	20	In kelp			Dispersed by observer's boat SE. Did not re-raft while 2 odisc present with Scuba divers conducting algae survey		
	E Humpback Is	2000	App. 25	In kelp					Wave action obscured accurate count observation

TABLE 3 (Page 9)

37.

TABLE OF BEHAVIOURS LOGGED AGAINST TIME

	LOCATION	TIME OBSERVED ¹	TOTAL ²	RESTING ³	FEEDING ⁴	GROOMING ⁵	SWIMMING ⁶	INTERACTION ⁷	BEHAVIOUR UNKNOWN ⁸
22	N Mid Rock	2000	1		1 food diving				
	N Gull Is	2015	2						Brief sighting
	W Burial Cave Is	2200	2				Travel		
24	E Humpback Is	1240 - 1445	15	In kelp	Mo/P - she dives retrieving food for both, NE of Humpback	Occasional	Flight - raft disperses to S as wind shift leaves observers upwind. Regrouped		
	Farout Reefs	1240 - 1445	R.P.						Distance obscured accurate count, observation
25	Midway Gull & Burial Cave Is	0545	3						Brief sighting
	E Humpback Is	0625 - 0945	20	50m off kelp to east. With exposure of kelp by ebbing tide, all moved in to kelp	1 - SW of Mid Rocks	Much grooming activity with move into kelp	Travel		
	SE Gull Is	2035	5						Brief sighting
	E Humpback Is	2100 - 2145	5	In kelp					
	Midway Gull & Humpback Is	2145	3				Travel NE		

TABLE 3 (Page 10)

TABLE OF BEHAVIOURS LOGGED AGAINST TIME

	LOCATION	TIME OBSERVED ¹	TOTAL ²	RESTING ³	FEEDING ⁴	GROOMING ⁵	SWIMMING ⁶	INTERACTION ⁷	BEHAVIOUR UNKNOWN ⁸
25	SE Gull Is	2145 - 2200	19	In kelp. Closely packed raft		Occasional			
26	SE Gull Is	0530 - 0720	8	Sleeping	0600 - on awakening		Travel	Individual jostles, awakens 3 others	
	E Humpback Is	0715	R.P.						Distance obscured sighting
	N Burial Cave Is	2010	1	In kelp					
	SE Gull Is	2115 - 2200	11	In kelp					
27	SE Gull Is	0750 - 0830	7	In kelp		Occasional - upon moving away from raft position	Travel		
28	SE Gull Is	0540 - 0605	R.P.		No feeding passing food to D		Flight - 4 to 5 dispersed northward from raft position probably caused by observer's approach in boat		
	E Humpback Is	0630	R.P.	Raft motionless					Observation from distance
	N Burial Cave Is	2010	1	In kelp					
	SE Gull Is	2050 - 2150	25	In kelp	1 - NE of raft area	Prior to sleep			

TABLE 3 (Page 11)

TABLE OF BEHAVIOURS LOGGED AGAINST TIME

DATE	LOCATION	TIME OBSERVED ¹	TOTAL ²	RESTING ³	FEEDING ⁴	GROOMING ⁵	SWIMMING ⁶	INTERACTION ⁷	BEHAVIOUR UNKNOWN ⁸
29	Gull Is	0530 - 0600	0				Travel		
	E Humpback Is	0710 - 0740	R.P.						Observation from distance
	E Humpback Is	1030 - 1045	23	In kelp			Flight - Dispersal as wind shift left observers upwind. Raft regrouped		
	E Humpback Is	1915 - 2120	11	In kelp	2 adjacent to raft area		Travel		
	SE Gull Is	2145	15	In kelp					
30	Farout Reef	0950	3						Observation over distance
	E Humpback Is	1035	3						Observation over distance
	E Humpback Is	2005 - 2020	11	In kelp		Occasional			
	SE Gull Is	2105 - 2145	8	In kelp		Some		Individual nips another, which swims off short distance. Returns. 2 sleep side by side	

TABLE 3 (Page 12)

TABLE OF BEHAVIOURS LOGGED AGAINST TIME

DATE	LOCATION	TIME OBSERVED ¹	TOTAL ²	RESTING ³	FEEDING ⁴	GROOMING ⁵	SWIMMING ⁶	INTERACTION ⁷	BEHAVIOUR UNKNOWN ⁸
1	Gull Is	0745 - 0845	5				Travel		
	E Humpback Is	0900	27	Majority in kelp		Some	Flight - observer's scent caught, 2 continue to travel SE, 2 travel NE	An individual which sighted observers first, appeared to jostle others into dispersal	
	E Humpback Is	1205	15	Majority in kelp	1 SSW of Mid Rock	Some			
	E Humpback Is	2005	7	In kelp			Travel	2 tumbling, nipping while en route towards Gull Is	
	SE Gull Is	2030 - 2150	10	In kelp	1 E of raft area. 1 P nursing	Prior to sleeping	Travel into raft area	2 seen rolling, tumbling together W of Dozing Rock	
2	Midway Gull Is & Farout Reef	0700	5						Observation from distance
	E Humpback Is	1030 - 1130	22	In kelp		Occasional & especially upon regrouping	Up and looking, dispersal. Cause unknown. Regroup		

TABLE OF BEHAVIOURS LOGGED AGAINST TIME

TE	LOCATION	TIME OBSERVED ¹	TOTAL ²	RESTING ³	FEEDING ⁴	CROOKING ⁵	SWIMMING ⁶	INTERACTION ⁷	BEHAVIOUR UNKNOWN ⁸
1	2 Farout Reef	1230	App. 35						Ocean swell hindered accurate count
	SE Gull Is	1925 - 2050	14	Upon arrival in rafting area	4 near Bleeding Rock	Upon arrival, prior to resting	Travel into raft area. Dispersed - by log drifting into raft area. Regrouped	D seizing food from Mo	
3	SE Gull Is	0505 - 0530	2	Asleep in kelp					
	E Humpback Is	0555 - 0800	22	In kelp	4 between Humpback raft area & Mid Rock	Occasional	Travel - from SE. Flight to SE. Up and sniffing behaviour. Cause unknown	1 brown-headed M seen to sniff ano-genital region of several otters in raft	
12	SE Gull Is	2130	4	In kelp					
15	E Humpback Is	1015 - 1325	17	Majority in kelp	4 N of raft, 1 nursing D	Many	Flight - dispersed when observers scent detected. Regrouped		
16	SE Gull Is	0515 - 0815	19	In kelp	2 W of Bleeding Rock	Upon waking	Travel away from raft area		
		2000 - 2200	8	Some in kelp Some drifting	1 D nursing	Prior to rest			

TABLE 3 (Page 14)

TABLE OF BEHAVIOURS LOGGED AGAINST TIME

TE	LOCATION	TIME OBSERVED ¹	TOTAL ²	RESTING ³	FEEDING ⁴	CROOKING ⁵	SWIMMING ⁶	INTERACTION ⁷	BEHAVIOUR UNKNOWN ⁸
7	SE Gull Is	0530 - 0830	11	All, most in kelp, motionless	3 E of raft. D dives, also seizes food from Mo	Upon waking and after feeding	Travel away from raft area	A trio, consisting of M and Mo/D - identifiable as a unit on basis of frequent sightings, subsequently, M, Mo tumble, nip together	
	E Humpback Is	0945 - 1045	27	In kelp		Occasional	Flight - by unknown cause. 16 regroup		
	SE Gull Is	2050 - 2215	3	In kelp	Attempted nursing by D; Mo resists	Prior to rest			
18	SE Gull Is	0530 - 0900	8	Motionless in kelp	3 E of raft. D seizes food from Mo	Upon awakening and while travelling away from raft area	Travel away from raft area	Trio interaction - M and Y roll together. M nips nose of D	
	SW Burial Cave Is	2030	1						Brief sighting
	SE Gull Is	2045 - 2215	3	In kelp		Prior to rest			
19	SE Gull Is	0535 - 1115	10	In kelp, trio - after feeding	Trio - NE of raft area. D nurses, seizes food from Mo	After feeding	Travel away from raft area		
	SW Boxing Rock	1940	1						Brief sighting
	E Humpback Is	1950 - 2015	12	Majority, in kelp		Occasional			

TABLE 3 (Page 15)

TABLE OF BEHAVIOURS LOGGED AGAINST TIME

	LOCATION	TIME OBSERVED ¹	TOTAL ²	RESTING ³	FEEDING ⁴	GROOMING ⁵	SWIMMING ⁶	INTERACTION ⁷	BEHAVIOUR UNKNOWN ⁸
19	Gull Is	2040 - 2125	3		Trio - NE of raft area	After feeding			
	NE Burial Cave Is	2140	1	Sleeping in kelp			M upon awakening - swims a full semi circle around observers (mostly under water) to leave them upwind		
	W Burial Cave Is	0530	2	In kelp					
	SE Gull Is	0600 - 2130	21	18 in kelp	7 E of Gull Is - nursing P	P grooms back of Mo's head	Travel away from raft area	Trio - M attempts biting of Mo nose, P interferes	
21	NE Burial Cave Is	0600	1	Sleeping in kelp					
	Gull Is	0615 - 0630	0						
	E Humpback Is	0700 - 0745	16	Majority, in kelp		Occasional			
	Midway Deer & Thomas Is	0810	1		Otter abandoned food item as observers approached				
	Ferret Reefs	App 1100	App. 25						Indirect observation
	SW Cautious Is	2025 - 2100	1	In kelp	Food dives	Occasional			

TABLE 3 (Page 16)

TABLE OF BEHAVIOURS LOGGED AGAINST TIME

	LOCATION	TIME OBSERVED ¹	TOTAL ²	RESTING ³	FEEDING ⁴	GROOMING ⁵	SWIMMING ⁶	INTERACTION ⁷	BEHAVIOUR UNKNOWN ⁸
23	Gull Is	1140 - 1300	2		NE of Gull Is	Occasional - after feeding	Flight; possibly due to passing fish boat		
	SE Gull Is	1950 - 2200	5	In kelp		Prior to rest		Mo/D arrive in raft position, nose to nose snuffing with 2 resting otters	
24	SE Gull Is	0530 - 0600	6	In kelp	1 nursing P				
	E Humpback Is	0615 - 1130	15	Majority, outside of kelp	1 - W Mid Rocks. 1 P nursing	Occasional by majority	Travel into raft area. Flight into reefs, due to fish boat passage between Humpback Is and Mid Rock. Regrouped		
	E Humpback Is	1950 - 2040	11	Approx. half of raft		Remainder, prior to rest			
	SE Gull Is	2050 - 2200	2	M and F, after grooming. F stayed very alert looking about, while M wrapped in kelp appeared asleep		Upon arrival in raft area. (M - 17 min.) (F - 40 min.)	Travel into raft area	M arrived 15 min. after F; rolling, touching noses; nipping upon meeting	
25	SE Gull Is	0530 - 0615	3	2 sleeping in kelp		1			

TABLE 3 (Page 17)

41.

TABLE OF BEHAVIOURS LOGGED AGAINST TIME

	LOCATION	TIME OBSERVED ¹	TOTAL ²	RESTING ³	FEEDING ⁴	GROOMING ⁵	SWIMMING ⁶	INTERACTION ⁷	BEHAVIOUR UNKNOWN ⁸
25	E Humpback Is	0530 - 0730	9	2 in kelp	1 nursing D	5 grooming			
	Farout Reefs	1210 - 1245	App. 35	Majority, in kelp		Some	Flight into reefs. Wind shift leaves observers upwind		
	E Humpback Is	1320 - 1400	13	In kelp	1 NE of raft	Occasional			
	Between Burial Cave & Gull Is	1800	1						Brief sighting
	E Humpback Is	2000 - 2130	9	In kelp	5 leave raft to feed		Travel to raft position		
	SE Gull Is	2140 - 2200	3				Travel into raft area		
26	1200m SSW of Gull Is	0710	1				Flight as observer's boat approached		Brief sighting
	Farout Reefs	0720 - 0745	App. 35				Flight, many moved into reefs as observer's boat approached		Wave action obscured sighting
	E Humpback Is	0815 - 1100	R.P.	In kelp		Occasional			
	Farout Reefs	1145 - 1245	15	Some	1 adjacent to NW reef. 2 nursing P in raft	Majority	Travel - off raft area		
	E Humpback Is	1245	9	In kelp					

TABLE 3 (Page 18)

TABLE OF BEHAVIOURS LOGGED AGAINST TIME

	LOCATION	TIME OBSERVED ¹	TOTAL ²	RESTING ³	FEEDING ⁴	GROOMING ⁵	SWIMMING ⁶	INTERACTION ⁷	BEHAVIOUR UNKNOWN ⁸
26	Deer Is	2050 - 2115	2	1 wrapped in kelp, sleeping			Travel - 1		
	SW Caution Is	2140	1						Obscured by darkness
27	N Deer Is	1950	1			While swimming			Brief sighting
	SE Gull Is	2100 - 2145	2	In kelp		Prior to sleep			
28	SE Gull Is	0500 - 0730	3	In kelp		Upon waking	Travel away from raft area		
	SE Gull Is	2100	1						Observation over distance
29	Midway Humpback Is & Farout Reefs	1100	2				Travel		
	Mid Rocks	1230	2		Both food diving				
30	E Gull Is	1930 - 2200	2	While drifting N and F, NW past N tip of Gull Is		N occasionally	N and F drifted approx. 4 mi. due to SE wind. Then swam back to E Gull Is		
31	SE Gull Is	0500 - 1615	15	In kelp, at outset	In vicinity of Gull Is	Upon waking (2 for 15 min.; before rest periods (1 for 25 min., on two separate occasions))	Travel away from raft area; around Gull Is	N and F pair roll and tumble together	
1	SE Gull Is	1930 - 2200	10	Majority, in kelp	2 nursing D	Occasional			

TABLE OF BEHAVIOURS LOGGED AGAINST TIME

TC.

TE	LOCATION	TIME OBSERVED ¹	TOTAL ²	RESTING ³	FEEDING ⁴	GROOMING ⁵	SWIMMING ⁶	INTERACTION ⁷	BEHAVIOUR UNKNOWN ⁸
E	E Humpback Is	0625 - 0700	10	Majority, in kelp	1 nursing D	Occasional			
	Cautious Triangle	0850 - 1645	3	After feeding, in kelp	3 food dive to- gether (2 ses- sions). D nurses	After feeding (2 sessions - 38 min. and 20 min.)		The trio (see July 17 - Inter- action) - No dis- courages D from climbing on her chest; play - 3 roll together; mating activity - M biting F nose, vigorous play, M sniffing F ano- genital region. Interference in mating activity by D, possibly attempted copulation. When not resting or feeding, M swam back and forth beside M/D pair. D vocalized frequently, F tends to D. as D. attempts to climb on her chest.	

BEHAVIOURS LOGGED AGAINST TIME

1. Time Observed - Single times are brief sightings. Time spans represent observation for a sustained length of time.
2. Total - Maximum number of otters seen for the time observed.
3. Resting - Behaviour was designated as Rest if an otter was lying quietly in the water on its back in or out of kelp. Rest was often interspersed with casual grooming. Sleep was assumed only if otters were motionless (no grooming) and wrapped in kelp, usually at daybreak or nightfall. Description of rest behaviour as "in kelp" indicates otters position in a kelp bed, though not necessarily wrapped in kelp.
4. Feeding - Behaviour was designated as feeding if an otter was seen, pass to mouth, consuming a food item, diving repeatedly in an area to retrieve food items, or using a rock anvil to pound open food items.
For breakdown of feeding times and items see Table 5, Feeding Activity Logged Versus Time.
5. Grooming - Behaviour was designated as grooming if individual otters were seen to engage in the care of their pelage. This is achieved by rubbing, squeezing, licking, and blowing air into the pelage. Also includes mutual grooming between mothers and young.
6. Swimming - Behaviour was designated as swimming if an otter moved over a distance along the surface or under the surface without pausing to engage in other activity. Swimming behaviour had two apparent purposes:

- (i) Travel - an otter usually on the surface traversing a distance apparently between two geographic locales (eg. rafting areas). Usually in a straight path.
- (ii) Flight or Dispersal - Otters were seen to move off in response to an apparent threat detected by sense of smell, sight, or hearing. Often into the shelter of nearby reefs, and frequently underwater (especially if rapid escape necessary).

For detail of travel observed see Table 4, Travel Logged Versus Time.

8. Behaviour Unknown -

Behaviour was recorded as unknown if otters were sighted but obscured by wave action or distance, thus not enabling an accurate monitoring of behaviour. Indirect reports or observations were by other observers.

Resting and grooming in rafts of otters are recorded as activities relative to each other, since both activities can occur concurrently.

Abbreviations used in Table 3

F	-	Female
M	-	Male
R.P.	-	Raft present, but no count of otters obtained
Mo	-	Mother
D	-	Dependent
Mo/D	-	Mother/Dependent pair
P	-	Pup
Mo/P	-	Mother/Pup pair
SA	-	Sub-adult

Numbers appearing in table refer to otters (not sexes).

Behaviour was recorded as unknown if otters were sighted but obscured by wave action or distance, thus not enabling an accurate monitoring of behaviour. Indirect reports or observations were by other observers.

Table 4. Travel Logged versus Time

TABLE 4 (Page 1)
TRAVEL LOGGED VERSUS TIME

# IN TRANSIT	0530 - 0800	0800 - 1100	1100 - 1400	1400 - 1700	1700 - 2000	2000 - 2200	2200 - 0530
5	2 (Mo/P)		SW Humpback Is to S				
	4 (2 Mo/P)					S then SW around Gull Is from raft pos. E then N back to raft pos.	
	4 (2 Mo/P)					Cautious Tri-angle to Gull Is raft	
	Majority of 20					NE around S tip Gull Is N to raft pos.	
13	4 (2 Mo/P)	NW into Humpback Is raft pos. 1040 - 0 tot. 1130 - 14 tot.					
18	Majority of 12					NE around S tip of Gull Is, N to raft pos.	
19	3	S then SW around S tip Gull Is					
20	2 (Mo/P)		SW from Gull Is raft pos. to Humpback Is raft				

TABLE 4 (Page 2)
TRAVEL LOGGED VERSUS TIME

DATE	# IN TRANSIT	0530 - 0800	0800 - 1100	1100 - 1400	1400 - 1700	1700 - 2000	2000 - 2200	2200 - 0530
20	Majority of 15						NE then N around S tip Gull Is to raft pos.	
	Majority of 38			Move westward into Humpback Reefs				
21	4 (2 Mo/P)	NW from Farout Reefs to Humpback Is raft						
	5	SE from Humpback Is raft towards Farout Reefs						
	Several of 8						E then N around S tip of Gull Is forming raft	
	8	8 present (Gull Is) at 2145 June 21, departed by 0555 June 22						
22	2 (Mo/P)						W Burial Cave Is towards Gull Is	

TABLE 4 (Page 3)

TRAVEL LOGGED VERSUS TIME

	# IN TRANSIT	0530 - 0800	0800 - 1100	1100 - 1400	1400 - 1700	1700 - 2000	2000 - 2200	2200 - 0530
25	3 (Mo/P + 1)	NW to Humpback Is raft pos.						
	2 (Mo/P)	SE from Hump- back Is towards Farout Reefs						
	3 (Mo/P + 1)						NE from Hump- back Is towards Gull Is	
26	3	S then SW around S tip Gull Is from raft pos.						June 25, 2200 - 19 in raft SE Gull Is, June 26, 0530 - 8
27	7	S then SW around S tip Gull Is, pro- ceeded toward Humpback Is						
28	2						NE from Hump- back Is past Mid Rock to- ward Gull Is	June 28, 2150 - 25 in raft SE Gull Is. June 29, 0530 - 0 at SE Gull Is
	4 (Mo/P + 2)						S to Humpback Is raft pos.	

TABLE 4 (Page 4)

TRAVEL LOGGED VERSUS TIME

	# IN TRANSIT	0530 - 0800	0800 - 1100	1100 - 1400	1400 - 1700	1700 - 2000	2000 - 2200	2200 - 0530
1	5	S then SW around S tip of Gull Is						
	1	SW from Gull Is raft to Humpback Is raft pos.						
	2		SE from Hump- back Is raft towards Farout Reefs					
	2 (Mo/P)			NE from Hump- back Is raft towards Gull Is				
	2						NE from Hump- back Is towards Gull Is	
	6 (2 Mo/P + 2)						N from S tip of Gull Is into raft pos.	
2	Majority of 14						NE then N around S tip of Gull Is into raft pos.	July 2, 2050 - 14 at SE Gull Is. July 3, 0530 - 2 at SE Gull Is

TABLE 4 (Page 5)

47.

TRAVEL LOGGED VERSUS TIME

DATE	# IN TRANSIT	0530 - 0800	0800 - 1100	1100 - 1400	1400 - 1700	1700 - 2000	2000 - 2200	2200 - 0530
July 13	3 (Mo/P + 1)	From SE to Humpback Is raft pos.						
15	3 (Mo/D + 1)						N from S tip of Cull Is into raft pos.	July 15, 2200 - 3 at SE Cull Is. July 16, 0515 - 19 at SE Cull Is
16	Majority of 19	S then SW around S tip of Cull Is						
	2 (Mo/D)	From Cull Is raft pos. S toward Farout Reefs						
17	11	S then SW around S Cull Is						July 17, 2215 - 3 at SE Cull Is. July 18, 0530 - 8 at SE Cull Is
18	4 (Mo/P + 2)	S then SW around S Cull Is						July 18 - 2215 - 3 at SE Cull Is. July 19, 0535 - 10 at SE Cull Is
	3 (Mo/P + 1)	From SE Cull Is raft pos. to Open Water raft pos.						

TABLE 4 (Page 6)

TRAVEL LOGGED VERSUS TIME

DATE	# IN TRANSIT	0530 - 0800	0800 - 1100	1100 - 1400	1400 - 1700	1700 - 2000	2000 - 2200	2200 - 0530
July 19	6	S then SW around S Cull Is						
20	Majority of 21	S then SW around S Cull Is						
24	3 (Mo/P + 1)	NW into Humpback Is raft pos. from vicinity of Open Water pos.						July 24, 2200 - 2 at SE Cull Is. July 25, 0530 - 4 at SE Cull Is
	4	SW to Humpback Is raft from vicinity of Cull Is						
	2						NE then N around S Cull Is into raft position	
25	2 (Mo/D)						NW to Humpback Is raft from Br. Rock	
	1						SW to Humpback Is raft from Mid Rocks	

TABLE 4 (Page 7)

TRAVEL LOGGED VERSUS TIME

	# IN TRANSIT	TRAVEL LOGGED VERSUS TIME						
		0530 - 0800	0800 - 1100	1100 - 1400	1400 - 1700	1700 - 2000	2000 - 2200	2200 - 0530
y 25	3						N from S tip of Gull Is into raft pos.	
6	App. 15			NW slowly from Farout Reefs raft pos. for approx. 200 m.				
	1						WSW to Burial Cave Is from Deer Is	
28	3	S then SW around S tip of Gull Is						
29	2		NW to Humpback Is from vicin- ity of Farout Reefs					
31	11	S then SW around S Gull Is from raft position						July 30, 2200 - 2 at SE Gull Is. July 31, 0500 - 15 at SE Gull Is
	1 M	N from raft pos., to pos. off NE corner of Gull Is in kelp		S then SW around S end of Gull Is	NW then N around N end of Gull Is			

TABLE 4 (Page 8)

TRAVEL LOGGED VERSUS TIME

	# IN TRANSIT	TRAVEL LOGGED VERSUS TIME						
		0530 - 0800	0800 - 1100	1100 - 1400	1400 - 1700	1700 - 2000	2000 - 2200	2200 - 0530
J 31	1 F			From position with M off NE corner Gull Is. S then SW around Gull Is. From W side Gull Is, SW past Mid Rocks	Mid Rocks NE from vicinity of Humpback Is. Mid Rocks to NE Gull Is			

NOTES ON TABLE 4TRAVEL LOGGED VERSUS TIME

1. # IN TRANSIT - Describes number of otters observed travelling a straight path. Origins and destinations of travel recorded if observed.
2. TIME PERIODS - Cover a full 24-hour period (PDT). 0530 represents first light, 2200 last light, of day. Therefore 2200 - 0530 represents darkness, and observation not possible.

Abbreviations

Mo	-	Mother
P	-	Pup
D	-	Dependent
M	-	Male
F	-	Female
tot.	-	total
pos.	-	position

Table 5. Feeding Activity Logged versus Time

FEEDING ACTIVITY LOGGED VERSUS TIME

LOCATION	FORAGE METHOD AND FOOD ITEM	0500 - 0800	0800 - 1100	1100 - 1400	1400 - 1700	1700 - 2000	2000 - 2200
N Humpback Is	pounding white clams			Mo/D			
7 Between Burial Cave and Cautious Is	pounding						Mo/P
N Dozing Rock	pounding		Individual				
16 SE Gull Is	pounding mussels				Individual		
1 SE Gull Is	pounding mussels					3 indiv.	2 indiv, 2 Mo/D
14 100m SE Humpback Is in Reefs	chewing, possibly chiton				Individual		
1 App. 50m E Gull Is Raft Position	pounding	4 indiv.					
20 S Dozing Rock	pounding white clams					M & F	
200m off SE Gull Is	pounding white clams						Individual
22 Midway between Gull Is, Dozing Rock	pounding	M & F					
N Mid Rock	pounding						Individual
24 NE Humpback Is	pounding			Mo/P			
25 SW Mid Rocks	chewing orange starfish	Individual					

TABLE 5 (Page 2)

FEEDING ACTIVITY LOGGED VERSUS TIME

LOCATION	FORAGE METHOD AND FOOD ITEM	0500 - 0800	0800 - 1100	1100 - 1400	1400 - 1700	1700 - 2000	2000 - 2200
a Few meters from SE Gull Is Raft Pos.	chewing, possibly mussels	3 indiv.					
c 28 E Gull Is	pounding	Mo/P					Individual
e NE Humpback Is	pounding white clams						Mo/P
y 1 SSW Mid Rock	purple urchin			Individual			
E Gull Is	pounding						Individual
y 100m W Bleeding Rock	pounding					2 indiv.	
400m W Bleeding Rock	pounding						Mo/D
y S Mid Rock	pounding	2 indiv.					
E Humpback Is	pounding	1 indiv.					
Unrecorded position near Humpback Is	pounding	Individual					
200m N Humpback Is Raft Position	pounding white clams	Mo/D					
y 20m N Humpback Is Raft Position	pounding white clams			2 Mo/D			
E Gull Is	pounding						Individual

TABLE 5 (Page 3)

FEEDING ACTIVITY LOGGED VERSUS TIME

DATE	LOCATION	FORAGE METHOD AND FOOD ITEM	0500 - 0800	0800 - 1100	1100 - 1400	1400 - 1700	1700 - 2000	2000 - 2200
July 16	W Bleeding Rock	pounding	No/D					
July 17	E Gull Is	pounding white clams (for 60 minutes)	Trio					
July 18	500m NE Gull Is Raft Position	pounding white clams (125 minutes)	Trio					
July 19	500m NE Gull Is Raft Position	pounding white clams, chewing small objects	Trio (140 min.)	Trio (95 min.)				Trio - feeding well past sunset (App. 2115)
July 20	500m NE Gull Is Raft Position	pounding white clams	Trio					
	NE Gull Is	pounding white clams 3 large red urchins 1 green urchin	3 Indiv. Trio (120 min.)		Trio (no time avail- able)	Trio (55 min.)		
	150m SW Bleeding Rock				Trio (no time avail- able)			Trio - (3rd feeding sess.)
July 22	Halfway between Deer & Thomas Is	red urchin		Individual				
	S Cautious Is	no pounding, items unknown						Individual - 3 food dives ob- served

TABLE 5 (Page 4)

FEEDING ACTIVITY LOGGED VERSUS TIME

DATE	LOCATION	FORAGE METHOD AND FOOD ITEM	0500 - 0800	0800 - 1100	1100 - 1400	1400 - 1700	1700 - 2000	2000 - 2200
July 23	NE Gull Is	pounding white clams one red urchin (25 minutes)			2 Indiv.			
July 24	W Mid Rocks	pounding		Individual				
July 25	NE Humpback Is	pounding white clams			Individual			
	N to E Dr. Rock	pounding						No/D
	Several m off Humpback Reefs	chewing						No/D
	E Dr. Rock	pounding						Individual
July 26	N Farout Reefs	urchin			Individual			
July 29	S Mid Rocks	pounding			No/D			
July 31	NE Gull Is	pounding	3 No/D					
	E Gull Is	pounding	2 F					
	SW Gull Is	red or purple urchin			1 F			
	From SW to NE Gull Is around W side	large red urchin, fleshy object, white clams				1 M		
Aug. 1	SE Bleeding Rock	pounding white clams, chewing small objects, 1 crab			Trio (75 minutes)	Trio		

NOTES ON TABLE 5FEEDING ACTIVITY LOGGED VERSUS TIME

1. Forage Method and Food Item - Forage method includes an initial diving to the bottom to retrieve food item in all cases. Food items named where known.

 Pounding - refers to the action of placing a stone anvil on the chest, and pounding food items against it to break them open for consumption of contents.

 Chewing - refers to the action of passing a food item directly into the mouth with the forepaws for consumption.
2. Time Periods - Time periods cover a 24-hour period (PDT). 0530 and 2200 are first and last light of day, respectively. Numbers within table are otters seen feeding.
3. Trio - Refer to Notes on Table 2, Note on Recognition of Individuals, for explanation.

Abbreviations

Mo - Mother
 P - Pup
 D - Dependent
 M - Male
 F - Female
 Indiv. - Individual (sex undetermined)

Table 6. Extended Behavioural Observations on Specific Otters

EXTENDED BEHAVIOURAL OBSERVATIONS ON SPECIFIC OTTERS

EXTENDED BEHAVIOURAL OBSERVATIONS ON SPECIFIC OTTERS

DATE	LOCATION	TIME	OTHERS	ACTIVITY ¹
July 20	Kelp E of Gull Is	0600 - 0710	Trio ²	Sleeping
	NE Gull Is	0710 - 0910	"	All three wake, leave kelp and begin feeding.
	Kelp E of Gull Is	0910 - 0935	"	Ceased feeding, swim back to kelp grooming en route and while in kelp. Dependent nurses.
	Kelp E of Gull Is	0935 - 1125	"	All three sleeping.
	Kelp E of Gull Is	1125 - 1153	"	Slowly move app. 75m SE of kelp. Grooming occurs with intermittent resting.
	Kelp E of Gull Is	1153 - 1230	"	Swim back to kelp slowly still grooming. Dependent nursing.
	NE Gull Is	1230 - 1235	"	Swim to feeding location.
	NE Gull Is	1235 - 1355	"	Feeding, pounding white clams.
	SE Gull Is	1355 - 1406	"	Disturbed by boat passage, swim to Bleeding Rock.
	SE Gull Is	1406 - 1432	"	Feeding, pounding white clams.
	Kelp E of Gull Is	1432 - 1439	"	Swim back to kelp E of Gull Is.
	Kelp E of Gull Is	1439 - 1530	"	Grooming and short period play (about 5 min.)
	Kelp E of Gull Is	1530 - 1545	"	Sleep.
	SE Gull Is	1545 - 1610	"	Swim S to Bleeding Rock. Start food diving.
	NE Gull Is	1610 - 1617	"	Swim while feeding to NE Gull Is.
	NE Gull Is	1617 - 1701	"	Feeding, pounding white clams.
	Kelp E of Gull Is	1701 - 1735	"	Grooming.

DATE	LOCATION	TIME	OTHERS	ACTIVITY ¹
July 20	Kelp E of Gull Is	1735 - 1907	Trio	Sleeping intermittent with grooming Pup nurses.
	Kelp E of Gull Is	1907 - 1916	"	Frightened by observer's movement. about 200m S grooming along the way
	SE Gull Is	1916 - 2006	"	Slowly drifting S to Bleeding Rock, grooming and playing (10 min.)
	E Gull Is	2006 - 2031	"	Feeding, pounding white clams.
	E Gull Is	2031 - 2044	"	Swim to kelp, grooming along the wa
	Kelp E of Gull Is	2044 - 2117	"	Grooming.
	Kelp E of Gull Is	2117	"	All three sleep. Observations terminated.
July 31	NE Gull Is	0715	Male & Female	Male swims N of Gull Is.
	NE Gull Is	0815	"	Male returns from N of Gull Is.
	NE Gull Is	0815 - 0820	"	Male swims in NE area Gull Is.
	NE Gull Is	0820 - 0845	"	Male grooms.
	NE Gull Is	0845 - 0940	"	Male sleeps, female arrives.
	NE Gull Is	0940 - 1100	"	Male and female continue sleeping.
	NE Gull Is	1100 - 1125	"	Male grooms, female sleeps.
	NE Gull Is	1125 - 1207	"	Male and female sleep.
	NE Gull Is	1207 - 1230	"	Female wakes and swims around S end Gull Is.
	NE Gull Is	1230 - 1305	"	Male wakes and swims around S end Gull Is stopping to groom in kelp at SW corner. Female lost from vi
	SW Gull Is	1305 - 1315	"	Female feeding (2 urchins) W of Gull Is. She swims toward kelp and male leaves kelp. Both roll together.

TABLE 1
EXTENDED BEHAVIOURAL OBSERVATIONS ON SPECIFIC OTTERS

DATE	LOCATION	TIME	OTHERS	ACTIVITY
July 31	SW Gull Is	1345 - 1345	Male & Female	Male returns to kelp and sleeps. Female swims towards Humpback Is and is lost from sight.
	SW Gull Is	1345 - 1430	"	Male sleeps in kelp.
	SW Gull Is	1431 - 1500	"	Male awakens and swims up W side Gull Is around N end to NE side Gull Is. En route consumed two large red urchins and a large fleshy object.
	NE Gull Is	1500 - 1520	"	Male feeding, pounding white clams.
	NE Gull Is	1520 - 1530	"	Male slowly swims to kelp E of Gull Is.
	Kelp E of Gull Is	1520 - 1555	"	Male grooming.
	Kelp E of Gull Is	1555 - 1615	"	Male sleeps, female returns. Observations terminated.
Aug. 1	N. Dozing Rock	0850 - 0925	Trio	Male and female biting each other and grasping each other around the neck. Dependent crawling up on back of female.
	N. Dozing Rock	0925 - 0935	"	All three swim SE to position W of Dozing Rock.
	W Dozing Rock	0935 - 0950	"	Swim back to original position N Dozing Rock.
	N Dozing Rock	0950 - 1000	"	Grooming.
	N Dozing Rock	1000 - 1005	"	Much rolling and splashing. Dependent crying frequently. The female emerges with a bloody and swollen nose which she vigorously rubs with forepaws. Possibly pre-ecupulatory behaviour.
	N Dozing Rock	1005 - 1020	"	Dependent cries continuously for 7 minutes while mother grooms. Stops crying as nursing started. Male grooms as well.

TABLE 2
EXTENDED BEHAVIOURAL OBSERVATIONS ON SPECIFIC OTTERS

DATE	LOCATION	TIME	OTHERS	ACTIVITY
Aug. 1	N Dozing Rock	1020 - 1040	Trio	Mother and dependent resting. Male casually grooming and resting alternately.
	N Dozing Rock	1040 - 1050	"	Mother awakes and begins grooming. Dependent nurses. Male continues casual grooming.
	N Dozing Rock	1050 - 1130	"	Slow swim SE to about 250m SE of Doz. Rock.
	SE Dozing Rock	1130 - 1245	"	Feeding consisting of pounding action.
	SE Dozing Rock	1245 - 1302	"	Swim back to N Dozing Rock. Grooming en route.
	N Dozing Rock	1302 - 1340	"	Concentrated grooming.
	N Dozing Rock	1340 - 1440	"	Casual grooming and resting. Pup attempts nursing but mother rolls to discourage this.
	N Dozing Rock	1440 - 1450	"	All grooming. Pup nurses.
	N Dozing Rock	1450 - 1535	"	Grooming and resting alternately.
	N Dozing Rock	1535 - 1556	"	Slowly swim to SE of Dozing Rock.
	SE Dozing Rock	1556 - 1634	"	Feeding. Near end of feeding swim while feeding to just N of Dozing Rock.
	N Dozing Rock	1634 - 1645	"	Grooming. Observations terminated.

NOTES ON TABLE 6

EXTENDED BEHAVIOURAL OBSERVATIONS ON SPECIFIC OTTERS

1. Activities - For description, see Notes on Table 3, Behaviours Logged Against Time.
2. Title - For description, see Notes on Table 2, Note on Recognition of Individuals.

Table 7. Timing of Food Dives

TABLE 2 (Contd.)

SAID GOOD TO BYE

[illegible]

June 2	N Humpback Is	1310 1600	65 105	
July 3	NE Humpback Is	0630	70 65 95 80 90	One otter, pounding white clams.
July 15	NE Humpback Is	0650	75 45 100 95 105	No/D pounding white clams. Dependent follows mother down. Dependent also receiving food from mother.
July 15	NE Humpback Is	1215	105 120 100 45 90 120 127	Male & female observed pounding white clams.
July 17	NE Gull Is	0645	90 90 55 70 75 75 65	Trio ² observed pounding white clams. Female dives first followed by dependent and then male.
July 18	NE Gull Is	0610	90 85 85 85 85 75 115 60 85	Trio observed pounding white clams.

Table 1 (continued)

SENTE GOV DO DILIT

DATE	LOCATION	TIME	DURATION OF DIVE (sec)	INTERVAL ON SURFACE (sec)	COMMENTS
July 18	NE Gull Is	0610	70 60 80 80 90 90 65		Trio observed pounding white clams.
		0750	70		
July 19	NE Gull Is	0715	75 60 80 75 65 60 60 80 85 95 60 70 60 40 85 80	70 85 90 80 75 160 65 40 120 60	Trio pounding white clams
		0805	80		
		0950	65 100 90 75 85 110	70 90 75 85 60	Trio pounding white clam
		2045	80 60 45 85 75 70	110 45 95 100 75 85	Trio pounding white clam

TABLE 7 (Page 3)

TIMING OF FOOD DIVES

DATE	LOCATION	TIME	DURATION OF DIVE (sec)	INTERVAL ON SURFACE (sec)	COMMENTS
July 20	NE Gull Is.	0710	80	180	On surface, swim to feed position.
			70	120	
			80	90	
			75	-	
			-	-	
			120	50	
			90	75	
			110	125	
			95	100	
			95	70	
			90	95	Trio pounding white clams
			75	105	These dives are timed for the female. She was followed down immediately by her dependent in all instances.
			85	115	Male followed in majority of dives. Arrival back on surface, all three within seconds.
			90	125	
			80	150	
			-	-	
			90	130	
			90	105	
			85	115	
			80	75	
			-	-	
			70	85	
			80	95	
			100	140	
			75	100	
			70	85	
			85	95	
			75	80	
			80	90	
			70	-	
			75	85	
			80	135	
			80	110	
			-	100	
			65	100	
			70	95	
			70	75	
			80	45	
			75	55	
			80	-	
		0910			Swam back to raft position (app. 450m in 405 sec.)

TABLE 7 (Page 4)

TIMING OF FOOD DIVES

DATE	LOCATION	TIME	DURATION OF DIVE (sec)	INTERVAL ON SURFACE (sec)	COMMENTS
July 20	NE Gull Is.	1235	-	-	Trio commenced feeding.
		1300	90	135	
			80	110	
			100	85	
			95	115	
			80	-	
			-	70	
			95	135	
			80	70	
			70	115	
			-	-	
			75	125	
			95	120	
			100	90	
			85	115	
			85	115	
			75	75	
			105	-	
		1355			Disturbed by boat passing.
	Immediately SW Bleeding Rock	1406	-	-	Resume feeding
			80	90	
			-	-	
			85	115	
			-	-	
			75	145	
		1432	90	-	Ceased feeding.
		1605-			
		1611	-	-	
	E Gull Is.	1611-			
		1701	-	-	18 dives counted.
	SW Bleeding Rock	2006-			
		2024	-	-	

TABLE 7 (Page 5)

TIMING OF FOOD DIVES

DATE	LOCATION	TIME	DURATION OF DIVE (sec)	INTERVAL ¹ ON SURFACE (sec)	COMMENTS
------	----------	------	------------------------------	--	----------

July 29	SW Bleeding Rock	2024	95	90	-
			75	165	Ceased feeding.
July 31	E Gull Is	0749	100	70	Female feeding.
			90	135	
			95	60	
			85	45	
			90	70	
			65	85	
		0909	105	-	Female disappears from sight.
	NE Gull Is	1500	-	-	Male feeding since 1440 while progressing along W Gull Is.
			75	90	
			95	95	
		1520	85	115	Ceased feeding.
Aug. 1	SE Bozeng Rock	1100	75	80	Trio feeding. Distance obscured the timing of dashed dives.
			100	90	
			105	85	
			-	-	
			-	-	
			90	95	
			-	-	
			90	75	
			80	95	
			90	125	
			-	-	
			95	95	
			-	-	
			90	75	
			-	-	
			95	130	
		1245	-	-	Ceased feeding.

Represents a first feeding session including 24 food dives in 1 hour, 45 minutes.

TABLE 7 (Page 6)

TIMING OF FOOD DIVES

DATE	LOCATION	TIME	DURATION OF DIVE (sec)	INTERVAL ¹ ON SURFACE (sec)	COMMENTS
------	----------	------	------------------------------	--	----------

Aug. 1	SE Bozeng Rock	1556	-	-	
			90	75	
			90	80	
			90	20	
			60	65	
			65	60	
			100	110	
			90	55	
			85	65	
			65	100	
			75	95	
			-	-	
		1634	-	-	Ceased feeding, grooming begins. Observations terminated.

Represents second feeding session including 13 dives in 1 hour, 18 minutes.

Trio feeding.

TIMING OF FOOD DIVES

1. Interval on Surface - The period of time between sequential food dives devoted to consumption of retrieved food items.

2. Time - For description, see Notes on Table 2, Note on Recognition of Individuals.

A dashed entry in table denotes food dive(s) not timed.

Table 8. Weather Conditions during Observation Periods.

TABLE 8
WEATHER CONDITIONS DURING OBSERVATION PERIODS

DATE	OBSERVATION PERIOD	CONDITIONS
June 2	1145 - 1610	NW wind, sunny, hot.
June 3	1000 - 1400	NW wind, sunny, hot.
June 4	1220 - 1310	NW wind, sunny, no cloud.
June 5	1030 - 1310	NE wind, sunny, hot.
June 6	1030 - 1130	SE wind, cloudy, choppy, 2 - 3 ft. swells outside reefs.
	1745 - 1830	SE wind increasing, cloudy.
June 7	1510 - 2140	SE wind, overcast.
June 9	1905 - 2110	SE breeze, cloudy, overcast.
June 10	1450 - 1510	SE breeze, cloudy, cool, rainy, some white caps.
	1635 - 1730	SE breeze, cloudy, cool, rainy, some white caps.
June 11	1230 - 1340	Brisk SE wind, cloudy, cold, choppy, white caps.
June 12	1510 - 2105	Brisk SE, rainy, cloud, choppy. Some clearing by evening.
June 13	1040 - 1305	Slight SE wind, sunny with some cloud.
June 14	1600 - 1800	Brisk NW wind, cloudy, cool, choppy.
June 15	1400 - 1700	NW wind, cloudy.
June 16	2030 - 2100	NW wind, sunny.
June 17	0800	NW wind, sunny, calm.
June 18	0600 - 0830	Stiff NW breeze, sunny, choppy.
	2015 - 2120	Stiff NW breeze.
June 19	0610 - 0735	NW wind, sunny.
June 20	0700 - 1000	NW breeze, sunny.

TABLE 8
WEATHER CONDITIONS DURING OBSERVATION PERIODS

DATE	OBSERVATION PERIOD	CONDITIONS
June 20	1030 - 1200	NW breeze increasing, sunny (marked increase 1145).
	2015 - 2200	NW wind.
June 21	0745 - 0815	NW wind, sunny, scattered cloud.
	0905 - 1000	NW wind, sunny. Wind increase intensity by noon.
	2030 - 2145	NW wind, sunny, scattered cloud.
June 22	0555 - 0730	NW wind, sunny.
	2000	SW wind, sunny.
June 23	morning	Sunny but foggy, clouding over in evening.
June 24	morning	Slight SW wind, cloudy.
	2100 - 2140	Slight NW wind, sunny, seas calm.
June 25	0625 - 0845	NW wind, sunny.
	2100 - 2125	Very brisk NW wind, choppy.
	2145 - 2200	Very brisk NW wind, choppy.
June 26	0545 - 0720	NW wind, sunny, seas rippled.
	2115 - 2200	NW wind, sunny, low swell.
June 27	0750 - 0830	Slight SE breeze, sunny, seas calm.
June 28	0540 - 0605	NW wind, sunny, seas rippled.
	2050 - 2150	NW wind, sunny, seas choppy.
June 29	0530 - 0630	SE breeze, foggy, seas rippled.
	0710 - 0740	SE breeze, foggy, seas rippled.
	1030 - 1045	Wind shifting W to SW, foggy, seas rippled.
	1915 - 2120	SE wind, sunny, rippled.

TABLE 8

WEATHER CONDITIONS DURING OBSERVATION PERIODS

DATE	OBSERVATION PERIOD	CONDITIONS
June 30	2105 - 2145	SE wind, sunny, rippled.
	2005 - 2040	SE wind, sunny, seas rippled.
July 1	0745 - 0845	Faint SE wind, sunny, seas calm.
	0900 - 1215	Faint SE wind, sunny, seas calm.
	1935 - 2040	Steady NW wind, sunny, light chop.
	2050 - 2150	Steady NW wind, sunny, light chop.
July 2	1045 - 1145	NW breeze, sunny, seas rippled.
	1925 - 2050	Brisk NW wind, sunny, seas choppy.
July 3	0505 - 0830	NW breeze, sunny, seas calm.
July 12		NW wind, sunny.
July 13		NW wind, sunny.
July 14		NW wind, sunny.
July 15	1015 - 1325	W-NW breeze, sunny, sea calm.
	2100 - 2200	Brisk NW wind, sunny, light chop.
July 16	0515 - 0815	Brisk NW wind, sunny, light chop, sunrise at 0615.
	2000 - 2220	High NW wind, sunny, seas choppy, many white caps.
July 17	0530 - 1045	NW breeze, sunny, seas rippled, sunrise at 0625.
	2050 - 2215	Very strong NW wind, cloudy, seas very choppy.
July 18	0530 - 0900	NW breeze, sunny, seas rippled.
	2045 - 2215	Brisk NW wind, sunny, seas choppy, sunset at 2110.
July 19	0535 - 1115	NW breeze, sunny, seas rippled.

WEATHER CONDITIONS DURING OBSERVATION PERIODS

DATE	OBSERVATION PERIOD	CONDITIONS
July 19	1950 - 2125	Very brisk NW wind, sunny, sea choppy.
July 20	0600 - 2130	NW wind, sunny, slightly choppy.
July 21	0615 - 0745	NW breeze, no cloud, slightly choppy, sunrise at 0625.
July 22	morning	NW wind, sunny.
July 23	1140 - 1300	Very brisk NW wind, sunny, choppy.
	1950 - 2200	Very brisk NW wind, sunny, choppy with some white caps.
July 24	0530 - 1130	Steady NW wind, sunny, slightly choppy, sunrise at 0625.
	2050 - 2200	Brisk NW wind, sunny, choppy, sunset at 2115.
July 25	0530 - 1245	NW wind, sunny, slightly choppy, sunrise at 0625.
	1320 - 1400	SE wind, sunny, sea slightly choppy.
	2000 - 2200	Slight SE breeze, sunny, sea calm.
July 26	0720 - 1100	Slight NW breeze, sunny, sea calm.
	2050 - 2115	SE breeze, overcast, sea rippled.
July 27	2100 - 2145	SE breeze, sunny, slightly choppy.
July 28	0500 - 0730	Slight NW wind, sunny.
July 29	afternoon	NW wind, sunny.
July 30	1930 - 2100	Stiff SE wind, sunny, seas choppy, high NW swell which was present entire day.
July 31	0500 - 0800	SE breeze, foggy, seas calm.
	0800 - 1615	Brisk NW wind, sunny, choppy.
Aug. 1	0545 - 0700	Very slight SE breeze, no cloud, seas calm.
	0700 - 1645	Brisk SE wind, sunny, slightly choppy.

TABLE 9NOTES FROM SCUBA DIVE SURVEYS OF INVERTEBRATE FOOD STOCKSDIVE 1

Transect followed SE corner Gull Island from 10 m offshore, east, 100 m.
Depth 3 m to 12 m.

The only potential otter food found was one octopus (Octopus sp.), three chitons (one Tonicella liniata and two Cryptochiton stelleri) and numerous top shells (Tegula funeralis). The most abundant broken shells were from mussels (Mytilus spp.) and clams (identification unknown). No live abalone (Haliotis kamtschatkana) or urchins (Strongylo spp.) were found.

DIVE 2

Area immediately east of Dozing Rock. Depth 3 m to 14 m.

No measurable concentrations of bottom fauna suitable for otter was found. Total of five urchins (Strongylocentrotis purpuratus) were seen during the 45 minute duration of the dive. Test diameter was less than 10 cm and all were in cracks in the rocks. One abalone about 4 cm long was found. In approximately the same area a previous diving survey (Miller, 1972) estimated the concentration of urchins at 6 to 10/m².

Table 10. Algal Inventory Transect Data

TRANSECT NO: 1 QUADRAT NO: 2 TIME: 1830 DATE: June
DEPTH: 29' ATTENUATION (cm): 0 - 5 SLOPE (°): 0 - 5°
SUBSTRATE: cobbles, sand.
LOCATION: Burial Cave Is.

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Lonicaria saccharina</i>	1	820*
<i>Catalpa coccinea</i>	1	-10
<i>Gemmangia platyphyllos</i>	1	-10
<i>Gemmangia saccharina</i>	1	-10
<i>Pleurothallis lanceolata</i>	1	20
<i>Pleurothallis saccharina</i>	1	-10*
<i>Polypodium saccharinum</i>	3	-10
<i>Polypodium spectabile</i>	1	25
<i>Trichostema</i>	1	-10
<i>Platanus grandis</i>	10+	-10
<i>Platanus grandis</i> (on all rocks)	1	-10
<i>Polypodium</i>	4	-10
<i>Gemmangia platyphyllos</i>	8	-10
<i>Codium saccharinum</i>	9	50
<i>Gelidium aculeatum</i>	8	-10
<i>Agardhiella subquadrata</i>		
<i>Callithrix</i>		
<i>Callithrix</i>		
TOTALS	51	1015

FAUNA - TAXON	NUMBER	LENGTH/ SIZE (cm)	WET WEIGHT (gm)
<i>Turbo</i> sp.	-50		
<i>Polychaete</i> worm	5		15
<i>Biodora aspera</i>	1		10
<i>Pygospio</i> sp.	1		-10
TOTALS	57+		35

TRANSECT NO: 1 QUADRAT NO: 1 TIME: 1815 DATE: June 18
DEPTH: 10' ATTENUATION (cm): 0 - 5 SLOPE (°): 5 - 10°
SUBSTRATE: cobbles, sand.
LOCATION: Burial Cave Is.

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Lonicaria saccharina</i>	1	790*
<i>Catalpa coccinea</i>	17	730*
<i>Gemmangia platyphyllos</i>	1	980
<i>Gemmangia saccharina</i>	1	30
<i>Pleurothallis lanceolata</i>	10	120
<i>Pleurothallis saccharina</i>	1	-10
<i>Polypodium saccharinum</i>	15+	-10
<i>Polypodium spectabile</i>	2	-10
<i>Trichostema</i>	2	-10
<i>Platanus grandis</i> (on all rocks)	10+	-10
<i>Platanus grandis</i>	3	-10
<i>Polypodium</i>	1	-10
TOTALS	64	2,690

FAUNA - TAXON	NUMBER	LENGTH/ SIZE (cm)	WET WEIGHT (gm)
<i>Turbo</i> sp.	100+		-10
<i>Polychaete</i> worm	2		-10
<i>Biodora aspera</i>	1		20
TOTALS	103		

NOTES

1. *Gemmangia*, average across 35 plants = 98.57 gm/plant.
2. *Callithrix*, average = 805 gm/plant.
3. *Polypodium*, average = 225 gm/plant.
4. *Polypodium* present in all quadrats.
5. *Gemmangia* present on all erect corallines.
6. *Biodora* found on site were visually identified on site, species present included: *Callithrix* *lanceolata*
Turbo sp.
Polychaete sp.
Biodora aspera
Acropora *sp.*

and the limpets:

TABLE 10
DIVE QUADRATS (1 m²)

TRANSECT NO: 1 QUADRAT NO: 4 TIME: 1845 DATE: June
DEPTH: 30' ATTENUATION (cm): 5 - 10 SLOPE (°): 0 - 5°
SUBSTRATE: Cobbles in sand/
shell bottom.
LOCATION: Serial Cave Is.

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Gracilaria sinuosticta</i>	4	15
<i>Rhodostilum plumosum</i>	2	40
<i>Ceramium pacificum</i>	2	-10
<i>Polysiphonia pacifica</i> var <i>pacifica</i>	2	35
<i>Laminaria saccharina</i>	1	45*
<i>Padraiphenia gracilis</i> (very common on all rocks)	36+	-10
<i>Phyllospora scolopendria</i>	2	-10
<i>Polysiphonia sinuata</i>	1	20
<i>Odonthalia floccosa</i>	1	20
<i>Tridacna cordata</i>	1	15
<i>Phaeothamnion pacificum</i>	1	10
TOTALS	51	210

TABLE 10
DIVE QUADRATS (1 m²)

TRANSECT NO: 1 QUADRAT NO: 3 TIME: 1840 DATE: June 18
DEPTH: 30' ATTENUATION (cm): 0 - 5 SLOPE (°): 0 - 5
SUBSTRATE: cobbles, sand bottom.
LOCATION: Serial Cave Is.

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Laminaria saccharina</i>	2	-10*
<i>Rhodostilum plumosum</i>	1	40
<i>Ceramium pacificum</i>	7	50
<i>Polysiphonia pacifica</i>	1	-10
<i>Polysiphonia pacifica</i> var <i>pacifica</i>	3	-10
<i>Laminaria saccharina</i>	5	-10
<i>Padraiphenia gracilis</i> (on all rocks)	-10	-10
<i>Phyllospora scolopendria</i>	1	-10
<i>Polysiphonia sinuata</i>	1	-10
<i>Odonthalia floccosa</i>	1	-10
<i>Tridacna cordata</i>	2	-10
<i>Phaeothamnion pacificum</i>	1	-10
TOTALS	28	-260

FAUNA - TAXON	LENGTH/ SIZE (cm)	NUMBER	WET WEIGHT (gm)
<i>Turbo, Tegula</i> sp. polychaete		100+	200 - 300
		1	-10
TOTALS		100+	-300

FAUNA - TAXON	LENGTH/ SIZE (cm)	NUMBER	WET WEIGHT (gm)
<i>Turbo, Tegula</i> sp. polychaete		2	-10
		2	-10
TOTALS		2	-10

TRANSECT NO: 1 QUADRAI NO: 5 TIME: 1855 DATE: June 18
 DEPTH: 32' ATTENUATION (cm): 5 - 10 SLOPE (°): 20 - 25°
 SUBSTRATE: cobbles, sand bottom.
 LOCATION: Surial Cave Is.

TABLE 10
DIVE QUADRATS (1 m)²

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Halimnobia subcapitata</i>	1	430*
<i>Halimnobia subcapitata</i>	1	10*
<i>Halimnobia subcapitata</i>	1	320*
<i>Halimnobia subcapitata</i>	1	305*
<i>Halimnobia subcapitata</i>	12	-10
<i>Halimnobia subcapitata</i>	1	-10
<i>Halimnobia subcapitata</i>	1	-10
<i>Halimnobia subcapitata</i>	1	-10
TOTALS	19	-1195

FACNA - TAXON	LENGTH/ SIZE (cm)	NUMBER	WET WEIGHT (gm)
<i>Tealia sp.</i>	100 - 200	1	200 - 300
<i>Tealia sp.</i>	1	1	-10
TOTALS	100+	100+	200+

Tealia sp.
Tealia sp.
Tealia sp.

TRANSECT NO: 2 QUADRAT NO: 1 DATE: June 19
 DEPTH: 10' ATTENUATION (cm): 20 TIME: 1745
 SUBSTRATE: bedrock. SLOPE (°): 10 - 15°
 LOCATION: Gull Is.

FLORA - TAXON	NUMBER	WEI WEIGHT (gm)
<i>Laminaria saccharina</i>	22	2168
<i>Laminaria saccharina</i> (juvenile)	2	80
<i>Nereocystis luetkeana</i>	2	15
<i>Desmarestia (munda) ligulata</i>	1	25
<i>Ulva cordata</i>	1	-10
<i>Costaria simplex</i>	2	-10
<i>Macrocystis integrifolia</i> (juvenile)	1	15
<i>Callithrix thompsonii</i>	1	-10
<i>Centrocercus tripliestis</i>	1	-10
<i>Callithrix firma</i>	1	15
<i>Rhizoclonium sorochellii</i>	1	-10
<i>Diva lactuca</i>	1	-10
<i>Callithrix fibellulata</i>	4	-10
<i>Pterodiplonea gracilis</i>	4	20
<i>Callithrix fibellulata</i> var. <i>californica</i>	1	-10
<i>Callithrix fibellulata</i> (on all rocks)	1	-10
<i>Callithrix fibellulata</i>	60	13800
TOTALS	105	16228

FAUNA - TAXON	LENGTH SIZE (cm)	NUMBER	WEI WEIGHT (gm)
<i>Callithrix fibellulata</i>	1 - 5	20	80
<i>Callithrix fibellulata</i>	8 cm shield	1	275
<i>Callithrix fibellulata</i>	6 - 5	1	75
<i>Callithrix fibellulata</i>		3	-10
<i>Callithrix fibellulata</i>		6	20
TOTALS		31	460

TRANSECT NO: 2 QUADRAT NO: 2 DATE: June 19
 DEPTH: 12' ATTENUATION (cm): 20 TIME: 1800
 SUBSTRATE: bedrock. SLOPE (°): 10 - 15°
 LOCATION: Gull Is.

FLORA - TAXON	NUMBER	WEI WEIGHT (gm)
<i>Laminaria saccharina</i>	70	6900
<i>Laminaria saccharina</i>	7	150
<i>Nereocystis luetkeana</i>	6	90
<i>Desmarestia (munda) ligulata</i>	1	15
<i>Ulva cordata</i>	6	20
<i>Costaria simplex</i>	5	50
<i>Macrocystis integrifolia</i> (juvenile)	1	75
<i>Callithrix thompsonii</i>	4	-10
<i>Centrocercus tripliestis</i>	1	-10
<i>Callithrix firma</i>	3	15
<i>Rhizoclonium sorochellii</i>	2	-10
<i>Diva lactuca</i>	107	7245
<i>Callithrix fibellulata</i>		
<i>Pterodiplonea gracilis</i>		
TOTALS	107	7245

FAUNA - TAXON	LENGTH SIZE (cm)	NUMBER	WEI WEIGHT (gm)
<i>Macrocystis helianthoides</i>	18	1	130
<i>Macrocystis helianthoides</i>	3.2	1	25
<i>Macrocystis helianthoides</i>		1	153+
TOTALS		234	153+

TRANSECT NO: 3 QUADRAT NO: 1 DATE: June 21 TIME: 0835 SLOPE (°): 0 - 5°
 DEPTH: +1.5' ATTENUATION (cm): -30
 SUBSTRATE: sand, shell with boulders, cobbles & bedrock outcrops, Macro bed.
 LOCATION: Bunsby Camp

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Callithamnion</i> sp.	1	10
<i>Callithamnion</i> sp.	49	190
<i>Callithamnion</i> sp.	4	35
<i>Callithamnion</i> sp.	5	25
<i>Callithamnion</i> sp.	7	-10
<i>Callithamnion</i> sp.	8	-10
<i>Callithamnion</i> sp.	20	50
<i>Callithamnion</i> sp.	3	120
<i>Callithamnion</i> sp.	5	-10
<i>Callithamnion</i> sp.	1	25
<i>Callithamnion</i> sp.	3	15
TOTALS	111	500

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Callithamnion</i> sp.	4	25
<i>Callithamnion</i> sp.	10 - 20	25
<i>Callithamnion</i> sp.	15	120
<i>Callithamnion</i> sp.	15	180
<i>Callithamnion</i> sp.	11	see average weight for macro
<i>Callithamnion</i> sp.	3	40
<i>Callithamnion</i> sp.	2	40
<i>Callithamnion</i> sp.	1	1
<i>Callithamnion</i> sp.	3	120
<i>Callithamnion</i> sp.	45	45
<i>Callithamnion</i> sp.	1	25
<i>Callithamnion</i> sp.	2	75
TOTALS	83	695

FAUNA - TAXON	LENGTH SIZE (cm)	NUMBER	WET WEIGHT (gm)
Red turban snail	ht. 5.5 base - 6.0	1	110
<i>Platylabus huntmani</i>	0.5 - 0.75	18	150
<i>Agastis</i> sp.	0.25 - 1	7	75
<i>Agastis</i> sp.	0.25 - 1.5	5	40
TOTALS		31	375

TRANSECT NO: 3 QUADRAT NO: 4 TIME: 0920 DATE: June 2
 DEPTH: 0.2 ATTENUATION (cm): 5 SLOPE (°): 0 - 5°
 SUBSTRATE: large rock with sand-shell around it.
 LOCATION: Bunsby Camp.

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Macrocyrtis integrifolia</i>	1	270
<i>Callianthron regenerans</i>	20	25
<i>Coralina vancouveriensis</i>	40	50
<i>Gastroleptus coulteri</i>	2	25
<i>Clethrionomys rufocollaris</i>	1	30
<i>Codium fragile</i>	1 group	550
<i>Leathesia difformis</i>	1	15
<i>Crustose corallina</i>		
TOTALS	66	965

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Coralina vancouveriensis</i>	6	20
<i>Callianthron regenerans</i>	5	15
<i>Coralina vancouveriensis</i>	25	200
<i>Gastroleptus coulteri</i>	20	15
<i>Clethrionomys rufocollaris</i>	3	15
<i>Codium fragile</i>	1	15
<i>Leathesia difformis</i>	1	15
TOTALS	61	280

FAUNA - TAXON	LENGTH/ SIZE (cm)	NUMBER	WET WEIGHT (gm)
<i>Pogonia sp.</i>	0.25 - 1 cm	3	15
<i>Oregonia gracilis</i>	0.25 - 1 cm	7	15
<i>Apilium sp.</i>	5 cm	2	110
<i>Hamites multirufus</i>		1	
<i>Distaplia occidentalis</i>			
<i>Diadema repens</i>			
TOTALS		15	140

FAUNA - TAXON	LENGTH/ SIZE (cm)	NUMBER	WET WEIGHT (gm)
<i>Pogonia sp.</i>	1 - 1.0	15 - 20	175
<i>Oregonia gracilis</i>	1 - 1.0	15 - 20	120
TOTALS		40	295



TRANSECT NO: 4 QUADRAT NO: 2 TIME: 1320 DATE: June 21
DEPTH: 22.3' ATTENUATION (cm): 0 - 5 SLOPE (°): 0 - 5°
SUBSTRATE: bedrock w/sand, shell.
LOCATION: Gulf Is.

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Laminaria groenlandica</i>	7	1.20 kg
<i>Porosiphonia californica</i>	9	2.95 kg
<i>Porosiphonia californica</i>	1	73
<i>Laminaria saccharina</i>	3	140
<i>Callophycis thomsonii</i>	1	250*
<i>Porosiphonia gracilis</i> (very common)	5	-10
<i>Codium setchellii</i>	1	200
<i>Hypnea ceratophylla</i>	23	5490
TOTALS		

FAUNA - TAXON	NUMBER	LENGTH/ SIZE (cm)	WET WEIGHT (gm)
---------------	--------	-------------------	-----------------

<i>Henricia leviscula</i>	1	12 cm	30
<i>Henricia leviscula</i>	1	14 cm	40
<i>Apidia</i> sp.	1	5.4 cm	25
<i>Valoniopsis</i> sp.	1	6	23
<i>Valoniopsis kotschykiana</i>	1	11.5	10
<i>Styela</i> sp.	1	3.0	approx 10
<i>Didemna aspera</i>	1		approx 15
<i>Arenaria nitra</i>	2		approx 10
<i>Abietinaria</i> sp.	9		155
TOTALS			

TRANSECT NO: 4 QUADRAT NO: 1 TIME: 1245 DATE: June 21
DEPTH: 15' ATTENUATION (cm): 40 - 60 SLOPE (°): 40°
SUBSTRATE: bedrock shelves.
LOCATION: Gulf Is.

FLORA - TAXON	NUMBER	WEIGHT WET (gm)
<i>Laminaria groenlandica</i>	6	7.3 kg.
<i>Porosiphonia californica</i>	6	6.6 kg
<i>Porosiphonia californica</i>	5	7.35 kg
<i>Laminaria saccharina</i>	10	3.5 kg
<i>Callophycis thomsonii</i>	10	3.45 kg
<i>Porosiphonia gracilis</i>	11	2.2 kg
<i>Codium setchellii</i>	9	1.0 kg
<i>Hypnea ceratophylla</i>	1	-10*
<i>Hypnea ceratophylla</i>	1	-10
<i>Hypnea ceratophylla</i>	1	-10
<i>Hypnea ceratophylla</i>	1	-10
<i>Hypnea ceratophylla</i>	8	20
<i>Hypnea ceratophylla</i>	1	-10
<i>Hypnea ceratophylla</i>	1	-10
TOTALS	71	31380

FAUNA - TAXON	NUMBER	LENGTH/ SIZE (cm)	WET WEIGHT (gm)
<i>Henricia leviscula</i>	2		-10
<i>Henricia leviscula</i>	3		-10
<i>Henricia leviscula</i>	1		25
<i>Henricia leviscula</i>	1		20
<i>Henricia leviscula</i>	3		50
<i>Henricia leviscula</i>	1		75
<i>Henricia leviscula</i>	1		-10
<i>Henricia leviscula</i>	3		-10
<i>Henricia leviscula</i>	6		25
<i>Henricia leviscula</i>	5		-10
TOTALS	25		255



TRAPSET NO: 4 QUADRAAT NO: 4 TIME: 1355 DATE: June 1
DEPTH: 36' ATTENUATION (cm): 0 - 5 SLOPE (°): 0 - 5
SUBSTRATE: sand with some rocks.
LOCATION: Gull Is.

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Laminaria groenlandica</i>	15	3.4 kg
<i>Enteromorpha californica</i>	5	1.20 kg
<i>Irishia cordata</i>	3	30
<i>Laurencia spectabilis</i>	4	-19
TOTALS	27	4640



TRAPSET NO: 4 QUADRAAT NO: 3 TIME: 1340 DATE: June 21
DEPTH: 36' ATTENUATION (cm): 5 SLOPE (°): 0 - 5
SUBSTRATE: rock, sand,
LOCATION: Gull Is.

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Enteromorpha californica</i>	6	2.3
<i>Enteromorpha californica</i>	1	95*
<i>Enteromorpha californica</i>	7	1.45 kg
TOTALS	14	3845

quad. 3 was mixed accidentally with
quad. 2 for the small algae only.

FAUNA - TAXON	LENGTH SIZE (cm)	NUMBER	WET WEIGHT (gm)
<i>Coronula stultica</i>	14.5 wide	1	375
<i>Coronula stultica</i>	23.7 long		
<i>Coronula stultica</i>	21.8 wide	1	710
<i>Coronula stultica</i>	30.2 long		
TOTALS		2	1085

FAUNA - TAXON	LENGTH/ SIZE (cm)	NUMBER	WET WEIGHT (gm)
<i>Lechocochiton martenisii</i>	2.1	1	-10
<i>Stella sp.</i>	15	1	-10
<i>Stella sp.</i>	12	1	-10
<i>Stella sp.</i>	19.3	1	-10
<i>Stella sp.</i>	14	1	-10
<i>Stella sp.</i>	10	1	-10
<i>Stella sp.</i>	11	1	-10
<i>Dendrobaenia sp.</i>		1	-10
<i>Chilomen sp.</i>	4.0	1	-10
<i>Tridacna lineata</i>	1.5	1	-10
<i>Diadema setacea</i>		1	-10
<i>Palaeophyllia elegans</i>	1.2 across	1	-10
<i>Asterias sp.</i>		5	-10
<i>Allopora sp.</i>			
TOTALS		15	2150

TRANSECT NO: 5 QUADRAT NO: 2 TIME: 1245 DATE: June 2
DEPTH: 23' ATTENUATION (cm): 15 - 20 SLOPE (°): 15°
SUBSTRATE: bedrock.
LOCATION: Humpback Is.

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<u>Laminaria gracilaudata</u>	1	180
<u>Laminaria saccharina</u>	8	250*
<u>Pterophora californica</u>	1	120
<u>Costantiana simplex</u>	1	45
<u>Hammonda subcapitata</u>	3	35
<u>Acetocystis lauradara</u>	7	65
<u>Desmarestia spuda</u>	18	220
<u>Codium botrychoides</u>	6	100
<u>Tridacna cordata</u>	1	20
<u>Desmarestia herbacea</u>	8	40
<u>Alaria nana</u>	1	25
<u>Botryoglossum farlowianum</u>	1	-10
TOTALS	56	1190

FAUNA - TAXON	NUMBER	WET WEIGHT (gm)
LENGTH/ SIZE (cm)		

Colastes stimpsoni	20	1	125
Remicla levinsculi	20	1	75
sponge			
Murex sp.			
Penaeopodia sp.			
brittle stars			
Dendrobaena sp.			
Apilidium sp.			
Polyserice worm			
Allopora sp.			
TOTALS	2		

TABLE 10
DIVE QUADRATS (1 m²)

TRANSECT NO: 6 QUADRAT NO: 2 DATE: June 1960
DEPTH: 23' ATTENUATION (cm): 10 TIME: 1340
SUBSTRATE: bedrock. SLOPE (°): 0 - 50
LOCATION: Bleeding Rock

FLORA - TAXON	NUMBER	WET WEIGHT (gm)	FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Palaeophoria pacifica</i> var <i>pacificae</i>	1	250	<i>Palaeophoria pacifica</i> var <i>pacificae</i>	1	-10
<i>Laminaria saccharina</i>	12	75*	<i>Laminaria saccharina</i>	16	3.2 kg
<i>Laminaria proterandica</i>	3	25	<i>Laminaria proterandica</i>	17	3.50 kg
<i>Nereocystis lutea</i> (small)	2	-10	<i>Nereocystis lutea</i> (small)	25	200
<i>Leptothamnion</i> sp.	7	15			
<i>Corallina vancouveriensis</i>	1	85			
<i>Alveolaria prolifica</i>	2	-10			
<i>Alveolaria livida</i>	1	-10			
<i>Knobelia pilosa</i>	1	1			
<i>Desmarestia (small) linearis</i>	1	-10			
<i>Desmarestia vancouveriensis</i>	1	-10			
<i>Callithrix caespitosa</i>	1	-10			
<i>Barnea setchellii</i>	1	-10			
<i>Galathea thompsonii</i>	1	-10			
TOTALS	35	560	TOTALS	75	6000

FAUNA - TAXON	LENGTH SIZE (cm)	NUMBER	WET WEIGHT (gm)	FAUNA - TAXON	LENGTH SIZE (cm)	NUMBER	WET WEIGHT (gm)
<i>Halotis kamtschatica</i>	1.5	1	20				
<i>Allopora</i> sp.		1	20				
<i>Chelonicarpha finmarkiensis</i>		1					
<i>Lentopagurus bellus</i>		1					
<i>Scaph</i> sp.		1					
<i>Dendrobola</i> sp.		2	110				
<i>Ischnochiton mertensii</i>	4	2					
<i>Asiatinaria</i> sp.		6+	130+				
TOTALS		22+	145+	TOTALS		6+	130+

QUASANT NO: 5
TIME: 1350
DATE: June 25
ATTENUATION (cm): 10
SLOPE (θ): 0 - 5°

FLORA - TAXON	NUMBER	NET WEIGHT (gms)
<u>Laminaria saccharina</u>	1	-10
<u>Opuntia californica</u>	1	-10
<u>Desmarestia aculeata</u>	1	-10
<u>Polysiphonia pacifica var pacifica</u>	1	50
<u>D. heterostyla (var.) linearis</u>	3	35
<u>Desmarestia (herbacea) linearis</u>	1	20
<u>Polysiphonia californica</u>	1	450
<u>Desmarestia heterostyla</u>	1	40
<u>Laminaria saccharina</u>	1	150
<u>Desmarestia aculeata</u>	1	-10
<u>Polysiphonia pacifica</u>	1	-10
<u>Cymodoceus leptophyllus</u>	1	-10
<u>Cymodoceus platyphyllus</u>	1	-10
<u>Callithron luteum</u>	1	-10
<u>Pterodroma gracilis</u>	1	-10
<u>Ceramium simplex</u>	1	25
<u>Callithron vancouveriensis</u>	1	-10
TOTALS	18	870

PLANT	TAXON	NUMBER	WET WEIGHT (gm)
27(8)		2661	
1		-10	
27		1.2 kg	
1		-10	
3		40	
1		55	
2		30	
1		-10	
1		-10	
1		-10	
1		-10	
1		-10	
1		-10	
TOTALS		67	4036

FAUNA - TAXON	LENGTH SIZE (cm)	NUMBER	WET WEIGHT (gm)
<u>Helictis kumatsubakana</u>	3.5	1	-10
<u>Hyomyzocentrotus droebachiensis</u>	5.0	1	-39
<u>Helinobellia elegans</u>		3	
<u>Schuchertion mertenii</u>	0.5	1	25
<u>Aurex sp.</u>	2	1	50
<u>Byzoan) Dendrobania sp.</u>			
<u>Velinus</u>	5	1	60
<u>San woras</u>		4	
<u>Hyomyzocentrotus droebachiensis</u>	4.5	1	40
<u>Lispora sp.</u>			

[illegible]

TRANSIT NO: 5 QUADRAT NO: 5 TIME: 1415 DATE: June 25
 TOWER: 12' ATTENUATION (cm): 10 SLOPE (°): 0 - 5°
 SUBSTRATE: Deadrock, LOCATION: Diggins Rock

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Pteridium caudex</i>	6(5)	2230
<i>Pteridium aquilinum</i>	19(9)	1873
<i>Pteridium aquilinum</i>	9	130
<i>Pteridium aquilinum</i>	5	120
<i>Pteridium aquilinum</i>	1	-10
<i>Pteridium aquilinum</i>	1	-10
<i>Pteridium aquilinum</i>	1	-10
<i>Pteridium aquilinum</i>	1	25
<i>Pteridium aquilinum</i>	2	-10
<i>Pteridium aquilinum</i>	40	40
TOTALS	45	4488

FLORA - TAXON	LENGTH SIZE(cm)	NUMBER	WET WEIGHT (gm)
<i>Pteridium caudex</i>	4	1	50
<i>Pteridium aquilinum</i>		1	
<i>Pteridium aquilinum</i>		2+	50+
TOTALS		2+	50+

TRANSECT NO: 7 QUADRAT NO: 1 DATE: June 26
DEPTH: 14' ATTENUATION (cm): 15-20 TIME: 0940
SUBSTRATE: Bare rock SLOPE (°): 5-10
LOCATION: North Gull Island

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Laurencia spectabilis</i>	17	220
<i>Calliactis rugosa</i>	8	789
<i>Boselliella plumosa</i>	3	55
<i>Pteroisiphonia gracilis</i>	1	-10
<i>Lithothamnion</i> sp.	4	55
<i>Vermetophora californica</i>	5	20
<i>Laurencia spectabilis</i>	2	15
<i>Calliactis rugosa</i>	40	1164
TOTALS		

FAUNA - TAXON	LENGTH SIZE (cm)	NUMBER	WET WEIGHT (gm)
<i>Gracila conterevensis</i>	3 - 6	4	240
<i>Gracila</i> sp.	1	1	25
<i>Ischnochiton merrilli</i>	2.5	4	50
<i>Pycnopodia helianthoides</i>	16	1	170
TOTALS		10	485

Gracila conterevensis
Gracila sp.
Ischnochiton merrilli
Pycnopodia helianthoides

TRANSECT NO: 7 QUADRAT NO: 2 DATE: June 26
DEPTH: 14' ATTENUATION (cm): 40 - 60 TIME: 0945
SUBSTRATE: Bare rock SLOPE (°): 5 - 10
LOCATION: North Gull Island

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Laurencia spectabilis</i>	3	25
<i>Calliactis rugosa</i>	1	-10
<i>Boselliella plumosa</i>	1	-10
<i>Pteroisiphonia gracilis</i>	1	-10
<i>Lithothamnion</i> sp.	5	
<i>Vermetophora californica</i>	3	1.2 kg
<i>Laurencia spectabilis</i>	9	1.8 kg
<i>Calliactis rugosa</i>	4	395
<i>Vermetophora californica</i>	1	-10
<i>Laurencia spectabilis</i>	6	275
<i>Calliactis rugosa</i>	1	-10
<i>Vermetophora californica</i>	3	-10
<i>Calliactis rugosa</i>	1	-10
<i>Calliactis rugosa</i>	1	-10
TOTALS	35	3775

FAUNA - TAXON	LENGTH SIZE (cm)	NUMBER	WET WEIGHT (gm)
<i>Dendrobranchia</i> sp.			
<i>Gracila conterevensis</i>	2	1	25
<i>Gracila</i> sp.		4	
<i>Ischnochiton merrilli</i>	3	1	45
<i>Pycnopodia helianthoides</i>	15	1	130
<i>Pycnopodia helianthoides</i>	15	1	120
<i>Aplidium</i> sp.			
<i>Halictis kutschakana</i>	7.5 cm	1	40
<i>Chlamys</i> sp.		1	
<i>Abietinaria</i>			
<i>Allopora</i> sp.			
TOTALS		10	360

TRANSECT NO: 7 QUADRAT NO: 3 DATE: Jun: 26
 DEPTH: 17' ATTENUATION (cm): 10 - 20 TIME: 1000
 SUBSTRATE: Bedrock. SLOPE (°): 10
 LOCATION: North Gull Island

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Parosiphonia gracilis</i>	1	-10
<i>Hypnea setchellii</i>	2	25
<i>Calliarthron vulgare</i>	1	-10
<i>Desmarestia munda</i>	1	-10
<i>Gelidium coulteri</i>	1	-10
<i>Palisadea pacifica</i>	5	35
<i>Posidonia flexilis</i>	1	-10
<i>Laminaria saccharina</i>	1	-10
<i>Laminaria groenlandica</i>	4	85
<i>Styrodonta californica</i>	1	720
<i>Codium setchellii</i>	1	1.2 kg
<i>Ceramium plumosum</i>	9	495
<i>Agardhiella subulata</i>	3	55
<i>Agardhiella subulata</i>	4	15
<i>Agardhiella subulata</i>	1	-10
<i>Agardhiella subulata</i>	1	30
<i>Agardhiella subulata</i>	1	25
TOTALS	40	2525

FAUNA - TAXON	LENGTH SIZE (cm)	NUMBER	WET WEIGHT (gm)
<i>Parosiphonia gracilis</i>	2	1	50
<i>Styrodonta californica</i>		2	
<i>Agardhiella subulata</i>		3+	50+
TOTALS		6	100

TRANSECT NO: 7 QUADRAT NO: 4 DATE: June
 DEPTH: 18' ATTENUATION (cm): 5 - 15 TIME: 1010
 SUBSTRATE: Bedrock. SLOPE (°): 5 - 10°
 LOCATION: North Gull Island

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Parosiphonia gracilis</i>		-10
<i>Hypnea setchellii</i>		-10
<i>Calliarthron vulgare</i>	1	-10
<i>Desmarestia munda</i>	1	-10
<i>Gelidium coulteri</i>	1	-10
<i>Palisadea pacifica</i>	1	-10
<i>Posidonia flexilis</i>	11	1084
<i>Laminaria saccharina</i>	9	1.8 kg
<i>Laminaria groenlandica</i>	4	2.9 kg
<i>Styrodonta californica</i>	3	125
<i>Codium setchellii</i>	3	-10
<i>Ceramium plumosum</i>	3	35
<i>Agardhiella subulata</i>		
TOTALS	33	6914

FAUNA - TAXON	LENGTH/ SIZE (cm)	NUMBER	WET WEIGHT (gm)
<i>Parosiphonia gracilis</i>	approx 2	1	?
<i>Styrodonta californica</i>	4	1	75
<i>Agardhiella subulata</i>	2	2	120
<i>Parosiphonia gracilis</i>	2	2	
<i>Styrodonta californica</i>	approx 12	5	
<i>Agardhiella subulata</i>	4.5	1	125
<i>Parosiphonia gracilis</i>			
TOTALS		12	320

TRANSECT NO: 8
DEPTH: 7'
SUBSTRATE: bedrock.
LOCATION: Deer Island

QUADRAT NO: 1
ATTENUATION (cm): 0 - 5
DATE: June 26
TIME: 1605
SLOPE (°): 0 - 5°

FLORA - TAXON

NUMBER WET WEIGHT (gm)

Phyllospadix scouleri
Bossetia plumosa
Corallina vancouveriensis
Calliarthron vancouverians
Hymanaea encrinellii
Argesia mucronalis

100+
1
1
1
1
1
1

3 - 5 kg
-10
-10
-10
50
175

TOTALS 106+ 3000 - 5000+

FAUNA - TAXON

NUMBER WET WEIGHT (gm)

Teniscella lineata
Polanophyllia elegans

8
1
1

175
-10
-10

TOTALS 10 185

TRANSECT NO: 8
DEPTH: 7'
SUBSTRATE: bedrock.
LOCATION: Deer Island

QUADRAT NO: 2
ATTENUATION (cm): 0 - 5
DATE: June 26
TIME: 1610
SLOPE (°): 0 - 5°

FLORA - TAXON

NUMBER WET WEIGHT (gm)

Phyllospadix scouleri
Bossetia plumosa
Corallina vancouveriensis
Calliarthron vancouverians
Hymanaea encrinellii
Argesia mucronalis

100
1
1
1
2
1

3 - 5 kilo
-10
-10
-10
25
225

TOTALS 106 3000 - 5000+

FAUNA - TAXON

NUMBER WET WEIGHT (gm)

Teniscella lineata
Polanophyllia elegans

1
9

75
150

TOTALS 10 225

TRANSECT NO: 8 QUADRAT NO: 4 TIME: 1615 DATE: June 26
 DEPTH: 12.5' ATTENUATION (cm): 5 - 20 SLOPE (°): 0 - 15°
 SUBSTRATE: Bedrock.
 LOCATION: Deer Island

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Alalia nana</i>	4	530
<i>Cestaria costata</i>	7	420
<i>Limnaria saccharina</i>	44	438
<i>Cynothera triflora</i>	3	230
<i>Limnaria groenlandica</i>	10	2.3 kg
<i>Chlamydomonas leptophyllus</i>	1	-10
<i>Protophormia gracilis</i>	1	-10
<i>Callithamnion revolutans</i>	1	-10
<i>Callithamnion platyphyllum</i>	1	-10
<i>Desmarestia plumosa</i>	1	-10
<i>Godium scabellum</i>	3	175
<i>Knautia palmaria</i>	1	-10
<i>Coralina vancouveriensis</i>	1	-10
<i>Desmarestia (aurata) ligulata</i>	4	200
<i>Zerophora perforata</i>	1	20
TOTALS	83	6223

FAUNA - TAXON	LENGTH SIZE (cm)	NUMBER	WET WEIGHT (gm)
<i>Murex</i> sp.	2	1	23
<i>Gastropoda pennata</i>	3	2	45
<i>Stella</i> sp.	5	1	30
<i>Apidium</i> sp.			
<i>Tonicella lineata</i>			
<i>Abietaria</i> sp.			
<i>Distaplia occidentalis</i>			
TOTALS		4	100

TRANSECT NO: 8 QUADRAT NO: 3 TIME: 1615 DATE: June 26
 DEPTH: 9' ATTENUATION (cm): 0 - 5 SLOPE (°): 0 - 5°
 SUBSTRATE: Bedrock.
 LOCATION: Deer Island

FLORA - TAXON	NUMBER	WET WEIGHT (gm)
<i>Alalia nana</i>	100	3 - 5 kg
<i>Cestaria costata</i>	1	-10
<i>Limnaria saccharina</i>	1	-10
<i>Cynothera triflora</i>	1	-10
<i>Limnaria groenlandica</i>	1	-10
<i>Chlamydomonas leptophyllus</i>	1	25
<i>Protophormia gracilis</i>	1	220
TOTALS	106	3000 - 5000

FAUNA - TAXON	LENGTH SIZE (cm)	NUMBER	WET WEIGHT (gm)
<i>Salpinctes elegans</i>	0.25 - 1	4	70
<i>Stella lineata</i>	0.5	2	20
TOTALS		6	90

TRAP NO: 5 QUADRAT NO: 5 TIME: 1630 DATE: June 26
 ATTENUATION (GR): 5 - 10 SLOPE (°): 0 - 10°
 SURVEYOR: B. J. J. LOCATION: West Island

FLORA - TAXON NUMBER WET WEIGHT (gm)

220	6	220
418	43	418
1.3 k2	6	1.3 k2
20	3	20
-10	1	-10
-10	1	-10
75	2	75
-10	1	-10
190	3	190
25	2	25
-10	1	-10
20	1	20
TOTALS	70	518

FLORA - TAXON LENGTH NUMBER WET WEIGHT (gm)

5	1	5
5	1	5
?	1	?
?	3	?
2", 3"	2	310
TOTALS	8	370

Notes on Table 10

Algal Inventory Transect Data

* - weight used in attaining an average weight per plant for the species.

Negative sign before a weight indicates specimen weighed less than the recorded weight.

Positive sign following a number indicates an estimated minimum number of individuals present for the quadrat.

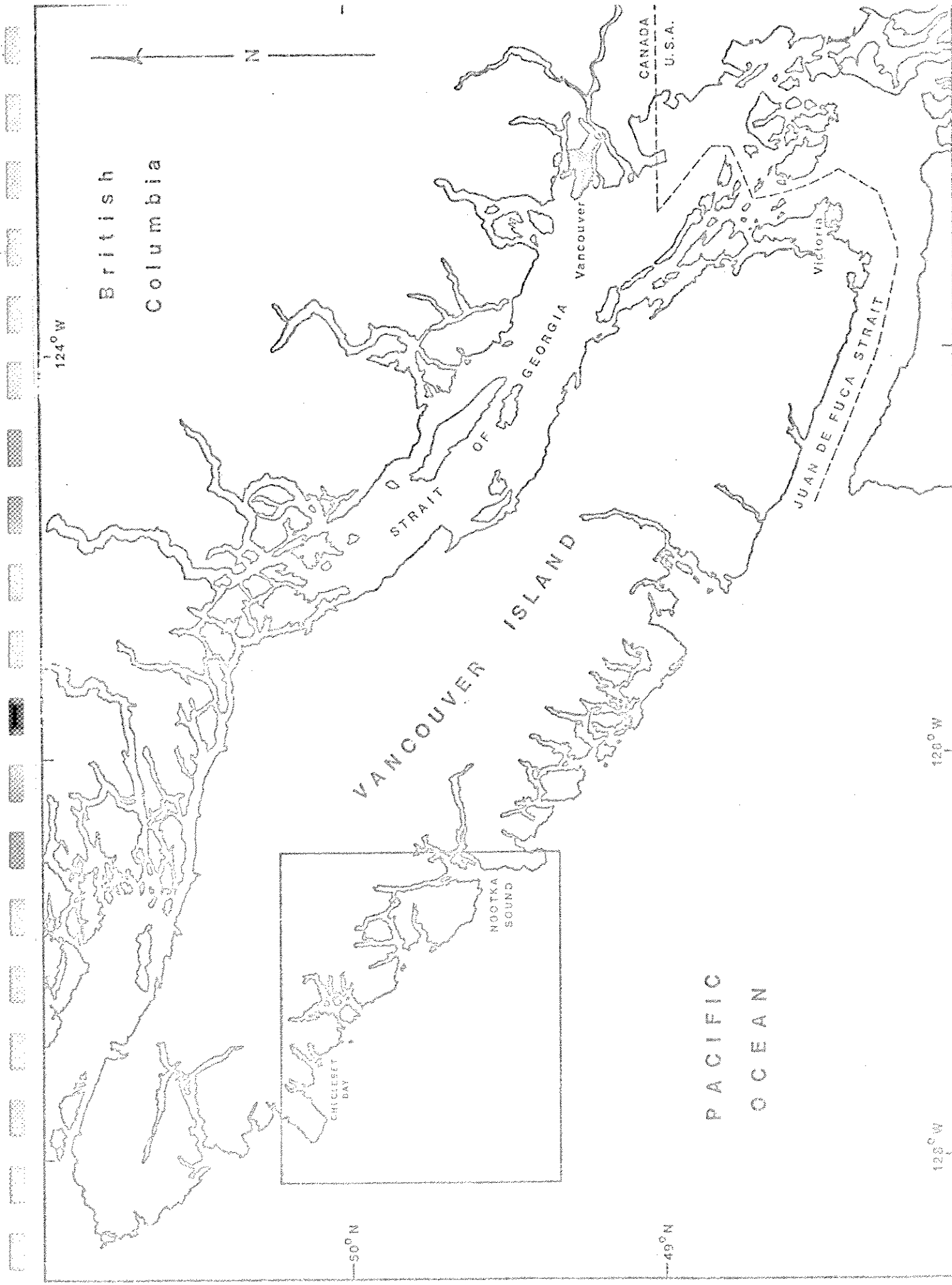


Figure 1. Location Map 1. Vancouver Island

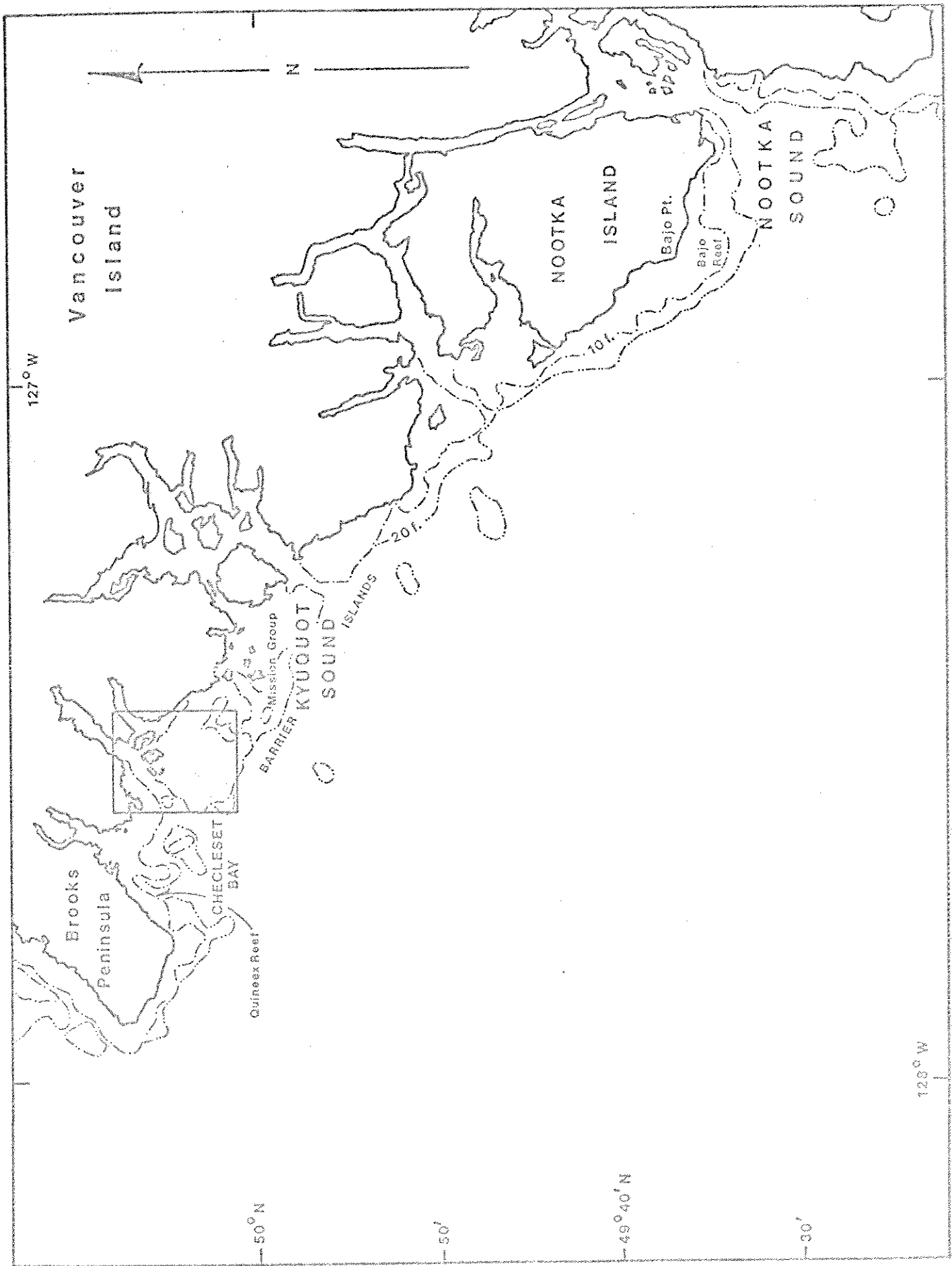


Figure 2. Location Map 2. Checleset Bay and Bajo Reef



Figure 3. Location Map 3. Bunsby Islands, Checleset Bay.



Figure 4: Diurnal Travel
(See notes on Figure 4 following)

NOTES ON FIGURE 4 -- DIURNAL TRAVEL

1. Arrowed pathways indicate a straight travel path along the surface.
2. Numbers within arrowed pathways indicate number of separate occasions this pathway was observed to be utilized by otters.
3. Dotted portions of arrowed pathways indicate a postulated direction of travel based on known rafting areas.

NOTES ON FIGURE 5 - DIURNAL FEEDING ACTIVITY

1. Numbers in figure 5 indicate locations where feeding occurred and number of times feeding was observed at that location.



Figure 6: Location of Algal Inventory Transects. (See notes on Figure 6 following).

Notes on Figure 6

Location of Algal Inventory Transects

T - transect. Line on figure describes location,
direction transect laid, but not length of transect.

