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No. 1389

Marine Resource Inventory of Pacific Rim National Park

by

J. Charlene Lee and N. Bourne

(Report prepared for Parks Canada under Contract No. VAN 5-281/1)

Pacific Biological Station, Nanaimo, B.C.

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INTRODUCTION

A marine resource inventory in Pacific Rim National Park was contracted on behalf of Parks Canada, Western Region, by Fisheries and Marine Service (Nanaimo), Department of the Environment. The goal of this inventory is to provide information on marine organisms and their associated habitats for Park planning, interpretation, and management. The project area encompasses the three sections of the Park - Long Beach, Broken Group Islands, and West Coast Trail. The study boundaries extend from the high tide line to a depth of 60 feet (10 fathoms) as shown on hydrographic charts of the area.

This inventory commenced with an up-dating of the "Marine Bibliographical and Review Study of Pacific Rim National Park", Fisheries Research Board of Canada Manuscript Report Series No. 1276, which was prepared under contract to Parks Canada in 1973. Species habitat lists and references were corrected and extended from literature acquired after 1973. Work listed under "Current Research Projects" was revised, and additional projects and data collections were documented. These revisions are presented in Appendix 1.

In 1975, a faunal survey was conducted in all three sections of the Park. This survey included studies of the distribution and relative abundance of fauna and flora in the intertidal zone. These data were used to broaden species lists and habitat types, to identify unique areas and areas of high recreational use for long term studies.

A major emphasis was placed on the Long Beach Section because the rock, sand and mud habitats were most readily accessible and subject to heavy recreational pressures at the height of the tourist season. Fauna and flora of sixteen survey sites were observed periodically from April to December during the monthly lowest tide cycles.

In the Broken Group Islands, the faunal survey was carried out on semi-exposed and protected sand, shell and gravel beaches and rocky shores. These habitats were given priority because of their potential for recreational use by boaters. This survey was conducted in June and August during each monthly series of low tides. Sixty-four sand, shell and gravel beaches and twenty-four rocky outcrops were sampled.

The faunal survey along the West Coast Trail was conducted within a five-mile radius around Carmanah Point. This area contained several different habitats (sand, gravel and boulder beaches and sandstone benches) within a short distance, all readily accessible from Carmanah Point. Twelve survey sites were sampled during the first week of September.

Recreational impact studies in 1975 were begun in the Long Beach Section to study organisms of particular interest to the public, either as food or for collection. The edible species studied were the razor clam

(Siliqua patula), littleneck clam (Protothaca staminea) and sea mussel (Mytilus californianus). The purple olive snail (Olivella biplicata) and purple starfish (Pisaster ochraceus) were the principal organisms removed for "souvenir" purposes. Studies of these organisms included estimations of adult populations, seasonal fluctuations and recruitment. The sea mussel project studied the re-establishment rate of mussel beds after clearance.

The terms of reference for this marine resource inventory are given in Appendix 2.

HABITAT TYPES

An understanding of the diversity of habitats in the Park is essential for managing Park resources and presenting the ecology of the Park to the public. Such understanding in turn requires an inventory of the major kinds of habitats and a knowledge of their locations and relative frequency. Intertidal habitats in the Long Beach Section of the Park have been classified, identified and mapped by Robilliard (1971) and also by the Parks Interpretive Section in the Interpretive Resource Atlas of Long Beach. Such descriptions have not been completed in the Broken Group Islands and West Coast Trail Sections. In 1975, therefore, a survey was conducted to re-examine the major distinct intertidal habitat types in the Long Beach Section, and to identify and describe those in the Broken Group Islands and West Coast Trail Sections.

Habitats of the Long Beach Section were examined by walking along the shore from Cox Point to Wya Point and along the west shore of Grice Bay. The area between Cox Point and Radar Beaches was not hiked because there were many wide surge channels to cross and no low tide period was long enough to hike this area safely. Habitats were identified from April to September during the lowest low tide periods of each month. This work was done in conjunction with the faunal survey of intertidal fauna and flora.

In the Broken Group Islands, a rubber boat was used for transportation. Habitats were observed by travelling among the islands and beaching the boat in semi-exposed or sheltered areas. Some areas of the Broken Group Islands were not studied because they were not easily accessible to boaters and stormy weather prevented further studies in the area in 1975. Four days in June and seven days in August were spent surveying in the Broken Group Islands.

During the first week of September, habitats within a five mile radius of Carmanah Point were identified. Habitats were examined by hiking along the shore during the lowest low tide periods of this week.

It must be recognized that "habitats" are rarely as distinct as the present classification might suggest. The degree of exposure to surf may change gradually along a shore, and boulder beaches may grade into gravel. In addition, what are called "habitats" here are really collections of microhabitats. From the perspective of the species on a shore, one boulder on a beach may contain several habitats with very different environments. The broad "habitats" discussed here may be justified by saying that the variation observed between habitat types is likely to be much greater than that seen among examples of the same habitat type.

The criteria used to define habitats followed the definitions presented by Robilliard (1971) and Lee and Bourne (MS 1973). Habitats were defined on the basis of two environmental parameters: degree of wave exposure and substrate.

Degree of exposure was estimated from the orientation of the shore, presence or absence of land masses offshore and the depth of water just offshore. Wind direction was also an important factor in determining the degree of exposure in a particular area because wind often modified the direction of the incoming oceanic waves. Orientation of the Park area to the open seas

was determined from nautical charts and wind vectors were superimposed over the chart. Areas unprotected from the full force of the surf, regardless of wind direction, were classified as exposed. Areas subject to some wave action from oceanic surf, depending on wind direction, but usually protected from direct wave shock by headlands and small bays were defined as semi-exposed. Areas continually protected from oceanic waves were classified as sheltered.

Inclination of the shore was also carefully surveyed. This is an important factor in understanding habitats, especially those of exposed areas, because the slope modifies the force and effect of the surf. Therefore, field observations were made to check orientation to open ocean, inclination of the shore and wind direction.

"Indicator" species (e.g. the sea palm, Postelsia palmaeformis, occurs only on exposed rocky shores) were also used to determine degree of exposure. During the survey, "indicator" species were identified from examinations of habitats, and could then be used in later determinations of habitat types.

Substrate was classified into the easily defined categories of mud, sand, gravel and rock. Beaches consisting of sand, shell and gravel were added to the substrate classification after field observations were made. Rock substrate may include boulder beaches, horizontal benches, vertical cliffs and other large expanses of rock.

Habitat types in the Park and their indicator species are discussed in the following section under the headings of exposed, semi-exposed and protected habitats. Habitat maps are not given in this report because habitat identification was not completed in the Broken Group Islands and West Coast Trail Sections. However, maps will be presented in a later report. In the discussion of wave action and indicator species reference is made to splash zone and upper, mid and low intertidal zones. These intertidal zones correspond to Zones 1-4 given in Ricketts and Calvin (1968). The splash zone (Zone 1) in the upper reaches of the beach is wetted only by high spray and storm waves. The high intertidal zone (Zone 2) corresponds to the area above the mussel beds and is covered by water only during high tides. The mid intertidal zone (Zone 3) is usually uncovered twice a day and corresponds to the area covered by mussel beds. The low intertidal zone (Zone 4) is uncovered during lowest low tides of each month and corresponds to the area below the mussel beds.

Exposed Habitats

Only rock and extensive sand or gravel beaches are found in exposed areas. The sand beaches slope very gently into the subtidal sandflats while the major gravel beaches are steep and drop off sharply. Exposed rocky shores can be further divided into gently sloping rocky shores, vertical cliffs, hortizontal benches and surge channels.

Gently sloping rocky outcrops in exposed situations are found along the exposed headlands of the Long Beach and West Coast Trail Sections. Point Cox, Green Point, Quisitis and Wya Points and Cape Beale, Pachena and Carmanah Points are the more prominent rocky expanses of these sections. The oceanic waves breaking on gently sloping rock habitats, rush up over the shore with a gradual reduction in force. In these areas, the zones of marine communities are displaced upward and the zones are both wider and higher than in sheltered

areas. A narrow splash zone is observed in gently sloping rock habitats.

The fauna and flora generally indicative of these exposed rocky outcrops tolerate the rigorous conditions of heavy surf. The brown algae Pelvetiopsis limitata is restricted to these exposed rocky regions and is found in the high intertidal zone. The sea mussel, Mytilus californianus, and the goose barnacle, Pollicipes polymerus, form an association in the mid intertidal area wherever a rocky shore is exposed to the open Pacific. Coralline red algae (Corallina spp., Calliarthron spp. and Bossiella spp.) are found in the low intertidal zone and are most noticeable among the other organisms because of their bright pink coloration.

Vertical cliffs or very steeply sloping rock outcrops are found along the exposed headlands of Long Beach but are more abundant along the West Coast Trail and on the southeastern side of the outer Broken Group Islands. The surf breaking on the vertical cliff face is carried up toward the top of the cliff before it retreats. In these areas, there is a very high splash zone.

The association between M. californianus and P. polymerus is found again along exposed cliffs. Coralline red algae are also found in the low intertidal area along these cliffs.

Where the rock forms a wide horizontal bench, oceanic waves break at the front edge and roll across the bench with a gradual reduction in force. Horizontal benches are found along exposed headlands and exposed sides of islands such as Wya Point and Box Island in the Long Beach Section. However, the sandstone benches from Carmanah Point to Walbran Creek in the West Coast Trail Section are the most extensive benches in the Park area. The organisms at the edge of the bench are typical of exposed areas, but the species nearer the shore are usually similar to those found on semi-exposed or sheltered areas.

Beds of Postelsia palmaeformis, the brown algal sea palm, are indicative of exposed fronts of horizontal benches. The sea urchin Strongylocentrotus purpuratus is often established in rows of holes scoured in depressions and tidepools along exposed horizontal benches and rocky outcrops. In this habitat, M. californianus and P. polymerus are restricted to crevices and small depressions on the otherwise smooth sandstone benches.

Surge channels running more or less perpendicular to the rocky shore may be found interrupting any of the exposed rocky habitats just discussed. The bottom of a surge channel is often sand or gravel which is continually churning under the force of incoming waves. The oceanic waves breaking on the shore surge up the channel before retreating. Progressing shoreward in longer channels, there is a gradation of species from those typical of exposed open coast to those found in protected areas. M. californianus and P. polymerus situated here may be found at a higher level than those elsewhere because of the upward surge of incoming waves in the channel.

Tidepools of exposed rocky shores are inhabited by the sculpin Oligocottus spp., the snail Calliostoma sp., coralline algae, nudibranchs and the shore crab Hemigrapsus nudus. The anemone Anthopleura xanthogrammica may be found in these pools but is more abundant in semi-exposed or sheltered situations. The limpet Acmaea mitra is located in these pools, especially those of the sandstone benches along the West Coast Trail. The sculpins and shore crabs are limited to these pools in exposed rock habitats. The other species

are low intertidal or subtidal forms that are indicative of exposed rock tidepools.

The most extensive exposed sand beach in the Park is Long Beach. Under the constant force of oceanic waves, the surface contours and slopes of exposed sand beaches are continually changing. However, a limited number of species have adapted to living in the exposed sand habitat. The species most indicative of exposed sand beaches are Olivella biplicata, the purple olive snail, and Siliqua patula, the razor clam, which are both present at the low water level.

Exposed gravel beaches are found along the West Coast Trail. The steep slope of these beaches is constantly moving with the pounding of oceanic waves. As the waves break on the beach, water is forced under the gravel and rolls the surface layer of gravel up the beach. When the waves retreat, the surface layer tumbles back down the slope of the beach. These beaches are barren of any conspicuous fauna or flora.

Semi-exposed habitats

Sand, shell or gravel beaches and rocky shores are found in semi-exposed areas in the Park.

All types of rocky shores observed in exposed situations are found here, and boulder beaches are also present. The northeastern side of Gowlland Rocks and Box Island of the Long Beach Section and shores of the outer Broken Group Islands are representative semi-exposed rocky shores. Semi-exposed rocky beaches are protected by points or islands along Quisitis and Wya Points in the Long Beach Section and along Cape Beale of West Coast Trail Section. As similar fauna and flora are found along semi-exposed rocky shores regardless of topography, the indicative fauna and flora will be discussed for this habitat as a whole.

Indicative species of brown algae are the rockweed, Fucus distichus, of the mid to upper intertidal zone and Leathesia difformis of the mid intertidal zone. The bay mussel, Mytilus edulis, may be located in a thin band above the extensive beds of M. californianus. P. polymerus is not found associated with M. californianus on semi-exposed rocky shores. The sea anemone Anthopleura elegantissima, present only in crevices on exposed rocky shores, is situated in the mid intertidal area on semi-exposed rocky shores where there are accumulations of sand and shell.

In tidepools of the splash zone, the water is subject to extremes of temperature and salinity. Blooms of microscopic algae and diatoms in these tidepools indicates an absence of grazers such as snails. Tidepools in the mid to low intertidal area are inhabited by turban snails Tegula funebralis, hermit crabs Pagurus spp., sculpins Clinocottus spp. and Oligocottus spp. and the green anemone Anthopleura xanthogrammica.

Semi-exposed beaches, made of sand, shell and gravel, are located on the shores of the inner Broken Group Islands. Those beaches with a gentle slope are inhabited by littleneck clams, Protothaca staminea and Venerupis japonica, and butter clams, Saxidomus giganteus. The blue ghost shrimp, Upogebia pugettensis, is also common on these beaches. The steeper sloping beaches are barren of any conspicuous fauna or flora because of the grinding action of the substrate caused by the surf breaking on the beach.

Semi-exposed sand beaches are located at the northwest and southeast ends of Long Beach and Florencia Bay. These beaches are sheltered from the full force of oceanic waves by Quisitis and Wya Points and groups of small islands as well as Box Island at the northwest end of Long Beach.

The species recorded as indicative of exposed sand habitats may also be found here. Two additional species found where there is some reduction in wave action are the lugworm Abarenicola sp. and the ghost shrimp Callianassa californiensis. These two species were most abundant in the mid to low intertidal zone at the northwest end of Long Beach.

Protected habitats

Substrates ranging from rocky outcrops to mudflats are found in sheltered areas.

Sheltered rocky shores may consist of gently sloping outcrops, cliffs or boulder beaches. Sheltered gently sloping rocky areas in the Long Beach Section are situated along the protected shores of Grice Bay. In the Broken Group Islands, sheltered rocky outcrops and cliffs are found on the northeastern shores of the inner islands, in bays such as Effingham Bay, and along the shores of clustered islands as illustrated by the Dodd, Willis and Turtle Islands grouping.

The rockweed, Fucus distichus, forms a luxuriant growth in the mid to upper intertidal zone. Indicative fauna of these sheltered rocky areas are Thais lamellosa, the turban snail Tegula funebralis, and the dire whelk Searlesia dira. Mytilus californianus of exposed rocky shores is replaced by the bay mussel, M. edulis, in sheltered rocky areas. At low tides, the wavy top snail, Astraea gibberosa, and the bat star, Patiria miniata, are often observed below the water's surface. Where there is seepage of fresh water onto rocky outcrops, the green alga Enteromorpha intestinalis is found at the higher levels of the intertidal zone.

Boulder beaches are found in sheltered bays and in channels between islands in the Broken Group Islands. Indicative fauna and flora of sheltered rocky outcrops may be found along these boulder beaches but there are also several species that live primarily under rocks. The shore crab Hemigrapsus nudus and porcelain crabs, Petrolithes cinctipes and P. eriomerus, are found when the rocks are turned over. Another shore crab H. oregonensis is common in areas where there is some sand or gravel among the boulders as on Effingham Island. On the lower edges of boulders, the limpet Notoacmea persona is abundant. This species is also indicative of shady rocky slopes. A species that is not usually common, the carnivorous chiton, Placiphorella velata, is found in the extreme low intertidal zone, among the boulders on Gilbert Island.

Few sheltered distinctly sand or gravel beaches occur in the Park. However, mixtures of sand, shell and gravel are common in "pocket" beaches and along sheltered shores of the Broken Group Islands. Where there is more sand than gravel, the moon snail, Polinices lewisi, is commonly found. These beaches are inhabited by several bivalves - butter clams, Saxidomus giganteus, littleneck clams, Protothaca staminea and Venerupis japonica, and horse clams, Tresus spp.. However, these bivalves may not all be found together on one beach. The starfish Pisaster brevispinus is associated with this habitat and at low tide is found just below the water's surface.

A few sheltered mud habitats are found in the Park. The gray-brown mudflats of Grice Bay, Long Beach Section, are the most extensive. Two smaller mudflats are found in the Broken Group Islands. One is located behind the natural breakwater on the south side of Wouwer Island; the other is situated in the bay formed by Jarvis and Jacques Islands. The substrate of the Wouwer Island mudflat is a mixture of sulphur-smelling mud and fine sand while that of Jarvis and Jacques Islands is a fine brown incohesive mud.

Beds of eelgrass, Zostera marina, are found in all three locations. Zostera is observed only in sheltered mud habitats and is not the same as the surfgrass, Phyllospadix scouleri, which is found on semi-exposed or sheltered rocky shores. The ghost shrimp Callianassa californiensis (only the blue mud shrimp, Upogebia pugettensis, is found at Wouwer Island) and several clams, primarily Mya arenaria, Macoma nasuta and Clinocardium nutalli are indicative fauna of these sheltered mudflats.

FAUNAL SURVEY

A survey of distribution and relative abundance of intertidal fauna and flora was conducted in the three sections of the Park. The survey provided a basis for compiling descriptions of habitat types and identifying unique areas and areas with high recreational use for further studies.

The survey in the Long Beach Section was conducted on exposed to sheltered rocky outcrops, exposed sandy beaches and sheltered mudflats. In the Broken Group Islands, the faunal survey was carried out in those semi-exposed and sheltered areas having potential recreational value to boaters. Fauna and flora were observed on sand, shell and gravel beaches, mudflats and rocky shores in these areas. The survey along the West Coast Trail was located within a five-mile radius of Carmanah Point. Organisms from exposed sand, gravel and boulder beaches and sandstone benches were observed.

Relative abundance of macroscopic organisms from subjective impressions and counts was recorded as few, common, and very common. Subjective impressions of abundance were based on the number of a species in a particular area compared to the abundance of that species in similar areas within the Park. Size of the species as well as numbers was important in this type of estimation. For instance, the sea mussel, Mytilus californianus, may grow to 40 mm wide and 100 mm long and would be considered very common if found grouped in extensive beds, as it is on exposed rocky shores. However, the blood worm, Euzonus mucronata, a small organism (2 mm wide and 40 mm long) of exposed sandy beaches, would be considered common if found at a density of 10 times that of Mytilus. Because Euzonus is much smaller than Mytilus, it takes many more of them to have the same visual impact on the observer as the same number of Mytilus. In other cases, Euzonus could be 10 times as dense as in the above example, and would be considered very common; if Euzonus were 10 times less dense, its abundance would be recorded as "few". Abundance would also be recorded as few if there were only two or three individuals of a particular species present in a sample area. If a species was not recorded in a particular habitat, it may have been absent but might also have been overlooked if it was present outside the sample area.

LONG BEACH SECTION

The intertidal fauna and flora of Long Beach were surveyed from Cox Point to Wya Point and in Grice Bay. Sample locations and habitat descriptions are given in Table 1 and Figure 1. The survey was conducted throughout the summer during the monthly series of lowest tides, when tidal height at low tide ranged from 0.1 m to 0.5 m.

Sand samples were dug in Schooner Cove (Locations 1 and 2), in Long Beach (Locations 3 - 8), and in Florencia Bay (Location 9). One sample, 0.36 m^2 and 25 cm deep, was taken at the driftwood line, another half-way down the beach, and a third at the low-water line in each location. Three similar samples were taken in Grice Bay (Location 16). The sand and mud samples were washed through a 2.0 mm mesh screen. (This size mesh was chosen because sand particles plugged the holes of smaller mesh screen.) Subjective estimates of abundance and

distribution of organisms remaining in the screen are given in Table 2.

Two transects were also established in the exposed sand beach to estimate abundance and distribution of marine organisms in this habitat. The locations of these transects correspond to Location 5, north of Shawd Rock, and Location 8, north of Quisitis Point, shown in Figure 1. (The beach from Shawd Rock to the Schooner Cove Cable at the north end of Long Beach was open to camping and motor vehicles in 1975. The remainder of the beach, south of Shawd Rock to Quisitis Point, was closed to traffic and was designated a day-use area only.) These transects ranged in length from 150 m to 275 m depending on location and tide height. A sand sample, 0.36 m^2 x 25 cm deep, was taken every 25 m from the driftwood line to the low-water line along each transect in May, August and December. These samples were washed through a 2.0 mm mesh screen. Numbers of organisms collected in the screen are shown in Table 3.

Exposed intertidal sand habitat supported relatively few species, although some species are found in large numbers. The indicator species referred in the habitat descriptions of exposed sand beaches (Habitat Types Section) were abundant and widely distributed throughout the Long Beach samples.

The most abundant polychaete found in the Long Beach samples was the bloodworm, Euzonus mucronata. The presence of these worms is indicated by a band of small, close-set holes at the sand surface in the mid-tide region. The position of Euzonus may change somewhat with season, as shown in Table 3. In May, the Euzonus band, north of Shawd Rock, was observed between 100 and 150 m levels of the transect. The sand at the 50 - 75 m level was packed hard from beach traffic during the May 24 holiday weekend. In August the beach traffic was much reduced because of summer storms and the Euzonus band was observed at the 50 - 75 m level, where it remained in December. The Euzonus band north of Quisitis Point remained fairly constant at the 25 - 50 m level where there was no beach traffic.

Other polychaetes, Abarenicola pacifica and Nepthys californiensis, were commonly found in the low intertidal zone of the beach. The presence of the lugworm, A. pacifica, was indicated by fecal sand castings on the sand surface. The lugworm was most abundant at the northern end of Long Beach (Location 4). Table 3 shows that these polychaetes were not restricted to any one level of the low intertidal zone.

Beach hoppers, Orchestia traskania and Orchestiodea californiana, were abundant in the high intertidal zone from Schooner Cove to Florencia Bay, as shown in Table 2. These amphipods were not observed in large numbers in the transect samples because they quickly jump out of the sample area when disturbed. However, O. traskania was observed around decaying seaweed that had been washed up onto the beach, and O. californiana was observed in greatest numbers at night or on cloudy days in the high intertidal zone.

Other common arthropods such as mysids, isopods and some decapods were observed from the driftwood line to the low-water line during low tide periods. They were often found just below the surface of moist sand but were also observed swimming in water-filled depressions in the sand. Numbers of isopods, amphipods and mysids given in Table 3 show that these organisms vary in abundance along the beach and are not confined to any one level.

Of the decapods recorded for Long Beach, the red ghost shrimp, Callianassa californiensis, was the most unexpected, as it is more commonly

associated with mud or sand beaches of sheltered areas (Smith and Carlton, 1975). Callianassa was found burrowing in the sand of the mid-intertidal region at the northern end of the beach (Location 4).

The olive snail, Olivella biplicata, was common in the mid to low intertidal zone from Schooner Cove to Florencia Bay. A few O. baetica were observed north of Quisitis Point (Location 8).

Siliqua patula, the razor clam, was observed in the low intertidal zone from Schooner Cove to Quisitis Point. Razor clams were most abundant from the northern end of Long Beach to Shawd Rock (Locations 4 and 5). Other bivalves observed in the sand habitat of Long Beach were a few Tellina bodegensis and T. carpenteri that were found at Location 2. Protothaca staminea, Mya arenaria and Clinocardium nuttalli were found in the sand and gravel habitat at the northern end of Florencia Bay (Location 9).

A few sand dollars, Dendraster excentricus, were found in the mid to low intertidal zone around Sandhill Creek (Location 7) and Quisitis Point (Location 8).

In the protected mudflats of Grice Bay (Location 16) the most abundant organisms found were the red ghost shrimp, Callianassa californiensis, and the bivalves Mya arenaria and Tellina carpenteri. A few polychaete worms, shore crabs and other bivalves were also found. Beds of eelgrass, Zostera marina, observed in the deeper waters of Grice Bay, did not extend into this sample area.

The intertidal fauna and flora of rocky shores were observed at Locations 10 - 15b (Table 1 and Figure 1). At each sample site, a transect was established from the top of the rocky outcrop to the low water mark. Relative abundance of macroscopic organisms was observed in one meter areas on either side of the transect line. Subjective estimates of abundance and distribution of rocky shore fauna and flora in the Long Beach Section are given in Table 4.

In the spray zone of rocky shores in the Long Beach Section, the periwinkles, Littorina scutulata and L. sitkana, were commonly grouped in depressions and crevices. A small red copepod, Tigriopus californicus, was common in tidepools in this zone at Cox, Quisitis and Wya Points (Locations 10, 14b and 15b). The isopod Ligia pallasi was only found under a rock ledge in the spray zone at Quisitis Point (Location 14a).

In the high intertidal zone, the rockweed, Fucus distichus, was the most common alga. In exposed situations at Box Island (Location 12a) and Quisitis and Wya Points (Locations 14a & b, 15b) a brown alga Pelvetiopsis limitata was common in the high intertidal area. The most abundant fauna in this zone were the barnacles Chthamalus dalli and Balanus glandula, and the limpets Collisella digitalis and Notoacmea persona. Notoacmea persona was most abundant in shaded areas.

In mid intertidal zone, the sea mussel, Mytilus californianus, was the most abundant organism in exposed and semi-exposed areas. In these areas a narrow band (30 - 50 cm) of bay mussels, M. edulis, was observed above the sea mussels. M. californianus was replaced by M. edulis on the protected rocky shores of Grice Bay (Location 11). In exposed areas, the goose barnacle, Pollicipes polymerus, was abundant among the sea mussels. Narrow vertical

colonies of Pollicipes were found interrupting the otherwise continuous beds of sea mussels. Acorn barnacles (Balanus glandula, B. cariosus and Chthamalus dalli) were found among the mussels of this zone. The chiton Katharina tunicata was common and most often found in this zone. The purple starfish, Pisaster ochraceus, was the most abundant starfish on rocky shores. Where there were boulders in the mid intertidal area (e.g. Grice Bay) shore crabs, Hemigrapsus spp., were common. These crabs were also observed in tidepools where there was some gravel or algae for shelter. The anemone Anthopleura elegantissima was most abundant along the rocky outcrop in Half Moon Bay (Location 14a) where there were accumulations of sand among the rocks. The snails (Tegula funebralis, Thais emarginata and T. lamellosa) were common in the mid intertidal zone. T. emarginata was most abundant along Cox Point (Location 10) and T. lamellosa was most abundant along the shores of Grice Bay (Location 11) and along the semi-exposed side of Box Island (Location 12b).

Several species of algae were observed in the mid intertidal area. Fucus was found in this area but was not as abundant as in the high intertidal zone. The brown algae Hedophyllum sessile and Leathesia difformis were common along Quisitis and Wya Points. The red alga Halosaccion glandiforme was common along all rocky shores but was most abundant at Grice Bay (Location 11) and the semi-exposed side of Box Island (Location 12a).

In the low intertidal zone, the encrusting sponges Haliclona permollis and Ophlitaspongia pennata were common in exposed and semi-exposed locations. The green anemone Anthopleura xanthogrammica was common along all rocky shores and was most abundant in mid to low intertidal tidepools. A few red anemones Telia lofotensis were observed along Cox Point (Location 10) and Box Island (Location 12b). Tube-dwelling polychaetes were observed in small crevices along the rocky shores and in more sheltered areas. Serpula vermicularis and Spirorbis sp. (species with calcareous tubes) were common along exposed and semi-exposed areas while only a few isolated clumps of Eudistyla vancouveri (species with "leathery" tubes) were observed in semi-exposed areas (Locations 12b and 14b). The chitons Mopalia sp. and Tonicella lineata were observed along exposed and semi-exposed areas, but Tonicella was not common. The sunflower starfish, Pycnopodia helianthoides, was most common along the semi-exposed side of Box Island (Location 12b). Sea urchins Strongylocentrotus purpuratus were common in tidepools in the mid and lower intertidal areas.

Surfgrass, Phyllospadix scouleri, is common in the low intertidal zone along exposed and semi-exposed areas. Phyllospadix was often found in pools or crevices along exposed rocky outcrops. Eelgrass, Zostera marina, which can easily be confused with Phyllospadix, was found only in Grice Bay (Location 11) and formed extensive beds on the mudflats of Grice Bay. In the spring and summer months, the red alga Smithora naiadum was found attached to surfgrass.

The flora observed in the low intertidal zone were predominantly brown and red algae. Brown algae (Laminaria spp., Alaria spp., Egregia menziesii) were common along exposed and semi-exposed areas while Postelsia palmaeformis was restricted to exposed rocky shores. Macrocystis and Nereocystis beds were observed just offshore along Cox, Quisitis and Wya Points.

The coralline red algae (Bossiella spp., Corallina spp., and Calliarthron spp.) were abundant along exposed rocky shores. These species were also observed in tidepools and crevices in the mid intertidal zone along exposed areas.

Red algae (Gigartina spp., Iridea spp., Odonthalia floccosa and Rhodomela larix) were common along exposed and semi-exposed areas.

BROKEN GROUP ISLANDS SECTION

In the Broken Group Islands, areas of potential recreational use to boaters were selected for the 1975 faunal survey. Sixty-four semi-exposed and sheltered areas were sampled in June and August. Sample locations and habitat descriptions are given in Table 5 and Figure 2.

Three samples, each 1 m^2 x 60 cm deep, were dug in each of the sand, shell and gravel beaches. Subjective estimates of abundance and distribution of intertidal bivalves and other macroscopic organisms are given in Table 6. Bivalves were recorded as very common when density was greater than about 20/m^2; common when density was about 10 - 20/m^2; few when density was less than about 10/m^2.

Macroscopic fauna and flora on the rocky shores adjacent to several of the above study sites were also observed. At each sample site, a transect was established from the top of the rocky outcrop to the low water mark. Organisms were observed in one meter areas on either side of the transect line. Subjective estimates of abundance and distribution are given in Table 7.

Locations of kelp beds, consisting of the giant kelp, Macrocystis integrifolia, and the bull kelp, Nereocystis luetkeana, are given in Figure 3.

The organisms observed in the semi-exposed and sheltered beaches were predominantly bivalves. Bivalve populations were found in 66% of the sample locations.

The beaches that supported the most abundant combined populations of littleneck, Manila and butter clams were at the bar between Trickett and Turret Islands (Locations 16 - 19), Prideaux Island (Location 20), Nettle Island (Location 21), Hand Island (Locations 25 - 28), Clarke Island (Locations 35 - 36), Effingham Island (Location 45), Cooper Island (Locations 49 - 51), Cambiain Island (Location 52) and Wouwer Island (Locations 57 & 58). Abundant littleneck clam populations were found on Chalk Island (Locations 37, 40 & 41), Gilbert Island (Location 47) and Wouwer Island (Locations 55 & 56). Effingham Island (Locations 44 & 46a) and Cambiain Island (Location 52) supported very dense populations of horse clams.

Seven bivalve species were found in the samples. Not all species were found in one sample area and the densities of one species varied from few in one area to abundant in another. Least common bivalves were the cockles, Clinocardium nuttalli, and the Pacific oyster, Crassostrea gigas. Cockles were found, in low numbers (about 10/m^2), in only 8% of the sample areas. A few Crassostrea (less than 10/m^2) were found in the lower reaches of rocky outcrops or adhering to larger rocks on the sand and gravel beaches in 10% of the sample locations. The most common bivalves were littleneck clams, Protothaca staminea, found in 52% of the beaches sampled. Density ranged from less than 10/m^2 to greater than 20/m^2. Butter clams, Saxidomus giganteus, were observed in 25% of the sample locations with densities greater than 10/m^2. Manila clams, Venerupis japonica, and horse clams, Tresus sp., were both found in 22% of the sample areas. Their densities

ranged from less than 10/m^2 to greater than 20/m^2. Mud or soft-shell clams, Mya arenaria, were observed in 20% of the beaches sampled and were found in densities ranging from less than 10/m^2 to greater than 20/m^2.

Other organisms found here were Euzonus mucronata, Upogebia pugettensis and Polinices lewisi. A few bands of bloodworms, Euzonus mucronata, were found in 6% of the beaches sampled. Upogebia pugettensis, the blue ghost shrimp, was abundant in 30% of the sample locations. In areas where this ghost shrimp was present, their burrows riddled the beach and the substrate was incohesive. A few Polinices lewisi were found in 20% of the sandy beaches and their egg-containing sand "collars" were often seen below the water's surface.

Species of algae on semi-exposed and protected rocky shores in the Broken Group Islands were analogous to those found in similar areas in the Long Beach Section. The distribution of algae in the Broken Group Islands is shown in Table 7.

The fauna in these areas was also comparable to that observed in the Long Beach Section (Table 7). However, several species were found in the Broken Group Islands that were not observed in the Long Beach Section. These species were observed in the low intertidal zone unless otherwise stated. A few white-plumed anemones. Metridium senile, were observed on Gilbert Island (Location 47) and Dicebox Island (Location 53). The cup coral Balanophyllia elegans was found on the underside of ledges and was most abundant on Gilbert Island (Location 47). The carnivorous chiton, Placiphorella velata, was common only in the extreme low intertidal zone, among the boulders on Gilbert Island (Location 47). The snail Searlesia dira was observed in the mid intertidal zone among or under rocks and was most common on Effingham Island (Locations 43 & 46), Gilbert Island (Location 47) and Dicebox Island (Location 53). The snail Bittium eschrichtii was not common in this area but a few were found among or under rocks on Hand Island (Location 26) and Gilbert Island (Location 47). The red turban snail, Astraea gibberosa, was observed below the low tide line on rock benches and was abundant on Chalk Island (Location 40) and Gilbert Island (Location 47). The Pacific oyster, Crassostrea gigas, was found throughout the area and was common on Turret Island (Location 12) and Hand Island (Location 26). The porcelain crabs, Petrolisthes spp., were common on boulder and gravel beaches on Effingham Island (Locations 43 & 46) and Gilbert Island (Location 47). Petrolisthes cinctipes was found in the high and mid intertidal zones while Petrolisthes eriomerus was usually found in the low intertidal zone. The bat starfish, Patiria miniata, was common in the low intertidal zone and below the low water mark. Patiria was most abundant on Prideaux Island (Location 20), Chalk Island (Location 40) and Gilbert Island (Location 47). A few Pisaster brevispinus were observed below the low water line. The red sea urchin, Strongylocentrotus franciscanus, was common below the low water mark where there was a current as on Turret Island (Locations 15 & 16), Nettle Island (Location 22), Hand Island (Location 26) and Dicebox Island (Location 53).

Locations of Nereocystis and Macrocystis beds were observed because these beds form an important part of the marine community. These beds provide shelter for fish, numerous small gastropods, crustaceans and other marine organisms. The beds also provide food for several herbivores especially the red sea urchin, Strongylocentrotus franciscanus, and the abalone Haliotus kamtschatkana.

Nereocystis beds were found in areas where there was some exposure to surf. The most extensive beds were seen around the southeastern islands that are

exposed to the full force of oceanic waves. Nereocystis and Macrocystis were occasionally found together, but Macrocystis was found closer to the shore. Macrocystis was abundant in semi-exposed or sheltered areas and was widely distributed throughout the Broken Group Islands.

WEST COAST TRAIL SECTION

In the West Coast Trail Section, the faunal survey was conducted during the first week of September, 1975. Exposed sand, gravel, boulder beaches and sandstone benches were sampled within a 5-mile radius around Carmanah Point (Figure 4). Sample locations and habitat descriptions are given in Table 8 and Figure 5.

Three samples, each 1 m^2 x 60 cm deep, were dug in each of the sand and gravel beaches (Locations 1, 6 & 10). These steeply sloping beaches were continually shifting and grinding under the force of oceanic waves. No conspicuous organisms were found on these beaches.

Macroscopic fauna and flora on boulder beaches and sandstone benches were observed. At each sample site, a transect was established from the high tide line to the low water mark. Organisms were observed in one meter areas on either side of the transect line. Subjective estimates of abundance and distribution are given in Table 9.

The fauna and flora of these areas were similar to those observed in exposed and semi-exposed areas in the Long Beach Section. Several species of limpets were observed that were not found in the Long Beach Section. Acmaea mitra was common in the low intertidal zone and in tidepools along the sandstone benches (Locations 2 - 4). The white shell of Acmaea mitra was usually covered with a coralline red algae. Notoacmea fenestrata was common in the low intertidal zone on the semi-exposed boulder beach (Location 5). Collisella pelta, found in the mid intertidal zone, was common in all rock sample sites.

On the sandstone benches, sea mussels and barnacles were observed clumped in hollows and crevices on the otherwise smooth surface. Sea mussels were not found in extensive beds as they were in the Long Beach Section. The purple sea urchin, Strongylocentrotus purpuratus, was abundant in the low intertidal area in rows of holes scoured in depressions and tidepools.

Intertidal faunal surveys will be continued in all three sections of the Park. Subtidal faunal surveys will be started in the Long Beach and Broken Group Islands in 1976.

RECREATIONAL IMPACT STUDIES

Recreational impact studies were begun in the Long Beach Section for 1975, in order to study those organisms that might be collected for food or souvenirs by the public. The edible species studied were the razor clam (Siliqua patula), littleneck clam (Protothaca staminea) and sea mussel (Mytilus californianus). At present, the Park is included in those areas closed to the taking of shellfish because of paralytic shellfish poisoning (PSP). The active toxic agent is found in phytoplankton blooms commonly referred to as "red tide", and the toxin is concentrated by all bivalve species. The bivalve species in the Long Beach Section are not exploited (except surreptitiously) at present, but might be subject to heavy exploitation in the future, if levels of toxin decrease to within safe limits for human consumption.

There was a moderate exploitation of razor clams in the past at Long Beach. Should the present closure be lifted, they may be subject to even heavier exploitation because more people are interested in digging razor clams than in the past. The intertidal razor clam studies were therefore begun in 1975, when there was little disturbance to the population from clam diggers.

The littleneck clam population at the north end of Florencia Bay was thought to be fairly large. After a transient group of people had settled in this area during the summer of 1971, it was thought that the clam population was much smaller. However, Robilliard (1971) found this population to be limited to a few individuals in the protected channels between islands. A re-assessment of the size of this population was begun in 1975.

Sea mussels are becoming more popular as an edible bivalve. A study was started to determine the recovery rate of a denuded mussel bed.

The main organisms removed by souvenir hunters were the purple olive snail (Olivella biplicata) and the purple starfish (Pisaster ochraceus). The olive snail was abundant in the low intertidal zone of exposed sandy beaches during the summer months and was collected in moderate numbers by tourists, despite the Park-wide ban on collecting of animals for souvenirs. A study of the intertidal migration of this species was begun. Starfish collected by tourists were mostly Pisaster ochraceus, but a few other starfish species (Pycnopodia helianthoides and Dermasterias imbricata) were also taken. A study site was established on a semi-exposed vertical wall of Box Island where the starfish population could be easily monitored.

RAZOR CLAM (Siliqua patula) STUDIES

In the Park, razor clam populations are restricted to the exposed sand beaches of the Long Beach Section and Pachena Bay beach in the West Coast Trail Section. Razor clams are occasionally dug for crab bait at Long Beach. Before the shellfish closure in 1972, there was moderate exploitation of the Long Beach population by recreational diggers (Bourne and Quayle, MS 1970).

In 1975, the intertidal distribution and density of the adult razor

clam population at Long Beach was measured. Studies were undertaken to measure growth rates, determine the time of spawning, and measure the density of the incoming year class. Results of this study were similar to those reported by Bourne and Quayle (MS 1970).

Density of adults

The fine sand habitat at Long Beach was divided into five areas for adult and juvenile razor clam sampling (Figure 6).

In the low intertidal area (0.3 m tide height or lower), adult razor clams were dug individually. This is referred to as "point digging". When razor clams are disturbed, they produce a "show" or dimple on the sand surface. The number of shows produced at any one time depends on tide height and weather (Quayle and Bourne, 1972). On cold wet days there are fewer shows than on warm dry days. In April and December, a layer of fresh water covered the sand surface and few clam shows were observed. The clams were disturbed by the diggers stamping their feet and pounding the sand with the shovel handle, in order to produce shows.

To determine the intertidal distribution of the adult razor clam population at Long Beach 14 representative sample areas, each 25 x 5 m, were selected, parallel to the shore in the intertidal zone below 0.3 m. The locations and substrate descriptions of sample areas are given in Table 10 and Figure 6. For the first sampling period in April, razor clams were collected by point digging and the shells retained for growth rate analysis. In order to obtain an estimate of population density, shows were counted in May, June and September. This method may underestimate density of the clam population because not all clams present will produce shows on a given day (Bourne, MS 1969).

The greatest density of adult razor clams was consistently found from the northwest end of Long Beach to the south side of Shawd Rock (Table 11). Low densities of adult razor clams were observed along Combers and Wickaninnish beaches during the summer. In May and June, a small clam population was observed in Schooner Cove. This population could not be sampled in April and September.

The mean density of adult razor clams at the northwest end of Long Beach was $0.104/m^2$ (Locations 3 - 6). At this density, the intertidal population can be estimated to be 7,000 razor clams per linear km of beach.

The density of the intertidal razor clam population may be affected by changes in substrate, slope, compaction and water retention. The greatest density of razor clams was found in areas where the fine sand was firm but wet (e.g. at the northwest end of the beach). In this area, where the full force of the surf was minimized by small islets, the gentle slope of the beach was interrupted by only a few low sandbars in the summer. From the south side of Green Point to the southeast end of Long Beach, where the razor clam density was low, the sand was coarser, more hard-packed and drier. This section of the beach was subject to the full force of the surf as well as to rip currents. These combined factors caused extensive sandbars separated by channels from the rest of the beach. The sand here was occasionally transported away, leaving a gravel layer during the summer. The continually changing profile and dry hard-packed sand may limit the razor clam population along the southern portion of Long Beach.

A mark-recapture census will be carried out in 1976 to further estimate population density in the intertidal zone. This technique was used in estimating the Masset razor clam population and proved to be a more accurate technique than counting shows or repeated digging (Bourne, MS 1969).

Subtidal razor clam studies will be started in 1976. Razor clam siphons were occasionally observed below the 0.3 m low tide line, and crab fishermen have reported razor clams in their traps as deep as 108 m. However, no accurate measure of this population has been made at Long Beach or at Masset.

Growth

Monthly beach screenings and samples of 25 adult razor clams were taken in April through October and in December.

Beach screenings (Figures 11 and 12) were carried out to determine the time of setting, density and growth rate of the zero year class. Screening sample areas correspond to Locations 5, 6 and 9 - 14 given in Table 10 and Figure 6. Five samples were taken in each sample area at intervals of 100 m. Samples were taken alternately at the low water line (0.3 m tide height) and in the mid intertidal area (50 - 100 m above the low water line). Each sample, 0.2 m square and 25 cm deep, was washed through a 2.0 mm mesh screen.

Samples of adult razor clams were taken to determine the growth rate and age composition of the intertidal adult population. The April sample was collected at sites along the full length of Long Beach; remaining samples were taken at the low water line (0.3 m tidal height) between Incinerator and Shawd Rocks (Figure 6; Location 5).

Total shell length and distances between annual winter checks were measured to the nearest millimeter. Total length measurements were grouped in 5 mm size classes to produce a length frequency spectrum. Measurements of the distance to each winter check were used to ascertain growth rates and age composition. The annual winter checks of the Long Beach razor clams are not as pronounced as those from Masset (Bourne and Quayle, MS 1970), but were sufficiently distinct to permit this estimate of growth rate (Figure 7).

The length frequency spectrum (Figure 8) shows that 98% of the intertidal razor clams sampled were above the commercial size limit of 90 mm. (No size limit is placed on razor clams for recreational digging.) The mean length was 132.7 mm.

Only 2% of the clams sampled were less than 90 mm. This figure is low because small clams were seldom sampled by point digging and no juvenile or zero year class clams were found in the intertidal beach screening samples. After stormy weather in September, a 1-2 meter wide band of shows was observed parallel to the shore, 50 m above the lower intertidal populations. Small clams (less than 90 mm) were dug in this area, but were difficult to remove from the sand intact because their shells were even more fragile than those of older clams. In October, several small clams were observed in the lower intertidal population but no distinct band of shows was observed.

Bourne and Quayle (MS 1970) reported that few zero year class clams were found in beach screening at Long Beach in 1966 - 67 and indicated that intertidal settlement was sparse and sporadic. Recruitment may be mainly subtidal in

this population and the juvenile clams observed in the intertidal zone may result from migration into the intertidal zone. During stormy weather, the small clams may be dislodged from the subtidal area and washed into the intertidal zone, where they apparently resettle until they are dislodged and moved again. These smaller clams would be more easily uncovered because they are not as deep in the sand as the older clams. Small clams were observed just below the sand surface to a depth of 30 cm while older clams were observed to dig vertically in the sand to 60 cm.

Growth rate of razor clams is summarized in Table 12 and Figure 9. The mean lengths recorded for each winter check indicate that the legal size of 90 mm is reached by 1½ years. This growth rate was also observed by Bourne and Quayle (MS 1970).

The first winter ring delineates growth of a juvenile clam from its spring or summer settlement to its first winter, a period of 6 - 9 months. Clams from a spring settlement have a longer growing period than those from a summer settlement of the same year. Variation in settlement time and variation in food abundance influence growth rates during the first year. These two factors probably explain the wide range in lengths recorded at each winter check. The variability found in growth decreases with age, because growth in length decreases.

Age frequency distribution is shown in Table 13 and Figure 10. The numbers of each year class in each sample were fairly constant during the sampling period. Only a few clams were found in the 0 - 1 year classes and these clams were found only in the September and October samples. The dominant year classes, found by digging, in the intertidal population were the 3 and 4 year olds. Whether this indicates a higher recruitment or survival in 1970 and 1971 than in subsequent years or sporadic migration from the subtidal population could not be determined.

Growth and age analysis will be continued to determine the magnitude of yearly fluctuations in the intertidal razor clam population. Intertidal beach screening will be continued in the coming year to measure the intertidal settlement of the zero year class. Subtidal samples will also be taken to ascertain where there is any subtidal settlement of razor clams.

Time of spawning

Monthly samples of razor clams discussed above were subjected to gonad analysis. A gonad sample, 1 cm thick, was taken from each clam and preserved in Davidson's solution. The stage of gonadal development was determined from examinations of cross sections stained with haematoxylon-easin. The categories used for classifying gonadal development were those of Bourne and Smith (1972), Machell and Martini (1971) and Ropes and Stickney (1965). Results are given in Table 14. No gonads were observed in the inactive phase. By the end of April, both male and female gonads were maturing. The sexes were easily distinguished because the reproductive tissues were partially filled with gametes, but the central portion remained empty. In May and June, the gonads continued to mature and some were completely filled and ready to spawn. By July 22, all gonads were ripe and one male and female had partially spawned. The gonads were classified as partially spent when more than 1/3 of the reproductive cells was found in the centre of the tissue. Two weeks later, on August 7, more than 68% of the gonads were partially or completely spent. By the middle of September, 82% of the clams had completely spawned out and only one ripe male was observed. In completely

spawned or spent clams, the gonad tissue is greatly reduced with only a few residual reproductive cells remaining in the tissue. The gonad samples continued to show partial or complete spawning through until December 5.

This study thus shows that spawning started in late July and continued through September. There was no indication of a spring spawning. Whether active spawning continued on into December, or whether some clams remained in the partially spent condition after partial spawning in September, could not be determined from this study.

Studies on spawning times will be continued to determine yearly variations.

The density of the intertidal razor clam population at Long Beach is lower than at Masset (Bourne and Quayle, 1970). However, should the closure for paralytic shellfish poisoning be lifted, the population at Long Beach could support moderate exploitation by sports diggers, providing the bag limit of 6 razor clams set by the Fisheries Service is enforced.

If there is migration from the subtidal population, the size and age of the clams in the intertidal population may change from year to year. Therefore, if a size limit is placed on these clams as exploitation increases, these fluctuations should be taken into account.

LITTLENECK CLAM (Protothaca staminea) STUDY

The littleneck clam is common on protected gravel beaches. In the Long Beach Section, the only substantial littleneck clam population is located behind a group of small islets at the northwest end of Florencia Bay. The substrate is coarse gravel mixed with shell and sand.

Before 1971, this population was thought to be fairly large and was moderately exploited (personal communication, Parks staff). In 1971, a transient group of people resided in the area for the summer. It was thought that the littleneck clams were used as a substantial portion of their diet. When these people left the area, the Park staff thought this clam population to be severely depleted. A study was begin in 1975 to determine the size and density of the present population.

In May, the area of the clam bed was determined by digging sample quadrats, each 60 cm^2 x 15 cm deep, in a pattern across the suitable substrate. The estimated extent of the clam bed, outlined in Figure 13, was 10 x 25 m. The number of clams and cockles dug from each quadrat is given in Table 15. Clam density was 313/m^2 within the bed. At this density, the population size was estimated to be 78,000 littleneck clams within the 250 m^2 bed.

In August, a sample of 51 littleneck clams was collected from a 3 x 5 m area situated between quadrats # 5 and 7 (Figure 13). Total shell length and the distance between annual winter rings were measured to the nearest mm to determine growth rate, age structure and size distribution in the population.

Growth rate, shown in Table 16 and Figure 14, indicates a slower growing population than is observed on the east side of Vancouver Island (Quayle and Bourne, 1972). The legal size of 40 mm for commercial diggers is not reached until after six years. There is no size limit placed on littleneck clams for recreational digging.

Age structure of the clam sample is shown in Figure 15. In this sample, 63% of the clams were 5 - 7 years old. No one or three year old clams were found. 14% of the clams were 2 and 4 years old. The 8 - 11 year old clams made up 24% of the sample. This age structure may indicate that recruitment is generally sporadic but there may be years when recruitment or survival is higher.

Length measurements were grouped into 5 mm size classes to produce a length frequency spectrum. The length frequencies, given in Figure 16, show two modes: at 40.0 - 44.9 mm and 50.0 - 54.9 mm. However, with such a small sample size, these peaks may be due to sampling error rather than recruitment.

From this study, the clam population was found in a small 250 m^2 plot. The area inhabited by littleneck clams was thought to be larger before a transient group of people resided here in 1971, using these clams as a substantial portion of their diet (personal communication, Parks staff). If this clam population did in fact occupy a larger area and the clam density was similar to that found in 1975, the population is much reduced. However, the present clam population is relatively large for a 250 m^2 plot.

Although this clam population is relatively large, the clams are slow growing and a size limit in addition to the bag limit set by the Fisheries Service would be advisable, should the shellfish closure for paralytic shellfish poisoning be lifted. If a size limit were set at 40 mm, 65% of the population would be available to the sports digger. This would leave 35% of the clams as a "recruiting" population.

This population is not exploited now but the bag limit of 24 littleneck clams set by the Fisheries Service would be adequate because the effort required to dig these clams in the coarse gravel is high (it took one hour to dig 51 clams for growth studies). This may act as a natural deterrent to recreational diggers exploiting this population.

This population will be studied in 1976 to determine yearly variation in population size and recruitment rate.

SEA MUSSELS (*Mytilus californianus*) STUDY

Sea mussels are found in the intertidal zone on exposed rocky shores in all three sections of the Park. Areas of mussel beds are periodically denuded during storms, when logs pound against the rocks. The recovery time of a denuded mussel area to its former state is not known. A study was begun in 1975 to determine the re-establishment pattern and recovery time of a denuded mussel bed area.

In July, a one m^2 plot in a mussel bed (Figure 17) was cleared on the semi-exposed north side of Cox Point. The tidal level of this plot was 1.5 m. The plot was divided into 25 sections each 20 x 20 cm. The organisms in each section were removed and taken to the laboratory to be identified and counted. (The sections were used as small units for transporting the organisms to the

laboratory and had no bearing on the actual counts.) Table 17 shows the total number of organisms observed in the plot.

Sand and bits of shell were found among the mussels. The dominant species were Mytilus californianus, M. edulis, Protothaca staminea and Balanus glandula. M. californianus and M. edulis were grouped together because the species of the small mussels (less than 1 cm) could not be determined. Other organisms were found either on the surface of the mussel bed (e.g. Collisella digitalis, Notoacmea persona, Thais emarginata and Pollicipes polymerus) or among the mussels, byssal threads and shell accumulations (e.g. Cucumaria pseudocurata, Hemigrapsus spp., Petrolisthes eriomerus, Anthropleura elegantissima and several species of flatworms). Polychaetes and nemerteans were observed in the accumulations of sand.

Organisms re-colonizing the cleared plot were counted in September, October and December. Results are given in Table 18. In September, Collisella digitalis, Littorina scutulata and Thais emarginata were observed in the m^2 plot. The size of these species indicated that they were not recently recruited, but had probably moved in from adjacent areas. In October and December, the number of Thais emarginata and Littorina scutulata decreased while number of limpets, both Collisella digitalis and Notoacmea persona, increased. Anthopleura elegantissima, Pollicipes polymerus and M. californianus were observed along the periphery of the square.

The re-establishment pattern and recovery time of this area will be observed through 1976.

PURPLE OLIVE SNAIL (Olivella biplicata) STUDY

The purple olive snail is commonly found on the exposed sandy beaches of Long Beach during the summer. A smaller species, O. baetica, is also encountered but is not common at Long Beach. These snails leave trails in the sand as they move just below the sand surface (Figure 18a), or create a small hump when they are stationary (Figure 18b).

During the period of monthly low tides (0.5 m tide height or lower) from May to August, Olivella were observed in the low intertidal zone. No Olivella were found in the intertidal area in April or in September to December. O. biplicata were counted in 3 x 3 m quadrats. Ten quadrat samples were taken in each of the following locations: north of Quisitis Point (Location 2), north of Sandhill Creek (Location 3), and north of Shawd Rock (Location 4). Location 1 was established at the north end of Florencia Bay. The sand at this site was eroded to a gravel layer and no Olivella were observed during the sampling period. These locations, shown in Figure 19, were chosen as representative areas to determine the density of Olivella along Long Beach.

Quadrats were located at 10 m intervals parallel to the shore, 4 m above the low water mark (0.5 m tide height). The outline of each quadrat was drawn in the sand and was not permanently marked. In each sample location, a vertical line was drawn from the first quadrat to the driftwood line. Behind the driftwood line, an identification post was marked to establish the position of the first quadrat. Quadrats were re-marked for each sampling period by using the identification posts to relocate the site of the first quadrat, and the

remaining quadrats were measured from the first.

The numbers of Olivella observed in the monthly quadrat samples are given in Table 19. In May, the density was $1/m^2$ or less. Density increased steadily during the summer and peaked in July with $5/m^2$ at Sandhill Creek and $3/m^2$ at Quisitis Point. Density decreased slightly in August, then in September to December, no Olivella were observed. The slight decrease in Olivella density in August may represent mortality, because windrows of Olivella shells were observed at the high tide line in July and August. Density in the windrows was 25 shells/m^2. No such windrows were seen after August.

The lowest densities were observed north of Shawd Rock where minor increases were noted during the summer. Density stabilized at $1/m^2$ in July and August. Whether this low density was caused by the higher recreational use of the area could not be determined. No windrows of Olivella shells were found at this location and no Olivella were observed after August.

Edwards (1969) and Stohler (1959, 1960) state that Olivella populations are primarily subtidal along the open coast of Oregon and California, and that individuals found intertidally may be migrants from the subtidal population. From studies of intertidal density, Edwards (1969) observed that Olivella moved from the intertidal zone to the line of low tide during winter and spring storms when beach contours were continually changing and heavy rains often flooded the beach with fresh water.

The disappearance of Olivella from the intertidal area of Long Beach coincided with a series of storms at the end of August. The beach contours changed and fresh water flooded the beach during the heavy rains. As no windrows of Olivella shells were observed between storms to indicate continued mortalities and no live Olivella were observed at the low tide marks, Olivella may have moved down into the subtidal area. Winter storms continued to change the beach contours and flood the beach with fresh water from September to December. No Olivella were observed in the intertidal zone after their disappearance in September.

Olivella density peaked during the height of the tourist season, and these snails were collected in large numbers by the public. The reasons for the possible vertical migration of Olivella are not known, but people should be made aware that they might be disturbing an important part of Olivella's life cycle.

The Olivella study will be continued to determine yearly variations in this population. Transects will be established along Long Beach to determine the extent of intertidal migration. Subtidal samples will be taken to ascertain the size of the subtidal population.

PURPLE OR OCHRE STARFISH (Pisaster ochraceus) STUDY

Pisaster ochraceus is a common starfish in the lower margin of the intertidal zone on rocky shores and in tidepools along the Pacific coast.

A study site, 2.5 x 7.0 m, was established along a semi-exposed vertical wall on the east side of Box Island (Figure 1, Location 12a). The study area extended from top of the Fucus zone to the base of the wall where large boulders

were scattered over a sand substrate (Figure 20). The study site could be reached only at 0.2 m tide level or lower. Starfish were counted in July, August, September and December. Number and density of Pisaster are given in Table 20. Number of sunflower starfish (Pycnopodia helianthoides) from among the boulders at the base of the wall are also given.

Numbers of both species of starfish steadily decreased throughout the summer. This decrease could not be attributed to actual removal of starfish, because no collecting was reported in this area. Pisaster showed a marked increase in December. The observed decline may have resulted from migration into deeper water during sunny calm weather. The increase in December may reflect winter migration into the intertidal area during cooler, overcast weather. No sunflower starfish were observed in December where sand had covered the boulders at the base of the wall.

From this study, the effects of starfish removal in an area could not be determined. However, Paine (1966; 1969) and Dayton (1971) have shown that Pisaster predation limits population density of many species and prevents any species from becoming dominant. In areas where Pisaster was continually removed, mussels in the lower intertidal zone successfully out-competed other species of plants and animals, and species diversity became reduced.

To prevent such ecological changes from occurring, the public should be encouraged to create a minimun of disturbance. The ideal solution is a "look but do not remove" policy which has been presented to the public by the Interpretive Program in the Park through posters (Figure 21) and intertidal beach walks. The policy must be intensified in the future as utilization of the Park increases.

Intertidal counts of Pisaster at low tide will continue in 1976. Additional sample sites will be established and subtidal counts will be taken to determine seasonal changes in density at various tide heights.

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REFERENCES

Bourne, N. MS 1969. Population studies on the Razor Clam at Masset, British Columbia. Fish. Res. Board Can. Tech. Rep. 118: 24 p.

Bourne, N. and D. B. Quayle. MS 1970. Breeding and growth of razor clams in British Columbia. Fish. Res. Board Can. Tech. Rep. 232: 42 p.

Bourne, N.B. and D. W. Smith. 1972. Breeding and growth of the horse clam, Tresus capax (Gould), in southern British Columbia. Proc. Nat. Shellfisheries Assoc. 62: 38-46.

Dayton, P. K. 1971. Competition, disturbance and community organization: the provision and subsequent utilization of space in a rocky intertidal community. Ecol. Mongr: 41:351-389.

Edwards, D. C. 1969. Zonation by size as an adaptation for intertidal life in Olivella biplicata. Amer. Zool. 9: 399-417.

Lee, J. C. and N. Bourne. MS 1973. Marine bibliographical and review study of Pacific Rim National Park. Fish. Res. Board Can. MS Rep. 1276: 121 p.

Lewis, J. R. and D. B. Quayle. MS 1972. Some aspects of the littoral ecology of British Columbia. Fish. Res. Board Can. MS Rep. 1213: 23 p.

Machell, J. R. and J. D. DeMartini. 1971. An annual reproductive cycle of the gaper clam, Tresus capax (Gould), in South Humboldt Bay, California. Calif. Fish and Game 57: 274-282.

Paine, R. T. 1966. Food web complexity and species diversity. The American Naturalist. 100(910): 65-75.

1969. The Pisaster - Tegula interaction: prey patches, predator food preference, and intertidal community structure. Ecology 50(6): 949-961.

Personal communication, Parks staff.

Quayle, D. B. and N. B. Bourne. 1972. The clam fisheries of British Columbia. Fish. Res. Board Can. Bull. 179: 70 p.

Ricketts, E. F. and J. Calvin. 1968. Between Pacific Tides. (4th ed.). Stanford Univ. Press, Calif.: 614 p.

Robilliard, G. A. 1971. Preliminary survey of intertidal and subtidal marine fauna and flora of Pacific Rim National Park with emphasis on Long Beach Section. Nat. Mus. Can. Rep., Ottawa: 156 p.

Ropes, J. W. and A. P. Stickney. 1975. Reproductive cycle of Mya arenaria in New England. Biol. Bull. (Wood's Hole) 128: 315-327.

Smith, R. J. and J. T. Carlton. [ed.] 1975. Light's Manual. Intertidal invertebrates of the central California coast. Univ. Calif. Press. 716 p.

Stephenson, T. A. and A. Stephenson. 1961. Life between tidemarks in North America. Part IVa, Vancouver Island, I. J. Ecol. 49: 1-29.

1961a. Life between tidemarks in North America. Part IVb, Vancouver Island, II. J. Ecol. 49: 227-243.

Stohler, R. 1959. Studies on mollusk populations: IV. Nautilus 73: 65-72.

1960. Studies on mollusk populations: IV. Nautilus 73: 95-103.

Table 1. Location and habitat description of intertidal faunal survey sites, Long Beach Section (1975).

Table 1

Sample No.	Location	Longitude	Latitude	Habitat	
				Substrate	Exposure
1.	North of first small island in Schooner Cove	125°48'06"	49°04'00"	fine sand	semi-exposed
2.	100m. northwest of Box Island	125°47'30"	49°03'48"	fine sand	exposed
3.	Halfway between Box Island and Schooner Cove Cable	125°47'00"	49°03'54"	fine sand	semi-exposed
4.	Beach east of IR3	125°46'42"	49°04'12"	fine sand	semi-exposed
5.	Halfway between Incinerator and Shawd Rocks	125°45'36"	49°04'12"	fine sand	exposed
6.	100m. west of Green Point	125°43'30"	49°03'06"	fine sand	exposed
7.	0.8 km. north of Sandhill Creek	125°42'00"	49°02'18"	coarse sand	exposed
8.	0.8 km. north of Quisitis Point	125°40'36"	49°00'48"	coarse sand	exposed
9.	Beach at north-west end of Florencia Bay	125°39'24"	49°00'00"	sand, gravel	semi-exposed
10.	North side of Cox Point	125°52'36"	49°05'48"	rock	exposed
11.	North end of gravel extension for Grice Bay Road	125°47'54"	49°06'57"	rock	sheltered
12a.	West side of Box Island	125°47'06"	49°03'36"	rock	exposed
12b.	East side of Box Island	125°47'06"	49°03'42"	rock	sheltered to semi-exposed
13.	West side of Green Point	125°43'15"	49°03'06"	rock	exposed
14a.	North side of Quisitis Point; adjacent to Wickaninnish Inn	125°40'36"	49°00'36"	rock	semi-exposed

Table 1 cont'd

Sample No.	Location	Longitude	Latitude	Habitat	
				Substrate	Exposure
14b.	South side of Quisitis Point from Florencia Bay	125°39'30"	48°59'48"	rock	exposed
15a.	Outcrop north of Half Moon Bay	125°36'42"	48°58'54"	rock	semi-exposed
15b.	West side of Wya Point	125°37'00"	48°58'36"	rock	exposed
16.	East side of culvert on Grice Bay Road	125°47'00"	49°06'26"	mud	sheltered

Table 2. Distribution and relative abundance of intertidal organisms from sand and mud samples, Long Beach Section (1975).

Sample numbers correspond to those from Table 1. Abundance is recorded as - few = f; common = c; very common = vc.

Table 2

Species	Sample Sites									
	1	2	3	4	5	6	7	8	9	16
PHYLUM Annelida Class Polychaeta										
Abarenicola pacifica (lugworm)	c	-	f	vc	c	f	f	f	-	-
Euzonus mucronata (bloodworm)	c	c	-	vc	vc	vc	f	vc	-	-
Nepthys californiensis	f	f	f	c	c	c	c	c	c	f
PHYLUM Arthropoda Class Malacostraca Order Mysidacea										
Archaeomysis grebnitzkii (opossum shrimp)	f	-	f	c	c	c	c	c	f	-
Order Amphipoda										
Orchestia traskiana (beach hopper)	vc	vc	vc	vc	vc	vc	vc	vc	vc	-
Orchestoidea californiana	vc	vc	vc	vc	vc	vc	vc	vc	vc	-
Order Isopoda										
Alloniscus perconvexus	c	c	c	c	c	c	c	c	c	-
Cirolana kincaidi	-	-	-	c	c	c	c	c	f	-
Order Decapoda Suborder Natantia										
Crangon munitella	-	-	c	c	c	c	f	f	-	-
Suborder Reptantia Section Macrura										
Callianassa californiensis (red ghost shrimp)	-	-	-	c	-	-	-	-	-	vc
Section Brachyura										
Hemigrapsus oregonensis	-	-	-	-	-	-	-	-	-	f

Table 2 cont'd

Species	Sample Sites 1	2	3	4	5	6	7	8	9	16
PHYLUM Mollusca Class Gastropoda Subclass Prosobranchia										
Olivella baetica	-	-	-	-	-	-	-	f	-	-
O. biplicata (purple olive snail)	c	c	vc	c	c	f	c	c	f	-
Class Bivalvia										
Clinocardium nuttalli (cockles)	-	-	-	-	-	-	-	-	f	-
Macoma nasuta	-	-	-	-	-	-	-	-	-	f
Mya arenaria	-	-	-	-	-	-	-	-	f	vc
Protothaca staminea (littleneck clam)	-	-	-	-	-	-	-	-	c	-
Siliqua patula (razor clam)	c	f	f	vc	vc	c	f	f	-	-
Tellina bodegensis	-	f	-	-	-	-	-	-	-	-
T. carpenteri	-	f	-	-	-	-	-	-	-	vc
PHYLUM Echinodermata Class Echinoidea										
Dendraster excentricus (sand dollar)	-	-	-	-	-	-	f	f	-	-

Table 3. Abundance of intertidal organisms observed in vertical transects at 25 m intervals, Long Beach Section (1975).

Table 3

Sample (m)	NORTH OF SHAWD ROCK														
	May					August					December				
	Isopods	Amphipods	Mysids	Polychaete worms	Blood worms	Isopods	Amphipods	Mysids	Polychaete worms	Blood worms	Isopods	Amphipods	Mysids	Polychaete worms	Blood worms
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	41	0	0	0	225	0	0	0	0	360
75	0	0	0	0	0	0	0	0	0	240	12	10	2	0	15
100	0	0	0	0	320	0	1	0	0	0	1	3	0	0	0
125	0	0	0	0	650	0	0	0	1	0	1	0	1	1	25
150	0	0	0	2	7	0	0	0	0	0	0	0	0	4	0
175	0	0	0	0	0	0	0	0	3	0	0	0	1	1	0
200	0	0	0	0	0	0	0	0	2	1	0	0	0	1	0
225	0	0	0	0	0	0	2	0	4	0	0	0	0	4	0
250	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
275	0	0	0	0	0	0	0	0	0	0*	-	-	-	-	-
Total per Transect	0	0	0	2	977	41	3	0	12	465	14	13	4	11	400

* one Olivella biplicata in August sample

Table 3 cont'd

Sample (m)	NORTH OF QUISITIS POINT														
	May					August					December				
	Isopods	Amphipods	Mysids	Polychaete worms	Blood worms	Isopods	Amphipods	Mysids	Polychaete worms	Blood worms	Isopods	Amphipods	Mysids	Polychaete worms	Blood worms
0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	1
25	13	0	0	3	90	0	5	0	0	0	4	1	0	0	120
50	1	0	0	0	9	4	8	0	0	24	0	3	0	0	20
75	0	0	0	2	0	2	0	0	3	0	0	3	1	1	0
100	1	6	0	2	0	0	1	0	2	0	0	0	0	0	0
125	0	0	0	2	0	0	3	0	4	0	0	3	0	1	0
150	0	0	0	2	0	1	0	0	2	0	0	1	0	1	0
175	-	-	-	-	-	0	1	0	1	0	0	1	0	0	0
200	-	-	-	-	-	-	-	-	-	-	0	0	0	2	0
Total per Transect	15	6	0	11	99	7	22	0	11	24	4	12	1	5	141

Table 4: Distribution and relative abundance of intertidal organisms from rocky shore samples, Long Beach Section (1975).

Sample numbers correspond to those from Table 1. Abundance is recorded as - few =f; common = c; very common = vc.

Table 4

Species	Sample Sites								
	10	11	12a	12b	13	14a	14b	15a	15b
PHYLUM Porifera (sponges)									
Haliclona permollis	c	-	c	-	c	c	c	-	c
Ophlitaspongia pennata	c	-	c	-	c	c	c	-	c
unidentified species	c	-	c	-	c	c	c	-	c
PHYLUM Cnidaria Class Anthozoa Order Actiniaria									
Anthopleura elegantissima	f	-	-	f	-	c	c	vc	f
A. xanthogrammica (green anemone)	vc	c	c	f	vc	c	c	c	c
Tealia lofotensis	f	-	-	f	-	-	-	-	-
PHYLUM Annelida Class Polychaeta									
Serpula vermicularis	c	-	c	-	-	c	c	-	c
Spirorbis sp.	c	-	c	-	-	c	c	-	c
Eudistyla vancouveri	-	-	-	f	-	-	f	-	-
PHYLUM Mollusca Class Amphineura									
Katharina tunicata	c	-	-	c	-	c	c	-	c
Mopalia sp.	f	-	-	c	c	f	f	f	f
Tonicella lineata	f	-	-	f	-	-	-	-	-
Class Gastropoda Subclass Opistobranchia									
Aeolidida papillosa	-	-	-	-	-	f	-	-	-
Archidoris montereyensis	-	-	-	-	-	f	-	-	-
Subclass Prosobranchia									
Ceratostoma foliata (leafy hornmouth)	f	-	-	-	-	f	f	f	f

Table 4 cont'd

Species	Sample sites								
	10	11	12a	12b	13	14a	14b	15a	15b
Subclass Prosobranchia cont'd									
Collisella digitalis (fingered limpet)	vc	vc	c	c	c	c	c	c	c
Diodora aspera (rough keyhole limpet)	f	-	-	-	-	-	f	f	-
Littorina scutulata (checkered periwinkle)	vc	vc	f	c	c	c	c	c	c
L. sitkana (sitka periwinkle)	c	c	c	c	c	c	c	c	c
Notoacmea persona	f	c	-	c	c	c	f	c	c
N. scutum	f	-	-	-	-	-	-	-	-
Tegula funebralis (black top shell)	-	-	-	-	-	c	c	-	c
Thais emarginata (short-spired purple)	vc	c	c	c	c	c	c	c	c
T. lamellosa (wrinkled purple)	-	vc	-	vc	f	c	f	-	-
Class Bivalvia									
Mytilus californianus (sea mussel)	vc	-	vc	c	vc	vc	vc	vc	vc
M. edulis (bay mussel)	c	c	-	f	c	c	c	c	c
PHYLUM Arthropoda Class Crustacea Subclass Cirripedia									
Balanus cariosus	c	-	c	c	c	c	c	c	c
B. glandula	vc	vc	vc	vc	vc	vc	vc	vc	vc
Chthamalus dalli	c	-	f	f	f	c	f	f	f
Pollicipes polymerus	vc	-	vc	-	vc	vc	vc	-	vc
Subclass Copepoda									
Tigriopus californicus	c	-	-	-	-	-	c	-	c

Table 4 cont'd

Species	Sample Sites								
	10	11	12a	12b	13	14a	14b	15a	15b
Subclass Malacostrata									
Cancer magister (Dungeness crab)	-	-	f	-	-	-	-	-	-
Hemigrapsus nudus (purple shore crab)	f	c	f	c	f	f	c	f	f
H. oregonensis	c	c	f	c	f	f	f	f	f
Pagurus sp.	c	c	f	c	c	c	c	f	f
Pugettia gracilis (kelp crab)	-	f	-	f	-	-	-	-	-
Order Isopoda									
Ligia pallasi	-	-	-	-	-	c	-	-	-
PHYLUM Bryozoa (Ectoprocta)									
Dendrobaenia lichenoides	-	-	-	c	-	-	-	-	-
Flustrellidra corniculata	-	-	-	c	-	-	-	-	-
PHYLUM Echinodermata Class Asteroidea									
Dermasterias imbricata (leather star)	-	-	-	c	-	f	-	-	-
Evasterias troschelii (mottled star)	-	-	-	f	-	f	-	-	-
Leptasterias hexactis (six-rayed starfish)	-	-	-	f	-	f	-	-	-
Pisaster ochraceus (purple star)	vc	c	vc	vc	vc	vc	vc	vc	vc
Pycnopodia helianthoides (sunflower star)	-	-	-	c	f	f	f	-	-
Solaster dawsoni (morning sun starfish)	-	-	-	-	f	-	f	-	-
S. stimpsoni (sun starfish)	-	-	-	-	-	-	f	-	-

Table 4 cont'd

Species	Sample Sites								
	10	11	12a	12b	13	14a	14b	15a	15b
Class Echinoidea									
Strongylocentrotus drobachiensis (green urchin)	-	-	-	f	-	-	-	-	-
S. purpuratus (purple urchin)	f	-	c	f	-	c	c	c	c
Class Holothuroidea									
Cucumaria miniata	-	c	-	f	-	f	-	-	-
PHYLUM Chordata Subphylum Urochordata Class Ascidiacea									
Clavelina huntsmani	-	-	-	f	-	f	f	-	-
Styela montereyensis	-	-	f	-	-	f	f	-	-
PHYLUM (DIVISION) Spermatophyta									
Phyllospadix scouleri (surf grass)	c	-	c	c	-	c	c	c	c
Zostera marina (eel grass)	-	vc	-	-	-	-	-	-	-
PHYLUM (DIVISION) Chorophyta (green algae)									
Codium fragile	-	-	-	-	-	c	f	-	-
Enteromorpha intestinalis	f	f	c	c	c	f	c	c	c
Prasiola meridionalis	-	-	-	-	-	c	c	-	c
Spongomorpha sp.	f	-	c	-	-	-	c	-	c
Ulva sp.	f	c	-	c	-	f	f	f	f

Table 4 cont'd

Species	Sample Sites								
	10	11	12a	12b	13	14a	14b	15a	15b
PHYLUM (DIVISION) Phaeophyta (brown algae)									
Alaria marginata	-	-	c	-	-	-	c	-	c
Egregia menziesii	c	-	vc	c	-	c	c	-	c
Fucus distichus	vc	vc	c	vc	vc	c	c	c	c
Hedophyllum sessile	-	-	-	-	-	c	c	-	c
Laminaria groenlandica	-	-	c	-	-	c	c	c	c
L. setchellii	-	-	vc	-	-	c	c	c	c
Leathesia difformis	-	-	-	c	-	c	c	c	c
Macrocystis integrifolia	-	-	-	f	-	c	c	c	c
Nereocystis luetkeana	c	-	c	-	-	-	c	-	c
Pelvetiopsis limitata	-	-	c	-	-	c	c	-	c
Postelsia palmaeformis	c	-	vc	-	-	-	c	-	vc
Sargassum muticum	c	-	c	c	-	c	c	c	c
PHYLUM (DIVISION) Rhodophyta (red algae)									
Bossiella sp.	c	-	vc	-	-	c	vc	-	vc
Corallina sp.	c	-	vc	-	-	c	vc	-	vc
Calliarthron sp.	c	-	vc	-	-	c	vc	-	vc
Gigartina exasperata	-	-	c	-	-	-	c	-	c
Halosaccion glandiforme	c	vc	c	vc	-	c	c	c	c
Iridea sp.	-	-	c	f	-	c	c	-	c
Odonthalia floccosa	c	-	-	-	-	c	c	-	c
Opuntiella californica	-	-	f	-	-	-	-	-	-
Rhodomela larix	c	-	-	-	-	c	c	c	c
Smithora naiadum	c	-	c	c	-	c	c	c	c

Table 5. Location and habitat description of intertidal faunal survey sites, Broken Group Islands Section (1975).

Table 5

Sample	Location	Longitude	Latitude	Habitat	
				Substrate	Exposure
1.	West end of Walsh Island	125°19'22"	48°55'06"	sand, shell, gravel	sheltered
2.	Between small island & south side of Walsh Island	125°19'11"	48°55'00"	sand, shell, gravel	sheltered
3.	Southeast point of Dodd Island	125°19'46"	48°55'03"	shell, gravel	sheltered
4.	North end of Willis Island	125°20'32"	48°55'06"	sand, shell, gravel	semi-exposed
5.	Inlet on southwest side of Dodd Island	125°20'17"	48°55'14"	shell	sheltered
6.	Gravel bar at north end of Willis Island	125°20'34"	48°55'07"	sand, shell, gravel	semi-exposed
7.	Gravel bar at north end of Willis Island	125°20'36"	48°55'09"	sand, shell, gravel	semi-exposed
8.	Gravel bar at north end of Willis Island	125°20'42"	48°55'06"	sand, shell, gravel	semi-exposed
9.	Adjacent to small rock outcrop on north side of Gibralter Island	125°15'16"	48°55'06"	fine gravel to boulder	sheltered
10.	Bay between Jarvis & Jacques Islands	125°16'30"	48°55'14"	mud	sheltered
11.	North side of southwest arm of Jarvis Island	125°17'23"	48°55'24"	sand, gravel	semi-exposed
12.	Pocket beach east side of Turret Island	125°19'48"	48°53'18"	sand, gravel	sheltered
13.	North side of small reef on east side of Turret Island	125°19'46"	48°53'53"	sand, shell	semi-exposed
14.	South side of small reef on east side of Turret Island	125°19'42"	48°53'51"	sand, shell	semi-exposed

Table 5 cont'd

Sample	Location	Longitude	Latitude	Habitat	
				Substrate	Exposure
15.	North side of the west end of Turret Island	125°20'54"	48°54'23"	sand	semi-exposed
16.	North side of the west end of Turret Island	125°20'57"	48°54'25"	gravel, rock	semi-exposed
17.	East side of bar between Trickett & Turret Islands	125°20'59"	48°54'27"	gravel	semi-exposed
18.	West side of bar between Trickett & Turret Islands	125°21'02"	48°54'28"	gravel	semi-exposed
19.	West side of bar between Trickett & Turret Islands	125°21'00"	48°54'29"	gravel	semi-exposed
20.	Pocket beach on east side of Prideaux Island	125°16'01"	48°56'15"	shell, gravel	sheltered
21.	Pocket beach on west end of Nettle Island	125°15'35"	48°56'13"	gravel	sheltered
22.	Northwest side of rock outcrop on northeast side of Nettle Island	125°15'00"	48°56'11"	sand, gravel	semi-exposed
23.	Northwest side of rock outcrop on northeast side of Nettle Island	125°14'50"	48°56'07"	sand, gravel	semi-exposed
24.	Northwest side of rock outcrop on northeast side of Nettle Island	125°14'36"	48°55'58"	sand, gravel	semi-exposed
25.	East side of Hand Island	125°18'36"	48°57'01"	sand, gravel	semi-exposed
26.	East side of small island adjacent to Hand Island	125°18'32"	48°57'03"	sand, gravel	semi-exposed

Table 5 cont'd

Sample	Location	Longitude	Latidude	Habitat	
				Substrate	Exposure
27.	Bay on north side of Hand Island	125°18'40"	48°57'04"	sand, gravel, mud	sheltered
28.	Adjacent to rock outcrop on north side of Hand Island	125°19'01"	48°57'10"	shell	semi-exposed
29.	Northwest side of Mence Island	125°18'35"	48°56'25"	sand, gravel	sheltered
30.	North side of bar at east end of Mence Island	125°18'20"	48°56'24"	shell, gravel	sheltered
31.	Southwest side of bar at east end of Mence Island	125°18'20"	48°56'22"	sand, shell, gravel	sheltered
32.	Pocket beach on east side of largest island in Brabant Islands group	125°18'30"	48°56'11"	sand, gravel	sheltered
33.	North side of Benson Island between rocky outcrops	125°22'46"	48°53'08"	sand, gravel	semi-exposed
34a.	North end of beach on east side of Benson Island	125°22'40"	48°53'01"	gravel	semi-exposed
34b.	South end of beach on east side of Benson Island	125°22'38"	48°52'58"	gravel	semi-exposed
35a.	North side of bar at northwest end of Clarke Island	125°22'35"	48°53'35"	sand, shell, gravel	sheltered
35b.	South side of bar at northwest end of Clarke Island	125°22'38"	48°53'32"	sand, shell, gravel	sheltered
36.	Beach on west side of Clarke Island	125°22'42"	48°53'28"	sand, shell, gravel	sheltered

Table 5 cont'd

Sample	Location	Longitude	Latitude	Habitat	
				Substrate	Exposure
37.	South side of bar between Chalk Island and small unnamed island (west side of Chalk Island)	125°18'58"	48°55'13"	sand, shell, gravel	sheltered
38.	North side of bar between Chalk Island and small unnamed island (west side of Chalk Island)	125°19'00"	48°55'15"	sand, shell gravel	sheltered
39.	North end of Chalk Island	125°18'57"	48°55'22"	shell, gravel	semi-exposed
40.	Beach on north side of rock outcrop on west side of Chalk Island	125°18'55"	48°55'11"	gravel	sheltered
41.	West side of bar at north end of Chalk Island	125°18'48"	48°55'05"	shell, gravel	sheltered
42.	East side of bar at north end of Chalk Island	125°18'50"	48°55'05"	sand, shell	sheltered
43.	Largest beach on east side of Effingham Bay	125°18'05"	48°52'28"	sand, shell, gravel	sheltered
44.	Small beach on south side of Effingham Bay	125°18'28"	48°52'29"	sand, mud	sheltered
45.	Small pocket beach north of Sample 43	125°18'12"	48°52'36"	sand, gravel	sheltered
46.	Beach on northwest side of Effingham Bay	125°18'43"	48°52'28"	boulder	sheltered
46a.	Bar between small island & Effingham Island (south side of Effingham Bay)	125°18'37"	48°52'30"	sand	sheltered

Table 5 cont'd

Sample	Location	Longitude	Latitude	Habitat	
				Substrate	Exposure
47.	East end of Gilbert Island	125°19'10"	48°52'33"	sand, gravel	sheltered
48.	Pocket beach on south side of Gilbert Island	125°19'16"	48°52'26"	mud, sand, gravel	sheltered
49.	Northeast end of Cooper Island	125°20'08"	48°52'33"	sand, shell, gravel	sheltered
50.	North side of Cooper Island	125°20'25"	48°52'39"	sand, shell, gravel	sheltered
51.	West side of Cooper Island	125°20'48"	48°52'35"	sand, gravel	sheltered
52.	East side of bar between north side of Camblain Island and small island	125°20'55"	48°52'41"	shell, gravel	sheltered
53.	Northeast side of Dicebox Island	125°19'55"	48°51'41"	gravel	semi-exposed
54.	Southwest side of Dicebox Island	125°19'58"	48°51'40"	boulder	semi-exposed
55.	South side of Wouwer Island	125°21'17"	48°51'43"	mud	sheltered
56.	South side of Wouwer Island	125°21'13"	48°51'44"	mud	sheltered
57.	East side of most eastern rock outcrop on north side Wouwer Island	125°21'09"	48°51'53"	sand, gravel	sheltered
58.	West side of most eastern rock outcrop on north side of Wouwer Island	125°21'13"	48°51'53"	sand, gravel	sheltered
59.	Eastern pocket beach on north side of Wouwer Island	125°21'30"	48°51'51"	sand, gravel	semi-exposed
60.	Middle pocket beach on north side of Wouwer Island	125°21'32"	48°51'48"	sand, shell, gravel	semi-exposed

Table 5 cont'd

Sample	Location	Longitude	Latitude	Habitat	
				Substrate	Exposure
61.	Western pocket beach on north side of Wouwer Island	125°21'37"	48°51'49"	sand, shell	semi-exposed

Table 6. Distribution and relative abundance of intertidal fauna from sand, shell and gravel beaches in Broken Group Islands (1975).
Sample numbers correspond to those given in Table 5.
Abundance is recorded as - few = f; common = c; very common = vc.

Table 6

Island	Sample No.	Euzonus mucronata	Upogebia pugettensis	Polinices lewisi	Clinocardium nuttalli	Crassostrea gigas	Mya arenaria	Protothaca staminea	Saxidomus giganteus	Venerupis japonica	Tresus sp.
Walsh	1	-	vc	-	-	-	vc	-	-	-	-
	2	-	vc	-	-	-	-	-	-	-	-
Dodd	3	-	vc	-	-	-	-	f	-	f	-
	5	-	-	-	-	-	-	-	-	-	-
Willis	4	-	-	-	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-	-	-	-
	7	-	-	-	-	-	-	-	-	-	-
	8	-	-	-	-	-	-	-	-	-	-
Gibraltar	9	-	-	-	-	f	-	f	-	-	-
Jacques/Jarvis	10	-	-	-	-	-	-	-	-	-	-
Jarvis	11	f	c	-	-	-	f	vc	-	f	-
Turret	12	-	c	f	-	-	-	c	c	-	c
	13	-	-	-	-	-	-	-	-	-	-
	14	-	-	-	-	-	-	-	-	-	-
	15	-	-	-	-	-	-	-	-	-	-
	16	-	-	f	-	-	f	vc	c	-	c
	17	-	-	-	-	-	c	vc	-	vc	-
	18	-	-	-	-	-	c	vc	-	vc	-
	19	-	-	-	-	-	c	vc	-	vc	-
Prideaux	20	-	c	-	c	-	vc	vc	vc	vc	-
Nettle	21	-	c	f	c	-	vc	vc	vc	vc	-
	22	-	-	f	-	-	-	-	-	-	-
	23	-	-	-	-	-	-	-	-	-	-
	24	-	-	-	-	-	-	-	-	-	-
Hand	25	-	-	-	f	-	f	vc	vc	c	-
	26	-	-	-	-	-	f	vc	-	vc	-
	27	-	-	-	-	-	c	c	vc	c	c
	28	-	-	-	-	f	-	c	-	-	-

Table 6 cont'd

Island	Sample No.	Euzonus mucronata	Upogebia pugettensis	Polinices lewisi	Clinocardium nuttalli	Crassostrea gigas	Mya arenaria	Protothaca staminea	Saxidomus giganteus	Venerupis japonica	Tresus sp.
Mence	29	-	c	-	-	f	-	vc	-	-	-
	30	-	-	f	-	-	-	-	-	-	-
	31	-	-	f	-	-	-	vc	-	c	-
Brabant	32	-	-	f	-	-	-	-	-	-	-
Benson	33	-	-	-	-	-	-	-	-	-	-
	34a	-	-	-	-	-	-	-	-	-	-
	34b	-	-	-	-	-	-	-	-	-	-
Clarke	35a	-	-	c	-	-	f	vc	vc	-	c
	35b	-	-	c	-	-	-	c	c	c	c
	36	-	-	c	f	-	f	vc	c	c	c
Chalk	37	-	vc	-	-	f	-	vc	-	-	-
	38	-	vc	-	-	f	-	-	-	-	-
	39	-	-	-	-	-	-	-	-	-	-
	40	-	vc	-	-	f	-	c	-	-	-
	41	-	vc	-	-	-	-	c	-	-	-
	42	-	vc	-	-	-	-	-	-	-	-
Effingham	43	-	-	-	-	-	-	-	-	-	-
	44	c	vc	-	f	f	-	vc	c	-	vc
	45	-	c	f	-	-	-	vc	c	-	-
	46	-	-	-	-	-	-	-	-	-	-
	46a	-	-	-	-	-	-	-	-	-	vc
Gilbert	47	-	-	-	-	-	-	vc	-	c	-
	48	-	c	-	-	-	-	-	-	-	-
Cooper	49	-	-	-	-	-	-	c	c	-	f
	50	-	-	f	-	-	-	vc	-	-	c
	51	-	-	-	-	-	-	c	c	-	c

Table 6 cont'd

Island	Sample No.	Euzonus mucronata	Upogebia pugettensis	Polinices lewisi	Clinocardium nuttalli	Crassostrea gigas	Mya arenaria	Protothaca staminea	Saxidomus giganteus	Venerupis japonica	Tresus sp.
Camblain	52	-	-	f	-	-	-	c	c	-	vc
Dicebox	53	-	-	-	-	-	-	-	-	-	-
	54	-	-	-	-	-	-	-	-	-	-
Wouwer	55	c	vc	-	-	-	-	c	-	-	-
	56	c	vc	-	-	-	-	c	-	-	-
	57	-	-	-	-	-	-	c	vc	-	vc
	58	-	f	-	-	-	-	vc	vc	-	vc
	59	-	-	-	-	-	-	-	-	-	-
	60	-	-	-	-	-	-	-	-	-	-
	61	-	-	-	-	-	-	-	-	-	-

Table 7. Distribution and relative abundance of intertidal organisms from rocky shores, Broken Group Islands (1975). Sample numbers correspond to those from Table 5. Abundance is recorded as - few = f; common = c; very common = vc.

Table 7

Species	Sample Sites																						
	1	2	3	9	12	13	14	15	16	20	21	22	26	32	38	40	43	45	46	47	48	49	50	53
PHYLUM Porifera (Sponges)																								
Cliona celata	-	-	-	-	-	f	f	-	-	-	-	-	f	-	-	-	-	-	-	f	-	-	-	-
Haliclona permollis	-	-	-	c	-	c	c	c	c	-	-	c	c	-	-	-	-	-	-	c	c	c	c	c
Ophlitaspongia pennata	-	-	-	-	-	c	c	-	-	-	-	-	c	-	-	-	-	-	-	f	f	-	-	c
PHYLUM Cnidaria Class Anthozoa Order Actiniaria																								
Anthopleura elegantissima	f	f	c	-	c	c	c	c	c	-	f	f	f	f	-	-	-	-	-	f	-	c	c	-
A. xanthogrammica (green anemone)	-	-	-	-	-	f	f	-	-	-	-	f	f	f	-	-	c	-	-	vc	f	c	c	c
Metridium senile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	f	-	-	-	f
Tealia lofotensis	-	-	-	-	-	-	-	-	-	-	-	f	-	-	-	-	c	-	-	f	f	-	-	f
Order Scleractinia																								
Ballanophyllia elegans	-	-	-	f	-	c	c	f	f	-	-	-	f	-	-	-	-	-	-	vc	-	-	-	c

Table 7 cont'd

Species	Sample Sites																							
	1	2	3	9	12	13	14	15	16	20	21	22	26	32	38	40	43	45	46	47	48	49	50	53
PHYLUM Annelida Class Polychaeta																								
Serpula vermicularis	-	-	-	-	c	-	c	c	c	-	-	c	c	-	-	-	c	-	-	c	c	-	-	c
Spirorbis sp.	-	-	-	-	c	-	f	-	f	-	-	c	c	-	-	-	-	-	-	c	-	-	-	c
PHYLUM Mollusca Class Amphineura																								
Katharina tunicata	-	-	-	-	f	-	f	-	-	-	-	c	c	-	f	f	c	-	-	c	f	-	-	c
Mopalia sp.	f	f	f	f	f	f	f	f	f	-	-	f	f	f	-	f	-	f	f	f	f	f	f	f
Placiphorella velata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	c	-	-	-	-
Tonicella lineata	-	-	-	-	-	-	f	-	-	-	-	f	-	-	-	-	-	-	-	c	-	-	f	-
Class Gastropoda Subclass Opisthobranchia																								
Aeolidida papillosa	-	-	-	-	-	-	-	f	f	-	-	-	f	-	f	-	-	-	-	f	f	-	-	f
Archidons montereyensis	-	-	-	-	-	-	-	-	f	-	-	-	f	-	-	-	-	-	-	f	f	-	-	-
Subclass Prosobranchia																								
Astraea gibberosa (red turban)	f	f	c	-	-	-	-	-	-	-	-	-	-	-	-	vc	-	c	-	vc	-	-	-	-
Bittium eschrichtii (threaded bittium)	-	-	-	-	-	-	-	-	-	-	-	-	f	-	-	-	-	-	-	f	-	-	-	-

Table 7 cont'd

Species	Sample Sites																							
	1	2	3	9	12	13	14	15	16	20	21	22	26	32	38	40	43	45	46	47	48	49	50	53
Subclass Prosobranchia cont'd																								
Ceratostoma foliata (leafy hornmouth)	-	-	f	-	-	-	-	-	f	-	f	f	f	-	f	f	-	-	-	f	-	-	-	-
Collisella digitalis (fingered limpet)	vc	vc	vc	vc	vc	vc	vc	vc	vc	vc	vc	vc	vc	vc	vc	c	vc	c	c	vc	c	c	c	c
Crepidula sp.	-	-	-	-	-	f	f	-	-	-	-	-	-	-	-	-	-	-	-	c	-	-	-	-
Diodora aspera (rough keyhole limpet)	-	f	-	-	-	-	-	-	-	-	f	-	f	-	-	-	-	-	f	f	f	f	f	f
Littorina scutulata (checkered periwinkle)	vc	c	c	vc	c	vc	vc	vc	vc	vc	vc	c	vc	c	vc	c	c	c	c	c	c	c	c	vc
L. sitkana (sitka periwinkle)	vc	c	vc	vc	vc	c	vc	vc	vc	c	vc	c	vc	c	c	c	vc	c	c	vc	c	c	c	vc
Notoacmea persona	f	f	f	f	-	f	f	-	-	f	f	-	f	-	f	-	f	f	-	f	f	-	-	-
N. scutum	-	-	-	-	-	f	f	f	f	-	-	-	f	-	-	-	-	-	-	c	-	f	f	f
Searlesia dira (dire whelk)	-	-	-	-	f	f	f	-	-	-	-	-	-	-	-	-	c	-	c	vc	-	-	-	vc
Tegula funebralis (black top shell)	c	c	c	-	c	vc	vc	c	c	-	-	-	-	-	c	c	c	c	-	vc	-	-	-	c
Thais emarginata (short-spired purple)	c	f	c	c	c	c	c	c	c	f	f	c	c	c	c	c	c	f	f	c	f	c	f	c
T. lamellosa (wrinkled purple)	f	f	f	-	-	c	c	-	-	f	f	f	f	f	f	f	f	-	-	c	c	f	f	f

Table 7 cont'd

Species	Sample Sites																							
	1	2	3	9	12	13	14	15	16	20	21	22	26	32	38	40	43	45	46	47	48	49	50	53
Class Bivalvia																								
Crassostrea gigas (Pacific oyster)	f	f	f	f	c	-	f	-	-	-	f	-	c	f	f	f	-	-	-	f	-	-	-	-
Mytilus californianus (sea mussel)	f	f	f	-	-	-	-	f	f	-	f	f	c	f	f	-	f	f	-	f	f	f	f	f
M. edulis (bay mussel)	c	c	c	c	vc	c	c	c	c	c	c	c	c	c	c	f	f	c	f	-	c	c	c	c
Pododesmus macroschisma (jingle shell)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	f	-	f	-	-	-	-
PHYLUM Arthropoda Class Crustacea Subclass Cirripedia																								
Balanus cariosus	-	-	-	-	c	f	f	c	c	-	f	c	c	f	f	-	c	-	-	c	c	c	c	c
B. glandula	vc	vc	vc	vc	vc	vc	vc	vc	vc	vc	vc	vc	vc	vc	vc	c	vc	vc	c	vc	vc	vc	vc	vc
Subclass Malacostraca																								
Cancer magister (Dungeness crab)	-	-	-	-	-	-	-	-	-	-	-	-	f	-	-	-	-	-	-	f	-	-	-	-
Hemigrapsus nudus (purple shore crab)	c	c	c	-	f	-	-	c	c	-	c	-	c	f	f	c	c	c	vc	c	c	f	f	f
H. oregonensis	c	c	f	-	f	f	f	f	f	-	f	-	c	f	-	-	c	c	vc	f	c	f	f	f
Lophopanopeus bellus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	f	-	-	-	-

Table 7 cont'd

Species	Sample Sites																						
	1	2	3	9	12	13	14	15	16	20	21	22	26	32	38	40	43	45	46	47	48	49	50	53
Subclass Malacostraca cont'd																								
Pagurus sp.	c	c	c	c	c	f	f	c	c	f	f	f	c	f	c	f	c	c	c	c	c	c	c	c
Petrolisthes cinctipes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	c	-	vc	c	-	-	-	-
P. eriomerus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	c	-	vc	c	-	-	-	-
Pugettia gracilis (kelp crab)	-	-	-	-	-	-	-	f	f	f	f	-	c	-	f	-	-	f	f	f	f	f	c	f
PHYLUM Bryozoa																								
Dendrobaenia lichenoides	-	-	-	-	-	-	-	c	c	-	-	-	c	-	-	-	-	-	-	c	-	c	c	c
unidentified species	-	-	-	-	-	c	c	c	c	-	-	-	-	-	-	-	-	-	f	c	f	f	-	-
PHYLUM Echinodermata Class Asteroidea																								
Dermasterias imbricata (leather starfish)	f	f	c	-	-	c	c	-	-	-	f	f	f	-	f	f	f	-	-	c	f	f	f	vc
Evasterias troschelii (mottled starfish)	-	-	-	-	f	-	-	-	-	-	-	-	f	-	f	f	-	-	-	f	-	f	-	-
Leptasterias hexactis (six-rayed starfish)	-	-	-	-	-	-	-	-	-	-	-	-	f	-	f	f	-	-	-	f	-	-	-	-

Table 7 cont'd

Species	Sample Sites																							
	1	2	3	9	12	13	14	15	16	20	21	22	26	32	38	40	43	45	46	47	48	49	50	53
Class Asteroidea cont'd																								
Patiria miniata (bat starfish)	-	-	-	-	c	f	f	c	c	vc	f	f	f	c	c	vc	c	-	-	vc	-	-	c	-
Pisaster brevispinus (pink short-spined starfish)	-	-	-	-	f	-	-	-	-	f	f	f	f	f	-	-	f	f	-	f	-	-	-	-
P. ochraceus (purple starfish)	c	c	c	f	f	c	c	c	c	c	c	c	c	c	c	f	f	c	f	f	c	c	f	c
Pycnopodia helianthoides (sunflower starfish)	-	-	-	-	-	-	-	f	f	f	-	-	f	-	f	f	-	-	-	c	-	-	-	-
Solaster dawsoni (morning sun starfish)	-	-	-	-	-	-	-	-	-	-	-	f	-	-	-	-	-	-	-	f	-	-	-	-
S. stimpsoni (sun starfish)	-	-	-	-	-	-	-	-	-	-	-	f	-	-	-	-	-	-	-	f	-	-	-	-
Class Echinoidea																								
Strongylocentrotus drobachiensis (green urchin)	-	-	-	-	-	f	f	f	f	-	-	-	c	-	-	-	-	-	-	-	f	-	-	c
S. franciscanus (red urchin)	-	-	-	-	-	-	-	c	c	-	-	c	c	-	-	-	-	-	-	-	-	-	-	c
Class Holothuroidea																								
Cucumaria miniata	-	-	f	-	-	f	f	f	f	-	-	f	c	f	f	-	-	c	f	c	f	f	f	c

Table 7 cont'd

Species	Sample Sites																							
	1	2	3	9	12	13	14	15	16	20	21	22	26	32	38	40	43	45	46	47	48	49	50	53
Class Holothuroidea cont'd																								
Parastichopus californicus (giant cucumber)	-	-	-	-	f	-	-	-	-	-	-	-	f	-	f	f	-	-	-	f	-	-	-	-
PHYLUM Chordata Subphylum Urochordata Class Ascidiacea																								
Clavelina huntsmani	-	-	-	-	-	f	f	-	-	-	-	-	c	-	-	-	-	-	-	f	-	-	-	-
Styela gibbsi	-	-	-	-	-	-	-	-	-	-	-	-	c	-	-	-	-	-	-	c	-	-	-	-
S. montereyensis	-	-	-	-	-	-	-	-	-	-	-	-	c	-	-	-	-	-	-	c	-	-	f	-
PHYLUM (DIVISION) Spermatophyta																								
Phyllospadix scouleri (surf grass)	-	-	-	-	-	c	c	-	-	-	-	-	-	-	-	-	-	-	-	-	c	vc	-	-
Zostera marina (eel grass)	-	-	-	-	-	-	-	-	-	vc	vc	-	vc	-	-	-	c	c	-	-	-	-	c	-
PHYLUM (DIVISION) Chlorophyta (green algae)																								
Codium fragile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	f	-	-	-	-	c	-	c	-	c
Enteromorpha intestinalis	f	f	c	f	-	f	f	f	-	f	-	-	f	f	-	-	c	f	f	f	f	f	f	-

Table 7 cont'd

Species	Sample Sites																							
	1	2	3	9	12	13	14	15	16	20	21	22	26	32	38	40	43	45	46	47	48	49	50	53
PHYLUM (DIVISION) Chlorophyta (green algae) cont'd																								
Spongomorpha sp.	-	-	-	-	-	-	-	-	-	-	-	-	f	-	-	-	-	-	-	-	f	-	-	c
Ulva sp.	-	-	c	c	c	c	c	c	c	c	c	c	c	c	c	-	c	c	c	c	-	c	c	c
PHYLUM (DIVISION) Phaeophyta (brown algae)																								
Alaria marginata	-	-	-	c	-	c	c	c	c	-	-	c	c	-	-	-	-	-	-	-	c	c	c	c
Cymathere triplicata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	f
Egregia menziesii	-	-	-	c	-	vc	vc	c	c	-	-	c	c	-	-	-	-	-	-	c	c	c	-	c
Fucus distichus	c	c	c	vc	vc	vc	vc	vc	vc	vc	vc	vc	c	c	vc	c	c	c	vc	vc	c	vc	vc	vc
Hedophyllum sessile	-	-	-	c	-	c	c	c	c	-	-	c	-	-	-	-	-	-	-	-	-	-	-	c
Laminaria groenlandica	-	-	-	c	-	c	c	c	c	-	-	c	c	-	-	-	-	-	c	vc	c	c	c	c
L. setchellii	-	-	-	f	-	c	c	f	f	-	-	f	c	-	-	-	-	c	c	-	c	c	c	f
Leathesia difformis	f	f	f	c	-	f	c	c	c	c	c	c	-	c	-	-	c	c	c	c	-	c	c	c
Macrocystis integrifolia	c	c	c	c	-	vc	vc	-	-	-	-	vc	f	c	vc	vc	-	-	c	vc	vc	c	vc	vc
Nereocystis luetkeana	-	-	-	f	vc	c	f	-	-	-	-	-	f	-	-	-	-	-	-	-	-	-	-	vc
Sargassum muticum	f	f	f	c	-	c	c	c	c	-	-	c	c	-	-	-	f	c	f	f	c	c	-	-

Table 7 cont'd

Species	Sample Sites																							
	1	2	3	9	12	13	14	15	16	20	21	22	26	32	38	40	43	45	46	47	48	49	50	53
PHYLUM (DIVISION) Rhodophyta (red algae)																								
Gigartina sp.	-	-	-	c	f	c	c	c	c	-	-	c	c	-	-	-	f	-	f	c	c	c	c	c
Halosaccion glandiforme	-	-	-	c	c	f	f	c	c	c	c	f	-	c	-	-	c	c	-	c	-	-	-	c
Iridea sp.	-	-	-	f	f	f	f	f	f	-	-	f	c	-	-	-	-	-	-	-	c	f	c	f
Odonthalia floccosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	f
Porphyra perforata	-	-	-	c	c	c	c	-	-	-	-	c	-	-	-	-	-	-	-	c	c	-	c	-
Rhodomela larix	-	-	-	f	c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	c	-

Table 8. Location and habitat description of intertidal faunal survey sites, West Coast Trail Section (1975).

Table 8

Sample No.	Location	Longitude	Latitude	Habitat	
				Substrate	Exposure
1.	Beach area adjacent to natural breakwater 2 miles northwest of Carmanah Point	124°46'14"	48°37'52"	sand	exposed
2.	1 mile northwest of Carmanah Point	124°45'48"	48°37'06"	sandstone bench	exposed
3.	Northwest side of Carmanah Point	124°45'12"	48°36'46"	sandstone bench	exposed
4.	Northeast side of Carmanah Point	124°44'58"	48°36'46"	sandstone bench	exposed
5.	Northeast side of Carmanah Point	124°44'38"	48°36'50"	boulders	semi-exposed
6.	½ mile southeast of Carmanah Point	124°44'10"	48°36'30"	gravel	exposed
7.	Northwest side of Bonilla Point	124°43'00"	48°35'42"	sandstone bench	exposed
8.	Northeast side of Bonilla Point	124°42'24"	48°35'36"	sandstone bench	exposed
9.	West side of Kulaht Creek	124°41'38"	48°35'28"	sandstone bench	exposed
10.	1 mile southeast of Kulaht Creek	124°41'04"	48°35'18"	gravel	exposed
11.	2 miles southeast of Kulaht Creek	124°40'20"	48°34'58"	sandstone bench	exposed
12.	West side of Walbran Creek	124°39'30"	48°34'48"	sandstone bench	exposed

Table 9. Distribution and relative abundance of intertidal organisms from rocky shore samples, West Coast Trail Section (1975)

Sample numbers correspond to those from Table 8. Abundance is recorded as - few = f; common = c; very common = vc.

Table 9

Species	Sample Sites								
	2	3	4	5	7	8	9	11	12
PHYLUM Porifera (sponges)									
Haliclona permollis	-	c	c	-	c	c	-	c	-
Ophlitaspongia pennata	-	c	c	-	c	c	-	c	-
PHYLUM Cnidaria Class Anthozoa Order Actinaria									
Anthopleura elegantissima	c	c	c	c	c	c	c	c	c
A. xanthogrammica (green anemone)	c	c	c	-	c	c	c	c	c
PHYLUM Mollusca Class Amphineura									
Katharina tunicata	f	f	f	-	f	f	f	f	f
Mopalia sp.	c	c	c	c	c	c	c	c	c
Class Gastropoda Subclass Prosobranchia									
Acmaea mitra	c	c	c	-	-	-	-	-	-
Astraea gibberosa (red turban)	f	f	-	-	-	-	-	-	-
Ceratostoma foliata (leafy hornmouth)	f	f	-	-	-	f	-	-	-
Collisella digitalis (fingered limpet)	vc	vc	vc	vc	vc	vc	vc	vc	vc
C. pelta	c	c	c	c	c	c	c	c	c
Diodora aspera (rough keyhole limpet)	f	f	-	f	-	f	f	f	-
Littorina scutulata (checkered periwinkle)	c	c	c	vc	c	c	c	c	c
L. sitkana (sitka periwinkle)	vc	vc	vc	c	vc	vc	vc	vc	vc
Notoacmea fenestrata	-	-	-	c	-	-	-	-	-
N. persona	f	c	f	c	c	c	f	f	f
N. scutum	f	f	f	f	f	f	f	f	f

Table 9 cont'd

Species	Sample Sites 2	3	4	5	7	8	9	11	12
Subclass Prosobranchia cont'd									
Searlesia dira (dire whelk)	c	f	-	-	-	-	-	-	-
Thais lamellosa (wrinkled purple)	-	-	-	f	-	-	-	-	-
T. emarginata (short-spired purple)	c	c	c	c	c	c	c	c	c
Class Bivalvia									
Mytilus californianus (sea mussel)	vc	vc	vc	c	vc	vc	vc	vc	vc
PHYLUM Arthropoda Class Crustacea Subclass Cirripedia									
Balanus cariosus	vc	vc	vc	vc	vc	vc	vc	vc	vc
B. glandula	f	f	f	-	f	-	f	f	f
Pollicipes polymerus	vc	vc	vc	-	vc	vc	vc	vc	vc
Subclass Malacostraca									
Hemigrapsus nudus (purple shore crab)	-	-	f	c	-	f	f	-	-
H. oregonensis	-	-	-	c	-	-	-	-	-
Pagurus sp.	-	-	-	f	-	-	-	-	-
PHYLUM Echinodermata Class Asteroidea									
Pisaster ochraceus (purple star)	c	c	vc	f	c	vc	c	c	c
Class Echinoidea									
Strongylocentrotus purpuratus (purple urchin)	vc	vc	vc	-	vc	c	vc	vc	vc
S. drobachiensis (green urchin)	-	-	f	-	f	-	-	f	-

Table 9 cont'd

Species	Sample Sites								
	2	3	4	5	7	8	9	11	12
PHYLUM (DIVISION) Spermatophyta									
Phyllospadix scouleri (surf grass)	c	c	vc	-	c	c	vc	c	c
PHYLUM (DIVISION) Chlorophyta (green algae)									
Enteromorpha intestinalis	-	c	-	c	-	c	c	c	c
Ulva sp.	c	c	c	c	c	c	c	c	c
PHYLUM (DIVISION) Phaeophyta (brown algae)									
Alaria marginata	c	c	c	-	c	c	c	c	c
Costaria costata	c	c	f	-	c	c	f	c	c
Egregia menziesii	c	c	c	-	c	c	c	c	c
Fucus distichus	c	c	c	c	c	c	c	c	c
Lamaria groenlandica	c	c	c	-	c	c	c	c	c
L. setchellii	c	c	c	-	c	c	c	c	c
Leathesia difformis	c	c	c	-	c	c	c	c	c
Nereocystis luetkeana	c	c	c	-	c	c	c	c	c
Postelsia palmaeformis	c	c	c	-	c	c	c	c	c
Sargassum muticum	c	c	c	-	c	c	c	c	c
PHYLUM (DIVISION) Rhodophyta (red algae)									
Bossiella sp.	c	c	c	-	c	c	c	c	c
Corallina sp.	c	c	c	-	c	c	c	c	c
Caliarthron sp.	c	c	c	-	c	c	c	c	c
Gigartina sp.	c	c	c	-	c	c	c	c	c
Halosaccion glandiforme	c	c	c	-	c	c	c	c	c
Rhodomela larix	c	c	c	-	c	c	c	c	c

Table 10. Location and substrate description of sample areas for intertidal distribution of adult razor clam population, Long Beach Section (1975).

Area	Sample No.	Location	Substrate
Schooner Cove (Area 1)	1	Northwest side of second small island in Schooner Cove	fine sand firm and wet; steep slope
	2	Between two small islands in Schooner Cove	fine sand firm and wet; steep slope
Long Beach (Area 2)	3	North end of Long Beach adjacent to IR 3	fine sand firm and wet; gentle slope
	4	North side of Incinerator Rock	fine sand firm and wet; gentle slope
	5	Between Incinerator and Shawd Rocks	fine sand firm and wet; gentle slope
	6	South side of Shawd Rock	fine sand firm and wet; gentle slope
	7	One mile north of Green Point	fine sand hard-packed and dry; gentle slope
	8	North side of Green Point	fine sand hard-packed and dry; gentle slope
Combers Beach (Areas 3 & 4)	9	½ mile north of Sandhill Creek (beacon towers behind beach area)	coarse sand hard-packed and dry; slope interrupted by sandbars
	10	¼ mile north of Sandhill Creek delta area	coarse sand hard-packed and dry; slope interrupted by sandbars
	11	South side of Sandhill Creek delta area	coarse sand hard-packed and dry; slope interrupted by sandbars
	12	¼ mile south of Sandhill Creek	coarse sand hard-packed and dry; slope interrupted by sandbars
Wickaninnish Beach (Area 5)	13	¼ mile north of Wickaninnish Inn	coarse sand hard-packed and dry; slope interrupted by sandbars
	14	Adjacent to access road by Wickaninnish Inn	coarse sand hard-packed and dry; gentle slope

Table 11. Intertidal distribution of adult razor clams, Long Beach Section (1975). The number of clams or clams and shows counted in 125 m^2 sampling areas described in Table 10.

Area	Sample	Numbers of adult razor clams			
		April 26 - 27	May 24,26 - 27	June 10 - 12	Sept. 16 - 18
1	1	-	9	11	-
	2	-	5	7	-
2	3	10	9	11	12
	4	19	13	16	14
	5	11	14	12	17
	6	14	16	11	11
	7	0	3	2	0
	8	1	3	5	6
3	9	0	3	1	3
	10	0	5	4	1
4	11	0	2	2	2
	12	0	3	3	0
5	13	0	0	0	1
	14	0	0	1	1
		s = 4.04	2.94	2.38	2.65
			s = 2.78		

Table 12. Mean shell length at winter checks of razor clams collected at Long Beach (1975).

Winter checks	1	2	3	4	5	6
Mean length (mm)	33.6	90.7	115.5	125.2	130.3	133.9
Standard deviation (mm)	10.5	10.3	6.5	6.3	5.8	5.4
Range (mm)	13.3 - 61.8	53.9 - 113.2	90.9 - 131.2	105.3 - 143.0	115.8 - 143.0	122.2 - 141.2
Number of clams measured	186.0	183.0	181.0	154.0	96.0	38.0

Table 13. Age frequency distribution of razor clams from Long Beach (1975)

Month	April	May	June	July	Aug.	Sept.	Oct.	Dec.	Total No.
Age (yrs.)									
0	Ø	1	Ø	Ø	Ø	1	2	Ø	4
1	Ø	1	Ø	Ø	Ø	Ø	Ø	1	2
2	3	8	3	5	3	3	Ø	2	27
3	6	10	6	9	7	10	6	4	58
4	15	3	8	6	7	4	6	9	58
5	1	1	9	4	5	4	6	8	38
Total No.	25	24	26	24	22	22	20	24	187

Table 14. Stage of gonadal development of razor clams collected at Long Beach (1975).

Date	Inactive Phase	Active Phase		Ripe Phase		Partially Spent Phase		Spent Phase		Total No. of Clams
April 26 - 27		8♂	17♀							25
May 6		3♂	6♀	9♂	7♀					25
June 10		12♂	12♀		2♀					26
July 22				14♂	9♀	1♂	1♀			25
Aug. 7				5♂	3♀	5♂	8♀	1♂	3♀	25
Sept. 18				1♂		2♂	2♀	5♂	19♀	29
Oct. 7						2♂		12♂	15♀	29
Dec. 4 - 5						9♂	2♀	3♂	14♀	28

Table 15. Number of clams and cockles observed in ten quadrats, each 60 cm^2 x 15 cm deep, in littleneck clam bed, Florencia Bay (May 25, 1975).

Sample No.	*Protothaca staminea* (littlenecks)	*Clinocardium nuttalli* (cockles)
1	0	0
2	0	0
3	1	0
4	1	0
5	1	0
6	4	3
7	3	1
8	2	0
9	1	0
10	2	0
Total	15	4
Mean	1.50	.40
Standard deviation	1.27	.97

Table 16. Mean shell length at winter checks of littleneck clams collected at Florencia Bay (1975).

Winter checks	1	2	3	4	5	6	7	8	9	10	11
Mean length (mm)	9.3	17.1	25.1	32.2	37.5	43.1	47.9	50.4	52.0	52.5	53.8
Standard deviation (mm)	1.8	3.8	4.9	5.3	6.4	5.6	4.4	3.5	2.7	3.6	5.1
Range (mm)	4.2 - 13.2	11.8 - 26.5	16.9 - 39.6	22.0 - 46.3	26.5 - 51.2	32.5 - 54.8	39.2 - 57.1	45.4 - 58.5	47.5 - 54.9	48.2 - 56.3	50.2 - 57.4
Number of clams measured	51	51	50	50	44	33	22	12	9	5	2

Table 17. Total number of organisms observed in m^2 plot of mussel bed, Cox Point (1975).

Species	Number
PHYLUM Cnidaria	
Class Anthozoa	
Order Actiniaria	
Anthopleura elegantissima	91
PHYLUM Annelida	
Class Polychaeta	
Polychaetes	≃341
Nereis vexillosa	5
PHYLUM Nemertea	
Nemerteans	≃ 286
PHYLUM Platyhelminthes	
Class Turbellaria	
Flatworms	≃ 264
PHYLUM Sipuncula	
Family Phascolosomatidae	
Phascolosoma agassizii	3
PHYLUM Echinodermata	
Class Holothuroidea	
Cucumaria pseudocurata	4833

Table 17 cont'd

Species	Number
PHYLUM Arthropoda	
Class Crustacea	
Subclass Cirripedia	
Balanus cariosus	1021
B. glandula	14,345
Chthamalus dalli	2676
Pollicipes polymerus	35
Subclass Malacostraca	
Division Eucarida	
Order Decapoda	
Suborder Reptantia	
Section Brachyura	
Hemigrapsus nudus	30
H. oregonensis	62
Section Anomura	
Pagurus sp.	2
Petrolisthes eriomerus	849
Division Peracarida	
Order Amphipoda	
Amphipods	33
Order Isopoda	
Isopods	12
PHYLUM Mollusca	
Class Amphineura	
Cyanoplax dentiens & *Tonicella* sp.	168

Table 17 cont'd

Species	Number
Class Gastropoda Subclass Prosobranchia	
Collisella digitalis	450
C. pelta	94
C. strigatella	11
Lacuna marmorata	2
Littorina scutulata	5
L. sitkana	42
Notoacmea persona	578
N. scutum	7
Tegula brunnea	1
Thais canaliculata & T. emarginata	327
T. lamellosa	1
Class Gastropoda Subclass Opistobranchia	
Onchidella borealis	43
Class Bivalvia	
Hiatella arctica	1
Mytilus californianus & M. edulis	
≥ 1.0 cm	4,578
< 1.0 cm	94,380
Petricola sp.	2
Protothaca staminea	
≥ 1.0 cm	63
< 1.0 cm	62,082

Table 18. Number of organisms re-colonizing cleared one m^2 plot of mussel bed, Cox Point (1975).

Species	Number		
	Sept.	Oct.	Dec.
PHYLUM Cnidaria			
Class Anthozoa			
Order Actiniaria			
Anthopleura elegantissima	3	3	3
PHYLUM Arthropoda			
Class Crustacea			
Subclass Cirripedia			
Pollicipes polymerus	-	-	2
PHYLUM Mollusca			
Class Gastropoda			
Subclass Prosobranchia			
Collisella digitalis	223	252	447
Littorina scutulata	210	53	21
Notoacmea persona	-	27	230
Thais emarginata	279	-	4
Class Bivalvia			
Mytilus californianus & M. edulis			
$\geq$ 1.0 cm	-	28	21

Table 19. Numbers of Olivella biplicata observed in 10 quadrats, each 3 x 3 m (1975).

Location	North of Shawd Rock				North of Sandhill Creek				North of Quisitis Point			
Date	May	June	July	Aug.	May	June	July	Aug.	May	June	July *	Aug.
Sample No.												
1	7	3	8	12	10	23	23	33	12	21	50	23
2	1	6	7	9	9	27	33	44	11	30	14	15
3	3	9	11	4	11	36	73	37	9	26	36	19
4	4	8	4	10	14	25	75	24	14	24	23	31
5	6	4	9	7	8	40	47	56	10	21	21	25
6	1	9	5	14	12	32	48	23	11	36	39	20
7	1	7	11	6	10	29	36	22	7	23	16	11
8	3	6	7	8	13	36	21	45	13	27	27	16
9	2	4	6	7	11	47	62	36	10	34	31	35
10	3	5	11	4	9	31	71	42	9	25	35	17
Total	31	61	79	81	107	326	489	362	106	267	292	212
Mean	3.1	6.1	7.9	8.1	10.7	32.6	48.9	36.2	10.6	26.7	29.2	21.2
No./m^2	0.34	0.67	0.87	0.90	1.18	3.62	5.43	4.02	1.17	2.96	3.24	2.35

* Six Olivella baetica noted in area, but not in quadrats

Table 20. Number of starfish recorded on the east side of Box Island (1975).

Date	Pisaster		Pycnopodia
	Total No.	No./m^2	Total No.
July 25	87	5.0	6
August 6	50	2.9	5
September 17	34	1.9	4
December 4	108	6.2	0

FIGURES

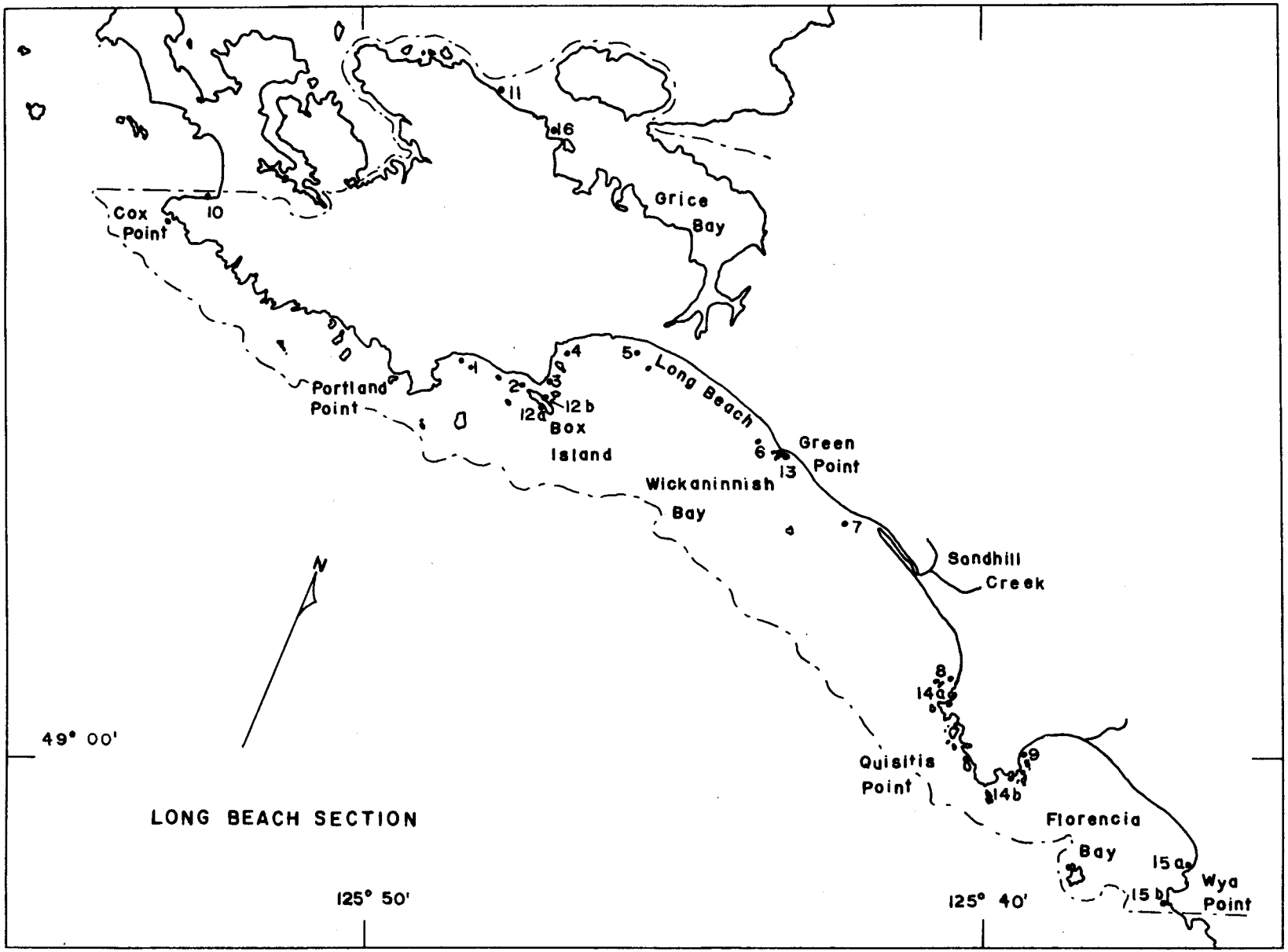

Figure 1. Locations of intertidal faunal survey sites (1975).

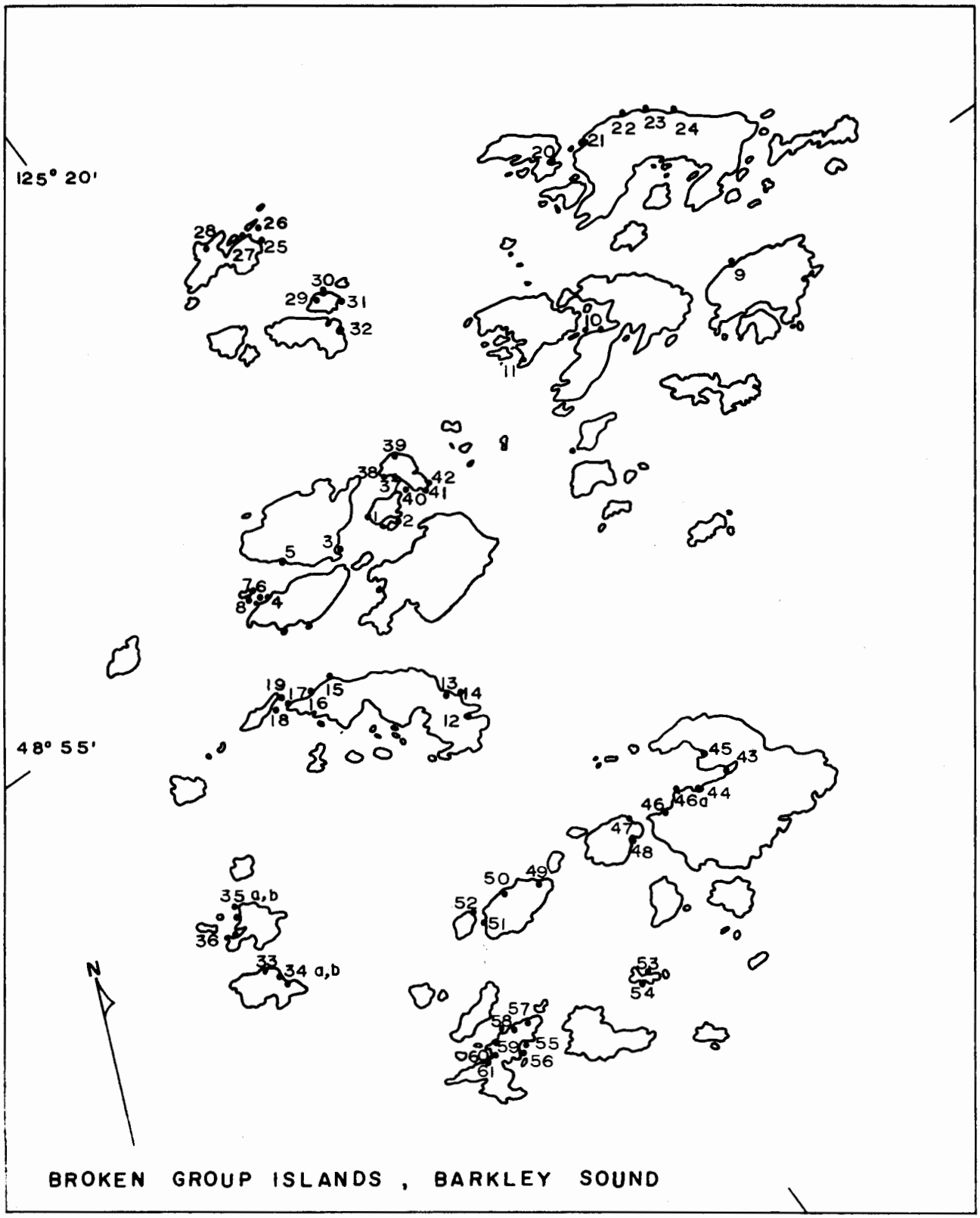

Figure 2. Locations of intertidal faunal survey sites (1975).

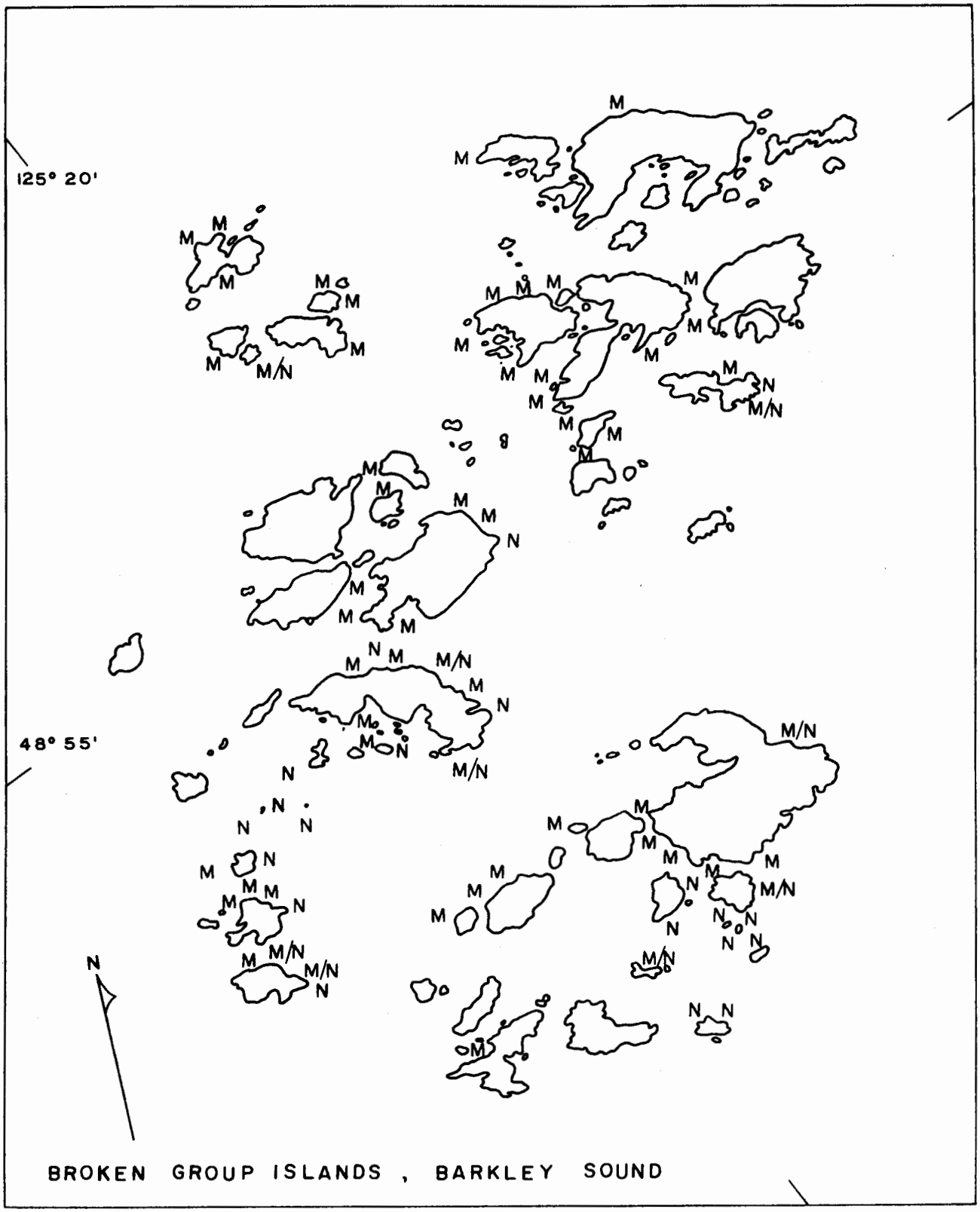

Figure 3. Locations of kelp beds (1975).

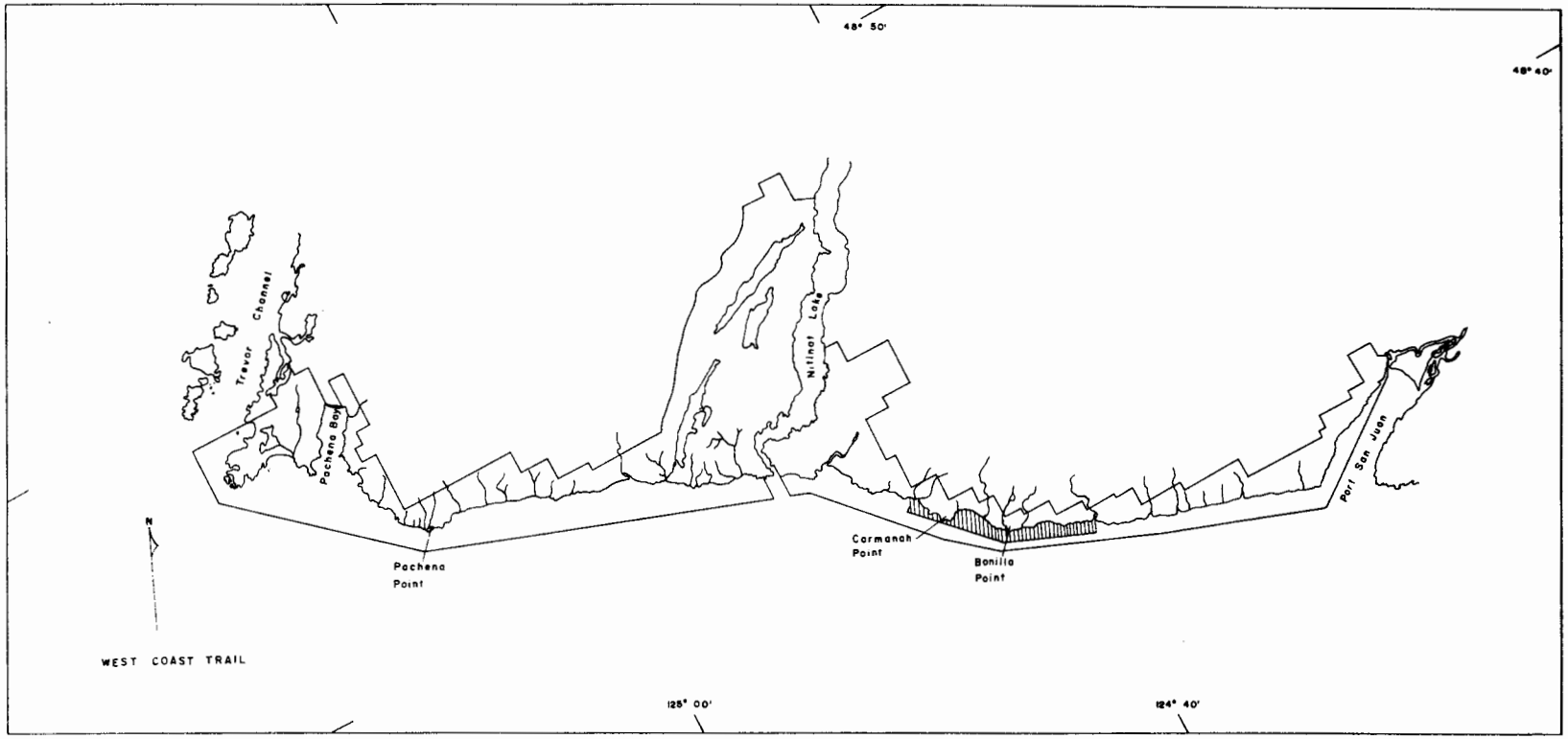

Figure 4. West Coast Trail Section showing area sampled (hatched area) in 1975.

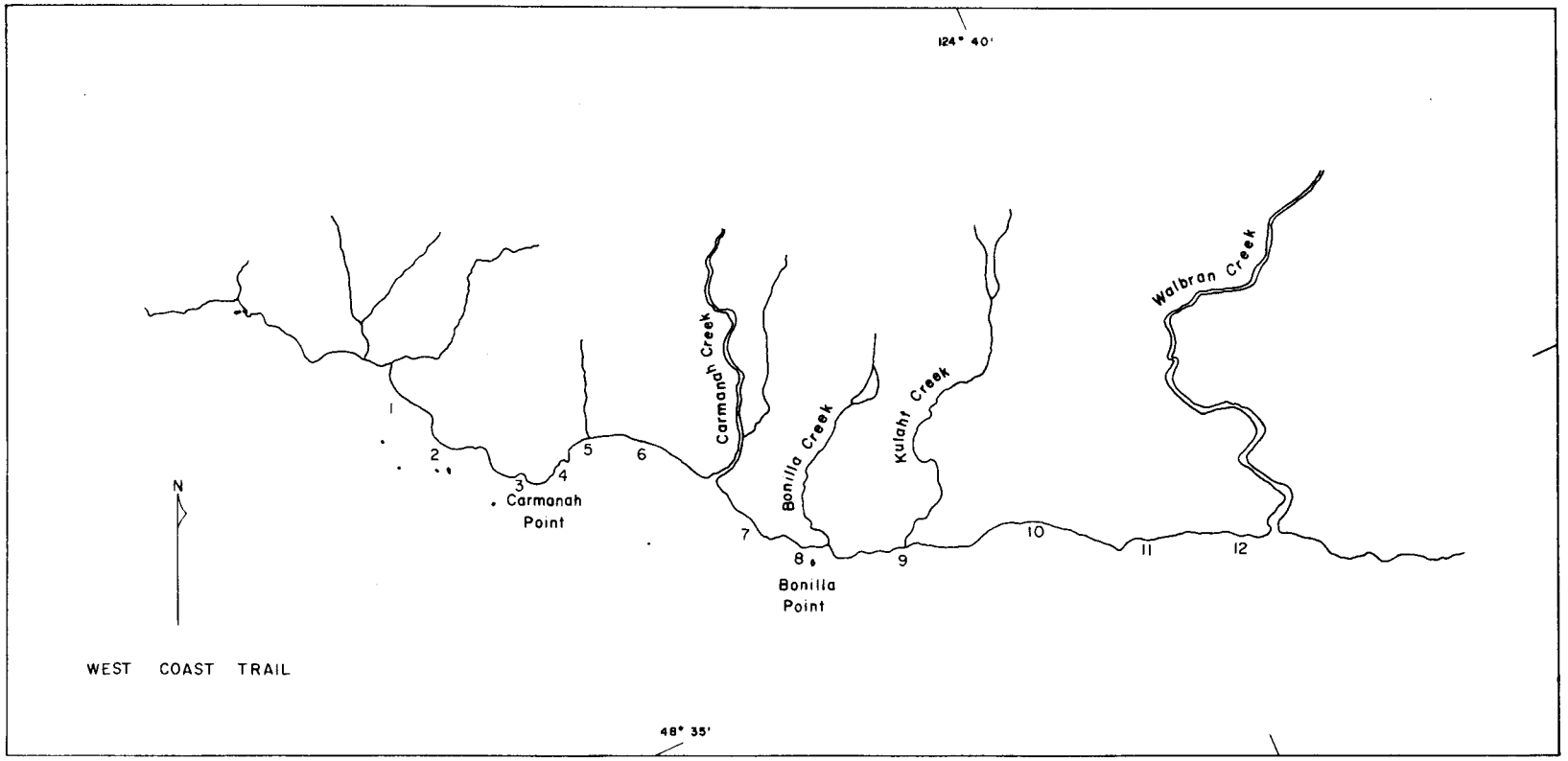

Figure 5. Locations of intertidal faunal survey sites (1975).

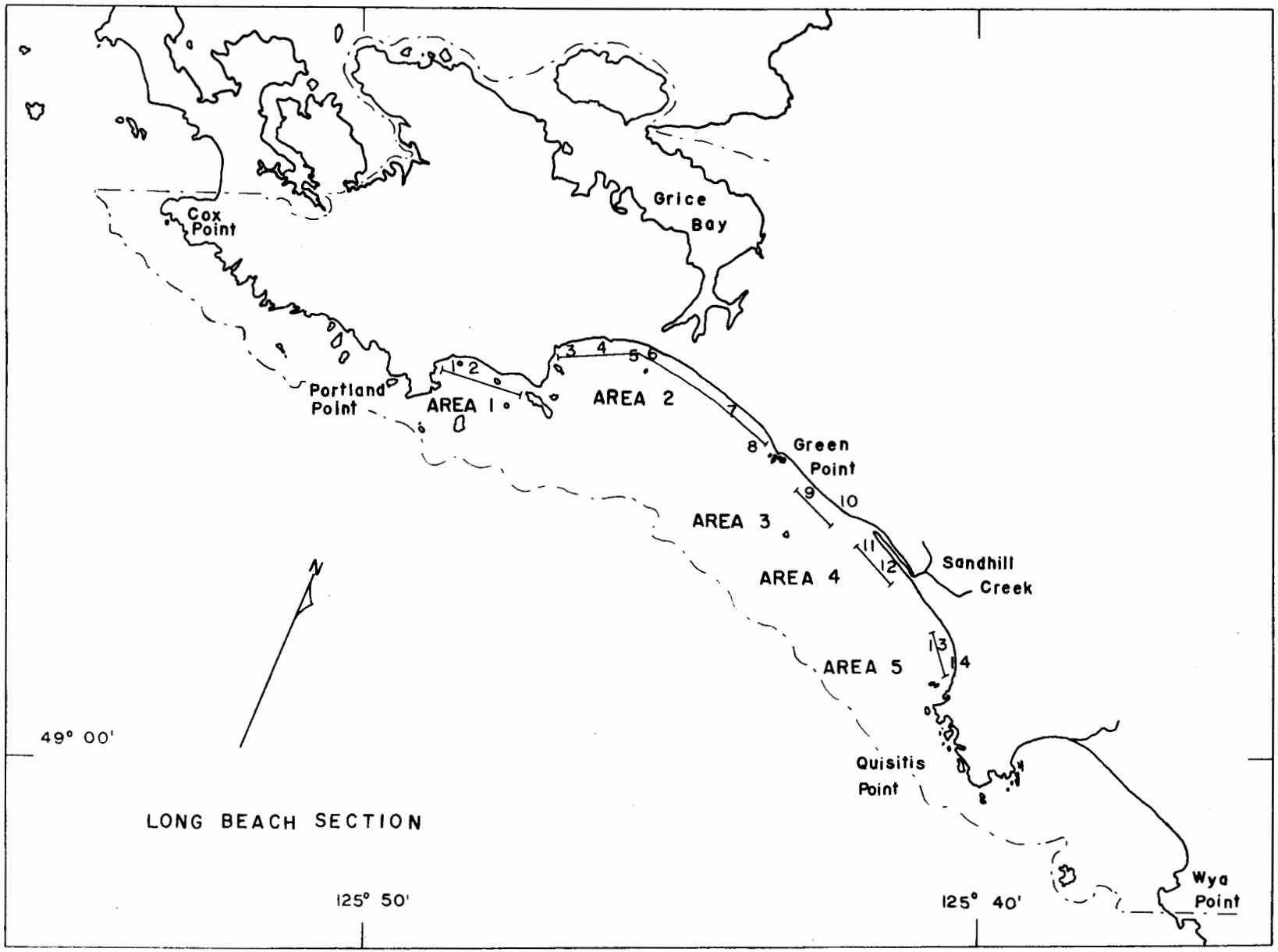

Figure 6. Locations of adult and juvenile razor clam sampling.

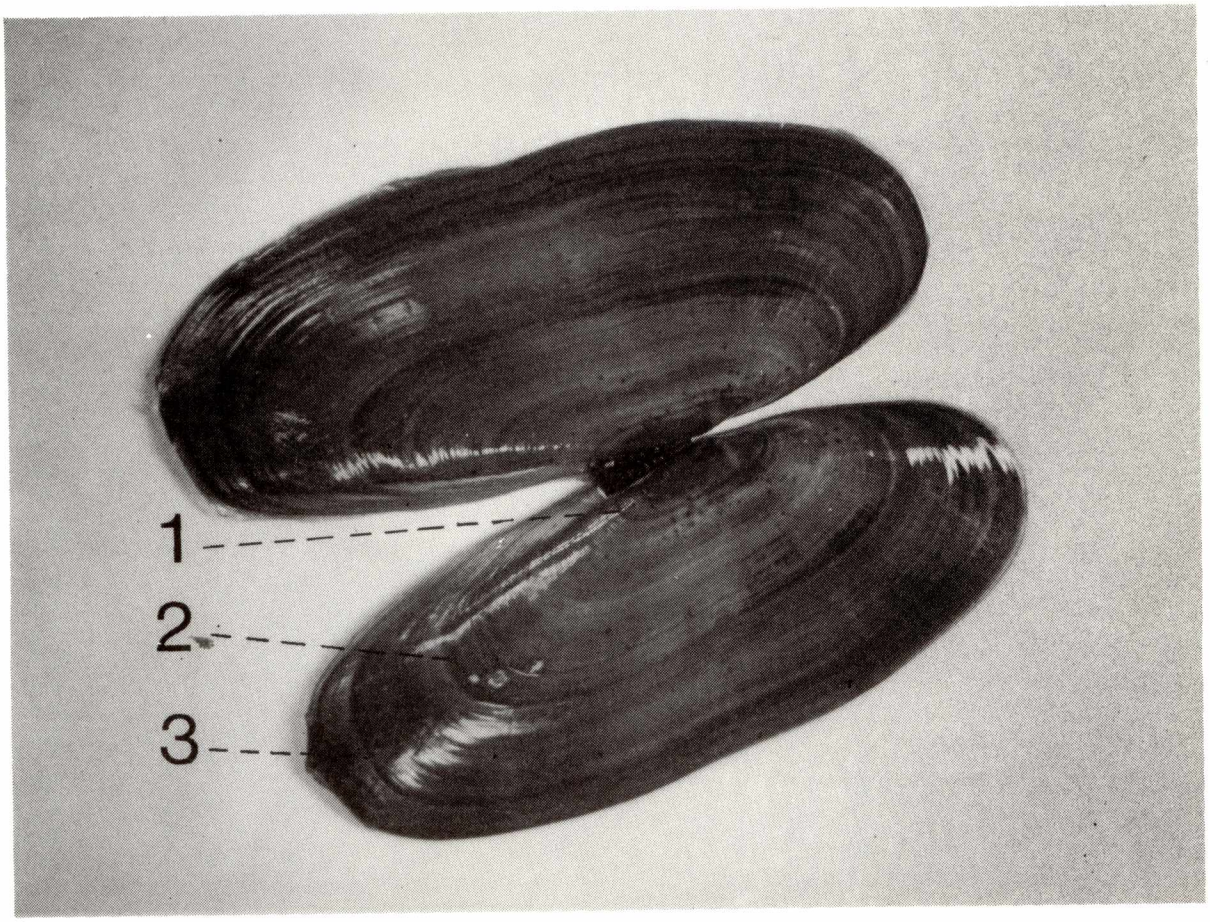

Figure 7. Razor clam shell showing winter checks.

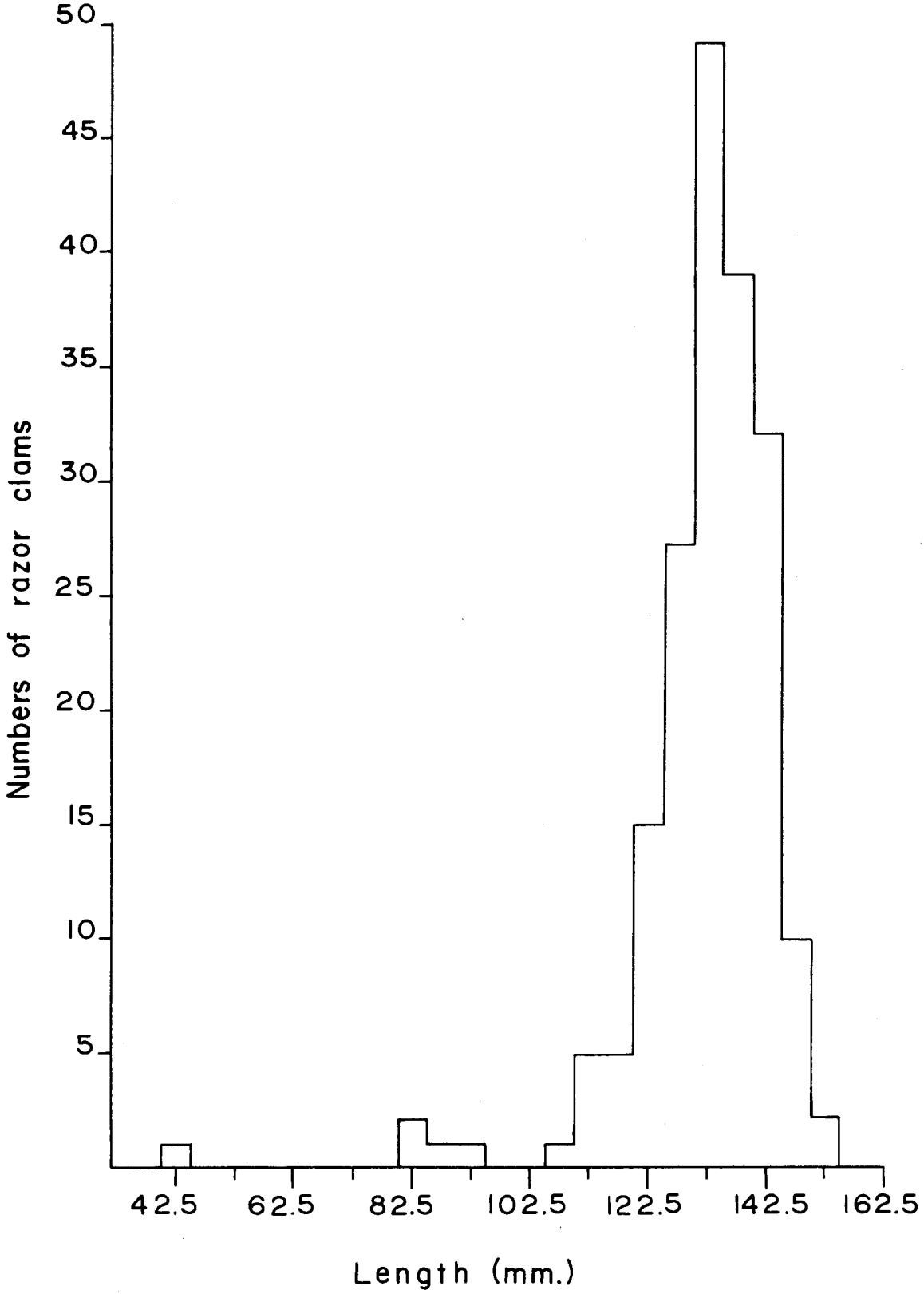

Figure 8. Length frequency distribution of razor clams, Long Beach (1975)
(Total number of clams is 187.)

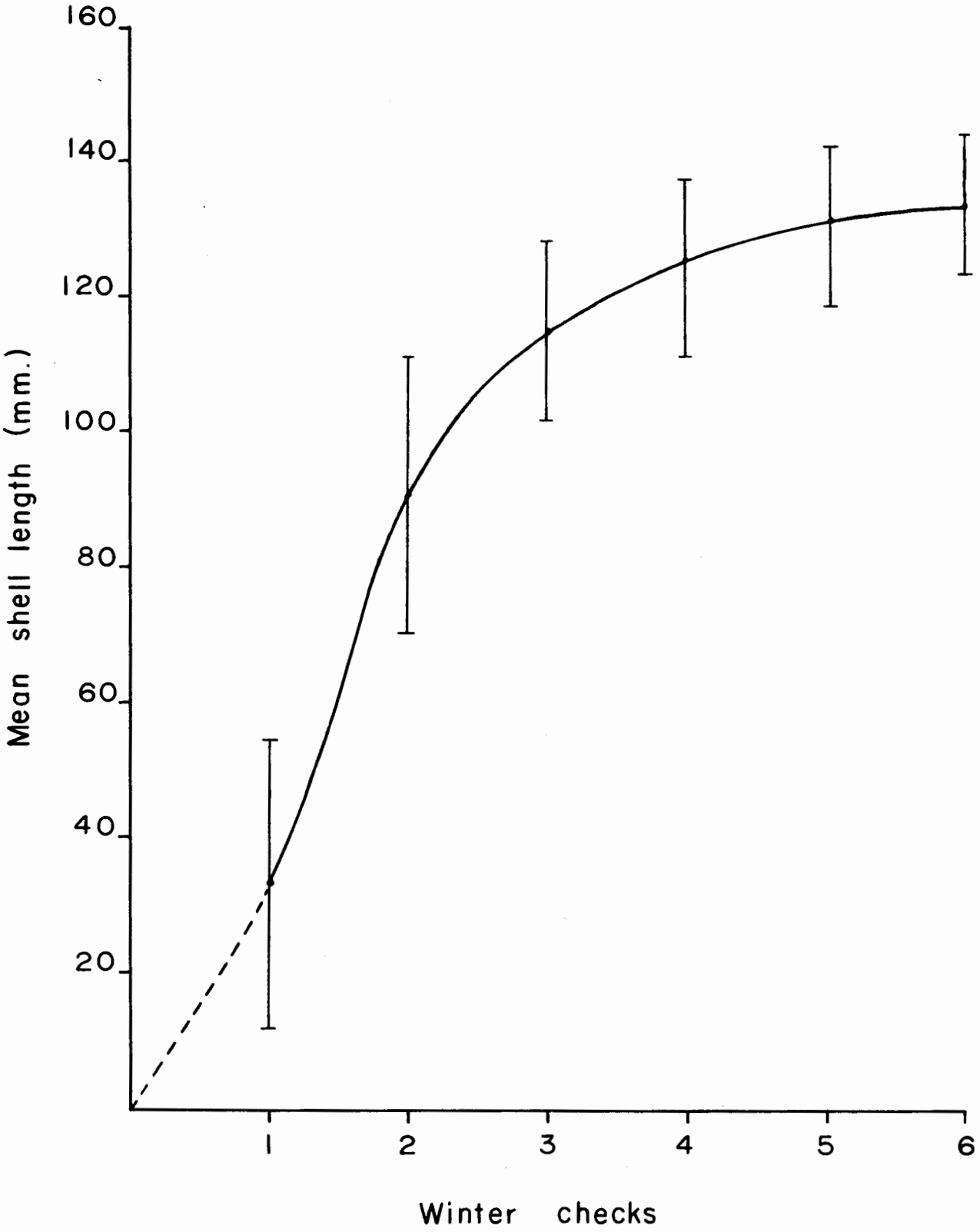

Figure 9. Annual growth rate of razor clams at Long Beach, 1975. (Vertical bars indicate two standard deviations about the mean.)

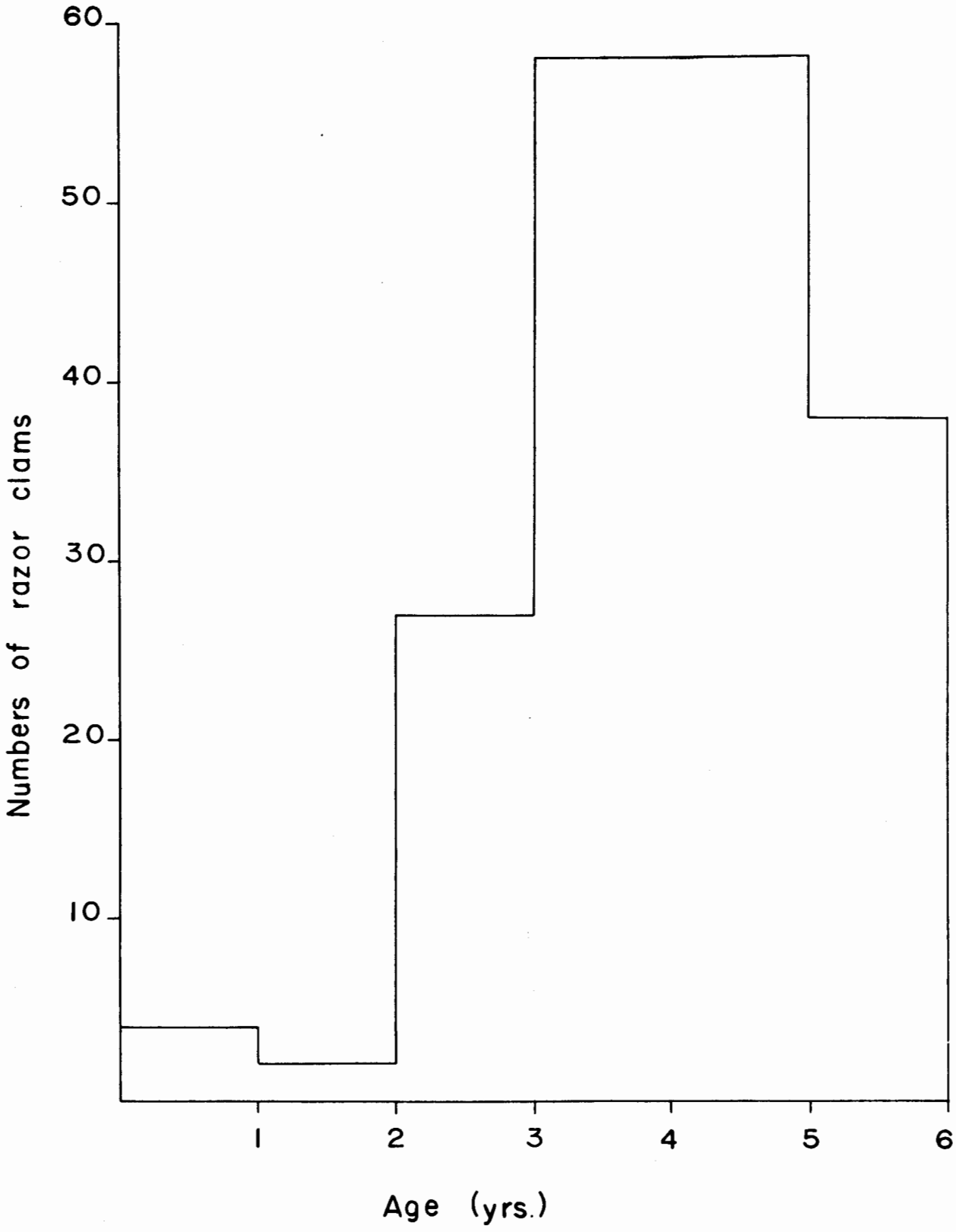

Figure 10. Age frequency distribution of razor clams from Long Beach, 1975.

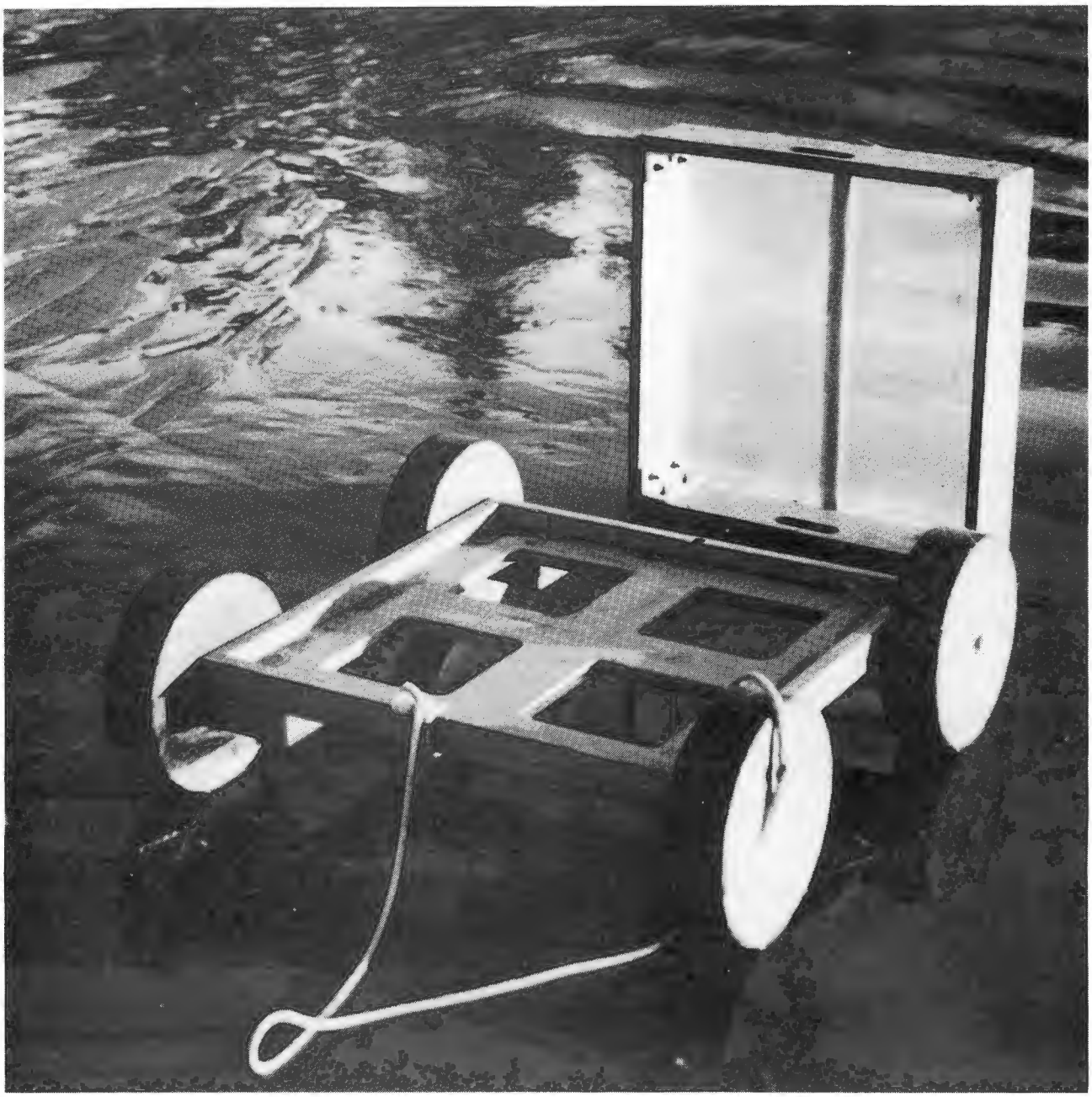

Figure 11. Beach buggy used in beach screening.

Figure 12. Screening for small razor clams. a) Digging sample; b) Washing sand through screen; c) Sorting through organisms and gravel for small clams left in screen.

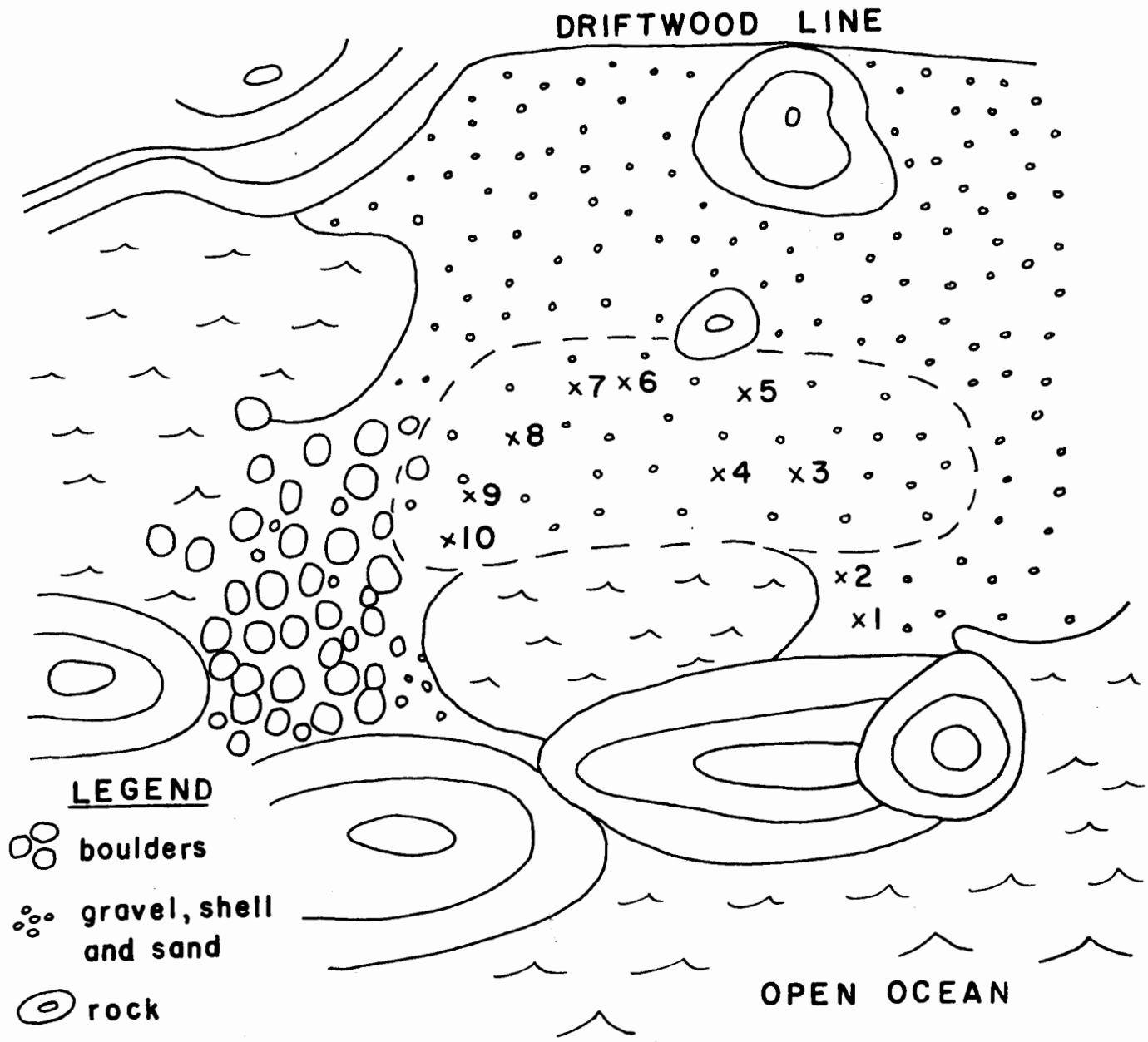

Figure 13. Schematic diagram of littleneck clam bed at the northwest end of Florencia Bay, 1975. Estimated area of bed, 10 x 25 m, outlined by heavy broken line; locations of quadrat samples taken in May 1975 are indicated by x and numbered in sequence.

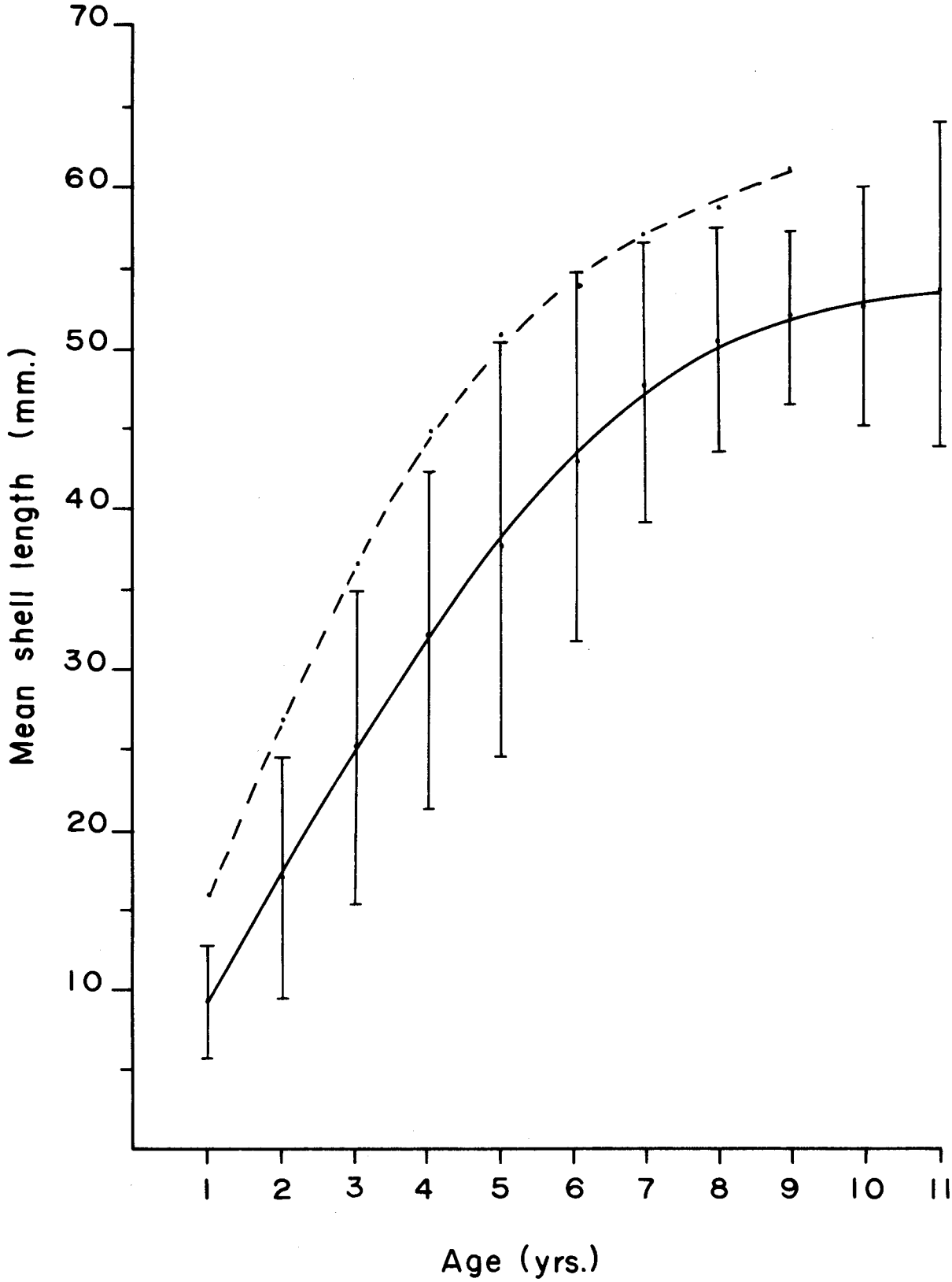

Figure 14. Annual growth rates of littleneck clams, Florencia Bay (1975).
.------. littleneck clams, the Strait of Georgia (Quayle & Bourne, 1972)
._____. littleneck clams, Florencia Bay ; vertical bars show 2 standard deviations about the mean.

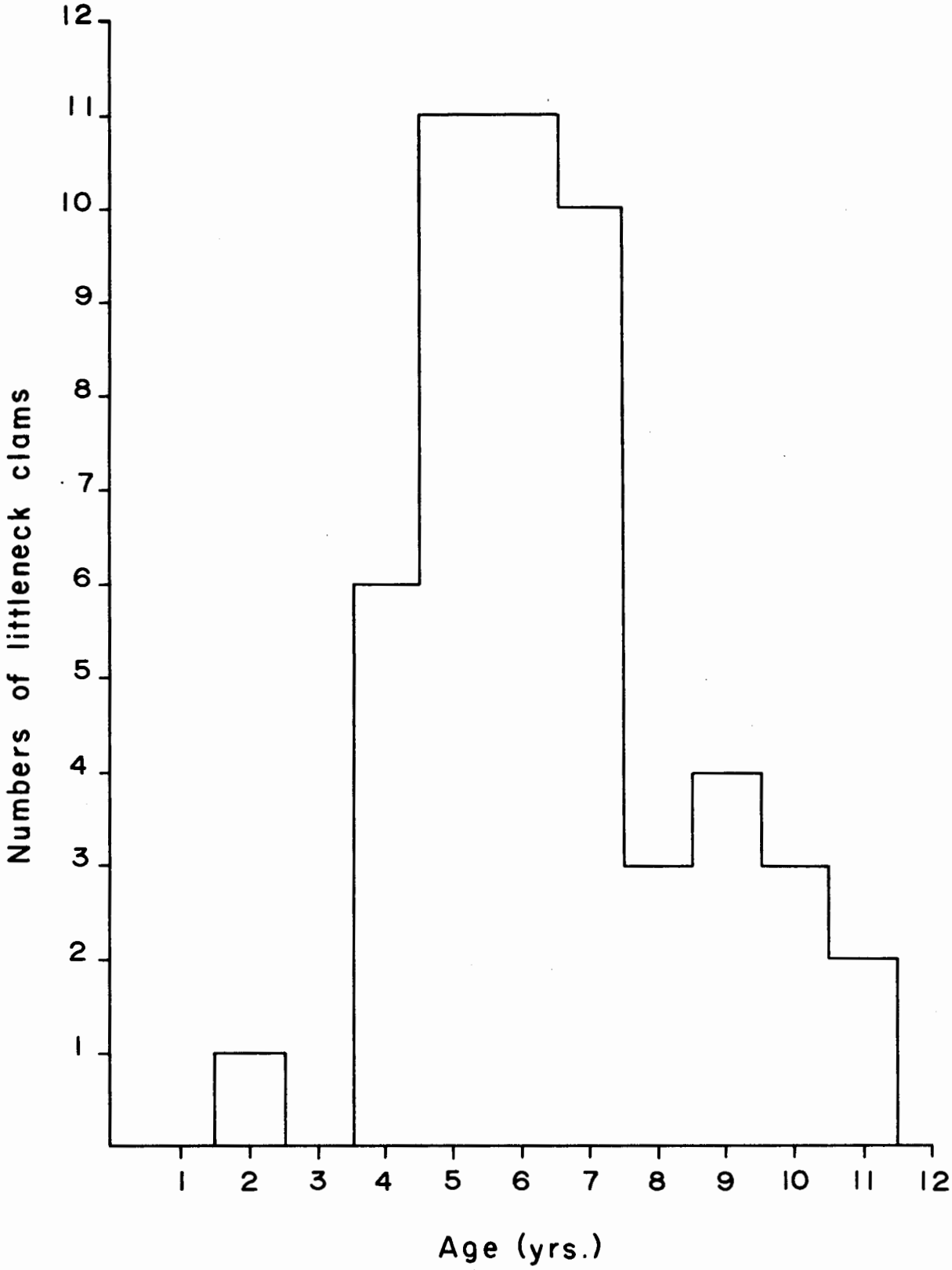

Figure 5. Age frequency of littleneck clams collected at Florencia Bay (1975).

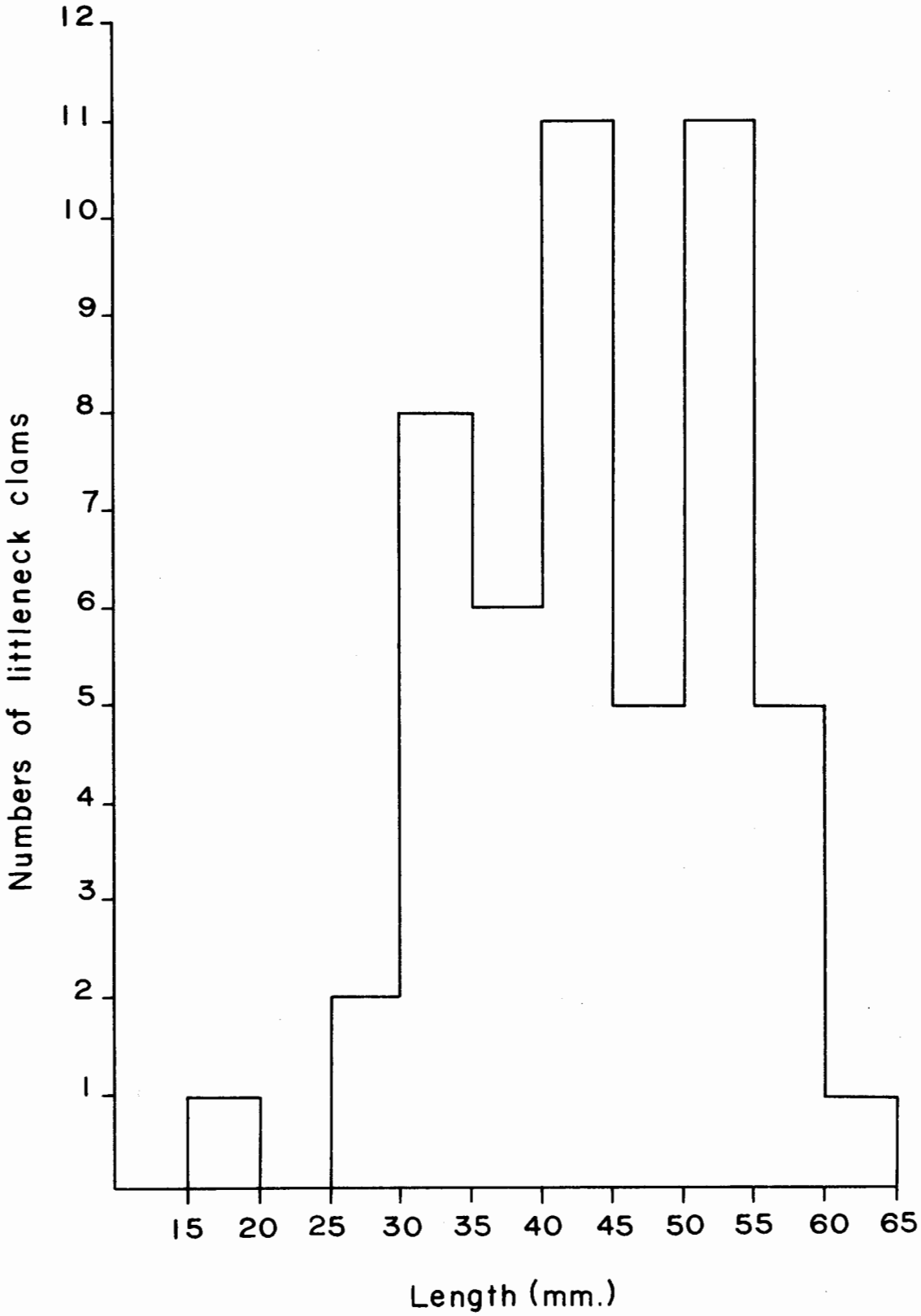

Figure 16. Length frequency distribution of littleneck clams collected from Florencia Bay (1975).

Figure 17. One m^2 plot in a mussel bed that was cleared on the semi-exposed side of Cox Point.

Figure 18. a) Olivella biplicata leaving trail in sand; b) Humps created by O. biplicata when they are stationary.

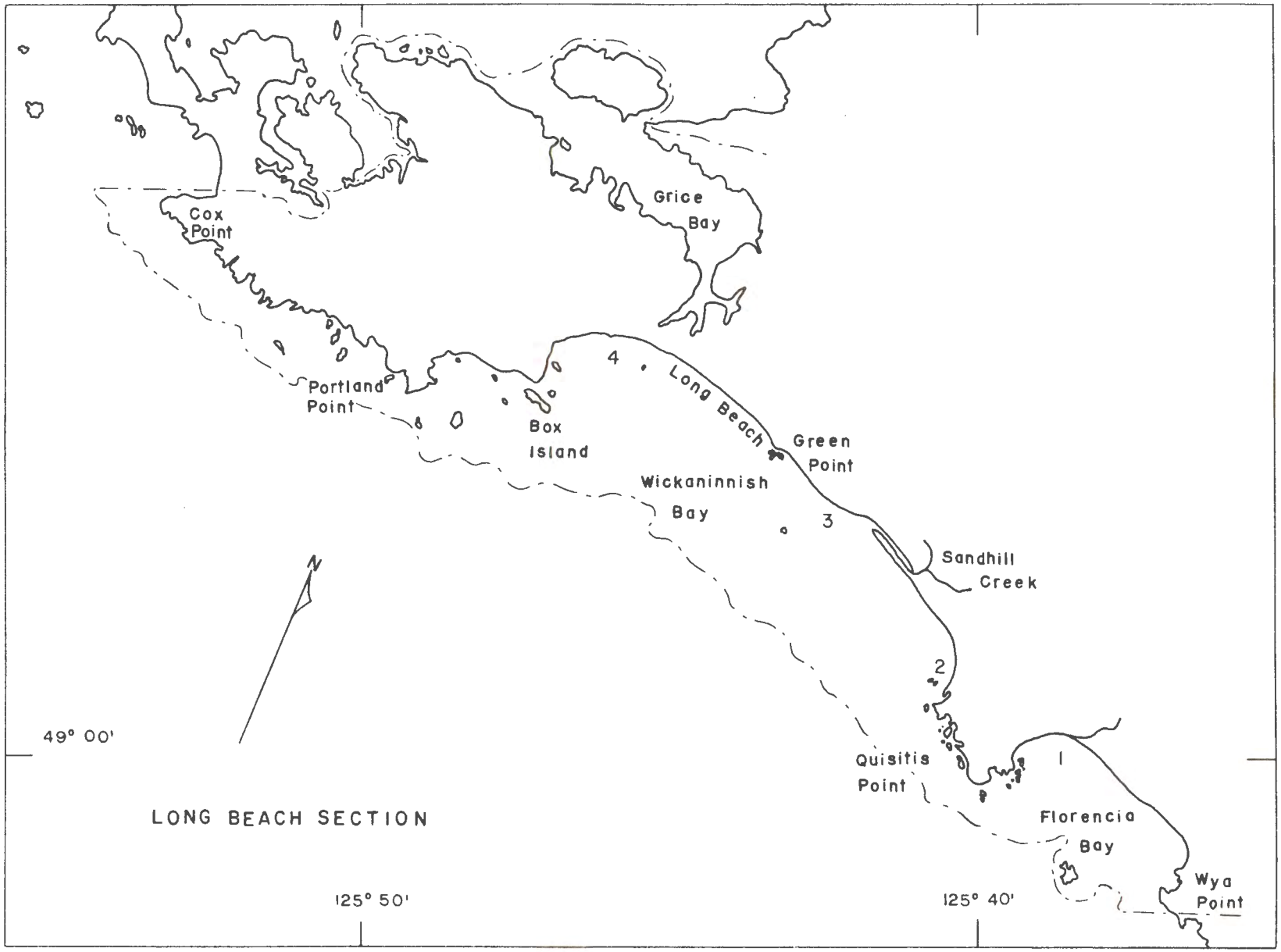

Figure 19. Locations chosen as representative areas to determine the density of Olivella along Long Beach.

Figure 20. Pisaster study area, along the semi-exposed vertical wall on the east side of Box Island, extended from the extreme left hand side to the right hand side of the photograph.

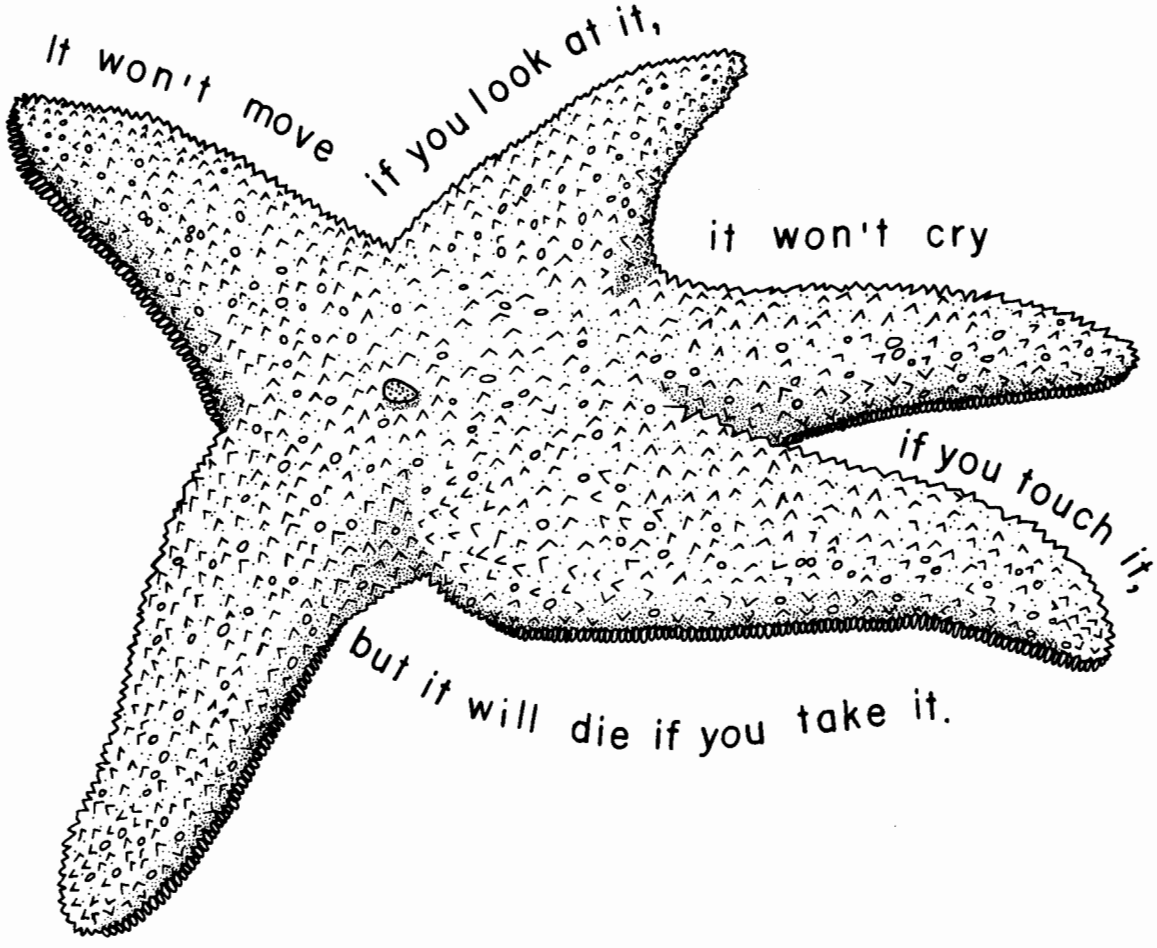

Figure 21. Poster of Pisaster "look but do not remove" policy taken from Interpretive Program 1974 pamphlet. (Re-drawn by Barbara Adkins).

APPENDIX 1

Up-dating of Fisheries Research Board of Canada Manuscript Report Series No. 1276.

RESEARCH PROJECTS

Many marine biological research programs are being undertaken in the Northeast Pacific region but few are confined within the boundaries of the Pacific Rim National Park. Regardless of location, many of these Northeast Pacific studies are pertinent and important in understanding the ecology of marine communities within the Park.

This section lists previous, current and proposed research projects. These projects, carried out entirely or in part within the boundaries of the Park, are not necessarily the entire research of the individual or institution. Research projects done adjacent to the Park boundaries have been included since they may be undertaken partly within the Park and in any case will supplement the ecological knowledge of marine life in the Park.

Previous research projects have been undertaken by some individuals and institutions within the Park boundaries. At present, some faunal collections of these studies are being reviewed and the material compiled for publication. Alth ough these projects may not be considered active research, they are included here since the publications will be of interest.

In addition to research projects, there are monitoring programs within or adjacent to the Park. These are important in understanding the forces influencing marine communities within the Park and this information is frequently incorporated into research projects.

Bamfield Marine Station, Bamfield, B. C.

The Bamfield Marine Station is operated by a consortium of western Canadian universities as a teaching facility, a research laboratory and graduate studies laboratory. Much of the research at this institute is carried out near Bamfield, but studies are also conducted in adjacent areas of Barkley Sound. In the following section, research undertaken within the Park area is listed by the supervisors. A list of university summer courses is given for 1975 and 1976.

Dr. W. C. Austin
Port Washington
Pender Island, B. C.

Research included studies of marine invertebrates and habitat types from an area encompassing the three sections of the Park.

Dr. L. Druehl
Department of Biological Sciences
Simon Fraser University
Burnaby, B. C.

Current research involves both Dr. Druehl and a graduate student, Chris Lobban. This research includes a study of the fauna and flora and other ecological aspects of kelp beds in Barkley Sound, both inside and outside the Broken Group Islands.

Dr. D. V. Ellis
Department of Biology
University of Victoria
Victoria, B. C.

Future research project will include a study of the sediment infaunal benthos in Barkley Sound.

Dr. D. Ross
University of Alberta
Edmonton, Alberta

A dredging survey in the Bamfield area including the Broken Group Islands was organized by Dr. Ross and was attended by researchers from universities in Alberta, British Columbia and Washington, the British Columbia Provincial Museum and Pender Island Laboratories. Lists of sample sites and species identified to date are available.

Mr. C. Smecher
University of Alberta
Edmonton, Alberta

Research includes an investigation of the sponges in the Broken Group Islands.

Dr. T. Widdowson
Department of Biology
Long Beach State College
California, U. S. A.

This research program included a taxonomic and ecological study of the algae along the west coast of Vancouver Island, and included some work inside the boundaries of all three sections of the Park.

Dr. N. J. Wilimovsky
Department of Animal Resource Ecology
University of British Columbia
Vancouver, B. C.

Current research involves both Dr. Wilimovsky and students, and includes:

(1) a taxonomic survey of fishes along the west coast of Vancouver Island;

(2) ecological and developmental studies of some fishes in Barkley Sound.

Study includes work both inside and outside the boundaries of the Park.

Summer Courses

In the summer of 1975 Bamfield Marine Station offered courses dealing with marine invertebrates, phycology and ecology, biological oceanography and the biology of fishes. For 1976 the courses include the biology of coelenterates, marine mammals and fishes, marine invertebrates and phycology, invertebrate embryology, ecology of marine birds and a study of marine pollution and its assessment. Many of these courses include field trips and studies in the Broken Group Islands.

British Columbia Provincial Museum, Victoria, B. C.

Dr. J. F. L. Hart

Present work involves the compiling of information on the taxonomy and distribution of reptant Decapoda in the Northeast Pacific for a British Columbia Provincial Museum Handbook. This work will include information on specimens collected in the Park area.

Dr. A. E. Peden
Curator of Marine Biology

The research program of 1973 included a qualitative survey of the intertidal and subtidal invertebrates and fishes within the Broken Group Islands with emphasis on rocky habitats and lagoons. A list of species and sample sites is now available.

Department of the Environment

Pacific Biological Station
Fisheries and Marine Service
Nanaimo, B. C.

Investigators at the Pacific Biological Station have carried out research projects within the Park boundaries in the past and some continue to have projects which encompass this area. Most of the studies involve stock identification and assessment with some ecological and taxonomic work. A list of the projects is given by investigation at the Station; the name of the person in charge of the investigation is given.

Benthic Ecology: Dr. F. R. Bernard

Current research includes a study of benthic organisms of the Eastern Pacific.

(1) systematics and morphology of bivalves and brachiopods;
(2) trophic relationships between benthic organisms.

Crab and Shrimp Investigation: Mr. T. H. Butler

Current research includes preparation of a handbook on the shrimps of the Pacific coast of Canada. Other research work specifically related to the Park includes:

(1) estimation of shrimp populations off the west coast of Vancouver Island which includes the area within the 12-mile limit off the northern part of Long Beach;

(2) a completed study on the condition of the crabs in the Long Beach area to determine the necessity for a soft-shelled closure of the crab fishery.

Groundfish Investigation: Mr. S. J. Westrheim

Current research includes a study of the distribution, abundance and biology of the groundfish of commercial importance in the northeastern Pacific Ocean. This study is concerned with the entire continental shelf and slope.

Herring Investigation: Dr. A. S. Hourston

Current research includes a study of the abundance and distribution of the four life-history stages of Pacific herring in the northeast Pacific and a study of the algal vegetation in herring spawning areas. Parts of this study were conducted in Barkley Sound and include the area encompassed by the Broken Group Islands.

Marine Climatology: Mr. W. P. Wickett

Research program includes studies conducted in the sub-Arctic Pacific Ocean.

(1) general patterns of water circulation;
(2) seasonal temperature changes;
(3) factors that affect catches of albacore and coho salmon.

Marine Invertebrates: Dr. N. Bourne, Dr. D. B. Quayle, Dr. P. A. Breen

Dr. N. Bourne: Current research includes a study of the ecology of clams in British Columbia.

(1) previous study of the life history and population structure of razor clams at Long Beach;
(2) growth, mortality and population dynamics of hardshell clam populations in Barkley Sound.

Dr. D. B. Quayle: Current research includes a study of the ecology of marine invertebrates in British Columbia and the potential of mussel culture in Barkley Sound.

Dr. P. A. Breen: Current research includes a study of the population dynamics of sea urchins, abalone and sea cucumbers within the Broken Group Islands.

Marine Mammals: Dr. M. Bigg

Current research includes:

(1) census work on California and Steller's sea lions and minke whales;
(2) migration of sea otters in Barkley Sound from transplant "studies";
(3) migration and feeding habits of fur seals and gray whales;
(4) behaviour studies of killer whales.

Parts of these studies include the area off Long Beach and in Barkley Sound.

Dr. M. N. Arai
Pacific Biological Station and
Department of Zoology
University of Calgary
Calgary, Alberta

Current research includes systematics and behaviour of British Columbia hydromedusae, of which some were collected in the Barkley Sound area.

Pacific Environment Institute
Fisheries and Marine Service
Research and Development Branch
West Vancouver, B. C.

Investigations at this Institute are concerned with research on environmental parameters in British Columbia; two projects have limited connection with the Pacific Rim Park.

Dr. J. Davis: Previous research included sampling shellfish in Barkley Sound to determine levels of zinc in the environment. Sampling stations were outside the Park.

Mr. A. Lamb: Samples of marine life were collected in the Ucluelet-Tofino-Bamfield area and comprehensive species and locality data has been kept.

Dr. C. D. Levings: Previous research included a short survey of biota at Toquart Bay, adjacent to the Park, and the effect of mine tailings on marine communities there.

Dr. J. A. J. Thompson: Previous research included taking bottom samples in Barkley Sound to measure levels of mercury in the environment.

In addition to these research projects under the Department of the Environment, the following monitoring programs are maintained within or adjacent to the Park and should be mentioned since results are frequently used in research.

Fisheries Operations Branch
Fisheries and Marine Service
1090 West Pender St.
Vancouver, B. C.

The Fisheries Operations Branch enforces fisheries regulations, records catch statistics and samples for paralytic shellfish poisoning within the boundaries of the Park.

Marine Sciences Directorate
Fisheries and Marine Service
Ottawa, Canada

The Marine Sciences Directorate operates recording "wave-rider" buoy approximately three miles off Quisitis Point as a sea-state monitor.

Marine Sciences Directorate
Fisheries and Marine Service
Victoria, B. C.

The Marine Sciences Directorate monitors oceanographic conditions along the coast. For the Park area, this includes daily surface water temperature and salinity measurements at Amphitrite Point, and tide gauges on a routine basis at Bamfield, Tofino and Port Renfrew. Short term research programmes have been carried out in the area and these will probably continue in the future.

National Museum, Ottawa, Canada

No current research projects are undertaken by National Museum personnel specifically within the borders of the Park. However, studies have been made of various species within the Park and this information is available. Two projects might also be mentioned.

Dr. E. L. Bousfield: Current program is compiling taxonomic and distribution studies of amphipods, some of which will be pertinent to the Park. Future work may involve intermittent sampling.

Dr. D. J. Faber: Previous research which is pertinent to the Park included a study of marine zooplankton.

Oceanographic Institute, University of British Columbia, Vancouver, B. C.

Current research projects do not include work within the Park boundaries; however, future work may entail intermittent sampling within the area.

LIST OF SPECIES OF MARINE ORGANISMS

The species list, given in Fisheries Research Board of Canada Manuscript Series No. 1276, has been corrected and extended from literature and faunal survey records acquired after 1973.

The species list is presented in the form of a presence (+)/absence (-) table (Table A). The headings refer to species of marine organisms; the three sections of the Park - Long Beach, Broken Group Islands, and West Coast Trail; the three main habitat categories of tidal position, exposure to surf, and substratum; and remarks pertinent to a given species. Information under these headings is recorded as in the literature except for the actual collecting stations which have been grouped by the three sections of the Park.

Species are arranged by phyla with subcategories broken down to some level convenient for locating a given species. Under the appropriate phylo-genetic subcategories the genus and species are listed alphabetically. Specimens identified to genus followed by "sp." have not been identified to species in the literature.

Table A. List of species of marine organisms, by section and habitat, within boundaries of the Pacific Rim National Park. (+ = presence, - = absence)

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Porifera (Sponges)													
Aldocia gellindra	+	+	-	+	-	+	-	-	-	-	-	-	
Aphrocallistes sp.	-	+	-	-	+	-	-	-	-	-	-	+	
Aplysilla glacialis	+	+	-	+	-	+	-	-	-	-	-	+	
Choanites suberea	-	+	-	-	+	-	-	+	-	-	+	+	rare
Cliona celata	+	+	-	-	+	+	+	+	-	-	+	+	
Craniella pullata	+	+	-	-	+	+	+	+	-	-	+	+	
Esperiopsis sp.	+	-	-	-	+	-	-	-	-	-	-	+	
Halichondria panicea	+	+	-	+	-	+	+	+	-	-	+	+	
Haliclona permollis	+	+	+	+	-	+	+	+	-	-	-	+	
Isodictya sp.	+	-	-	-	+	+	+	+	-	-	+	+	
Leucosolenia sp.	+	+	-	-	+	+	+	+	-	-	+	+	
Lissodendoryx sp.	-	+	-	-	-	+	-	-	-	-	-	+	
Myxilla incrustans	-	-	+	-	-	-	-	-	-	-	-	-	
Ophlitaspongia pennata	+	+	+	+	-	+	+	+	-	-	-	+	
Podotuberculum hoffmanni	-	-	+	-	-	-	-	-	-	-	-	-	
Spongionella sp.	+	-	-	-	+	-	-	-	+	-	-	-	
Syringella amphispicula	-	+	-	-	+	-	-	-	-	+	-	-	
Tedania sp.	+	+	-	-	+	+	+	+	-	-	+	+	

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Cnidaria (jellyfishes, corals, etc.)													
Class Hydrozoa (hydroids and hydromedusae)													
Abietinaria sp.	+	-	-	-	+	+	+	+	-	-	+	+	
Aequorea sp.	+	-	-	-	+	-	-	+	-	-	-	-	planktonic
Aglaophenia sp.	-	-	+	-	+	+	-	-	-	-	-	+	
A. struthionides	+	-	-	+	-	+	-	-	-	-	-	+	
Allopora sp.	+	+	-	+	+	+	+	+	-	-	+	+	
A. norvegicus	+	-	+	-	+	-	-	-	-	-	-	+	
A. petrograpta	-	-	+	+	+	+	-	-	-	+	+	+	
Calycella sp.	+	-	-	-	+	-	-	-	-	-	-	-	
Campanularia sp.	+	-	-	-	+	+	-	-	-	-	-	+	
Catablema vesicarium	-	-	+	-	+	-	-	+	-	-	-	-	planktonic
Dipleurosoma sp.	-	+	-	-	+	-	-	-	-	-	-	-	planktonic
Eperetmus typus	-	+	-	-	+	-	-	-	-	-	-	-	planktonic
Errinopora pourtalesia	+	+	-	-	+	+	+	-	-	-	+	+	
Eudendrium sp.	+	-	-	+	+	+	-	-	-	-	-	+	
E. californicum	+	-	-	+	-	+	-	-	-	-	-	+	
Filellum sp.	+	-	-	-	+	+	-	-	-	-	-	+	
Gonionemus sp.	+	-	+	+	+	-	-	+	+	-	-	-	planktonic
Gonothyraea	+	-	-	+	+	-	-	-	-	-	-	-	
Grammaria sp.	+	-	-	+	-	-	-	-	-	-	-	-	
Halecium sp.	+	-	-	+	+	-	-	-	-	-	-	+	
Halimedusa typus	+	-	-	-	+	-	-	-	-	-	-	-	planktonic
Halistaura cellularia	+	+	-	-	+	+	+	+	-	-	-	-	planktonic
Hydractinia sp.	+	-	-	+	+	-	-	+	+	-	-	+	
Hydrallmania sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Lafoea sp.	+	-	-	-	+	+	-	-	-	-	+	+	
Lensia conoidea	+	-	-	-	+	-	-	-	-	-	-	-	

Table A cont'd

SPECIES PHYLUM Cnidaria cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Hydrozoa cont'd													
Obelia sp.	+	+	-	-	+	+	+	+	+	+	+	+	
Ophiodissa sp.	+	-	-	-	+	-	-	-	-	-	-	+	
Perigonimus sp.	+	-	-	+	+	+	-	-	-	-	-	+	
Plumularia sp.	+	+	-	-	+	+	+	+	-	+	+	+	
Polyorchis sp.	+	-	+	-	+	+	+	+	-	+	-	+	planktonic
P. penicillatus	+	-	-	-	+	+	-	-	-	+	+	+	
Proboscidactyla flavicirrata	+	-	+	-	+	-	-	+	-	-	-	-	planktonic
Sarsia tubulosa	+	+	-	-	+	-	-	+	-	-	-	-	planktonic
Sertularella sp.	+	-	-	-	+	+	-	-	-	-	-	+	
Sertularia sp.	+	-	-	+	+	+	-	-	-	-	-	+	
Syncoryne sp.	+	-	-	+	-	-	-	-	-	-	+	+	
Thuiaria sp.	+	+	-	-	+	-	-	+	-	-	-	+	
T. argentea	+	+	-	-	+	-	-	+	+	-	-	+	
Tubularia sp.	+	-	+	+	+	+	+	+	+	+	+	+	
Velella velella	+	+	-	-	+	+	-	-	-	+	-	-	planktonic
Class Scyphozoa (Jelly fishes)													
Haliclystus auricula	+	+	-	+	+	-	-	+	+	+	-	-	grows on eelgrass
Kisshinouyea sp.	+	-	-	-	+	-	-	-	-	-	-	+	
Manania sp.	+	-	-	-	+	+	+	+	-	-	+	+	
Phacellophora camschatica	+	-	-	-	+	-	-	+	+	+	-	-	

Table A cont'd

SPECIES PHYLUM Cnidaria cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Anthozoa (sea anemones and corals)													
Actinostola sp.	-	+	-	-	+	-	-	+	+	+	+	-	
Anthopleura artemisia	+	-	-	-	+	+	+	+	-	+	+	+	
A. elegantissima	+	+	-	+	+	+	+	+	-	-	+	+	
A. xanthogrammica	+	+	-	+	+	+	+	+	-	+	+	+	
Balanophyllia elegans	+	+	-	+	+	+	+	+	-	+	+	+	
Cerianthus sp.	+	+	-	-	+	+	+	+	+	+	+	+	
Clavularia moresbii	+	-	-	-	+	+	+	-	-	-	+	+	
Diadumene sp.	+	+	-	-	+	-	-	-	-	+	-	+	
Epiactis prolifera	+	+	-	+	+	+	+	+	-	+	+	+	
Epizoanthus scotinus	-	+	-	-	+	+	-	+	-	+	+	+	
Euplexaura sp.	+	-	-	-	-	-	+	-	-	-	-	+	
Gersemia rubiformis	+	-	-	-	+	+	-	-	-	-	+	+	
Metridium senile	+	+	+	+	+	+	+	+	-	+	+	+	
Pachycerianthus fimbriatus	-	+	-	-	+	-	-	-	+	+	+	+	
Ptilosarcus gurneyi	+	+	+	-	+	+	+	+	+	+	+	+	
Stomphia coccinea	+	-	-	-	+	-	-	-	+	-	-	-	
Stylatula elongata	+	-	-	-	+	-	-	+	+	+	-	-	
Tealia sp.	+	+	-	-	+	+	+	+	-	+	+	+	
T. columbiana	+	-	-	-	+	+	+	-	-	+	+	+	
T. coriacea	+	+	-	+	+	+	+	+	+	+	+	+	
T. crassicornis	+	-	-	+	+	+	+	+	-	-	+	+	
T. lofotensis	+	+	-	+	+	+	+	+	-	-	+	+	rare intertidally

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Ctenophora (comb jellies or sea walnuts)													
Class Tentaculata													
Mertensia sp.	+	-	-	-	+	-	-	-	-	-	-	-	pelagic
Pleurobrachia pileus	+	+	-	-	+	-	-	-	-	-	-	-	pelagic
Class Nuda													
Beroë cucumis	-	+	-	-	+	-	-	-	-	-	-	-	pelagic

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Platyhelminthes (flatworms)													
Class Turbellaria													
Leptoplana acticola	+	+	-	+	-	+	+	+	-	-	+	+	
Notoplana timida	-	+	-	-	+	-	-	-	-	-	-	+	
Syndesmis franciscanus	+	-	-	-	-	-	-	-	-	-	-	-	parasitic
Class Trematoda													
Aporocotyle macfarlani	-	+	-	-	-	-	-	-	-	-	-	-	parasitic
Lecithodesmus sp.	+	+	+	-	-	-	-	-	-	-	-	-	parasitic
Ogmogaster sp.	+	+	+	-	-	-	-	-	-	-	-	-	parasitic
Psettarium sebastodorum	-	+	-	-	-	-	-	-	-	-	-	-	parasitic
Class Cestoda													
Phyllobothrium sp.	+	+	+	-	-	-	-	-	-	-	-	-	parasitic

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Nemertea (ribbon worms)													
Amphiporus bimaculatus	+	+	+	+	-	+	+	+	-	+	+	+	
Cerebratulus herculeus	-	+	-	-	+	-	-	-	+	+	-	-	
C. latus	-	+	-	-	+	-	-	-	-	+	-	-	
Emplectonema gracile	+	+	-	+	-	-	+	+	-	-	+	+	
Paranemertes peregrina	+	+	-	+	-	-	+	+	-	+	+	+	
Tetrastemma nigrifrons	-	-	+	+	-	-	-	-	-	-	-	+	
Tubulanus sp.	+	-	-	-	+	+	+	+	+	-	+	+	
PHYLUM Entoprocta													
Barentsia robusta	-	-	+	-	+	-	-	-	-	-	-	+	on Styela
PHYLUM Rotifera (Wheel animalcules)													
Unidentified species; presume no. of spp. in region													
PHYLUM Gastrotricha													
presume sev. spp. in region													
PHYLUM Kinorhyncha (=Echinodera)													
presume sev. spp. in region													
PHYLUM Nematoda (roundworms)													
presume large no. of spp. in various environments													

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Nematomorpha (hairworms)													
presume sev. spp. in region													
PHYLUM Acanthocephala													
presume sev. spp. in region - endoparasitic													

Table A cont'd

SPECIES PHYLUM Annelida (segmented worms)	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Polychaeta													
Abarenicola pacifica	+	-	-	+	+	+	+	+	+	+	-	-	
Ampharete goesi	-	+	-	-	+	-	-	-	-	-	-	-	
Amphicteis scaphobranchiata	-	+	-	-	+	-	-	-	-	-	-	-	
Aphrodita sp.	-	+	-	-	+	-	-	-	-	-	-	-	
Arabella iricolor	+	-	-	+	+	-	-	-	-	-	-	+	
Arctonoë fragilis	+	-	+	+	+	+	-	-	-	+	+	+	
A. vittata	+	-	-	+	-	-	-	-	-	-	-	-	on Diodora
Aricidae sp.	+	-	-	+	-	+	-	-	-	+	-	-	
Armandia brevis	-	+	-	-	+	-	-	-	-	-	-	-	
Boccardia proboscidea	+	-	-	-	-	-	-	-	-	-	-	-	
Callizona nasuta	+	+	-	-	+	-	-	-	-	-	-	-	
Chitinopoma groenlandica	-	+	-	-	+	-	-	-	-	-	+	+	
Chone ecuadata	+	-	-	+	-	+	+	-	-	+	+	+	
C. gracilis	+	-	-	+	-	+	-	-	-	-	+	+	
Demonax gracilis	+	-	-	+	-	+	+	-	-	-	-	-	
D. medius	+	-	-	-	-	-	-	-	-	-	-	+	
Dodecaceria fewkesi	+	+	+	+	+	+	+	+	-	+	+	+	
Dorvillea moniloceras	-	+	-	+	-	-	-	-	-	-	+	+	
Eudistylia vancouveri	+	+	-	+	+	+	+	+	-	+	+	+	
Eulalia viridis	+	-	-	+	-	-	-	-	-	-	-	+	
Euzonus mucronata	+	-	-	+	-	+	+	-	-	+	-	-	
Fabrica minuta	+	-	-	+	-	+	+	-	-	-	+	+	
Glycera americana	-	+	-	-	+	-	-	-	+	-	-	-	
G. capitata	-	+	-	-	+	-	-	-	-	+	+	-	
G. gigantea	-	+	-	-	+	-	-	-	-	+	+	+	
Glycinde armigera	-	+	-	-	+	-	-	-	-	-	-	-	

Table A cont'd

SPECIES PHYLUM Annelida (segmented worms)cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Polychaeta cont'd													
Goniada brunnea	-	+	-	-	+	-	-	-	+	-	-	-	
Halosydna brevisetosa	+	-	-	+	-	-	-	-	-	+	+	+	
Hemipodus borealis	-	+	-	-	+	-	-	-	+	-	-	-	
Idanthyrus armatus	-	+	-	-	+	-	-	-	-	-	-	+	
Lumbrineris latreilli	-	+	-	-	+	-	-	-	+	-	-	-	
Magelona sp.	-	+	-	-	+	-	-	-	+	+	+	+	
Myxicola infundibulum	+	+	-	-	+	+	+	+	+	+	+	+	
Nephtys caecoides	+	-	-	+	-	+	+	-	-	+	+	+	
N. californiensis	+	-	-	+	-	+	+	-	-	+	-	+	
Nereis vexillosa	+	+	-	+	-	+	+	+	-	+	+	+	
Nerine cirratulus	+	-	-	+	-	-	-	-	-	+	-	-	
Odontosyllis phosphorea	+	-	-	+	-	-	-	-	-	+	+	+	
Onuphis elegens	+	-	-	+	-	-	-	-	-	+	-	-	
Pectinaria belgica	-	+	-	-	+	-	-	-	+	+	-	-	
P. brevicoma	-	+	-	-	+	-	-	-	+	+	-	-	
Phyllochaetopterus prolifica	-	+	-	-	+	-	+	+	+	+	+	+	
Pista elongata	-	-	+	-	+	-	-	-	-	-	-	+	
P. fasciata	+	-	-	-	+	-	-	-	+	-	-	-	
P. moorei	-	+	-	-	+	-	-	-	-	-	-	-	
Protocapitella simplex	+	-	-	+	-	-	-	-	-	-	+	+	
Pseudopotamilla reniformis	-	+	-	-	+	-	-	-	+	-	-	-	
Sabellaria cementarium	+	-	-	-	+	+	-	-	-	+	+	+	
Serpula vermicularis	+	+	+	+	+	+	+	+	-	+	+	+	
Spirorbis granulatus	+	-	-	+	-	+	+	-	-	-	+	+	
S. racemosus	-	+	-	+	-	+	+	-	-	+	+	+	
S. spirillum	+	-	-	+	-	+	+	-	-	-	+	+	

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Annelida (segmented worms)cont'd													
Class Polychaeta cont'd													
Sternaspis scutata	-	+	-	-	+	-	+	-	+	-	-	-	
Syllus elongata	+	-	-	+	-	+	+	-	-	-	+	+	
Tomopteris cavallii	+	+	-	-	+	-	-	-	-	-	-	-	
T. septentrionalis	+	+	-	-	+	-	-	-	-	-	-	-	
Travisia pupa	-	+	-	-	+	-	-	-	-	-	-	-	

Table A cont'd

SPECIES PHYLUM Mollusca	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Amphineura (Chitons)													
Chaetopleura gemma	-	-	+	-	-	-	-	-	-	-	+	+	
Cryptochiton stelleri (gumboot chiton)	+	+	+	+	+	+	+	+	-	-	+	+	
Cyanoplax hartwegii	-	+	-	-	+	-	-	+	-	-	+	+	
Ischnochiton mertensii	-	+	-	-	+	-	-	-	-	-	-	+	
I. radians	-	+	-	-	+	-	-	-	-	+	+	+	
Katharina tunicata (black Katy)	+	+	+	+	-	+	+	+	-	-	+	+	
Lepidochiton flectens	-	+	-	-	-	-	+	+	-	-	+	+	
Lepidopleurus internexus	-	+	-	-	-	-	+	+	-	-	+	+	
Mopalia ciliata	+	+	-	+	-	+	+	-	-	-	+	+	
M. hindsii	+	+	-	+	+	+	+	-	-	-	+	+	
M. lignosa	+	+	-	+	-	+	+	-	-	-	+	+	
M. muscosa (mossy chiton)	+	+	+	+	+	-	+	+	-	-	+	+	
Placiphorella velata	-	+	+	-	+	-	+	+	-	+	+	+	
Tonicella insignis (red-lined chiton)	+	+	-	+	-	+	+	+	-	-	+	+	
T. lineata	+	+	+	+	+	+	+	+	-	+	+	+	
T. ruber	-	+	-	+	+	+	-	-	-	-	+	+	

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Mollusca cont'd													
Class Cephalopoda (Octopus, Squid)													
Loligo opalescens	+	+	-	-	+	-	-	-	-	-	-	-	
Octopus dofleini	+	+	+	-	+	-	-	-	-	-	-	+	
Rossica pacifica	-	+	-	-	+	-	-	-	-	-	-	-	
Class Scaphopoda (Tusk Shells)													
Dentalium sp. (money tusk, wampum)	+	-	+	-	+	-	-	-	+	-	-	-	

Table A cont'd

SPECIES PHYLUM Mollusca cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Gastropoda													
Subclass Prosobranchia													
Acmaea cassis	+	-	-	+	-	-	-	-	-	+	+	+	
A. mitra (whitecap limpet)	+	+	-	+	+	+	+	+	-	+	+	+	
A. rosacea	-	-	+	+	+	-	+	+	-	+	+	+	
Acteocina culcitella	+	+	-	+	+	-	-	-	-	-	+	+	
Admete couthouyi	+	-	-	-	+	-	-	-	-	+	+	-	
Agrobuccinum oregonensis	-	+	-	+	+	-	-	-	-	-	+	+	
Alvania carpenteri	+	+	-	+	+	-	-	-	-	+	+	+	
A. compacta	-	+	-	-	+	-	-	-	-	+	+	+	
Amphissa columbiana	+	+	+	+	+	-	+	+	+	+	+	+	
A. reticulata	-	+	-	+	+	-	+	+	-	+	+	-	
A. versicolor	-	+	-	+	+	-	+	+	-	+	+	+	
Antiplanes thalea	+	-	+	-	+	-	-	-	-	-	-	-	
A. perversa	+	-	+	-	+	-	-	-	+	-	+	-	
A. vinosa	+	-	-	-	+	-	-	-	-	-	+	-	
A. voyi	+	-	-	-	+	-	-	-	-	-	+	-	
Astraea gibberosa (red turban)	+	+	-	+	+	+	+	+	-	-	+	+	
Balcis micans	-	+	-	+	+	-	-	+	-	+	+	-	
Barleeia sanjuanensis	-	+	-	-	+	+	+	-	-	+	+	+	
B. subtenuis	-	+	-	-	+	+	+	-	-	+	+	+	
Beringius eyerdami	+	-	+	-	+	-	-	-	-	+	+	-	
Bittium attenuatum (slender Bittium)	-	+	-	+	+	-	-	-	-	-	+	+	
B. boreale	-	+	-	-	+	-	-	-	-	-	+	+	
B. eschrichtii (threaded Bittium)	-	+	+	+	-	-	-	-	+	+	+	+	

Table A cont'd

SPECIES PHYLUM Mollusca cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Subclass Prosobranchia cont'd													
B. munitum	-	+	-	-	+	-	-	-	-	+	+	-	
B. vancouverense	-	+	-	-	+	-	-	-	-	+	-	+	
Boreotrophon macouni	-	+	+	-	+	-	-	-	+	+	-	-	
B. multicostata	-	-	+	-	+	-	-	-	+	+	-	-	
B. pacificus	+	+	+	-	+	-	-	-	+	+	-	-	
B. tenuisculptus	-	+	+	-	+	-	-	-	+	+	-	-	
Buccinum plectrum	+	-	+	-	+	-	-	-	-	+	+	-	
B. strigillatum	+	-	+	-	+	-	-	-	-	+	+	-	
Calliostoma annulatum (ringed top-shell)	-	+	+	+	+	+	-	-	-	-	+	+	uncommon intertidally
C. caeruleum	-	-	+	-	+	+	-	-	-	-	+	+	
C. canaliculatum	+	+	-	+	+	+	-	-	-	-	+	+	
C. ligatum (blue top-shell)	+	+	-	+	+	+	+	+	-	-	+	+	
C. platinum	+	+	-	-	+	+	-	-	-	-	+	+	
C. variegatum	+	+	-	+	+	+	-	-	-	-	+	+	
Calyptraea fostigata (Chinese hat shell)	-	+	-	+	+	-	-	-	-	-	+	+	
Ceratostoma foliata (leafy hornmouth)	+	+	+	+	+	+	+	+	-	+	+	+	
Cidarina cidaris	-	-	+	-	+	+	-	-	+	-	+	+	
Collisella digitalis (fingered limpet)	+	+	+	+	-	+	+	+	-	-	+	+	
C. instabilis (unstable limpet)	+	-	+	+	+	-	-	+	-	+	-	+	
C. pelta (shield limpet)	+	+	+	+	-	+	+	+	-	-	+	+	
C. strigatella	+	+	-	+	-	+	+	+	-	+	+	+	

Table A cont'd

SPECIES PHYLUM Mollusca cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Subclass Prosobranchia cont'd													
Colus sp.	-	+	-	-	+	-	-	-	-	+	+	-	deep subtidal - rare
Crepidula adunca (hooked slipper-shell)	+	+	+	+	+	+	+	+	-	+	+	+	
C. lingulata (wrinkled slipper-shell)	-	-	+	+	-	-	-	-	-	-	-	+	
C. nummaria (white slipper-shell)	+	+	+	+	+	-	+	-	-	-	+	+	
C. orbiculata	-	+	-	+	+	-	-	-	-	+	+	+	
Crepipatella lingulata (half slipper-shell)	-	+	-	+	+	-	-	+	-	+	+	+	
Cypraeolina pyriformis (pear-shaped marginella)	+	-	+	+	+	-	+	-	+	+	+	+	
Diodora aspera (rough keyhole limpet)	+	+	+	+	+	+	+	+	-	+	+	+	
Epitonium acrostephanus	-	+	-	-	+	+	-	+	-	+	+	+	
E. caamanoi	-	+	-	-	+	-	+	+	-	+	+	+	
E. catalinae	+	+	-	-	+	-	-	-	-	+	+	-	
E. crebricostatum	-	+	-	-	+	-	+	-	-	+	+	-	
E. denisclathrata	-	+	-	-	+	-	+	-	-	+	+	+	
E. indianorum	+	+	-	+	+	+	+	-	-	+	+	-	
Exilioidea rectirostris	+	-	+	-	+	-	-	-	+	-	-	-	
Fusitriton oregonensis (Oregon triton)	-	+	-	+	+	-	-	-	-	-	+	+	
Haliotis kamtschatkana (Northern abalone)	+	+	-	+	+	+	+	+	-	-	+	+	
Halistylus pupoides	-	+	-	-	-	-	-	-	-	+	+	+	
Hipponix cranoides (flat hoof-shell)	+	-	+	+	-	-	+	+	-	-	+	+	

Table A cont'd

SPECIES PHYLUM Mollusca cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Subclass Prosobranchia cont'd													
Homalopoma bacula	-	+	-	-	+	-	-	-	-	+	+	-	
H. luridum (carpenter dwarf turban)	+	+	-	+	+	-	-	-	-	+	+	+	
Lacuna carinata (wide chink-shell)	+	+	-	+	-	-	-	-	-	+	+	+	
L. variegata (variegated chink-shell)	-	+	-	+	-	-	-	-	-	-	+	+	
L. solidula	-	+	-	+	-	-	-	-	-	-	+	+	
L. vincta	-	+	-	+	-	-	-	-	-	-	+	+	
Lamellaria rhombica	+	+	-	-	+	+	-	-	-	+	+	+	
L. stearnsii	+	+	-	+	+	+	-	-	-	+	+	+	
Lepeta alba	-	+	-	-	+	+	-	-	-	-	-	+	
Littorina scutulata (checkered periwinkle)	+	+	-	+	-	+	+	+	-	-	+	+	
L. sitkana (sitka periwinkle)	+	+	-	+	-	-	+	+	-	-	+	+	
Lottia gigantea (owl limpet)	-	-	+	+	-	-	-	-	-	-	-	+	
Mangelia arteaga	-	+	-	-	+	-	-	-	-	-	+	-	
M. hecatae	-	+	-	-	+	-	-	-	-	-	+	-	
M. newcombei	-	+	-	-	+	-	-	-	-	-	+	-	
Margarites costatus	+	+	-	-	+	-	-	-	-	+	+	+	
M. funiculatus	-	+	-	+	+	-	-	-	-	+	+	+	
M. lacunatus	-	+	-	+	+	-	-	-	-	+	+	-	
M. lirulatus (lirulate margarite)	-	+	-	+	+	-	-	+	-	-	+	+	
M. parcipictus	-	+	-	+	+	-	-	-	-	+	+	-	
M. pupillus (puppet margarite)	+	+	-	+	+	+	-	+	-	-	+	+	

Table A cont'd

SPECIES PHYLUM Mollusca cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Subclass Prosobranchia cont'd													
M. rhodius	+	+	-	-	+	+	-	-	-	+	+	+	
M. succinctus (tucked Margarite)	+	+	-	+	+	-	+	+	-	+	+	+	
M. tenuisculptus	+	+	-	-	+	-	-	-	-	-	+	+	
Marginella sp.	-	-	+	+	+	-	-	-	-	-	+	+	
Megatebennus bimaculatus (spotted keyhole limpet)	+	+	+	+	+	+	-	+	-	-	+	+	
Micranellum barkleyense	-	+	-	-	+	-	-	-	-	+	+	-	
Mitrella carinata (dove shell)	+	-	-	+	+	+	-	-	+	+	+	+	
M. gouldii	+	+	-	-	+	+	-	-	+	+	+	+	
M. hypodra	-	+	-	-	+	+	-	-	-	-	+	+	
M. tuberosa	-	+	-	-	+	+	-	-	-	-	+	+	
Nassarius cooperi	+	+	-	-	+	-	-	-	-	-	-	-	
N. fossatus (channeled dog whelk)	+	+	+	+	-	-	+	-	+	+	+	+	
N. hypodra	-	+	-	-	-	-	-	-	-	-	-	-	
N. mendicus (lean dog whelk)	+	+	-	+	+	-	-	+	-	-	+	+	
N. perpinguis	+	-	-	+	+	-	-	-	-	-	+	+	
Natica aleutica	+	+	-	+	+	-	-	-	-	+	+	+	
Neptunea ithia	+	-	-	-	+	-	-	-	-	-	+	+	
N. phoeniceus	+	-	-	-	+	-	-	-	-	-	+	+	
N. smirnia	+	-	+	-	+	-	-	-	-	-	+	+	
N. stilesi	-	+	-	-	+	-	-	-	-	+	+	+	
N. tabulata	-	+	-	-	+	-	-	-	-	+	+	+	
Nitadella gouldi	+	+	-	+	-	-	+	+	-	+	+	+	

Table A cont'd

SPECIES PHYLUM Mollusca cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Subclass Prosobranchia cont'd													
Notoacmea inessa	-	+	-	+	+	+	+	-	-	-	-	+	
N. persona	+	+	+	+	-	+	+	+	-	+	+	+	
N. scutum	+	+	+	+	-	+	+	+	-	+	+	+	
Ocenebra atropurpurea	+	+	+	+	+	+	-	-	-	-	+	+	
O. interfossa (sculptured rock shell)	+	+	+	+	+	+	-	-	-	-	+	+	
O. lurida (lurid rock shell)	+	+	+	+	-	+	+	+	-	-	+	+	
Odostomia angularis	-	+	-	+	+	-	-	-	-	+	+	-	
O. barkleyensis	-	+	-	+	+	-	-	-	-	+	+	+	
O. canfieldi	-	+	-	+	+	-	-	-	-	-	+	-	
O. deliciosa	-	+	-	+	+	-	-	-	-	+	+	+	
O. kennerlyi	-	+	-	+	+	-	-	-	-	+	+	+	
O. quadrae	-	+	-	+	+	-	-	-	-	+	+	+	
O. saturna	+	-	-	+	+	-	-	-	-	-	+	+	
O. spreadboroughi	-	+	-	+	+	-	-	-	-	-	+	+	
O. stephensae	-	+	-	+	+	-	-	-	-	+	+	+	
O. tenuisculpta	-	+	-	+	+	-	-	-	-	+	+	+	
O. valdezi	-	+	-	+	-	-	-	-	-	-	+	+	
O. vancouverensis	-	+	-	+	+	-	-	-	-	+	+	+	
O. youngi	-	+	-	+	+	-	-	-	-	-	+	+	
Olivella baetica (brown olive shell)	+	+	-	+	+	+	-	-	-	+	-	-	
O. biplicata (purple olive shell)	+	+	-	+	+	+	+	+	-	+	-	-	
Onchidella borealis	+	+	-	+	-	+	+	+	-	+	+	+	
Opalia borealis	-	+	-	+	+	-	-	-	-	+	+	-	

Table A cont'd

SPECIES PHYLUM Mollusca cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Subclass Prosobranchia cont'd													
O. chacei	+	-	-	+	+	-	-	-	-	+	+	-	
O. evicta	+	-	-	-	+	-	-	-	-	-	+	+	
O. wroblewskii	+	+	-	-	+	-	-	-	-	+	+	+	
Polinices draconus	+	-	-	-	+	-	-	-	+	+	+	-	
P. lewisii (Lewis moon-snail)	+	+	+	+	+	-	+	+	+	+	+	-	
P. pallida	+	+	-	-	+	-	-	-	-	+	+	-	
Puncturella cooperi	-	+	-	-	+	-	-	-	-	+	+	+	
P. cucullata	+	+	-	-	+	-	-	-	-	+	+	+	
P. galeata	-	-	+	-	+	-	-	-	-	+	+	+	
P. multistriata	+	+	-	+	+	-	-	-	-	+	-	+	
Searlesia dira (dire whelk)	-	+	+	+	+	+	+	-	+	+	+	+	
Solariella nuda	+	+	-	-	+	-	-	-	-	+	+	-	
S. permabilis	+	-	-	-	+	-	-	-	-	+	+	+	
Tegula funebralis (black top shell)	+	+	+	+	-	+	+	+	-	-	+	+	
T. pulligo (dusky turban)	+	+	-	+	+	+	+	+	-	-	+	+	
Thais canaliculata (channeled purple)	+	+	-	+	-	+	+	+	-	-	+	+	
T. emarginata (short-spired purple)	+	+	-	+	-	+	+	+	-	-	+	+	
T. lamellosa (wrinkled purple)	+	+	+	+	+	+	+	+	+	-	-	+	
T. lima (rough purple)	+	-	+	+	+	-	+	-	-	-	+	+	
Trichotropis borealis	-	-	+	+	+	-	-	-	-	+	+	+	
T. cancellata (checkered hairy snail)	+	+	-	+	+	+	+	+	-	-	+	+	

Table A cont'd

SPECIES PHYLUM Mollusca cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Subclass Prosobranchia cont'd													
Turbonilla barkleyensis	-	+	-	-	+	-	-	-	-	+	-	-	
T. eschscholtzi	-	+	-	-	+	-	-	-	-	+	-	-	
T. macouni	-	+	-	-	+	-	-	-	-	+	-	-	
T. newcombei	-	+	-	-	+	-	-	-	-	+	-	-	
T. pesa	-	+	-	+	+	-	-	-	-	+	-	-	
T. rinella	-	+	-	+	+	-	-	-	-	+	-	-	
T. serrae	-	+	-	+	+	-	-	-	-	+	-	-	
T. talma	-	+	-	+	+	-	-	-	-	+	-	-	
T. taylori	-	+	-	+	+	-	-	-	-	+	-	-	
T. valdezi	-	+	-	+	+	-	-	-	-	+	-	-	
T. vancouverensis	-	+	-	+	+	-	-	-	-	+	-	-	
T. victoriana	-	+	-	+	+	-	-	-	-	+	-	-	
Velutina laevigata (velvet snail)	+	-	+	+	+	+	-	-	-	-	+	+	
V. prolongata	-	+	-	+	+	+	-	-	-	-	+	+	
Vermetus compactus	-	+	-	+	-	-	-	-	-	-	+	+	
Volutharpa ampulacea	-	+	-	-	+	-	-	-	-	+	+	-	
Subclass Opisthobranchia													
Anisodoris nobilis	+	+	+	-	+	+	+	-	-	+	+	+	
Archidoris montereyensis	+	+	-	+	+	+	+	+	-	+	+	+	
Archtonchis borealis	-	+	+	+	-	+	-	-	-	-	+	+	
Armina californica	+	+	-	-	+	-	-	+	+	-	-	-	
Cadlina flavomaculata	+	-	-	-	+	-	-	-	-	+	+	+	
C. luteomarginata	+	+	+	-	+	+	+	+	-	+	+	+	
Cratena longicauda	-	+	-	-	+	-	-	-	-	+	-	-	

Table A cont'd

SPECIES PHYLUM Mollusca cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Subclass Opisthobranchia cont'd													
Cylichna nucleola (cup-shell)	-	+	-	-	+	-	-	-	+	-	-	-	
Dendrodoris fulva	-	+	-	-	+	-	-	-	-	-	+	+	
Dendronotus iris	-	+	-	-	+	-	+	+	-	+	+	+	
D. rufus	-	+	-	+	+	-	-	-	-	+	+	+	
Diaulula sandiegensis	+	+	-	+	+	+	+	+	-	+	+	+	
Dirona albolineata	+	+	-	-	+	+	+	-	-	+	+	+	
Discodoris heathi	+	+	-	-	+	+	+	+	-	+	+	+	
Gastropteron cinerum	+	-	+	-	+	-	-	-	+	-	+	-	
G. pacificum	-	-	+	-	+	-	-	-	+	-	-	-	
Haminoea vesicula (white bubble shell)	+	-	-	+	-	-	-	+	+	+	+	-	
H. virescens	+	+	-	+	+	-	-	-	+	-	+	-	
Hermissenda crassicornis	+	+	-	+	+	+	+	+	-	+	+	+	
Melibe leonina	-	+	-	+	-	+	-	-	-	-	+	+	
Phyllaplysia taylori	+	-	-	-	+	-	-	+	+	-	-	-	
Polycera tricolor	+	-	-	-	+	-	-	+	+	-	+	+	
Retusa sp.	-	+	-	-	+	-	-	-	-	+	-	-	
Rostanga pulchra	+	+	+	+	+	+	+	+	-	+	+	+	rare
Triopha carpenteri	+	+	-	-	+	+	+	+	-	+	+	+	
Tritonia exsulans	+	-	-	-	+	-	-	-	-	+	+	+	
T. festiva	+	+	-	-	+	+	+	+	-	+	+	+	rare
Volvulella cylindrica	-	+	-	-	-	-	-	-	-	-	-	-	

Table A cont'd

SPECIES PHYLUM Mollusca cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Bivalvia (clams, cockles mussels, oysters, etc.)													
Acila castrensis (Tent nut clam)	-	+	-	-	+	-	-	-	+	+	+	-	
Astarte sp.	-	+	-	-	+	-	-	-	-	+	+	-	
Bankia setacea (northwest shipworm)	-	+	-	+	+	-	-	-	-	+	+	+	abund. on wood
Cardiomya planetica	-	+	-	-	+	-	-	-	-	+	+	+	
Chlamys hastata (pink scallop)	-	+	-	+	+	-	-	+	+	+	+	+	adults free swimming
Chironia laperousi	-	+	-	-	+	-	+	-	-	-	+	+	
C. suborbicularis	-	+	-	-	+	-	+	-	-	-	+	+	
Clinocardium nuttalli (cockle)	+	+	-	+	+	-	-	+	+	+	+	-	
Compsomyax subdiaphana	-	+	-	-	+	-	-	-	-	+	-	-	
Crassostrea gigas (Pacific oyster)	-	+	-	+	-	-	-	+	+	+	+	+	
Cryptomya californica	+	+	-	+	+	+	+	+	+	+	+	-	
Entodesma saxicola (Northern ugly clam)	+	+	-	+	+	+	+	-	-	+	+	+	
Gari californica (sunset shell)	+	+	-	+	+	-	+	-	-	+	-	-	
Glans carpenteri	-	+	-	-	+	-	-	-	-	-	+	+	on kelp
Glycymeris subobsoleta (ark shell)	-	+	-	+	+	-	+	-	-	+	+	-	
Hiatella arctica	+	+	+	+	+	+	+	+	-	+	+	+	
H. pholadis	-	-	+	+	+	+	+	+	-	-	-	+	
Hinnites giganteus	+	+	-	+	+	+	+	+	-	+	+	+	
Humularia kennerlyi	-	+	-	+	+	-	-	+	-	+	+	-	
Kellia suborbicularis (kelly shell)	-	+	-	+	+	-	-	+	-	+	+	+	

Table A cont'd

SPECIES PHYLUM Mollusca cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Bivalvia cont'd													
Lucinoma sp.	-	+	-	+	+	-	-	-	+	+	-	-	
Lyonsia inflata	-	+	-	-	+	-	-	-	-	+	+	+	
L. saxicola	+	+	-	+	+	-	+	-	-	-	+	+	
Macoma balthica	-	-	+	+	+	-	-	+	+	+	-	-	
M. elimata	-	+	+	-	-	-	-	-	-	+	+	+	
M. inquinata	+	+	-	+	+	-	-	+	+	+	-	-	
M. nasuta	+	+	+	+	+	-	-	+	+	+	-	-	
Modiolus sp. (horse mussel)	-	+	+	+	+	-	+	+	+	+	+	+	
Mya arenaria (mud clam)	+	+	-	+	+	-	+	+	+	+	-	-	
M. truncata (blunt soft-shell clam)	+	+	-	+	+	-	+	+	+	+	-	-	
Mytilus californianus (sea mussel)	+	+	+	+	-	+	+	+	-	-	-	+	
M. edulis (bay mussel)	-	+	+	+	+	-	-	+	-	-	+	+	
Nemocardium sp.	-	+	-	-	+	-	-	-	-	+	+	-	
Nuculana acuta	-	+	-	-	+	-	-	-	-	+	+	+	
N. penderi	-	+	-	-	+	-	-	-	-	+	+	+	
Ostrea lurida (Native or Olympia oyster)	-	+	-	+	-	-	+	+	+	+	+	+	
Pandora filosa	-	-	+	-	+	-	-	-	+	+	-	-	
P. glacialis	-	-	+	-	+	-	-	-	+	-	-	-	
Panopea generosa (geoduck)	+	+	-	+	+	-	+	+	+	+	+	-	
Penitella penita (piddock)	+	-	+	+	+	+	+	-	-	-	-	+	
Pododesmus macroschisma (jingle shell)	+	+	-	+	+	+	+	+	+	+	+	+	

Table A cont'd

SPECIES PHYLUM Mollusca cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Bivalvia cont'd													
Protothaca staminea (Native little-neck clam)	+	+	+	+	+	+	+	+	+	+	+	-	
Psephidia lordi (Lord pebble shell)	+	+	-	+	+	-	-	-	-	+	-	-	
Saxidomus giganteus (butter clam)	+	+	-	+	+	-	-	+	-	+	+	-	
Semele rubropicta (red-painted Semele)	+	+	-	+	+	+	-	-	-	+	+	-	
Siliqua patula (razor clam)	+	-	-	+	+	+	+	-	-	+	-	-	
Spisula catilliformis (surf clam)	-	+	-	+	-	-	-	+	-	+	-	-	
Tellina bodegensis (Bodega clam)	+	-	-	+	+	+	+	-	-	+	-	-	
T. carpenteri (carpenter tellen)	+	+	-	+	+	-	+	+	+	+	-	-	
T. modesta	+	-	-	+	+	-	+	+	-	+	-	-	
T. salmonea (salmon tellen)	+	-	-	+	+	-	+	-	-	+	-	-	
Thracia curta	-	+	-	-	-	-	-	-	-	+	+	+	
Thyasira sp.	-	+	-	-	+	-	-	-	+	+	-	-	
Tresus capax	+	+	-	+	+	-	+	+	+	+	+	-	
T. nuttalli	+	+	-	+	+	-	-	-	+	+	+	-	
Venerupis japonica (Manila clam)	-	+	-	+	-	-	+	+	+	+	+	-	
Xylophaga washingtonia	-	+	-	-	+	-	-	-	+	+	-	-	
Yoldia limatula	-	+	-	-	+	-	-	+	+	+	+	+	
Y. martyria	-	+	-	-	+	-	-	-	+	+	+	-	
Y. scissurata	-	+	-	-	+	-	-	-	+	-	-	-	

Table A cont'd

SPECIES PHYLUM Arthropoda	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Crustacea Subclass Branchiopoda Order Cladocera													
Evadne nordmanni	+	-	-	-	+	-	-	-	-	-	-	-	pelagic
Podon leuckarti	+	-	-	-	+	-	-	-	-	-	-	-	pelagic
Subclass Copepoda													
Acartia clausii	+	-	-	-	+	-	-	-	-	-	-	-	
A. longiremis	+	-	-	-	+	-	-	-	-	-	-	-	
A. danae	+	-	-	-	+	-	-	-	-	-	-	-	
Aegisthus mucronatus	+	-	-	-	+	-	-	-	-	-	-	-	
Aetideus armatus	+	-	-	-	+	-	-	-	-	-	-	-	
Aetideopsis multiserrata	+	-	-	-	+	-	-	-	-	-	-	-	
Anthessius nortoni	+	-	-	+	-	-	-	-	-	-	-	-	in Diodora
Brachiella robusta	+	-	-	-	-	-	-	-	-	-	-	-	parasitic
Calanus cristatus	+	-	-	-	+	-	-	-	-	-	-	-	
C. finmarchicus	-	+	-	-	+	-	-	-	-	-	-	-	
C. plumchrus	+	+	-	-	+	-	-	-	-	-	-	-	
Centropages abdominalis	+	-	-	-	+	-	-	-	-	-	-	-	
Chondracanthus pinguis	+	-	-	-	-	-	-	-	-	-	-	-	parasitic
Clausidium vancouverense	-	+	-	-	-	-	-	+	+	+	-	-	
Clausocalanus arcuicornis	+	-	-	-	+	-	-	-	-	-	-	-	
Clavella adunca	+	-	-	-	-	-	-	-	-	-	-	-	parasitic
C. parva	+	-	-	-	-	-	-	-	-	-	-	-	parasitic
C. perfida	+	-	-	-	-	-	-	-	-	-	-	-	parasitic
Clytemnestra rostrata	+	-	-	-	+	-	-	-	-	-	-	-	
Conaea rapax	+	-	-	-	+	-	-	-	-	-	-	-	

Table A cont'd

SPECIES PHYLUM Arthropoda cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Subclass Copepoda cont'd													
Corycaeus anglicus	+	+	-	-	+	-	-	-	-	-	-	-	
Dendrapta cameroni longiclavata	+	-	-	-	-	-	-	-	-	-	-	-	parasitic
Epilabidocera amphitrites	+	-	-	-	+	-	-	-	-	-	-	-	
Eucalanus bungii	+	+	-	-	+	-	-	-	-	-	-	-	
E. japonica	+	-	-	-	+	-	-	-	-	-	-	-	
Euchaeta propinqua	+	-	-	-	+	-	-	-	-	-	-	-	
Euchirella curticauda	+	-	-	-	+	-	-	-	-	-	-	-	
Gaetanus armiger	+	-	-	-	+	-	-	-	-	-	-	-	
Haemobaphes sp.	+	-	-	-	-	-	-	-	-	-	-	-	parasitic
Heterorhabdus longipinus	+	-	-	-	+	-	-	-	-	-	-	-	
H. proximus	+	-	-	-	+	-	-	-	-	-	-	-	
Heterostylites longicornis	+	-	-	-	+	-	-	-	-	-	-	-	
Holobomolochus occultus	+	-	+	-	-	-	-	-	-	-	-	-	parasitic
Lernaeopodina pacifica	+	-	-	-	-	-	-	-	-	-	-	-	parasitic
Lucicutia flavicornis	+	-	-	-	+	-	-	-	-	-	-	-	
Metridia lucens	+	-	-	-	+	-	-	-	-	-	-	-	
Microsetella norvegica	+	-	-	-	+	-	-	-	-	-	-	-	
M. rosea	+	-	-	-	+	-	-	-	-	-	-	-	
Nectobrachia indivisa	+	-	-	-	-	-	-	-	-	-	-	-	parasitic
Oncaea conifera	+	-	-	-	+	-	-	-	-	-	-	-	
Oithona helgolandica	+	-	-	-	+	-	-	-	-	-	-	-	
O. similis	+	+	-	-	+	-	-	-	-	-	-	-	
O. spinorostris	+	+	-	-	+	-	-	-	-	-	-	-	
Paracalanus parvus	+	-	-	-	+	-	-	-	-	-	-	-	

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Arthropoda cont'd													
Subclass Copepoda cont'd													
Phrixocephalus cincinnatus	-	+	-	-	-	-	-	-	-	-	-	-	parasitic
Pleuromamma abdominalis	+	-	-	-	+	-	-	-	-	-	-	-	
P. xiphias	+	-	-	-	+	-	-	-	-	-	-	-	
Pseudocalanus sp.	+	+	-	-	+	-	-	-	-	-	-	-	
Pseudocharopinus dentatus	+	-	-	-	-	-	-	-	-	-	-	-	parasitic
Pseudochirella obtusa	+	-	-	-	+	-	-	-	-	-	-	-	
Schistobrachia tertia	+	-	-	-	-	-	-	-	-	-	-	-	parasitic
Tigriopus californicus	+	-	-	+	-	+	-	-	-	-	-	+	
Subclass Cirripedia (barnacles)													
Balanus balanus	+	-	-	+	+	+	-	-	-	-	-	+	
B. cariosus	+	+	+	+	-	+	+	-	-	-	-	+	
B. crenatus	+	+	-	+	+	+	+	-	-	-	+	+	
B. engbergi	-	-	+	-	+	-	-	-	-	-	-	+	
B. glandula	+	+	+	+	-	+	+	-	-	-	-	+	
B. hesperius	+	-	-	-	+	-	-	-	-	+	-	-	
B. nubilus	+	+	+	+	+	+	-	-	-	-	-	+	
Chthamalus dalli	+	-	-	+	-	+	+	+	-	-	-	+	
Lepas fascicularis	+	-	-	-	+	-	-	-	-	-	-	-	pelagic
L. pectinata	+	-	-	-	+	-	-	-	-	-	-	-	pelagic
Pollicipes polymerus (goose barnacle)	+	+	+	+	+	+	+	+	-	-	-	+	
Scalpellum columbianum	+	-	-	-	+	+	+	-	-	-	-	+	

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Arthropoda cont'd													
Subclass Malacostraca Order Mysidacea													
Acanthomysis pseudomacropsis	+	-	-	+	-	-	+	+	-	-	-	+	
A. sculpta	+	-	-	+	-	-	+	+	-	-	-	+	
Archaeomysis grebnitzkii	+	-	-	+	-	+	+	-	-	+	-	-	
Eucopia unguiculata	+	+	-	-	-	-	-	-	-	-	-	-	
Holmesiella anomala	+	-	-	-	-	-	-	-	-	-	-	-	
Neomysis rayi	+	-	+	+	-	+	+	-	-	+	-	-	
N. franciscorum	+	-	-	-	-	-	-	-	-	-	-	-	
Order Isopoda (pill bugs etc.)													
Alloniscus perconvexus	+	-	-	+	-	+	-	-	-	+	-	-	
Argeia pugettensis	-	-	+	-	+	-	-	-	-	-	-	-	on Crangon
Bopyroides hippolytes	-	+	-	-	+	-	-	-	+	+	-	-	on Pandalus
Cirolana harfordi	+	+	-	+	+	+	+	+	-	-	+	+	on Haliotis
C. vancouverensis	+	-	-	-	+	-	-	-	-	-	-	+	
Exosphaeroma oregonensis	+	-	-	+	-	+	+	-	-	-	+	+	
Idotea ochotensis	+	+	+	+	+	-	-	+	+	-	-	+	
I. resecata	+	+	-	+	+	-	-	+	+	-	-	+	
I. urotoma	+	-	-	+	-	+	+	+	-	+	-	+	
I. wosnesenskii	-	+	-	+	+	-	-	+	+	-	-	+	
Ligia pallasi	+	+	+	+	-	+	+	+	-	-	+	+	
Pseudione galacanthae	+	-	-	-	-	-	-	-	-	-	-	-	on Munida
Rocinela angustata	-	+	-	-	+	-	-	-	-	-	-	-	
R. belliceps	+	-	-	-	+	-	-	-	-	-	-	-	
R. propodialis	+	-	-	-	+	-	-	-	-	-	-	-	on Hippoglossus

Table A cont'd

SPECIES PHYLUM Arthropoda cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Order Amphipoda (sand flies, beach hoppers, etc.)													
Amphithoe humeralis	+	-	-	-	+	-	-	-	-	-	-	-	
A. simulans	+	-	-	+	-	-	+	+	-	-	-	+	
Anisogammarus confervicalus	+	-	-	+	-	-	+	-	-	-	-	+	
A. pugettensis	+	-	-	+	-	-	-	-	-	-	-	-	
A. ramellus	+	-	+	+	-	-	+	+	-	+	+	+	
Atylus levidensus	+	-	-	+	-	-	-	+	-	+	-	+	
A. tridens	+	-	-	+	-	-	-	+	-	+	-	+	
Byblis sp.	+	-	-	-	+	-	-	-	+	-	-	-	
Capriella angusta	+	+	-	+	+	+	-	+	-	-	-	-	
C. californica	+	+	-	+	+	+	-	+	-	-	-	-	
C. equilibra	+	-	-	+	-	+	-	-	-	-	-	-	
C. ferrea	+	+	-	+	-	+	-	+	-	-	-	-	
C. laeviscula	+	-	-	+	+	+	-	+	-	-	-	-	
C. pustulata	+	-	-	+	-	+	-	+	-	-	-	-	
C. radiuscula	+	-	-	+	-	+	-	+	-	-	-	-	
C. verrucosa	+	+	-	+	+	+	-	-	-	-	-	-	
Corophium spinicorne	+	-	-	+	-	-	+	-	-	-	-	+	
Corophium sp.	+	-	-	+	+	-	-	-	+	-	-	-	
Cyphocaris challengeri	-	+	-	-	+	-	-	-	-	-	-	-	
Eohaustorius washingtonianus	+	-	-	+	-	-	+	-	-	+	-	-	
Euprimno sp.	-	+	-	-	+	-	-	-	-	-	-	-	
Hyale frequens	+	-	-	+	-	+	-	-	-	-	-	+	
H. pugettensis	+	-	-	+	-	-	+	+	-	-	-	+	
Hyalella azteca	+	-	-	+	-	-	-	-	-	-	-	-	
Metacaprella kennerlyi	+	-	-	+	+	+	-	+	-	-	-	-	
Monoculodes spinipes	+	-	-	+	-	+	+	-	-	+	-	+	

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Arthropoda cont'd													
Order Amphipoda cont'd													
Orchestia traskiana	+	-	-	+	-	+	+	+	+	+	+	+	under Fucus & eel grass
Orchestoidea californiana	+	-	+	+	-	+	+	-	-	+	-	+	
O. columbiana	+	-	-	+	-	-	-	-	-	+	-	-	
O. pugettensis	+	-	-	+	-	-	-	-	+	+	+	+	
Parapleustes pugettensis	+	-	-	-	+	-	-	-	-	-	-	-	
Parathemisto pacifica	+	-	-	-	+	-	-	-	-	-	-	-	
Perotripus brevis	-	+	-	+	+	+	-	+	-	-	-	-	
Pontharpinea milleri	+	-	-	+	-	-	+	+	-	+	-	-	
Synchelidium shoemakeri	+	-	-	+	-	+	-	-	-	+	-	-	
Tritella laevis	+	+	-	+	-	+	-	+	-	-	-	-	
T. pilimana	+	-	-	+	+	+	-	+	-	-	-	-	
Order Euphausiacea													
Euphausia pacifica	+	-	-	-	+	-	-	-	-	-	-	-	
Thysanoessa longipes	+	-	-	-	+	-	-	-	-	-	-	-	
T. raschii	+	-	-	-	+	-	-	-	-	-	-	-	
T. spinifera	+	-	-	-	+	-	-	-	-	-	-	-	

Table A cont'd

SPECIES PHYLUM Arthropoda cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Order Decapoda (shrimps, lobsters, crabs) Suborder Natantia													
Argis alaskensis	+	-	-	-	+	-	-	-	-	+	-	-	
A. levior	+	-	-	-	+	-	-	-	-	-	-	+	
Betaeus setosus (eye-shaded shrimp)	+	-	-	-	+	-	-	-	-	+	+	+	
B. harimani	+	-	-	-	+	-	-	-	-	+	+	+	
Crangon alaskensis	+	+	-	-	+	-	-	-	-	+	-	-	
C. alba	+	-	-	-	+	-	-	-	-	-	-	+	
C. communis	-	+	-	-	+	-	-	-	+	+	+	-	
C. franciscorum	-	-	+	-	-	-	-	-	-	-	-	-	Nitinat Lake
C. munita	+	+	-	-	+	-	-	-	+	+	+	+	
C. munitella	+	+	-	+	+	+	+	-	+	+	+	-	
C. nigricauda (black-tailed shrimp)	+	-	-	-	+	-	-	-	-	+	-	-	
C. resima	-	+	-	-	+	-	-	-	+	+	+	-	
C. spinosissima	+	+	-	-	+	-	-	-	+	+	+	-	
C. stylirostris	+	-	-	+	-	+	+	-	-	+	-	-	
Eualus avinus	-	-	+	-	+	-	-	-	-	+	-	-	
E. barbatus	-	+	-	-	+	-	-	-	+	+	+	-	
E. berkeleyorum	-	+	-	-	+	-	-	-	+	+	+	-	
E. macrophthalmus	-	+	-	-	+	-	-	-	+	+	+	-	
E. suckleyi	-	-	+	-	+	-	-	-	-	+	+	+	
E. towsendi	+	+	-	-	+	-	-	-	+	+	+	-	
Heptacarpus brevirostris	+	-	-	+	-	-	-	-	-	+	-	-	
H. decorus	-	-	+	-	+	-	-	-	-	+	+	+	
H. kincaidi	-	-	+	-	+	-	-	-	-	-	+	+	
H. moseri	-	+	-	-	+	-	-	-	+	+	+	-	

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Arthropoda cont'd													
Suborder Natantia cont'd													
H. sitchchensis	+	-	-	+	-	-	-	-	-	+	-	-	
H. stylus	-	+	-	-	+	-	-	-	+	+	+	-	
H. tenuissimus	-	+	-	-	+	-	-	-	+	+	+	-	
H. tridens	-	-	+	-	+	-	-	-	-	-	+	+	
Hippolyte clarki (glass shrimp)	-	+	-	-	+	-	-	-	+	+	+	-	
Hymenodora frontalis	-	-	+	-	+	-	-	-	-	+	+	+	
Pandalopsis dispar	-	+	+	-	+	-	-	-	-	+	+	-	
Pandalus borealis	-	-	+	-	+	-	-	-	-	+	+	+	
P. danae	+	+	-	-	+	-	-	-	-	+	+	+	
P. jordani	-	+	+	-	+	-	-	-	-	+	+	+	
P. montagui tridens	-	-	+	-	+	-	-	-	-	+	-	-	
P. platyceros	-	+	+	-	+	-	-	-	-	+	+	+	
P. stenolepsis	-	-	+	-	+	-	-	-	-	-	+	+	
Paracrangon echinata	-	+	-	-	+	-	-	-	+	+	-	-	
Pasiphaea pacifica	-	+	+	-	+	-	-	-	-	+	+	+	
Sclerocrangon alata	+	-	-	-	+	-	-	-	-	+	-	-	
Sergestes similis	-	-	+	-	+	-	-	-	+	-	-	-	
Spirontocaris arcuata (broken-back shrimp)	-	-	+	-	+	-	-	-	-	+	+	+	
S. holmesi	-	+	+	-	+	-	-	-	-	+	-	-	
S. lamellicornis	-	+	-	-	+	-	-	-	+	+	+	-	
S. murdochi	-	+	-	-	+	-	-	-	+	+	+	-	
S. sica	-	+	-	-	+	-	-	-	+	+	+	-	

Table A cont'd

SPECIES PHYLUM Arthropoda cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Suborder Reptantia Section Astacura													
Axiopsis spinulicauda	-	+	-	-	+	-	-	-	+	+	+	-	
Callianassa californiensis (red ghost shrimp)	+	-	-	+	+	-	+	+	+	+	-	-	
Upogebia pugettensis (blue mud shrimp)	+	-	+	+	-	-	-	+	+	+	+	+	
Section Anomura													
Cryptolithodes sp. (turtle crab)	+	-	-	+	+	+	+	+	-	+	+	+	
Emerita analoga (sand crab)	+	-	-	+	-	+	+	-	-	+	-	-	
Hapalogaster mertensii (red or brown hairy crab)	-	+	-	+	-	-	-	-	-	-	-	+	
Lopholithodes mandtii	-	+	-	-	+	-	-	-	-	-	-	+	
Munida quadrispina	-	+	+	-	+	-	-	-	-	+	+	+	
Oedgnathus inermis	+	+	+	+	+	+	-	-	-	-	-	+	
Orthopagurus schmitti	-	+	-	-	+	-	-	-	-	-	-	+	
Pachycheles pubescens (porcelain crab)	+	+	-	+	+	-	-	-	-	+	+	+	
P. rudis	-	+	-	+	+	+	-	-	-	+	+	+	
Paguristes turgidus	-	+	+	-	+	-	-	-	+	+	+	-	
Pagurus beringanus (hermit crab)	+	+	-	-	+	-	-	-	-	-	-	-	
P. dalli	-	+	-	-	+	-	-	-	-	-	-	+	
P. granosimanus	+	+	-	+	+	+	+	+	-	+	+	+	
P. hemphilli	+	+	+	+	+	-	+	+	-	-	+	+	
P. hirsutiusculus	-	+	-	-	+	-	-	-	-	+	+	+	
P. kennerlyi	+	+	-	-	+	-	-	-	-	-	-	-	

Table A cont'd

SPECIES PHYLUM Arthropoda cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Section Anomura cont'd													
P. ochotensis	+	+	-	-	+	-	-	-	-	+	+	-	
P. setosus	+	+	-	-	+	-	-	-	-	-	-	-	
Petrolisthes cinctipes (porcelain crab)	+	+	+	+	+	+	+	+	+	+	+	+	
P. eriomerus	+	+	+	+	+	+	+	+	-	+	+	+	
Phyllolithodes papillosus	+	-	-	-	+	+	-	-	-	-	+	+	
Placetron wosnesenskii	-	+	-	-	+	-	-	-	-	-	+	+	
Section Brachyura													
Cancer branneri	+	-	-	-	+	-	-	-	-	+	+	-	
C. gracilis	+	-	-	-	+	-	-	+	+	+	-	-	
C. magister (Dungeness crab)	+	+	-	-	+	-	-	-	+	+	+	+	
C. oregonensis	+	+	+	+	+	+	-	-	+	+	+	+	
C. productus	+	+	+	+	+	+	+	+	-	+	+	+	
Chorilia longipes	+	-	-	-	-	-	-	-	-	+	+	+	
Hemigrapsus nudus (purple shore crab)	+	+	+	+	-	+	+	+	+	+	+	+	
H. oregonensis (green shore crab)	+	+	+	+	-	-	+	+	+	+	+	+	
Hyas lyratus	+	+	-	+	+	+	+	+	+	+	+	+	
Lophopanopeus bellus	+	+	-	+	+	-	+	-	-	+	+	+	
Loxorhynchus sp.	+	-	-	+	+	-	+	-	-	-	-	+	
Mimulus foliatus	+	+	-	-	+	-	-	-	-	-	-	-	
Oregonia gracilis (spider crab)	+	+	-	-	+	-	-	-	+	-	+	+	
Pinnixa eburna (pea crabs)	+	-	-	+	+	-	-	+	+	-	-	-	commensal
P. faba	+	-	-	+	+	-	-	+	+	-	-	-	commensal

Table A cont'd

SPECIES PHYLUM Arthropoda cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Section Anomura cont'd													
P. littoralis	+	-	-	-	-	-	-	+	+	+	+	-	commensal
P. schmitti	+	+	-	-	+	-	-	+	+	-	-	-	commensal
P. tubicola	+	-	-	+	+	-	-	+	+	-	-	-	commensal
Pinnotheres taylori	+	-	-	+	+	-	-	-	-	-	-	-	commensal
Pugettia gracilis (kelp crabs)	+	+	+	+	+	+	+	+	+	-	+	+	
P. richi	+	+	-	+	+	+	+	+	+	+	+	+	
P. producta	+	+	+	-	+	+	-	-	+	+	+	+	
Scyra acutifrons	+	+	-	+	+	-	-	-	+	+	-	+	
Telmessus cheiragonus	+	-	-	-	+	-	-	+	+	-	-	-	

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Sipunculida (peanut worms)													
presume sev. spp. in region													
Phascolosoma agassizi	+	+	-	+	+	+	+	+	-	+	-	+	
PHYLUM Echiurida													
presume sev. spp. in region													
PHYLUM Priapulida													
presume sev. spp. in region													
PHYLUM Tardigrada (water bears)													
presume sev. spp. in region													
PHYLUM Pentastomida (tongue worms)													
presume sev. spp. in region													parasitic
PHYLUM Phoronida													
expect sev. spp. in region													

Table A cont'd

SPECIES PHYLUM Ectoprocta (=Bryozoa)	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Alcyonidium sp.	-	+	+	+	-	-	+	+	-	+	-	+	
Bugula californica	-	-	+	+	-	+	-	-	-	-	-	+	
Caberea boryi	-	-	+	-	+	-	-	-	-	+	+	+	
Callopora circumclathrata	-	-	+	-	+	-	-	-	-	+	+	+	
Cauloramphus spiniferum	-	+	-	-	+	-	-	-	-	+	+	+	
Cellaria diffusa	-	-	+	-	+	-	-	-	-	+	+	+	
C. mandibulata	-	-	+	-	+	-	-	-	-	+	+	+	
Corynoporella spinosa	-	-	+	-	+	-	-	-	-	+	+	+	
Costazia costazzi	+	-	+	-	+	-	-	-	-	+	+	+	
Crisia serrulata	-	+	+	+	+	+	-	-	-	-	+	+	
Crisidia cornuta	-	-	+	-	+	-	-	-	-	-	-	+	
Dendrobeania lichenoides	+	+	+	+	+	+	+	+	-	-	+	+	
Fenestrulina malusi	-	-	+	-	+	-	-	-	-	+	+	+	
Filicrisia sp.	-	+	+	+	+	+	-	-	-	-	-	+	
Flustrellidra corniculata	+	+	+	+	+	+	+	+	-	-	+	+	
Hippodiplosia insculpta	-	-	+	+	-	+	-	-	-	-	-	+	
Hippothoa hyalina	-	-	+	-	+	-	-	-	-	+	+	+	
Idmonea sp.	-	+	+	+	+	+	-	-	+	-	-	+	
Lagenipora spinulosa	-	-	+	-	+	-	-	-	-	+	+	+	
Membranipora sp.	-	+	+	-	+	+	-	-	+	+	+	+	
Myriozoum coarctatum	-	-	+	-	+	-	-	-	-	+	-	+	
M. membranacea	+	-	-	-	-	-	-	-	-	+	+	-	
M. tenue	-	-	+	-	+	-	-	-	-	+	+	+	
Phidolopora pacifica	-	+	-	-	+	-	-	-	-	-	-	+	
Scrupocellaria californica	-	-	+	-	+	-	-	-	-	+	+	+	
S. diegensis	-	-	+	-	+	-	-	-	-	+	+	+	
Tegella sp.	-	+	+	+	-	+	-	-	-	-	-	+	

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Ectoprocta (=Bryozoa) cont'd													
Tricellaria gracilis	-	-	+	-	+	-	-	-	-	+	+	+	
T. pribilof	+	-	-	+	-	-	-	-	-	+	+	-	
T. ternata	+	-	+	-	+	-	-	-	-	+	+	+	
Tubulipora sp.	+	+	+	+	+	+	+	+	-	-	+	+	

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Brachiopoda (lamp shells)													
Laqueus californianus	-	+	-	-	+	-	-	-	-	+	+	+	
Terebratalia transversa	-	+	+	-	+	-	-	-	-	+	+	+	
Terebratulina unguicula	-	+	+	-	+	-	-	-	-	-	-	+	

Table A cont'd

SPECIES PHYLUM Echinodermata	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Crinoidea (feather stars)													
Florometra serratissima	+	+	-	-	+	-	-	-	+	-	+	+	
Class Holothuroidea (sea cucumbers)													
Chirodota laevis	+	-	-	-	+	-	-	-	-	+	-	-	
Cucumaria curata	-	-	+	+	+	-	-	-	-	-	-	+	
C. lubrica	+	-	-	+	+	+	+	+	-	-	+	+	
C. miniata	+	+	+	+	+	+	+	+	-	+	+	+	
C. piperata	+	+	-	+	+	+	+	+	-	+	+	+	
C. pseudocurata	+	+	+	+	-	+	+	+	-	-	-	+	found in mussel beds
Eupentacta quinquesemita	+	-	-	+	+	+	+	+	-	-	-	+	
Leptosynapta sp.	+	-	+	-	+	-	-	-	+	+	-	+	
Parastichopus californicus	+	+	-	-	+	-	-	+	+	+	+	+	
Pentamera sp.	+	-	+	+	+	-	-	+	-	-	-	+	
Psolus chitonoides	+	+	-	-	+	+	+	+	-	+	-	+	
Class Ophiuroidea (basket stars, brittle stars)													
Amphiodia craterodmeta	+	-	-	-	+	-	-	-	-	+	-	-	
A. occidentalis	+	+	-	-	+	-	-	-	+	-	+	+	
A. urtica	-	+	-	-	+	-	-	-	+	-	+	-	
Amphipholis pugetana	-	+	+	-	+	-	-	-	+	+	-	-	
Amphioplus strongyloplax	-	+	-	-	+	-	-	-	-	+	-	-	
Gorgonocephalus caryi	+	+	-	-	+	-	-	-	+	+	-	+	
Ophiacantha normani	+	-	-	-	+	-	-	-	-	-	-	+	

Table A cont'd

SPECIES PHYLUM Echinodermata cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Ophiuroidea cont'd													
Ophiopholis aculeata	+	+	-	+	+	+	+	+	+	+	-	+	
O. bakeri	-	+	-	-	+	-	-	-	+	+	-	+	
Ophiopteris papillosa	-	+	-	-	+	-	-	-	-	-	-	+	
Ophiura luetkeni	-	+	+	-	+	+	-	-	+	+	-	+	
O. sarsi	-	+	-	-	+	-	-	-	+	+	-	+	
Class Asteroidea (sea stars)													
Crossaster papposus (rose starfish)	+	+	+	-	+	-	-	-	+	+	-	+	
Dermasterias imbricata (leather star)	+	+	+	+	+	+	+	+	+	+	+	+	
Evasterias troschelii (mottled star)	+	+	+	+	+	+	+	+	-	-	+	+	
Gephyreaster swifti	+	-	-	-	+	-	-	-	-	-	-	+	
Henricia aspera	-	-	+	-	+	-	-	-	+	+	+	+	
H. leviuscula (blood star)	+	+	+	+	+	+	+	+	+	+	+	+	
Hippasteria spinosa (spiny red starfish)	-	-	+	-	+	-	-	-	-	+	-	+	
Leptasterias hexactis (six-rayed starfish)	+	+	+	+	+	+	+	+	-	-	+	+	
Luidia foliolata	-	+	+	-	+	-	-	-	+	+	-	-	
Mediaster aequalis (equal-arm or vermillion starfish)	-	+	+	-	+	+	-	-	+	-	-	+	
Orthasterias koehleri (long-rayed starfish)	+	+	+	+	+	-	-	-	-	-	+	+	
Patiria miniata (bat star)	+	+	-	+	+	-	+	+	+	+	+	+	

Table A cont'd

SPECIES PHYLUM Echinodermata cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Asteroidea cont'd													
Pisaster brevispinus (pink short-spined starfish)	+	+	-	-	+	-	+	+	+	+	+	+	
P. ochraceus (purple star)	+	+	+	+	+	+	+	+	-	-	+	+	
Pteraster tesselatus	+	+	-	+	+	-	-	-	+	+	-	+	
Pycnopodia helianthoides (sunflower or twenty-rayed star)	+	+	+	+	+	+	+	+	+	+	+	+	
Solaster dawsoni (morning sun starfish)	+	+	+	+	+	-	-	+	-	+	+	+	
S. endeca	-	-	+	+	+	-	+	+	-	-	+	+	
S. stimpsoni (sun starfish)	+	+	+	+	+	-	-	+	+	+	+	+	
Stylasterias forreri	-	+	+	-	+	-	+	+	-	+	-	+	
Class Echinoidea (sea urchins, sand dollars)													
Allocentrotus fragilis	-	-	+	-	+	-	-	-	-	-	-	-	
Brisaster latifrons	-	+	-	-	+	-	-	-	+	-	-	-	
Dendraster excentricus (common sand dollar)	+	-	+	+	+	-	-	-	-	+	-	-	
Strongylocentrotus droebachiensis (green sea urchin)	+	+	+	+	+	+	+	-	-	-	+	+	
S. franciscanus (red sea urchin)	+	+	+	-	+	+	-	-	-	+	+	+	
S. purpuratus (purple sea urchin)	+	+	+	+	+	+	+	+	-	-	+	+	

Table A cont'd

SPECIES PHYLUM Chordata Subphylum Urochordata (sea squirts, tunicates, ascidians)	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Ascidiacea													
Aplidium californicum	+	-	-	+	+	-	-	-	-	+	+	+	
Archidistoma sp.	+	+	-	-	+	-	-	-	+	-	-	-	
Ascidia callosa	+	+	-	-	+	-	-	-	+	-	-	-	
A. paratropa	+	+	-	-	+	-	-	-	+	+	-	-	
Boltenia villosa	+	+	-	+	+	-	-	+	+	+	+	+	
Chelyosoma columbianum	-	-	+	-	+	-	-	-	+	+	-	-	
C. productum	-	+	+	+	+	+	-	-	-	+	+	+	
Ciona intestinalis	-	+	-	-	+	-	-	-	-	+	+	-	
Clavelina huntsmani	+	-	-	+	+	+	+	+	-	+	+	+	
Corella willmeriana	+	+	+	-	+	+	-	-	-	-	-	+	
Cnemidocarpa finmarkiensis	+	+	+	+	+	-	+	+	-	-	+	+	
Diplosoma sp.	+	-	-	-	+	-	-	-	-	+	+	+	
Distaplia occidentalis	+	-	-	+	-	-	-	-	-	+	+	+	
D. smithi	+	-	-	+	-	-	-	-	-	+	+	+	
Halocynthia aurantium	+	+	-	-	+	-	-	-	+	+	+	-	
H. hilgendorfi igaboja	+	+	+	-	+	-	-	-	+	+	-	-	
Metandrocarpa taylori	+	+	+	+	+	+	-	+	+	+	-	+	
Molgula pacifica	+	-	-	+	-	-	-	-	-	-	-	+	
M. pugetiensis	+	-	-	-	+	-	-	-	-	+	+	+	
Perophora annectens	+	+	-	+	-	-	-	-	-	-	-	+	
Pycnoclavella stanleyi	+	-	-	+	-	+	+	+	-	+	-	+	
Pyura haustor	+	+	+	+	+	-	+	-	-	+	+	+	
P. mirabilis	-	+	-	-	+	-	-	-	-	+	+	-	
Styela coriacea	+	-	-	-	+	-	-	-	-	+	+	+	
S. gibbsi	+	+	-	+	+	-	-	+	-	+	+	+	
S. montereyensis	+	+	+	+	+	+	+	+	-	+	+	+	

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Chordata													
Subphylum Urochordata (sea squirts, tunicates, ascidians) cont'd													
Class Ascidiacea cont'd													
S. truncata	+	-	-	+	+	-	-	-	-	+	+	+	
S. yakutatensis	+	-	-	+	-	-	-	-	-	+	+	+	
Synoicum sp.	+	-	-	+	+	-	-	-	-	+	+	+	
Tridemnum opacum	+	-	-	-	+	-	-	-	-	+	+	+	

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Chordata													
Subphylum Craniata													
Class Agnatha (hagfish, lampreys)													
Entosphenus tridentatus	+	+	-	-	+	-	-	-	-	-	-	-	
Polistotrema stoutii	+	+	-	-	+	-	-	-	-	-	-	-	
Class Chondrichthyes (= Selachii) (cartilaginous fishes) Subclass Elasmobranchii (sharks, rays, skates)													
Apristurus brunneus	+	-	-	-	+	-	-	-	-	-	-	-	
Cetorhinus maximus	-	+	-	-	+	-	-	-	-	-	-	-	
Eptatretus stouti	-	+	-	-	+	-	+	+	+	+	-	-	
Hexanchus griseus	-	+	-	-	+	-	-	-	-	-	-	-	
Prionace glauca (Blue shark)	-	+	-	-	+	-	-	-	-	-	-	-	
Raja binoculata	+	+	-	-	+	-	-	-	-	-	-	-	
R. inornata	+	+	-	-	+	-	-	-	-	-	-	-	
R. rhina	+	+	-	-	+	-	-	-	-	-	-	-	
Squalus acanthias (spiny dogfish)	+	+	-	-	+	-	-	-	-	-	-	-	
Torpedo californica	+	+	-	-	+	-	-	-	-	-	-	-	
Subclass Holocephali (chimaeras)													
Hydrolagus colliei	+	+	-	-	+	-	-	-	-	-	-	-	

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Chordata													
Subphylum Craniata cont'd													
Class Osteichthyes (bony fish)													
Alosa sapidissima (American shad)	+	+	-	-	+	-	-	-	-	-	-	-	
Agonomalus n. sp.	-	+	-	-	-	-	-	-	-	-	-	-	
Agonopsis emmelane	-	+	-	-	+	-	-	-	-	-	-	-	
Agonus acipenserinus	-	+	-	-	+	-	-	-	-	-	-	-	
Allosmerus elongatus	-	+	-	-	+	-	-	-	-	-	-	-	
Ammodytes hexapterus (Pacific sand lance)	+	+	-	-	+	-	-	-	-	-	-	-	
Anarrhichthys ocellatus (wolf-eel)	+	+	-	-	+	+	+	-	-	-	-	+	
Anoplarchus insignis	-	+	-	+	+	-	-	-	-	-	-	-	
A. purpurescens	-	+	-	-	+	-	-	-	-	-	-	-	
Anoplopoma fimbria (sablefish)	+	+	-	-	+	-	-	-	+	+	+	-	
Antimora rostrata (Pacific flatnose)	+	+	-	-	+	-	-	-	-	-	-	-	
Apodichthys flavidus	-	+	-	+	+	-	+	+	-	-	-	+	
Aptocyclus ventricosus (lumpsucker)	+	+	-	-	+	-	-	-	-	-	-	-	
Artedius fenestralis	+	+	-	-	+	-	-	-	-	-	-	-	
A. harringtoni	+	+	-	-	+	-	-	-	-	-	-	-	
A. lateralis	-	+	+	+	+	-	+	+	-	-	-	+	
Ascelichthys rhodorus	+	+	+	+	-	+	+	-	-	-	-	+	
Asemichthys taylori	-	+	-	+	-	+	+	+	-	-	-	+	
Asterotheca infraspinata	-	+	-	-	+	-	-	-	-	-	-	-	
Atheresthes stomias (arrowtooth flounder)	+	+	-	-	+	-	-	-	+	+	+	-	
Aulorhynchus flavidus	-	+	-	-	+	-	-	-	-	-	-	-	

Table A cont'd

SPECIES PHYLUM Chordata Subphylum Craniata cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Osteichthyes cont'd													
Bathyagonus nigripinnus	-	+	-	-	+	-	-	-	-	-	-	-	
Bathymaster signatus	-	+	-	-	+	-	-	-	-	-	-	-	
Blepsias cirrhosus	-	+	+	-	+	-	-	-	-	-	-	-	
Bothragonus swani	-	+	-	-	+	-	-	-	-	-	-	-	
Brachyistius frenatus	-	+	-	-	+	-	-	-	-	-	-	-	occur in kelp beds
Careproctus melanurus (snailfish)	+	+	-	-	+	-	-	-	-	-	-	-	
Chitonotus pugetensis	+	+	-	-	+	-	-	-	-	+	-	-	
Chauliodus macouni (viperfish)	+	+	-	-	+	-	-	-	-	-	-	-	
Chirolophis nugator	-	+	-	+	+	-	-	-	-	-	-	+	
Citharichthys sordidus (sanddab)	+	+	-	-	+	-	-	-	-	-	-	-	
C. stigmaeus	-	+	-	-	+	-	-	-	-	+	-	-	
Clinocottus embryum	-	+	-	-	+	-	-	-	-	-	-	-	
C. globiceps	+	+	-	+	+	-	-	-	-	-	-	+	
Clupea pallasii (Pacific herring)	+	+	+	-	+	-	-	-	+	+	+	-	spawned intertidally
Coryphaenoides filifera (rattail)	+	+	-	-	+	-	-	-	-	-	-	-	
Coryphopterus nicholsi	-	+	-	-	+	-	-	-	-	-	-	-	
Cymatogaster aggregata	-	+	-	-	+	-	-	-	-	-	-	-	
Dasycottus setiger	-	+	-	-	+	-	-	-	-	-	-	-	
Embiotoca lateralis (striped seaperch)	+	-	-	-	+	-	-	-	-	-	-	-	
Engraulis mordax (northern anchovy)	+	+	-	-	+	-	-	-	-	-	-	-	
Enophrys bison	-	+	-	-	+	-	-	-	-	-	-	-	

Table A cont'd

SPECIES PHYLUM Chordata Subphylum Craniata cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Osteichthyes cont'd													
Eopsetta jordani (petrale sole)	+	+	-	-	+	-	-	-	+	+	+	-	
Epigeichthys atropurpureus	-	+	-	-	+	-	-	-	-	-	-	-	
Gadus macrocephalus (Pacific cod)	+	+	-	-	+	-	-	-	+	+	+	-	
Gasterosteus aculeatus	-	+	-	-	+	-	-	-	-	-	-	-	
Gibbonsia montereyensis	+	+	-	-	+	+	-	-	-	-	-	-	
Gilbertidia sigalutes	-	+	-	-	+	-	-	-	-	-	-	-	
Glyptocephalus zachirus (Rex sole)	+	+	-	-	+	-	-	-	-	-	-	-	
Gobiesox maeandricus	+	+	+	+	+	+	+	+	-	-	-	+	
Hemilepidotus hemilepidotus	-	+	-	-	+	-	-	-	-	-	-	-	
H. spinosus	+	+	-	-	+	-	-	-	-	-	-	-	
Hexagrammos decagrammos	-	+	-	-	+	-	-	-	-	-	-	-	
H. lagocephalus	-	+	-	-	+	-	-	-	-	-	-	-	
Hippoglossoides elassodon (flathead sole)	+	+	-	-	+	-	-	-	-	-	-	-	
Hippoglossus stenolepis (Pacific halibut)	+	+	-	-	+	-	-	-	-	+	+	-	
Hyperprosopon ellipticum	+	+	-	-	+	-	-	-	-	-	-	-	
Hypomesus pretiosus	-	+	-	-	+	-	-	-	-	-	-	-	
Hypsagonus quadricornis	-	+	-	-	+	-	-	-	-	-	-	-	
Icelinus borealis	-	+	-	-	+	-	-	-	-	-	-	-	
I. burchami	-	+	-	-	+	-	-	-	-	-	-	-	
I. filamentosus	-	+	-	-	+	-	-	-	-	-	-	-	
I. tenuis	-	+	-	-	+	-	-	-	-	-	-	-	
Icosteus aenigmaticus (ragfish)	+	+	-	-	+	-	-	-	-	-	-	-	
Isopsetta isolepis (butter sole)	+	+	-	-	+	-	-	-	-	-	-	-	

Table A cont'd

SPECIES PHYLUM Chordata Subphylum Craniata cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Osteichthys cont'd													
Jordania zonope	-	+	+	-	+	-	-	-	-	-	-	-	
Lepidopsetta bilineata (rock sole)	+	+	-	-	+	-	-	-	-	+	+	-	
Leptocottus armatus	-	+	-	+	+	-	-	-	-	-	-	-	
Liparis cyclopus	-	+	-	-	+	-	-	-	-	-	-	-	
L. florae	-	+	-	-	+	-	-	-	-	-	-	-	
L. fucenis	-	+	-	-	+	-	-	-	-	-	-	-	
L. mucosus	+	+	-	-	+	-	-	-	-	-	-	-	
L. pulchellus	-	+	-	-	+	-	-	-	-	-	-	-	
Lumpenus sagitta	-	+	-	-	+	-	-	-	-	-	-	-	
Lycenchelys jordani	-	+	-	-	+	-	-	-	-	-	-	-	
Lycodapus parviceps	-	+	-	-	+	-	-	-	-	-	-	-	
Lycodopsis pacifica	-	+	-	-	+	-	-	-	-	-	-	-	
Lyconectes aleutensis	-	+	-	-	+	-	-	-	-	-	-	-	
Lyopsetta exilis (slender sole)	+	+	-	-	+	-	-	-	+	+	+	-	
Merluccius productus (Pacific hake)	+	+	-	-	+	-	-	-	+	+	+	-	
Microgadus proximus (Pacific tomcod)	+	+	-	-	+	-	-	-	-	-	-	-	
Microstomus pacificus (Dover sole)	+	-	-	-	+	-	-	-	-	-	-	-	
Morone saxatalis	+	-	-	-	+	-	-	-	-	-	-	-	
Myoxocephalus polyacanthocephalus	-	+	-	-	+	-	-	-	-	-	-	-	
Nautichthys oculofasciatus	-	+	-	-	+	-	-	-	-	-	-	-	
Occa verrucosa (poacher)	+	+	-	-	+	-	-	-	-	-	-	-	
Odontopyxis trispinosa	-	+	-	-	+	-	-	-	-	-	-	-	

Table A cont'd

SPECIES PHYLUM Chordata Subphylum Craniata cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Osteichthys cont'd													
Oligocottus maculosus	-	+	-	+	-	-	-	-	-	-	-	+	
O. rimensis	-	+	-	-	+	-	-	-	-	-	-	-	
O. snyderi	+	+	-	-	+	-	-	-	-	-	-	-	
Oncorhynchus keta (chum salmon)	+	+	+	-	+	-	-	-	-	-	-	-	
O. kisutch (coho salmon)	+	+	+	-	+	-	-	-	-	-	-	-	
O. nerka (sockeye salmon)	+	+	+	-	+	-	-	-	-	-	-	-	
O. tshawytscha (chinook salmon)	+	+	+	-	+	-	-	-	-	-	-	-	
Ophiodon elongatus (lingcod)	+	+	-	-	+	-	-	-	-	+	+	+	
Osmerus mordax dentex	-	+	-	-	+	-	-	-	-	-	-	-	
Oxylebius pictus	-	+	-	-	+	-	-	-	-	-	-	+	
Pallasina barbata aix	-	+	-	-	+	-	-	-	-	-	-	-	
Paraliparis deani	-	+	-	-	+	-	-	-	-	-	-	-	
Parophrys vetulus (english sole)	+	+	-	-	+	-	-	-	-	+	+	-	
Peprilus simillimus	-	+	-	-	+	-	-	-	-	-	-	-	
Pholis clemensi	-	+	-	-	+	-	-	-	-	-	-	-	
P. laeta	-	+	-	+	+	-	-	-	-	-	-	+	
P. ornata	-	+	-	-	+	-	-	-	+	-	-	-	
P. schultzi	+	+	-	-	+	+	-	-	-	-	-	-	
Phytichthys chirus	-	+	-	+	-	-	-	-	-	-	-	+	
Platichthys stellatus (starry flounder)	+	+	-	-	+	-	-	-	-	+	+	-	
Plectobranchus evides	-	+	-	-	+	-	-	-	-	-	-	-	
Pleuronichthys coenosus	-	+	-	-	+	-	-	-	-	-	-	-	

Table A cont'd

SPECIES PHYLUM Chordata Subphylum Craniata cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Osteichthyes cont'd													
P. decurrens (curlfin sole)	+	+	-	-	+	-	-	-	-	+	+	-	
Porichthys notatus	-	+	-	-	+	-	-	-	-	-	-	-	
Poroclinus rothrocki	-	+	-	-	+	-	-	-	-	-	-	-	
Psettichthys melanostictus (sand sole)	+	+	-	-	+	-	-	-	-	+	+	-	
Psychrolutes paradoxus	-	+	-	-	+	-	-	-	-	-	-	-	
Radulinus asprellus	-	+	-	-	+	-	-	-	-	-	-	-	
Reinhardtius hippoglossoides (greenland halibut)	+	+	-	-	+	-	-	-	-	+	+	-	
Rhacochilus vacca (pile perch)	+	-	-	-	+	-	-	-	-	-	-	-	
Rhamphocottus richardsoni	+	+	-	+	+	-	-	-	-	+	-	+	
Rimicola muscarum	+	+	-	-	+	-	-	-	-	-	-	-	
Ronquilus jordani	-	+	-	-	+	-	-	-	-	-	-	-	
Scorpaenichthys marmoratus	-	+	-	-	+	-	-	-	-	-	-	-	
Scytalina cerdale	-	+	-	+	-	-	-	-	-	+	+	-	
Sebastes aleutianus (rockfishes)	+	+	-	-	+	-	-	-	+	+	+	-	
S. alutus	+	+	-	-	+	-	-	-	+	+	+	-	
S. auriculatus	+	+	-	+	+	-	-	-	-	-	-	-	
S. aurora	+	+	-	-	+	-	-	-	-	-	-	-	
S. babcocki	+	+	+	-	+	-	-	-	-	-	-	-	
S. brevispinis	+	+	+	-	+	-	-	-	-	+	+	-	
S. caenaematicus	+	+	-	-	+	-	-	-	-	-	-	-	
S. caurinus	+	+	-	-	+	-	-	-	-	-	-	-	
S. crameri	+	+	-	-	+	-	-	-	+	+	+	-	
S. diploproa	+	+	-	-	+	-	-	-	+	+	+	-	
S. elongatus	+	+	-	-	+	-	-	-	-	+	+	-	

Table A cont'd

SPECIES PHYLUM Chordata Subphylum Craniata cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Class Osteichthyes cont'd													
S. entomelas	+	+	-	-	+	-	-	-	-	+	+	-	
S. flavidus	+	+	-	-	+	-	-	-	-	-	+	-	
S. helvomaculatus	+	+	-	-	+	-	-	-	+	+	+	-	
S. jordani	+	+	-	-	+	-	-	-	-	+	+	-	
S. maliger	+	+	-	-	+	-	-	-	-	-	-	-	
S. melanops	+	+	-	-	+	-	-	-	-	-	-	-	
S. melanostomus	+	+	-	-	+	-	-	-	-	-	-	-	
S. miniatus	+	+	-	-	+	-	-	-	-	-	-	-	
S. mystinus	+	+	-	-	+	-	-	-	-	-	-	-	
S. nebulosus	+	+	-	-	+	-	-	-	-	-	-	-	
S. nigrocinctus	+	+	-	-	+	-	-	-	-	-	-	-	
S. paucispinis	+	+	-	-	+	-	-	-	-	+	+	-	
S. pinniger	+	+	-	-	+	-	-	-	-	+	+	-	
S. proriger	+	+	-	-	+	-	-	-	-	+	+	-	
S. reedi	+	+	-	-	+	-	-	-	-	-	-	-	
S. ruberrimus	+	+	-	-	+	-	-	-	-	-	+	-	
S. saxicola	+	+	-	-	+	-	-	-	-	-	-	-	
S. wilsoni	+	+	-	-	+	-	-	-	-	-	-	-	
S. zacentrus	+	+	-	-	+	-	-	-	+	+	+	-	
Sebastolobus alascanus (rockfishes)	+	+	-	-	+	-	-	-	+	+	+	-	
S. altivelis	+	+	-	-	+	-	-	-	-	-	-	-	
Spirinchus thaleichthys	-	+	-	-	+	-	-	-	-	-	-	-	
Synchirus gilli	-	+	-	-	+	-	-	-	-	-	-	-	
Syngnathus griseolineatus	-	+	-	-	+	-	-	-	-	-	-	-	
Thaleichthys pacificus (eulachon)	+	+	-	-	+	-	-	-	-	+	+	-	
Theragra chalcogrammus (pollock)	+	+	-	-	+	-	-	-	+	+	+	-	

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Chordata Subphylum Craniata cont'd													
Class Osteichthyes cont'd													
Xeneretmus latifrons	+	+	-	-	+	-	-	-	-	-	-	-	
X. triacanthus	-	+	-	-	+	-	-	-	-	-	-	-	
Xererpes fucorum	+	+	-	+	-	-	-	-	-	-	-	+	lives in masses of Fucus
Xiphister mucosus	-	+	-	+	+	-	-	-	-	-	-	-	
Zaprora silenus (prowfish)	+	+	-	-	+	-	-	-	-	-	-	-	
blenny (Stichaeidae)	+	+	-	+	+	-	-	-	+	+	+	+	
eelpout (Zoarcidae)	+	+	-	-	+	-	-	-	-	-	-	-	
lanternfish (Myctophidae)	+	+	-	-	+	-	-	-	-	-	-	-	
liparids (Cyclopteridae)	+	+	-	-	+	-	-	-	-	-	-	-	
poacher (Agonidae)	+	+	-	-	+	-	-	-	-	-	-	-	
sculpin (Cottidae)	+	+	-	+	+	-	-	-	-	+	+	+	
Class Mammalia Order Pinnipeda (sea lions, seals)													
Callorhinus ursinus (Northern fur seal)	+	+	+	-	+	-	-	-	-	-	-	-	rare-migrants
Eumetopias jubatus (Steller sea lion)	+	+	+	-	+	-	-	-	-	-	-	-	
Mirounga angustirostris (Northern elephant seal)	+	-	-	-	+	-	-	-	-	-	-	-	rare
Phoca vitulina richardi (Pacific harbour seal)	+	+	+	-	+	-	-	-	-	-	-	-	
Zalophus californianus (California sea lion)	-	+	+	-	+	-	-	-	-	-	-	-	

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Chordata													
Subphylum Craniata cont'd													
Order Cetacea (whales, dolphins, porpoises)													
Balaenoptera acutorostrata (minke whale)	-	+	-	-	+	-	-	-	-	-	-	-	
B. musculus (blue whale)	+	+	+	-	+	-	-	-	-	-	-	-	
Eschrichtius gibbosus (gray whale)	+	-	+	-	+	-	-	-	-	-	-	-	
Globicephala macrorhyncha (Pacific pilot whale)	-	+	-	-	+	-	-	-	-	-	-	-	
Mesoplodon carlhubbsi	+	-	-	-	+	-	-	-	-	-	-	-	
M. stejnegeri	+	-	-	-	+	-	-	-	-	-	-	-	
Phocoena phocoena (Pacific harbour porpoise)	+	+	+	-	+	-	-	-	-	-	-	-	
Phocoenoides dalli (dall porpoise)	+	-	-	-	+	-	-	-	-	-	-	-	
Physeter catadon (sperm whale)	+	+	+	-	+	-	-	-	-	-	-	-	
Orcinus orca (killer whale)	+	+	+	-	+	-	-	-	-	-	-	-	

Table A cont'd

SPECIES PHYLUM Protozoa (Phytoplankton - diatoms)	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Achnanthes hauckiana	+	-	-	-	-	-	-	-	-	-	-	-	
A. laevis	+	-	-	-	-	-	-	-	-	-	-	-	
A. longipes	+	-	-	-	-	-	-	-	-	-	-	-	
A. pseudogroelandica	+	-	-	-	-	-	-	-	-	-	-	-	
Actinocyclus sp.	-	+	-	-	-	-	-	-	-	-	-	-	
Amphiprora sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Amphora baccata	+	-	-	-	-	-	-	-	-	-	-	-	
A. porteus	+	-	-	-	-	-	-	-	-	-	-	-	
A. pusio	+	-	-	-	-	-	-	-	-	-	-	-	
Asterionella formosa	+	-	-	-	-	-	-	-	-	-	-	-	
Auliscus sculptus	+	-	-	-	-	-	-	-	-	-	-	-	
Bacteriastrum delicatulum	-	+	-	-	-	-	-	-	-	-	-	-	
B. elongatum	+	-	-	-	-	-	-	-	-	-	-	-	
Biddulphia aurita	+	+	-	-	-	-	-	-	-	-	-	-	
Caloneis sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Campyloneis grevilleri	+	+	-	-	-	-	-	-	-	-	-	-	
Climacosphenia sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Cocconeis angermannica	+	-	-	-	-	-	-	-	-	-	-	-	
C. disculoides	+	-	-	-	-	-	-	-	-	-	-	-	
C. placentula	+	+	-	-	-	-	-	-	-	-	-	-	
C. scutellum	+	+	-	-	-	-	-	-	-	-	-	-	
C. speciosa	+	-	-	-	-	-	-	-	-	-	-	-	
C. sublitoralle	+	-	-	-	-	-	-	-	-	-	-	-	
Coscinodiscus excentricus	-	+	-	-	-	-	-	-	-	-	-	-	
C. radiatus	-	+	-	-	-	-	-	-	-	-	-	-	
Cymatopleura sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Dimeregramma minor	+	-	-	-	-	-	-	-	-	-	-	-	
Diploneis didyma	+	-	-	-	-	-	-	-	-	-	-	-	

Table A cont'd

SPECIES PHYLUM Protozoa (Phytoplankton - diatoms) cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Fragilaria sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Gomphonema sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Grammatophora marina	+	-	-	-	-	-	-	-	-	-	-	-	
Hantzschia sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Licmophora joergensii	+	-	-	-	-	-	-	-	-	-	-	-	
Melosira juergensii	+	+	-	-	-	-	-	-	-	-	-	-	
Navicula digito-radiata	+	-	-	-	-	-	-	-	-	-	-	-	
N. directa	+	+	-	-	-	-	-	-	-	-	-	-	
N. ramosissima	+	-	-	-	-	-	-	-	-	-	-	-	
Nitzschia angularis	+	-	-	-	-	-	-	-	-	-	-	-	
N. lanceolata	+	-	-	-	-	-	-	-	-	-	-	-	
N. litoralis	+	-	-	-	-	-	-	-	-	-	-	-	
N. punctata	+	-	-	-	-	-	-	-	-	-	-	-	
N. thermalis	+	-	-	-	-	-	-	-	-	-	-	-	
Nitzcqua bukibata	+	-	-	-	-	-	-	-	-	-	-	-	
Opeophora pacifica	+	-	-	-	-	-	-	-	-	-	-	-	
Paralia sulcata	+	-	-	-	-	-	-	-	-	-	-	-	
Pinnularia sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Plagiogramma sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Pseudoeunotia sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Rhabdonema sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Rhoicosphaenia curvata	+	+	-	-	-	-	-	-	-	-	-	-	
Skeletonema costatum	+	+	-	-	-	-	-	-	-	-	-	-	
Surirella crumella	+	-	-	-	-	-	-	-	-	-	-	-	
S. elegans	+	-	-	-	-	-	-	-	-	-	-	-	
S. gemma	+	-	-	-	-	-	-	-	-	-	-	-	
Synedra tabulata	+	-	-	-	-	-	-	-	-	-	-	-	
S. undulata	+	-	-	-	-	-	-	-	-	-	-	-	

Table A cont'd

SPECIES	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Protozoa (Phytoplankton - diatoms) cont'd													
Thalassionema nitzschioides	-	+	-	-	-	-	-	-	-	-	-	-	
Thalassiosira decipiens	-	+	-	-	-	-	-	-	-	-	-	-	
T. nordenskioldii	+	+	-	-	-	-	-	-	-	-	-	-	
Thalassiothrix delicatula	+	-	-	-	-	-	-	-	-	-	-	-	
T. frauenbeldii	+	-	-	-	-	-	-	-	-	-	-	-	
T. mediterranea	+	-	-	-	-	-	-	-	-	-	-	-	

Table A cont'd

SPECIES Zooplankton (Protozoans, reproductive and planktonic forms of invertebrates)	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Protozoa													
unidentified foraminferans	+	-	-	-	-	-	-	-	-	-	-	-	
unidentified radiolarians	+	-	-	-	-	-	-	-	-	-	-	-	
PHYLUM Cnidaria Class Hydrozoa													
Dipleurosoma sp.	+	+	-	-	-	-	-	-	-	-	-	-	
Lensia sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Obelia sp.	-	+	-	-	-	-	-	-	-	-	-	-	
Polyorchis penicillatus	+	-	-	-	-	-	-	-	-	-	-	-	
Proboscidactyla flavicirrata	+	-	-	-	-	-	-	-	-	-	-	-	
Saria tubulosa	+	+	-	-	-	-	-	-	-	-	-	-	
PHYLUM Ctenophora Class Tentaculata													
Mertensia sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Pleurobranchia pileus	+	-	-	-	-	-	-	-	-	-	-	-	
Class Nuda													
Beroë cucumis	-	+	-	-	-	-	-	-	-	-	-	-	
PHYLUM Nematoda													
unidentified specimens	+	-	-	-	-	-	-	-	-	-	-	-	
PHYLUM Chaetognatha													
Eukronia hamata	+	+	-	-	-	-	-	-	-	-	-	-	
Sagitta elegans	+	+	-	-	-	-	-	-	-	-	-	-	

Table A cont'd

SPECIES Zooplankton cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
PHYLUM Mollusca Class Gastropoda													
Limacina sp.	-	+	-	-	-	-	-	-	-	-	-	-	
gastropod egg case	+	+	-	-	-	-	-	-	-	-	-	-	
unidentified thecosome pteropod	-	+	-	-	-	-	-	-	-	-	-	-	
Class Pelycepoda													
bivalve larva	+	-	-	-	-	-	-	-	-	-	-	-	
PHYLUM Echinodermata													
asteriod larvae	+	-	-	-	-	-	-	-	-	-	-	-	
ophiuroid larvae	+	-	-	-	-	-	-	-	-	-	-	-	
PHYLUM Arthropoda Class Crustacea Subclass Brachiopoda Suborder Cladocera													
Evadne sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Podon sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Subclass Copepoda													
Acartia longiremis	+	+	-	-	-	-	-	-	-	-	-	-	
Amonardia sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Calanus finmarchicus	-	+	-	-	-	-	-	-	-	-	-	-	
C. plumchrus	-	+	-	-	-	-	-	-	-	-	-	-	
Centropages abdominalis	+	-	-	-	-	-	-	-	-	-	-	-	
Corycaeus anglicus	-	+	-	-	-	-	-	-	-	-	-	-	
Eucalanus bungii bungii	+	+	-	-	-	-	-	-	-	-	-	-	
Euchaeta japonica	-	+	-	-	-	-	-	-	-	-	-	-	

Table A cont'd

SPECIES Zooplankton cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Subclass Copepoda cont'd													
Harpacticus sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Metridia sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Oithona sp.	+	-	-	-	-	-	-	-	-	-	-	-	
Pseudocalanus minutus	+	+	-	-	-	-	-	-	-	-	-	-	
unidentified nauplii	+	-	-	-	-	-	-	-	-	-	-	-	
Subclass Cirripedia													
barnacle nauplius	+	+	-	-	-	-	-	-	-	-	-	-	
barnacle cypris	+	-	-	-	-	-	-	-	-	-	-	-	
Subclass Malacostraca Order Amphipoda													
Cyphocaris challengeri	-	+	-	-	-	-	-	-	-	-	-	-	
Euprimno abyssalis	-	+	-	-	-	-	-	-	-	-	-	-	
Parathemisto pacifica	-	+	-	-	-	-	-	-	-	-	-	-	
Order Decapoda													
anomuran zoea	-	+	-	-	-	-	-	-	-	-	-	-	
brachyuran zoea	+	+	-	-	-	-	-	-	-	-	-	-	
caridean zoea	+	+	-	-	-	-	-	-	-	-	-	-	
macruran zoea	+	-	-	-	-	-	-	-	-	-	-	-	
macruran megalops	+	-	-	-	-	-	-	-	-	-	-	-	
penaeidean zoea	+	+	-	-	-	-	-	-	-	-	-	-	
Order Euphausiacea													
Euphausia pacifica	-	+	-	-	-	-	-	-	-	-	-	-	
Thysanoëssa longipes	-	+	-	-	-	-	-	-	-	-	-	-	
T. spinifera	-	+	-	-	-	-	-	-	-	-	-	-	
Calyptopis larva	+	-	-	-	-	-	-	-	-	-	-	-	

Table A cont'd

SPECIES Zooplankton cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Order Mysidacea													
Neomysis	-	+	-	-	-	-	-	-	-	-	-	-	
PHYLUM Annelida Class Polychaeta													
Autolytus alexandri	-	+	-	-	-	-	-	-	-	-	-	-	
A. cornutus	+	+	-	-	-	-	-	-	-	-	-	-	
Typhloscolex muelleri	+	-	-	-	-	-	-	-	-	-	-	-	
apionid trochophore larvae	+	-	-	-	-	-	-	-	-	-	-	-	
spionid trochophore larvae	+	-	-	-	-	-	-	-	-	-	-	-	
PHYLUM Chordata Subphylum Urochorata													
Fritillaria borealis	-	+	-	-	-	-	-	-	-	-	-	-	
Oikopleura sp.	+	+	-	-	-	-	-	-	-	-	-	-	

Table A cont'd

SPECIES PHYLUM (DIVISION) Spermatophyta	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Group Zosteraceae (marine grasses)													
Phyllospadix scouleri	+	+	+	+	-	+	-	-	-	-	-	+	
P. torreyi	+	+	+	+	+	-	+	+	-	-	-	+	
Zostera marina	+	+	+	+	+	-	-	+	+	+	-	-	

Table A cont'd

SPECIES PHYLUM (DIVISION) Chlorophyta (green algae)	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Cladophora hutchinsiae	+	-	-	+	-	-	-	+	-	-	-	+	
C. microcladioides	+	-	-	+	-	+	-	-	-	-	-	+	
C. trichotoma	+	+	-	+	-	+	-	+	-	-	-	+	
Codium fragile	+	+	-	+	+	+	+	-	-	-	-	+	
C. setchellii	+	+	-	+	+	+	-	-	-	-	-	+	
Enteromorpha clathrata	-	+	-	-	+	-	+	-	-	-	-	+	epiphytic
E. intestinalis	+	+	+	+	+	+	+	+	-	-	-	+	
E. linza	+	-	-	+	-	+	-	-	-	-	-	+	
E. tubulosa	+	-	-	+	+	-	+	+	-	-	-	+	
Monostroma zostericola	+	-	-	+	-	+	+	-	-	-	-	+	epiphytic on Zostera
Prasiola meridionalis	+	+	-	+	-	+	-	-	-	-	-	+	
Rhizoclonium implexum	+	-	-	+	-	+	-	-	-	-	-	+	
Spongomorpha arcta	+	-	-	+	-	+	-	-	-	-	-	+	
S. coalita	+	-	-	+	-	+	-	-	-	-	-	+	
S. mertensii	-	+	-	+	-	+	-	-	-	-	-	+	
S. saxatilis	+	-	-	+	-	+	-	-	-	-	-	+	
S. spinescens	+	+	-	+	-	+	-	-	-	-	-	+	
Ulva expansa	-	+	-	+	+	+	-	+	-	-	-	+	
U. fenestrata	+	-	-	+	+	+	-	-	-	-	-	+	
U. lactuca	+	+	-	+	-	+	-	+	+	-	-	+	
U. rigida	+	-	-	+	-	+	-	-	-	-	-	+	
Urospora mirabilis	+	-	-	+	-	+	-	-	-	-	-	+	

Table A cont'd

SPECIES PHYLUM (DIVISION) Phaeophyta (brown algae)	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Agarum fimbriatum	-	+	-	+	+	-	+	-	-	-	-	+	
Alaria marginata	+	+	-	+	+	-	+	-	-	-	-	+	
A. nana	+	+	+	+	-	+	-	-	-	-	-	+	
A. tenuifolia	+	+	-	+	-	-	-	+	-	-	-	+	
Analipus japonicus	-	+	-	+	+	+	+	-	-	-	-	+	
Chordaria flagelliformis	-	+	-	-	+	-	+	-	-	-	-	+	
Colpomenia peregrina	-	+	-	-	+	-	+	-	-	-	-	+	
C. sinuosa	+	-	-	+	-	+	-	-	-	-	-	+	
Compsonema sp.	-	+	-	+	-	+	-	-	-	-	-	+	epiphytic
Costaria costata	+	+	-	+	+	+	+	-	-	-	-	+	
Desmarestia herbacea	-	+	-	+	+	-	+	-	-	-	-	+	
D. munda	-	+	-	+	+	-	+	-	-	-	-	+	
Egregia menziesii	+	+	-	+	+	+	+	+	-	-	-	+	
Elachistea fucicola	-	+	-	+	-	+	-	-	-	-	-	+	
Fucus distichus edentatus	+	+	+	+	-	+	-	+	+	-	-	+	
F. distichus evanescens	+	+	-	+	-	+	+	+	-	-	-	+	
Hedophyllum sessile	+	+	+	+	+	+	+	+	-	-	-	+	
Heterochordaria abientina	+	-	-	+	-	+	-	-	-	-	-	+	
Laminaria groenlandica	+	+	+	+	+	-	+	-	-	-	-	+	
L. setchellii	+	+	+	+	+	+	+	-	-	-	-	+	
Leathesia difformis	+	+	-	+	-	+	-	-	-	-	-	+	
Lessoniopsis littoralis	+	+	+	+	-	+	-	-	-	-	-	+	
Macrocystis integrifolia	-	+	-	+	+	+	+	+	-	-	-	+	
Melanosiphon intestinale	-	+	-	+	-	+	-	-	-	-	-	+	
Nereocystis luetkeana	+	+	+	-	+	+	+	-	-	-	-	+	
Pelvetiopsis limitata	-	+	-	+	-	+	-	-	-	-	-	+	epiphytic
Petalonia fascia	-	+	-	+	-	+	-	-	-	-	-	+	
Phaeostrophion irregulare	+	-	-	+	-	+	-	-	-	-	-	+	

Table A cont'd

SPECIES PHYLUM (DIVISION) Phaeophyta (brown algae) cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Pilayella littoralis	+	-	-	+	-	+	-	-	-	-	-	+	
Pleurophycus gardneri	-	+	-	+	+	-	+	-	-	-	-	+	
Postelsia palmaeformis	+	+	+	+	+	+	-	-	-	-	-	+	
Pterygophora californica	-	+	-	-	+	+	+	-	-	-	-	+	
Punctaria hesperia	-	+	-	-	+	-	+	-	-	-	-	+	epiphytic
Ralfsia fungiformis	-	+	-	-	+	-	+	-	-	-	-	+	
R. pacifica	+	+	-	+	-	+	-	-	-	-	-	+	
Sargassum muticum	+	+	-	+	+	-	-	+	-	-	-	+	
Saundersella simplex	+	-	-	+	-	+	-	-	-	-	-	+	
Scytosiphon lomentaria	+	+	-	+	-	-	-	+	-	-	-	+	

Table A cont'd

SPECIES PHYLUM (DIVISION) Rhodophyta (red algae)	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Acrochaetium pacificum	+	+	-	+	-	+	-	-	-	-	-	+	
Agardhiella tenera	-	+	-	-	+	-	+	-	-	-	-	+	
Bossiella californica	-	+	-	+	+	-	+	-	-	-	-	+	
B. chiloensis	-	+	-	-	+	-	+	-	-	-	-	+	
B. dichotoma	-	+	-	+	+	+	-	-	-	-	-	+	
B. orbigniana	-	+	-	-	+	-	+	-	-	-	-	+	
B. plumosa	-	+	-	+	+	+	-	-	-	-	-	+	
Calliarthron regenerens	-	+	-	-	+	-	+	-	-	-	-	+	
Callithamnion pikeanum	+	+	-	+	-	+	-	-	-	-	-	+	
Callophyllis flabellulata	-	+	-	-	+	-	+	-	-	-	-	+	
Ceramium californicum	-	+	-	+	+	-	+	-	-	-	-	+	epiphytic
C. codicola	-	+	-	+	+	+	-	-	-	-	-	+	epiphytic
C. pacificum	-	+	-	+	-	+	-	-	-	-	-	+	
C. washingtoniensis	-	+	-	-	+	-	+	-	-	-	-	+	
Clathromorphum compactum	-	+	-	-	+	-	+	-	-	-	-	+	
Constantinea simplex	-	+	-	+	+	+	-	-	-	-	-	+	
Corallina officinalis	-	+	-	-	+	-	+	-	-	-	-	+	
C. vancouveriensis	+	+	-	+	+	+	-	-	-	-	-	+	
Cryptopleura lobulifera	-	+	-	+	+	+	-	-	-	-	-	+	
C. ruprechtiana	-	+	-	+	+	-	+	-	-	-	-	+	
Cryptosiphonia woodii	+	+	-	+	-	+	-	-	-	-	-	+	
Dilsea californica	+	-	-	+	+	+	-	-	-	-	-	+	
Endocladia muricata	+	+	+	+	-	+	-	-	-	-	-	+	
Erythrophyllum delesserioides	+	+	-	+	+	+	-	-	-	-	-	+	
Erythrotrichia carnea	-	+	-	+	+	+	-	-	-	-	-	+	
Farlowia compressa	-	+	-	+	+	+	-	-	-	+	-	+	
F. mollis	+	-	-	+	-	+	-	-	-	-	-	+	
Farlowia sp.	+	-	-	+	-	-	-	+	-	-	-	+	

Table A cont'd

SPECIES PHYLUM (DIVISION) Rhodophyta (red algae) cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Fauchea laciniata	-	+	-	-	+	-	+	-	-	-	-	+	
Fryeella gardneri	-	+	-	-	+	-	+	-	+	+	-	-	
Gastroclonium coulteri	-	+	-	+	+	+	-	-	-	-	-	+	
Gelidium coulteri	-	+	-	+	+	-	+	-	-	+	-	+	
G. robustum	-	+	-	-	+	-	+	-	-	-	-	+	
G. sinicola	-	+	-	+	-	+	-	-	-	-	-	+	
Gigartina agardhii	-	+	-	+	-	+	-	-	-	-	-	+	
G. exasperata	+	+	-	+	+	-	+	-	-	-	-	+	
G. papillata	-	+	-	+	-	+	-	-	-	-	-	+	
Gloiopeltis furcata	+	+	-	+	-	+	-	-	-	-	-	+	
Gracilaria verrucosa	-	+	-	+	+	-	+	-	-	+	-	+	
Grateloupia doryphora	-	+	-	-	+	-	+	-	-	-	-	+	
Gymnogongrus linearis	+	-	-	+	-	-	+	-	-	-	-	+	
Halosaccion glandiforme	+	+	-	+	-	+	-	+	-	-	-	+	
Hildenbrandia occidentalis	+	+	-	+	-	+	-	-	-	-	-	+	
H. prototypus	-	-	-	-	-	-	-	-	-	-	-	+	
Iridaea sp.	+	+	-	+	-	+	-	-	-	-	-	+	
Laurencia spectabilis	+	+	-	+	+	+	-	-	-	-	-	+	
Lithophyllum imitans	-	+	-	-	+	-	+	-	-	-	-	+	
L. muricatum	-	+	-	+	-	+	-	-	-	-	-	+	
L. proboscideum	-	+	-	-	+	-	+	-	-	-	-	+	
Lithothamnion pacificum	-	+	-	+	+	-	+	-	-	-	-	+	
L. phymatodeum	-	+	-	-	+	-	+	-	-	-	-	+	
Melobesia mediocris	+	-	-	+	-	+	-	-	-	-	-	+	epiphytic
Microcladia borealis	+	+	-	+	-	+	-	+	-	-	-	+	
Odonthalis floccosa	+	-	-	+	-	+	-	-	-	-	-	+	
Opuntiella californicus	-	+	-	+	+	-	+	-	-	-	-	+	
Petrocelis franciscana	-	+	-	+	-	+	-	-	-	-	-	+	

Table A cont'd

SPECIES PHYLUM (DIVISION) Rhodophyta (red algae) cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Petrocelis sp.	+	-	-	+	-	+	-	-	-	-	-	+	
Platythamnion villosum	-	+	-	+	+	-	+	-	-	-	-	+	
Peyssonnelia pacifica	-	+	-	+	+	+	-	-	-	-	-	+	
Plocamium violaceum	+	+	-	+	-	+	-	-	-	-	-	+	
P. pacificum	+	+	-	+	+	+	-	-	-	-	-	+	
Polyneura latissima	-	+	-	+	+	-	+	-	-	-	-	-	grows on stones, wood & worm tubes
Polysiphonia hendryi	+	+	-	+	-	+	-	-	-	-	-	+	epiphytic
P. pacifica	+	-	-	+	-	+	-	+	-	-	-	+	
Polysiphonia sp.	+	-	-	+	-	+	-	-	-	-	-	+	
Porphyra lanceolata	+	-	-	+	-	-	+	-	-	-	-	+	
P. nereocystis	-	+	-	-	+	+	-	-	-	-	-	-	epiphytic on Nereocystis luetkeana
P. perforata	+	+	-	+	+	+	+	-	-	-	-	+	
P. schizophylla	-	+	-	+	-	+	-	-	-	-	-	+	
Prionitis lanceolata	+	+	-	+	+	-	-	+	-	-	-	+	
P. lyalli	-	+	-	+	+	+	+	-	-	-	-	+	
Pseudogloiosphloea confusa	-	+	-	-	+	-	+	-	-	-	-	+	
Pterosiphonia bipinnata	+	+	-	+	+	+	-	+	-	-	-	+	
P. dendroidea	-	+	-	+	+	-	+	-	-	-	-	+	epiphytic
Ptilota hypnoides	-	+	-	+	-	+	-	-	-	-	-	+	epiphytic
P. tenuis	+	-	-	+	-	+	-	-	-	-	-	+	
Pugetia fragilissima	-	+	-	-	+	-	+	-	-	-	-	-	grows on worm tubes and pebbles
Rhodoglossum californicum	-	+	-	-	+	-	+	-	-	-	-	+	
Rhodomela larix	+	+	-	+	-	+	-	-	-	-	-	+	
R. lycopodioides	-	+	-	+	-	+	-	-	-	-	-	+	

Table A cont'd

SPECIES PHYLUM (DIVISION) Rhodophyta (red algae) cont'd	Long Beach	Broken Islands	West Coast Trail	Intertidal	Subtidal	Exposed	Semi-exposed	Sheltered	Mud	Sand	Gravel	Rock (Boulders)	Remarks
Rhodoptilum plumosum	-	+	-	-	+	-	+	-	-	-	-	-	grows on wood and stones
Rhodymenia stipitata	-	+	-	+	-	+	-	-	-	-	-	+	
Schizymenia pacifica	-	+	-	+	+	+	+	-	-	-	-	+	
Smithora naiadum	+	-	-	+	+	+	+	+	+	+	-	+	epiphytic on Zostera

REFERENCES

Abbott, D. P., and W. B. Trason. 1968. Two new colonial ascidians from the west coast of North America. Bull. S. Calif. Acad. Sci. 67: 143-153.

Alderdice, D. F., and C. R. Forrester. 1971. Effects of salinity and temperature on embryonic development of the petrale sole (Eopsetta jordani). J. Fish. Res. Board Can. 28: 727-744.

1971. Effects of salinity, temperature, and dissolved oxygen on early development of the Pacific cod (Gadus macrocephalus). J. Fish. Res. Board Can. 28: 883-902.

Alverson, D. L. 1960. A study of annual and seasonal bathymetric catch patterns for commercially important groundfishes of the Pacific northwest coast of North America. Pac. Mar. Fish. Comm. Bull. 4, Washington State Department of Fisheries.

Alverson, D. L., A. T. Pruter, and L. L. Ronholt. 1964. A study of demersal fishes and fisheries of the northeastern Pacific Ocean. H. R. MacMillan Lectures in Fisheries, Institute of Fisheries, Univ. of British Columbia, Vancouver, B.C.

Anderson, R. M. 1946. Catalogue of Canadian recent mammals. Nat. Mus. Can. Bull. 102: 238 p.

Anon. 1969. Naturalists looking for stranded whales. Tofino-Ucluelet Press, Ucluelet. Feb. 27, 1969: p. 9.

Arai, M. N. 1965. A new species of Pachyceranthus, with a discussion of the genus and an appended glossary. Pac. Sci. 19: 205-218.

1971. Pachyceranthus (Ceriantharia) from British Columbia and Washington. J. Fish. Res. Board Can. 28: 1677-1680.

Arai, M. N. and J. Fulton. 1973. Diel migration and breeding cycle of Aglantha digitale from two locations in the northeastern Pacific. J. Fish. Res. Board Can. 30: 551-553.

Archerd, G. D. 1958. West coast limpets Acmaea and Fissurellidae. Veliger 1: 5-6.

Austin, W. C. 1970. Preliminary list of marine invertebrates of the Barkley Sound region. Bamfield Marine Station Rep. No. 3, Bamfield Survey Part V: 125 p.

Austin, W. C., L. D. Druehl, and S. B. Haven. 1971. Marine benthic habitats and biota in the Bamfield area. Bamfield Marine Station Rep. No. 2, Bamfield Survey Part IVa: 1-30.

Austin, W. C., and M. P. Haylock. MS 1973. Ophiuroids from the northeast Pacific: British Columbia Faunistic Survey Report. Fish. Res. Board Can. Tech. Rep. 426: 36 p.

Bailey, L. 1924. An annotated catalogue of the diatoms of Canada, showing their geographical distribution. Contrib. Can. Biol. 2: 31-67.

Bakus, G. J. 1966. Marine poecilosclerid sponges of the San Juan Archipelago, Washington. J. Zool. (London). 149: 415-531.

Banner, A. H. 1948. A taxonomic study of the Mysidacea and Euphausiacea (Crustacea) of the northeastern Pacific. I. Mysidacea, from family Lophogastridae through tribe Erythropini. Trans. Roy. Can. Inst. 27: 347-399.

1948a. A taxonomic study of the Mysidacea and the Euphausiacea (Crustacea) of the northeastern Pacific. II. Mysidacea, from tribe Mysini through subfamily Mysidellinae. Trans. Roy. Can. Inst. 27: 65-125.

Banse, K. 1963. Polychaetous annelids from Puget Sound and the San Juan Archipelago, Washington. Proc. Biol. Soc. Wash. 76: 197-208.

Barraclough, W. E. 1947. A new record of a species of agonid fish Occa verrucosa (Lockington) from the west coast of Vancouver Island, British Columbia. Can. Field Natur. 61: p. 39.

Bartsch, P. 1911. The recent and fossil mollusks of the genus Cerithiopsis from the west coast of America. Proc. U. S. Nat. Mus. 40: 327-367.

1911a. The recent and fossil mollusks of the genus Bittium from the west coast of America. Proc. U. S. Nat. Mus. 40: 383-414.

1912. The recent and fossil mollusks of the genus Alvania from the west coast of America. Proc. U. S. Nat. Mus. 41: 333-361.

1917. Description of new west American marine mollusks and notes on previously described forms. Proc. U. S. Nat. Mus. 52: 637-681.

1920. The Caecidae and other marine mollusks from the northwest coast of America. J. Wash. Acad. Sci. 10: 565-572.

Bayer, F. M., and H. B. Owre. 1968. The free-living lower invertebrates. MacMillan Co., New York. 229 p.

Bean, B. A., and A. C. Weed. 1919. Notes on a collection of fish. Trans. Roy. Soc. Can. (3rd series). 13: 69-83.

Bell, M. 1971. Annotated bibliography of the National Park, Ucluelet, B. C. Mimeo, Project No. 77/S-R.2, National and Historic Parks Branch, Ottawa. 185 p.

Belyaeva, T. 1963. The composition and the distribution of diatom algae in the surface layer of the Pacific Ocean sediments. Oceanologia 3: 684-696.

Benedict, J. E. 1903. Description of a new genus and forty-six new species of crustaceans of the family Galatheidae, with a list of the known marine species. Proc. U. S. Nat. Mus. 26: 243-334.

Berkeley, C. 1930. Symbiosis of Beroë and a flagellate. Contrib. Can. Biol. Fish. N. S. 6: 13-21.

1966. Records of some species of Polychaeta new to British Columbia and of extensions in distribution of some others. Can. J. Zool. 44: 839-849.

1967. A checklist of Polychaeta recorded from British Columbia since 1923, with references to name changes, descriptions and synonymies. I Errantia. Can. J. Zool. 45: 1049-1059.

1968. A checklist of Polychaeta recorded from British Columbia since 1923, with references to name changes, descriptions and synonymies. II Sedentaria. Can. J. Zool. 46: 557-567.

Berkeley, E. 1923. Polychaetous annelids from the Nanaimo district, 1. Syllidae to Sigalionidae. Contrib. Can. Biol. 1: 203-218.

1924. Polychaetous annelids from the Nanaimo district, 2. Phyllodocidae to Nereidae. Contrib. Can. Biol. 2: 285-293.

1927. Polychaetous annelids from the Nanaimo district, 3. Leodicidae to Spionidae. Contrib. Can. Biol. 3: 405-422.

1927a. A new genus of Chaetopteridae from the northeast Pacific: with some remarks on allied genera. Proc. Zool. Soc. London: 441-445.

1929. Polychaetous annelids from the Nanaimo district, 4. Chaetopteridae to Maldanidae. Contrib. Can. Biol. 4: 305-316.

1930. Polychaetous annelids from Nanaimo district, 5. Ammocharidae to Myzostomidae. Contrib. Can. Biol. 6: 65-77.

Berkeley, E., and C. Berkeley. 1932. On a collection of littoral Polychaeta from the west coast of Vancouver Island. Contrib. Can. Biol. 7: 309-318.

1932a. Some Capitellidae (Polychaeta) from the northeastern Pacific: with a description of a new genus. Proc. Zool. Soc. London: 669-675.

1936. Notes on Polychaeta from the coast of western Canada, 1. Spionidae. Ann. Mag. Natur. Hist. Ser. 10, 18: 468-477.

1938. Notes on Polychaeta from the coast of western Canada, 2. Syllidae. Ann. Mag. Natur. Hist. Ser. 11, 1: 33-49.

1942. North Pacific Polychaeta, chiefly from the west coast of Vancouver Island, Alaska, and Bering Sea. Can. J. Res., Sec. D, 20: 183-208.

1945. Notes on Polychaeta from the coast of western Canada, 3. Further notes on Syllidae and some observations on other Polychaeta. Errantia. Ann. Mag. Natur. Hist. Ser. 11, 12: 316-335.

1948. Polychaeta Errantia. Fish. Res. Board Can., Canadian Pacific Fauna 9 (b) 1: 1-100.

Berkeley, E., and C. Berkeley. 1950. Notes on Polychaeta from the coast of western Canada, 4: Polychaeta Sedentaria. Ann. Mag. Natur. Hist. Ser. 12, 3: 50-69.

1952. Polychaeta Sedentaria. Fish. Res. Board Can., Canadian Pacific Fauna 9 (b) 2: 1-139.

1954. Additions to the polychaete fauna of Canada, with comments on some older records. J. Fish. Res. Board Can. 11: 454-471.

1957. On some pelagic Polychaeta from the northeast Pacific north of latitude 40°N and east of longitude 175°W. Can. J. Zool. 35: 573-578.

1960. Some further records of pelagic Polychaeta from the northeast Pacific north of latitude 40°N and east of longitude 175°W, together with records of Siphonophora, Mollusca, and Tunicata from the same region. Can. J. Zool. 38: 787-799.

1962. Polychaeta from British Columbia; with a note on some western Canadian Arctic forms. Can. J. Zool. 40: 571-577.

Bernard, F. R. MS 1967. Prodrome for distributional check-list and bibliography of the recent marine mollusca of the west coast of Canada. Fish. Res. Board Can. Tech. Rep. 2: 261 p.

MS 1968. Incidence and effect of copepod Mytilicola orientalis Mori in the Pacific oyster of British Columbia. Fish. Res. Board Can. MS Rep. 993: 14 p.

1970. A distributional check-list of marine molluscs of British Columbia: based on faunistic surveys since 1950. Syesis 3: 75-94.

1972. The living Brachiopoda of British Columbia. Syesis 5: 73-82.

1972a. The genus Thyasira in western Canada (Bivalvia: Lucinacea). Malacologia 11: 365-389.

Bernard, F. R., N. Bourne, and D. B. Quayle. MS 1967. British Columbia faunistic survey. A summary of dredging activities in Western Canada, 1878-1966. Fish. Res. Board Can. MS Rep. 920: 61 p.

MS 1968. British Columbia faunistic survey. A summary of dredging activities, 1966-1967. Fish. Res. Board Can. MS Rep. 975: 6 p.

MS 1970. British Columbia faunistic survey. A summary of dredging activities, 1967-1969. Fish. Res. Board Can. MS Rep. 1082: 7 p.

Bernard, F. R., and D. C. Miller. MS 1973. Preliminary investigation on the red sea urchin resources of British Columbia (Strongylocentrotus franciscanus (Agassiz)). Fish. Res. Board Can. Tech. Rep. 400: 37 p.

Bigelow, H. B. 1916. Halimedusa, a new genus of Anthomedusae. Trans. Roy. Soc. Can. 10: 91-95.

Bigg, M. A. 1969. The harbour seal. Fish. Res. Board Can. Bull. 172: 33 p.

Bigg, M. A., and I. B. MacAskie. MS 1974. Report on Canadian pelagic fur seal research in 1972-73. Fish. Res. Board Can. MS Rep. 1292: 21 p.

Birkeland, C., P. Roe, T. Spight, R. Strathmann and R. Vance. 1968. Report on the ecology training grant field trip on the west coast of Vancouver Island, September 5 - 8, 1968. Dept. of Zoology, University of Washington (unpub. MS).

Bishop, Y. M. M., and L. Margolis. 1955. A statistical examination of Anisakis larvae (Nematoda) in herring (Clupea pallasi) of the British Columbia coast. J. Fish. Res. Board Can. 12: 571-592.

Bourne, N. MS 1969. Scallop resources of British Columbia. Fish. Res. Board Can. Tech. Rep. 104: 59 p.

MS 1969 a. Population studies on the razor clam at Masset, British Columbia. Fish. Res. Board Can. Tech. Rep. 118: 24 p.

Bourne, N., and D. B. Quayle. MS 1970. Breeding and growth of razor clams in British Columbia. Fish. Res. Board Can. Tech. Rep. 232: 42 p.

Bourne, N., and D. W. Smith. 1972. Breeding and growth of the horse clam, Tresus capax (Gould), in southern British Columbia. Proc. Nat. Shellfisheries Assoc. 62: 38-46.

Bousfield, E. L. 1958. Ecological investigations on shore invertebrates of the Pacific coast of Canada, 1955. Nat. Mus. Can. Bull. 147: 104-115.

1958a. Distributional ecology of the terrestrial Talitridae (Crustacea: amphipoda) of Canada. Proc. Tenth Intern. Congr. Entomology. 1: 833-898.

1958b. Fresh-water amphipod crustaceans of glaciated North America. Can. Field Natur. 72: 55-113.

1963. Investigations on seashore invertebrates of the Pacific coast of Canada, 1957 & 1959. I. Station List. Nat. Mus. Can. Bull. 185: 72-89.

1968. Studies on littoral marine invertebrates of the Pacific coast of Canada, 1964. Nat. Mus. Can. Bull. 223: 49-57.

Bowman, T. E., and J. C. McClain. 1967. Variation and distribution of the pelagic amphipod Cyphocaris challengeri in the northeast Pacific (Gammaridea: Lysianassidae). Proc. U. S. Nat. Mus. 122: 1-14.

Brett, J. R., J. R. Calaprice, R. J. Ghelardi, W. A. Kennedy, D. B. Quayle, and C. T. Shoop. MS 1972. A brief on mariculture. Fish. Res. Board Can. Tech. Rep. 301: 46 p.

Brinckmann-Voss, A. MS 1974. British Columbia marine faunistic survey report on the Hydrozoa: Part I. Medusae. Fish. Mar. Serv. Res. Dev. Tech. Rep. 492: 21 p.

Butler, T. H. 1959. A record of the anomuran crustacean Emerita analoga (Stimpson) from British Columbia. J. Fish. Res. Board Can. 16: p. 761.

1961. Records of decapod Crustacea from British Columbia. Can. J. Zool. 39: 59-62.

1964. Redescription of the parasitic isopod Holophryxus alaskensis Richardson, and a note on its synonymy. J. Fish. Res. Board Can. 21: 971-976.

1964a. Records of shrimps (Order Decapoda) from British Columbia. J. Fish. Res. Board Can. 21: 419-421.

1971. Eulaus berkeleyorum n.sp., and records of other caridean shrimps (Order Decapoda) from British Columbia. J. Fish. Res. Board Can. 28: 1615-1620.

Butler, T. H., A. N. Yates, and C. C. Wood. MS 1973. G. B. Reed Shrimp cruise 73-S-1, May 7-23, 1973. Fish. Res. Board Can. MS Rep. 1255: 1-46.

Calman, W. T. 1912. The Crustacea of the order Cumacea in the collection of the U. S. National Museum. Proc. U. S. Nat. Mus. 41: 603-676.

Campbell, M. 1929. Some free-swimming copepods of the Vancouver Island region. Trans. Roy. Soc. Can. 23: 303-331.

1930. Some free-swimming copepods of the Vancouver Island region (II). Trans. Roy. Soc. Can. 24: 177-182.

Campbell, R. W. 1968. The Stellar Sea-lion. The Victorian Natur. 24: 97-98.

Carl, G. C. 1959. Albinistic killer whales in British Columbia. Report of the Provincial Museum of Natural History and Anthropology, Victoria, B. C. : 29-36.

1971. Some common marine fishes of British Columbia. Brit. Columbia Prov. Mus. Handb. 23: 86 p.

1973. Guide to marine life of British Columbia. Brit. Columbia Prov. Mus. Handb. 21: 135 p.

Carlgren, O. 1949. A survey of the Ptychodactiaria, Corallimorpharia and Actiniaria. Kel. Svenska Ver. (4) 1 (1): 121 p.

Carpenter, P. P. 1864. Supplementary report on the present state of our knowledge with regard to the Mollusca of the west coast of North America. Rep. Brit. Assoc. Adv. Sci. for 1863: 517-686.

Carter, A. H. 1965. The life history and ecology of the gray whale (unpub.). Available through B. C. Provincial Museum, Victoria, B. C.

Carter, L., and J. W. Murray. 1969. Topography and bottom sediments in Barkley Sound and the adjacent continental shelf, south western British Columbia. Geol. Surv. Can. Pap. 69-1 pt. A: 12-14.

Cawley, P. 1969. Pachena Point's sea lion colony. The Daily Colonist, Victoria Magazine Section. Jan. 26, 1969: p. 16.

Chace, F. A. 1951. The grass shrimps of the genus Hippolyte from the west coast of North America. J. Wash. Acad. Sci. 41: 35-39.

Clark, H. L. 1907. The apodous holothurians. A monograph of the Synaptidae and Molpadiidae. Smithsonian Contrib. Knowledge. 35: 1-231.

1911. North Pacific ophiurans in the collection of the U. S. National Museum. U. S. Nat. Mus. Bull. 75: 1-302.

1924. Some holothurians from British Columbia. Can. Field Natur. 38: 54-57.

Clemens, W. A. 1933. A check list of marine fauna and flora of the Canadian Pacific Coast. Nat. Res. Counc. 933: 88 p.

Clemens, W. A., J. L. Hart, and G. V. Wilby. MS 1936. Analysis of stomach contents of fur seals taken off the west coast of Vancouver Island in April and May, 1935. Dept. Fish. Canada, Ottawa: 20 p.

Clemens, W. A., and G. V. Wilby. 1961. Fishes of the Pacific Coast of Canada. (2nd ed.). Fish. Res. Board Can. Bull. 68: 443 p.

Coe, W. R. 1905. Nemerteans of the west and northwest coasts of America. Bull. Mus. Comp. Zool. 67: 1-318.

Collins, F. S. 1913. The marine algae of Vancouver Island. Nat. Mus. Can. Bull. 1: 99-137.

Connell, J. H. 1970. A predator-prey system in the marine intertidal region. 1. Balanus glandula and several predatory species of Thais. Ecol. Monogr. 40: 49-78.

Cornwall, I. E. 1925. A review of the Cirripedia of the coast of British Columbia, with glossary, and key to genera and species. Contrib. Can. Biol. 2: 469-502.

1955. The barnacles of British Columbia. Brit. Columbia Prov. Mus. Handb. 7: 69 p.

Cowan, I. McT. 1936. California sea lions from British Columbia. Can. Field Natur. 50: 145-148.

1944. The Dall porpoise, Phocoenoides dalli (True), of northern Pacific Ocean. J. Mammalogy 25: 295-306.

1945. A beaked whale stranded on the coast of British Columbia. J. Mammalogy 26: 93-94.

1964. New information on the distribution of marine mollusca on the coast of British Columbia. Veliger 17: 110-113.

Cowan, I. McT., and G. C. Carl. 1945. The northern elephant seal (Mirounga angustirostris) in British Columbia waters and vicinity. Can. Field Natur. 59: 170-171.

Cowan, I. McT., and C. J. Guiguet. 1965. The mammals of British Columbia. Brit. Columbia Prov. Mus. Handb. 11: 414 p.

Cupp, E. 1943. Marine plankton diatoms of the west coast of North America. Bull. Scripps Inst. Oceanogr. Univ. Calif. 5: 1-237.

Dahl, E. 1952-53. Some aspects of the ecology and zonation of the fauna on sandy beaches. Oikos 4: 1-27.

Dales, R. P. 1963. Annelids. Hutchinson University Library, London. 200 p.

Dall, W. H. 1871. Descriptions of sixty new forms of mollusks from the west coast of North America and the north Pacific Ocean, with notes on others already described. Amer. J. Conchol. 7: 93-159.

1921. Summary of the marine shell bearing mollusks of the northwest coast of America, from San Diego, California, to the Polar Sea, mostly contained in the collection of the United States National Museum, with illustrations of hitherto unfigured species. U. S. Nat. Mus. Bull. 112: 1-217.

Dall, W. H., and P. Bartsch. 1909. A monograph of west American pyramidellid mollusks. U. S. Nat. Mus. Bull. 68: 1-258.

1910. New species of shells collected by Mr. John Macoun at Barkley Sound, Vancouver Island, British Columbia. Canada Dept. of Mines, Geol. Survey Branch Mem. 14-N: 1-22.

Darling, J. 1973. Pacific Gray Whale, (Eschrichtius glaucus Cope). National and Historic Parks Branch, Department of Indian Affairs and Northern Development: 193 p.

Davis, C. 1949. The pelagic copepods of northeastern Pacific Ocean. Univ. Wash. Publ. Biol. 14: 1-117.

Day, D., and C. R. Forrester. MS 1971. A preliminary bibliography on the trawl fishery and groundfish of the Pacific coast of North America. Fish. Res. Board Can. Tech. Rep. 246: 91 p.

Dayton, P. K. 1971. Competition, disturbance and community organization: the provision and subsequent utilization of space in a rocky intertidal community. Ecol. Monogr. 41: 351-389.

1972. Dispersion, dispersal and persistance of the annual intertidal alga, Postelsia palmaeformis Ruprecht. Ecology 54: 433-438.

Dean, D., and J. A. Blake. 1966. Life-history of Boccardia hamata Webster on the east and west coasts of North America. Biol. Bull. (Woods Hole) 130: 316- 330.

Doty, M. S. 1946. Critical tide factors that are correlated with vertical distribution of marine algae and other organisms along the Pacific coast. Ecology 27: 315-328.

Doty, M. S., and J. G. Archer. 1950. An experiment test of the tide factor hypothesis. Amer. J. Bot. 37: 458-464.

Druehl, L. B. 1966. Taxonomy and distribution of northeast Pacific species of Laminaria. Can. J. Bot. 46: 539-547.

1967. Distribution of two species of Laminaria as related to some environmental factors. J. Phycol. 3: 103-108.

1967a. Vertical distribution of some marine algae in a British Columbia inlet, as related to some environmental factors. J. Fish. Res. Board Can. 24: 33-46.

Dunnill, R. M., and E. V. Coan. 1968. A new species of the genus Macoma (Pelecypoda) from the west American coastal waters, with comments on Macoma calcarea (Gmelin, 1791). Nat. Mus. Can. Natur. Hist. Pap. 43: 1-19.

Dunnill, R. M., and D. V. Ellis. 1969. Recent species of the genus Macoma (Pelecypoda) in British Columbia. Nat. Mus. Can. Natur. Hist. Pap. 45: 1-34.

Durham, J. W. 1947. Corals from Gulf of California and the north Pacific coast of America. Geol. Soc. Amer. Mem. 20: 68 p.

Edwards, D. C. 1968. Reproduction in Olivella biplicata. Veliger 10: 297-304.

1969. Zonation by size as an adaptation for intertidal life in Olivella biplicata. Amer. Zool. 9: 399-417.

1969a. Predators of Olivella biplicata, including a species - specific predator avoidance response. Veliger 11: 326-333.

Eltringham, S. K. 1971. Life in mud and sand. English Univ. Press.

Evans, M. S. MS 1973. The distributional ecology of calanoid copepod Pareuchaeta longatta Esterly. Institute of Oceanography and Zoology, MSc Thesis, Univ. of British Columbia, Vancouver, B. C.

Faber, D. J. 1972. A preliminary survey of larval fish, zooplankton and phytoplankton of Pacific Rim National Park. Can. Ocean. Ident. Centre, Nat. Mus. of Natur. Sci. (Ottawa): 38 p.

Fee, A. R. 1927. The Isopoda of Departure Bay and vicinity with descriptions of new species, variations and colour notes. Contrib. Can. Biol. Fish., N. S. 3: 13-46.

Figueira, A. J. G. 1971. Pacific zooplankton. In C. T. Shih, A. J. G. Figueira, and E. H. Grainger. Canadian marine zooplankton. Fish. Res. Board Can. Bull. 176: 111-188.

Fisher, W. K. 1911. Asteroida of the North Pacific and adjacent waters (Phanerozonia and Spinulosa). U. S. Nat. Mus. Bull. 76, pt. 1: 419 p.

1928. Asteroida of the North Pacific and adjacent waters (Forcipulata). U. S. Nat. Mus. Bull. 76, pt. 2: 245 p.

1930. Asteroida of the North Pacific and adjacent waters (Forcipulata). U. S. Nat. Mus. Bull. 76, pt. 3: 356 p.

1938. Hydrocorals of the North Pacific Ocean. Proc. U. S. Nat. Mus. 84: 493-554.

Foerster, R. E. 1923. The Hydromedusae of the west coast of North America, with special reference to those of the Vancouver Island region. Contrib. Can. Biol. Fish., N. S. 1: 221-277.

Forrester, C. R. 1966. Length and age composition of petrale sole (Eopsetta jordani) in western Canadian waters. 1. Lower west coast of Vancouver Island. Fish. Res. Board Can. Nanaimo Biol. Sta. Cir. (Statist. Ser.) 17: 44 p.

1969. Sinistrality in Platichthys stellatus off British Columbia. J. Fish. Res. Board Can. 26: 191-196.

MS 1973. The ling cod (Ophiodon elongatus) in waters off western Canada. Fish. Res. Board Can. MS Rep. 1266: 27 p.

Forrester, C. R., A. E. Peden, and R. M. Wilson. 1972. First records of the striped bass, Morone saxatilis, in British Columbia waters. J. Fish. Res. Board Can. 29: 337-339.

Forrester, C. R., and J. E. Smith. MS 1972. The British Columbia groundfish fishery in 1970, some aspects of its investigation and related fisheries. Fish. Res. Board Can. Tech. Rep. 302: 1-46.

MS 1972a. The British Columbia groundfish fishery in 1971, some aspects of its investigation and related fisheries. Fish. Res. Board Can. Tech. Rep. 338: 67 p.

Fraser, C. McL. 1913. Hydroids from Vancouver Island. Canada Geol. Survey. Victoria Memorial Mus. Bull. 1: 147-155.

1935. Hydroids from the west coast of Vancouver Island. Can. Field Natur. 49: 143-145.

1937. Hydroids of Pacific Coast of Canada and United States. Univ. of Toronto Press, Toronto: 207 p.

1946. Distribution and relationship in American hydroids. Univ. of Toronto Press, Toronto: 464 p.

Frolander, H. F. 1962. Quantitative estimations of temporal variations of zooplankton off the coast of Washington and British Columbia. J. Fish. Res. Board Can. 19: 657-675.

Fulton, J. MS 1968. A laboratory manual for the identification of British Columbia marine zooplankton. Fish. Res. Board Can. Tech. Rep. 55: 141 p.

MS 1972. Keys and references of the marine copepoda of British Columbia. Fish. Res. Board Can. Tech. Rep. 313: 63 p.

1973. Some aspects of life history of Calanus plumchrus in the Straits of Georgia. J. Fish. Res. Board Can. 30: 811-815.

Galigher, A. E. 1925. On the occurrence of the larval stages of Scyphozoa. Amer. Natur. 59: 94-96.

Gardner, N. L. 1922. The genus, Fucus, on the Pacific coast of North America. Univ. Calif. Publ. Bot. 10: 1-180.

Ghelardi, R. J. MS 1967. Progress report on the 1965 and 1966 lobster introductions at Fatty Basin, Vancouver Island, British Columbia. Fish. Res. Board Can. Tech. Rep. 44: 40 p.

Ghelardi, R. J., and C. T. Shoop. MS 1972. Lobster (Homarus americanus) production in British Columbia. Fish. Res. Board Can. MS Rep. 1176: 31 p.

Gooding, R. V. 1960. North and South American copepods of the genus Hemicyclops (Cyclopoida: Clausidiidae). Proc. U. S. Nat. Mus. 112: 159-195.

Griffith, L. M. 1967. Intertidal univalves of British Columbia. Brit. Columbia Prov. Mus. Handb. 26: 101 p.

Guiguet, C. J. 1953. California sea lion (Zalophus californianus) in British Columbia. Can. Field Natur. 67: p. 140.

Halstead, B. W. 1965. Poisonous and venomous marine animals of the world. Vol. 1, Invertebrates. U. S. Gov't Printing Office.

Hancock, D. 1965. Killer whales kill and eat minke whale. J. Mammalogy 46: 341-342.

1970. California sea lion as a regular winter visitant off the British Columbia coast. J. Mammalogy 51: p. 614.

Hansen, H. J. 1915. The Crustacea Euphausiacea of the U. S. National Museum. Proc. U. S. Nat. Mus. 48: 59-114.

Harling, W. R., D. Davenport, L. E. McLeod, and S. J. Westrheim. MS 1968. G. B. Reed Groundfish Cruise No. 68-2, April 2 - June 11, 1968. Fish Res. Board Can. Tech. Rep. 81: 63 p.

Harling, W. R., D. Davenport, M. S. Smith, and R. M. Wilson. MS 1969. G. B. Reed Groundfish Cruise No. 69-3, Sept. 8 - 25, 1969. Fish. Res. Board Can. Tech. Rep. 144: 35 p.

Harling, W. R., D. Davenport, M. S. Smith, and R. M. Wowchuck. MS 1970. G. B. Reed Groundfish Cruise No. 70-3, Sept. 9 - 25, 1970. Fish. Res. Board Can. Tech. Rep. 221: 35 p.

Harling, W. R., D. Davenport, M. S. Smith, A. C. Phillips, and S. J. Westrheim. MS 1973. G. B. Reed Groundfish Cruise No. 73-2, Sept. 5 - 25, 1973. Fish. Res. Board Can. Tech. Rep. 424: 37 p.

Harrington, N. R., and B. B. Griffin. 1897. Notes on the distribution and habits of some Puget Sound invertebrates. Trans. N. Y. Acad. Sci. 16: 152-165.

Hart, J. F. L. 1931. Some Cumacea of the Vancouver Island region. Contrib. Can. Biol. N. S. 6: 25-40.

1940. Zooplankton from the west coast of Vancouver Island. Pac. Biol. Sta. Man. Rep. 349: 10 p.

1940a. Reptant decapod Crustacea of the west coasts of Vancouver and Queen Charlotte Islands, B. C., Canada. J. Res. 18: 86-105.

1961. Records of distributions of some Crustacea in British Columbia. Rep. Prov. Mus. 1961 W17-W19: 17-19.

1964. Shrimps of the genus Betaeus on the Pacific coast of North America with descriptions of three new species. Proc. U. S. Nat. Mus. 115: 431-466.

1971. New distribution records of reptant decapod Crustacea, including descriptions of three new species of Pagurus, from the waters adjacent to British Columbia. J. Fish. Res. Board Can. 28: 1527-1544.

1971a. Key to planktonic larvae of families of decapod Crustacea of British Columbia. Syesis 4: 227-234.

Hart, J. L. 1973. Pacific fishes of Canada. Fish. Res. Board Can. Bull. 180: 740 p.

Hartman, O. 1951. The literature of the polychaetous annelids, Part I: Bibliography and subject analysis. Edward Brothers, Inc., Los Angeles: 290 p.

1959. Catalogue of the polychaetous annelids of the world. Parts I and II. Occasional Papers of the Allan Hancock Foundation, 23. (Supplement and Index, 1960 - 1965).

Hatch, M. H. 1947. The Chelifera and Isopoda of Washington and adjacent regions. Univ. Wash. Publ. Biol. 10: 155-274.

Hatler, D. F. 1972. Mammals of Pacific Rim National Park. National and Historic Parks Branch, Department of Indian Affairs and Northern Development. 223 p.

Healy, E. A., and G. P. Wells. 1959. Three new lugworms (Arenicolidae: Polychaeta) from the North Pacific area. Proc. Zool. Soc. Lond. 133: 315-335.

Henry, D. P. 1940. Notes on some pedunculate barnacles from the North Pacific. Proc. U. S. Nat. Mus. 88: 225-236.

1942. Studies on the sessile Cirripedia of the Pacific coast of North America. Univ. Wash. Publ. Oceanogr. 4: 95-134.

Herlinveaux, R. H. MS 1966. Oceanographic phase of the Fatty Basin Study for a lobster transplant. Fish. Res. Board Can. MS Rep. Oceanogr. and Limnol. 228: 66 p.

1973. Oceanographic phase of the Fatty Basin study of a lobster transplant. Part II. Surface-water movements and bottom temperatures. Marine Sciences Directorate, Pacific Region. Pac. Mar. Sci. Rep.: 20 p.

Hewatt, W. G. 1935. Ecological succession in the Mytilus californianus habitat as observed in Monterey Bay, California. Ecology 16: 244-251.

Hickson, S. J. 1915. Some Alcyonaria and a Stylaster from the west coast of North America. Proc. Zool. Soc. London. 38: 541-557.

Hirschhorn, G. 1962. Growth and mortality rates of the razor clam (Siliqua patula) on Clatsop beaches, Oregon. Contrib. Fish. Comm. Oregon. 27: 55 p.

Hollenberg, G. J., and I. A. Abbott. 1966. Supplement to Smith's marine algae of the Monterey Peninsula. Stanford Univ. Press, Calif.: 130 p.

Hollister, H. MS 1968. Sea surface temperature and salinity at shore stations along the British Columbia coast during 1966. Fish. Res. Board Can. Tech. Rep. 82: 39 p.

Holmes, J. C. 1971. Habitat segregation in sanguinicolid blood flukes (Digenea) of scorpaenid rockfishes (Perciformes) on the Pacific coast of North America. J. Fish. Res. Board Can. 28: 903-909.

Hourston, A. S. MS 1952. Juvenile herring studies on the west coast of Vancouver Island. Pac. Bio. Sta. MS Rep.: 62 p.

1958. Population studies on juvenile herring in Barkley Sound, British Columbia. J. Fish. Res. Board Can. 15: 909-960.

1959. Effects of some aspects of environment on the distribution of juvenile herring in Barkley Sound. J. Fish. Res. Board Can. 16: 283-308.

1959a. The relationship of juvenile herring stocks in Barkley Sound to the major adult herring populations in British Columbia. J. Fish. Res. Board Can. 16: 309-320.

MS 1973. Preliminary analysis of British Columbia herring stocks in 1973. Fish. Res. Board Can. MS Rep. 1285: 19 p.

Hourston, A. S., and R. S. K. Isaacson. MS 1972. British Columbia herring landings 1950 - 1970. Fish. Res. Board Can. MS Rep. 1184: 1-29.

Hughes, G. C. 1969. Marine fungi from British Columbia: occurrence and distribution of lignicolous species. Syesis 2: 121-140.

Humphreys, R. D., and L. A. Webb. 1972. The abundance of herring spawn in the coastal waters of British Columbia in 1972. Can. Dept. of Envir., Fish. Ser. Pac. Reg. Tech. Rep. 1972-11.

Huntsman, A. G. 1912. Ascidians from the coast of Canada. Trans. Can. Inst., ann., 1911: 111-148.

1912a. Holosomatous ascidians from the coast of western Canada. Contrib. Can. Biol. 1906 - 1910: 103-185.

Hyman, L. H. 1971. The Invertebrates: Protozoa through Ctenophora, Vol. I. McGraw-Hill Book Co., Inc., New York. 726 p.

1971a. The Invertebrates: Platyhelminthes and Rhynchocoela, the acoelomate Bilateria, Vol. 2. McGraw-Hill Book Co., Inc., New York.

1971b. The Invertebrates: Acanthocephala, Aschelminthes and Entoprocta, the pseudocoelomate Bilateria, Vol. 3. McGraw-Hill Book Co., Inc., New York.

1971c. The Invertebrates: Echinodermata, the coelomate Bilateria, Vol. 4. McGraw-Hill Book Co., Inc., New York.

1971d. The Invertebrates: Small coelomate groups, Vol. 5. McGraw-Hill Book Co., Inc., New York.

1971e. The Invertebrates: Mollusca I. Aplacophora, Polyplacophora, Monoplacophora, Gastropoda, the coelomata Bilateria, Vol. 6. McGraw-Hill Book Co., Inc., New York.

Illg, P. 1960. Marine copepods of the genus Anthessius from the northeastern Pacific Ocean. Pac. Sci. 14: 337-372.

Johnson, H. P. 1901. The Polychaeta of the Puget Sound region. Proc. Boston Soc. Nat. Hist. 29: 381-437.

Kabata, Z. 1967. The genus Haemobaphes (Copepoda: Lernaeoceridae) in the waters of British Columbia. Can. J. Zool. 45: 853-875.

1968. Some Chondracanthidae (Copepoda) from fishes of British Columbia. J. Fish. Res. Board Can. 25: 321-345.

1969. Phrixocephalus cincinnatus Wilson, 1908 (Copepoda: Lernaeoceridae): morphology, metamorphosis and host-parasite relationship. J. Fish. Res. Board Can. 26: 921-934.

1970. Some Lernaeopodidae (Copepoda) from fishes of British Columbia. J. Fish. Res. Board Can. 27: 865-885.

1971. Four Bomolochidae (Copepoda) from fishes of British Columbia. J. Fish. Res. Board Can. 28: 1563-1572.

Kabata, Z. 1973. The species of Lepeophtherus (Copepoda: Caligidae) from fishes of British Columbia. J. Fish. Res. Board Can. 30: 729-759.

Ketchen, K. S. 1961. Observations on the ecology of the Pacific Cod (Gadus macrocephalus) in Canadian waters. J. Fish. Res. Board Can. 18: 513-558.

Ketchen, K. S., and C. R. Forrester. 1966. Population dynamics of the petrale sole, Eopsetta jordani, in waters off western Canada. Fish. Res. Board Can. Bull. 153: 195 p.

Kozloff, E. N. 1973. Seashore life of Puget Sound, the Strait of Georgia and the San Juan Archipelago. J. J. Douglas Ltd. Canada. : 282 p.

1974. Keys to the marine invertebrates of Puget Sound, the San Juan Archipelago and adjacent regions. Univ. of Washington Press: 226 p.

Kramp, P. L. 1961. Synopsis of the medusae of the world. J. Mar. Biol. Ass. U. K. 40: 469 p.

Lambe, L. M. 1895. Sponges from the west coast of North America (1894). Proc. Trans. Roy. Soc. Can. 12: 113-138.

LaRocque, A. 1953. Catalogue of the recent Mollusca of Canada. Nat. Mus. Can. Bull. 129: 1-406.

Laubitz, D. R. 1970. Studies on the Caprellidae (Crustacea, Amphipoda) of the American North Pacific. Nat. Mus. Natur. Sci. (Ottawa). Publ. Biol. Oceanogr. No. 1: 89 p.

Lea, H. 1955. The chaetognaths of western Canadian waters. J. Fish. Res. Board Can. 12: 593-617.

LeBrasseur, R. J. MS 1964. A preliminary checklist of some marine zooplankton from the northeastern Pacific Ocean. Fish. Res. Board Can. MS Rep. Oceanogr. and Limnol. 174: 14 p.

MS 1970. Larval fish species collected in zooplankton samples from the northeastern Pacific Ocean, 1956 to 1959. Fish. Res. Board Can. Tech. Rep. 175: 47 p.

Lee, J. C., and N. Bourne. MS 1973. Marine bibliographical and review study of Pacific Rim National Park. Fish. Res. Board Can. MS Rep. 1276: 121 p.

Lee, R. K. S. (no date). List of benthic algae species with ecological data. The Herbarium, Nat. Mus. Can., Ottawa. (unpub.).

1966. Development of marine benthic algal communities on Vancouver Island, British Columbia, p. 100-120. In R. L. Taylor and R. A. Ludwig [ed.]. The evolution of Canada's flora. Univ. Toronto Press, Toronto.

Lee, R. K. S., and A. L. Sutherland. 1972. Benthic marine algal survey of Pacific Rim National Park. Nat. Mus. Natur. Sci., Phycology Section: 14 p.

Leet, L. D., and S. Judson. 1954. Physical geology. Prentice-Hall, Inc., New York. 466 p.

Levings, C. D., and N. G. McDaniel. MS 1974. Invertebrates at the Maplewood mudflats, a rare habitat in Vancouver harbour. Fish. Res. Board Can. MS Rep. 1314: 22 p.

Lewis, J. R. 1961. The littoral zone on rocky shores - a biological or physical entity. Oikos 12: 280-301.

1964. The ecology of rocky shores. English Univ. Press: 323 p.

Lewis, J. R., and D. B. Quayle. MS 1972. Some aspects of the littoral ecology of British Columbia. Fish. Res. Board Can. MS Rep. 1213: 23 p.

Littlepage, J. 1971. Zooplankton survey of Trevor Channel, Barkley Sound. Bamfield Marine Station Rep. 2: 3 p.

Machell, J. R., and J. D. DeMartini. 1971. An annual reproductive cycle of the gaper clam, Tresus capax (Gould), in South Humboldt Bay, California. Calif. Fish and Game. 57: 274-282.

Mann, A. 1907. Report on the diatoms of the "Albatross" voyage in the Pacific Ocean, 1888-1904. U. S. Nat. Herb. Contr. 10: 220-419.

Margolis, L., and G. C. Pike. 1955. Some helminth parasites of Canadian Pacific whales. J. Fish. Res. Board Can. 12: 97-120.

Mauzey, K. P. 1966. Feeding behaviour and reproductive cycles in Pisaster ochraceus. Biol. Bull. 131: 127-144.

Mayer, A. G. 1910. Medusae of the world. Carnegie Inst. Wash. Publ. 109: 499-735.

Mills, E. L. 1959. Amphipod crustaceans of the Pacific Coast of Canada. I. Family Atylidae. Nat. Mus. Can. Bull. 172: 13-33.

1962. Amphipod crustaceans of the Pacific Coast of Canada. Nat. Mus. Can. Natur. Hist. Pap. 15: 1-21.

McAllister, D. E. 1960. List of the marine fishes of Canada. Nat. Mus. Can. Bull. 168: 76 p.

1963. A revision of the smelt family, Osmeridae. Nat. Mus. Can. Bull. 191: 53 p.

McInerney, J. E., and D. O. Evans. 1970. Habitat characteristics of Pacific hagfish, Polistotrema stouti. J. Fish. Res. Board Can. 27: 966-968.

McLaren, I. 1966. Taxonomy of harbour seals of the western North Pacific and evolution of certain other hair seals. J. Mammalogy 47: 466-473.

McLean - Fraser, C. 1930. The razor clam, Siliqua patula (Dixon), of Graham Island, Queen Charlotte group. Trans. Roy. Soc. Can. (Series 3) 24: 141-154.

McMillin, H. C. 1924. Life history and growth of the razor clam. Wash. Dept. Fish., Olympia, Washington: 52 p.

McMullen, J. C. 1967. Some aspects of the life history of razor clams **Siliqua patula** (Dixon) in Cook Inlet, Alaska. Alaska Dept. Fish and Game. Information Leaflet 110: 18 p.

McMurrich, J. P. 1916. Notes on the plankton of the British Columbia coast. Trans. Roy. Soc. Can., Ser. 3, 10: 75-89.

Nagasaki, F. 1958. The fecundity of Pacific herring (Clupea pallasi) in British Columbia coastal waters. J. Fish. Res. Board Can. 15: 313-330.

Neushul, M. 1967. Studies of subtidal marine vegetation in western Washington. Ecology 48: 83-94.

Newcombe, C. F. 1893. Catalogue of the Crustacea in the Provincial Museum, Victoria. Nat. Hist. Soc. Brit. Columbia Bull.: 19-30.

1893. Report on the marine shells of British Columbia. Nat. Hist. Soc. Bull. 1893: 31-72.

Newman, M. A., and P. L. McGeer. 1966. The capture and care of a killer whale, Orcinus orca, in British Columbia. N. Y. Zool. Soc. 51: 59-69.

Nicholson, G. 1954. Portuguese Man of War, Jellyfish with stingers. The Daily Colonist, Victoria, Magazine Section. June 24, 1954: p. 3.

Nickerson, R. B. 1975. A critical analysis of some razor clam (Siliqua patula, Dixon) populations in Alaska. Alaska Dept. Fish and Game: 294 p.

O'Donoghue, C. H., and E. O'Donoghue. 1923. A preliminary list of the Bryozoa from the Vancouver Island region. Contrib. Can. Biol. N. S. 1: 143-201.

Ohivada, M., and H. Kon. 1963. Distribution of the microplankton and their relations to the character of water masses in the Bering Sea and Northern North Pacific Ocean in the summer of 1960. Oceanogr. Mag. 14: 87-99.

Oldroyd, I. S. 1924. The marine shells of the west coast of North America. Stanford Univ. Publ. Geol. Sci. 1: 248 p.

1927. The marine shells of the west coast of North America. Stanford Univ. Publ. Geol. Sci. 2 (Pts. 1,2,3.): 940 p.

Osburn, R. C. 1950. Bryozoa of the Pacific Coast of America. Allan Hancock Pac. Exp. 14: 1-269.

1952. Bryozoa of the Pacific coast of America. Allan Hancock Pac. Exp. 14: 270-611.

1953. Bryozoa of the Pacific Coast of America. Allan Hancock Pac. Exp. 14: 612-841.

Outram, D. N. MS 1957. Guide to marine vegetation encountered during herring spawn surveys in southern British Columbia. Fish. Res. Board Can. Gen. Ser. Circ. 44: 18 p.

1965. Canada's pacific herring. Dept. of Fisheries Information Publication, Ottawa, 1965. Queens Printer, No. FS34-1965/1: 23 p.

MS 1969. The time and extent of herring spawn along the Pacific coast in 1969. Fish. Res. Board Can. Gen. Ser. Circ. 88: 15 p.

Paine, R. T. 1966. Food web complexity and species diversity. Amer. Natur. 100: 65-75.

1969. The Pisaster-Tegula interaction: prey patches, predator food preference, and intertidal community structure. Ecology 50: 950-961.

1969a. A note on trophic complexity and community stability. Amer. Natur. 103: 91-93.

1971. Energy flow in a natural population of the herbivorous gastropod Tegula funebralis. Limnol. and Oceanogr. 16: 86-98.

1974. Intertidal community structure. Oecologia 15: 83-120.

Pettibone, M. H. 1967. Type specimens of polychaetes described by Edith and Cyril Berkeley (1923-1964). Proc. U. S. Nat. Mus. 119: 1-23.

Pianka, E. R. 1966. Latitudinal gradients in species diversity: a review of concepts. Amer. Natur. 100: 33-46.

Pike, G. C. MS 1956. Guide to the whales, porpoises, and dolphins of the Northeast Pacific and Arctic waters of Canada and Alaska. Fish. Res. Board Can. Gen. Ser. Circ. 32: 14 p.

MS 1958. Food of the Northern Sea Lion. Fish. Res. Board Can. Prog. Rep. 112: 18-20.

1961. The Northern Sea Lion in British Columbia. Can. Audubon 23: 1-5.

1962. Migration and feeding of the gray whale (Eschrichtius gibbosus). J. Fish. Res. Board Can. 19: 815-838.

Pike, G. C., and I. B. MacAskie. 1969. Marine Mammals of British Columbia. Fish. Res. Board Can. Bull. 171: 54 p.

Pike, G. C., and B. E. Maxwell. 1958. The abundance and distribution of the northern sea lion, Eumetopias jubata, on the coast of British Columbia. J. Fish. Res. Board Can. 15: 5-17.

Pike, G. C., D. J. Spalding, I. B. MacAskie, and A. Craig. MS 1959. Preliminary report on Canadian pelagic fur seal research in 1959. Fish. Res. Board Can. MS Rep. 629: 51 p.

Pike, G. C., D. J. Spalding, I. B. MacAskie, and A. Craig. MS 1960. Report on Canadian pelagic fur seal research in 1960. Fish. Res. Board Can. MS Rep. 700: 92 p.

MS 1963. Report on Canadian pelagic fur seal research in 1963. Fish. Res. Board Can. MS Rep. 761: 29 p.

Pilsbury, H. A. 1916. The sessile barnacles (Cirripedia) contained in the collections of the U. S. National Museum; including a monograph of the American species. U. S. Nat. Mus. Bull. 93: 366 p.

Quayle, D. B. 1954. Growth of purple seastar. Brit. Columbia Dept. Fish. Oyster Bull. 5: 11-13.

1964. Distribution of introduced marine Mollusca in British Columbia waters. J. Fish. Res. Board Can. 21: 1155-1181.

1969. Paralytic shellfish poisoning in British Columbia. Fish. Res. Board Can. Bull. 168: 68 p.

1969a. Pacific oyster culture in British Columbia. Fish. Res. Board Can. Bull. 169: 192 p.

1971. Pacific oyster raft culture in British Columbia. Fish. Res. Board Can. Bull. 178: 34 p.

MS 1971. Growth, morphometry and breeding in the British Columbia abalone (Haliotis kamtschatkana Jonas). Fish. Res. Board Can. Tech. Rep. 279: 84 p.

1973. The intertidal bivalves of British Columbia. Brit. Columbia Prov. Mus. Handb. 17: 140 p.

MS 1974. The Vanlene oil spill. Fish. Res. Board Can. MS Rep. 1289:21 p.

Quayle, D. B., and F. Bernard. MS 1966. Shellfish toxicity records, 1942-1965 Fish. Res. Board Can. MS Rep. 860: 210 p.

Quayle, D. B., and N. B. Bourne. 1972. The clam fisheries of British Columbia. Fish. Res. Board Can. Bull. 179: 70 p.

Rathburn, M. J. 1902. Description of new decapod crustaceans of the northwest coast of North America. Proc. U. S. Nat. Mus. 24: 885-905.

1904. Decapod crustaceans of the northwest coast of North America. Harriman Alaska Exp. 10: 1-210.

1910. Decapod crustaceans of the northwest coast of North America. Harriman Alaska Exp. 10: 1-211.

1918. The grapsoid crabs of America. U. S. Nat. Mus. Bull. 97: 445 p.

1925. The spider crabs of America. U. S. Nat. Mus. Bull. 129: 598 p.

Rathburn, M. J. 1930. The cancroid crabs of America of the families Euryalidae, Portunidae, Alelecyclidae, Cancridae and Xanthidae. U. S. Nat. Mus. Bull. 152: 609 p.

Rice, T. C. 1968. A check list of the marine gastropods from the Puget Sound region. Of Sea and Shore, Port Gamble, Washington: 169 p.

Richardson, H. 1905. A monograph on the isopods of North America. U. S. Nat. Mus. Bull. 52: 727 p.

Ricketts, E. F., and J. Calvin. 1968. Between Pacific Tides (4th. ed.). Stanford Univ. Press, Calif.: 614 p.

Rigg, G. B., and R. C. Miller. 1949. Intertidal plant and animal zonation in the vicinity of Neah Bay, Washington. Proc. Calif. Acad. Sci. (Ser. 4) 26: 323-351.

Ritter, W. E. 1913. The simple ascidians from the northeastern Pacific in the collection of the United States National Museum. Proc. U. S. Nat. Mus. 45: 427-505.

Robilliard, G. A. 1971. Preliminary survey of intertidal and subtidal marine fauna and flora of Pacific Rim National Park with emphasis on Long Beach Section. Nat. Mus. Can. Rep., Ottawa: 156 p.

Ropes, J. W., and A. P. Stickney. 1965. Reproductive cycle of Mya arenaria in New England. Biol. Bull. (Woods Hole) 128: 315-327.

Scagel, R. F. MSc 1948. The life history and distribution of Macrocystis in British Columbia coastal waters. MSc Thesis. Dept. Bot., Univ. of British Columbia, Vancouver. 64 p.

1957. An annotated list of the marine algae of British Columbia and northern Washington. Nat. Mus. Can. Bull. 150: 289 p.

1961. Marine plant resources of British Columbia. Fish. Res. Board Can. Bull. 127: 39 p.

1966. Marine algae of British Columbia and northern Washington, Part I: Chlorophyceae (green algae). Nat. Mus. Can. Bull. 207: 257 p.

1972. Guide to common seaweeds of British Columbia. Brit. Columbia Prov. Mus. Handb. 27: 330 p.

1973. Marine benthic plants in the vicinity of Bamfield, Barkley Sound, British Columbia. Syesis 6: 127-145.

Setchell, W. A., and N. L. Gardner. 1920. The marine algae of the Pacific coast of North America, Part II: Chlorophyceae. Univ. Calif. Publ. Bot. 8: 139-374.

1925. The marine algae of the Pacific coast of North America, Part III: Melanophyceae. Univ. Calif. Publ. Bot. 8: 383-898.

Shelford, V. E., A. O. Weese, L. A. Rice, D. I. Rasmussen,and A. MacLean. 1935. Some marine biotic communities of the Pacific coast of North America. Pt. I. Ecol. Monogr. 5: 251-362.

Shih, Chang-tai. 1973. A preliminary survey of invertebrate zoologists and their present activities in Canada. Nat. Mus. Natur. Sci. (Ottawa). Syllogeus 3: 39 p.

Shoemaker, C. R. 1949. Three new species of the amphipod genus Amphithoe from the west coast of America. J. Wash. Acad. Sci. 39: 66-82.

Smith, G. M. 1944. Marine algae of the Monterey Peninsula, California. Stanford Univ. Press, Calif.: 622 p.

1969. Marine algae of the Monterey Peninsula, California, including supplement of Hollenberg and Abbott. Stanford Univ. Press, Calif.: 752 p.

Smith, R. J., and J. T. Carlton [ed.]. 1975. Light's manual. Intertidal invertebrates of the central California coast. Univ. Calif. Press.: 716 p.

Southward, A. J. 1958. The zonation of plants and animals on rocky sea shores. Biol. Rev. Cambridge Phil. Soc. 33: 137-177.

1965. Life on the sea-shore. Heineman. 153 p.

Spalding, D. J. 1964. Comparative feeding habits of the fur seal, sea lion and harbour seal on the coast of British Columbia. Fish. Res. Board Can. Bull. 146: 52 p.

Spencer, G. J. 1932. The commercial crab, Cancer magister Dana, in Clayoquot Sound, Vancouver Island. Biol. Board Can. Bull. 30: 18 p.

Steele, J. H.,and I. E. Baird. 1968. Production ecology of a sandy beach. Limnol. Oceanogr. 13: 14-25.

Stephen, A. C. 1953. Life on some sandy shores. Essays in Marine Biology. Oliver & Boyd, Edinburgh: 50-72.

Stephenson, T. A., and A. Stephenson. 1949. The universal features of zonation between tide-marks on rocky coasts. J. Ecol. 37: 289-305.

1961. Life between tide-marks in North America. Part IVa, Vancouver Island, I. J. Ecol. 49: 1-29.

1961a. Life between tide-marks in North America. Part IVb, Vancouver Island, II. J. Ecol. 49: 227-243.

1972. Life between tide-marks on rocky shores. W. H. Freeman and Co., San Francisco: 425 p.

Sterling, D. 1964. Additional Records - Long Beach Campsite. Available through Interpretation, B. C. Parks Branch, Dept. of Recreation and Conservation, Victoria (unpubl.).

Stevens, B. A. 1928. Callianassidae from the west coast of North America. Publ. Puget Sound Biol. Sta. 6: 315-369.

Stevenson, J. C. 1962. Distribution and survival of herring larvae (Clupea pallasi Valenciennes) in British Columbia waters. J. Fish. Res. Board Can. 19: 735-810.

Stohler, R. 1952. Studies on mollusk populations: II. Nautilus 65: 135-137.

1959. Studies on mollusk populations: IV. Nautilus 73: 65-72.

1960. Studies on mollusk populations: IV. Nautilus 73: 95-103.

1962. Preliminary report on growth studies in Olivella biplicata. Veliger 4: 150-151.

1969. Growth study in Olivella biplicata (Sowerby, 1825). Veliger 11: 259-267.

Swedmark, B. 1964. The interstitial fauna of marine sand. Biol. Rev. 39: 1-42.

Tattersall, W. M. 1933. Euphausiacea and Mysidacea from western Canada. Contrib. Can. Biol. 8: 183-205.

Taylor, F. H. C. 1964. Life history and present status of British Columbia herring stocks. Fish. Res. Board Can. Bull. 143: 1-81.

Taylor, G. W. 1912. Preliminary list of one hundred and twenty-nine species of British Columbia decapod crustaceans. Contrib. Can. Biol. 1906-1910: 187-214.

Tegelberg, H. C. 1964. Growth and ring formation of Washington razor clams. Wash. Dept. Fish., Fish. Res. Pap. 2: 69-103.

Tegelberg, H. C., and C. D. Magoon. 1969. Growth, survival and some effects of a dense razor clam set in Washington. Proc. Nat. Shellfisheries Assoc. 59: 126-135.

Tester, A. L. 1949. Populations of herring along the west coast of Vancouver Island on the basis of mean vertebral number with a critique of the method. J. Fish. Res. Board Can. 7: 403-420.

Thompson, R. J., and B. L. Bayne. 1974. Some relationships between growth, metabolism, and food in the mussel Mytilus edulis. Mar. Biol. (Berl.) 27: 317-326.

Thorson, G. 1957. Bottom communities (sublittoral or shallow shelf). Mar. Ecol. Amer. Geol. Soc. 67: 461-534.

Thorsteinson, E. D. 1941. New or noteworthy amphipods from North Pacific Coast. Univ. Wash. Publ. Oceanogr. 4: 50-96.

Torrey, H. B. 1902. Anemones: papers from the Harriman Alaska expedition, 30. Proc. Wash. Acad. Sci. 4: 373-410.

Townsend, C. H. 1901. Dredging and other records of the U. S. Fish Commission steamer ALBATROSS with bibliography relative to the work of the vessel. U. S. Com. Fish. Rep. for 1900, Pt. 26: 387-562.

Treadwell, A. L. 1914. Polychaetous annelids of Pacific coast in the collections of the zoological museum of the University of California. Univ. Calif. Publ. Zool. 13: 175-234.

Trower, P. 1972. B. C. Whaling: The white man. Raincoast Chronicles. 1: 41-46.

vanName, W. G. 1945. The North and South American ascidians. Bull. Amer. Mus. Natur. Hist. 84: 1-476.

Wailes, G. H. 1929. Marine zooplankton of British Columbia. Mus. and Art Notes (Vancouver). 4: 159-165.

Webb, P. W., and J. R. Brett. 1972. Respiratory adaptations of prenatal young in the ovary of two species of viviparous seaperch, Rhacochilus vacca and Embiotoca lateralis. J. Fish. Res. Board Can. 29: 1525-1542.

1972. Oxygen comsumption of embryos and parents, and oxygen transfer characteristics within the ovary of two species of viviparous seaperch, Rhacochilus vacca and Embiotoca lateralis. J. Fish. Res. Board Can. 29: 1543-1553.

Westrheim, S. J. 1964. Rockfish (Sebastodes brevispinis) in British Columbia waters. J. Fish. Res. Board Can. 21: 855-856.

MS 1967. G. B. Reed Groundfish Cruise Reports, 1963-66. Fish. Res. Board Can. Tech. Rep. 30: 286 p.

1968. First records of three rockfish species (Sebastodes aurora, S. ciliatus and Sebastolobus altivelis) from waters off British Columbia. J. Fish. Res. Board Can. 25: 2509-2513.

Westrheim, S. J., W. R. Harling, D. Davenport, and M. S. Smith. MS 1968. Preliminary report on maturity, spawning season and larval identification of rockfishes (Sebastodes) collected off British Columbia in 1968. Fish. Res. Board Can. MS Rep. 1005: 28 p.

MS 1974. G. B. Reed groundfish cruise No. 74-1, February 5-22, 1974. Fish. Res. Board Can. MS Rep. 1301: 15 p.

MS 1974a. G. B. Reed Groundfish Cruise No. 74-3, June 4-26, 1974 (Data record). Fish. Mar. Serv. Res. Div. Tech. Rep. 478: 26 p.

MS 1974b. G. B. Reed Groundfish Cruise No. 74-4, Sept. 4-25, 1974 (Data record). Fish. Mar. Serv. Res. Div. Tech. Rep. 497: 37 p.

Westrheim, S. J., W. R. Harling, D. Davenport, M. S. Smith, and A. C. Phillips. MS 1973. G. B. Reed Groundfish Cruise No. 73-1, June 5 - July 26, 1973. Fish. Res. Board Can. Tech. Rep. 410: 51 p.

Westrheim, S. J., D. Davenport, M. S. Smith, and D. M. Bianchin. MS 1969. G. B. Reed Groundfish Cruise No. 69-2, June 18 - July 2, 1969. Fish. Res. Board Can. Tech. Rep. 132: 8 p.

Westrheim, S. J., D. Davenport, W. R. Harling, and M. S. Smith. MS 1972. G. B. Reed Groundfish Cruise No. 72-3, Sept. 9-28, 1972. Fish. Res. Board Can. Tech. Rep. 345: 28 p.

Westrheim, S. J., C. W. Haegele, U. B. G. Kristiansen, and N. A. Webb. MS 1970. G. B. Reed Groundfish Cruise No. 70-2, Aug. 7-20, 1970. Fish. Res. Board Can. Tech. Rep. 210: 15 p.

Weymouth, F. W., and H. C. McMillin. 1930. Relative growth and mortality of the Pacific razor clam (Siliqua patula, Dixon) and their bearing on the commercial fishery. U. S. Bureau Fish. Bull. 46: 543-567.

Weymouth, F. W., H. C. McMillin, and H. B. Holmes. 1925. Growth and age at maturity of the Pacific razor clam, Siliqua patula (Dixon). U. S. Bureau Fish. Bull. 41: 201-236.

Whiteaves, J. F. 1893. Notes on some marine invertebrata from the coast of British Columbia. Ottawa Natur. 7: 133-137.

Widdowson, T. B. 1965. A survey of the distribution of intertidal algae along a coast transitional in respect to salinity and temperature. J. Fish. Res. Board Can. 22: 1425-1454.

Wilby, G. V. 1937. The ling cod, Ophiodon elongatus Girard. Biol. Board Can. Bull. 54: 81 p.

Williamson, H. 1930. Notes on the occurrence of various animals on the fishing grounds of the coast of British Columbia. Can. Field Natur. 54: 153-156.

Yonge, C. M. 1953. Aspects of life on muddy shores. Essays in Marine Biology. Oliver and Boyd, Edinburgh: 29-49.

APPENDIX 2

Terms of reference

PARKS CANADA - FISHERIES AND MARINE SERVICES

TERMS OF REFERENCE

MARINE RESOURCE INVENTORY - PACIFIC RIM NATIONAL PARK

INTRODUCTION

The following terms of reference were initially prepared by Miss Charlene Lee and Dr. N. Bourne, Fisheries and Marine Services (February, 1975) and subsequently modified by Mr. Zinkan, Assistant Resource Studies Manager, Parks Canada (March, 1975) to satisfy Parks Canada's format requirements. The terms of reference were again modified, as follows, on February 18, 1976, as a result of a review meeting held at the Park on February 11, 1976.

1. Purpose

The principal aim of this project is to undertake a biophysical resource inventory of the marine flora and fauna of the Pacific Rim National Park. The study will include:

1) a qualitative assessment of the marine flora and fauna within the Park borders;
2) a quantitative assessment of these organisms;
3) a description of their habitat types;
4) an evaluation of the effect of recreational pressure and human encroachment.

The study will be conducted on behalf of Parks Canada by the Fisheries and Marine Service, D.O.E., and will be under the direction of Dr. N. Bourne. Funding will be transferred from Parks Canada, Western Region to the Pacific Biological Station.

This information is required to ensure effective Park planning, interpretation and management and is an integral part of the Resource Inventory program for Pacific Rim National Park.

2. Project Area

Studies will be undertaken concurrently in all three phases of Pacific Rim National Park. In the initial year emphasis will be placed on the Long Beach Section because:

1) easy access;
2) acute recreation pressure;
3) relatively few habitat types are present in this area. Studies will be initiated in all three phases of the Park during the first year and emphasis will increase in Phases 2 and 3 after the initial year.

The boundaries of the study area will extend from the high-tide to a subtidal depth of 60' (10 fathoms).

3. Project Requirements

Major emphasis in the studies will be on the invertebrate populations within the Park. However, attention will also be given to the fish populations.

Because the lower limit of the photosynthetic zone and of most diving is 50', data requirements for depths greater than 50' will be extrapolated from sampling etc. done at shallower depths where possible.

More specifically but without limiting the generality of the foregoing, the project requirements include:

3.1. Update of Fisheries Research Board of Canada Manuscript Report No. 1276; Marine Bibliographical and Review Study of Pacific Rim National Park. This report was undertaken under contract to Parks Canada in 1973. Specifically information concerning species habitat lists and references acquired after 1973 shall be gathered and the status of all work listed under "Current Research Projects" in MS Rept. No. 1276 in addition to other recent projects and data collections shall be ascertained and documented.

3.2. Studies will be undertaken concurrently in all three phases of the Park under the following general schedule.

3.2.1. Baseline Studies

From systematic and distributional studies qualitative data will be gathered to:

(i) Correct and broaden information on habitat types, zonation and species lists.

(ii) Determine areas of uniqueness (e.g., habitat types and/or species populations).

(iii) Establish control and recreational pressure study sites for each habitat type.

3.2.2. Long-Term Studies

Ecology and community structures will be continuously studied seasonally and yearly in intertidal and subtidal (where possible) areas using transect and random sampling procedures. Quantitative data obtained will be required to:

(i) Determine populations of marine organisms and monitor fluctuations in these populations.

(ii) Assess adult populations and recruitment of marine organisms particularly in areas where recreational pressure is greatest,

i.e., are populations in danger of being seriously depleted?

(iii) Determine if any populations will require further protection.

(iv) Identify potential locations for intertidal and subtidal trails where collection of specimens is permitted and where collection is not permitted.

(v) Determine recruitment and mortality rates and whether bag limits are needed for species which will be taken in the recreational fisheries: clams, fish, oysters, abalone, etc.

3.3 Description of Habitat types

The marine ecological parameters and habitat types within the project area will be identified, mapped and described. The descriptive format shall allow easy comparison of one habitat type to another. All criteria used in habitat identification shall be defined.

3.4 Sampling will be confined primarily to the period March to December. During the remainder of the time, samples will be identified, data analyzed and reports prepared. A tentative sampling schedule is outlined for each year.

4. Submission Requirements

Yearly reports, similar to Manuscript Report No. 1276, will be submitted. A final report at the end of the 5-year study which will summarize all work will also be prepared.

The annual report will include all results of work outlined in section 3. Future submission requirements will be based on review of the first annual report. The annual reports will be submitted in twenty-five (25) copies.

5. Project Cost

20.0 / 1975-76.

6. Completion Schedule

At present the project is planned to be conducted over a 5-year period, 1975/76-1979/80 inclusive.

7. Material Supply

The contractor shall provide all material and equipment required for the completion of the study with the exception of:

7.1 Chronaflex base maps, transparencies, and/or paper prints of the area at a scale of 1:12,500, 1:25,000, and 1:50,000 for final mapping.

7.2 The contractor shall be allowed access to reports in the Research and Resource Inventory collection which pertain to the project, and where necessary, may be provided pertinent information from Branch files. Such material is located at Branch Headquarters, Regional Office, and Park Offices and shall be utilized at these places.

7.3 For the field season 1976/77 to 1979/80 inclusive Parks Canada will make available 1 zodiac boat (Grandrapid III) with 20hp motor and a smaller 7hp backup motor. Parks Canada will also attempt to provide cabin facilities in the Broken Islands Group and will encourage staff assistance in diving when staff time permits.

8. Special Conditions

8.1 The contractor agrees not to transfer the responsibility to a third party without the consent of the department.

8.2 The contract price includes all expenses which may be incurred by the contractor in connection with the work.

8.3 The contractor shall supply all equipment and materials required for the study, except where otherwise specifically noted in this contract, and shall provide all necessary assistance and pay all incidental expenses.

8.4 All reports shall be sent to:

Director,
Western Region - Parks Canada,
Department of Indian & Northern Affairs,
134 - 11th Avenue S.E.,
Calgary, Alberta,
T2G 0X5

Attention: Resource Studies Manager

8.5 The final report will be professionally adequate in content, presentation and terminology, and of a quality such that it could, at the discretion of the Director, Parks Canada, be published.
The reports paid for under this contract are the property of the Government of Canada.

8.5.1 The contractor or principal assistant with the approval of the contractor may, subject to consultation with and approval of the Director or his designated representative, publish the report in whole or in part under his own name as a thesis, scientific or professional paper or other form of publication which is acceptable to the Director. However, the foregoing in no way limits the rights of the Government of Canada to publish the report.

8.6 Collection of specimens will be strictly limited to those specified by the contract or to those which are made necessary by the terms of the contract. The contractor and his designated assistants shall comply with the following requirements when collecting specimens under the contract agreement:

8.6.1 Carry the collecting permit supplied by the Parks Canada Branch at

all times when engaged in collecting activities or when in possession of specimens and present it upon request of National Parks staff or R.C.M.P. officers.

8.6.2 Obtain any permits that may be required by other agencies relating to collection of certain species or types of specimens.

8.6.3 Comply with conditions specified on the permit.

8.6.4 Provide the Park Superintendent with a list of specimens collected, and, at his request, present the specimens for inspection prior to removing them from the Park.

8.7 The contract field supervisor shall be the Park Superintendent at Pacific Rim National Park.

8.8.1 The contractor shall inform the field supervisor in advance of his plans for field work in the Park and shall make arrangements so that the field supervisor is kept informed of progress.

8.8.2 At the start of the field work in the Park each season, the contractor or his authorized representative shall meet with the field supervisor and such Park staff as he designates to review his plans for the season.

8.8.3 Prior to leaving the Park for the season, the contractor or his designated representative shall meet with the field supervisor to review progress and inform him of any important results to date.

8.9 The contractor shall maintain a close liaison with the Resource Studies Manager, Western Regional Office, and shall arrange for the work to be reviewed at critical points in the project.

8.10 Before leaving the Park, upon completion of the field season and upon presentation of the final report, the contractor should be prepared to give a seminar on his research to provide all interested Park personnel with a better understanding of the results, purpose, and methodology of this study.