STATE WATER RESOURCES CONTROL BOARD

AREAS OF SPECIAL BIOLOGICAL SIGNIFICANCE

Designated March 21, 1974, April 18, 1974, and June 19, 1975

1. Pygmy Forest Ecological Staircase
2. Del Mar Landing Ecological Reserve
3. Gerstle Cove
4. Bodega Marine Life Refuge
5. Kelp Beds at Saunders Reef
6. Kelp Beds at Trinidad Head
7. Kings Range National Conservation Area
8. Redwoods National Park
9. James V. Fitzgerald Marine Reserve
10. Farallon Island
11. Duxbury Reef Reserve and Extension
12. Point Reyes Headland Reserve and Extension
13. Double Point
14. Bird Rock
15. Ano Nuevo Point and Island
16. Point Lobos Ecological Reserve
17. San Miguel, Santa Rosa, and Santa Cruz Islands
18. Julia Pfeiffer Burns Underwater Park
19. Pacific Grove Marine Gardens Fish Refuge and Hopkins Marine Life Refuge
20. Ocean Area Surrounding the Mouth of Salmon Creek
21. San Nicolas Island and Begg Rock
22. Santa Barbara Island, Santa Barbara County and Anacapa Island
23. San Clemente Island
24. Mugu Lagoon to Latigo Point
25. Santa Catalina Island — Subarea One, Isthmus Cove to Catalina Head
26. Santa Catalina Island — Subarea Two, North End of Little Harbor to Ben Weston Point
27. Santa Catalina Island — Subarea Three, Farnsworth Bank Ecological Reserve
28. Santa Catalina Island — Subarea Four, Binnacle Rock to Jewfish Point
29. San Diego—La Jolla Ecological Reserve
30. Heisler Park Ecological Reserve
31. San Diego Marine Life Refuge
32. Newport Beach Marine Life Refuge
33. Irvine Coast Marine Life Refuge
34. Carmel Bay

CALIFORNIA MARINE WATERS

AREAS OF SPECIAL BIOLOGICAL SIGNIFICANCE

RECONNAISSANCE SURVEY REPORT

GERSTLE COVE
SONOMA COUNTY

STATE WATER RESOURCES CONTROL BOARD

DIVISION OF PLANNING AND RESEARCH

SURVEILLANCE AND MONITORING SECTION

WATER QUALITY MONITORING REPORT NO. 79-17

ACKNOWLEDGEMENT

This State Water Resources Control Board Report is based on a reconnaissance survey report submitted by Dr. John D. DeMartini of Humboldt State University Marine Laboratory. The latter report was prepared in fulfillment of an agreement with the California Department of Fish and Game, which has coordinated the preparation of a series of Area of Special Biological Significance Survey Reports for the State Board under an Interagency Agreement.

ABSTRACT

The Gerstle Cove Area of Special Biological Significance is located in Sonoma County near the town of Jenner on Highway 1. The surface area of the ASBS is about 1.56 acres (0.63 ha) with the shoreline being about one half mile long (0.8 km).

Most of the subtidal substrate within the ASBS is less than 40 feet (12 m) deep, consisting of bedrock, slump blocks, boulders, sandstone, coarse sand and fine sand. The intertidal substrate consists of large to medium sized sandstone boulders whose source is a nearby sea cliff.

A very diverse assemblage of fish, invertebrate and aquatic plant species is found within the subtidal and intertidal areas of Gerstle Cove. Some of the more common species of fish are the rock greenling, the striped surfperch and the coralline sculpin. A few of the dominant invertebrates are the bat star, sea urchins, sponges and sea anemones. Dominant algae include split whip, color changer, and bull kelp.

The Marine Ecological Reserve within the ASBS was established to allow replenishment of the heavily fished red abalone stocks. It now appears that Reserve status has improved the abalone stocks.

A noteworthy feature of Gerstle Cove ASBS is that it includes Gerstle Cove Marine Biological Reserve and is itself contained in Salt Point State Underwater Park.

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FINDINGS AND CONCLUSIONS

Findings

Gerstle Cove ASBS is unusual in that it contains a marine ecological reserve and that it is itself contained within Salt Point State Underwater Park.

The ASBS supports a diverse community of plants and animals that encourage sportfishing and diving as primary recreational uses of this area.

Because the lands adjacent to the ASBS are underdeveloped, no major municipal or industrial pollutant discharges threaten water quality. No offshore oil developments now exist that threaten water quality in the ASBS, although future oil leases may be possible.

No routine water quality monitoring program is being conducted in the ASBS.

Conclusions

The establishment of the Marine Ecological Reserve within the ASBS has evidently allowed recovery of abalone populations that had become depleted from excessive fishing.

Future threats to water quality in the ASBS appear slight; this conclusion assumes, however, that no major landside or offshore developments occur.

Existing pollution caused by fish filleting and power boat operation in the ASBS should be eliminated.

Because the California Department of Parks and Recreation, the California Department of Fish and Game, and the California State Water Quality Control Board all have formal interest in the ASBS, a monitoring program utilizing their combined expertise may be expedient. Assuming increased human activity occurs in and around the ASBS, initiating a monitoring program very soon would give baseline data for assessing possible future impacts.

In order for the State Water Resources Control Board to evaluate the status of protection of Gerstle Cove ASBS, a reconnaissance survey integrating existing information and additional field study was performed by Dr. John D. DeMartini of Humboldt State University Marine Laboratory. The survey report was one of a series prepared for the State Board under the direction of the California Department of Fish and Game and provided the information compiled in this document.

ORGANIZATION OF SURVEY

All observations of the fauna and flora were qualitative. Most intertidal observations were made during summer low tides beginning in June, 1977. The objectives of the survey were to describe the intertidal biota according to the zones of Ricketts and Calvin, 1968 (13), and to describe zones according to degree of air exposure. The presence, relative abundance and distribution of the macrobiota was observed at high tide. Also, intertidal fishes were observed by means of SCUBA gear.

Subtidal observations on biotic and physical features were also made with SCUBA. Using compass bearings, underwater transects were run repeatedly between various exposed landmarks. A slate was used for recording species seen, relative abundance, topography, substrate type, and depth. In addition, examples of the more difficult organisms to identify were collected. The observations resulted in the ASBS being classified for this report into various areas based on habitats and associated biotas.

Literature on local land vegetation, on physical and chemical features, on land and water use, on actual or potential pollution threats, and on special water quality requirements, were reviewed and integrated with observations made by the authors. Considerable information and guidance to this study came from staff at the California Department of Fish and Game. Photographs were taken for augmenting and corroborating the investigation; these are archived at the State Water Resources Control Board and are available for review.

PHYSICAL AND CHEMICAL DESCRIPTION

Location and Size

Gerstle Cove ASBS is located in Sonoma County at about 39°33'57" north latitude and 123°19'45" west longitude. The nearest towns are Gualala, located about 20 miles north on Highway 1, and Jenner, located about 23 miles south on Highway 1.

The surface area of the ASBS is about 1.56 acres (0.63 ha). The shoreline of the ASBS is about 0.51 miles (0.82 km) long (Figure 1).

The official boundary description for the Gerstle Cove ASBS, as found in the California State Water Resources Control Board publication "Areas of Special Biological Significance" (1976), is as follows:

> That portion of Gerstle Cove bounded by a line drawn from USGS Bench Mark 293 tangent to the southernmost extension of the mean high tide line at Salt Point and by a continuation of the mean high tide line from its southernmost extension at Salt Point around the northern end of the cove to the point where the mean high tide line intersects the line drawn from USGS Bench Mark 293 tangent to the southernmost extension of the mean high tide line at Salt Point.

Nearshore Waters

Submarine topography: The submarine topography within the ASBS is extremely irregular, probably owing to exposure of the coastline to wave action, and concomitant erosion of the shoreline. The hardness of the sedimentary rock is highly variable, resulting in differential erosion producing a wave-cut and indented coastline. Thus, large slump blocks and boulders are continually being supplied to the marine environment. Large to small boulders dominate most of the gently sloping subtidal terrain. Slump blocks, wash rocks and emergent sea stacks also occur immediately offshore and constitute the only other topographic features in and adjacent to the ASBS.

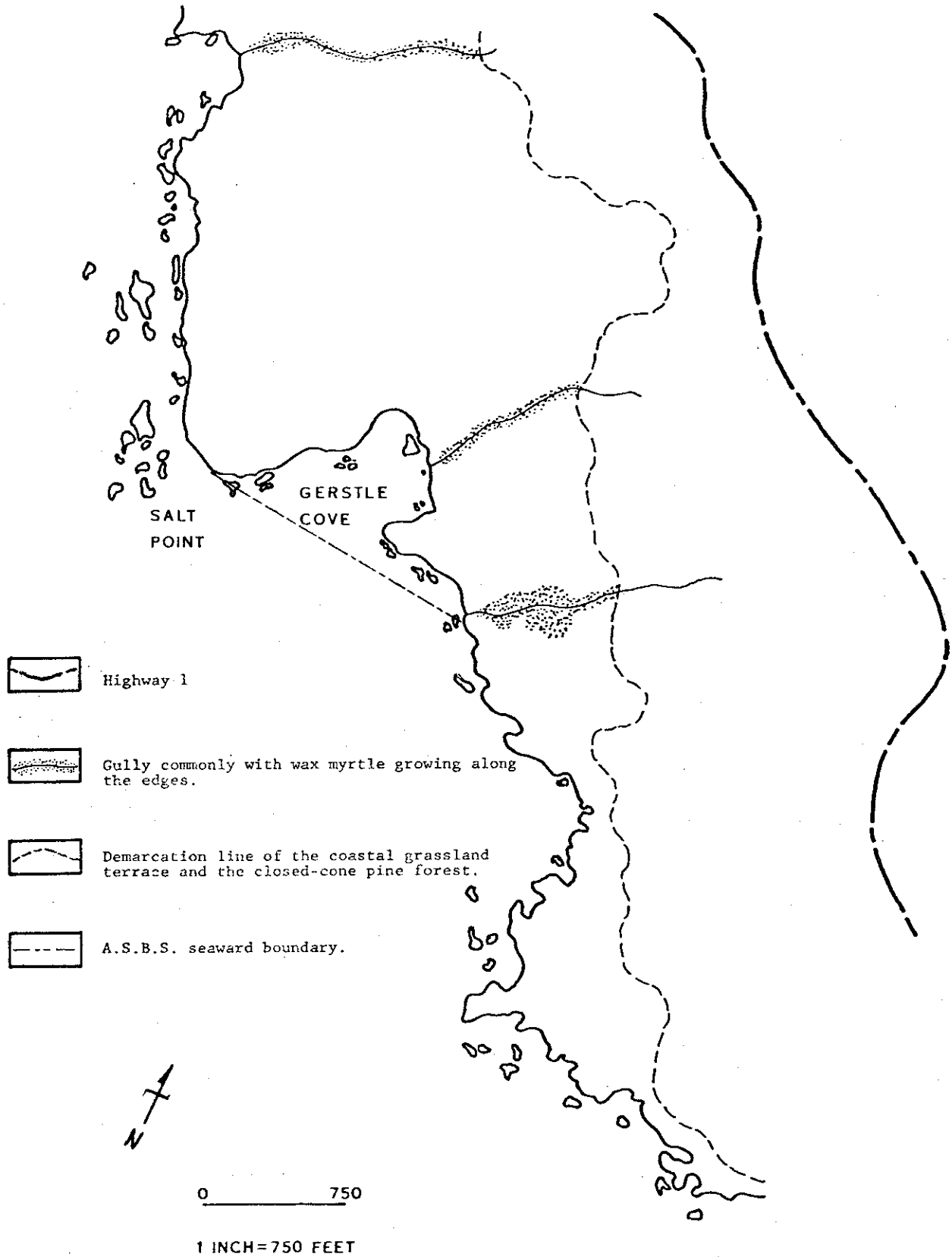

Figure 1. Map showing Gerstle Cove ASBS and adjacent coastline.

Currents: During the summer, upwelling induced by prevailing northwesterly winds occurs on the Northern California coast; however, the upwelling may cease for a few days at a time when winds diminish. North Gerstle Cove is protected from the prevailing northwesterly swell during the summer, as evidenced by the presence of numerous jellyfish, and by the deposition of fine particulate matter there. During the winter, when southerly gales are common, the general water flow is northward, associated with the Davidson Current. (12, 13)

Water Column: Turbidity: The fine particulate matter which settles in North Gerstle Cove during the summer appears to become resuspended later in the year. During a southerly gale in September, 1977, an increase in turbidity was observed while visibility was reduced virtually to zero. In January, during a period of westerly seas, turbidity levels similar to summer conditions were observed. The material suspended in September had probably been removed to deeper water in January.

Temperature: Surface temperatures have been monitored at Salt Point State Park since January, 1973, by State Park staff for Scripps Institution of Oceanography (2). For the years 1973 through 1976, the months of August through November ranked as those having the four highest seasonal mean temperatures (Table 1). The four greatest ranges in temperature occurred in June, July, August and January (Table 2). During summer, the development of a shallow thermocline occurs, especially on very calm days.

Water Quality: The California Department of Parks and Recreation does not expect deterioration of marine water quality due to development of Salt Point State Park (3). Pit-type toilets are adjacent to the parking area on the northwest side of the ASBS. There was no evidence of leach water draining from the cliff adjacent to these toilets; however, 1977 was a year of drought. Also, there was no evidence of leaching from the toilets associated with the A-frame buildings, one of which is the Interpretive Center, adjacent to the northeast side of the ASBS. The General Development Plan (GDP) (3) for Salt Point State Park calls for a 60-car parking facility on the northwestern corner of Gerstle Cove and for 40 picnic units with parking spaces for 40 cars on the northeastern corner

Table 1. Monthly mean surface temperatures in °C, their ranking for a given year (1 = highest to 12 = lowest), the sum of monthly ranks among years and ranking of the sum of ranks for four consecutive years in Gerstle Cove, Salt Point State Park.

Month	Years									
	1973		1974		1975		1976		Sum of Ranks	Ranking of Sum of Ranks
	$\bar{x}$ temp.	rank	$\bar{x}$ temp.	rank	$\bar{x}$ temp.	rank	$\bar{x}$ temp.	rank		
Jan.	11.40	5	9.75	11	9.43	9	9.32	12	37	10
Feb.	11.87	3	9.40	12	9.58	8	9.75	11	34	8.5
Mar.	10.70	10	10.70	8	10.20	6	9.99	10	34	8.5
Apr.	9.87	12	10.10	9	8.96	12	10.06	9	42	12
May	10.36	11	9.80	10	9.36	10	10.56	8	39	11
June	11.02	8	11.00	6	11.48	3	11.83	6	23	5
July	11.00	9	11.50	5	11.38	4	11.67	7	25	6
Aug.	11.70	4	12.40	1	12.32	1	13.89	2	8	1
Sept.	12.00	1	12.20	2	11.50	2	12.91	5	13	2.5
Oct.	11.93	2	12.00	3	10.91	5	13.10	3	13	2.5
Nov.	11.26	7	11.60	4	9.80	7	14.14	1	19	4
Dec.	11.27	6	10.75	7	9.30	11	13.08	4	28	7

of the Cove. The Plan further states that ultimate development will require waste treatment and disposal either on-site, or near the park. In the interim, either leach fields, pits, or transportation of sewage to Santa Rosa will be employed.

Presently, overflow camping is allowed on the marine terrace on the northwestern side of Gerstle Cove. However, with full execution of the GDP, only day-use will occur here. Although the GDP calls for upgrading 30 campsites and construction of 100 new campsites west of Highway 1, the Coastal Zone Commission may restrict camping to the area east of the highway.

Data from District 2 Headquarters, California Department of Parks and Recreation, Santa Rosa, was used to depict public use of the park (Table 3). The least amount of camping in 1976 was during the winter and the most was during the summer. Park visitation was also least in the winter and greatest during the summer in 1975-76.

Daily diver use of the park for June, July and August 1977 can be found in Table 4. For those three months, July had the fewest divers, correlating with the fact that abalone season was closed that month. According to the District Park Ranger, the majority of users of the park are abalone fishermen.

A possible source of water quality reduction is the filleting of fish in the launching area by sportsmen. During the summer, numerous carcasses were found in the intertidal and subtidal zones. Mouldering fish did generate a smell and the site was aesthetically unpleasing during the survey.

Salinity: The salinity regime appears to be characteristic of the surrounding coastline. Runoff sources are from the adjacent cliffs and two small rivulets which probably supply freshwater from late fall through early summer during normal rain years. Because the freshwater supply is relatively small and mixing is generally great, steep, localized salinity gradients are probably rare.

Table 3. The monthly number of visitors and their seasonal monthly averages for 1975 and 1976 and the monthly number of campers and their seasonal monthly averages for 1975 at Salt Point State Park.

Month	Year 1975 # campers	1975 total # visitors	1976 total # visitors
Jan.	1357	3374	2344
Feb.	1430	4115	2069
Mar.	941	2737	5604
ave:	1243	ave: 3422	ave: 3339
Apr.	1628	5345	7905
May	2302	6634	10388
June	2912	7216	9410
ave:	2280	ave: 6398	ave: 9234
July	3255	7800	8322
Aug.	3255	7464	8099
Sept.	2807	6319	5589
ave:	3106	ave: 7194	ave: 7337
Oct.	2419	5782	3154
Nov.	3807	7816	3234
Dec.	1565	6545	2192
ave:	2597	ave: 6714	ave: 2960
Annual Totals	27678	71187	68230

Table 4. Summary of number of divers using Salt Point State Park during June, July and August, 1977.

Date	June	July	August
1	40	18	42
2	10	33	50
3	300	20	24
4	600	20	26
5	300	4	38
6	4	6	280
7	4	6	15
8	8	4	20
9	26	40	12
10	30	60	21
11	250	10	24
12	100	6	42
13	15	10	250
14	18	8	258
15	21	52	15
16	27	50	10
17	17	60	14
18	125	5	26
19	80	6	55
20	20	2	450
21	14	0	180
22	10	4	15
23	6	61	20
24	32	56	20
25	150	15	10
26	75	12	27
27	37	6	80
28	42	2	110
29	60	8	20
30	150	34	12
31		-	9
Total # of divers:	2631	618	2175
Daily average # of divers:	87.70	20.60	70.16

Topography and Geomorphology

Subtidal Substrate: The ASBS was subdivided into areas based on substrates and attendant biotic assemblages (Figure 2). Most of the subtidal substrates in the ASBS are less than 40 ft (12 m) deep (Figure 3). From the southern boundary to about the beginning of North Gerstle Cove, the substrate consists of bedrock, slump blocks and giant boulders. The western portion of Area C and all of Area D (Figure 2) of North Gerstle Cove consist of moderately coarse sandstone bedrock extending about 20 ft. (6 m) deep and about 74 ft. (23 m) offshore. In the launching site (Figure 2), coarse sand occurs to about 10 to 15 ft. (3 to 4.5 m) deep; below this depth, sand, gravel, and fine sediment (the latter was common during the summer) occur with rounded, small to medium sized boulders. A geological fault crosses the northeast corner of North Gerstle Cove and runs northward toward the Kruse Fault (7).

Intertidal Substrate: The western sector of Gerstle Cove, Area A, consists primarily of large to medium sized coarse sandstone boulders. The source of boulders is apparently the adjacent sea cliff. The boulders are round, indicating that rolling must occur, especially during extreme winter gales. Moving eastward, a cobble field occurs and further still some bedrock, part of the adjacent sea cliff, reaches the intertidal zone. Area B consists of small to medium sized boulders surrounded by coarse sand. The source of both materials is apparently the adjacent cliff. Area C is comprised of a boulder field with some intrusive bedrock. Sloping into North Gerstle Cove, the southern portion, Area D, consists totally of intertidal bedrock and is part of the sea cliff. Area E is located immediately downcoast from Area D and consists of bedrock, except near its southern boundary where small boulders and coarse sand occur.

Adjacent Land Mass: The adjacent land mass is emergent coast, featuring a series of wave-cut marine terraces produced by relatively higher sea levels. The youngest marine terrace, bordering the ASBS, begins at the bluff, is about 25 to 50 ft. (8 to 15 m) high and extends northeastward several hundred feet (10). Heavy foot traffic along the northwestern side of the ASBS is resulting in deterioration of the edge of the bluff.

GERSTLE COVE ASBS

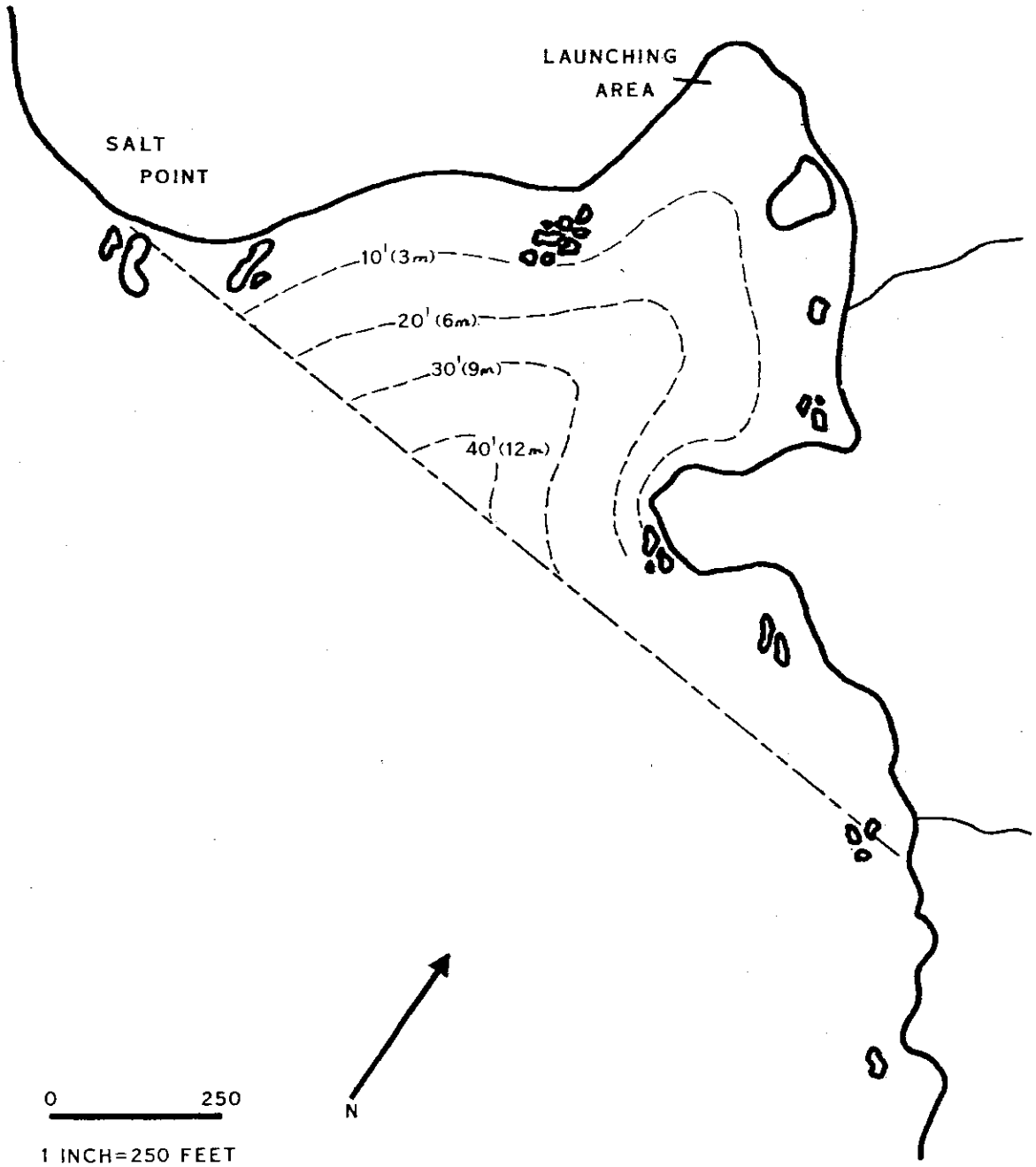

Figure 3. Bathymetric map of Gerstle Cove ASBS.

The next older terrace is about 250 to 300 ft. (75 to 90 m) high and is at the level of Highway 1 (10). This terrace is overlain by coastal terrace deposits, with Eocene sediments underneath consisting primarily of sandstone, mudstone, and conglomerate (10).

Climate

Rainfall: Annual rainfall averages about 47 inches (120 cm).

Air Temperature: Summer air temperature averages 64°F (18°C) and the winter air temperature is 42°F (6°C).

Wind Pattern: During the summer, prevailing winds are westerly to northwesterly and, although persistent, are fairly light most of the time (3). Occasional summer squalls bring winds from the south and disrupt the summer wind pattern. Fall and winter storms typically have winds from the south.

BIOLOGICAL DESCRIPTION

Subtidal Biota

The Gerstle Cove ASBS was divided subtidally and intertidally into seven areas, as shown in Figure 3. The subsequent discussion describes the biota of these areas. These descriptions should be used as guides, but should not be construed as definitive. With low visibility and extreme variability in the biota, organisms and their relative abundance can change within a few meters. The more common species that were observed are listed in Appendicies 1 through 3.

The most abundant fishes observed (Appendix 1) during the summer of 1977 were the black rock fish, Sebastes melanops, and Sebastes juveniles found throughout the ASBS; the rock greenling, Hexagrammos decagrammus, common among boulders and kelp; the striped perch, Embiotoca lateralis, which is most often found in and near kelp beds; and the coralline sculpin, Artedius corallinus. Other rock fishes seen were the brown, S. auriculatus, the copper, S. caurinus which is uncommon; the black-and-yellow S. chrysomelas, found in the Pterygophora forest; the blue, S. mystinus, occurring throughout most of the reserve area; the china, S. nebulosus, the grass, S. rastrelliger, and the olive rockfish, S. serranoides which is uncommon. The hexagrammids found were the painted greenling, Oxylebius pictus (fairly common) and the lingcod, Ophiodon elongatus, the cottids observed were the buffalo sculpin, Enophrys bison (uncommon); Irish Lords, Hemilepidotus sp., found near the Nereocystis bed on the west side of the cove; the longfin sculpin, Jordania zonope, and the cabezon, Scorpaenichthys marmoratus, (common); the bluespot goby, Coryphopterus nicholsi, found in many areas throughout the ASBS; the kelpfish, Gibbonsia sp., the mosshead prickleback, Chirolophus nugator, found in cracks and holes; and the pile perch, Damalichthys vacca found in Areas D and E; the walleye surfperch, Hyperprosopon argenteum; the white seaperch, Phanerodon furcatus, most of which were found in the Pterygophora forest, and the rubberlip seaperch, Rhacochilus toxotes, which is uncommon.

Most species observed during summer 1977 and winter 1978 were the same, except juvenile rockfish Sebastes spp. which were fewer in winter.

Area A: In the near subtidal zone, large boulders about 6 to 10 ft. (1.8 to 3 m) in diameter occurred with interstitial gravel. The area's maximum depth was about 20 ft. (6 m) and averaged 10 to 15 ft. (3.4 to 5 m) deep. Near the middle of Area A, giant boulders prevailed from about 20 ft. (6 m) deep to the intertidal zone. During the summer, rocks near the seaward boundary were relatively clean of fine sediment. In the middle of the cove, a veneer of fine sediment was observed; however, during the winter the sediment decreased greatly (Figure 4).

The dominant invertebrates (Appendix 2) were the sponge, Leucosolenia eleanor, the bat star, Patiria miniata, the sea urchins, Strongylocentrotus franciscanus and S. purpuratus and various unidentified tunicates. Other invertebrates included the sponges Leucandra heathi and Tethya aurantia, all primarily seen on giant boulders in portions of Area A; the hydrozoans Abietinaria sp., Plumularia sp., Sertularia sp., and the hyrdrocoral Stylantheca porphyra; the scyphozoans Aurelia aurita and Chrysaora melanaster with the medusa stages in the water column; the small red anemone, Corynactis californica, and Tealia lofotensis; the polychaetes Dodecaceria fewkesi (common); the plumed sabellid worm, Eudistylia polymorpha and the limy-tubed worm, Serpula vermicularis; the chitons Ischnochiton spp. found under boulders, and the lined chiton, Tonicella lineata, on crustose coralline algae. The snail Acmaea mitra was found on crustose coralline algae; the red abalone, Haliotis rufescens, Homalopoma sp. located under boulders; the brown turban snail, Tegula brunnea, was observed on kelp; the nudibranch, Dirona albolineata; the large barnacle, Balanus nubilus; the masking crab, Loxorhynchus crispatus, the hermit crab, Pagurus sp., and Pugettia richii found within tufts of Calliarthron tuberculosum; the bryozoans Crisia occidentalis, Dendrobeania laxa, Disporella sp. and unidentified crustose forms; the red starfish, Henricia leviuscula, the bat star, the pink skinned star, Pisaster brevispinus, P. giganteus and P. ochraceus; the tunicate Archidistoma sp., Metandrocarpa dura, common where surge was strong, and other unidentified compound ascidians.

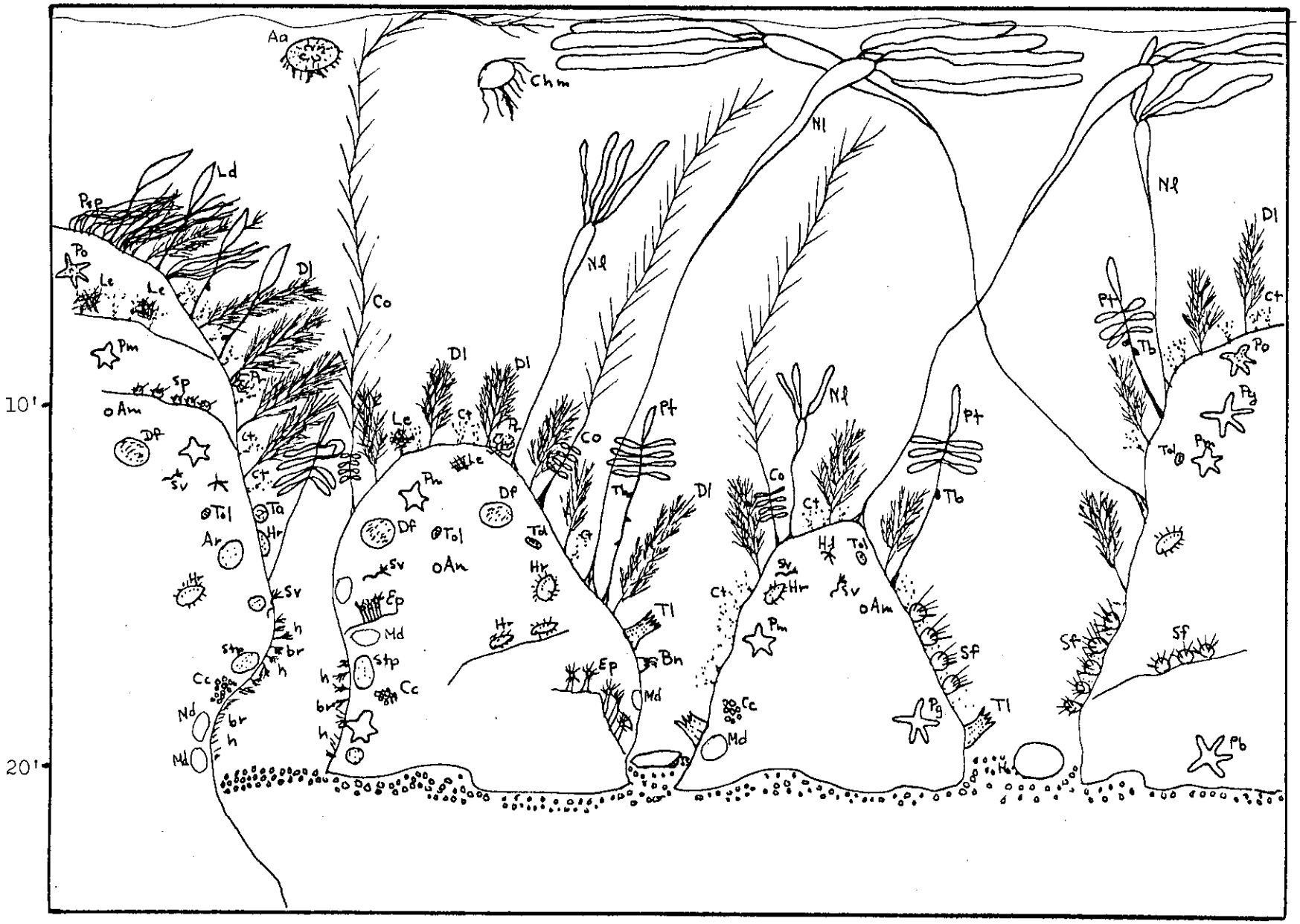

Figure 4. The macrobiota observed in Area A of Gerstle Cove ASBS.

The dominant algae (Appendix 3) were Calliarthron tuberculosum, common and being grazed by sea urchins in some portions; color changer, Desmarestia ligulata var. ligulata, found at all depths and dominant in the summer; split whip, Laminaria dentigera, abundant in the most westerly region correlating with greater exposure to water movement there; and bull kelp, Nereocystis luetkeana, forming a surface canopy from 15 to 20 ft. (4.5 to 6 m) deep, primarily during the summer. Other algae included Corallina vancouveriensis, Cystoseira osmundacea, common to about 15 ft. (4.5 m) and reaching the surface during the summer; Fryeella gardneri, which is rare; Peyssonellia hairii, common throughout; red point, Prionitis lanceolata, in the shallow portion and Pterygophora californica.

Flowering plants observed included the surf grasses, Phyllospadix scouleri in the western portion and P. torreyi in the eastern portion of the area.

Area B: This area serves for boat launching, since it is easily accessible and is generally the calmest part of the Cove. Inshore, during the summer, the area consisted of coarse sand and fine sediment and widely spaced small boulders. The numbers of boulders and amount of silt increased going seaward. During the summer, fish carcasses, left by fishermen, were always found in this area and often produced strong odors. Maximum depth was about 15 ft. (4.5 m) and average depth was about 10 ft. (3 m) (Figure 5).

The dominant invertebrates (Appendix 2) were the bat star, P. miniata, apparently feeding from sediments during the summer, and the brown turban snail, T. brunnea, found on P. californica. Other invertebrates included the innkeeper worm, Urechis caupo, locally common in sand; red abalone, Haliotis rufescens, with juveniles under boulders and adults common on sides and tops of boulders; the chiton, Placiphorella velata, the brittle star, Amphiodia occidentalis with rays extending through the sand and into the water, and the sea urchin, S. franciscanus located amongst boulders.

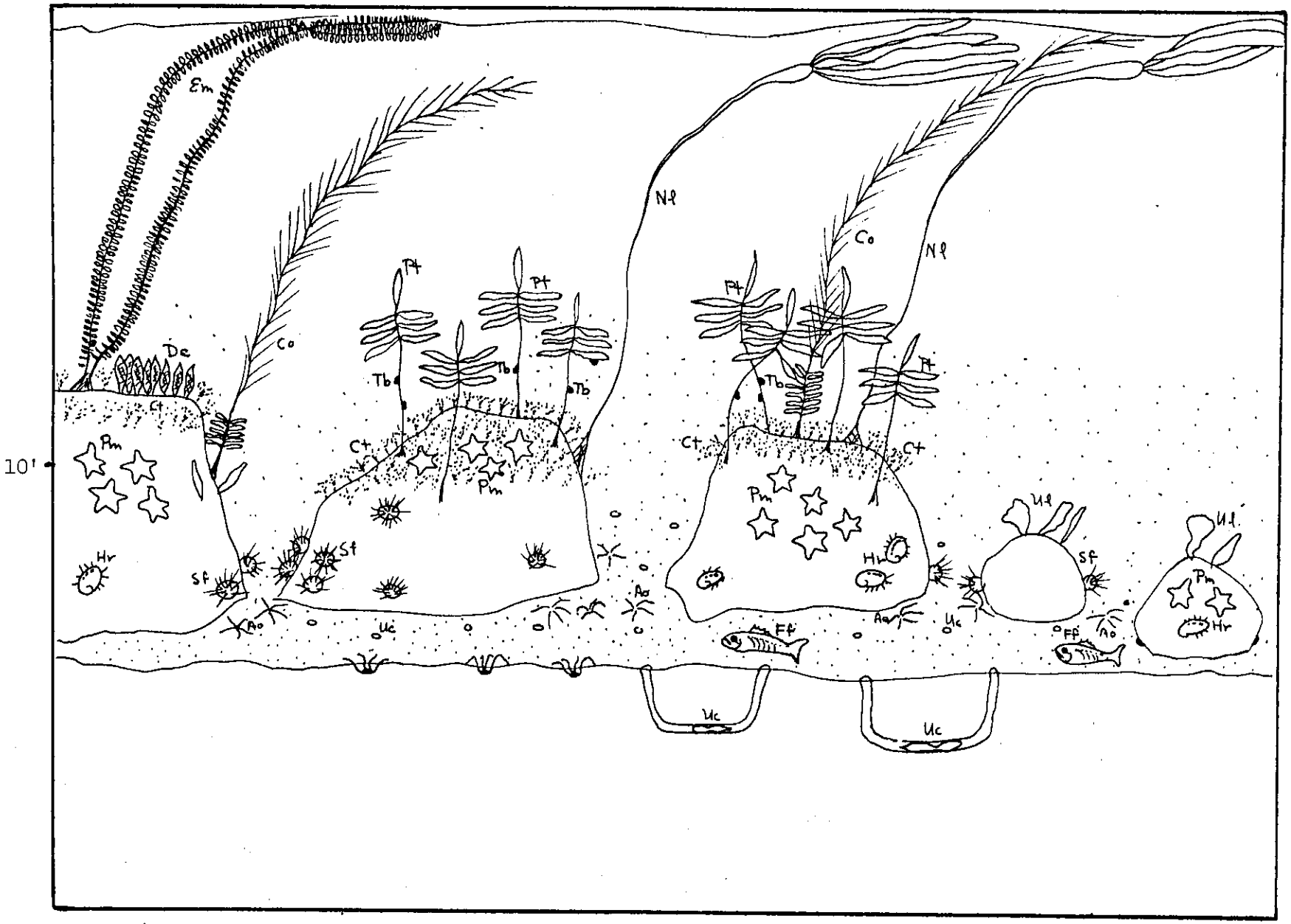

Figure 5. The macrobiota observed in Area B of Gerstle Cove ASBS.

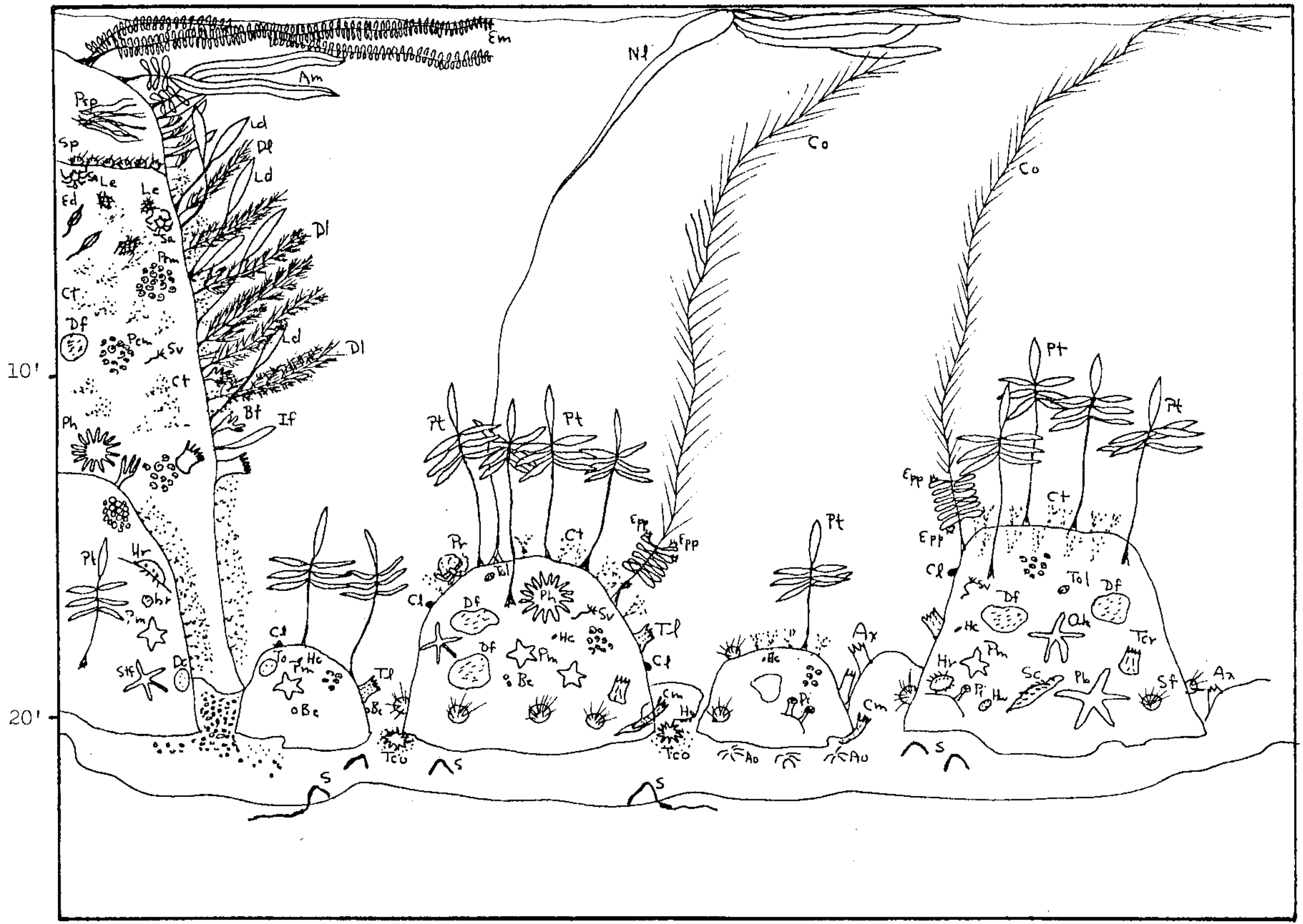

Figure 6 . The macrobiota of Area C of Gerstle Cove ASBS.

were also observed. The sea stars Orthasterias koehleri, the bat star, P. brevispinus, Stylasterias forreri, several were seen; the long-spinned sea urchin, S. franciscanus, seen in crevices; the sea cucumber, Cucumaria miniata seen in cracks and under bases of boulders and the California cucumber, Stichopus californicus where sedimentation is common; the brittle stars A. occidentalis, observed in dirty gravel between boulders and Ophiopholis aculeala found under boulders. The tunicates Didemnum carnulentum, Pyura haustor seen in crevices on vertical faces, and Tridemnum opacum; and the acorn worm Saccoglossus sp. were seen in dirty gravel.

Algae seen in area C (Appendix 3) were C. tuberculosum, Corallina vancouveriensis, both forming the dominant turf, D. ligulata var. ligulata the dominant and most conspicuous alga during the summer to 20 ft. (6 m), Microcladia borealis to 20 ft. (6 m) during summer and P. californica found on tops of boulders. Other brown algae were Alaria marginata, C. osmundacea, D. californicum, feather boa, common inshore; split whip, and bull kelp, sparse in this case. Other red algae were Botryoglossum farlowianum, Grateloupia doryphora, Iridaea cordata, I. flaccida, and red point. The last five species occurred in the immediate subtidal zone. The corallines Bossiella californica var. californica and Lithothamnion sp., Peysonnellia hairii, Hymenena flabelligera, Erythrophyllum delesserioides were found at shallow depths, and Polysiphonia pacifica was found at all depths.

Flowering plants observed in the area were the surf grasses P. scouleri and P. torreyei.

Area D: This is the most exposed portion of North Gerstle Cove during the summer time, and receives the brunt of northwesterly swells. Along this side of the Cove, the sandstone bedrock continued subtidally to about 25 ft. (7.7 m) deep and approximately 75 ft. (23 m) from shore. Large boulders with many small boulders around them afforded good habitat for many crevice-dwelling invertebrates. The rock was clean to about 20 ft. (6 m) deep, below which rocks became dirty during the summer. During the winter the whole area was clean. Gravel filled the interstices between many boulders (Figure 7).

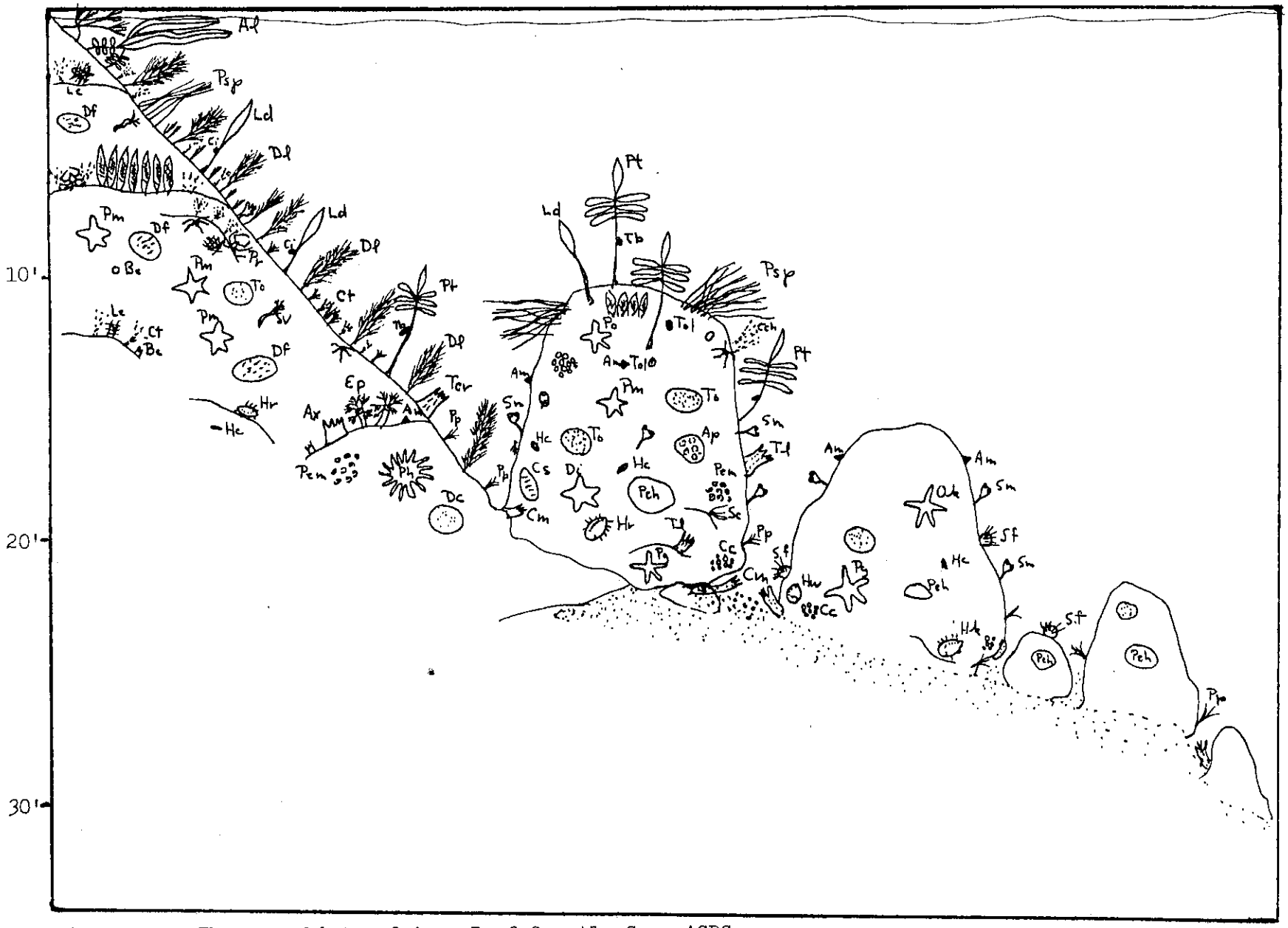

Figure 7 . The macrobiota of Area D of Gerstle Cove ASBS.

Many small invertebrates inhabited the Calliarthron turf and were readily visible, including the cup coral B. elegans; the polychaete Nereis latescens; juvenile red abalone, (to about 15 mm long); the kelp crab, and various unidentified crustose bryozoans.

The dominant invertebrates (Appendix 2) were the sponge L. eleanor usually found attached to C. tuberculosum; the polychaetes D. fewkesi, E. polymorpha in cracks and crevices and S. vermicularis; the bat star; and the sea cucumber, C. miniata, also found in crevices.

Other invertebrates occurring were the sponges Petrosia dura and Plocamia karykina; the solitary anemone, common in large crevices, the small red anemone, common at bases of boulders; T. crassicornis and T. lofotensis; the scyphozoans A. aurita and C. melanastar, medusae in the water column; the polychaetes Dodecaceria concharum, uncommon, Salmacina tribanchiata, and Streblosoma crassibranchia, in cracks; the gum boot chiton, and P. velata, common in turf of C. tuberculosum, and T. lineata on clean inarticulate coralline algae. Also observed were the dunce-cap limpet on crustose coralline algae; Collisella instabilis, common on stipes of split whip; Haliotis kamtschatkana and red abalone in crevices and on underhangs; Megatebennus bimaculatus, and the brown turban snail, found on stipes of split whip and surfgrasses. Other invertebrates found were the vermetid snail, P. montereyensis; the nudibranchs Diaulula sandiegensis and H. crassicornis, very common; the bryozoans Heteropora pacifica and unidentified crustose species. The leather star, Dermasterias imbricata, O. koehleri, the common star fish, the ochre star fish and the sunflower star were all observed during the summer transect. The brittle star, the sea cucumber, found on underhangs of boulders, the giant red urchin, found in crevices below 15 ft. (4.5 m); the tunicates Aplidium sp., Didemnum carnulentum, Styela montereyensis, which is common, and T. opacum also common, were noted during the subtidal dives.

Algae (Appendix 3) occurred throughout this area with the dominant algae being A. marginata, C. tuberculosum, C. vancouveriensis, and color changer. Beginning at 20 ft. (6 m) filamentous diatoms cover the rocks during the summer. Other algae included B. californica var. californica

and var. schmittii, Botryoglossum farlowianum to 10 ft. (3 m), the articulate coralline Calliarthron cheilosporioides, common on vertical faces of boulders and indicative of strong surge, D. californicum found on tops of boulders at 10 ft. (3 m) or less, split whip, at depths of 15 ft. (4.5 m) or less, Lithothamnion sp., present but sparse; delicate sycophant, Microcladia borealis, P. hairii, common, P. pacifica, present throughout, P. lanceolata to 10 ft. (3 m), and P. californica, common and old.

The surfgrass P. scouleri was common to 15 ft. (4.5 m) deep on tops of boulders.

Area E: The habitat consisted of nearly vertical bedrock along the shore to a depth of 10 to 15 ft. (3 to 4.5 m), below which giant boulders and large slump rocks predominated. During the summer, a layer of silt covered rock and gravel surfaces below 15 ft. (4.5 m) deep. Few plants remained below 20 ft. (6 m), apparently due to the grazing activities of the longspined urchin (Figure 8).

The dominant invertebrates (Appendix 2) were the polychaete D. fewkesi, the vermetid snail, P. montereyensis, and the giant red urchin. Other invertebrates included the sponges L. eleanor, common to 10 ft. (3 m) deep on C. tuberculosum and T. aurantia; the hydrocoral S. porphyra; the solitary anemone, in large crevices, the small red anemone, E. prolifera, the colorful Metridium senile, T. crassicornis and T. lofotensis; the sea coral, Balanophyllia elegans; the jellyfishes C. melanaster and Pelagia noctiluca; the polychaetes D. concharum, E. polymorpha, locally abundant in cracks and crevices, S. tribranchiata, and S. vermicularis; the gum boot chiton, in the sediments around boulders, Ischnochiton spp. under rocks, and the lined chiton on clean coralline surfaces; the abalones H. kamtschatkana, the red abalone, and H. walallensis; the phoronid Phoronis sp., common on vertical bedrock; the bryozoans Hippodiplosia insculpta, Phidolopora pacifica and unidentified crustose sp.; the purple urchin; the bat star, common in cracks, P. brevispinus, and the common sea star; the tunicates Aplidium sp., Archidistoma sp., D. carnulentum, common, S. montereyensis, on both sides of boulders and various unidentified species.

Figure 8. The macrobiota of Area E of Gerstle Cove ASBS.

The most prevalent algae (Appendix 3) were C. tuberculosum, heavily grazed below 20 ft. (6 m), color changer, during the summer to about 15 ft. (4.5 m) deep and Peyssonellia sp. Other algae observed were Halicystis ovalis. split whip, to about 10 ft. (3 m), the crustose coralline Lithothomnion sp. and bull kelp.

Area F: The bottom consisted primarily of low relief boulders of medium size with their interstices bearing sand and gravel (Figure 9). During the summer, a thick veneer of silt and diatoms covered the tops of boulders. The depth for this area ranged from about 25 to 40 ft. (7.7 to 12.5 m).

The most notable invertebrate was the long-spined urchin, S. franciscanus. Other invertebrates included the small red anemone, C. californica, Halcampa decemtentaculata, in sand and T. crassicornis; the polychaetes Diopatra ornata often found in the larger cracks of the boulders, D. fewkesi, S. vermicularis and Streblosoma crassibranchia, common under boulders. The peanut worm, Phascolosoma agassizii, was noticed under boulders; the chitons Ischnochiton sp. were found under boulders and Placiphorella velata were also observed; the mollusks Haliotis rufescens, or the red abalone, Homalopoma sp. and Petaloconchus montereyensis were seen; the sea lemon, Anisodoris nobilis, Diaulula sandiegensis, the yellow and green colored Hermissenda crassicornis, common in this area, and the white-bodied Triopha carpenteri were also noticed. The basket cockle, Clinocardium nuttalli, Gari californica, the rock cockle, Protothaca staminea, and Semile decisa were all found dead during this transect. The sea stars Henricia leviuscula, the fragile, O. koehleri, P.miniata, the common sea star, the sunflower star and the sun star and the brittle stars A. occidentalis and Ophiothrix spiculata were found in dirty gravel or under rocks. The sea cucumbers, C. miniata, in cracks and crevices, Leptosynapta sp. burrowed in dirty gravel and Stichopus californicus, in a slurry between and on boulders; and the acorn worm Saccoglossus sp., found in dirty gravel (Appendix 2). The algae found to be most prevalent were C. tuberculosum, in poor condition apparently due to grazing by the long-spined sea urchin, Peyssonellia hairii and P. californica, with many plants grazed to short stipes by the long-spined sea urchins. Other algae

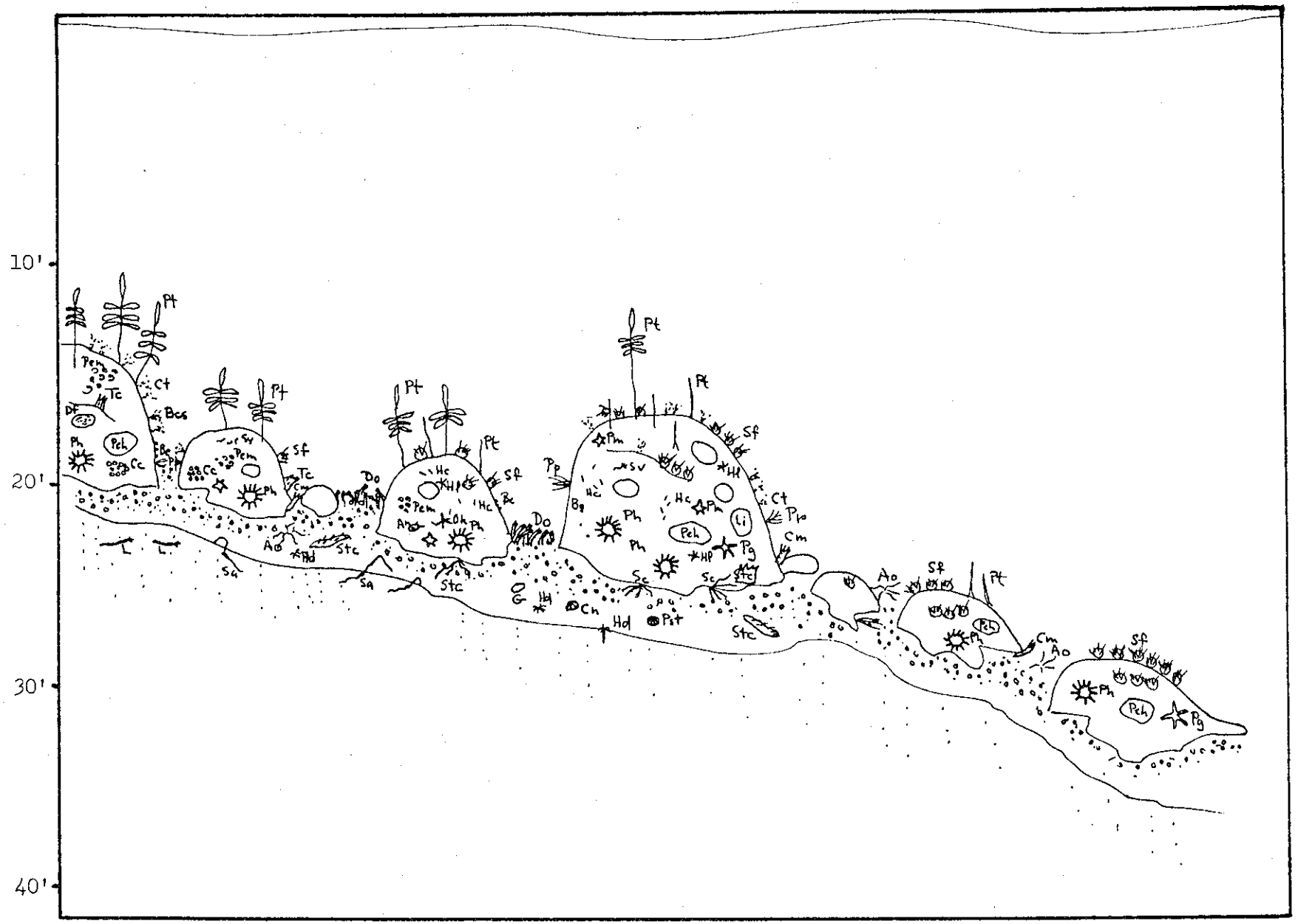

Figure 9. The macrobiota of Area F of Gerstle Cove ASBS.

included the corallines B. californica var. schmittii on sides of boulders, Lithothamnium sp. possibly heavily grazed, bull kelp, which was sparse, and P. pacifica, which was common (Appendix 3).

Area G: The substrate consisted of medium to large boulders with smooth uneven surfaces and a thin layer of sediment during the winter (no observations were made during the summer; however, sediment probably was thicker during the summer). Old pits formed by the sea urchin, S. purpuratus, were present in some boulders. Gravel, cobble and shell fragments occurred in interstices. This area is very similar to Area F inside the reserve. The depths averaged 30 to 40 ft. (9 to 12 m) with a maximum depth of about 45 ft. (13.8 m) (Figure 10).

The invertebrates (Appendix 2), with the greatest occurrence were the sponge Axocielita sp.; the cup coral, B. elegans; the polychaete Diopatra ornata in gravel between boulders; the vermetid snail, P. montereyensis and the dunce-cap limpet. Other invertebrates included the small red anemone, the proliferating anemone, E. prolifera, T. ciruacea in gravel, T. crassicornis, T. lofotensis; the cup coral Paracyathus stearnsi which is rare; the polychaetes D. fewkesi, E. polymorpha, Phyllochaetopterus prolifica and P. elongata; the snails C. ligatum, Ceratostoma foliatum, Dendropoma sp., Diodora aspera, H. kamtschatkana, the red abalone, H. walallensis, haliotid juveniles, the last four were rare, Homalopoma sp. common under rocks, the Japanese oyster drill, Ocenebra sp., Opalia chacei, Tegula pulligo, common; the clams Gari californica (dead), Humilaria kennerlyi (dead), the oyster, Pododesmus cepio; the nudibranchs C. luteomarginata and Rostanga pulchra; the bryozoans Diaperoecia californica, Disporella sp., Eurystomella bilabiata, and H. pacifica; the long-spined urchin; the sea stars D. imbricata, H. leviuscula, Leptasterias hexactis, O. koehleri, P. brevispinus, the common sea star, the sunflower star, S. dawsoni and Stylasterias forreri; and the tunicate S. montereyensis.

The dominant algae (Appendix 3) were Lithothamnion sp. and P. hairii, both occurring patchily on boulders.

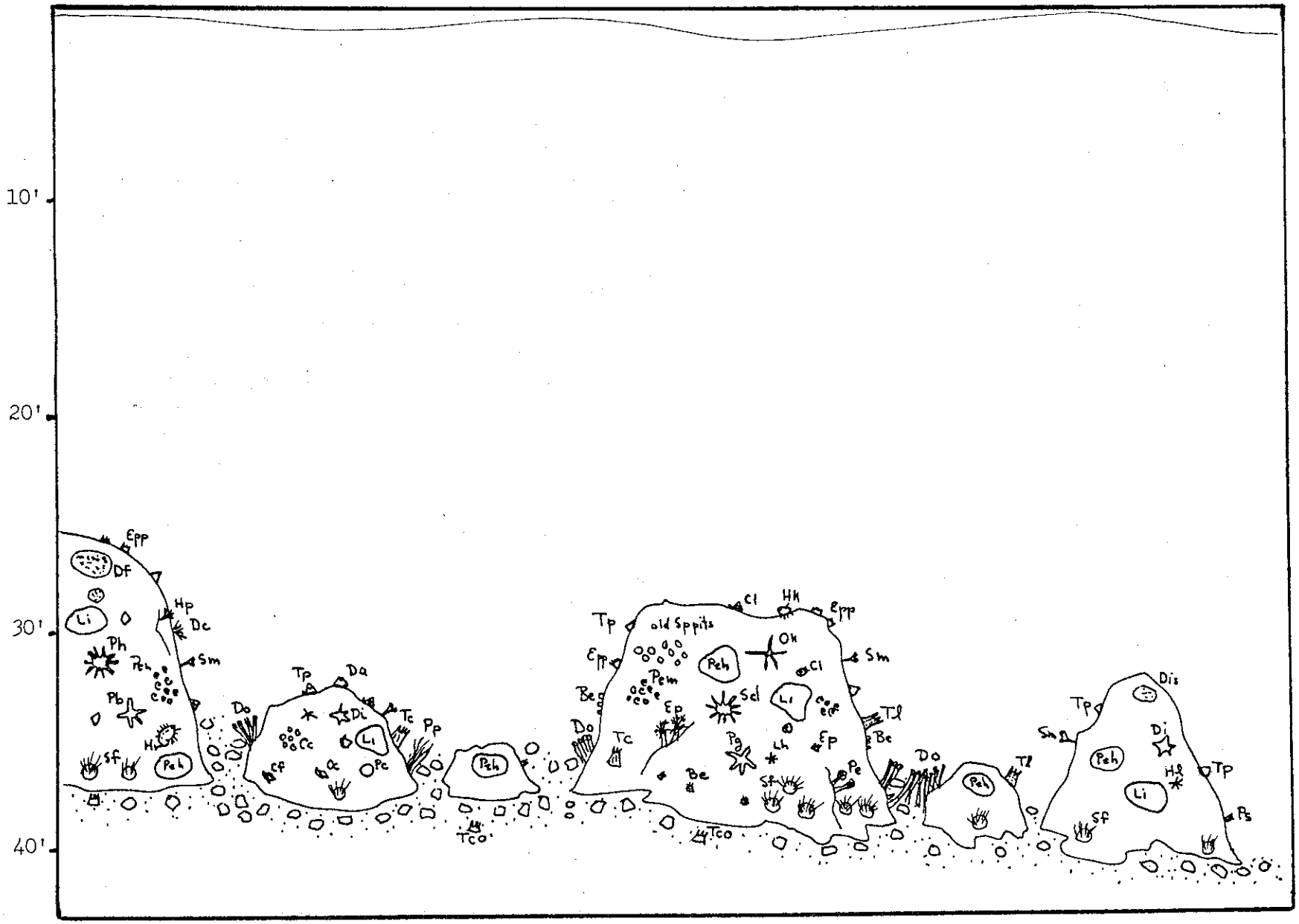

Figure 10. The macrobiota of Area G of Gerstle Cove ASBS.

Zone 2: A more diverse biota was observed in this zone, as was expected.

A weak balanoid belt occurred containing the acorn barnacles B. glandula and Chthamalus dalli with both being small in size and sparse in number. Also found were juveniles of the periwinkle L. scutulata and of the limpets C. digitalis and Collisella pelta, all three being common. Often seen at the bases of boulders were the limpet Notoacmaea scutum; the black turban snail, Tegula funebralis; the shore crabs, H. nudus and Pachygrapsus crassipes; and the porcelain crab, Petrolisthes cinctipes. The polychaete Spirorbis sp. dominated some boulders, but was generally uncommon (Appendix 5).

The fucoid brown algae including Fucus distichus, Pelvetia fastigiata, and Pelvetiopsis limitata occurring very patchily in the higher portions of the zone. In the midportions, the bushy red Endocladia muricata was locally abundant. Also occurring were ocean pin cushion, Cladaphora columbiana, turkish towel, Gigartina papillata, Hapalospongidion gelatinosum, forming a slime on many lower boulders, Hedophyllum sessile, sparse in this zone, and red laver, Porphyra schizophylla, locally abundant. The lower portion of the zone harbored Analipus japonicus, Callithamnion pikeanum, the bladder-like, Halosaccion glandiforme, Leathesia difformis, Microcladia borealis, Spongomorpha coalita and Urospora doliifera (Appendix 6).

Zone 3: Relative to Zones 1 and 2, the diversity of the macrobiota did not increase appreciably in this zone. Observed were the aggregating anemone, Anthopleura elegantissima, in gravel between boulders; the chiton, Katharina tunicata, sparse; the limpets Collisella pelta and N. scutum; the opisthobranch Onchidella borealis; the sea mussel Mytilus californianus, small and sparse; the shore crab H. nudus; the sea star Pisaster ochraceus; and the purple sea urchin Strongylocentrotus purpuratus, common to abundant in the lower portion of the zone.

Many of the boulders in this zone were covered with H. gelatinosum. H. Sessile was the only other evident brown alga. The common red algae

included Corallina vancouveriensis, Gelidium coulteri; Gigartina papillata, Iridaea flaccida, I. heterocarpa, M. borealis, Odonthalia floccosa, Petrocelis franciscana and P. schizophylla (Appendix 6).

Zone 4: The algal growth was expectedly lush during the summer, but the macrofauna was not diverse. The gumboot chiton and the second largest chiton, Katharina tunicata; the crab Cancer antennarius; and the bat star, and the ochre sea star were all observed (Appendix 5). Brown algae became far more abundant in this zone and included neptune's quill, Alaria marginata, woody chain bladder, Cystoseira osmundacea, feather boa, H. sessile and split whip. Red algae included C. vancouveriensis, red sea feather, Erythrophyllum delesserioides, , iridescent seaweed, Laurencia spectabilis, Lithothamnion sp., bottle brush, Odonthalia floccosa, O. oregona, Peyssonellia hairii and red point. All the above species are common in this area. The only green alga observed was Spongomorpha coalita, also common. Flowering plants included the surf grasses Phyllospadix scouleri and P. torreyi on the tops of boulders (Appendix 6).

Area B: The intertidal habitat consisted primarily of course sand, cobble, and rounded boulders. The biota was not diverse, undoubtedly due to sand abrasion and to rolling of boulders. The area is well protected from the prevailing summer northwesterly swell, but during southerly gales is subjected to intense wave action. Presently, it is utilized as a small boat landing. During the summer, drift algae often collected along the beach; some of these were not found growing within the ASBS.

Zone 1: The macrobiota was extremely sparse throughout, with the periwinkles L. planaxis and L. scutulata and the limpet C. digitalis the only invertebrates observed.

Zone 2: Diversity increased only slightly with the limpets Collisella digitalis and C. scabra; the periwinkle L. scutulata; and acorn barnacles.

During the summer, the filamentous brown alga H. gelatinosum covered many of the lower boulders. Also occurring patchily were Leathesia difformis, yellow rockweed, and red laver (Appendix 6).

Zone 3: The only invertebrates present were the limpet N. fenestrata and the black turban snail. During the summer the alga H. gelatinosum dominated many of the boulders, along with the iridescent seaweeds I. cordata and I. flaccida. Other red algae observed in the lower part of the zone included Ceramium eatonianum, sea grapes, Grateloupia doryphora, I. heterocarpa, delicate sycophant, bottle brush and P. schizophylla. The green alga were sea lettuce, Ulva angusta and U. californica (Appendix 6).

Zone 4: The substrate was mainly coarse sand and a few abraded boulders; thus the habitat was harsh and the biota was sparse. No invertebrates were observed in this zone. A few brown algae (Appendix 6) were present, including C. osmundacea and feather boa. The red algae included both Ahnfeltia plicata and beach sentry, Gymnogongris linearis, both partially buried in sand; Anthithamnion defectum, iridescent seaweed, bottle brush, and sea lettuce.

Area C: This area consisted of several large bedrock outcrops surrounded by medium to giant boulders with interstitial coarse sand. The intertidal zone was wide (approximately 50 to 75 ft. (15.4 to 23 m) at low tide) due to a shoreline of low relief. During the summer, wave action was usually minimal because of protection conferred by Salt Point. Occasionally, this area was surgy, associated with westerly and southerly seas. Marine plants dominated this area during the summer. The fauna was not abundant.

Zone 1: C. digitalis, the periwinkle, L. planaxis, acorn barnacles, and L. occidentalis were the common invertebrates seen (Appendix 5).

The green algae, ocean pincushion, and Entermorpha sp. were also observed.

Zone 2: The juvenile periwinkle L. scutulata, the acorn barnacle and C. dalli were common. Also observed were the polychaetes Halosydna brevisetosa seen under rocks, and Spirorbis sp. The black turban snail, found locally abundant at bases of boulders, C. digitalis and C. pelta, and the lined shore crab were seen (Appendix 5).

Yellow rockweed was abundant on tops of boulders interspersed with the rockweed F. distichus and P. limitata, both being sparse. H. gelatinosum was abundant. Other algae included C. vancouveriensis, nail brush, turkish towel, Gigartina papillata, sea sack, bottle brush, Petrocelis franciscana, which was patchy, and P. schizophylla (Appendix 6).

Zone 3: The invertebrates (Appendix 5) seen in Zone 3 were the sponge Ophlitaspongia pennata; the aggregating sea anemone; the polychaete Dodecaceria concharum, found under rocks; the chitons Ischnochiton sp. and K. tunicata; the snails Nucella emarginata, the black and the brown turban snails, both common; the nudibranch Rostanga pulchra, on O. pennata; the California mussel, the gooseneck barnacle, Pollicipes polymerus, uncommon; H. nudus and the lined shore crab, the hermit crab, Pagurus hemphilli, and the porcelain crab, Petrolisthes cinctipes; the sea stars Leptasterias hexactis, the bat star and the ochre sea star.

The dominant marine plants were C. vancouveriensis, G. papillata, iridescent seaweed and P. schizophylla. Other plants included the brown alga H. sessile; the red algae Botryoglossum farlowianum, C. pikeanum, Hymenena multiloba, delicate sycophant, common, bottle brush, Petrocelis franciscana, red point, and the green alga Spongomorpha coalita (Appendix 6).

Zone 4: The diversity of the biota was higher here than in Zone 3 with the giant green anemone, A. xanthogrammica, and the proliferating anemone, Epiactis prolifera, common on C. osmundacea; the polychaete Streblosoma crassibranchia found in crevices; the chitons Ischnochiton sp. under boulders and K. tunicata; the snails Bittium eschrichtii, the red abalone, Homalopoma sp. seen under rocks, the dire whelk, Searlesia dira, the brown and the black turban snails, the masking crab, Scyra acutifrons; the leather sea star, L. hexactis and the bat star, the purple urchin, in isolated aggregations; and the tunicates Didemnum carnulentum and Tridemnum opacum (Appendix 5).

The flowering surfgrass Phyllospadix scouleri was common on tops of boulders. The brown algae were A. marginata, woody chain bladder, ruffled sword, Dictyoneurum californicum, feather boa, H. sessile and split whip. The red algae included B. californica var. californica, corallines, Hymenena flagelligera, iridescent seaweed, encrusting algae, Peysonnellia hairii and Pterochondria woodii (Appendix 6).

Area D: The intertidal zone consisted of moderately sloping (approximately 45°) sandstone bedrock. The surface was relatively smooth, but contained many pits 2 to 3 in. (5 to 7.5 cm) in diameter apparently produced by the purple sea urchin. Boulders were lacking except near the eastern edge. The intertidal zone was narrow due to high relief. Species diversity was higher here than in other areas of the Cove, especially in the number of marine plants. Wave exposure was greatest along the southern tip and gradually decreased moving eastward into the Cove. During the summer the brown algae Lessoniopsis littoralis and sea palm occurred at the southern point and are indicative of exposed coast.

Zone 1: Observed within Zone 1 were the periwinkle L. planaxis and C. digitalis. The green alga Cladophora sp. was noticed here also.

Zone 2: The polychaete Spirorbis sp.; the snails C. digitalis, C. pelta, juvenile C. scabra, L. scutulata and N. scutum; and the acorn barnacles and C. dalli were observed here (Appendix 5).

The sea palm, Postelsia palmaeformis, occurred at the exposed southwest point. The brown algae included H. gelatinosum and the rockweed, P. limitata; the red algae were C. vancouveriensis, highly bleached, nail brush, common in the lower part of the zone, Gloiopeltis furcata, P. franciscana, P. schizophylla and shore brush, Rhodomela larix; the only green alga observed was ocean pin cushion (Appendix 6).

Zone 3: The giant green anemone and the aggregating anemone were seen in tidal pools. Katharina tunicata; C. digitalis, common, and the limpet N. scutum; N. emarginata, the opisthobranch, O. borealis, and the black turban snail; the California mussel; C. dalli, Balanus cariosus,

the red and white barnacle, B. tintinnabulum, which is rare and P. polymerus; Leptasterias pusilla and the ochre seastar were also seen (Appendix 5).

The dominant algae in this zone were C. vancouveriensis, Cryptopleura lobulifera, locally dominant at the southwest point, I. flaccida, delicate sycophant and O. floccosa. Other red algae included C. pikeanum, Gigartina canaliculata, iridescent seaweed, and P. schizophylla. The brown alga Lessoniopsis littoralis was common around the southwest point. The only green algae observed were ocean pin cushin and green rope, S. coalita (Appendix 6).

Zone 4: Observed were the sponge Leucosolenia elanor, abundant in the lower portion of the zone; the giant green anemone, the gumboot chiton; the red abalone, in crevices, and the brown turban snail. The crab Pugettia producta; the bat star; the brittle star, Amphiodia occidentalis, with arms extended from cracks in the rocks; and the purple urchin in one large patch along the eastern boundary were observed as well (Appendix 5).

The brown algae in this zone included hyaline weed A. marginata which formed a horizontal belt along the shore, Costaria costata, C. osmundacea, color changer, Desmarestia ligulata var. ligulata which is very common, D. californicum seen on tops of rocks, feather boa, H. sessile, split whip, and bull kelp which was sparse. The most abundant red algae were C. tuberculosum, C. vancouveriensis, O. floccosa and P. hairii. Other red algae were B. farlowianum, Calliarthron cheilosporioides, Callophyllis heanophylla, C. flabellulata, E. delesserioides, turkish towel, Grateloypia doryphora, locally common, Hymenena multiloba, iridescent seaweed, also locally common, Lithothamnion sp., delicate sycophant, Neoptilota californica, bottle brush, red point and Pterochondria woodii (Appendix 6).

Area E: This area was not studied well because it was not indicated initially to be part of the ASBS. The area appeared to be similar to the southwest point of Area D. The shoreline was nearly vertical except

for a few large slump blocks at its southern end. Its southern boundary had a gravel and cobble beach with a sparse biota. This area is exposed coast as indicated by the presence of the sea palm, P. palmaeformis, and of L. littoralis. Most of the intertidal zone was inaccessable.

Ecological Considerations

Primary production: Primary production both intertidally and subtidally by benthic algae occurs primarily between late spring and early fall in the ASBS. Based on the sizes of algal standing crops and species composition, most production is apparently due to annual species. Intertidally, the most abundant summer forms were feather boa and iridescent seaweed (possibly also sea palms, Postelsia palmaeformis, in Area E). Subtidally, along the perimeter of the ASBS, color changer Desmarestia ligulata var. ligulata predominated. Also occurring were neptune's quill, Alaria marginata forming a narrow subtidal band especially where rocky surfaces were steep, and the perennial split whip where water movements were strong. Toward and within the middle of North Gerstle Cove, a canopy of bull kelp developed and were dense during the summer of 1977; it was the most important annual of the middle area (Figure 11). The most important perennial of the middle and of the deeper portions having algae was Pterygophora californica (Figure 11). Woody chain bladder was common subtidally to about 20 ft. (6 m). Feather boa also extended into the shallow subtidal zone. A portion of the benthic algae break off to drift either on shore or onto the bottom of the ASBS, or to be carried into deeper offshore waters.

Consumption: Herbivores are important biotic components. A major consumer of kelp was the red abalone, Haliotis rufescens. The Marine Ecological Reserve within the ASBS was established to allow replenishment of the heavily fished red abalone stocks. In 1971, 120 minutes of surveying within the Reserve yielded a count of only eight juvenile red abalone; in 1975, 40 minutes of diving yielded a count of 201 specimens. In January, 1978, the area was surveyed again. In 40 minutes 840 were counted,

GERSTLE COVE ASBS

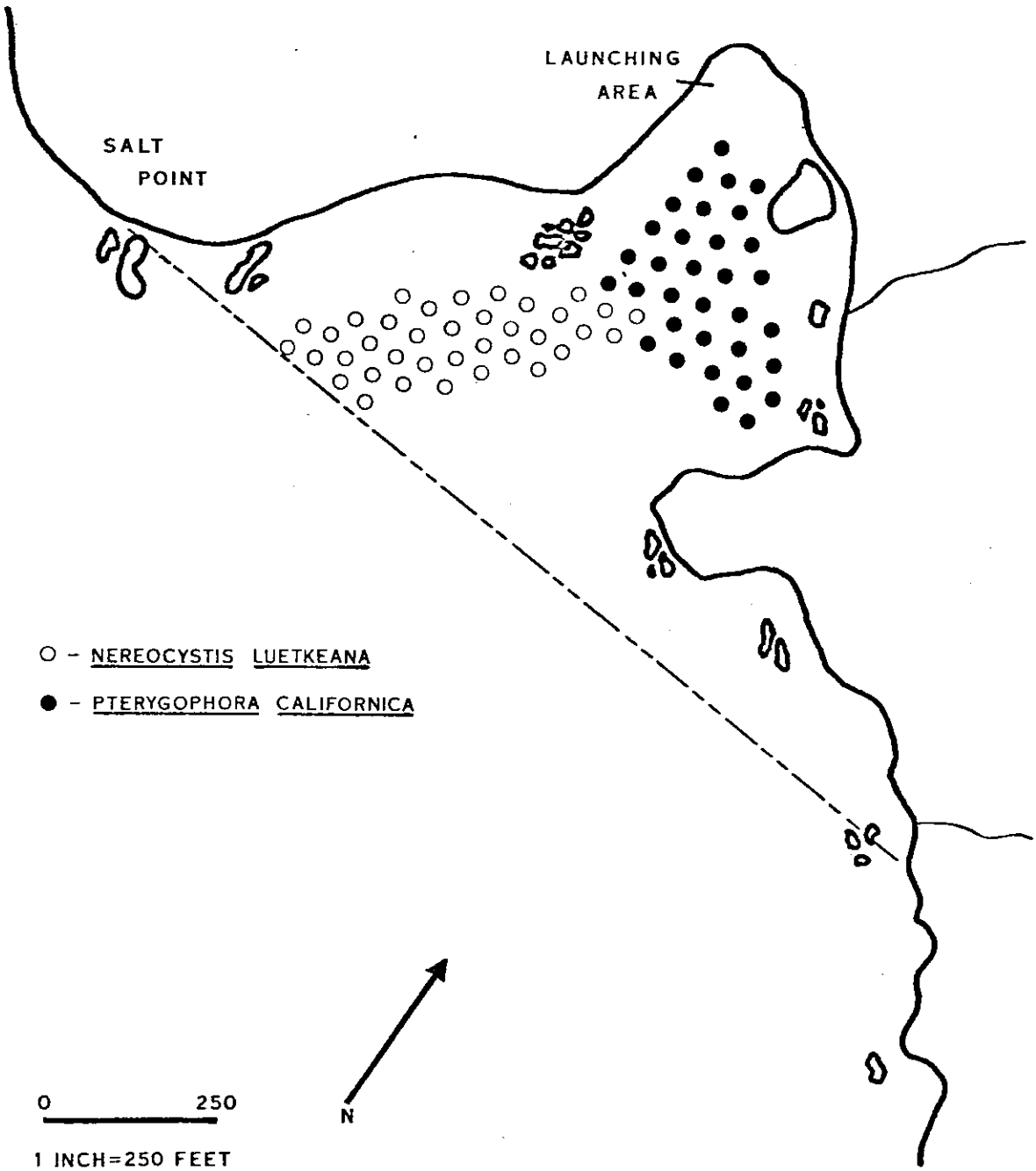

Figure 11. Map denoting the summer distribution (1977) of *Nereocystis luetkeana* and *Pterygophora californica*, the major patch-forming kelps in Gerstle Cove ASBS.

bush monkey flower, Mimulus aurantiacus, California blackberry, Rubus vitifolius, cow parsnip, Heracleum lanatum, coyote brush, Baccharis pilularis, Indian paintbrush, Castilleja douglasii, live-forever, Dudleya farinosa, some poison oak, Rhus diversiloba, salal, Gaultheria shallon and seaside daisy, Erigeron glaucus.

The adjacent terrace for several hundred feet eastward was covered by a Coastal Prairie Community traversed by gullies. Plants included: downy chess, Bromus tectorum, hair grass, Deschampsia caespitosa spp. holciformis, oat grass, Danthonia sp., rye grass, Lolium sp., soft chess, Bromus mollis, and velvet grass, Holcus lanatus. Other plants included blue-eyed grass, Sisyrhynchium bellum, eryngium, Eryngium armatum, iris, Iris douglasiana, and rush, Juncus sp. Gullies contained hellebore, Veratrum californicum, wax myrtle, Myrica californica, and, near the Interpretive Center, Dichondra donnelliana, a rare and endangered species.

Eastward, Coastal Prairie abutted a Closed Cone Pine Forest Community. The dominant species was Bishop pine, Pinus muricata, along with Douglas fir, Pseudotsuga menziesii, wax myrtle, black huckleberry, Vaccinium ovatum, coffee berry, Rhamnus californicus, brake fern, Pteridiuim aquilinum, and blue blossom, Ceanothus thyrsiflous.

Unique Components

A unique feature of Gerstle Cove ASBS is that it includes Gerstle Cove Marine Ecological Reserve and is itself contained in Salt Point State Underwater Park.

LAND AND WATER USE DESCRIPTION

Marine Resource Harvesting

Sports Fishing Activity: Outside the present markers of Gerstle Cove Marine Ecological Reserve, but within the ASBS, abalone and sport fishing occur. Fish are taken by hook and line and by spear. Boat fishermen generally come ashore at the launching area within North Gerstle Cove. Most sport diving is prompted by the presence of red abalone, *Haliotis rufescens*.

Governmental Designated Open Space

Gerstle Cove ASBS is completely bordered on its terrestrial side by Salt Point State Park which is designated as open space. The park's northern boundary extends about 1.8 mi. (2.94 km) north of the northern boundary of the ASBS and about 1.04 mi. (1.7 km) south of the southern boundary of the ASBS. The park extends northeastward by about 3 mi. (4.9 km).

Recreational Uses

Skin diving is perhaps the most popular aquatic activity within and around the ASBS. Both fishing and SCUBA diving are also popular aquatic activities. Abalone collecting and spear fishing are the most common activities of skin divers in areas adjacent to the reserve. A launching area in the ASBS allows easy access to calm waters for small boats. Also, boats launched at Timber Cove Boat Landing located several miles to the south use the launching area for overnight haul-outs. Other activities include sightseeing, strolling along bluffs, picnicking, or just sitting and looking.

Scientific Study Uses

No formal scientific investigations are being performed in Salt Point State Park, except for the Sea Grant-funded program that is being carried out for developing a resources management plan and interpretation of the intertidal and subtidal portions of the park. Intertidal excursions are made by school groups in the Park, but particular groups generally do not come on a regular basis.

Transportation Corridors

Highway 1 runs along the coast east of the ASBS and is the only adjacent transportation corridor.

SPECIAL WATER QUALITY REQUIREMENTS

Presently, human waste disposal is not an apparent problem. In the near future, such a problem is not anticipated with park development. However, increased use of the marine portion of the park by fishermen and divers may increase fish filleting within the ASBS. Also noted were some gasoline and oil slicks at the boat launching site. More boating would probably result in an increase in spillage. Moldering fish carcasses and gasoline and oil slicks could reduce water quality, and certainly would reduce the aesthetic aspects of the Marine Ecological Reserve, the ASBS and the State Underwater Park. Consequently, fish filleting should cease, and boats should be rowed in and out of the ASBS. Implementation of the latter recommendation would also increase diver safety, because most diving occurs within the ASBS.

(6) Kjeldsen, Chris K. 1971. A checklist of the marine algae in the vicinity of Sonoma State College, Marin, Sonoma and Mendocino Counties. (This account is a stenciled check list of algae apparently collected by the author. Annotations for species include geographic range, host if epiphyte, and collecting sites. No information was given as to whether specimens were collected in situ or as detached or drift examples.

(7) Kozloff, Eugene H. 1974. Keys to the marine invertebrates of Puget Sound, the San Juan Archipelago, and Adjacent Regions. University of Washington Press, Seattle, Washington. 226 pp. (Used as an augmentation to Light's manual.)

(8) Laubenfels, M.W. de. 1932. The marine and freshwater sponges of California. Proc. U.S. Natural Museum. 81:1-140. (used for identifying some sponges.)

(9) Miller, Daniel J. and Robert N. Lea. 1972. Guide to coastal marine fishes of California. California Department of Fish and Game, Fish. Bull., 157:1-235. (The author used this account often for fish identification.)

(10) Morris, Eugene, E. 1970. Salt Point State Park Project. Sacramento: California State Department of Education. 144 pp. (This report was used in Section A-3c (Adjacent land mass). The author probably obtained his information from Wentworth (17). A list of marine algae is present with information on range and habitat; however, it is not sure whether the algae were actually observed in the Park. The list of invertebrates and fishes does not distinguish intertidal from subtidal forms. The list contains species that may not occur in Salt Point State Park, or if they do they are probably rare.)

(11) Munz, Phillip A. 1973. A California flora with supplement. University of California Press. 1094 pp. (including supplement).

(12) North, Wheeler J. 1976. Underwater California. California Natural History Guides: 39. University of California Press. 276 pp. (The author gives divers a very general description of Gerstle Cove.)

(13) Ricketts, Edward F., Jack Calvin and Joel W. Hedgpeth. 1968. Between Pacific tides. 4th edit. Stanford University Press. 614 pp.

(14) Schultz, Steven A. and Richard T. Burge. 1976. Cruise Report 75-KB-10

APPENDIX 1

List of subtidal fishes observed in Gerstle Cove ASBS: The following list of fishes is based on observations made primarily during the summer of 1977, unless indicated to the contrary.

Family Scorpaenidae

Sebastes auriculatus - signted by Steven Schultz, California Department of Fish and Game in January, 1978.
S. caurinus
S. chrysomelas - uncommon in *Pterygophora* beds
S. melanops - very common
S. mystinus - very common
S. nebulosus
S. rastrelliger
S. serranoides
Sebastes juveniles - abundant during summer

Family Hexagrammidae

Hexagrammos decagrammus - common
Ophiodon elongatus
Oxylebius pictus

Family Cottidae

Artedius corallinus - common
Artedius sp.
Enophrys bison
Hemilepidotus sp.
Scorpaenichthys marmoratus

Family Gobiidae

Coryphopterus nicholsi

APPENDIX 1 continued

Family Clinidae

Gibbonsia sp.

Family Stichaeidae

Chirolophus nugator - cryptic in cracks and holes

Family Embiotocidae

Damalichthys vacca
Embiotoca lateralis - common amongst kelp
Hyperprosopon argenteum
Phanerodon furcatus
Rhacochilus toxotes - observed by Steven Schultz, California Department of Fish and Game in January, 1978

APPENDIX 2

List of subtidal invertebrates observed in Gerstle Cove ASBS and their accompanying symbols in parentheses when shown in Figures 4 through 10. The following list of invertebrates is based on observations made primarily during the summer of 1977, unless indicated to the contrary.

Phylum Porifera: Class Calcarea

Leucandra heathi

Leucilla nuttingi

Leucosolenia eleanor (Le) - abundant in shallow, surgy areas and attached to *Calliarthron tuberculosum* (Areas A, D and E).

Class Demospongiae

Antho lithophoenix

Axocielita sp.

Cliona celata - most commonly seen in the shells of red abalone, *Haliotis rufescens*

Ophlitaspongia pennata

Petrosia dura - most commonly found in Area D

Plocamia karykina - mostly in shallower regions of Area D

Spheciospongia confoederata

Tethya aurantia (Ta)

Phylum Cnidaria: Class Hydrozoa (h for all species unless otherwise indicated)

Abientinaria abietina

A. greenei

Aglaophenia sp.

Eudendrium californicum

Eutonina indicans - medusae common at times in the water column; no symbol

Garveia annulata

Hydractinia sp.

Plumularia sp.

Polyorchis sp. - medusae common at times in the water column; no symbol

Sertularella sp.
Sertularia sp.
Stylantheca porphyra (Stp) - most commonly noted in Areas A and D
Tubularia marina
Unidentified siphonophore

Class Scyphozoa

Aurelia aurita (Aa) - common at times, especially in North Gerstle Cove
Chrysaora melanaster (Cm) - common at times, especially in North Gerstle Cove
Pelagia noctiluca
Phacellophora camtschatica - noted only in July 1977
Unidentified stauromedusan

Class Anthozoa

Anthopleura artemisia - rare in Area B and C
A. xanthogrammica (Ax) - common except in deeper areas (25 ft or greater); prefers wide depressions in rock
Balanophyllia elegans (Be) - common under Calliarthron tuberculosum and at bases of many large boulders
Clavularia sp.
Corynactis californica (Cc) - locally abundant in aggregations
Epiactis prolifera (Epp) - common, especially on Cystoseira osmundacea during summer
Halcampa decemtentaculata (Hd) - in gravel and sand of Area F
Metridium senile - seen only in Area E
Metridium sp.
Paracyathus stearnsi
Tealia coriacea (Tco) - occasional where veneer of sand or gravel covers rock
T. crassicornis (Tcr) - common
T. lofotensis (Tl) - common

Family Cirratulidae

Dodecaceria concharum

D. fewkesi (Df) - common and forming colonies on rocks

Family Maldanidae

Axiothella rubrocincta

Family Sabellariidae

Idanthyrsus ornamentatus

Sabellaria cementarium

Family Terebellidae

Pista elongata (Pe)

Streblosoma crassibranchia (Pc) - common under small boulders and in cracks

Family Sabellidae

Eudistylia polymorpha (Ep) - locally abundant in rocky crevices

Sabella sp.

Family Serpulidae

Salmacina tribranchiata - isolated colonies widely scattered

Serpula vermicularis (Sv) - common

Spirorbis sp.

Phylum Arthropoda: Class Crustacea: Subclass Cirripedia

Balanus nubilus (Bn)

Balanus sp.

Subclass Malacostraca:

Superorder Peracarida:

Order Mysidacea

Unidentified mysid in water column

Order Amphipoda

Metacaprella kennerlyi

Superorder Eucarida:
Order Decapoda

Cancer antennarius
C. productus
Cryptolithodes sitchensis
Hapalogaster cavicauda
Loxorhynchus crispatus
Mimulus foliatus
Pagurus hemphilli - common, in shells of brown turban shell, T. brunnea
Pagurus sp.
Petrolisthes cinctipes
Phyllolithodes papillosus
Pugettia producta
P. richii (Pr) - common in turf of Calliarthron tuberculosum
Scyra acutifrons (Sa) - common in shallow areas of Area C

Phylum Mollusca: Class Polyplacophora

Cryptochiton stelleri (Cs) - common in Area C
Ischnochiton radians (Is) - common on underside of boulders
Ischnochiton sp. (Is) - common on underside of boulders
Mopalia lignosa
Placiphorella velata
Tonicella lineata (Tol) - common on crustose coralline algae

Class Gastropoda: Sublcass Prosobranchia

Acmaea mitra (Am) - common on crustose coralline algae
Amphissa columbiana
Brittium eschrichtii
Calliostoma annulatum
C. canaliculatum
C. ligatum (Cl) - common in Area C
Ceratostoma foliatum
Collisella instabilis (Ci) - on stypes of Laminaria dentigera

C. pelta
Crepidula adunca
Dendropoma sp.
Diodora aspera
Diodora sp.
Haliotis kamtschatkana (Hk)
H. rufescens (Hr) - common in less than 25 ft (8 m) of water
H. walallensis (Hw) - locally common
Homalopoma sp. (Ho) - common under small boulders
Margarites sp.
Megatebennus bimaculatus
Nucella lamellosa
Ocenebra lurida - either one or both were common to abundant under
Ocenebra sp. - boulders surrounded by gravel
Opalia chacei
Petaloconchus montereyensis (Pem) - common on boulders through most of ASBS
Searlesia dira
Tegula brunnea (Tb) - common on stypes of L. dentigera and Pterygophora californica
T. pulligo (Tp) - locally common in areas 20 ft. (6 m) or deeper

Subclass Opisthobranchia

Aegires albopuncatus - only seen in Area B
Aeolidia papillosa
Anisodoris nobilis - common
Archidoris montereyensis
Archidoris odhneri
Cadlinda luteomarginata
C. modesta
Dendronotus frondosus
Diaulula sandiegensis
Dirona albolineata
Discodoris heathi
Doriopsilla albopunctata
Hermissenda crassicornis (Hc) - most common and widely distributed nudibranch

Hopkinsia rosacea
Laila cockerelli
Rostanga pulchra - common on red sponges
Triopha carpenteri - common
Tritonia sp.
Unidentified dorid nudibranch #1
Unidentified dorid nudibranch #2

Class Bivalvia

Clinocardium nuttalli (dead)
Gari californica (dead)
Hinnites giganteus
Humilaria kennerlyi (dead)
Kellia laperousii
Macoma sp. (dead)
Pododesmus cepio
Protothaca staminea (dead)
Semile decisa (dead)

Class Cephalopoda

Octopus apollyon

Phylum Bryozoa (br for all apecies): Order Ctenostomata

Flustrellidra corniculata

Order Cheilostomata

Arthropoma cecili
Bugula sp.
Costazia robertsonae
Dendrobeania laxa
Eurystomella bilabiata - common under *Calliarthron tuberculosum*
Heteropora pacifica
Hippodiplosia insculpta - colonies generally smaller than those observed in Carmel Bay
Phidolopora pacifica - colonies generally smaller than those observed in

Scrupocellaria sp.

Order Cyclostomata

Crisia occidentalis - locally common in Area A

Diaperoecia californica - colonies smaller than those observed in Carmel Bay

Disporella sp. - locally common in Area A

Filicrisia sp.

Bryozoans were not abundant in Areas A, D and E

Phylum Phoronida

Phoronis sp.

Phylum Hemichordata

Saccoglossus sp. (S) - locally common in sand and gravel containing fine sediment

Phylum Echinodermata: Class Echinoidea

Strongylocentrotus franciscanus (Sf) - widely distributed but most common below 25 ft. (8 m)

S. purpuratus (Sp) - locally dominant in shallow portion of Area C

Class Asteroidea

Dermasterias imbricata (Di)

Evasterias troschelii

Henricia leviuscula (Hl) - common in Area F

Leptasterias hexactis

Orthasterias koehleri (Ok)

Patiria miniata - most common large sea star and a dominant in Area A, B and D

Pisaster brevispinus (Pb) - second most common sea star, primarily found below 25 ft (8 m), especially in Area G

P. giganteus (Pg) - common in Areas D and E, but not as common as P. brevispinus

P. ochraceus (Po)

Pycnopodia helianthoides (Ph) - a dominant in Area C

Solaster dawsoni (Sd)
S. stimpsoni
Stylasterias forreri (Stf)

Class Ophiuroidea

Amphiodia occidentalis (As) - locally common in sand and gravel containing fine sediment
Ophiopholis aculeata - common under boulders
O. bakeri
Ophioplocus esmarki
Ophiopteris papillosa
Ophiothrix spiculata

Class Holothuroidea

Cucumaria miniata (Cm) - locally common in crevices and amongst boulders
C. piperata
C. pseudocurata
Eupentacta quinquesemita
Leptosynapta sp. (L) - burrowing in sand and gravel containing fine sediment
Psolus chitonoides
Stichopus californicus (Sc) - scattered in Area F; characterized by fine veneer of sediment during summer

Phylum Chordata: Subphylum Urochordata: Class Ascidiacea

Aplidium californicum (Ap) - common in Area D
Aplidium sp. (Ap)
Archidistoma diaphanes
Archidistoma sp. #1
Archidistoma sp. #2
Chelyosoma productum
Clavelina huntsmani
Cnemidocarpa finmarkiensis
Didemnum carnulentum (Dc) - locally abundant in surgy areas
Distaplia occidentalis
Metandrocarpa dura (Md) - common in Area A where surge was very strong
M. taylori

APPENDIX 2 continued

Perophora annectens - locally common in surgy areas

Pycnoclavella stanleyi

Pyura haustor - common in crevices

Ritterella pulchra

Styela montereyensis (Sn) - locally common in turf of *Calliarthron tuberculosum* of Area D

Synoicum parfustis

Tridemnum opacum (To)

APPENDIX 3

List of subtidal attached aquatic plants observed in Gerstle Cove ASBS.

Division Chlorophyta: Order Ulotrichales: Family Ulvaceae

Ulva angusta (Ul) - common in the clam part of the Cove (Area B) to about 10 ft. (3 m) deep

U. expansa (Ul) - common in the calm part of the Cove (Area B) to about 10 ft. (3 m) deep

U. lactuca (Ul) - common in the calm part of the Cove (Area B) to about 10 ft. (3 m) deep

Order Codiales:
Family Derbesiaceae

Halicystis ovalis

Division Phaeophyta: Class Phaeophyceae: Order Chordarilaes:
Family Chordariaceae

Haplogloia andersonii

Order Dictyosiphonales:
Family Dictyosiphonaceae

Coilodesme californica - abundant on *Cystoseira osmundacea*

Order Desmarestiales:
Family Desmarestiaceae

Desmarestia kurilensis

D. ligulata var. *ligulata* (Dl) - a dominant throughout most of the Cove from 0 to 20 ft. (0 to 6 m)

Order Laminariales:
Family Laminariceae

Costaria costata

Hedophyllum sessile

Laminaria dentigera - a perennial dominant in Area A and common in Areas C and D

Family Alariaceae

Alaria marginata (Am) - abundant in Area D just subtidally

Egregia menziesii (Em) - a common, shallow perennial in Area C

Pterygophora californica (Pt) - a dominant perennial in Area C, on tops of boulders to about 20 ft. (6 m)

Family Lessoniaceae

Dictyoneurum californicum (Dc) - common in Areas C and D on tops of boulders

Nereocystis luetkeana (Nl)

Order Fucales:

Family Cystoseiraceae

Cystoseira osmundacea (Co) - common perennial throughout the quieter parts of the ASBS to about 15 ft. (4.5 m)

Division Rhodophyta: Class Bangiophyceae: Order Bangiales:

Family Erythropeltidaceae

Smithora naiadum - common on Phyllospadix spp.

Class Florideophyceae: Order Cryptonemiales:

Family Dumontiaceae

Dilsea californica

Family Peyssonelliaceae

Peysonnellia hairii (Peh) - common perennial at all depths of the ASBS

Family Corallinaceae - all observed species were perennial

APPENDIX 3 continued

Bossiella californica var. schmittii - most common in deep areas

Calliarthron cheilosporioides (Cch) - common in surgy areas, especially in Area D

C. tuberculosum (Ct) - dominant coralline turf throughout ASBS to about 20 to 25 ft. (6 to 8 m)

Corallina officinalis var. chilensis

C. vancouveriensis - common to abundant throughout ASBS to about 10 ft. (3 m) except Area B

Neopolyporolithon reclinatum - on Calliarthron

Family Cryptonemiaceae

Grateloupia doryphora

Halymenia coccinea

Prionitis lanceolata

Family Kallymeniaceae

Callophyllis flabellulata

C. pinnata

Erythrophyllum delesserioides (Ed)

Order Gigartinales:

Family Nemastomataceae

Schizymenia pacifica

Family Plocamiaceae

Plocamium violaceum

Family Phyllophoraceae

Ahnfeltia plicata

Family Gigartinaceae

Gigartina exasperata

Iridaea flaccida (If)

APPENDIX 4

List of intertidal fishes observed in Gerstle Cove ASBS.

Family Clinidae

Gibbonsia sp.

Family Cottidae

Artedius sp. - very common

Family Embiotocidae

Embiotoca lateralis - common

Damalichthys vacca

Family Stichaeidae

Chirolophis nugator

Family Gobiidae

Coryphopterus nicholsi

APPENDIX 5

List of intertidal invertebrates observed in Gerstle Cove ASBS.

Phylum Porifera

Leucosolenia eleanor - abundant in lowest portion of Zone 4, Area D

Ophlitaspongia pennata

Plocamia karykina

Phylum Cnidaria: Class Anthozoa

Anthopleura elegantissima - locally common in patches in Zone 3 of Areas C and D

A. xanthogrammica

Epiactis prolifera

Phylum Sipuncula

Phascolosoma agassizii

Phylum Annelida: Class Polychaeta: Family Polynoidae

Halosydna brevisetosa

Family Nereidae

Nereis latescens - in turf of *Calliarthron tuberculosum*

Family Cirratulidae

Dodecaceria concharum

D. fewkesi

Family Sabellariidae

Idanthyrus ornamentatus

Family Terebellidae

Streblosoma crassibranchia

Family Serpulidae

Spirorbis sp. - locally abundant on isolated boulders, Zone 2 of Areas A and B

Phylum Arthropoda: Class Crustacea: Subclass Cirripedia

Balanus cariosus
B. glandula - common to abundant in Zones 2 and 3
B. tintinnabulum
Chtamalus dalli - common to abundant in Zones 2 and 3
Pollicipes polymerus - common in Zone 3 of Areas A and D

Subclass Malacostraca:
Superorder Peracarida:
Order Isopoda

Ligia occidentalis

Superorder Eucarida:
Order Decapoda

Cancer antennarius
Hemigrapsus nudus - common in Zones 2 and 3, Areas A and C
Pachycheles rudis
Pachygrapsus crassipes - common in Zones 2 and 3, Areas A and C
Pagurus hemphilli
Pagurus sp. - common
Petrolisthes cinctipes
Pugettia producta
Scyra acutifrons

Phylum Mollusca: Class Polyplacophora
Cryptochiton stelleri
Ischnochiton sp.
Katharina tunicata
Tonicella lineata

APPENDIX 5 continued

Class Gastropoda: Subclass Prosobranchia

Acmaea mitra

Bittium eschrichtii

Collisella digitalis - common in Zones 1, 2 and 3

C. pelta - common in Zones 2 and 3, except in Areas B and E

C. scabra

Crepidula adunca

Diodora aspera

Haliotis rufescens

Homalopoma sp.

Littorina planaxis - common in Zone 1

L. scutulata

Notoacmea fenestrata

N. persona

N. scutum - common in Zone 3, Areas A and C

Nucella emarginata - common in Zone 3 of Area D

Ocenebra sp.

Searlesia dira

Tegula brunnea

T. funebralis - common in Zones 3 and 4

Subclass Opisthobranchia

Aegires albopunctatus

Cadlina luteomarginata

Hermissenda crassicornis

Onchidella borealis - in Zone 3 of Areas A and D

Rostanga pulchra

Triopha carpenteri

Class Bivalvia

Hinnites giganteus

Macoma sp. dead

Protothaca stamindea -dead

Phylum Bryozoa: Order Ctenostomata

Flustrellidra corniculata

Order Cheilostomata

Arthropoma cecili

Unidentified spp.

Order Cyclostomata

Crisia sp.

Phylum Echinodermata: Class Echinoidea

Strongylocentrotus purpuratus - locally abundant in Zone 4 of Areas A and C

Class Asteroidea

Dermasterias imbricata

Leptasterias hexactis

L. pusilla

Patiria miniata - common in Zone 4 of Areas A, C and D

Pisaster ochraceus

Pycnopodia helianthoides

Class Ophiuroidea

Amphiodia occidentalis

Class Holothuroidea

Leptosynapta sp.

Phylum Chordata: Subphylum Urochordata: Class Ascidiacea

Aplidium sp.

Archidistoma sp.

Didemnum carnulentum - common in Zone 4 of Areas C and D

Styela montereyensis

Trididemnum opacum - common in Zone 4 of Areas C and D

APPENDIX 6

List of attached intertidal plants of Gerstle Cove ASBS. Those observed only by Kjeldsen, 1971, are indicated by an asterisk.

Division Chlorophyta: Order Ulotrichales: Family Ulvaceae

Enteromorpha sp.

Ulva angusta - common in Zones 3 and 4 of Area B

U. californica - common in Zones 3 and 4 of Area B

U. lactuca

**U. lobata*

Order Cladophorales: Family Cladophoraceae

Cladophora columbiana

Cladophora sp. - common in Zones 2 and 3 of Areas A and D

Spongomorpha coalita - locally common in Zones 3 and 4 of Areas A, C and D

Urospora doliifera

Order Codiales: Family Codiaceae

Codium fragile

Division Phaeophyta: Class Phaeophyceae: Order Chordariales: Family Ralfsiaceae

Hapalospongidion gelatinosum - abundant on rocks throughout Cove

Family Chordariaceae

Analipus japonicus

**Haplogloia andersonii*

Family Corynophlaeaceae

Leathesia difformis - common in Zones 2 and 3 of Areas A and B

Order Dictyosiphonales: Family Punctariaceae

APPENDIX 6 continued

Fucus distichus

Pelvetia fastigiata - abundant in Zones 2 of Area C; common in Zone 2 of Area A

Pelvetiopsis limitata - common in Zone 2 of Area C

Division Rhodophyta: Class Bangiophyceae: Order Bangiales:

Family Erythropeltidaceae

Smithora naiadum - common on *Phyllospadix* spp.

Family Bangiaceae

Porphyra schizophylla - locally abundant in Zones 2 and 3 of Area A; common in Zones 2 and 3 of Areas B and C

Porphyra sp. - juveniles present in Zone 2 of Area C in winter

Class Florideophyceae: Order Nemaliales:

Family Gelidiaceae

Geligium coulteri

Order Cryptonemiales:

Family Peyssonelliaceae

Peyssonellia hairii

Family Corallinaceae - all species observed were perennials

Bossiella californica var. *californica*

Calliarthron cheilosporioides

C. tuberculosum - abundant in Zone 4, except Area B

Corallina vancouveriensis - abundant in Zone 4, common in Zone 3 except Area B

Lithothamnion sp.

Neopolyporolithon reclinatum - on *Calliarthron tuberculosum*

Endocladia muricata - abundant along Area A, common in Area D

Gloiopeltis furcata

APPENDIX 6 continued

Family Cryptonemiaceae

Grateloupia doryphora

Prionitis lanceolata

Family Kallymeniaceae

Callophyllis flabellulata

C. heanophylla

Erythrophyllum delesserioides

Order Gigartinales:

Family Phyllophoraceae

Ahnfeltia plicata - winter

Gymnogongrus linearis - winter

Family Petrocelidaceae

Petrocelis franciscana - common on rocks in Zone 2

Family Gigartinaceae

Gigartina canaliculata

G. corymbifera

G. papillata - abundant in Zones 2 and 3 of Area C

Iridaea cordata - common throughout most of Cove in Zones 3 and 4

I. flaccida - abundant in Areas A, C and D and common elsewhere in Zones 3 and 4

I. heterocarpa

Order Rhodymeniales:

Family Rhodymeniaceae

Halosaccion glandiforme

Family Rhodomelaceae

Pterochondria woodii

Family Champiaceae

Gastroclonium coulteri

Order Ceramiales

Family Ceramiaceae

Antithamnion defectum - seen summer and winter in Zone 4 of Area B

Callithamnion pikeanum

Microcladia borealis - common in Zone 3, Areas C and D

M. coulteri

Neoptilota californica

Family Delesseriaceae

Botryoglossum farlowianum

Cryptopleura lobulifera - locally abundant in Zone 3 of Area D

Hymenena flabelligera

H. multiloba

Family Rhodomelaceae

Laurencia spectabilis

Odonthalia floccosa - abundant in Zone 3 of Areas A, C and D

O. oregona

O. washingtoniensis

Rhodomela larix

Division Spermatophyta: Family Zosteraceae

Phyllospadix scouleri - locally common in Zone 4, except in Areas A and C

P. torreyi - locally common in Zone 4 of Area A