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THE NEAR-SHORE BENTHOS OFF POINT MOLATE, SAN FRANCISCO BAY

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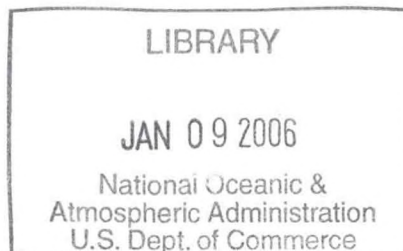
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ABSTRACT

The near shore bay floor off Point Molate is soft mud populated by an assemblage of organisms typical of that wide-spread habitat in San Francisco Bay. Polychaetes and phoronids predominate, but various small crustacea, particularly cumaceans, are abundant as well. This was determined by core samples taken by divers at stations along a tract running southwestward from the point. No eel grass was detected, either with visual inspection from above the water or by dragging a benthic rake over the bay floor. Because the water was exceptionally turbid, underwater visibility was essentially zero, thus precluding visual assessments of the benthos by divers. There was virtually no visible light on the bay floor in the study area, which probably is why the beds of eel grass that occur in the much shallower water both sides of Point Molate do not extend to the area of the point itself.

INTRODUCTION

This account of benthic organisms off Point Molate, in San Francisco Bay (37° 57' N, 122° 25' W), is based on a report prepared for the U. S. Navy. Although the work was done to permit anticipating effects of construction at that site, the results are presented here in response to the general need for biological data on San Francisco Bay.

STUDY AREA

The bay floor off Point Molate is soft mud. Close to shore, however, the mud lies over and among boulders that have been imported to consolidate the shoreline. From the shore, the bottom drops sharply to depths of about 2 m, then slopes gently to depths of 5 m about 50 m from shore. From that low point, the bottom rises to an expansive mud flat under about 3 to 4 m of water that extends 300 m offshore. There the bottom drops to a depth of 6 m and continues at that level for another 50 m before falling into the channel at the end of the pier (Figure 2). Because of extreme turbidity, underwater visibility during this work was zero and there was virtually no visible light on the bottom at any of the sampling sites.

Samples of the biota were taken with benthic corers in three zones along a tract running southwestward from the point. The benthos in each of these zones is represented by data from four core samples--two from each of two stations, 10 to 20 m apart. The first zone was in mud lying over and among rocks on the near-shore slope, whereas the other two zones were on the offshore mud flat, one on the inner flat and the other on the outer flat.

The area experiences strong tidal currents, so samples and measurements were taken when these currents were reduced. Tide level at the time was 2 feet above mean lower low water. Methods used in this survey are detailed in Appendix 1.

THE BENTHOS

The habitat near shore off Point Molate is common and widespread in San Francisco Bay, as are the organisms that occur there.

Benthic Invertebrates

Virtually all the benthic invertebrates sampled with corers in the three zones are typical of mud-bottom habitats (Table 1), and the few exceptions are common inhabitants of rock substrata, which were present at the inshore stations. The collections were

dominated by polychaetes and phoronids. The few differences between the three zones sampled can be attributed to the presence of rock substrata in zone 1. Thus, cirripedians, which normally live on solid substrata (Newman 1975), were sampled only in zone 1 (a single 0.8-mm individual), whereas tellinid bivalves, which inhabit soft sediments (Keen 1971), were sampled only in zones 2 and 3. Similarly, the tanaid Leptochelia dubia and the caprellid Caprella californica, which are known to prefer hard substrata over soft sediments (unpublished data of the Tiburon Laboratory), were most abundant in zone 1 while the cumacean Eudorella pacifica, which is known to favor soft mud (Gladfelter 1975), was most abundant in zones 2 and 3.

Eel Grass

Although beds of eel grass have been mapped in the coves on both sides of Point Molate (Echeverria and Rutten 1989), they do not extend to the area off the point itself. This conclusion is based on visual inspection from above water and failure to take any eel grass with a benthic rake that was dragged over the bay floor. (Visual assessments by divers were precluded by the lack of visibility underwater). Perhaps the beds are limited to the coves (where the water is <1 m deep at low tide), because in the exceptionally turbid water characteristic of this area, sufficient sunlight is available to the plant only in extreme shallows. With the absence of visible light at all stations sampled during this study, including those in 2 m of water 12 m from shore, it is likely that benthic plants find conditions off the point intolerable.

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BENTHOS OFF POINT MOLATE
MAY 1991

Taxa	Station 1			Station 2			Station 3		
	freq	x no.	(S.E.)	freq	x no.	(S.E.)	freq	x no.	(S.E.)
Actinaria (sea anemones)									
Unidentified actinaria	0.25	0.25	(0.25)	0.00	0.00	-	0.00	0.00	-
Polycladida (flatworms)									
Unidentified polycladida	0.25	0.75	(0.75)	0.25	0.25	(0.25)	0.00	0.00	-
Nemertea (ribbon worms)									
Unidentified nemertea	0.50	1.00	(0.58)	0.25	0.50	(0.50)	0.50	0.50	(0.29)
Oligochaeta (marine worms)									
Unidentified oligochaeta	1.00	31.50	(6.91)	1.00	6.50	(2.63)	1.00	5.75	(1.93)
Polychaeta (marine worms)									
Ampharetidae									
Unidentified ampharetids	0.00	0.00	-	0.25	0.25	(0.25)	0.00	0.00	-
Cirratulidae									
Unidentified cirratulids	0.25	0.25	(0.25)	0.00	0.00	-	0.00	0.00	-
Goniadidae									
<u>Glycinde polygnatha</u>	1.00	2.50	(0.76)	0.75	2.00	(0.71)	0.50	1.00	(0.71)
Lumbrineridae									
<u>Lumbrineris</u> sp.	0.25	0.50	(0.50)	0.00	0.00	-	0.00	0.00	-
Nephtyidae									
<u>Nephtys</u> sp.	0.50	0.50	(0.29)	0.25	0.75	(0.75)	0.50	1.75	(1.18)
Neridae									
Unidentified nereids	0.25	1.00	(1.00)	0.00	0.00	-	0.00	0.00	-
<u>Cheiloneris cyclurus</u>	0.25	0.25	(0.25)	0.00	0.00	-	0.00	0.00	-
Orbinidae									
Unidentified orbinids	0.25	0.25	(0.25)	0.25	0.25	(0.25)	0.50	1.00	(0.71)

BENTHOS OFF POINT MOLATE
MAY 1991

Taxa	Station 1		Station 2		Station 3	
	freq	x no. (S.E.)	freq	x no. (S.E.)	freq	x no. (S.E.)
Pectinariidae						
<u>Pectinaria</u> sp.	0.00	0.00	0.00	0.00	0.25	0.25 (0.25)
Phyllodocidae						
Unidentified phyllodocids	0.00	0.00	0.25	0.25 (0.25)	0.25	0.25 (0.25)
Polynoidae						
Unidentified polynoids	0.75	1.75 (1.11)	0.25	0.25 (0.25)	0.25	0.50 (0.50)
Spionidae						
Unidentified spionids	0.25	0.75 (1.75)	0.25	0.50 (0.50)	0.00	0.00 - -
Syllidae						
Unidentified syllids	0.25	1.25 (1.25)	0.25	0.25 (0.25)	0.25	0.25 (0.25)
<u>Exogone</u> sp.	0.25	0.75 (0.75)	0.00	0.00 - -	0.00	0.00 - -
Terebellidae						
Unidentified terebellids	0.25	0.25 (0.75)	0.00	0.00 - -	0.25	0.25 (0.25)
<u>Amaena occidentalis</u>	0.25	0.25 (0.25)	0.50	0.50 (0.29)	0.00	0.00 - -
Unidentified polychaetes	0.50	1.50 (1.00)	0.50	1.75 (1.03)	0.25	0.25 (0.25)
Bivalvia (Bivalved Mollusks)						
Corbulidae						
<u>Potamocorbula amurensis</u>	0.25	0.50 (0.50)	0.50	0.75 (0.48)	0.25	0.50 (0.50)
Myidae						
<u>Cryptomya californica</u>	0.25	0.25 (0.25)	0.50	0.75 (0.48)	0.25	2.50 (2.50)
Mytilidae						
<u>Musculus senhousia</u>	0.25	0.25 (0.25)	0.50	0.75 (0.48)	0.00	0.00 - -
Tellinidae						
<u>Macoma nasuta</u>	0.00	0.00 - -	0.25	0.25 (0.25)	0.00	0.00 - -
<u>Macoma</u> sp.	0.00	0.00 - -	0.50	0.50 (0.50)	0.00	0.00 - -
<u>Tellina carpenteri</u>	0.00	0.00 - -	0.25	0.25 (0.25)	0.50	1.00 (0.58)
Ostracoda (ostracod crustaceans)						
<u>Sarsiella zostericola</u>	0.75	1.50 (0.87)	0.50	0.75 (0.48)	0.50	0.50 (0.29)

(Cont. 3 of 4)

BENTHOS OFF POINT MOLATE
MAY 1991

Taxa	Station 1		Station 2		Station 3	
	freq	x no. (S.E.) n=4	freq	x no. (S.E.) n=4	freq	x no. (S.E.) n=4
Harpacticoida (harpacticoid copepods)						
Unidentified harpacticoids	0.25	0.25 (0.25)	0.25	0.25 (0.25)	0.00	0.00 - -
Cirripedia (barnacles)						
Unidentified cirripedians	0.25	0.25 (0.25)	0.00	0.00 - -	0.00	0.00 - -
Cumacea (cumacean crustaceans)						
<i>Eudorella pacifica</i>	0.75	1.00 (0.41)	1.00	8.50 (2.78)	1.00	20.00 (7.01)
<i>Leucon</i> sp.	1.00	5.25 (1.65)	0.25	0.25 (0.25)	1.00	14.00 (4.71)
Tanaidacea (tanaid crustaceans)						
<i>Leptochelia dubia</i>	1.00	11.25 (8.29)	0.25	0.75 (0.75)	0.00	0.00 - -
Isopoda (isopod crustaceans)						
Cirrolanidae						
Unidentified cirrolanids	0.25	0.25 (0.25)	0.00	0.00 - -	0.00	0.00 - -
Munnidae						
<i>Munna</i> sp.	0.25	0.25 (0.25)	0.00	0.00 - -	0.00	0.00 - -
Gammaridean Amphipods						
Ampeliscaidae						
<i>Ampelisca milleri</i>	0.25	0.50 (0.50)	1.00	9.50 (4.92)	1.00	11.25 (3.68)
Aoridae						
Unidentified aorids	0.25	0.50 (0.50)	0.00	0.00 - -	0.00	0.00 - -
Corophiidae						
<i>Corophium baconi</i>	0.25	0.25 (0.25)	0.00	0.00 - -	0.00	0.00 - -
<i>Corophium stimpsoni</i>	0.00	0.00 - -	0.75	1.00 (0.41)	0.75	2.25 (1.32)

BENTHOS OFF POINT MOLATE
MAY 1991

Taxa	Station 1		Station 2		Station 3	
	freq	x no. (S.E.)	freq	x no. (S.E.)	freq	x no. (S.E.)
Isaeidae						
<u>Photis</u> sp.	0.50	6.75 (6.42)	0.00	0.00	0.00	0.00
Podoceridae						
<u>Dulichia</u> sp.	0.25	0.25 (0.25)	0.00	0.00	0.00	0.00
Pleustidae						
Unidentified pleustids	0.25	0.25 (0.25)	0.00	0.00	0.00	0.00
Juvenile gammarideans	0.00	0.00 -	0.25	0.25 (0.25)	0.00	0.00
Caprellidean amphipods						
Caprellidae						
<u>Caprella californica</u>	0.50	0.50 (0.29)	0.00	0.00	0.00	0.00
Juvenile caprellids	0.25	0.50 (0.50)	0.00	0.00	0.00	0.00
Decapoda (crabs and shrimps)						
<u>Upogebia pugettensis</u>	0.50	0.50 (0.29)	0.25	0.25 (0.25)	0.00	0.00
Phoronida (phoronids)						
<u>Phoronis pallida</u>	0.75	19.50 (10.88)	1.00	47.00 (21.55)	0.75	11.50 (8.57)
Ophiuroidea (brittle stars)						
Unidentified ophiuroids	0.00	0.00 -	0.25	0.25 (0.25)	0.50	0.50 (0.29)
<u>Ophioneries eurybrachyplax</u>	0.25	0.25 (0.25)	0.00	0.00 -	0.00	0.00
Invertebrate eggs	0.50	1.25 (0.95)	0.25	0.25 (0.25)	0.25	0.25 (0.25)

APPENDIX 1. SAMPLING METHODS.

A. Preliminary Reconnaissance

The study area was assessed at midday on April 3, 1991. Hydroacoustic transects from a 17' whaler at that time are the basis for the depth contour depicted in Figure 2. The water level at the time was approximately 2 feet above mean lower low water.

B. Conditions during Sampling

Core samples were taken at the Point Molate site between 0830 and 0930 on May 20, 1991. The tide was on its ebb during the sampling, a decreasing tidal current of about 0.5 knots was flowing through the area at the outset, and the water level was 2 feet above mean lower low water.

C. Benthic Cores

Specifications: Vented, capped tube of ABS pipe, 10 cm in diameter.

Procedure: A total of 12 samples were taken at the sites identified in the text. All samples were taken in pairs, one meter apart. For each, the core was inserted approximately 13 cm into the sediment so that each sample involved one liter of material. Upon returning to the laboratory, the samples were sieved through a 0.5 mm screen, and the organisms retained were then identified to the lowest taxa feasible.

D. Benthic Rake

Specifications: Weight 11 kg, flat stock 99 cm long by 5 cm wide by 2.5 cm thick, with 12 curved teeth on opposite sides of the bar (total of 24 teeth), each pair about 9 cm apart.

Procedure: The rake was towed behind the whaler over all but the most shoreward perimeter of the study area (where submerged rocks precluded its use).