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JULY 1975

AN OTTER TRAWL SURVEY
OFF POINT LOMA

Robert M. Voglin

SOUTHERN CALIFORNIA COASTAL WATER RESEARCH PROJECT
1500 East Imperial Highway, El Segundo, California 90245

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Grant R801152.

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INTRODUCTION

Very little recent information has been available on the fish and epibenthic invertebrate fauna off the Point Loma waste discharge area; this is particularly true beyond the kelp forests of this region.

A one-day trawl survey was organized to 1) provide specimens of fish for analysis of trace elements and chlorinated hydrocarbons and 2) determine the composition of demersal fauna between 61 and 137 meters, a depth range comparable to depths sampled off Los Angeles and Orange Counties (Southern California Coastal Water Research Project 1973).

Data on fish and invertebrate catch statistics are reported below; chemical analysis data are in progress and will be reported later.

METHODS

The Point Loma area was sampled by otter trawl on 12 February 1975 aboard the R/V Sea Quest (Lockheed Aircraft Services, San Diego). Hauls were conducted using a 25-foot (headrope length) otter trawl with 1/2-in. cod-end mesh, which had an estimated spread of 16 ft while fishing, constructed for the Coastal Water Project by Jim Willis (Morro Bay, California).

Eight stations, ranging in depth from 61 to 137 meters, were sampled; the station numbers and locations are shown in Figure 1.

The trawl was towed for 10 min. (on bottom time) at 2.5 knots along constant depth contours. Fishes and invertebrates were then sorted, identified, and counted. Fish were measured (to nearest centimeter size class for abundant species or to nearest millimeter for low abundance species) and weighed by species. All fish were examined for deformities, parasites, and signs of disease (fin erosion and tumors). Dover sole (Microstomus pacificus) were selected, labeled, and frozen for chemical analysis.

Temperature profiles were made at the end of each trawl transect using a 450-ft calibrated bathythermograph (BT). Surface, middepth, and bottom water temperatures were tabulated from the BT graphs. Secchi disc depths were also recorded.

RESULTS

A total of 8 hauls were made at the 8 stations. Haul and station characteristics are given in Table 1. Survey catch statistics are summarized in Table 2. A total of 1,084 fish specimens were taken during the survey with mean and median values of 135.5 and 146.5 fish per station, respectively.

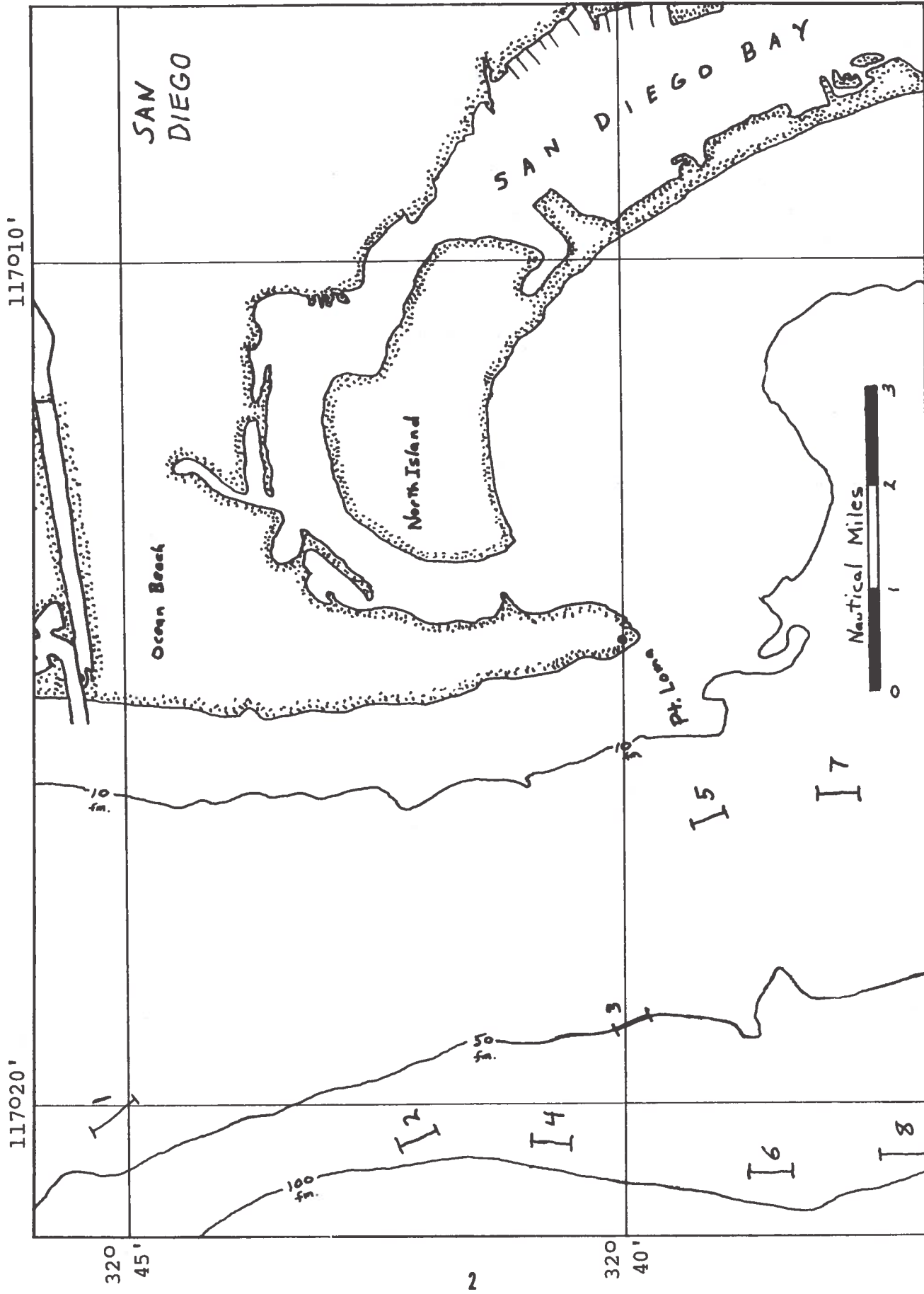


Figure 1. Stations trawled, Point Loma survey, February 12, 1975.

Table 1. Station and sample data from Point Loma trawl survey, 12 February 1975.

Station Number	Time of Day	Latitude	Longitude	Depth (m)
7	0910	32 37.85	117 16.40	61
5	1040	32 39.05	117 16.65	64
1	1820	32 45.10	117 20.05	82
3	1435	32 39.85	117 19.15	91
4	1635	32 40.80	117 20.50	137
6	1335	32 38.35	117 20.90	137
2	1715	32 42.05	117 20.45	137
8	1150	32 37.20	117 20.70	137

The biomass data for this survey is listed in Table 2. Station 3 had the highest biomass with 14.5 kg, while Station 4 had the lowest with 2.5 kg.

A total of 32 species, representing 14 families, were taken in the survey (Table 3). The number of species per haul ranged from 3 at Station 4 to 17 at Station 1 (Table 2; Figure 3). The species taken in this survey ranked according to abundance are shown in Table 4, together with the frequency of occurrence (commonness) of each species. The Pacific sanddab (Citharichthys sordidus), pink seaperch (Zalembeius rosaceus), and striped tail rockfish (Sebastes saxicola) were the most abundant fish taken in the survey. However, Pacific sanddab, pink seaperch, and longspine combfish (Zaniolepis latipinnis) had the highest mean abundance in the stations where they were found. Pacific sanddab and English sole (Parophrys vetulus) were found at all stations, while Dover sole (Microstomus pacificus) was found in 7 out of 8 stations.

One species, the red brotula (Brosmophycia marginata), taken in the survey had not been previously recorded in other trawl surveys conducted by the Coastal Water Project.

Brillouin, Shannon-Weaver, and Standard Deviation species diversities are shown in Table 2. The distribution of the Shannon-Weaver and Standard Deviation diversities over the survey area are shown in Figures 4 and 5. The Shannon-Weaver diversities ranged from 2.00 at Station 5 to 0.89 at Station 4, while the Standard Deviation diversities ranged from 0.64 at Station 5 to 0.13 at Station 8. The Gleason diversity (a measure of species richness) is also plotted and shown in Figure 6. The range is from 6.80 at Station 1 to 1.18 at Station 4.

Table 2. Summary of fish catch statistics from eight trawl hauls off Point Loma, San Diego, 12 February 1975.

Station	No. Fish	No. Species	Biomass (kg)	Diversities			
				Brillouin H	Shannon Weaver H'	Standard Deviation SD(s)	Gleason's Index D
4	49	3	2.50	0.808	0.885	0.501	1.183
7	158	13	4.50	1.583	1.700	0.517	5.458
1	225	17	9.35	1.795	1.907	0.544	6.802
5	208	15	8.50	1.891	2.004	0.639	6.040
3	142	12	14.5	1.346	1.453	0.449	5.111
6	71	6	9.90	1.308	1.429	0.592	2.701
2	151	10	8.00	1.329	1.419	0.500	4.131
8	80	13	4.50	0.976	1.150	0.132	6.306
Total	1084	32	61.72				
Survey Diversity	-	-	-	2.127	2.177	0.587	10.21
Median	146.5	12.5	8.25	1.338	1.157	0.509	5.285
\bar{x} /Haul	135.5	11.13	7.72	1.380	1.493	0.484	4.717

Table 3. Common and scientific names of fish species taken by otter trawl off Point Loma, California, February 12, 1975.

Species	Common Name
MYXINIDAE	
<u>Eptatretus stouti</u>	Pacific hagfish
SYNODONTIDAE	
<u>Synodus lucioceps</u>	California lizardfish
BATRACHOIDIDAE	
<u>Porichthys notatus</u>	Plainfin midshipman
OPHIDIIDAE	
<u>Brosmophycis marginata</u>	Red brotula
<u>Chilara taylori</u>	Spotted cusk-eel
SCIAENIDAE	
<u>Genyonemus lineatus</u>	White croaker
EMBIOTOCIDAE	
<u>Zalemnius rosaceus</u>	Pink seaperch
BATHYMASTERIDAE	
<u>Rathbunella n. sp.</u>	
SCORPAENIDAE	
<u>Sebastes chlorostictus</u>	Greenspotted rockfish
<u>Sebastes dalli</u>	Calico rockfish
<u>Sebastes elongatus</u>	Greenstriped rockfish
<u>Sebastes rosenblatti</u>	Greenblotched rockfish
<u>Sebastes rubrivinctus</u>	Flag rockfish
<u>Sebastes saxicola</u>	Stripetail rockfish
<u>Sebastes semicinctus</u>	Halfbanded rockfish
<u>Sebastes vexillaris</u>	Whitebelly rockfish
HEXAGRAMMIDAE	
<u>Ophiodon elongatus</u>	Lingcod
<u>Zaniolepis frenata</u>	Shortspine combfish
<u>Zaniolepis latipinnis</u>	Longspine combfish
COTTIDAE	
<u>Chitonotus pugetensis</u>	Roughback sculpin
<u>Icelinus quadriseriatus</u>	Yellowchin sculpin
<u>Icelinus tenuis</u>	Spotfin sculpin
AGONIDAE	
<u>Odontopyxis trispinosa</u>	Pygmy poacher
BOTHIDAE	
<u>Citharichthys fragilis</u>	Gulf sanddab
<u>Citharichthys sordidus</u>	Pacific sanddab
<u>Hippoglossina stomata</u>	Bigmouth sole
PLEURONECTIDAE	
<u>Lepidopsetta bilineata</u>	Rock sole
<u>Lyopsetta exilis</u>	Slender sole
<u>Microstomus pacificus</u>	Dover sole
<u>Parophrys vetulus</u>	English sole
<u>Pleuronichthys verticalis</u>	Hornyhead turbot
CYNOGLOSSIDAE	
<u>Symphurus atricauda</u>	California tonguefish

Table 4. Rank of fish species in the Point Loma survey, February 12, 1975.

Species Name	Total Abundance	No. of Stations Where Found	Percent of All Stations	Mean Abundance Where Found	Mean Abundance Over Survey
Citharichthys sordidus	412	8	100.00	51.5	51.5
Zalembius rosaceus	121	5	62.50	24.2	15.1
Sebastes saxicola	101	5	62.50	20.2	12.6
Zaniolepis latipinnis	96	4	50.00	24.0	12.0
Parophrys vetulus	90	8	100.00	11.2	11.2
Microstomus pacificus	64	7	87.50	9.1	8.0
Icelinus quadriseriatus	50	4	50.00	12.5	6.2
Lyopsetta exilis	46	4	50.00	11.5	5.7
Symphurus atricaudus	27	3	37.50	9.0	3.4
Hippoglossina stomata	11	3	37.50	3.7	1.4
Porichthys notatus	8	2	25.00	4.0	1.0
Genyonemus lineatus	7	3	37.50	2.3	0.9
Sebastes dalli	7	2	25.00	2.5	0.9
Chilara taylori	7	1	12.50	7.0	0.9
Pleuronichthys verticalis	5	3	37.50	1.7	0.6
Sebastes semicinotus	5	3	37.50	1.7	0.6
Zaniolepis frenata	4	3	37.50	1.3	0.5
Icelinus tenuis	3	3	37.50	1.0	0.4
Chitonotus pugetensis	3	2	25.00	1.5	0.4
Sebastes elongatus	3	2	25.00	1.5	0.4
Ophiodon elongatus	2	2	25.00	1.0	0.2
Odontopyxis trispinosa	2	2	25.00	1.0	0.2
Lepidopsetta bilineata	1	1	12.50	1.0	0.1
Eptatretus stouti	1	1	12.50	1.0	0.1
Sebastes rosenblatti	1	1	12.50	1.0	0.1
Sebastes rubrivinctus	1	1	12.50	1.0	0.1
Synodus lucioceps	1	1	12.50	1.0	0.1
Citharichthys fragilis	1	1	12.50	1.0	0.1
Rathbunella N. Sp. A	1	1	12.50	1.0	0.1
Sebastes vexillaris	1	1	12.50	1.0	0.1
Brosmophycis marginata	1	1	12.50	1.0	0.1
Sebastes chlorostictus	1	1	12.50	1.0	0.1

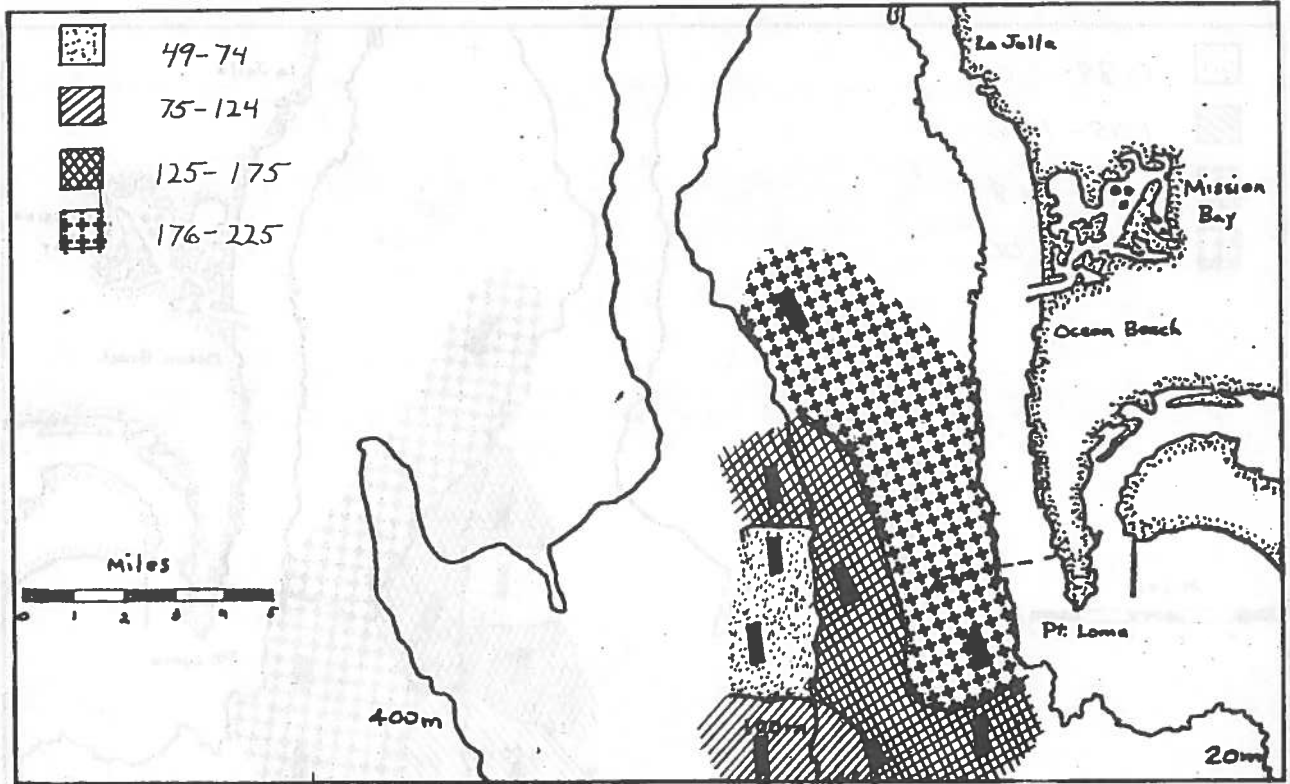


Figure 2. Fish catch per haul of stations sampled for the Point Loma survey, February 12, 1975.

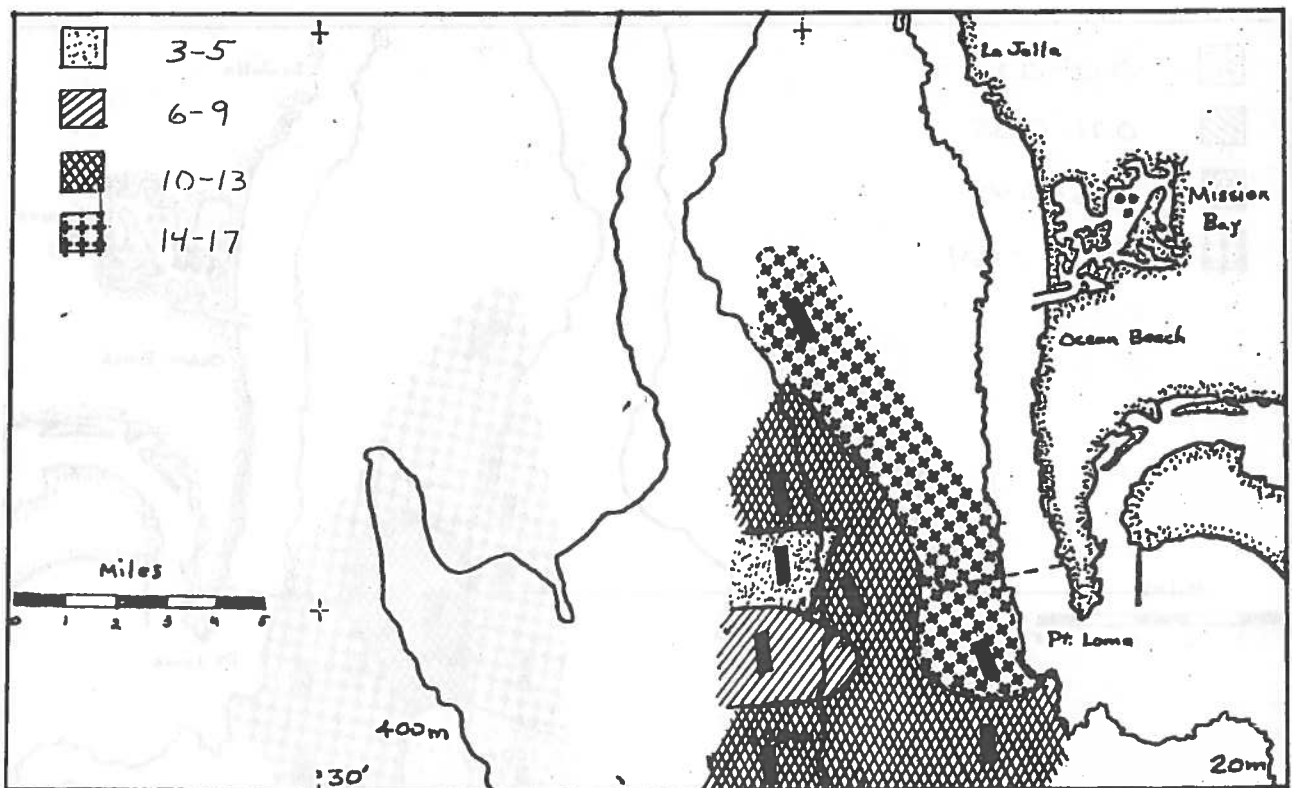


Figure 3. Fish species per haul of stations sampled for the Point Loma survey, February 12, 1975.

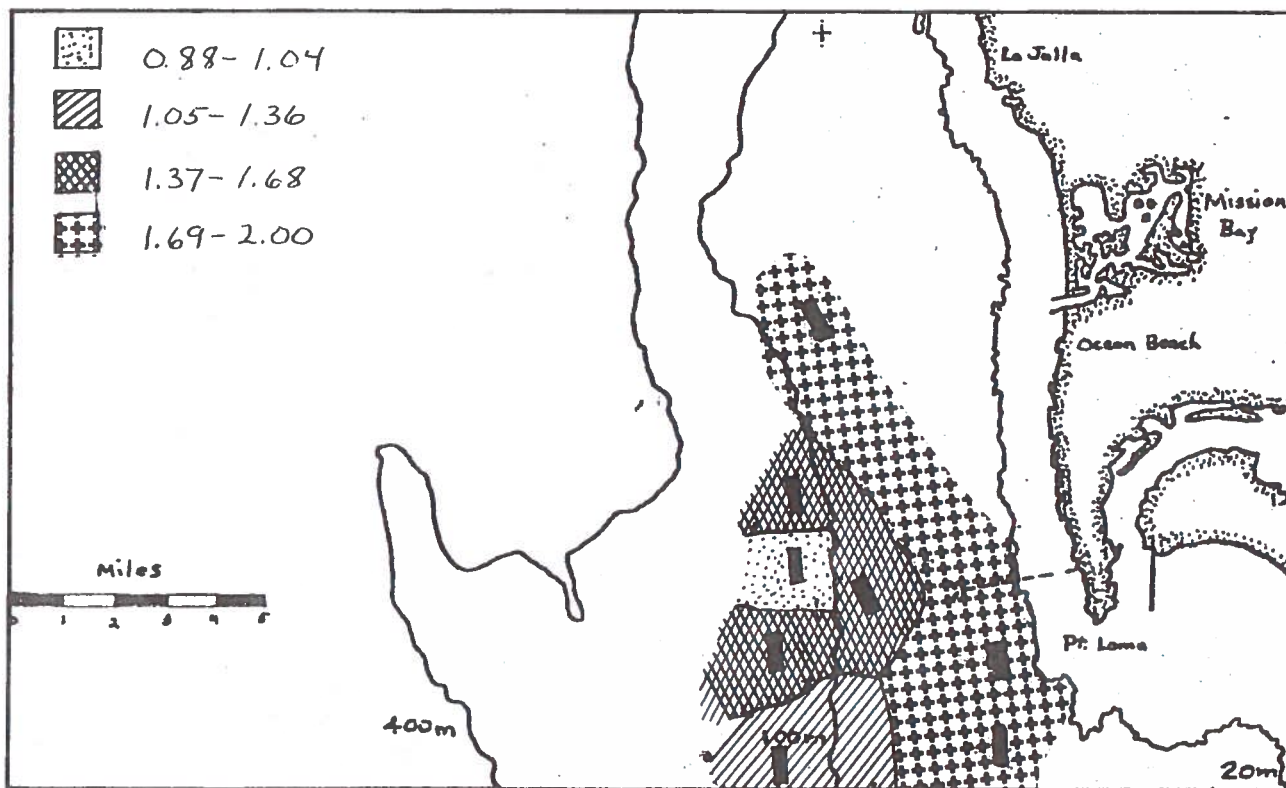


Figure 4. Shannon-Weaver diversity per haul of fishes taken on the Point Loma survey, February 12, 1975.

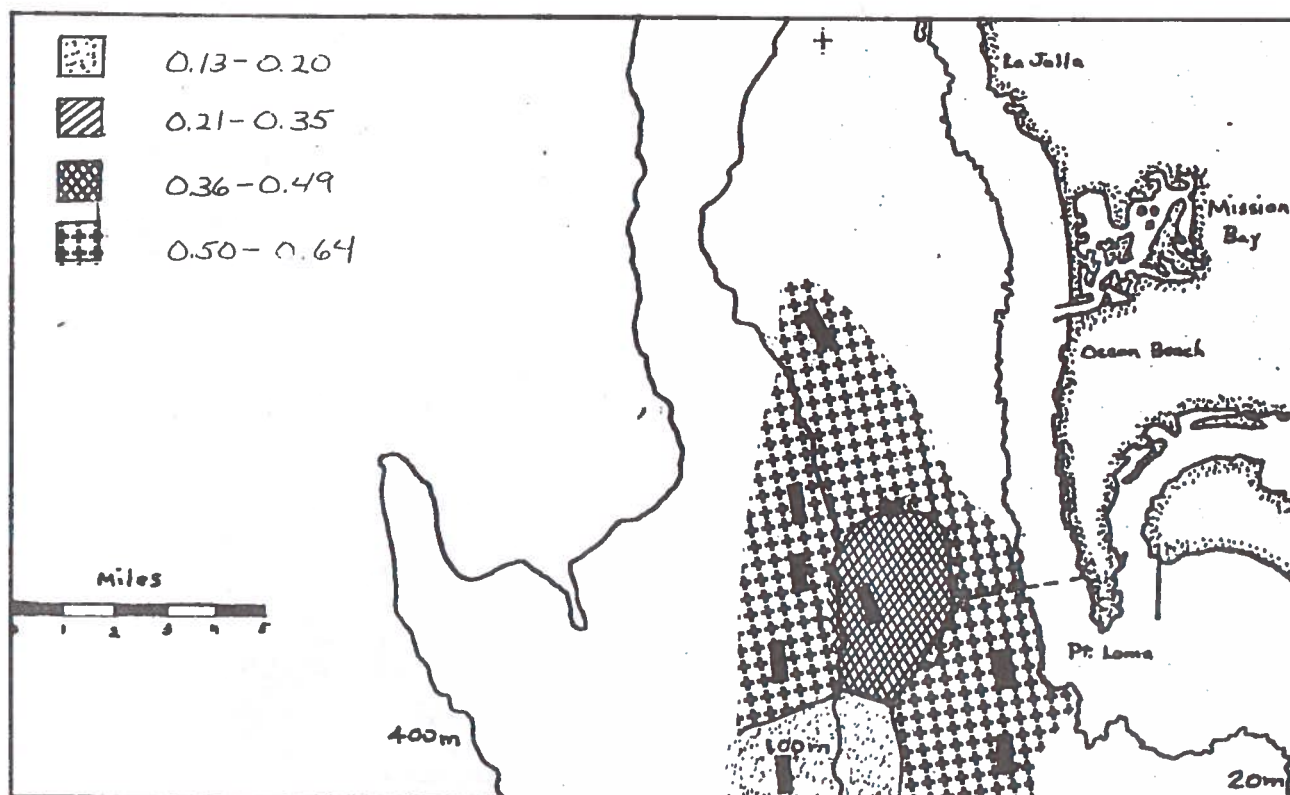


Figure 5. Standard Deviation diversity of fishes taken on the Point Loma survey, February 12, 1975.

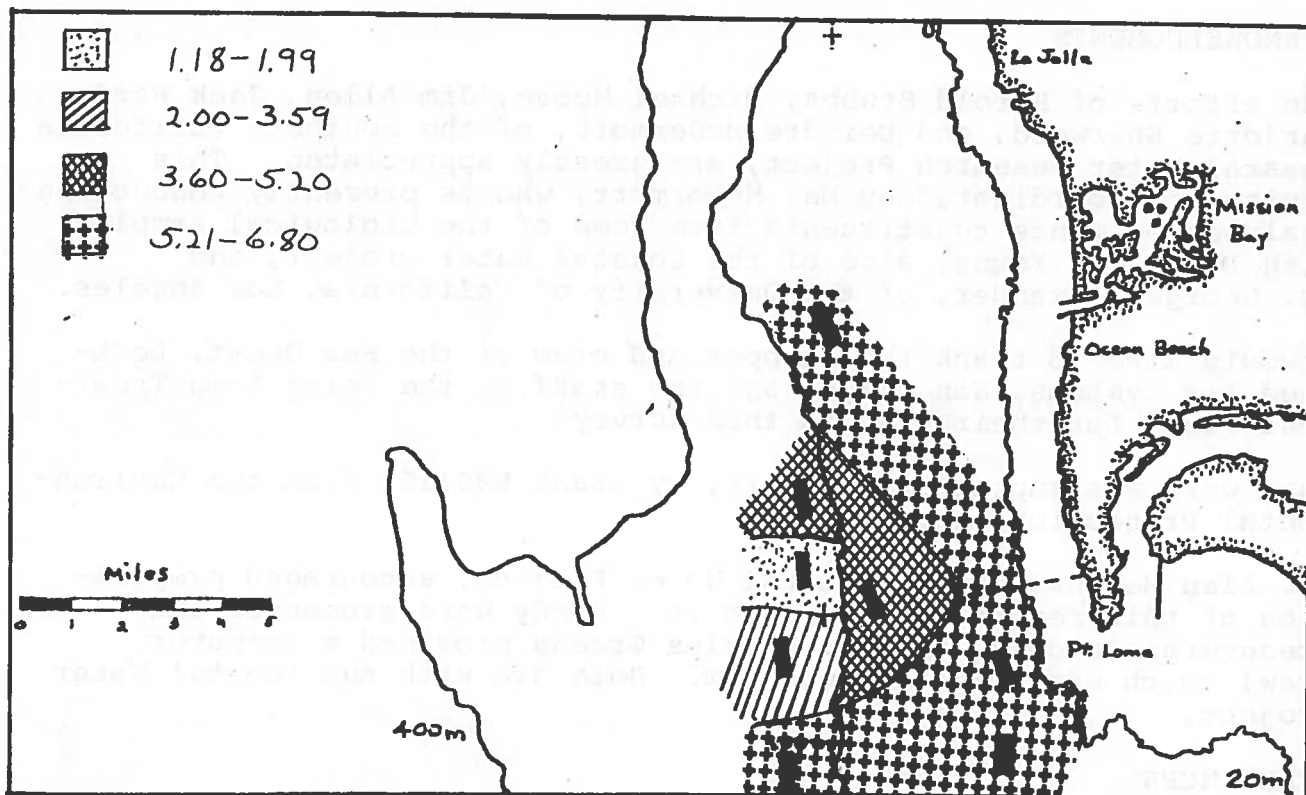


Figure 6. Gleason diversity per haul for fishes taken on the Point Loma survey, February 12, 1975.

DISEASED AND ANOMALOUS FISHES

The most abundant anomaly was the copepod eye parasite (Phrioxcephalus cincinnatus) which occurred on the Pacific sanddab (Citharichthys sordidus). One white croaker (Genyonemus lineatus) had a structural deformity of the mouth, a missing maxillary, which may have been caused by an earlier fishing accident. These data are summarized in Table 5.

INVERTEBRATES

The number of invertebrates was not particularly high compared to other surveys in southern California, although the number of species was moderately high. A total number of 4,123 specimens representing 60 species was collected. Echinodermata, Mollusca, Arthropoda, and Annelida contributed to most of the diversity. Common and abundant species were Lytechinus anamesus (sea urchin), Sicyonia ingentis (ridgeback prawn), Astropecten verrilli (sand star), and Parastichopus californicus (sea cucumber). These species appear to indicate a generally normal benthic environment. All invertebrate data is summed up in Appendix 3.

The large number of species present at Station 8 (40) was in large part due to the many pieces of metal and plastic which contained many of these animals. Excluding Station 8, the number of species found in Point Loma ranged from 8 to 11.

ACKNOWLEDGMENTS

The efforts of Harold Stubbs, Michael Moore, Jim Allen, Jack Word, Marjorie Sherwood, and Deirdre McDermott, of the Southern California Coastal Water Research Project, are greatly appreciated. This cruise was coordinated by Ms. McDermott, who is presently conducting analyses of trace constituents from some of the biological samples with Dr. David Young, also of the Coastal Water Project, and Dr. George Alexander, of the University of California, Los Angeles.

I would like to thank the skipper and crew of the Sea Quest, Lockheed Air Systems, San Diego, and the staff of the Point Loma Treatment Plant for their help in this survey.

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Dr. Alan Mearns, of the Coastal Water Project, encouraged preparation of this report and reviewed it. Cindy Word processed the oceanographic data, and Dr. Charles Greene provided a computer trawl catch summarization program. Both are with the Coastal Water Project.

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Southern California Coastal Water Research Project. 1973. The ecology of the Southern California Bight: Implications for water quality management. TR104, So. Calif. Coastal Wat. Res. Proj., El Segundo, Calif.

Table 5. Anomaly information of fish species sampled during an otter trawl survey off Point Loma, California, February 12, 1975.

Station	Anomaly	Species	No. of Fish	Size Class (mm SL)
7	eye parasite*	<u>Citharichthys sordidus</u>	2	75, 85
7	ambicoloration	<u>Symphurus atricauda</u>	1	115
7	parasite (isopod)	<u>Ophiodon elongatus</u>	1	225
5	eye parasite*	<u>Citharichthys sordidus</u>	1	75
8	eye parasite*	<u>Citharichthys sordidus</u>	1	65
3	eye parasite*	<u>Citharichthys sordidus</u>	5	65(2), 75(2), 85
3	mouth deformity	<u>Genyonemus lineatus</u>	1	235
2	eye parasite*	<u>Citharichthys sordidus</u>	2	65(2)
1	eye parasite*	<u>Citharichthys sordidus</u>	10	55, 65(3), 85(3), 105, 115, 125

* eye parasite identified as Phrioxcephalus cincinnatus (Wilson 1908)

Appendix 1. Catch per fish species per trawl, Point Loma otter trawl survey, 12 Feb. 1975.

Depth (m)	Station								Total
	7	5	1	3	4	6	2	8	
Eptatretus stouti	61	64	82	91	137	137	137	137	1
Synodus lucioceps	-	1	-	-	-	-	-	-	1
Citharichthys sordidus	45	49	93	67	9	31	58	60	412
Hippoglossina stomata	8	-	1	1	-	-	-	2	11
Citharichthys fragilis	-	-	1	-	-	-	-	1	1
Lepidopsetta bilineata	-	-	2	-	-	16	27	1	1
Lypopsetta exilis	4	6	26	17	-	2	5	4	46
Microstomus pacificus	1	16	8	40	8	14	1	2	64
Parophrys vetulus	2	2	1	-	-	-	-	2	90
Pleuronichthys verticalis	16	10	2	1	-	-	-	1	5
Symphurus atricaudus	-	4	2	3	-	-	-	-	27
Genyonemus lineatus	64	25	26	1	-	-	-	3	7
Zalembius rosaceus	-	4	-	1	-	-	-	-	121
Sebastes chlorostictus	3	-	-	-	-	-	-	-	1
Sebastes dalli	-	-	-	-	-	2	1	-	7
Sebastes elongatus	-	-	-	-	-	-	1	-	3
Sebastes rosenblatti	-	-	1	-	-	-	1	-	1
Sebastes rubrivinctus	-	-	3	8	32	6	52	-	1
Sebastes saxicola	-	-	3	1	-	-	-	1	5
Sebastes semicinctus	-	1	-	-	-	-	-	-	1
Sebastes vexillaris	1	1	-	-	-	-	-	-	2
Ophiodon elongatus	-	-	-	1	-	-	1	-	2
Zaniolepis frentata	2	56	37	1	-	-	1	2	4
Zaniolepis latipinnis	2	1	-	1	-	-	-	-	96
Chitonotus pugetensis	9	31	9	1	-	-	-	-	3
Icelinus quadriseriatus	-	-	1	-	-	-	1	1	50
Icelinus tenuis	1	-	1	-	-	-	-	1	3
Odontopyxis trispinosa	-	-	1	-	-	-	-	1	2
Rathbunella N. Sp. A	-	-	4	-	-	-	4	-	1
Porichthys notatus	-	-	-	-	-	-	-	1	8
Brosomphyois marginata	-	-	7	-	-	-	-	1	1
Chilara taylori	-	-	-	-	-	-	-	-	7
Total	49	208	225	142	49	71	151	80	1084
Total Species	3	15	17	12	3	6	10	13	32

Appendix 2. Diversity formulas used for calculating data.
 Log e used for all diversities.

Brillouin $H = \frac{1}{N} \ln \frac{N!}{n_1!n_2!\cdots n_s!}$

Shannon-Weaver $H' = \frac{1}{N} \sum_{i=1}^j \frac{n_i}{N} \ln \frac{N}{n_i}$

Standard Deviation(s) $SD_{calc} = \left[\frac{S(\sum_{i=1}^j n_i^2) - N^2}{S(S-1)} \right]^{1/2}$

$$SD(S) = \frac{SD_{max} - SD_{calc}}{SD_{max} - SD_{min}}$$

Gleason's Index $D = \frac{S-1}{\ln N}$

Appendix 3. Invertebrates found from the otter trawl survey
at Point Loma, February 12, 1975.

	Stations							
	1	2	3	4	5	6	7	8
CNIDARIA								
<u>Acanthoptilum</u> sp.								P
Coral unid.								P*
<u>Filigella mitzukurii</u>						P		P
<u>Metridium senile</u>								5*
Plumulariidae unid.								P*
Sertulariidae unid.								P*
CTENOPHORA unid.		P						
ECHIUROIDEA								
<u>Listriolobus pelodes</u>					P			
ANNELIDA								
<u>Amphitrite</u> sp.								1*
<u>Lepidasthenia ? interrupta</u>								1*
<u>Lepidonotus squamatus</u>								3*
Polynoid unid.								1*
<u>Protula superba</u>								1*
Sabellariidae unid.								2
<u>Vermiliopsis infundibulum</u>								1*
ARTHROPODA								
Pycnogonid unid.				1				
<u>Crangon alaskensis elongata</u>	3		1				3	
<u>Crangon resima</u>		3						
<u>Crangon zaca</u>		5						1
<u>Pandalus platyceros</u>	1							
<u>Spirontocaris snyderi</u>								1
<u>Sicyonia ingentis</u>	3	6		7	13	4	3	
<u>Mursia gaudichaudii</u>					1			
MOLLUSCA								
Lucinidae unid.								1
<u>Lucina (Paryilucina) sp.</u>								1
<u>Odostomia</u> sp.								1
<u>Acanthodoris brunnea</u>							2	
<u>Armina californica</u>	1							
<u>Corolla spectabilis</u>		P	P	P	P	P	P	P
<u>Flabellinopsis iodinea</u>							1	
<u>Philine alba</u>								7
<u>Pleurobranchaea californica</u>			1				1	
<u>Triopha carpenteri</u>							1	
<u>Tritonia dlomedia</u>				1				1
<u>Rossia pacifica</u>		3			2		2	1
<u>Octopus</u> sp.			1					
Chiton unid.								1
BRACHIOPODA								
<u>Terebratalia occidentalis</u>								1
<u>Terebratulina</u> sp.								1

P = Present; * = invertebrates found on scraps of metal or plastic.

	Stations							
	1	2	3	4	5	6	7	8
ECHINODERMATA								
<u>Cucumaria sp.</u>								1
<u>Parastichopus californicus</u>	1	5	3	1	1	2		
<u>Amphiodia occidentalis</u>								1
<u>Ophiopholis bakeri</u>								13*
<u>Ophiothrix speculata</u>								1*
<u>Ophiura lutkeni</u>		1		2	1	2		15
Ophiuroid unid.				1				6
<u>Astropectem verrilli</u>	2	6	2	2		3		1
<u>Amphiura arcystata</u>				1		1		
? <u>Luidiaster californica</u>							1	1
<u>Mediaster aequalis</u>	1			1				1
<u>Petalaster foliolata</u>			2		1			7
<u>Rathbunaster californica</u>								1
<u>Stylasterias ? forreri</u>								1*
<u>Allocentrotus fragilis</u>		3				1		
Echinoid unid.				2				
<u>Lytechinus anemesus</u>	845	2	673	2		24	1	2374
<u>Spatangus californicus</u>								3
UROCHORDATA								
Acidean unid.							2	
<u>Pyrosoma sp.</u>						1		
Tunicate unid.								1
TOTALS	857	34	683	20	19	38	17	2455

P = Present; * = invertebrates found on scraps of metal or plastic.

