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AN OTTER TRAWL SURVEY OF THE CENTRAL ORANGE COUNTY COAST

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INTRODUCTION

In August 1972, a trawl survey conducted by Marine Biological Consultants, Inc., in association with SCCWRP personnel revealed that, off northern Orange County, Dover sole with eroded fins were in greater abundance than had been previously recorded. Because of these observations and the need to collect specimens for trace constituent analyses, a SCCWRP-sponsored survey of the area between Newport Beach and Dana Point was conducted on 15 August 1972. The area was selected because it is characterized by a narrow coastal shelf unique to the region south of Los Angeles.

Coordination of this survey with the Orange County Department of Education resulted in selection of stations already being randomly trawled by that agency. The results of the SCCWRP survey are presented in this report.

METHODS

The Fury II was the trawling vessel used in the SCCWRP survey; samples were taken with a 16-foot semiballoon trawl net with a 1-1/2-inch stretch mesh body and a 1/2-inch knotless stretch mesh inner liner in the cod end. Trawling speed was approximately 2.0 knots. A total of 10 hauls were made at 9 stations that ranged in depth from 90 to 288 feet (Figures 1 and 2). All trawls were 15 minutes in duration, with the exception of a 10-minute haul (Haul 2A) at Station OCS-8. At each of the six "grid" stations off Three Arch Bay, water temperatures were measured from the surface to the bottom at 5-meter intervals using a remote temperature depth conductivity probe.

RESULTS

Community and Population Parameters. Catch data for the ten hauls are summarized below. Data for individual hauls are given in Table 1.

	Total No.of Individuals	Total No.of Species	Species/Haul		Shannon-Weaver Diversity/Haul	
			Std. Dev.	Std. Error	Std. Dev.	Std. Error
All Stations	3,101	47	18.0	±1.7	2.10	±0.10
Three Arch Bay Grid	1,894	38	15.3	±1.9	1.92	±0.08

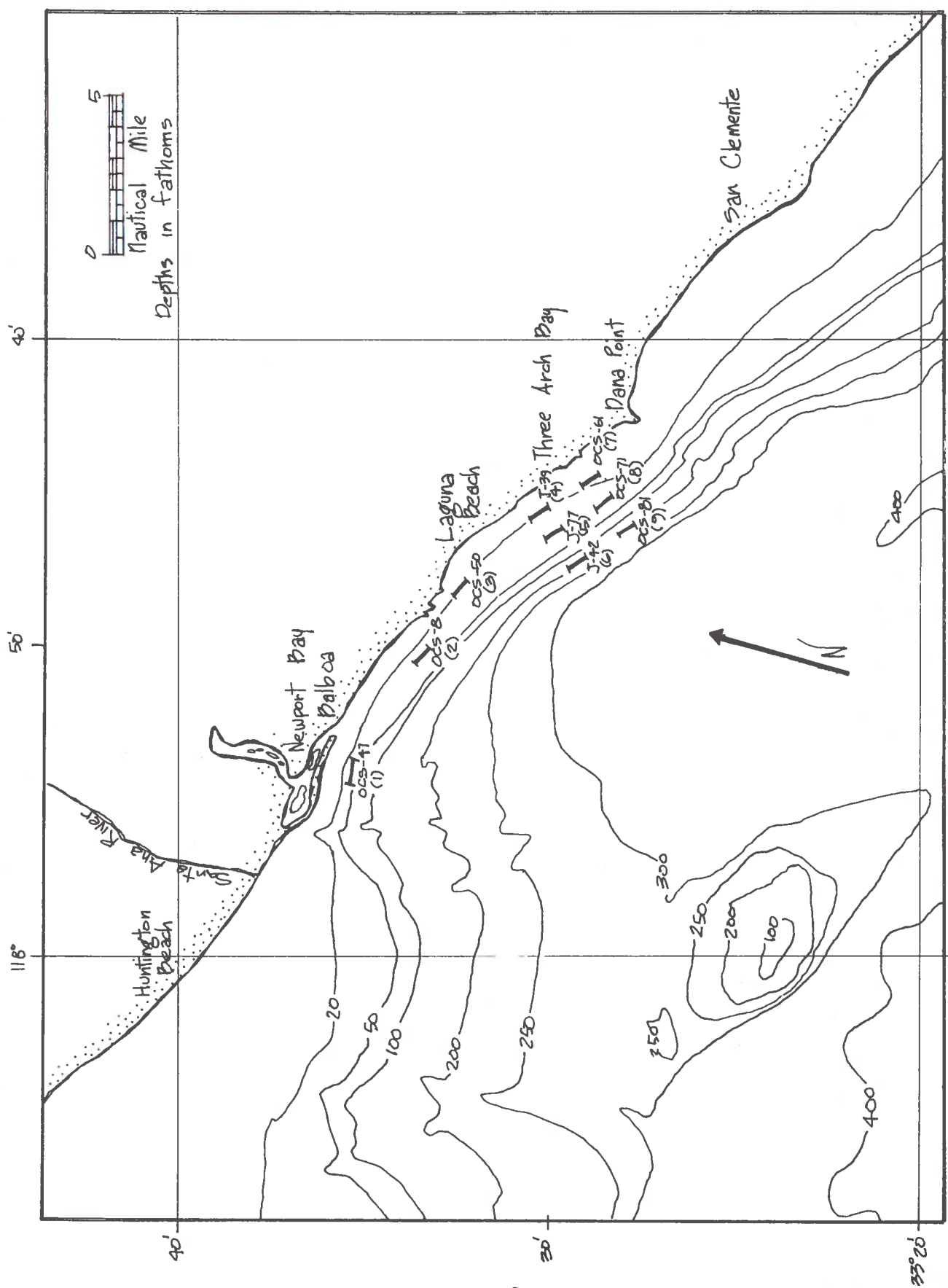


Figure 1. Stations and haul numbers (parentheses), Orange County survey, 15 August 1972.

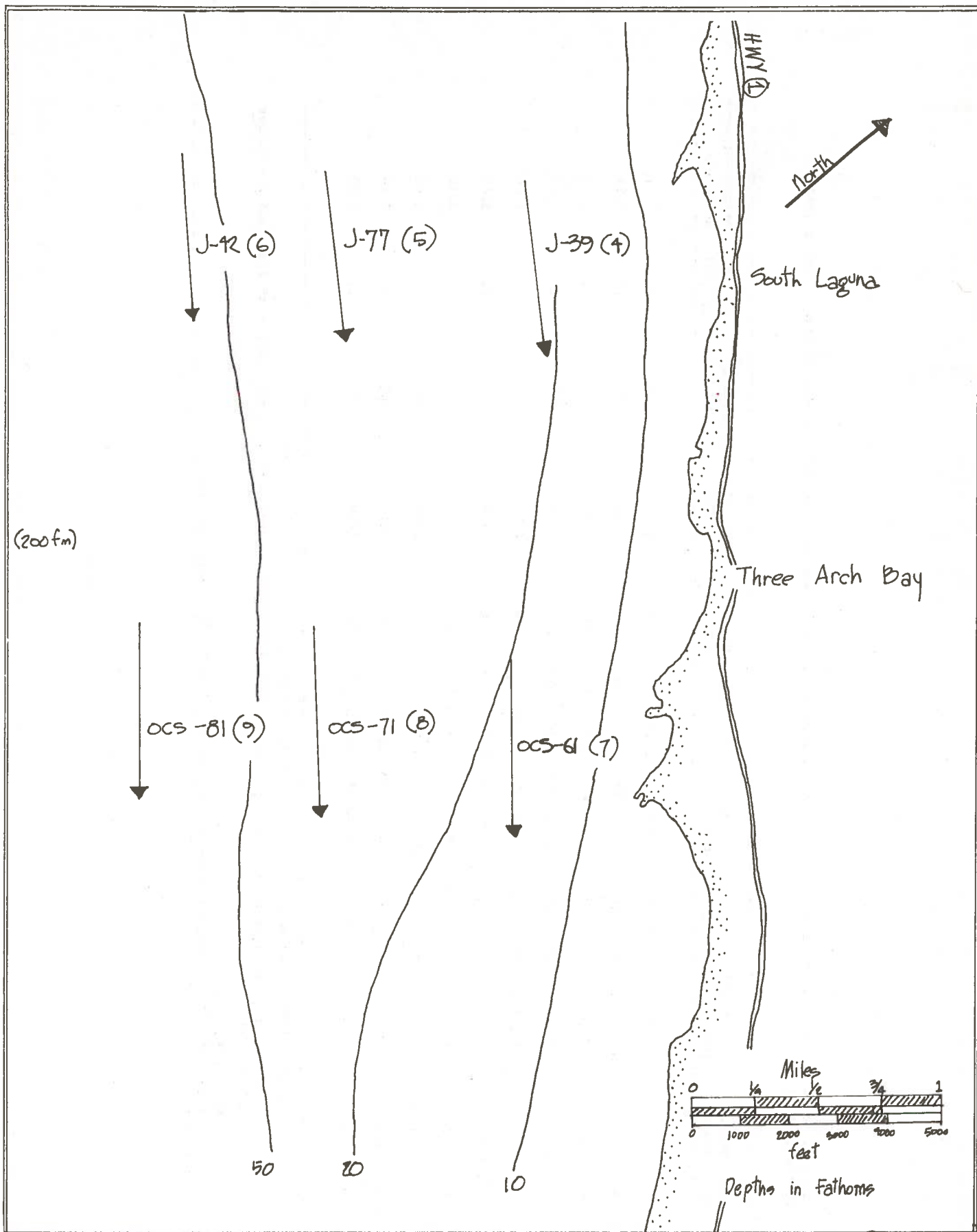


Figure 2. Stations and haul numbers (parentheses) of six-station grid off Three Arch Bay, 15 August 1972.

TABLE 1. Station location and fish catch statistics from otter trawl samples taken off the central Orange County coast, 15 August 1972.

Haul No.	O.C.D.B. Station	Latitude (N) Start Finish	Longitude (W) Start Finish	Average Depth(ft)	Est. Time of Day	Number of Individuals	No. of Species	Shannon-Weaver ¹ Diversity
1	OCS-47	33°35'10" 33°35'10"	117°55' 0" 117°54'10"	210	0855	595	24	2.33
*2A	OCS- 8	33°33'15" 33°33'00"	117°50'30" 117°50'00"	180	1020	95	21	2.50
2B	Repeat	33°33'00" 33°33'15"	117°50'00" 117°50'30"	180	1145	293	26	2.58
3	OCS-50	33°32'00" 33°31'50"	117°58'10" 117°57'30"	156	1220	228	17	2.02
4 ⁺	J-39	33°30'25" 33°30'00"	117°56' 0" 117°45'30"	96	1255	32	9	1.96
5 ⁺	J-77	33°30'00" 33°29'30"	117°47'00" 117°46'30"	156	1330	1012	21	1.58
6 ⁺	J-42	33°29'30" 33°29'00"	117°47'30" 117°46'45"	288	1430	151	15	2.16
7 ⁺	OCS-61	33°29'00" 33°28'30"	117°45'00" 117°44'30"	90	1515	273	18	1.92
8 ⁺	OCS-71	33°28'30" 33°28'00"	117°45'30" 117°45'00"	180	1615	362	17	2.04
9 ⁺	OCS-81	33°28'00" 33°27'30"	117°46'30" 117°45'30"	288	1700	63	11	1.90

¹Shannon-Weaver Diversity (Information theory formula): $\bar{H} = \sum_{n=1}^s n_i/N \log_e n_i/N$
 where \bar{H} = species diversity index; n_i = number of individuals in species i ; N = total number of fish; and s = number of species.

*10 minute haul

+These stations represent the 6 station grid, off Three Arch Bay; see text.

A total of 3,101 fish, representing 47 species and 20 families, were collected, identified, measured, and preserved or returned to the sea. Species are listed in Table 2, and data on catch per haul per species are given in Table 3. No average catch per haul values were calculated because of the low number of hauls and the great variability in catch size. Species that were present at the northern stations but not at Three Arch Bay include the ratfish, rubberlip seaperch, blackeye goby, Pacific pompano, cow rockfish, vermilion rockfish, greenblotched rockfish, roughback sculpin, and longfin sanddab.

The stripetail rockfish was the most abundant fish in the overall survey (Table 4). It was followed in abundance by the Pacific sanddab and the pink seaperch. Stripetail rockfish were numerically dominant at Stations OCS-47, OCS-8 (Haul 2A), J-77, J-42, and OCS-71; Pacific sanddab at OCS-50, J-39, and OCS-81; Dover sole at OCS-8 (Haul 2B); and pink seaperch at OCS-61. The Pacific sanddab and the pink seaperch occurred in all hauls; the English sole in all but Haul 9 (Table 5).

Catch information collected during this survey was also compared to the recurrent group community analyses performed by SCCWRP on 303 trawl samples from the region between Port Hueneme and Newport Beach. The groups identified are presented in Figure 3. The fish species in Table 3 are arranged according to these groups. All members in the five groups were present in this survey; one associate of the slender sole/rex sole group, the blacktip poacher (Xeneretmus latifrons), was absent. Groups 2 and 3 were present at Station OCS-61; Group 5 was present at Stations OCS-47, OCS-8 (Hauls 2A and 2B), OCS-50, J-77, and OCS-81; Group 1 appeared at Stations OCS-47, OCS-8 (Hauls 2A and 2B), J-42, OCS-71, and OCS-81. Thus the major "communities" sampled were those of the yellowchin sculpin and the Pacific sanddab, both apparently typical of mid-depths of the coastal shelf of southern California.

Diseased and Anomalous Fishes. Several diseased and anomalous fishes were also collected during the 15 August 1972 trawling survey (Figure 4). Eighty-seven Dover sole, Microstomus pacificus, were collected at the most northern station, OCS-47; two of these (2.3 percent), in the size range 170 to 180 mm, S.L., were affected with fin erosion (Figure 4). Of 13 white croaker (Genyonemus lineatus) captured at Station J-77, one (184 mm, S.L.) had a reddish lesion in the tail region. Incidence of the anomaly in white croaker at the six-station grid off Three Arch Bay was 1.8 percent.

Tumor-bearing Dover sole were captured only at Station OCS-47. Three of the 87 fish (3.4 percent) were affected; all were recently settled young-of-the-year, 70 to 90 mm, S.L. As a total of 12 Dover sole in the 50- to 90-mm size range were captured at Station OCS-47, incidence of tumors in this size range was 25 percent. Few individuals in this size range occurred at stations off Newport Beach, Laguna Beach, and Dana Point, and SCCWRP studies suggest that the rarity of small Dover sole may account for the absence of tumor-bearing specimens in these hauls (Figure 4).

TABLE 2. Fishes taken by otter trawl at 9 stations off the central Orange County coastal zone on 15 August 1972 by the Fury II. Depth range sampled: 90-288 ft.

SPECIES	COMMON NAME
Chimaeride	
<u>Hydrolagus colliei</u>	Ratfish
Engraulidae	
<u>Engraulis mordax</u>	Northern Anchovy
Argentinidae	
<u>Argentina sialis</u>	Pacific Argentine
Synodontidae	
<u>Synodus lucioceps</u>	California Lizardfish
Batrachoididae	
<u>Porichthys notatus</u>	Plainfin Midshipman
Ophidiidae	
<u>Chilara taylori</u>	Spotted Cusk-eel
Zoarcidae	
<u>Lycodopsis pacifica</u>	Blackbelly Eelpout
Syngnathidae	
<u>Syngnathus californiensis</u>	Kelp Pipefish
Serranidae	
<u>Paralabrax nebulifer</u>	Barred Sand Bass
Sciaenidae	
<u>Genyonemus lineatus</u>	White Croaker
<u>Seriphus politus</u>	Queenfish
Embiotocidae	
<u>Cymatogaster aggregata</u>	Shiner Perch
<u>Embiotoca jacksoni</u>	Black Perch
<u>Hyperprosopon argenteum</u>	Walleye Surfperch
<u>Phanerodon furcatus</u>	White Seaperch
<u>Rhacochilus toxotes</u>	Rubberlip Seaperch
<u>Zalembeius rosaceus</u>	Pink Seaperch
Gobiidae	
<u>Coryphopterus nicholsi</u>	Blackeye Goby
<u>Lepidogobius lepidus</u>	Bay Goby
Stromateidae	
<u>Peprilus simillimus</u>	Pacific Pompano
Scorpaenidae	
<u>Scorpaena guttata</u>	California Scorpionfish
<u>Sebastes dalli</u>	Calico Rockfish
<u>Sebastes goodei</u>	Chilipepper
<u>Sebastes jordani</u>	Shortbelly Rockfish
<u>Sebastes levis</u>	Cow Rockfish
<u>Sebastes miniatus</u>	Vermilion Rockfish

Table 2: Continued

SPECIES	COMMON NAME
<u>Sebastes rosenblatti</u>	Greenblotched Rockfish
<u>Sebastes saxicola</u>	Stripetail Rockfish
<u>Sebastes semicinctus</u>	Halfbanded Rockfish
<u>Sebastes serranoides</u>	Olive Rockfish
Hexagrammidae	
<u>Zaniolepis frenata</u>	Shortspine Combfish
<u>Zaniolepis latipinnis</u>	Longspine Combfish
Cottidae	
<u>Chitonotus pugentensis</u>	Roughback Sculpin
<u>Icelinus quadriseriatus</u>	Yellowchin Sculpin
Agonidae	
<u>Odontopyxis trispinosa</u>	Pygmy Poacher
Bothidae	
<u>Citharichthys sordidus</u>	Pacific Sanddab
<u>Citharichthys stigmaeus</u>	Speckled Sanddab
<u>Citharichthys xanthostigma</u>	Longfin Sanddab
<u>Hippoglossina stomata</u>	Bigmouth Sole
<u>Paralichthys californicus</u>	California Halibut
Pleuronectidae	
<u>Glyptocephalus zachirus</u>	Rex Sole
<u>Lyopsetta exilis</u>	Slender Sole
<u>Microstomus pacificus</u>	Dover Sole
<u>Parophrys vetulus</u>	English Sole
<u>Pleuronichthys decurrens</u>	Curlfin Sole
<u>Pleuronichthys verticalis</u>	Hornyhead Turbot
Cynoglossidae	
<u>Symphurus atricauda</u>	California Tonguefish

Table 3. Abundance per haul of each species of the otter trawl survey off the central Orange County coast on August 15, 1972 by FURY II. First 21 species are arranged according to the recurrent groups to which they belong.

SPECIES	1	2A	2B	3	4	HAUL				8	9	TOTAL ABUNDANCE	
						5	6	7	7			All Stations	Station Grid
White Croaker	1		4		3	13		39				60	55
Queenfish			1			1		14				16	15
White Seaperch					3			7				10	10
Northern Anchovy								1				1	1
Speckled Sanddab					1			10				11	11
California Tonguefish	15	5	10	10		10		3	5			58	18
Hornyhead Turbot				3	3	2	2	8	2			20	17
English Sole	1	1	1	1	1	1	2	2	2			12	8
Curlfin Sole	3	1		1		1						6	1
Yellowchin Sculpin	7	2	3	10		31			22			75	53
Longspine Combfish	3	5	21	32	1	15		3	38			118	57
Pygmy Poacher	1	2	2			1			2			8	3
Pacific Sanddab	75	17	22	68	8	164	19	10	84	18		485	303
Dover Sole	87	9	50	15		26	26		11	11		235	74
Plainfin Midshipman	62	5	44	6		46	27		13	15		218	101
Pink Seaperch	36	5	17	55	5	121	8	105	55	3		420	297
Shortspine Combfish	7	1	6				1		1	1		17	3
Stripetail Rockfish	115	22	46	19		550	34		103	1		890	688
Slender Sole	22	3	16			2	12			1		56	15
Rex Sole							4			1		5	5
Blackbelly Eelpout	60	1	2			1	11		11	7		93	30
Ratfish	1											1	0
Pacific Argentine			1							1		2	1

TABLE 3. Continued

SPECIES	HAUL										TOTAL ABUNDANCE	
	1	2A	2B	3	4	5	6	7	8	9	All Stations	6 Station Grid
Spotted Cusk-eel	4						1				5	1
Kelp Pipefish						1					1	1
Barred Sand Bass								1			1	1
Shiner Perch				7				60			67	67
Black Perch			2					1			3	1
Walleye Surfperch								1			5	5
Rubberlip Seaperch			1					5			1	0
Blackeye Goby		2	2								4	0
Bay Goby						8			4		12	12
Pacific Pompano	1										1	0
California Scorpionfish			1					2			3	2
Calico Rockfish	4	9	10				1				24	1
Chilipepper		1	4			1			1		7	2
Shortbelly Rockfish	2						1				3	1
Cow Rockfish	2		1								3	0
Vermilion Rockfish		1		2							3	0
Greenblotched Rockfish			2								2	0
Halfbanded Rockfish	83	1	21			10				4	119	14
Olive Rockfish				1					1		2	1
Roughback Sculpin		1									1	0
Longfin Sanddab	2	1	2	1							6	0
Bigmouth Sole	1		3	1		7	2	1	7		22	17
California Halibut								1			1	1
California Lizardfish			1			1					2	1

TABLE 4. 10 most abundant fishes taken by otter trawl from 10 hauls at 9 stations off the central Orange County coast on August 15, 1972 by the Fury II. Depth range sampled: 90-288 ft.

SPECIES	ABUNDANCE
1. Stripetail Rockfish	890
2. Pacific Sanddab	485
3. Pink Seaperch	420
4. Dover Sole	235
5. Plainfin Midshipman	218
6. Halfbanded Rockfish	119
7. Longspine Combfish	118
8. Blackbelly Eelpout	93
9. Yellowchin Sculpin	75
10. Shiner Perch	67

TABLE 5. 11 most frequently occurring fishes taken by otter trawl from 10 hauls at 9 stations off the central Orange County coast on August 15, 1972 by the Fury II. Depth range sampled: 90-288 ft.

SPECIES	FREQUENCY OF OCCURRENCE
1. Pink Seaperch	10
2. Pacific Sanddab	10
3. English Sole	9
4. Longspine Combfish	8
5. Dover Sole	8
6. Plainfin Midshipman	8
7. Stripetail Rockfish	8
8. California Tonguefish	7
9. Blackbelly Eelpout	7
10. Bigmouth Sole	7

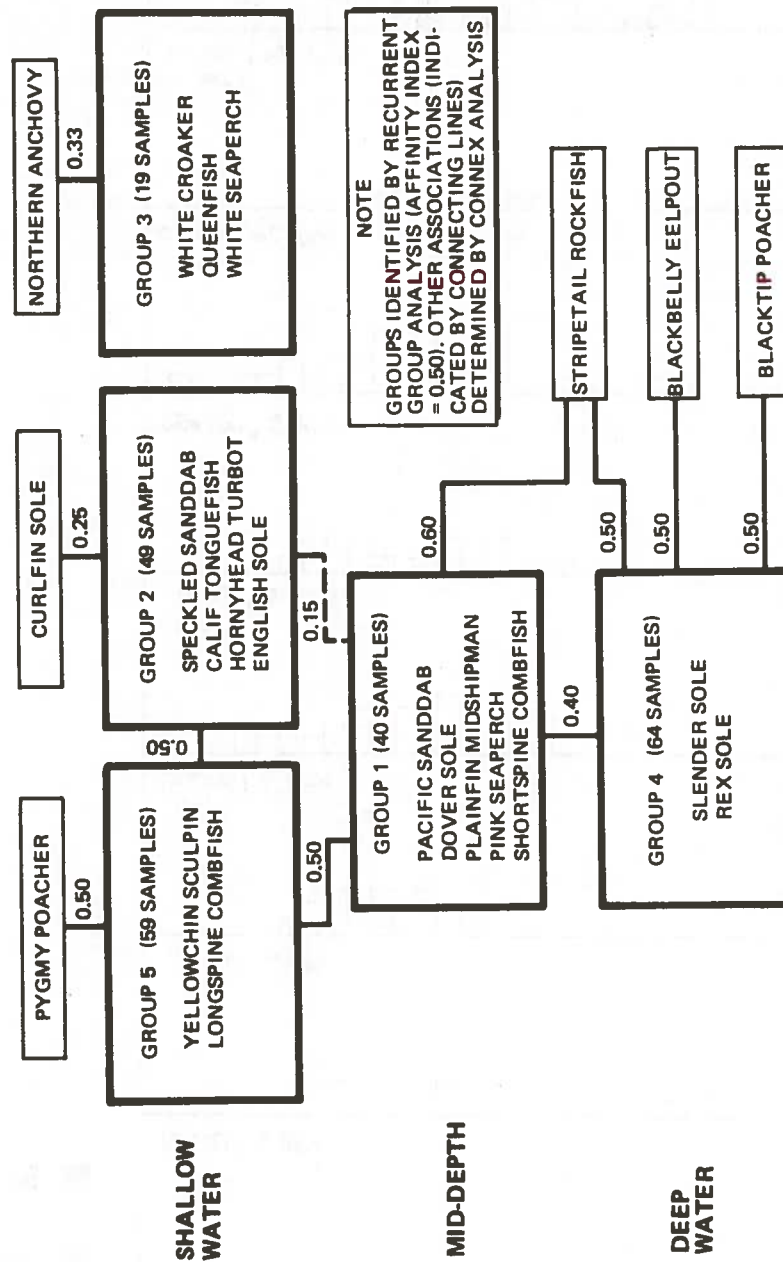


Figure 3. Species Associations of Southern California Nearshore Demersal Fishes, 1969-72.

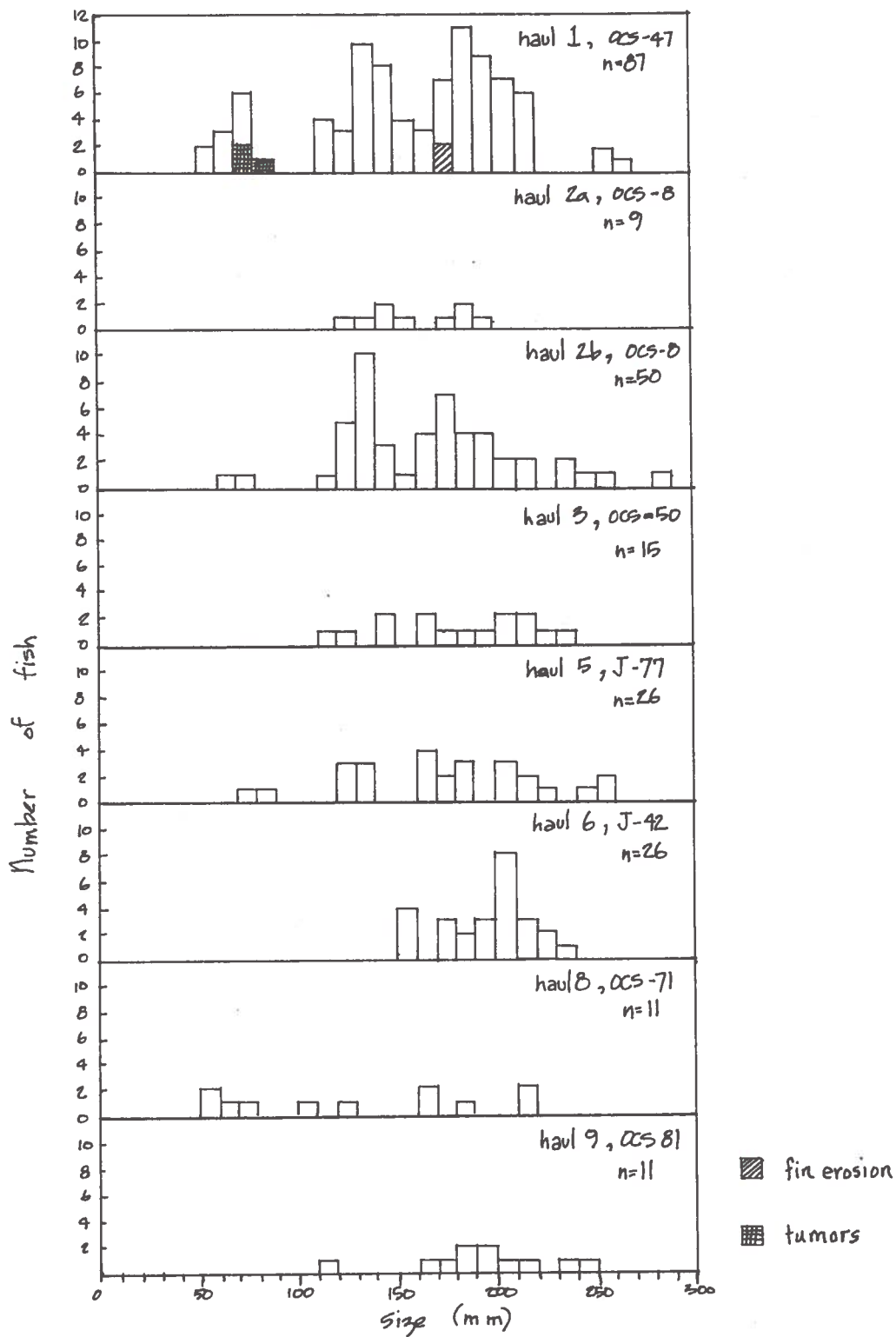


Figure 4. Size distribution (in 10 mm size classes) of normal and diseased Dover sole.

Only one barred sandbass (Paralabrax nebulifer) was captured during the survey (Station OCS-61 off Three Arch Bay). The specimen had no external parasites or lesions but the gill rakers on both first gill arches were badly deformed; this condition is described by Valentine and Bridges (1969) and is known to occur in relatively high frequency in sandbass from the central Orange County coastal area (Valentine and Soule 1972). None of the 485 Pacific sanddabs (Citharichthys sordidus) collected were infected with the copepod eye parasite Phrioxcephalus cincinnatus (Kabata 1967 and 1969), which has been found on this species elsewhere in southern California. Several leeches were observed on two partially ambicolored horny head turbot (Pleuronichthys verticalis) from Station OCS-50; the occurrence of these two phenomena together merits further study.

Water Temperature Relationships. Water temperature measurements taken at 5- and 10-meter depth intervals at the six Three Arch Bay stations are presented in Table 6; depth contours are plotted in Figure 5. There is presently insufficient information to determine species temperature preferences; however, relationships have been hypothesized from data collected in the Santa Monica Bay 6-year trawl study (SCCWRP 1973). Measurements of bottom temperatures should be extremely valuable in understanding demersal fish distributions. Examination of the temperature plots in Figure 5 reveal the presence of a moderate thermocline at a depth of about 10 meters in the survey area.

CONCLUSIONS

1. The occurrence of members of five recurrent groups at stations sampled during this survey suggest that inshore coastal fishes in this region are relatively abundant and diverse. However, fish abundance, diversity, and commonness in this and other areas cannot be quantitatively compared at this time because of the small number of trawls taken and differences in the vessels and gear used in each area. Corrections of previous species misidentifications made during the survey will aid in making future comparisons meaningful.

2. The survey also demonstrated that the increase in incidence of Dover sole with eroded fins recorded during the MBC, Inc. survey in northern San Pedro Bay did not extend south of Corona del Mar.

RECOMMENDATIONS

The absence of Dover sole with eroded fins and the apparently high abundance and diversity of inshore coastal fishes in the region of Three Arch Bay suggest that this area may serve as a "control" for southern California trawling surveys. Dover sole

Table 6. Temperature data from six trawl stations off Three-Arch Bay, California, August 15, 1972.

DEPTH (m)	HAUL					
	4 J-39	5 J-77	6 J-42	7 OCS-61	8 OCS-71	9 OCS-81
0	20.5	20.8	20.0	20.8	20.8	20.1
5	19.0	18.5	19.0	19.9	19.5	19.4
10	17.1	16.1	15.5	16.9	15.8	17.3
15	15.4	15.2	13.8	14.2	14.1	13.9
20	14.3	14.4	13.2	13.6	13.5	13.4
25	13.8	13.3	12.6	12.5 (23)	12.9	12.3
30		12.5	12.2		12.3	12.0
35		--	12.0		--	
40	--	12.0	11.9		11.5	11.0
45		--	--		11.3	--
50		12.0	11.1			--
58						10.5
Bottom Depth						
ft	96	156	288	90	180	288
m	29	47	88	28	55	88
fm	15.9	26	48	15.3	30	48

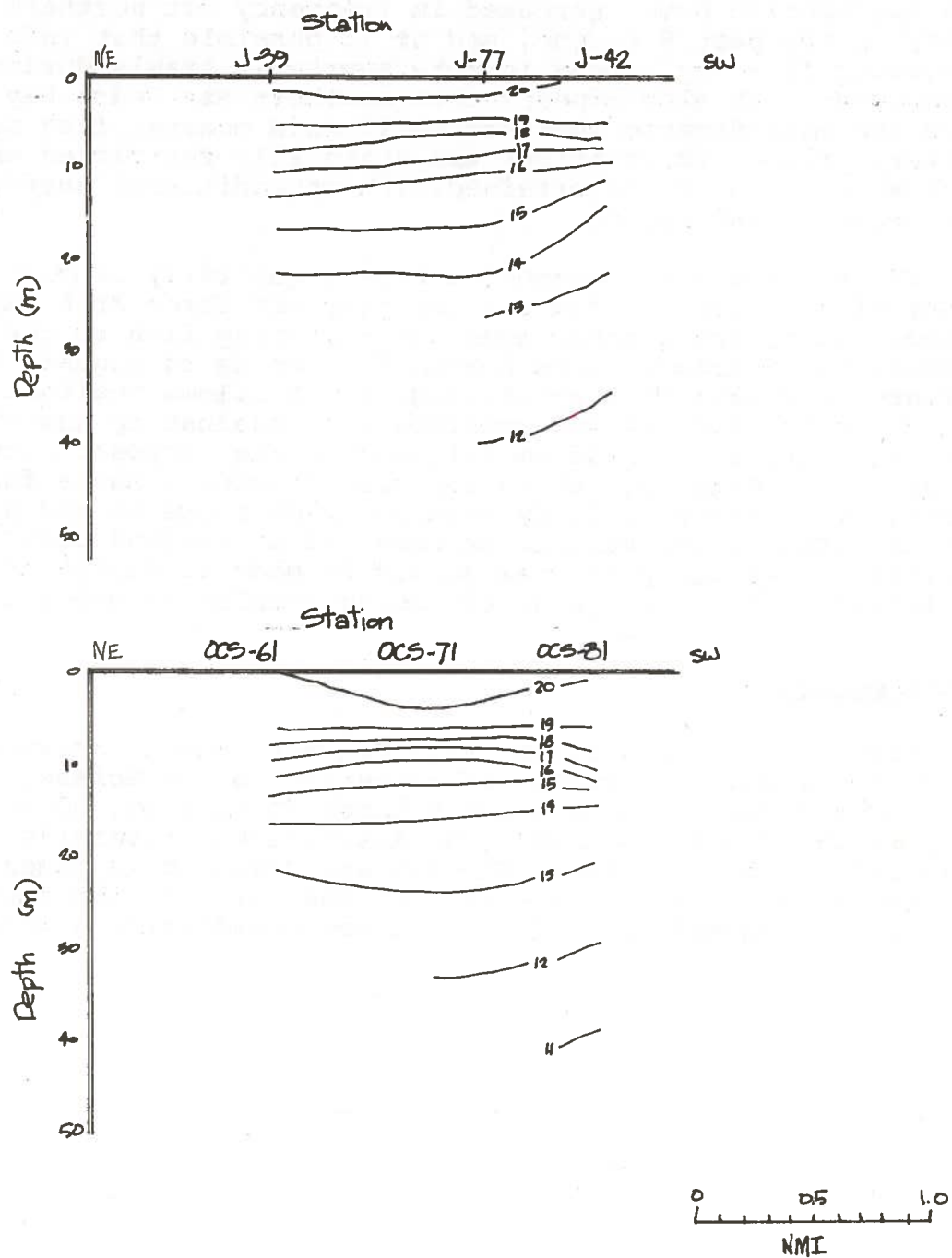


Figure 5. Temperatures ($^{\circ}\text{C}$) at Three-Arch Bay stations, 15 August 1972.

with fin erosion have increased in frequency off northern Orange County in the past 6 months, and it is possible that infected or recovering fish may appear in more southerly trawls during the coming year. It also appears that southern San Pedro Bay may yield the most diverse southern California coastal fish fauna. However, present observations are seasonally restricted and their importance cannot be ascertained without additional surveys in the fall, winter, and spring.

It is therefore recommended that a quarterly single-day trawl survey of at least the six-station grid off Three Arch Bay be conducted. At present, other agencies surveying fish to the north schedule their grid surveys during the months of August, November, February, and May; this scheduling, which allows regional seasonal changes to be observed and considered in evaluating wastewater discharge effects, should be followed in the proposed surveys. The quarterly sampling scheme can also provide a basis for interpreting the results of daily samples taken close to and distant from the grid during various seasons and at various depths. If possible, these daily samples should be made at depths of 15 to 100 fathoms, the range presently being sampled in other areas.

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