

## A TRAWL SURVEY OFF LAGUNA BEACH AND DANA POINT

December 1974 marked the completion of a 2-year quarterly trawl survey at nine stations off the coastal region between Laguna Beach and Dana Point, California. The Purpose of this survey, which was sponsored by the Environmental Protection Agency, was to obtain information on the abundance, -diversity, and health of demersal fish and invertebrate populations at a coastal site away from the direct influence of large wastewater discharge sites of Los Angeles and Orange Counties yet close enough to represent a possible control site.

The surveys were conducted aboard the FURY II by Coastal Water Project personnel, with the assistance of staff members of the Orange County Department of Education. Daytime cruises were conducted in February, May, August, and November 1973 and February, May, August, and December 1974. On most cruises, nine standardized stations, on three transects at three depths, were sampled (Figure 1) using a Marinovich otter trawl with a 7.62-m (25-foot) head-rope and a 1.27-cm (1/2-inch) stretch mesh cod-end liner. At each station, the net was towed for 10 minutes (on bottom time) at 1.3 m/sec (2.5 knots). With a door spread of 5 m, the net covered an area of about 3,860 sq m (0.95 acres).

Fishes and invertebrates were sorted aboard ship, and fishes were weighed, identified, counted, and examined for parasites and signs of disease. After each tow, water samples taken at each station were measured for temperature, clarity, dissolved oxygen content, and, in some cases, pH.

A total of 12,696 fish representing 75 species and 30 families of fishes, sharks, and rays were taken and examined during the eight surveys (68 hauls). (The invertebrate catch data is still being examined.) Total catch (number of fish per haul or per survey), number of species, and diversity varied seasonally, with highest values in spring or summer and lowest in fall or winter (Table 1). However, there was also a marked decline in catches in late 1974, contributing to an overall decline in fish catch during the 2-year period. Although the low catches in August and December 1974 were, in part, attributed to gear problems (and may not reflect fish abundance relative to previous sampling periods), these catches did coincide with a period of high water temperature, elevated daytime oxygen values, and very low visibility (Figure 2). The high oxygen and low visibility were likely due to the onset of a long period of red tides (blooms of the dinoflagellate, *Gonyaulax polyhedra*) throughout the southern California coastal zone, and this situation may have affected the abundance of fish in ways we still do not understand.

Existing literature, based on coastal trawl surveys using small otter or shrimp trawls, provides some estimate of numbers and biomass of fish per unit area trawled; all are based on an assumption of 100 percent capture efficiency (which, although it is probably invalid, does provide a relative basis for comparison of catches among areas). Based on our calculations, the Dana Point/Laguna catches averaged 18.8 kg of fish per hectare (10,000 sq m or about 2 acres) trawled. During 1973 and 1974, we estimated coastal average values of 27.2 kg/ha (a range of 4.0 to 50.7 kg/ha) based on 17 trawl surveys

(155 samples) from Oxnard to Point Loma. Other sites yielded higher values and narrower ranges (Oxnard shelf, 16.3 to 23.3 kg/ha; Orange County outfall area, 30.3 to 48.2 kg/ha). Values obtained elsewhere using small otter trawls (not commercial fish trawls) include 31.9 kg/ha in Narragansett Bay, Rhode Island, and 20 to 70 kg/ha in a Gulf of Mexico estuary. Thus, the average annual biomass of benthic fish off Dana Point/Laguna tends to be low for local coastal areas, while our coastal areas on a whole tend to be comparable to other regions sampled in a similar fashion. Sampling with commercial fish trawls is required for a more definitive assessment.

Of the 75 species encountered during the 2-year period, 15 accounted for 90 percent of the specimens taken, and seven species accounted for three-quarters of all fish taken. The most prevalent and abundant fish was the Pacific sanddab (*Citharichthys sordidus*, 25 percent of the catch) followed by the stripetail rockfish (*Sebastes saxicolus*, 17.4 percent), pink seaperch (*Zalembus rosaceus*, 10.4 percent), plainfin midshipman (*Porichthys notatus*, 10.3 percent), Dover sole (*Microstomus pacificus*, 5.8 percent), longspine combfish (*Zaniolepis latipinnis*, 3.1 percent), and speckled sanddab (*Citharichthys stigmaeus*, 3 percent). All are common fishes of the subtidal soft-bottom fauna and are present at most wastewater outfall sites.

Seven of the 10 most abundant species here were also among the 10 species reported by Carlisle (1969) to be most abundant in Santa Monica Bay. However, the pink seaperch, Pacific sanddab, and stripetail rockfish are relatively more abundant at Dana Point/Laguna than they were in Santa Monica Bay (although such observations must include a detailed comparison of sampling effort by depth). Most of the common species were particularly abundant in late spring or summer, but some, such as the California scorpionfish (*Scorpaena gutatta*), appeared to be more abundant in the winter.

Other common, but not abundant, species included the English sole (*Parophrys vetulus*), hornyhead turbot (*Pleuronichthys verticalis*), longfin sanddab (*Citharichthys xanthostigma*), shiner perch (*Cymatogaster aggregata*), white sea perch (*Phanerodon furoatus*), rex sole (*Glyptocephalus zacharis*), Pacific pompano (*Peprilus simillimus*), Pacific argentine (*Argentina sialis*), and shortbelly rockfish (*Sebastes jordani*). The California halibut (*Paralichthys californicus*) was taken in all surveys through February 1973 but not thereafter.

There were 30 diseased and anomalous fishes, representing eight species and eight kinds of abnormalities or para-sites. Dover sole with eroded fins occurred in May and August 1973 (0.5 and 0.9 percent of the Dover sole catch, respectively) and in February and December 1974 (5.6 and 4.8 percent of the Dover sole catch, respectively). The overall prevalence of the disease was 0.81 percent (6 of 741 specimens affected). Three tumor-bearing Dover sole were also collected in May catches. Other anomalies included leeches on several species of sole and copepod eye parasites on Pacific sanddabs. One of several barred sand-bass collected had deformed gill rakers, a condition prevalent throughout southern California. Most of the anomalies found are probably not a result of wastewater discharge.

We are still evaluating the data from the survey—in particular, to determine the merit of using the Dana Point/Laguna Beach region as a control area in future studies of wastewater outfall areas. In any case, these data do suggest that (1) the bottomfish of a southern California coastal site unaffected by major wastewater outfalls are similar to those at outfall sites, (2) the fauna in the area is more diverse, and the individual species and total fish assemblage somewhat less abundant, than those near outfalls, and (3) the fauna shows a low but measurable prevalence of disease and anomalies.

REFERENCE Carlisle, J.G., Jr. 1969. Results of a six-year trawl study in an area of heavy waste discharge: Santa Monica Bay, Calif. Calif. Fish Game 55:26-46.

Table 1. Summary of fish catch statistics for eight quarterly trawl surveys off the Dana Point/Laguna Beach region

	Sampling Dates								Total or Overall Average
	1973				1974				
	9 Feb	8 May	8 Aug	15 Nov	14 Feb	14 May	23 Aug	12 Dec	
No. of Stations	9	7	8	9	9	8	9	9	68
Total No. of Fish	858	2,575	3,216	1,714	1,310	2,619	343	411	12,696
Catch per haul									
Mean	95	368	402	190	146	241	38	46	187
Median	83	163	418	145	158	180	31	38	
No./ha	246	954	1,043	492	378	625	99	119	494
No. of Species									
Total per survey	34	40	50	40	33	42	24	21	75
Mean per haul	10.9	14.9	20.8	13.6	10.4	15.4	5.8	5.3	10.9
Mean Diversities									
Brillouin, H	1.54	1.76	1.96	1.60	1.27	1.89	0.99	0.82	1.48
Scaled, H(s)	0.59	0.65	0.64	0.59	0.50	0.66	0.46	0.47	0.55
Biomass									
kg/haul	3.31	12.01	13.84	8.06	4.78	13.05	1.56	1.79	7.3
kg/ha*	8.18	31.2	36.0	21.0	12.4	33.9	4.06	4.34	18.9

\*kg/ha x 0.89 = lb/acre.

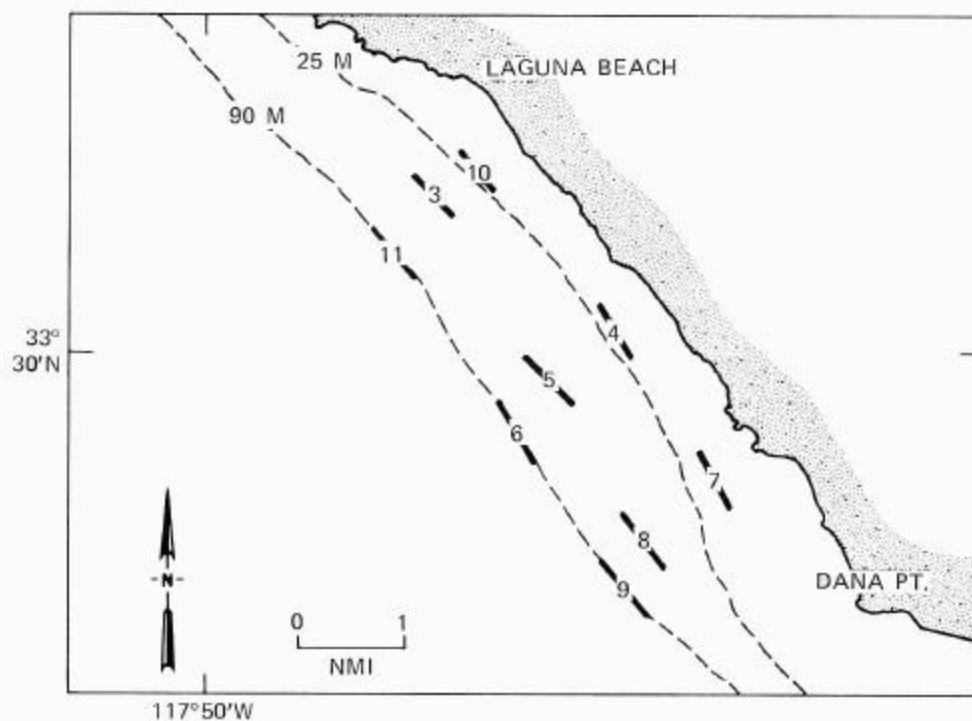


Figure 1. Map of nine standardized stations sampled during cruises conducted in 1973-74.

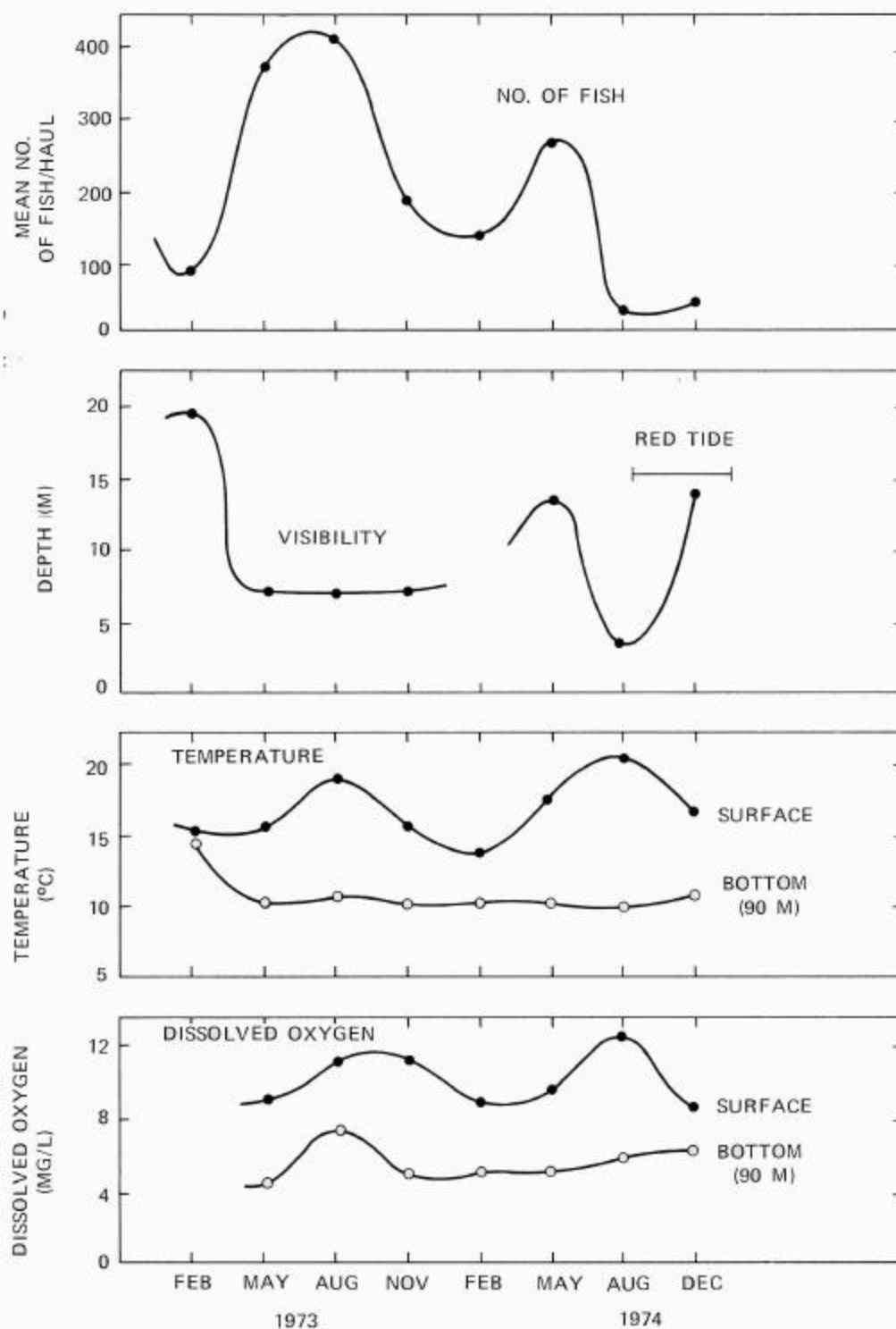


Figure 2. Fluctuations in fish catch per unit efforts, visibility, water temperature, and dissolved oxygen off Dana Point/Laguna Beach, 1973-74.