STANDARDIZING SAMPLING PROCEDURES

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Remote collecting devices such as cores, grab samplers, and trawl nets are routinely used to obtain samples for biological analysis of coastal marine communities. Although there are only a few basic models of each device, there are literally hundreds of ways to modify the equipment and its use. The modifications result in variations in sampling efficiency, which can lead to serious problems in assessment if many types of devices are used in a single region.

As an example, at least eight types of trawl gear are or have been used to monitor the health, abundance, and diversity of nearshore fish populations by various agencies in southern California. A comparison of the data from Ventura, Los Angeles, and Orange Counties made by the Project in 1973 indicated major differences among sampling regions Santa Monica Bay appeared to have a significantly lower abundance of fish than San Pedro Bay. But because of differences in gear and procedures used in collecting the data, we could not be sure of this conclusion.

During the past year, we have completed several studies to estimate the comparative efficiencies of trawl sampling. These investigations were supported by a grant from the Environmental Protection Agency and will be reported in detail to that agency. In the major study, a synoptic trawl survey, we used one gear/vessel combination to sample several sites along the coasts of Los Angeles and Orange Counties within a period of several days. A second study involved estimating net opening efficiencies of six gear types towed under similar conditions (identical speed and bridle lengths).

SYNOPTIC TRAWL SURVEY

In September 1973, we conducted a 27 station trawl and benthic water quality survey at three important coastal areas Santa Monica Bay, the Palos Verdes shelf, and San Pedro Bay using one vessel/gear combination. The survey was done aboard the R V Vantuna in cooperation with Dr. John Stephens and his fisheries students at Occidental College, Los Angeles, and personnel from the Los Angeles County Sanitation Districts The net used was a Marinovich 25 ft (headrope) semiballoon otter trawl with 1 1/2 in. stretch mesh body and a 1/2 in. stretch mesh cod end liner. Otter boards measured 15 x 34 in. and were attached to the net by 4 ft leglines. We did not use a tickler chain on the footrope. The otter boards were adjusted to proper towing altitude and attached by 75 ft bridles to a single warp, 5/32 in. steel cable on board the Vantuna.

At each coastal site, we sampled three transects, and three depths (27, 60, and 140 m) at each transect, (Figure 1) by a single trawl haul of 10 minutes on bottom time at 2.5 knots. When the trawl was retrieved, fishes and invertebrates were sorted, identified, counted, weighed and measured, and observed for parasites and anomalies. Water samples from

surface, middepth, and bottom waters were taken and analyzed for dissolved oxygen, temperature, and salinity.

The data from this survey were examined for major regional differences in number of species, abundance, Brillouin diversity, biomass (weight), and disease frequencies. As shown in Table 1, the survey hauls produced approximately 34,000 specimens, representing 68 species of fish and 101 invertebrates. Invertebrates made up about 70 percent of the species.

Of the three regions sampled, Palos Verdes was the most productive in terms of numbers of species of both fish (52 species) and invertebrates (60 species), and San Pedro Bay was least productive (41 fish species and 47 invertebrate species). Santa Monica Bay and Palos Verdes produced higher numbers of specimens (12,700 and 14,500 respectively) than San Pedro Bay, but the Palos Verdes catches had a much lower invertebrate biomass. Survey diversities (pooled samples from each area) indicated higher diversity in San Pedro Bay compared to Santa Monica and Palos Verdes, and higher diversities for fish than for invertebrates. Depth and depth related factors (temperature, dissolved oxygen, etc.) appeared to have a more profound effect on biomass and diversity than "region."

A number of organisms common and abundant in the two bay areas were rare~or in low abundance off Palos Verdes. These included the Pacific sanddab (*Citharichthys sordidus*), the California tonguefish (*Symphurus atrioauda*), the pink seaperch (*Zalembius rosaocus*), the shrimp *Pandalus jordani*, the sea star *Astropeotin verrilli*, and the sea cucumber *Parastiahopus California*. In contrast, several species occurred in greater abundance off Palos Verdes than in the bay areas: These included the dover sole (*Microstomus pacficus*), the shiner perch (Cymatogaster aggregata), the curlfin sole (*Pleuronichthys deourrens*), the white croaker (*Genyonemus lineatus*), and the shrimps *Spirontooaris bispinosa* and *Sioyonia ingentis*.

We also observed regional differences in the quantifiable diseases of fish (Table 1). Tumor bearing fish appeared to occur in lower frequencies off Palos Verdes than in the bay areas, while Palos Verdes had a considerably higher frequency of fin erosion.

In general, then, there did not appear to be major differences in the abundance and variety of demersal organisms in the three areas during this survey. But there were regional differences in species composition and disease frequency. (We will test whether or not these conclusions are valid during the winter months, when fish abundance is generally low, in a future survey.) Finally, major differences in many parameters, especially biomass and diversity, did occur with depth: Middepth stations generally produced richer and heavier hauls than inshore or offshore stations.

COMPARISON OF GEAR AND PROCEDURES

The synoptic survey results, as well as previous data on species composition, indicated to us that major regional differences in the abundance of demersal organisms might have

partly resulted from differences in the efficiency of the sampling techniques used by the independent agencies surveying the regions. Thus we decided to make a closer inspection of gear used in previous and present surveys throughout southern California.

Various agencies kindly loaned us their trawl nets and associated gear. Each net and otter board combination was fitted to a standard set of bridles and towed at 2.5 knots close astern of a vessel in calm waters within Morro Bay, California, by Mr. James Willis, netmaker, and Mr. Ricard Gammon, research technician. Estimates of the spread of the otter boards and nets were calculated from measurements of the angle of the spread of the bridles. The results (Table 2) indicated a rather wide range of board spread for five commonly used 25 ft nets and a relatively low opening efficiency for one 40 ft net. Based on these estimates, we would predict generally low catches for the Santa Monica Bay area, modest catches for gear used in San Pedro Bay, and moderately high catches off Palos Verdes, assuming similar tow conditions and similar abundance of organisms in each area. Generally, this is the trend of the actual data collected with these nets.

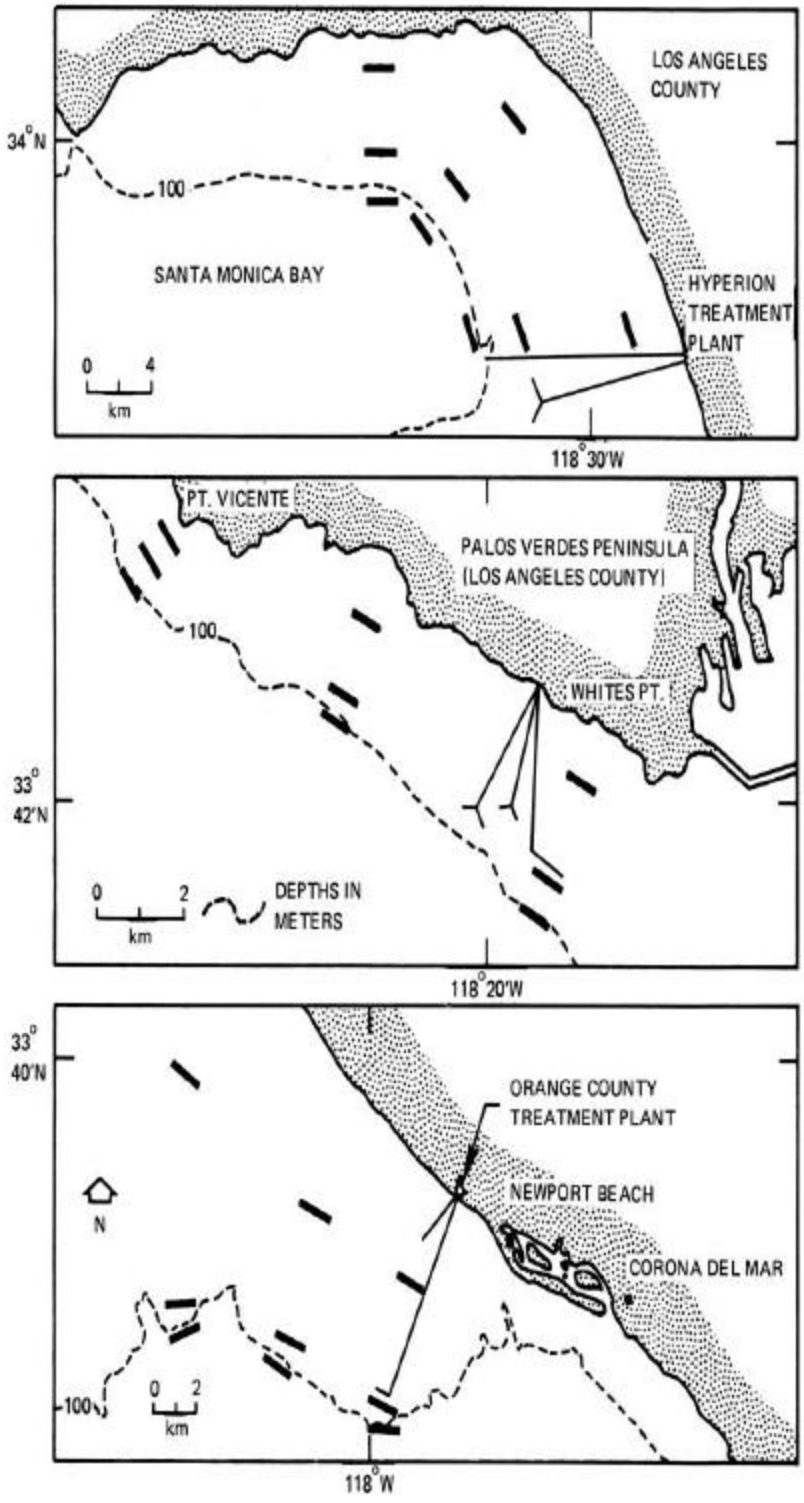
Further study of the nets indicated that a number of other factors could contribute to variation in opening efficiency, including legline lengths, otter board dimensions, body and cod end mesh, use of cod end liners, and vessel speed and bridle lengths during operations.

These data are not conclusive, but clearly indicate that gear and gear use differences between sampling agencies do affect results. We cannot recommend specific changes in gear without further studies of their influence on factors such as diversity. However, we feel that the goal in monitoring should not be to catch as many fish as possible but to sample an area adequately and to assess the relative abundance of common organisms.

Studies of other factors (such as day/night differences, the effects of transparency, and use of other gear) and of the usefulness of sampling demersal communities are in progress.

FIGURES

Figure 1.
Stations trawled in synoptic survey, September 1973



TABLES

Table 1.
Description of fish and invertebrate catches, synoptic survey, September 1973.

	Santa Monica Bay	Palos Verdes Shelf	San Pedro Bay	Combined
No. samples	9	9	9	27
Total No. species	105	112	88	169
Fish	51	52	41	68
Invertebrates	54	60	47	101
Total No. specimens	13,795	13,760	6,103	33,658
Fish	5,455	5,813	3,019	14,287
Invertebrates	8,340	7,947	3,084	19,371
Total biomass (kg)	227	215	189	631
Fish	126	174	95	395
Invertebrates	101	41	94	236
Survey (pooled) diversites--				
Brillouin				
Fish	2.13	2.19	2.67	--
Invertebrates	1.90	2.05	2.07	--
Diseases				
Tumors in Dover sole (%)	1.7	0.6	1.6	
No. species with fin erosion	3	5	3	
Fin erosion in Dover sole (%)	2.1	37.0	1.5	

Table 2.
Spread of 72-ft bridles at 3 ft from cable,* and calculated spread of trawl boards for seven nets used in southern California trawl surveys.

Agency	Net Size	Head-rope Length (ft)	Bridle Spread at 3 ft from Cable (in.)	Calculated Board Spread (ft)
Los Angeles Co. San. Dist.	40-ft Wilcox	40	13	26
	25-ft Wilcox	27	12	24
Hyperion	25-ft Wilcox	27	4.5	9
Marine Biological Consultants, Inc.	25-ft Marinovich	25	8	16
Occidental College	25-ft Marinovich	25	8	16
Coastal Water Research Project	25-ft Marinovich	25	7.5	15
Marine Biological Consultants, Inc.	16-ft Marinovich	16	5.5	11