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TRAWL-CAUGHT FISH AND INVERTEBRATES

Many trawls have been made in southern California waters over the last few decades by government agencies, universities, and monitoring groups. For various reasons much of the data so obtained are not complete, reliable, nor readily available. This Project recognized that a conveniently available collection of trawl data covering much of the coastal shelf in the Los Angeles region would be valuable to many interested persons.

Therefore, this paper is a summary of 317 trawls at 148 stations in all seasons at depths ranging from 10 meters to 627 meters that were made by Project personnel during the period 1977 to 1982. A complete account of this work, as well as the similar surveys of benthic invertebrates and bottom chemistry, will be published in a SCCWRP Technical Memorandum in 1983. We believe this to be the best information available about near-bottom fish and epibenthic invertebrates on the southern California coastal shelf. The principal virtues of these data are their uniformity and their reasonably complete coverage of a region where man's activities might be expected to influence sea animals.

Our trawl data have been tabulated according to depth, distance from outfall, and general location along the coast (Table 1). The depth groups are shallow (10-50 m), moderate (50-200 m), and deep (200-627 m). The following numbers are averages per trawl.

Using depth as a criterion, the most species of fish (12.6) are found in moderate depths and the most species of invertebrates (17.5) are found in deep waters. The biomass of both is greater below 200 m, 17.3 kg fish and 47.3 kg invertebrates.

Using distance from outfalls as a criterion, at a depth range of 55-65 m (that includes the four largest outfalls) the number of species within 1 km of the outfall are: fish 11.5, invertebrates 10.3. Within 2 km there are 11.3 species of fish and 10.5 of invertebrates. And, within 3 km the comparable numbers are 11.9 fish and 10.8 invertebrates. Further than 3 km from the outfalls at the same depth range the number of species of fish is 11.6 and of invertebrates, 14.6. In other words, these data show little difference in the average number of fish species as one approaches an outfall and the standard deviation is smaller (the area in the canyon near the mile sludge outfall averages 17.4 species of fish and 15.4 species of invertebrates, possibly because it is deeper [130-170 m] [Bascom 1980]). The number of species of invertebrates increases with the distance from an outfall.

All of the trawls reported here were made using the same kind of nets towed along the bottom at the same speed for the same length of time. Positions of touchdown and liftoff were fixed by LORAN C and depths were recorded. All animals were identified, measured, weighed by species or groups of species, and tabulated. The results of this work are species lists that include nearly 200 species of fish and over 500 species of invertebrates. The 25 most abundant of each are given in Table 2. The total abundance of each species was obtained, but these can be used only as a generalized guide because a school of fish or cluster of invertebrates sometimes gives a false impression of the actual abundance in a given area.

Table 1. Average numbers of species and biomass of demersal fish and epibenthic invertebrates taken in 317 standard trawls.

				Demersal fish						Epibenthic Inverbebrates						
		Number of trawls	Number of stations	Number of species	Range	Standard deviation	Biomass (kg)	Range	Standard deviation	Number of species	Range	Standard deviation	Biomass (kg)	Range	Standard deviation
DEPTH	10-49	86	33	9.9	3-19	3.4	5.4	0.5-46	5.1	11.5	4-42	4.6	8.7	0.1-52	15.5
	50-199	212	98	112.6	1-24	3.5	10.9	0.1-49	7.8	13.0	5-34	4.3	13.3	0.1-117	14.9
	200-627	19	15	11.3	6-18	3.0	17.3	4-42	10.1	17.5	10-43	7.3	47.3	7-163	30.7
NEARNESS TO OUTFALL	1 km	33	9	11.5	7-16	1.7	7.6	2-10	2.8	10.3	7-16	2.6	3.9	0.1-8	2.4
	2 km	47	16	11.3	8-16	2.1	8.1	2-28	4.2	10.5	5-16	2.5	4.8	0.1-17	2.9
	3 km	61	23	11.9	1-20	2.5	8.5	2-28	4.3	10.8	5-20	2.7	10.4	0.1-57	14.6
	3 km	57	32	11.6	2-23	4.3	6.9	0.1-41	7.0	14.6	6-31	5.1	13.9	1-45	14.8
LOCATION	Pt. Dume - Ventura	21	21	9.2	2-18	4.8	5.6	0.1-21	6.6	12.4	4-23	4.9	9.6	0.1-40	11.7
	Santa Monica Bay	114	70	12.4	3-24	4.7	10.8	0.1-46	9.7	13.9	5-34	4.6	19.6	0.2-117	18.5
	Palos Verdes	118	25	11.7	7-15	2.0	10.9	3.5-48	7.2	11.0	6-18	2.4	9.7	0.3-52	13.6
	San Pedro Bay	38	13	11.6	1-16	3.3	7.6	0.1-17	4.5	15.4	7-42	6.6	7.8	0.2-42	10.7
	Pt. Loma	16	12	13.8	10-17	1.9	4.7	1.3-10	2.8	10.6	7-17	3.0	2.2	0.1-5	1.6
	All trawls	317	148	11.8	1-24	3.7	10.3	0.1-49	11.8	12.9	4-43	4.8	14.1	0.1-163	18.5

Project personnel have reviewed the procedures and trawl catch data of several other marine laboratories and agencies. We have found, at various times and places, inconsistencies in the rigging, gear type and size, navigation, time on the bottom, taxonomic identification and record keeping which made us wary of using the data. Therefore, in this account we have relied entirely on our own data from trawls taken after 1977 for which all needed data were available.

As a result of taking hundreds of trawls, using various ships in depths to 600 meters, we have learned much about the mechanics of trawling not covered by our previous papers on the subject (Mearns *et al.* 1974 and 1978).

Under ordinary working conditions Project personnel average 7 standard trawls a day in 60 m of water, 11 in 30 m and 4 in 400 m. This is accomplished by leaving early and trawling between 7:00 A.M. and noon, before the afternoon breeze comes up. We find that careful deployment of the net and maintenance of vessel speed at 1.1 m/sec are the most important factors in trawling. The animals caught are identified and counted on board; this must be done with care if the data is to be useful.

Table 2. The most frequently occurring epibenthic organisms in taxonomic order in central southern California coastal waters at 148 stations and 317 ten-minute trawls.

FISH (25 of 200)		INVERTEBRATES (25 of 500)	
Porichthys notatus	Plainfin midshipman	*Acanthoptilum gracile*	Sea pen
Lycodopsis pacifica	Blackbelly eelpout	*Filigella mitsukurii*	Sea whip
Zalembius rosaceus	Pink Seaperch	*Stylatula elongata*	Sea pen
Lepidogobius lepidus	Bay goby	*Cerebratulus* sp.	Ribbon worm
Scorpaena guttata	California scorpionfish	*Calinaticina oldroydi*	Moon snail
Sebastes dalli	Calico rockfish	*Nassarius* spp.	Dog welk
S. diploproa	Splitnose rockfish	*Polinices draconis*	Moon snail
S. rosenblatti	Greenblotched rockfish	*Acanthodoris brunnea*	Nudibranch
S. saxicola	Stripetail rockfish	*Pleurobranchaea californica*	Nudibranch
Sebastolobus alascanus	Shortspine thornyhead	*Octopus* spp.	octopus
Zaniolepis frenata	Shortspine combfish	*Scalpellum californicum*	Barnacle
Z. latipinnis	Longspine combfish	*Cragnon* spp.	Shrimp
Chitonotus pugetensis	Roughback sculpin	*Sicyonia ingentis*	Shrimp
Icelinus quadriseriatus	Yellowchin sculpin	*Spirontocaris* spp.	Shrimp
Odontopyxis trispinosa	Pygmy poacher	*Paguristes* spp.	Hermit crab
Xeneretmus latifrons	Blacktip poacher	*Mursia gaudichaudii*	Crab
Citharichthys sordidus	Pacific sanddab	*Pyromaia tuberculata*	Crab
C. stigmaeus	Speckled sanddab	*Astropecten verrilli*	Starfish
Hippoglossina stomata	Bigmouth sole	*Luidia foliolata*	Starfish
Glyptocephalus zachirus	Rex sole	*Allocentrotus fragilis*	Sea urchin
Lyopsetta exilis	Slender sole	*Brisaster latifrons*	Sea urchin
Microstomus pacificus	Dover sole	*Brisopsis pacificus*	Sea urchin
Parophrys vetulus	English sole	*Lytechinus anamesus*	Sea urchin
Pleuronichthys verticalis	Hornyhead turbot	*Ophiura luetkeni*	Brittle star
Symphurus atricauda	California tonguefish	*Parastichopus californicus*	Sea cucumber

METHOD

One or more ten minute (on-bottom time) trawls were taken at each of the 148 stations shown in Figure 1, using a bottom trawl manufactured by James Willis of Morro Bay, CA. The principal characteristics of the Willis net are: Headrope length is 7.6 m. (25 ft.); mesh (stretched) 4.1 cm. body, 5.1 cm. cod end, 1.3 cm. liner; the headrope has 16 plastic floats and the foot rope has 6.6 kg. of chain; the otterboards measure 76 x 51 x 5 cm; the doors are connected to 23 m. bridles. These trawls were pulled along the bottom parallel to the depth contour at a speed of 1.1 m/sec or 2.5 knots and a scope of 3 to 1 (3 times as much cable out as the waterdepth). LORAN C coordinates were recorded for the start of the trawl (full deployment of cable) and at the end of the trawl (initiation of cable retrieval).

Upon retrieval, the catches were sorted by species (fishes and invertebrates) and specimens were measured, counted, weighed and examined for external signs of disease. All fish with possible health problems were brought into the laboratory for further study; the remainder were returned to the sea.

RESULTS

For purposes of data presentation the area from Ventura on the west to Point Loma at the south has been divided into five geographic regions. These regions are 1) Ventura to Point Dume, 2) Point Dume to Palos Verdes Point (Santa Monica Bay), 3) Palos Verdes Point to Angels Gate (Palos Verdes), 4) Angeles Gate to Dana Point (San Pedro Bay), and 5) Point Loma. Table 1 summarizes the findings in each region and gives the combined totals and averages for all regions. The largest number of trawls were made in Santa Monica Bay and off Palos Verdes because these two regions are most likely to be affected by man's activities. The average catch in these two areas does not show any decrease in the number of species or biomass compared to the other areas.

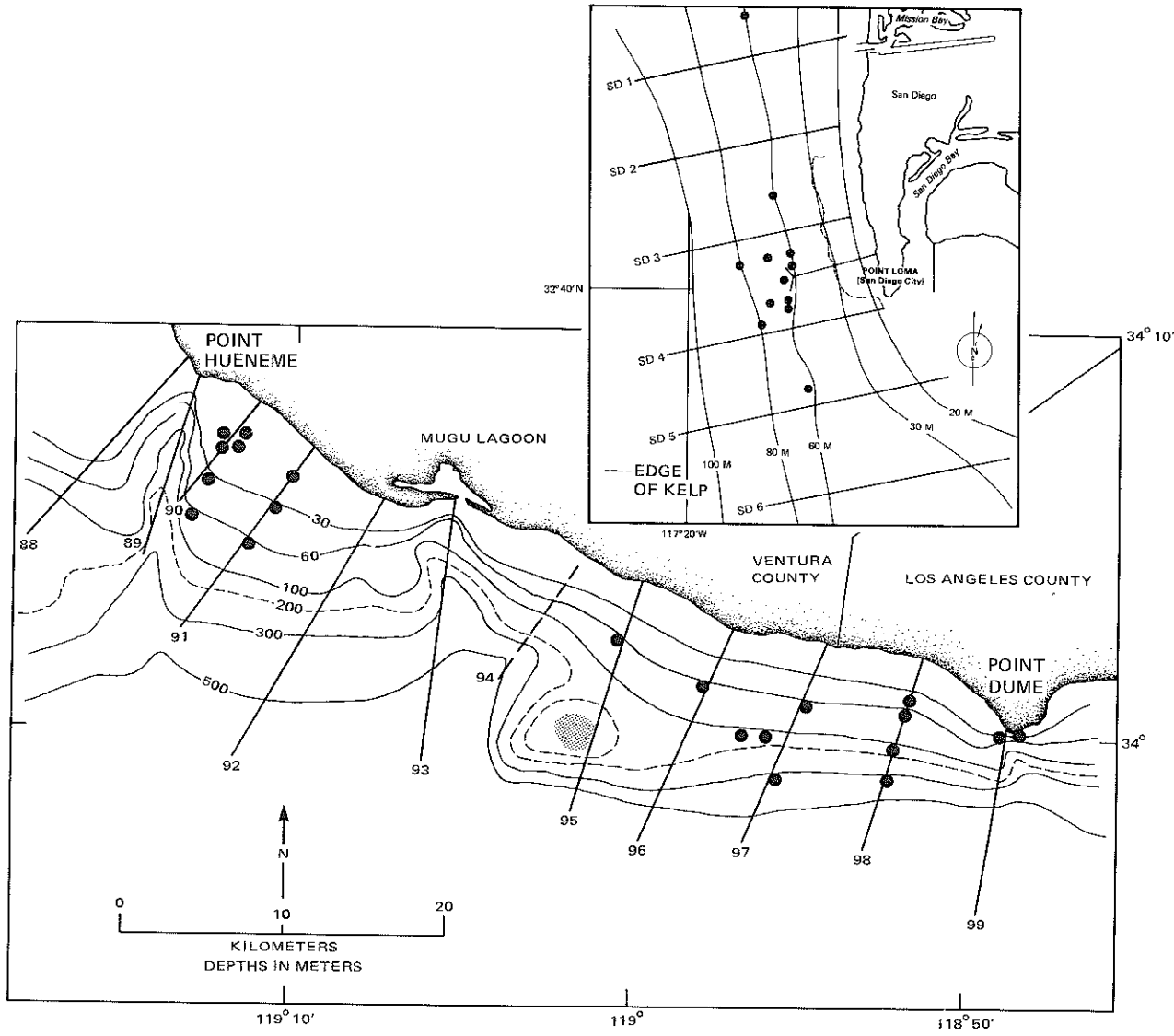
The twenty-five most frequently occurring species of fish and invertebrates are shown in Table 2. The majority of these species were collected on nearly all of the 317 trawls. Using all data from all regions the average number of species of fish was 11.7 whose average weight was 11.1 kilograms. There were 11.6 species of invertebrates per trawl with an average weight of 13.6 kilograms.

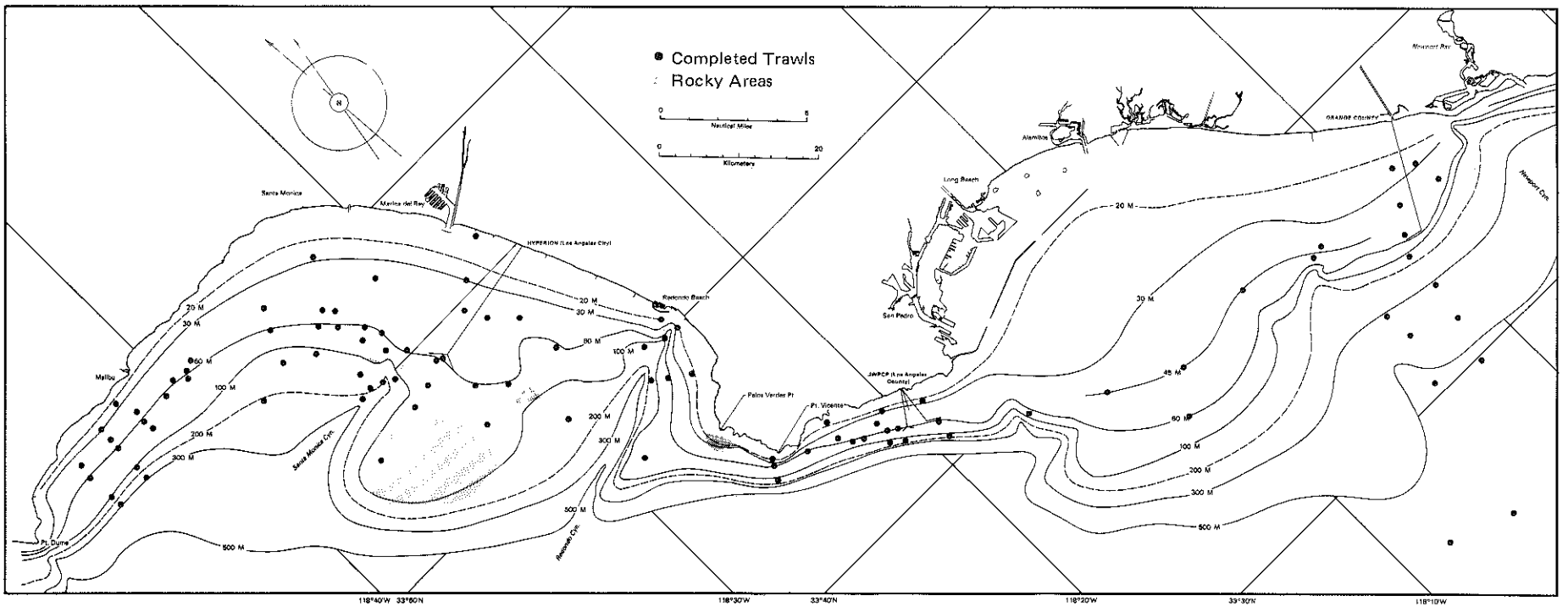
This information must be considered in the light of the following paper by Cross which demonstrates that data on the number of species are quite reliable, but that on biomass and numbers are highly variable.

REFERENCES

Mearns, A. J. and H. H. Stubbs. 1974. Comparison of otter trawls used in southern California coastal surveys. SCCWRP Tech. Mem. 213, 15 pp.

Mearns, A. J. and M. J. Allen. 1978. Use of small otter trawls in coastal biological surveys. Rpt. to EPA Grant No. R801152 SCCWRP Contribution No. 66, 35 pp.





SCCWRP BENTHIC OTTER TRAWLS
JULY 1977 – JULY 1982

Figure 1.