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# **COASTAL GRADIENTS IN SPORTFISH CATCHES**

Millions of fish are taken by sport fishermen in southern California each year, making sport fishing one of the region's most important marine activities. The public wishes to have unobstructed access to the sport, to know that the fish landed are safe to eat, and to be assured that man's other coastal activities do not damage stocks of desirable fish or their prey. In turn, fisheries biologists are concerned that overfishing (both commercial and sport) might reduce the abundance of desirable fish or cause other significant ecological change in the structure of coastal marine communities.

Areas near deepwater municipal waste and thermal out-falls are frequently fished by commercial party boats, private fishermen, and scuba divers. This year, I reviewed a portion of the statistics on commercial party boat catches, using available data from the California Department of Fish and Game. The analysis indicated that, in 1973, nearly half the coastal catch (and one-third of the entire catch in the Southern California Bight) was taken within 20 km of the largest municipal wastewater outfalls. Moreover, areas near outfalls appear to receive at least 10 times more fishing pressure than the coastal area as a whole.

Although the Department of Fish and Game prepares summaries of commercial and party boat landings for each year, I examined only data from 1973, the most recent year for which records were available to us. The summaries contain data on monthly landings of each species in each of over 200 statistical blocks, most of which are approximately 18 km square. Included in the listings are number of fish caught, number of anglers, number of angler-hours, and number of boat days. I examined data for 28 blocks adjacent to the coast between Point Conception and the U.S./Mexico border and 9 additional blocks located just offshore (Figure 1). I extracted detailed data on total catch, number of species, and number of angler-hours and calculated overall catch per angler-hour (catch per unit effort) and species richness, one of a variety of indices occasionally used to compare numbers of species when there is a wide variation in sample size. I used Gleason's index of richness, which is appropriate for large samples.

A total of 3.69 million fish were landed by 508,000 anglers aboard commercial party boats fishing California waters south of Point Conception in 1973. This is twice the annual catch in the same area during the late 1940's and early 1950's, indicating the degree to which catches have increased during the past 30 years. Overall effort expended was 2.05 million angler-hours, with an overall catch of 1.8 fish/angler-hour (Table 1).

As shown in Table 1, nearly 62 percent (2.27 million fish) of the southern California catch were taken by anglers fishing from party boats in the 37 coastal blocks outlined on Figure 1. Over half these fish—one-third of the total catch—were captured in the seven blocks occupied by the five largest municipal wastewater outfalls; catch statistics for these blocks are shown in Table 2.

The overall catch per block and fishing effort per block in outfall areas were ten times higher than the catch and effort per block in the Bight as a whole and three times higher than in the coastal blocks as a whole (Table 1). Also, the catch per unit effort in the outfall blocks as a unit was somewhat lower than in the Bight as a whole but somewhat higher than in the coastal blocks as a whole.

Plots of the catch statistics revealed major regional gradients in fish landings, catch per unit effort, and species richness. As shown in Figure 2, the numbers of fish landed in each of the coastal blocks between Oxnard and Point Loma were generally similar, varying within a factor of 10. However, between Point Conception and Oxnard, reported landings were much lower; this is probably because there is only one harbor along this stretch of coast, and most party boats in the area visit the offshore channel islands (data for the islands are not shown on Figure 2, although they are included in the overall summary, Table 1).

Catch per unit effort was high along the more limited stretch of coast between Oxnard and San Pedro Bay (about 2 fish/angler-hour, Figure 2). Such differences in landings may reflect differences in the species sought in regions along the coast rather than in the actual numbers of fish present. For example, southern party boats frequently seek albacore (*Thunnus alalunga*) and California yellowtail (*Seriola dorsalis*) in season; catch per unit effort on such trips is probably lower because of the increased time required to find schools of these fish.

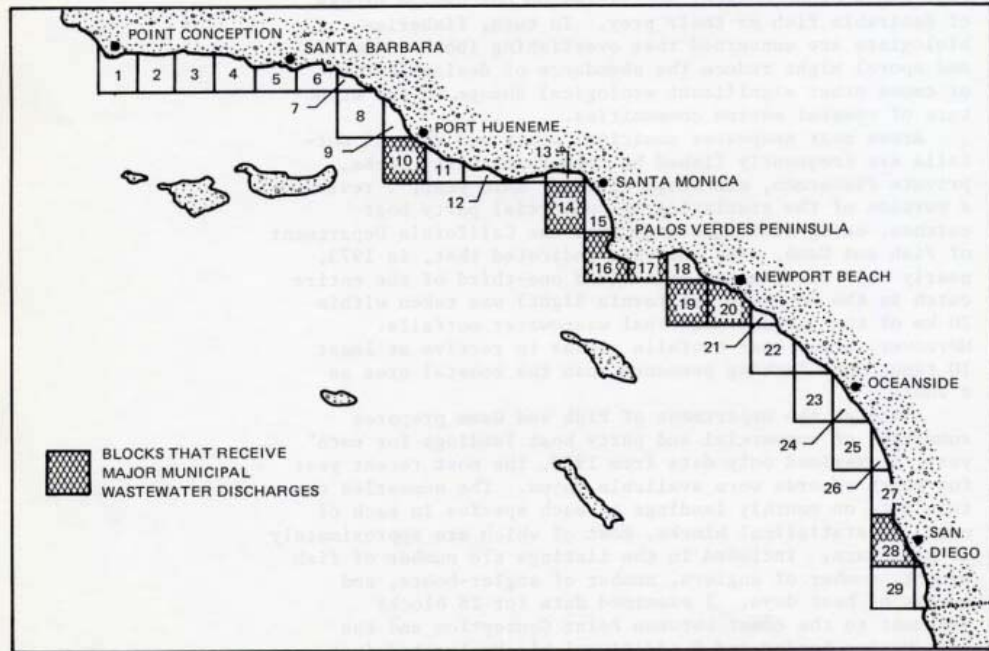
Species richness appeared to increase from north to south (Figure 2). This may reflect an increase in types of desirable sport fish in the south, a change that is ushered in by the seasonal return of subtropical surface fish, such as yellowtail and albacore and, in particular, Pacific barracuda (*Sphyraena argentea*).

Data from eleven blocks were examined in more detail; these blocks were those containing or adjacent to those containing major municipal wastewater outfalls and two blocks off Santa Barbara. Geographical trends were even more apparent in landings of individual species from these blocks. Rockfish (*Sebastes* spp.) dominated northern catches, and Pacific bonito (*Sarda chiliensis*) and Pacific (or chub) mackerel (*Scomber japonicus*) dominated southern catches (Figure 3), reflecting a shift in preference from bottom fishing in the north to surface fishing in the south. Catches of rock bass (*Paralabrax* spp.) were somewhat higher at southern sites, and catches of Pacific barracuda were markedly higher. California scorpionfish (or sculpin; *Scorpaena guttata*) and ocean whitefish (*Caulolatilus princeps*) formed larger

percentage of the catches near the Palos Verdes area than to the north or south.

While not definitive, these data suggest trends in sport fishing that should be more thoroughly analyzed. In this analysis, I did not make any adjustments for variation in the sizes of blocks nearshore; such an adjustment would probably decrease variation in landings but would not affect calculation of catch per unit effort. If these 1973 party boat data are representative of other types of sport fishing (from private boats, piers, and jetties), it is possible that at least half the annual sport fish catch on the southern California mainland shelf is taken within 10 to 20 kilometers of the large sewage outfalls. The reason for the high catches is probably the proximity of outfall-occupied blocks to vessels' ports of call (urban harbors, piers, and marinas). The catch composition data, however, suggest that the types of fish landed near each outfall differ, and these differences must be taken into account in future pollutant-effects studies; for example, the surface fish dominating southern catches are less likely to reside in discharge areas and are less likely to become contaminated than the bottom and reef fishes dominating northern catches. Finally, the landing data suggest that outfall sites are receiving above-average fishing pressure. Over many years of fishing, this increased pressure could be contributing to ecological changes in fish and prey communities and could decrease the catches of large or adult fishes in these areas. Scientists at the Department of Fish and Game are currently evaluating some of these potential problems.

I thank Leo Pinkas and Kathy Wine (California Department of Fish and Game) for their comments on the evaluation of these data.



**Figure 1. California Department of Fish and Game blocks used to examine coastal trends in sport fish landings in 1973.**

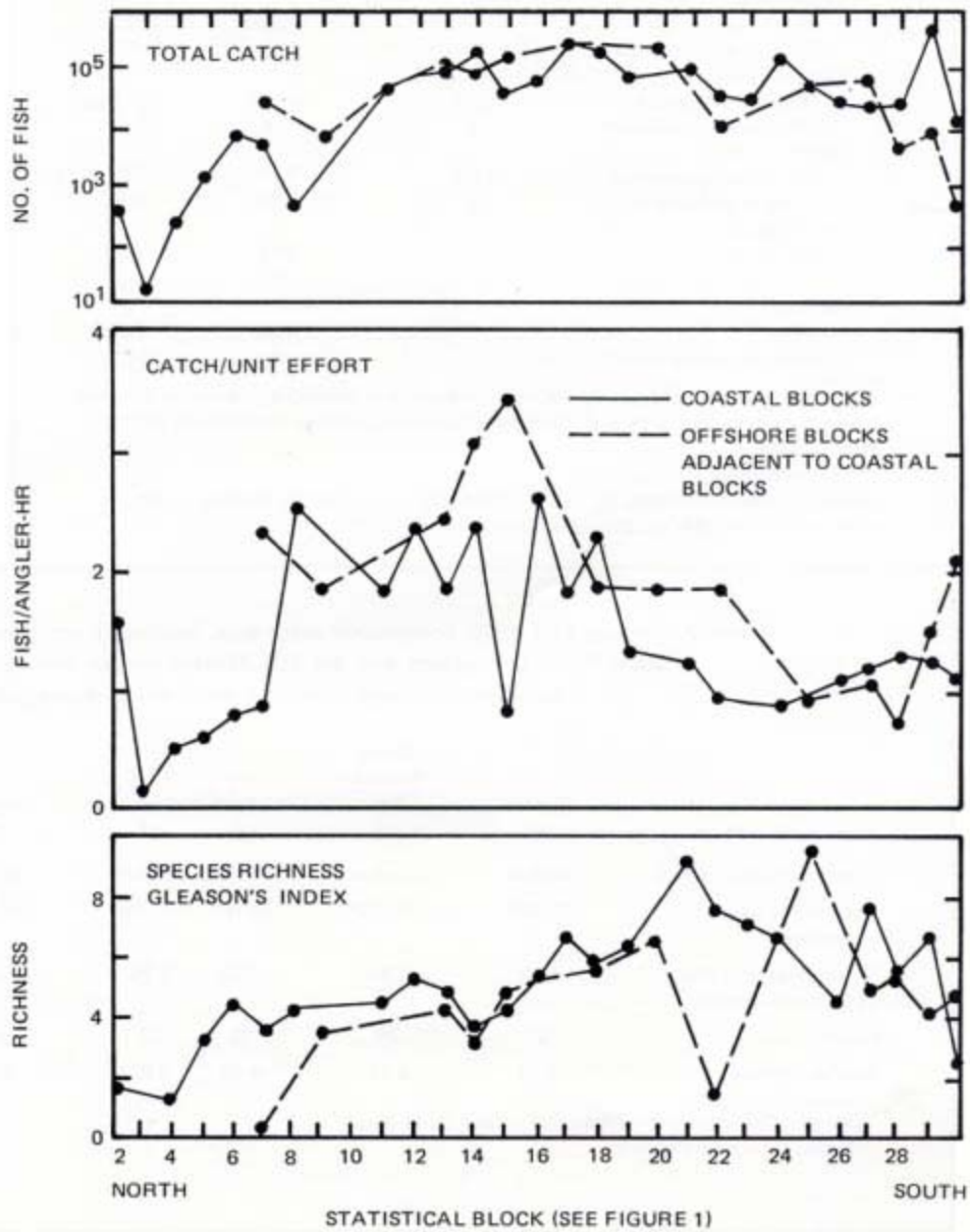
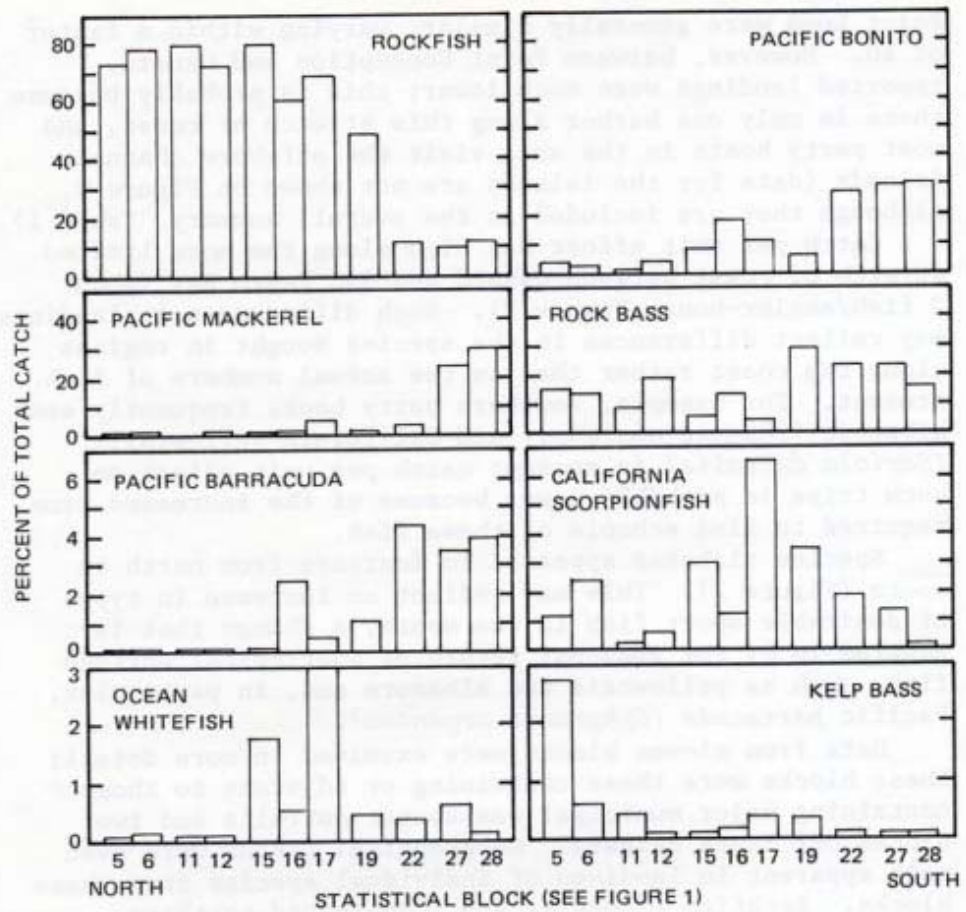


Figure 2. Coastal trends in commercial party-boat landings, 1973.



**Figure 3. Alongshore variation in 1973 party-boat catch composition in eleven statistical blocks along the coast of California. Based on California Department of Fish and Game data.**

**Table 1. Summary of 1973 commercial party boat catch statistics for statistical blocks between Point Conception and the U.S./Mexico border.\***

|                              | Southern California<br>Bight<br>(All Blocks) | Coastal<br>Blocks | Outfall<br>Blocks |
|------------------------------|--|-------------------|-------------------|
| No. of blocks                | 214  | 37                | 7                 |
| Total catch                  |  |                   |                   |
| No. of fish                  | 3,689,932                                    | 2,272,752         | 1,250,130         |
| % of total catch             | 100  | 62                | 34                |
| Total effort                 |  |                   |                   |
| No. of angler-hours          | 2,047,506                                    | 1,545,437         | 749,372           |
| % of total angler-hours      | 100  | 75                | 37                |
| Overall statistics per block |  |                   |                   |
| Catch/block                  |  |                   |                   |
| No. of fish                  | 17,243                                       | 61,426            | 178,590           |
| Ratio to all-block value     | 1  | 3.4               | 10.4              |
| Effort/block                 |  |                   |                   |
| No. of angler-hours          | 9,568  | 41,769            | 107,053           |
| Ratio to all-block value     | 1  | 4.4               | 11.2              |
| Catch/unit effort            |  |                   |                   |
| No. of fish/angler-hour      | 1.80   | 1.47              | 1.67              |
| Ratio to all-block value     | 1  | 0.82              | 0.92              |
| Species/block                |  |                   |                   |
| No. of species               | —**  | 24.3              | 34.0              |
| Ratio to coastal value       |  | 1                 | 1.4               |
| Richness†                    |  |                   |                   |
| Value                        | —**  | 4.93              | 6.39              |
| Ratio to coastal value       |  | 1                 | 1.3               |

\*A map of all blocks is shown in the preceding article in this report; coastal and outfall blocks are shown on Figure 1 of this article. Based on California Department of Fish and Game data.

\*\*Not calculated.

†Gleason's index: Richness,  $D_g = (S - 1) / \log_{10} N$ , where S = total number of species taken and N = number of specimens, total catch.

**Table 2. Summary of 1973 commercial party-boat landings from seven statistical blocks\* between Point Conception and the U.S./Mexico border that receive southern California's largest wastewater discharges.**

|   | Oxnard | Santa<br>Monica<br>Bay | Palos<br>Verdes | Orange<br>County | Point<br>Loma |
|---|--------|------------------------|-----------------|------------------|---------------|
| Block number**                              | 10     | 14                     | 16 17           | 19 20            | 28            |
| Total catch (No. of fish)                   | 42,644 | 119,409                | 170,471 269,475 | 84,241 186,357   | 377,533       |
| Total effort (No. of angler-hours)          | 23,486 | 31,122                 | 75,189 151,246  | 67,113 99,667    | 301,549       |
| Catch/unit effort (No. of fish/angler-hour) | 1.82   | 3.84                   | 2.26 1.78       | 1.25 1.87        | 1.25          |
| No. of species                              | 22     | 25                     | 32 37           | 47 36            | 39            |
| Species richness                            | 4.54   | 4.73                   | 5.93 6.63       | 9.43 6.64        | 6.81          |

\*Based on California Department of Fish and Game data.

\*\*Blocks shown on Figure 1.