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GROWTH IN NORMAL AND DISEASED DOVER SOLE POPULATIONS

To evaluate the health of local populations of Dover sole and to gain insight into the development of the fin erosion disease, we looked at the growth and condition of individuals from a number of southern California localities. Data taken over the past few years indicate that, with some notable exceptions, southern California is not a particularly hospitable region for growth and reproduction of Dover sole, even though the species is common along our coast. Fish from a number of local sites (Santa Monica Bay, Palos Verdes, San Pedro Bay, Santa Catalina Island, and Laguna Beach) taken during surveys sponsored by the Environmental Protection Agency were examined to determine age, length, sex, body weight, and liver weight. These data were used to compare growth among southern California localities and between local sites and areas in central and northern California and Oregon. Age was determined by counting the number of translucent rings in the left otolith (an internal ear bone).

The differences in growth of Dover sole in several local regions were striking, as shown by example in Figure 1. Fish ranging in age from 2 to 5 years from Santa Monica Bay, Laguna Beach, and San Pedro Bay were nearly twice the weight of fish of an equivalent age from Catalina Island; those from Palos Verdes between the ages of 2 and 6 years were of intermediate size. Similar but less dramatic trends were found for length versus age.

These data indicate that coastal Dover sole are growing significantly faster than offshore fishes, and that fish from Palos Verdes are growing at lower than normal rates for the coast.

Liver weight, often a good indication of general health, provided additional revealing information. As shown in Figure 2, livers from Palos Verdes fish were markedly larger than those in fishes of similar body weight from other localities. Furthermore, livers from Dover sole at Palos Verdes with fin erosion were some 40 percent heavier than livers of apparently healthy fish from the same area, and nearly twice the size of livers from healthy fish from Catalina Island. Fish from other coastal areas had intermediate-sized livers.

These data indicate that the fin erosion disease is in some way related to liver growth and metabolism and that this set of conditions is unique to fishes inhabiting the Palos Verdes area. The enlarged livers of these fish may, in part, explain the comparatively low metal values found previously in the livers of Palos Verdes fish (de Goeij et al. 1974).

In addition, these observations may help in finding the cause of fin erosion disease, which does not appear to be initiated at waste discharge sites other than Palos Verdes (Mearns and Sherwood 1974). Previously discharged DDT, which still resides in sediments and is taken up by benthic animals, may be one factor contributing to these abnormal disease and growth symptoms; the fish may be detoxifying DDT isomers in their livers at the expense of energy required for other life processes such as growth, immune responses, or regeneration of damaged tissues.

Despite the relatively good growth of coastal Dover sole populations compared to the island forms, additional data suggest that their potential growth rates could be even higher. Comparison of growth rates of Dover sole from southern California (and Catalina Island) with data from central and northern California (kindly provided to us by Mr. Tom Jow, California Department of Fish and Game, Menlo Park) and from Oregon (Demory, 1966 data) suggest that local Dover sole are not as long-lived as those to the north and that between Ages II and VI, southern California fish are comparatively slow-growing. Figure 3 indicates that slower growth is a feature common to fish of equivalent ages south of an area between Santa Barbara and Morro Bay, California.

How can these data be explained? With one exception, proximity to waste discharge sites appears to have an enhancing effect on growth of Dover sole; thus, other unique coastal features may bear some importance. In particular, the anaerobic and low-oxygen basins occupy depths (900 to 1,800 m) required by Dover sole for spawning, and the fish are known to migrate into such depths during fall and winter (Harry 1959, Westrheim and Morgan 1963). Maturing fish migrating into local basins would thus face metabolic demands not apparent in environments to the north. The basins, then, may be an effective limiting factor to Dover sole and other coastal fishes with similar reproductive and migratory requirements.

It appears that the Dover sole is capable of invasion and expansion into coastal areas on the edge of its range. Clearly, we need to develop life history data and to examine data from a large region to understand man's effects on this species. Work is in progress to examine possible relation-ships between growth and trace materials (such as metals and DDT). The present studies have been presented at the 1974 Annual Conference of the California Oceanic Fisheries Investigation (CalCOFI) and will be reported in CalCOFI Report 18.

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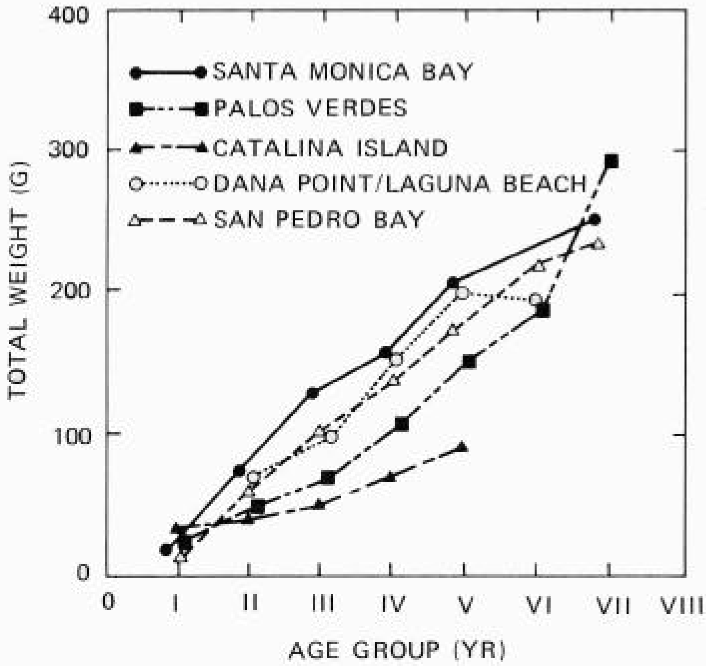


Figure 1. Age/weight curves for Dover sole from four coastal and one island area in southern California. Points represent mean values for weight.

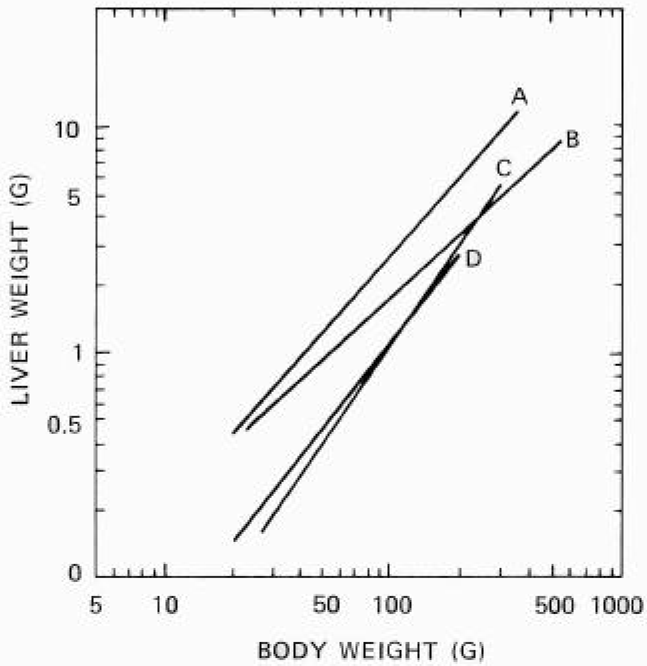
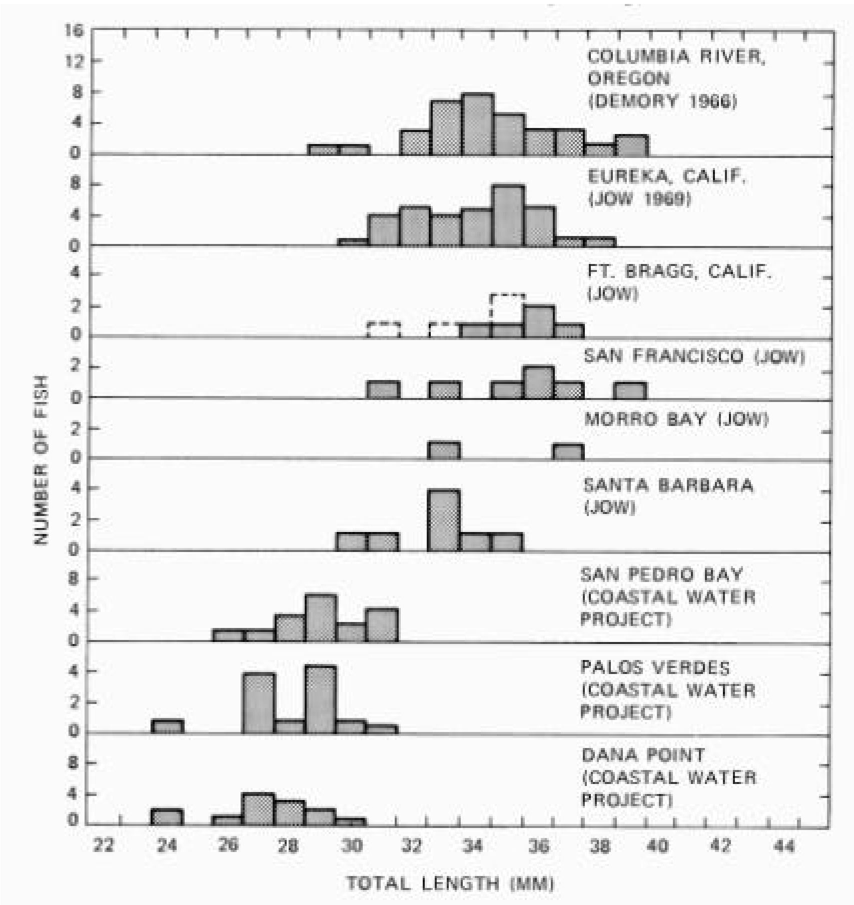


Figure 2. Regression lines of liver weight vs. body length for (A) diseased Dover sole from Palos Verdes and San Pedro Bay (n = 46); (B) apparently healthy fish from Palos Verdes and San Pedro Bay (n = 155); (C) healthy fish from Catalina Island (n = 30); and (D) healthy fish from Santa Monica Bay (n = 14).



NUMBER OF FISH
COLUMBIA RIVER, OREGON (DEMORY 1966)
EUREKA, CALIF. (JOW 1969)
FT. BRAGG, CALIF. (JOW)
SAN FRANCISCO (JOW)
MORRO BAY (JOW)
SANTA BARBARA (JOW)
SAN PEDRO BAY (COASTAL WATER PROJECT)
PALOS VERDES (COASTAL WATER PROJECT)
DANA POINT (COASTAL WATER PROJECT)
22 24 26 28 30 32 34 36 38 40 42 44
TOTAL LENGTH (MM)