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FIN REGENERATION IN DOVER SOLE

Tissue regeneration is an important process in marine fishes and invertebrates recovering from injury or disease. Field observations made over the last 4 years suggest that this process may be occurring in local populations of Dover sole (*Microstomus pacificus*) in which fin erosion is present: A limited number of individuals with bent fin rays—a possible sign of regeneration—have been noted at several of the collection sites.

Dover sole with eroded fins have been most prevalent on the Palos Verdes shelf. Prevalence data from sites to the north and south of the shelf and chlorinated hydrocarbon analyses of specimens from one southerly site suggest that some migration of affected individuals takes place (McDermott-Ehrlich et al. 1977). Specimens with bent fin rays have been collected off Palos Verdes, in south San Pedro Bay, and off Dana Point (Table 1). Prevalence of the condition has been low in all areas (less than 1 percent), but was greatest on the Palos Verdes shelf.

The objective of this study was to determine if local Dover sole maintained in the laboratory could regenerate portions of their dorsal and anal fins that had been artificially removed. Information on the ability of individuals to regenerate their fins might shed light on the process by which fin erosion takes place in the field.

METHODS

The Dover sole used in this experiment were selected from collections of fish taken by otter trawl off Palos Verdes and Point Dume in September 1976 and maintained for up to 10 weeks in recirculating aquaria in the Project's laboratory. Six individuals from each area were selected; the specimens from Palos Verdes had slight or no apparent fin erosion and ranged from 127 to 164 mm, standard length (SL); those from Point Dume were 134 to 181 mm, SL.

The experiment was initiated in December, at which time each fish was anesthetized, and a section of its dorsal fin about 1 by 0.5 cm was removed. The fish were then kept in two aquaria, separated according to collection site, for 22 weeks; they were fed Tetramin staple tablet food. Water quality measurements were made by Jean Wright on a weekly basis.

During the test, one of the Point Dume fish became diseased; this individual was sacrificed 8-1/2 weeks into the experiment.

RESULTS

Fin repair and regeneration appeared to follow the same general pattern in both groups of specimens; however, there were individual variations. At 1 to 3 weeks, the distal edge of the damaged portion of the fin was bordered by a narrow band of clear tissue. Beginning at 3 weeks, opaque lines indicating the development of rays were evident. When ray development appeared complete, the tips of the newly formed portions of fin whitened to a color that matched the distal edge of the adjacent parts of the fin. Fin repair appeared complete in several specimens from each group at 4 to 5 months (Figure 1). DISCUSSION The results of this study suggest that Dover sole are able to repair and regenerate dorsal fin tissue. It is therefore possible that these processes are occurring in the field. However, if repair and regrowth are indicated by the occurrence of bent fin rays, the percentage of individuals with fin erosion in which these take place appears to below. Laboratory data support this conclusion to some extent: One Dover sole with moderate dorsal and anal fin erosion from the September 1976 Palos Verdes collection did not regenerate the missing areas of its fins even after 8 months in the laboratory.

Earlier studies have suggested that the rate of fin regeneration is dependent on the size of the missing portion (Goss 1969), that innervation of the tissue is necessary (Goss and Stagg 1957), and that hormonal control is a factor (Goss 1969). More recent work has indicated that regrowth is retarded by exposure to certain dissolved insecticides (Weis and Weis 1975) and certain dissolved metals (Weis and Weis 1976). In conjunction with the present study, Dover sole from the same collections as the test fish were sacrificed immediately after collection, and their liver tissue was analyzed for total DDT. The median value for the Palos Verdes fish was 50 times the value for Point Dume specimens and 250 times that for specimens taken in an earlier collection off Dana Point, a control area (Sherwood and McCain 1976). Although levels of total DDT were different in specimens from the Palos Verdes and Point Dume collections, no marked gross differences in the regeneration of dorsal fin tissue in the two groups of fish were noted. Finer differences might have been obscured by individual variations in the regeneration process that could have resulted from differences in fish age, dominance, and/or the relative depth of the cut. In addition, the actual levels of contaminants in the specimens at the initiation of the test, up to 10 weeks after collection, were unknown.

In a future experiment, we plan to examine the ability of Palos Verdes Dover sole with moderate fin erosion to regenerate both artificially removed portions of their fins and areas of erosion developed in the field.

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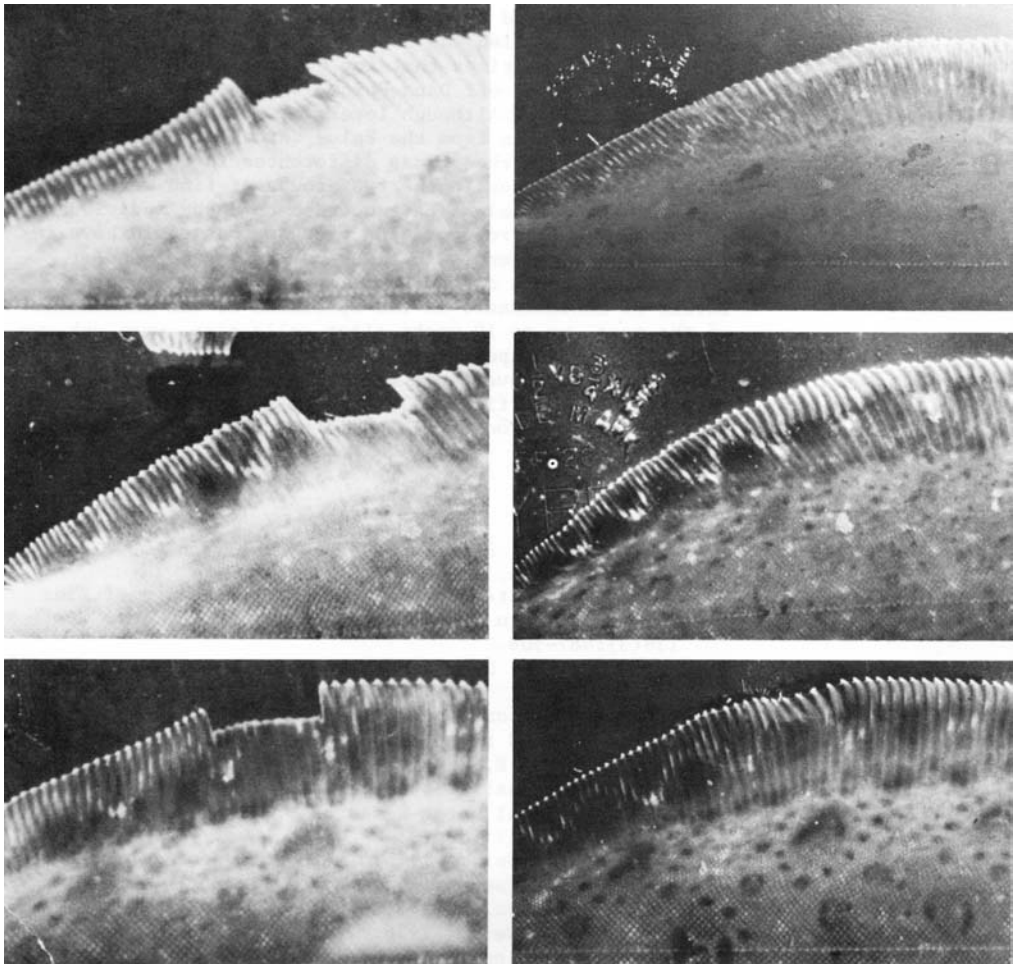

Figure 1. Repair and regeneration of artificially removed sections of dorsal fin tissue in Dover sole. Fish shown at top was captured off Point Dume; other two fish were captured off Palos Verdes.

Table 1. Prevalence of Dover sole (*Microstomus pacificus*) with bent fin rays from southern California coastal waters, May 1972 to December 1976.

	Number Dover sole Examined	Dover sole with Bent Fin Rays	
		Number	Percent
Santa Monica Bay	867	0	0
Palos Verdes Shelf	22,567	89	0.39
South San Pedro Bay	5,132	6	0.12
Dana Point	889	1	0.11
Point Loma	100	0	0
Santa Catalina Island	145	0	0