

## METALS IN DISEASED DOVER SOLE

The purpose of this research was to investigate the association of fin erosion in Dover sole with exposure of the species to high levels of trace metals in bottom sediments off the Palos Verdes Peninsula. We examined concentrations of 25 trace metals and major cations in several tissues from Dover sole with and without fin erosion from the Palos Verdes shelf and from healthy Dover sole from the control region off Dana Point. The analyses were performed by optical emission spectrography in collaboration with George Alexander, University of California, Los Angeles. Samples of muscle, kidney, gonad, and skin (from both the blind and eyed sides) were taken from ten individuals in each of the three categories. Preliminary results for the levels of cadmium, chromium, copper, and lead and for calcium, magnesium, and sodium in these samples were available at the time of this report. Median concentration levels of these elements in the various tissues are presented in Table 1.

We performed three distinct statistical comparisons (using the Mann-Whitney U-test) to identify the differences in element concentrations associated with the occurrence of eroded fins and those associated with regional variations. These statistical comparisons were between (1) the diseased and unaffected Palos Verdes specimens (2) the diseased Palos Verdes and unaffected Dana Point specimens and (3) the unaffected Palos Verdes and Dana Point specimens.

### DIFFERENCES ASSOCIATED WITH FIN EROSION

Differences in trace metal or major cation levels were considered to be associated with fin erosion if, for a given element and tissue, significant statistical differences ( $p < 0.05$ ) were observed between the concentrations of elements in the diseased Palos Verdes fish and the unaffected fish from both Palos Verdes and Dana Point. On the other hand, no statistical difference should be observed between the unaffected specimens from the two regions.

Only three significant differences associated with the occurrence of fin erosion were observed. These were in the gonad for the trace metal copper and the major cations calcium and magnesium. The diseased Palos Verdes fish had significantly lower levels of these elements in all three cases. The median levels of gonadal copper and calcium in the Palos Verdes Dover sole were approximately two-thirds the level found in unaffected Dover sole from either Palos Verdes or Dana Point, and the level of magnesium in the gonads was one-third the levels in unaffected specimens from the two regions.

### REGIONALLY ASSOCIATED DIFFERENCES

Differences in trace metal or major cation levels were considered to be regionally associated if, for a given element and tissue, significant statistical differences ( $p \leq 0.05$ ) were observed between the levels of these constituents in the Palos Verdes fish (both with and without fin erosion) and the unaffected Dana Point fish. In contrast, no statistical difference should be observed between the diseased and unaffected Palos Verdes specimens.

Seven regionally associated significant differences were detected. Levels of copper in the kidney and chromium in the gonads and skin (from the eyed side of the specimens) were

significantly higher by a factor of 2 in the Palos Verdes Dover sole than in the Dana Point fish. Calcium was also significantly higher in the kidney (by a factor of 3.5) and in the muscle (by a factor of 1.6) of the Palos Verdes specimens. Sodium levels in the gonad and eyed-side skin of Palos Verdes fish were approximately two-thirds the levels in the Dana Point fish.

These results do not imply any cause and effect relationships but may reflect physiological and metabolic conditions associated with exposure to the Palos Verdes environment. We are currently investigating correlations between the various trace metals and major cations in the three groups of fish.

**Table 1. Concentrations of trace metals and major cations (mg/dry kg) in tissues of fin eroded and apparently unaffected Dover sole collected off Palos Verdes and Dana Point. February – March 1975\*.**

Trace Metal	Muscle	Kidney	Gonad	Skin	
				Eyed Side	Blind Side
<b>Cadmium</b>					
Palos Verdes					
Fin eroded	**	<3.2	10	4.6	<3.0
Unaffected	<3.0	4.2	14	7.6	<3.0
Dana Point					
Unaffected	<3.0	<3.7	4.8	14	<3.0
<b>Chromium</b>					
Palos Verdes					
Fin Eroded	<0.2	**	<0.2	0.4	0.8
Unaffected	<0.2	**	0.4	<0.2	0.6
Dana Point					
Unaffected	<0.2	**	**	**	0.6
<b>Copper</b>					
Palos Verdes					
Fin eroded	1.4	17	9.0	2.0	3.6
Unaffected	1.4	17	13	2.8	2.2
Dana Point					
Unaffected	1.4	7.2	15	2.1	4.2
<b>Lead</b>					
Palos Verdes					
Fin eroded	**	9.1	3.0	**	<1.0
Unaffected	**	12	5.6	<2.3	<1.0
Dana Point					
Unaffected	**	9.6	<1.0	**	**
<b>Major Cation</b>					
<b>Calcium</b>					
Palos Verdes					
Fin eroded	840	2,000	1,000	16,000	12,000
Unaffected	750	2,500	1,300	15,000	13,000
Dana Point					
Unaffected	500	630	1,800	16,000	12,000
<b>Magnesium</b>					
Palos Verdes					
Fin eroded	900	1,300	1,100	1,100	720
Unaffected	860	1,000	2,700	1,100	690
Dana Point					
Unaffected	970	940	3,200	1,200	820
<b>Sodium</b>					
Palos Verdes					
Fin eroded	13,000	15,000	15,000	4,700	5,100
Unaffected	11,000	16,000	17,000	4,500	2,900
Dana Point					
Unaffected	11,000	17,000	24,000	7,200	8,200

\*Solid-line boxes mark regionally associated significant differences,  $p < 0.05$ ; dashed-line boxes mark fin-erosion-associated significant differences,  $p < 0.05$ .

\*\*Below the limit of detectability.