Juvenile Salmon: Migration Routes and Survival Results from the Demonstration Phase of the Pacific Ocean Shelf Tracking Project (POST)

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The Census of Marine Life and the Gordon and Betty Moore Foundation are helping to develop the Pacific Ocean Shelf Tracking Project (POST), a permanent continental-scale tracking array for the west coast of North America. This new tool for marine research can help provide an improved understanding of marine animal behavior and thereby facilitate better fisheries management. It can make available more precise data on such things as timing, rate and route of migration; differences in stock and species behavior, and the location of freshwater and marine mortality. The development of long-life modem-equipped ("wireless") receivers means that it is possible to put in place a permanent year-round tracking array, which could potentially also include other sensors to supplement the tracking data with direct observation of changes in oceanic properties.

2004–2005 was a two year field demonstration, and used six 20 km long listening lines and several thousand acoustically tagged juvenile salmon (12–15 cm long) to test the concept. Detection rates for individual fish crossing 20 km long acoustic lines was approximately 95% in both years, meaning that only one fish in 20 was not detected as they crossed each listening line. As a consequence, very precise measurements of salmon biology (including survival) are now feasible.

The results demonstrate striking differences in marine migration pathways and survival even between different populations of the same fish species, as well as between species—and that these differences are measurable.

Data on two stocks of endangered sockeye salmon from southern British Columbia contained a number of surprises. They showed that a portion of the tagged fish from both Cultus and Sakinaw Lakes spent time in nearby Howe Sound before migrating north and that in both years a proportion of the Sakinaw fish left Georgia Strait by means of Juan de Fuca Strait rather than by the more obvious route through Johnstone and Queen Charlotte Straits.

Acoustic data from a line of 22 receivers across Queen Charlotte Strait suggests interesting variations in the way in which both species and stocks migrate, as well as differences in the migratory behavior of hatchery and wild components of the same stock. For example, wild steelhead from the Keogh River tended to fan out across Queen Charlotte Strait toward the mainland before turning north over the listening line, while most hatchery fish crossed the line nearer to Vancouver Island. Individual Sakinaw sockeye were repeatedly detected over a much longer period on the Queen Charlotte Strait line by comparison with Cultus sockeye which seemed thereby to be migrating more quickly.

Freshwater and early marine survival of most stocks studied was generally high, and indicates that substantial mortality must occur beyond the geographic range and period of time that the current POST array measures. Although survival rates generally seem to be stable between the two years, we observed a six-fold drop in the freshwater survival of Cultus Lake sockeye in 2005. Other stocks of salmon that also migrate out of the Fraser River showed no decline in 2005, and subsequent survival in the ocean of Cultus Lake sockeye was similar to that measured in 2004. Although the reason for the poor survival in 2005 is unclear, the key point is that it is now possible to measure these changes and isolate the parts of the life history affecting salmon conservation.

The array was able to measure both freshwater and marine survival for tagged fish by comparing the number leaving freshwater with those that subsequently migrated out of the Strait of Georgia ecosystem to the open ocean across the Queen Charlotte Strait and Juan de Fuca Strait listening lines, and provide detailed data on the speed of migration of individual fish. It should be noted that during the demonstration phase, sensors were removed from the water in September–October and they could not therefore detect and later movement to the open ocean of coho stocks like those from the Cheakamus and Nimpkish Rivers that maintain a period of initial residence in nearby salt water before further migration. The permanent lines being installed in 2006 will make such data available.

The development of POST promises a radical change in how scientific research can be conducted on salmon in freshwater or continental shelf waters. For example, it is now possible to contemplate direct experiments in the ocean of how different groups of marine fish respond (movement rates, survival) after "treatment" (e.g. sea lice burden or El Nino) or to measure seasonal movements of individual stocks of fish—of all species, not just salmon. This can change marine salmon research from a discipline based on a very limited observational capacity to one

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based on direct experiment.

For further information, see www.postcoml.org.