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Development of the POST Acoustic Tracking Network and Database

By

J. Thar¹, G.L. Kristianson²

¹*Research Program Co-ordinator, Pacific Ocean Shelf Tracking Project
[Jonathan.Thar@vanaqua.org]*

²*Vice-Chair, Pacific Ocean Shelf Tracking Project [gerrykr@telus.net]*

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Abstract

The Pacific Ocean Shelf Tracking Project (POST) was conceived in 2001 as one of 17 projects of the Census of Marine Life, a global network of scientists engaged in a 10-year effort to assess and explain the distribution, diversity and abundance of life in the ocean – past, present and future.

POST was designed to determine the scientific value and feasibility of building a permanent, large-scale acoustic telemetry array for studying the movement and behavior of marine animals. Acoustic tracking was not a new technology, but its coordinated application on a continental scope had never been attempted before.

Although at the outset POST was mainly seen as a means to explore questions around salmon migration and survival, it quickly became apparent that the array is capable of answering questions around more than just salmon behavior. Today, POST serves as an accessible research tool for studying a variety of marine animals along the west coast of North America, contributing to conservation and stewardship of marine resources.

Methodology

From 2001-2005, the concept of deploying highly efficient lines, or “curtains”, of acoustic receivers on the ocean bottom was tested primarily in the inland waters of Vancouver Island, BC.

Taking advantage of the acoustic technology behind POST that works seamlessly between fresh and saltwater, concurrent trials of the utility of those curtains for experimental science were completed mostly by tracking the out-migrations of various salmonid stocks from regional river systems. Surgically implanted tags with unique codes allow individual animals to be tracked as they are detected by one or more receivers in a given line, or by receivers in a series of POST lines along the coast.

After a successful proof of concept phase, the initial permanent POST array was deployed in 2006. Receivers with long-lasting batteries are anchored to the sea bed, protected by a buoyant collar, and can communicate stored data to a ship-board computer via an acoustic modem. With receivers running from shore to 200m depth, lines detect nearly all acoustically tagged animals passing through them.

Results

Since 2006, when the permanent POST array was put in place, we have seen the network of acoustic receivers grow to “wire off” over 3,000km of the west coast of North America. Presently, the northern terminus of the POST array is in Prince William Sound, Alaska, with lines stretching across the continental shelf through Southeast Alaska,

British Columbia, Washington, Oregon and California. POST lines have also been deployed in three major rivers along the coast: the Columbia, Fraser and Skeena.

POST has actively engaged a growing community of local scientists who not only are using the tool for their tracking research, but also contributing their own resources and data from sometimes large regional networks of acoustic receivers. The expanding network and new ability to link any segment of a very large dataset to correlated environmental conditions, is increasing the value of POST significantly.

Over 50 independent researchers have contributed to and received data from POST's database to date, having tagged over 16,000 individuals of 18 different species. POST's infrastructure and online database serves as a free tool available to academe, agencies and the public.

This coast-wide work of tracking marine animal movements includes recent and ongoing research. Seven salmonid species have been tagged in each state and province from California to British Columbia, with the longest recorded journey belonging to a juvenile Chinook that travelled over 2,500km, from the headwaters of the Columbia River to Southeast Alaska in just over three months. Other salmon studies have compared the timing, survival, and physiology of out-migrating groups of hatchery and wild coho; examined the relative success of various stocks through both dammed and unimpounded rivers; and linked acoustic tracking with physiology and genomic studies for an interdisciplinary look at high profile Fraser River sockeye.

Community-initiated and -executed array expansion has allowed researchers to track animals in new regions. Lingcod researchers in Prince William Sound are using the array to describe habitat use, residency, and long-distance movements of these stocks of critical concern to fisheries managers. Salmon sharks have been tagged with both acoustic and satellite tags, with the hope that the dual effort will reveal patterns of residency and site fidelity as the sharks move along the entire Northeast Pacific coast.

Pilot studies of tagging and detection devices, conducted by state, federal and international agencies, are determining the feasibility of applying acoustic telemetry equipment in novel ways that will allow acoustic tracking of important species such as Pacific herring, halibut and sablefish. POST is exploring the deployment of receivers on new platforms, such as underwater gliders and oceanographic buoys. Existing regional partnerships have POST contributing valuable biological observations to America's Integrated Ocean Observing System (IOOS).

Beyond these results, POST has been applied by researchers in myriad ways, bringing new insights into the lives of a variety of species.

Highlights include:

- The first acoustic tagging of Humboldt squid, conducted off the northern coast of Washington, as an attempt to evaluate POST as another tool for tracking the movement of the predator through its significantly expanding range.
- Documentation of atypical northwards winter migrations of green sturgeon from California, Oregon and Washington, moving as far up the coast as Southeast Alaska, leading to the designation of critical habitat for a threatened population of the sturgeon.
- New observations of sixgill sharks initiated in Puget Sound, where short-term movements are minimal but longer time scales show the sharks moving to the coastal ocean, bringing researchers to a new hypothesis that Puget Sound might serve as a nursery.

Future Directions

Together with Dalhousie University's Ocean Tracking Network, POST is planning new lines of acoustic receivers in the Gulf of Alaska and Southern British Columbia in the coming two years. Locations being considered will augment the existing array and grow local research interests, allowing scientists to chart the movements of even more marine animals transiting our coast. This collaborative array expansion will also serve to further link POST into worldwide observing initiatives, like the Global Ocean Observing System (GOOS).

With the current success of community-based POST initiatives, and planned deployments of more receiver curtains along the coast, the tool that POST provides will continue to advance marine science and lend new knowledge about the movements and behavior of numerous marine animals, ultimately contributing to conservation and stewardship in the Northeast Pacific.

While the array was built using financial support from two private foundations within the context of the Census of Marine Life, the POST Management Board and community are determined to see the continuing operation and expansion of the valuable tool that POST provides. At present, funding support is being sought from both the Canadian and US governments.

References

The following link leads to the online POST special collection in the Public Library of Science's open-access journal, PLoS ONE:

<http://www.ploscollections.org/article/browseIssue.action?issue=info%3Adoi%2F10.1371%2Fissue.pcol.v01.i05>. In addition, below is a partial list of articles citing information or insight pertinent to the NPAFC, and gained from the POST array.

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