NPAFC
Doc. 903
Rev. _____

Report on the 2004-05 Pacific Ocean Shelf Tracking (POST) Project- Objectives, Goals, & Initial Results

by

David Welch[1], Gerry Kristianson[2], & Peggy Tsang[3]

[1]Chief Scientist, POST, 4737 Vista View Crescent, Nanaimo, B.C. Canada V9V 1N8
[2] Chairman, POST Management Board, 67 McKenzie Cr., Sidney, BC V8L 5Y7
[3] Executive Director, POST Secretariat, Vancouver Aquarium Marine Science Centre, PO Box 3232, Vancouver, B.C. V6B 3X8

Submitted to the
NORTH PACIFIC ANADROMOUS FISH COMMISSION
by

CANADA

October 2005

THIS PAPER MAY BE CITED IN THE FOLLOWING MANNER:
Welch, D.W., G. Kristianson, and P. Tsang. 2005. Report on the 2004-05 Pacific Ocean Shelf Tracking (POST) Project- Objectives, Goals, & Results. (NPAFC Doc. 903) 6 p.

SUMMARY

The POST project was successful in deploying the test array in the Salish Sea in 2004, as reported to the NPAFC last year. The work in 2005 was conducted to confirm the key findings of the previous year. Recovery of the array is still underway at the time of preparing this report. The number of salmon smolts tagged (2,600) were more than twice that in 2004, as a result of greater acceptance of the technology and participation by the scientific community. Detection efficiency of individual tagged smolts over each acoustic listening line was 91% in 2004, and should be improved upon in 2005. This means that it is now possible to measure directly salmon survival in the ocean and stock-specific migration pathways at a level of precision impossible to attain previously. The 2004 results also demonstrate that there are differences in migration pathways between species as well as between stocks of the same species. Another major milestone achieved in 2005 was the successful development of the permanent version of the acoustic tracking receiver. POST is ready to begin the deployment of the permanent system, aiming at completing the coverage along the Pacific coast of North America by 2010.

LONG-TERM GOAL

The goal of POST is to develop a permanent marine telemetry array for the west coast of North America by 2010, and facilitate the adoption of similar systems by coastal regions in other parts of the world. The POST array will sit on the seabed where it will permit an essentially complete census of the movement and survival of tagged animals ranging from salmon smolts to blue whales. The system will also host oceanographic sensors capable of monitoring ocean properties of the seabed and the water column.

OBJECTIVES

The three current objectives for POST are to: (1) demonstrate that the acoustic telemetry system is capable of the previously unattainable – providing a complete census of tagged animals along the entire continental shelf; (2) develop the technical components for the permanent system; and (3) develop the physical infrastructure to host ocean sensors at low marginal cost.

FIELDWORK COMPLETED

The test array was deployed on the west coast of North America, stretching from north of the Alaskan panhandle to southern Washington from April to September 2004 (Figure 1). This was repeated in 2005, with the Alaskan outer shelf line extended all the way to the edge of the continental shelf (instead of just halfway in 2004). The array consisted of 6 acoustic listening lines or “curtains”, each 20 km or more in length, totaling ca. 150 km in length and made up of >135 individual acoustic receiver units. The lines and receivers were strategically placed to demonstrate the capability to track essentially every tagged animal passing over the array. At the time of preparing this report, the 2005 field operation is at the last stage of recovering the receivers. Therefore, the latest biological findings are not available in this document.

The permanent version of the receiver units passed all performance tests in a large-scale field trial from mid-April to end of July, 2005. These units have sufficient power to support continuous year-round operation on the seabed for a 6-7 year period and have the ability to remotely

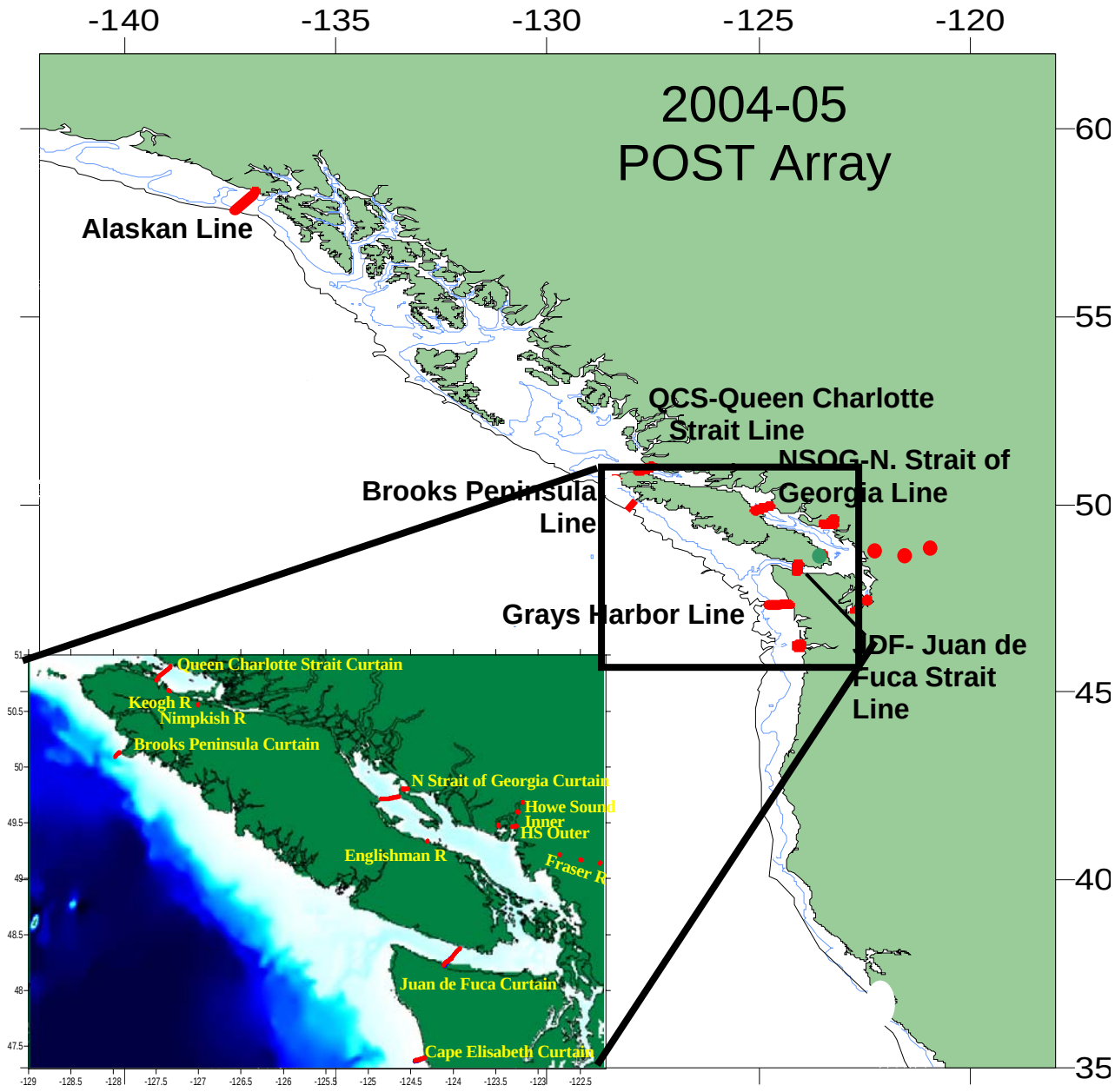

Figure 1. POST array in 2004 and 2005, from Cape Elisabeth (just north of the Columbia River at the Washington-Oregon border) to beyond the Alaska panhandle. River systems where salmon smolts were surgically implanted with acoustic tags and then released are indicated with red dots.

upload the stored data using an acoustic modem. This will greatly increase the reliability and manageability of recovering data from the large-scale array.

Three “MASH”-like mobile surgical units, staffed by two biologists or veterinarians, traveled to various locations with portable surgical equipment, between April and June, to implant salmon smolts with Vemco V7 and V8 acoustic tags. Wild smolts were captured in the rivers as they migrated to sea and hatchery-reared smolts were tagged in the hatcheries and then released. Each smolt was given a pre-operative sedative to minimize stress from handling, then put under full anesthesia using a second drug (MS-222). The animal was placed on its back in a trough on

the surgical table. During surgery, oxygenated water containing anesthetic was pumped over the gills. Oxygen level and temperature of the water was maintained carefully to keep the animals in the comfort zone. A tag was inserted into the abdominal cavity through a 1 cm incision which was then sutured shut.

POST core studies tagged about 1,500 smolts. Together with affiliated projects a total of 2,600 fish were tagged in 2005. The number of fish tagged more than doubled that of the year before and covered an expanded range of salmon stocks.

SCIENCE RESULTS

The most significant result for the demonstration phase is that salmon smolts as small as 12-15 cm can be detected by the POST array as they moved along the continental shelf. Using the tag programming and array geometry developed by POST, the battery life of the smallest tag is >4.5 months. While the recovery of the array is still underway this year, the data recovered so far indicate that the 2005 array appears to work as well as the 2004 system and promises a wealth of data. The 2004 data have been uploaded to the POST website and made fully accessible to researchers and the general public. The 2005 data will be also posted and analyzed in due course.

In 2004 we achieved over 90% detection rate for the salmon smolts as they made their way over the “acoustic curtains” out to sea. This performance is expected to improve and the recovery of the detection data would become more reliable and economical. As in 2004, we are measuring the speed and direction of movement, and survival in various parts of the sea. Although there is nothing new about juvenile salmon dying at sea, it is a revolutionary achievement to know the rate of attrition, when they die, where they die, and the differences between stocks and species.

We programmed our receivers to also pick up acoustic tag codes used by other researchers and detected green sturgeon (*Acipenser medirostrus)* tagged in California. This is a species with only three known spawning populations in all of North America and not much is known about them. In 2004, eight of them were heading south with one fish swam 480 km in 4 days!

The POST system allows us to replace “educated” guesses of movements and survivals by actual observations. As the geographic coverage of the array grows and its operation maintained year-round, the power of the system should increase exponentially. Scientists can use the array for studies of their choice. We have no doubt that the most important findings are ones that we cannot even guess at right now.

IMPACT AND OTHER APPLICATIONS

Marine Ecosystem-based Resource Management The ability to understand the movements of marine animals is crucial to their management. The fact that animals move between jurisdictions requires that fisheries management agencies co-ordinate in the assessment of exploitation levels. There is also the need to know the areas of high or low survival for a given species along the continental shelf. Marine Protected Areas must be designed with reference to the ambit of the animals.

Ocean Observing Systems Ocean observing systems for continental shelf regions are ususally moorings that need to be serviced by ships or systems connected by cable to a shore

base. These systems tend to be expensive and have limited geographic coverage. POST is made up of low-cost autonomous units, with the capability of hosting a wide range of ocean sensors (subject to power requirements and data volumes being relatively low), along the entire continental shelf. POST will be a new model for delivering large-scale, long-term ocean observations.

AFFILIATED PROJECTS

Project	Principal Investigator	Location
Marine Survival Assessment of Juvenile Thompson Steelhead	Robert Bison, BC Ministry of Environment	Thompson Nicola, Salish Sea
Marine Survival of juvenile coho and steelhead from the Squamish River watershed	Michael Melynchuk, University of British Columbia	Squamish River, Salish Sea
Migratory behaviour and ocean survival of juvenile and adult Sakinaw sockeye	Chris Wood, DFO	Sakinaw Lake, Salish Sea
Survival of Columbia River chinook salmon	Dr. Carl Schreck, Oregon State University & USGS	Columbia River
Residence of Puget Sound hatchery coho	Scott Steltzner, Squaxin Indian Tribe	South Puget Sound
Salar-MAP	Dr. Fred Whoriskey, Atlantic Salmon Federation	NE Atlantic
POST – “Oz”	Prof George Jackson, Univ Tasmania	Australia
Puget Sound Salmon Migration	Correigh Greene, NMFS	N Puget Sound
Hood Canal Steelhead	Barry Berejekian, NMFS	N Puget Sound
Elwha River Restoration	Charles Boggs, Univ. of Idaho	Strait of Juan de Fuca

OUTREACH

The POST website (www.postcoml.org) has been redesigned with the new POST logo and updated with comprehensive information, including an animation video to explain how POST works. This portal also provides access to the tracking data, hosted on a separate server. A number of information products (posters, flyers, slide decks) have been prepared and used at outreach opportunities.

Fifty-one presentations were made in 2004 and 2005 on 34 occasions to inform scientific communities and fisheries constituencies about the project and its findings. POST was the subject in 8 print media articles, 2 radio interviews, 2 TV broadcasts during this period. A special outreach to senior Canadian government officials was undertaken in January 2005. Particular effort was also made to share information with European, Australian and South African science communities to help them initiate similar projects in their regions. Discussions with the US National Oceanic and Atmospheric Administration (NOAA) are ongoing to identify the mechanisms for collaboration. POST maintains its close liaison with Fisheries and Oceans Canada (DFO) and intends to expand the engagement of DFO scientists in their use of the tracking system.

NEXT PHASE

POST will begin the implementation of the permanent system in 2006, aiming at completing the coverage along the Pacific coast of North America by 2010.

ACKNOWLEDGEMENTS

POST receives funding support from the Census of Marine Life, the Gordon and Betty Moore Foundation and the Bonneville Power Administration. The project is managed by the Vancouver Aquarium Marine Science Centre.