



**NOAA** NATIONAL OCEANIC AND  
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## **Satellite Tags Help Unravel Mysteries of Atlantic Salmon Migration at Sea**

Satellite tags from adult Atlantic salmon tagged and released near Nuuk, Greenland are telling researchers where the fish go in the ocean and what environmental conditions are experienced during their journey.

The archival tags record information continually and remain on the fish for months, then pop-off or dislodge. Once on the ocean surface, the tags transmit information about water depths, ocean temperatures, and sunlight levels experienced by the fish since the time of release. These data are accessed by researchers, and allow them to re-create salmon migration routes and provide information on the oceanographic conditions the fish experienced en route to their natal rivers to spawn.

The Greenland satellite tagging project is headed by Mark Renkawitz and Tim Sheehan at NOAA's Woods Hole Laboratory of the Northeast Fisheries Science Center (NEFSC). The tags that Renkawitz and Sheehan are using are similar to those other NEFSC researchers have successfully deployed on sea turtles and other marine animals.

In September 2011, Renkawitz, Sheehan and colleagues attached tags to 17 salmon in Greenland's coastal waters; ten tags remain attached to the fish and are programmed to pop-off on April 1, 2012. April 1 is a predetermined pop-off date as the tag detachment apparatus is dependent on being in saltwater and there is a very low likelihood that any tagged fish will have entered their natal river by this time. Once at the ocean surface, tags transmit the data recorded since installation.

Data obtained from a tag attached during the pilot project in 2010 that popped off as programmed in 2011 have already been valuable. Researchers have assembled a picture of where this fish had travelled during its nearly eight months at sea. When coupled with the water temperature and depth data, the movement pattern of the tagged fish will be further refined, and will aid in future tagging plans to improve the quantity of data obtained.

Atlantic salmon are anadromous fish, meaning they are born in fresh water and migrate from rivers to the ocean after undergoing a number of distinct stages of development over several years. As smolts, the thin silver fish head to the ocean, usually between April and June, to begin a stage of aggressive feeding and growth. After 1-2 years at sea, adults return to the freshwater streams and rivers where they were born to reproduce.

At one time, Atlantic salmon could be found in rivers throughout much of New England, but Maine is now the only state in the Northeast region with wild Atlantic salmon populations. While increasing numbers of smolts are entering the ocean via the Gulf of Maine, few are returning, raising questions as to where the fish are going and what is happening to them while at sea.

Data from the satellite tagging project may hold some of the answers. Many salmon from the US and Canada find their way to the waters off Greenland and the Labrador Sea. North American and European salmon stocks co-mingle in the waters off Greenland, yet individuals from each stock somehow find the way back home.

Advances in genetics and tagging technology will one day make it possible to tell where an individual fish came from, not only the country of origin but also perhaps its specific river. Genetic information is collected when each fish is tagged, adding to the database.

The four-member Greenland tagging team includes Renkawitz and Sheehan from NEFSC, and colleagues Rasmus Nygaard from the Greenland Institute of Natural Resources in Nuuk, Greenland and Audun Rikardsen from the University of Tromso, Norway. Local fishermen also participate in the project, supplying salmon caught from various locations. Greenland has an internal use only fishing policy, and has not allowed commercial export of salmon since 2001.

As the tag technology advances and the size of the tags decrease, the NEFSC team hopes to tag even more salmon in the future. In the meantime, the researchers await results from the remaining ten tags from 2011 that may make it to the April 1, 2012 pop-off date.

“Salmon are dying in the ocean at an increased rate. This project allows us to study the migration of pre-spawning adults from their feeding grounds off Greenland to their natal rivers in both North America and Europe,” Renkawitz said. “What we learn from this project, coupled with other related projects, will provide a much better picture of what oceanographic conditions are important for salmon survival and how large-scale ecosystem level changes over time have influenced the trends we are seeing.”

“Each project adds another piece to the puzzle,” Sheehan said. “What we learn will help us better understand the global picture for salmon and for other fishery resources.”

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#### Background:

The Greenland satellite tagging project is one of several salmon research projects being conducted by Renkawitz, Sheehan and other NEFSC researchers. A similar, but separate, project tracks salmon smolts during the first portion of their marine migration, after they leave the freshwater rivers where they were born (see Signals from the Atlantic Salmon Highway:[http://www.nefsc.noaa.gov/press\\_release/2008/SciSpot/SS0814/](http://www.nefsc.noaa.gov/press_release/2008/SciSpot/SS0814/)).

Center scientists have been conducting baseline sampling of salmon populations for years, working with international colleagues and local fishermen. Data from this ongoing effort is essential for stock assessment models, and also provides information on the biological characteristics and stock composition of salmon over many decades. In addition, an expanded international sampling program known as SALSEA brought together researchers from North American and Europe (<http://www.nasco.int/sas/salsea.htm>) to conduct a coordinated and comprehensive research program focused on investigating Atlantic salmon marine survival across the North Atlantic. NEFSC scientists are integral participants in this program.

A “salmon summit” held in October 2011 in La Rochelle, France, was attended by more than 130 scientists and managers from nations around the North Atlantic Ocean, the Baltic Sea and the

North Pacific interested in salmon marine survival questions. The international meeting, officially entitled “Salmon at Sea: Scientific Advances and their Implications for Management,” was co-convened by the North Atlantic Salmon Conservation Organization (NASCO) and the International Council for the Exploration of the Sea (ICES). In 2012, ICES plans to publish many of the research findings presented at the salmon summit in special issues of the *ICES Journal of Marine Science*.

Related links:

NEFSC’s Orono, Maine Field Station: <http://www.nefsc.noaa.gov/nefsc/orono/>

The SALSEA Program: <http://www.nasco.int/sas/salsea.htm>

North Atlantic Salmon Conservation Organization (NASCO): <http://www.nasco.int/>

SALSEA – West Greenland: [http://www.nasco.int/sas/wgc\\_sampling.htm](http://www.nasco.int/sas/wgc_sampling.htm)

Signals from the Atlantic Salmon Highway (August 2008 NEFSC news release):

[http://www.nefsc.noaa.gov/press\\_release/2008/SciSpot/SS0814/](http://www.nefsc.noaa.gov/press_release/2008/SciSpot/SS0814/)