

## Results of Pop-Up Satellite Tagging of Atlantic Bluefin Tuna Yield Surprises

Dr. Molly Lutcavage<sup>1</sup>, Dr. Rich Brill<sup>2</sup>, Dr. Julie Porter<sup>3</sup>, Greg Skomal and Brad Chase<sup>4</sup>, Anne Everly<sup>1</sup> and U.S. tuna fishermen Ed Murray Jr., Mike Genovese, Bill Chaprales, Anthony Mendillo<sup>5</sup>

<sup>1</sup>New England Aquarium, Edgerton Lab, Central Wharf, Boston MA 02110

<sup>2</sup>Honolulu Lab, NMFS, 2570 Dole Street, Honolulu, HI 96822

<sup>3</sup>Department of Fisheries and Oceans, Biological Station, St. Andrews, New Brunswick E5B 2L9, Canada

<sup>4</sup>Massachusetts. Division of Marine Fisheries. PO Box 68, Vineyard have, MA 02568; Division of Marine Fisheries, 30 Emerson Ave., Gloucester, MA 01930

<sup>5</sup>Palm Beach Gardens, FL; Cape May Courthouse, NJ; Marstons Mills, MA; Isla Mujeres, Mexico

Beginning in 1997, in a collaboration between scientists and fishermen, our research group conducted satellite tagging of giant Atlantic bluefin tuna, *Thunnus thynnus*, in New England and Canada. Our goals were to determine the long-term movements, origins and behavior of bluefin tuna schools found on the New England shelf in summer and fall. We targeted adult fish comprising spawning-size classes (>80 inches SFL) and programmed the majority of the satellite tags to detach from the fish over their presumed spawning period (April to July).

From 1997 to 1999, all successfully released single point satellite tags reported from the central Atlantic roughly between Bermuda and the Azores. Each year, about 30 percent of tags on New England fish reported from east of the 45° W stock-division line, and none of the giant bluefin were in or near their only known spawning grounds in the Gulf of Mexico or Mediterranean Sea. Since none of the giant bluefin tagged in the Gulf of Maine were located in either spawning ground when their tags reported, it seemed possible that a previously unknown spawning area might exist in the Central North Atlantic. The alternative hypothesis, that bluefin tuna do not spawn annually, is also an astonishing, although remote, possibility.

Another possible explanation of why giant bluefin were not found in either known spawning area is that the timing of tag releases was insufficient to detect spawning. In 1999, we deployed 21 of Microwave Telemetry's newly developed pop-up archival tags (PTT-100) on New England giant bluefin for attachments of up to one year.

These pop-up archival tags are pressure tested to 3,300 psi, record ambient light levels at two minute intervals, and temperature ( $\pm 0.2^\circ$  C) and depth once an hour and at sunrise and sunset. As a fail-safe, the tag can be programmed to detach at a preset depth (e.g., 1,000 m), or when the tag stays at a user-defined constant depth for a predetermined interval. The tag transmits raw data defining temperatures, pressures and estimates of sunrise and sunset time. The data is processed by the manufacturer, and longitude and latitude estimates are generated with proprietary software; estimated errors are given as about one degree of longitude and several degrees of latitude.

In February 2000, at the PFRP Symposium "Tagging and Tracking Marine Fish with Electronic Devices," we presented estimated migration paths from the first two pop-up satellite archival tags. The two 400 pound fish, schoolmates released from a purse seine set in October 1999, had crossed the Gulf Stream and taken similar routes to the southeast, but were thousands of miles apart when their tags jettisoned on Christmas day (fig. 1).

We obtained high reporting rates with these new tags (17 out of 21 tags, or 81 percent) and they returned data capable of depicting daily geolocation estimates and ambient temperatures (80–340 days) of 12 fish. Without exception, these migration paths overlap reporting locations of single-point tags from previous years, and stretch to the Azores. It was also apparent that not all Gulf of Maine giant bluefin return annually to the New England shelf. Furthermore, migration

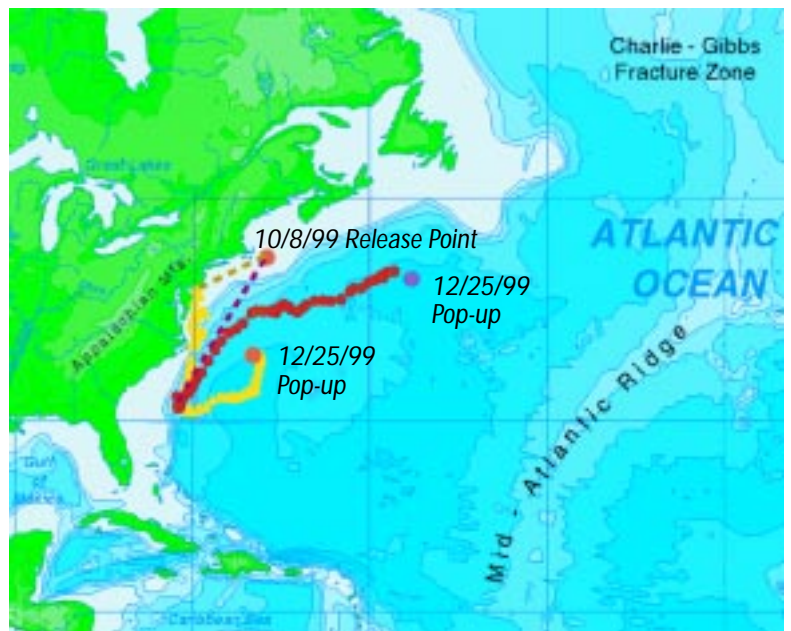


Fig. 1. Estimated migration paths of two bluefin tuna released from a purse seine on October 8, 1999. Their pop-up archival tags reported on December 25, 1999.

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