Do Tags Put a Drag on Marine Organisms?

A new generation of small electronic tags has opened exciting research opportunities for marine scientists, allowing them to track fish and other organisms across the open ocean, into the deep sea, and during long migrations.

The new tags can gather and archive information about an animal's location and behavior for months at a time, then automatically release from the fish and transmit the stored data via satellites to scientists on land. The technology provides access to animals that have proven difficult to follow for long periods with traditional tracking techniques.

Data from these "pop-up satellite archival tags" (or PSATs) are giving scientists important insights into the behavior of a wide variety of fishes, including tuna and marlin (see article on front page). These insights help regulatory agencies better manage commercial and recreational fisheries.

Ocean researchers are applying electronic tags to more and smaller fish to help gather the data needed to effectively manage commercial and recreational stocks. VIMS scientists are now studying whether drag from tethered tags might affect fish enough to alter the very behavior the tag is meant to record.

However, increasing use of PSAT technology has some scientists concerned. "We've generally assumed that these tags are so small and streamlined that they don't impose a major drag on large marine organisms," says VIMS researcher Dr. John Graves. "But current research is expanding their use to much smaller species and individuals. Drag from these tags may pose a significant energetic cost for smaller organisms."

For example, the International Commission for the Conservation of Atlantic Tunas recently mandated the release of all live blue and white marlin by international fleets (U.S. longliners have been prohibited from keeping any marlin since 1988). The measure also limited U.S. recreational landings of both marlin species to 250 total fish per year.

Although Graves and Kerstetter have shown post-release survival for blue marlin, which often weigh in at 300 pounds or more, adult white marlin are typically much smaller at only 30-70 pounds.

The white marlin mandates, together with a growing conservation ethic among recreational anglers (who now release more than 95% of the billfish they catch), have raised the question of how many of these smaller fish survive a catch-and-release episode—a question best answered through the use of PSATs.

Graduate students David Kerstetter (L) and Andrij Horodysky prepare the VIMS flume for their tag-drag study.

To measure the additional energy a fish needs to drag a tethered tag through the water, Graves' graduate students David Kerstetter and Andrij Horodysky have begun a series of experiments in VIMS' flume facility. They are investigating seven different tag types, both commercial and homemade.

The flume, which is 80 feet long and holds 6,000 gallons of water, can generate a current of up to 1.2 knots. (Blue marlin, one of the largest and most migratory of pelagic fishes, typically swim at about this speed.) To measure drag, the pair gradually accelerate the flume current while recording the force a submerged tag exerts on a vertical suspension rod. The rod, fabricated onsite by VIMS technician Wayne Reiser, has two cutouts that lie at right angles to each other. Each is fitted with two tiny strain gauges. The electrical resistance of the two gauges changes as the rod and gauges bend, and the resulting change in electric current tells Kerstetter and Horodysky how much force the tag exerts. One set of gauges measure drag, the force that opposes the tag's velocity; the other measures lift.

Kerstetter and Horodysky also videotape the tags so that they can carefully observe and document whether the tags move through the water smoothly or instead swing up and down or from side to side. Such movements may increase the possibility of tags working themselves out of the fish's musculature, resulting in premature tag releases and losses of data.

The duo use the measured drag value and the known speeds at which a particular fish typically swims to calculate the energy the organism needs to expend to pull the attached tag through the water. They then compare this value with the known metabolic rates of other fish species.

So far, says Kerstetter, "our results suggest that the tags don't constitute an excessive energetic cost to the host animals." However, he cautions that researchers should carefully consider the possible effects of these tags on the animals' behavior.

"As tags become smaller and more powerful, the range of species that can adequately carry this technology will only expand," says Kerstetter. "When matched to the appropriate scientific question, these tags remain an invaluable tool for better understanding habitat preferences and movements for marine animals."

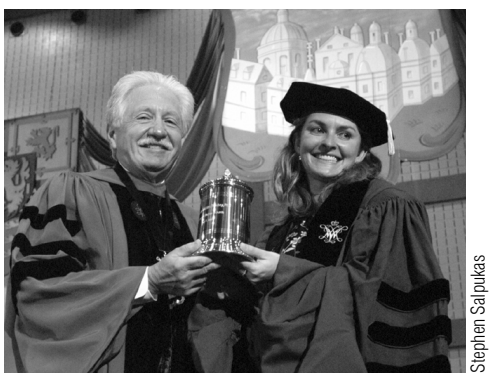
VIMS Graduate Dr. Beth Hinchey Awarded Thatcher Prize

Dr. Elizabeth K. Hinchey, a recent graduate of the School of Marine Science, has been awarded The Thatcher Prize for Excellence in Graduate and Professional Study by the College of William and Mary.

Hinchey accepted the award during the College's commencement ceremony, sharing the stage with former British Prime Minister Margaret Thatcher, for whom the award is named.

The College awards the Prize each year to recognize an outstanding graduate student from the schools of Arts and Sciences, Education, Marine Science, Business Administration, or Law. This marks the second time in the four-year history of the prize that the award has gone to a student from VIMS.

Hinchey earned her PhD under advisor Dr. Linda Schaffner by studying how physical disturbances such as tides, waves, and currents affect the invertebrate communities that live within muddy sediments of Chesapeake Bay and other estuaries. These communities are important because they help support marine food webs and serve as sensitive indicators of estuarine health.



Stephen Salpukas

William & Mary President Timothy Sullivan awards the Thatcher Prize to Dr. Elizabeth Hinchey during commencement ceremonies at the college.

"Beth distinguished herself both as a scientific scholar and a model campus citizen," says Schaffner. "It was an enormous pleasure to serve as her academic advisor."

While at VIMS Hinchey showed an avid interest in science education. "She gave generously of her time to participate in public outreach events ranging from Elder Hostel to Career Days at local elementary schools," says Schaffner. Hinchey even took time from her research to publish a paper for biology teachers on an inexpensive way to build a "critter collector" for gathering marine organisms for classroom or laboratory study.

Hinchey is currently employed at the US EPA Atlantic Ecology Division in Narragansett, Rhode Island. She earned her Masters degree from VIMS in 1996, and a Bachelor of Science degree in Biology from Notre Dame in 1993. Previous recognition includes the Craig L. Smith Memorial Educational Scholarship from VIMS in 1999, the International Women's Fishing Association Scholarship (1997-1999), an Honorable Mention in VIMS' Best Student Paper Award (2001), and Best Student Poster awards at the Atlantic Estuarine Research Society meetings in Beaufort, NC (1998), and Hampton, Virginia (1996). Hinchey also received the Dean's Prize for the Advancement of Women in Marine Science in 2002.