

LARGE PELAGICS RESEARCH CENTER
SEMI-ANNUAL PROGRESS REPORT – DEADLINE 07/30/2007



Report: #1

Reporting Period: 11/01/2006 – 05/30/2007

Project Title: Distribution, migration and behavior of the ocean sunfish, *Mola mola*, in the north Atlantic

Principal Investigator(s): W. Hunting Howell and Inga F. Potter, Department of Zoology, Spaulding Life Science Bldg., University of New Hampshire, Durham, NH 03824

Purpose of the project:

The purpose of the project is to improve the understanding of the habitat, migration routes, behavior and environmental associations of *M. mola* in the North Atlantic Ocean. The project is the first to examine the distribution, movement, and behavior of *Mola mola* in the North Atlantic, establishing a baseline of information for the species in the region. The primary objectives of the study are: 1) to determine the spatial and temporal distribution of *Mola mola* off the northeast coast of the United States; 2) to study their movement and migratory patterns; and 3) to quantify their temperature and depth preferences. Results of the project will contribute to the development of predictive models and management strategies that will aid in the management of a poorly understood marine species, whose populations are believed to be declining due to bycatch and its increasing commercial use in Asia. Data on distribution of *Mola mola* may serve as a useful indicator of nutrient rich areas with high productivity, where other important marine organisms may be found.

Progress during the last six months:

The project continues to progress successfully in its second six months, and is in keeping with its original objectives.

Objective 1: To determine the spatial and temporal distribution of *Mola mola* off the northeast coast of the United States (by analysis of aerial sightings of *M. mola* from the North Atlantic Right Whale Consortium and the OBIS-SEAMAP Databases).

There has been continued collection of aerial survey data from past years as well as from the current year (NMFS Right Whale Sightings for the northeast US, spring-summer 2007). As the project progresses and satellite tagging has proven successful, emphasis has been placed more heavily on Objectives 2 & 3.

Objectives 2 & 3: To study the movement and migratory patterns of *M. mola*, and to quantify temperature and depth preferences (by tagging individuals with pop-up satellite archival tags (PSAT's)).

After the successful tagging of 14 fish with PSAT's during August and September 2006, 12 of the 14 popped off and transmitted data to Argos satellites. Eight of those 12 stayed on for the full attachment period (five tags for the designated 5 month period, three tags for the designated 8 month period). Two tags never reported.

Of the tags that successfully reported (n=12), the attachment period ranged from 7 to 242 days. Four tags came off prematurely. Two of those tags were attached for approximately 70 days and came off for no apparent reason (vertical behavior of the fish up until premature detachment appeared healthy). One tag came off after 13 days due to constant pressure at the surface for four consecutive days (depth range between 0 - 16.1 meters which also is considered "normal" behavior of *M. mola* in certain environments). One tag came off after 7 days due to constant pressure at depth (365 meters) for four consecutive days which is indicative of mortality. The mean percent of data transmitted from the tags was 55% (between 4% - 100%) (n =12).

Preliminary data:

Preliminary data analysis indicates that *M. mola* are moving from the tagging region (northeast US) south along the continental shelf or shelf break. Several individuals made frequent dives to as deep as 750 meters (n=6); much deeper than previously recorded for the species. Maximum depth recorded during this study is 866 meters. Examining data from 11 individuals tagged between 2005-06 shows 25% of total time spent between 0 – 10 meters, and 75% of time spent between 0 – 200 meters (**FIGURE 1**). Temperature data retrieved from the tags indicate a broad range of temperatures experienced by *M. mola*. Examining data from 11 individuals tagged between 2005-06 shows 50% of total time was spent between 16° - 22°C. Also interesting is the shift in diving behavior. Vertical behavior of the fish changes from primarily surface oriented with high frequency diving to shallow depths (100-200 meters) in the autumn months, to little to no time spent at the surface and remaining at constant depths of 200 - 300m with lower frequency diving to as deep as 800 meters (**FIGURE 2**). This change in vertical behavior has been observed in the majority of individuals (n =7), while some others appear to experience a less marked change and never reach depths greater than 400 meters. Preliminary analysis of the temperature and pressure data suggests that this shift in behavior may be due to warming sea surface temperatures as the fish move southward, as well their encounter with the warm, rapid moving surface waters of the Gulf Stream. Data from the PSAT's with the most recent detachment dates (May 17th – May 26th 2007) suggest that as the fish moves northward it again resumes a shallower, surface oriented depth profile.

Due to the fact that *M. mola* spend considerable time at depth, geolocation position estimates retrieved from light level data stored by the tag are virtually useless. Therefore, reconstructing the probable paths taken by the fish upon tagging has proven difficult. We are actively working with, and learning from, colleagues at UNH's Large Pelagics Laboratory in analysis of data for track reconstruction. The majority of pop-off locations have occurred on frontal features associated with changes in depth on the shelf slope (n=8). Between November 2006 and February 2007, pop-off locations were primarily in two areas: off of southern Florida/The Bahamas (n=3), and off of South Carolina (n=4).

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The three most recent pop-off locations in May 2007 occurred on the northern tip of Florida (tag washed ashore), off the coast of North Carolina, and well off the coast of Long Island (on the 3000m depth contour) (**FIGURE 3**). Preliminary analysis of probable paths taken by *M. mola* suggests that they may be visiting the Gulf of Mexico before again moving north. As discussed in a previous LPRC report, this was the case with a fish tagged in September of 2005 (ID 14538).

Difficulties:

Thus far, the project is moving forward with few difficulties. However, the delay in this year's LPRC funding could slow the project's momentum for the 2007 field season.

Plans for the next six months to year:

Twelve additional fish will be tagged this season (September/October) with PSAT's in the Gulf of Maine and off of Cape Cod and Nantucket, Massachusetts. These fish will be tagged utilizing the same protocol and tagging vessels as last season. Six of the tags will be programmed to release at 5 months, and six of the tags will be programmed to release at 8 months. Twelve month attachment periods were considered but decided against due to funding (additional satellite time) and time (completion of dissertation) constraints. Analysis of PSAT data from last season as well as aerial survey data will continue.

Dissemination of results:

Publications: none

Workshops: none

Conferences:

Inga Potter participated in the Large Pelagics Research Center PI Conference, University of New Hampshire, Durham, New Hampshire, April 2007. **She** will also present data from the project at the Second International Symposium on Tagging and Tracking Marine Fish with Electronic Devices, to be held 8-11 October 2007 in Donostia-San Sebastian, Spain. Hunt Howell will also attend the conference.

Manuals, Protocols: none

Outreach activities:

An article was featured in the spring 2007 Microwave Telemetry, Inc. Newsletter *Tracker News*: "Movement and Behavior of Ocean Sunfish, *Mola mola* in the northwest Atlantic".

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A *Mola mola* project website, created through the UNH Large Pelagics Laboratory: (<http://www.tunalab.unh.edu/molaresearch.htm>), includes an interactive “Have you seen a *mola*?” feature. (Becca Topin, website manager).

Patent, Copyright, Invention Disclosure Activity: none

Collaborators and personnel:

Mola tagging captains, vessels, and homeports:

Josh Eldridge, F/V Monomoy, Nantucket Island, MA

Dave Linney, F/V Peregrine, York, ME

Eric Hesse, F/V Tenacious, Harwichport, MA

Data Analysis:

Francois Royer, Ph.D., Postdoc (through spring 2007), University of New Hampshire Large Pelagics Research Laboratory, Durham, NH, 03824

Students:

Inga F. Potter, PhD student in Zoology, Anticipated graduation date: spring semester, 2009

Images and Captions:

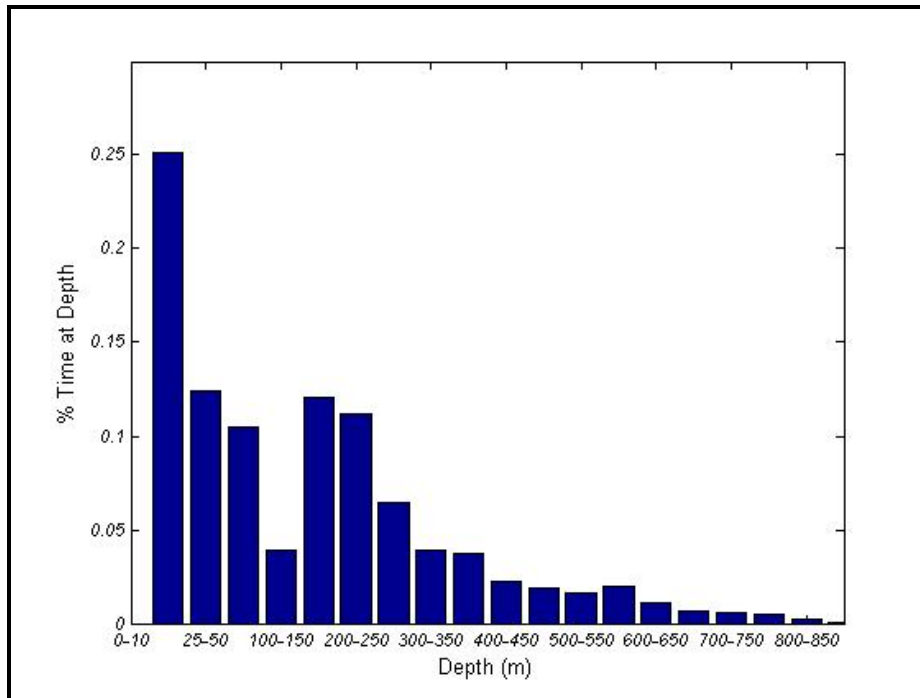


Figure 1. Depth profile for 11 *Mola mola* tagged with PSAT's during 2005-06 shown as percent time spent at depth.

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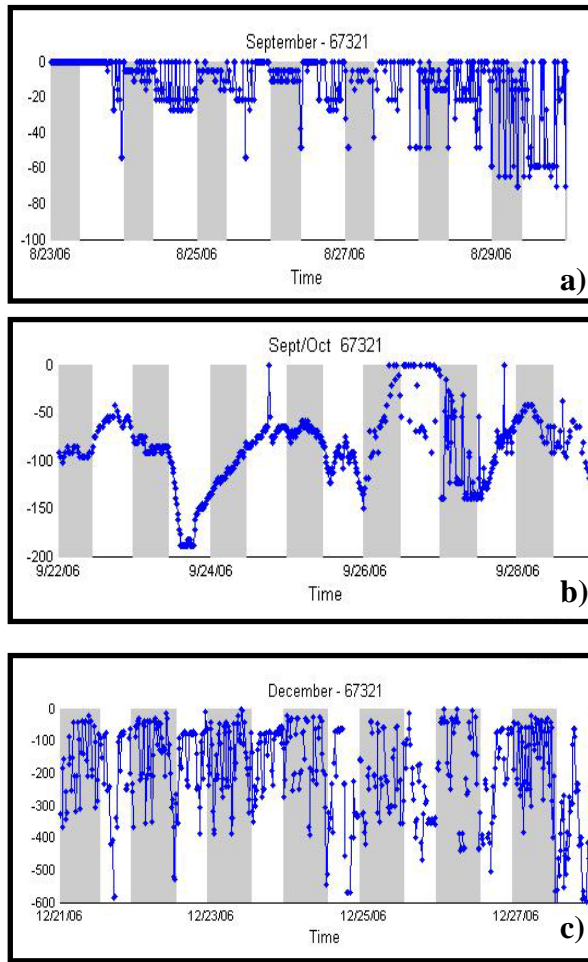


Figure 2. Depth profile of PSAT ID 67321 for 3 week long periods during the 143 day tagging period: a) 8/23/06-8/30/06; b) 9/22/06-9/29/06; c)12/21/06-12/28/06. Gray bars indicate night.

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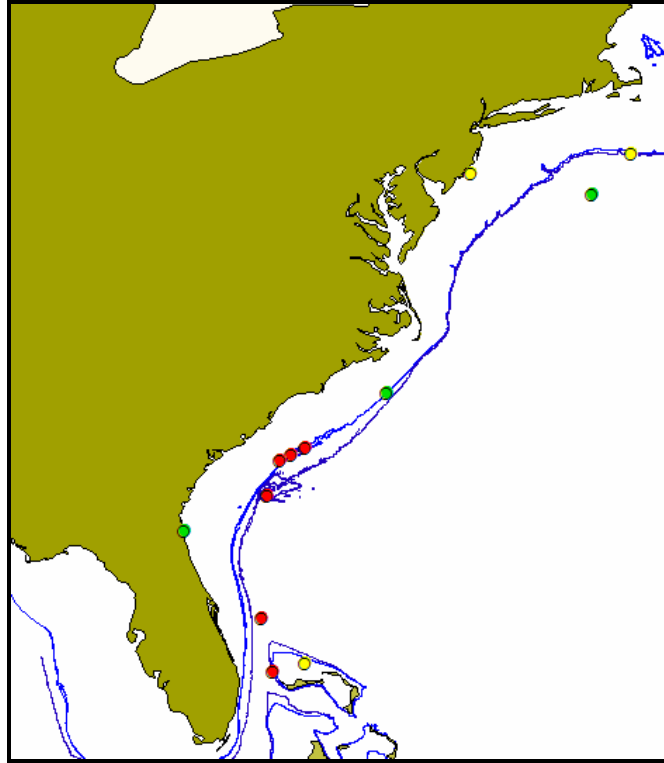


Figure 3. Map of PSAT endpoint locations for the 2006 tagging season. Yellow circles indicate pop-up dates during the months of September – November 2006 (n=3), red circles indicate pop-up dates in January-February 2007 (n=6), green circles indicate pop-up dates in May 2007 (n=3).

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