United States—Hawaii

Convergent evolution of diving behavior in species of pelagic fishes and sharks

Photos courtesy of Phil White, NOAA

Swordfish immediately after harpooning

Researchers in Hawaii are using Archival Pop-up Tags to study important fisheries interaction and allocation issues related to the management of pelagic fishes, sharks and sea turtles in the Pacific Ocean (see Microwave Telemetry, Inc. Newsletter, Winter 2002). Quite serendipitously, Musyl and Brill discovered a commonality of diving behavior among numerous species of pelagic sharks and fishes with different morphological and physiological characteristics. They discovered that many pelagic species that evolved large eyes for enhanced visual capabilities (e.g. bigeye tuna, swordfish, bigeye thresher sharks) and other species with presumably overriding olfactory modalities (e.g. blue shark, short fin mako) have evolved amazingly similar dive strategies. These fishes and sharks display a pattern of deep (450-800 m) oscillatory diving patterns during the day and predominately shallow diving (surface to 80 m) at night.

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Nighttime dive patterns of some species are highly correlated with moon phase. Certainly this oscillatory diel diving pattern fits in well with what is known of the thermoregulatory abilities and constraints of pelagic fishes and sharks. Interestingly, it also dovetails nicely into a forage utilization theory whereby pelagic predators have evolved convergent dive strategies to exploit and mirror the vertically migrating organisms which comprise the Sound Scattering Layer (SSL, i.e., various species of squids, mesopelagic fish, euphausiids) to the extent allowed by each species' physiological limitations.

Mike Musyl and Rich Brill prepare to attach an Archival Pop-up Tag to a blue shark

Musyl and Brill expect to continue this line of inquiry and will try to develop unique characters based on dive patterns in order to examine the evolution of ecological relationships and vertical niche partitioning in the ocean.

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You need to know...

How to retrieve your data from Argos

Even if you receive your data via Argos ADS, it is useful to know how to log in and check it for yourself. Occasionally, ADS fails; should that happen, you may want to log in directly and retrieve your data.

The simplest way to download your data is to log into Argos via Telnet. We recommend using HyperTerminal which comes free with most Windows operating systems. (Of course, any other Telnet program which has text capturing capability is fine.) Open a connection to your local Argos data server (currently datadist.argosinc.com for North American users, netdis.cls.fr for all other users.)

Once you've logged in, begin capturing to a text file. Use the PRV/A command to get your DS data (PRV/A,,DS, *[enter day of the year—1…365, e.g., 46]*,). Use the DIAG command (DIAG,, *[enter day—1…365]*,) for Argos location data. For details see the Argos user manual chapter 4 (http://www.cls.fr/manuel/html/chap4/chap4.htm). Section 4.3 describes how to use Telnet; Section 4.4.9 describes how to use the PRV/A and DIAG commands.

An Argos user can log in and access the prior ten days of data; after ten days the data is archived, and is no longer easily accessible.

If you are concerned that your bird has died, or that your PTT is reaching the end of its operating life, the DS format data is where to look for answers. DS data provides all the PTT's sensor data, whereas the DIAG format gives only a sampling.

The basic PTT's four sensors are for temperature, battery voltage, the transmission count and the activity count, respectively. Temperature and battery voltage data are integers representing the PTT's internal temperature and battery voltage; these can be converted using the calibration formulas listed in your PTT manual. The transmission counter increments every time the PTT transmits, and wraps back to zero when it reaches its maximum value.

The activity sensor indicates movement. During a PTT's ON time, it checks every minute for movement. If there is movement, the sensor increments up, then wraps back to zero when the maximum value has been reached. The activity sensor value in itself does not have meaning, it is the change (or lack thereof) that is significant. If the activity sensor value is constant (plus or minus 1) over two or more transmission cycles, it is indicative of bird mortality or PTT detachment.