Use of PSATs to follow the movements and survival of sea turtles following interactions with pelagic longline gear

Yonat Swimmer, Richard Brill, Mike Musyl, Randall Aruaz
NMFS Objective:

Keep Hawaiian tuna and swordfish longline fishery open without effecting population statuses of threatened and endangered marine turtles.

Must satisfy needs of both fishermen and environmental groups... no simple matter.
• Must determine how hooking and entangling effects survival of marine turtles.
(Do hooked/entangled turtles die??)

• Must understand pelagic behavior of marine turtles-- geolocation, dive depths/duration, migratory corridors, etc.
Decided to employ pop-up satellite archival tags.
PSAT

Internal clock and sensor record:

- geographic location
  (via sunrise/sunset times)

- dive depth, duration

- temperature
When will PSAT float to surface?

1) At pre-set pop-up date

2) After tag has been at constant depth for 4 days*

3) After tag has exceeded 1500 m depth*

*these parameters exceed what is expected to occur in a live turtle, and thus suggest mortality has occurred.
Use PSAT data to:

• Estimate occurrence of delayed mortality following longline-turtle interaction.

• Define pelagic behavior (e.g. geolocation, dive depths/duration, migratory corridors)
Post-hooking mortality and morbidity (PSAT data) will be correlated with:

– Hook location

– Severity of Injury

– Assessment of general health status
But first had to:

1. Devise simple and reliable attachment method

2. Test attachment method

3. Get necessary approvals for attachment method

4. Train observer pool & equip them with tagging kits
Area A:
No longline fishing allowed

Area B:
Number of sets limited to less than ~25% historical level; 100% observer coverage required.

Area C:
No swordfish-targeted (shallow-set) longline fishing allowed; targeting tuna allowed.
Syntactic foam base-plate used to prevent crushing at depth
2-part marine epoxy

- easy to use
- safe to use on boat

Note: Base-plate and tag will float if tag is shed prematurely
Using turtles maintained at the Kewalo Research Facility,

PSAT remained attached for up to nine months
Observer tagging kit
Baseplate attached to flat part of carapace
Cauterize with a few drops of Clotisol, if needed
Drip Betadine into hole
Select appropriate bolt length
Insert nylon bolt and secure with nylon washer and stainless lock nut
Relative location of the drilled holes for PAT tags

(Practice holes for conventional satellite tag attachment)
Thread thimble of PAT tag tether over free end of eyestrap

Reposition eyestrap and drill second hole

Cauterize hole if needed and sterilize with Betadine

Insert second bolt and secure with nylon washer and stainless lock nut
Use tools provided to tighten nuts.

Bolts must pass past the nylon inserts in the stainless lock washers.

Use cutters to remove excess bolt length.

Protect PAT Tag with PVC Sleeve.
Photograph turtle

Lower turtle close to the surface of the water to release

Observe a newly released turtle and record observations on ability to swim and dive normally

Clean tools and remaining hardware with fresh water; dry and return them to kit
Attachment of PSATs to leatherback turtles remains problematic.

Unlikely animals could be removed from water.
Rotator Cuff Anchor
Mitek Products, A Division of Ethicon, Inc. (Johnson & Johnson)

- 9.2 mm length x 2.8 mm diameter, titanium alloy
- Appears suitable as subdermal anchor for PSAT attachment
- Currently being tested on nesting leatherbacks in Puerto Rico by Molly Lutcavage, Anders Rodin, and Russ Andrews
- PSATs supplied by NMFS Honolulu Laboratory
PSATS and PTT tags placed on leatherbacks in eastern Pacific

resultant data will be used to test accuracy of PSAT geolocations

Data from
Peter Dutton and Scott Eckert
Working with longline fishermen in Costa Rica, have recently tagged seven olive ridley turtles.

Fishery averages about 100 mahimahi and 4 turtles per 800-1000 hooks daily set.
four animals caught on longline, three captured free swimming

first real “controls” in any turtle-PSAT study
Condition ranged from lightly hooked.
To deeply hooked, where hook could not be removed
In summary:

Safe, easy, and effective attachment PSAT attachment method developed and approved for hardshelled turtles

Successfully tested for up to nine months

PSAT attachment method for leatherbacks remains problematic

One olive ridley tagged in Hawaiian fishery, seven in Costa Rican longline fishery