Application methods, retention rates and preliminary results for two types of electronic tags used to study Atlantic halibut (*Hippoglossus hippoglossus*) in the Gulf of Maine

J. Kohl Kanwit[1] and Christopher Bartlett[2]

[1]Maine Department of Marine Resources: PO Box 8, West Boothbay Harbor, ME 04575 USA
[2]Maine Sea Grant/University of Maine Cooperative Extension: 16 Deep Cove Road, Eastport, ME 04631 USA

INTRODUCTION:

The Maine Department of Marine Resources, Maine Sea Grant and several participating fishermen received funding in 2007 to conduct an abundance and movement survey for Atlantic halibut (*Hippoglossus hippoglossus*) in the near-shore Gulf of Maine waters. Three types of tags were deployed on Atlantic halibut caught in this study; conventional wire tags, data storage tags (DSTs) and pop-up satellite archival tags (PSATs). Electronic tags were incorporated into this study in order to collect data on the temperature and depth preference of Atlantic halibut throughout their annual movements. Two types of electronic tags were used to determine the effectiveness and efficiency of both DSTs and PSATs in collecting the relevant habitat information. The methods developed for the application of the electronic tags, preliminary results from two PSATs and the results from a controlled retention and mortality study are presented here.

METHODS:

SURVEY DEIGN

A random grid design was developed for surveying the inshore Gulf of Maine for the presence of Atlantic halibut. All fish were captured using demersal longline gear set according to the project protocols. A total of 65 stations were fished between June and July of 2007 (Figure 1).

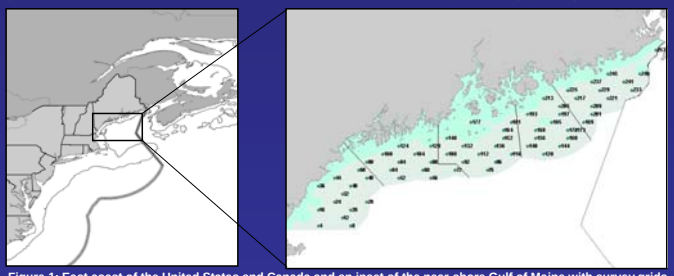

Figure 1: East coast of the United States and Canada and an inset of the near-shore Gulf of Maine with survey grids

PSAT CONSTANT DEPTH

These tags were programmed with a modified constant depth trigger designed to accommodate the demersal behavior of Atlantic halibut. The constant depth sensor was set for the minimal range of depth change possible (1.25 m). The assumption was that the change in pressure due to the daily tidal cycles in the Gulf of Maine would be enough to keep the tag attached to the fish even if it remained stationary for a prolonged period of time. This would eliminate the possibility of the tag coming off due to a mortality event and waiting the remainder of the year to transmit the archived data.

TAG RETENTION STUDY

In addition to the tags released in the field, a controlled tank study was implemented to test tag retention and mortality. Seven Atlantic halibut were transported live to a holding facility and allowed to acclimate for a minimum of two weeks. Dummy DSTs were applied to four fish and dummy PSATs were applied to three fish in the same manner as they were attached in the field (Figure 2).

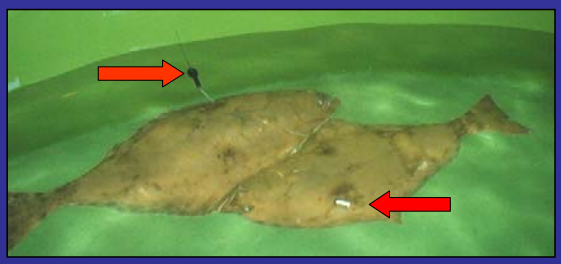

Figure 2: Captive halibut, one with a dummy PSAT and the other with a dummy DST

TAG ATTACHMENT

Most halibut were tagged with a conventional wire tag and a subset of fish also received a DST or PSAT (Figure 3). The attachment methods for both types of archival tags were first tested on a dead halibut to determine the best placement. Fish were tagged in the wild without anesthetic or specialized restraining systems.

The DSTs were attached to the fish using a "harness" system originally developed for Greenland halibut by Tone Vollen, Ole Thomas Albert (both of the Institute of Marine Research, Norway) and staff at Star Oddi. Star Oddi Milli tags were first attached to a plastic plate, backed with a silicone pad. This plate was then attached to the fish on the upper edge of dorsal side toward the head. Large, hollow, stainless needles (16 gage, 10 cm long) were used to puncture the fish from the underside and the attachment wires were then threaded into the needles and drawn through the body of the halibut. A back plate with a silicone pad was also applied on the underside of the fish and the wires were secured by tightly twisting the two ends together. The fish were released as quickly as possible and the procedure generally took less than two minutes.

The PSAT tethers were based on the designs developed for bluefin tuna in the Northwestern Atlantic (Molly Lutcavage, per. comm.). These tethers were constructed using an umbrella dart, developed by Michael Domeier of the Marine Conservation Science Institute, attached to Microwave Telemetry's X-Tag by 400 pound test monofilament secured with stainless steel crimps. This tether, along with a conventional wire tag with return information was sealed in surgical grade silicone tubing to create a smooth, uniform surface from the point of attachment to the tag. These tags were applied to the fish using a stainless steel tagging harpoon specifically designed to fit the umbrella dart. The darts were inserted directly below the apex of the dorsal fin on the topside of the halibut at approximately a 45º angle. Only fish larger then 106 cm were tagged due to information from the International Pacific Halibut Commission indicating that if the antenna touches the tail it can interfere with swimming behavior (Tim Loher, per. comm.).

Figure 3: From left to right - Atlantic halibut with DST and conventional tag (through first operculum), DST "harness" and applicator needles, PSAT and tether, Atlantic halibut with PSAT and conventional tag

RESULTS:

TAG RELEASES

Between June and July of 2007, 29 DST tags were applied to Atlantic halibut ranging in size from 51 to 145 cm. An additional four Atlantic halibut were tagged in the field with PSATs. As of October 1, 2007, no DST tags were returned, however two of the four PSATs had released prematurely and transmitted complete datasets.

PSAT CONSTANT DEPTH

Two of the PSATs that were deployed in the early summer of 2007 released after only two weeks and one month at large, respectively. Complete data sets for both tags were retrieved.

Fish number 34260 went to a depth of 120 m within the first day after release (Figure 4). Throughout the two week period the halibut remained at a fairly constant temperature (between 5 and 5.7ºC). Within the first 10 days this fish moved between 86 and 161 m in depth. After day 10, it apparently remained at a constant depth with the tag only registering a change of 0.16 m over the remaining five days, significantly less than the 1.25 m required to keep the tag attached.

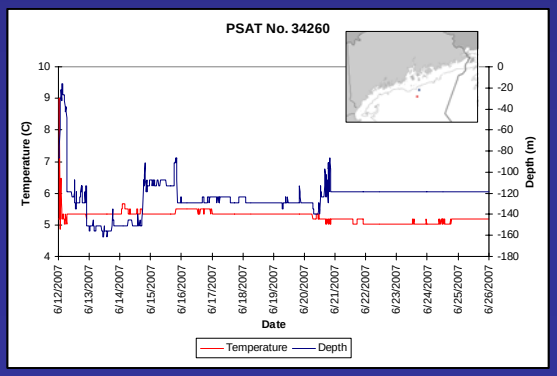

Figure 4: Temperature and depth profile for PSAT number 34260 and inset of release and "recapture" point

Fish number 34256 went to a depth of 70 m within the first day after release and remained in comparatively shallow water between 59 and 75 m (Figure 5). Throughout the month long period, the halibut remained within a 1.5 degree temperature range (between 6.2 and 7.7ºC). This tag recorded a depth change of more than five meters, 9.5 hours before it released. Therefore, it does not appear that the constant depth trigger caused the early release of tag number 34256.

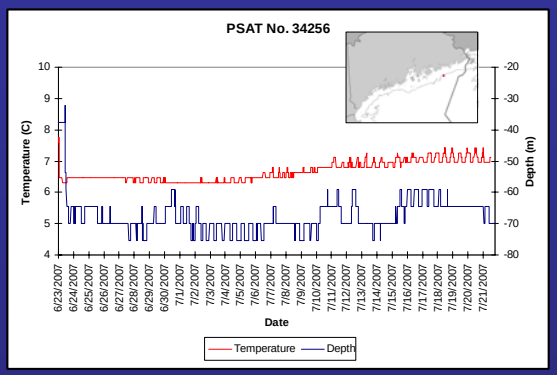

Figure 5: Temperature and depth profile for PSAT number 34256

TAG RETENTION STUDY

All seven fish that were transferred to the holding facility were healthy and active before and after the tagging events. The captive halibut were somewhat more energetic and difficult to handle than the fish tagged in the wild which was attributed to the wild fish being tagged immediately after they were caught on longline gear. The three fish that were tagged with the dummy PSATs experienced some localized bleeding that coagulated quickly. The darts appeared to hold well and anchor in the interstitial bones as designed. The PSATs did not interfere with fish movement and floated well away from their body and tails. Only one fish had a somewhat raw wound that persisted until week six. The tagging wounds on the other fish with PSATs healed within the first two weeks. The four fish that were tagged with DSTs had no visible bleeding, the wounds were very small and all had healed completely within the first two weeks. After three months of captivity all seven fish were alive and healthy with five of them accepting feed. All the tags remained secure and in place.

CONCLUSIONS:

The information provided by data storage tags will contribute significantly to our understanding of Atlantic halibut habitat preferences and movement in the Northwest Atlantic. These tags will complement the larger conventional tagging program that is ongoing in coastal Maine waters. The retention study, although small in scale, seems to indicate that halibut have high survival with both the DST and PSAT attachment methods used in this study. Further work needs to be done exploring the use of a constant depth trigger set to the smallest increment allowed by the PSAT model. Given the results from the retention study it might be appropriate to turn the constant depth sensor off.

Correspondence: kohl.kanwit@maine.gov or 207-633-9535