JIMAR, PFRP ANNUAL REPORT FOR FY 2004

P.I. NAMES:

Yonat Swimmer, Christofer Boggs, Marti McCracken National Marine Fisheries Service, NOAA-PIFSC

Richard Brill Virginia Institute of Marine Science/ National Marine Fisheries Service, NOAA

Randall Arauz, PRETOMA/Sea Turtle Restoration Program

PROJECT PROPOSAL TITLE:

"DIRECT TESTS OF THE EFFICACY OF BAIT AND GEAR MODIFICATIONS FOR REDUCING INTERACTIONS OF SEA TURTLES WITH LONGLINE FISHING GEAR IN COSTA RICA"

FUNDING AGENCY: PFRP/NMFS

1. Purpose of the Project and indicative results:

The objective of the proposed research was to determine the efficacy of a bait or gear modification that could significantly reduce the incidental capture of marine turtles in longline fishing gear. Specifically, we tested the effectiveness of blue-dyed bait in reducing sea turtle bycatch. An analysis of data made after 22 sets suggest that blue dye is not an effective sea turtle deterrent for longline fishing operations.

The research was also designed to understand survivorship and behavior of sea turtles post-capture by placing pop-up satellite archival tags on turtles release from longline fishing gear. Results of this are more fully described in the PFRP Progress report entitled "Survivorship, migrations, and diving patterns of sea turtles released from commercial longline fishing gear, determined with pop-up satellite archival transmitters".

2. Progress during FY 2004. Provide a discussion of accomplishments <u>and</u> problems.

I. Experimental Fishery:

Two longline excursions were held simultaneously from December 1 to December 15, 2003 in order to test the efficacy of blue-dyed bait as a potential sea turtle deterrent. Sets were randomly alternated between blue-dyed and untreated bait. The two boats fished in the same general area for the duration of the trips to reduce confounding variables that could influence turtle bycatch rates. The boats made 22 sets, nine with blue dye and 13 with untreated bait within the EEZ of Costa Rica (Figure 1) Turtle catch rates were relatively high for both bait types, with a similar average CPUE of 8.4 vs. 8.1 turtles caught for every 1,000 hooks deployed for untreated and blue bait sets, respectively (t=0.096, p=0.92). During both trips, 108 olive ridley turtles (*Lepidochely olivacea*) and 7

green turtles (*Chelonia mydas agassizi*) were caught. CPUEs recorded were similar to previously recorded CPUEs during observer programs on board the Papagayo Seafood fleet in this same general area.

Unfortunately, the overall catch rate, including target and non target species, was extremely low, averaging ca. 3.8% of the hooks for both boats. This was believed to be due to very warm water surface temperature (27°C) recorded throughout the fishing activities. This time of the year (late November) is the transition from the rainy to the dry season. Typically, cold waters from the south head north, which attracts abundant mahi mahi resources, the target of the Playas del Coco longline fishery. Apparently, oceanographic conditions this past year differed from previous years, confounding fishing predictability.

Because of low catch rates, due to warmer waters and possibly the blue dye, fishers required/demanded compensation, totaling approximately \$2300, which was an unfortunate expense. However, because of our willingness to provide this compensation, the fleet is willing to continue to test another method in the near future. In addition to poor catch rates due to unusual temperature regimes in the area, observers on board (Jorge Ballestero and Randall Arauz) had difficulty maintaining a deep blue color within the treated baits, even when squid was used exclusively. As the project progressed, other fish species (e.g. sailfish) were introduced as baits

Independent of the problems, however, we believe we have sufficient data to determine that simply dying bait blue is not an effective means to reduce turtle bycatch in the fisheries.

II. PSATs on Turtles:

We also tagged sea turtles with pop-off satellite archival tags in order to better understand the impact of the fishery interaction on survivorship and movements. This aspect of the research was conducted independently from the experimental fishery while on-board commercial fishing vessels. As of April, 2004, we have successfully tagged 10 sea turtles (9 olive ridleys, 1 green) incidentally captured in fishing gear, and 5 freeswimming "controls" to which the behaviors of longline-caught turtles could be compared. Tags remained deployed for approximately 2 months, after which time they apparently shed. Turtles' horizontal movements are not markedly different for longlinecaught turtles and controls (Figure 2).

Our results indicate that olive ridley turtles apparently survive their encounter with longline fishing gear at least for the first two months post-release. Turtles in this study that were incidentally-captured in longline gear (and for which we received some response from the satellite tag) all survived a minimum of 3.5 weeks, and most survived a minimum of six weeks post-release before the tag was shed.

In the one case for which we have data indicating a mortality (#38604), the turtle was tagged after it had been resting on the ocean surface and thus served as a "control". Perhaps as a result of "natural causes", we speculate that after approximately 5 weeks at liberty, the turtle sank to the bottom and remained on a coastal shelf or on a seamount at approximately 900 m for four days before the PSAT released to the surface (Figure 3). The PSAT performed exactly as programmed which we feel validates the utility of PSATs to identify delayed mortality.

Tag retention for PSATs in this study was disappointing, as the average time at-liberty (ca. 58 days) fell far short of our pre-programmed pop-off date set at one year. Despite the relatively short tracks, we believe this is sufficient in order to determine a mortality as a result of the hooking event incurred on the day of tagging. Curiuosly, PSATs attached with epoxy have remained attached to loggerhead (*Caretta caretta*) sea turtles incidentally-caught in the North Pacific Ocean for much longer periods of time (average=136 days; range=71-196). We see no obvious biological reason why the epoxy bond would differ between a loggerhead and an olive ridley carapace.

Early tag shedding may be explained by turtle-turtle interactions. The Gulf of Papagayo is an important breeding ground for the eastern Pacific population of olive ridleys, which nest either solitarily or in groups of 100 or more turtles ("arribada") from June through November. Both males and females are known to assemble in large groups prior to and possibly post-nesting. The majority (8) of the turtles we tagged were done so late in the breeding season, but reproductive behavior (i.e., turtle-turtle interactions) could explain early tag shedding due to the high density of olive ridleys.

3. Plans for the next Fiscal Year:

We plan to repeat the study with the following changes:

Instead of blue dye, treated gear will include a larger hook size, specifically a 14/0 or 15/0 Circle hook. In this experimental design, hook type can be alternated along the length of the line, which will reduce the potentially confounding effects of fishing on different days and locations. In future experiments, care will be taken to ensure that bait types do not differ within trips.

We are not planning to tag more turtles in this area.

4. List of Papers Published in Referred Journals during FY 2004.

5. Other Papers, Technical Reports, Meeting presentations, etc.

- 6.
- Swimmer, Y., Arauz, R., Musyl, M., Ballestero, J., McNaughton, L. and R. Brill. 2004. Survivorship and behavior of olive ridley turtles off the coast of Costa Rica following interactions with longline fishing gear. Poster presented at the 24th Annual Symposium on Sea Turtle Conservation and Biology22 - 29 February 2004, San Jose, Costa Rica.
- Swimmer, Y. and L. Mailloux. 2003. Bait Modification Research: Reducing Incidental Interactions between Sea Turtles and Longline Fishing Gear. 2003. In: Proceedings of the 54th Annual Tuna Conference. Lake Arrowhead, California, May 13-16. 2003.
- Swimmer, Y, Brill, R., Arauz, R., Mailloux, L., Musyl, M., Bigelow, K., Nielsen, A., Sibert, J. 2003. Surivorship and Behaviors of Sea Turtles after their release from

Longline Fishing Gear. In: Proceedings of the 54th Annual Tuna Conference. Lake Arrowhead, California, May 13-16. 2003.

- Brill, R. and Y. Swimmer. 2003. Laboratory Experiments Aimed at Reducing Pelagic Longline Interactions with Marine Turtles. In: Proceedings of the 54th Annual Tuna Conference. Lake Arrowhead, California, May 13-16. 2003.
- Swimmer, Y., Arauz, R., Musyl, M., Ballestero, J., McNaughton, L., and Brill, R. 2004. Survivorship and dive behaviour odf olive ridley sea turtles after their release from longline fishing gear off Coasta Rica. (manuscript in preparation).

7. Names of Students Graduating with MS or PhD Degrees during FY 2003 Titles of their Thesis or Dissertation.

n/a

8. For multi-year projects, provide budget for the next year on a separate page.

Our original grant was for \$12,100. Our remaining budget is \$7650. We request additional funds in order to repeat the original experiment using larger circle hooks. This will be more expensive than the original proposal due to the added expense of buying hooks and paying for labor involved in replacing smaller circle hooks for larger ones. See proposed budget below.

The revised budget for FY2005 to conduct experiments to test the use of large circle hooks is \$12,250. Given our current budget available (\$7650), we request \$4,600 for another year of funding.



Figure 1. Locations of 22 longline sets made during 2 trips off the coast of Costa Rica.

All 2004 der 5 : 0:00:25 anstations Projector: Reveate

Figure 2. Movements of 7 olive ridley turtles plus one green turtle (dashed lines) after release from longline fishing gear, and movements of 4 olive ridley turtles that were free-swimming prior to tagging (solid lines). Lines represent the shortest possible distance between tag deployment and pop-off location and are not meant to indicate turtles' tracked movements.



Figure 3. Depth data for olive ridley turtle # 38604 suggesting normal behavior After it was tagged on June 8, 2003, until the turtle apparently died and sunk on Aug. 13, 2003. The turtle and tagged remained on the seafloor for the required four days, then the tag floated to the surface and began to transmit its data to the satellite overhead.



Depth (m) for Tag 38604