INTERNATIONAL DOLPHIN CONSERVATION PROGRAM

SCIENTIFIC ADVISORY BOARD

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PROPOSAL TO STUDY THE TUNA-DOLPHIN ASSOCIATION

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1. Background

In the eastern tropical Pacific, large mixed-species aggregations of dolphins, tunas, sharks, and seabirds are common. Central to these aggregations are spotted dolphins (*Stenella attenuata*) and yellowfin tuna (*Thunnus albacares*). Tuna fishermen have exploited this association for many decades because the dolphins are easier to sight at a distance and make the tuna swimming beneath them easier to follow and catch. Pole-and-line fishermen would locate the dolphin herds, cued often by the presence of seabirds overhead, chum the water with live baitfish to attract the tuna to the surface, and then catch them with hook-and-line gear. By the mid 1960s, however, the pole-and-line fishery had largely been transformed into a purse-seine fishery, and the dolphins were no longer used just to find the tuna, but were actively chased and encircled to catch the tuna.

Over the long history of fishing tunas associated with dolphins and the intensive management-oriented research on the two species, we have attempted to answer pivotal questions about the tuna-dolphin association. In particular, managers of the fishery would keenly like to discover whether knowledge of the dynamics of the tuna-dolphin bond would provide a key to breaking the bond, thus allowing fishermen to make sets on large yellowfin tuna without encircling dolphins.

2. Previous Studies

The IATTC conducted a series of studies to answer questions about the tuna-dolphin association (Scott *et al.* in review, SARM-9-INF-A). In 1992-1993, chartered purse seiners captured spotted dolphins and yellowfin tuna; the dolphins were radio-tagged and the tuna were acoustic-tagged, and then both species were released. Three simultaneous tracks monitored their movements and their association for 1, 8, and 32 hours. We found that the association was not a permanent one; during the longest track, the tuna separated from the dolphins and did not re-associate with other dolphins (even when dolphin herds were sighted close by). We also found that the two species swam at different depths; during the day, the tuna swam at about the depth of the thermocline while the dolphins swam at a depth of 10-15 m. At night, the pattern reversed, with the tuna coming closer to the surface and the dolphins diving deeper to forage. While the study demonstrated that large yellowfin tuna do occur without dolphins, the sample sizes were too small to provide fishermen enough information to find and catch these fish without encircling the dolphins.

3. Proposed study

The proposed study will again attempt to simultaneously track tuna and dolphins. This study would provide larger sample sizes to confirm the results of the previous tracking study and to determine under what circumstances the tuna-dolphin bond is formed and broken, and to predict where and when large yellowfin tuna may be found when not in association with dolphins. In particular, this study will attempt to answer the following questions:

1. At what times of day does the tuna-dolphin association form and break down?

2. Once the tunas and dolphins have separated, do the large yellowfin tuna remain in cohesive schools and where can they be found?

This study would require a purse-seine vessel to capture both dolphins and tuna in the same set and a research vessel, capable of launching 4-8 m tracking launches, to track the animals. We would use the capture and tagging techniques that were shown to be successful in 1992-1993 (Scott and Chivers 2009; Scott *et al*., in review).

Dolphins would be captured by swimmers and outfitted with radio transmitters[1] and time-depth recorders (TDRs)[2]. These devices will be mounted on plastic saddles[3] and attached to dolphin dorsal fins with bio-compatible Delrin pins secured by corrosible magnesium nuts. The TDRs will record the time and the depth of the package every second; the dolphin must be recaptured to remove the package and recover the data. The range of the transmitter is over 20 km (Scott and Chivers 2009[4]).

The tuna will be tagged with pressure-sensitive sonic transmitters[5] attached to flat dart tips. Swimmers with lances will implant the dart tips into the dorsal musculature of the yellowfin tuna as they are being released from the net during backdown. The range of the acoustic transmitter is about 2 km.

We will attempt to release all the dolphins and tuna together, either by the normal backdown release procedure or by “dropping the ortza” from the boat to open the net. The tuna would be tracked using a hydrophone[6] towed from one or more of the research vessel’s launches. The pulse repetition rate of the pressure-sensitive sonic transmitter will be recorded and decoded, and the position of the launch, and the time and depth of the tuna recorded approximately every 5 seconds. Dolphins would be tracked using a radio receiver[7] and four-antenna array[8] mounted on the launches, the research vessel, and, if needed, the purse seiner. The two species will be tracked for one to several days (depending on weather) and the dolphins recaptured to recover the time-depth recorder and its data. The position, time, heading of the vessel, bearing to the dolphin, and signal strength will be recorded every 15 minutes. The purse seiner’s helicopter can also allow us to observe the behavior of the dolphins and tuna and monitor changes in dolphin herd and tuna school sizes. A Conductivity-Temperature-Depth profiler or an expendable bathythermograph will be deployed to measure depth and temperature from the research vessel approximately every 4 h to a depth of at least 200 m to compare the swimming depths of the dolphins and tuna with the depth of the thermocline.

To determine the circumstances under which the tuna-dolphin bond is formed and broken, and to predict where and when large yellowfin tuna may be found when not in association with dolphins, this study could also collect data on daily patterns of dolphin vocalizations that would complement a study proposed by Kurt Schaefer (IATTC) and Tomonari Akamatsu (Fisheries Research Agency, Japan). Their study proposes the attachment of acoustic data loggers on yellowfin tuna to detect the presence of dolphins by monitoring dolphin echolocation sounds. Because of the simpler logistics involved in capturing and tagging only the tuna (rather than having to capture both dolphins and tuna), large sample sizes would be possible. However, baseline data on dolphin echolocation patterns are required to distinguish between when dolphins are not present and when the dolphins are not echolocating. Therefore, we also propose to attach acoustic data loggers to the tracking package of the dolphins to determine what periods of the day and night they are vocally active and when they are not. As with the time-depth recorders, the dolphins would have to be captured to remove the data loggers to recover the data. This would not only provide additional information on dolphin feeding times and general activity levels (based on their echolocation and diving patterns), but also provide the necessary information to help in the programming of the Schaefer and Akamatsu acoustic data loggers and in the interpretation of their results.

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[1] MOD-050 HP transmitter, 148 MHz: Telonics, Mesa, Arizona, USA.
[2] Model Mk 9 TDR: Wildlife Computers, Redmond, Washington, USA .
[3] Molded polyethylene plastic saddle: Trac-Pak, Destin, Florida, USA .
[4] http://www3.interscience.wiley.com/cgi-bin/fulltext/121481244/PDFSTART
[5] Model V16P pinger, 50 kHz: VEMCO, Halifax, Nova Scotia, Canada.
[6] Models VR-28 receiver, VH-41 hydrophone, and VFIN depressor: VEMCO, Halifax, Nova Scotia, Canada.
[7] Model TR-2 receiver with a Model TS-1 scanner/programmer: Telonics, Mesa, Arizona, USA
[8] 4-element Yagi-Uda antennas, directional indicator: Advanced Telemetry Systems, Isanti, Minnesota, USA

4. Shiptime and Budget

The most expensive and critical piece of the study is the use of a tuna purse seiner for two months. However, it is possible that allowing a vessel to fish during closure periods may offer an incentive to cooperate in the research at a discounted rate.

Another potentially expensive piece of the study is the use of a satisfactory second vessel upon which to base the tracking operations. Previously research ships of the U.S. National Oceanographic and Atmospheric Administration (NOAA) have been used to track the dolphins and tuna; one advantage of these ships is that their costs are borne by NOAA. NOAA has been and continues to be supportive of cooperative research such as this, but due to the retirement of the San Diego-based ship *David Starr Jordan*, it is unlikely that any US research shiptime would be available prior to 2011.

Other Expenses	**US$**
Radio-tracking and sonic-tracking equipment	35,000
Computer and other equipment	9,000
Acoustic data loggers	25,000
Travel expenses, sea pay and overtime expenses	15,000
Contracts	6,000
Miscellaneous	10,000
Total	**US$ 100,000**