

**JIMAR/PFRP Annual Report  
FY 2004**

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**Project Title(s):** Trophic Ecology and Structured-Associated Aggregation Behavior in Bigeye and Yellowfin Tuna in Hawaiian Waters / Instrumented Buoys as Autonomous Observatories of Pelagic Ecosystems

**Funding Agency:** NOAA

**Purpose of Project.** This report covers work accomplished in these two interrelated projects that are designed to explore the dynamics of aggregations of tuna when they associate with various man-made structures and to elucidate the underlying biology that results in these types of aggregation/association phenomena.

**Progress during 2004.** Significant advances were made in all facets of the program.

- Captive tuna facilities were established at HIMB (Coconut Island) and a custom-built transfer tank was installed on the collection vessel. Fishing techniques were developed to capture yellowfin tuna in ways that would minimize capture stress. To date, on 12 collecting trips, 100 yellowfin have been successfully transferred into captivity and these animals have supported various aspects of the program's goals.
- Isotope/trophic status experiments. Stable isotope analyses of yellowfin and bigeye tuna collected in Hawaiian waters have demonstrated significant differences in the trophic status of similarly sized yellowfin and bigeye tuna and have shown a rapid change in isotope signatures in yellowfin between 35cm to 45cm FL. Captive tuna are currently being used to obtain isotope signature transition rates that will be used in the interpretation of isotope data collected from wild animals. Ongoing experiments with the captive tuna are showing very promising results and indicate significant differences in turnover rates between different body tissues (e.g., blood, white muscle, red muscle, liver). These preliminary data have been presented at several different symposia.
- Yellowfin tuna sonar target strengths. Captive tuna have been used to obtain sonar target strengths with the fish at various angles relative to the sonar beam. This was achieved by simultaneous video recording of animals as they passed through the sonar beam. These results are currently being analyzed and will be used to assist in interpretation of data acquired from the acoustic observatories when they are deployed during the subsequent phases of this research program. Similar results were also obtained during field trials aboard the R/V Opah. During these experiments, a Simrad EK 60 sonar was used to obtain target strengths of tuna aggregations associated with "S" FAD in Waianae.

Experimental fishing confirmed that the target strength measurements were obtained from schools of yellowfin tuna.

- Development of new types of electronic tags (“ecology tags”). Progress was made in two areas. The captive tuna were used to obtain passive acoustic recordings of the acoustic signature generated by the captive school of tuna. These data are currently being analyzed and will be used to assist in interpretation of acoustic data acquired around FADs in the open ocean. Second, we have recently reached an agreement with Dr. William Burgess (Greenfield Technologies, Santa Barbara, CA) to take delivery of his most recent version of an “acoustic collection tag” that is designed to collect and record the ambient sound field around aquatic animals. This tag will be tested to determine its ability to detect the acoustic signature of a school of captive tuna.
- Progress is also being achieved in developing a stomach pH transmitter. Three-way discussions are being conducted between our group, the German company that manufactures the pH probe and Vemco (Canada) who are considering engineering a sonic transmitter that will telemeter the pH data. A prototype device should be tested on captive sharks at HIMB within the next year.
- Design of a “Smart FAD”. Consultations have occurred between the PIs and Dr. Jules Jaffe (SIO) concerning the design and deployment of a prototype “Smart FAD” equipped with a 360-degree scanning sonar. Dr. Jaffe participated in field trips in Hawaii to familiarize himself with the conditions under which the prototype will be deployed and one PI (KH) visited Dr. Jaffe’s laboratory in La Jolla to assist in the preliminary design of the Smart FAD sonar. One of the few setbacks in the overall progress of the program is that Dr. Jaffe’s lab has experienced a reduction in the number of skilled technicians employed in his lab and hence progress on the production of the prototype is moving more slowly than anticipated.
- Acoustic monitoring of inter-FAD movements of Tuna. This phase of the research continues to be extremely successful and productive. We have maintained 100% VR2 (acoustic data logger) coverage of all 13 Oahu FADs and have repeatedly downloaded residence and inter-FAD movement data throughout the year. Significant insights are being obtained into the residence times and movement patterns of bigeye and yellowfin tuna within the FAD network around Oahu. These data are currently being prepared for publication and presentation at various symposia. Some tags are still being deployed and auxiliary funding has recently been acquired (from WPFMC) to expand the scope of this facet of the program to include Pacific blue marlin

#### **Plans for Next Fiscal Year.**

- Continued isotope work with captive tuna
- Additional target strength and acoustic signature tests with captive tuna

- Laboratory testing of various “ecology tags” (tuna and sharks)
- Deployment of prototype “Smart FAD”
- Analysis and publication of stable isotope data