JIMAR, PFRP ANNUAL PROGRESS REPORT
FY 2001

P.I. Name: Dr. Christofer Boggs
National Marine fisheries Service, Honolulu Laboratory
2570 Dole St., Room 212, Honolulu, Hawaii 96822
Phone(808)983-5370, FAX(808)983-2902
Email: Christofer.Boggs@noaa.gov

Project Proposal Title: Population Biology of Pacific Oceanic Sharks (#653457)

Funding Agency: JIMAR-PFRP NOAA Cooperative Agreement No. NA67RJ0154

1. Purpose of the project and indicative results.

This project will provide biological information needed for simulation models of shark populations and their ecosystem relationships, and for stock assessment of pelagic shark species taken by foreign and U.S. longline fisheries in the central North Pacific. The purpose is also to provide species identification and whole shark size estimation techniques that can be applied via monitoring of fins, as shark catches are poorly reported in many fisheries and fins are frequently the only identifiable portion of shark catches that ever reach shore. Evaluation of the population status of species other than the predominant blue shark requires novel approaches including simulations of productivity based on an understanding of differences in life history characteristics and ecology. Analyses of shark catch-per-unit- effort (CPUE) in relation to fishing depth and subsurface temperature structure provided from field studies deploying time-depth-temperature recorders (TDTRs) will be provided for CPUE standardization methods applying hook-depth versus vertical habitat structure. Habitat data will also be obtained through archival tagging. Archival tagging data will provide movement data needed to identify the range of stocks for stock assessment purposes as well as estimates of post-release mortality.

2. Progress during FY 2001.

The project continued to review the literature and consult with collaborators and advisors to identify the most important gaps in knowledge of the life history and ecology of oceanic sharks. With the advent of a ban on shark finning in the Hawaii longline fleet, utilization of fins as a tool to estimate total length of sharks was abandoned. Ecosystem modeling continued, focusing on the role of sharks as predators on turtles. Preliminary results indicated that non-removal of apex predators (like sharks) from the pelagic system by longliners might actually have a deleterious effect on turtle populations via increased predation from large individuals that were previously removed by longline fishers. The Ecosim model was reexamined in January of 2001, using more realistic estimates of turtle mortality, and found that cessation of longline fishing had little influence on turtle populations because fishing mortality and mortality due to removed sharks was roughly balanced.

A longline research cruise conducted in April of 2001 (in conjunction with JIMAR project 657062) resulted in the successful attachment of 14 blue sharks and 1 oceanic white-tip shark with popup archival tags. In addition, biological samples and morphometric measurements were obtained from blue sharks whenever a shark was believed to have a low chance of survival.

3. Plans for the next fiscal year.

This project will now focus on gaining knowledge of habitat preference and behavior mechanisms of pelagic sharks. We plan to equip 14 more blue sharks (in conjunction with JIMAR project 657062) with popup archival tags and to also attempt to design more successful methods of handling large oceanic white tip sharks, shortfin mako sharks, and silky sharks. Wire leader gear will be purchased and constructed so as to minimize losses of sharks due to line failure. The next attempt to attach popup archival tags is planned for April of 2002. After which, the data will begin to be retrieved and analyzed as it is reported from the ARGOS satellite system. Analysis should provide insights into feeding behaviors, geographic movement patterns, and mortality rates of pelagic sharks caught by longline gear. We will continue to collect biological samples and morphometric information from sharks terminally wounded during the capture process. This will allow us to provide associates with information for studies of growth and maturation, stock structure, trophic ecology, and species identification. Ecosystem modeling will continue with an emphasis on utilizing better estimates of trophic mechanisms affecting the diets of sharks and other apex predators.

4. List of papers published in refereed journals during FY 2001.

Musyl, M.K., R.W. Brill, D.S. Curran, J.S. Gunn, J.R. Hartog, R.D. Hill, D.W. Welch, J.P. Eveson, C.H. Boggs, and R.E. Brainard. 2001. Ability of archival tags to provide estimates of geographical position based on light intensity. Reviews in Fish Biology (*In Press*)

5. Other papers, technical reports, meeting presentations, etc.

Curran, D.S., and C.H. Boggs. 2001. The use of Intrinsic Rebound Potential Indices in Comparing Disparate Species Groups in the Central Pacific. Presentation at the 52nd Annual Tuna Conference, Lake Arrowhead, CA. May 21-25, 2001.

Abstract. A demographic technique formulated to compare the intrinsic rate of population increase in sharks is used across disparate species groups to evaluate its potential in creating a theoretical index of concern for pelagic species in the central Pacific Ocean. These rates (r2m) are a theoretical measure of a species ability to recover from fishing pressure. The method is useful in application to species where little documentation exists as to life history, migration patterns, and stock characteristics. Biological information on female age at maturity, maximum reproductive age, and average fecundity are the only parameters used in a density dependent population model to estimate a theoretical rebound potential for each species. The rebound potential (expressed as a doubling time of a population) for

pelagic sharks ranged from 10-36.2 yrs. The doubling time for large bodied, low fecundity, long-lived mammals ranged from 20.6-37.3 yrs. Relatively fast growing, fecund, short-lived mammals and fish ranged from 5-10.7 yrs.

Kaplan, I. 2001. Avenues to Recovery of Pacific Leatherback and Loggerhead Turtle Populations: Estimating the Relative Importance of Longline Effects vs. Other Anthropogenic Mortality. Presentation at the 52nd Annual Tuna Conference, Lake Arrowhead, CA. May 21-25, 2001.

Abstract. .Populations of leatherback (Dermochelys coriacea) and loggerhead turtle (Caretta caretta) have declined drastically over the last 10 years. The turtles are listed as endangered and threatened under the U.S. Endangered Species Act, and this status has led to closures and restrictions on the Hawaii-based US longline fleet. The two most likely causes for the turtles' declines are: 1) high mortality of subadults due to interactions with longline gear targeted at swordfish and tuna, and 2)hunting of eggs and adults on nesting beaches. We combined available estimates of demographic parameters, abundances and fishing-related mortality to construct population trajectories for the period from 1990 to 2000, using two model frameworks: a stage-structured Lefkovitch model, and an Ecopath/Ecosim dynamic mass-balance foodweb model. For each model, we estimated the additional mortality on the nesting beaches that would be necessary to cause the observed decline. The results of both models indicate that nesting beach mortality has an effect that is greater than or comparable to fishing mortality. This suggests that future conservation efforts should focus on preserving the nesting beaches as well as reducing longline bycatch of turtles.

6. Names of students graduating with MS or Ph.D. degrees during FY 2001. Include title of thesis or dissertation.

None.