

## JIMAR ANNUAL REPORT FOR FY 2008

**P.I./SPONSOR NAME:** Timothy E. Essington, Robert Olson, Mark Maunder, John Sibert

**NOAA OFFICE** (Of the primary technical contact): Pacific Islands Fisheries Science Center

**PROJECT PROPOSAL TITLE:** Intra-guild predation and cannibalism in pelagic predators: implications for the dynamics, assessment and management of Pacific tuna populations.

**FUNDING AGENCY:** Pelagic Fisheries Research Program

**NOAA GOAL** (Check those that apply):

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management
- To understand climate variability and change to enhance society's ability to plan and respond
- To serve society's needs for weather and water information
- To support the nation's commerce with information for safe, efficient, and environmentally sound transportation

**PURPOSE OF THE PROJECT** (One paragraph): The purpose of this project is to evaluate the importance of intra-guild predation and cannibalism on Pacific tuna population dynamics and the fisheries targeting them. The project goals are to (1) identify the sources, magnitude, and variability in predation on skipjack and yellowfin tunas, (2) determine the life history stages when predation by apex predators (tunas, sharks, marlins) has the largest impact on tuna populations, and (3) quantify biologically plausible responses of skipjack and yellowfin tuna populations to predation. Our approach for accomplishing these goals is to combine a research synthesis of the extensive historical and contemporary food habit studies of apex predators with simulation and mass-balancing modeling. The models can be used to explore the implications of predation and predator removals for management strategies and policy-relevant reference points. Additionally, the synthesis of food habits data for this project serves as a framework for the first comprehensive data repository of diet data for pelagic fish predators in the Pacific Ocean. This database will be shared with scientists worldwide.

**PROGRESS DURING FY 2008** (One-two paragraphs, including a comparison of the actual accomplishments to the objectives established for the period and the reasons for the slippage if established objectives were not met):

The second year of this project has focused on the completion of the predator food habits database and a coarse evaluation of the diet data. This has involved collating, organizing, digitizing, and analyzing historical and contemporary food habits data of tuna and tuna predators. To date, we have compiled summary data from 37 previously-published diet studies through an extensive literature search. The data contain diet information for 20 large-bodied predators, including seven species of sharks, five species of tuna, and three marlin species. The sampling years for these studies span nearly a 50-year time period, ranging from approximately 1950 – 2005. The study regions encompass the western, central, and eastern tropical Pacific Ocean. In addition, we have “rescued” and digitized historical records of primary diet data for apex predators collected in the eastern and central tropical Pacific Ocean (F.G. Alverson, ETP; Pacific Ocean Fish and Invert project (POFI), CTP). Further, we have nearly completed the collation of contemporary diet records for these fishes provided by researchers associated with the Inter-American Tropical Tuna Commission (IATTC), the ECOTAP research program (Etude du comportement des thonidés par acoustique et par pêche / study of tuna behavior using acoustics and fishing), CICIMAR (Centro interdisciplinario de ciencias marinas), and the NOAA - SWFSC (Southwest Fisheries Science Center). We’ve receive data from the POFI cruises near Hawai’i and begun digitizing those data records.

The project objectives established for the FY 2008 were to develop models of skipjack and yellowfin tuna populations and to assess the range of impacts that apex predators may have on stock productivity and on the values of key fisheries reference points. We have used skipjack tuna as a “test case” to develop the modeling framework that will link observed information on size-structure of predated individuals, the proportional contribution of tuna to predator diets, together with information on stock sizes and age structure. The model can then predict the proportion of individuals that are not consumed by a predator while it passes through the age/size ranges at which it is vulnerable. Skipjack tuna in the western pacific ocean “warm pool” is a particularly interesting test case, as a dominant component of pre-recruit mortality comes from large skipjack who cannibalize on them. Our modeling approach indicates that a small fraction (<10%) of pre-recruit skipjack tuna avoid being consumed by larger skipjack tuna during the 6 week period when they are of the size range that makes them vulnerable to cannibalism. This work is presently being written up for publication, and the model framework will then be used to explore predation impacts on yellowfin and skipjack in various ocean regions.

#### **PLANS FOR THE NEXT FISCAL YEAR (One paragraph):**

Our main objective for the next year is to utilize the completed food habits database to provide a more detailed description of predation on skipjack and yellowfin tunas and to estimate the sizes of tunas consumed by each predator species. We will use this information to conduct modeling exercises to determine whether it’s plausible for apex predators to have an impact on the reproductive output of these tunas. Upon completion of these tasks, we will tackle the subsequent objective of modeling the responses of skipjack and yellowfin tuna populations to predation and predator depletions

and exploring the implications of these interactions for fisheries management strategies. Manuscripts for peer-reviewed publication will follow shortly after the completion of each objective.

**LIST OF PAPERS PUBLISHED IN REFERRED JOURNALS DURING FY 2008**

No papers

**OTHER PAPERS, TECHNICAL REPORTS, ETC.:** None

**GRADUATES** (Names of students graduating with MS or PhD degrees during FY 2008; Titles of their Thesis or Dissertation):

None

**AWARDS** (List awards given to JIMAR employees or to the project itself during the period):

None

**PUBLICATION COUNT** (Total count of publications for the reporting period and categorized by NOAA lead author and Institute (or subgrantee) lead author and whether it was peer-reviewed or non peer-reviewed (not including presentations):

None

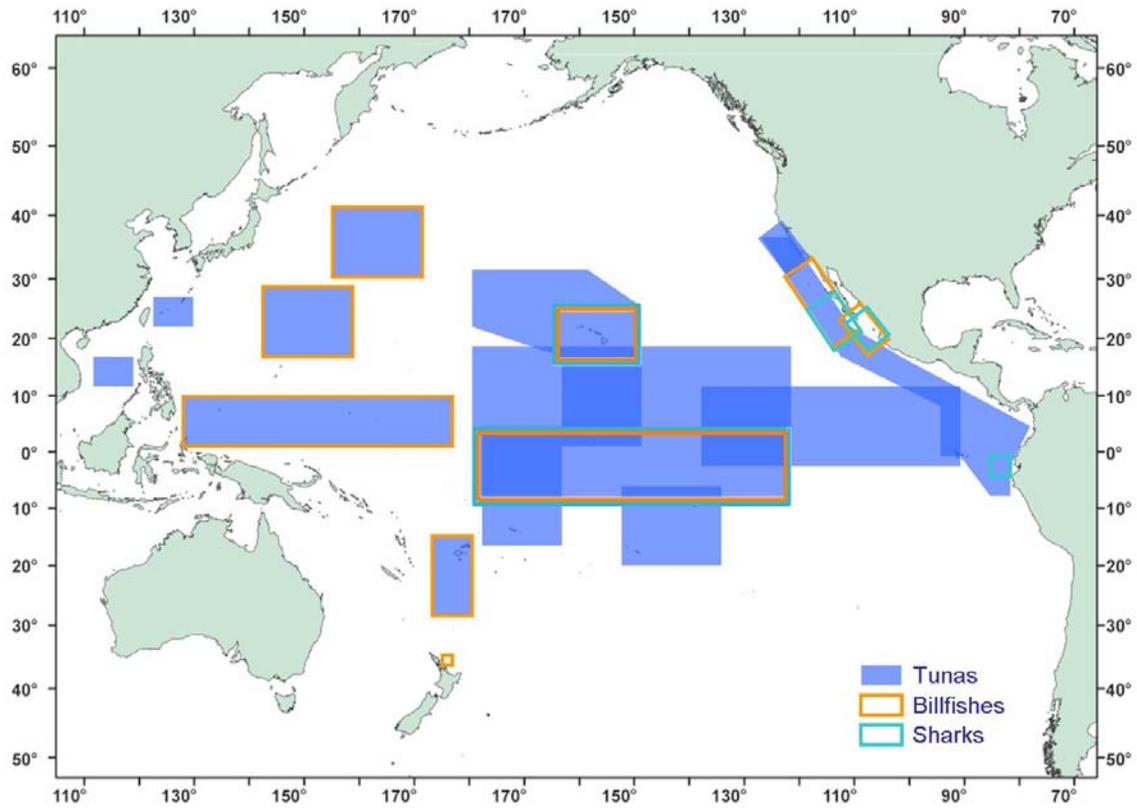
	JI Lead Author	NOAA Lead Author	Other Lead Author
Peer Reviewed			
Non-Peer Reviewed			

**PERSONNEL:**

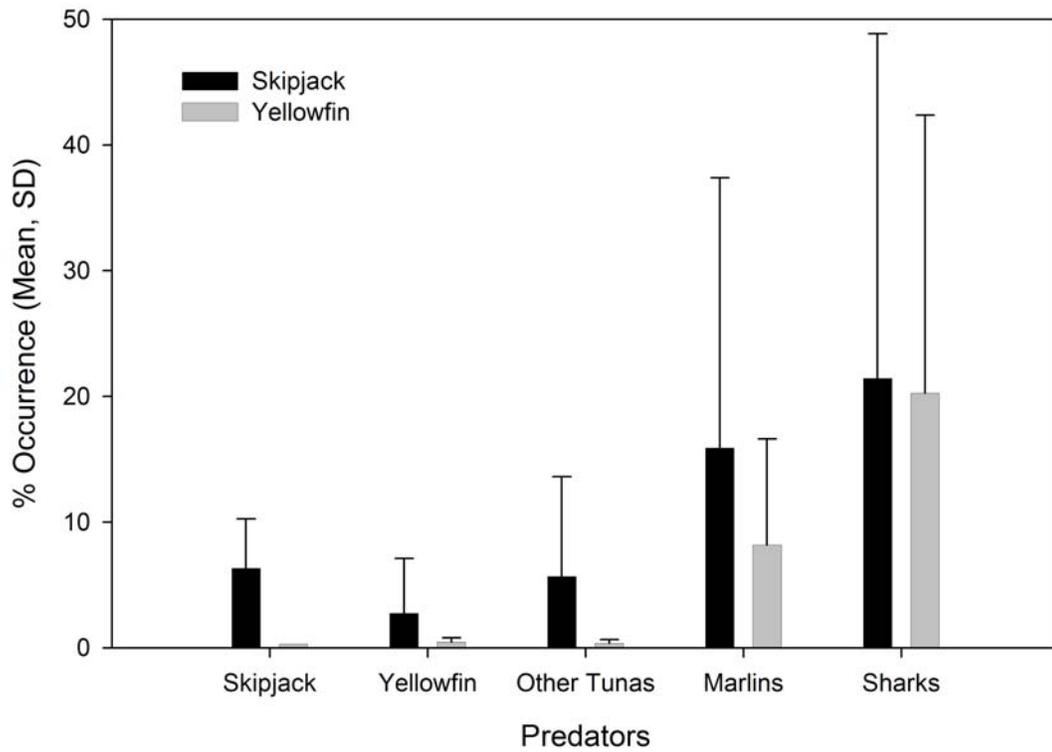
For projects that awarded subcontracts in the fiscal year, please provide the number of supported postdocs and students from each subgrantee.

Mary Hunsicker, a Ph.D. student at University of Washington, has been partially supported by this contract.

**IMAGES AND CAPTIONS** (We will also be including images for the annual report. Please send two of your best high-resolution, color images (photo, graphic, schematic) as a **JPEG or TIFF (300 dpi)** with a caption for each image. If you do not have an electronic version of the image, a hardcopy version may be dropped off at the JIMAR office located in the Marine Sciences Building, Room 312):



- Caption 1: Approximate locations of tuna, marlin, and shark diet studies that are compiled in the apex predator food habits database.



- Caption 2: The percent occurrence of skipjack and yellowfin tunas in the diet contents of apex predators captured throughout the tropical Pacific Ocean between the years 1950 – 2004.