

JIMAR – PFRP ANNUAL REPORT FOR FY 2007

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Project Proposal Title: Intra guild predation and cannibalism in pelagic predators: implications for the dynamics, assessment and management of Pacific tuna populations

Funding Agency: NOAA

NOAA Goal (Check those that apply):

- ☒ To protect, restore, and manage the use of coastal and ocean resources through ecosystem-base 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

1. Purpose of the Project (one paragraph)

Pelagic longline fisheries for tunas, sharks and marlins are unique compared to other fisheries in the world in that they catch a relatively narrow component of the food web. Although these piscivorous fishes constitute the apex predators in these ecosystems, many of these species also prey upon members of their own guild. The work we propose seeks to quantify the magnitude and nature of these "intra-guild" predation and cannibalism interactions and to explore their implications for tuna population dynamics and for the fisheries targeting them. Our approach combines a research synthesis of the extensive historical and contemporary studies that describe food habits of these fishes, with simulation modeling to quantify biologically plausible responses of skipjack, yellowfin, and bigeye tuna to fishery-induced depletion of their predators. The latter will include an explicit emphasis of the policy implications of alternative plausible representations of tuna population dynamics. Our project fits within the framework of the GLOBEC regional program CLIOTOP, trophic studies and modeling working groups. Moreover, our work addresses the third topic of PFRP's RFP of January 2006, and focuses on the highest ranking individual topic of the Ecosystem Integration session of the November 2005 PFRP Research Priorities Workshop.

2. Progress during FY 2007 (One-two paragraphs, including a comparison of the actual accomplishments to the objectives established for the period, and the reasons for slippage if established objectives were not met):

This project consists of two linked components: a synthesis of food habits data and a modeling effort that can be used to estimate the impacts of predation on tuna production. We describe our progress on each of these, in turn.

Food Habits Data: To date, we have compiled food habits data from twenty-nine published studies, which contain diet information for fifteen large-bodied predators, including tunas, marlins, and sharks (Table 1). The published data have been digitized by manual entry into an Access database. The data sources, at a minimum, contain information on the sampling time periods and ocean regions, the range of predator body sizes sampled, and the proportional contribution of tuna species to predator diets. When available, we recorded detailed information on individual samples such as predator body size, the precise location and date of collection and the size of tuna that was consumed. The sampling periods for the published studies span nearly 50 years, ranging from 1949 – 1996, and the study regions encompass the western, central, and eastern tropical Pacific Ocean (Table 1). The published data range from highly aggregated summaries to diet contents summarized by sampling region, season, and predator body size. Yellowfin and skipjack tuna are commonly identified to species level and thus these two species will be the focus of this project.

Modeling: We have developed a novel computational framework that allows us to simulate the impact of predators on juvenile fishes by calculating predation mortality on pre-recruited individuals. This framework has initially been developed based upon demographic data and feeding habits data of western Pacific Ocean skipjack tuna (where very high rates of cannibalism are common). Our initial model results suggest that only between 0.1% and 10% of individuals survive the period during which time their body lengths are 5 – 15 cm.

3. Plans for the next fiscal year (one paragraph):

The food habits database is near complete, and thus far, the majority of the data have been compiled from published studies. Although an important aim of this study is to recover and compile raw data from historical published diet studies and unpublished raw data. Historical raw diet data available from the IATTC is currently being digitized by a technician under the supervision of Dr. Robert Olson. Further, there are additional sources of unpublished data that will be paired with our database, including the extensive dataset collected through the PFRP-funded project, Trophic structure and tuna movement in the cold tongue-warm pool pelagic ecosystem of the equatorial Pacific, P.I.: Allain, Olson, Galvan Magana, Popp; the apex predator diet database of Secretariat of the Pacific (Valerie Allain, David Kirby); and the extensive shark food habits database of Enric Cortes at NOAA- SWFSC. These datasets will fill in the gaps of contemporary food habits data, particularly the sizes of tunas consumed by large-bodied predators. The modeling exercise will be greatly expanded in year two. First, we intend to make the static model dynamic, allowing for simulation of alternative fishing policy outcomes. Second, we intend to use this basic framework to apply the model to yellowfin and bigeye tuna in the Eastern Pacific Ocean.

4. List of papers published in refereed journals during FY 2007.

none

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

Essington, T. Hunsicker, M., Olson, R, Maunder, M. Allain, V., Kitchell, J. Cortes En.
Intra-guild predation and cannibalism in pelagic predators: implications for the
dynamics, assessment and management of Pacific tuna populations. 58th Tuna
Conference. Lake Arrowhead, CA. Oral Presentation

6. Graduates (Names of students graduating with MS or PhD degrees during FY 2007.
Provide titles of their thesis or dissertation):

none

7. Awards (List awards given to JIMAR employees or to the project itself during the
period): none

8. Publication Count (Total count of publications for the reporting period and previous
periods categorized by NOAA lead author and Institute (or subgrantee) lead author
and whether it was peer-reviewed or non peer-reviewed (not including presentations):

No publications this year

	JL Lead Author			NOAA Lead Author			Other Lead Author		
	FY05	FY06	FY07	FY05	FY06	FY07	FY05	FY06	FY07
Peer-reviewed									
Non-peer reviewed									

9. Students and Post-docs (Number of students and post-docs that were associated with
NOAA funded research. Please indicate if they received any NOAA funding. For
institutes that award subcontracts, please include information from your subgrantees):

Mary Hunsicker, Ph.D. student.

10. Personnel:

(i) Number of employees by job title and terminal degree that received more than
50% support from NOAA, including visiting scientists (this information is not
required from subgrantees): NA

(ii) Number of employees/students that received 100% of their funding from an OAR
laboratory and/or are located within that laboratory. none

(iii) Number of employees/students that were hired by NOAA during the past year:
none

11. Images and Captions. (JIMAR will be including images in the annual report. Please
send two of your best high-resolution, color images (photo, graphic, schematic) as a

JPEG or TIFF with a caption for each image. Hardcopies of images can be dropped off at the JIMAR office if no electronic versions are available.

- Caption 1:

- Caption 2:

12. For multi-year projects, provide budget for the next year on a separate page. Contact Dodie Lau to confirm whether or not your project is receiving continuation funds (e.g., year 2, year 3), and for budget preparation assistance, lau@hawaii.edu