JIMAR ANNUAL REPORT FOR FY 2010

P.I./SPONSOR NAME: Kevin Weng, Réka Domokos, Kim Holland, and Jeffrey Polovina

NOAA OFFICE (Of the primary technical contract): PIFSC

PROJECT PROPOSAL TITLE: Synchronous assessment of bigeye tuna (*Thunnus obesus*) and micronekton biomass, distribution, and movement patterns at Cross Seamount, and the effects of the seamount environment

FUNDING AGENCY: NOAA

NOAA GOAL (Check those that apply):

- [x] 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.

- [ ] Mission Support

PURPOSE OF THE PROJECT (One paragraph): Globally, seamounts play an important role in shaping the distribution of pelagic species, such as tunas and sharks. Cross seamount in the Hawaiian archipelago --- a seamount with a 5 nmi diameter 400 m deep plateau, rising from a 5000 m seafloor and lying in the path of the North Equatorial Current (NEC) and internal tides generated at the Main Hawaiian Islands chain --- is known to aggregate economically important fish such as juvenile and subadult bigeye tuna, a population which is heavily targeted by the local fishery. Reported moderate exploitation rates have recently raised concerns that the local fishery removes too many juveniles that could otherwise recruit to adult grounds and help maintain Pacific stocks. Since adult bigeye tuna are an important target species of both local and international fisheries, reducing recruitment into adult populations of bigeye could have wide ranging negative effects. These concerns call for closely monitoring the biomass of bigeye tuna aggregated at Cross Seamount. Since conventional fisheries dependent stock assessment methods are known to be inaccurate and biased, the current research undertakes the development of a fisheries independent method of bigeye tuna biomass estimation using active acoustics. Further, since populations of bigeye tuna depend on the biological and physical environment, the distribution, composition, and movement patterns of bigeye tuna forage, micronekton, as well as the effects of the unique environment at Cross seamount on both bigeye and micronekton, are investigated.
PROGRESS DURING FY 2010 (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):

All data analyzes for the effects of abrupt topography on ambient currents and on primary productivity, as well as the characterization of the effects of seamount environment on the spatiotemporal distribution and composition of micronekton, has been completed during FY09. A manuscript was being prepared for publication in a peer-review journal on this part of the project. During FY10, the manuscript was completed and submitted for publication.

Data analyzes during FY10 were focused on the characterization of the movement patterns and spatiotemporal distribution of bigeye tuna associated with Cross Seamount using quantitative analyzes. These analyzes confirmed that tracks that were detected using settings to eliminate fish tracks of other large fish, such as yellowfin and skipjack tunas, mahi-mahi, and ono, were successful. Mean acoustic target strengths (TS) for bigeye tracks during the FY07 and FY08 surveys were -30.16 and -30.61 dB, not significantly different from each other. These TS values correspond to 59.75 and 57.26 cm FL bigeye, corresponding to the mean size expected for the population associated with Cross Seamount. These same TS values would correspond to 99.42 and 95.42 cm FL yellowfin and a much larger skipjack, much larger than the expected mean sizes of yellowfin and skipjack found at the Seamount. Further, TS from tracks of fish swimming upward and downward showed a significantly lower and higher mean TS than fish swimming horizontally (Fig 1). These results correspond to TS measurements of bigeye that were previously published in the literature by researchers at Institute de Recherche pour le Développement (IRD), France.

To quantitatively describe the spatiotemporal distribution of bigeye, tracks were summed over 0.2 x 0.2 minute boxes for each hour over the entire survey area. The number of tracks for each bin was normalized by 1 km traveled by the ship. These maps reveal that over all, the highest densities of tracks were observed at the upstream edges of the plateau (Fig. 2), although the highest number of tracks was observed typically in mid-day during both survey periods. TS from bigeye tracks showed increasing TS values with depth, indicating that larger fish occupy deeper regions over the plateau. These results correspond to results of previous studies using data from tags and experimental and commercial fishing records. Further, the total number of normalized tracks was 1.5 times higher during the FY07 than the FY08 survey. The results of this part of the project indicate that true biomass estimates of bigeye over Cross Seamount is possible given that the acoustic data can be collected at speeds so each survey can be completed in an appropriately short enough time frame, which requires the ability of collecting clean acoustic data at relatively higher speeds (6-8 knots). However, relative biomass of bigeye associated with Cross Seamount can be monitored using the existing data in combination with data collected during surveys in the future.
As all data analyzes is completed, a manuscript on the bigeye tuna part of the project is being prepared for publication in a peer-review journal.

PLANS FOR THE NEXT FISCAL YEAR (One paragraph): Submit the bigeye part of the project for publication in a peer-review journal.

LIST OF PAPERS PUBLISHED IN REFERRED JOURNALS DURING FY 2010, in the following format: (Author or authors with last name and initials, publication year: Article title. Journal name, volume, page range.) For example: Charney, J.G., and A. Eliassen, 1964: On the growth of the hurricane depression. J. Atmos. Sci., 21, 68-75.

none

OTHER PAPERS, TECHNICAL REPORTS, ETC.:


Domokos, R., 2010. Characterization of the physical environment at Cross Seamount and its effects on bigeye tuna and its forage, micronekton. University of Hawaii, Department of Oceanography, graduate seminar series, February, Honolulu, HI


GRADUATES (Names of students graduating with MS or PhD degrees during FY 2010; 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):

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<th>JI Lead Author</th>
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PERSONNEL (on Subcontracts):
For projects that awarded subcontracts in the fiscal year, please provide the number of supported postdocs and students from each subgrantee. None

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: Kernel Densities of TS values from bigeye tracks with -45°, 0°, and +45° degrees from the horizontal (±22.5°) from data collected in 2007 (left) and 2008 (right). TS values are significantly different from each other between angles but not between years.

• Caption 2: Number of bigeye tracks summed over 0.2 x 0.2 minutes bins for the entire cruise periods in 2007 (left) and 2008 (right). Number of tracks are normalized by 1 km of ship track. Red arrows indicate the prevailing current directions during the two surveys. Contours indicate bathymetry at every 100 m, with the innermost contour at 400 m and the thick, white contour at 1000 m.

ACRONYMS: Please provide the complete descriptions for any acronyms used in any areas of the report. For example: UH (University of Hawaii)