

JIMAR – PFRP ANNUAL REPORT FOR FY 2005

P.I./Sponsor Name: Michael P. Seki and Jeffrey J. Polovina

Project Proposal Title: Oceanographic Characterization of the American Samoa Longline Fishing Grounds for Albacore, *Thunnus alalunga*

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

The American Samoa domestic longline fishery has undergone extraordinary growth, particularly in the fleet composition of large vessels (>50 ft. in length) that have fueled a fivefold increase in fishing effort and landings from 1999 to 2001. Prior to the sudden expansion, most longline fishing around American Samoa were accomplished through a fleet of smaller, 30-ft, open-decked catamarans known as *alia*. To illustrate the expansion, over 50 boats actively participated in the fishery during 2001 deploying 4,690 sets (over 5 million hooks) resulting in catch rates of about 40 fish/1000hooks. By comparison, only 23 vessels made up the fishery in 1999, making 2,102 sets (ca. 912,742 hooks) yielding 32.38 fish/1000 hooks. Albacore tuna, *Thunnus alalunga* is the target species in the fishery and dominates the catch.

Oceanographically there has been little study regarding the pelagic habitat in the American Samoa region. The current research undertakes the task of characterizing the pelagic habitat and fishing grounds occupied by the American Samoa longline fishery through the use of satellite oceanographic remote sensing and *in situ* shipboard surveys. Coupled with the oceanographic assessment will be fishery information to develop a functional understanding of the spatial and temporal occupation and movement tendencies of large South Pacific albacore and the role of the environment on longline gear performance and catch. These data include albacore depth distribution and gear performance obtained from commercial longlines instrumented with time-depth-temperature recorders (TDRs) and the set level catch information from the American Samoa fishery logbook program.

2. Progress during FY 2005

Analysis of all data sets collected for the assessment of physical processes affecting the American Samoa fishing grounds, as well as albacore distribution and longline performance, have been completed. Data used for this project included sea surface height along with derived geostrophic currents from Jason satellite data, American Samoa longline fishing logs, temperature-depth recorders (TDR's) attached to longline sets, popup satellite tags (PAT's) (see PFRP albacore vertical movement project by Polovina and Seki), and bioacoustic and CTD data (temperature, salinity, dissolved oxygen, and chloropigments) collected during an oceanographic survey aboard the NOAA ship *Oscar Elton Sette* in March 2004.

Results of the study thus far identifies the American Samoa fishing grounds as a dynamic region with strong mesoscale eddy activity that shows temporal variability on scales of less than 1 week. In addition, the South Equatorial Counter Current (SECC) --- a strong, eastward flowing jet with a pronounced intra-annual signature that traverses the northern section of the American Samoa Exclusive Economic Zone (EEZ) --- creates strong horizontal shear at its boundary regions with the westward flowing South Equatorial Current (SEC), resulting in dynamic instability which contributes further to the formation of eddies and meanders within the northern section of the EEZ on a seasonal scale. Longline albacore catch seem to be influenced by both the mesoscale eddy and intra-annual SECC variability; year round catch tended to be located at the eddy periphery while albacore catch per effort (CPUE) showed intra-annual variability with high CPUE during May through August relative to that during September through April. Further, during the May-August period, CPUE tended to be significantly higher in the northern half relative to the southern half of the American Samoa EEZ. This intra-annual variability in CPUE lags that of the SECC by about two months.

Vertical distribution information from PAT instrumented albacore within the EEZ show that the fish spend most of their time between 150 – 250m depth, corresponding to 25° - 21°C, with depths (temperatures) between 150 -300m (25° - 18°C) during the day and 0 – 200m (30° - 24°C) during the night. These daytime and nighttime depths of ~150 and ~250m correspond to depths of relatively high biomass – as estimated from acoustic backscatter – as well as to strong temperature and salinity gradients. TDR's attached to longline sets show that the American Samoa longline fleet target the 150 – 250m depth well.

The most prominent feature of the acoustic backscatter is the diurnal patterns of the vertical migrating sonic scattering layer (SSL) (Fig. 1). The SSL exhibited strongest scattering between 20 – 120 m during the nighttime and between 400 – 700 m during the day. While the nighttime 38 kHz backscatter (vertically integrated over the upper 200 m) show greater values than that acquired with the 120 kHz transducer, the daytime 200 m integrated 120kHz backscatter tend to be higher than the 38 kHz suggesting that the diurnal vertical migratory pattern is predominantly due to

relatively larger organisms (\geq 5-10cm); i.e., micronekton. Further, acoustic backscatter strength tended to increase toward the north at both 38 kHz and 120 kHz frequencies on a larger scale while showing some correlation of higher backscatter with eddy boundaries (Fig. 2). Between two meridional transects positioned 1.5° longitude apart from each other within the EEZ, the western transect had higher backscatter and corresponded to lower dissolved oxygen and higher chloropigments measurements than the eastern transect at both frequencies. Dissolved oxygen and chloropigments along both meridional transects exhibited a northward decrease and increase, respectively, although temperature and salinity profiles were relatively uniform from south to north.

The results of this work continue to be prepared for publication.

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

In FY 2006, a second shipboard survey will be conducted during the month of April to further examine the dynamic variability within the EEZ. Emphasis of the survey will be on the characterization of the SECC, which peaks in strength yearly during the months of March and April, and to further assess its effects on the American Samoa longline fishing grounds and longline performance in general and the distribution of albacore in particular.

4. List of papers published in refereed journals during FY 2005.

None

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

Domokos, R., D. R. Hawn, J. J. Polovina, and M. P. Seki (2004). American Samoa albacore tuna habitat and oceanographic characterization of the American Samoa fishing grounds. Presented at PFRP annual winter PI meeting, Nov. 29-Dec. 01, 2004, Honolulu, HI.

Domokos, R., D. R. Hawn, J. J. Polovina, and M. P. Seki (2005). American Samoa albacore tuna habitat and oceanographic characterization of the American Samoa fishing grounds. Presented at Tuna Conference, May 23-26, 2005, Lake Arrowhead, CA.

6. Graduates (Names of students graduating with MS or PhD degrees during FY 2005. 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)):

	JL Lead Author			NOAA Lead Author			Other Lead Author		
	FY03	FY04	FY05	FY03	FY04	FY05	FY03	FY04	FY05
Peer-reviewed				1	1	1			
Non-peer reviewed				1	0	0			

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):

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): None
- (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:

One – laboratory assistant

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: Nautical Area Scattering Coefficients (NASC, $\text{m}^2 \cdot \text{nmi}^{-2}$) from shipboard Simrad EK-60 echosounder measurements (38 and 120 kHz GPTs) aboard the NOAA ship *Oscar Elton Sette*, March 2004.
- Caption 2: Integrated (to 200 m depth) Nautical Area Scattering Coefficients (NASC, $\text{m}^2 \cdot \text{nmi}^{-2}$) from shipboard Simrad EK-60 38 kHz echosounder measurements overlaid onto concurrent weekly mean sea surface height (SSH) and derived geostrophic currents.

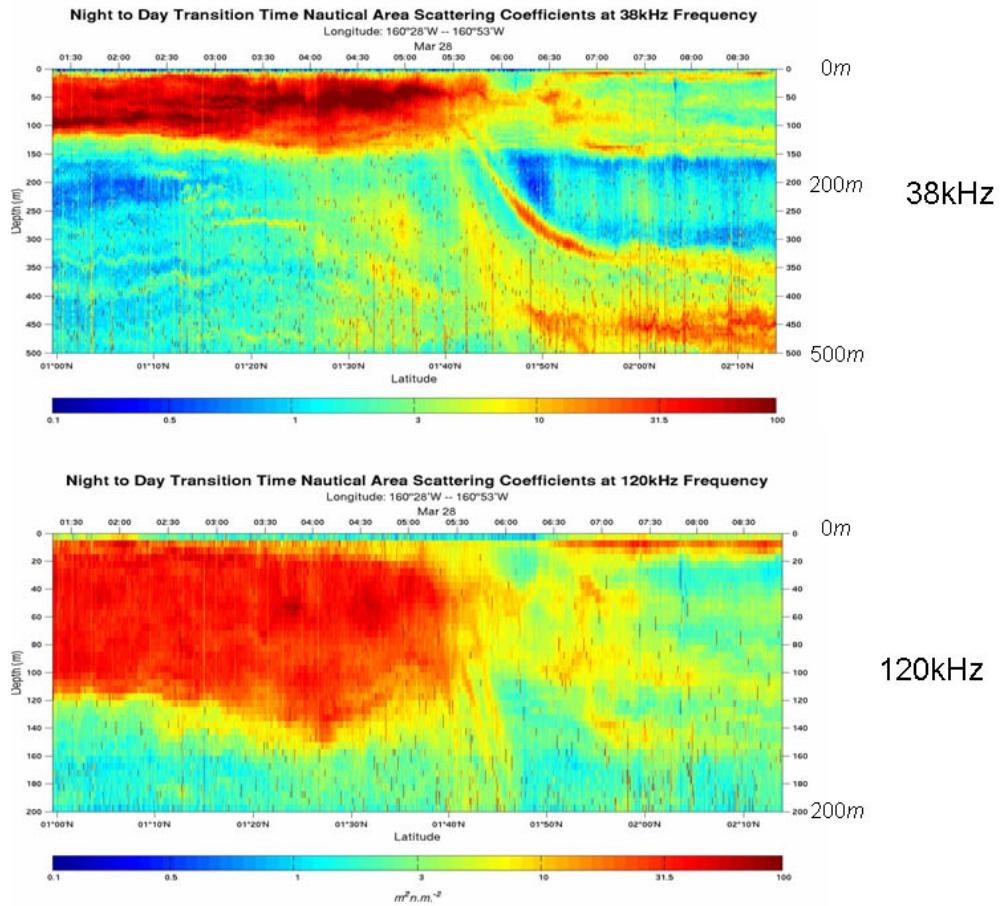


Figure 1. Nautical Area Scattering Coefficients (NASC, $m^2 \cdot nmi^{-2}$) from shipboard Simrad EK-60 echosounder measurements (38 and 120 kHz GPTs) aboard the NOAA ship *Oscar Elton Sette*, March 2004.

OES-04-03 200m Integrated 38kHz NASC and Weekly Mean SSH and Geostrophic Currents

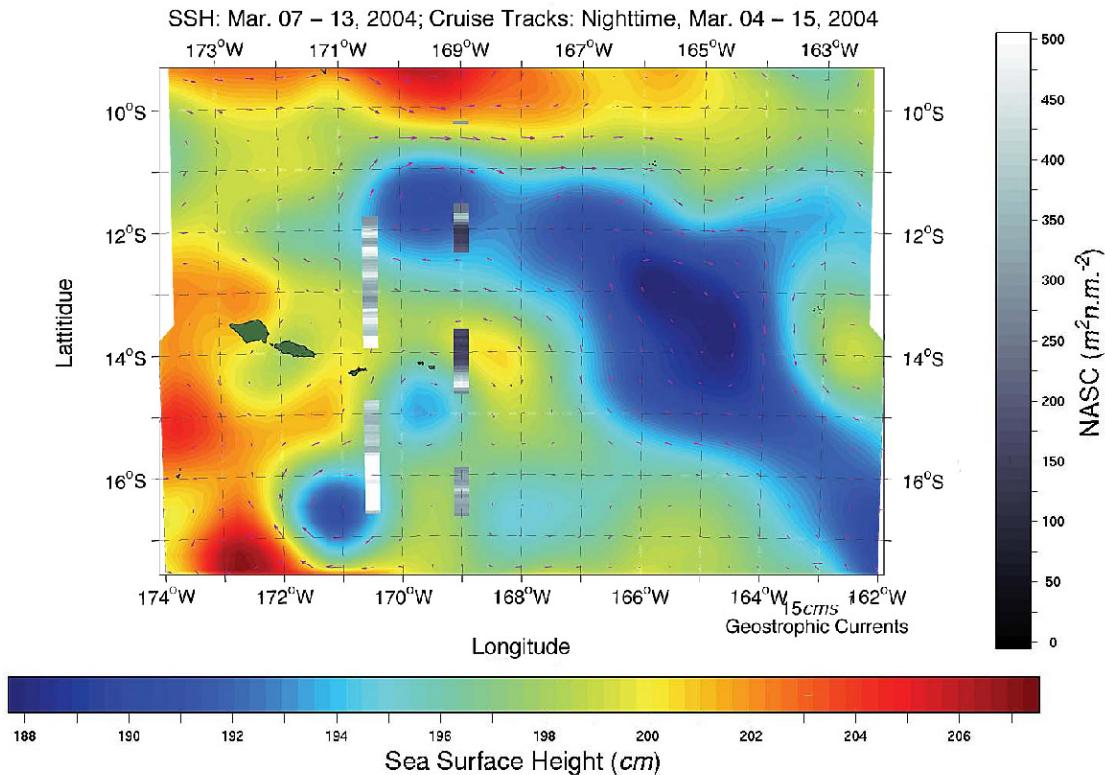


Figure 2. Integrated (to 200 m depth) Nautical Area Scattering Coefficients (NASC, $m^2 \cdot nmi^{-2}$) from shipboard Simrad EK-60 38 kHz echosounder measurements overlaid onto concurrent weekly mean sea surface height (SSH) and derived geostrophic currents.