JIMAR ANNUAL REPORT FOR FY 2008

P.I./SPONSOR NAME: Michael P. Seki, Jeffrey J. Polovina, and John Sibert

NOAA OFFICE (Of the primary technical contract): PIFSC

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-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 American Samoa domestic longline fishery has undergone extraordinary growth, particularly in the fleet composition of large vessels (>20 m in length) that have fueled a fivefold increase in fishing effort and landings from 1999 to 2001. The most intense period of the expansion occurred during 2001, when the total number of hooks set increased tenfold from 860 thousand during 2000 to 8.6 million in 2002. The target species of the longline fleet is albacore tuna, *Thunnus alalunga*, which dominates the catch. The fisheries performance for albacore peaked with 334 thousand fish caught during 2002, which was followed by a steep decline in 2003-2005 and a modest come back in 2006. 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, fishery information is used to develop a functional understanding of the spatial and temporal occupation and movement tendencies of large South Pacific albacore and its forage, micronekton, 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.

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):

Final analyses and results confirm that the South Equatorial Counter Current (SECC) strongly influences the American Samoa Exclusive Economic Zone (EEZ) and changes strength on a seasonal and ENSO cycle. Strong SECC is associated with a predominantly anticyclonic eddy field (r^2 between the strength of the SECC and the number and strength of anticyclonic eddy activity are 0.67 and 0.74, with $p = 0.009$ and 10^{-4}, respectively) as well as increased chlorophyll-a (Chl-a) concentrations, micronekton biomass, and catch-per-unit-effort (CPUE) for albacore tuna. The origins of the higher Chl-a concentrations and micronekton biomass in SECC waters relative to those in South Equatorial Current (SEC) waters are events that are taking place seasonally at the north coast of New Guinea, near the origin of the SECC. During boreal winter, northwesterly monsoon results in upwelling at the north coast of New Guinea and the reversal of the New Guinea Coastal Current (NGCC). The upwelling results in an increase in primary productivity, as evidenced from the SeaWiFS Chl-a maps (Figure 1, left panels). Most of the eastward flow in the NGCC feeds the SECC, which peaks a month or two later. Thus, waters relatively high in Chl-a concentrations feed the SECC, which carries the Chl-a rich waters to the east (Figure 1, right panels). It takes a minimum of 3-4 months for the SECC waters to reach the EEZ, during which time the higher Chl-a concentrations allow for the development of relatively high micronekton biomass. Observed differences in micronekton composition in SECC waters, relative to those in SEC waters, is consistent with having origins that differ from each other. Relatively stable anticyclonic eddies show a further increase in micronekton biomass, apparently advected in from neighboring SECC waters. The presence of forage presumably concentrates albacore, thus resulting in the observed increase in CPUE (Figure 2a).

During El Niños, the seasonal signals at the north shore of New Guinea and in the SECC, and the resulting eddy activity in the EEZ, are exceptionally strong. During the past 15 years, five of the six El Niños (top arrows in Figure 2b) correspond to unusually strong peaks of eddy activity in the EEZ, with $r^2 = 0.31$, $p = 10^{-3}$. As a result of the intensification of seasonal upwelling and the eastward velocities of the NGCC and SECC, waters reaching the EEZ during El Niño years are richer in Chl-a and micronekton concentrations than during non El Niño years (Figure 1, compare top and bottom panels). As years with the highest EEZ eddy activity correspond to El Niño years, El Niño years correspond to years with the highest albacore CPUE (Figure 2a). The correlation coefficient between the Southern Oscillation Index and albacore CPUE in the EEZ is significantly different from zero at >95% confidence level ($r^2 = 0.35$, $p = 10^{-4}$). Results of this work suggest that the strength of upwelling and the resulting increase in chlorophyll-a concentrations at New Guinea, the strength of the SECC, and the Southern Oscillation Index could be used to predict the performance of the local longline fishery for albacore tuna in the American Samoa EEZ.

PLANS FOR THE NEXT FISCAL YEAR (One paragraph): Final report.

LIST OF PAPERS PUBLISHED IN REFERRED JOURNALS DURING FY 2008, 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.

Domokos, R., 2008: Environmental effects on forage and longline fishery performance for albacore (*Thunnus alalunga*) in the American Samoa Exclusive Economic Zone. Submitted to *Fisheries Oceanography*

Prior to FY08:

Domokos, R., M. P. Seki, J. J. Polovina, and D. R. Hawn, 2007: Oceanographic Investigation of the American Samoa albacore (*Thunnus alalunga*) habitat and longline fishing grounds**.** *Fish. Ocean.*,16, 555-572.

OTHER PAPERS, TECHNICAL REPORTS, ETC.:

Domokos, R., 2008: Environmental effects on forage and longline fishery performance for albacore (*Thunnus alalunga*) in the American Samoa Exclusive Economic Zone. Presented at SEAFACTS-ICES Symposium on the Ecosystem Approach with Fisheries Acoustics and Complementary Technologies, June 16-20, Bergen, Norway.

Domokos, R., 2008: Environmental effects on forage and longline fishery performance for albacore (*Thunnus alalunga*) in the American Samoa Exclusive Economic Zone. Presented at the 59th International Tuna Conference, May 19-22, Lake Arrowhead, CA.

Domokos, R., 2007: Environmental effects on forage and longline fishery performance for albacore (*Thunnus alalunga*) in the American Samoa Exclusive Economic Zone. Presented at the FPRP PI workshop, Nov. 18-19, Honolulu, HI.

Prior to FY08:

Domokos, R., J. J. Polovina, and M. P. Seki, 2006: Oceanographic Influences on Albacore and its Forage in the American Samoa Longline Fishing Grounds. Presented at PFRP annual winter PI meeting, Nov. 14-17, Honolulu, HI.

Domokos, R., J. J. Polovina, and M. P. Seki, 2006: Oceanographic Influences on Albacore Catch Rates in the American Samoa Longline Fishery. EOS, Trans. Am. Geophys. Union, Vol. 87, no. 36, suppl., September.

Domokos, R., J. J. Polovina, and M. P. Seki, 2006: Oceanographic Influences on Albacore and its Forage in the American Samoa Longline Fishing Grounds.

Presented at the 57th International Tuna Conference, May 22-25, Lake Arrowhead, CA.

Domokos, R., J. J. Polovina, and M. P. Seki, 2005: Oceanographic Influences on Albacore Catch Rates in the American Samoa Longline Fishery. Presented at PFRP annual winter PI meeting, Nov. 14-15, 2005, 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 the 56th International Tuna Conference, May 23-26, Lake Arrowhead, CA.

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, Honolulu, HI.

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):

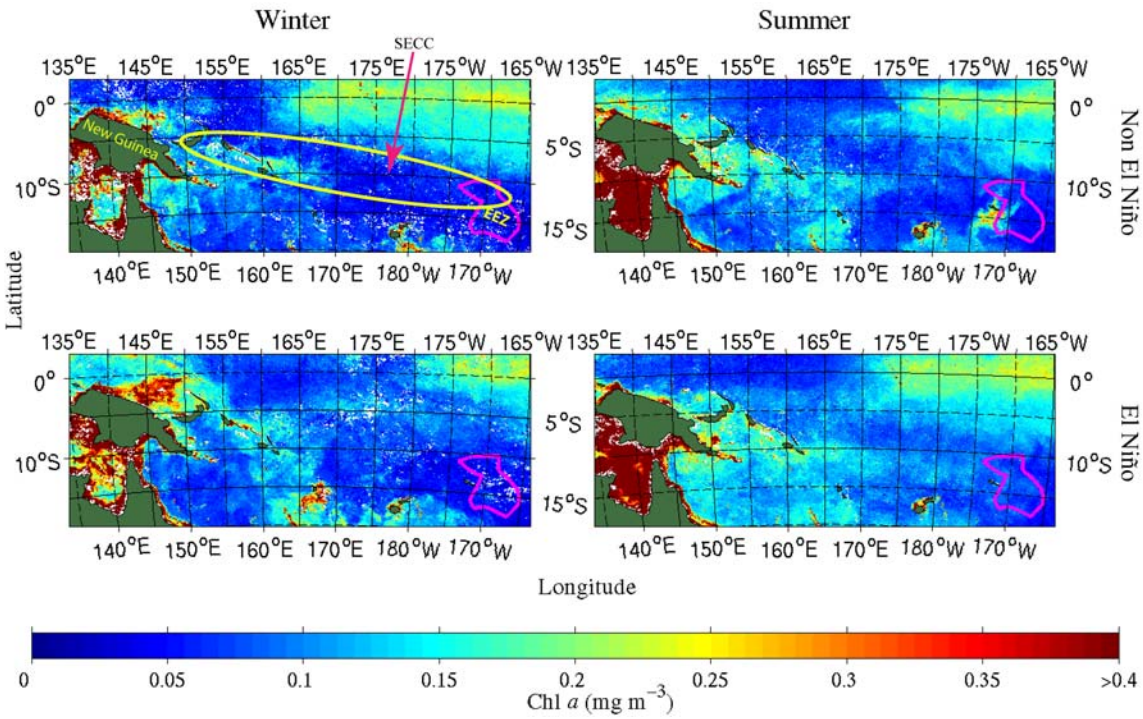
	JI Lead Author	NOAA Lead Author	Other Lead Author
Peer Reviewed		1	
Non-Peer Reviewed			

PERSONNEL:

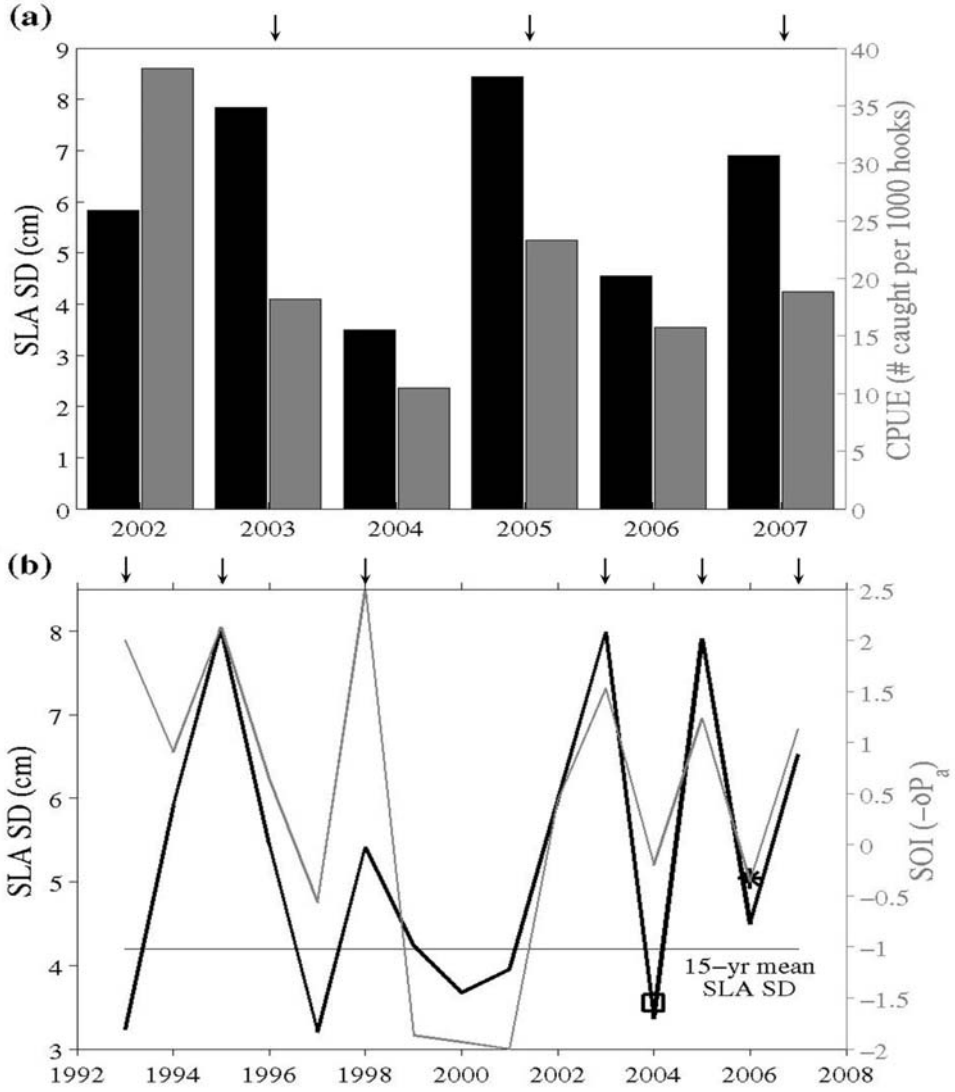
For projects that awarded subcontracts in the fiscal year, please provide the number of supported postdocs and students from each subgrantee.

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:Example of monthly sea surface chlorophyll-a concentrations, proxy for primary productivity, at New Guinea and in the SECC in winter (left) and summer (right) during non El Niño (top) and El Niño (bottom) conditions. The borders of the American Samoa EEZ are shown at the lower right of the maps in magenta. Months are selected to show the largest Chl-a bloom at the north coast of New Guinea during winter and the furthest eastward extent of the relatively high Chl-a in the SECC during summer for a given year. Top row: January and June, 2002; bottom row: February and July, 2003.



- Caption 2: Time series of mean sea level anomaly standard deviation (SLA SD, the measure of eddy activity in the EEZ) (a) with albacore CPUE in the American Samoa EEZ and (b) with the Southern Oscillation Index. Means are calculated over the peak three-month periods for SLA SD (March-May) and CPUE (April-June), and for the three-month period for the previous Oct-Dec for SOI, the peak

of El Niño influence at the origin of the SECC. Years in (a) represent post-expansion times only. Top arrows indicate El Niño events, while the horizontal line in (b) represents the peak-time mean weekly SLA SD for the same period.