Environmental effects on forage and longline fishery performance for albacore tuna in the American Samoa EEZ

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(Fisheries Oceanography, 18:6, 2009)
Background

• Motivation
  – exponential growth of fishery targeting albacore
  – Seasonal and interannual variability in albacore CPUE

• Previous results* suggest
  – seasonally and interannually varying South Equatorial Counter Current (SECC) has significant effects on fishery performance for albacore
  – distribution of albacore forage plays an important role

*Domokos et al., 2007
Objectives

- Investigate the characteristics of the SECC
- Investigate the effects of the SECC in the American Samoa EEZ on
  - the environment
  - micronekton composition, distribution, and biomass
  - albacore CPUE
In situ data

- Micronekton:
  - Simrad EK60 (38 & 120 kHz) acoustic system
  - Midwater trawl samples

- Environment:
  - ADCP (75 kHz)
  - CTD (T, S, DO, Chl)

Satellite data

- AVISO altimetry (SLA & \( \bar{u}_g \))
- SeaWiFS ocean color (Chl-a)
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Strength of SECC and # of anticyclonic eddies: $r^2 = 0.67$, $p = 0.009$

Strength of SECC and strength of anticyclonic eddies: $r^2 = 0.74$, $p = 10^{-4}$
Satellite Cloud Image of the Pacific Ocean

SPCZ

ITCZ

(from Tomczak and Godfrey, 1994)
Pelagic Fisheries Research Program

- warm pool
- SPCZ
- SECC
- NGCC

Pacific Islands Fisheries Science Center
Ecosystems and Oceanography Division
Pelagic Fisheries Research Program
Correlation between SOI & SLA SD from 1992 to present:
$r^2 = 0.31$, $p = 10^{-3}$
Correlation between SOI & CPUE: $r^2 = 0.35$, $p = 10^{-4}$

Winter

Summer

Chl a (mg m$^{-3}$)
Conclusion

• During peak times, SECC carries Chl-a rich waters towards east from upwelling regions at NGCC
• Enhanced primary productivity in SECC allows for an increase in micronekton biomass, reaching the EEZ
• Anticyclonic eddies advect Chl and micronekton from surrounding SECC waters
• Seasonal signals in primary productivity at NGCC and strength of SECC are exceptionally strong during El Niños
• Albacore CPUE in EEZ and strength of SECC positively correlate with El Niño events
• Observed micronekton biomass in the SECC and albacore CPUE are most likely linked by higher concentration of albacore in presence of forage
• Results indicate that the local longline fishery performance for albacore may be predicted from
  – strength of upwelling and eastward velocity of NGCC
  – Chl-a concentrations in the NGCC and SECC
  – Strength of the seasonal intensification of the SECC
  – SOI