Appendix D1: Spillover Effect of Sea Turtle Regulation in Hawai'i Longline Fisheries

Spillover Effect of Sea Turtle Regulation in Hawaii Longline Fisheries

1. Domestic issue --Trade-off between fishery and turtle protection

2. International issue -- Spillover effect of turtle protection

Pacific Islands Fisheries Science Center

PR Economic Supports from PIFSC

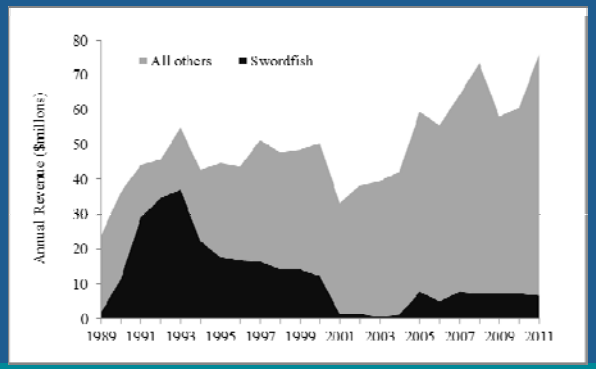
	Interaction	Data Support	Analysis /Studies
Marine Mammals			
False Killer Whales	Hawaii Longline	√	
Hawaiian Monk Seal	Hawaii small boats	√	
Spinner Dolphins	Hawaii tourists	√	√
Sea Turtles			
Loggerhead & Leatherback	Hawaii	√	√

Leatherback & Loggerhead Interactions with Longline

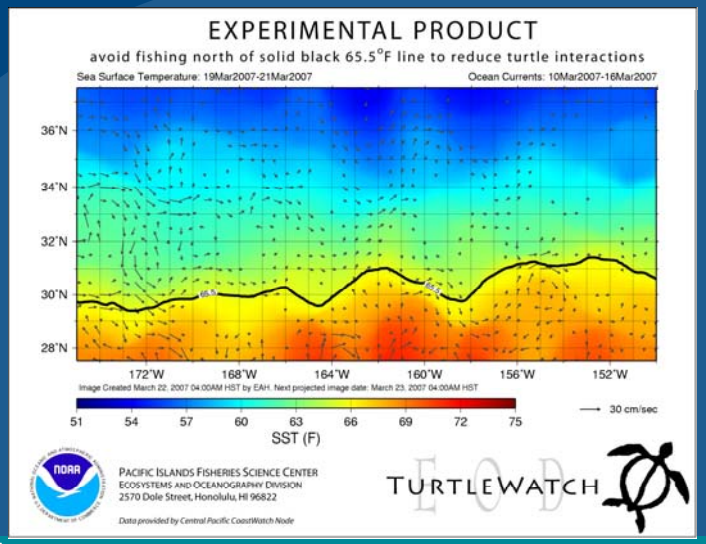
- Lawsuit in 1999 led to complete closure of the swordfish in 2001
- Re-open with new regulations in 2004
  - Use circle hooks (not J hooks)
  - Use fish as bait (not squid)
  - 2120 sets effort limits (< 50% historical level)
  - 17 loggerhead or 16 leatherback limit 2004 – 2012
- Unstable fisheries
  - 2006 & 2011 fisheries was closed b/c turtle interactions reached the caps
  - 17 loggerheads in March 17; 16 leatherbacks in Nov. 15

Economic Impacts under Current Policy

- Economic loss – Foregone fishing opportunity
  - Lower production
  - The sudden closure resulted in bad market conditions



Turtle Watch Analysis - SST 65.5 °F



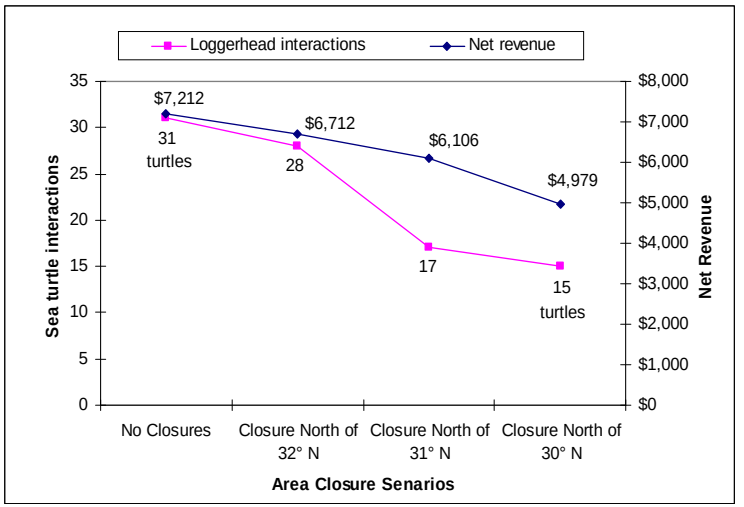
The Spatial & Temporal Economic Model to Exam the impacts of alternative policy Options

- To understand the trade-offs
  - ✓ Sea turtle interaction reduction vs. economic returns
- Predicted sea turtle interactions associated with fishing efforts
  - ✓ A few observations (5-100% observation rates) on sea turtles interactions
  - ✓ Need to build a model to estimate turtle bycatch rate associated with fishing effort
  - ✓ Model was built by the scientists in PIFSC using GAMs model
  - ✓ Modified to predict sea turtle interactions associated with SST, location, moon face, & season
- To build a net revenue function
  - Built a cost-function to related fishing activities
  - Historical average CPUE by season and location & recent fish price

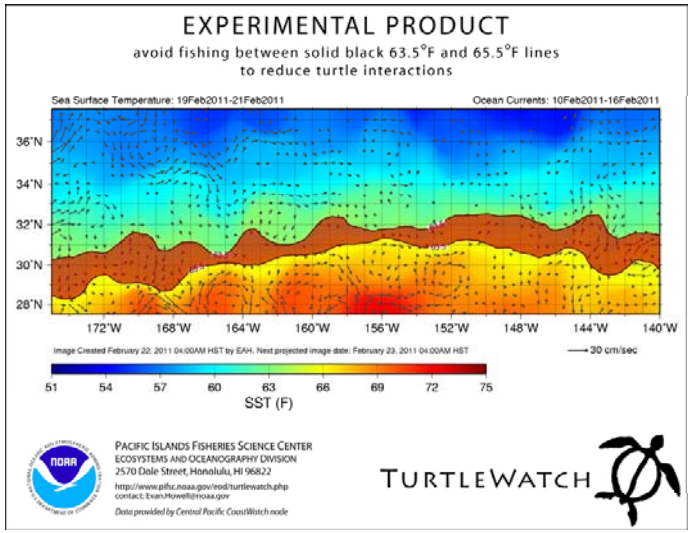
Model Applications – Analyzing Tradeoffs Through Scenario Simulations

- Control Policy for Fisheries Management
  - ✓Seasonal closure
  - ✓ Area closure
- Trade-off under different polices
  - ✓Net revenue from fishing
  - ✓ Sea turtle interactions

Trade-offs under Different Options of Closure



Turtle Watch in the Science Center Website

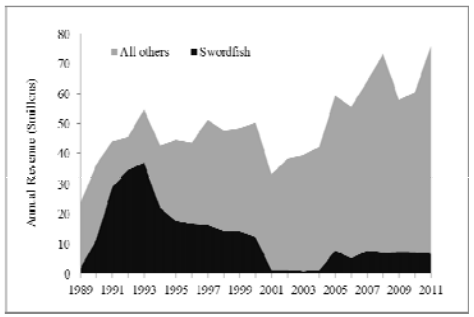


Spillover Effects of Sea Turtle Protection: The Case of the Hawaii Swordfish Longline Fishery

Hing Ling Chan and Minling Pan

Economic Impacts under Current Policy

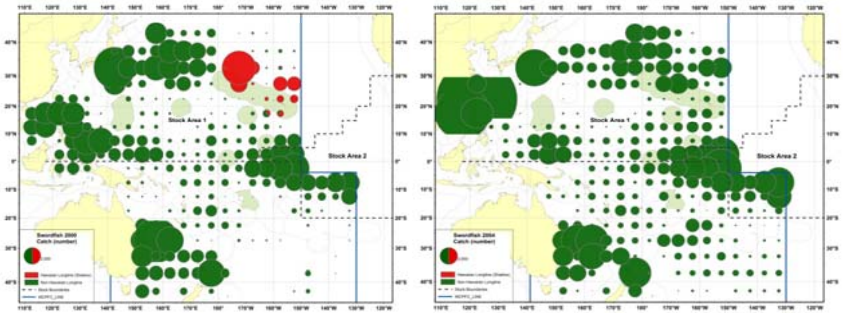
- U.S. consumed more swordfish that it produced
  - ✓ Foreign imports increases
  - ✓ Spillover effect, more imports, more turtle were caught (Rausser 2008)
- Foreign productions
  - ✓ Production displacement



Shared Stock with Other Countries

Before the closure

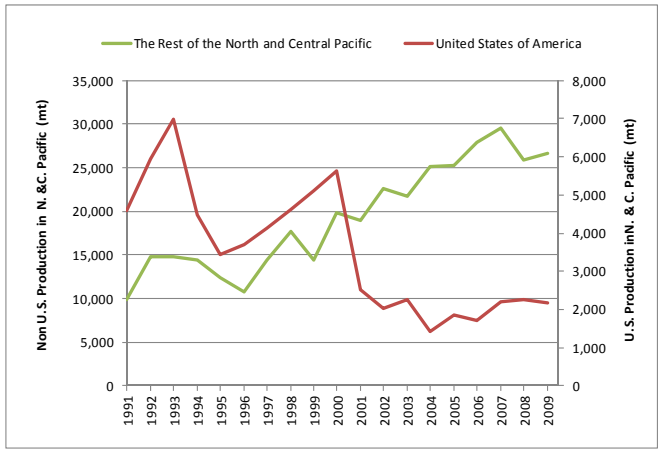
Four years later



Swordfish catch distribution in 2000
- ✓Red represents Hawaii catch
- ✓ Green catch by other countries

Swordfish catch distribution in 2004
- ✓Same catch but caught by other countries

Swordfish Production – U.S. vs. Non-U.S



Models for the Estimation the Spillover Effect (Displacement in Production)

1. Test the correlation between non-U.S. and U.S. production from 1991 to 2009

   X_j *U.S. production*

   Yj non-U.S. production

2. The trend for non-U.S. production without any regulatory impact by U.S. production 1991 to 2000, then predicted Y after 2001

$$Y_j = a + bT$$

3. How did non-U.S. swordfish production indeed respond to the changes of U.S. production from 2001 to 2012

$$Y_t - \hat{Y}_t = c + d\,X_t$$

4. 1 to 1 production replacement was found

SPILLOVER EFFECTS in the HI Longline Fishery

	All Countries Turtle Interactions	Reduction in Turtle Interactions from Current (Value)	Reduction in Turtle Interactions from Current (Percent)
Current sea turtle interactions	1866	-	-
Scenario 1: Hawaii shallow-set longline swordfish fishery production increases to 5500 sets with one-for-one replacement of foreign production	1645	221	12%
Scenario 2: Production by all countries if all had the same bycatch rate as the Hawaii shallow-set longline swordfish fishery	333	1533	82%

Happy Ending?

- New BiOp was published with higher sea turtle caps and won over the court case (hearing in July 25 2013)
- Turtle caps increase

✓Leatherback turtle cap 16 to 26

✓Loggerhead turtle cap 17 to 34