Analyses of Observer Program Data for the Hawaii-based Longline Swordfish Fishery

- Effects of sea turtle regulations on (i) sea turtle interactions, (ii) catch rate of retained marketable species, and (iii) catch rate of sharks; and
- Comparison between 2005 and 2006 turtle catch rates and temporal distribution of effort to explain the cause of a loggerhead cap being reached in 2006 but not in 2005.

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Comparison Between Two Periods

i) 2 March 1994 -- 20 Feb 2002
ii) 3 May 2004 -- 19 March 2006
Differences in Fishing Methods and Gear Between the Two Periods

(a) 9/0 J hook (left) 4.0 cm-narrowest width. 18/0 circle hook (right) 4.9-cm narrowest width.

(b) Squid vs. fish for bait

(c) Blue-dyed vs. untreated bait

(d) Timing of gear setting and retrieval

(e) Turtle abundance at fishing grounds

Confounding factor prevent making definitive conclusions regarding single factor effects on turtle and fish interactions.
Turtle CPUE Pre and Post Turtle Regs

CPUE (number caught turtles per 1000 hooks)

- All turtle species pre regs: 0.25 decline
- All turtle species post regs: 0.2 decline
- Loggerhead pre regs: 0.15 decline
- Loggerhead post regs: 0.1 decline
- Leatherback pre regs: 0.05 decline
- Leatherback post regs: 0.0 decline
Proportion of Turtles Tangled vs. Lightly Hooked vs. Deeply Hooked Pre and Post Turtle Regs

Hardshelled turtles pre regs (left), post regs (right)
Difference was not significant.

Leatherbacks pre regs (left), post regs (right)
Difference was not significant.
Pre regulations 40% of hooked turtles were released after removing all terminal tackle (N = 178). Post regulations 67% of hooked turtles were released after removing all terminal tackle (N = 33), difference was significant.
Sea turtle capture rates in the Hawaii-based pelagic longline swordfish fishery for combined turtle species, loggerhead turtles and leatherback turtles for first quarters of 2005 and 2006.
Turtles Dead vs. Alive Pre and Post Turtle Regs

Pre-regs 2 dead, 215 alive
Post-regs 0 dead, 38 alive
Number of Turtles Caught Per Set

Pre-regs. 0 turtles caught in 1,439 sets.

Post-regs. 0 turtles caught in 2,591 sets.

23% of turtles were caught in ‘clusters’ (> 1 caught in a single set).

Of the sets where ≥ 1 turtle was caught, 24% (55) were in consecutive sets (two or more sets in a row where one or more turtle was caught per set).
Turtle and Retained Swordfish CPUE by Vessel

Catch rate of retained swordfish and sea turtles combined species of individual vessels of the Hawaii-based longline swordfish fishery, 1994-2006 (N = 68)
Retained fish CPUE (number per 1000 hooks) in the Hawaii-based longline swordfish fishery for the periods before and after the turtle regulations came into effect.
Shark Captures Rates

Shark combined species CPUE (number per 1000 hooks) in the Hawaii-based longline swordfish fishery for the periods before and after the sea turtle regulations came into effect.

36% decrease
Summary of Main Results

After the sea turtle regulations came into effect, sea turtle and shark CPUE were significantly lower, the proportion of deeply hooked turtles was lower, more caught turtles are released after removal of terminal tackle, without compromising target species catch rates.
Next Steps

Investigate differences between vessels with high sword and low turtle CPUE vs. low sword and high turtle CPUE

- Lengths of float and branch lines;
- Amount and placement of weight on branch lines;
- Number of hooks per basket and number of buoys per unit length of main line;
- Float line material;
- Timing of setting and hauling; and
- Different types of main line floats.

Observer data collection protocols
Ring vs. non-ring hooks