Case history: Hawaii longline fishery and sea turtle interactions

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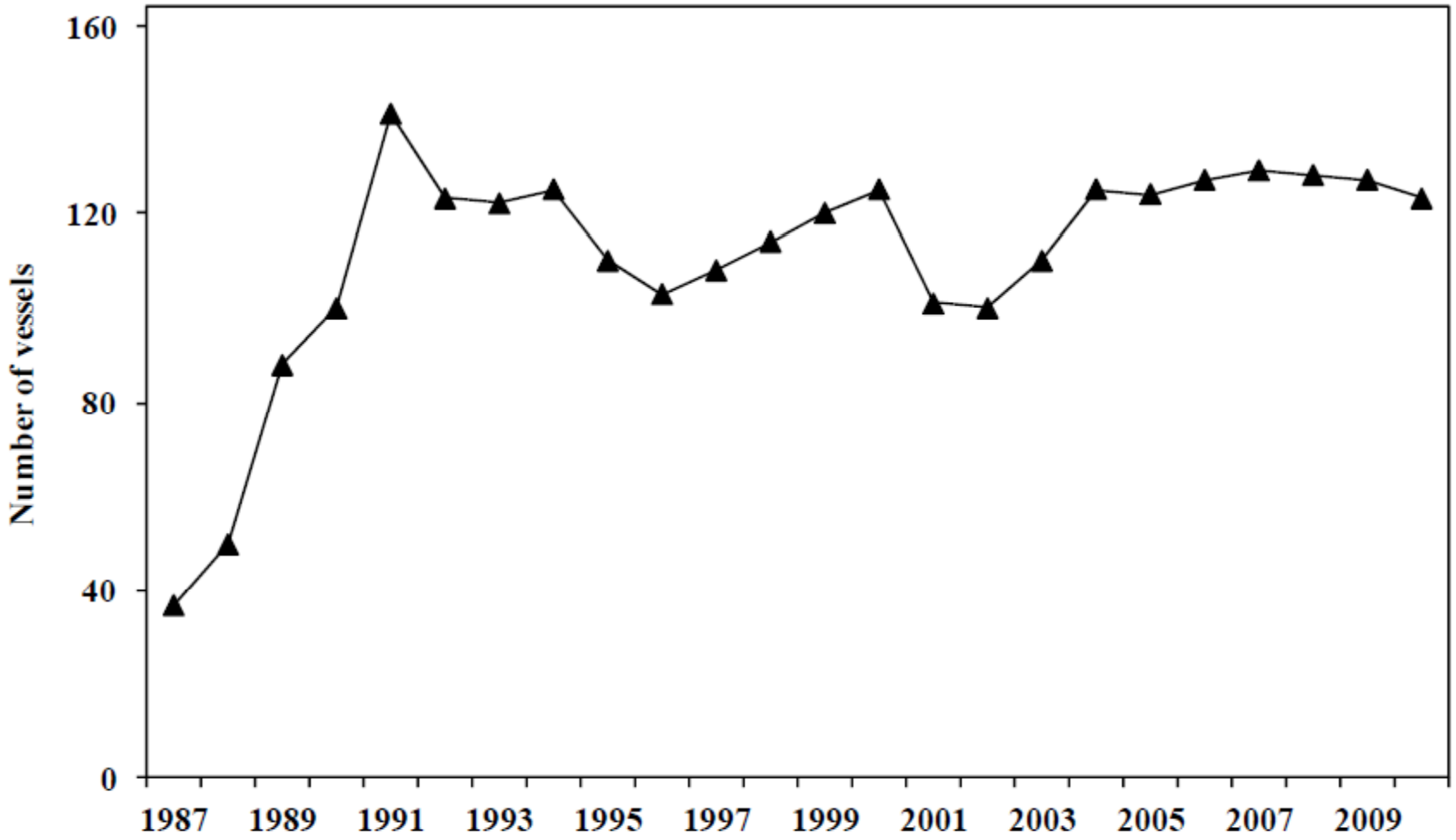
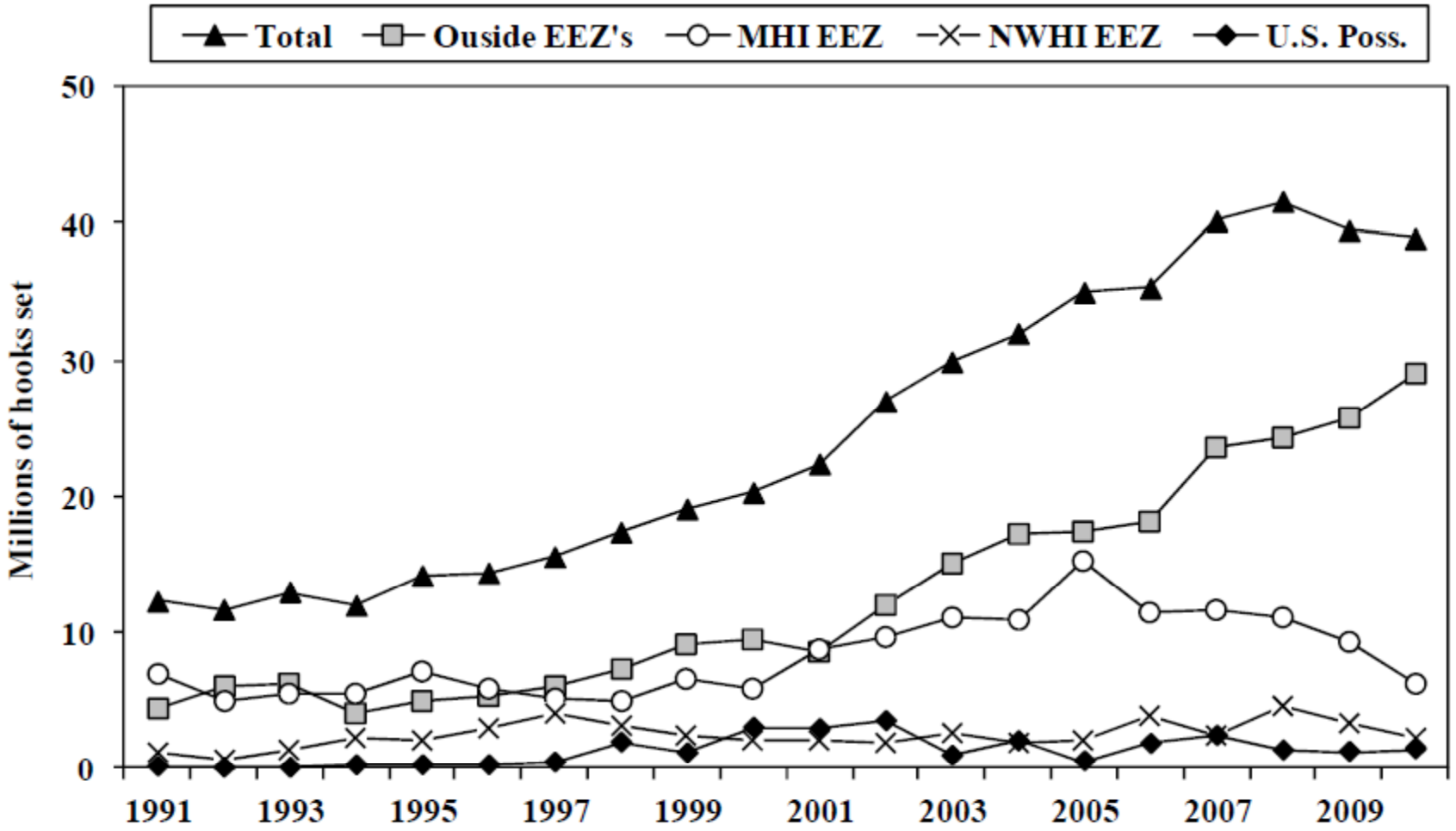
History of Hawaii longline fishery

- Commenced by Okinawan migrants to Hawaii in 1917
- Nearshore fishery using tarred rope and buoys with flag (flag-line fishery)
- Reached peak of about 50 vessels in mid 1950s, after which long period of decline
- Revival in mid 1980s with discovery of swordfish resource
- Rapid expansion in late 80s-early 90s
- Fleet size peaked in 1991 (141 vessels)
- Effort in hooks peaked in 2008 with 41.6 million hooks

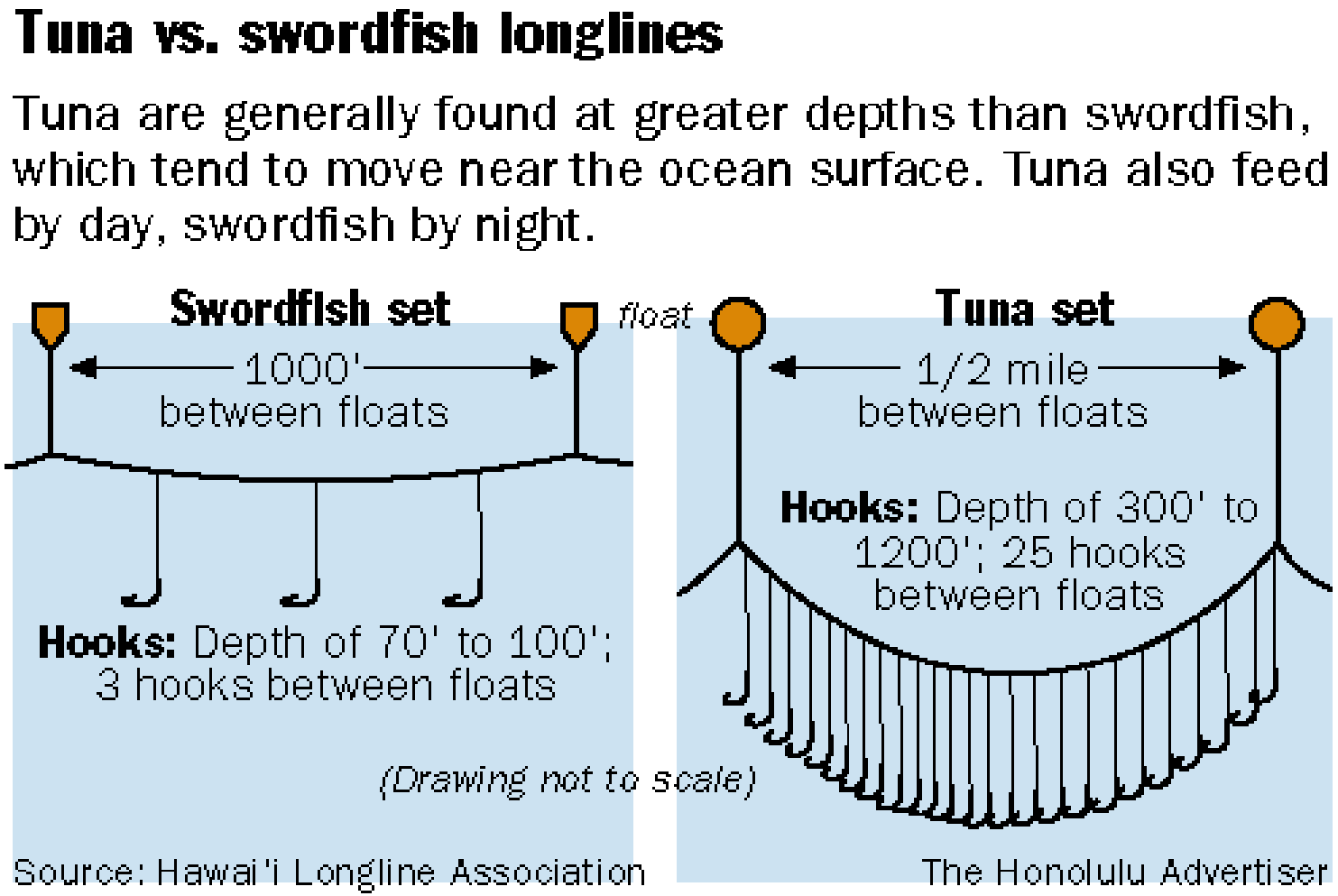
Fleet size

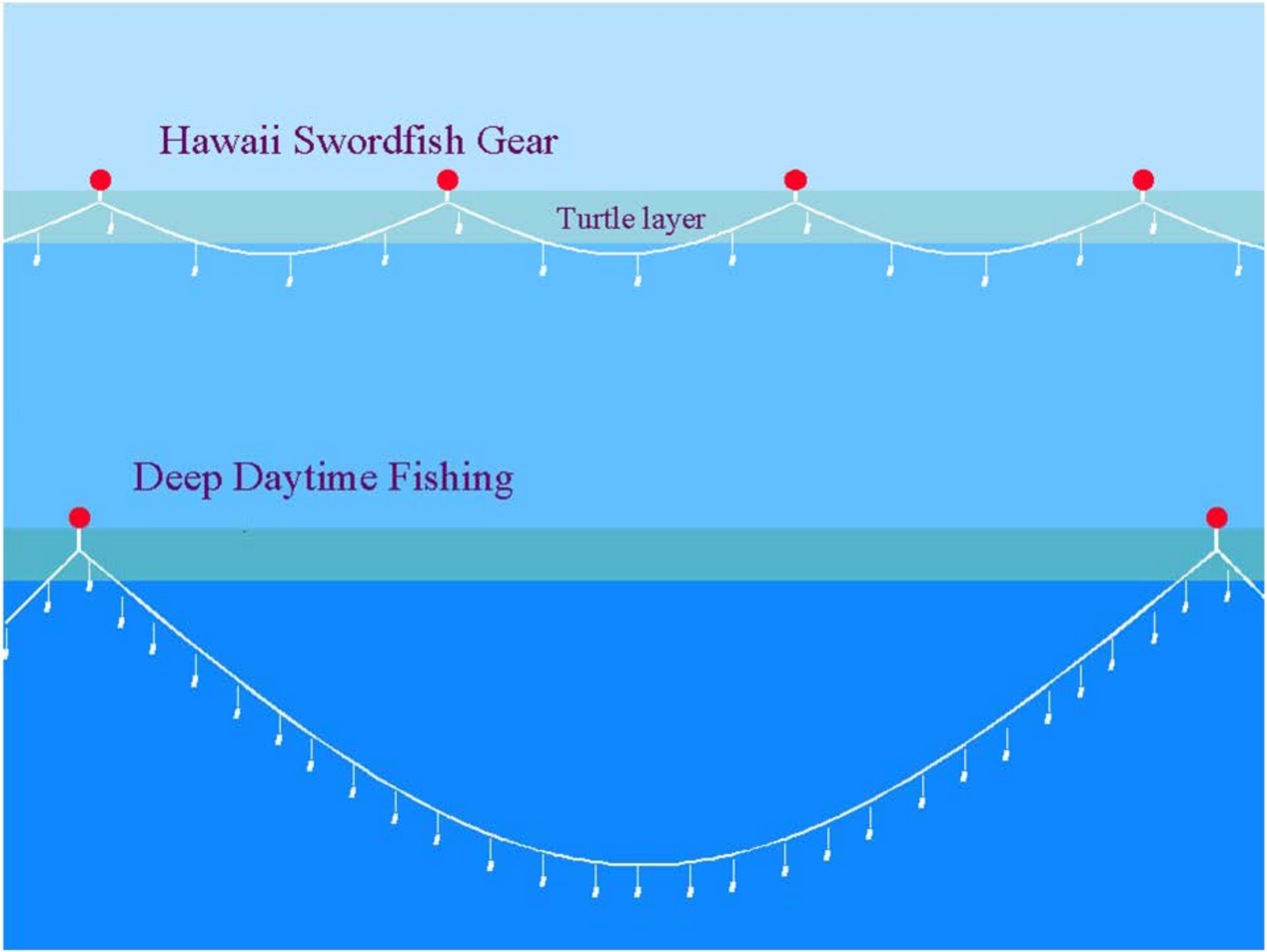

Number of vessels
160
120
80
40
0
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009

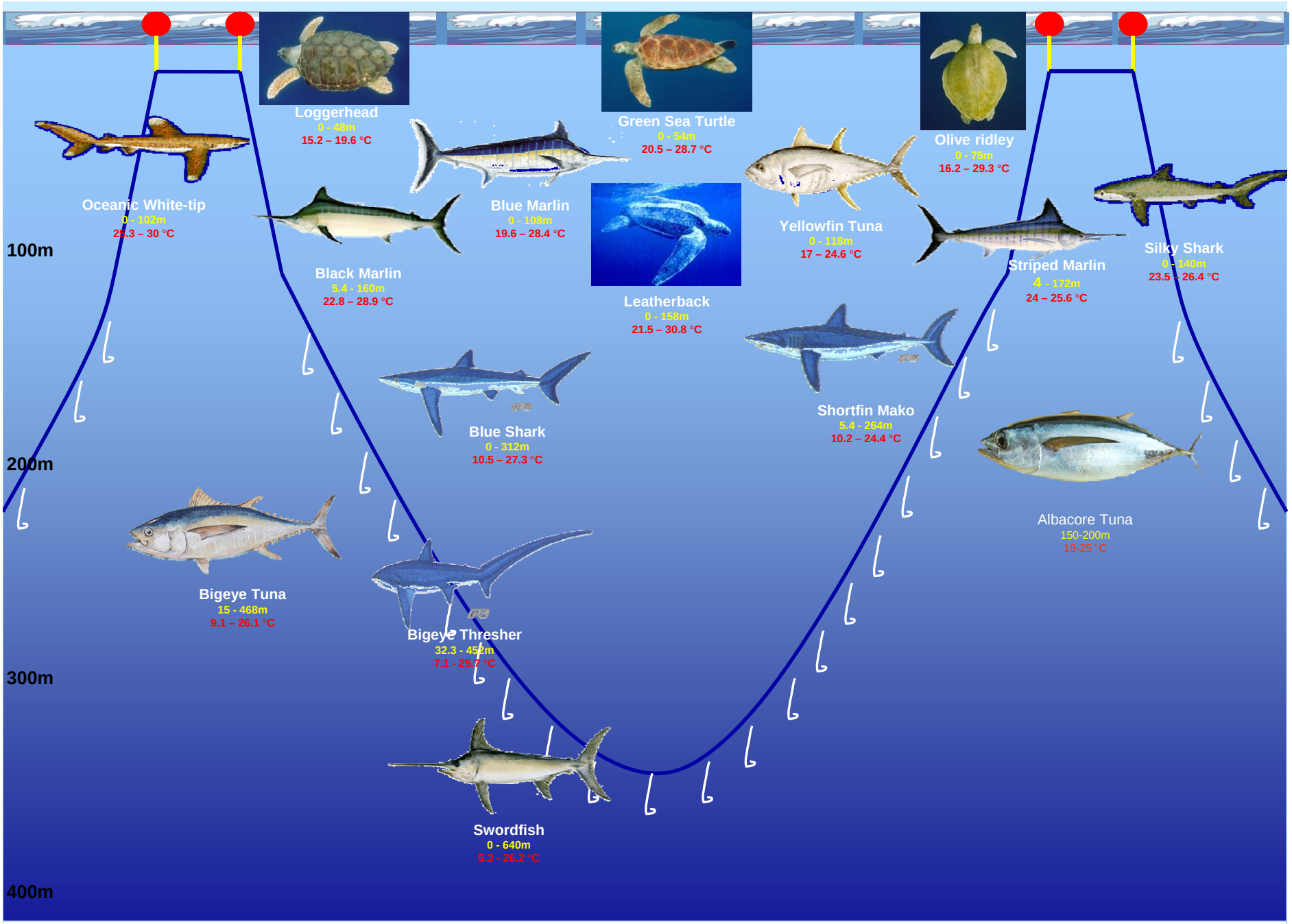
Hooks deployed



Shallow set longlining for swordfish takes the most turtles




Hawaii Swordfish Gear
Turtle layer
Deep Daytime Fishing



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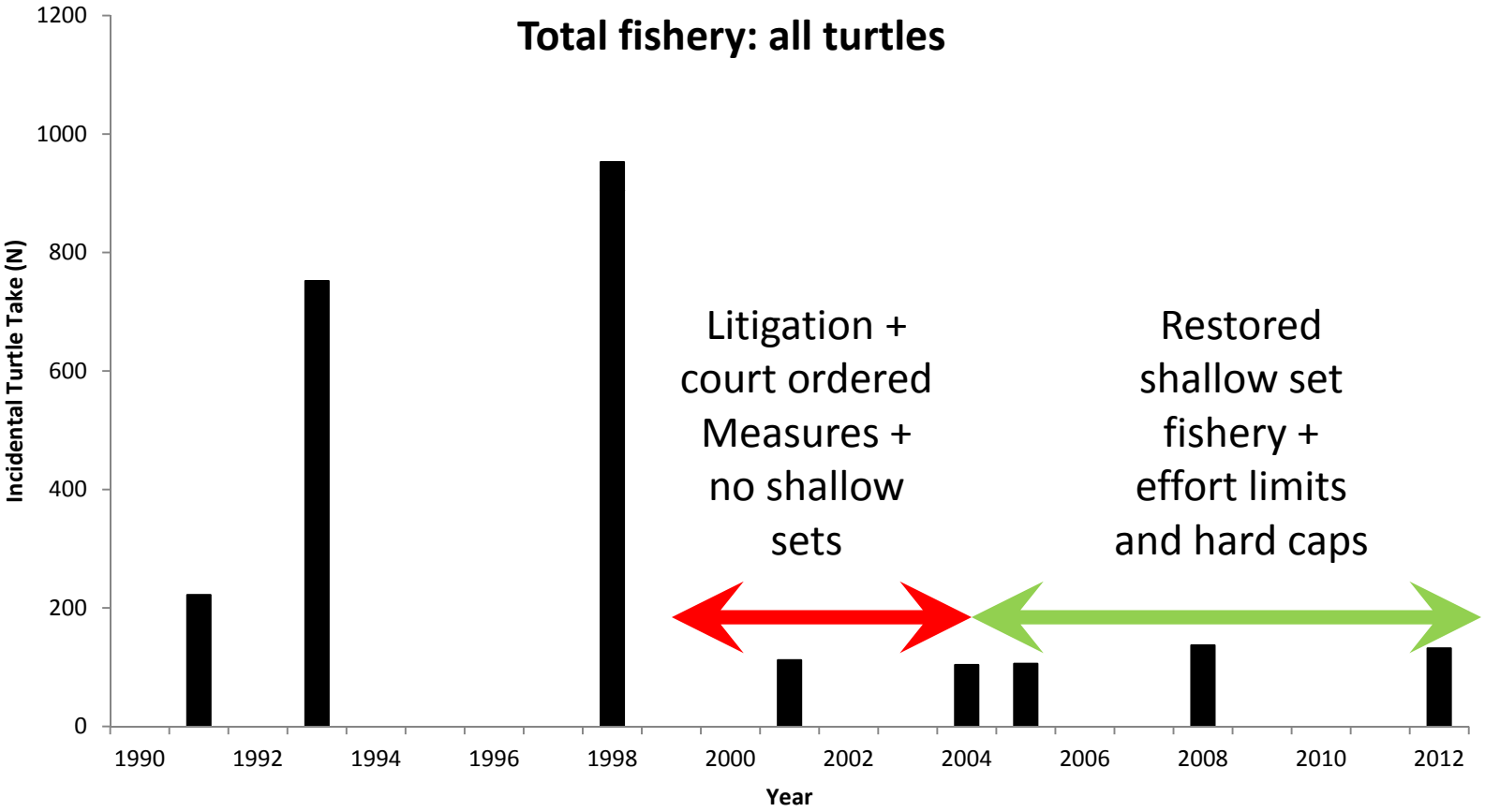
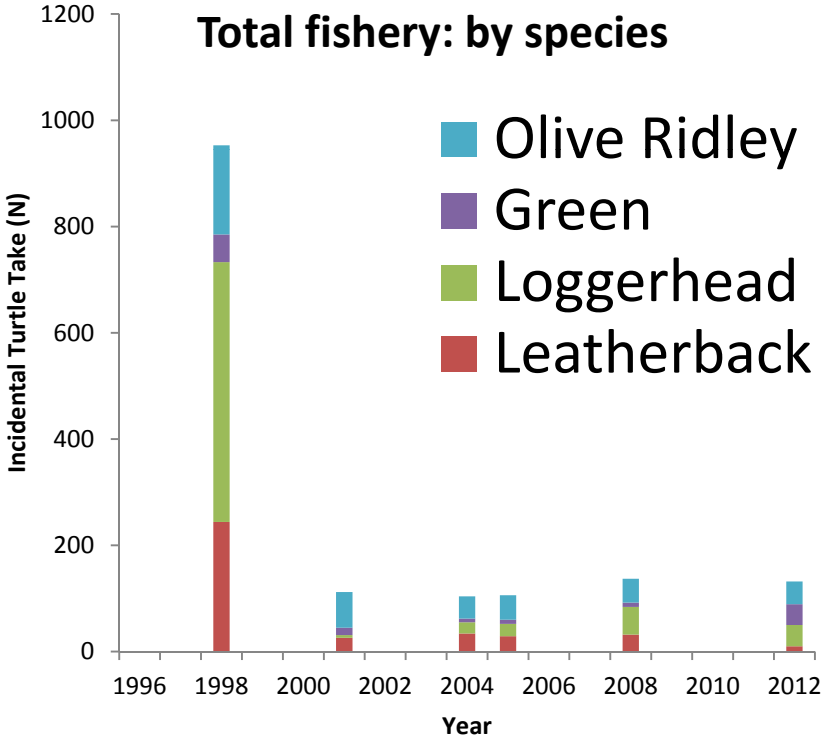
Biological Opinion History

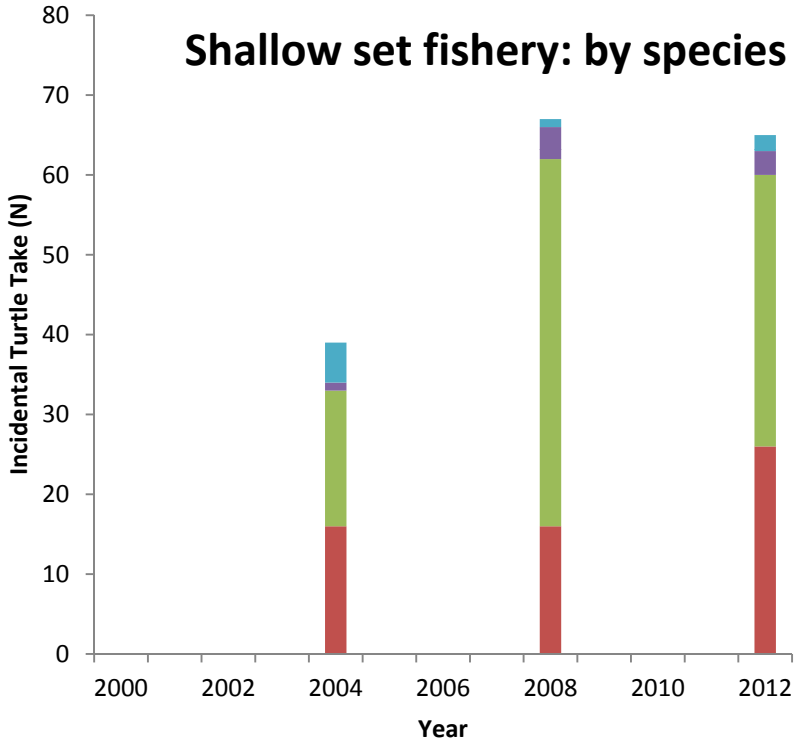
Year	Fishery	Jeopardy?	Model?
1991	Entire fishery	No jeopardy	None used
1993	Entire fishery	No jeopardy	None used
1998	Entire fishery	No jeopardy	TURTSIM
2001	Entire fishery	**Jeopardy** for LH, LB, GT; closes swordfish fishery	Not clear
2004	Entire fishery	No jeopardy; permits swordfish fishery w/ gear/effort modifications	Not clear
2005	Deep-set	No jeopardy	Quasi-extinction model
2008	Shallow-set	No jeopardy	Quasi-extinction model
2012	Shallow-set	No jeopardy	Climate forcing model

Incidental takes of all turtles in Hawaii longline fishery

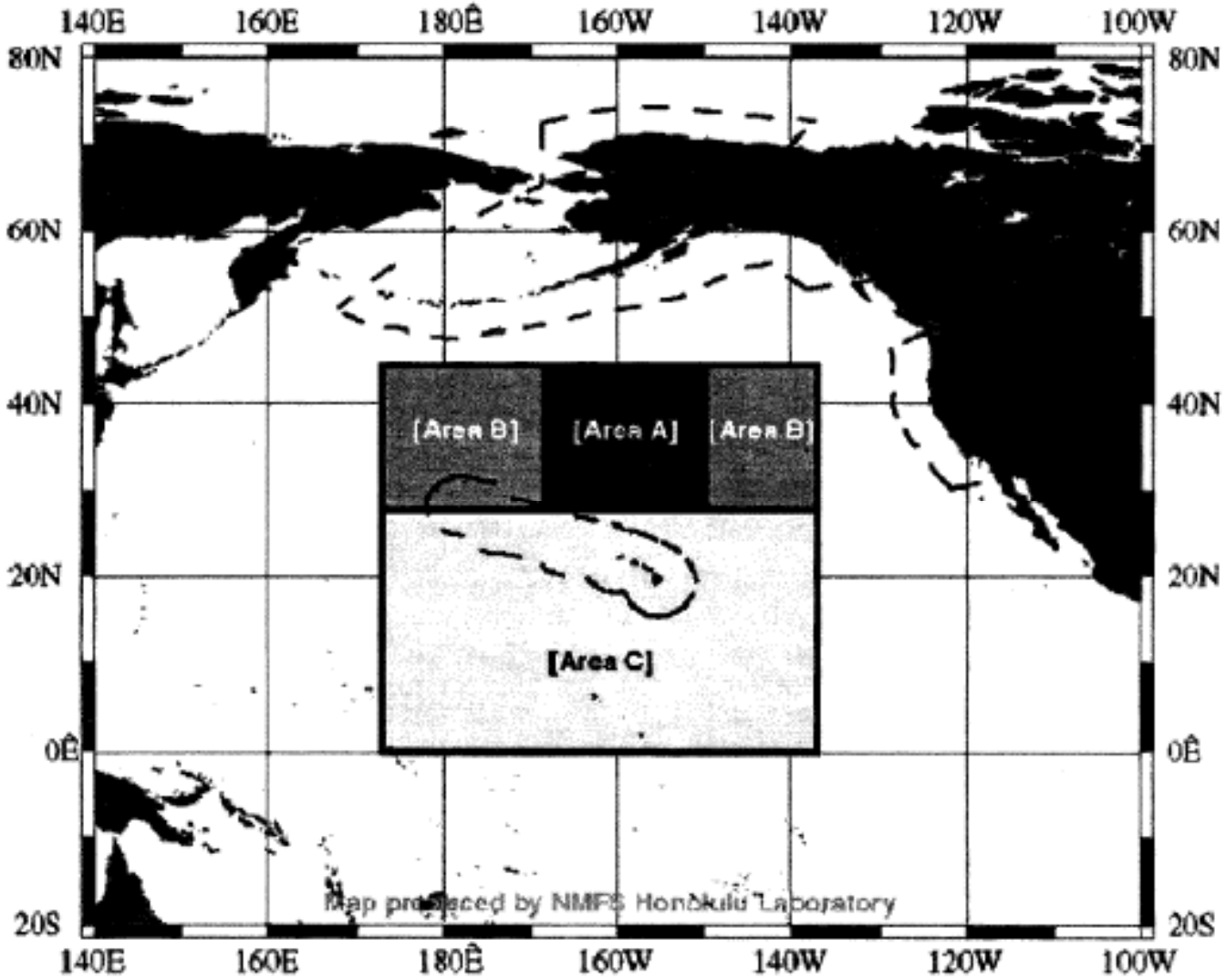


Composition of permitted turtle takes

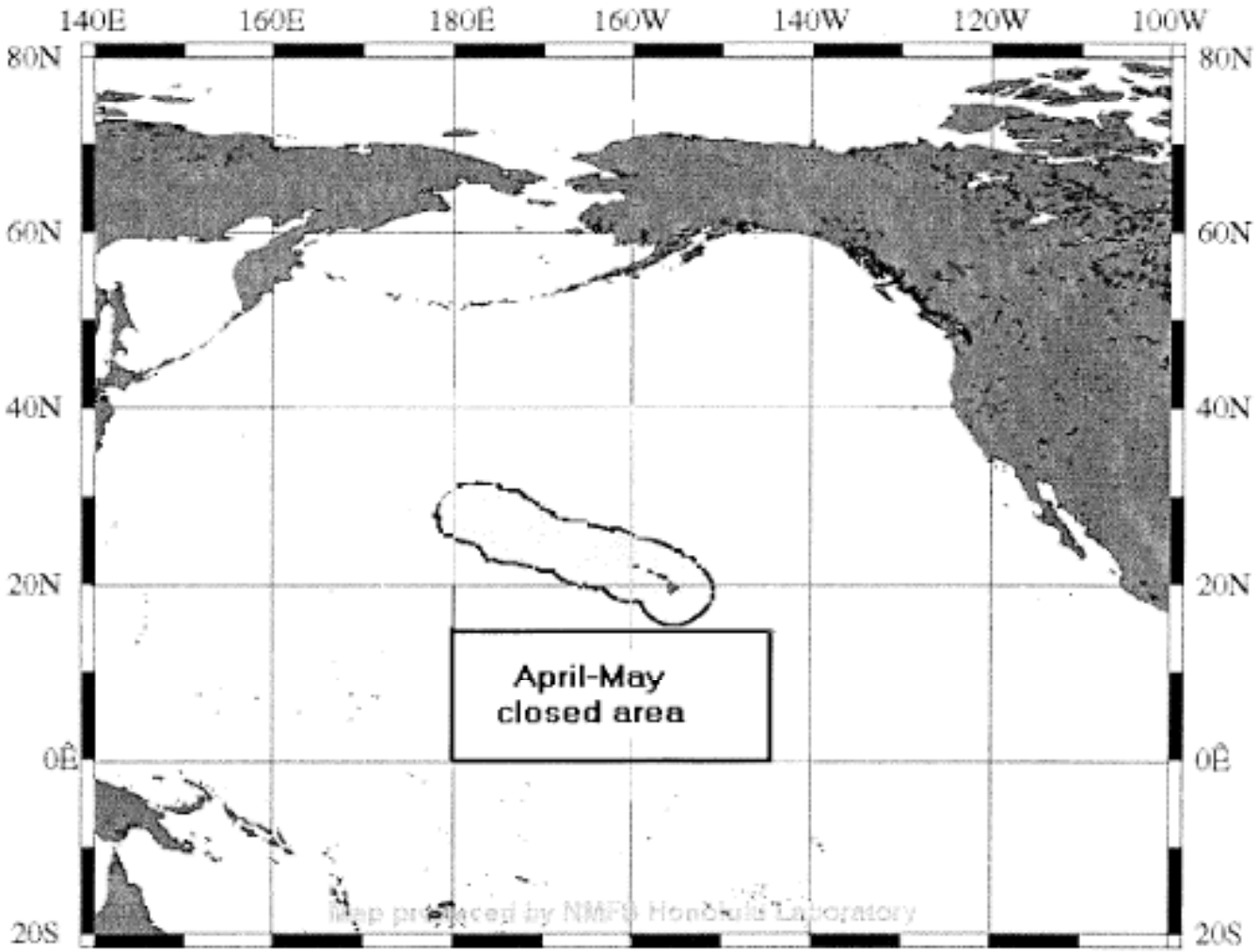




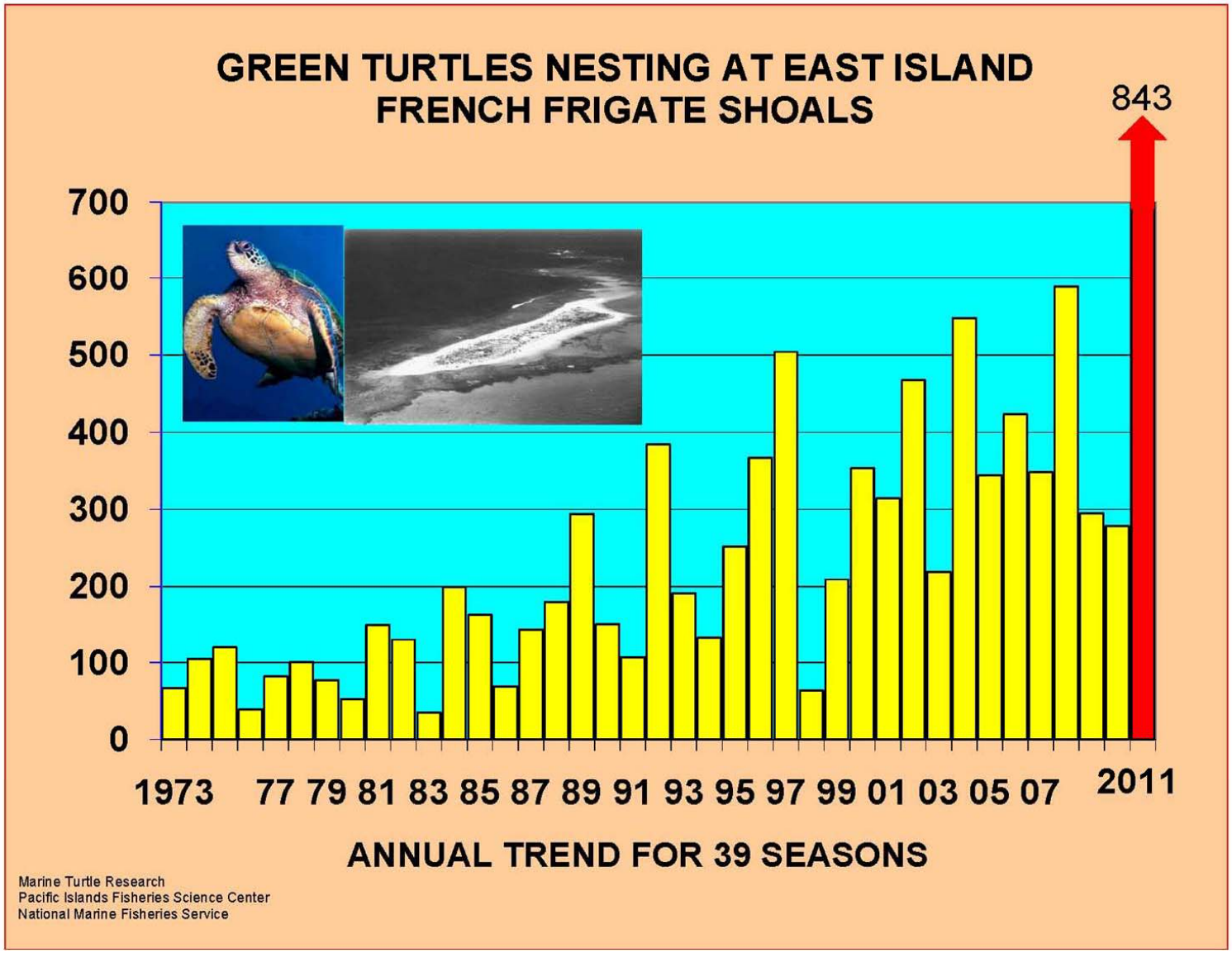
Spatial Management: Initial (2000)



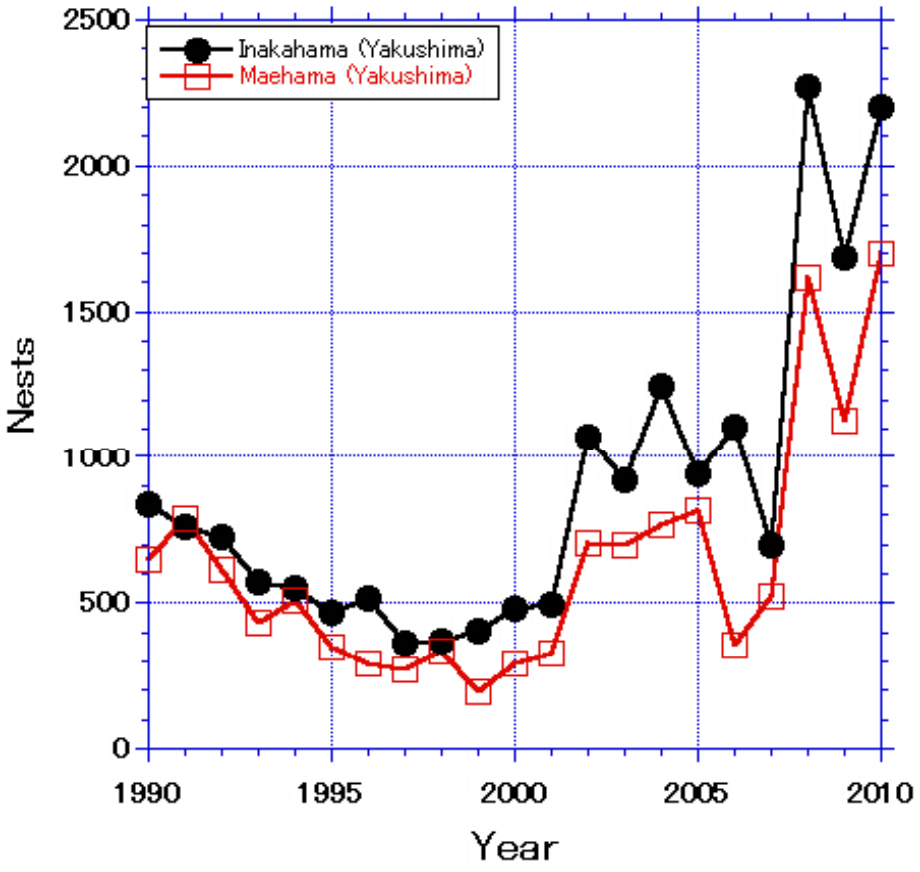
Spatial Management: Final (2001)

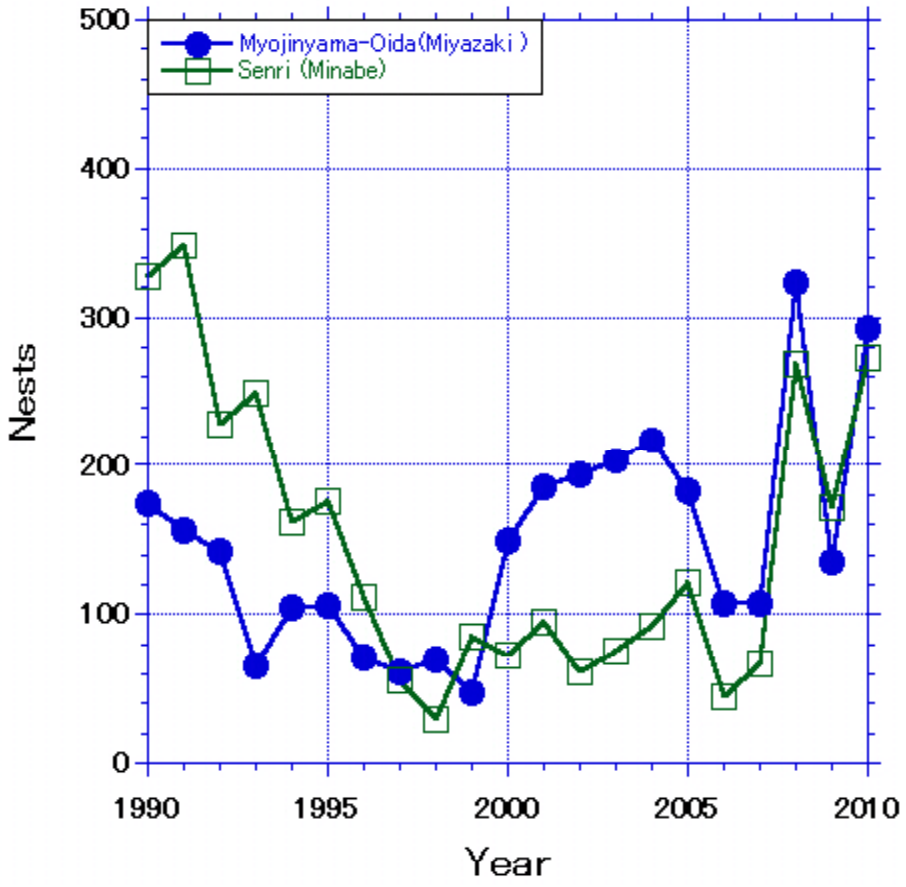


Turtle Population Dynamics: Hawaii Green Sea Turtles



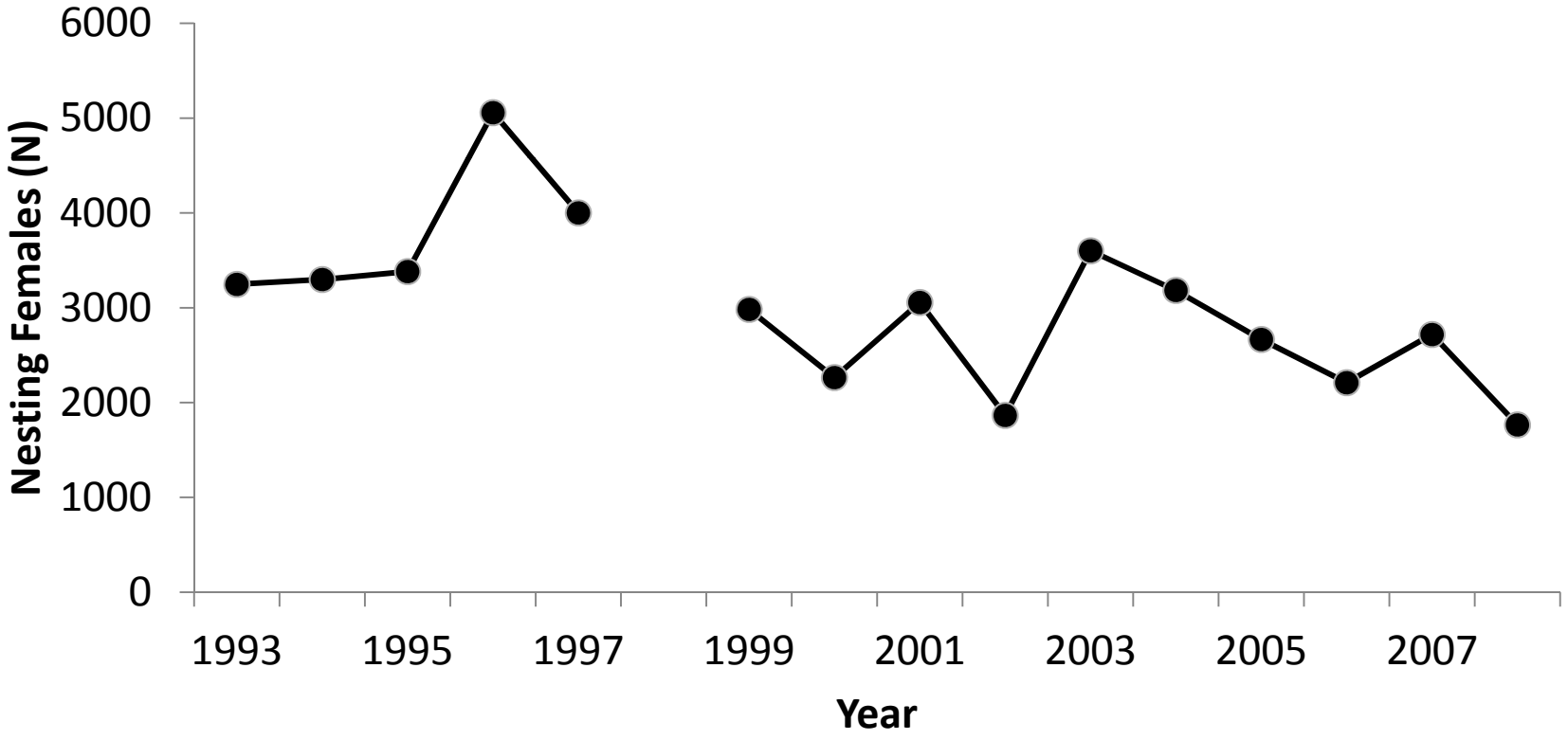
Turtle Population Dynamics: North Pacific loggerheads





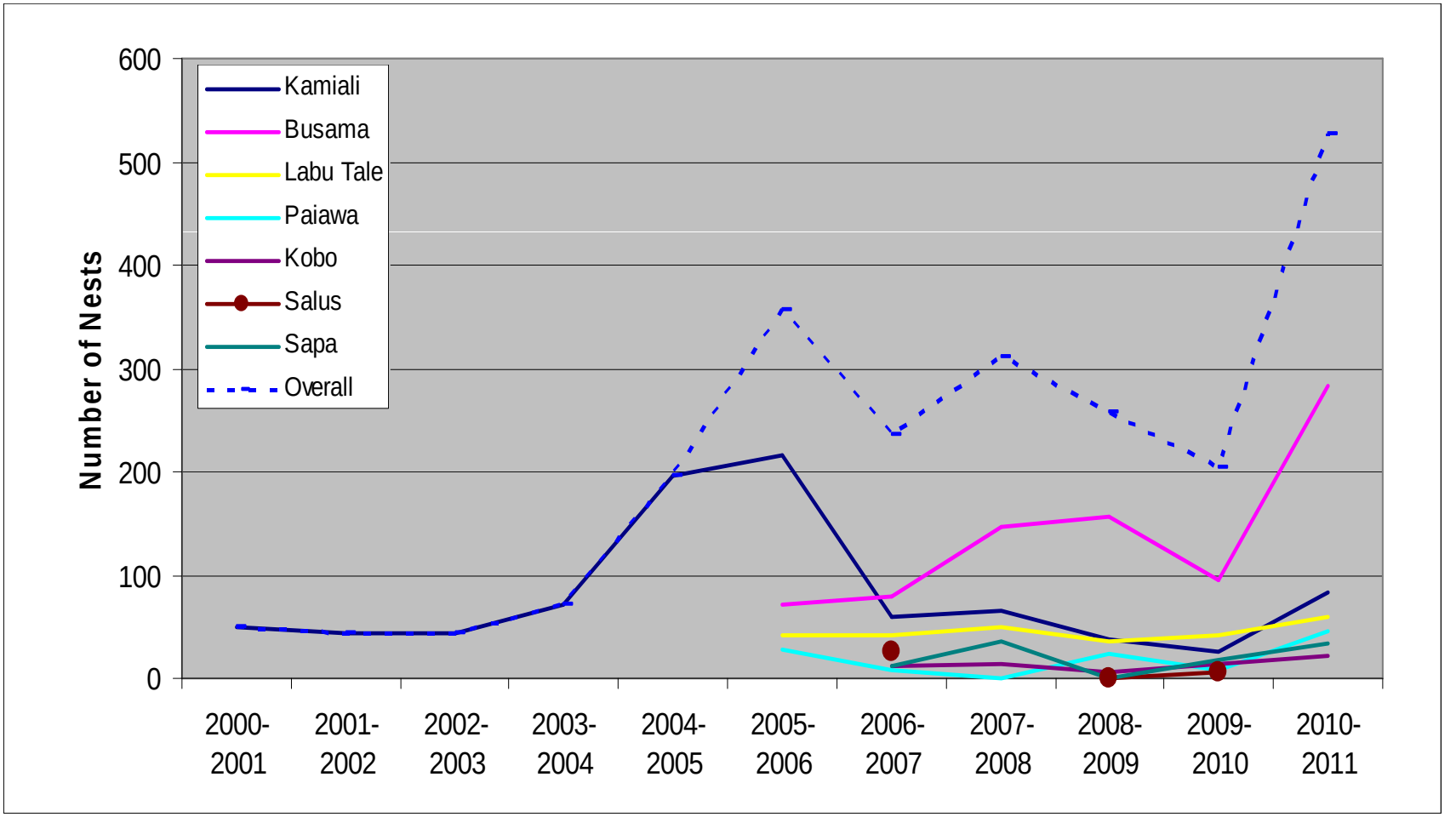
Source: Matsuzawa (2011)

Turtle Population Dynamics: Jamursba-Medi (Papua Barat, Indonesia) leatherbacks



Source: WWF-Indonesia

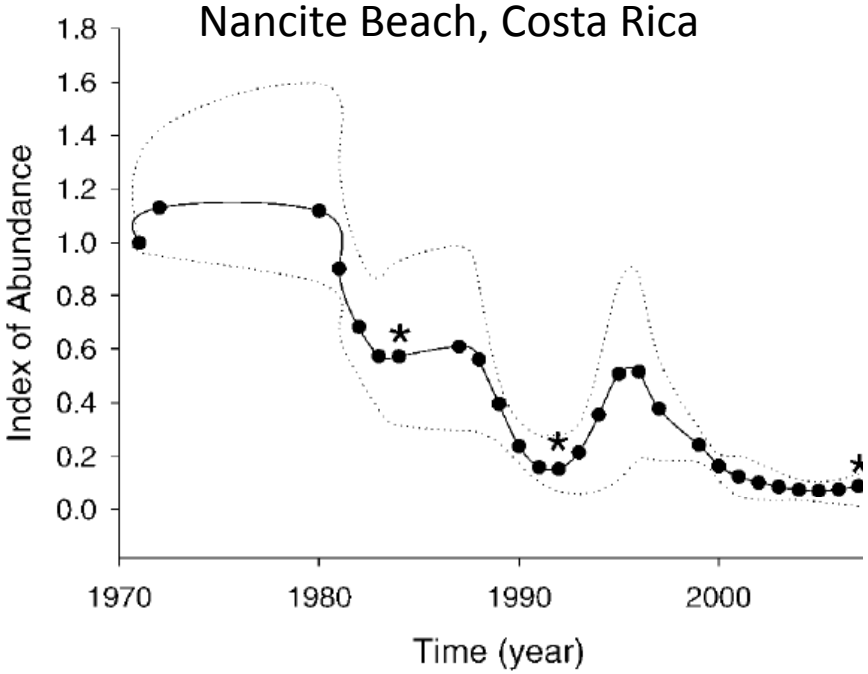
Dynamics of turtle populations: PNG leatherbacks



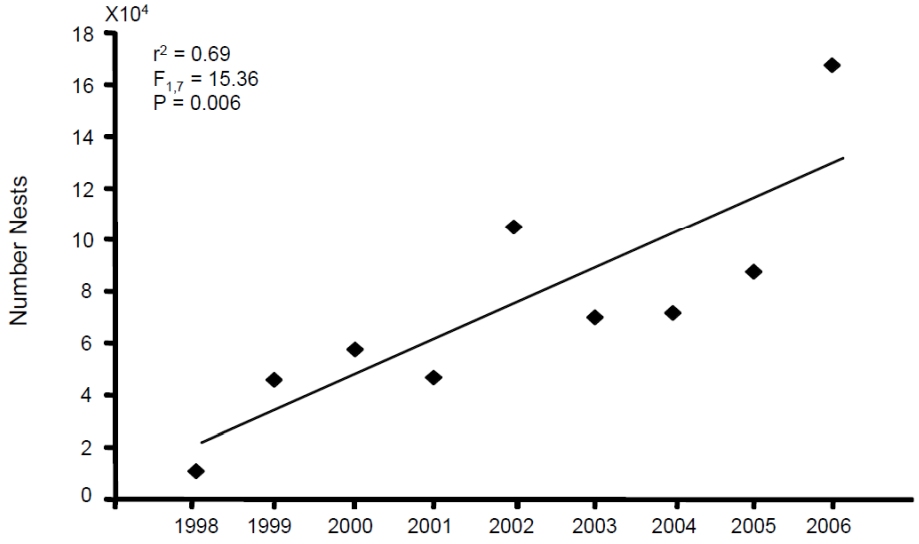
Source: Pilcher (2011)

Dynamics of turtle populations: EPO Olive-Ridleys

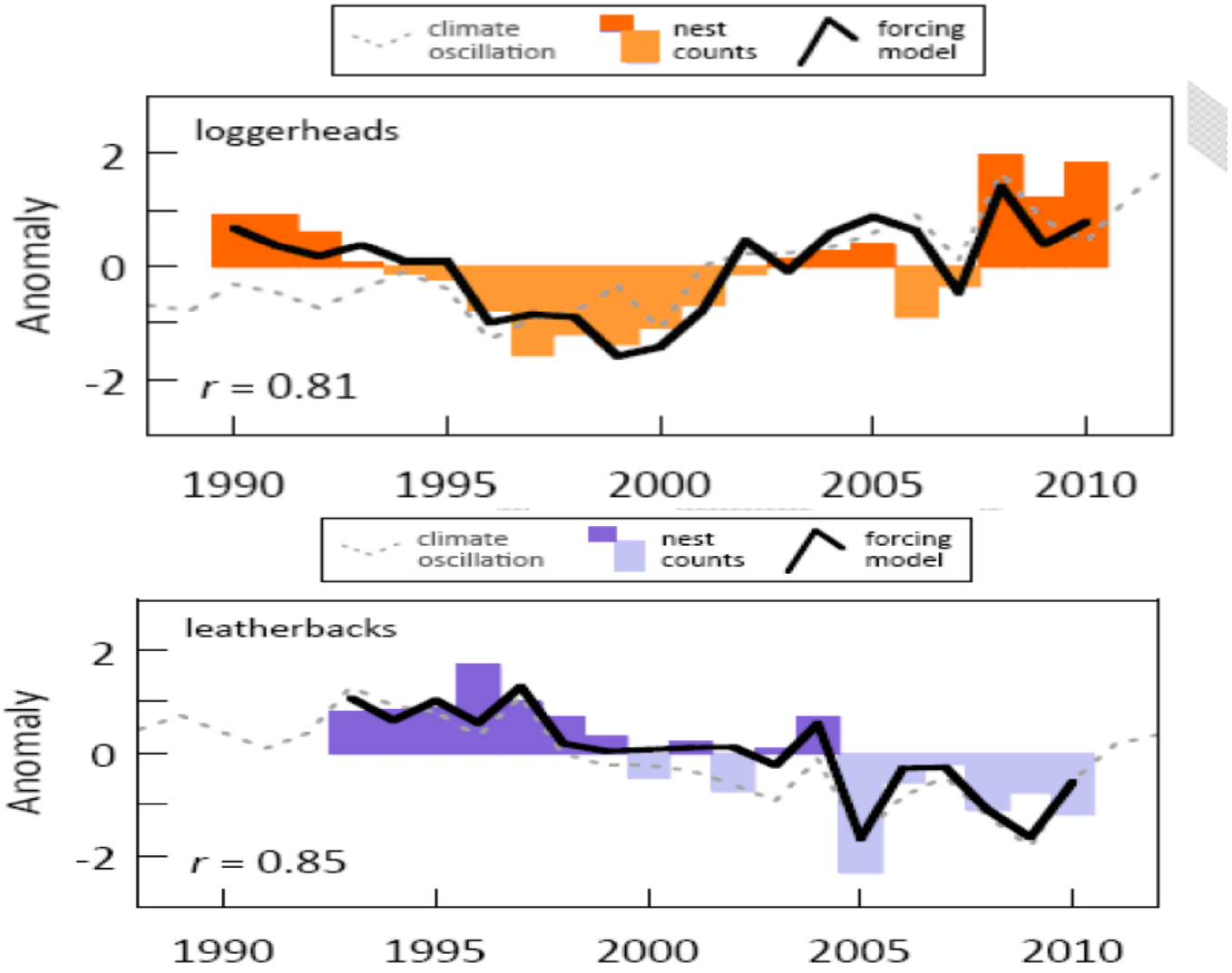
Nancite Beach, Costa Rica



La Flor Beach, Nicaragua



2012 BiOp Climate forcing models for loggerheads and leatherbacks



Conclusions

- Since the early 1990s several BiOps have been drafted for the Hawaii longline fishery
- In the 1990s the trend was to set the take at the expected interaction level for the fishery without any mitigation measures
- Modeling at that time suggested that the relatively high interactions rates would not jeopardize turtles
- After 1999, NMFS concluded jeopardy determinations for green, loggerhead and leatherback turtles
- Swordfish fishing was prohibited between 2001-2004, and reopened with very low take rates.

Conclusions

- Most focus has been on leatherback and loggerhead turtles, 2008 and 2012 BiOps concluded non jeopardy for the fishery at expected low take levels
- Over the life of the fishery population trends in green and loggerheads species have shown positive increases in nesting abundance, while olive ridley and leatherback trends are mixed
- The 2008 and 2012 BiOps have employed the most sophisticated modeling approaches to determine if a given take and mortality rate has an appreciable effect on the affected turtles
- They are at best, however, simulation models that do not evaluate take and mortality rates against absolute turtle population abundance
- What is jeopardy?

JEOPARDY!