Analyses of Catch Data for Blue and Striped Marlins (Istiophoridae)

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Background

Need for research:

The Billfish Working Group (BILLWG) of the International Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) is responsible for stock assessments for blue and striped marlins (Istiophoridae) and swordfish *Xiphias gladius* (Xiphiidae).

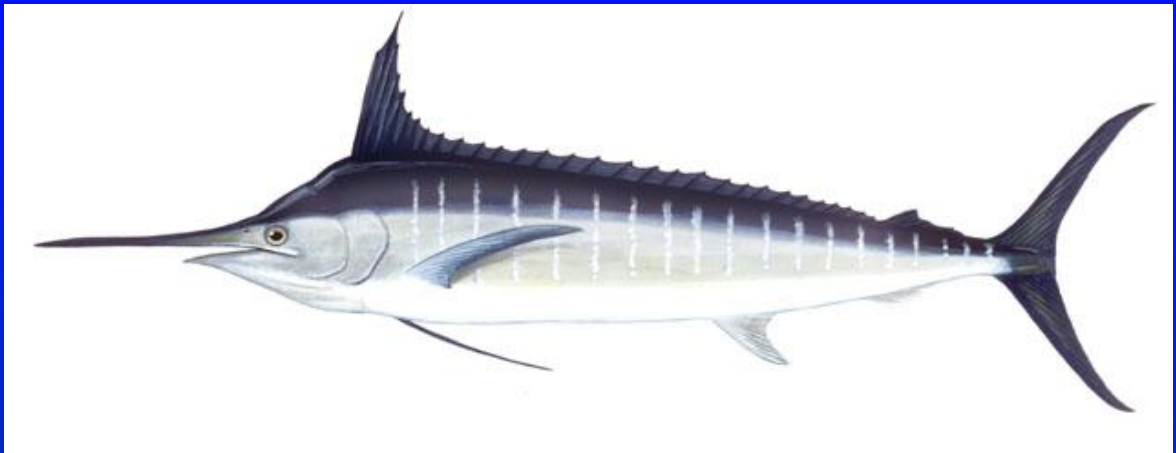
Contributions to ISC stock assessments from this project:

Corrected catch histories for marlins

CPUE standardizations for marlins

Species of Interest

Blue marlin (*Makaira nigricans*)



Striped Marlin (*Kajikia audax*)

Species of Interest: Biological Parameters

Striped marlin (*Kajikia audax*)

Maximum size: About 230 cm in eye-fork length (WCNPO)

Life span: Probably ≥ 10 years

Age at 50% maturity: About 5 years

Fecundity: About 11–29 million eggs

ISC BILLWG webpage:
http://isc.ac.affrc.go.jp/working_groups/billfish.html

Species of Interest: Biological Parameters

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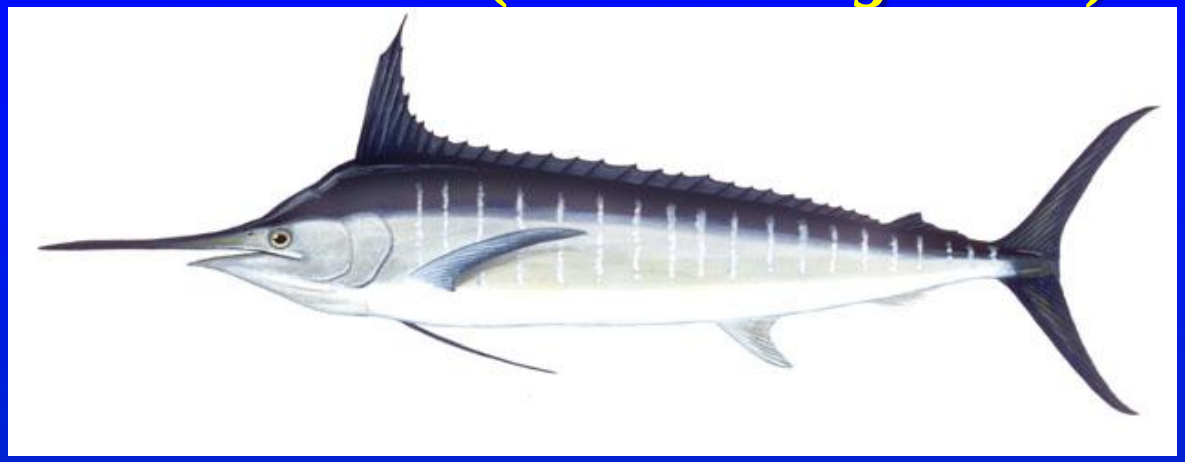

Maximum size: About 400 cm in eye-fork length

Life span: Probably ≥10 years

Age at 50% maturity: About 2 years (♂) and 5 years (♀)

Fecundity: About 11–29 million eggs

ISC BILLWG webpage:

http://isc.ac.affrc.go.jp/working_groups/billfish.html

Relevant Publications

"Analysis of logbook accuracy for blue marlin (*Makaira nigricans*) in the Hawaii-based longline fishery with a generalized additive model and commercial sales data."
W.A. Walsh, R.Y. Ito, K.E. Kawamoto, and M. McCracken. 2005. *Fisheries Research* 75:175–192.

"Corrected catch histories and logbook accuracy for billfishes (Istiophoridae) in the Hawaii-based longline fishery." W.A. Walsh, K.A. Bigelow, and R.Y. Ito. 2007. NOAA Technical Memorandum NMFS-PIFSC-13. 33 pp.

"Model averaging and probable status of North Pacific striped marlin, *Tetrapturus audax.*"
J.K.T. Brodziak and K.R. Piner. 2010. *Canadian Journal of Fisheries and Aquatic Sciences* 67: 793-805

Completed ISC BILLWG Stock Assessment

STOCK ASSESSMENT OF STRIPED MARLIN IN THE WESTERN AND CENTRAL NORTH PACIFIC OCEAN

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JIMAR

Kevin R. Piner
NMFS Southwest Fisheries Science Center

Robert Humphreys
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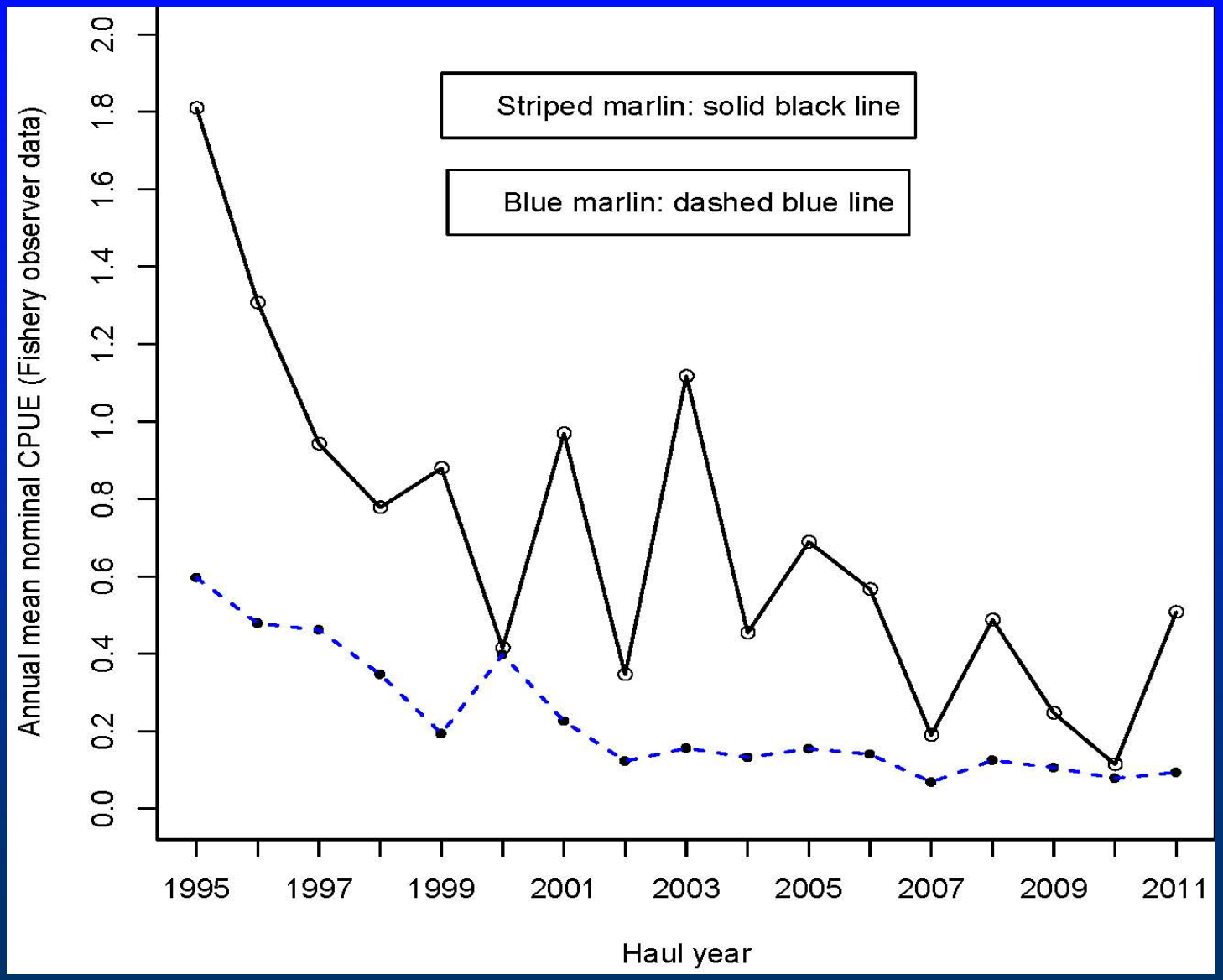
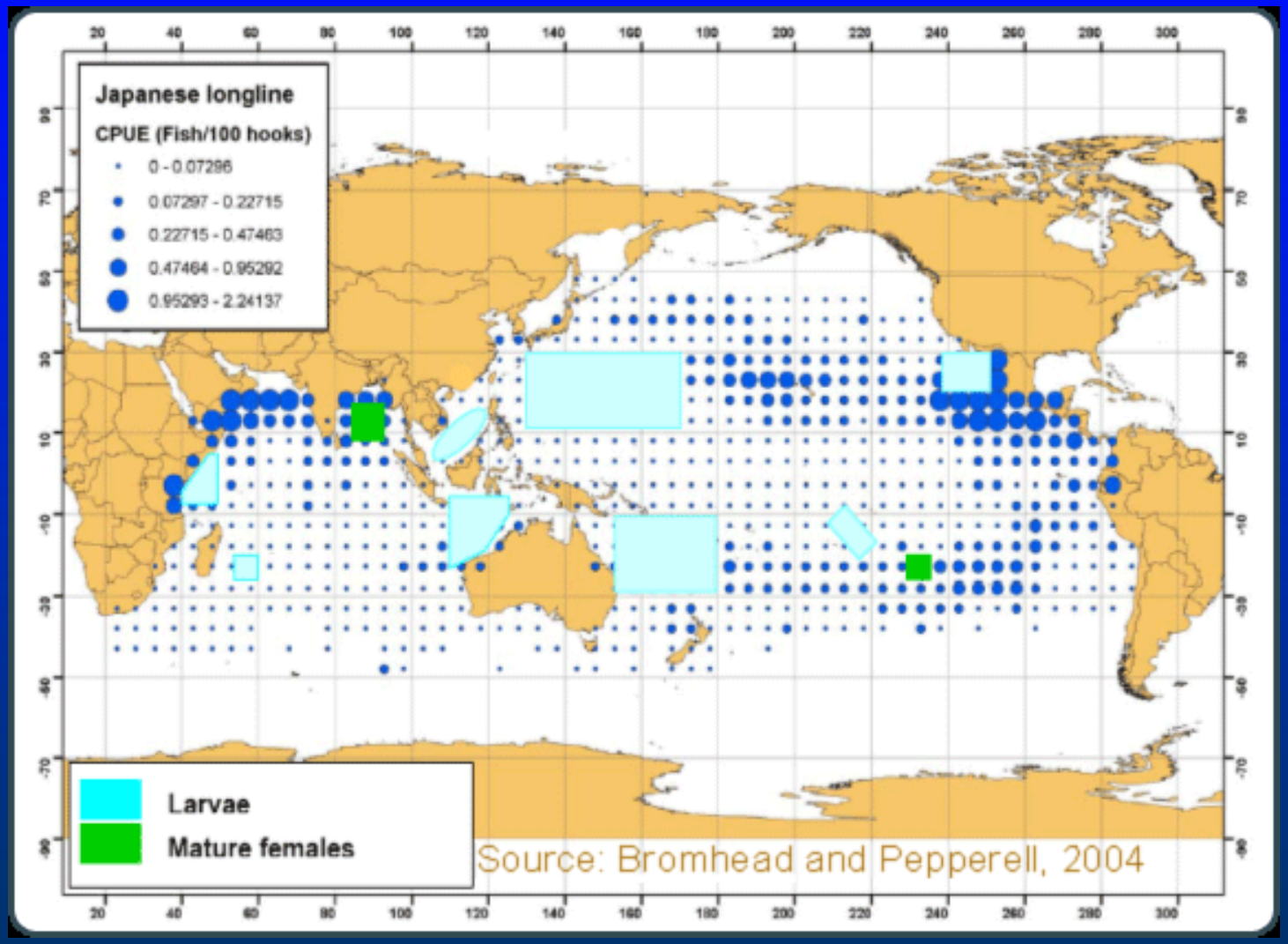
Jon Brodziak
NMFS Pacific Islands Fisheries Science Center

October 2012

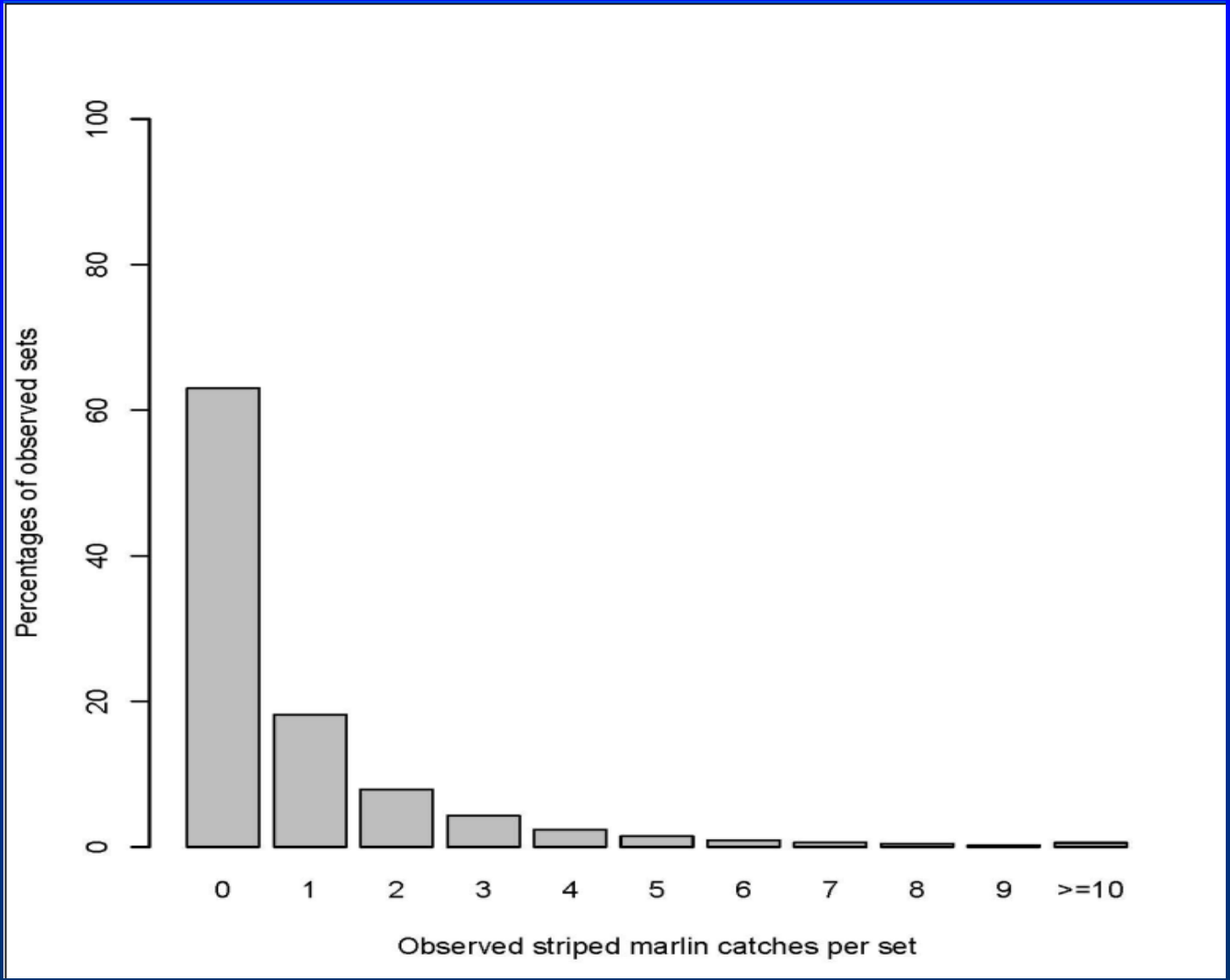
Striped and Blue Marlins: Annual Mean Nominal CPUE, 1995–2011



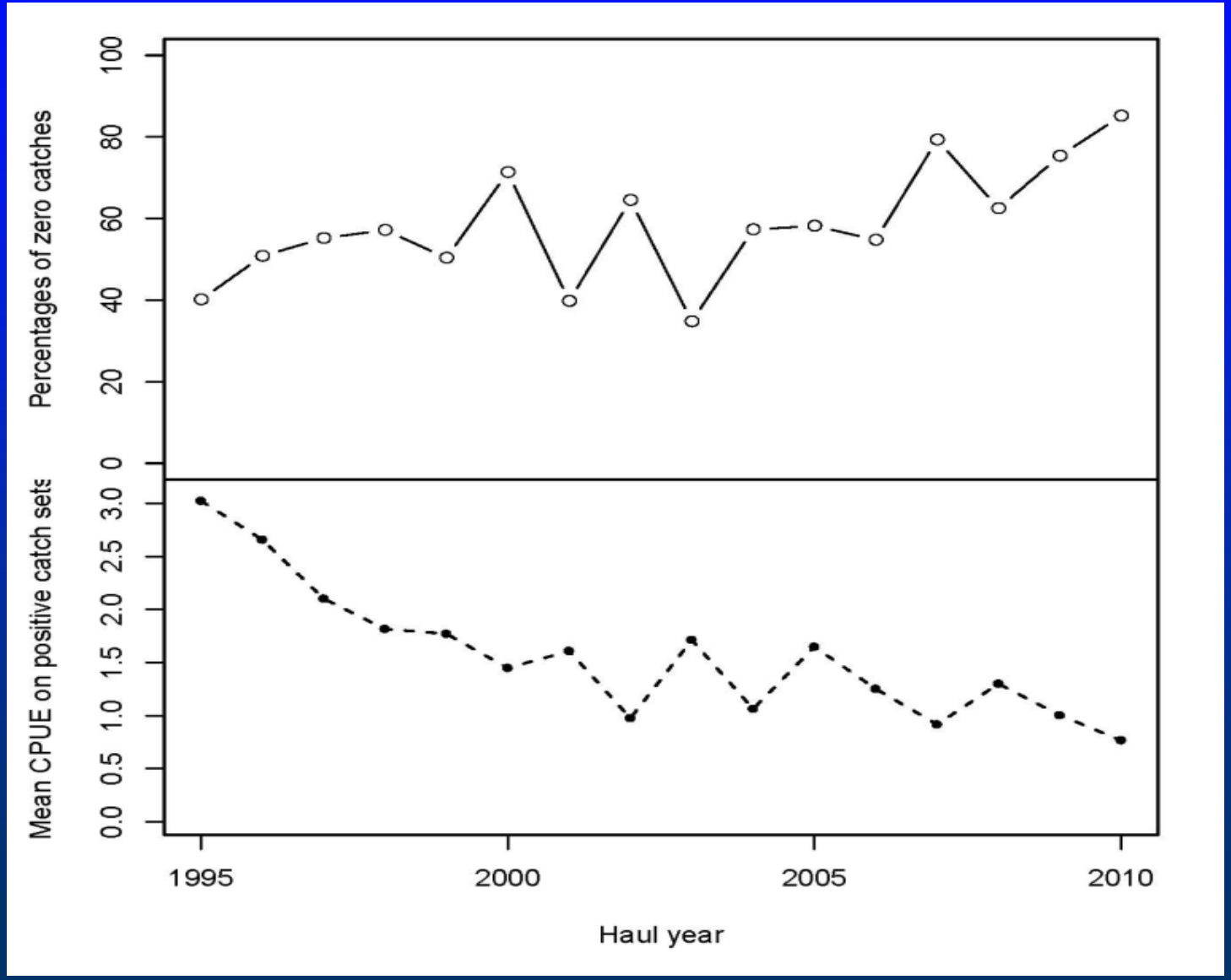
Striped Marlin:
Indo-Pacific Distribution inferred from CPUE



Striped Marlin Observed Catches: 1995–2010



Striped Marlin Trends: 1995–2010
Zeroes and CPUE on Sets with Positive Catches



Summary: Striped Marlin CPUE Standardization

Response Variables:

Binomial GLM: Catch (counts)

Lognormal GLM: $\log_e$ (CPUE), sets with positive catch

Predictors:

Binomial GLM: Year, Quarter, Fishing Region, SST

Lognormal GLM: Year, Quarter, Fishing Region, Hooks per Float

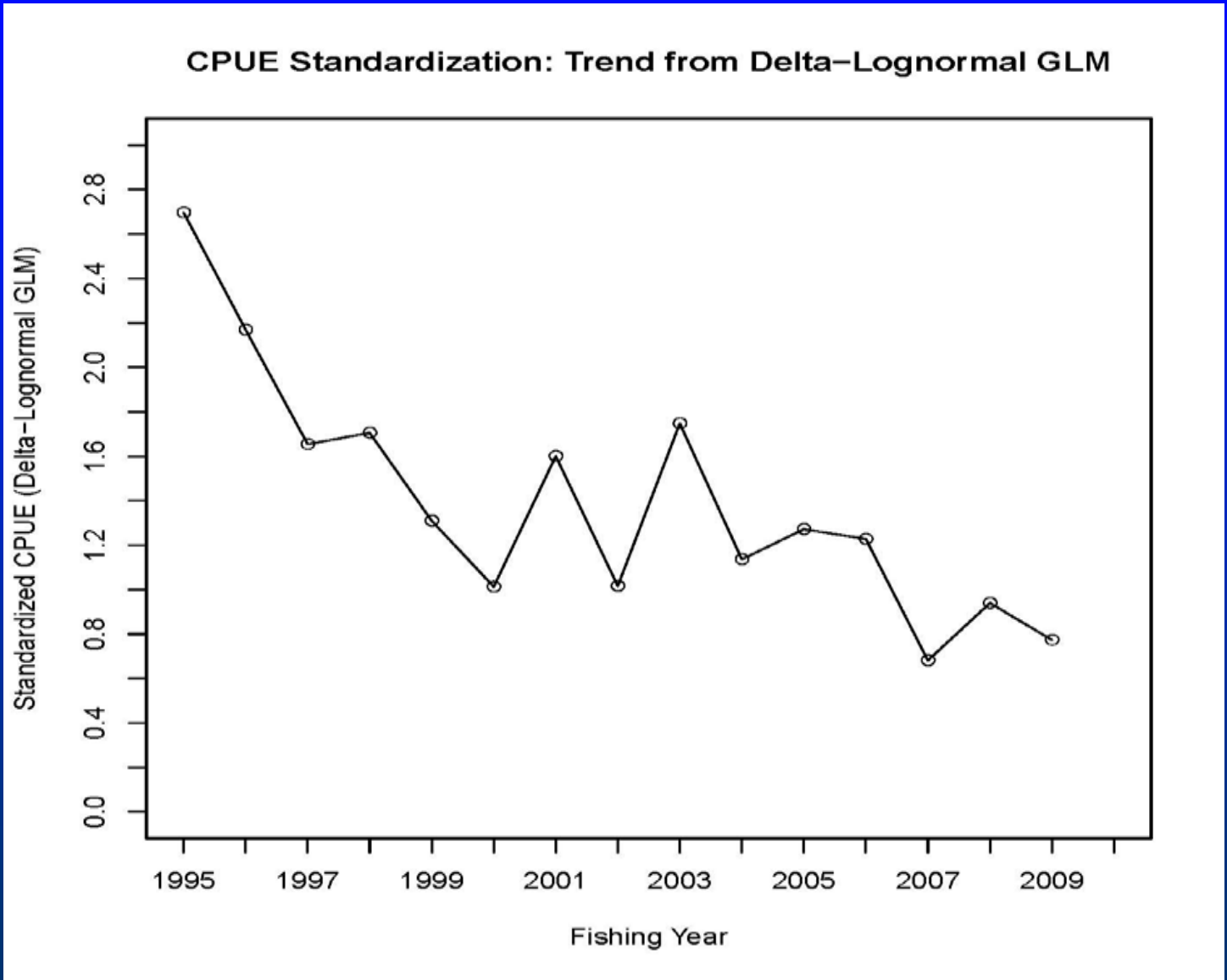
Explanation of Null Deviance:

Binomial GLM: 17.2% **Lognormal GLM**: 27.3%

Standardized CPUE Average Trend:

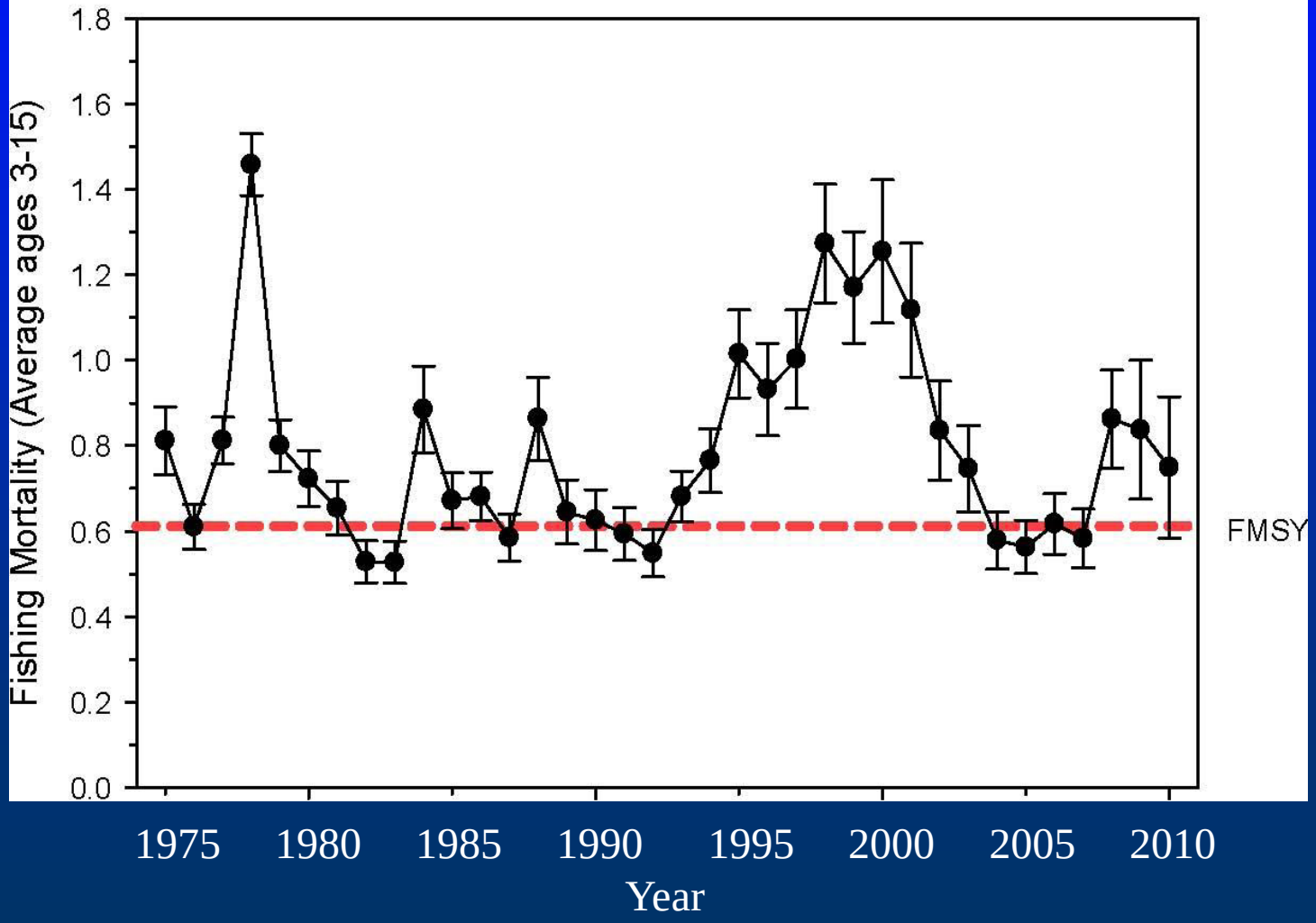
-4.9% per year

Standardized Striped Marlin CPUE Time Series



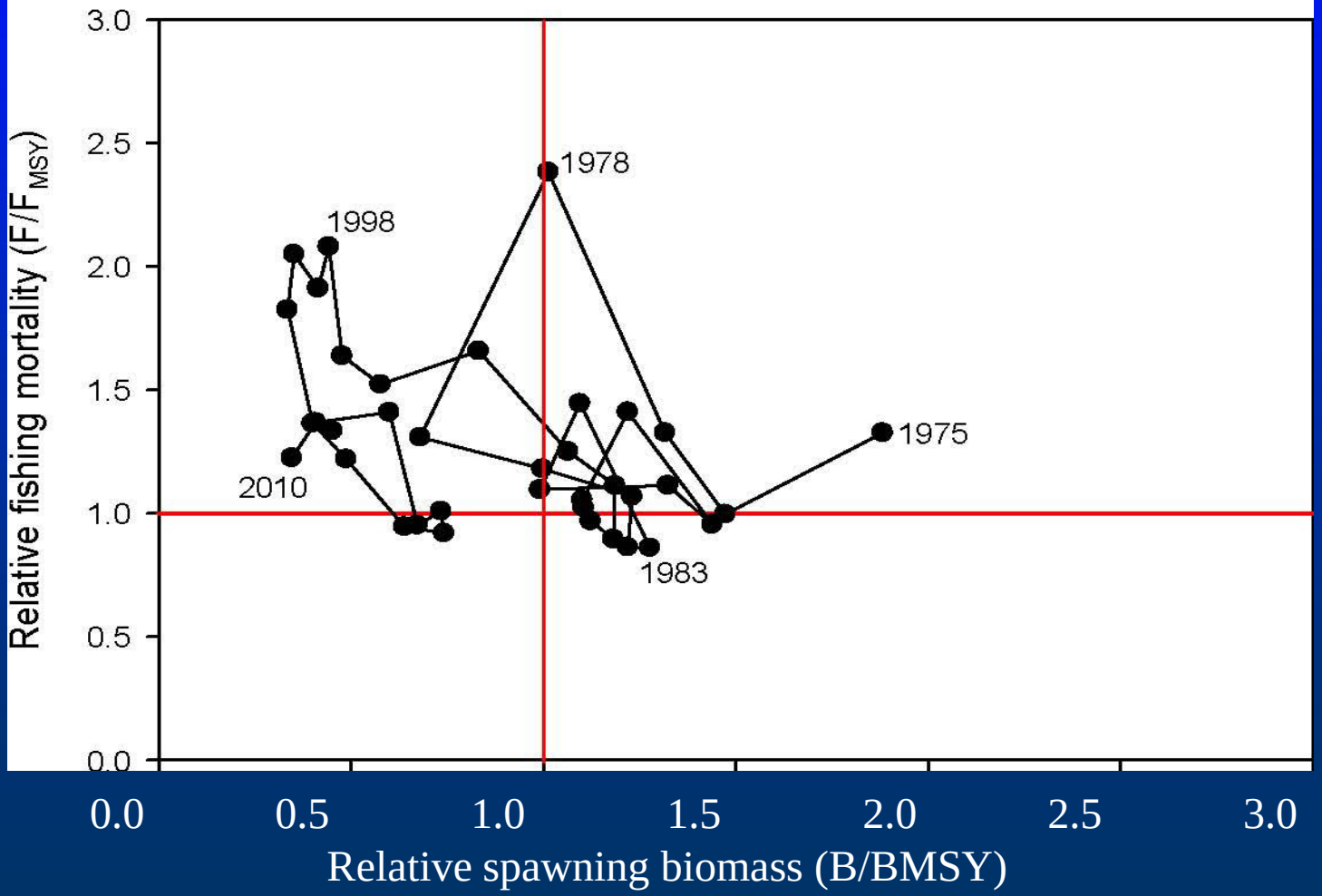
Striped Marlin Fishing Mortality: 1975–2010

Figure A3. Trends in estimates of fishing mortality of Western and Central North Pacific striped marlin (*Kajikia audax*) during 1975-2010 along with 80% confidence intervals.

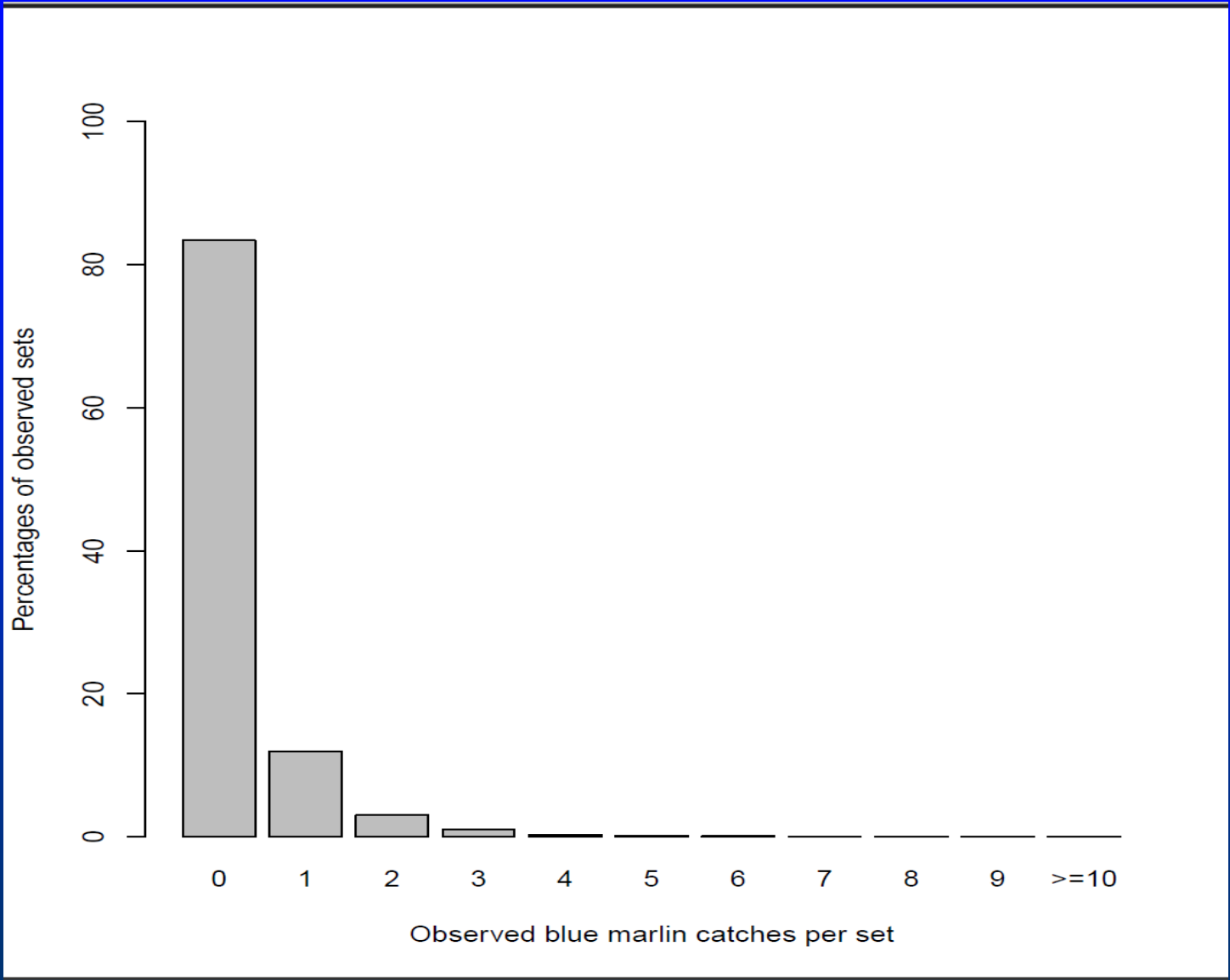


Striped Marlin Kobe Plot: 1975–2010

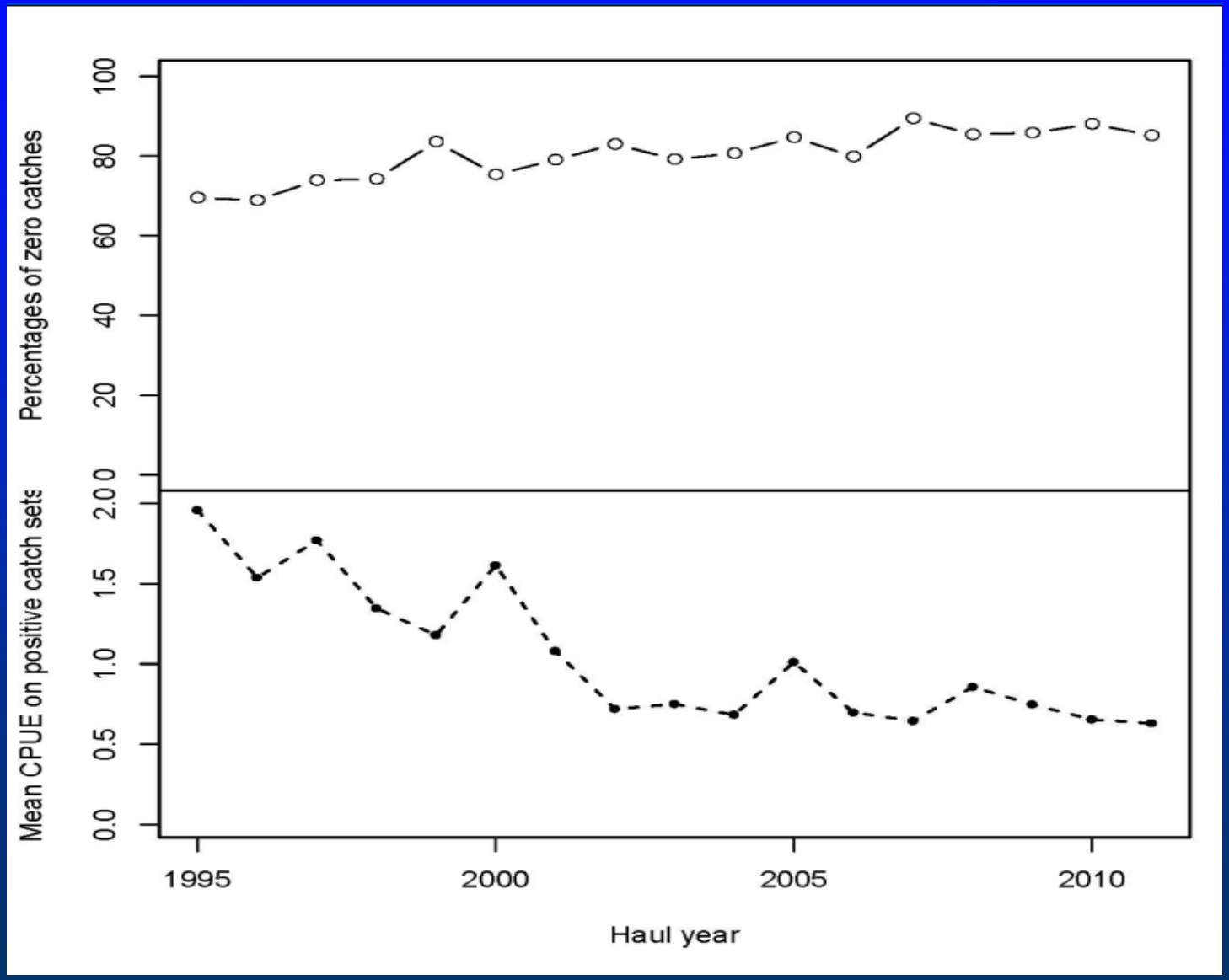
Figure A4. Kobe plot of the trends in estimates of relative fishing mortality and spawning biomass of Western and Central North Pacific striped marlin (*Kajikia audax*) during 1975-2010.



Blue Marlin Observed Catches: 1995–2011



Blue Marlin Trends: 1995–2011
Zeroes and CPUE on Sets with Positive Catches



Blue Marlin: Progress to Date

Catch history correction in progress (Walsh et al. 2005; 2007).

Blue marlin CPUE standardizations in progress (Walsh et al. 2005; Brodziak and Walsh, in preparation).

Blue Marlin CPUE Standardization: Analytical Opportunities

Ongoing CPUE standardization analyses (Brodziak and Walsh, in preparation) with oceanic whitetip shark *Carcharhinus longimanus*, traditionally considered abundant but now increasingly rare, have demonstrated the applicability of multi-model inference to a bycatch species. This work should serve as the basis for a similar study with these incidentally caught marlins.

Inclusion of environmental factors (e.g., ENSO; bathymetry) may increase the explanatory power of the CPUE standardization models comprehensibly.
Dr. Y.-J. Chang (JIMAR/PIFSC) will be co-investigator.

Conclusions

This project met its first set of objectives by providing a corrected catch history and standardized CPUE series for the striped marlin stock assessment.

This project will soon meet (*ca*. January 2013) its second set of objectives by providing a corrected catch history and several standardized CPUE series for the upcoming blue marlin stock assessment.

Acknowledgments

Hui-Hua Lee provided statistical advice for the striped marlin CPUE standardization.

Brent Miyamoto, Christopher Y. Tokita, and Diosdado Gonzales of the PIFSC have assisted greatly with comparisons of catch and sales data for marlins for several years.

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