Recent Progress in Analyses of Catch Data from Fishery Observers and in Logbooks

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Recent Activities

- "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 et al., 2005. Fisheries Research 75: 175-192
- Provision of corrected catch data for a striped marlin stock assessment being conducted at the PIFSC
- Oral presentation and submittal of a paper for the Fourth International Billfish Symposium proceedings
- Logbook catch data correction; archival of corrections
- Exploratory analyses: within fisheries, between species; between fisheries, within species

Analytical Objectives: Billfish Symposium

- General:

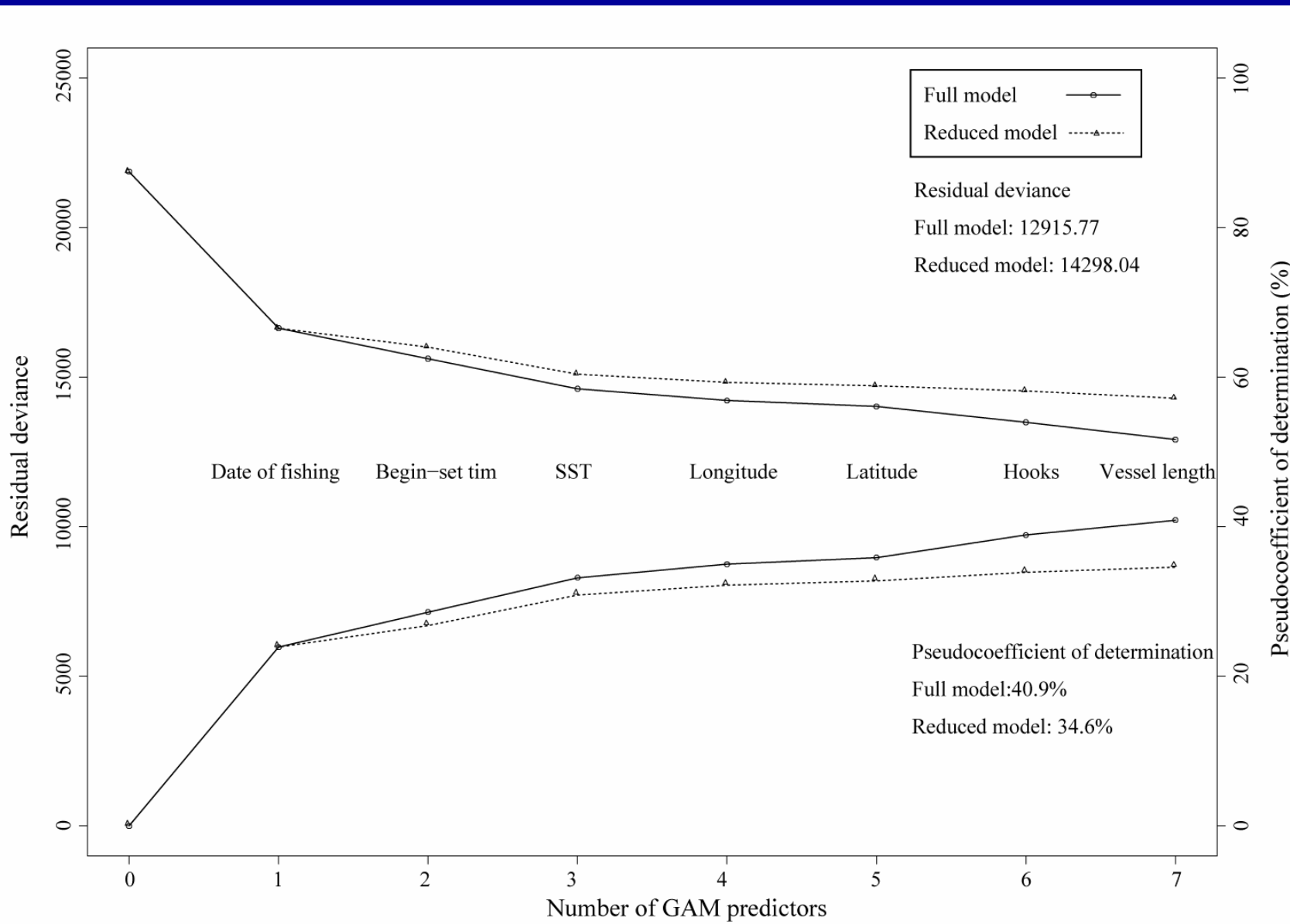
  To improve modeling techniques for blue marlin catch data gathered by fishery observers

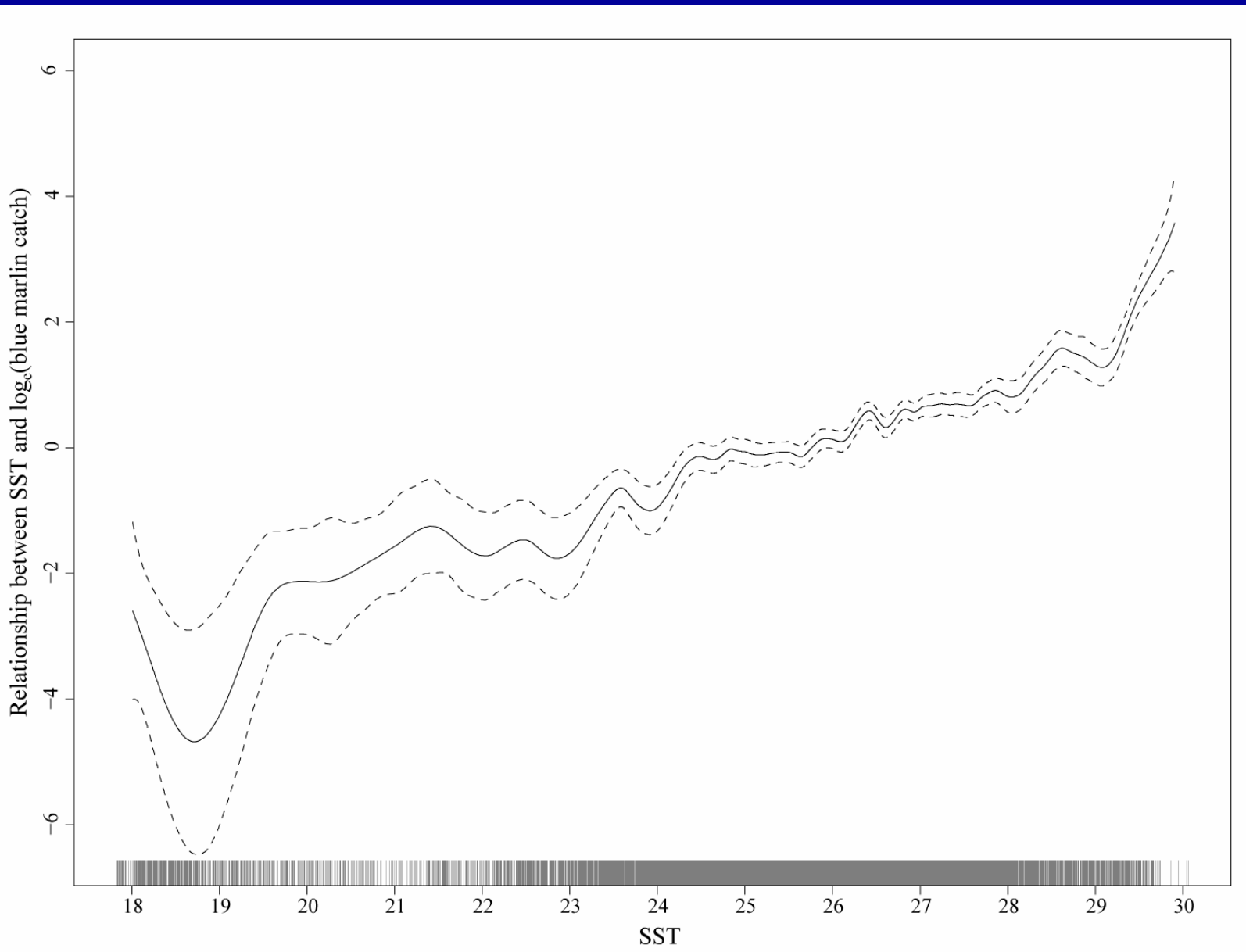
- Specific:

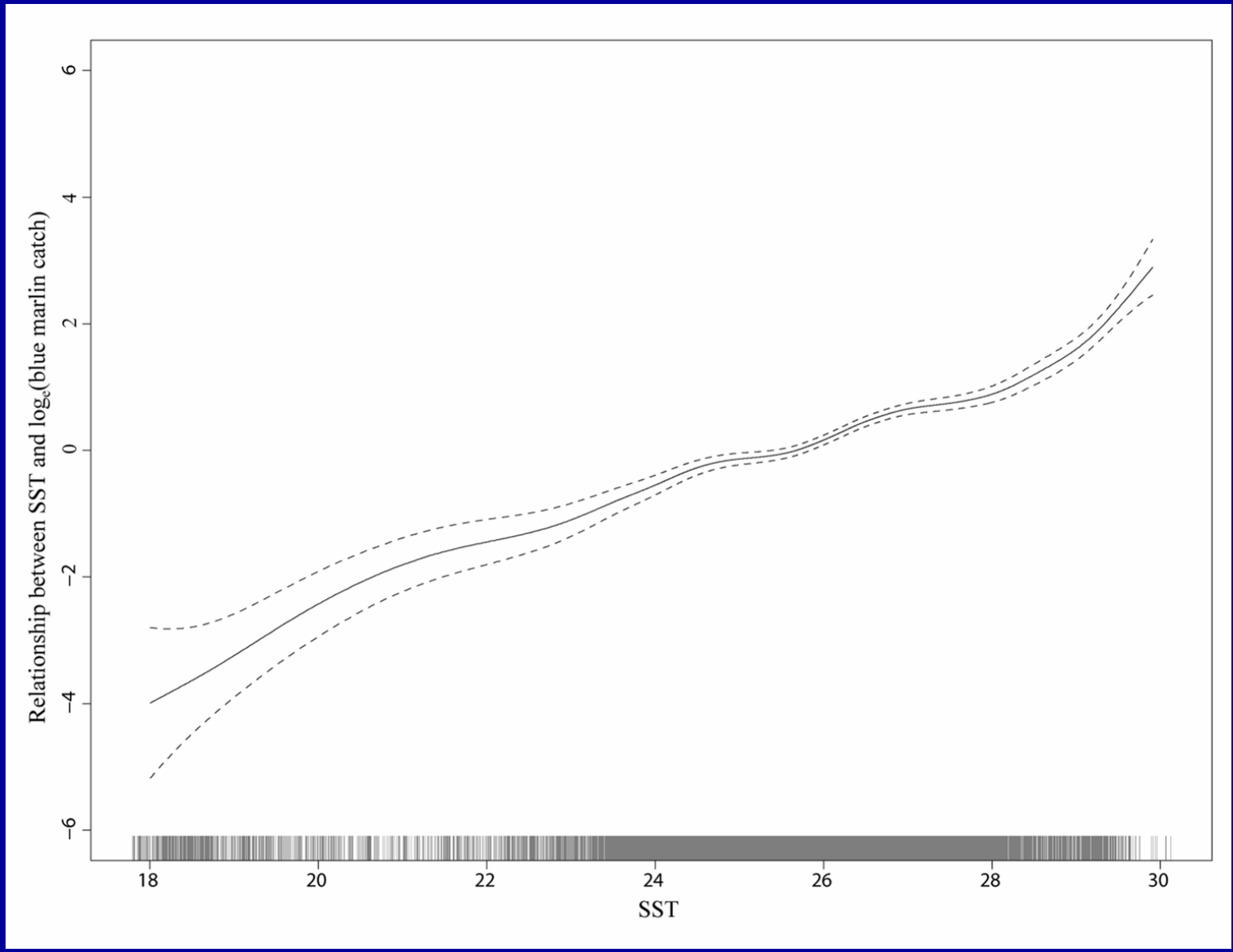
  1) To reduce overparameterization in a predictive GAM

  2) To develop predictive GAMs from operational and environmental predictors (but not both)

  3) To develop an explanatory GAM that includes extrinsic factors that affect catches (in addition to those previously known)


Full model
Reduced model
Residual deviance
Full model: 12915.77
Reduced model: 14298.04
Date of fishing
Begin−set tim
SST
Longitude
Latitude
Hooks
Vessel length
Pseudocoefficient of determination
Full model:40.9%
Reduced model: 34.6%
Residual deviance
Pseudocoefficient of determination (%)
Number of GAM predictors
0
5000
10000
15000
20000
25000
0
20
40
60
80
100
0
1
2
3
4
5
6
7

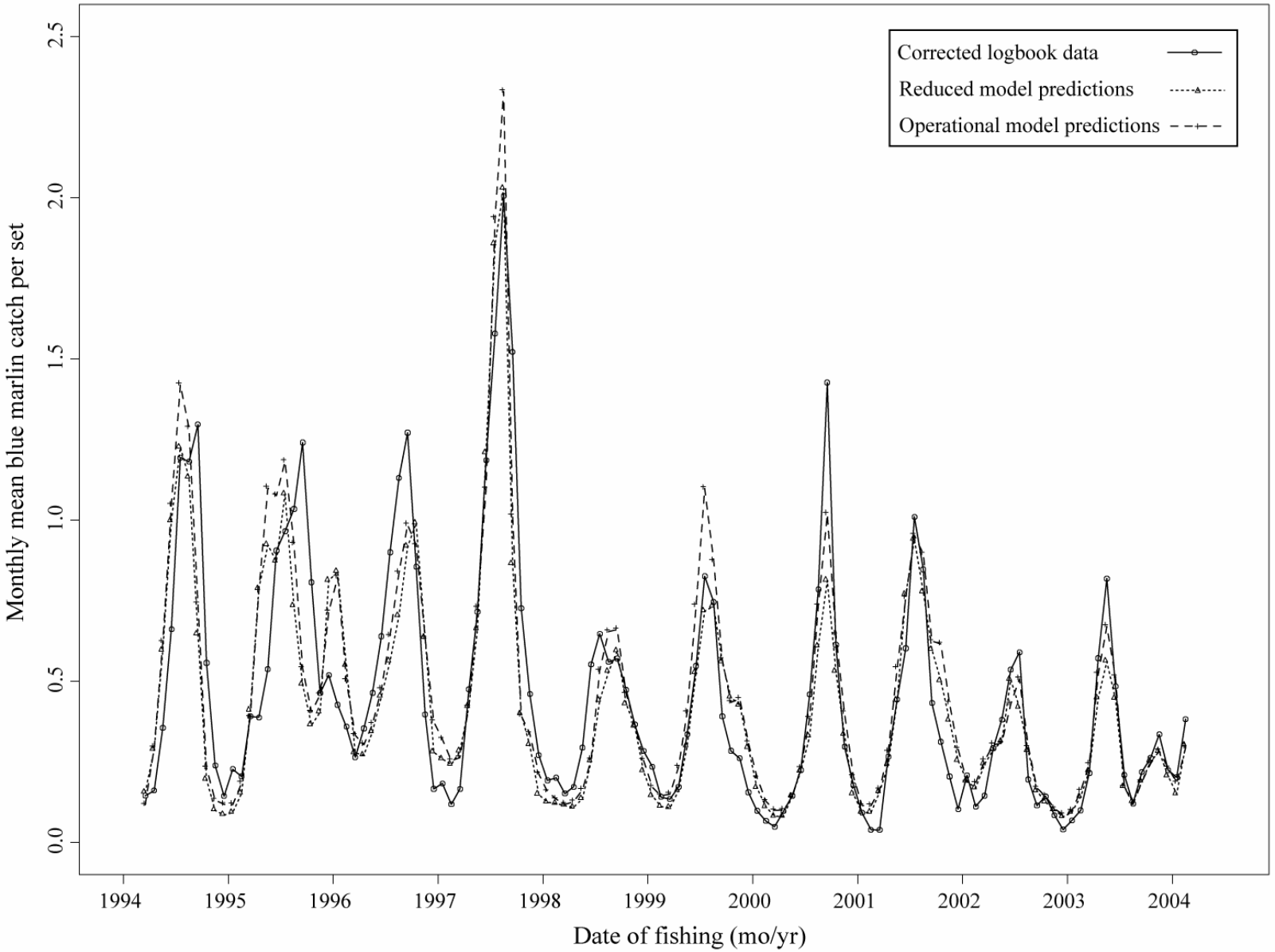

Relationship between SST and log$_e$(blue marlin catch)
6
4
2
0
−2
−4
−6
18
19
20
21
22
23
24
25
26
27
28
29
30
SST


Relationship between SST and log$_e$(blue marlin catch)
6
4
2
0
−2
−4
−6
18
20
22
24
26
28
30
SST

Summary of Results: Predictive Models

- A GAM with model df equivalent to 0.5% of total df yielded an accurate (+6.5%) and relatively precise (95% PI: 24% of point estimate) catch estimate when coefficients were applied to unobserved sets
- Significant variables (all operational factors): seasonality (predominant), position, begin-set time, vessel length, hook numbers

- A GAM with model df equivalent to 0.4% of total df (all environmental factors) had a lower pseudo-R^2 and larger residual deviance than the other GAMs.
- Significant variables: SST (predominant), SST frontal index, SST anomaly, SSH anomaly, Wind stress curl, Current velocity


Corrected logbook data
Reduced model predictions
Operational model predictions
Monthly mean blue marlin catch per set
0.0
0.5
1.0
1.5
2.0
2.5
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Date of fishing (mo/yr)

Summary of Results: Explanatory Model

- This model not limited to variables present in logbooks – intention was to describe as adequately as possible this stochastic process
- Fifteen variables significantly associated with blue marlin catches
- Operational factors predominant – nine of the first 10 model entries
- Hooks/float most influential of the newly assessed variables
- Sea surface temperature - the predominant environmental variable
- Operational variables more strongly associated with catches than environmental variables, apparently due to greater measurement error in the latter.

Data Correction and Archival

- Ten-year time series (March 1994 – February 2004) of corrected logbook catch data for blue marlin, striped marlin, black marlin, shortbill spearfish, and sailfish

- Estimated Bias
  Blue marlin: +21%
  Striped marlin: -9%
  Shortbill spearfish: -14%
  Sailfish: +43%
  Black marlin: +441%

- Contact: Brent Miyamoto (PIFSC data manager)
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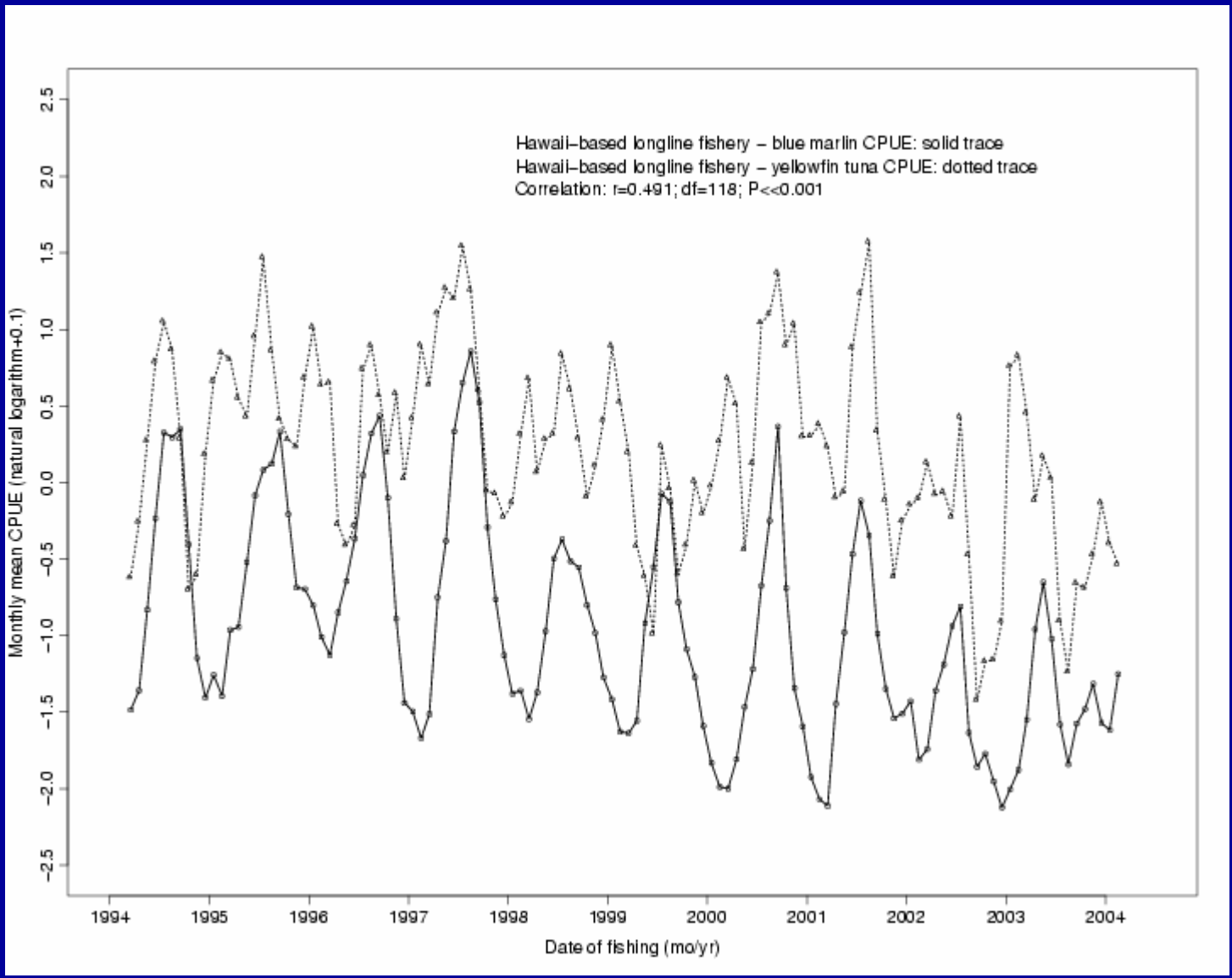
Exploratory Analyses

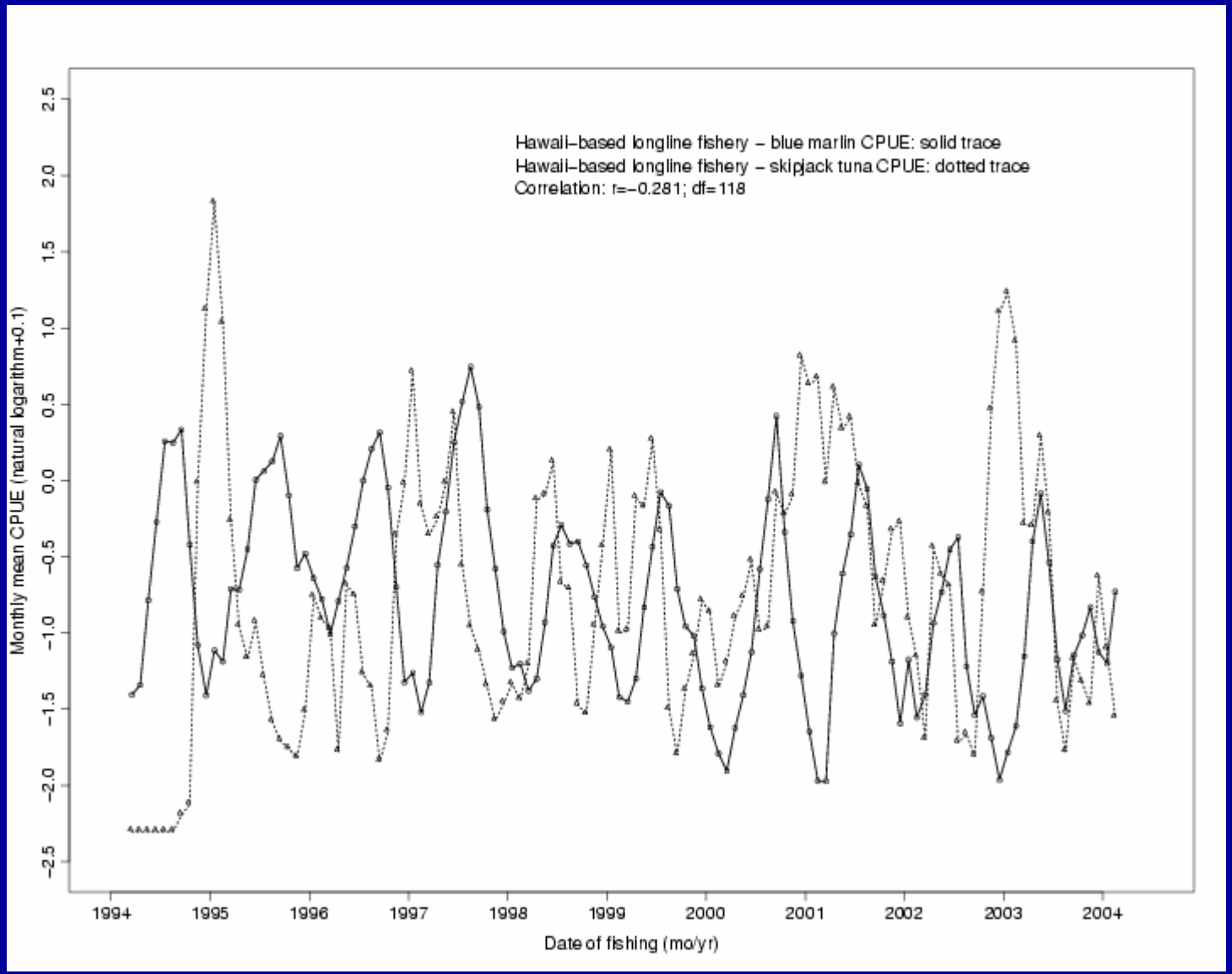
- Preliminary assessment of possible associations between catches of yellowfin or skipjack tunas and blue marlin or striped marlin in the Hawaii-based longline fishery
- March 1994 – February 2004: blue marlin CPUE significantly correlated with yellowfin tuna CPUE;

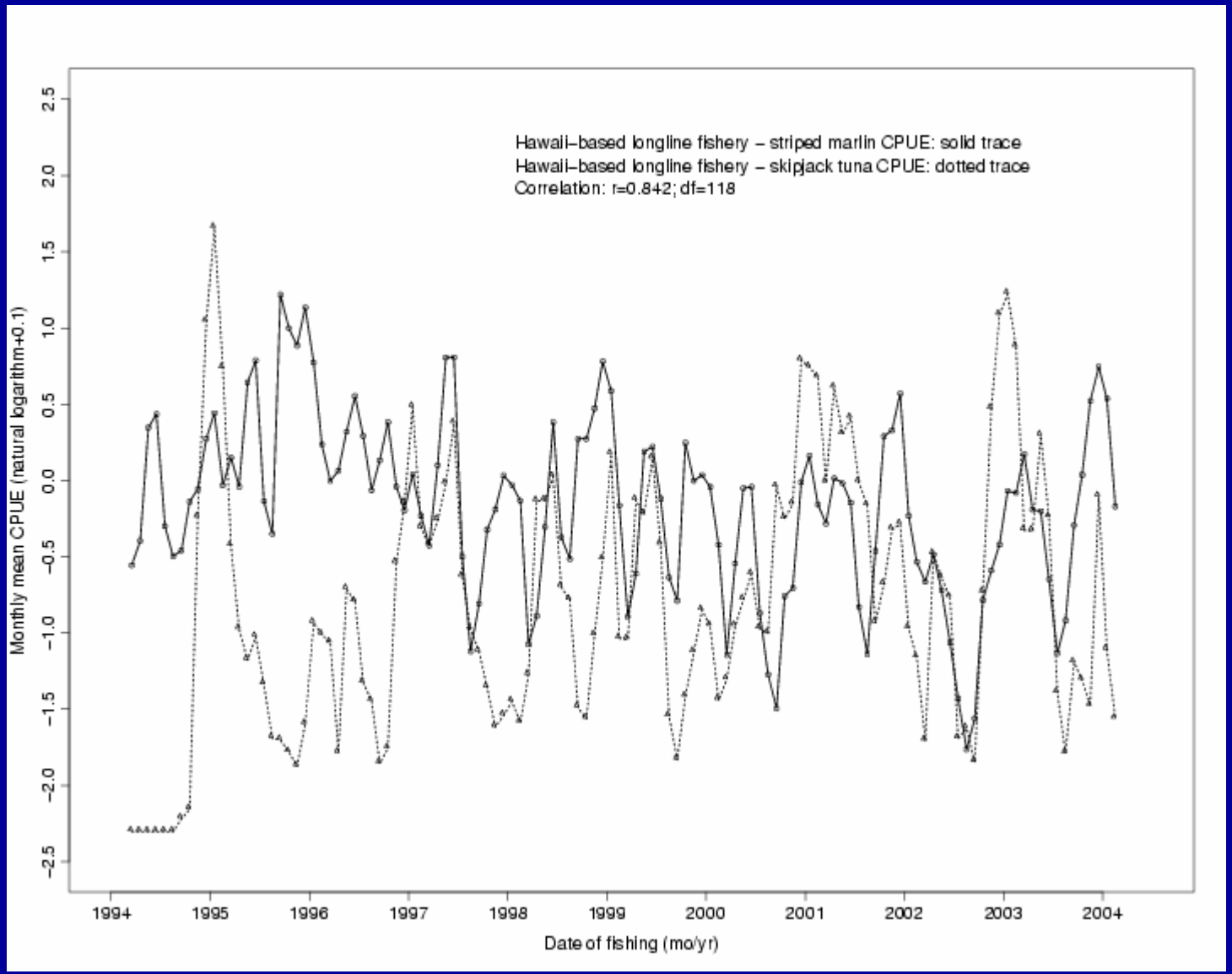
  blue marlin and striped marlin CPUE not correlated with skipjack tuna CPUE

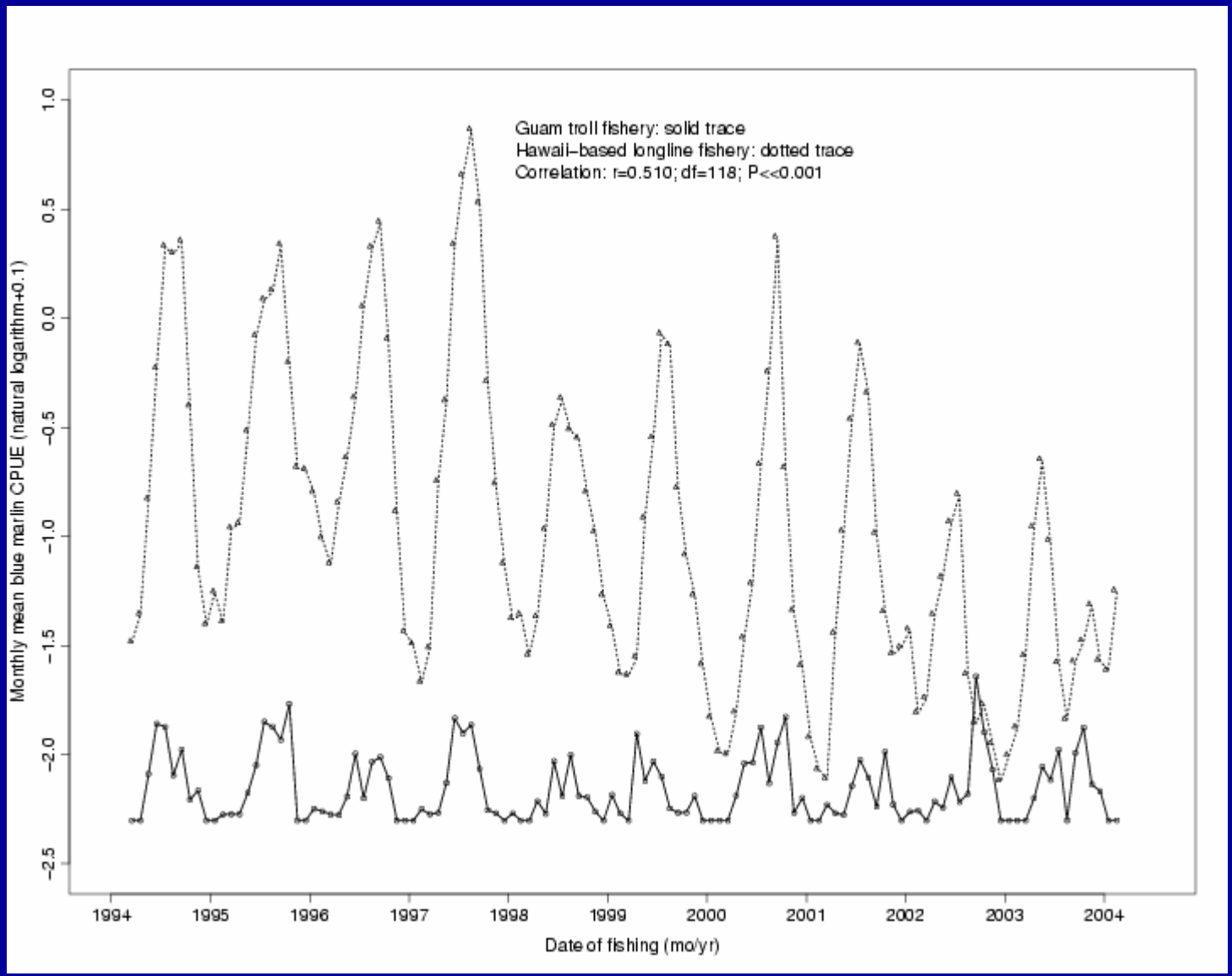
- Preliminary assessment of temporal correspondence in blue marlin or yellowfin tuna CPUE from the Hawaii-based longline fishery and the Guam-based troll fishery
- March 1994 – February 2004: blue marlin CPUE significantly correlated in the two fisheries;

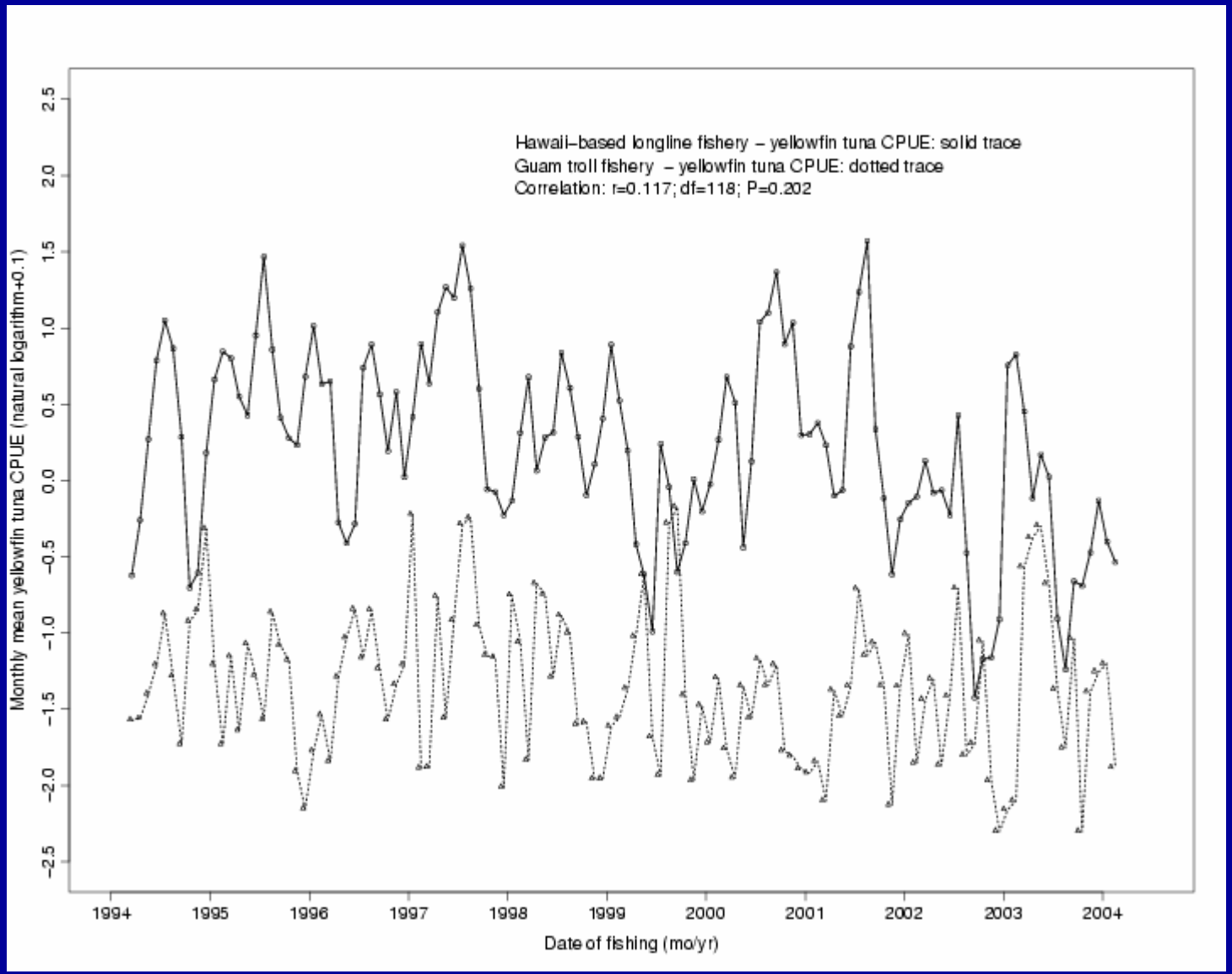
  blue marlin CPUE from the Hawaii-based longline fishery not correlated with yellowfin tuna CPUE


Hawaii–based longline fishery – blue marlin CPUE: solid trace
Hawaii–based longline fishery – yellowfin tuna CPUE: dotted trace
Correlation: r=0.491; df=118; P<<0.001
Monthly mean CPUE (natural logarithm+0.1)
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Date of fishing (mo/yr)


Hawaii–based longline fishery – blue marlin CPUE: solid trace
Hawaii–based longline fishery – skipjack tuna CPUE: dotted trace
Correlation: r=–0.281; df=118
Monthly mean CPUE (natural logarithm+0.1)
2.5
2.0
1.5
1.0
0.5
0.0
–0.5
–1.0
–1.5
–2.0
–2.5
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Date of fishing (mo/yr)


Hawaii–based longline fishery – striped marlin CPUE: solid trace
Hawaii–based longline fishery – skipjack tuna CPUE: dotted trace
Correlation: r=0.842; df=118
Monthly mean CPUE (natural logarithm+0.1)
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Date of fishing (mo/yr)


Guam troll fishery: solid trace
Hawaii–based longline fishery: dotted trace
Correlation: r=0.510; df=118; P<<0.001
Monthly mean blue marlin CPUE (natural logarithm+0.1)
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Date of fishing (mo/yr)


Hawaii–based longline fishery – yellowfin tuna CPUE: solid trace
Guam troll fishery – yellowfin tuna CPUE: dotted trace
Correlation: r=0.117; df=118; P=0.202
Monthly mean yellowfin tuna CPUE (natural logarithm+0.1)
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Date of fishing (mo/yr)

Acknowledgments

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