Predicting yellowfin tuna recruitment in EPO using on oceanographic data.

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Background WCPO

- Development of yellowfin recruitment model for WCPO. Improve recent estimates of recruitment and understand key oceanographic influences.
- Recruitment indices from SA model related to range of oceanographic variables, at different temporal and spatial stratifications.

Log(recruit) ~ var1 + var2 + var3 + ….

- High explanatory power (R^2 68%) and cross validation of model.
- Submitted to CJFAS for publication.

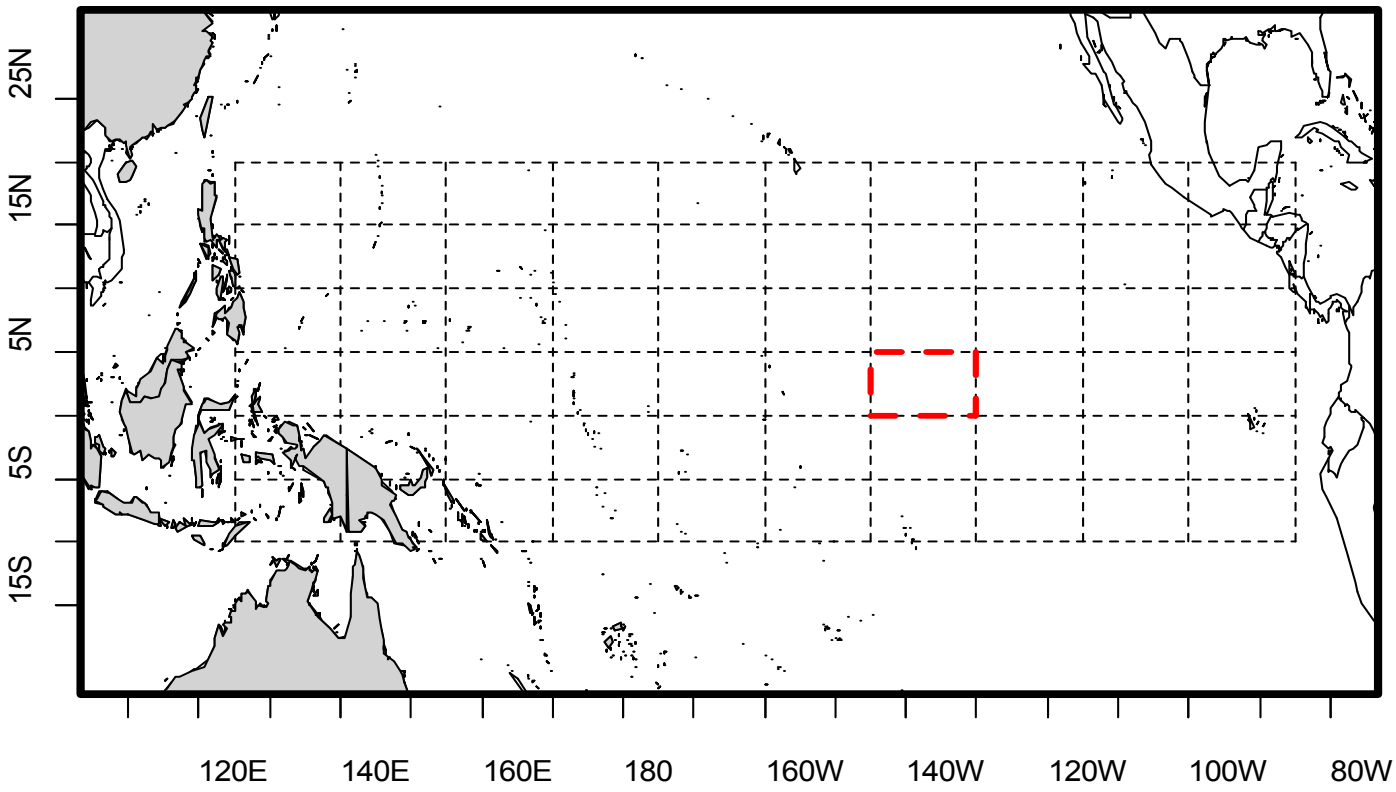
EPO

- Application of the same approach to EPO fishery.
- Recruitment estimates from A-SCALA model.
- Oceanographic data from NCEP/NCAR Reanalysis provided by NOAA Earth System Research Laboratory.
- Apply recruitment model to predict 2004-2006 recruitments (12 quarters).
- Magnitude of recent recruitment? Does this explain low catches in 2006?

Potential explanatory variables

Attribute	Description	Units
tempavg	Mean sea temperature at 5 m depth	°C
temprange	Range in sea temperature at 5 m depth.	°C
sstdepth	Depth of the 20°C isotherm	m
currentuavg	Mean zonal (E-W) current velocity within at 45 m depth.	ms^{-1}
currenturange	Range in zonal current velocity at 45 m depth.	ms^{-1}
currentvavg	Mean meridional (N-S) current velocity at 45 m depth.	ms^{-1}
currentvrange	Range in meridional current velocity at 45 m depth.	ms^{-1}
currentdir	Current direction at 45 m depth.	quadrant
winduavg	Mean zonal (E-W) wind at 10 m altitude	$m\ s^{-1}$
windvavg	Mean meridional (N-S) wind at 10 m altitude	$m\ s^{-1}$
turbulence	Index of turbulent kinetic energy –wind speed cubed	$m^3\ s^{-3}$

Spatial, temporal resolution



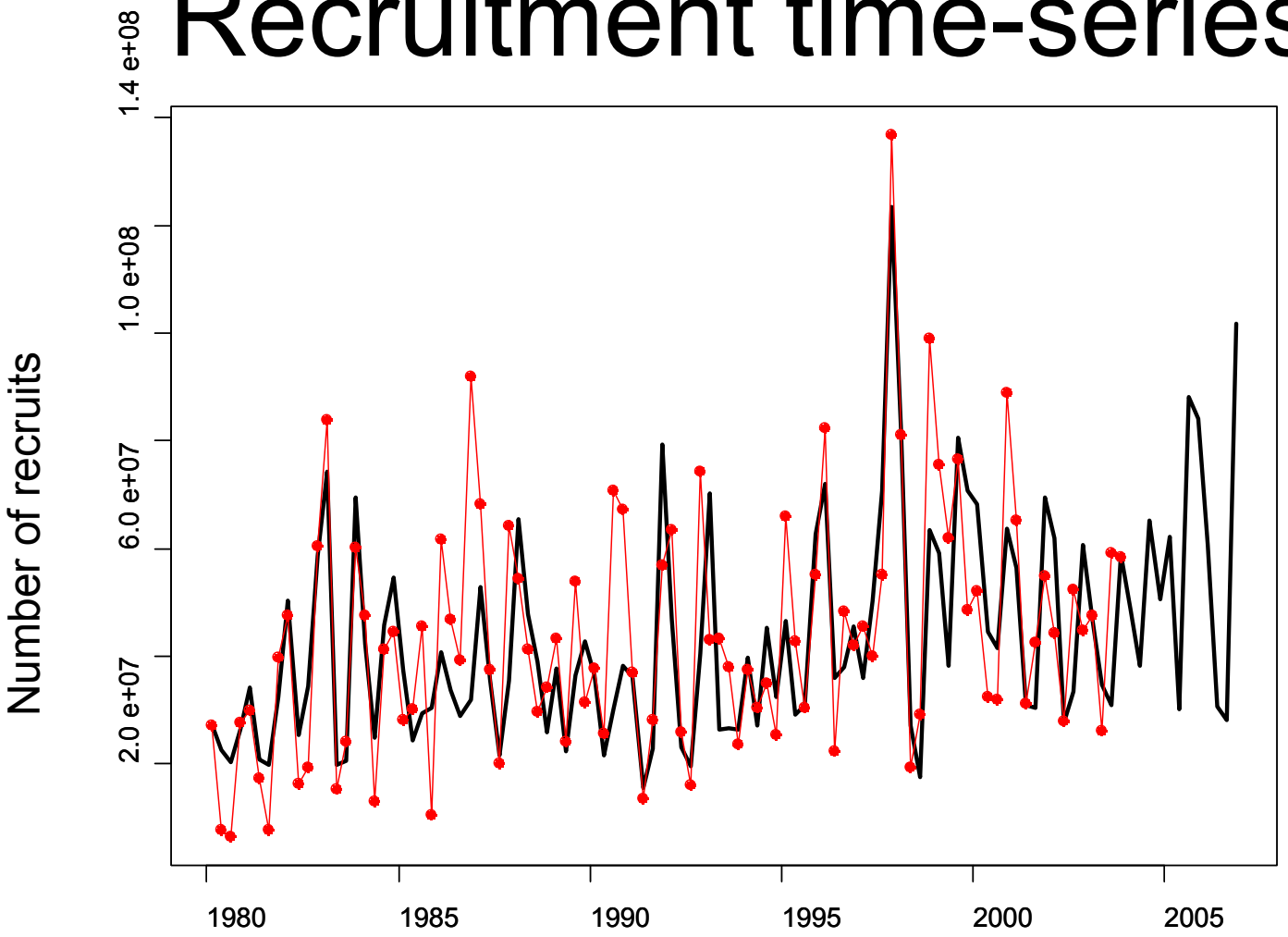
Spatial strata: equatorial Pacific stratified at 5*15 lat/long and 5*30 lat/long

Temporal strata: quarter of spawning, quarter pre/post spawning.

EPO Model

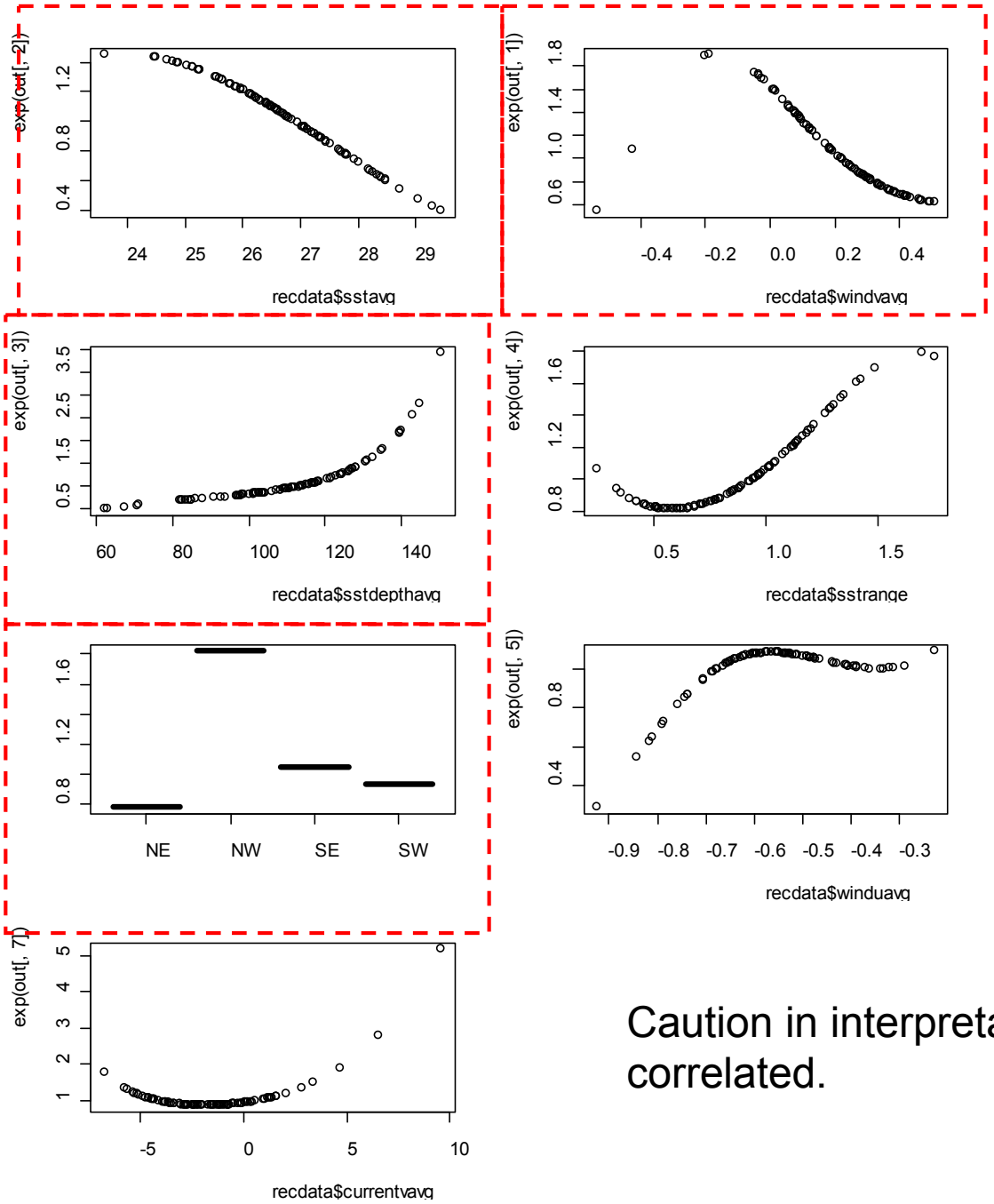
- Single spatial stratum within eastern equatorial region (Southern Equatorial Current).
- Temporal. Quarter post spawning.
- Explained 54% of variance in recruitment (1980-2003, 96 quarters). Cross validation following Francis 2006.
- Potential to include additional areas in model – increased explanatory power?
- Predict recruitment for 2004, 2005, 2006.

Recruitment time-series



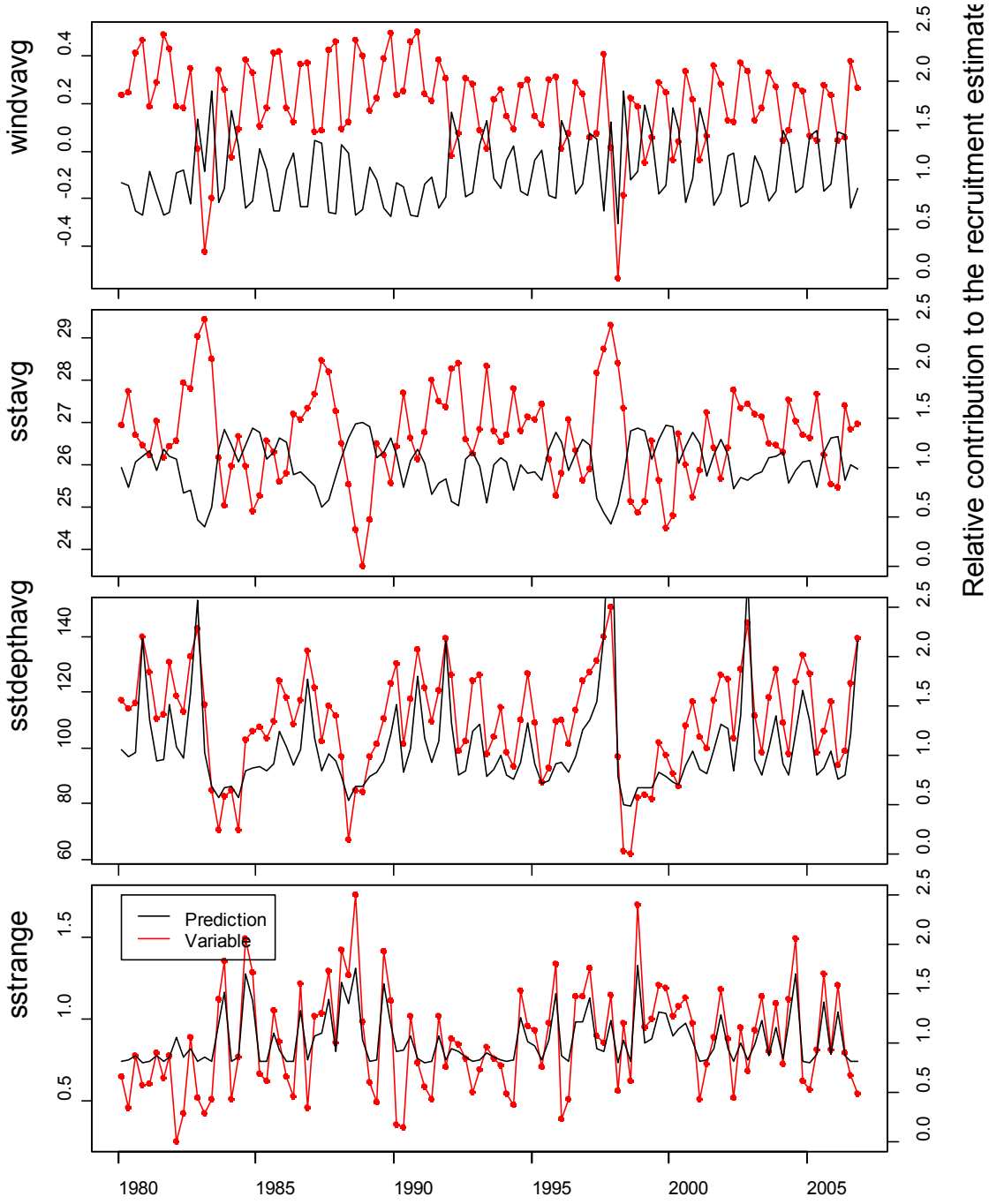
Generally, model predictions (lines) approximate seasonal and decadal variation in “observed” recruitment (points).

Model predicts high seasonal peaks in recruitment for 2005 and 2006. Modest recruitment predicted for 2003 and 2004.



Key variables in model 1. Parameterisation.

Caution in interpretation – all are highly correlated.

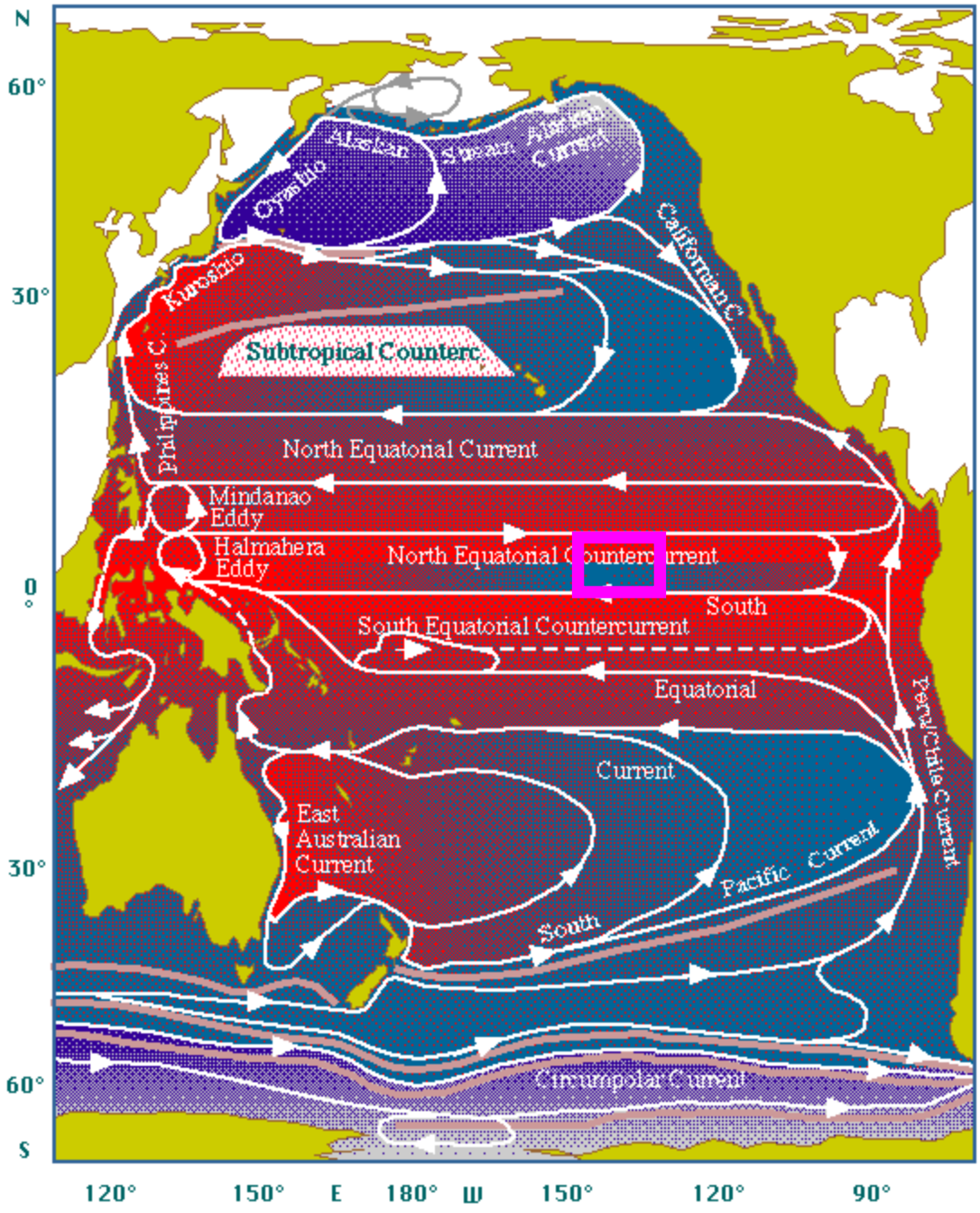


Key variables in model. Influence on predicted recruitment index

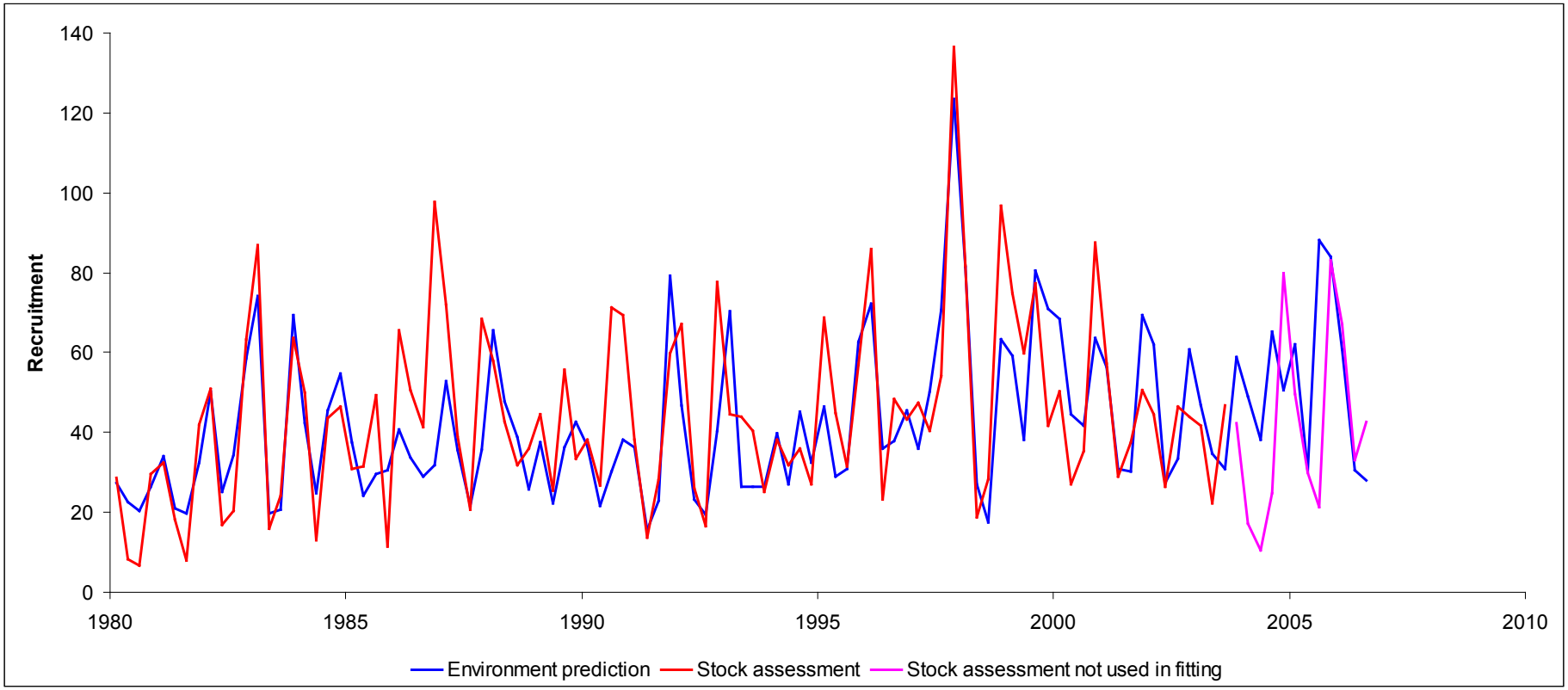
Higher recruitment: weaker northerly winds, deeper thermocline, cooler SST (?), higher variation in SST.

High recruitment late 1990s, early 2000s correlated with weaker northerly winds, higher variation in SST.

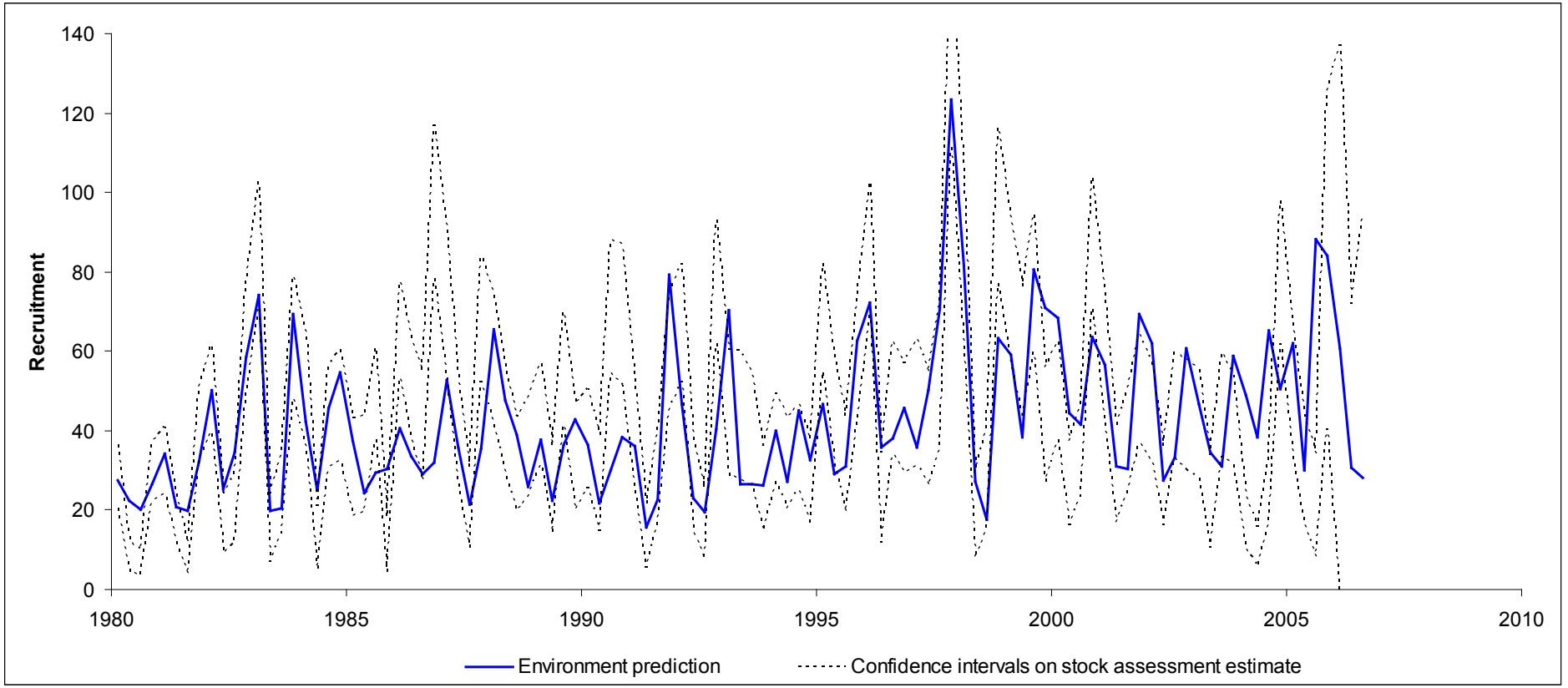
Pacific Ocean



Comparison to current stock assessment



Comparison to current stock assessment: confidence intervals



Summary

- Model explains a high proportion of variation in recruitment.
- Relatively small area is an indictor of overall oceanographic conditions affecting YFT recruitment in EPO.
- Supports phase changes in YFT recruitment. Environmental rather than SRR.
- Model predicts high recent (2005, 2006) recruitment.
- Potential to improve recent recruitment estimates in SA and improve model 2-3 year projections.
- Continued collaborations between SPC and IATTC: improve yellowfin and apply to bigeye