Stock Status Indicators for Silky Sharks in the Eastern Pacific Ocean
(Document SAC-05-11a)

A. Aires-da-Silva, C. Lennert-Cody, M. N. Maunder and M. Román-Verdesoto

Comisión Interamericana del Atún tropical
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Outline of talk

- ## Background

    - § Stock structure assumptions
    - § Update on collaborative assessment work (SAC-05 INF-F)
    - § Alternative information is needed for management

- ## Stock status indicators (SSIs)

    - § Spatial distribution of silky bycatch-per-set on floating-objects (OBJ)
    - § Standardized CPUE from purse-seine sets on OBJ sets
    - § Nominal proportions of positive sets (OBJ, DEL, NOA sets)
    - § Standardize indices of presence/absence on DEL and NOA sets
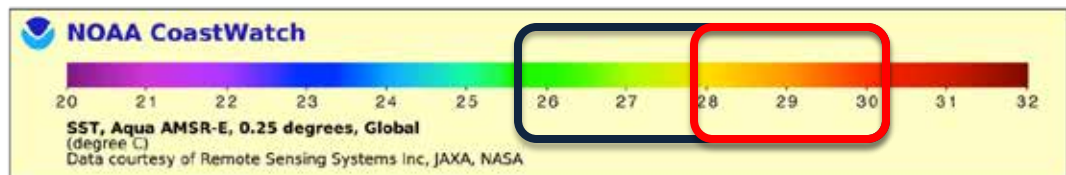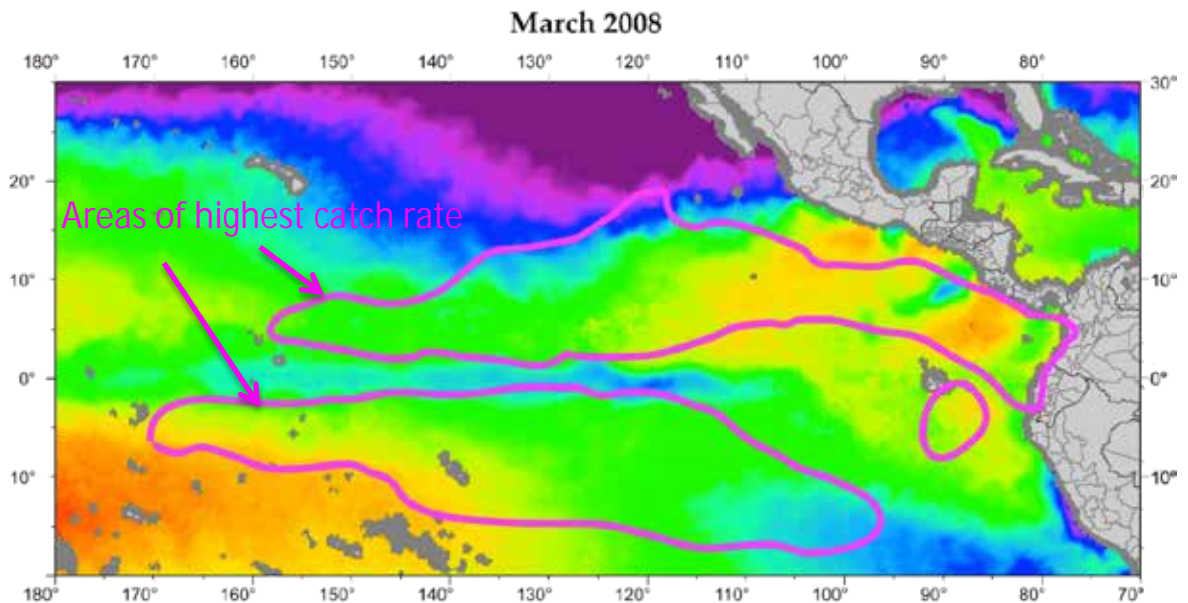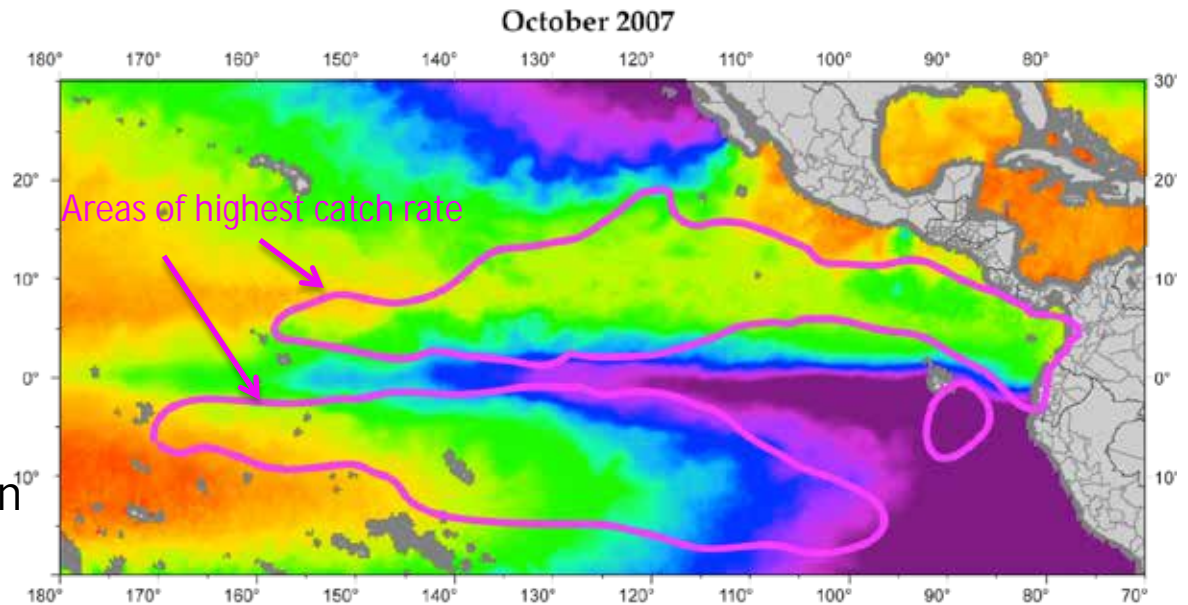   - § Average length by purse-seine set type (OBJ, DEL, NOA)
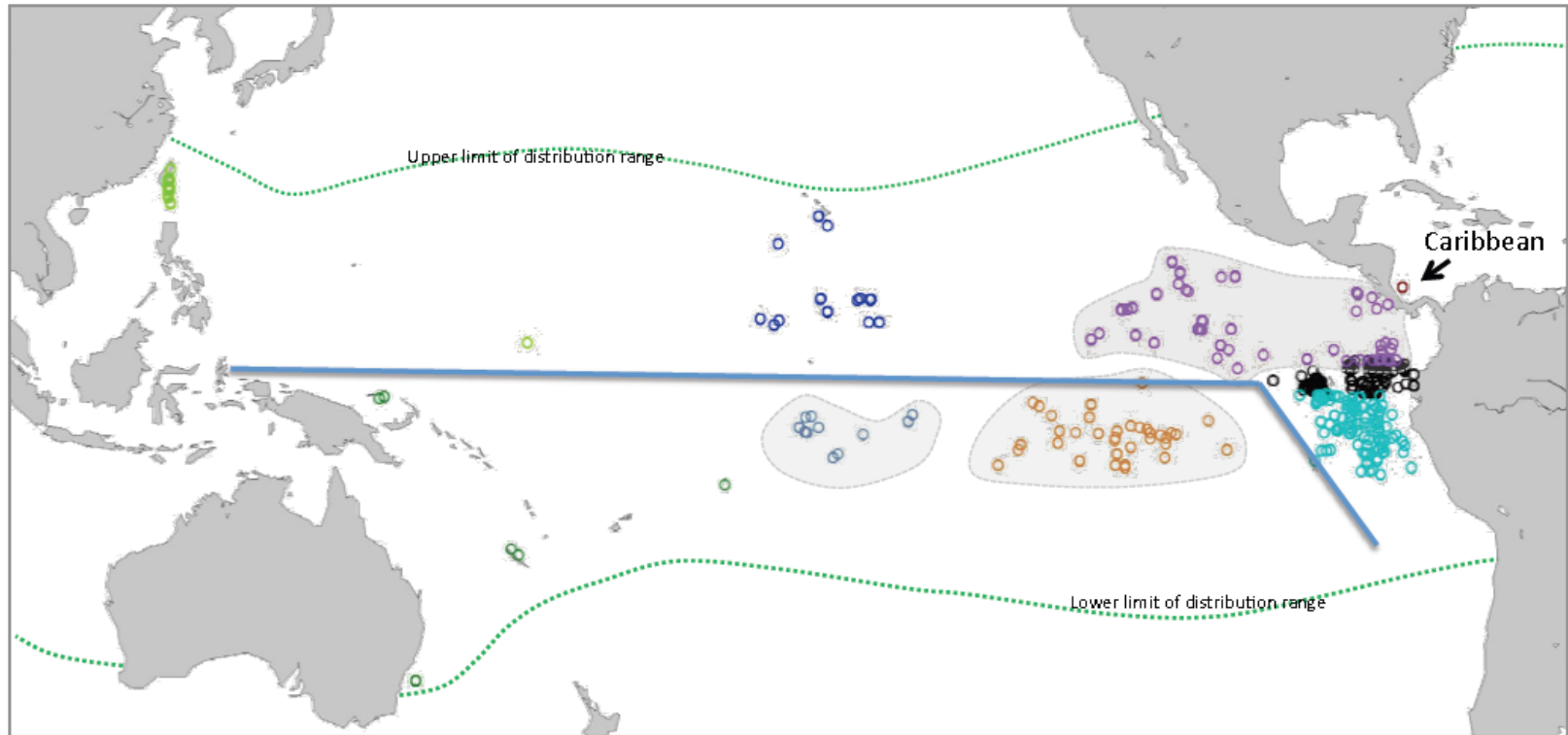
- ## Summary conclusions

Conclusions

- Weak N – S structure
- Animals south of the equator and near the S. American coast most closely allied with Northern animals
  - Seasonal overlap?

Future directions?

- More satellite tagging
- More samples from central and western South Pacific

Source: John Hyde, NMFS-SWFSC

October 2007

Areas of highest catch rate

March 2008

Areas of highest catch rate

NOAA CoastWatch

SST, Aqua AMSR-E, 0.25 degrees, Global
(degree C)
Data courtesy of Remote Sensing Systems Inc, JAXA, NASA

Sample distribution and hypothesized stock boundary
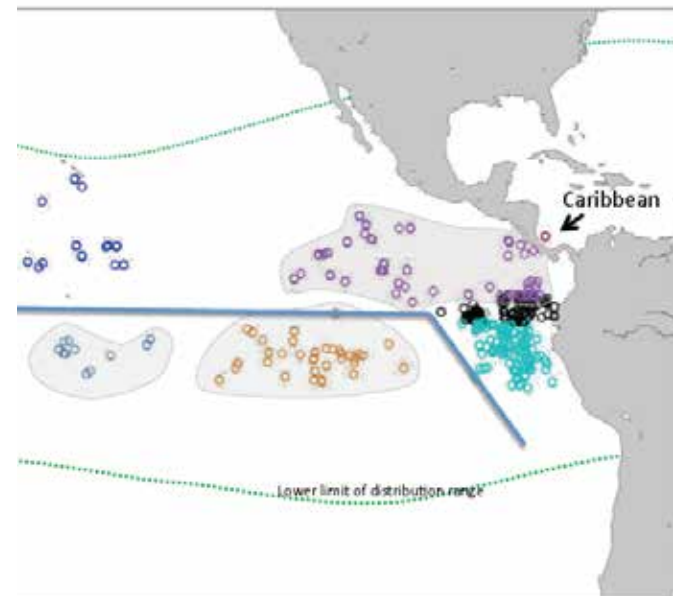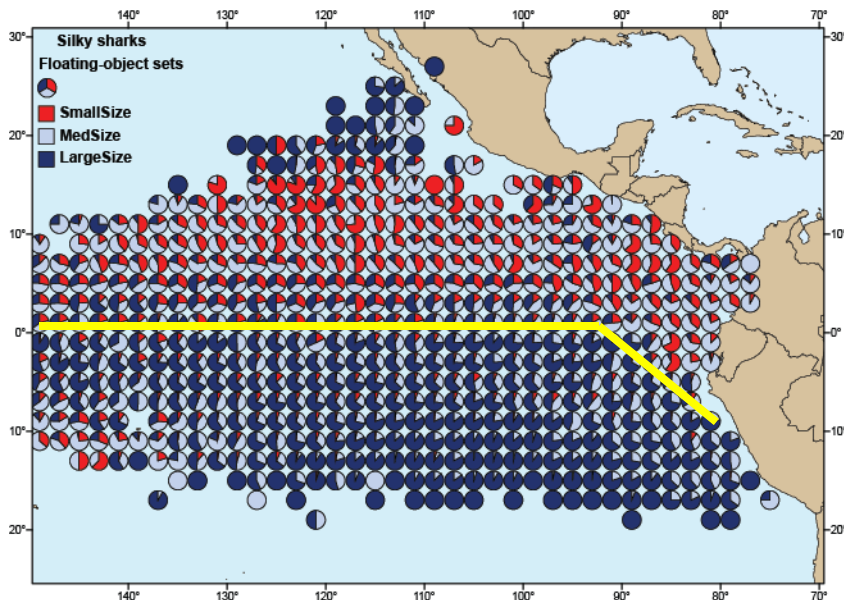

Source: John Hyde, NMFS-SWFSC

Stock assessment

- ## Northern Stock

  - § Stock Synthesis model and fishery indicators (standardized CPUE and average sizes)
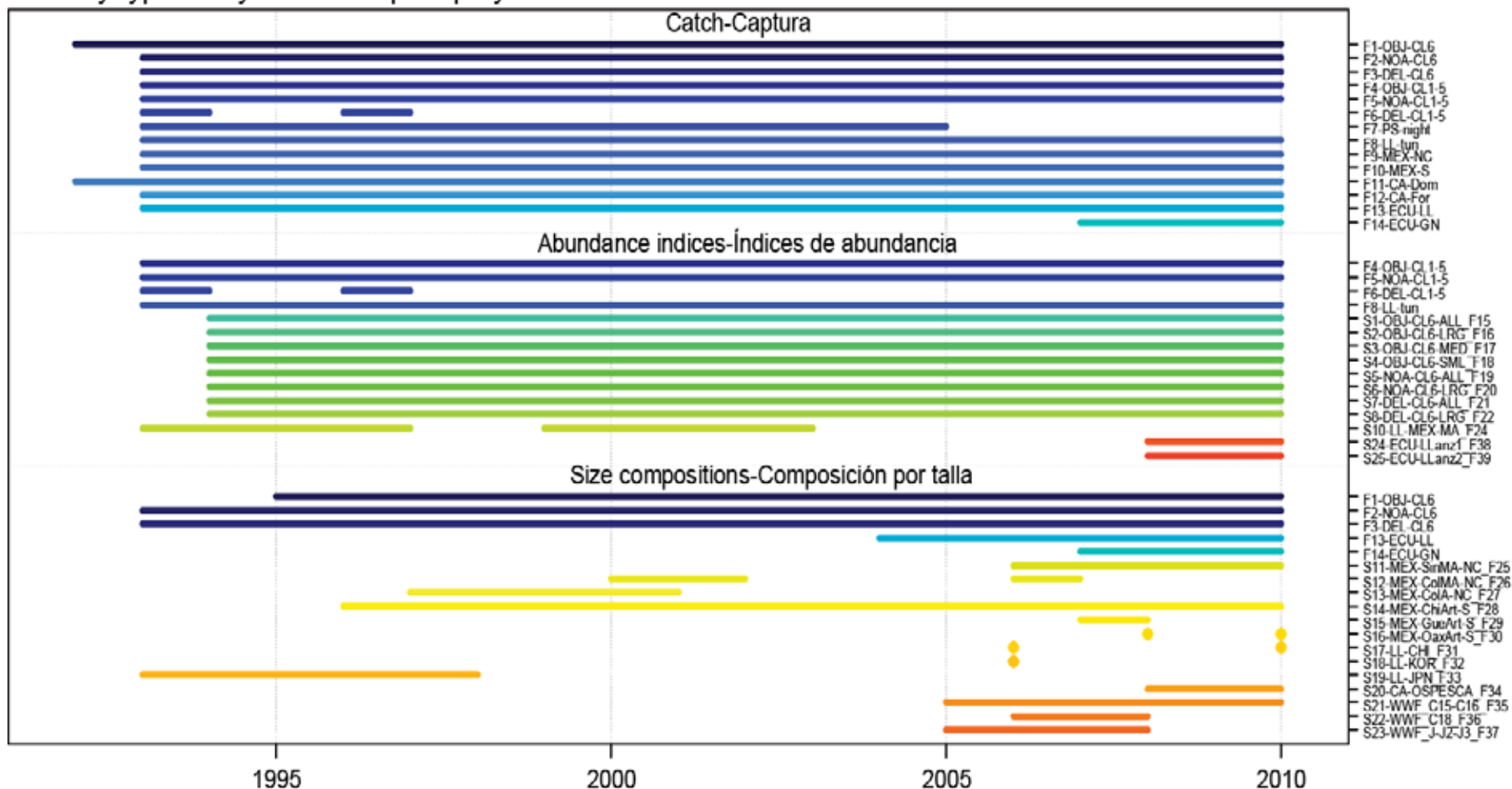
- ## Southern Stock

  - § Fishery indicators: standardized CPUE

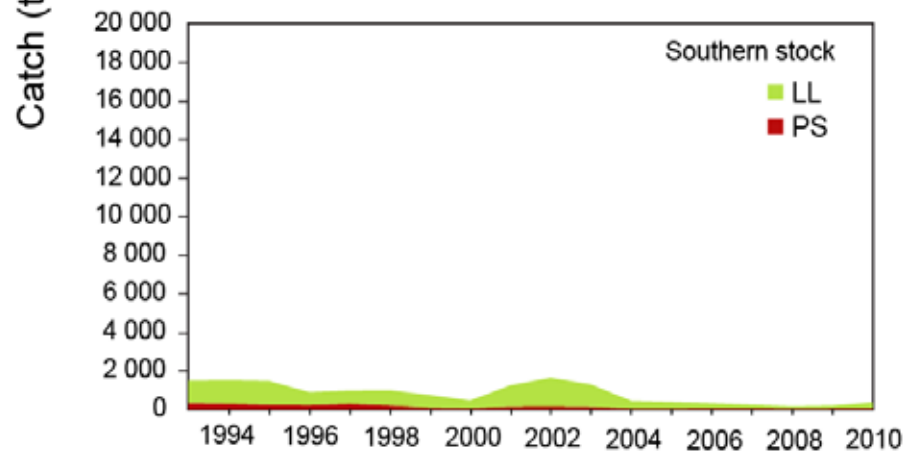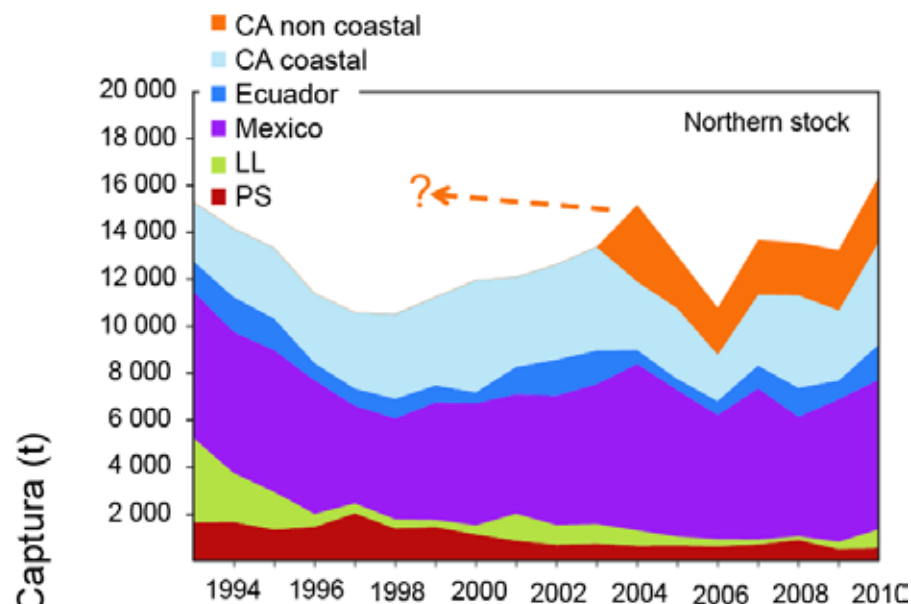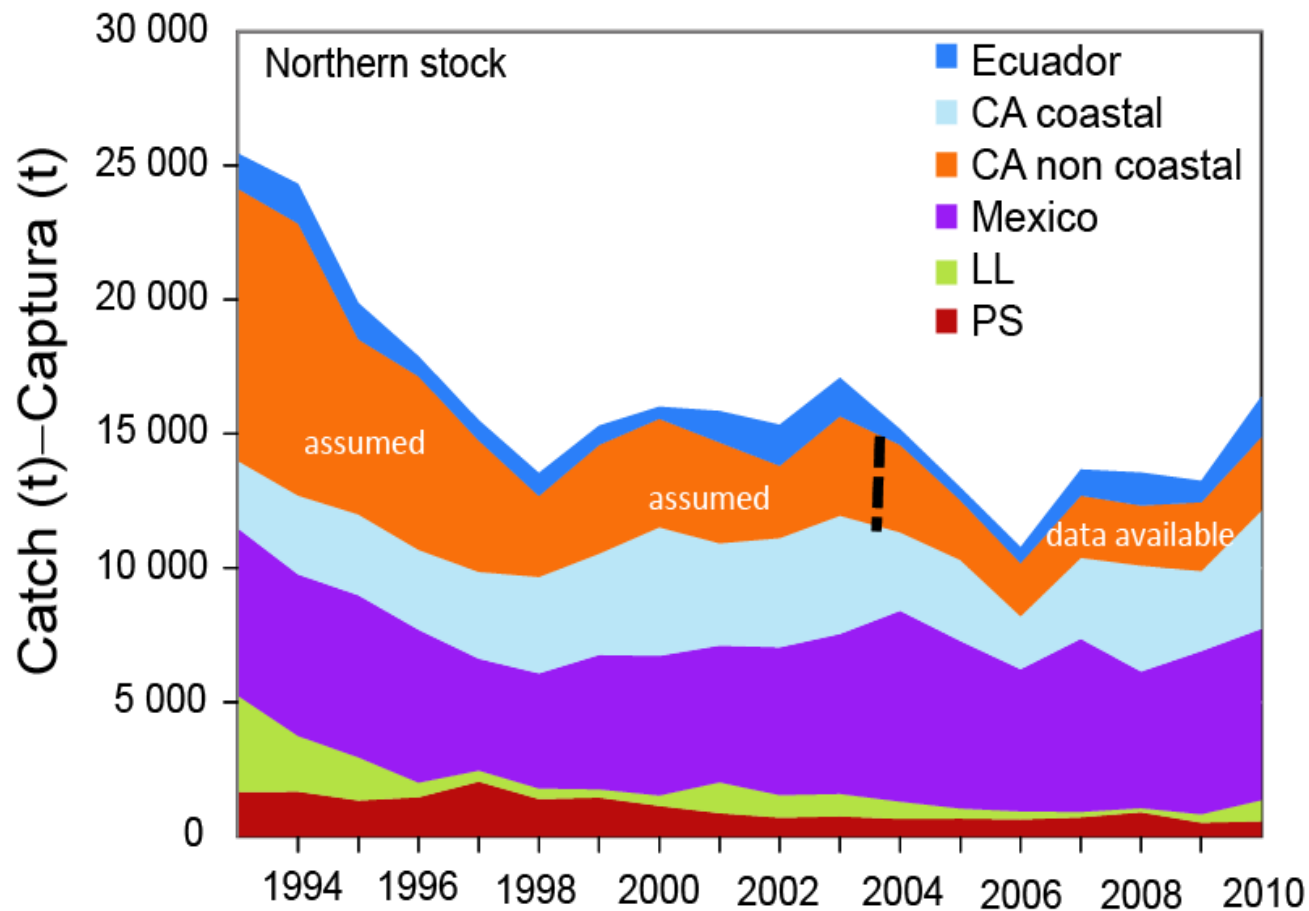# Stock assessment:
data sources obtained
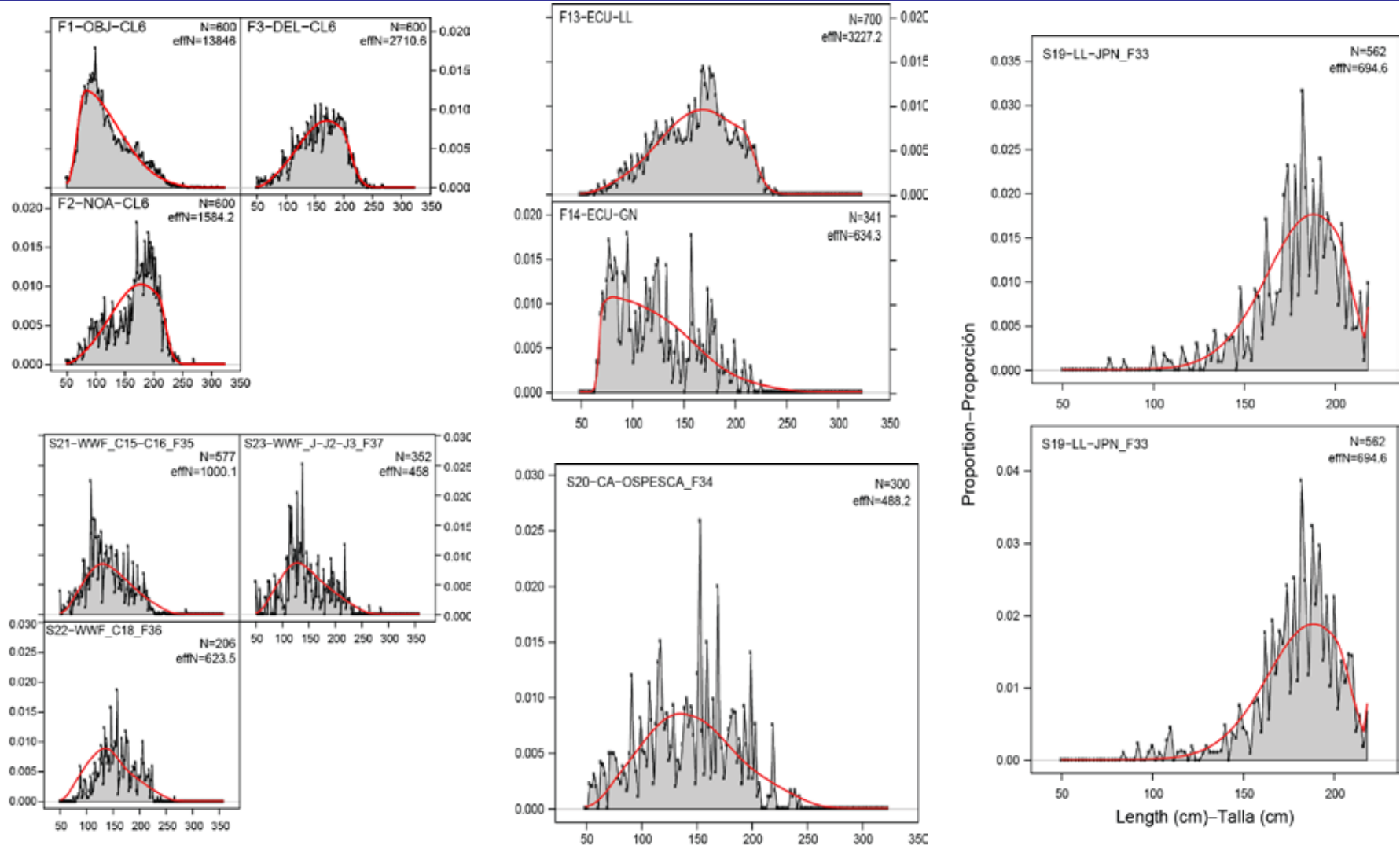
Stock assessment:
"missing catch" in early period

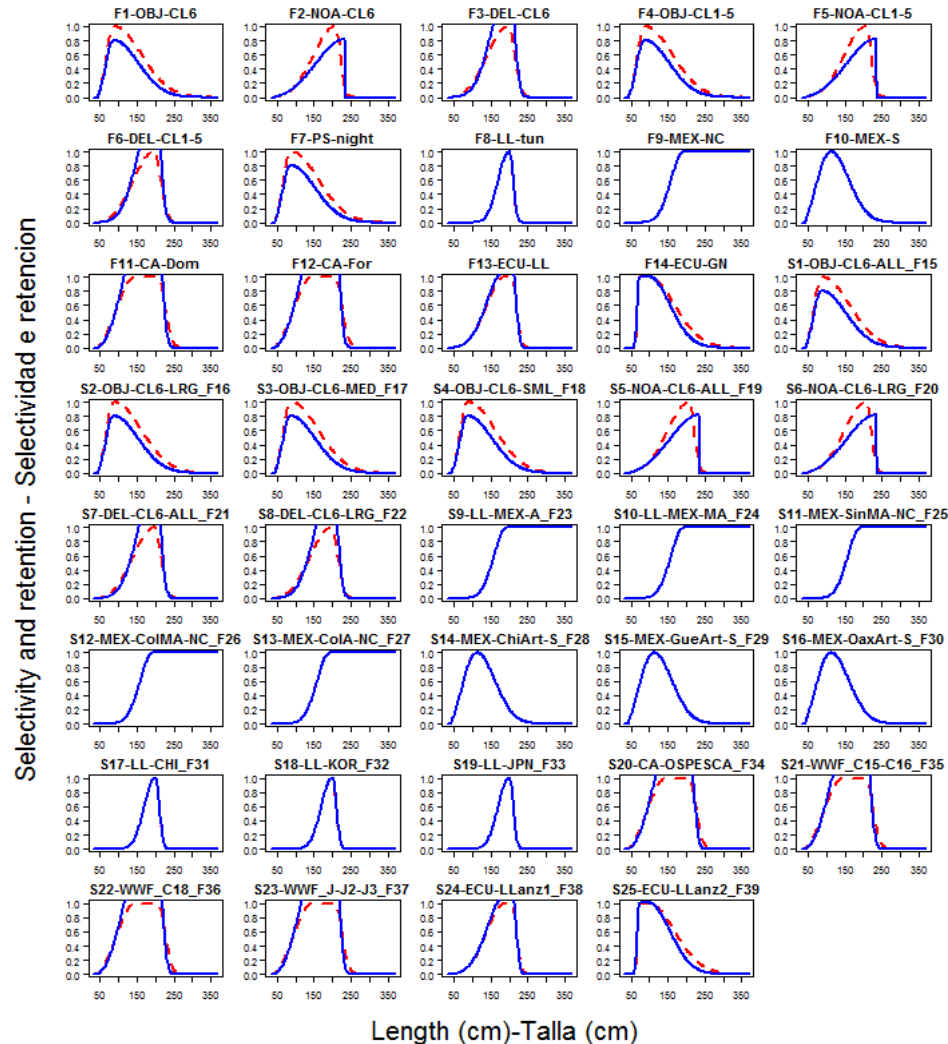# Stock assessment:
reconstruction of "missing catch"
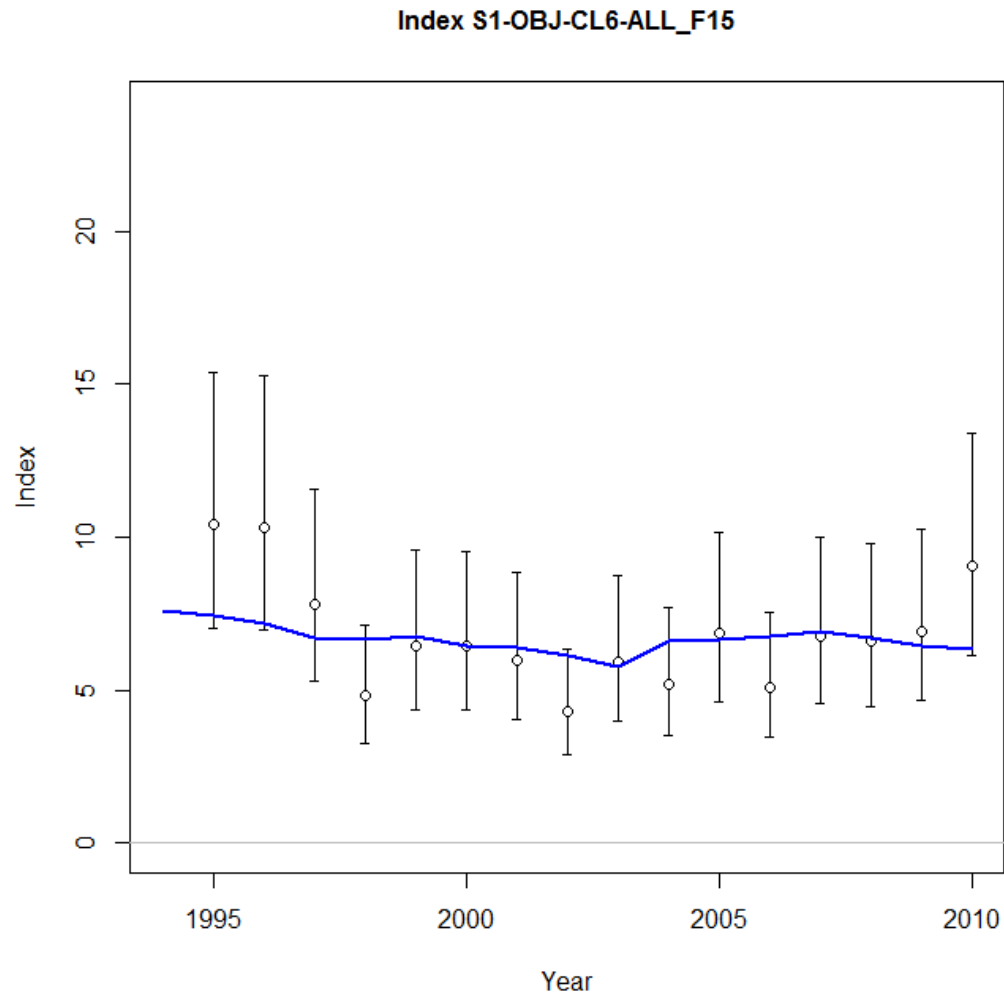
Stock assessment:
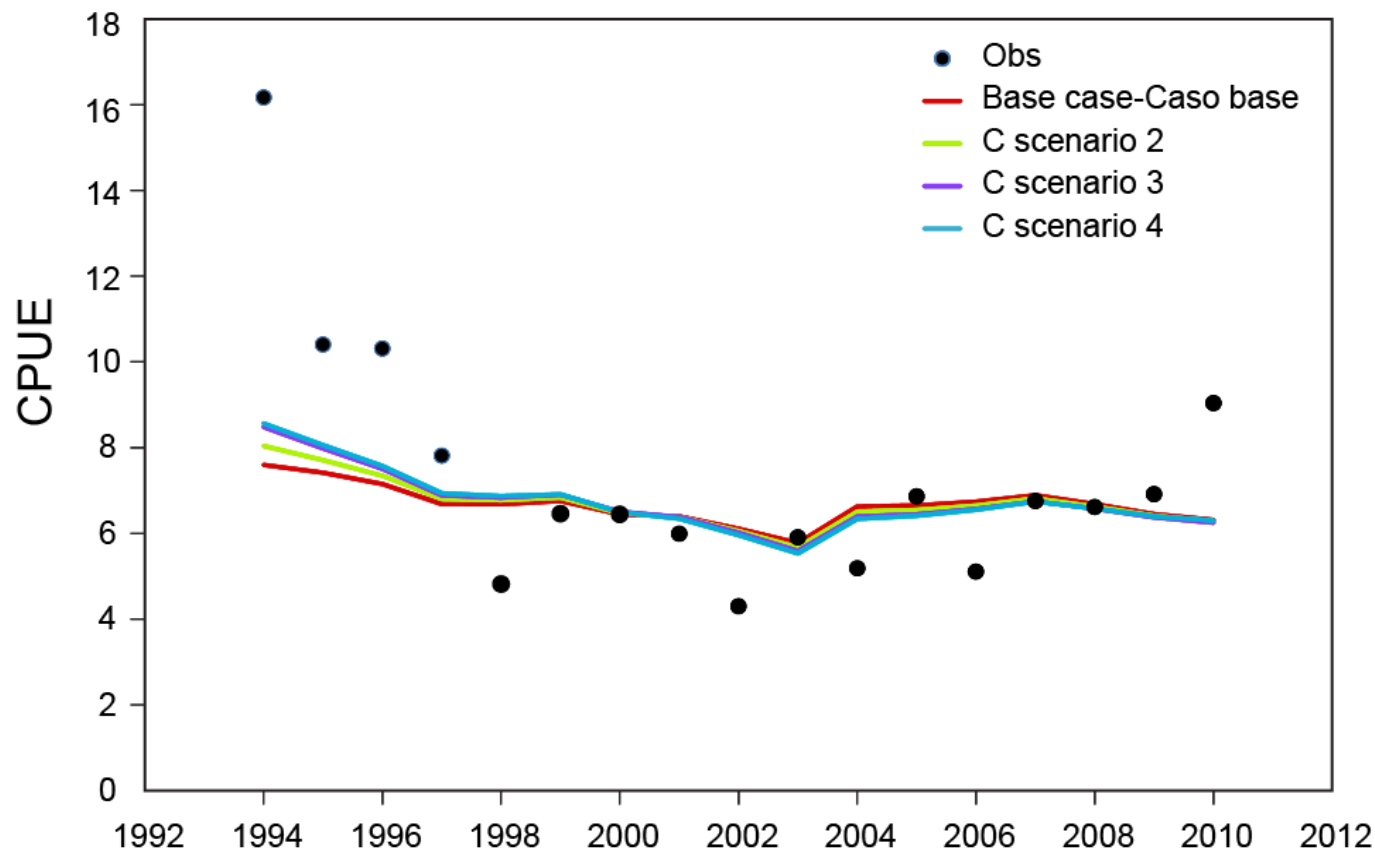## model fit to length compositions

Stock assessment:
selectivities

Stock assessment:
model misfit to early CPUE

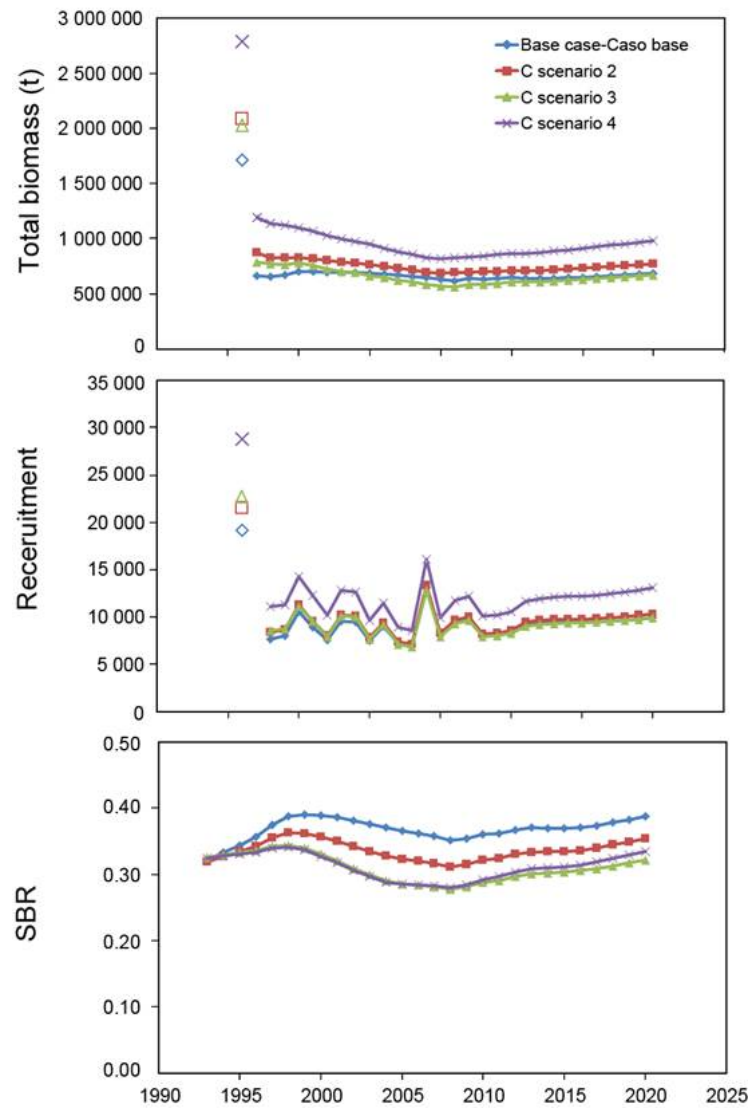

Index S1-OBJ-CL6-ALL_F15

Stock assessment:
model misfit to early CPUE (sensitivities)

Stock assessment:
estimated time series

Stock assessment - conclusions

- Stock assessment was attempted using Stock Synthesis (1993-2010)

- Improved knowledge on length composition of the catches and selectivities

- Unfortunately, the model was unable to fit the main index of abundance and therefore the results are not reliable

- Poor performance of the model was probably due to the incomplete knowledge of the total catch in the EPO, particularly for the early period of the assessment (1990s and early 2000s)

- An alternative approach is needed to provide management advice

- Use indicators until information is adequate for a full assessment

Fishery indicators (1994-2013)

Spatial distribution of BPS
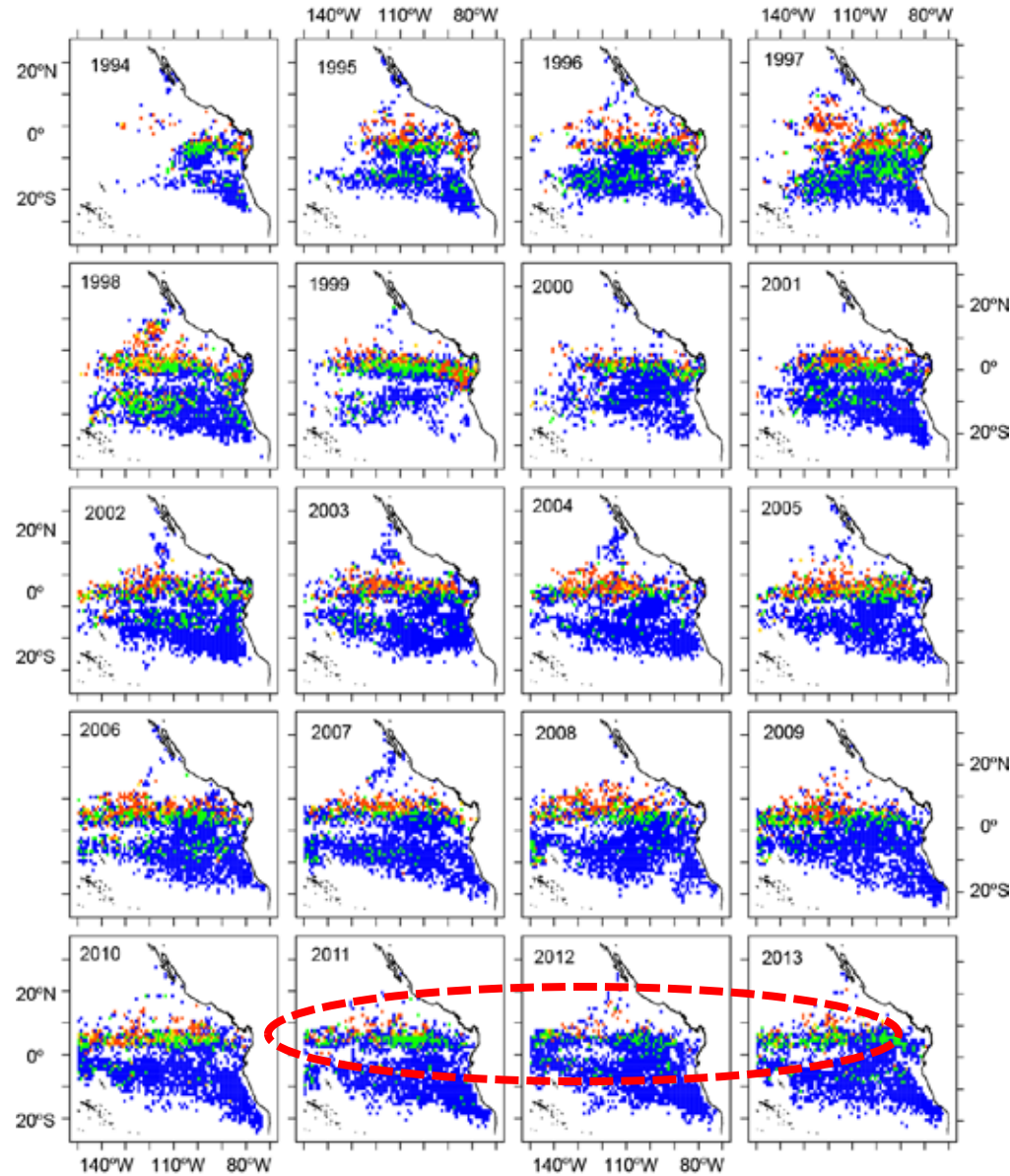
Fltobj sets
small silky (< 90 cm)

Color scale:
blue: 0 bps
green: <= 1 silky/set
yellow: 1-2 silky/set
red: > 2 silky/set
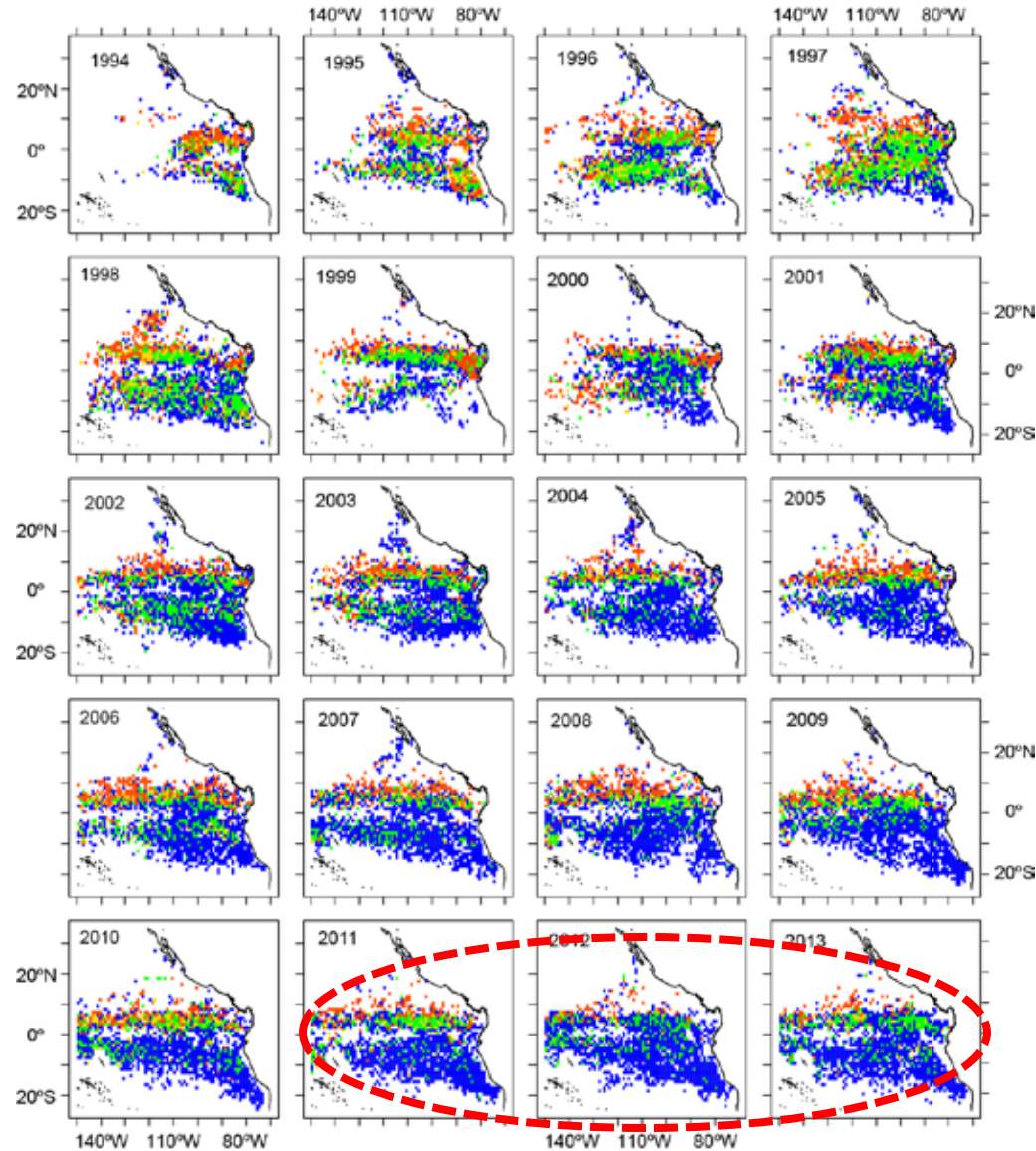
Spatial distribution of BPS

Fltobj sets
medium silky (90-150 cm)

Color scale:
blue: 0 bps
green: <= 1 silky/set
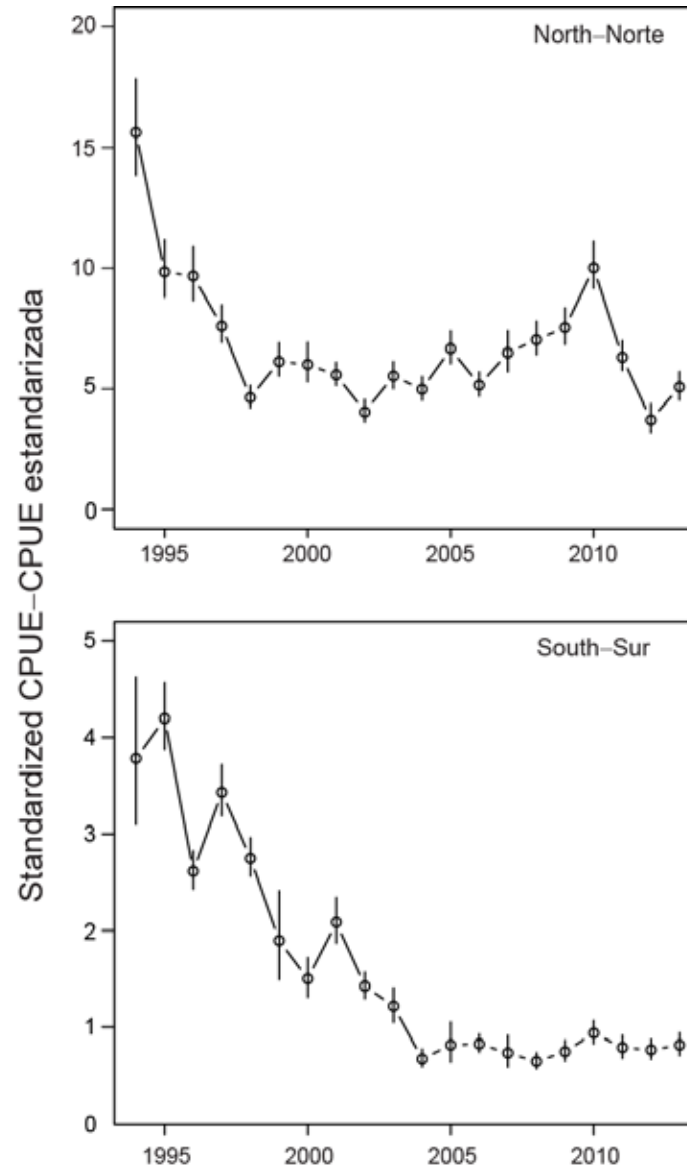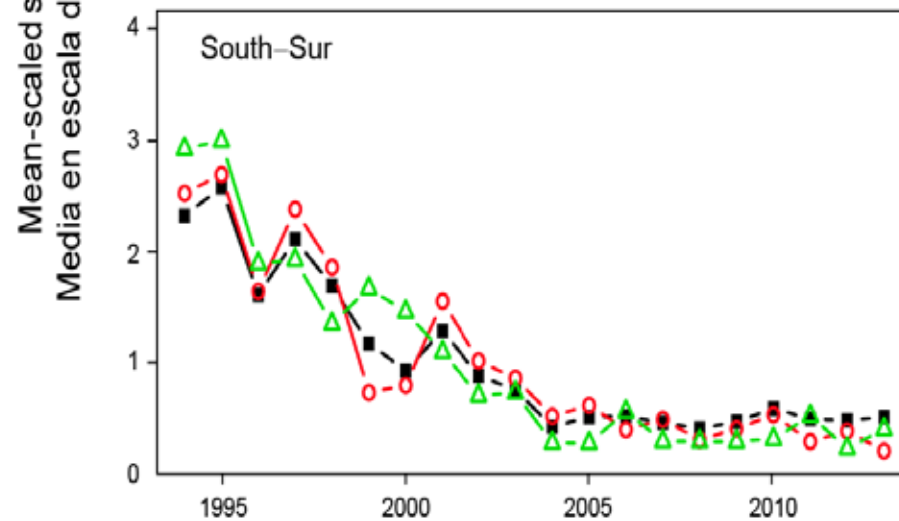yellow: 1-2 silky/set
red: > 2 silky/set

Spatial distribution of BPS

Fltobj sets
large silky (> 150 cm)

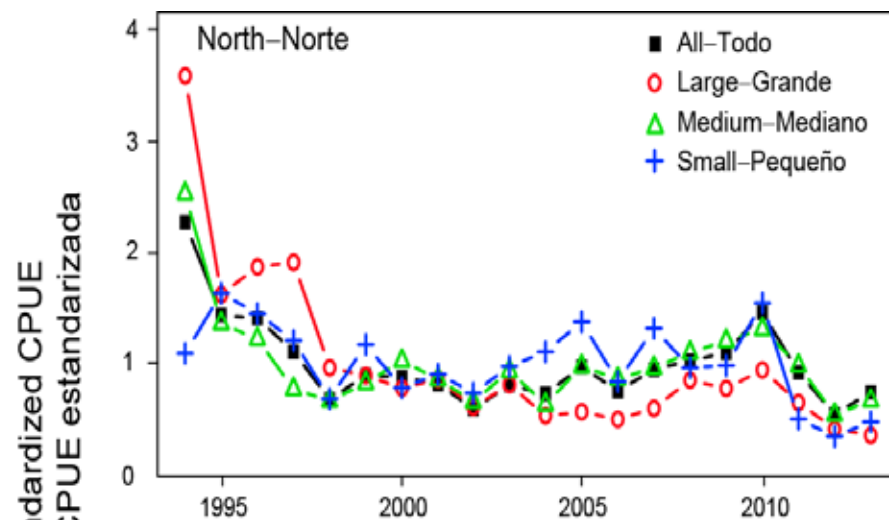Color scale:
blue: 0 bps
green: <= 1 silky/set
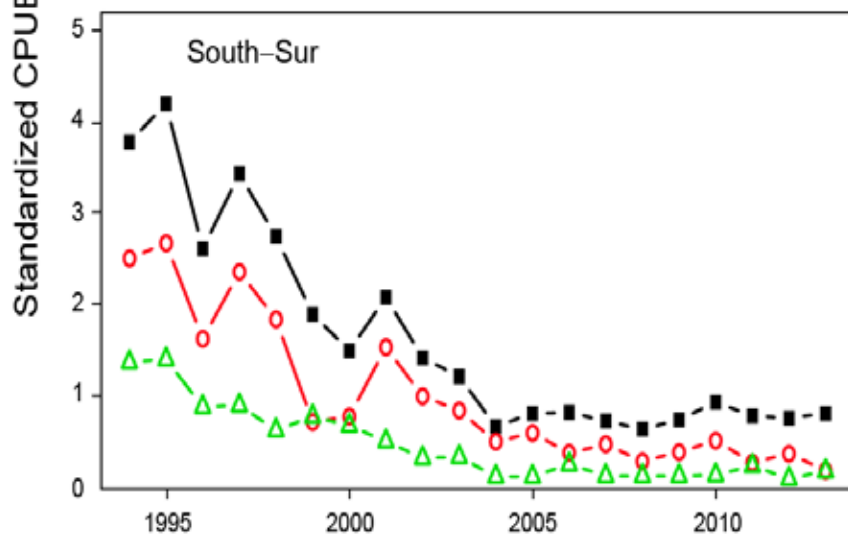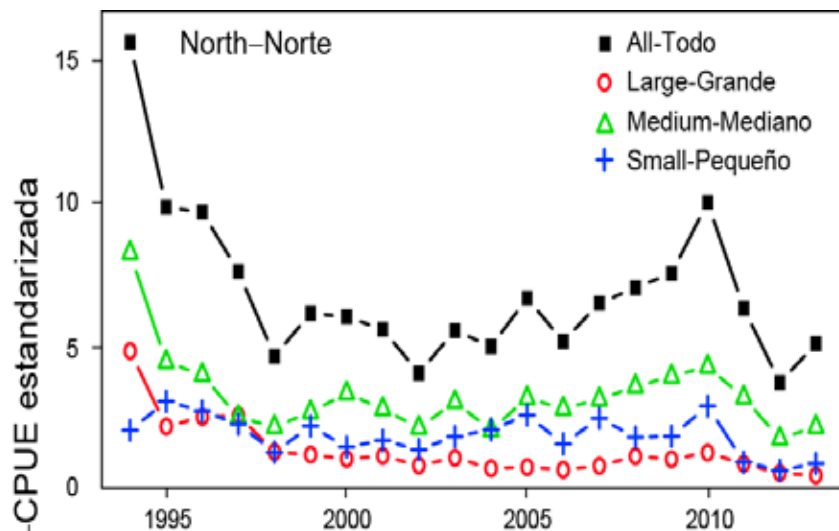yellow: 1-2 silky/set
red: > 2 silky/set

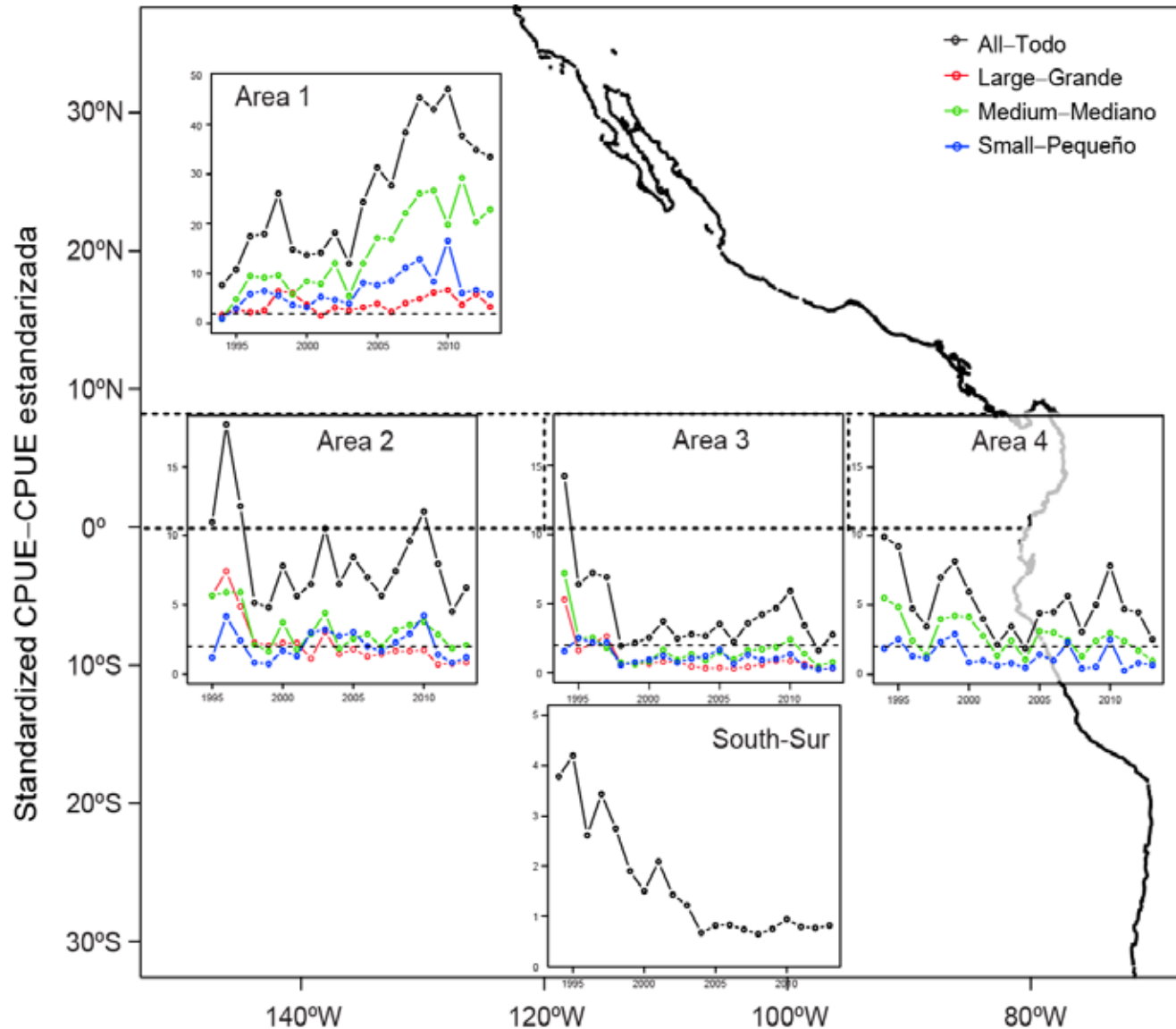# Standardized CPUE-OBJ
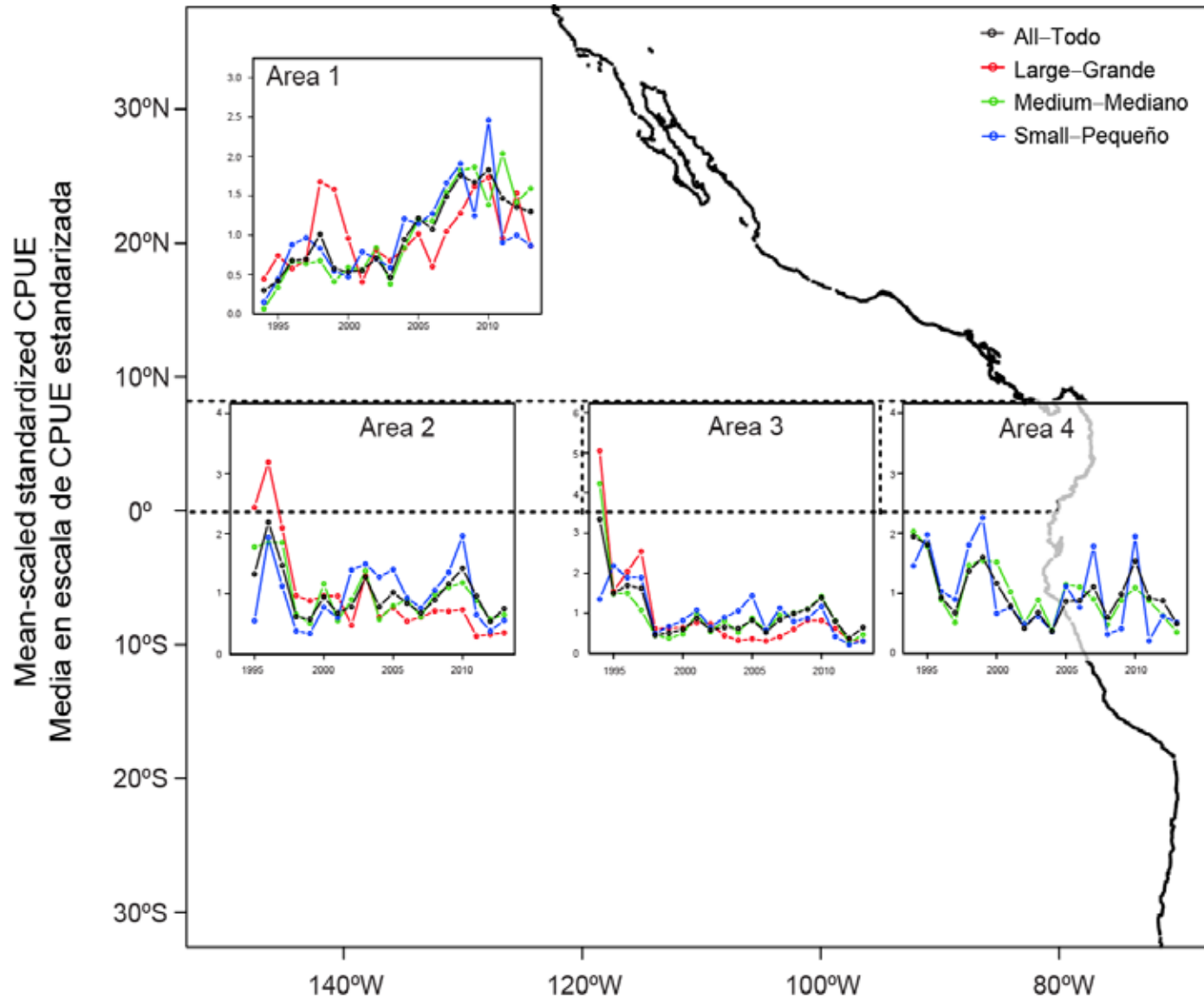
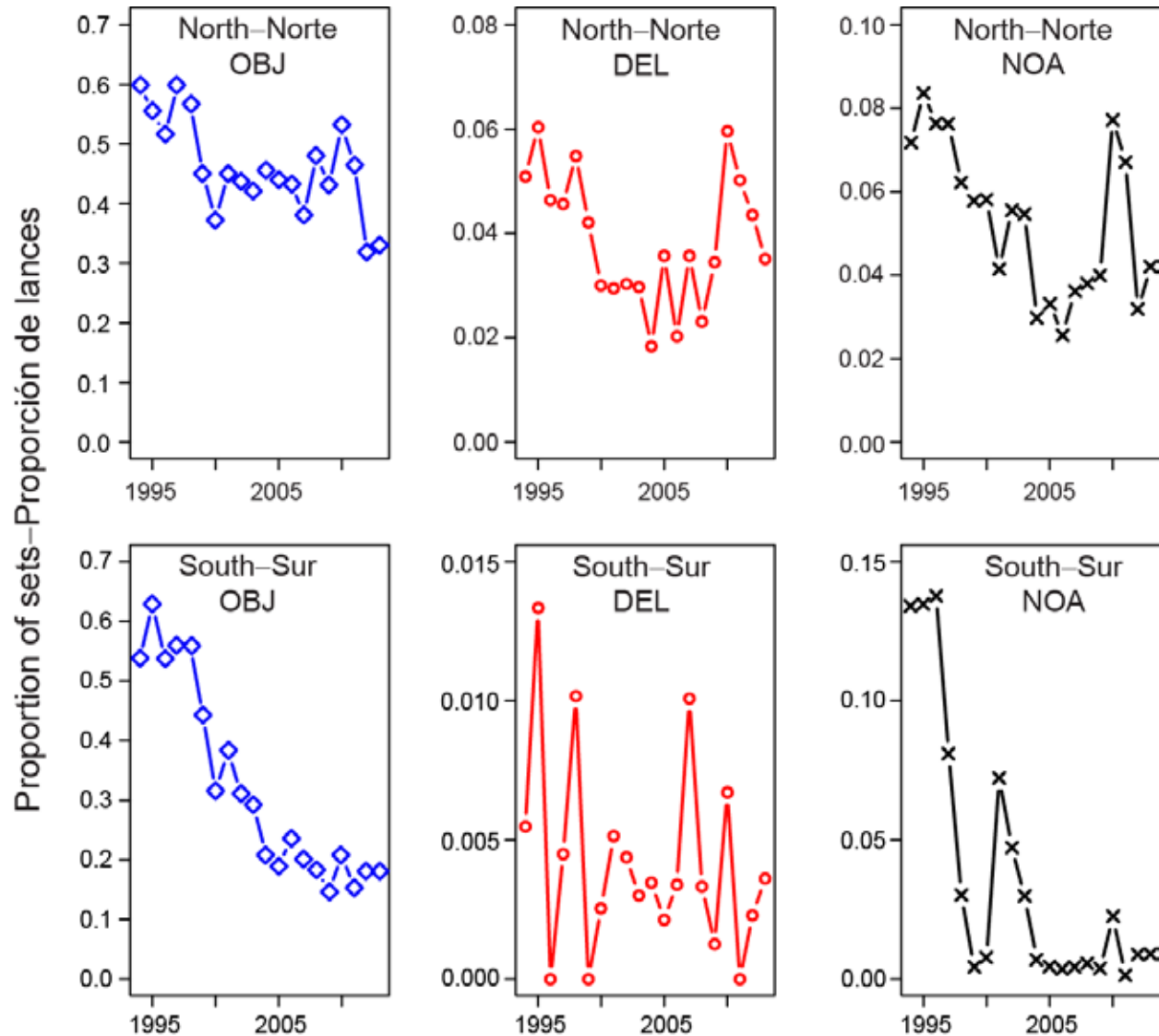# Standardized CPUE-OBJ
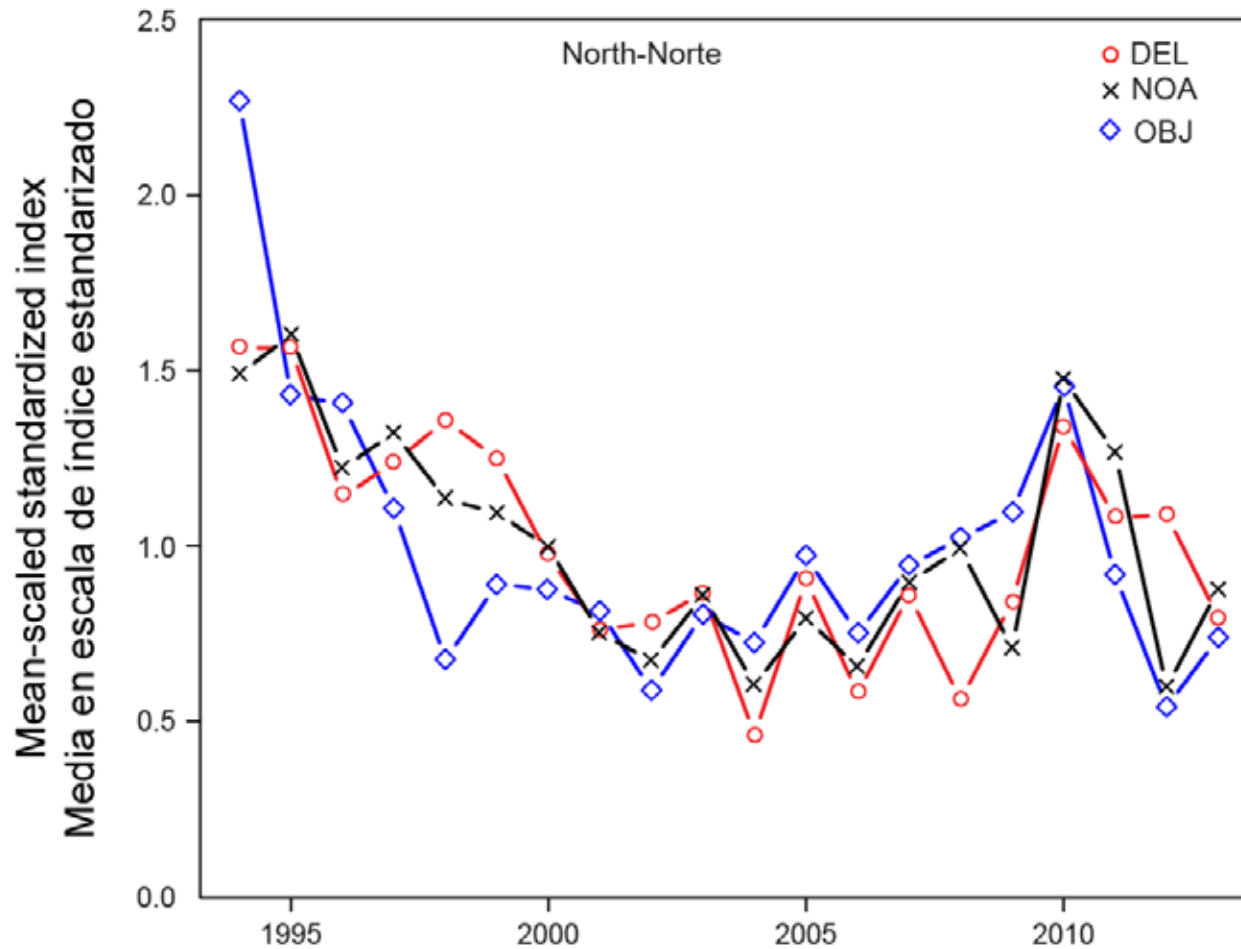
Standardized CPUE-OBJ

Standardized CPUE-OBJ

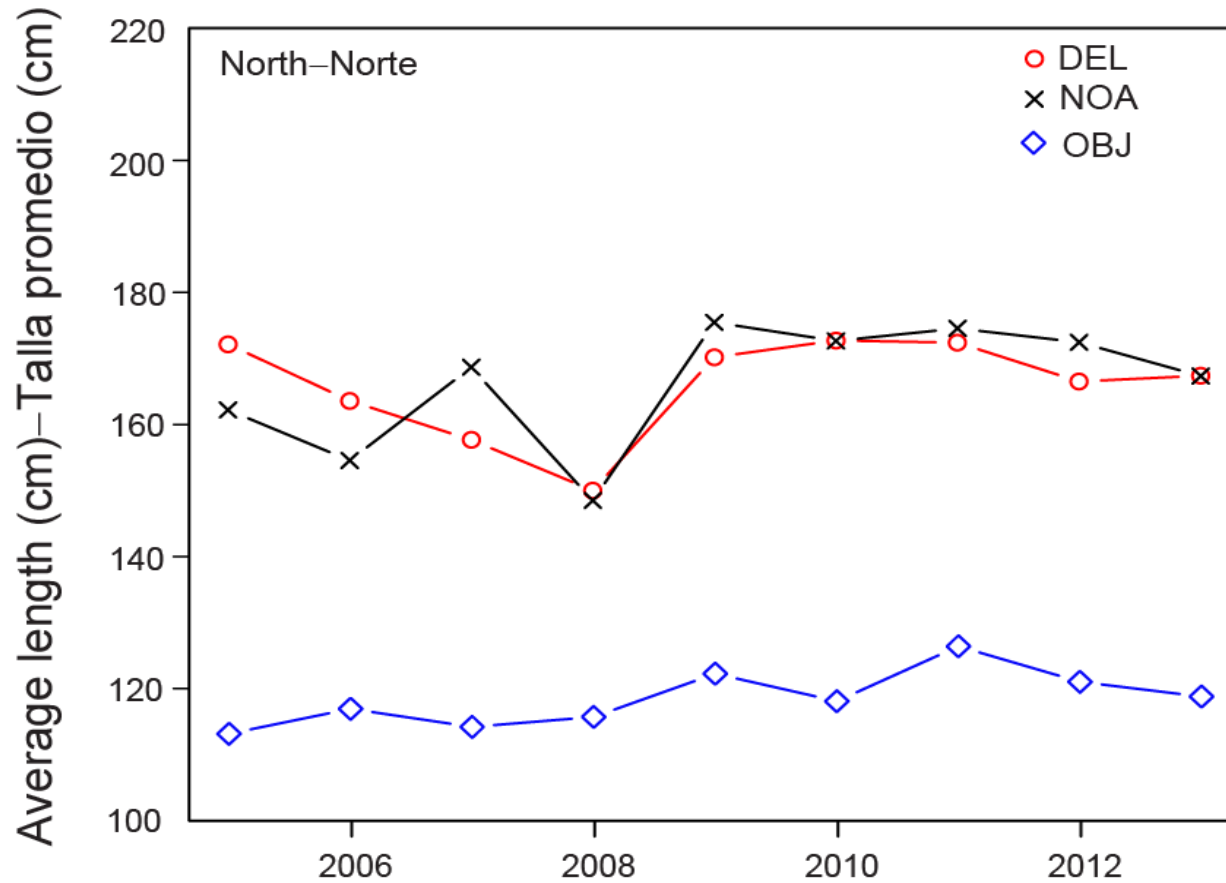# Nominal proportions of positive sets by set type
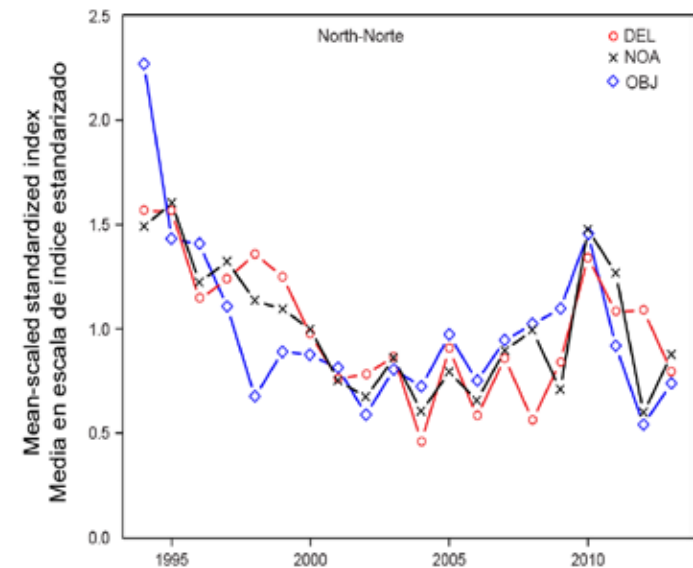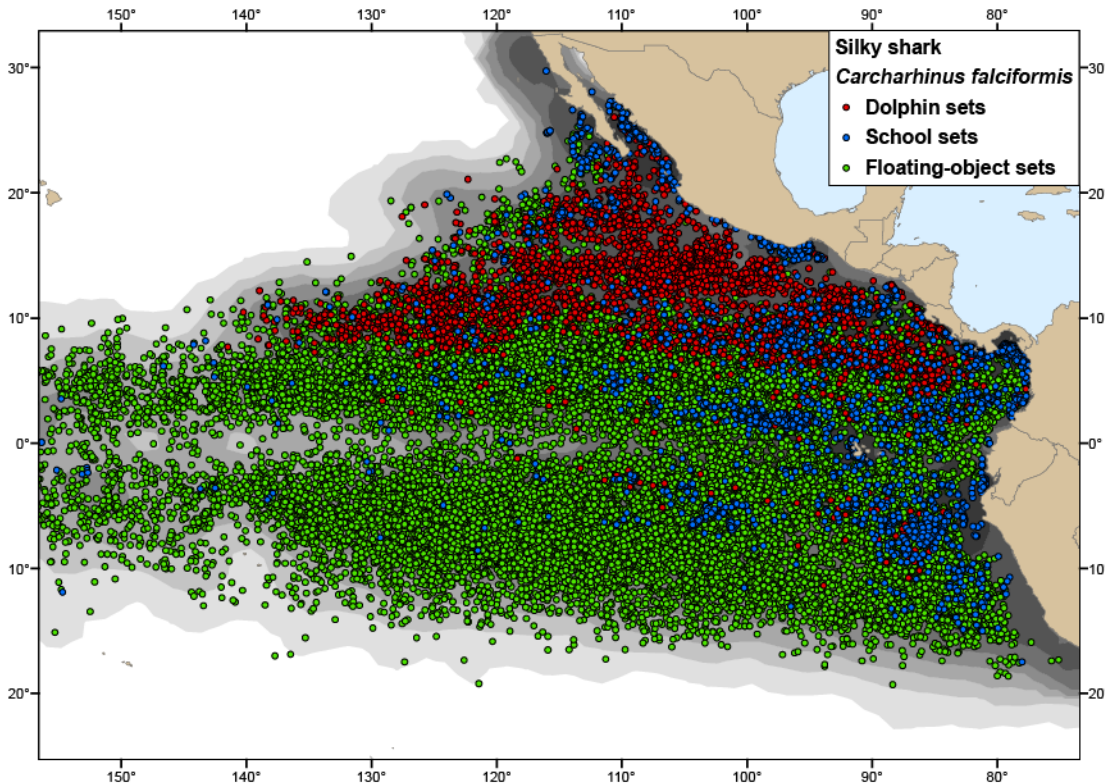
Comparisons among set types

Average length

Conclusions

- Indices based on standardized CPUE in PS-OBJ are proposed as best indicators for representing silky population trends in the EPO
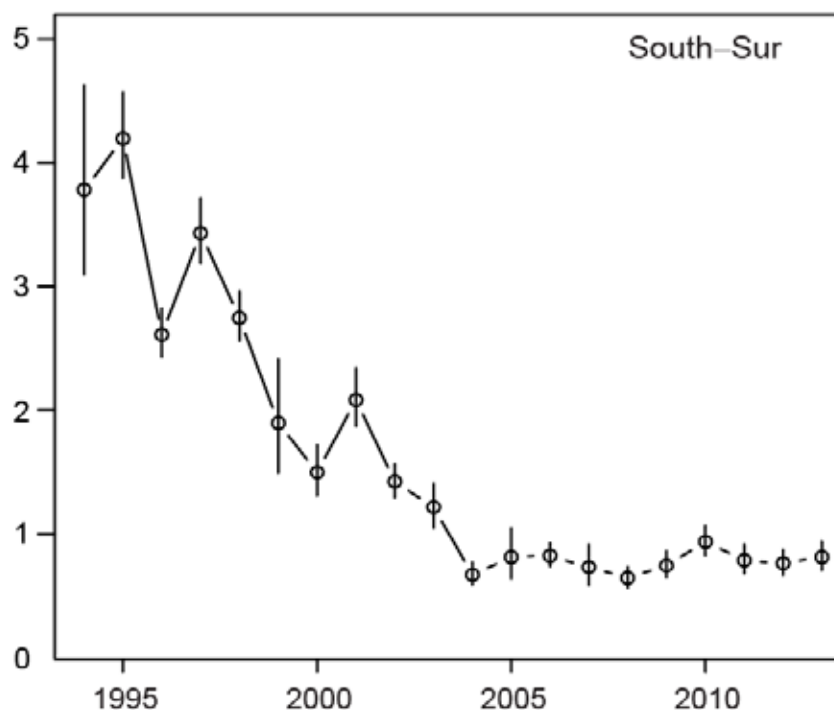
Indicators - conclusions

- Northern stock:
  - § Initial sharp decline over wide spatial range (1994-1998), followed by a period of stability (1996-2006), and possibly increase (2006-2010)
  - § However, such increase has been reversed in recent years (2010-2013)
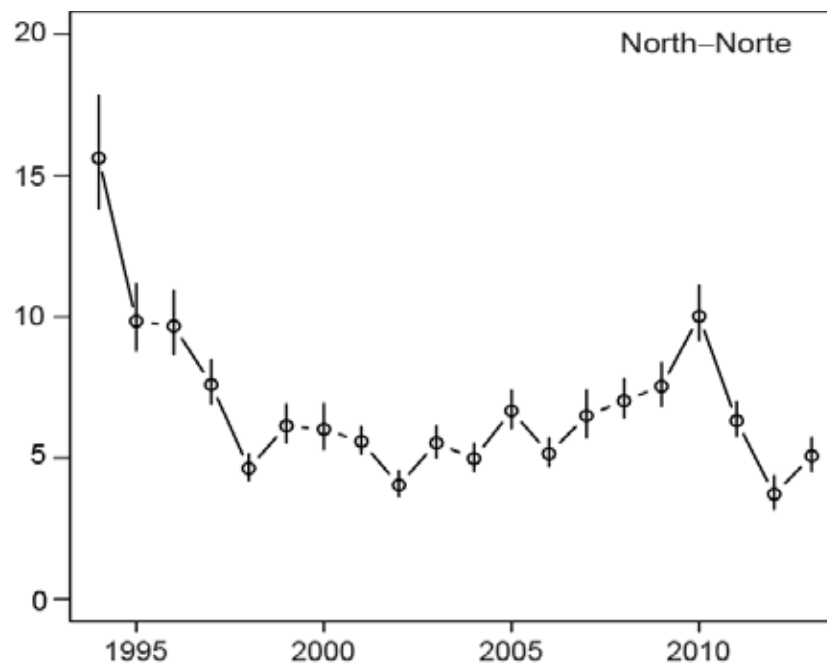
Indicators - conclusions

- Southern stock:
    - § CPUE-OBJ indicator shows sharp decline during 1994-2004, followed by a period of stability at much lower levels

Indicators - conclusions

- No stock status target and limit reference points have been developed for silky sharks based on these indicators

- Harvest control runs have not been develop and tested neither

- Future research: Management strategy evaluation work (MSE) to identify the reference points and harvest control rules that can achieve conservation goals

- Management: It is critical that precautionary management be implemented immediately to allow silky shark populations to rebuild

QUESTIONS?