Comisión Interamericana del Atún Tropical
Inter-American Tropical Tuna Commission

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Use of diagnostic tools to understand integrated stock assessment models:

the case of yellowfin tuna in the eastern Pacific Ocean

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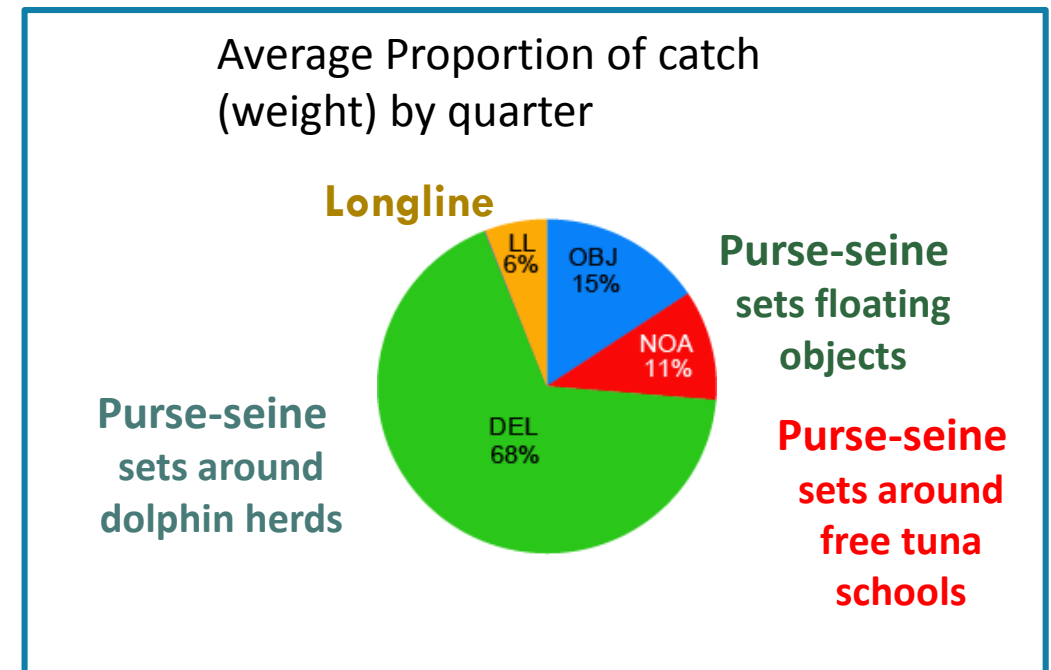2nd Stock assessment Review Workshop, La Jolla, California USA, 2-6 December 2019

Main goals

To investigate the ability of the integrated assessment model to estimate abundance in for yellowfin tuna in the eastern Pacific Ocean (EPO).

By using recently-proposed **diagnostic tools**
that use different components of the data,
and one **auxiliary model**
to **better understand the integrated model** and
detect potential model misspecification

Background

The "former" assessment of yellowfin tuna the EPO

- Integrated statistical age-structured population dynamics model (Stock Synthesis)
- Conditioned on catches

- **Fit to:**
  - 5 indices of relative abundance(main index from longliners)
  - size-composition data
- **Assumes:**
  - one stock
  - Purse-seine fisheries by set type
  - 2 longline fisheries (one with asymptotic selectivity)
  - Richard growth curve (L2=182 cm)
  - Sex-specific natural mortality
  - Steepness h=1
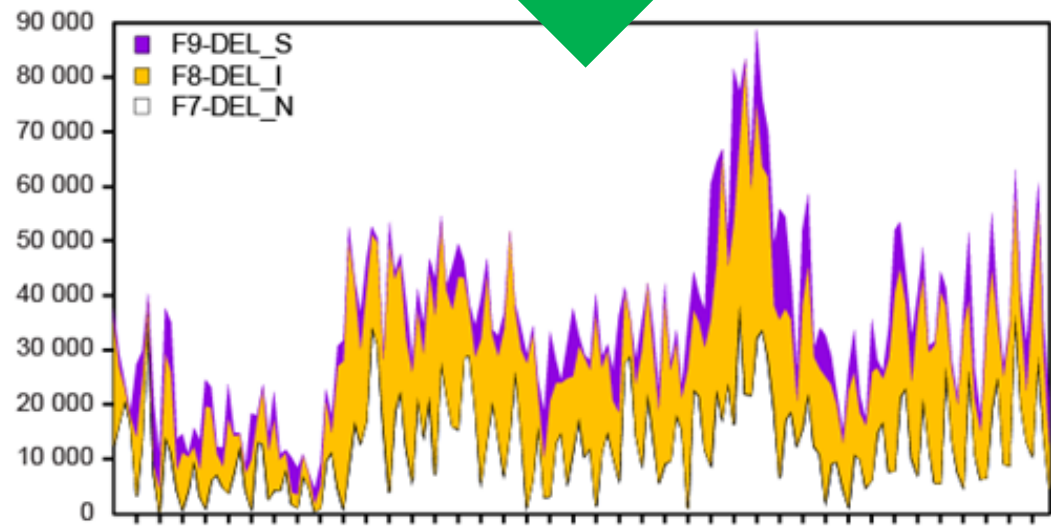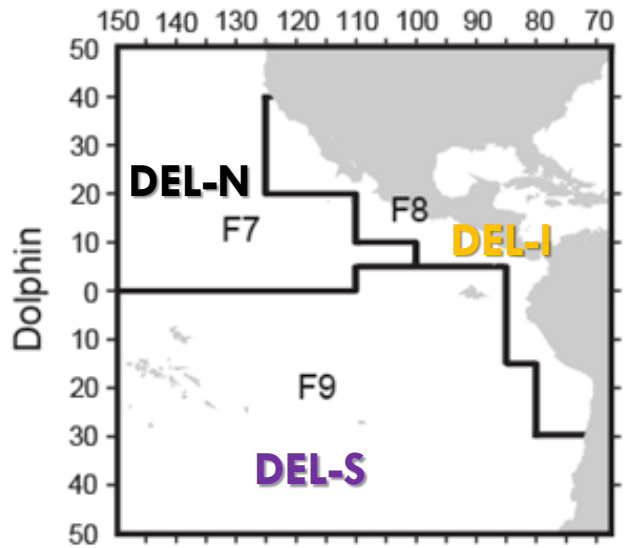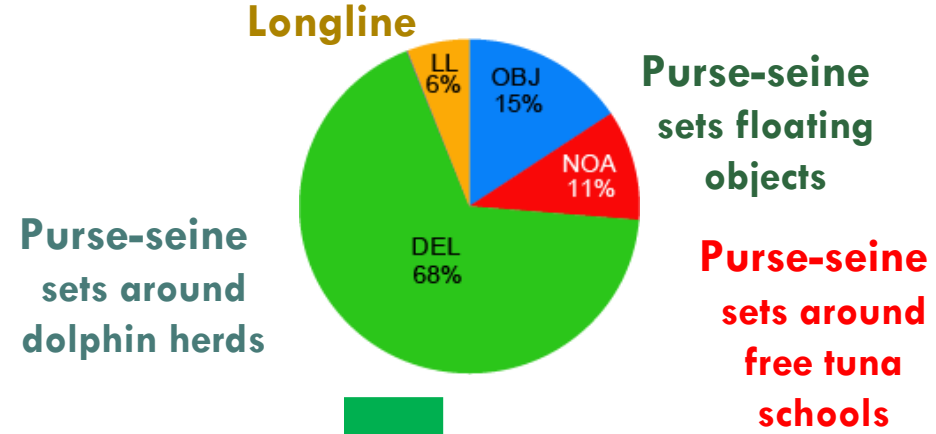 - Recruitment CV =0.6
  - Temporal scale: quarter

Average Proportion of catch (weight) by quarter

Longline

Purse-seine sets floating objects

Purse-seine sets around free tuna schools

Purse-seine sets around dolphin herds

LL 6%
OBJ 15%
NOA 11%
DEL 68%

The "former" assessment of yellowfin tuna the EPO

- Fisheries defined by gear (set type) and area of operation.

Fishery definitions for DEL: Purse-seine sets around dolphin herds

Average Proportion of catch (weight) by quarter

Longline

Purse-seine sets floating objects

Purse-seine sets around dolphin herds

Purse-seine sets around free tuna schools

Depletion model

[Article]

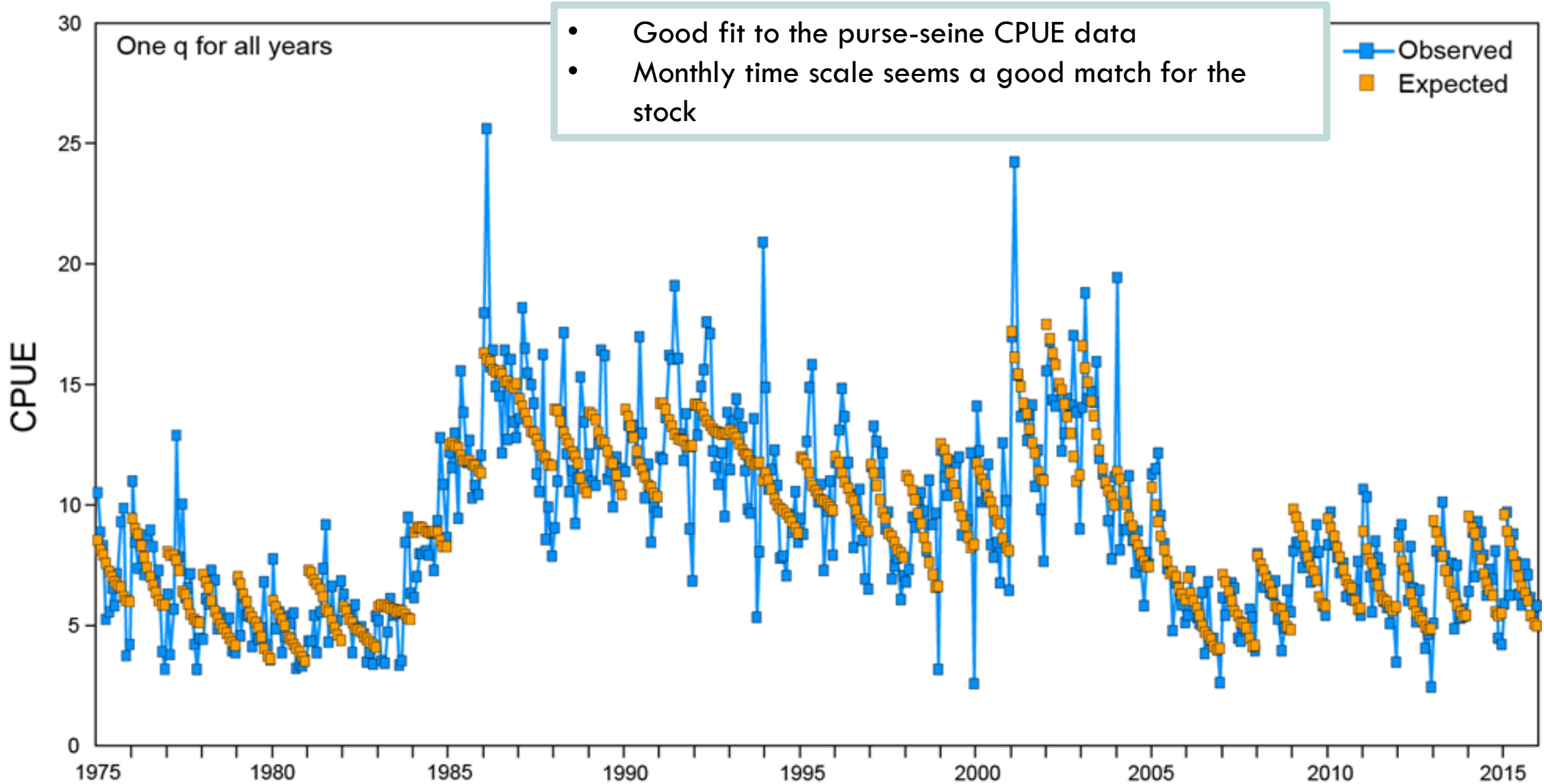## A Depletion Estimator for Within-Season Management of Yellowfin Tuna

MARK N. MAUNDER

Inter-American Tropical Tuna Commission,
8604 La Jolla Shores Drive,
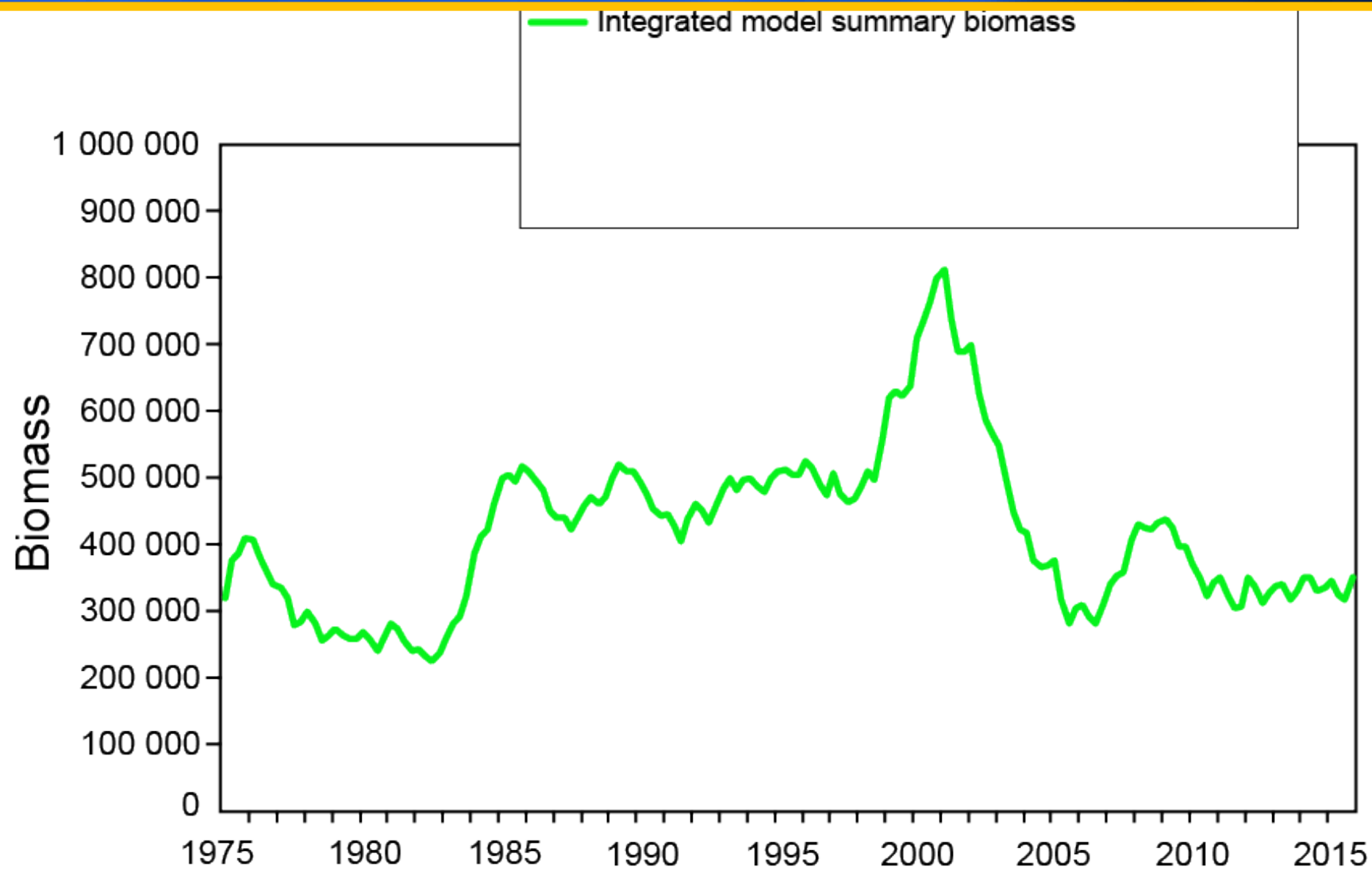La Jolla, CA, 92037-1508, USA
mmaunder@iattc.org

- Monthly time scale
- One recruitment a year at the beginning of the year
- Growth and mortality assumptions similar to the integrated model
- Fit to catch per set of all PS
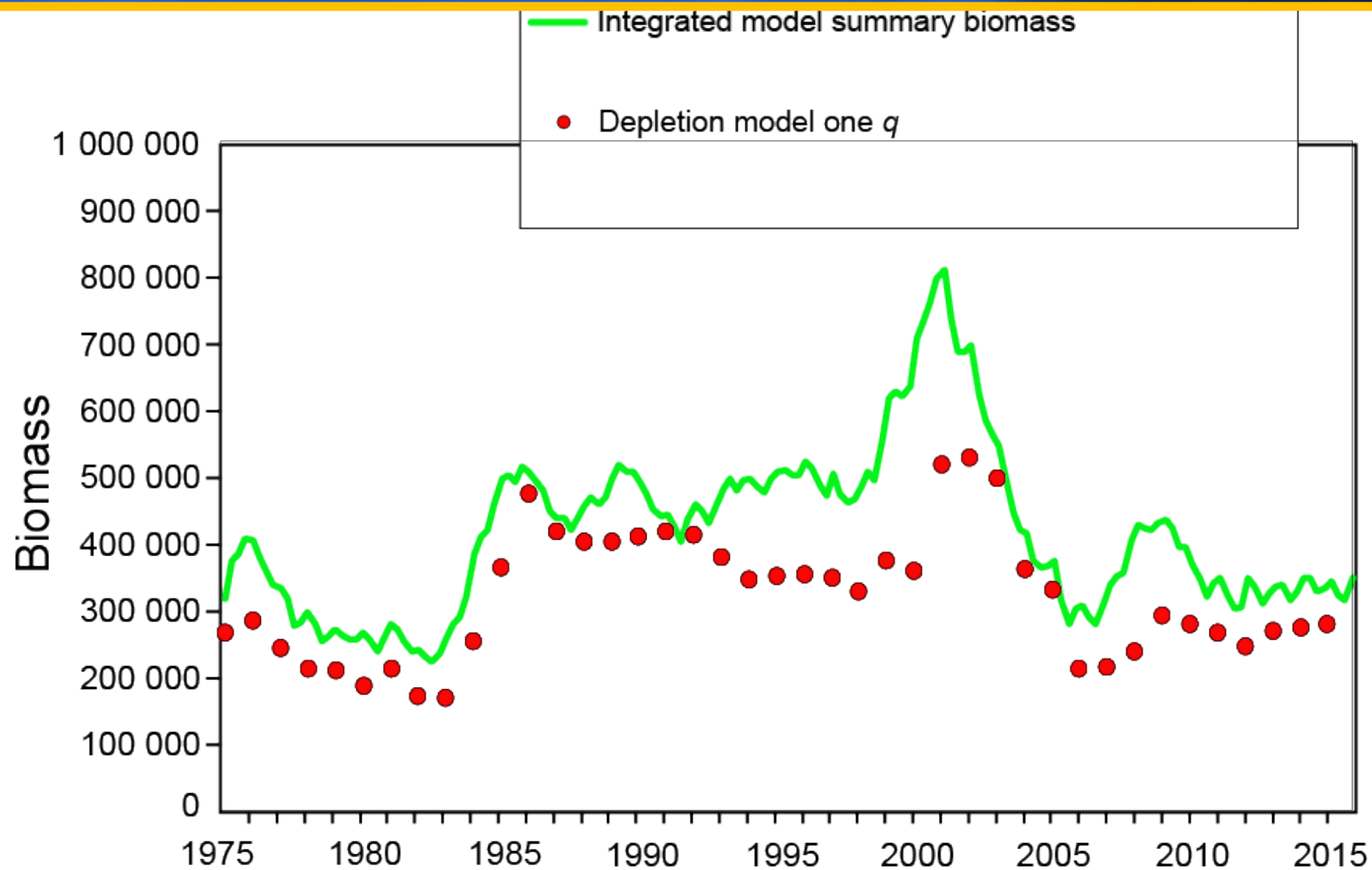- Catchabilities estimated

Depletion model

One q for all years

- Good fit to the purse-seine CPUE data
- Monthly time scale seems a good match for the stock

Observed
Expected

Depletion model

Integrated model summary biomass

Depletion model

Legend:
- **Integrated model summary biomass** (green line)
- **Depletion model one q** (red dots)

Depletion model

Legend:
- Integrated model summary biomass (green)
- Integrated model vulnerable biomass (F8 - DEL-I) (black)
- Depletion model one q (red dots)

Depletion model

Legend:
- Integrated model summary biomass
- Depletion model independent qs
- Depletion model independent qs extreme values /10

Depletion model

Depletion model

Legend:
- **Integrated model summary biomass** (green line)
- **Integrated model vulnerable biomass (F8 - DEL-I)** (black line)
- ● Depletion model one q (red)
- ● Depletion model independent qs (blue)
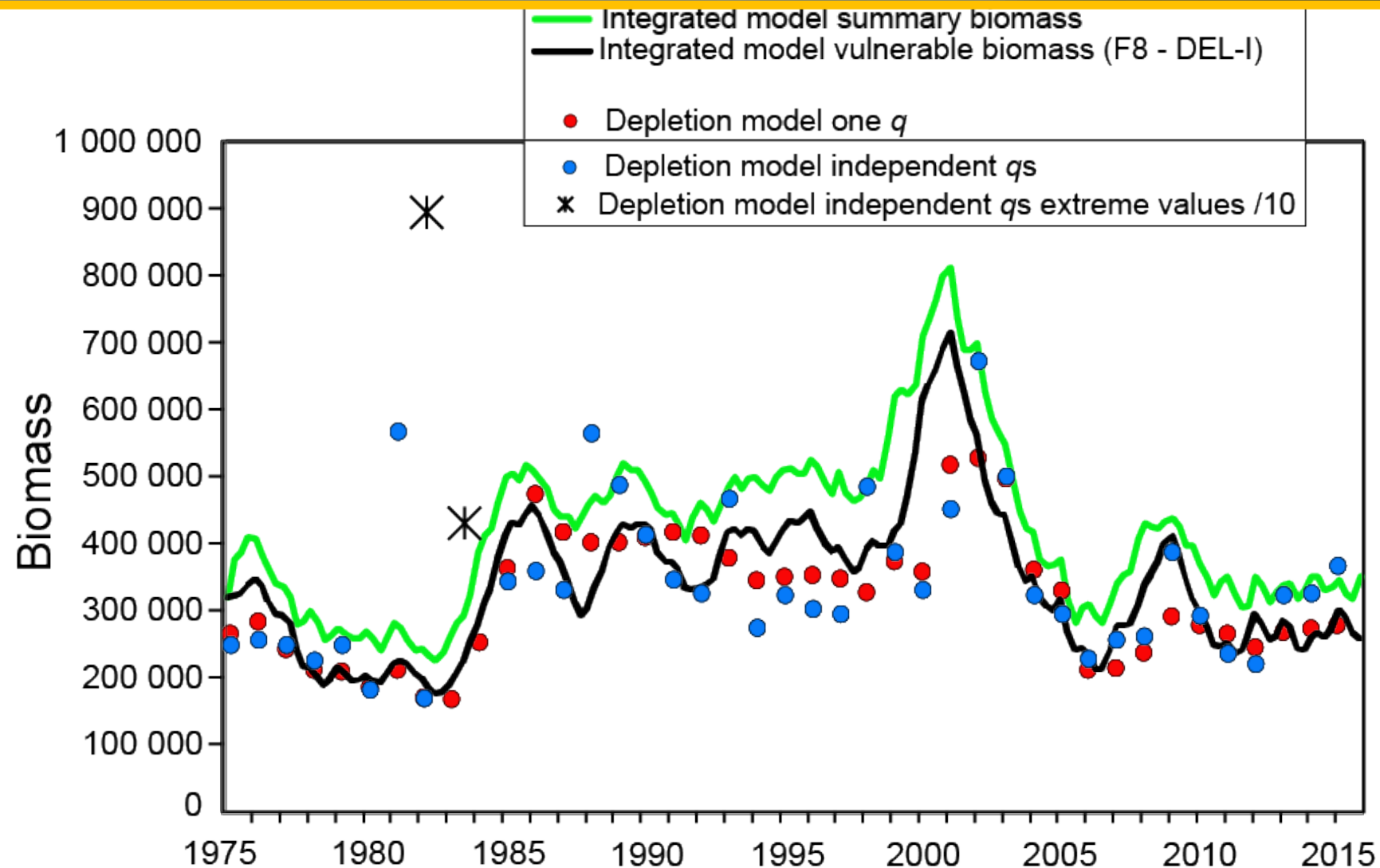- ✱ Depletion model independent qs extreme values /10
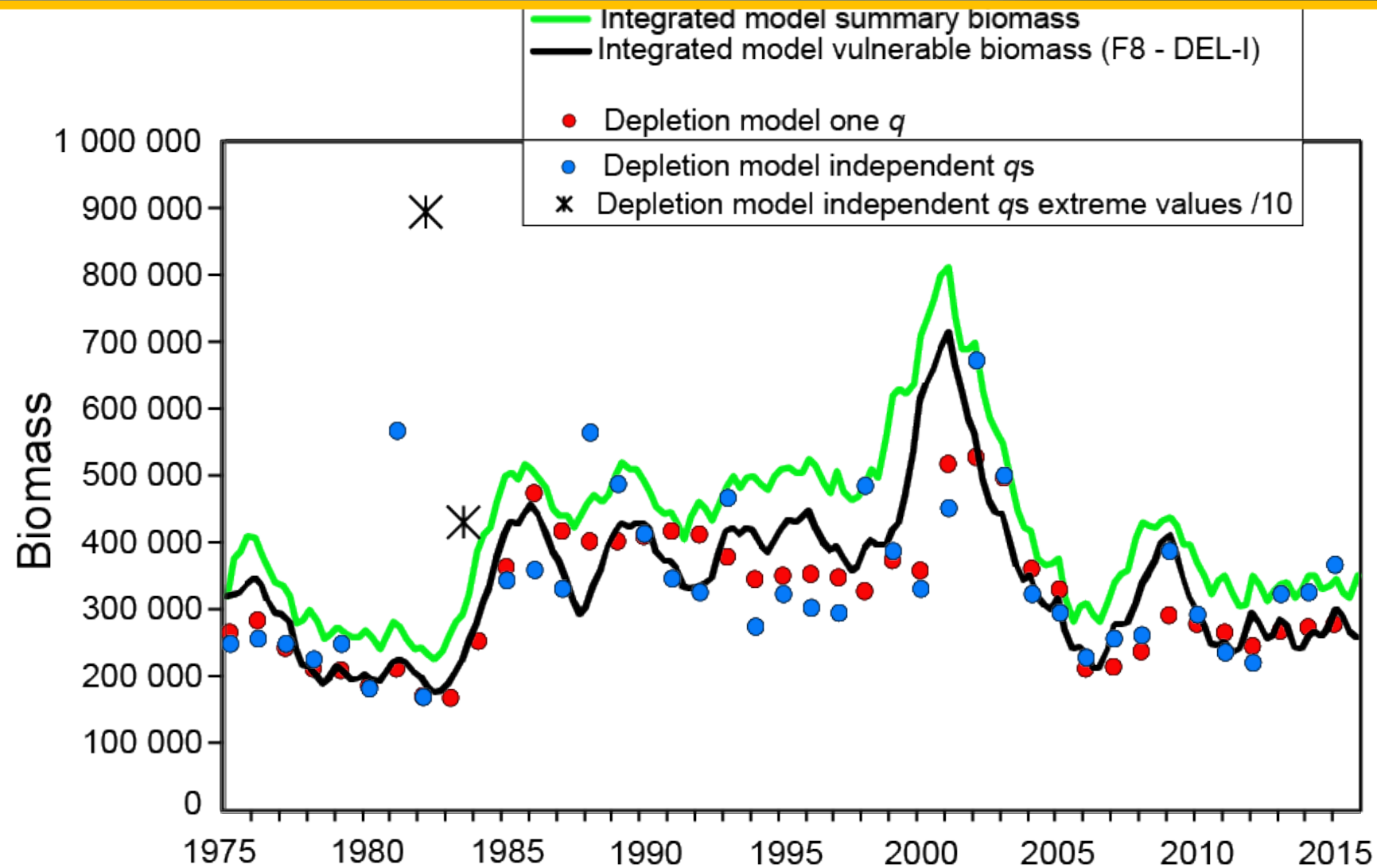
Conclusions

- Depletion models estimate of the absolute abundance coincides with the integrated model
- About 50% of the recruits in the integrated model are born in the first quarter, 75% in the first 2 quarters
- The integrated model may be profiting from the "depletion type" of behavior in the system
- Growth and natural mortality assumptions are probably correct in the IM
- A monthly time scale may improve the IM

Thank you!