Comparison of EPO & IO yellowfin stocks & stock assessment results

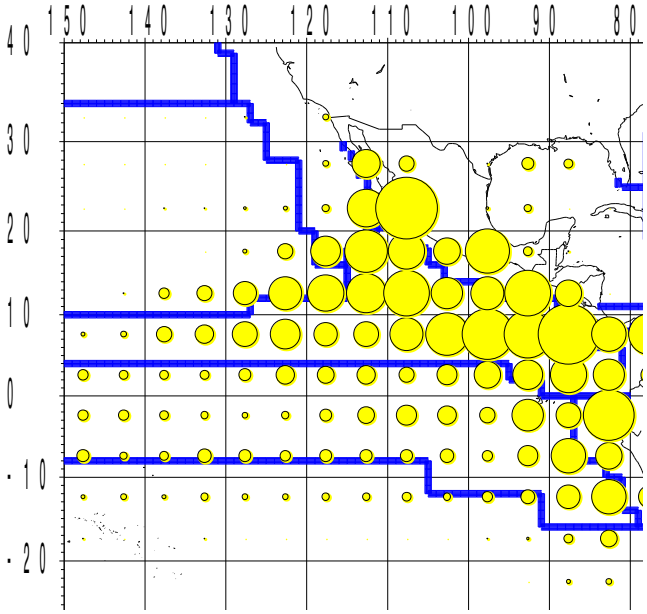
A comparison between stocks and 2011 stock assessment results of yellowfin in the Indian and Eastern Pacific oceans

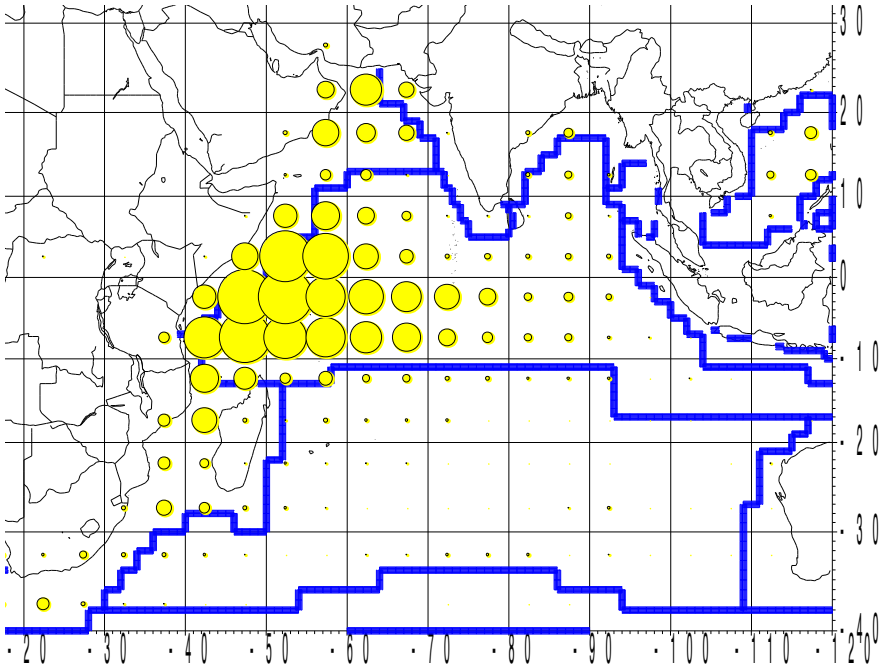
YFT stocks in the Indian and Eastern Pacific ocean:
(1) Major similarities in the fisheries & in the biology of the species

Very similar sizes of YFT fishing zones & in similar equatorial ecosystems

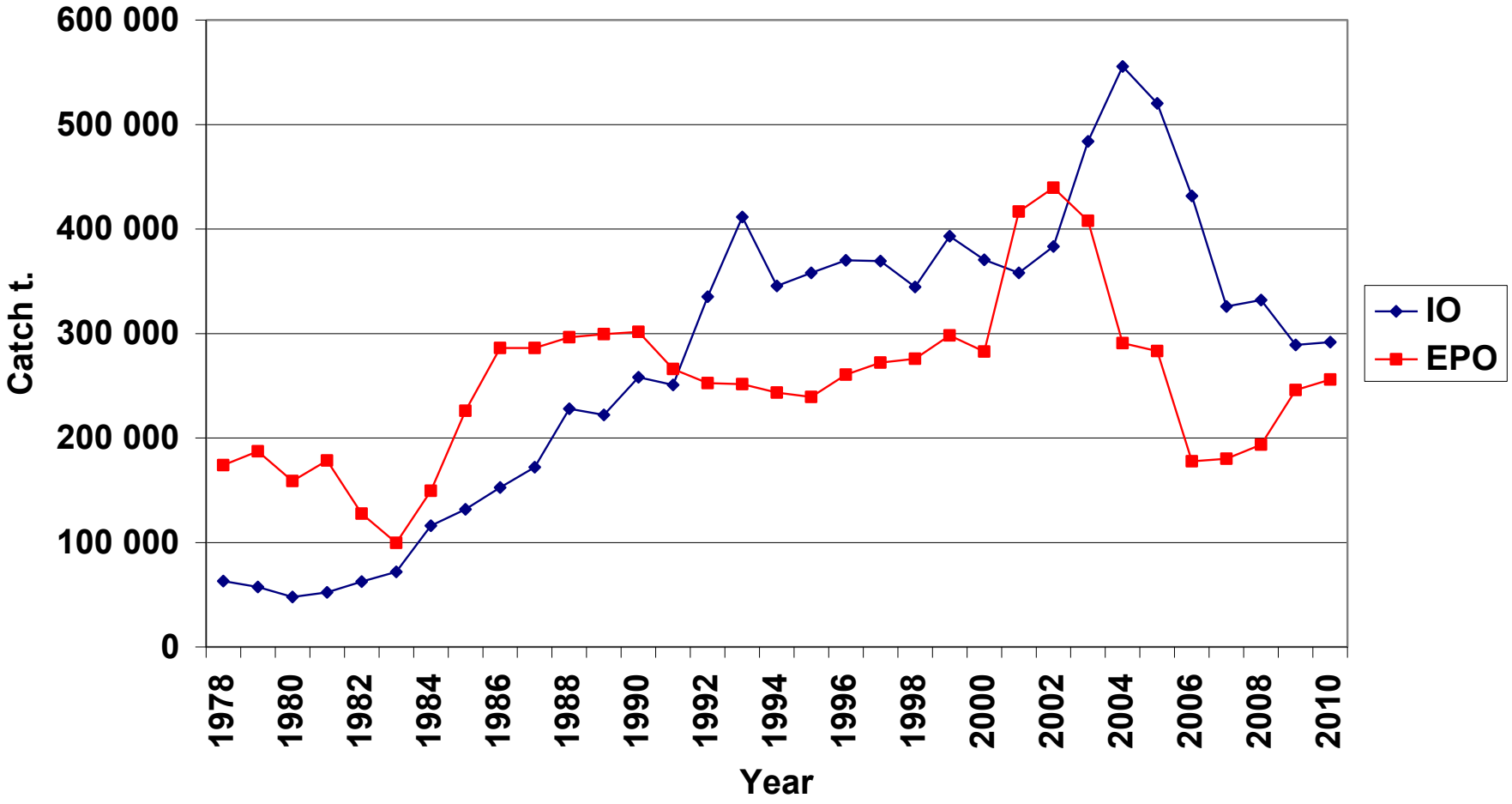
Numbers of 5° squares with a YFT catch >5t during the 1991-2005 period:

- **Eastern Pacific = 165 five degree squares**
- **Indian Ocean = 171 five degree squares**



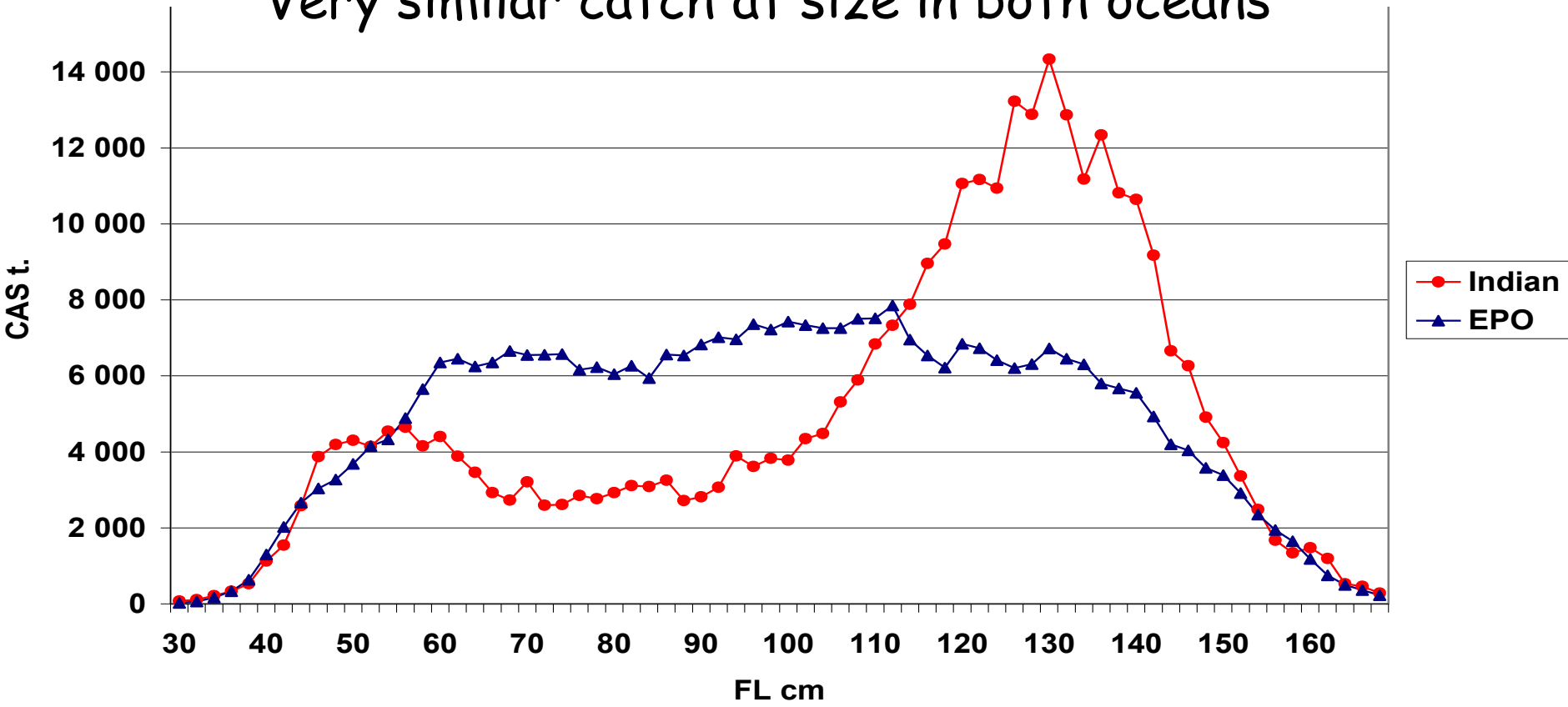


Similar level of total catches



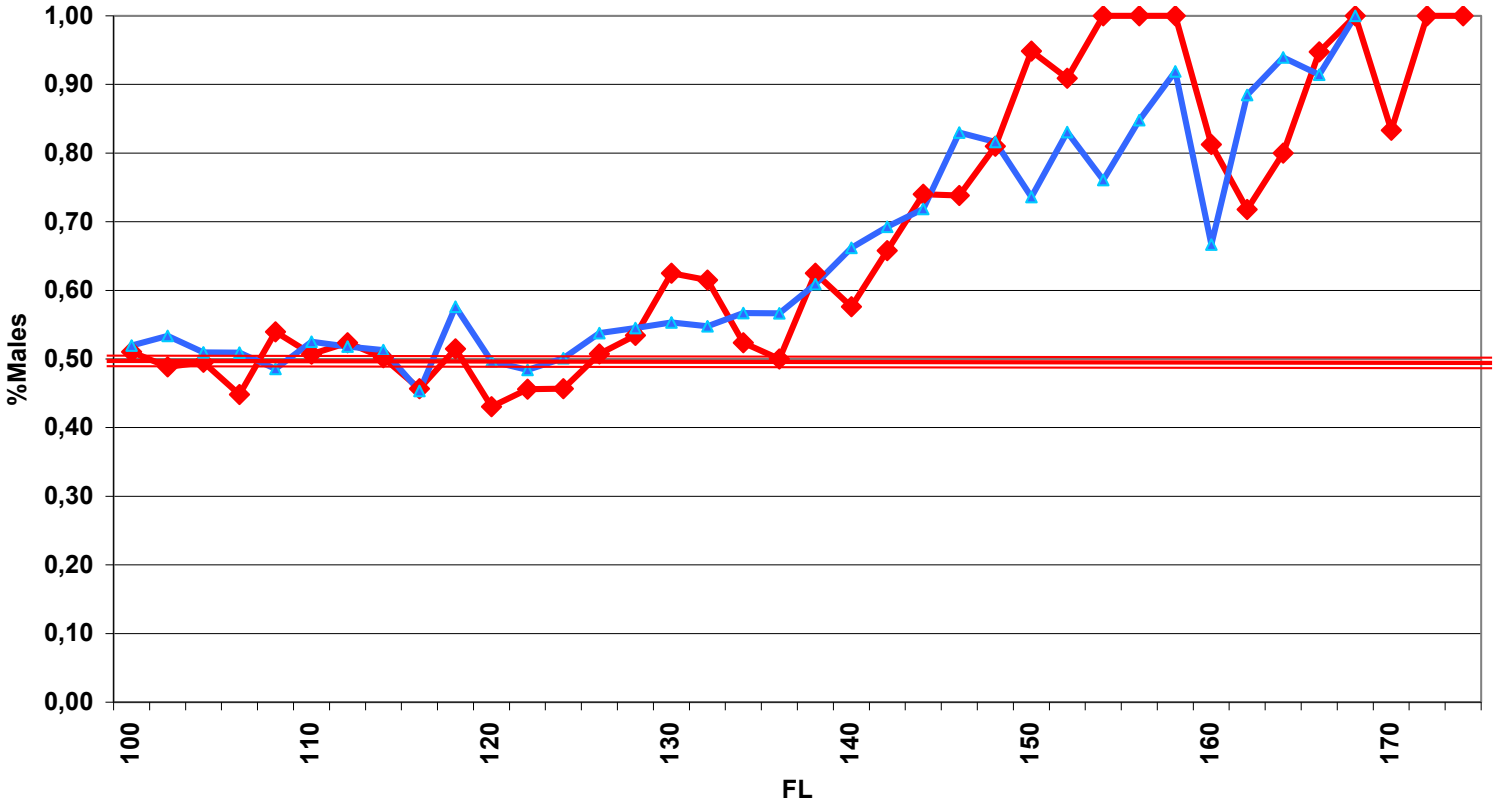
- Average catches 1990-2010: IO=370.000 t. vs EPO=280.000 t.
- 3 best yearly catches: average IO=520.000 t. (2004-2006) and EPO=420.000 t. (2003-2005), noting a strange similarity between these 2 patterns of very high catches in the IO & EPO?

Very similar catch at size in both oceans



- Same sizes of YFT recruitment in the EPO & IO: 40 cm
- Same larger sizes: 165 cm
- & same levels of significantly caught larger sizes: 158cm IO & 160 cm (corresponding to 99% of adult sizes caught during recent years)
- Very similar patterns and level of catch at size

Same sex ratio at size in both oceans

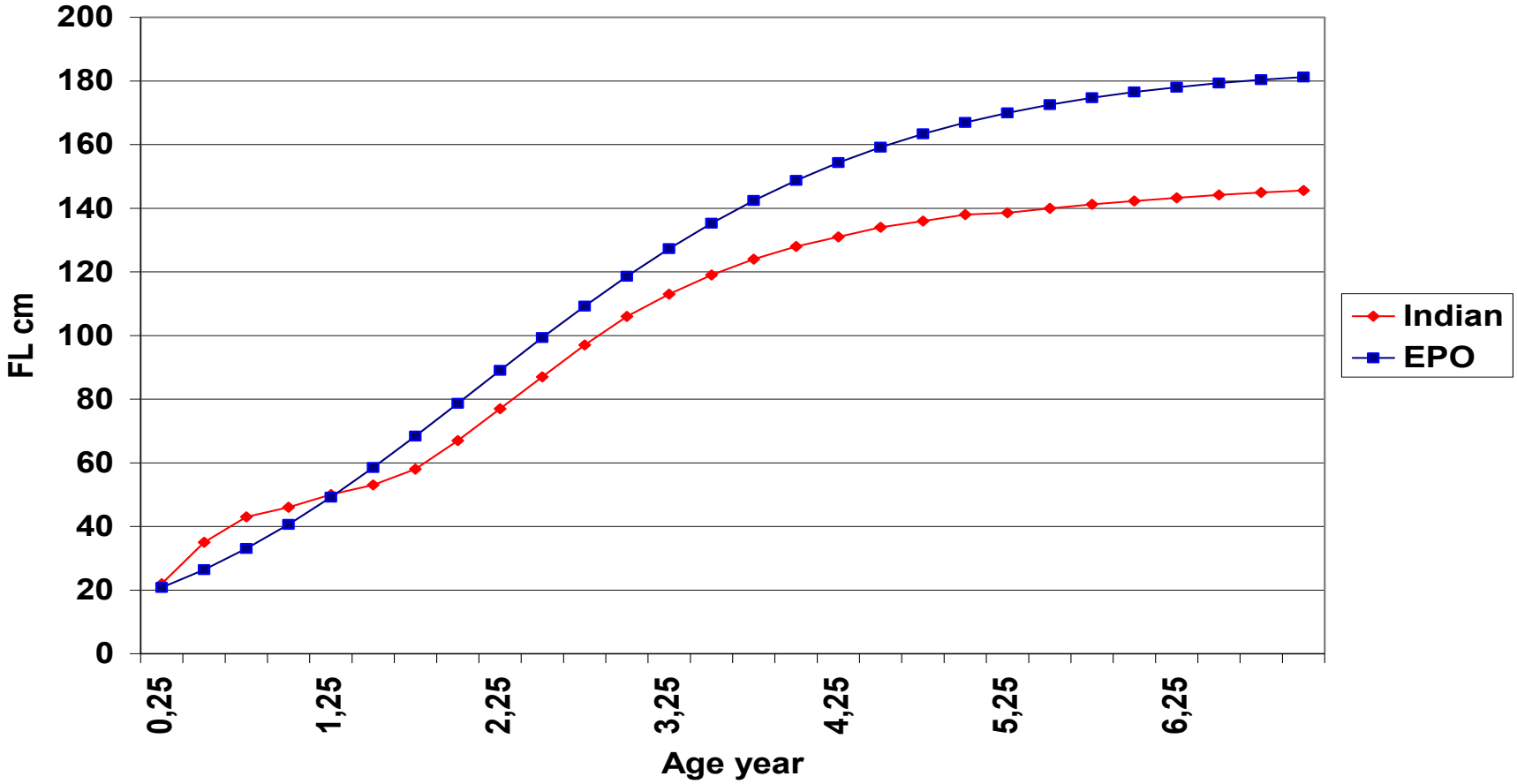


In both the IO & the EPO:

- Males YFT start to be dominant at sizes over 130-140 cm

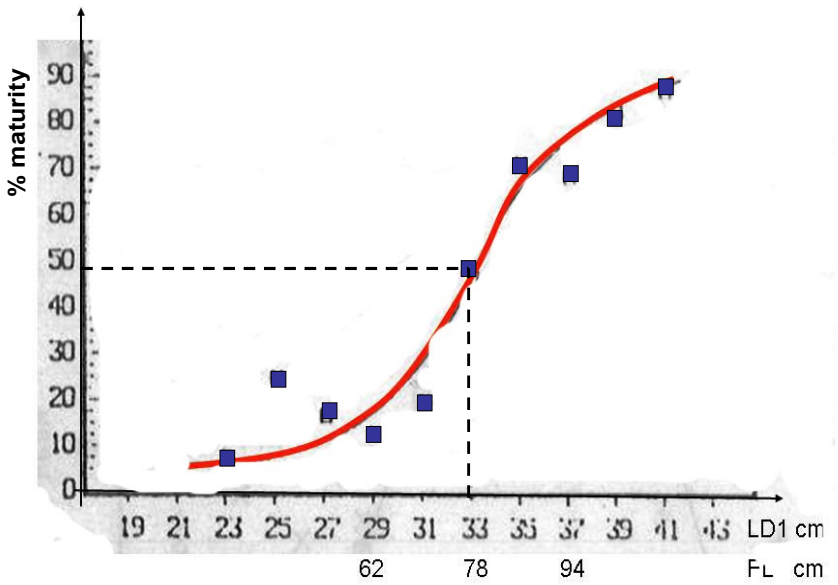
- & they are widely dominant at sizes over 145 cm.

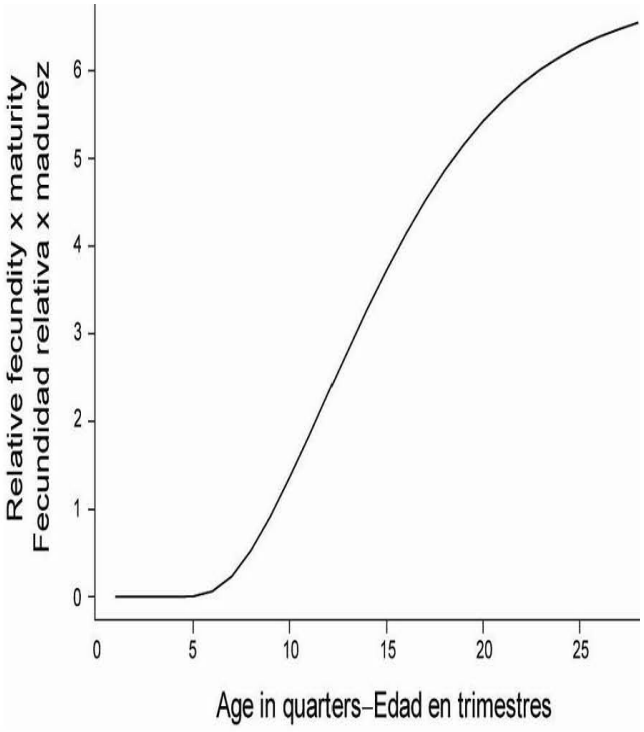
Growth: similar YFT growth in both oceans



-Similar growth curves estimated in both oceans, at least for juvenile YFT
-But quite different asymptotic sizes: much larger in the EPO!

Spawning biology: very similar YFT size & age at first maturity in both oceans





- Full maturity & 50% of spawning at a size of less than **1 meter** in both oceans, i e at an age of about 2 to 2.5 years in both oceans
- The EPO models assumes a more realistic fecundity increases with age of females.
- Not the IOTC model

Identical duration of the modelled exploited life span of the 2 stocks: **7 years**

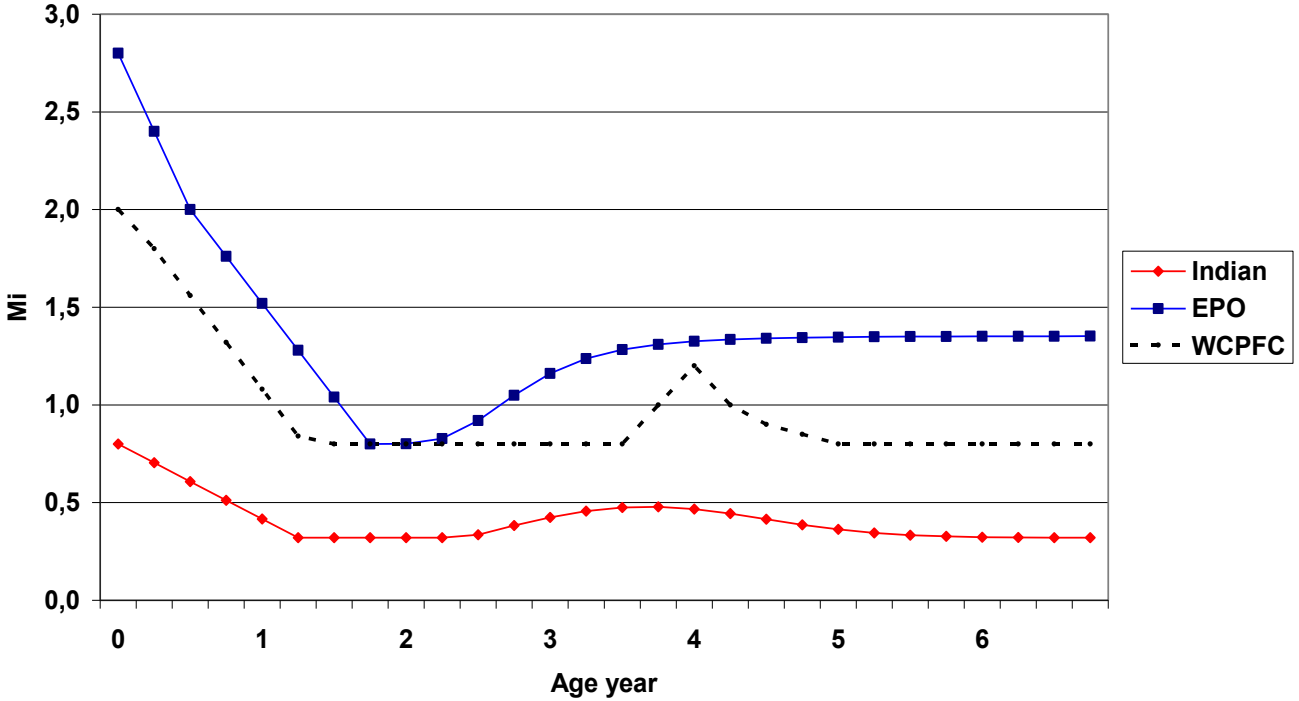
- ✓ **This similarity of modelled durations may be logical if the 2 stocks are showing the same growth and the same longevity: this is the probably the case**
- ✓ **This duration of 7 years seems to be consistent with the estimated life expectancy of YFT: probably less than 10 years based on Pacific recoveries**
- ✓ **However, this identical modelled duration of 7 years would be valid only if (1) Natural mortality is high and (2) equivalent in the 2 oceans**

Conclusion on the **YFT parameters**:

fisheries and biological ones:

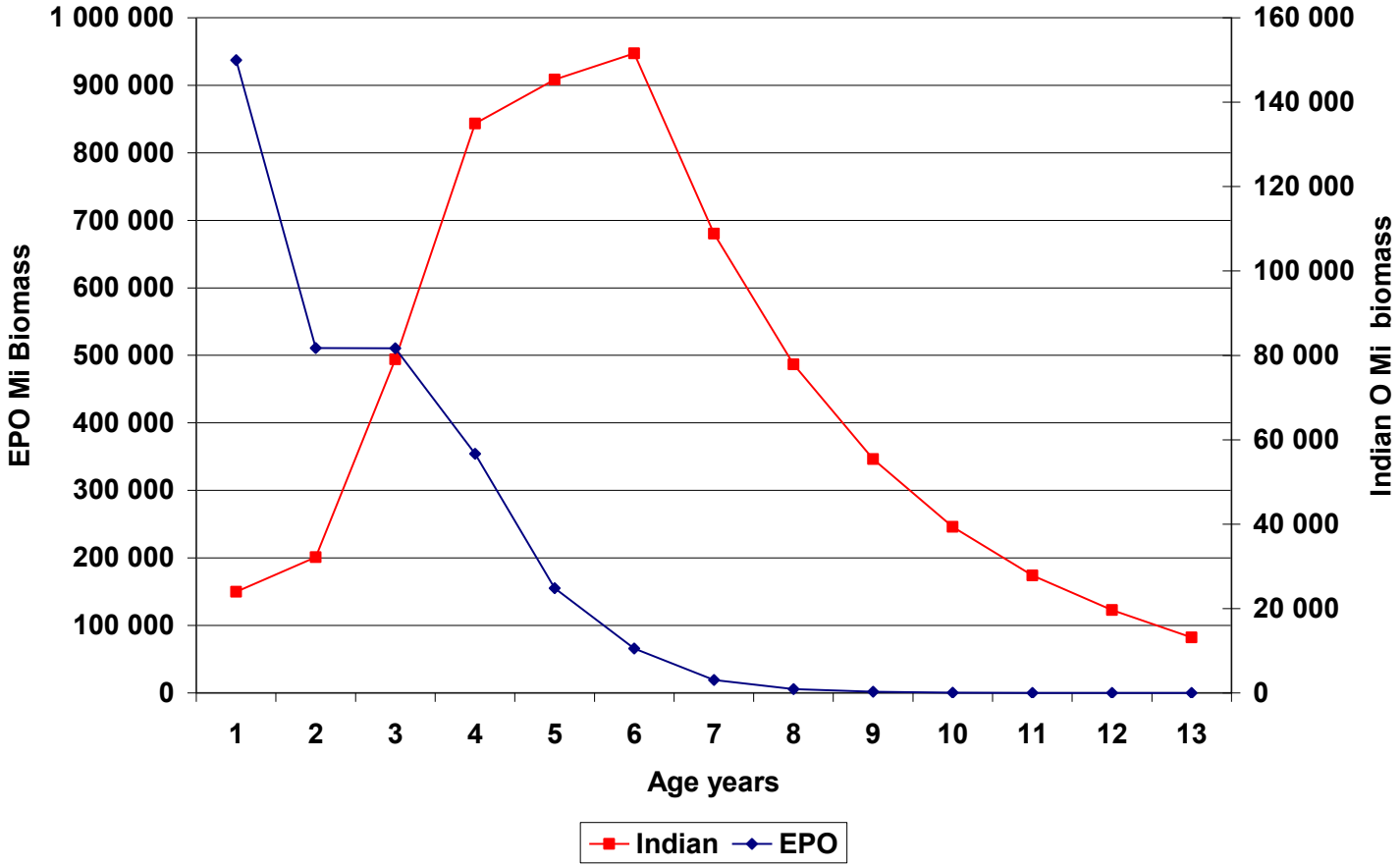
- All the visible fishery parameters in the EPO and IO YFT fisheries are widely similar, or surprisingly most often identical
- Furthermore, all the well observed YFT biological parameters in the EPO and IO are widely similar, or surprisingly identical
- But a totally different vector of natural mortality at age used in the 2 stock assessments, see the following slides

(2) But a totally different natural mortality at age assumed in the IO & the EPO stock assessment



- Major differences observed between the Mi levels assumed in the IO and EPO YFT SA, & at all ages: juvenile & adult
- Very low Mi estimated in the IO, and very high levels in the EPO (intermediate levels in the WCPO model)
- **Such major differences in the Natural mortality of the 2 stocks should be considered as being widely or totally unrealistic: because of the major similarities that are well osberved in these 2 stocks**

A logical much greater longevity at low Natural mortality?



- the Indian Ocean Mi correspond to a quite large biomass of fish older than age 7: 40% of the total biomass at age 7+ (the oldest age in today IO stock assessments)
-The low level of M assumed in the Indian ocean would preferably imply the use of at least 10 years in stock assessment analysis.

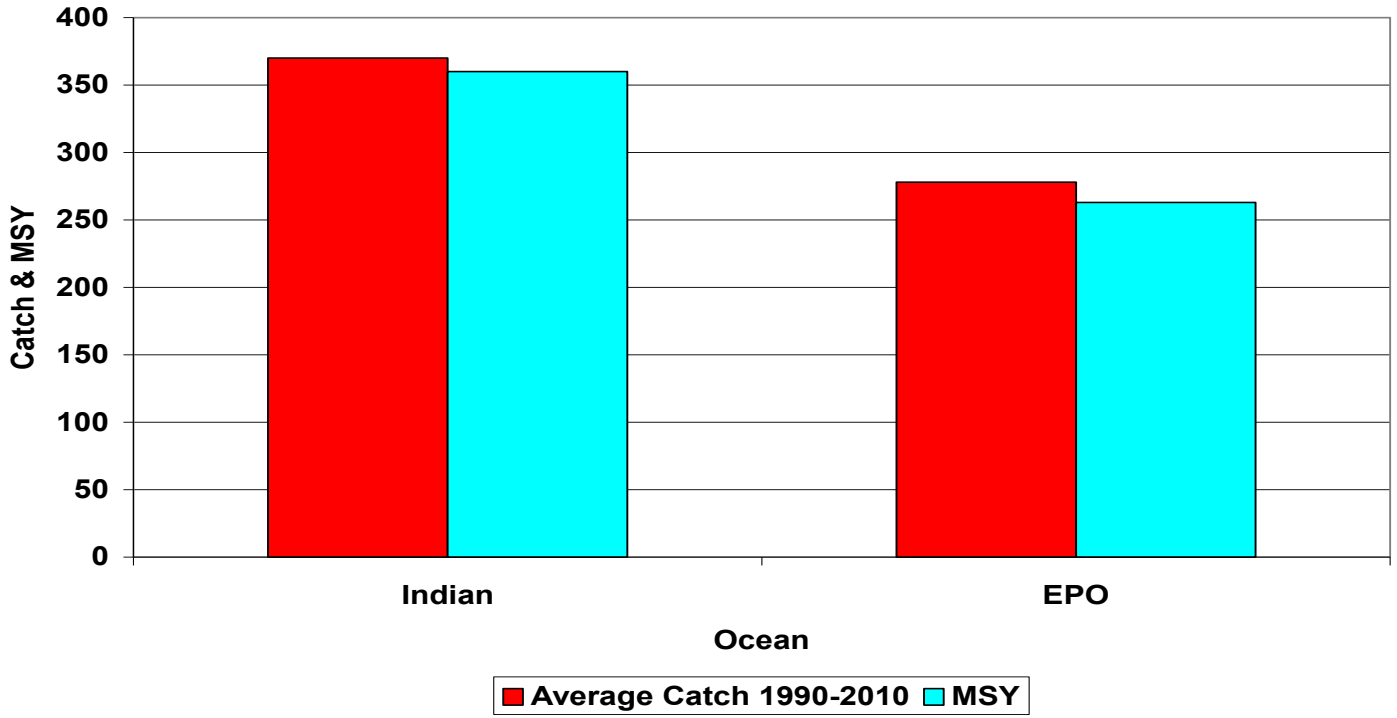
What best Natural mortality at age?

- Vectors of natural mortality at age used in the EPO and IO are still widely hypothetical: often obtained by a Crystal ball or from a best fit in an over parameterized statistical model.
- NB: there is a small potential advantage for the Indian Ocean low natural mortality, because it is based on the analysis of multiple YFT recovery results (using Brownie Petersen method)
- But these Indian Ocean preliminary estimates of low Mi would need to be confirmed by further statistical analysis
- The increase of female natural mortality assumed in the EPO would be questionable in the Indian ocean: the differential sex ratio in this Ocean being probably well explained by a differential growth of males and females, well shown by sexed recoveries of adult YFT (larger L infinity for males)

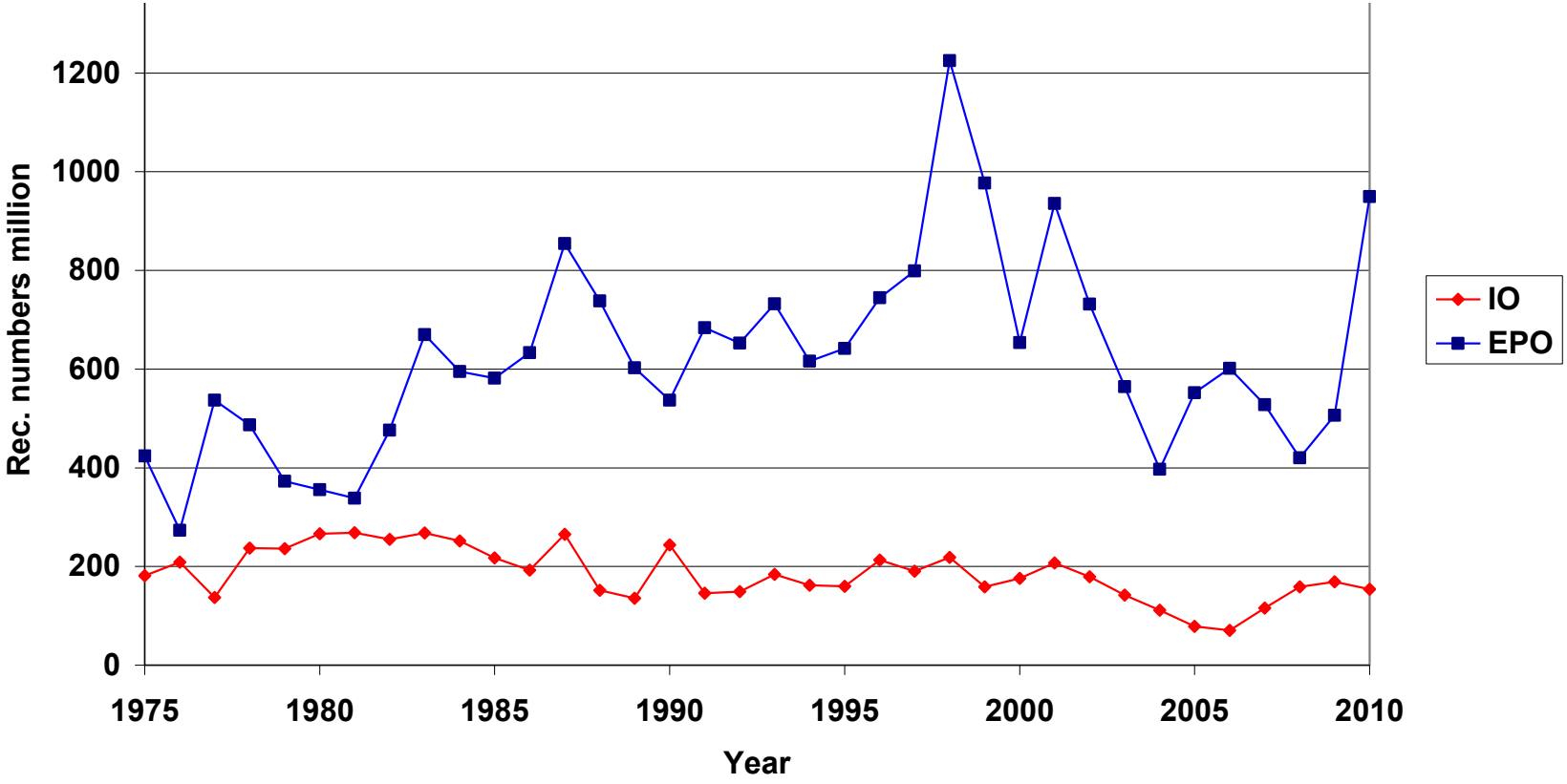
Very similar MSY estimated by the same SS3 model in both oceans

•The estimated MSYs in the 2 oceans have been variable from 1 year to the other, and from 1 model to the other, as well as a function of the assumed model steepness,
•But most MSYs estimated in the 2 oceans tend to be in proportion of total catches,
•Being simply a bit lower than recent observed catches:

➢Indian Ocean 1990-2010 catches = 370 000 tons and MSY at about **360 000 t**.
➢EPO 1990-2010 catches = 280 000 tons and MSY at about **260 000 t**.



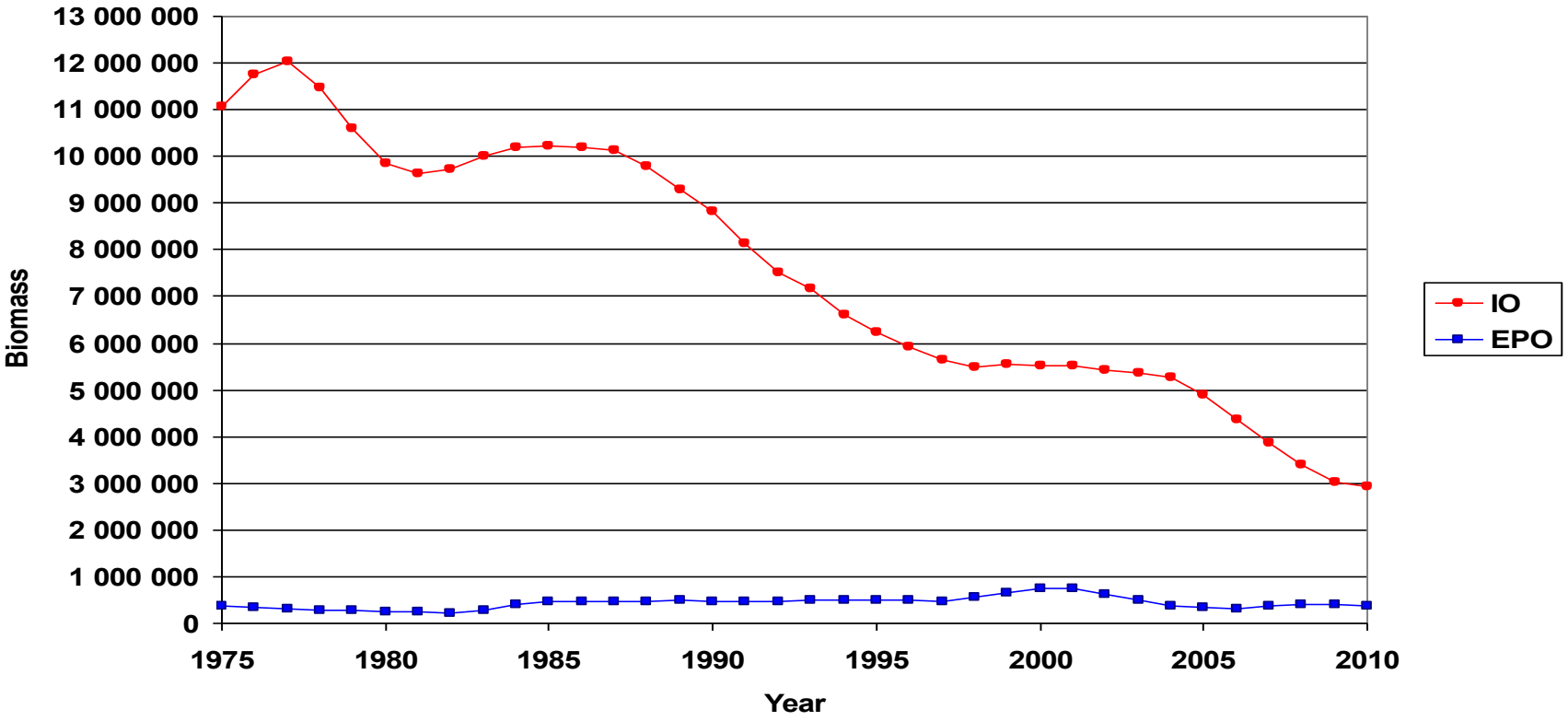
Stock assessment results: totally different levels of recruitment



Yearly recruitment estimated at much larger levels in the EPO: a **ratio of 4.5** during the last 10 years

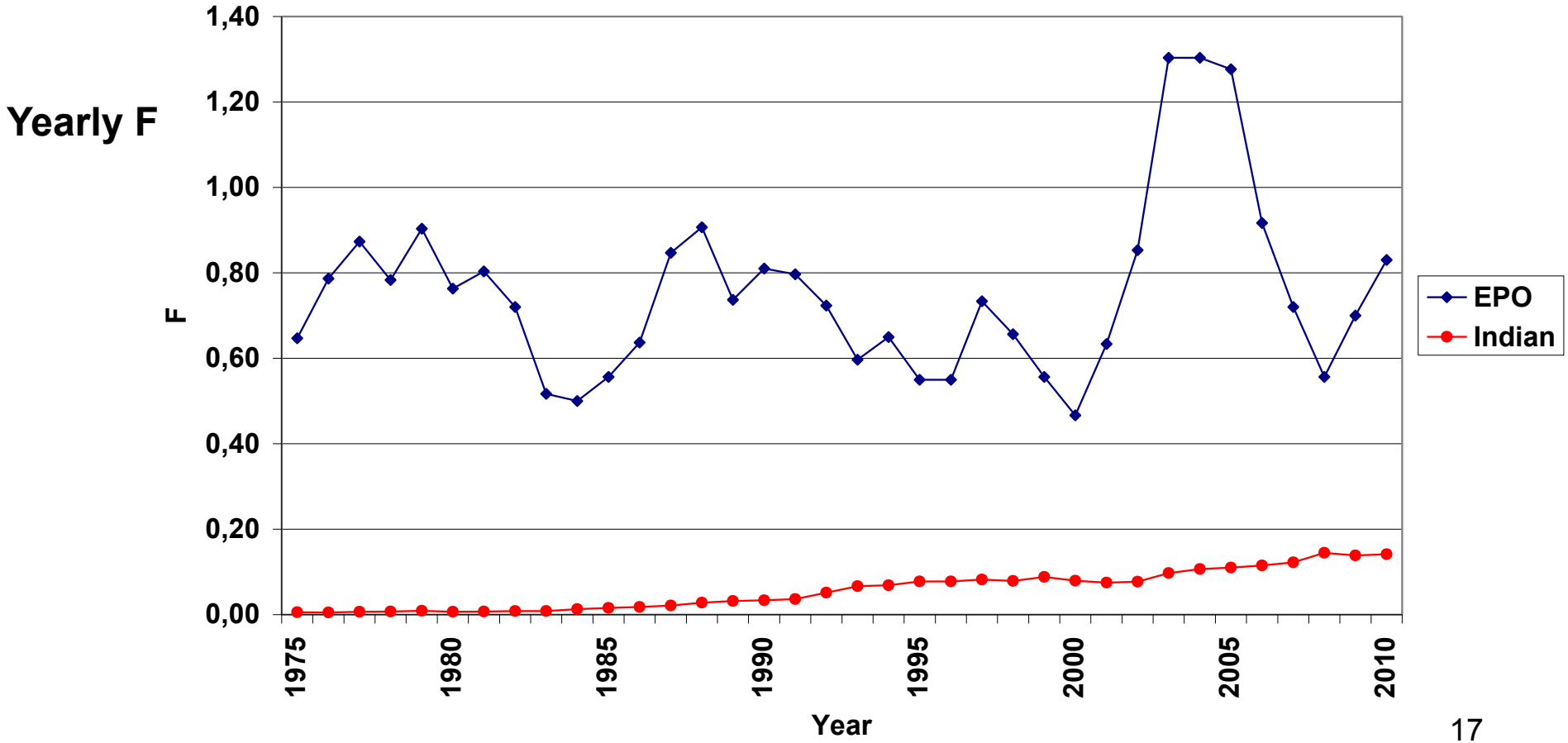
This is simply to « compensate » for the very large natural mortality assumed.

Stock assessment results: totally different levels of YFT stocks biomass

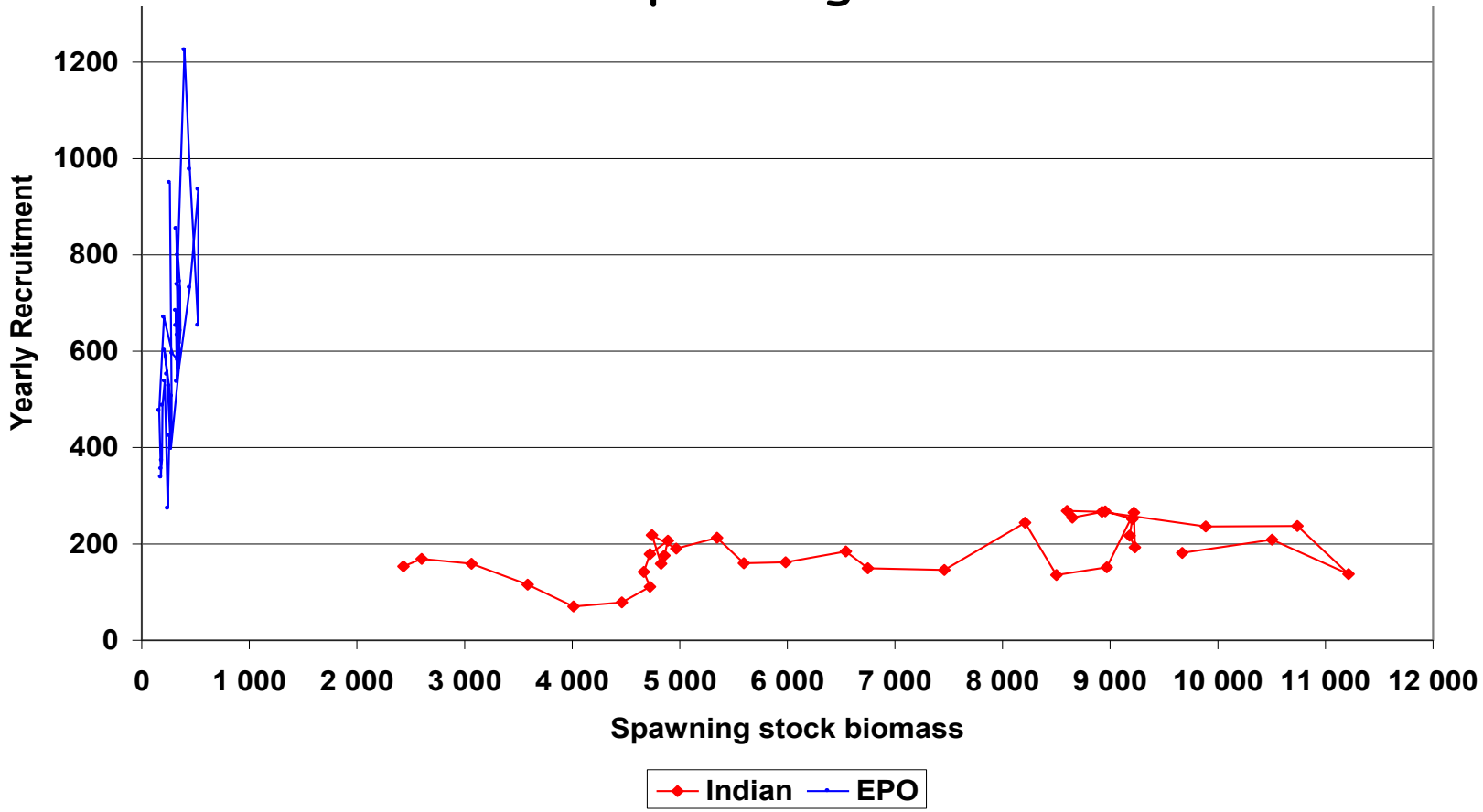


Yearly biomass estimated at much lower levels in the EPO:
Indian Ocean estimated biomass being 10 times larger than EPO estimated biomass (last 10 years)

Stock assessment results: Subsequently: totally different estimated Fishing mortalities



Stock assessment results : Subsequently, totally different relationship between recruitment and spawning stock biomass



- An Indian Ocean YFT stock with an enormous fecund biomass producing quite low levels of recruitments
- An EPO YFT stock with a very small fecund biomass producing much larger levels of recruitments than in the IO

Conclusion & recommendation

- It is striking to note how much the yellowfin stocks & fisheries in the EPO and IO are very similar in all their basic caracteristics
- Estimated MSY also similar for these 2 stocks, but these estimated MSY being widely driven by total catches
- Surprisingly, the best stock assessment results, obtained by the best & same Stock Assessment models and by the best scientists, are **totally incompatible in their trends and order of magnitude**
- This major uncertainty needs to be urgently clarified: **it is urgent & highly recommended to organize as soon as possible a small ad hoc WG between the IOTC and IATTC stock assessment experts & expert in YFT, in order to clarify the causes of these divergencies**,
- The goal of this WG would be to found some convergence grounds and similarities between their IO and EPO stock assessments hypothesis & results
- what are the **real natural mortality** in the 2 oceans? & what are the **real biomass** of YFT swimming today in the Indian and Eastern Pacific oceans?
- This type of comparison should also be useful at a world wide scale?