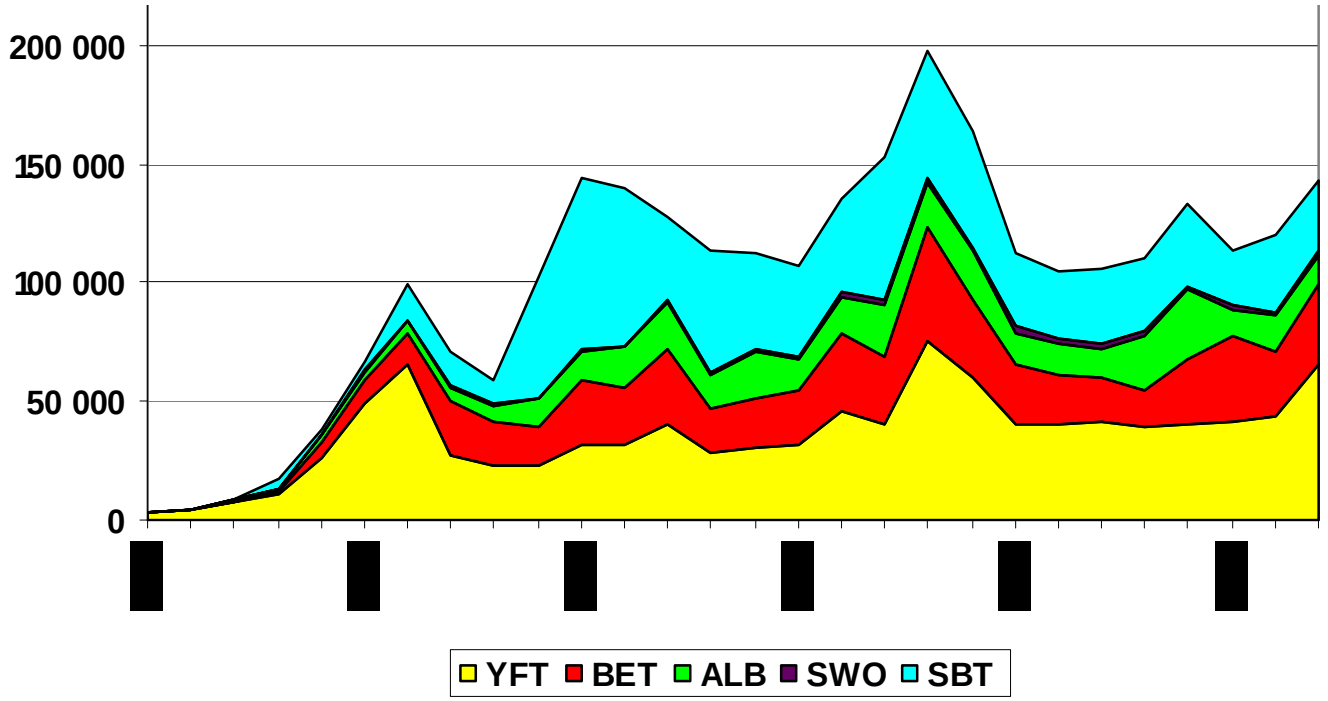
Shimizu June 1979: 30 years after, what's new in the IO, in terms of stock status and fisheries?

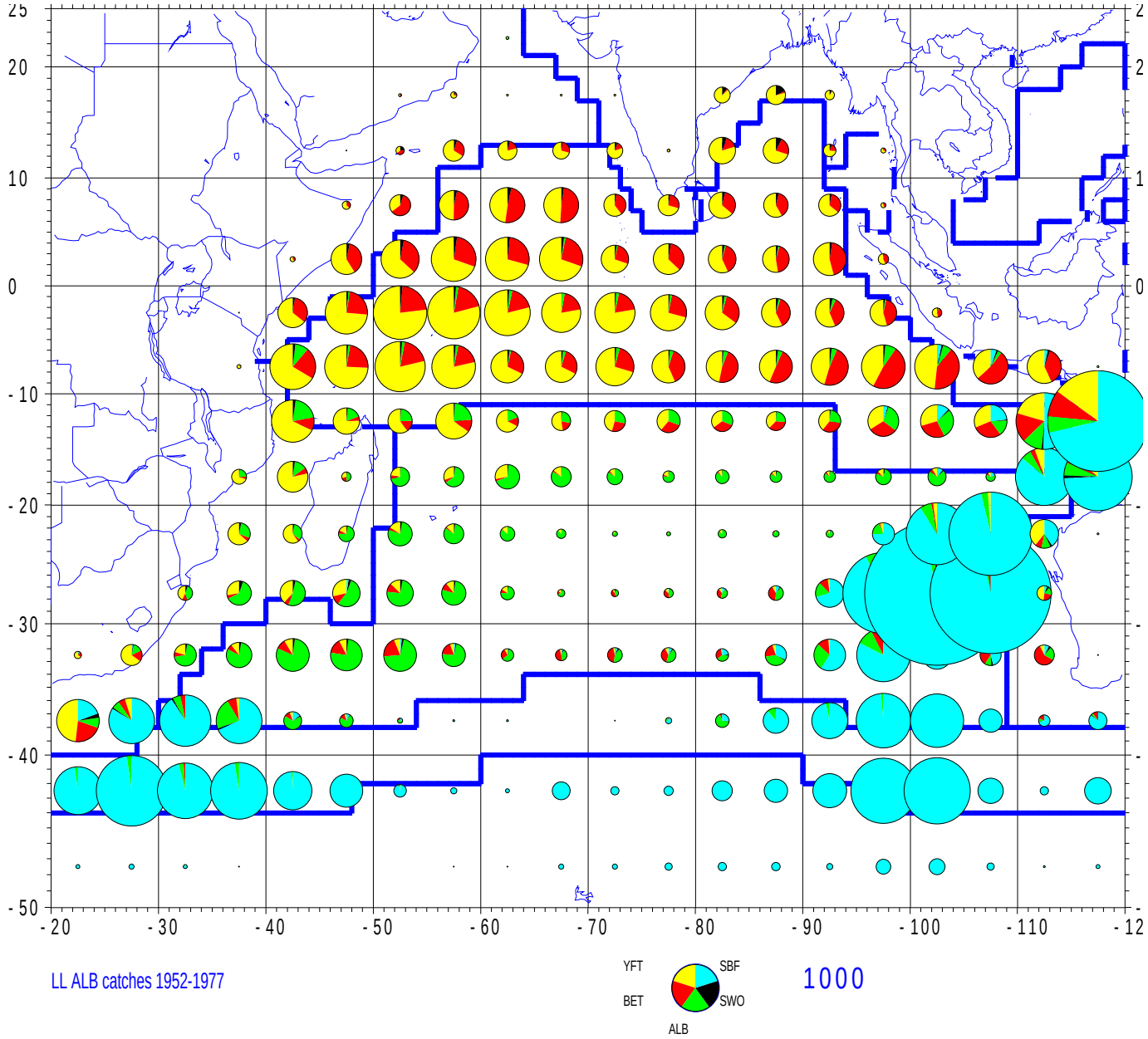
1979: The 1st FAO WG on Pacific & Indian Ocean Tunas and billfishes…..

a WG based on the longline fishery data, a period of low exploitation rates & stable catches, & with good statistics;

The end of seventies: a changing world, at the beginning of deep freezing and deep longline…& at the beginning of EEZ..

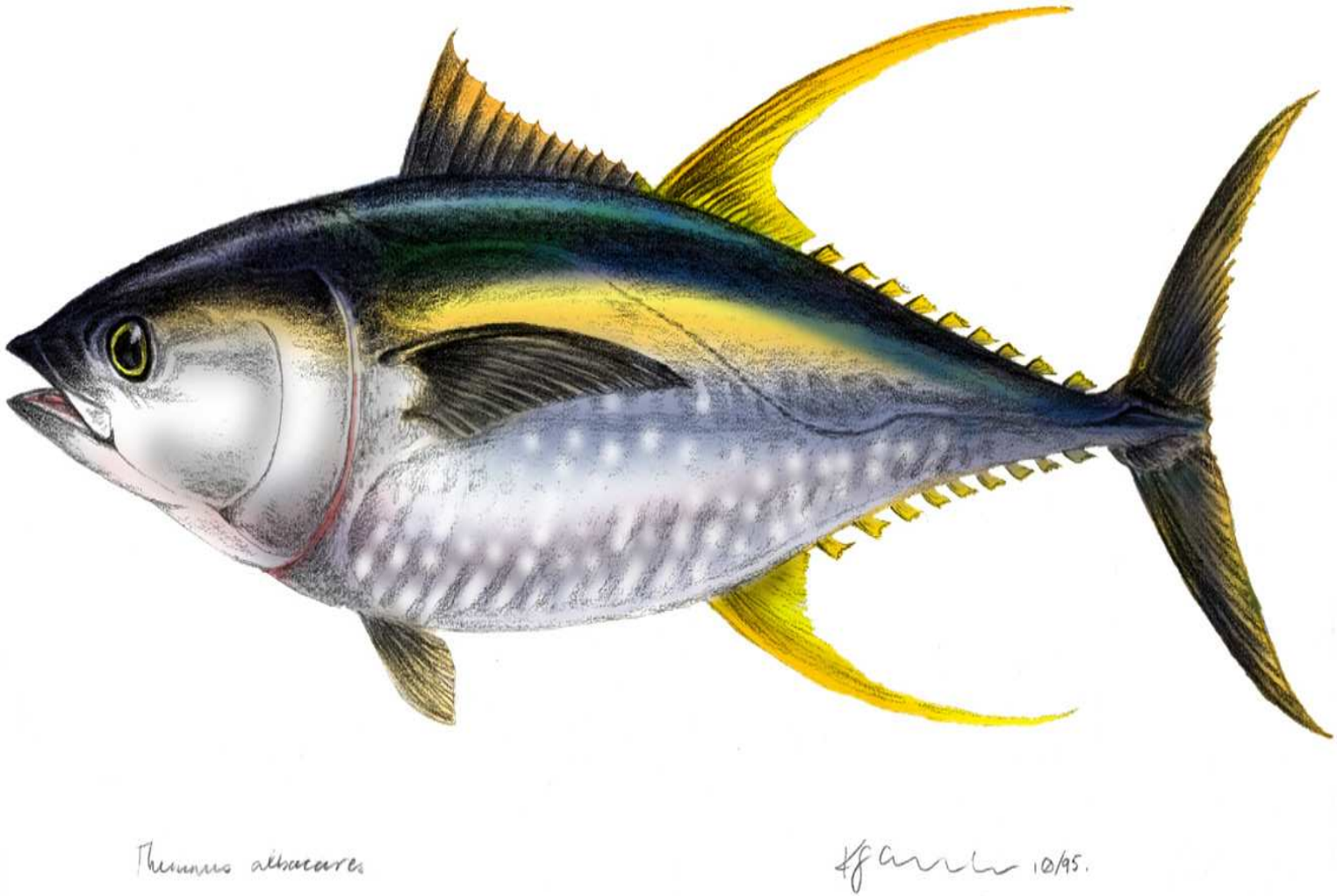
Stock Assessment mainly limited to production models, and a total lack of biological knowledge upon most of the IO species (SBT being the exception….)

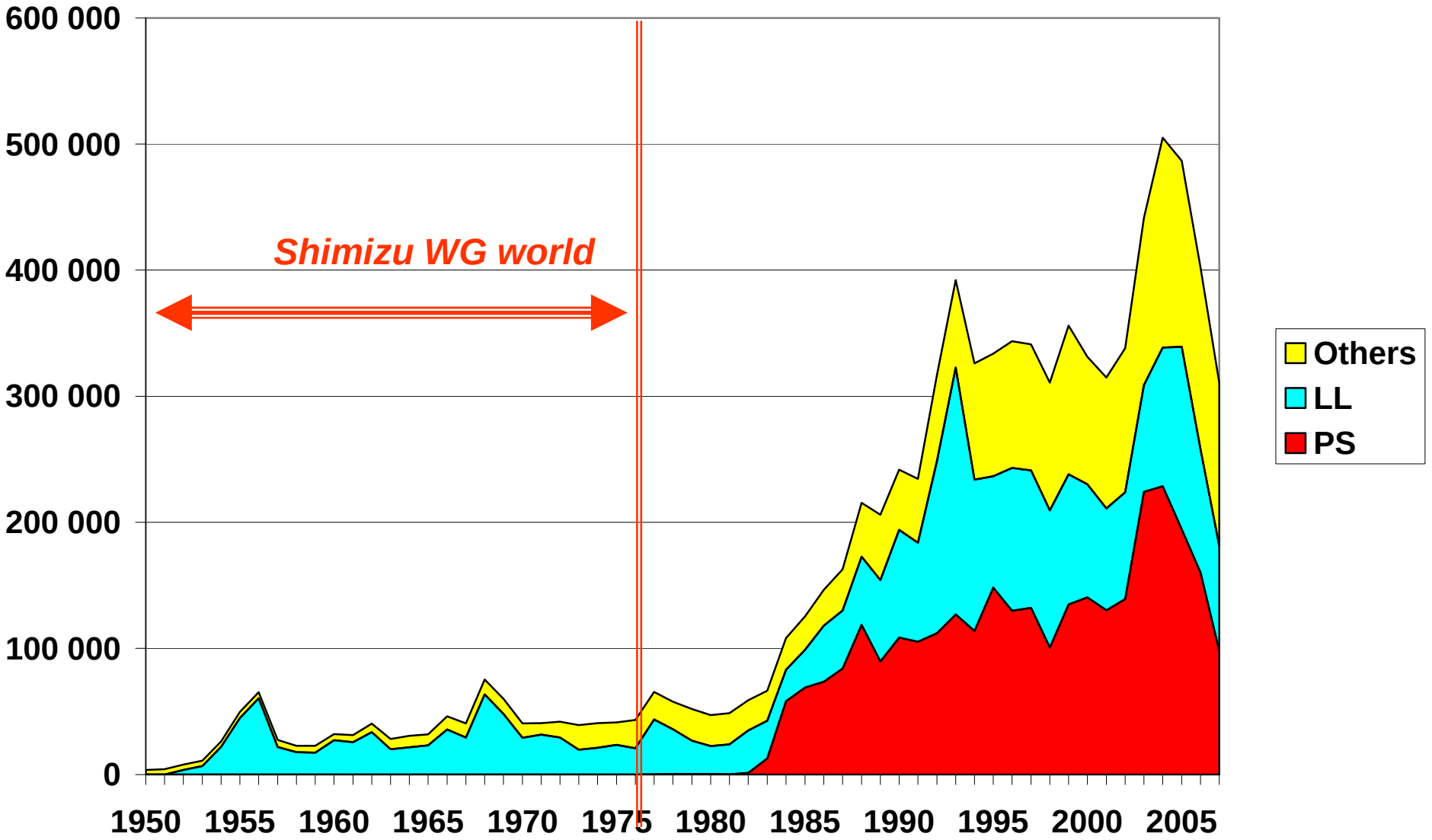




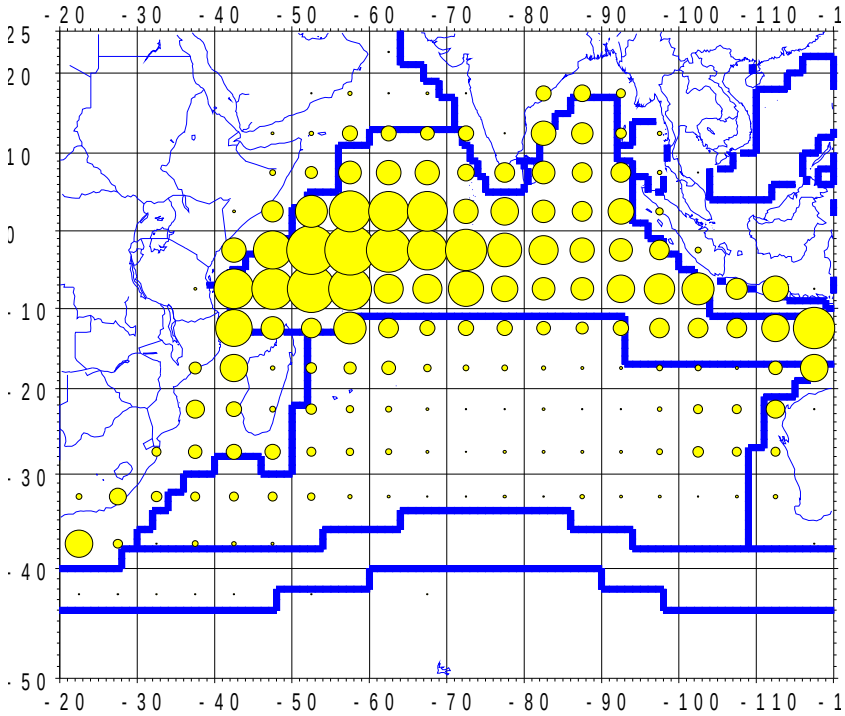
The world of tuna fisheries in 1979 in the IO: tropical tuna dominated by YFT in the 15°N-15°S area, W & E being equivalent. Great importance of SBT even in warm waters, & small quantities of ALB caught in the SW IO.

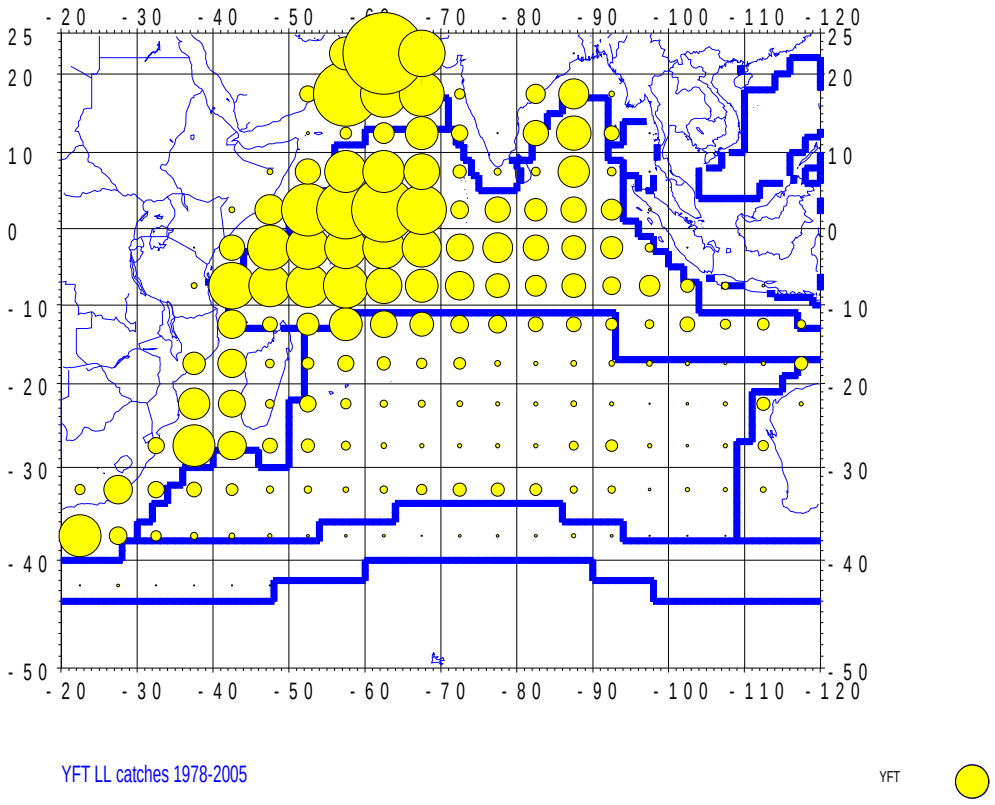
Yellowfin





- **Major changes observed in total catches: post 1977 catches X 8.5**
- **LL catches are now still significant in weight , but catches by various gear widely increasing and dominant**
- **Catches of small YFT are now very significant**





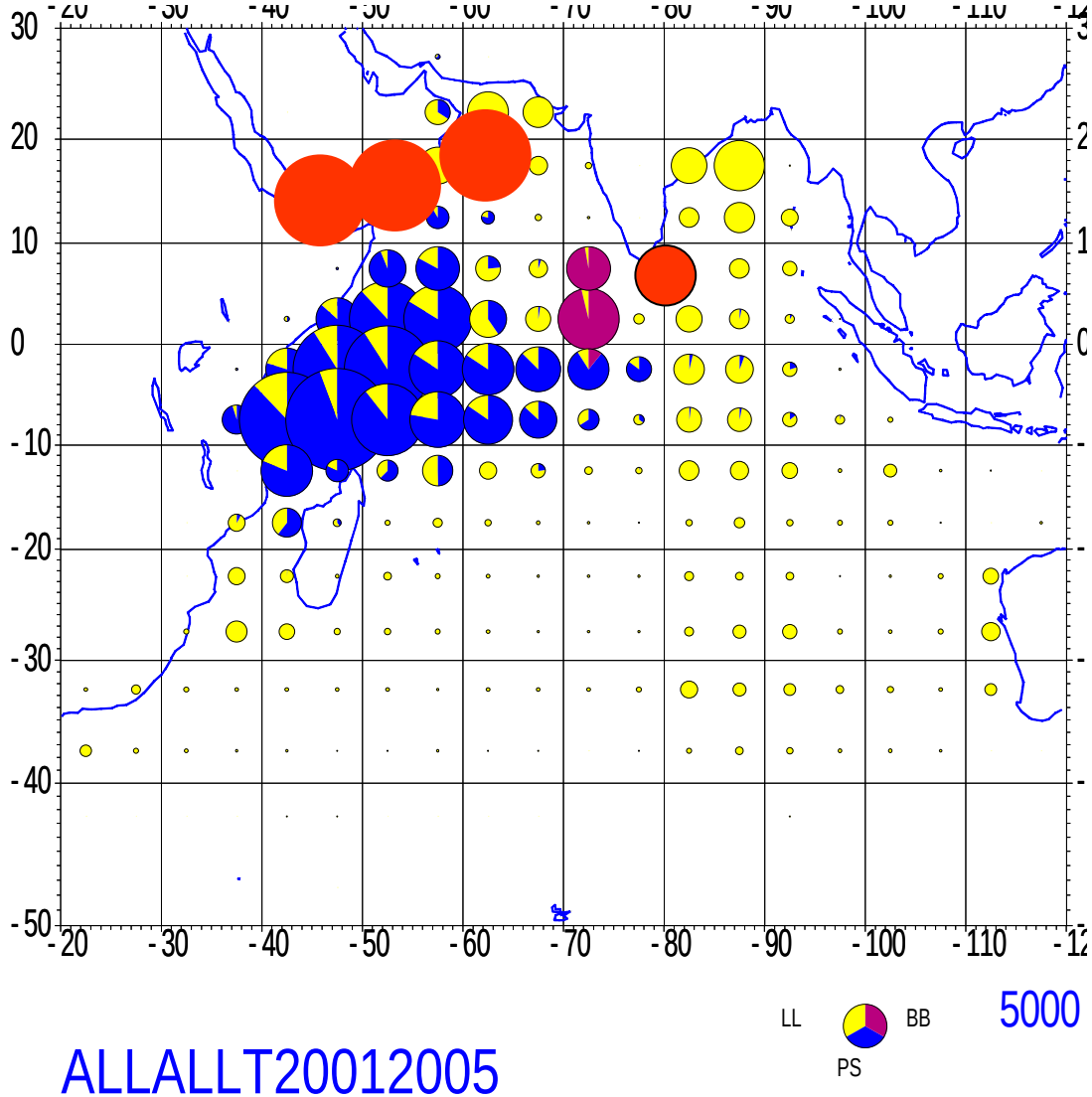
YFT Fishing zones: 1952-1977
During the SHIMIZU 1979 WG

LL YFT fisheries : 1978-2006

-New fishing zone in the Arabian Sea
- But major development of new gears, PS and other surface gear,
- in some areas already fished by LL, but predominantly in the Western Indian Ocean

Typical YFT recent fisheries 2001-2005:

Minor LL catches taken in a wider area & large surface fisheries mainly in the Western IO

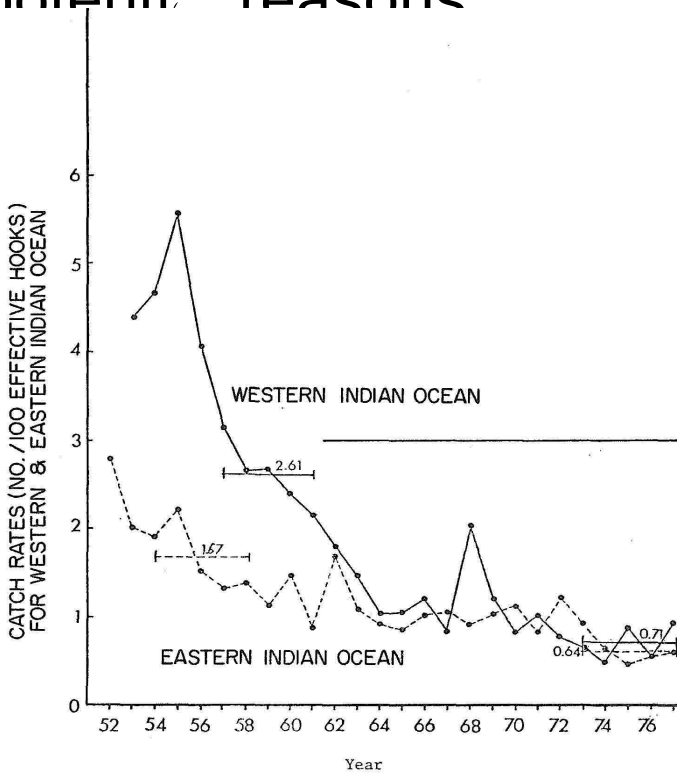


The early decline of YFT LL CPUEs, well discussed in the Shimizu report:

a good discussion of various main potential reasons

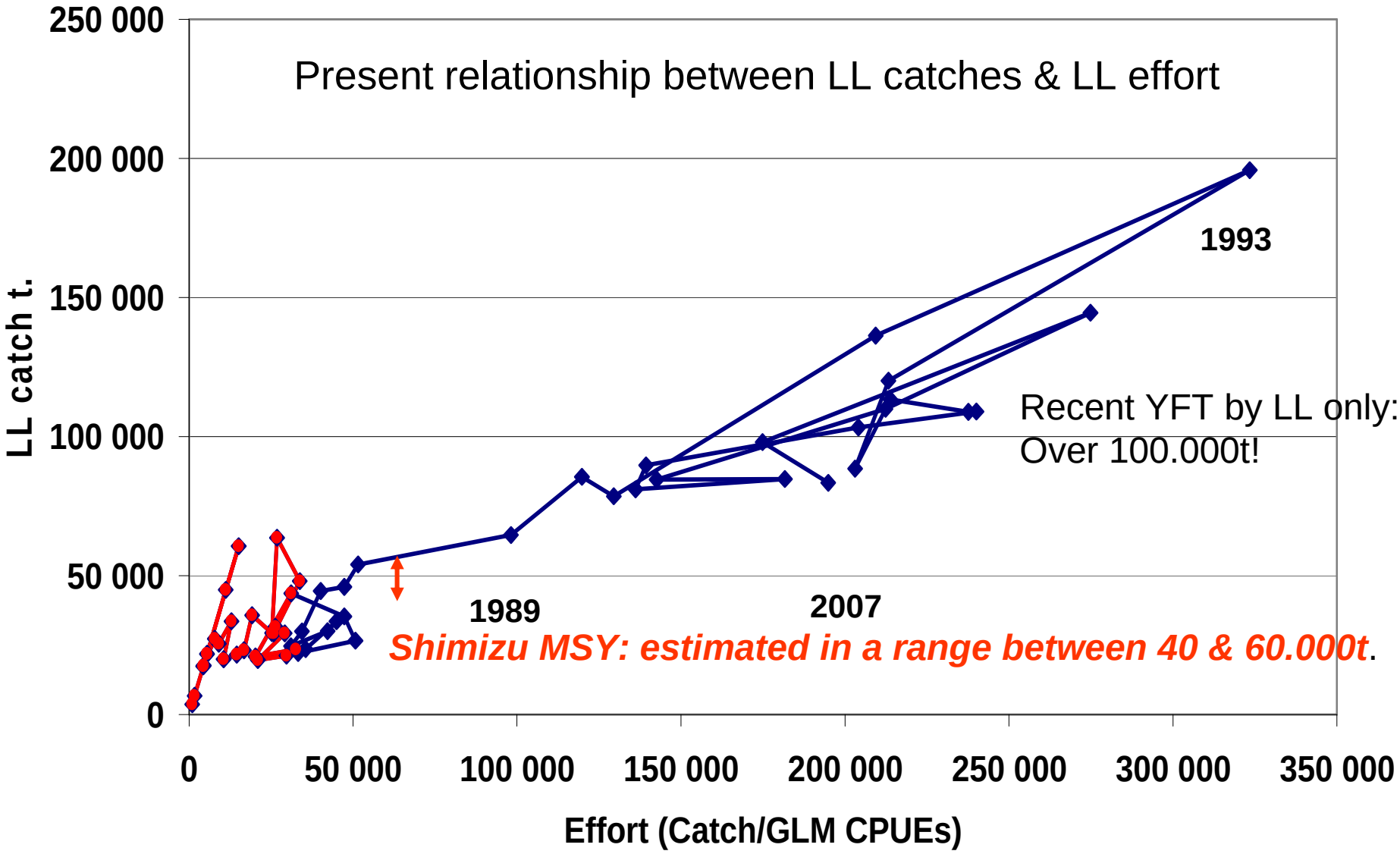
The decline of early CPUEs was clearly assumed to be widely excessive, compared to biomass trend, this was attributed to 2 combined reasons:

- The early efforts were highly mobile and concentrated in few small strata with the highest YFT densities, not representative of regional densities
- The early fishing effort was more efficient due to the small numbers of longliners then active, but this efficiency has been permanently declining by the increase of competing hooks in all strata with high local efforts.



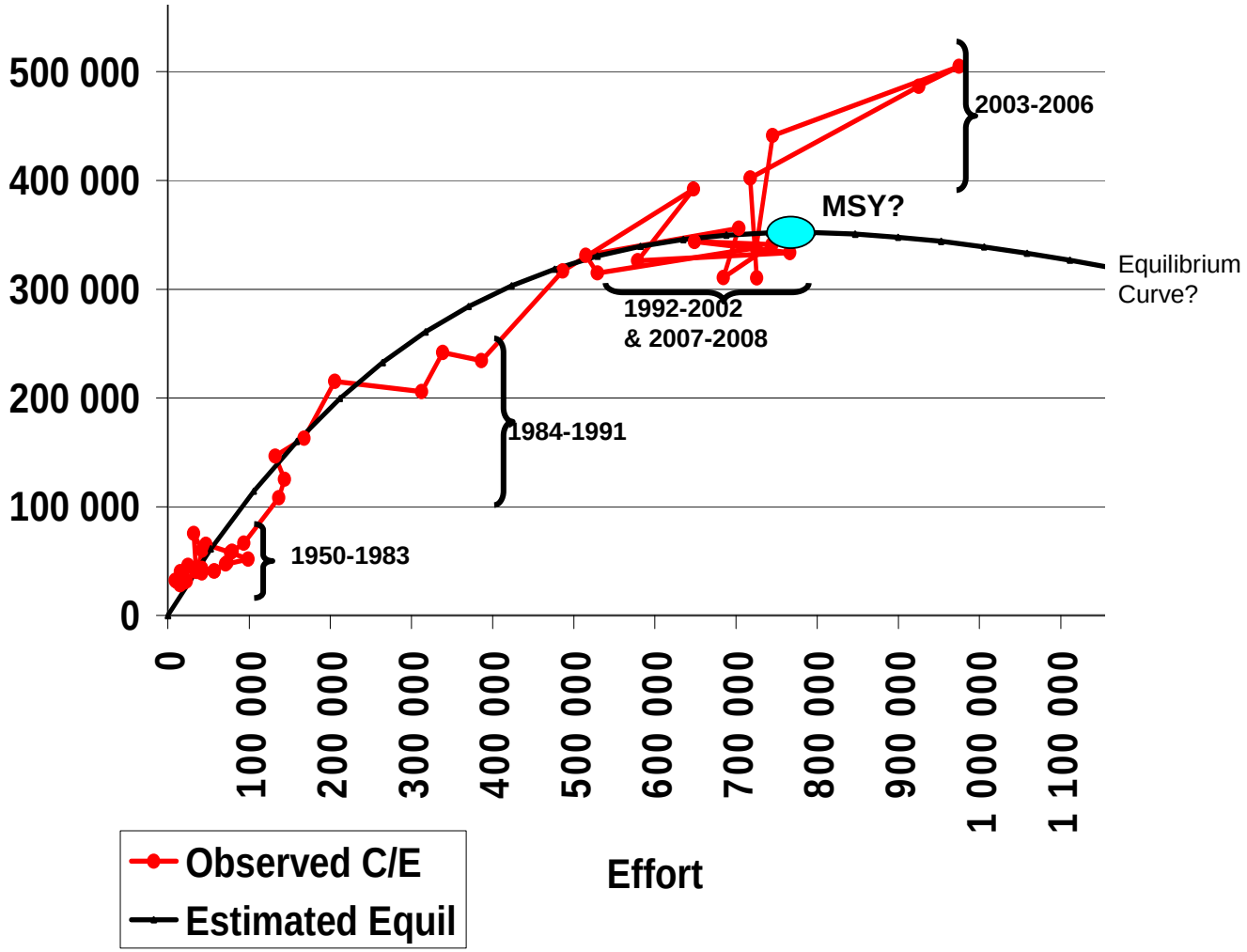
YFT CPUEs
Honma method
the more important CPUE decline was noted in the WIO

30 years after, this major uncertainty in the present YFT stock assessment remains very poorly studied/explained and seldom discussed in the present SA IOTC reports

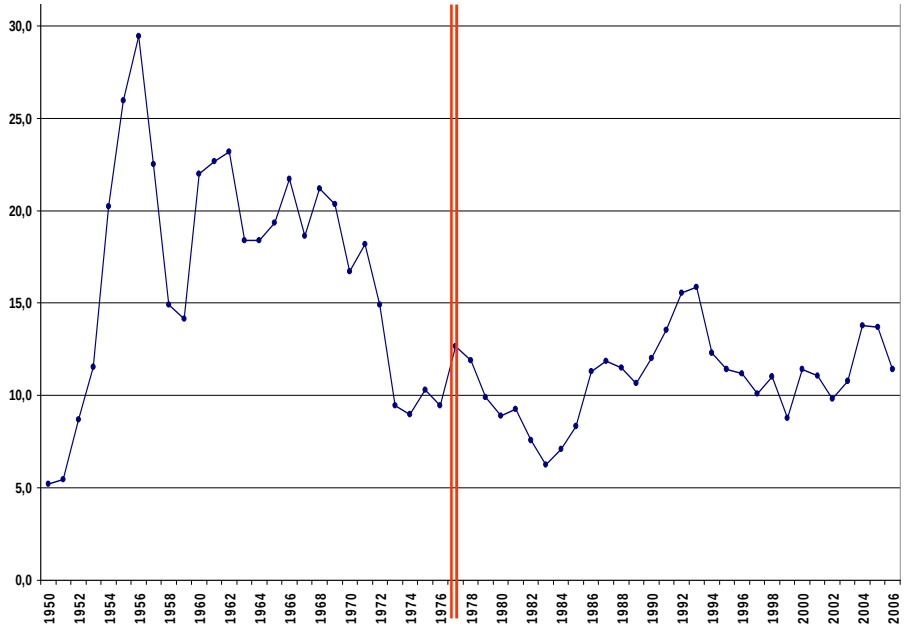


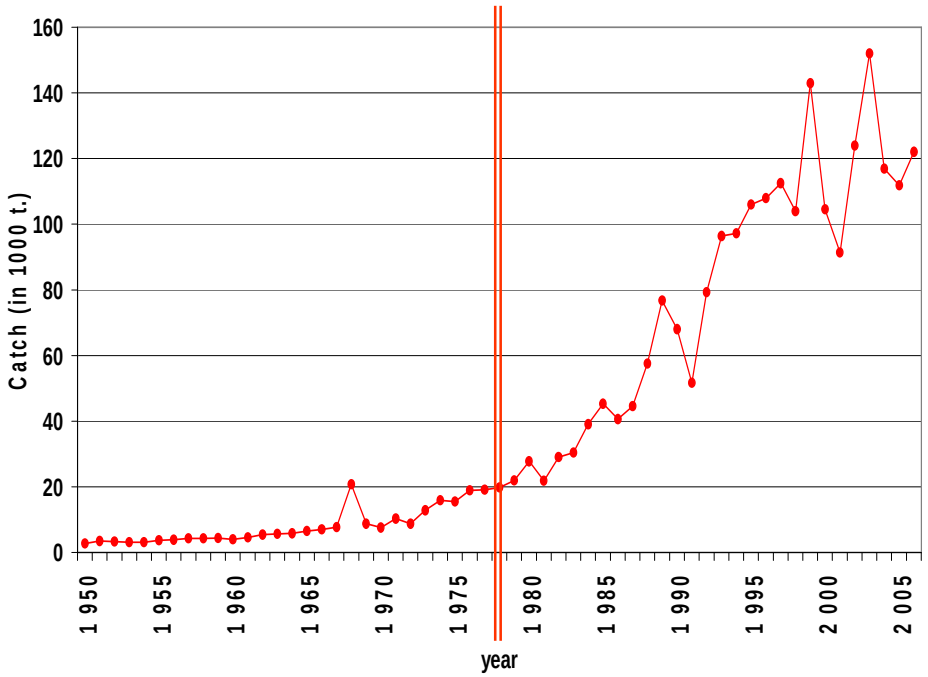
Longline alone: catch & effort relationship: a large increase of LL catches, following the major further increase of effort post 1977….

Production model with all the YFT fisheries: same Yield and effort relationship, but at a much higher level, probably MSY well over 300.000 tons!



Average weight YFT



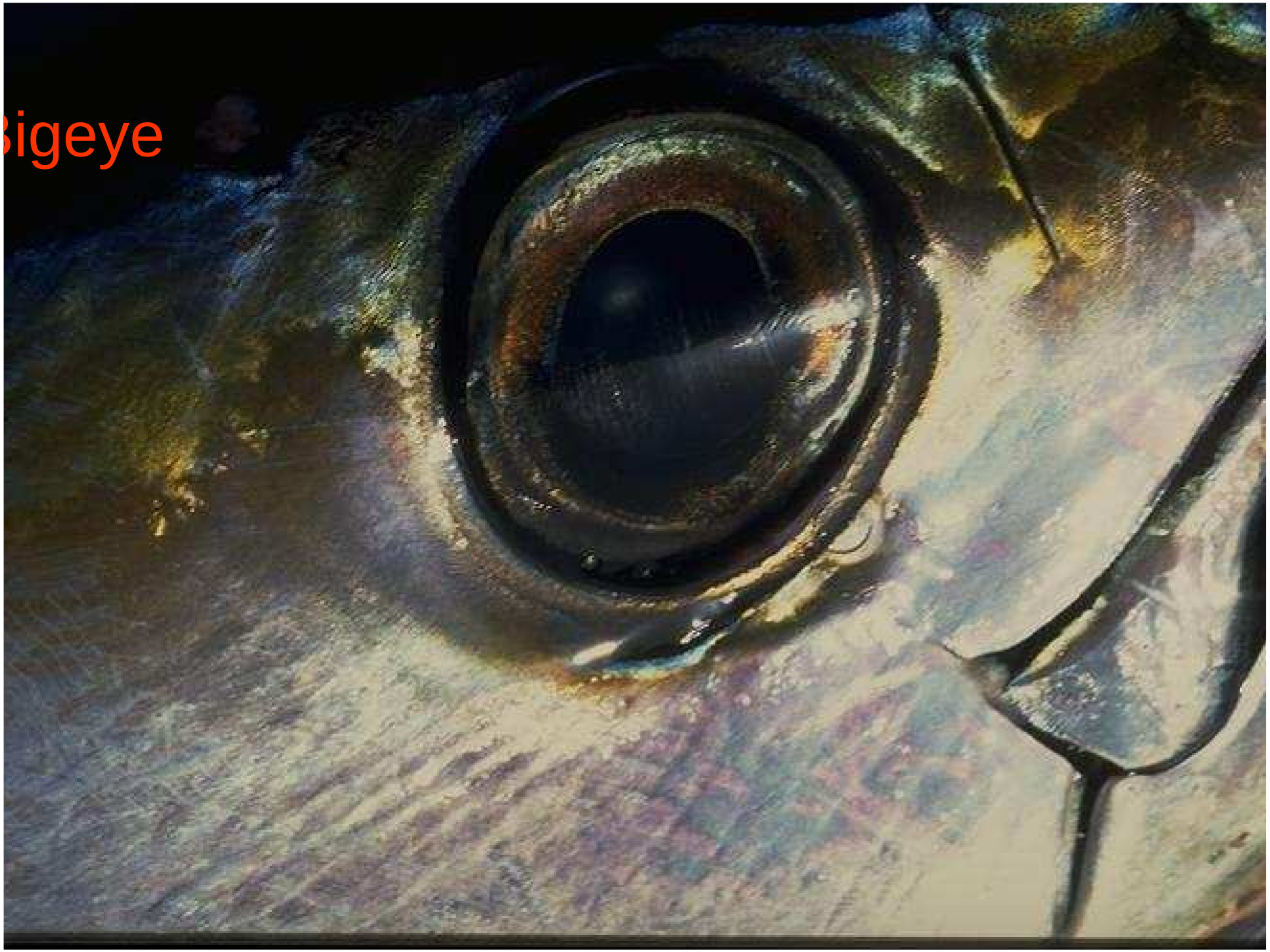


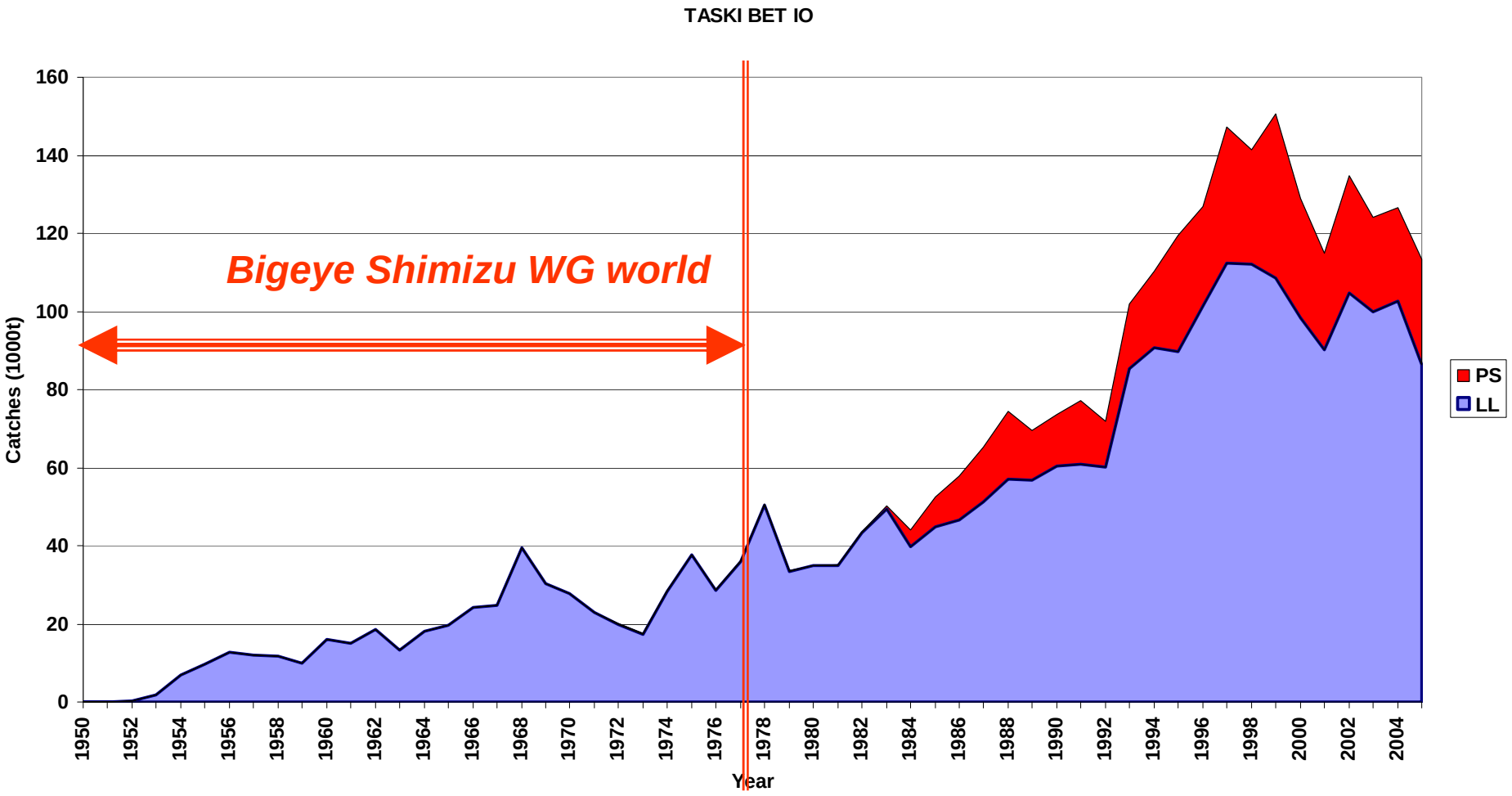
- A significant but not a major decline of the average weight of YFT caught
- But a 10 fold increase of small YFT caught, comparing the 15 years period before 1977 and before 2005.

YFT lessons and conclusions:

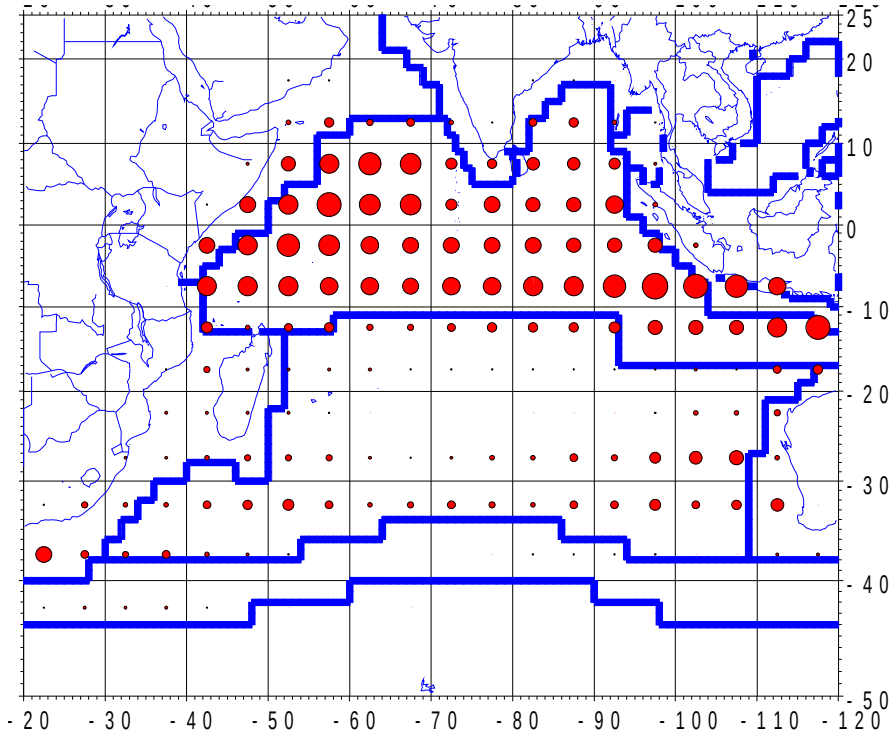
YFT fisheries and SA 30 years after Shimizu WG

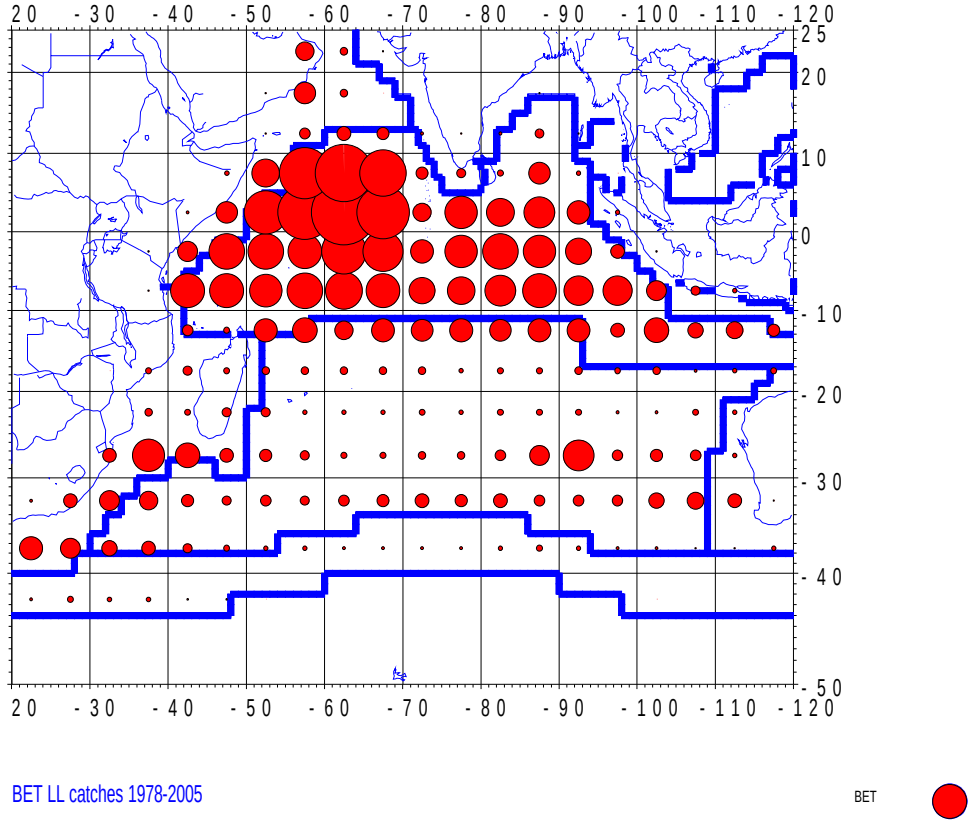
- The 1979 diagnosis was completely wrong, being driven by the major early declines of the YFT CPUEs
- Its MSY was widely underestimated, despite of the major increase of small YFT catches observed since: no visible effects of improved Y/R!
- The “apparent increase” of MSY has been observed + or - in the same fishing zones and in shallow supra thermoclinal waters-: no effect of increasing fishing zones (only in the Arabian Sea, a small % of total catches)
- It seems that surface fisheries have now an access to a new biomass of YFT tuna, then widely increasing the potential MSY, despite of the lower sizes caught, that should produce a decline in Yield per Recruit
- At least we should question: how much would be an MSY for a YFT stock fished only / LL? As in the Shimizu time


Bigeye



- **Major changes observed in total catches, post 1977 catches X 4.8**
- **LL catches still dominant in weight , but PS catches of small BET are now very significant**



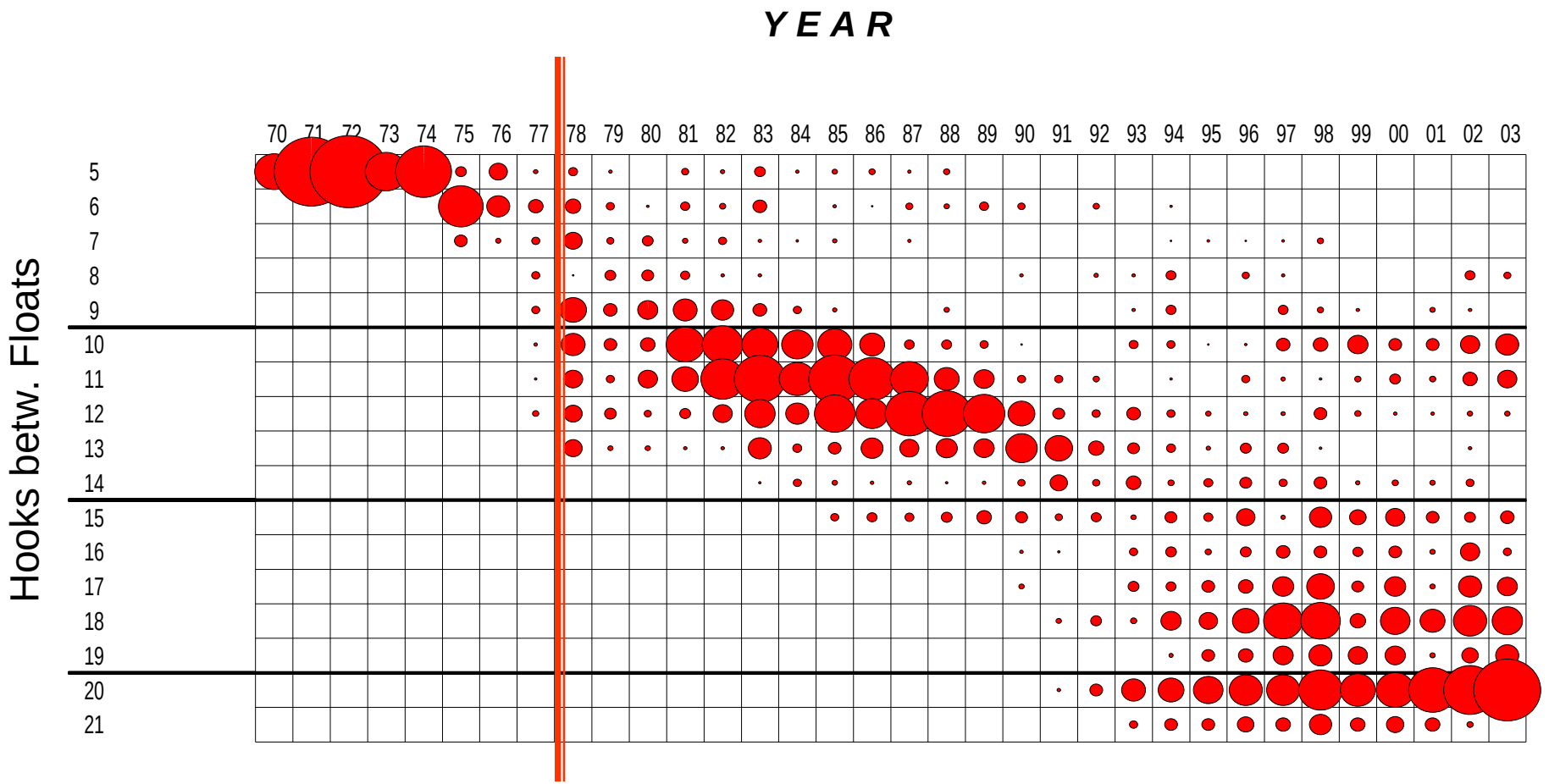


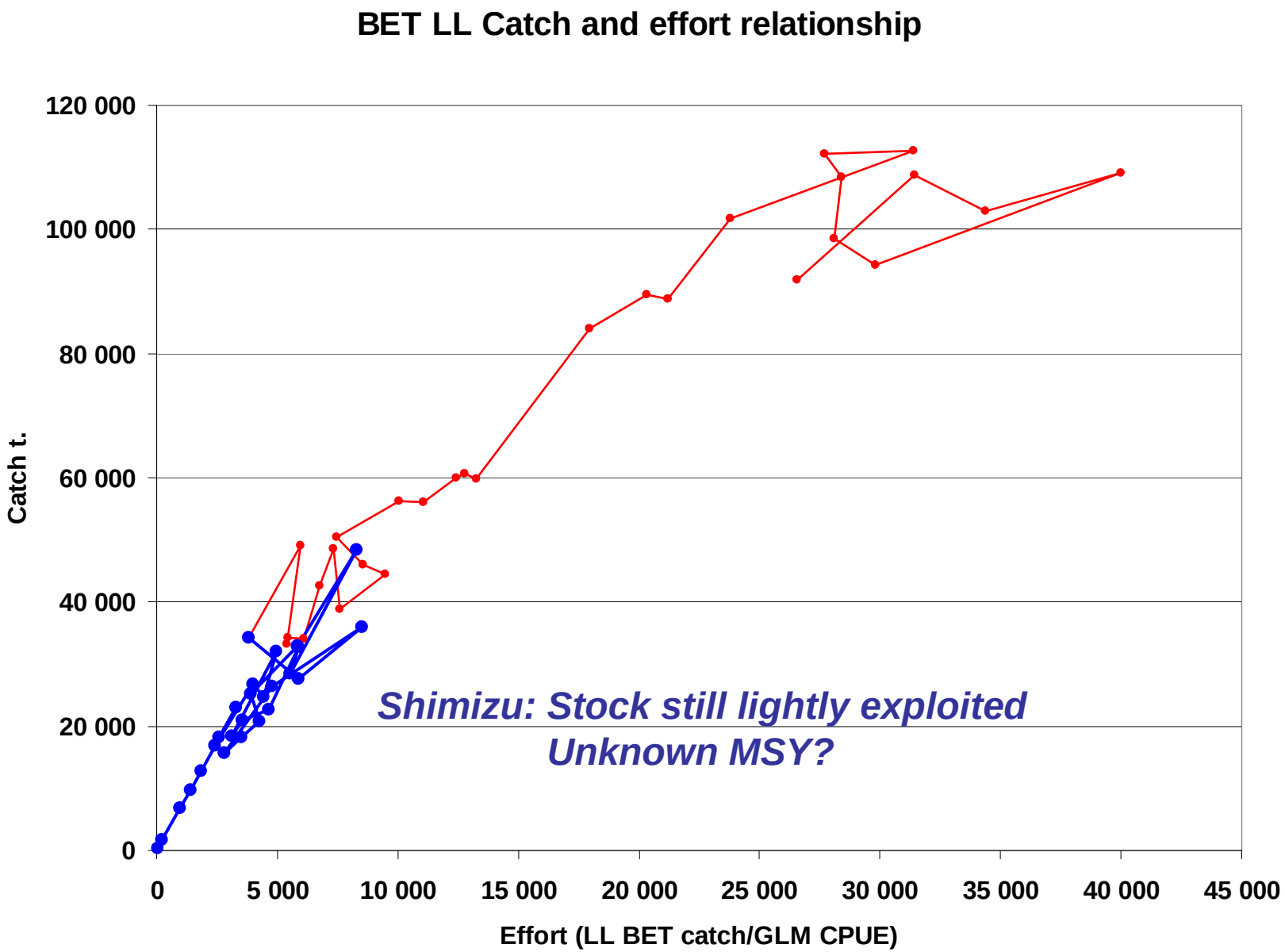
BET Fishing zones: 1952-1977
During the SHIMIZU 1979 WG

After it: 1978-2006

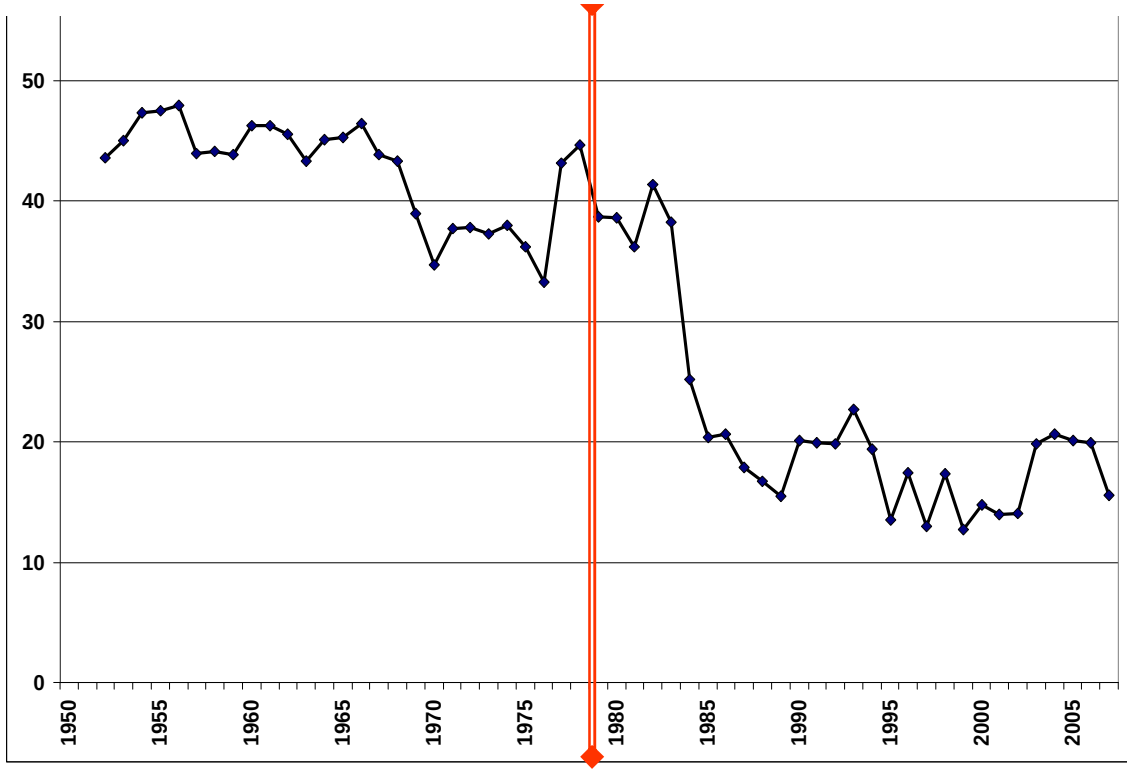
Similar fishing zones, but now a major increase of LL catches in most of the historical fishing areas, widely due to deep longline.

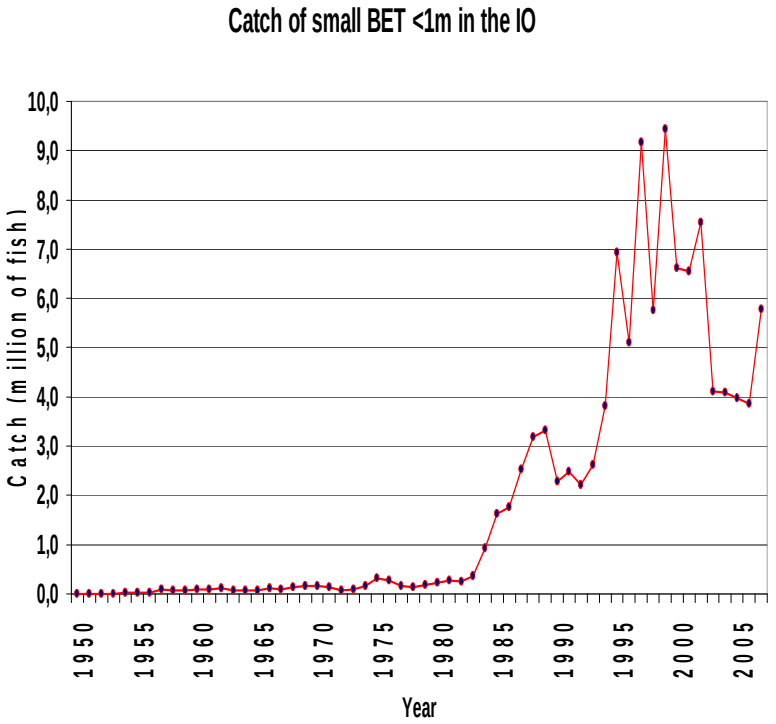
Shimizu WG: the beginning of deep LL, allowing to efficiently catch deeper BET, and +++





A valid conclusion…. But what MSY?





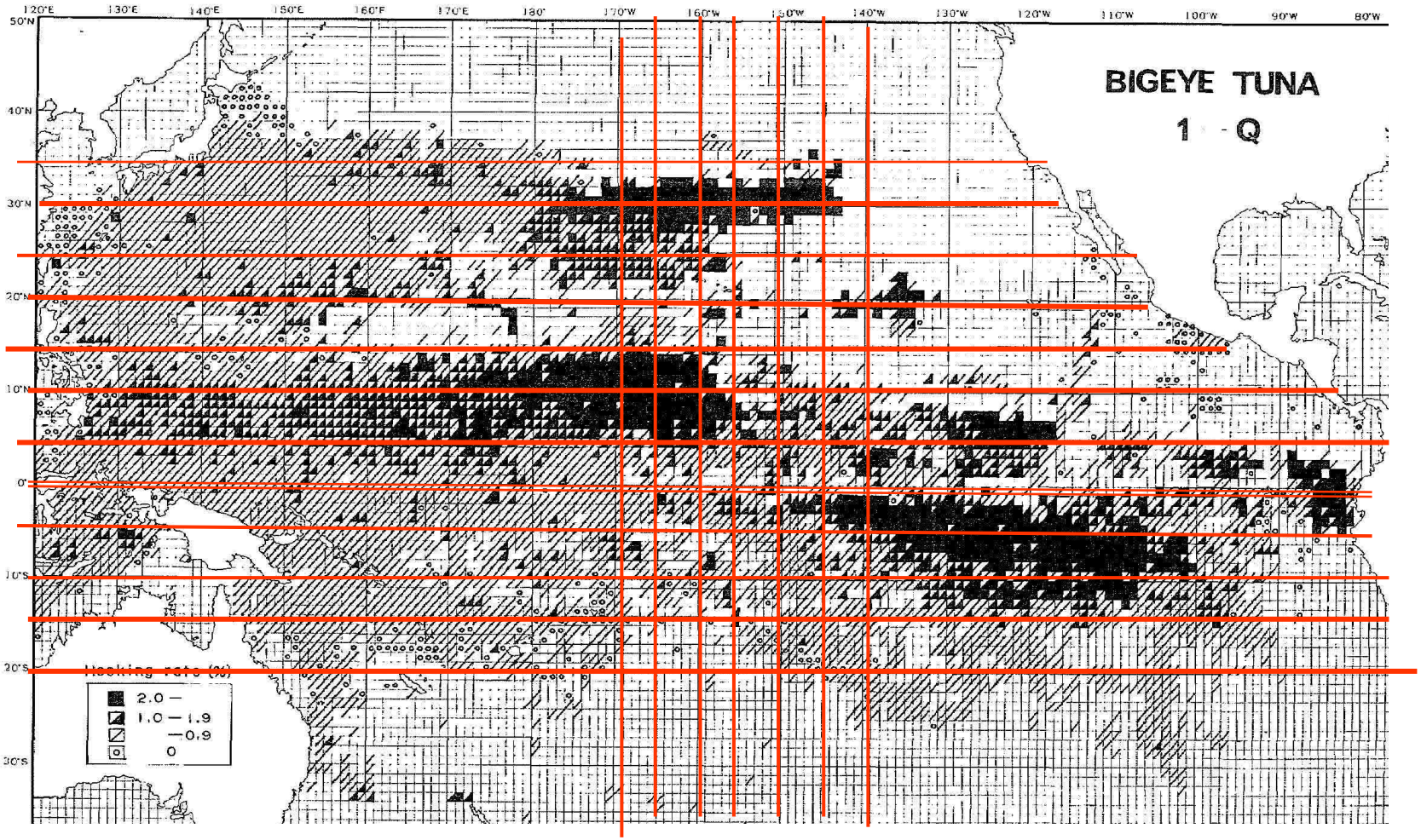
Average weight of BET taken by the IO Fisheries

Post 1977: A significant decline of average W caught, due to PS increased catches of small BET (FADs)

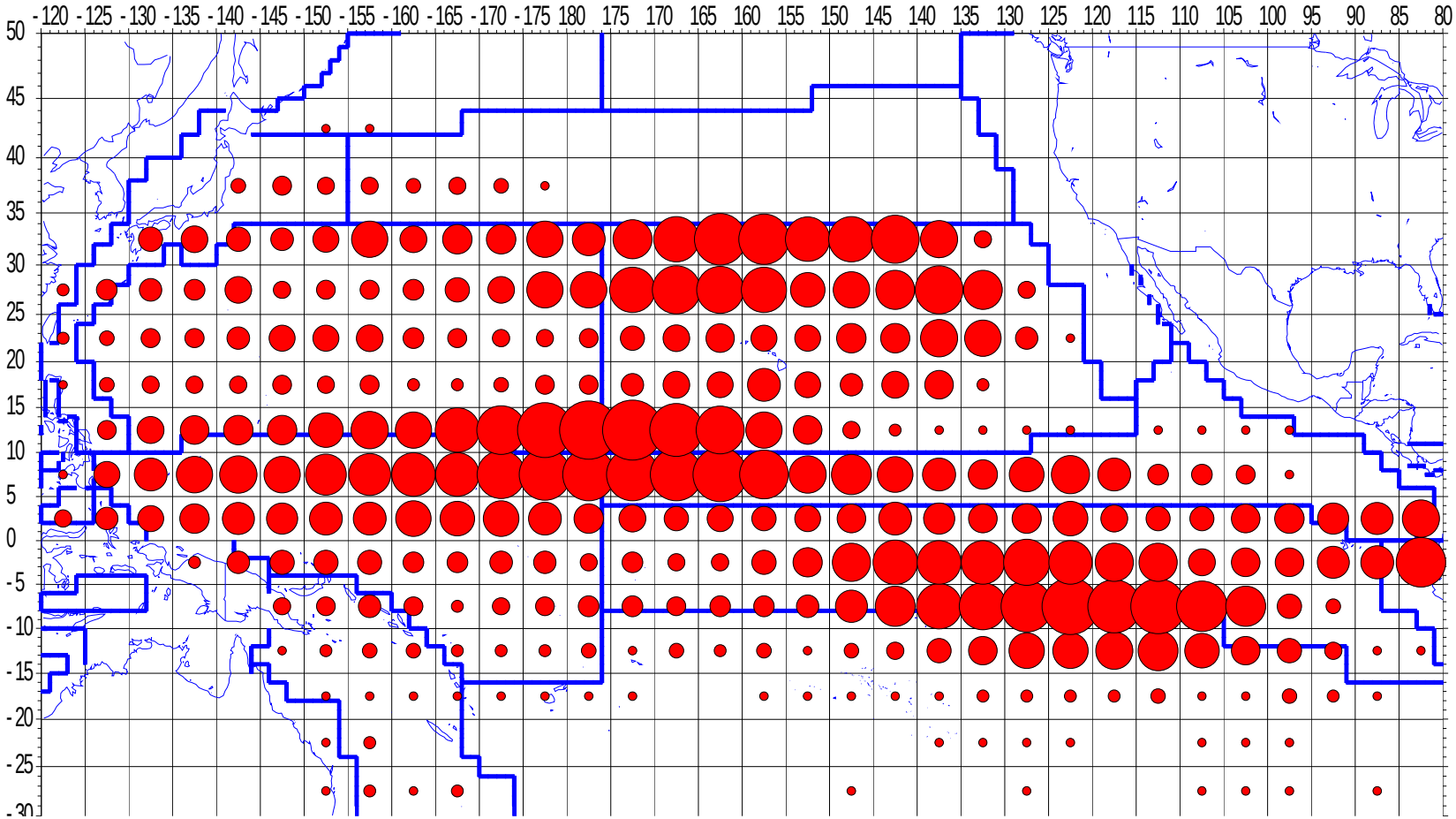
BET lessons and conclusions:

Bigeye fisheries and SA 30 years after Shimizu WG

- **No major changes in fishing zones, but the increasing use of deep longline, in the same zones, allowed to widely increase LL catches,**
- **These increased catches and the presently estimated MSY are in quite good agreement with the Shimizu 1979 report**
- **PS fisheries should have produced a decline of Y/R, but how much?**
- **Scientists should now question: how much would be an MSY for a BET stock fished only / LL? As in the Shimizu time.. What are the real interactions between gears?**



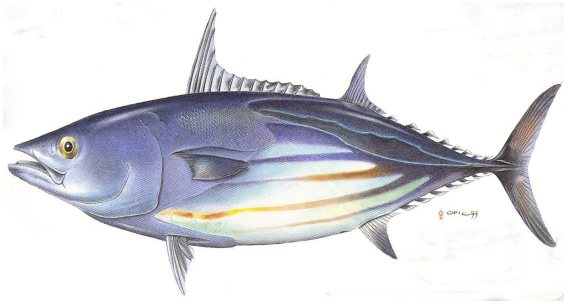
In this 1979 WG: Japanese LL Catch & effort statistics were available in the Pacific ocean by 1°square,
Cf these nice hand made maps of quarterly CPUEs, done without computer?



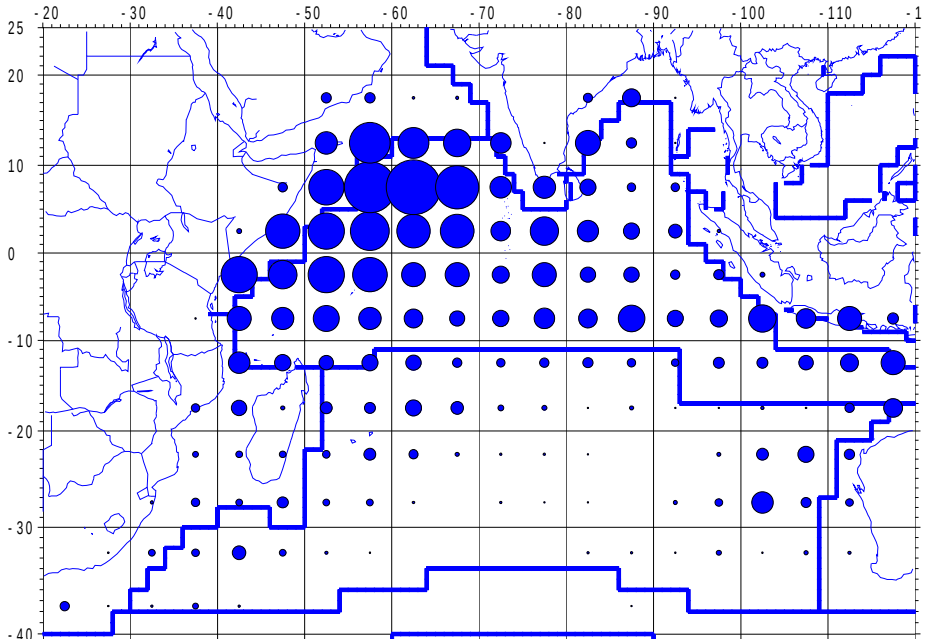
Same CPUE map / today 5°squares ….

And a lot of geographical smoothing, & lost information!

Skipjack



- A species not studied by the WG, as it was only working on longline data
- SKJ catches were then 10 times lower than since 1978.
- But SKJ was already highly “visible” in longline fisheries, being already taken at large size in all equatorial and sub tropical areas
- During the same period, the MSY of the IO SKJ stock was estimated by various Japanese scientists (based on larvae) in a range between 200 to 300.000 t. (Kawasaki 1972), then a too low, but very reasonable MSY level…



a potential 1979 fishing map: Skipjack catches by Japanese longliners during the 1952-1977 period

A general comment: a Shimizu 1979 WG without computers

- **Indirectly this was a positive factor: producing various global scientific discussions & conclusions in the report that are still widely valid today, and often a abandoned today in their reports by modern WGs and their PC..as an example….:**

The problem of estimating the impact of surface fisheries on longline fisheries is even greater (SAWS/BP/4). Factors which affect the impact are: (1) the relative size of fish taken by the two gears; (2) variability in natural mortality; (3) the difference in "stocks" or groups of fish exploited by the two fisheries; and (4) differences in time/area strata in which the fish are exploited by the two fisheries.

"Several papers discussed stock recruitment relationship. Over the range of abundance so far experienced, no large variation in recruitment with stock size has been found. This is consistent with the high individual fecundity of tunas. However in view of the serious consequences if recruitment is impaired and the increased possibility of this occurring with very high levels of effort, the matter deserves careful attention".

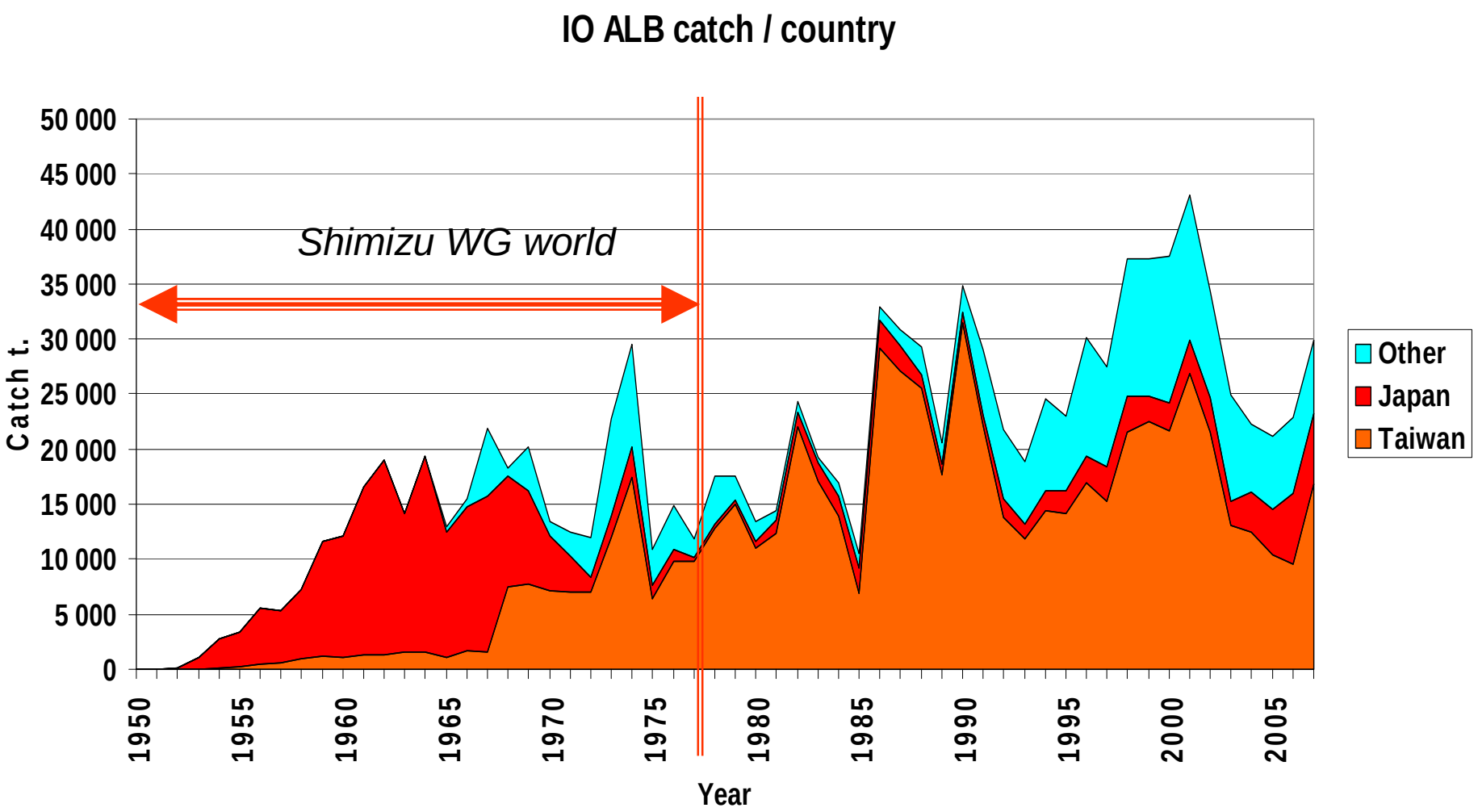
And 30 years after: some lessons

- MSY can be estimated only at high exploitation rates: & major increases of fishing efforts, many gears and a wide range of areas and depth. Overfishing have been very useful for scientists to estimate MSY!
- **This fact reinforce the deep need and full priority to permanently obtain Catch, Effort and size data from all the fisheries, as these data are the backbone of any tuna or billfish SA.**
- Additional **biological research and tagging programs** are of course also necessary to allow any comprehensive modeling & diagnosis upon stock status and their prospects

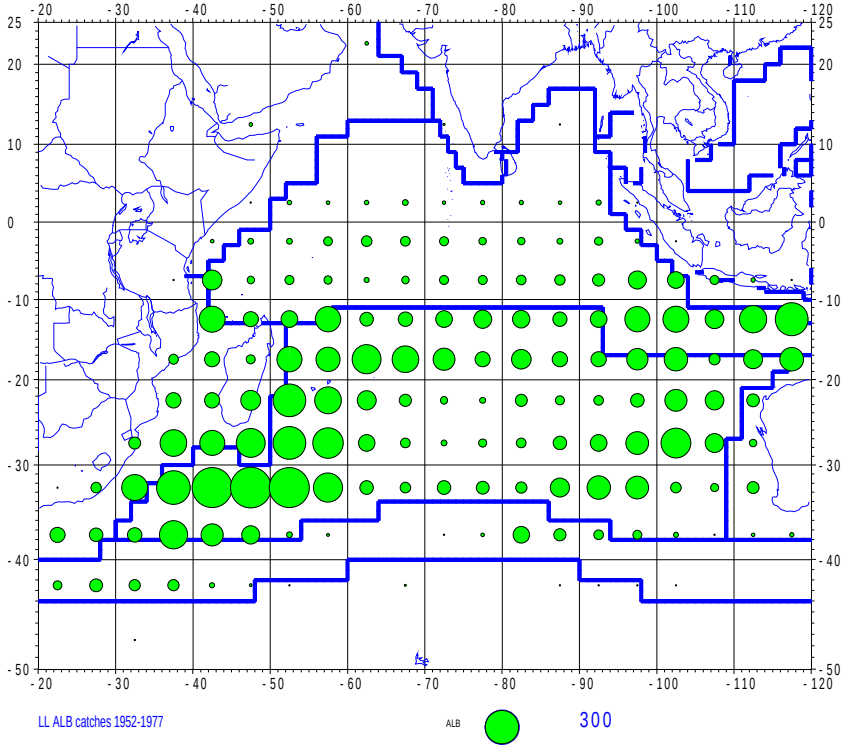
What has been achieved by IO tuna scientists since 1977, and why?

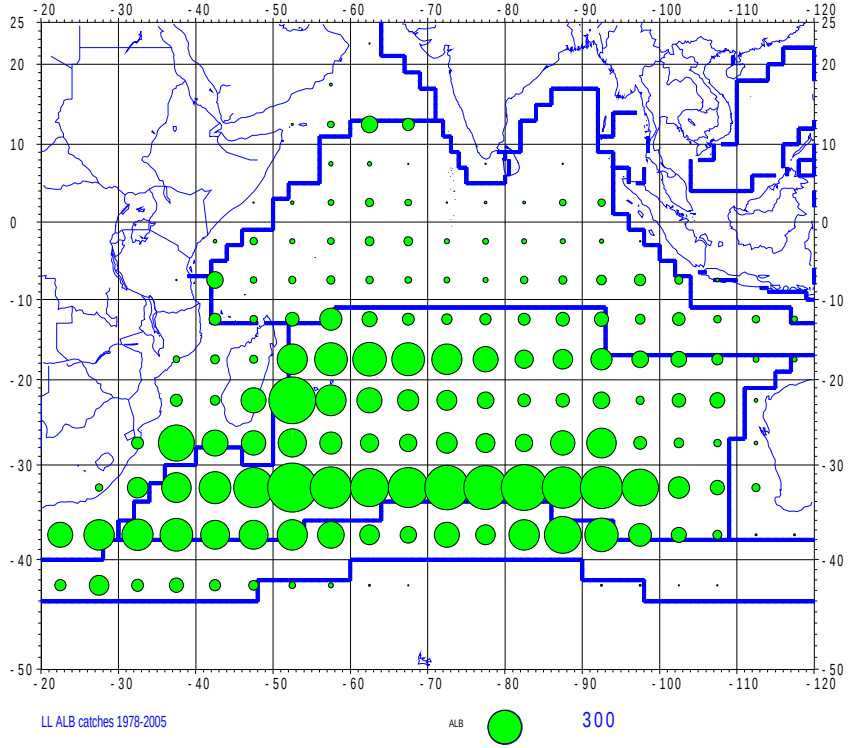
Species	Main scientific achievements	Why?: science input	Why? Lessons from fisheries
Yellowfin	major scientific progress	Many biological & fishery investigations, and major progress recently obtained from the IOTTP tagging.	Experimental sucessful overfishing has been showing that MSY was much higher than expected
Bigeye	major scientific progress	Many investigations, and major progress recently obtained from the IOTTP tagging.	Experimental successful overfishing has been showing the real level of MSY
Albacore	standby: nothing new	Very few investigations, very minor scientific progress	Experimental overfishing has been showing the MSY was higher than expected, but still unknown?
Billfish	standby: nothing new	Very few investigations, very minor scientific progress	Few lessons learned from fisheries, as billfishes are by-catch species
Swordfish	moderate scientific progress	Minor investigations, and minor scientific progress	Experimental overfishing has been showing the real level of MSY, at a level higher than expected
Skipjack	major scientific progress	Many investigations, and major progress recently obtained from the IOTTP tagging.	Experimental overfishing has confirmed the large MSY that was estimated in 1978 by Japanese scientists
Southern Bluefin	major scientific progress	Major & highly successful investigations, but too slow diagnosis and management failure	A too successful Overfishing experiment: the best & only case of recruitment overfishing observed for a tuna stock


Albacore



- **No major changes observed in total catches, but post 1977 catches X 2.1**
- **LL catches have been permanently & widely dominant**



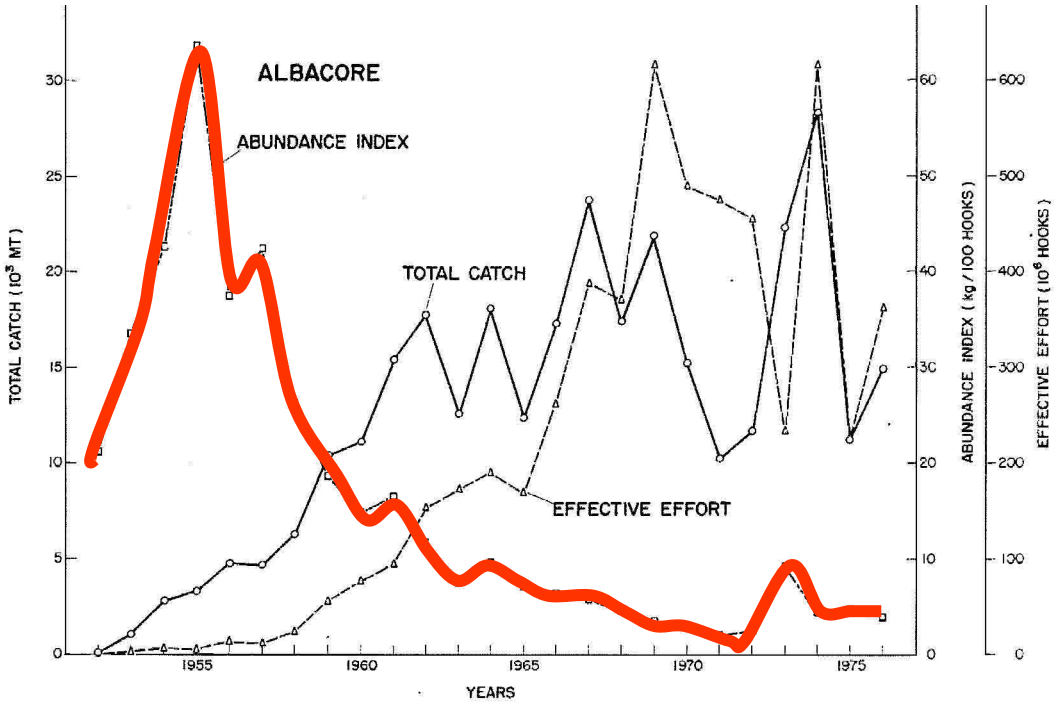


ALB Fishing zones: 1952-1977
During the SHIMIZU 1979 WG

After it: 1978-2006

WG Conclusion in 1978:
"Aside from routine collection of catch and effort statistics, there is essentially no research effort on Indian Ocean albacore"

A conclusion that remains unfortunately still valid 30 years after….

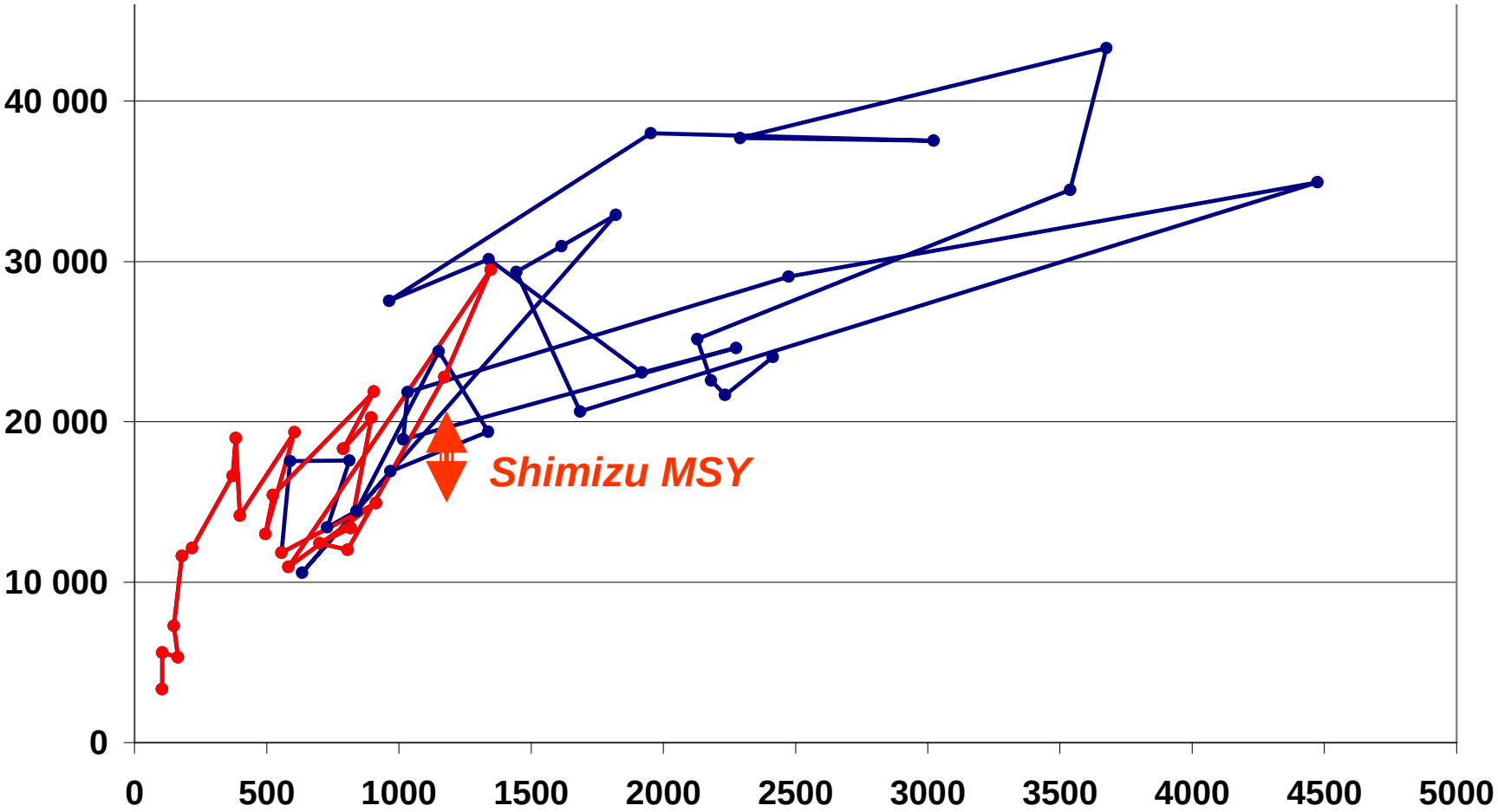


Shimizu report: ALB CPUE, effort & catches

1978 main conclusions:

- A Major early decline of LL CPUEs, very similar to YFT CPUEs…
- But *"no reason for concern"*….. Based on the conclusion that this decline of CPUE was excessive and ot in proportion of biomass
- 1978 MSY was then estimated at levels of the 1960-1977 catches, in a range between **15 and 20.000t**.

Albacore catch & effort relationship



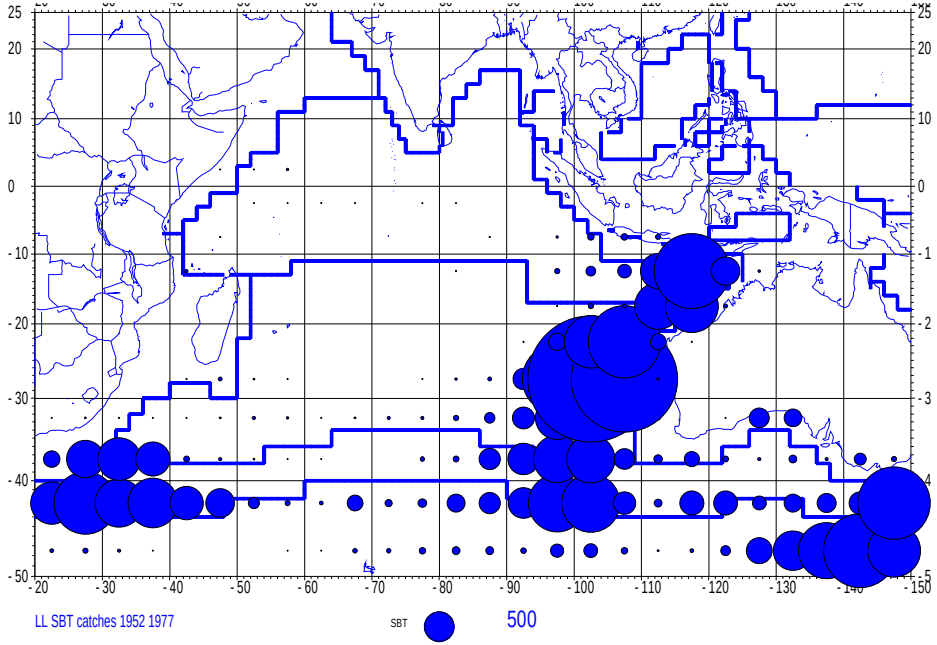
Since 1977: major increases of fishing effort targeting ALB have been observed
And mainly by Taiwanese fisheries, producing a doubling of ALB catches

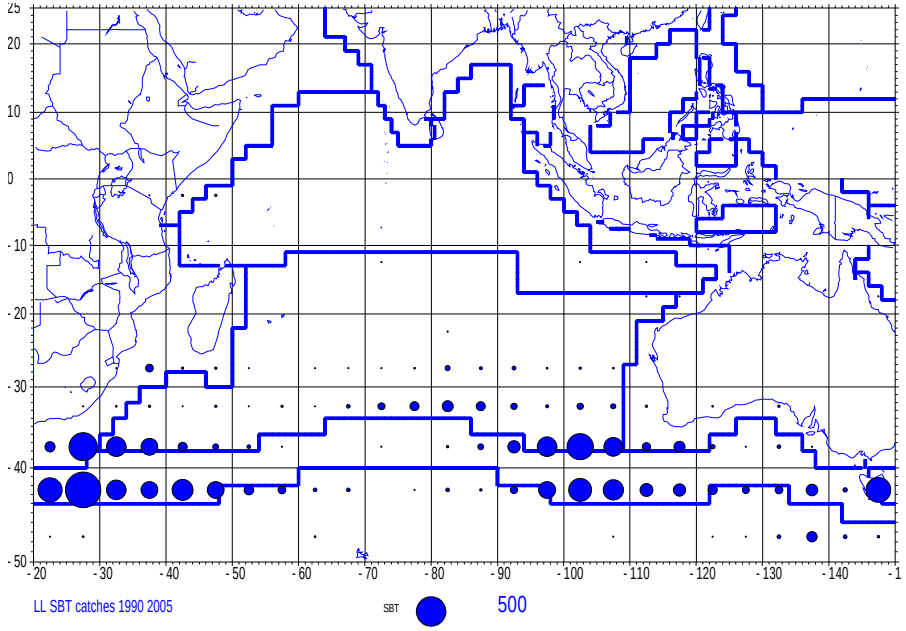
Albacore lessons and conclusions: Albacore fisheries and Stock Assessment, 30 years after the Shimizu WG

- Stable fisheries in term of fishing gear and of fishing zones; simply increased catches in the core of the gyre area, where ALB is the dominant tuna species
- A 1977 stock assessment underestimating the MSY, by a factor of at least 2?, due to the early “excessive” CPUE decline and to the fact that the best fishing zones were not yet heavily fished in 1977.
- Still a deep need to develop basic research upon this interesting stock

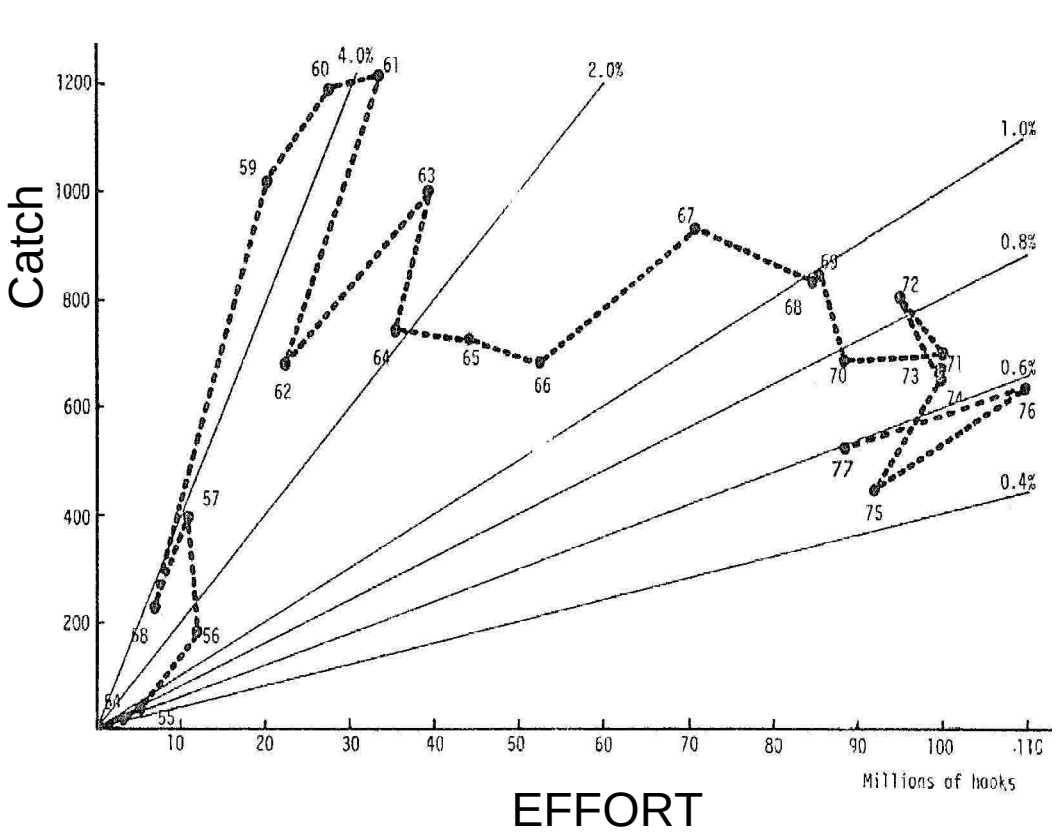
Southern Bluefin

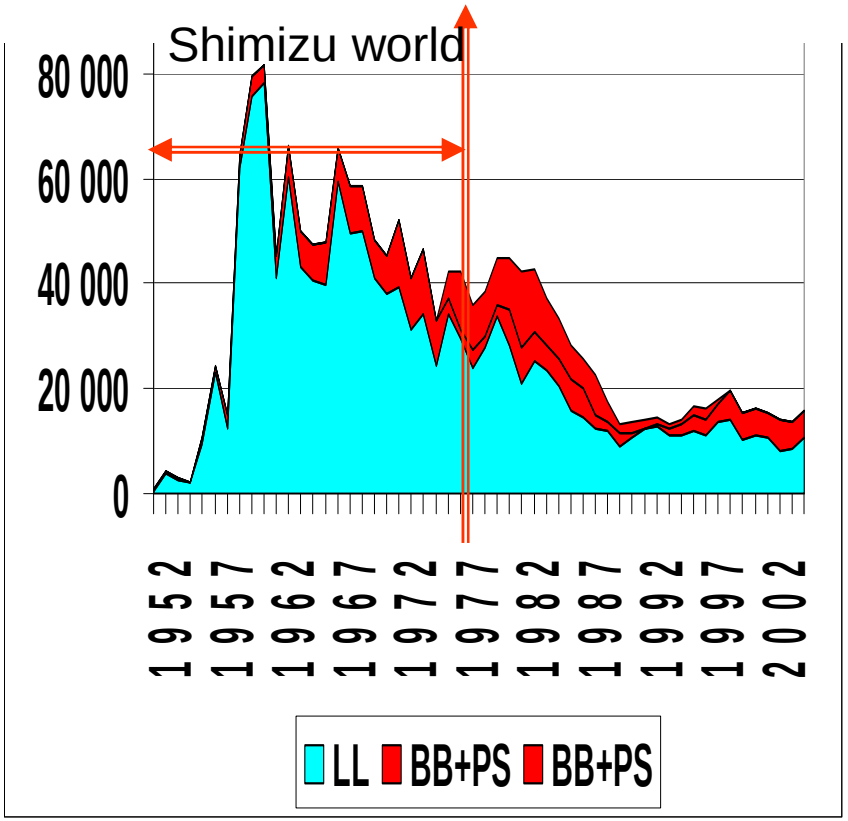
The anomaly: a species already very well studied & fully exploited in 1977





- Pre 1977 SBT fishing zone were mixed: Equat & tropical areas in the Eastern IO and temperate ones (subtropical convergengy)
- Present fishing areas are purely temperate ones, & at a low level of catches
- 1978 SA based on very good data: good CE, good sizes, tagging, biology, etc

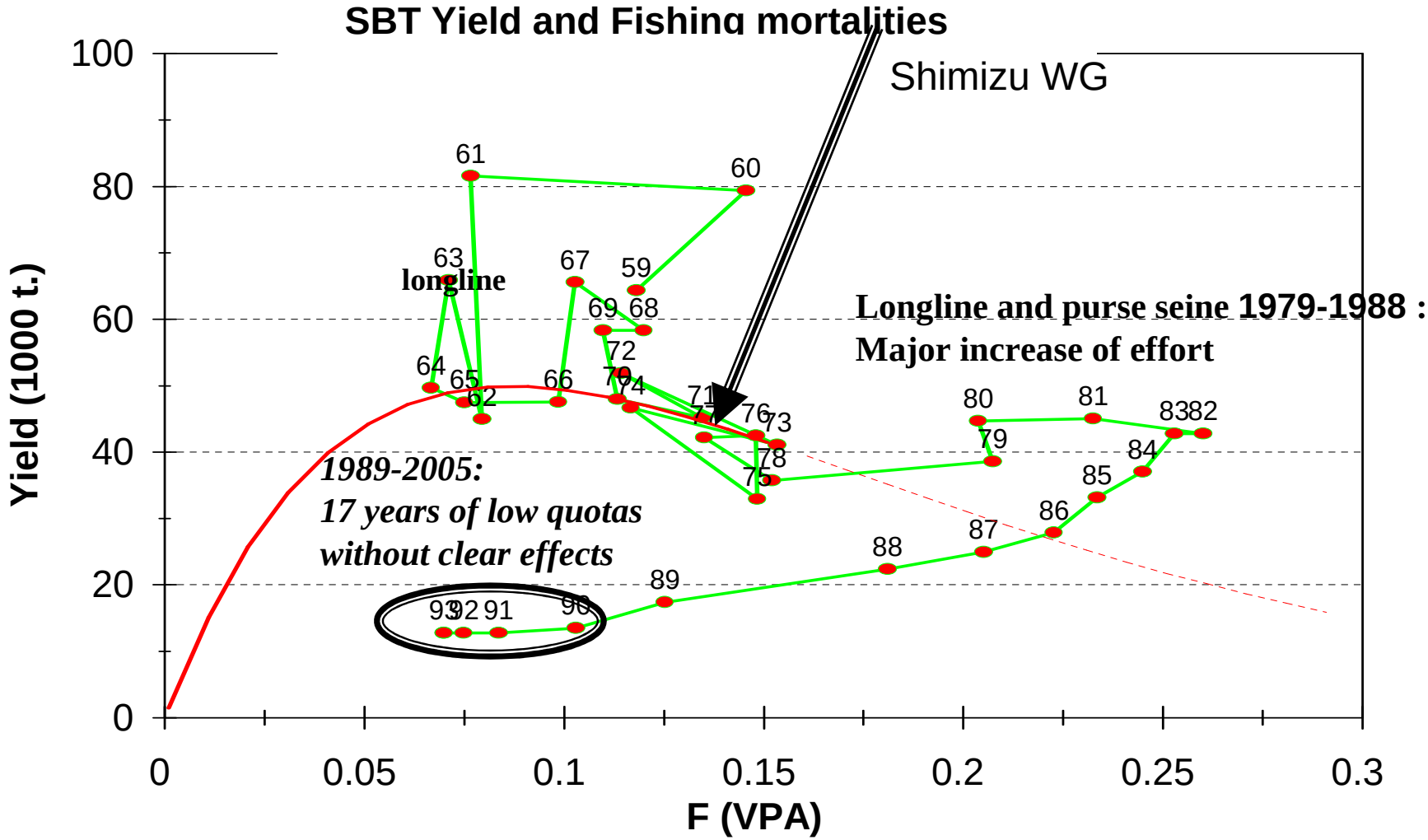




Shimizu WG conclusion:

"The high catches in 1959-61 could have been due to fishing on previously unexploited old fish; however as effort has increased, catches have continued to decline. An attempt should be made to assess whether a reduction in longline fishing effort would result in an increased total sustained catch. It appears that further increased effort from PS or LL fisheries would not result in substantially increased catches"

Surprisingly the 1979 was not ringing any alarm bell on the risk of overfishing, a risk that was Already highly visible in 1979 in the C/E data for such a long living species… Precautionary approach should have made at least a firm recommendation to freeze the effort… & wait 10 years..

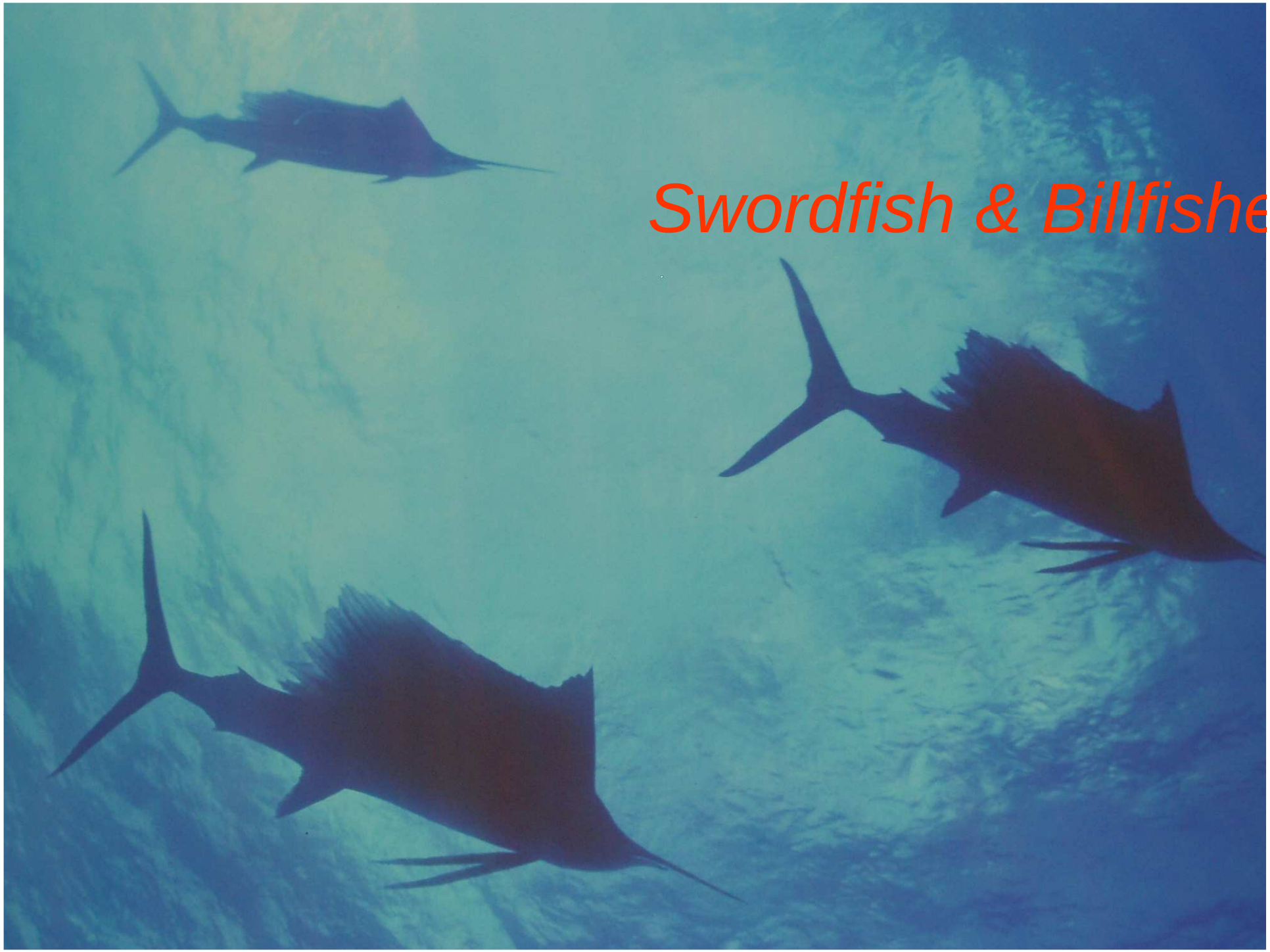


We can now ask the question: could the Shimizu WG have prevented the present SBT stock overfishing, making in 1977 a much pessimistic and much stronger management recommendation? Recruitment overfishing occurred only in the early nineties, but there was already strong evidence in 1979 that the 60ies catches would not be sustainable: being taken on accumulated adult biomass, not a biological productivity. This was typically a case were Precautionary approach should have been used firmly by scientists in their recommendations!

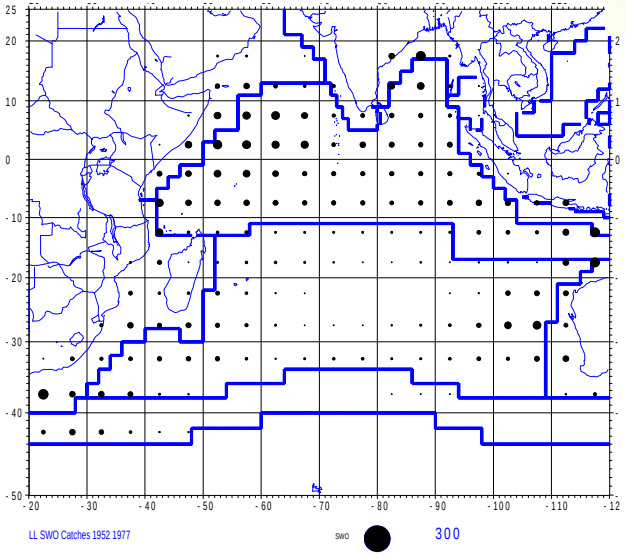
Then a question in 2008: what would be today the SBT recruitment under the 1979 effort?

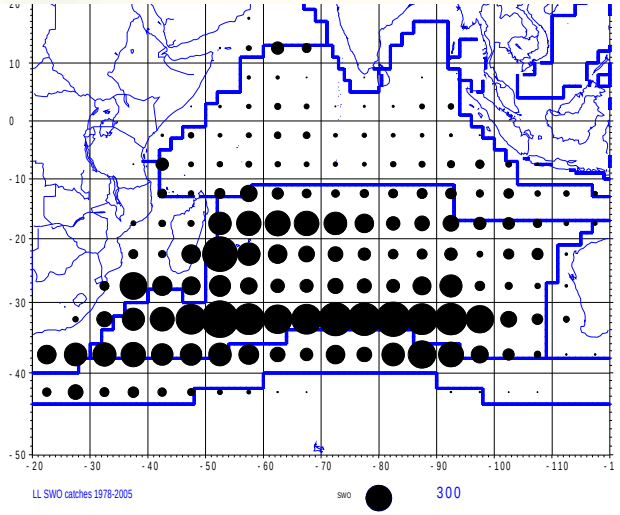
A lesson from the Shimizu 1070 WG and the subsequent collapse of the SBT stock?

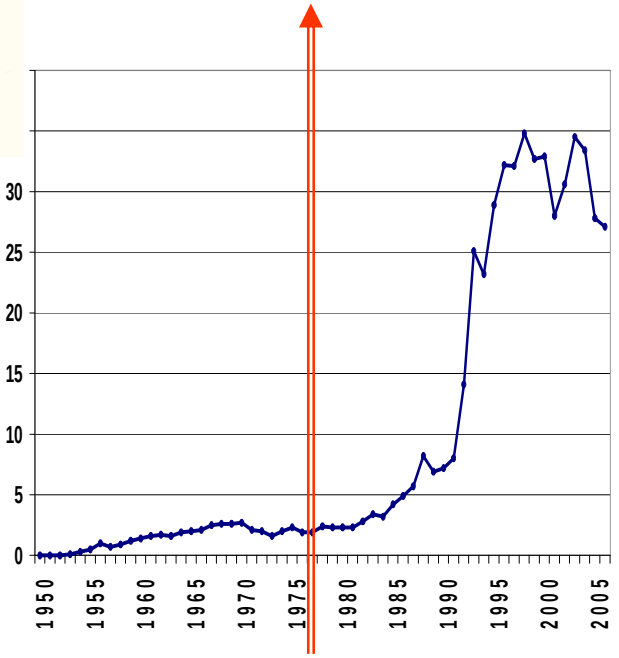
- It may be strange ti see that Southern Bluefin: the most valuable stock, and in 1979 with the best statistics, the best scientists, the best tagging, best biological research, best modeling, has been providing the only case of major overfishing for a tuna stock & of major decline in recruitment… that was totally unexpected 30 years ago.
- This fatal weakness of the 1979 SBT scientific advice should be a lesson for us today: when scientists have serious & well founded reasons to make a precautionary management recommendation, they have the obligation to do it, and firmly, even when they have not been able to estimate the exact stock status in a Kobe plot..


Swordfish & Billfishe

Swordfish



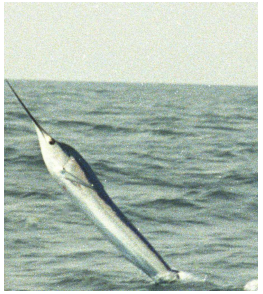




Catches

- **No attempt done by the 1979 WG to estimate SWO stock status or its MSY: SWO was always a secondary by-catch**
- **Recent SWO catches have been X 21,**
- **Major changes observed since 1977 in the SWO fishing zones: now dominated by temperate waters, targeted efforts and significant by-catches due to deep longlining (& BET targeting)**

Billfish and their SA 30 years after Shimizu WG



- 1979: A still valid comprehensive review of the historical billfish fisheries, and their statistical difficulties. Unfortunately, most of the 1979 statistical and biological recommendations are still fully valid today and could be kept in our 2008 WG report!
- A 1979 review that is consistent with the present historical fishing maps shown by the 2008 Billfish WP report
- But a major global decline of LL catches for several billfishes species in their historical core areas & vanishing major historical fishing zones for white and black marlin,
- in 1979, very few investigations were done on billfishes, but still today the same lack of active research and of scientific results on these species, rather abandoned by IOTC….