IOTC 2007/WPTT/20

Preliminary analysis of tuna catches by Purse Seiners fishing in the Western Indian Ocean over the period January to April 2007.

by

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Abstract

The goal of this paper is to analyze the catches and CPUE of the Purse seine fleet active in the western Indian Ocean during the 4 first months of 2007 and to compare these results with the same parameters observed during previous years. This analysis has been mainly targeting yellowfin tunas, taking note that the yellowfin catches by the purse seine fleet in 2007 have been at low levels. The paper also analyses the 2007 fishing zones as well as the catches at size observed for yellowfin during the beginning of 2007. The low levels of catches observed in both the FAD and the free schools fisheries are discussed. These low catches and CPUEs observed during the first months of 2007 could correspond either to a low overfished adult biomass following 4 years of excessive catches, or to an environmental anomaly temporarily reducing the stock catchability (and the the fishing mortality). Such environmental anamoly could be compared to the anomaly observed during the September 1997-April 1998 period, but at a much less severe level for the yellowfin fishery.

Résumé

Le but de cet article est d'analyser les données de prises et de PUE de la flotte de senneurs actifs dans l'Ouest de l'Océan Indien durant les 4 premiers mois de 2007, et de comparer ces résultats avec les paramètres équivalents récoltés pour la même flottille depuis 1984. Cette analyse vise

surtout l'albacore (*Thunus albacares*) du fait que les prises de cette espèce par les senneurs ont été très faibles en 2007. Cet article analyse aussi les zones de pêche exploitées en 2007 ainsi que les prises par tailles des senneurs la même année. Ces bas niveaux de prises et de PUE observés tant dans la pêcherie sur DCP que dans celle sur bancs libres sont discutés. Ces bas niveaux de prise et de PUE observeés en 2007 pourraient correspondre soit à une biomasse adulte d'un stock surexploité après 4 années de captures excessives, ou bien à une anomalie de l'environnement qui réduits temporairement la caturabilité d stock (et donc la mortalité par pêche). Cette éventuelle anomalie serait comparable à celle observée dans la région de septembre 1997 à Avril 1998, mais bien moindre pas ses conséquences sur la pêcherie d'albacore.

1. Introduction

It has been noticed that over a four year period (beginning in December 2002) that there has been a major increase in yellowfin tuna catches by purse seiners in the Western Indian Ocean. During the same period high catches of skipjack catches, most often associated to FADs were also noticed. A record of 201,728 Mt of yellowfin was reported for purse seiners in 2004. No significant changes were recorded during this period for the catches of the other target species such as skipjack and bigeye tuna.
During 2005 and 2006 a slowly decreasing trend was then observed in the yellowfin tuna catches, although the yellowfin catches were still at much higher levels than during the pre 2001 period. This seems to suggest that we were returning to the normal situation. However it was also noted that in 2007, the catches of yellowfin (and also of skipjack) were at low or very low level, when the fishing effort exerted by the fishery was at its highest level. This report aims to examine the preliminary catch and effort statistics and sizes of tunas measured, reported for the first four months of 2007 and to compare these results to the same period of previous years (1984 to 2006). The final goal of the paper is to analyse all the purse seine fishery data during these first month of 2007 allowing to incorporate later these results in the IOTC WG stock assessments. These 4 first months of each year are very interesting to study as the yellowfin catches during this period tend to be important, providing each year nearly 40% of the .yearly yellowfin catches. This analysis should help the IOTC WG to a realistic stock status analysis for the yellowfin stock answering to the basic question: do we have in 2007 a severely depleted yellowfin stock? A situation that could easily be understood, after taking during 4 years, total catches at an average level 60% higher than the estimated MSY.

2. Materials and methods

The statistics compile in this report are information gathered from the mandatory purse seine logbooks system for all vessels licensed to operate in the Seychelles exclusive economic Zone. For some analysis the historical data obtained from the IOTC (1984-1999) has been used for comparison purposes. The species composition of catches has been corrected using port sampling data and the logbook data has also been raised to landing data. Three categories of yellowfin tuna have been considered in this analysis:

- ✓ Small YFT at sizes <10kg,
- ✓ Medium size YFT at sizes between 10-30kg
- ✓ Large YFT at sizes >30kg.

The two types of associations, FADs associated and free swimming schools, have been also widely kept and used in this analysis.
The 2007 catch per species and per boat was also available for the entire French fleet (20 purse seiners) until the end of June 2007 and this information partly used in the analysis

3. Results

3.1. Vessels active

The number of vessels active during the first four months of 2007 has remained more or less similar to that of the same period for the previous seven years. An average of 48 purse seiners was active per month in 2007.

3.2. Fishing effort

The total number of fishing days reported by the sampled fishing fleet of purse seiners during the first four months of the year has been increasing since 2004. A 7% increase was recorded in 2007 compared to the same period in 2006 (figure 1). The nominal effort exerted during this period of 2007 was at the highest level observed since 1999, when several of these vessels active in 2007 being vessels more recent, larger and more efficient than in the 1999 fleet.

3.3. Catches

The total catches recorded by the purse seiners fleet during the 4 first month of 2007 is estimated at 75,000 Mt, the lowest catch reported for that period since 1996 (Figure 2). This represents a decrease of 36% over the catches reported for the same period of the previous year.

3.4. Species composition

Analysis of species composition shows that the catches of skipjack and bigeye tuna have remained more or less constant throughout the period under study, when the yellowfin catches have been showing a decreasing trend since 2005, followed in

January 2007 by a very sharp decrease. The catches dropped by 56%, from 65,400 Mt in 2006 to 28,678 Mt in 2007. This is the lowest yellowfin catches recorded for that period since the El Nino year of 1998 (figure 2).
A slight decrease (of only 8.%) in the catches of skipjack has also been recorded during that period.

3.5. Catch Rate: nominal CPUEs

The corresponding catch rate expressed in terms of catch per unstandardized fishing day is shown in figure 3. The same fishing days are used in both the FAD and in the free school fisheries.

The figure 3 shows that the total CPUE of the January-April periods has been on slowly decreasing since its peak in 2003, reaching a low average of 15.01 Mt/fishing day in 2007, after the exceptional 35 Mt/fishing day in 2003. The last time such low catch rate was reported for the period under review was in 1996 when 15 Mt/fishing day was reported.

Yellowfin nominal CPUE also shows a similar pattern

3.6. Catches and CPUE by school type/association

Figure 4 shows an increase in set on FADs associated schools and a decrease in set on free swimming schools. Catches on free swimming schools decreased by 50%, whereas that of FAD's associated schools dropped by a slight 3%. The catches on free swimming school are the lowest recorded over the period under study (2000 – 2007) (figure 5)..

The corresponding species composition shows a decrease in yellowfin catch on both free and FADs associated schools (figure 6).The decline in the Yellowfin CPUE is in the same range of declines: the yellowfin CPUEs observed on FADs and on free schools during the first 4 month of each year are shown since 1983 on figure 8. This figure shows that the yellowfin CPUE was very low on free schools (large fishes) and also quite low in the FAD fishery (small and medium size fishes) (a reduction of 64% and 13 % respectively).

The average catch per positive set (in Mt) was also calculated for the free school fishery (figure 9), and this figure shows a sharp decreasing trend since a record of 53.70 Mt/ positive set in 2004 to a low average of 15.34 Mt/ positive set in 2007. The yellowfin catch rate per positive set has remained more or less stable on FADs associated schools.

3.7. Yellowfin Size category

The total catches of large yellowfin (category 3) have been on the decreased since the record catch on these sizes class in 2004 (68,119 Mt). During the first four months of 2007, only 21,167 Mt of these large yellowfin was caught, e.g. at levels similar to

what was estimated in 2000 (figure 10). The catches of small and medium yellowfin have remained more or less the same as for the previous three years.

Analysis of yellowfin nominal catches by size category and by school type reveal no significant difference in the size classes caught by school type in 2007 when compared to the previous seven years. Around 79% of the large yellowfin (>30 kg) were caught on Free swimming school (figure 11).

The changes in the numbers of medium and large yellowfin caught by the purse seine fleet during the first quarters of the period 1991-2007 are also indicative of these changes of the yellowfin sizes caught (see figure 12). It shows that the 2007 yellowfin sizes were mainly in the traditional size range between 110 and 140cm of fork length (in 2007 a total catch of 20220 tons vs. an average 31600 tons taken during the 1999-2006 period in this size range), larger fishes over 140cm being very rare in the 2007 catches (a total 2007 catch of 3400 tons vs. an average 9200 tons taken during the 1999-2006 period).

3.8. Fishing Areas

Figure 13, 14 and 15 shows the fishing zones of the purse seine fleet during the first 4 months of the average 1999-2002 and 2003-2006 periods (a normal period and the period of very high yellowfin catches), and the same efforts in 2007 respectively. These maps show that in 2007 the purse seine fleet did not expand eastward its fishing zone, as in previous years. Furthermore it should be noted that there was very little fishing effort (5 fishing days) in the Chagos area and no catches, when this area has been often producing high yellowfin catches in January of previous years see Fonteneau 2007). The 2007 fishing zone appears to be a quite typical fishing zone for this season, but with very low fishing effort exerted in the fishing zone east of 60°East, a typical yellowfin area at this season (figure 16). This lack of fishing effort in the eastern areas, for instance East of 60°E, that are potentially rich in yellowfin tuna at this season should be better understood by scientists.

3.9. Analysis by Month

Figure 17 shows the trend of fishing effort in terms of fishing days made by month for the years 2000 to 2007. The effort for the month of January and February were slightly higher than for the same months of the previous year whilst that for the months of March and April were slightly lower.

The total catches by month shows that the catches for the month of January to March 2007 were the lowest when compared to the same months for the years 2000 to 2006 whilst the catches for April is similar to that of the previous three years (figure 18). This may be an indication that the situation may be getting back to normal. The same was observed for the catch rate (figure 19).

Analysis of yellowfin catches reveals that yellowfin catches in 2007 were the lowest for all four months (figure 20).

3.10- French Purse seiners catches until June 30th

The comparison between the catches per boat of the French fleet during the first 6 months of 2006 and 2007 shows that the 17 vessels having fished continuously in the area during both years had in 2007 an average total catch per vessel 28% lower than in 2006, when their yellowfin 2007 catches was less than half of its 2006 level (being 54% lower). These data would tend to confirm the results analyzed during the first 4 month of the year 2007.

4. Discussion

The main question targeted by this paper was: what is happening now in 2007 when low PS YFT CPUEs are observed after 4 years of very high catches and CPUEs.
The analysis of 2007 PS data confirms the low levels of both free schools YFT catches as well as of the FAD associated tunas (mainly SKJ). The observed 2007 catches and CPUE are among the historically lowest levels in the short history of the Indian Ocean PS fisheries, but not the lowest.
Scientists now need to conclude if these poor catches/CPUE are due:

(1) to low biomass, for instance to the overfishing of the stocks (after 4 years of record high catches for the yellowfin stock (and also for skipjack), at levels 60% above the estimated MSY during 4 years.

(2) or to a low catchability of these stocks, for instance due to an environmental anomaly (similar to the anomaly observed during 1998 in the Indian Ocean or during 1984 in the Atlantic). In such cases, present biomass of the tuna stocks would be maintained at their "normal" levels of 2006, but these tunas are not fully available to purse seine fisheries: being too deep, too scattered or having moved in other areas (for instance in the Central or Eastern Indian Ocean). Such hypothesis of deep tunas not available to the purse seine fishery seems to be a frequent rumor for some captains, but presently this rumor does not have yet a scientific basis

In such hypothesis, the present low catches would work as a reduction of fishing mortality upon stocks that are in good shape and suffering reduced exploitation rates during the anomaly. In this case the potential catches and CPUE would be higher when the environmental anomaly will be finished.
In the opposite hypothesis, if present stocks are at low and overfished levels, urgent management measures should be possibly recommended by the IOTC in order to reduce the fishing mortality exerted upon a reduced YFT adult stock A poor status of the skipjack stock could also be envisaged, based on the quite poor skipjack CPUEs on FADs during the first month of 2007, a potential indicator of low skipjack biomass (as during this period of low catches on free schools, the tendency of the purse seine fishery should have been to concentrate its activities on FADs, at least at the levels observed during the previous years. Surprisingly, this has not been the case in 2007, as the SKJ CPUE on FADs, only 5.7 tons per fishing day, was at its lowest levels observed since 1991 (before the development of the FAD fishery).

These two hypotheses are quite opposite ones. In the context of a precautionary approach, a priority should possibly be given by scientists and commissioners to the pessimistic one of overfished low stocks, because if this hypothesis is a reality, then a lack of management action could have deleterious effects of the conservation of the stocks, in the present context of very high fishing efforts that are presently exerted in

the Western Indian Ocean by a wide range of fisheries (purse seiners, longliners and artisanal ones).

However, if the existence of an environmental anomaly can be confirmed by the analysis of recent data, and if this anomaly can explain a reduced catchability of the yellowfin stock, then these precautionary management measures would loose their interest.

Then we are now in a situation that is very similar to the ICCAT situation in 1984, when the CPUE of large yellowfin was extremely low[1]: nowadays we know that these reduced levels were simply due to an El Niño effect, and to a temporary deepening of the thermocline, but in 1984, the ICCAT Scientific committee had serious reasons to wonder upon the urgent need to take management actions.

A good knowledge of the potential present environmental anomaly is essential to evaluate the present real stock status of the yellowfin and skipjack stocks.

The other major and famous El Niño event (Marsac 1999, Marsac and Le Blanc 2000) observed in the Indian Ocean at the end of 1997 and the beginning of 1998 also offers such an example of their major effects upon the catches by purse seiners: during the period November 1997 to April 1998 the yellowfin purse seine CPUE on free schools was at a zero level. However it should be noticed that the longline CPUE of yellowfin in the same area (same sizes of fishes being targeted) was at its typical "ordinary" level, and without any visible anomaly (the same observation was also done in the Atlantic during the 1984 anomaly).

It is now clear that in both cases, Eastern Atlantic 1984 and Western Indian Ocean 1998, the 2 yellowfin stocks had stable biomass and probably in the same areas, but these tuna were not available to the purse seine fisheries because of their peculiar behavior (being too deep or/and too scattered).

5-Conclusion

It is probably too early to recommend for the yellowfin stock management action based on the first 6 month of 2007, but this is possibly a dangerous situation in the present context of the wide capacity of the IO fishing fleets that are presently targeting yellowfin.

There will be clearly a need to do an in depth updated analysis of the 2007 situation before the next scientific committee meeting in November 2007: analyzing in depth all the fishery and the environmental data. This analysis should preferably use GLM CPUE of the purse seine fleet targeting more realistic estimates of yellowfin apparent abundance. This new analysis should also be based on 2007 provisional data obtained from the longline fishery in 2007 (these data are at least fully known by the owners of these vessels), because these longline data are essential (even if they are preliminary and incomplete) to confirm (or not) that the very low yellowfin CPUE observed in 2007 in the purse seine fishery were due, (1) to an environmental anomaly (in this case the longline CPUE should be at their average levels) or (2) to a very low biomass of an overfished stock (in this case the longline CPUE should also be low or very low).

[1] These low CPUE have been a major cause explaining the migration of many purse seiners from the Atlantic to the Indian Ocean during the first quarter of 1984, all the purse seine French fleet moving then to the Indian Ocean.

Bibliography

Fonteneau Alain 2007 Time and space diagrams of the Indian Ocean purse seine fisheries during the period 1982-2006. Document IOTC-2007-WPTT-06, 10p.

MARSAC, F. & J-L LE BLANC (1999). Oceanographic changes during the 1997-1998 El Niño in the Indian ocean and their impact on the purse seine fishery. 1st session of the IOTC working party on tropical tunas, Mahe, Seychelles, 4-8/09/99. WPTT/99/03. *IOTC Proceedings* 2 : 147-157.

MARSAC, F. & J-L LE BLANC (2000). ENSO cycle and purse seine tuna fisheries in the Indian Ocean with emphasis on the 1998-1999 La Niña. 2nd session of the IOTC working party on tropical tunas, Mahe, Seychelles, 23-26/09/2000. WPTT/00/17. *IOTC Proceedings* 3: 354-363.

Fonteneau Alain 1991. Les anomalies de l'environnement en 1984 dans le Golfe de Guinée. Effets possibles sur la capturabilité du yellowfin (Thunnus albacares). Rec. Doc . Scient. ICCAT, Vol XXXVI, pp 380-408.

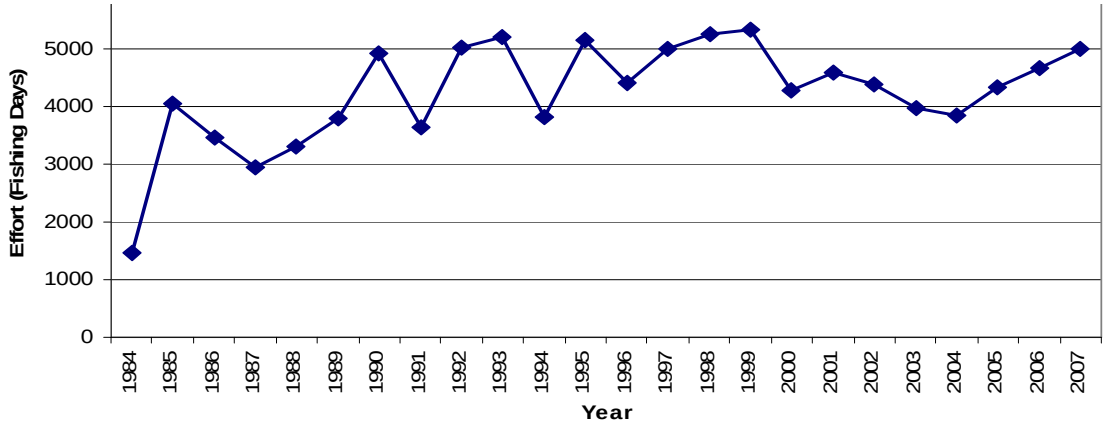


Fig 1. Nominal fishing effort (fishing days), January to April, 1984 – 2007

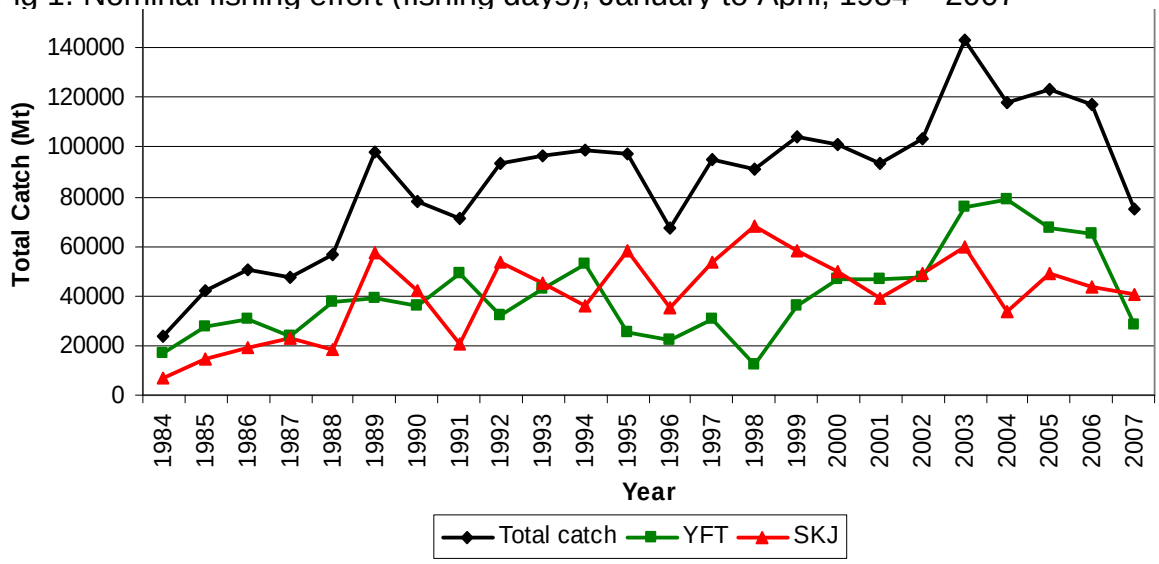


Fig 2. Nominal catches by species, January to April, 1984 – 2007

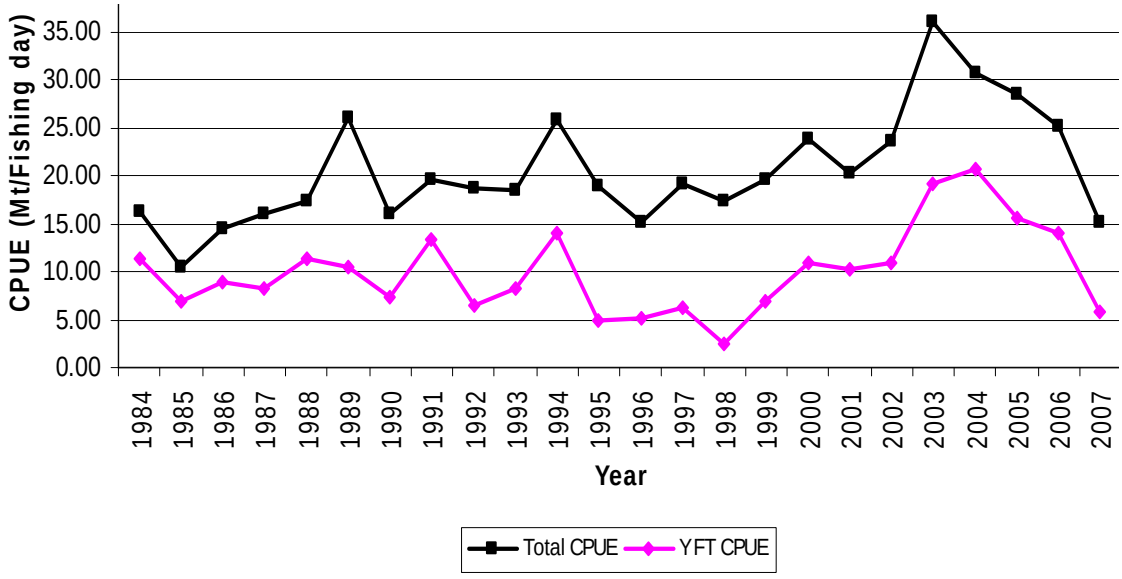


Fig 3.Total and Yellowfin nominal CPUE (Mt/fishing day), January to April, 1984 – 2007

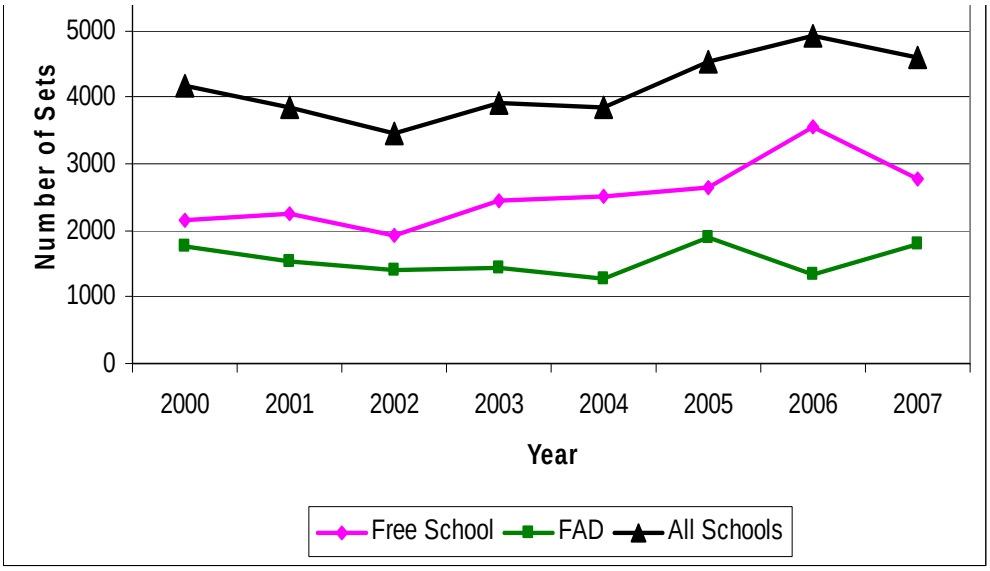


Fig 4. Number of sets made by school type, January to April, 2000 – 2007

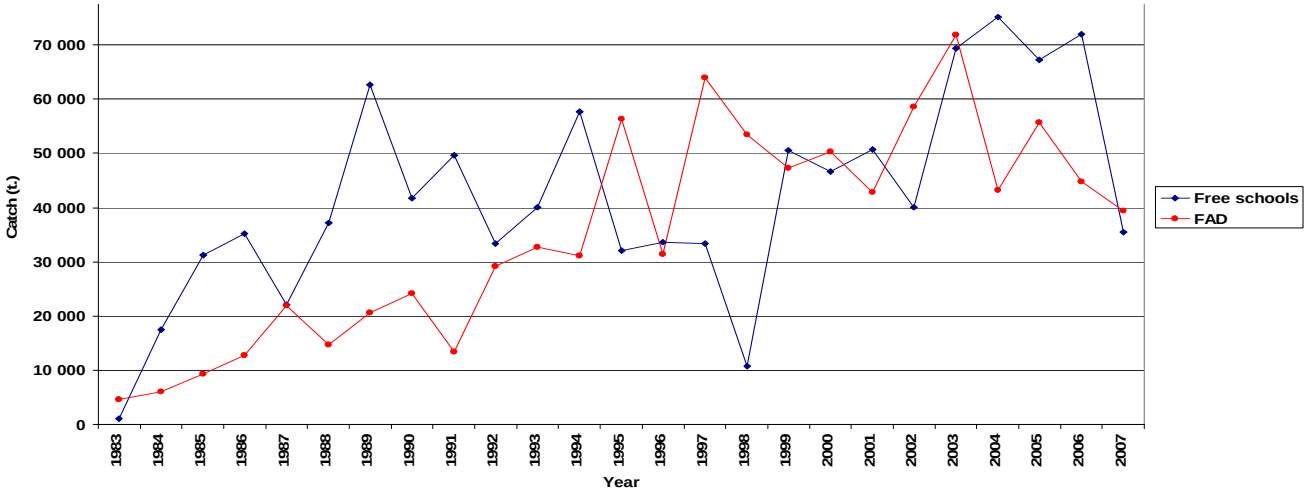


Fig 5.Total nominal catch by school type, January to April, 2000 – 2007

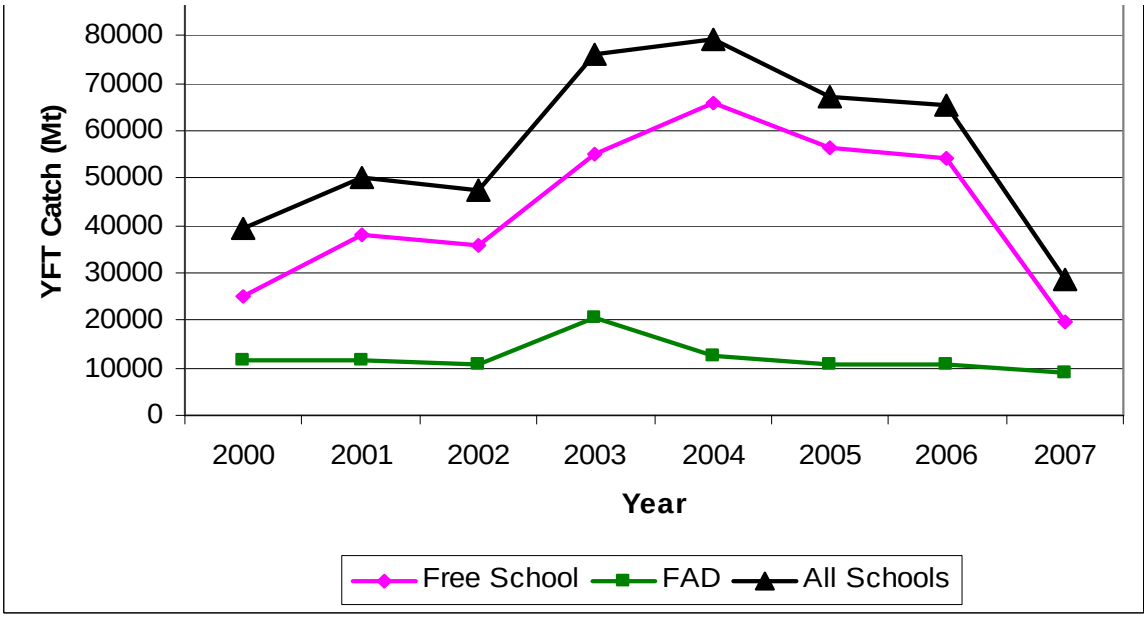


Fig 6.Yellowfin nominal catches by school type, January to April, 2000 – 2007

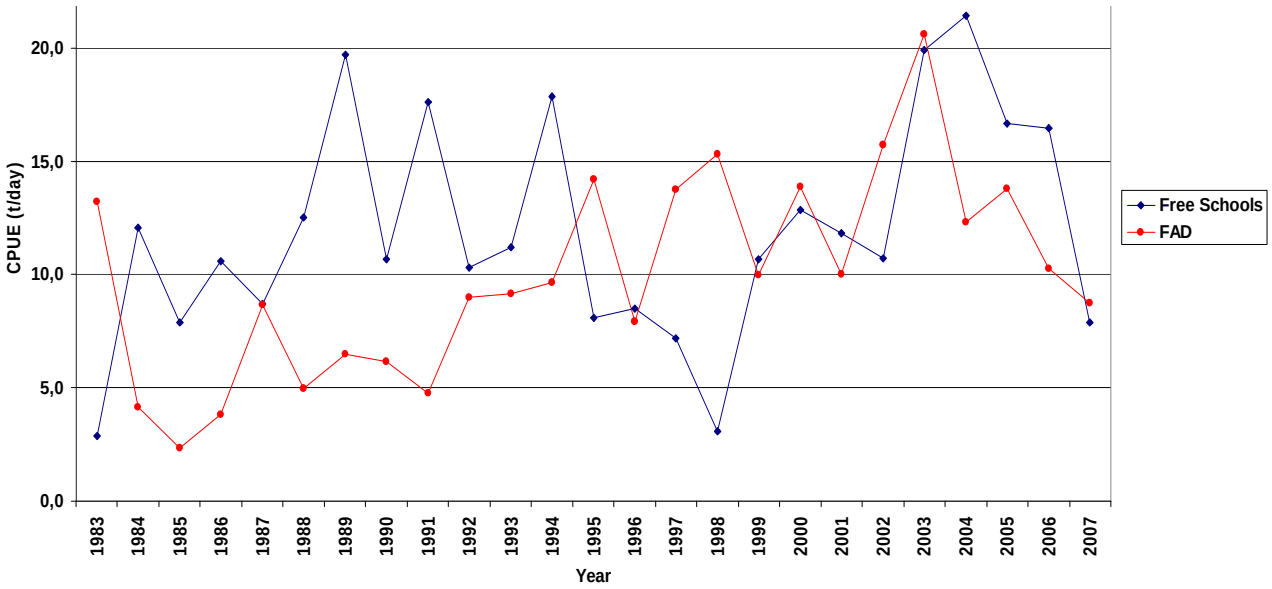


Fig 7.Nominal CPUE (Mt/fishing day) by school type, Jan- Apr, 1984 -2007

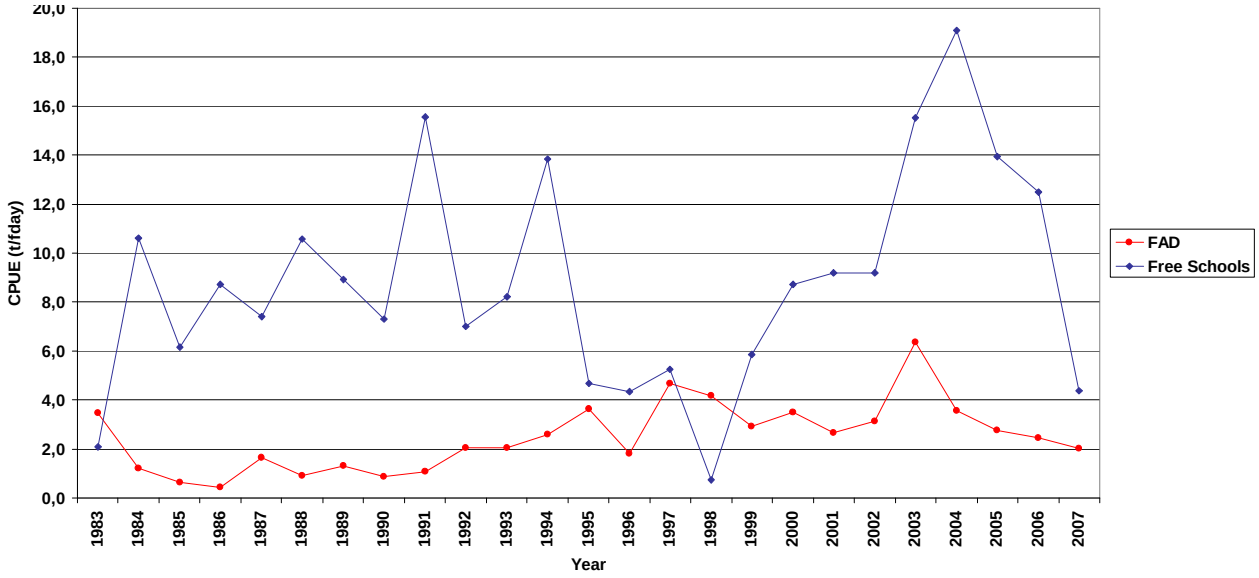


Fig 8.Yellowfin nominal CPUE (Mt/fishing day) by school type, Jan- Apr, 1984 – 2007.

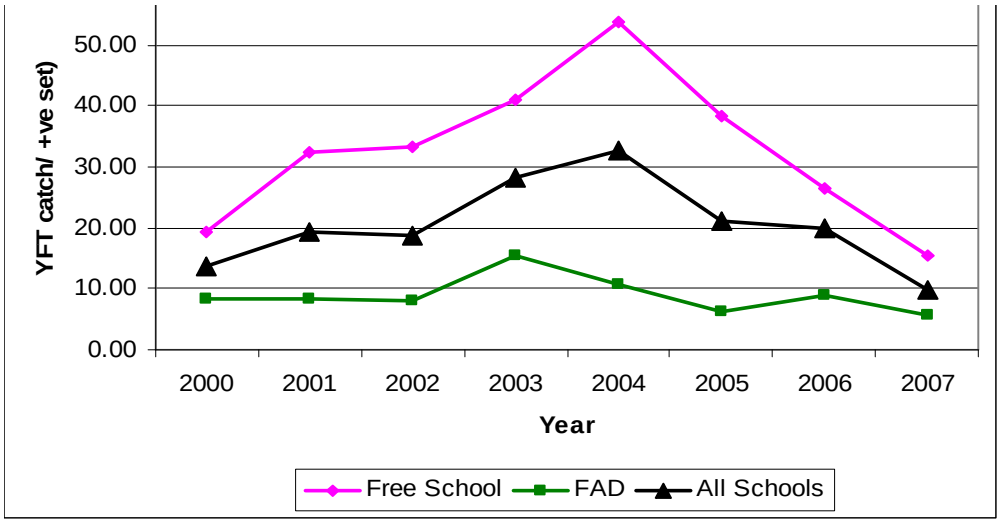


Fig 9. Yellowfin nominal catch / positive set by school type, January to April, 2000 – 2007

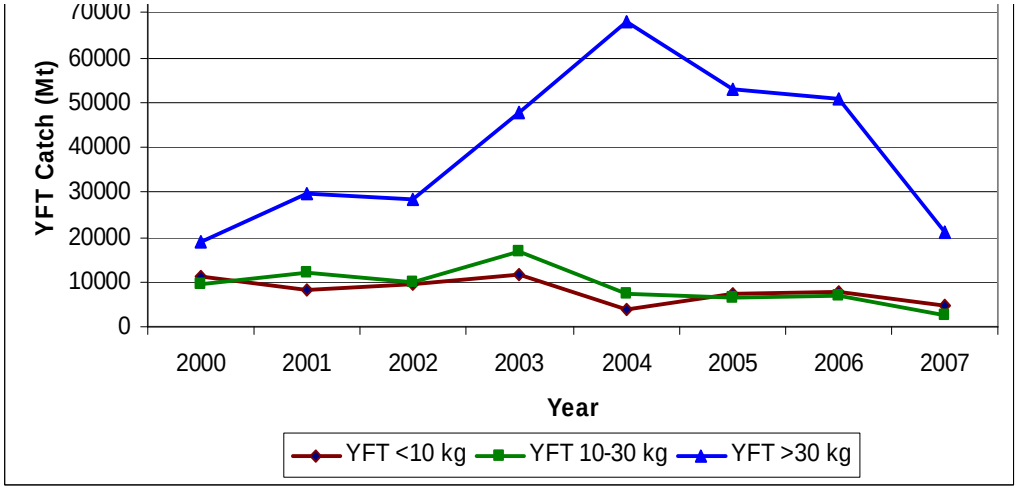


Fig 10.Yellowfin nominal catches taken by size category, January to April, 2000 – 2007

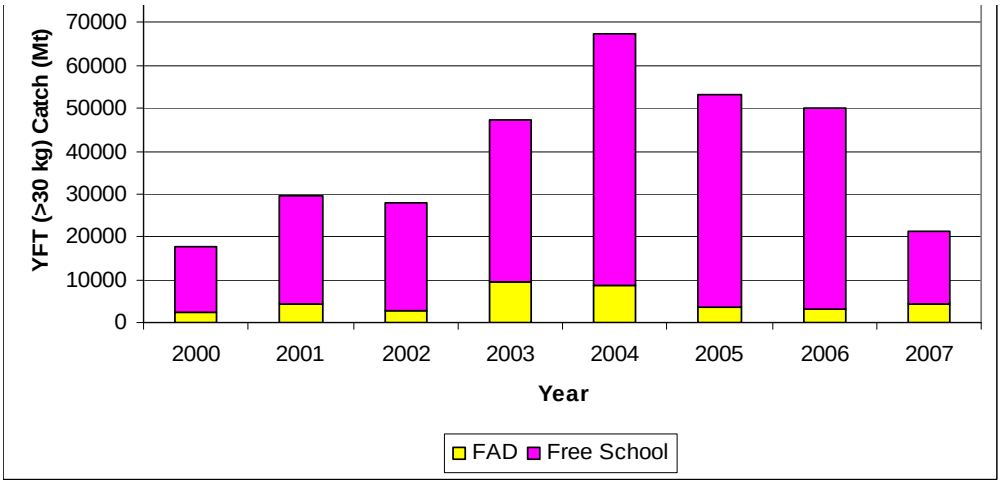


Fig 11. Yellowfin (>30 kg) nominal catchestaken by school type, January to April, 2000 – 2007

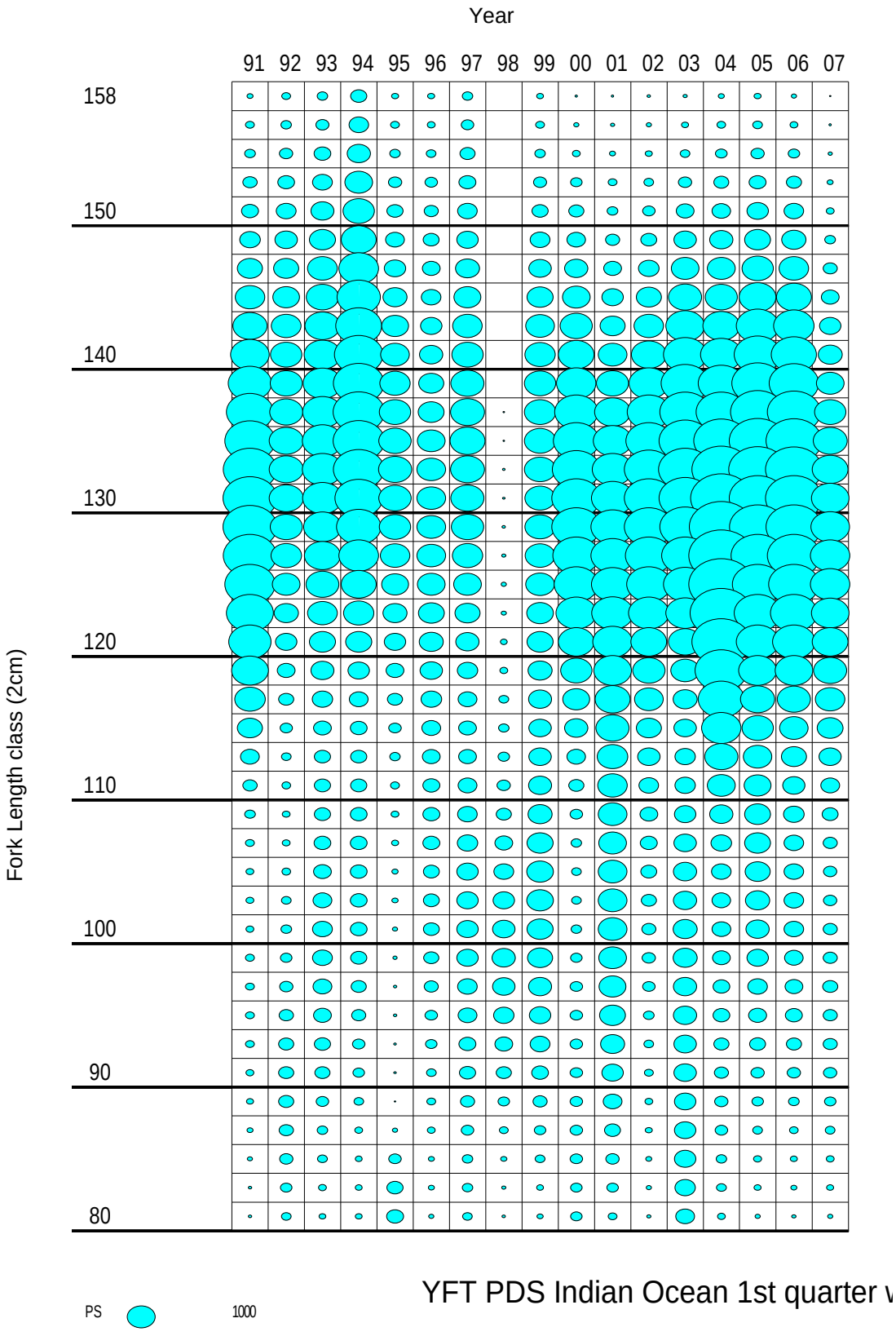
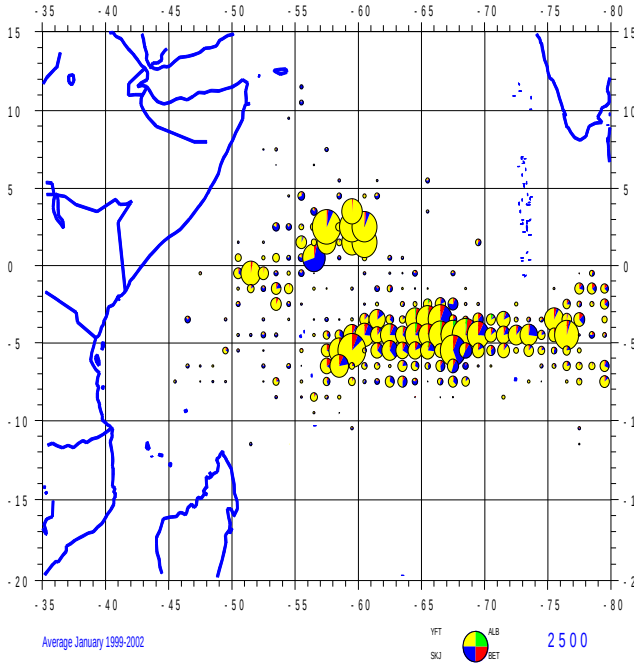


Fig 12. Catch at size (in weight) of large yellowfin (over 10kg and 80cm) taken yearly in the Indian ocean during the first quarters of each year during the 1991-2007 period



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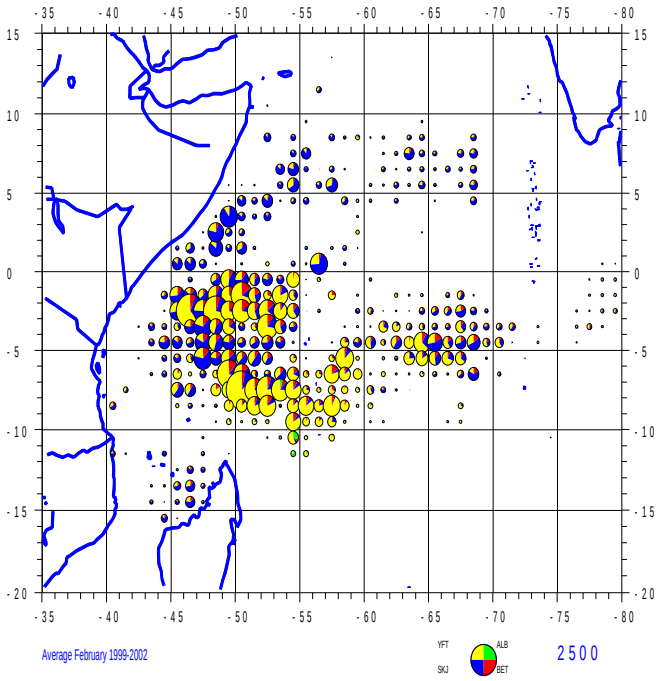

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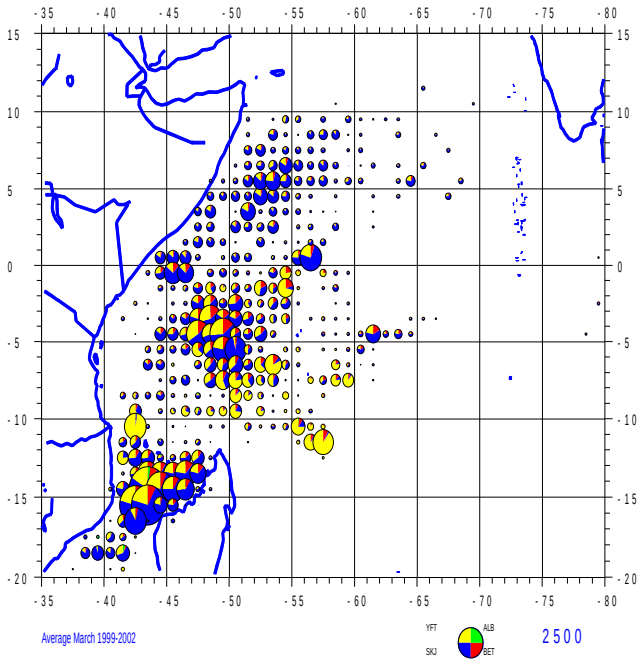

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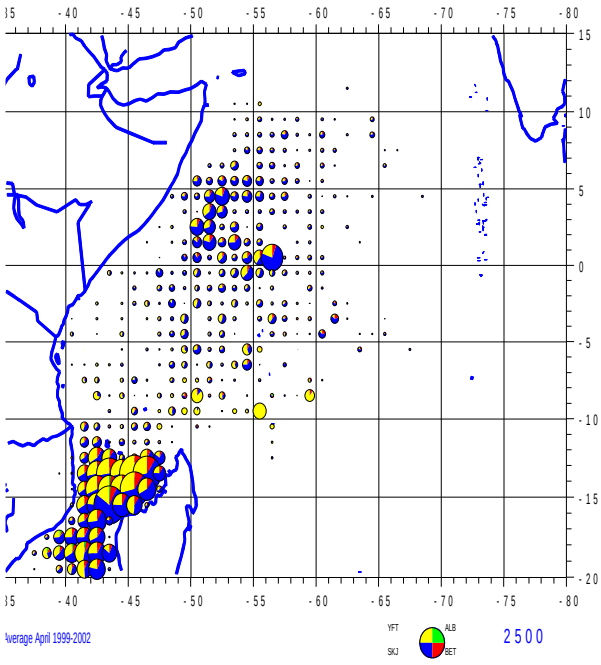


April

Figure 13: Monthly fishing catches by species, by 1°s quare, of the sampled purse seine fishery during the first 4 months of the average 1999-2002 period (a period of « normal » catches)

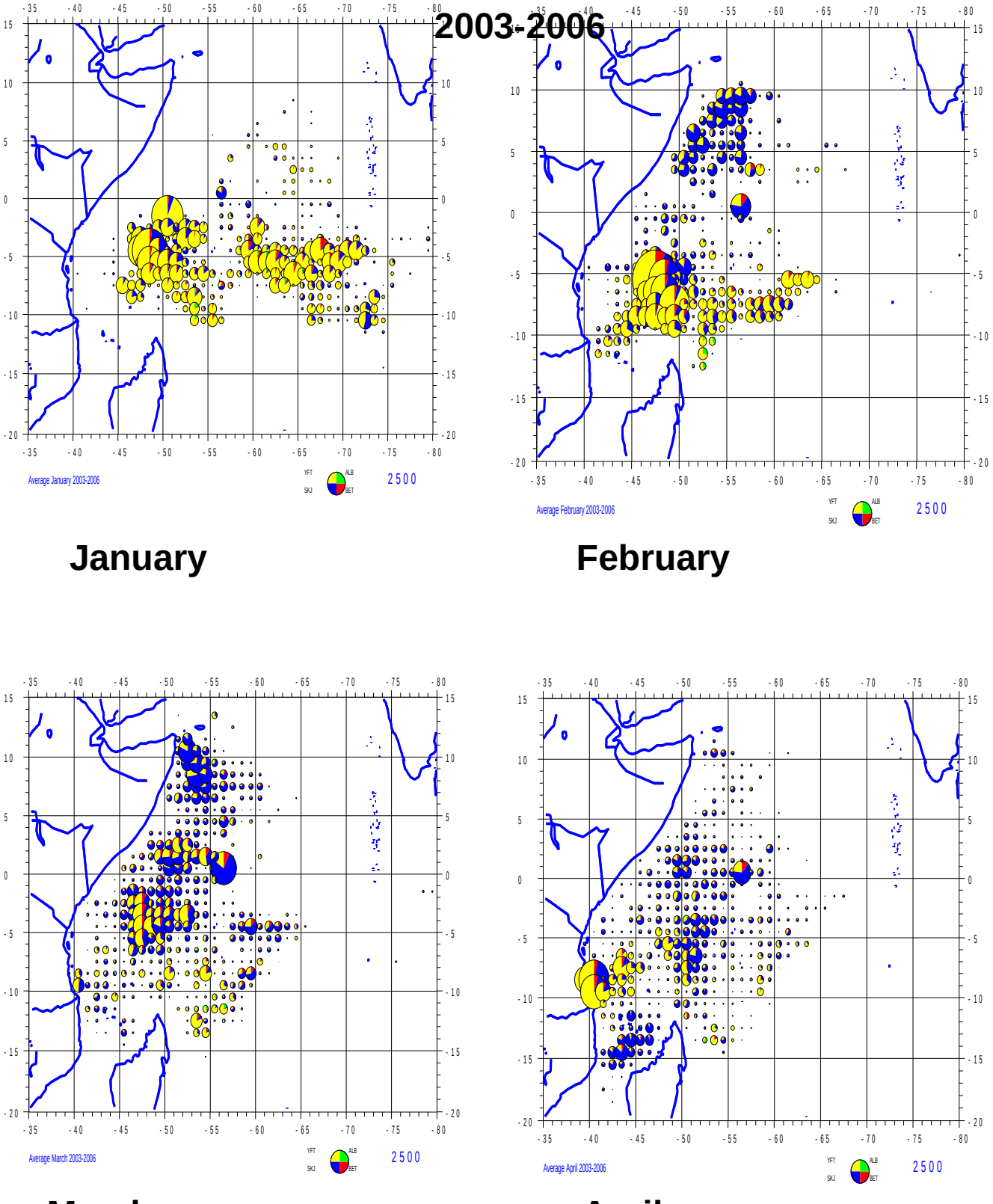
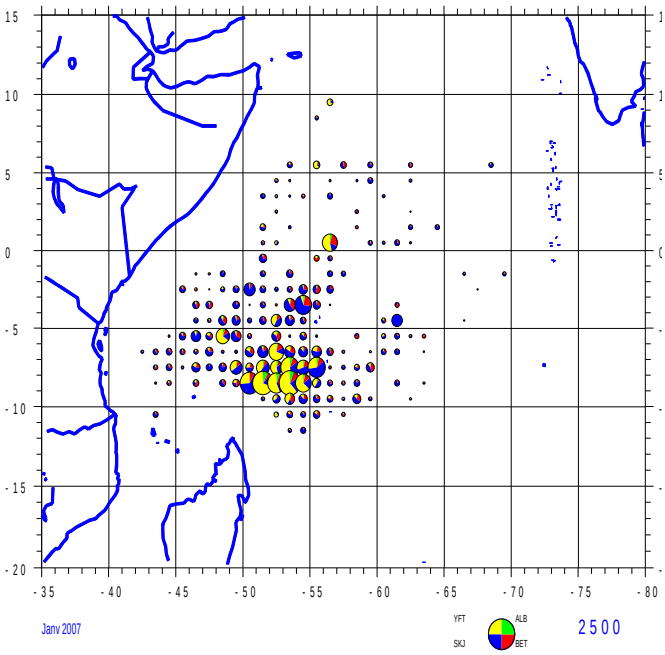


Figure 14: Monthly fishing catches by species, by 1°s quare, of the sampled purse seine fishery during the first 4 months of the average 2003-2003 period (a period of very high catches)



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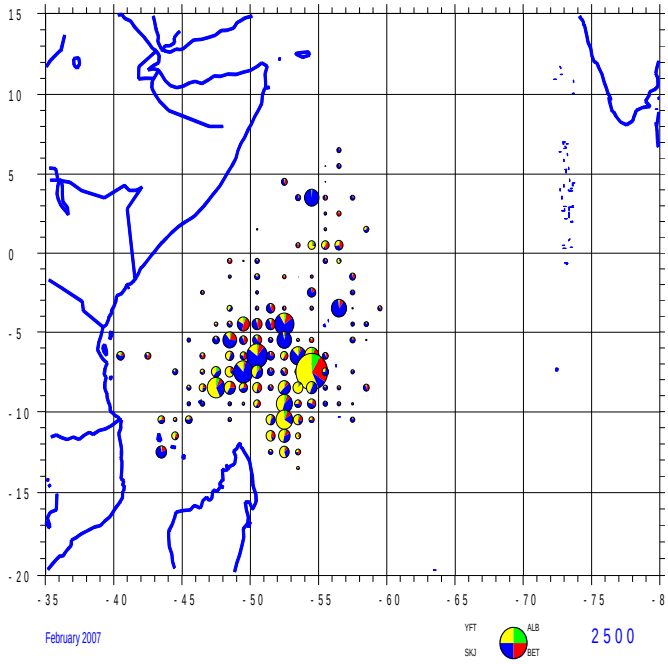

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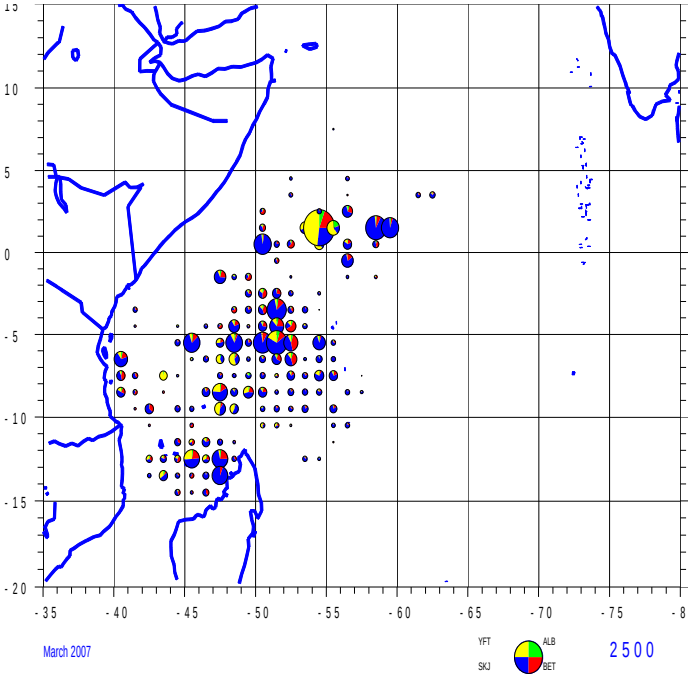

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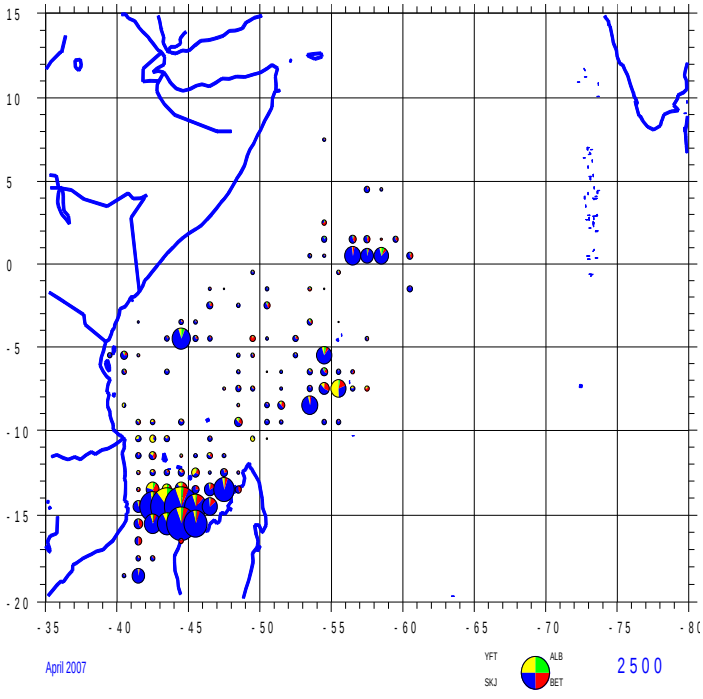

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Figure 15: Monthly fishing catches by species, by 1°s quare, of the sampled purse seine fishery during the first 4 months of 2007

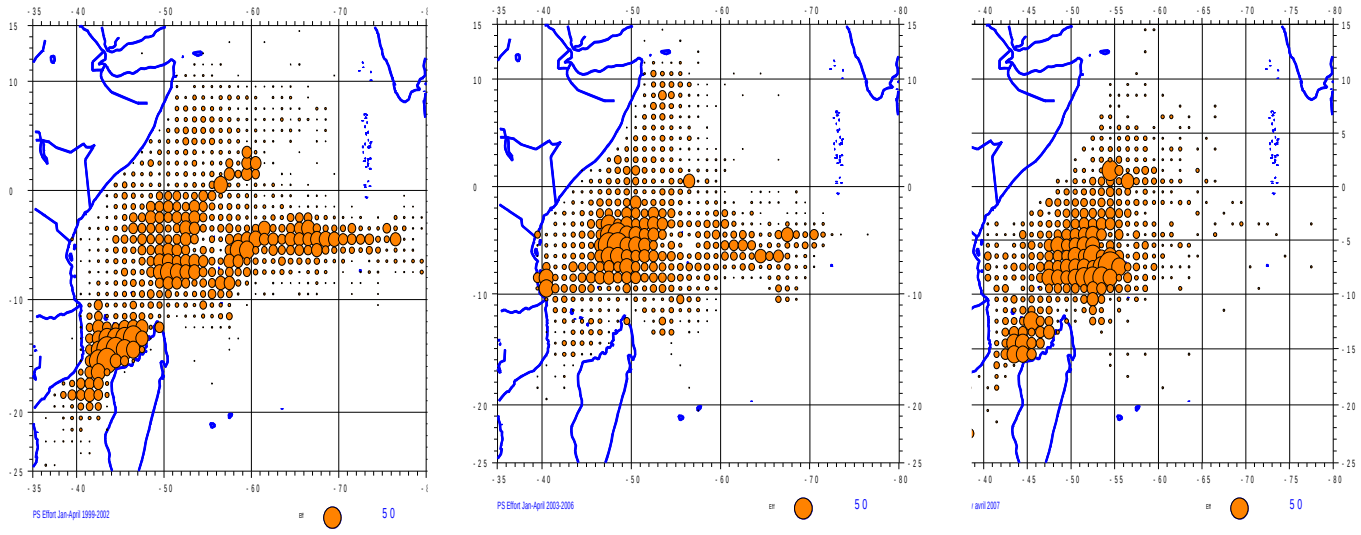

Fig 16. Maps of the fishing efforts exerted by the sampled purse seine fleet during three periods averaging the 4 month of each year: average of the 2 periods 1999-2002 and 2007

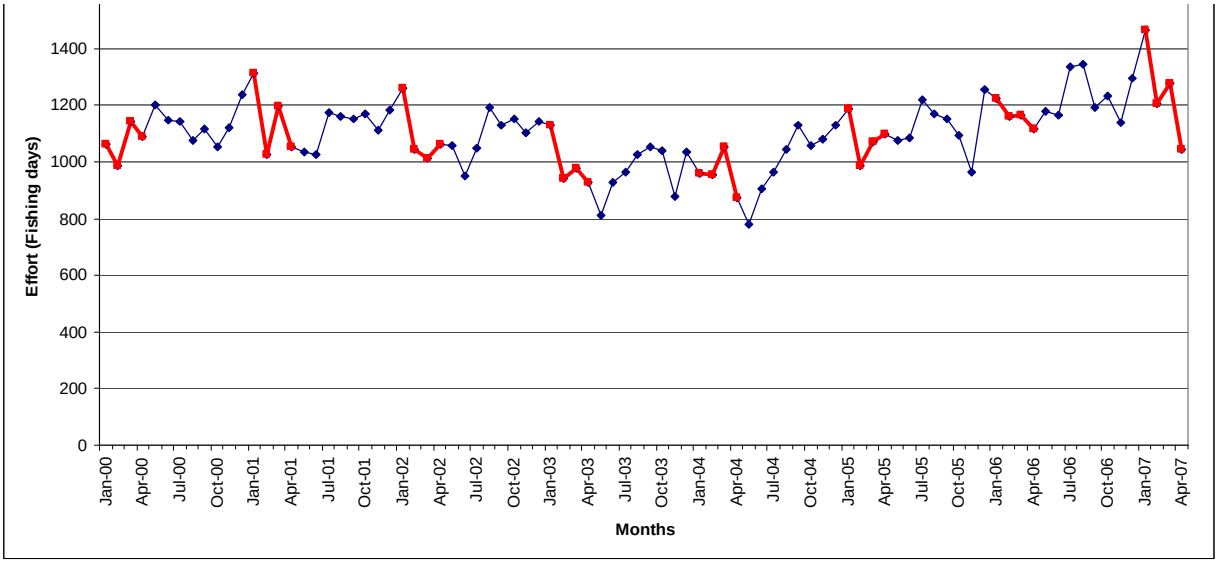

Fig 18. Monthly nominal efforts exerted by the sampled purse seine fishery during the 2000 – 2007 period

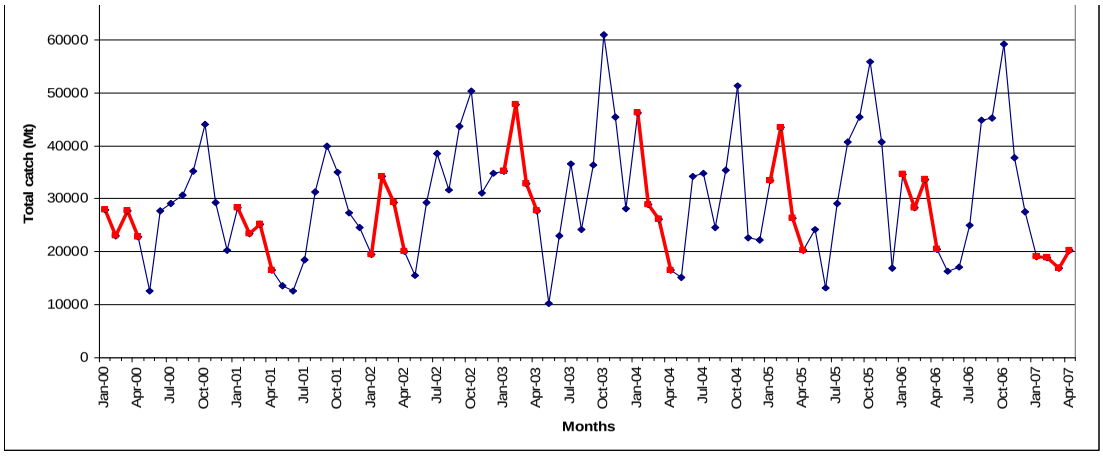

Fig 18. Monthly catch of the sampled purse seine fishery during the 2000 – 2007 period

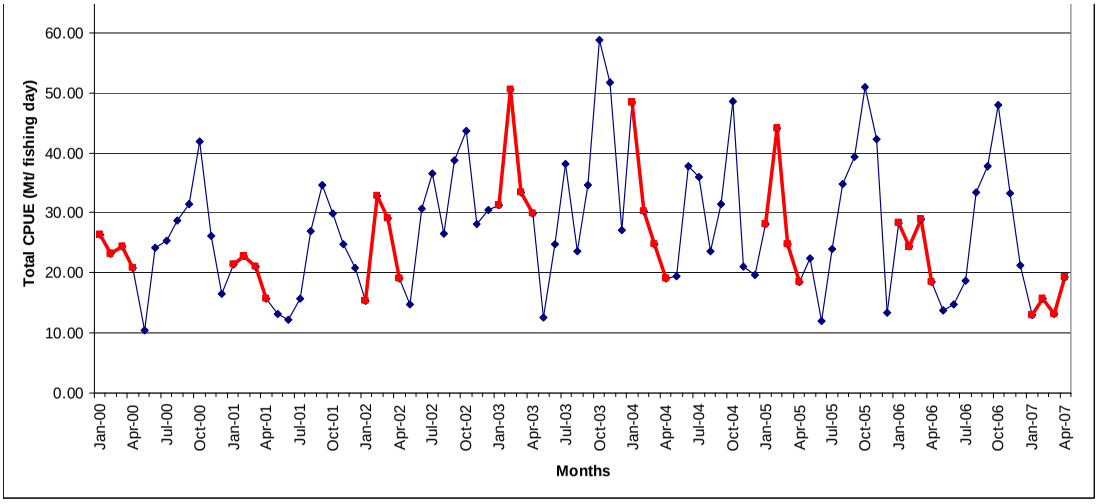

Fig 19. Monthly nominal CPUE (t./day) of the sampled purse seine fishery during the 2000 – 2007 period

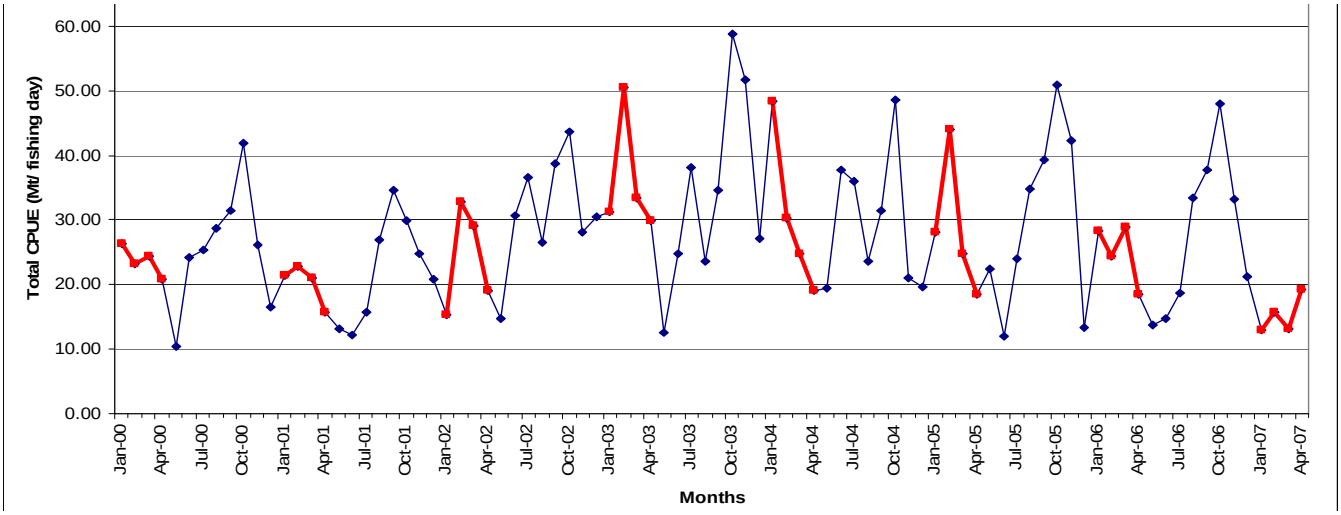

Fig 19. Monthly nominal CPUE, 2000 - 2007

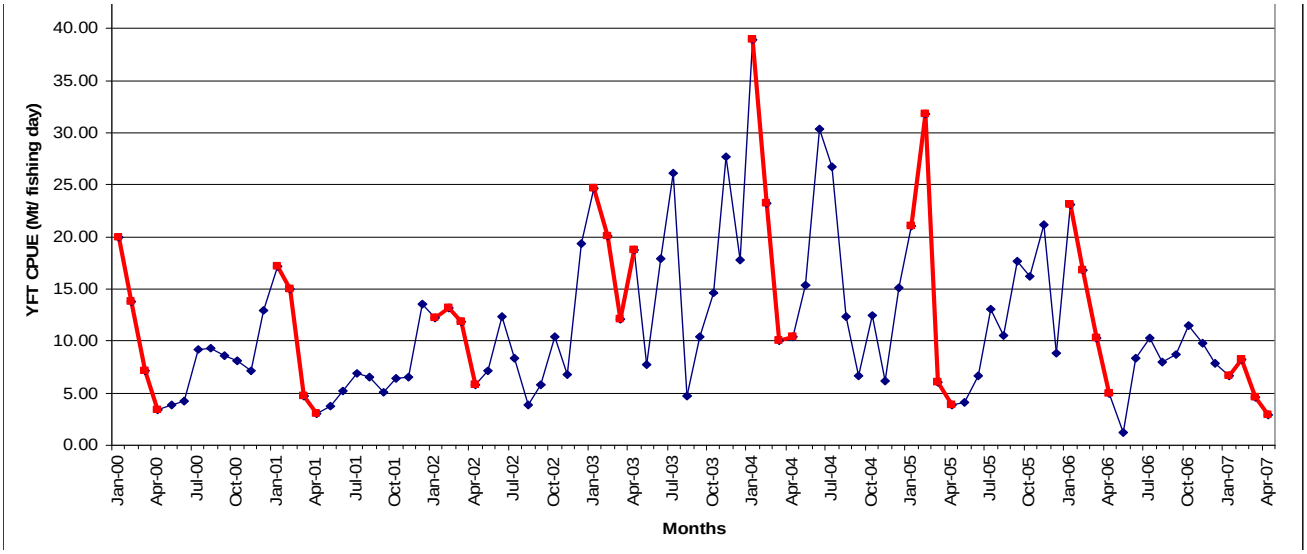

Fig 20. Monthly yellowfin nominal CPUE , 2000 - 2007

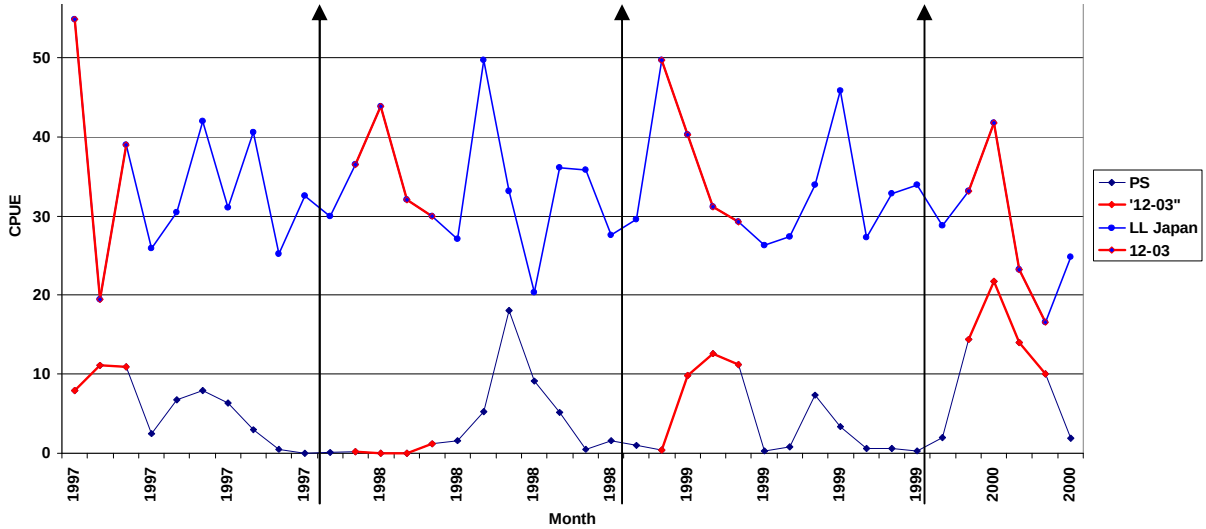

Figure 21. Monthly CPUEs of the free schools purse seine and for the longline fisheries in the south equatorial area of the West Indian Ocean (West of 70°E, Equator to 10°S). Months from December to March are drawn in red. *This figure shows that the PS free schools CPUE has been reduced to nearly zero during the El Niño, between November 1997 and April 1998, when longline CPUE in the same area & during the same period were « as usual » and without anomaly.*