

## ATLAS OF INDIAN OCEAN PURSE SEINE FISHERIES 1982-2001 WITH A SPECIAL EMPHASIS FOR YELLOWFIN TUNA TAKEN ON FAD AND FREE SCHOOLS

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### ABSTRACT

This document is a « visual document ». Its goal is targeting a visual presentation of the most important changes observed in the purse seine fishery that has been active in the Indian Ocean during the period 1982-2001. This working document prepared for the IOTC working group held in Shanghai in June 2002, is focusing on yellowfin tuna, because this species will be the primary species assessed by this meeting. The main fleet of purse seiners covered by this document is the fleet of purse seiners which has been permanently sampled by scientists and technicians from Seychelles, France, Spain and Madagascar during its 20 years of activity. The total catches of yellowfin taken yearly by this fleet which has been well followed by scientists is compared with other purse seine fisheries. Other fleets of purse seiners are not covered by this document, either because detailed data on the activity were not available, such as the Japanese fleet (for instance on free schools catches), or simply because data on these purse seiners have never been submitted to the IOTC (such as the Singapore based fleet of the so called Russian purse seiners). This document presents various types of information and figures which are dealing with various levels of data:

(1) Figures done on data belonging to the public domain which are taken from the most recent IOTC data base

(2) Figures obtained from confidential data, original log book information, which are not available in the IOTC data base but only at national levels in scientific data bases.

These figures are given either for the total fleet combining all flags, or by flag country. In this case the two major fleets, Spain and France, are kept on each figure, but all the other flags are combined in an entity called others or NEI (this category may include vessels of flags which are perfectly reporting their data to the IOTC combined with less cooperating fleets). In the same category of detailed data, the document presents various fishery indices calculated on a sub sample of a stable group of eleven purse seiners (8 French and 3 Spanish) which have been more or less permanently active in the area during the entire period.

This document will try to show the trend and variability of multiple parameters such as catches, efforts, cpue, sizes, and of more detailed information such as size of area fished, frequency of null sets, age of the fleet, etc...

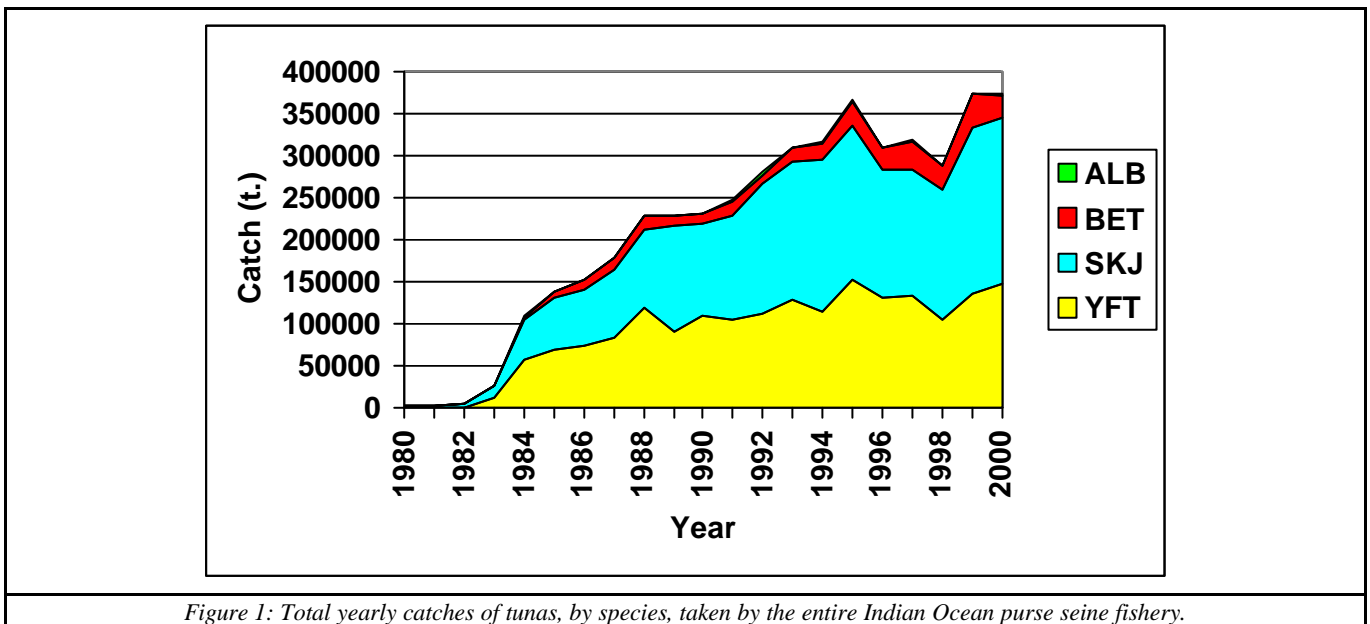


Figure 1: Total yearly catches of tunas, by species, taken by the entire Indian Ocean purse seine fishery.

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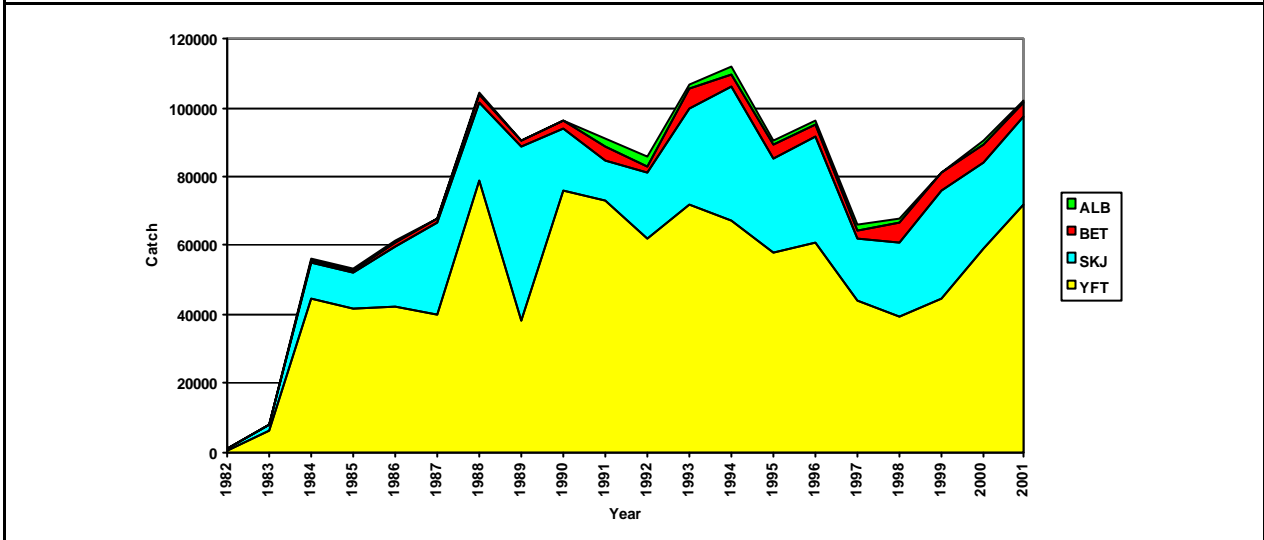
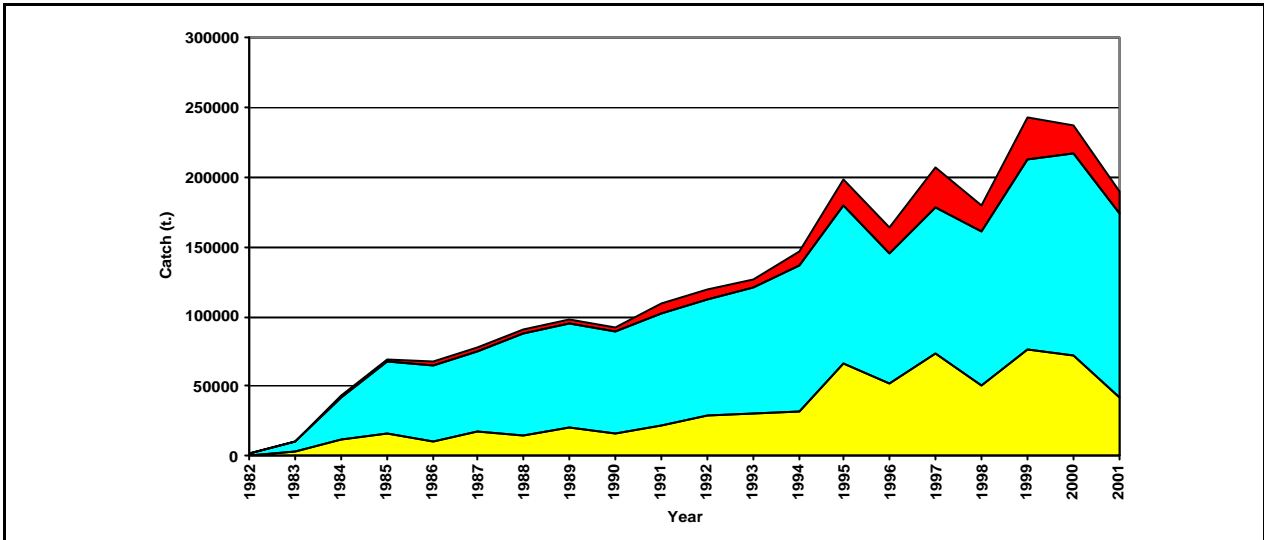


Figure 2: Total yearly catches of tunas, by species, taken by fishing mode, under free schools (right), and under FADs (left) in the sampled purse seine fishery.

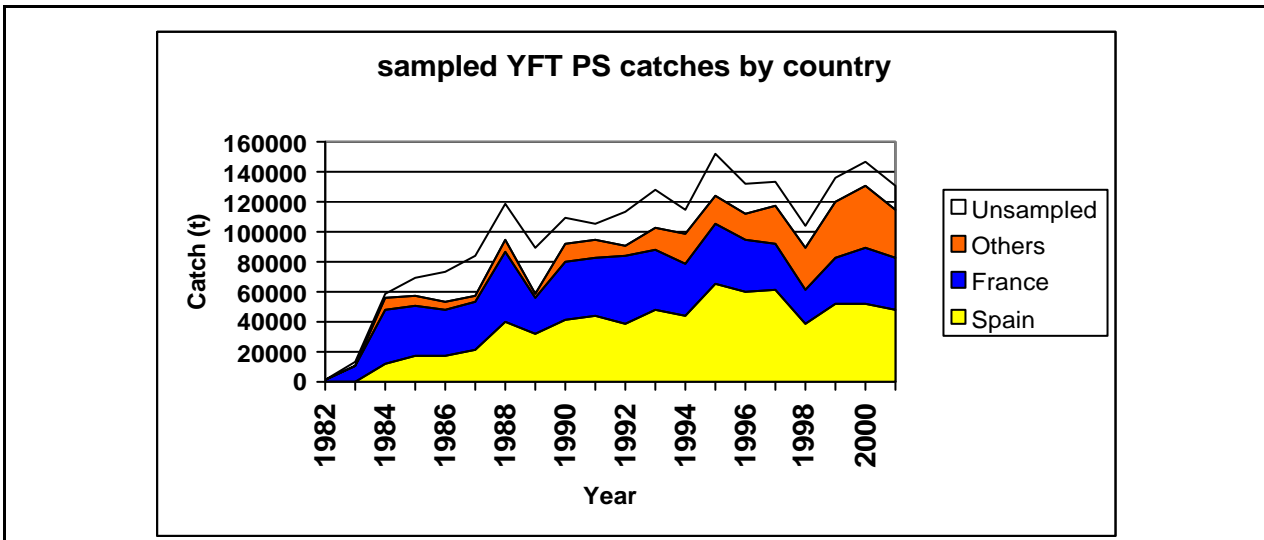


Figure 3: Total yearly catches of yellowfin tuna, by flag, in the sampled purse seine fishery under study and total estimated catches of yellowfin for the purse seine fisheries in the Indian Ocean.

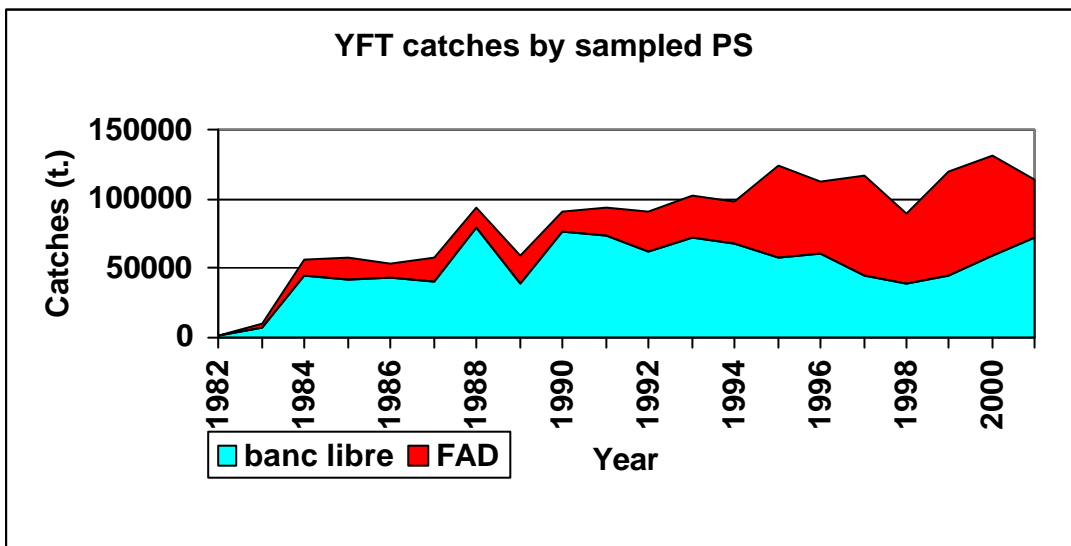
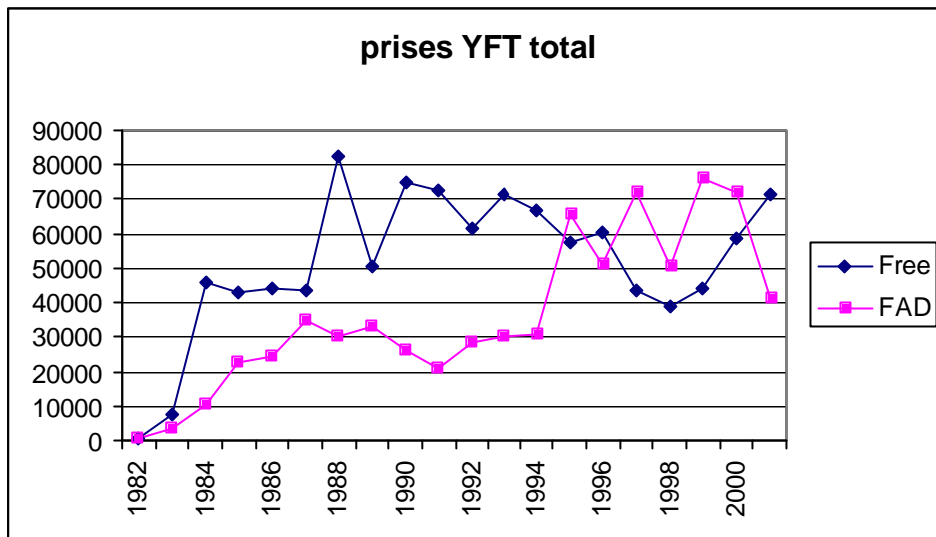


Figure 4 : Total yearly catches of yellowfin tuna by fishing mode, free school or Fish Aggregating Device (or FAD) in the sampled purse seine fishery (shown by line and area figures)

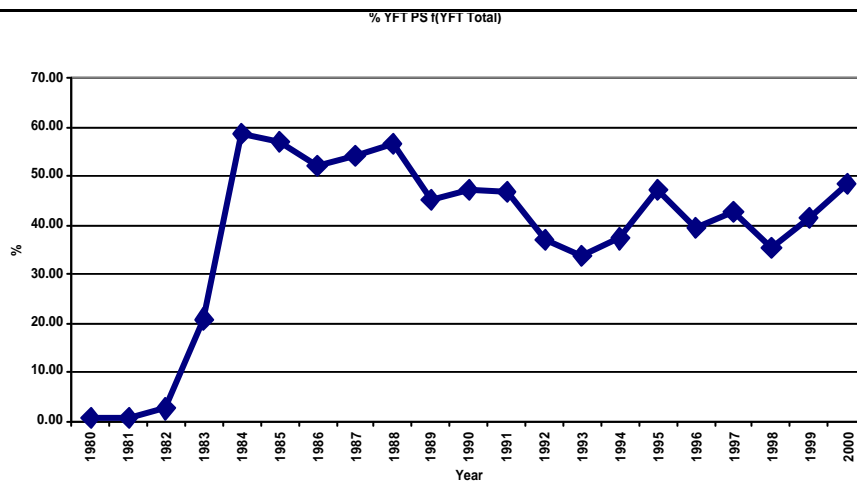


Figure 5: Yearly percentage of yellowfin taken by the purse seine fishery as a function of total yellowfin catches in the Indian Ocean.

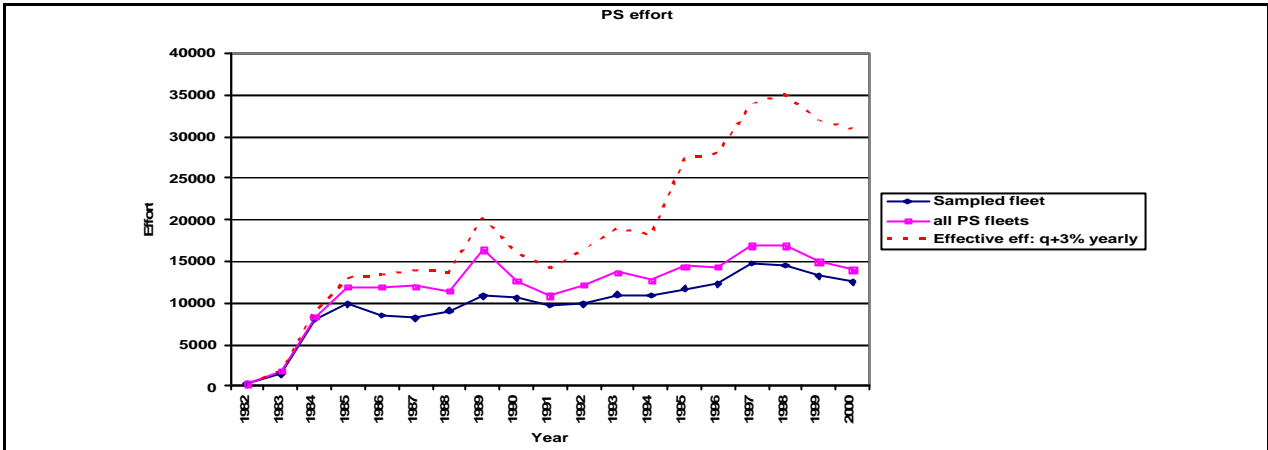


Figure 6: Total yearly nominal effort of the sampled purse seine fishery (non standardized fishing days) and estimation of total nominal effort by purse seiners (based on ratio of yellowfin catches). This figure also shows an indicative estimate of effective effort applying an indicative constant ratio of increased efficiency of 3% yearly

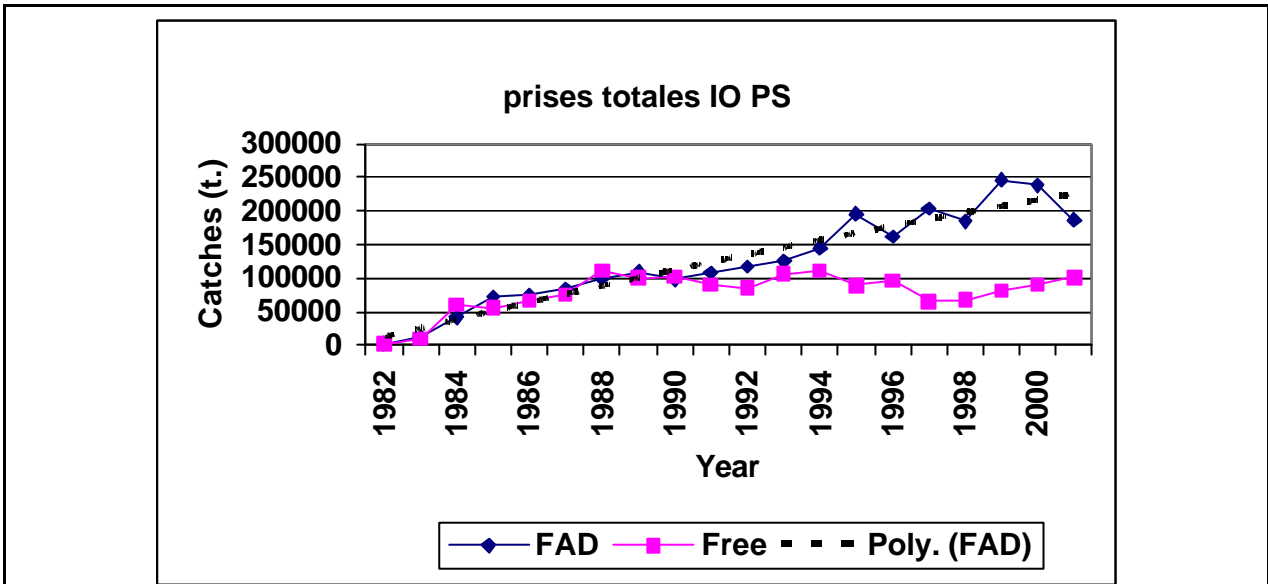


Figure 7: Total yearly catches by fishing mode, free school or Fish Aggregating Device (or FAD) in the sampled purse seine fishery (Catches in the FAD fishery are dominated by skipjack).

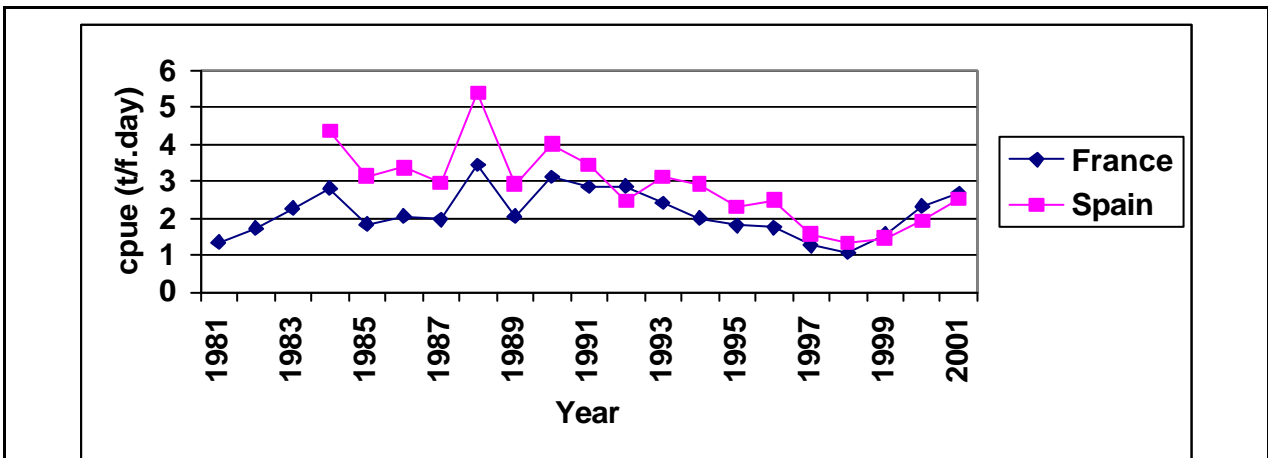


Figure 8: Total yearly nominal cpue of yellowfin tuna on free school for the French and Spanish purse seiners. This cpue is calculated as the ratio of the Yellowfin catches on free schools divided by the total number of non standardized fishing days.

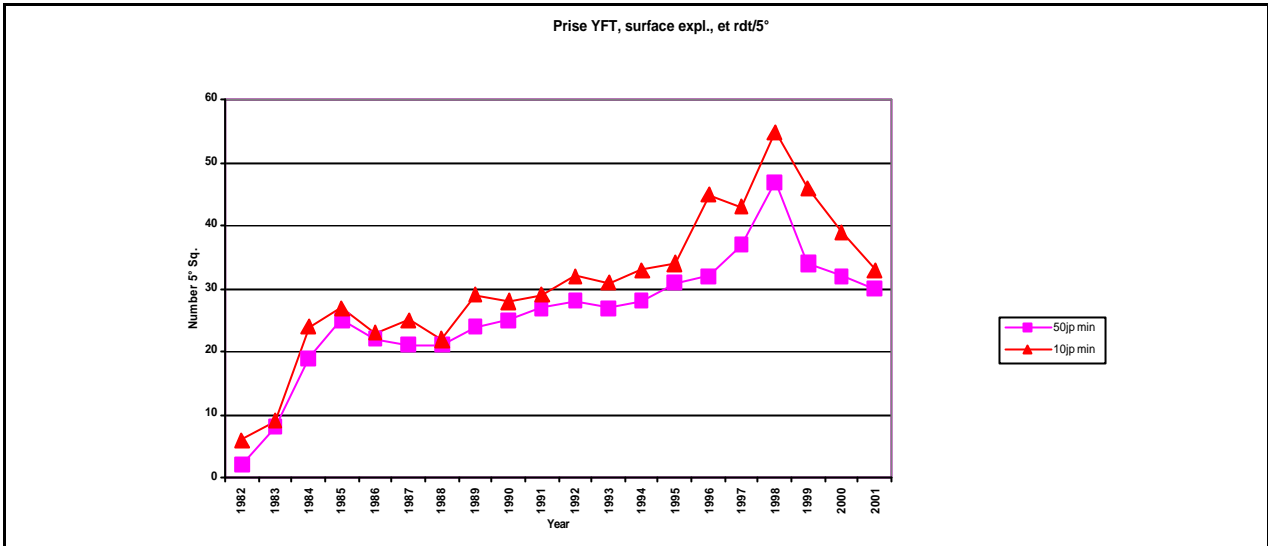


Figure 9: Yearly number of 5° squares fished by the sampled purse seine fleet at minimum levels of 10 and 50 fishing days yearly.

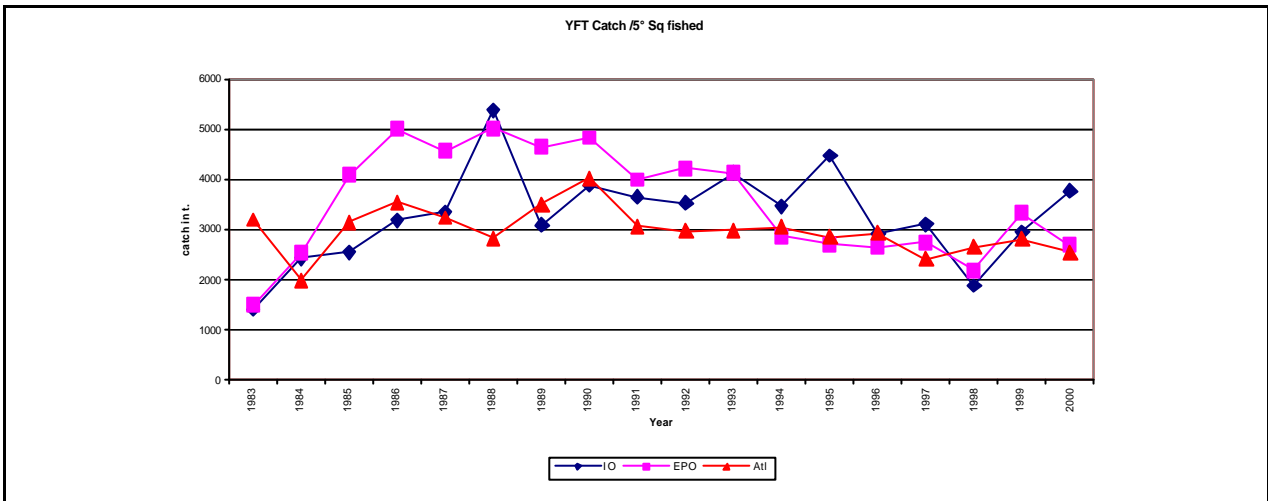


Figure 10: Average catches of yellowfin taken by 5° square areas in the Indian, Atlantic and Eastern Pacific oceans.

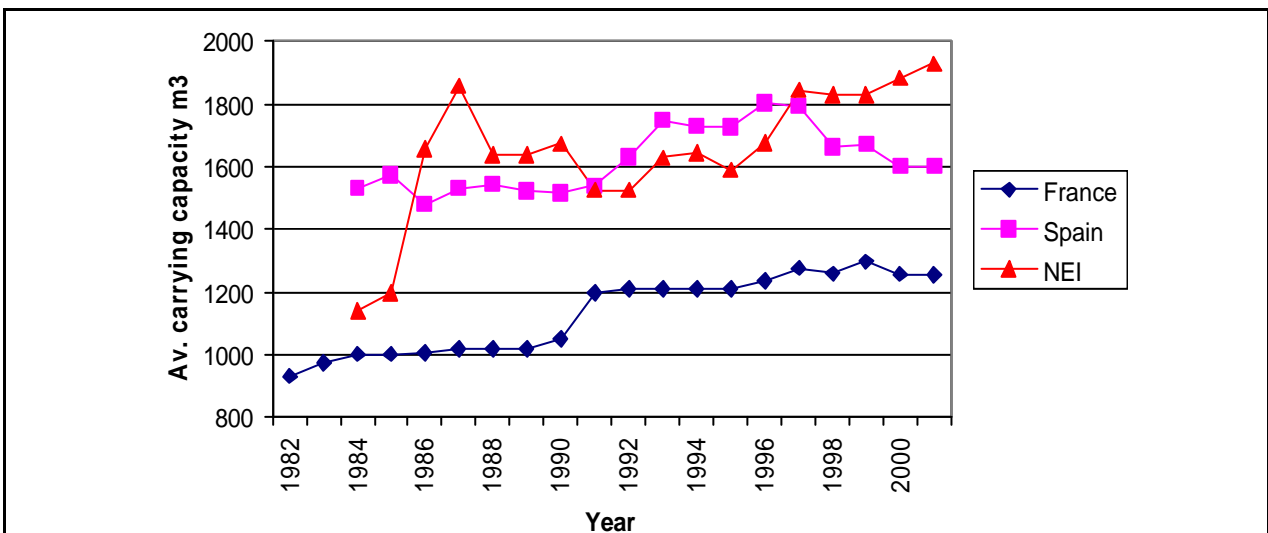


Figure 11 : Average yearly carrying capacity of the French, Spanish and NEI sampled individual purse seiners (in m3 of capacity)

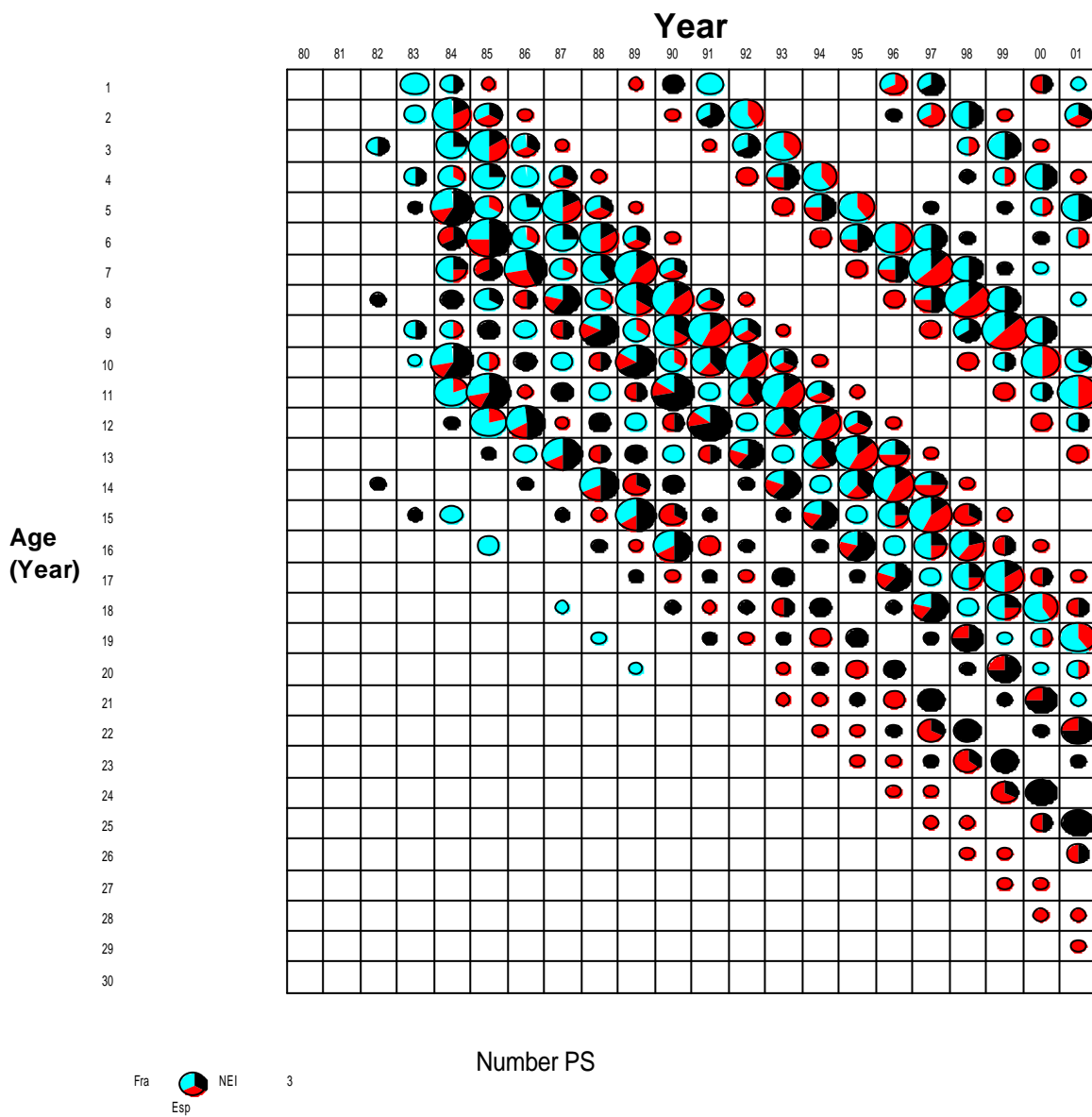
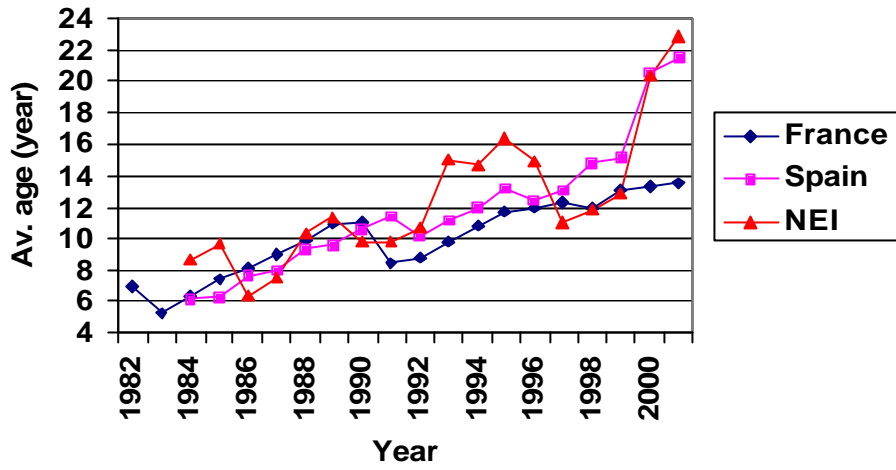


Figure 12: Ageing of the sampled purse seine fishery shown by the average yearly age of the sampled purse seiners' fleet, by flag (upper figure) and by a pie diagram showing the yearly distribution of ages of active purse seiners.

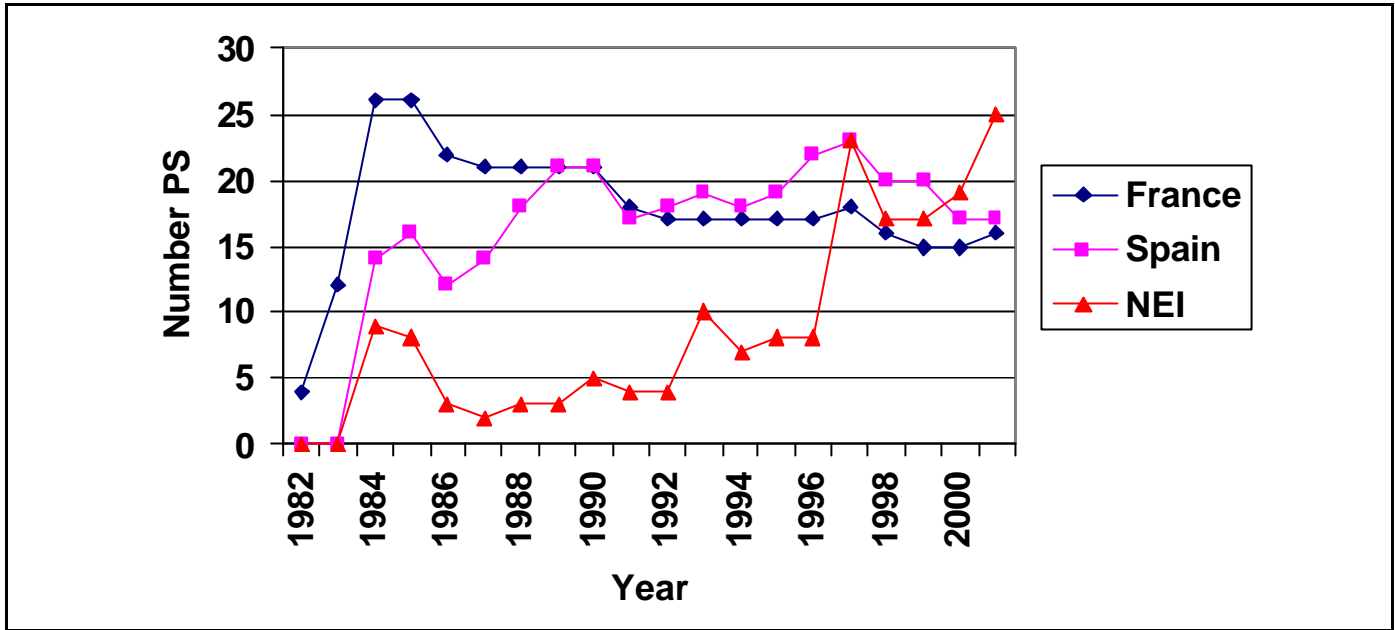


Figure 13: Yearly number of vessels in the sampled fleet, by flag (some boats having fished during limited period of time).

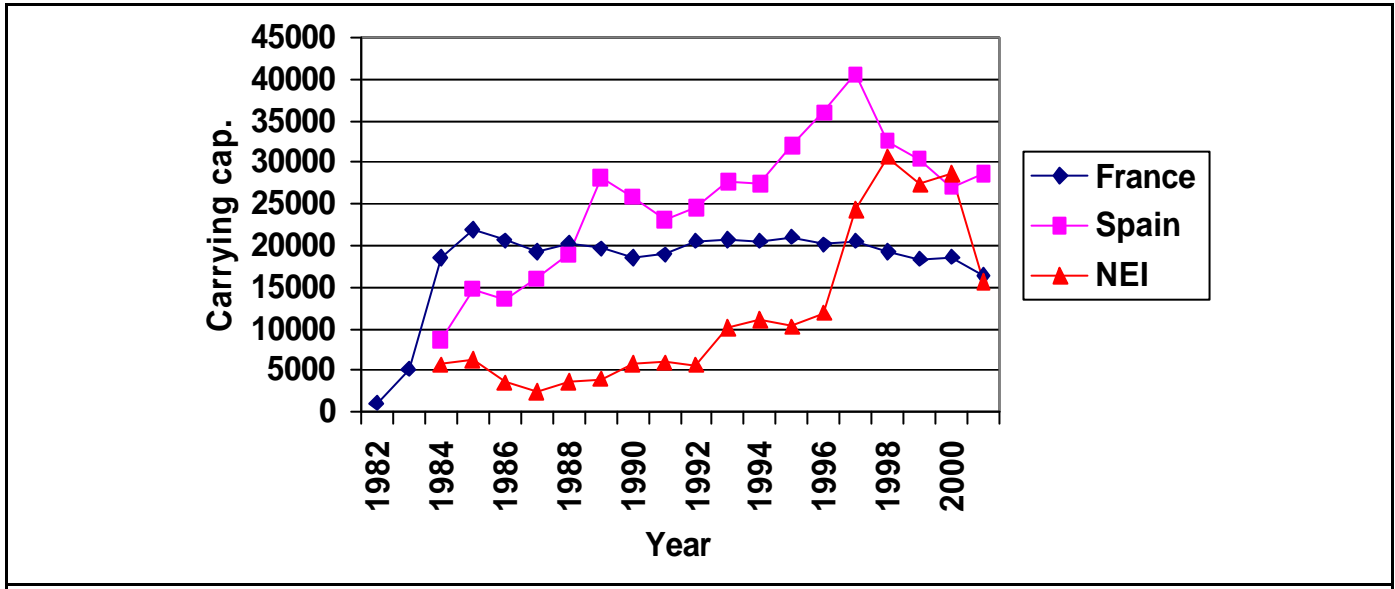


Figure 14: Yearly total carrying capacity (weighted by the fishing time of each vessel) developed by the sampled fleet, by flag.

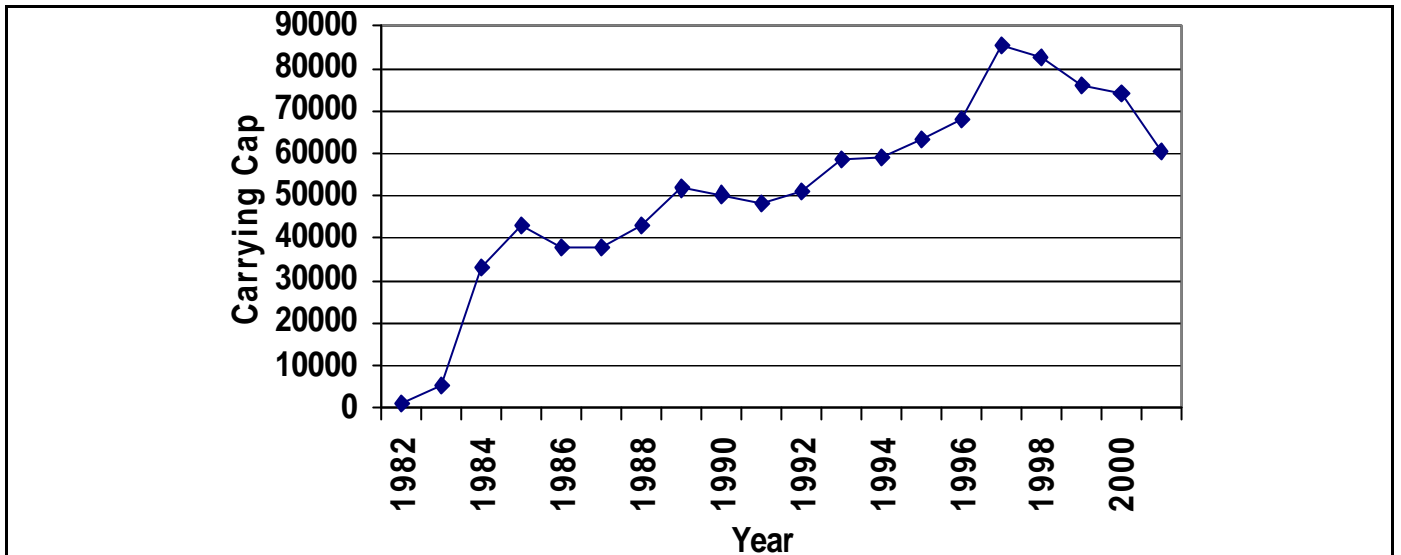
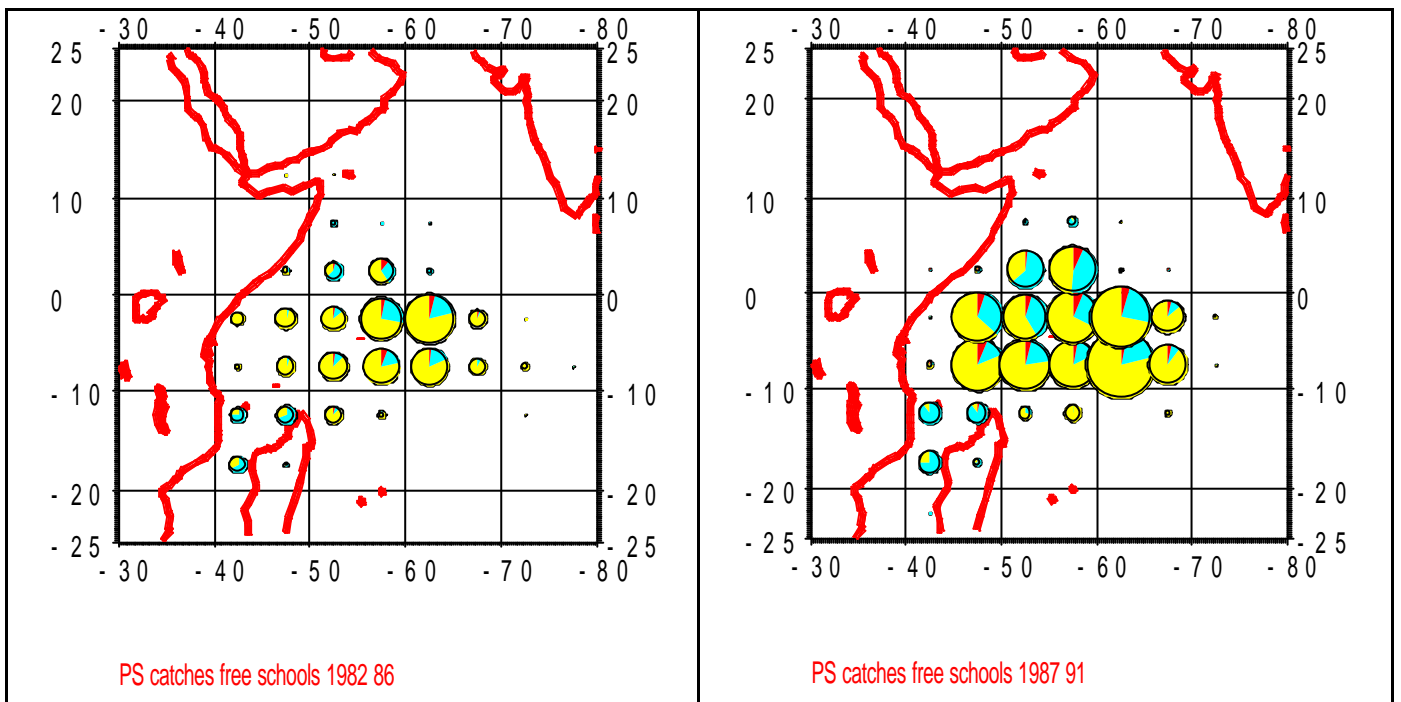


Figure 15: Yearly total carrying capacity (weighted by the fishing time of each vessel) developed by the sampled fleet, for all flags.





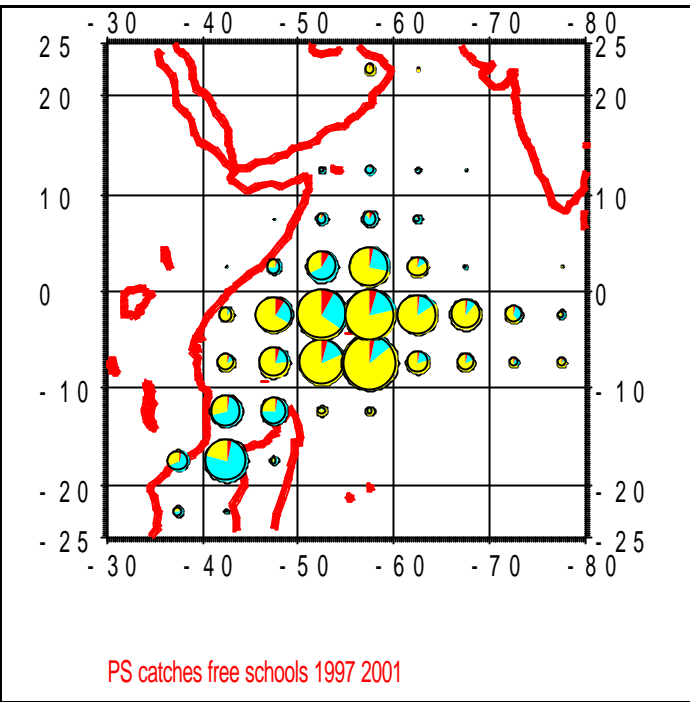
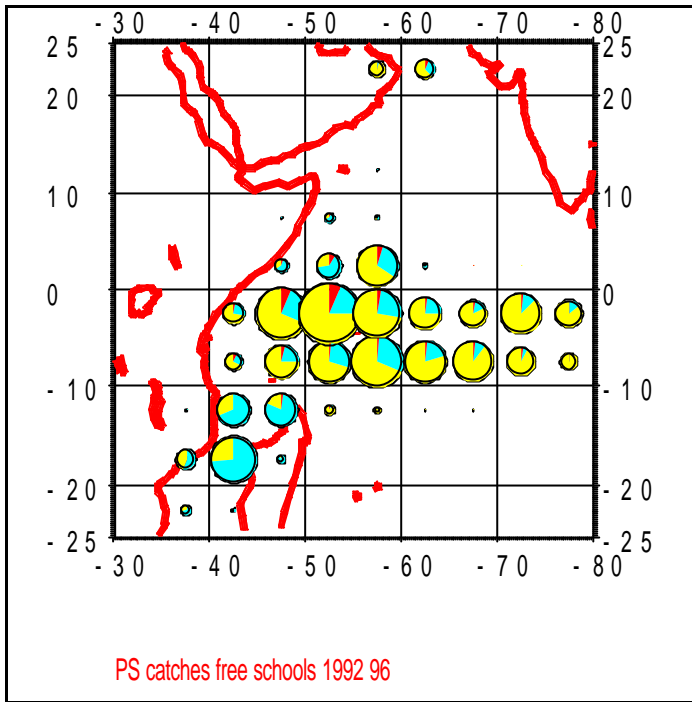
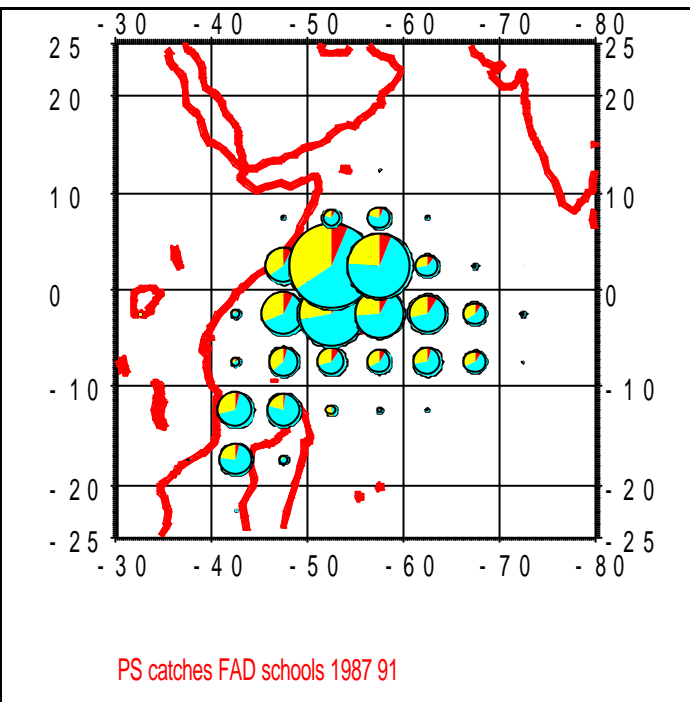
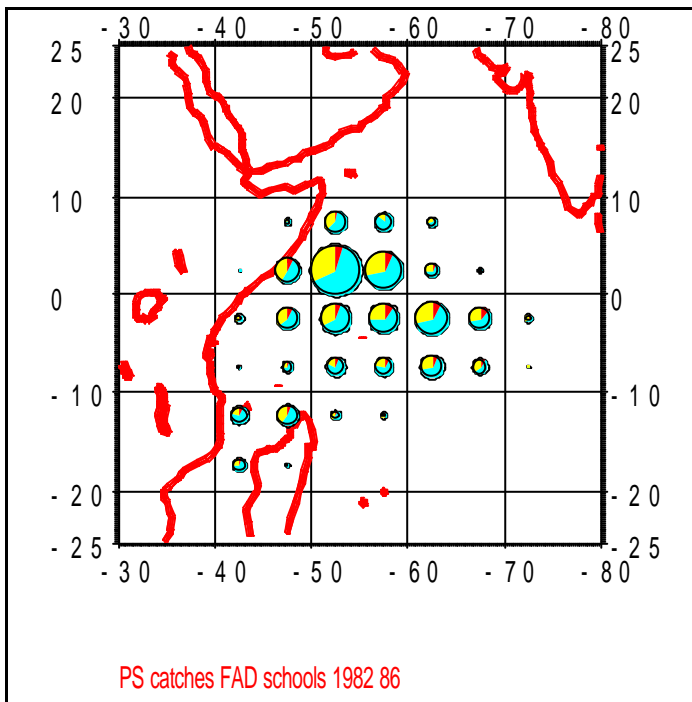


Figure 16: Average fishing maps of catches by species taken by the sampled fleet on free swimming schools, by 5 years periods: average 1982-1986, 1987-1991, 1992-1996 and 1997-2001

YFT  BET   
SKJ 5000 t.



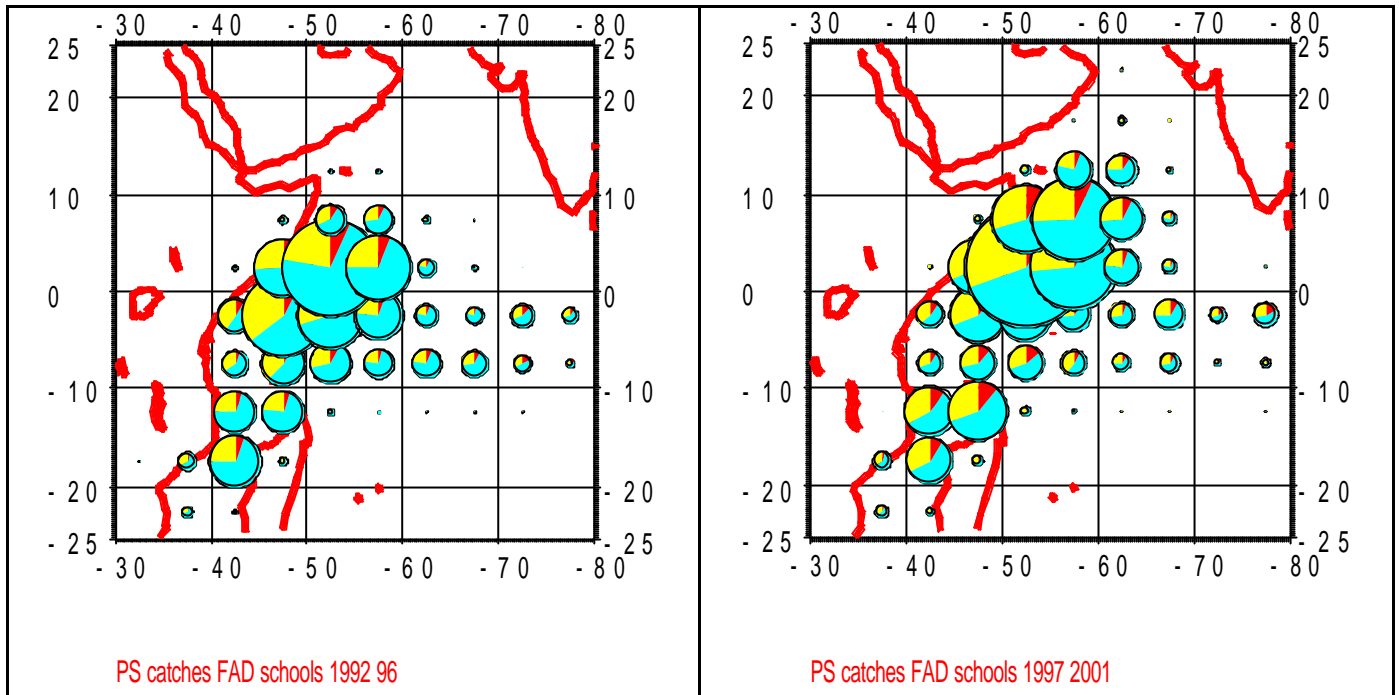




Figure 17: Average fishing maps of catches by species taken by the sampled fleet on FAD associated schools, by 5 years periods: average 1982-1986, 1987-1991, 1992-1996 and 1997-2001

YFT  BET  
SKJ  5000 t.

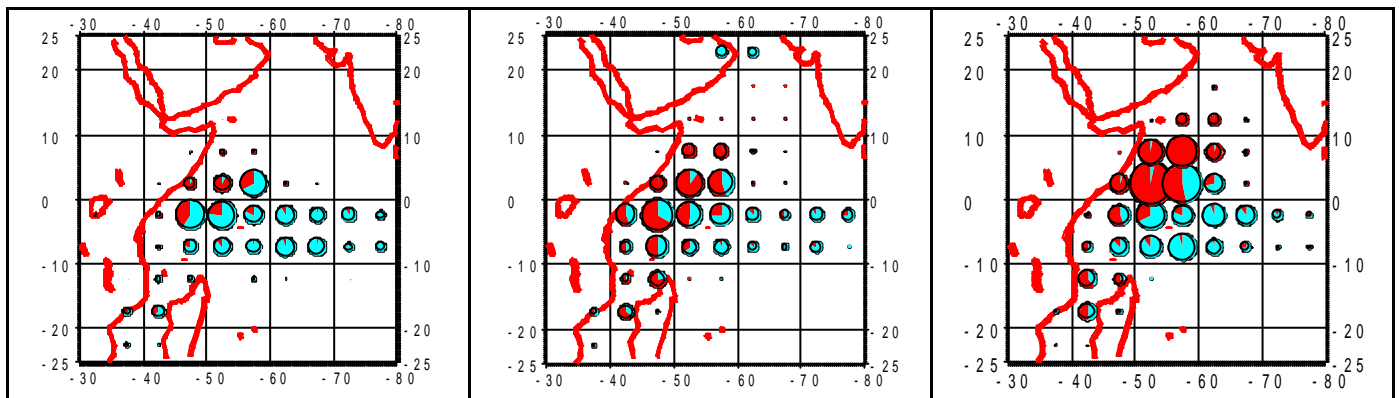


Figure 18: Average fishing maps of yellowfin catches of the Spanish fleet, by fishing mode (FAD and free schools), during three recent periods: average 1991-1994, 1995-1998 and 1999-2001

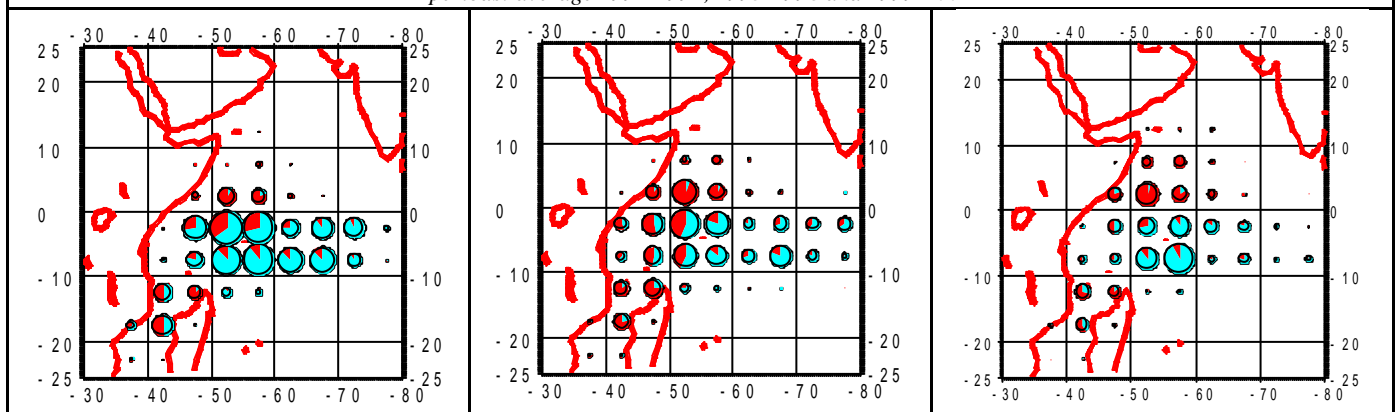


Figure 19: Average fishing maps of yellowfin catches of the French fleet, by fishing mode (FAD and free schools), during three recent periods: average 1991-1994, 1995-1998 and 1999-2001

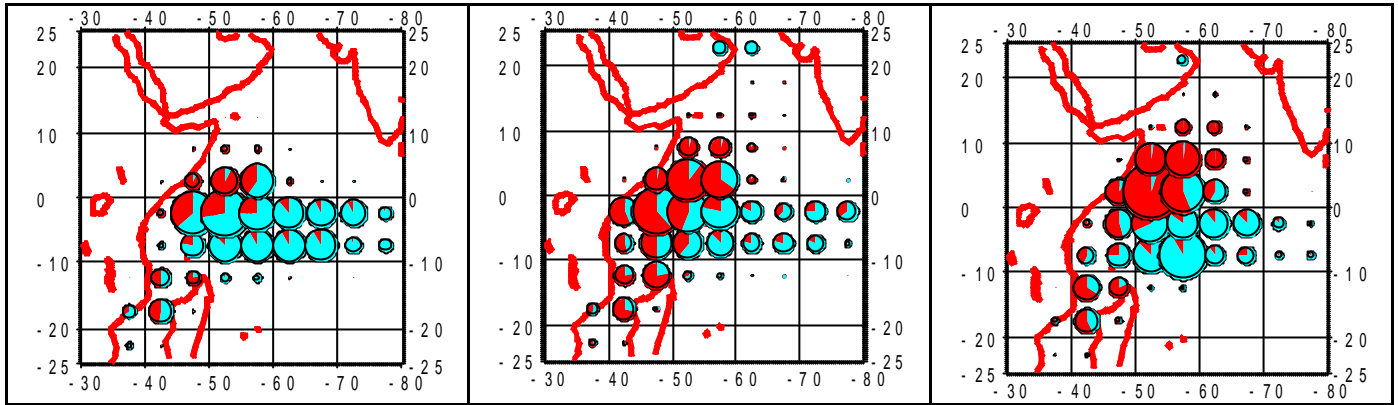


Figure 20: Average fishing maps of yellowfin catches of the entire purse seine fleet, by fishing mode (FAD and free schools), during three recent periods: average 1991-1994, 1995-1998 and 1999-2001

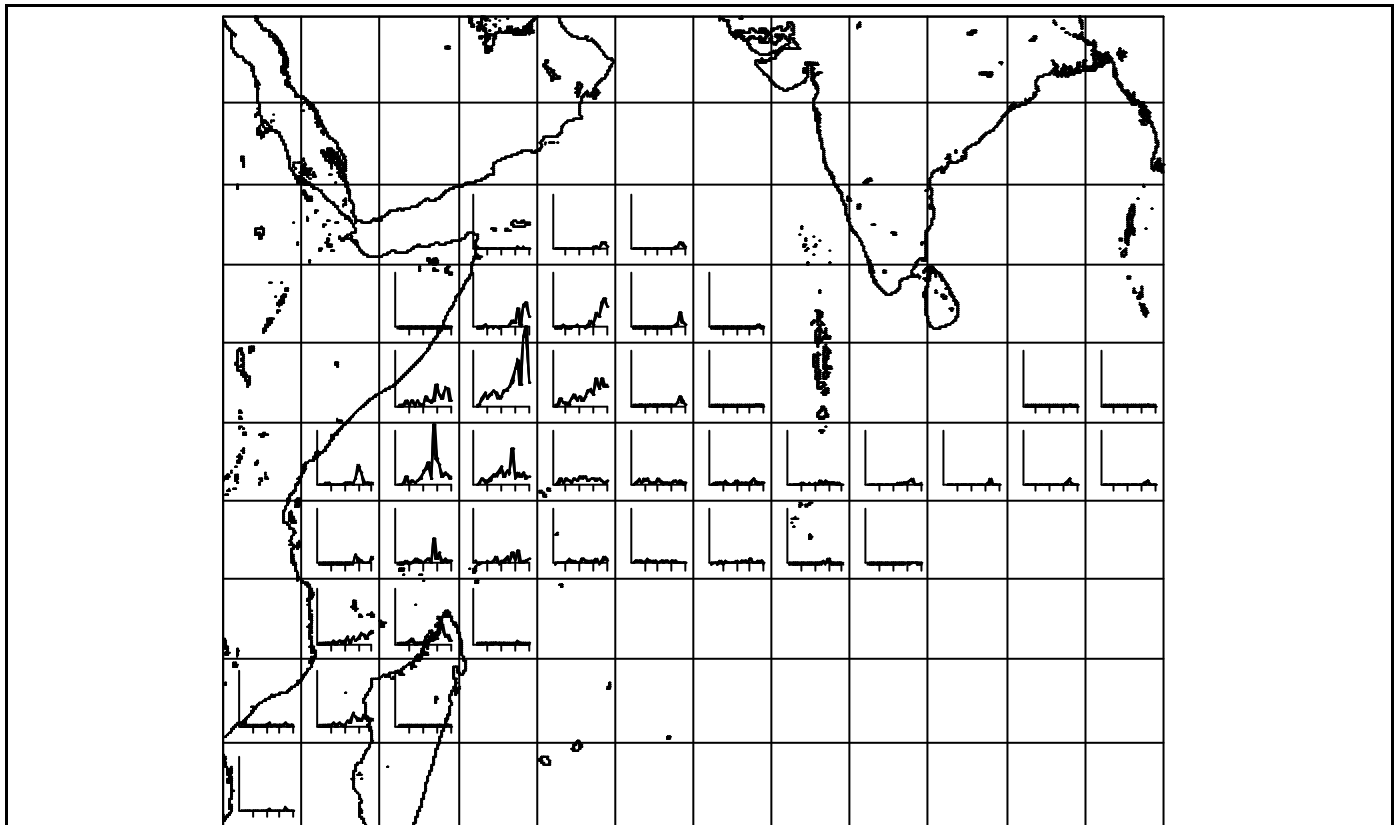


Figure 21: Map showing the yearly levels of nominal fishing efforts by the sampled purse seine fleet by 5° squares during the period 1982-2001

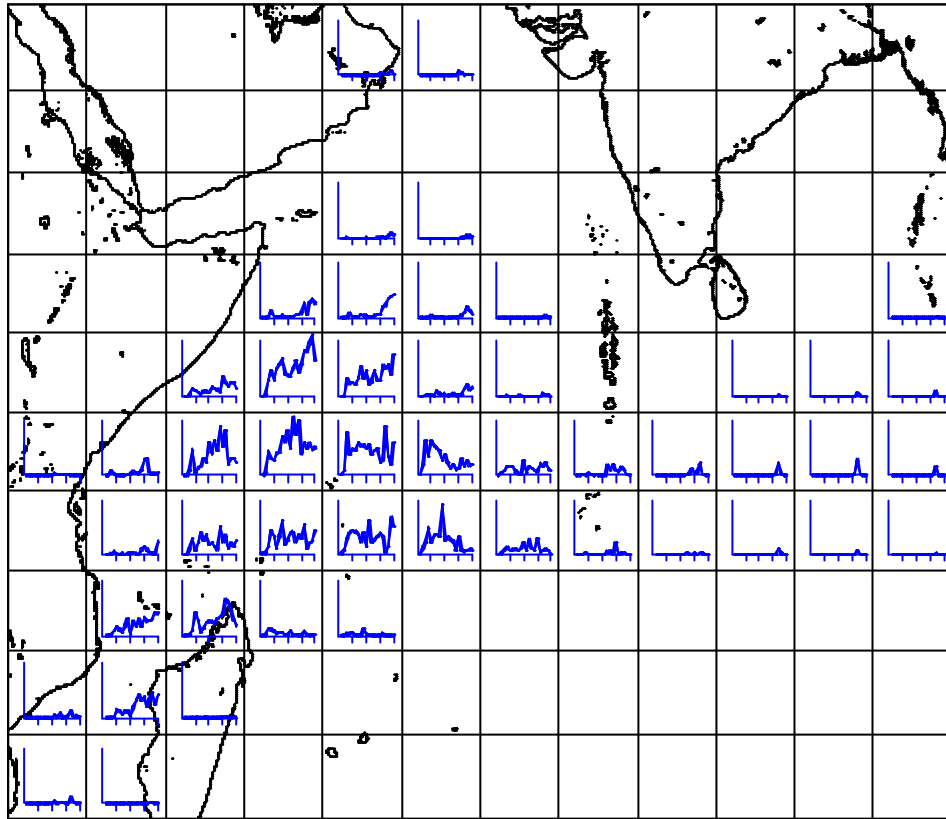


Figure 22: Map showing the yearly catches of yellowfin tuna taken on FADs by the sampled purse seine fleet, by 5° squares, during the period 1982-2001

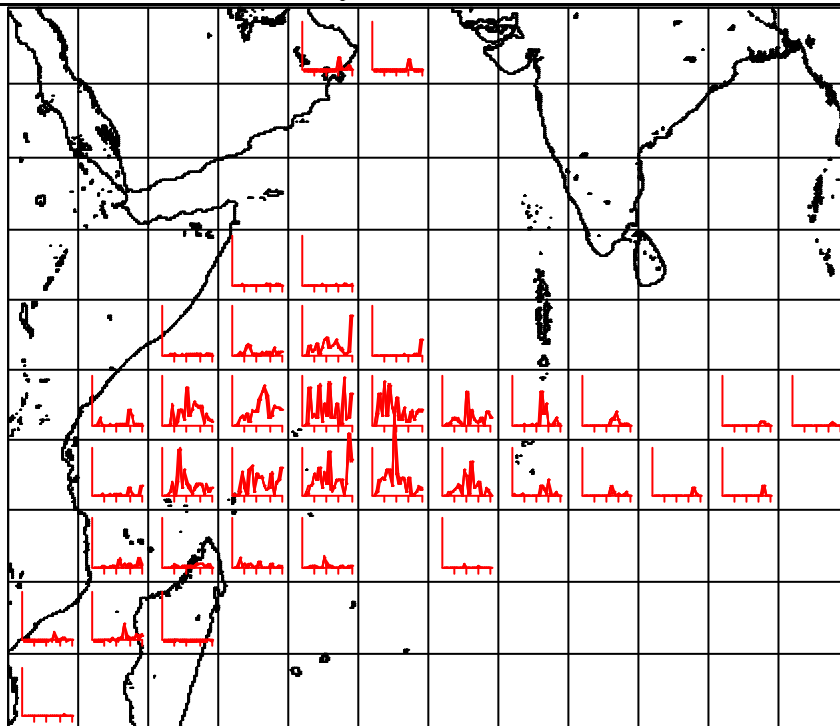


Figure 23: Map showing the yearly catches of yellowfin tuna taken on free schools by the sampled purse seine fleet, by 5° squares, during the period 1982-2001

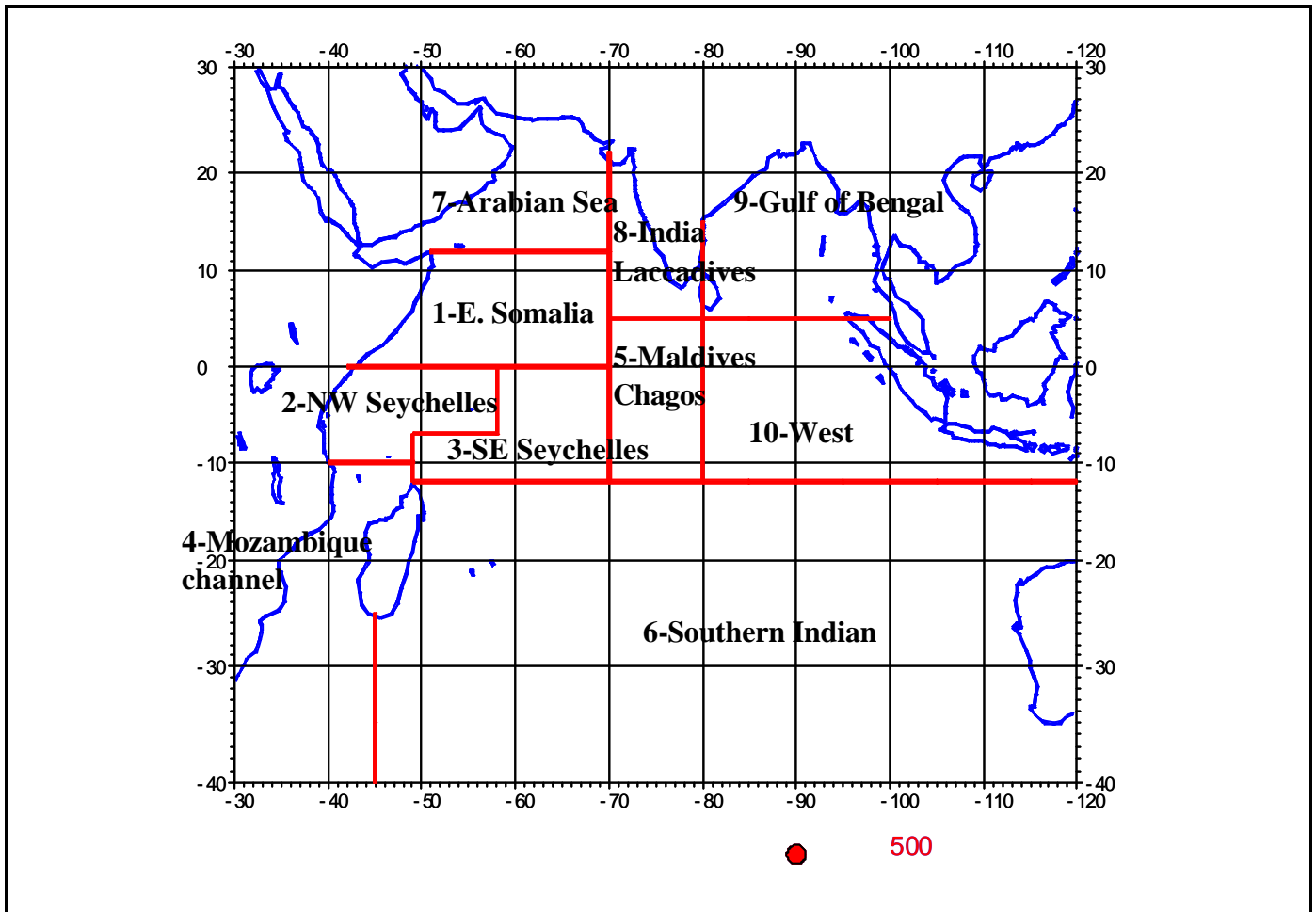


Figure 24: Map showing the typical fishing zones used to draw the pie diagrams showing the activities of the purse seine fleet and the sizes of yellowfin given on the following figures.

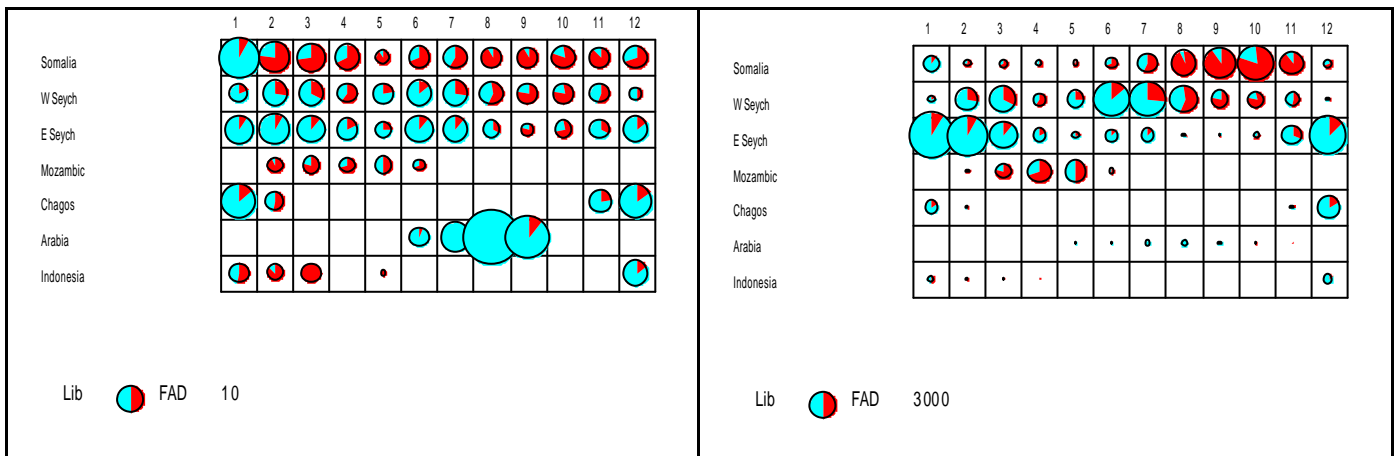
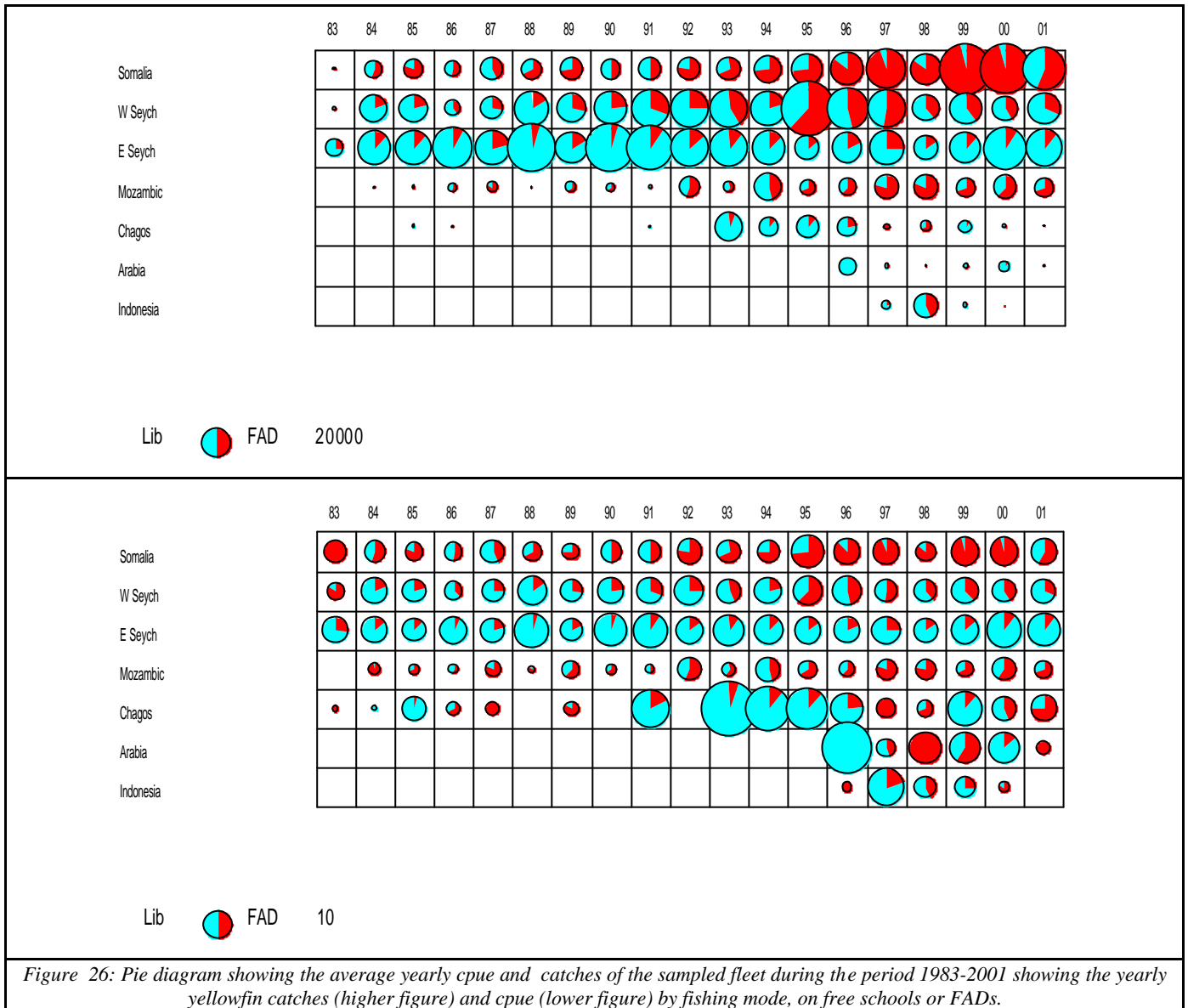


Figure 25 : Pie diagram showing the average monthly cpue (left) and monthly catches (right) of the sampled fleet during the period 1983-2001 , by fishing mode, on free schools or FADs.



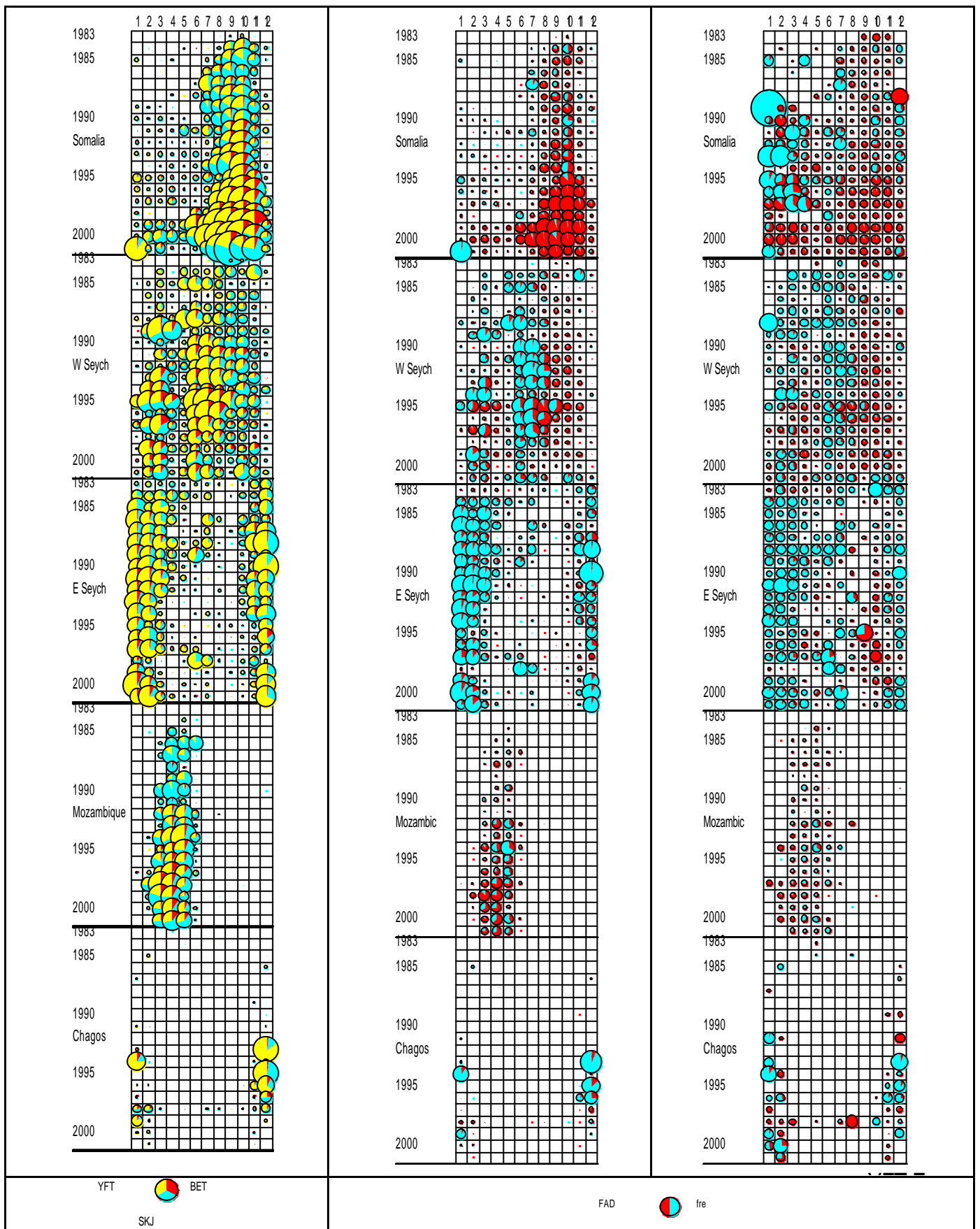


Figure 27 : Pie diagram showing the monthly catches by area and species during the period 1983-2001 by species (left), the catches of yellowfin by fishing mode (center) and cpue (right) by the same fishing mode (free schools/FADs).

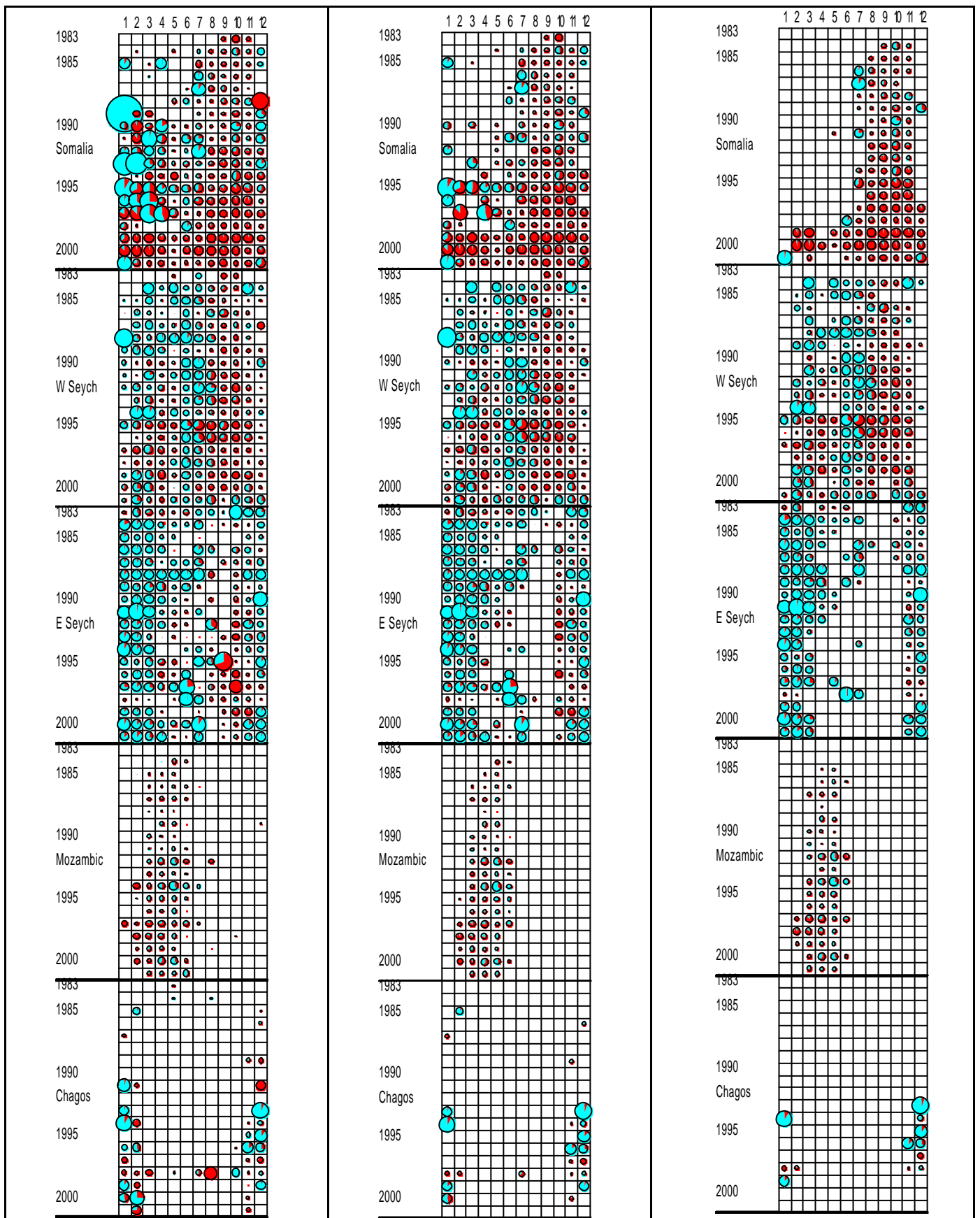


Figure 28 : Pie diagram showing the yellowfin cpue by area and fishing mode during the period 1983-2001, calculated for every fished strata (left), and eliminating the 1% lowest fishing effort (center) and the 5% lowest fishing effort (right).



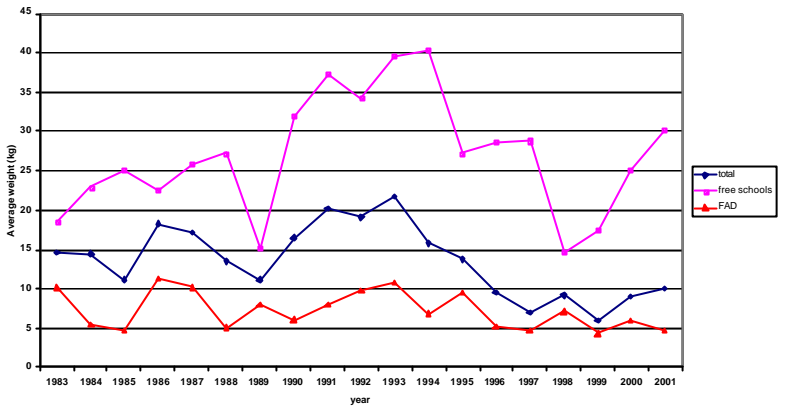
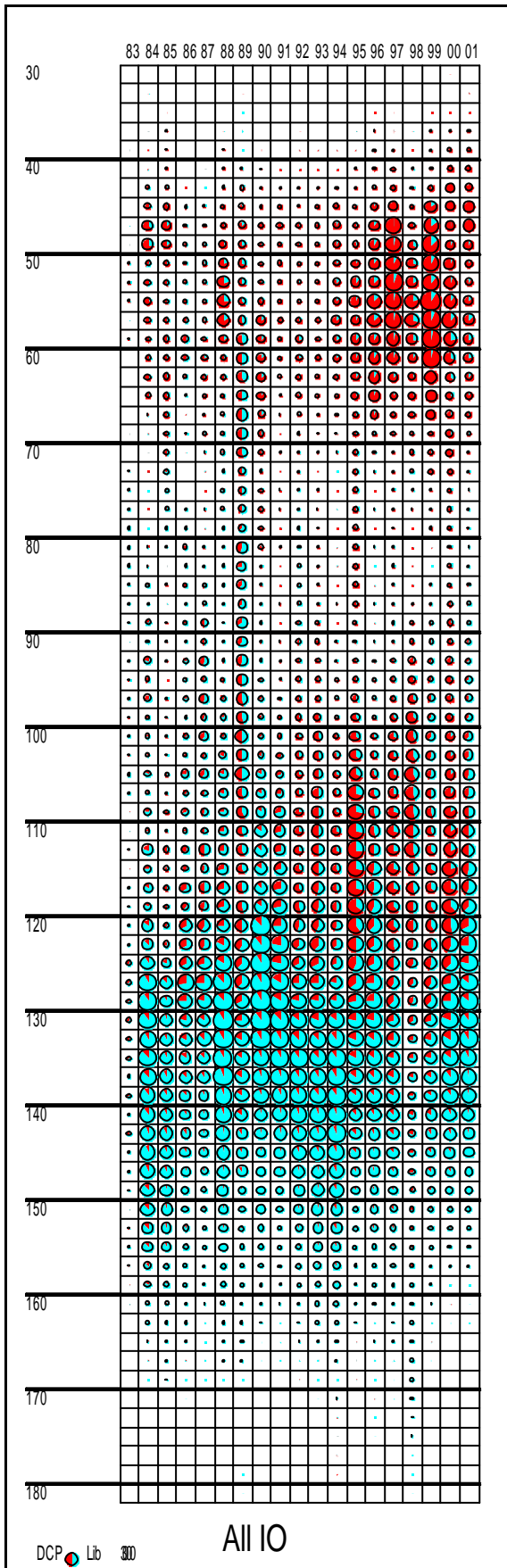


Figure 29: Pie diagram showing the yearly sizes of yellowfin in weight, by 2cm classes, taken during the period 1983-2001 by fishing mode and average yearly weights of yellowfin by fishing mode and total

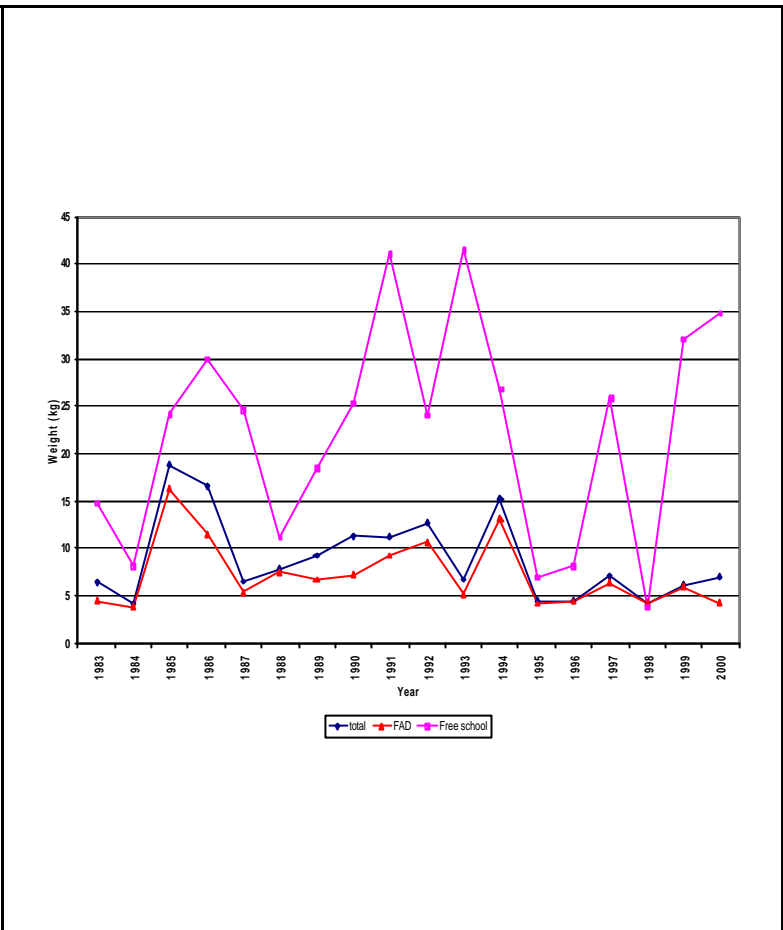
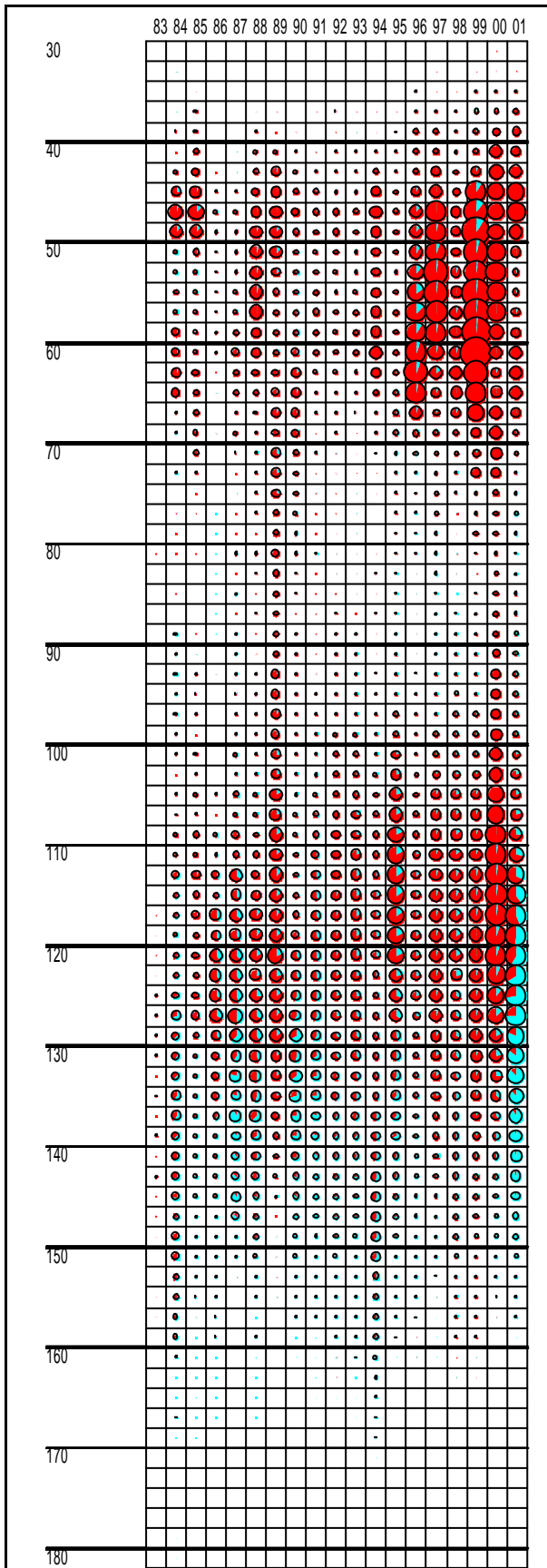


Figure 30: Pie diagram showing the yearly sizes of yellowfin in weight, by 2cm classes, taken during the period 1983-2001 by fishing mode in the Somalia area and average yearly weights of yellowfin by fishing mode and total in the same area.

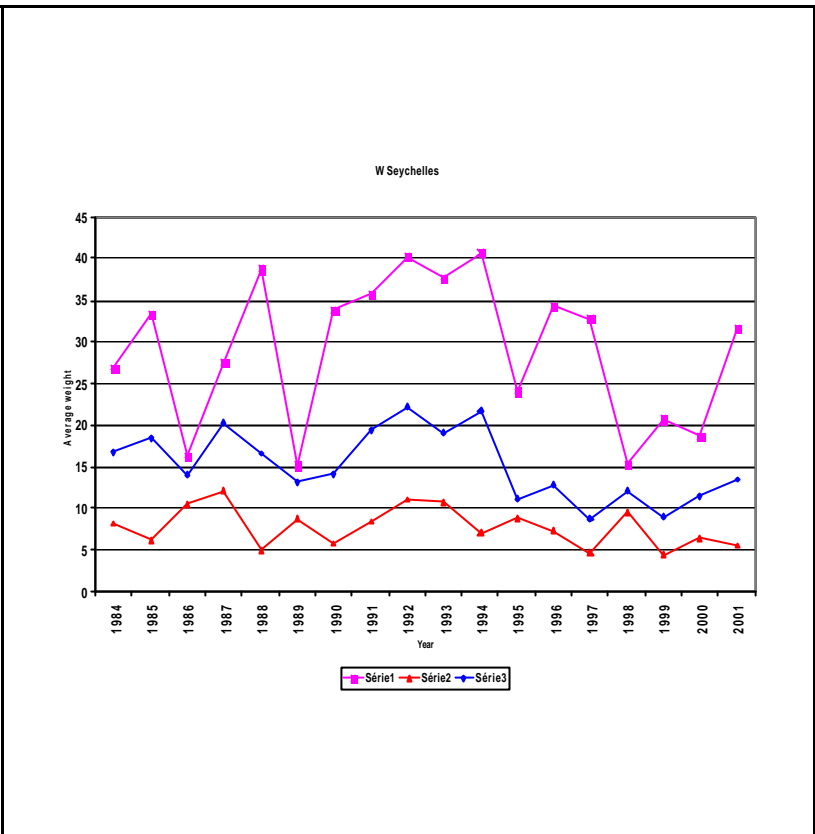
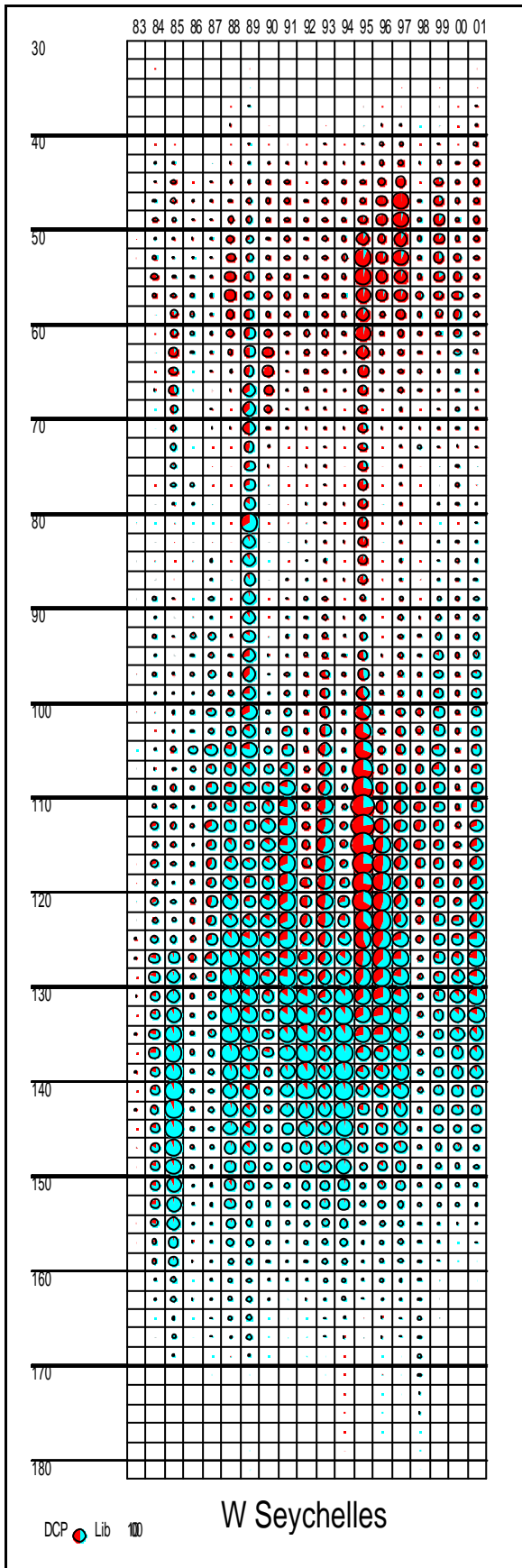


Figure 31 : Pie diagram showing the yearly sizes of yellowfin, by 2cm classes, taken during the period 1983-2001 by fishing mode in the West Seychelles area and average yearly weights of yellowfin by fishing mode and total in the same area

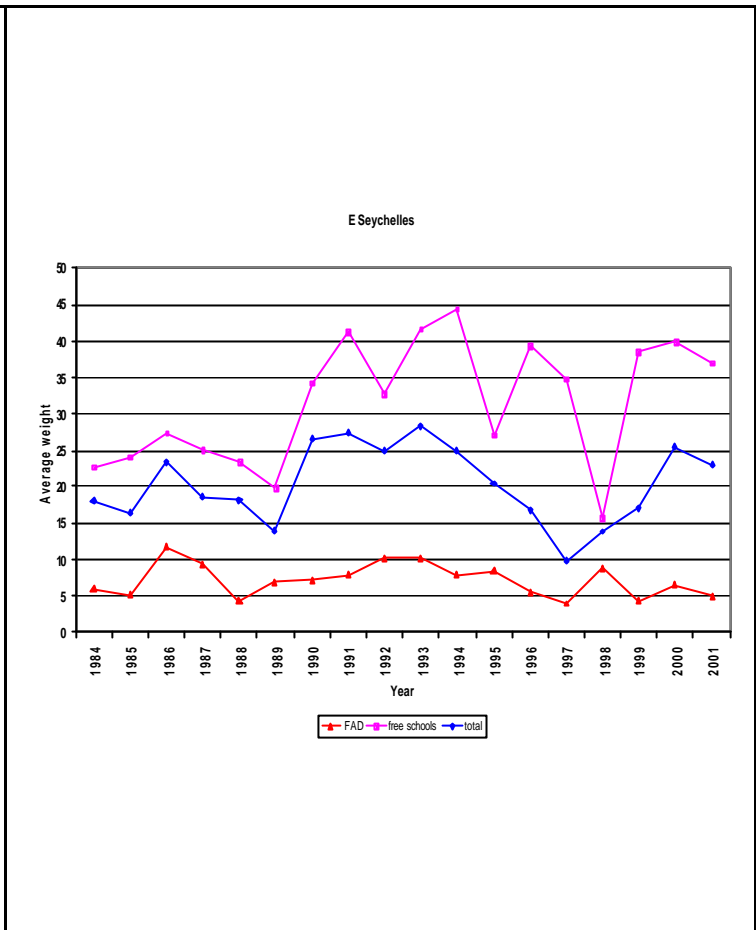
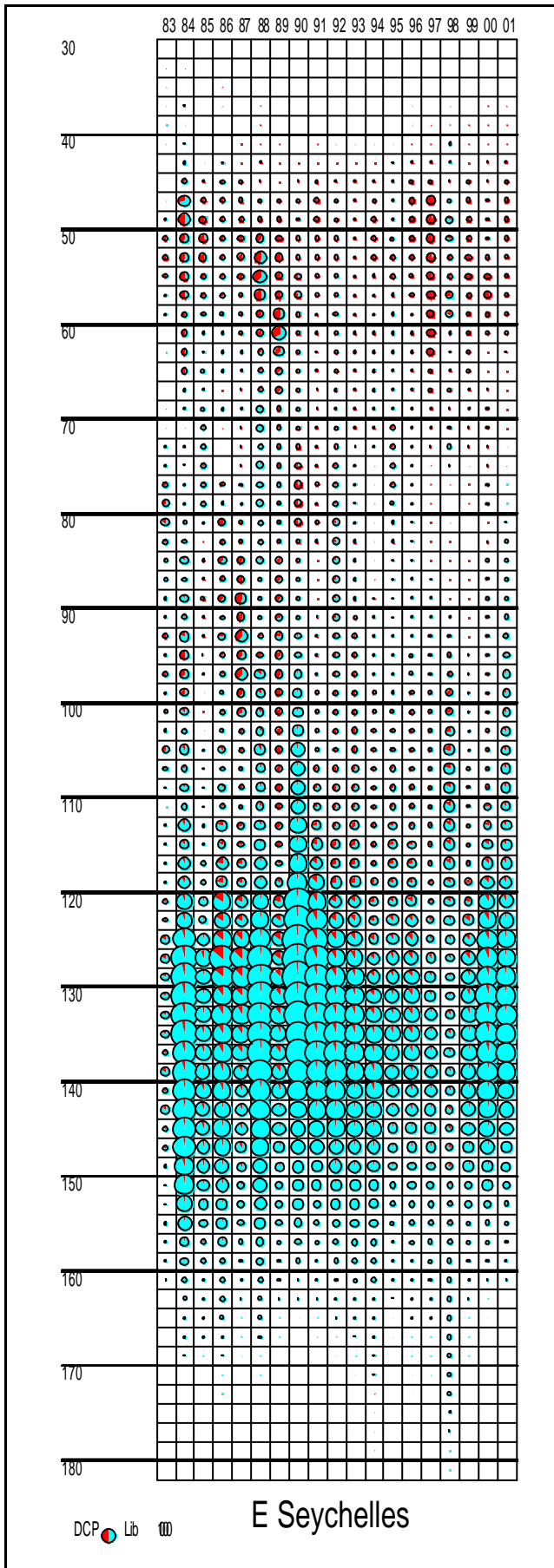


Figure 32: Pie diagram showing the yearly sizes of yellowfin, by 2cm classes, taken during the period 1983-2001 by fishing mode in the East Seychelles area and average yearly weights of yellowfin by fishing mode and total in the same area.

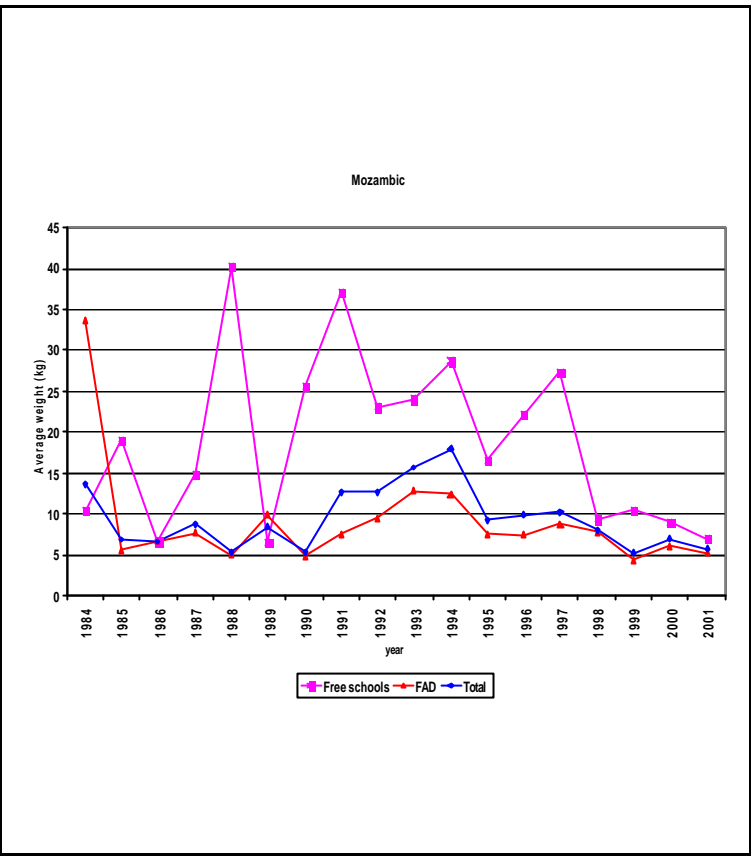
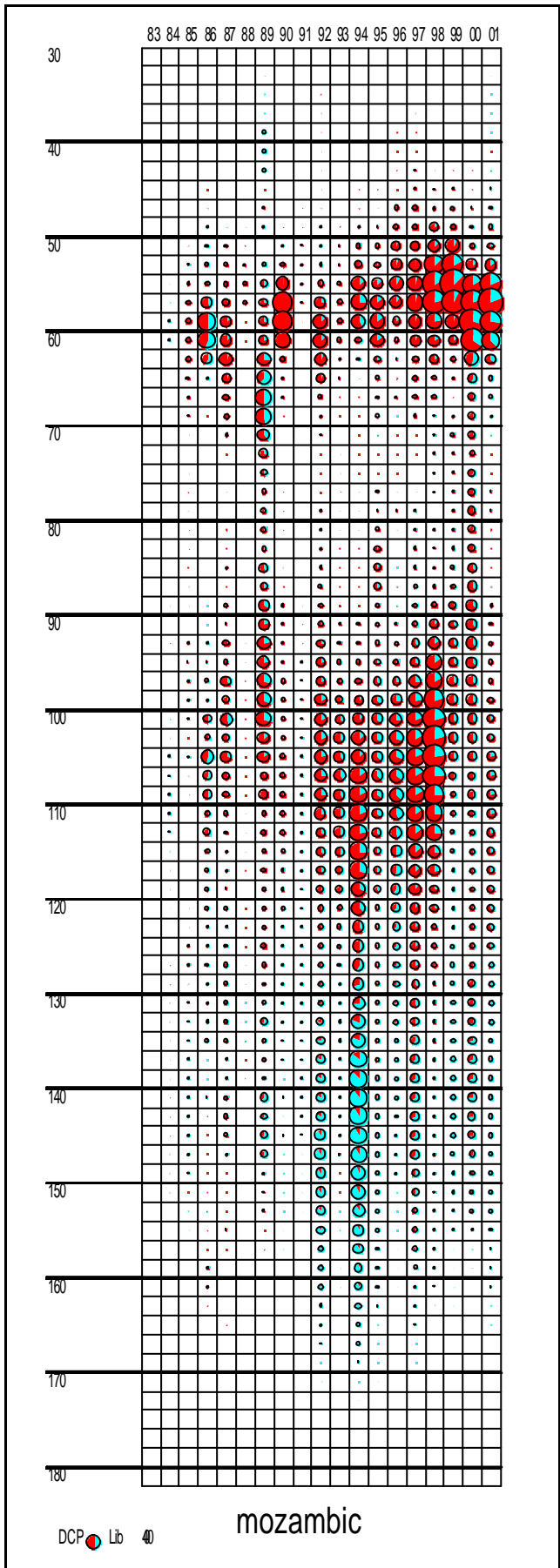


Figure 33: Pie diagram showing the yearly sizes of yellowfin, by 2cm classes, taken during the period 1983-2001 by fishing mode in the Mozambique channel area and average yearly weights of yellowfin by fishing mode and total in the same area.

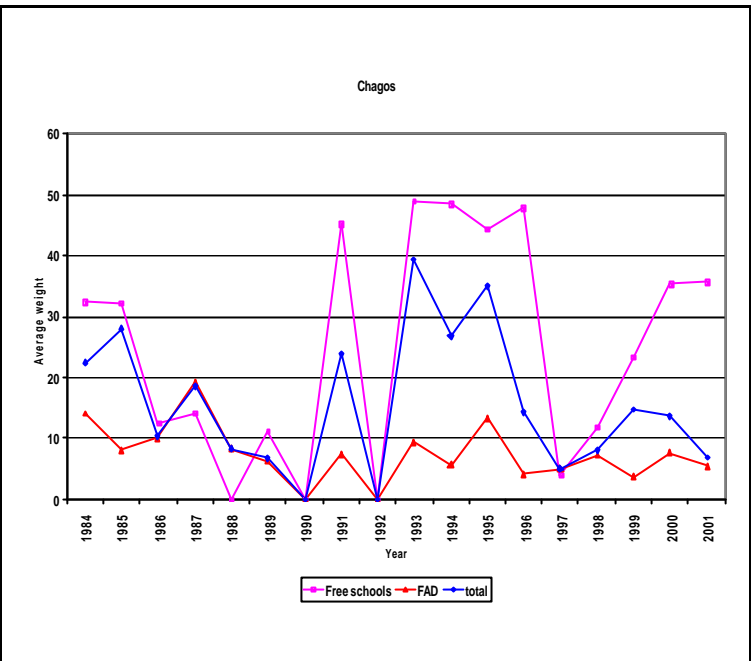
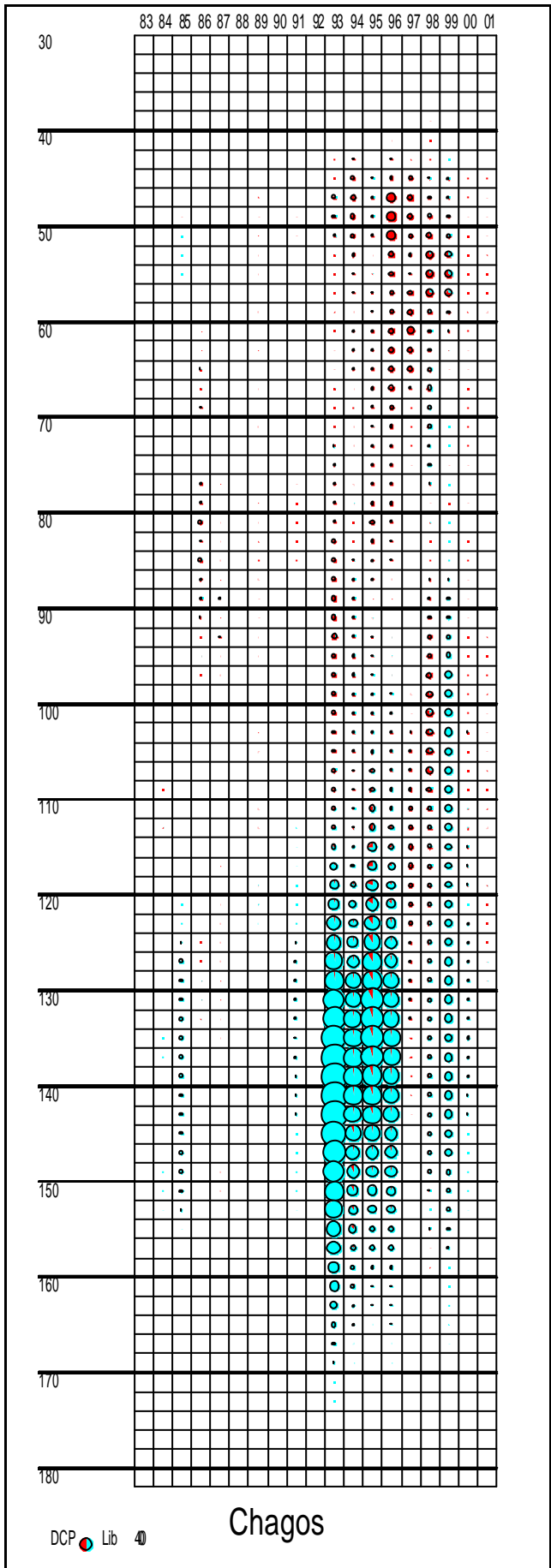


Figure 34: Pie diagram showing the yearly sizes of yellowfin, by 2cm classes, taken during the period 1983-2001 by fishing mode in the Chagos area and average yearly weights of yellowfin by fishing mode and total in the same area.

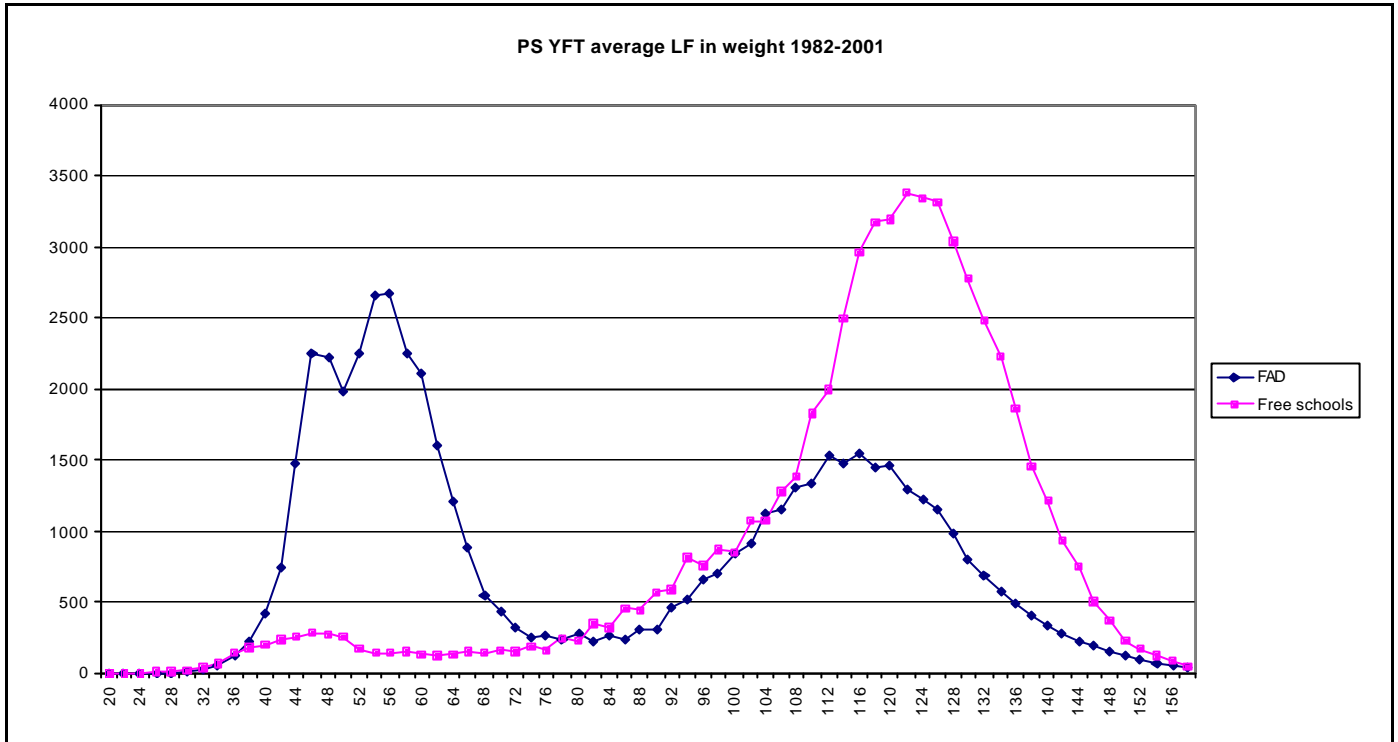


Figure 35: Average size distribution in weight of yellowfin taken by the purse seine fleet, by fishing mode.

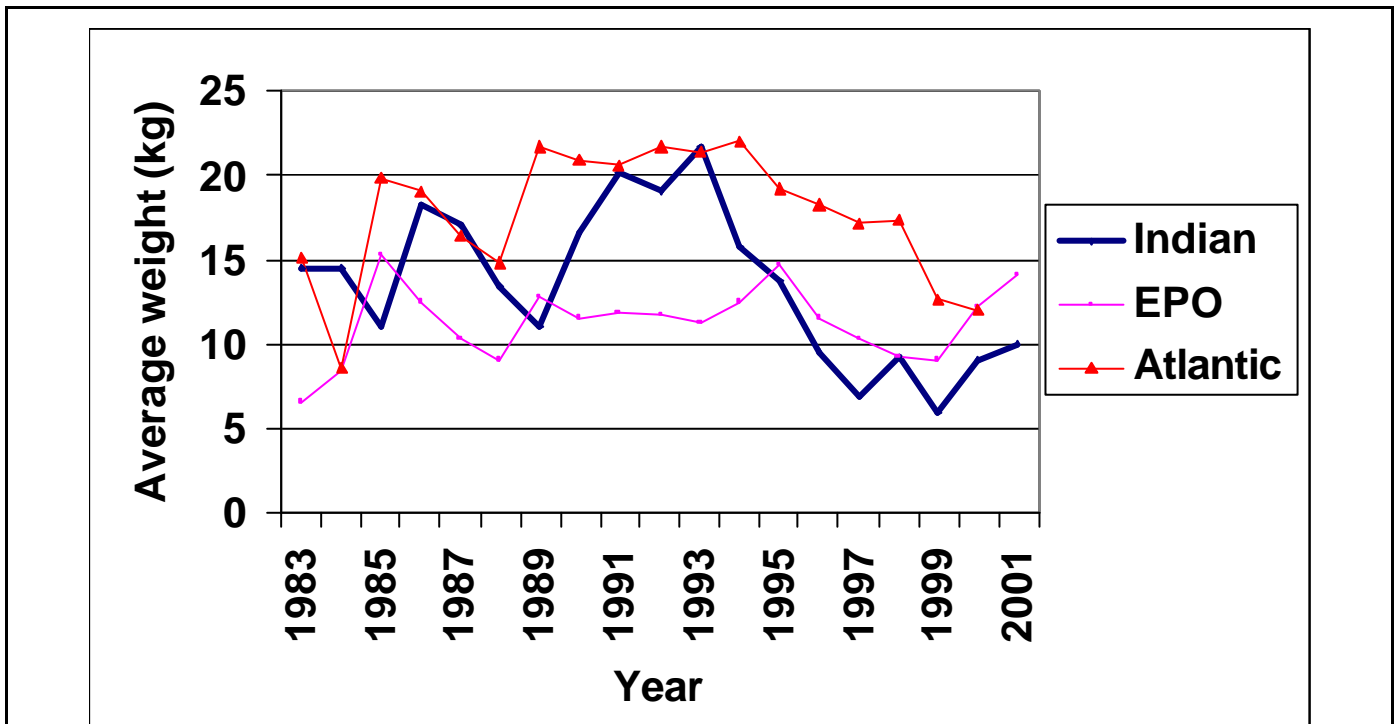


Figure 36: Comparison of average weight of yellowfin tunas taken by purse seiners in various areas: Indian, Atlantic and Eastern Pacific oceans.

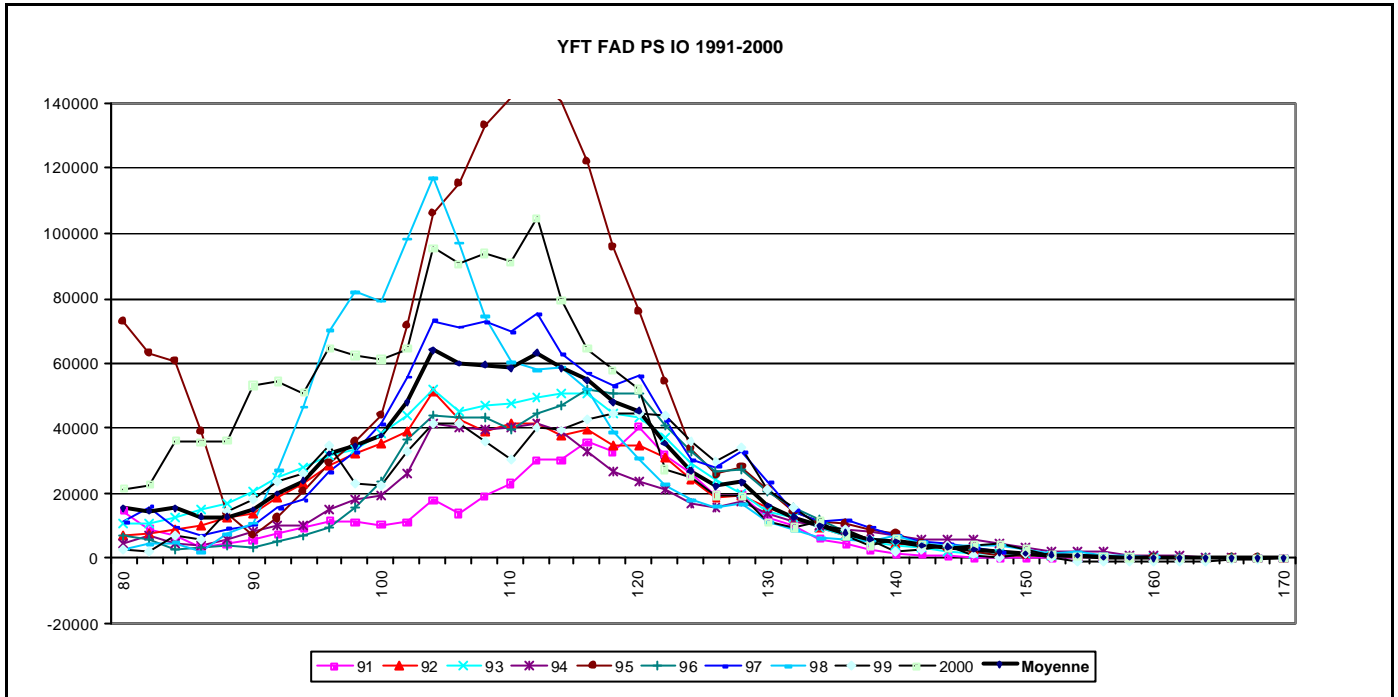


Figure 37: Yearly size distribution of large yellowfin (>80cm) taken under FADs by the purse seine fishery

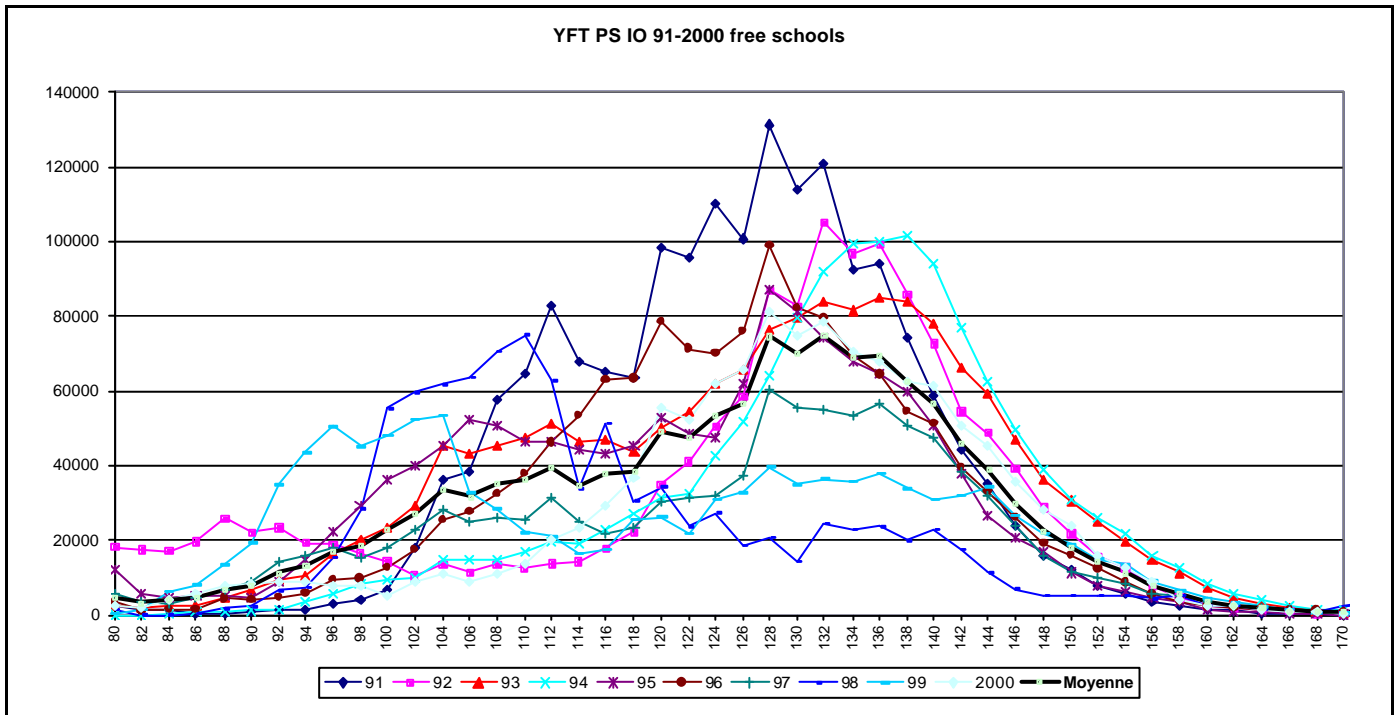


Figure 38: Yearly size distribution of large yellowfin (>80cm) taken under free schools by the purse seine fishery



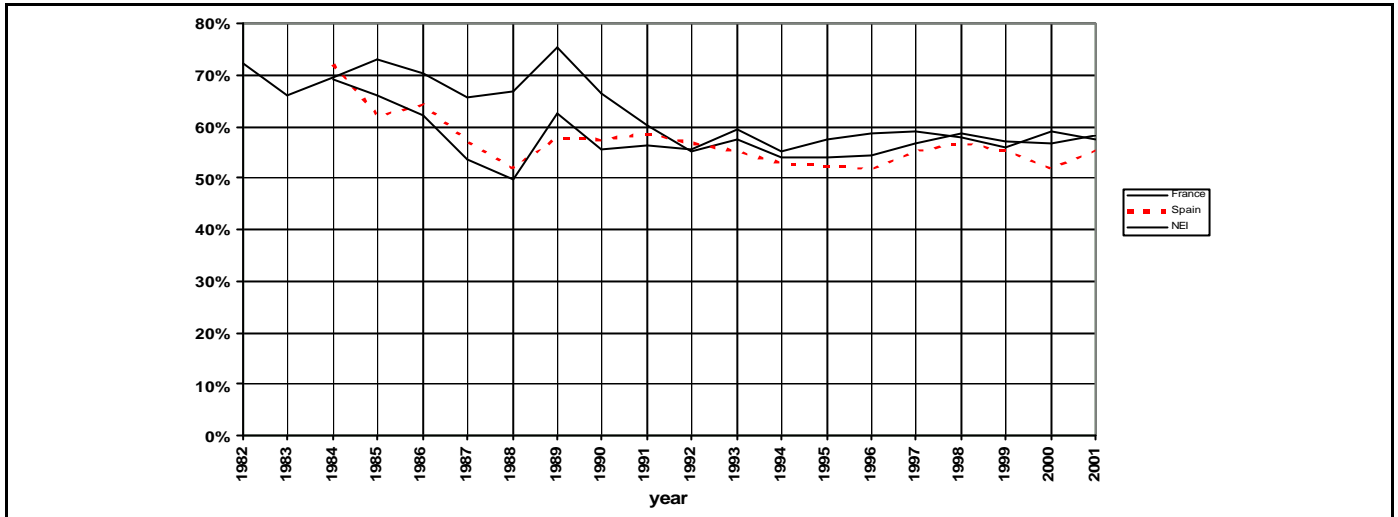


Figure 39: Log book results showing the percentage of 1 degree squares visited without catches

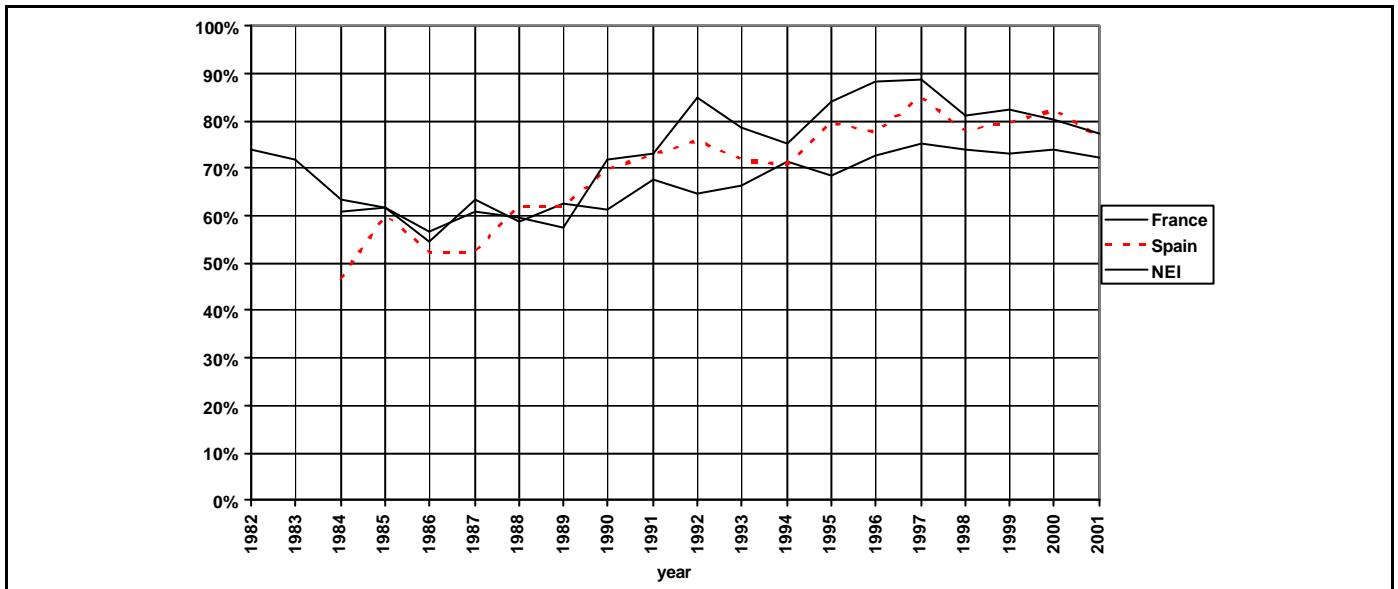


Figure 40: Yearly percentage of positive sets in the sampled fishery, by country.

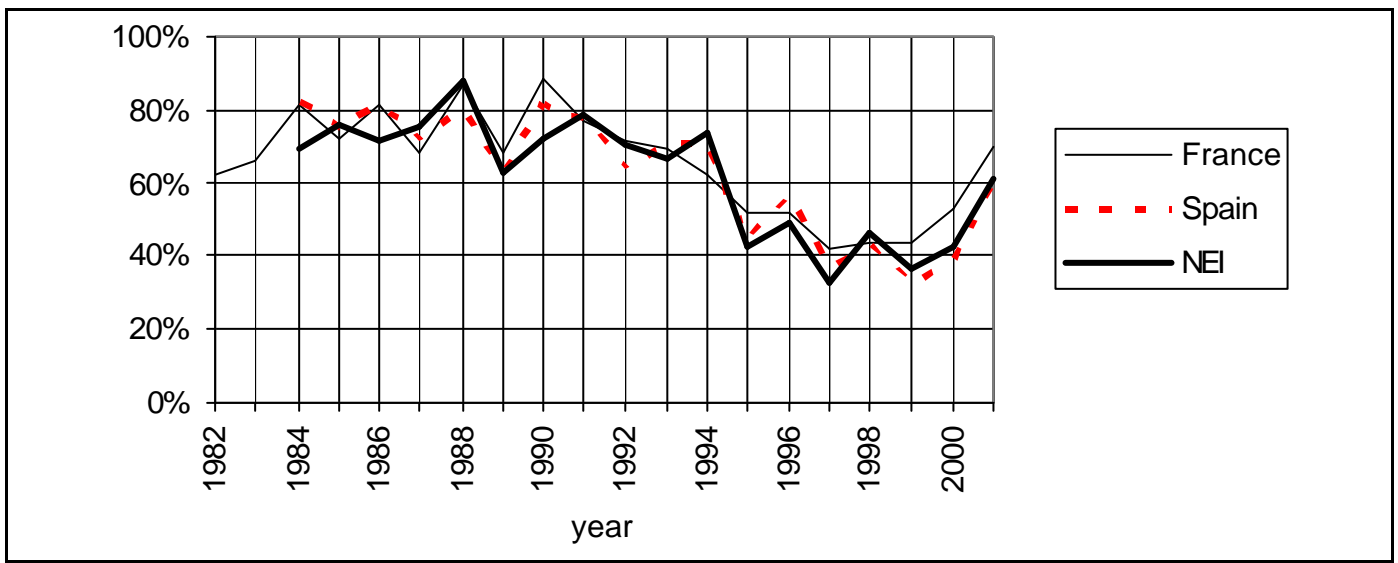


Figure 41: Yearly percentage of yellowfin in the free swimming school catches, by country.

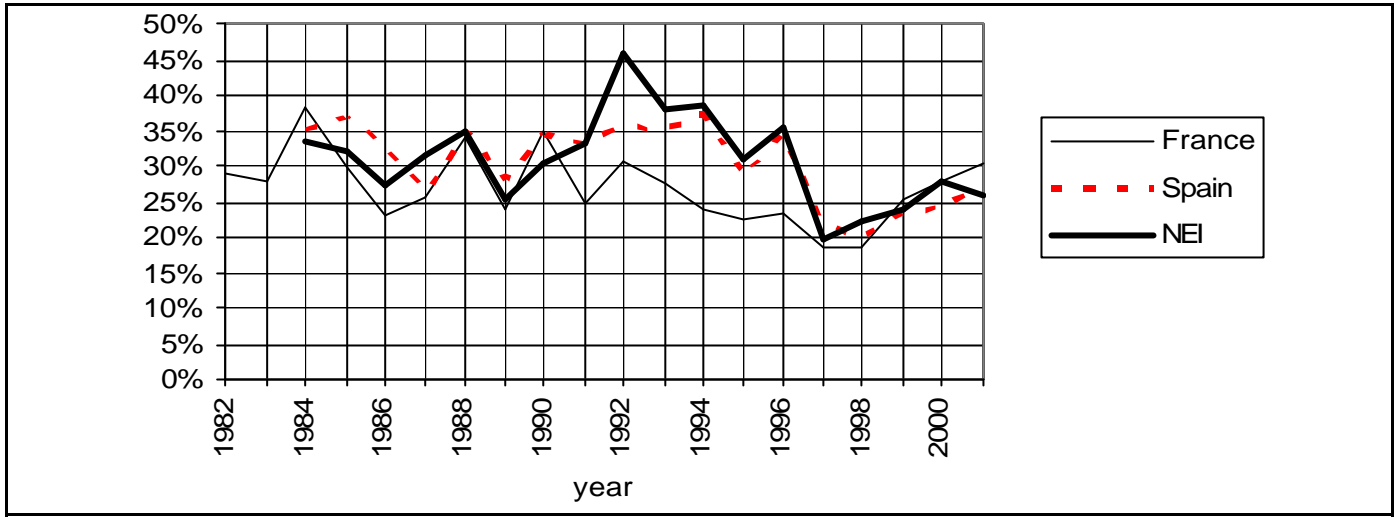


Figure 42: Yearly percentage of sets done upon free swimming schools, by country,

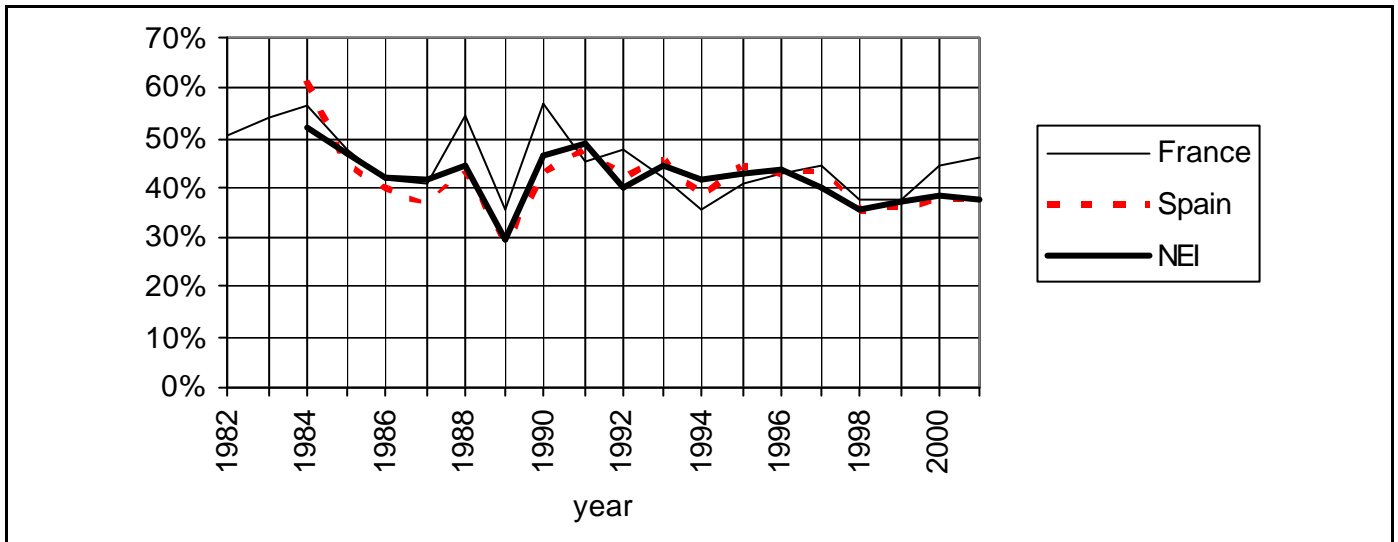


Figure 43: Yearly percentage of yellowfin in the total catches of purse seiners, by country.

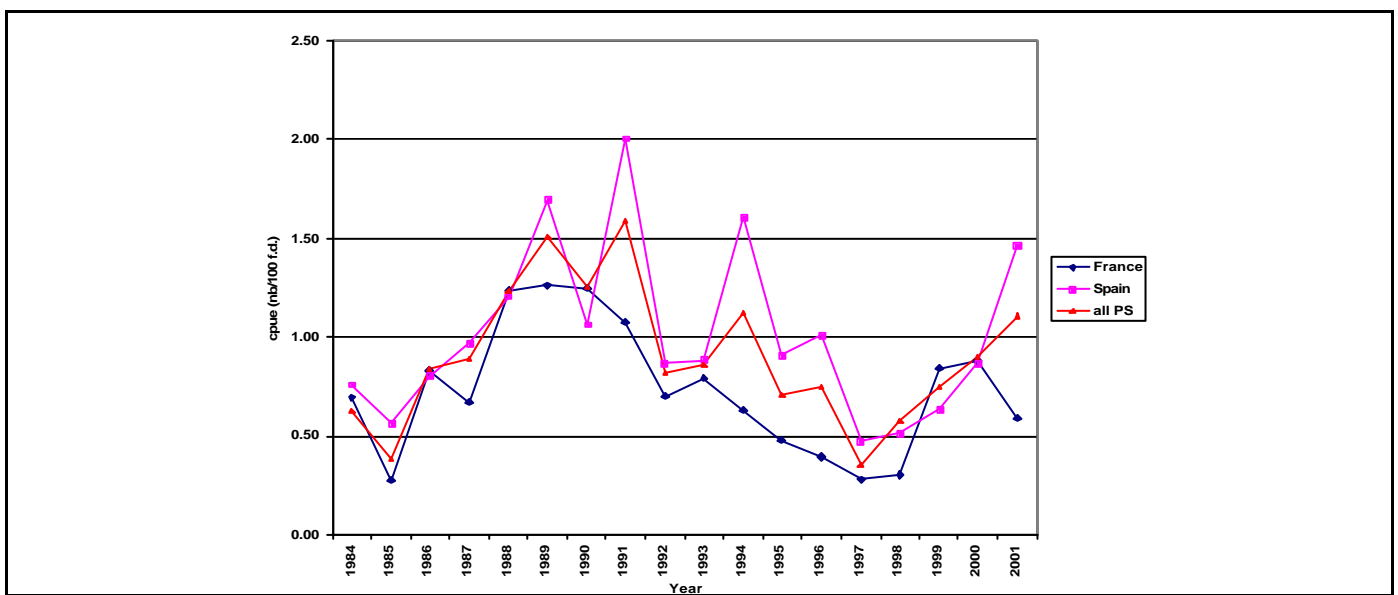


Figure 44: Catch per unit of effort of very large sets (>100t) taken by country on free schools (in tons by 100 fishing days).

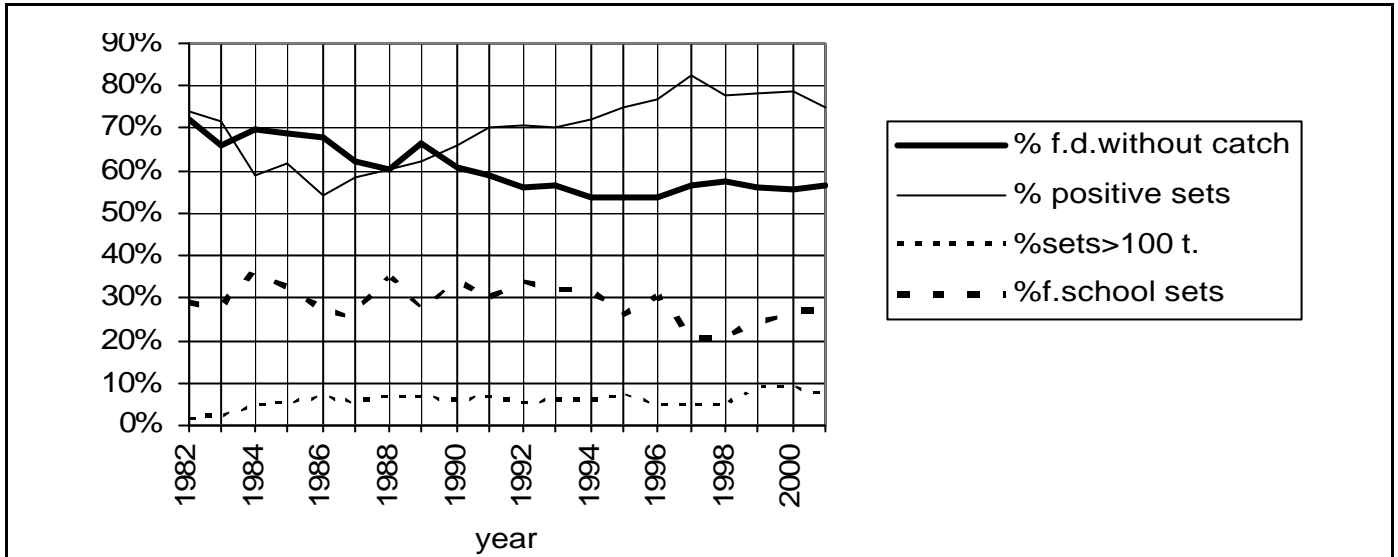


Figure 45: Various indices calculated on the total fleet of sampled purse seiners: percentage of fishing days without any catch, percentage of positive sets, percentage of large sets over 100t and percentage of free schools sets.

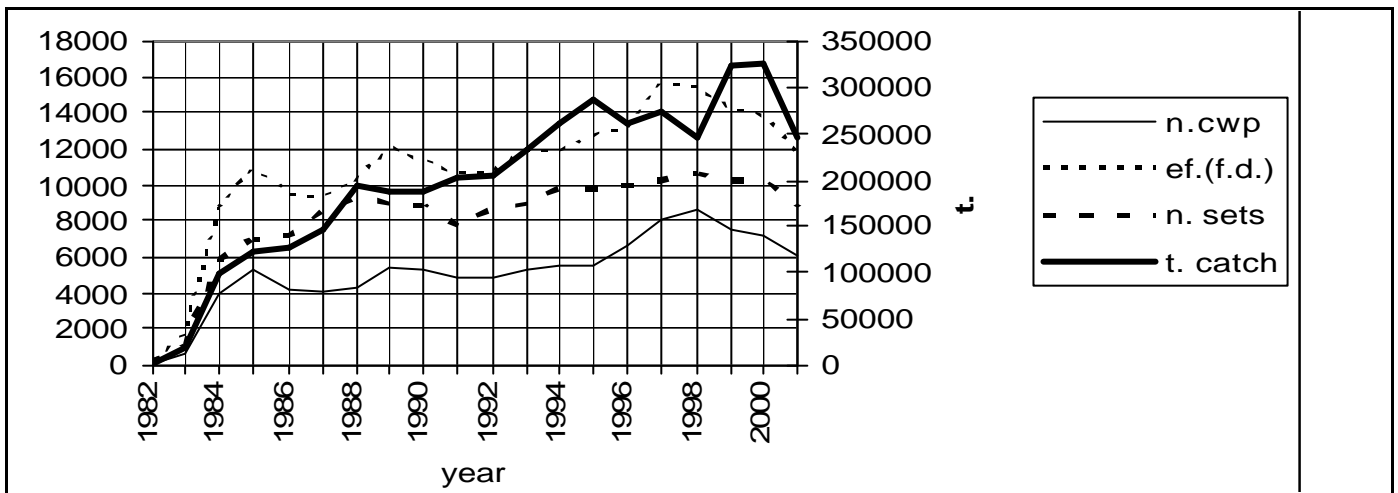


Figure 46: Various indices calculated on the total fleet of sampled purse seiners: total number of 1° squares fished, fishing effort of the vessels, number of sets and yearly total catches.

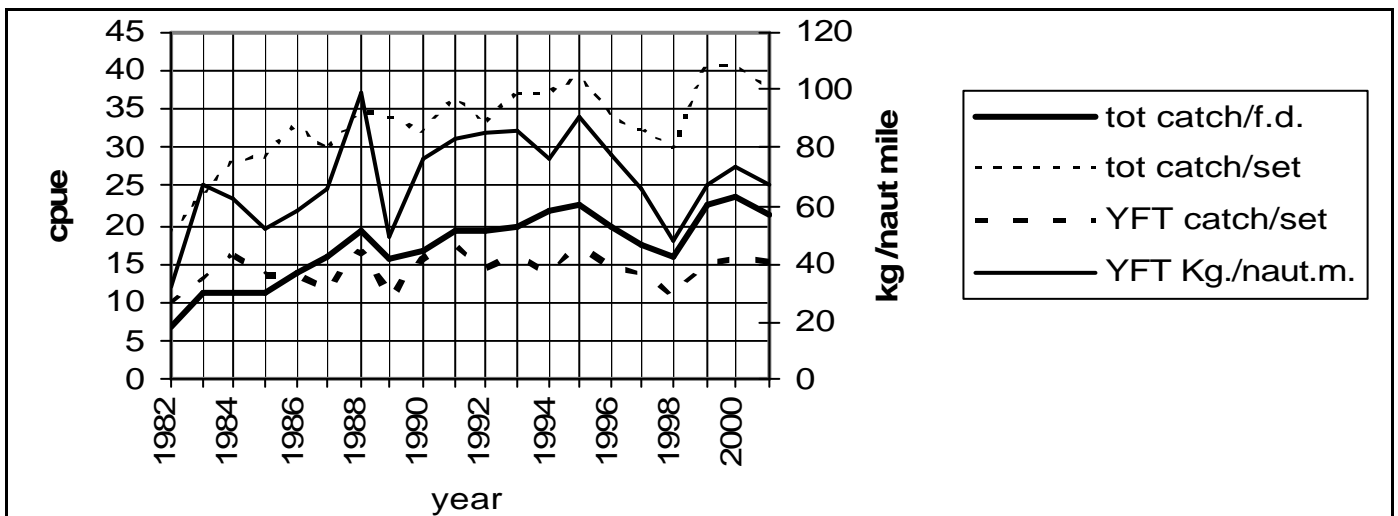


Figure 47: Various indices calculated on the total fleet of sampled purse seiners: total number of 1° squares fished, fishing effort of the vessels, number of sets and yearly total catches.

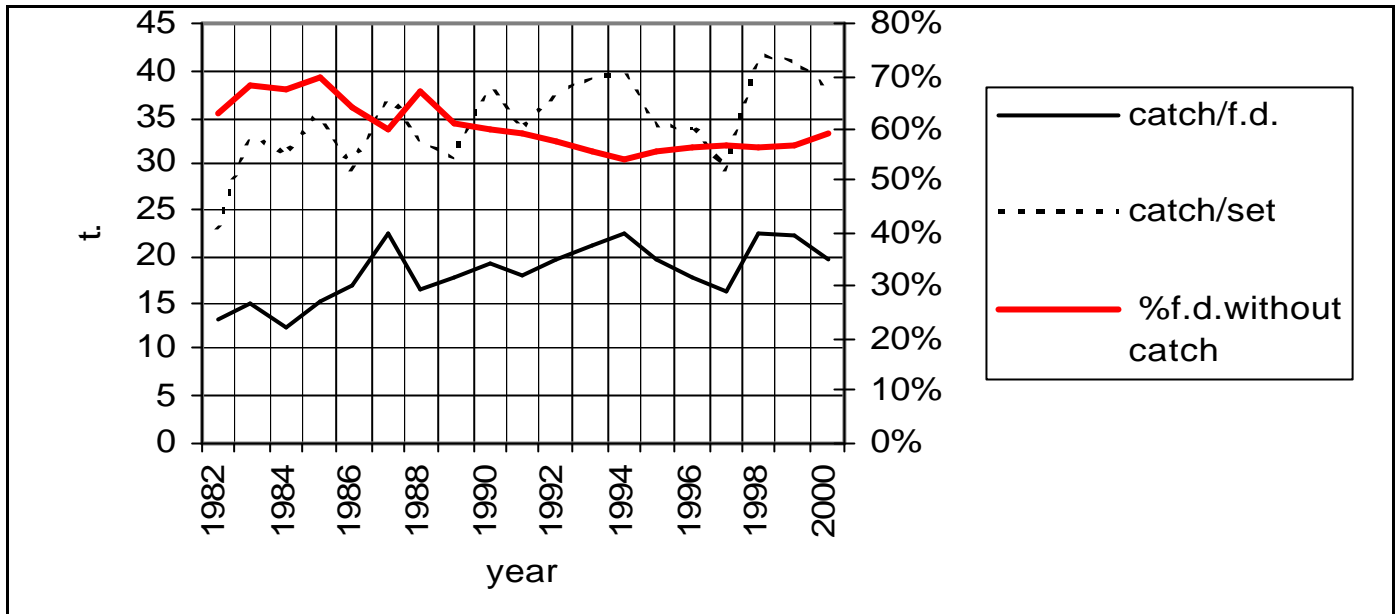


Figure 48: Various indices calculated on the selected subset of 11 permanently active purse seiners: total catch per fishing day, total catch per set, percentage of fishing days without any catch.

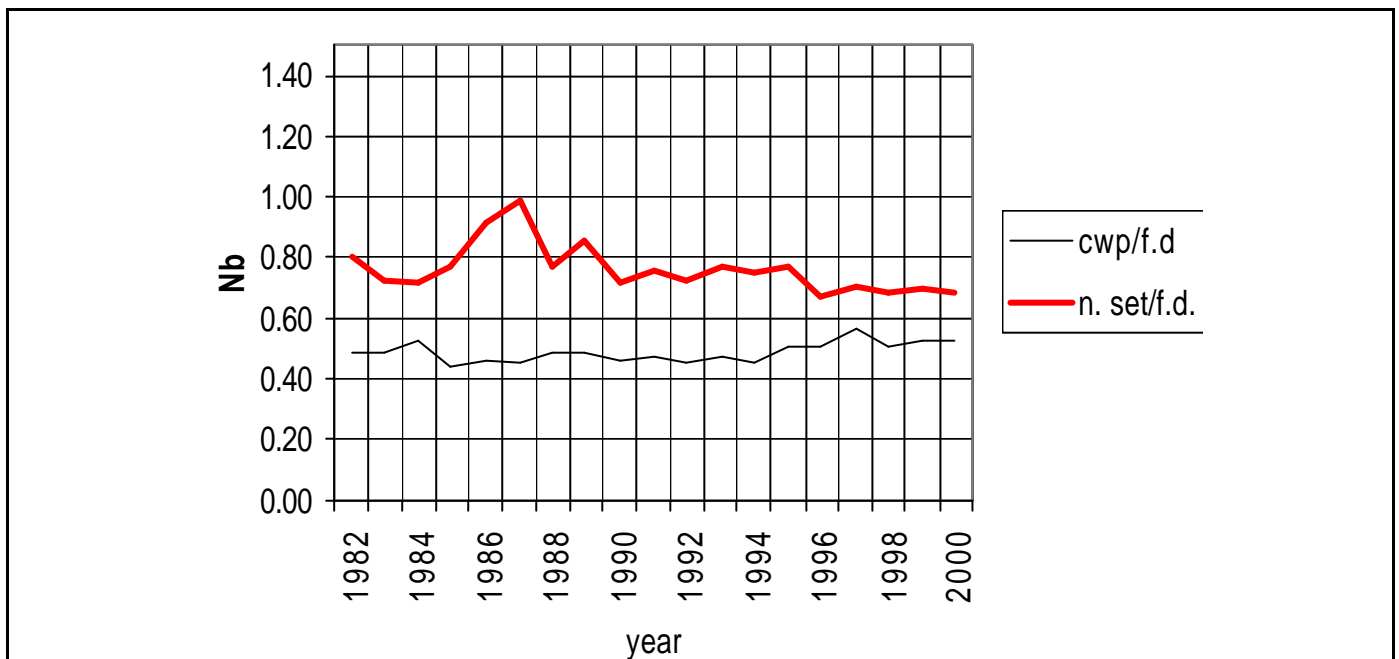


Figure 49: Various indices calculated on the selected subset of 11 permanently active purse seiners: numbers of 1° squares visited per fishing day and total numbers of sets per fishing day.