

IOTC CEdata – Exploratory Analysis – Longline

Humber A. Andrade

Applied Statistical Modeling
Fisheries and Aquaculture Department – DEPAq
Federal Rural University of Pernambuco – UFRPE

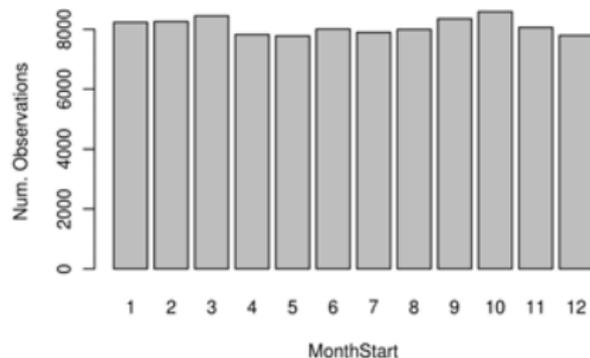
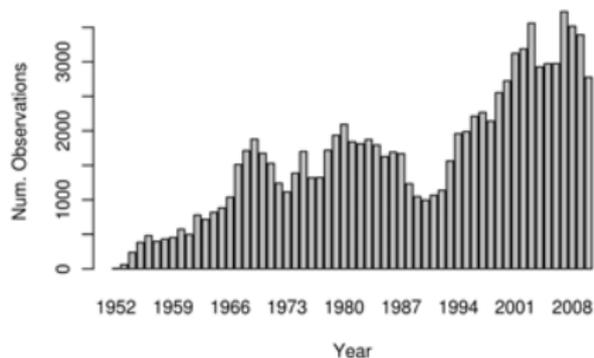
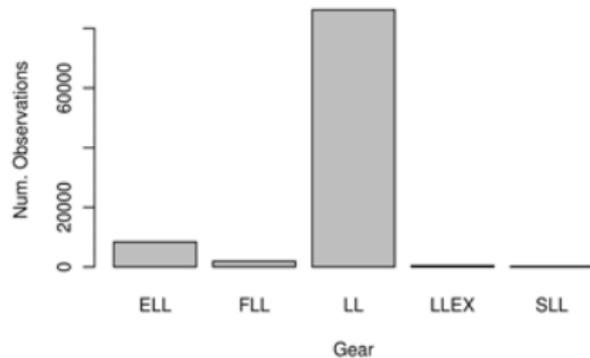
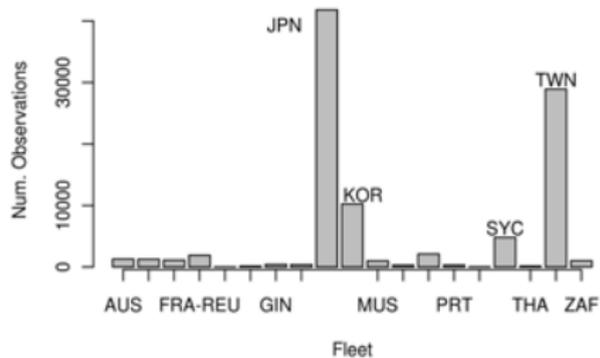


Summary

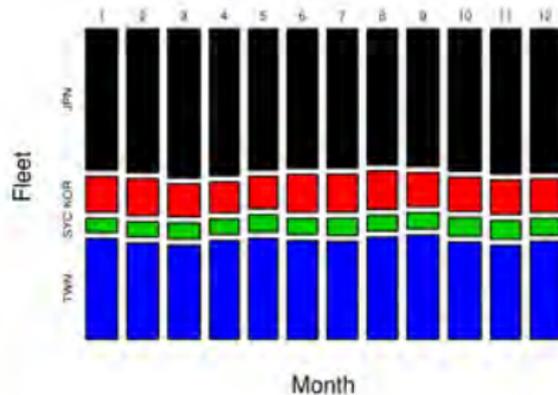
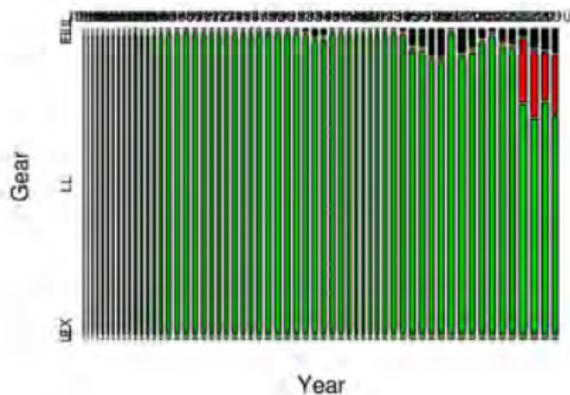
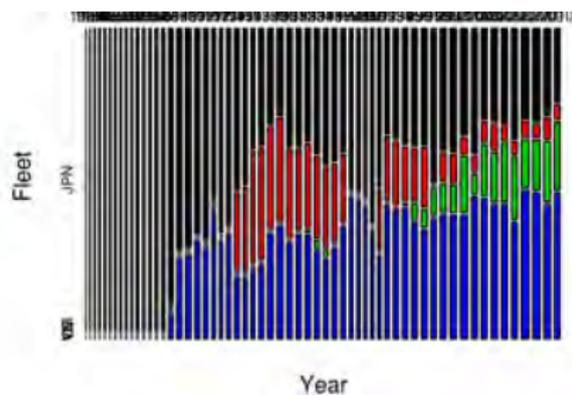
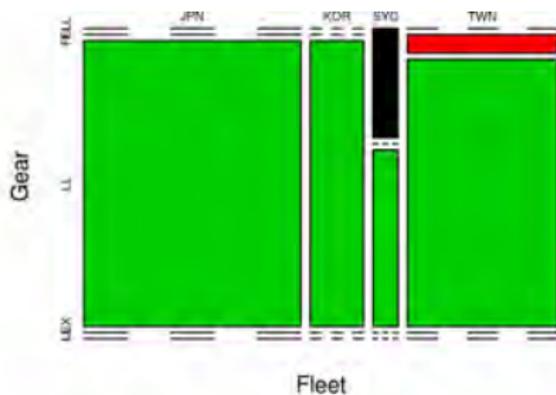
- 1 Overall
 - Japan Dataset
 - Taiwan Dataset
 - Korea Dataset
 - Seychelles Dataset
- 2 Blue Marlin (BUM)
 - Japan Dataset
 - Taiwan Dataset
 - Korea Dataset
 - Seychelles Dataset
- 3 Black Marlin (BLM)
 - Japan Dataset
 - Taiwan Dataset
- Korea Dataset
- Seychelles Dataset
- 4 Striped Marlin (MLS)
 - Japan Dataset
 - Taiwan Dataset
 - Korea Dataset
 - Seychelles Dataset
- 5 Indo-Pacific Sailfish (SFA)
 - Japan Dataset
 - Taiwan Dataset
 - Korea Dataset
 - Seychelles Dataset
- 6 Final Remarks



Number of Observations



Balance

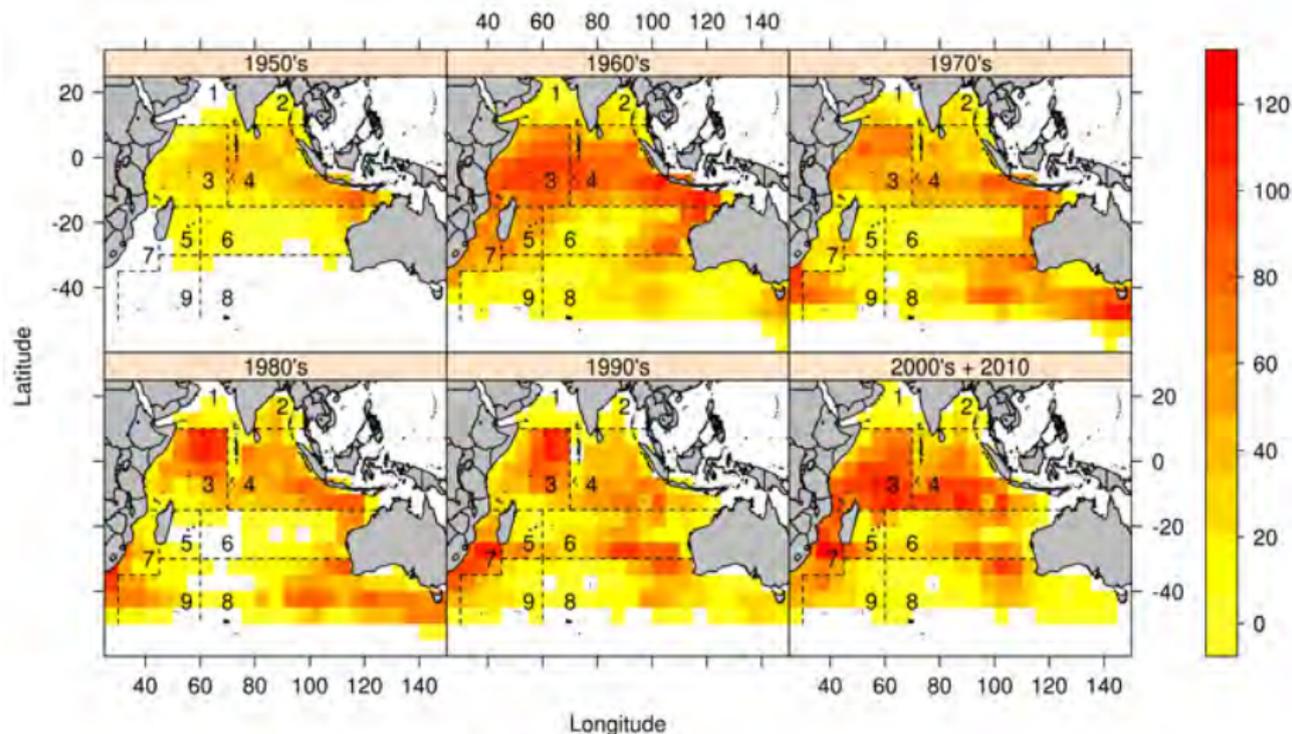


Remarks/Questions

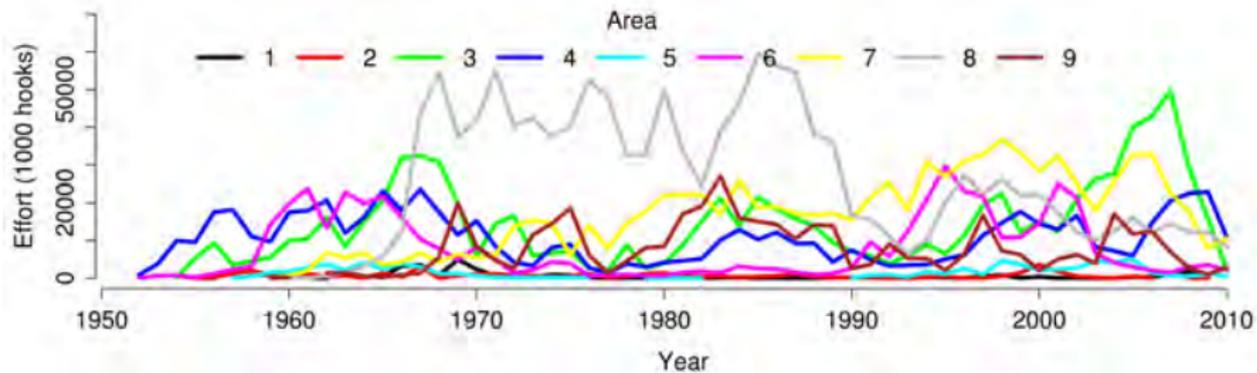
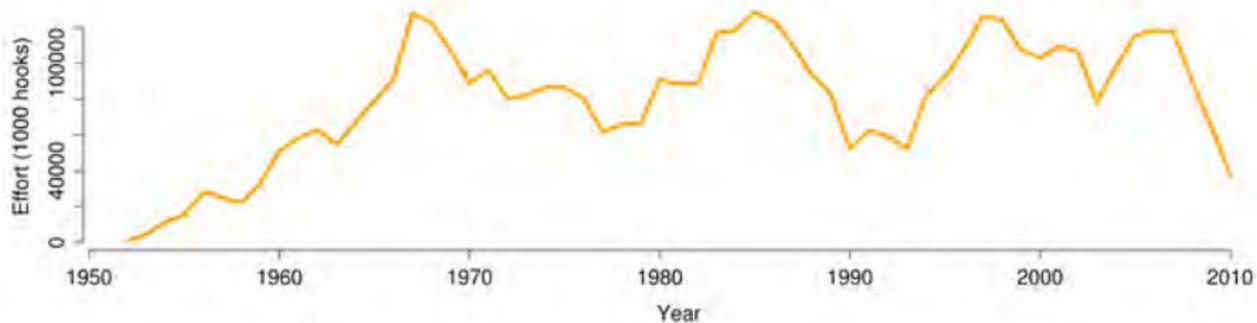
- 1 Sample size is large for LL Korea, Japan, Seychelles and Taiwan
- 2 Continuous series for more than two decades (LL – Japan and Taiwan)
- 3 LL + ELL + LL ?



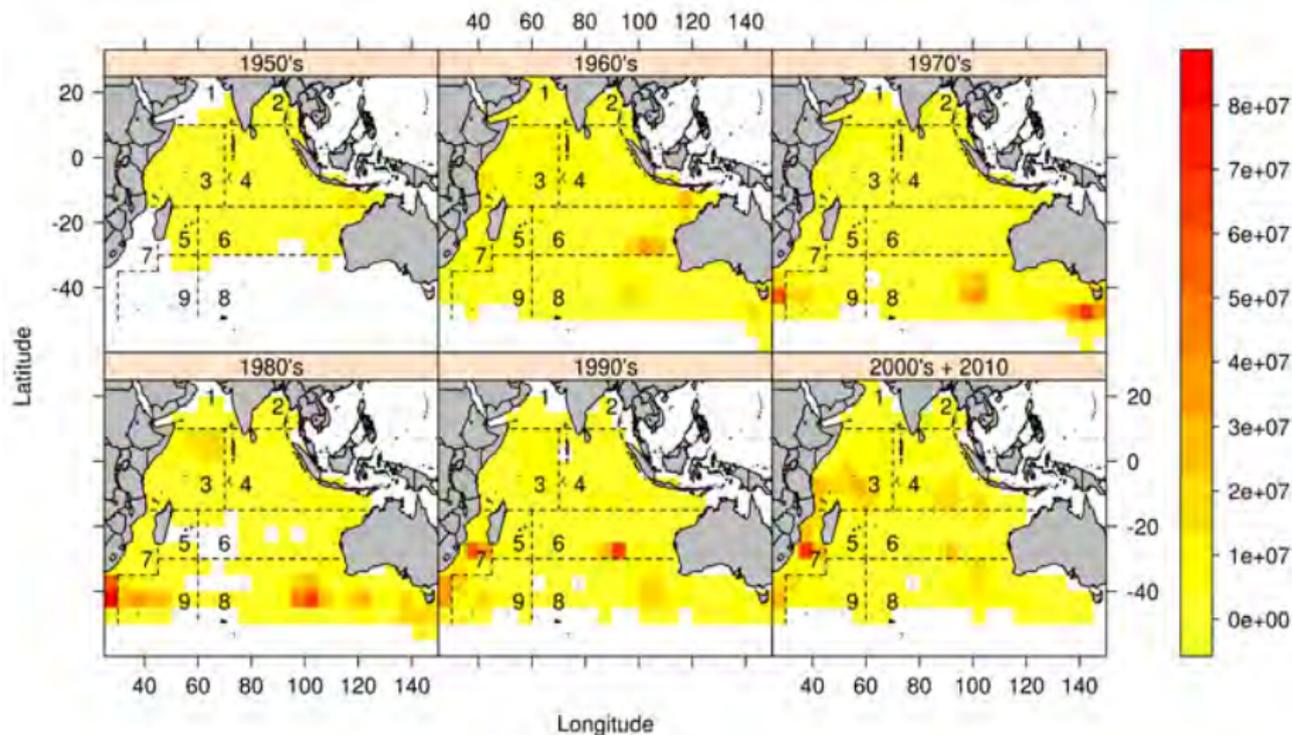
Japan Dataset - Sample Size



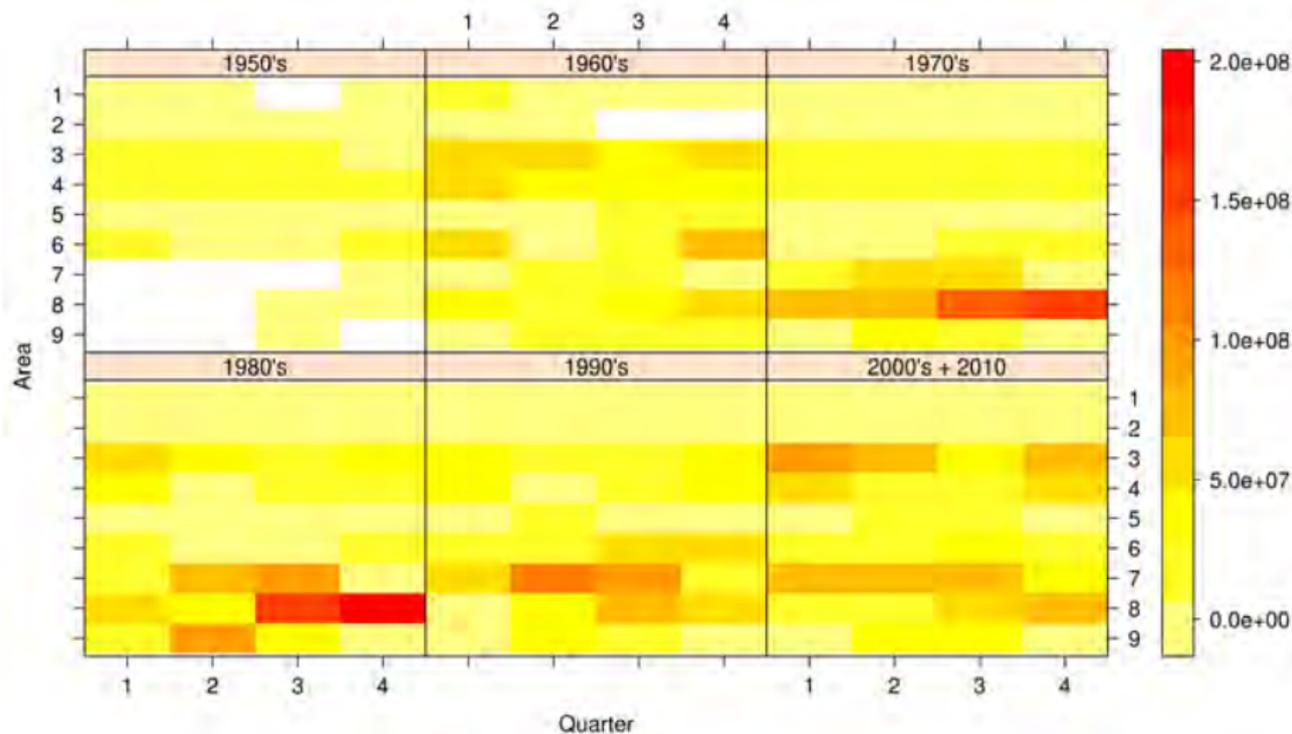
Effort



Effort - number of hooks - Decade x Lat x Lon



Effort - number of hooks - Decade x Quarter x Area

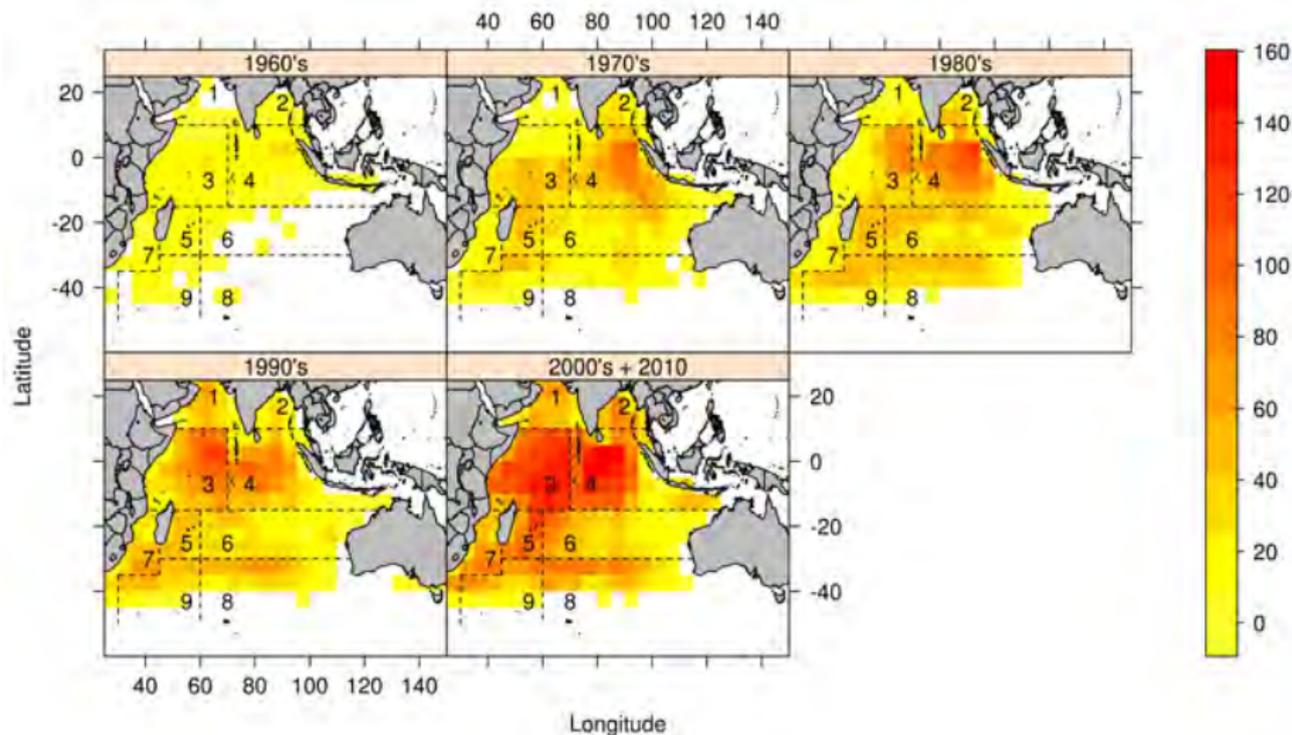


Remarks – LL Japan Dataset

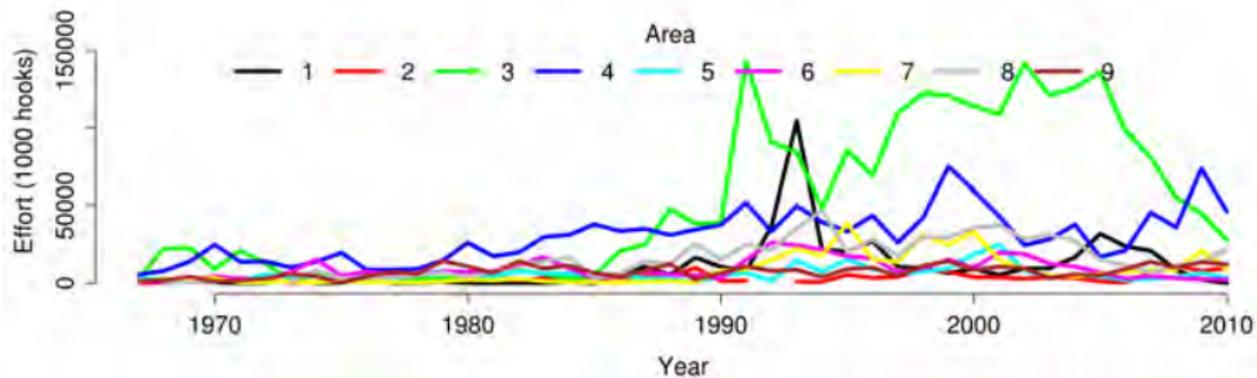
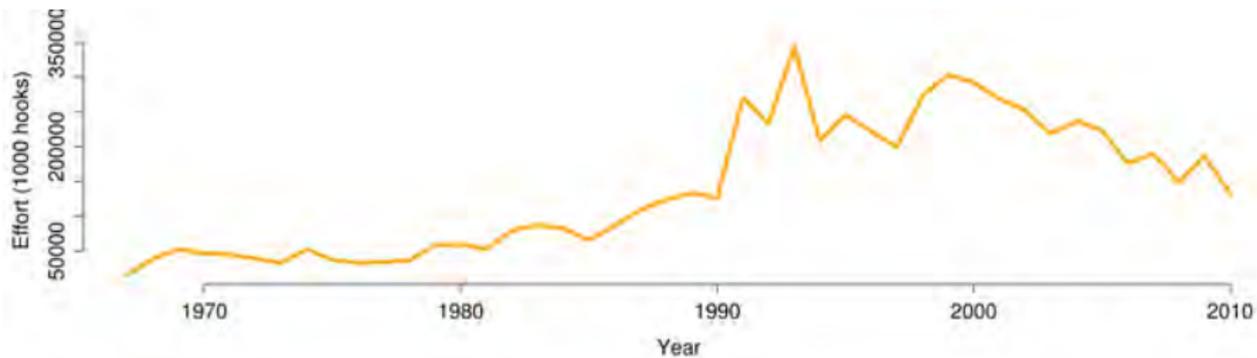
- ① Consistent time series in the sense the sample size is large for all areas, quarters and decades
- ② High efforts appear in areas 3, 4, 7 and 8. Effort was especially high in area 8 during 1970's and 1980's (3rd and 4th)



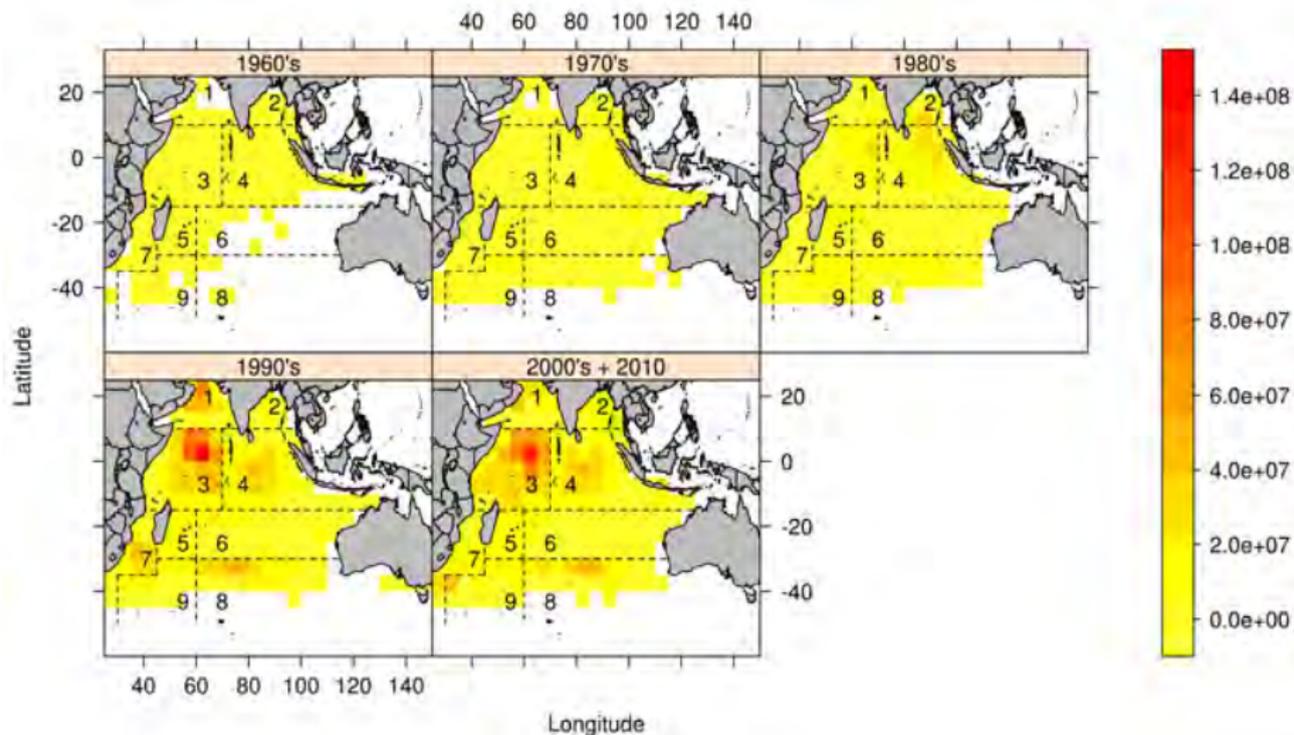
Taiwan Dataset - Sample Size



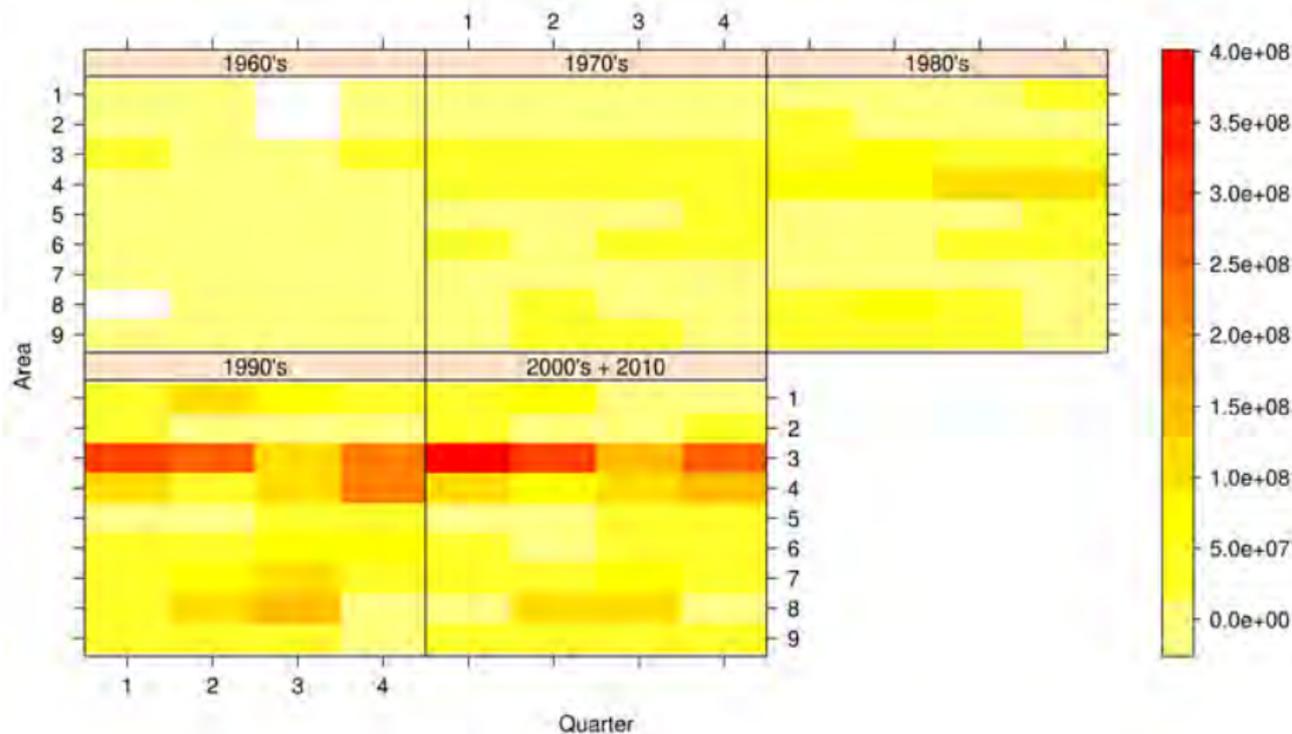
Effort



Effort - number of hooks - Decade x Lat x Lon



Effort - number of hooks - Decade x Quarter x Area

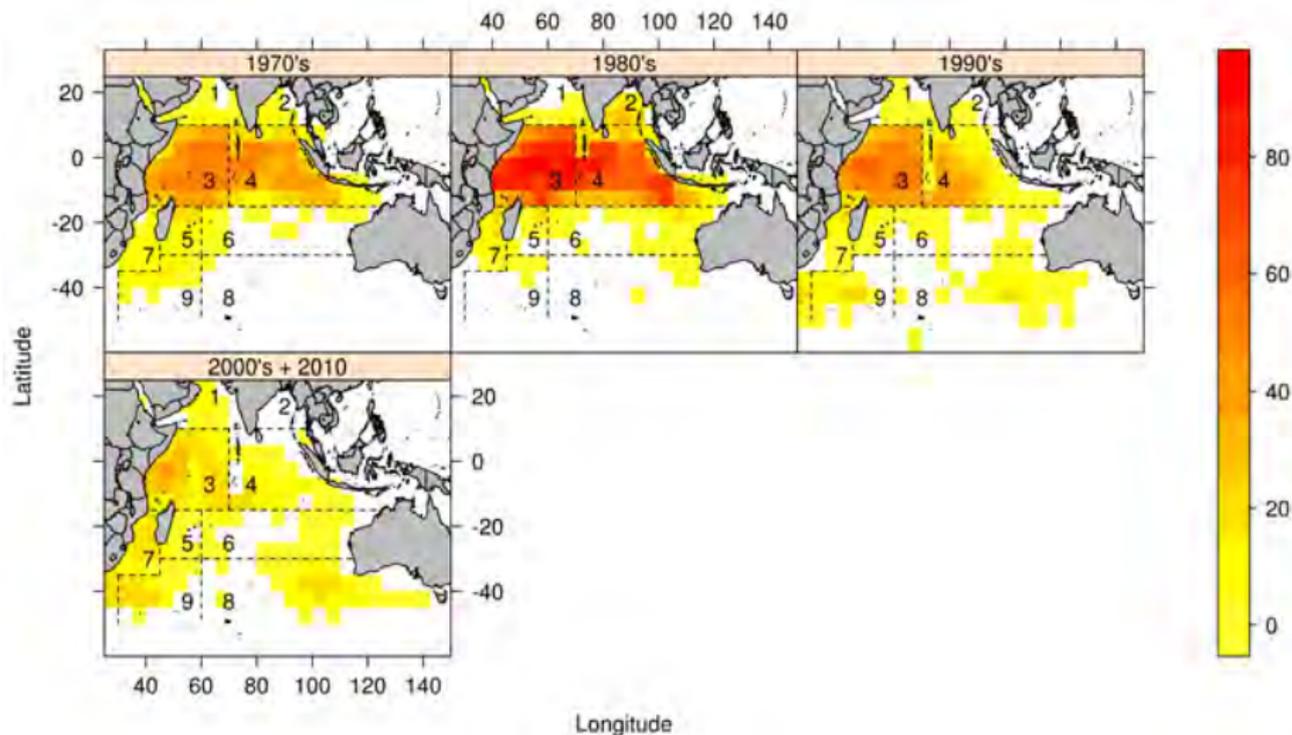


Remarks – LL Taiwan Dataset

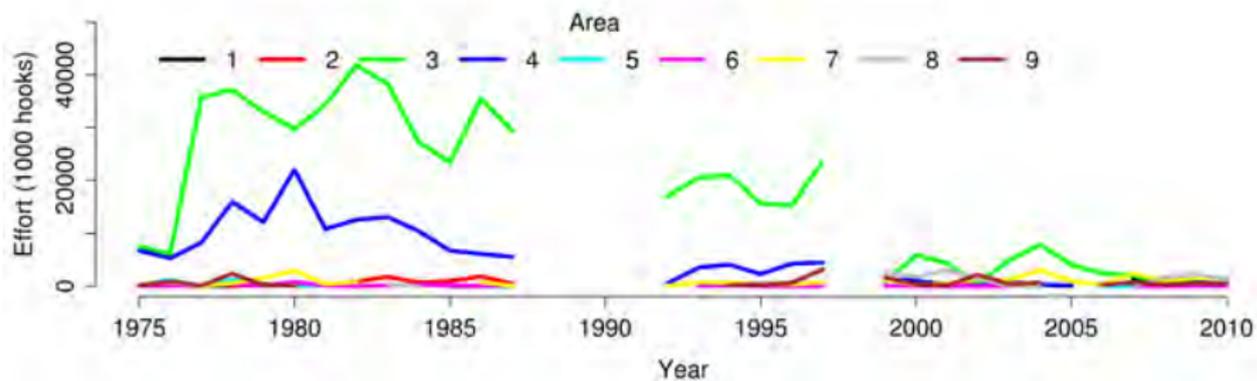
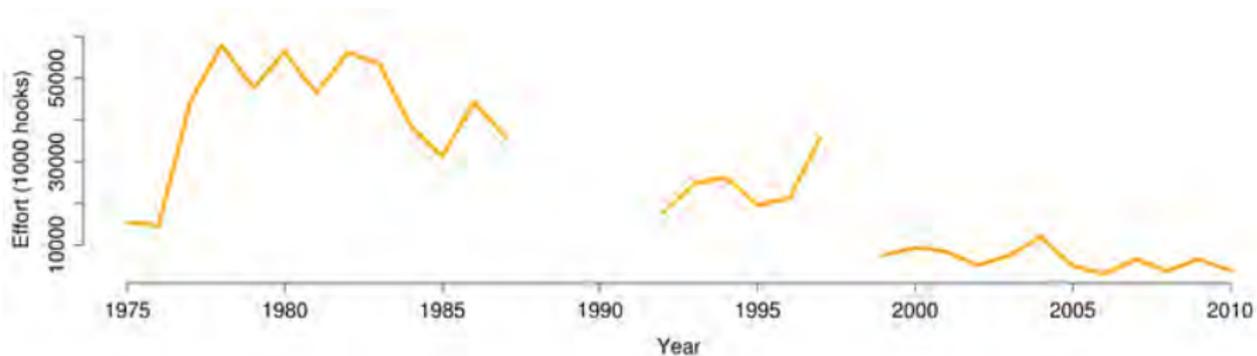
- ① Sample size is especially large in area 3 though time series for area 4 is also large
- ② Effort in 3rd quarter is smaller than in other quarters in the main fishing ground (area 3)



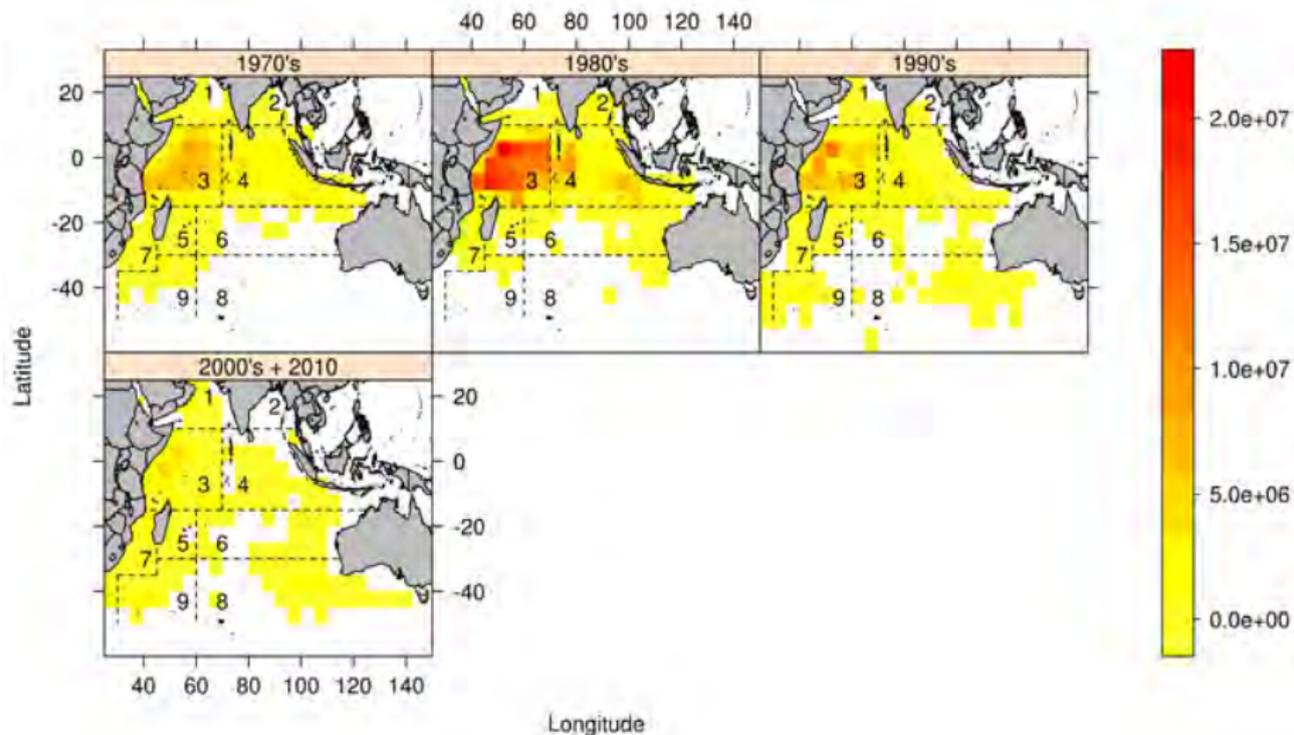
Korea Dataset - Sample Size



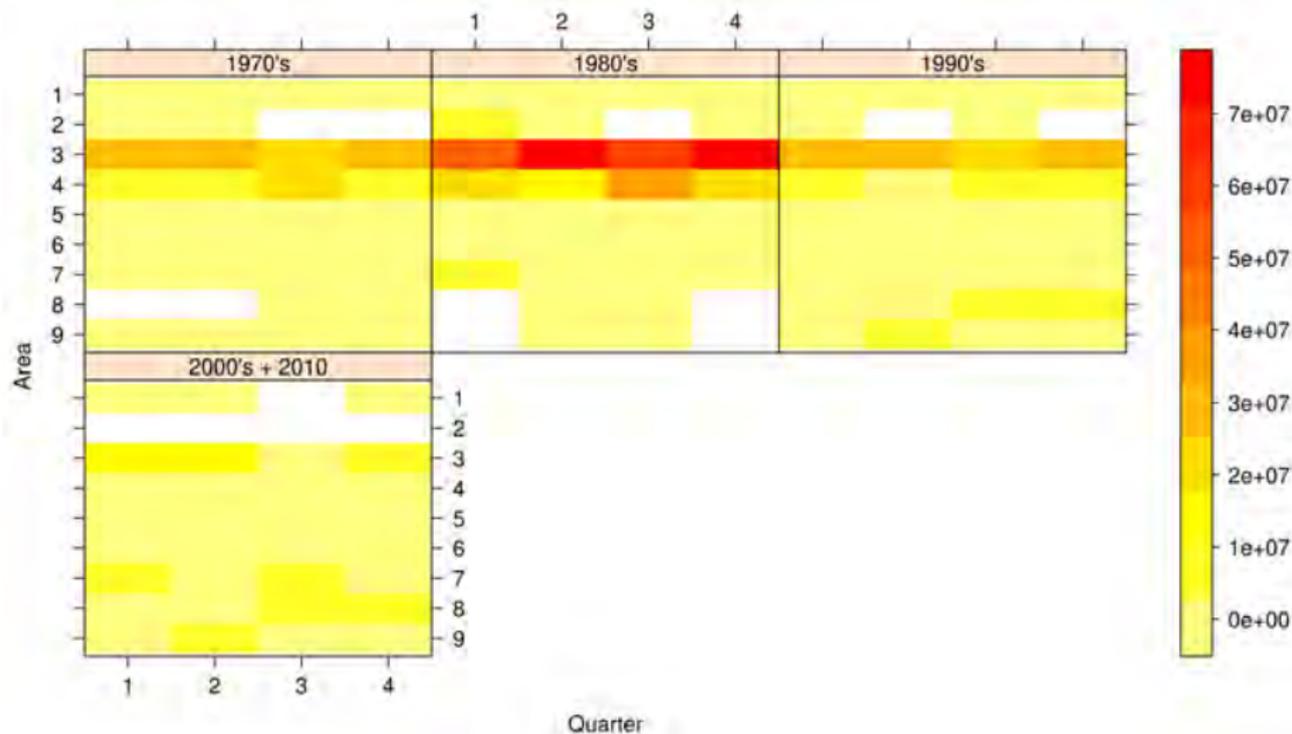
Effort



Effort - number of hooks - Decade x Lat x Lon



Effort - number of hooks - Decade x Quarter x Area

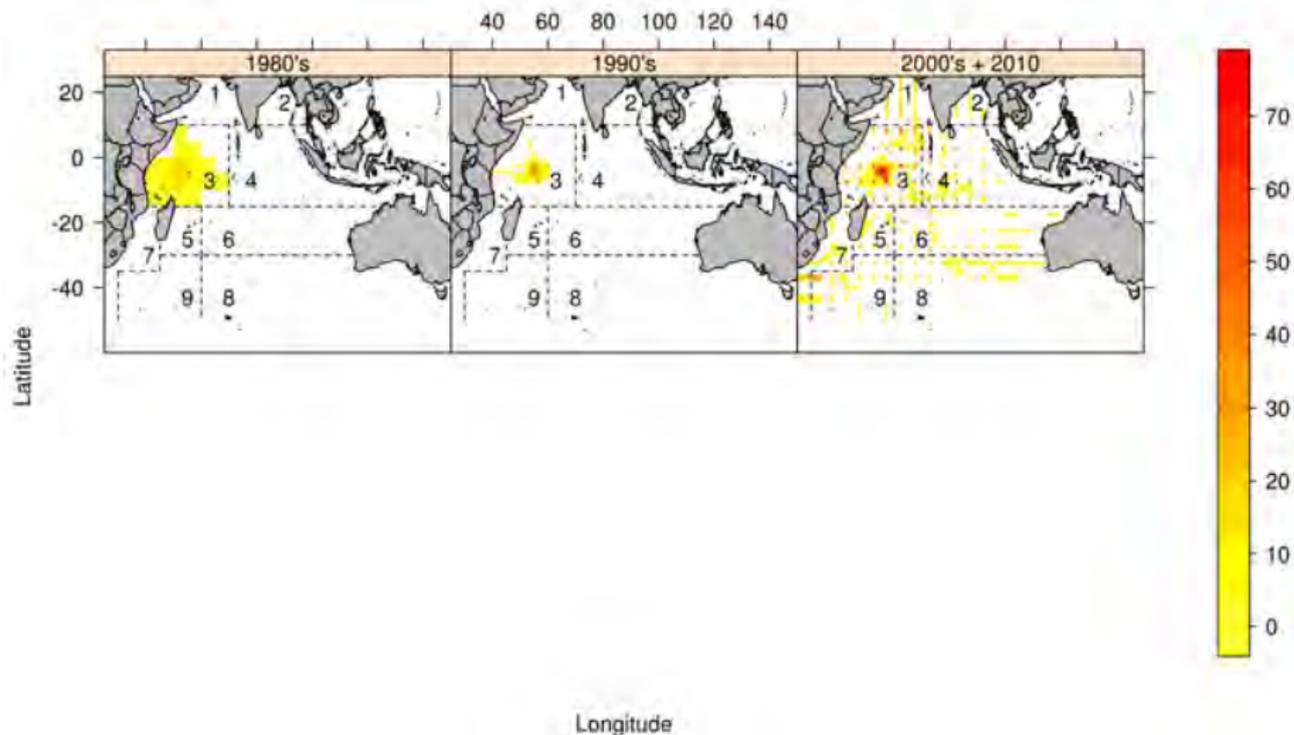


Remarks – LL Korea Dataset

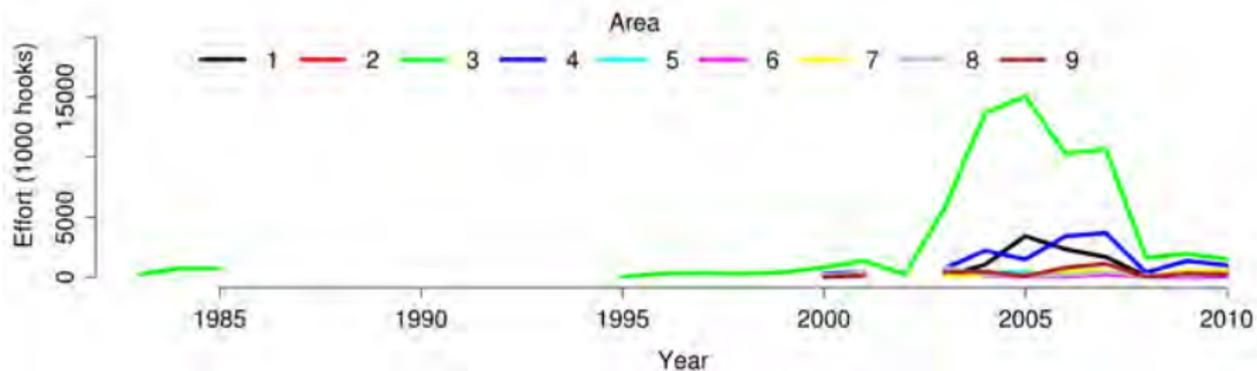
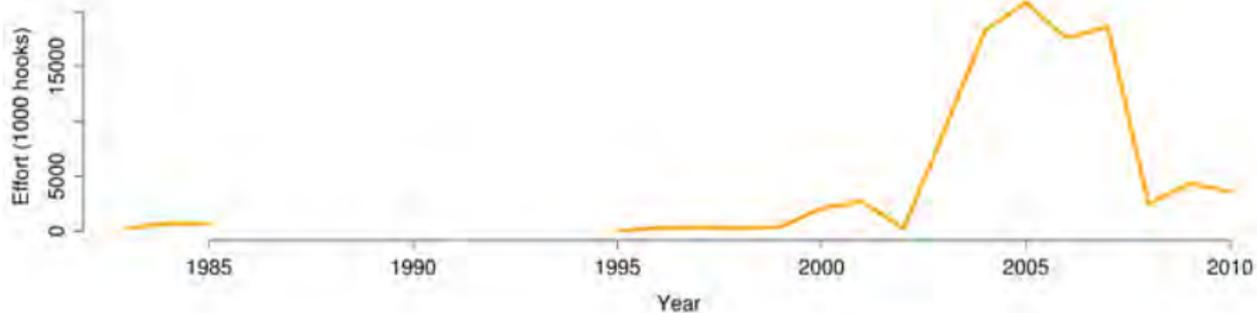
- 1 Sample size is especially large in area 3 in 1980's
- 2 There are no data for several years



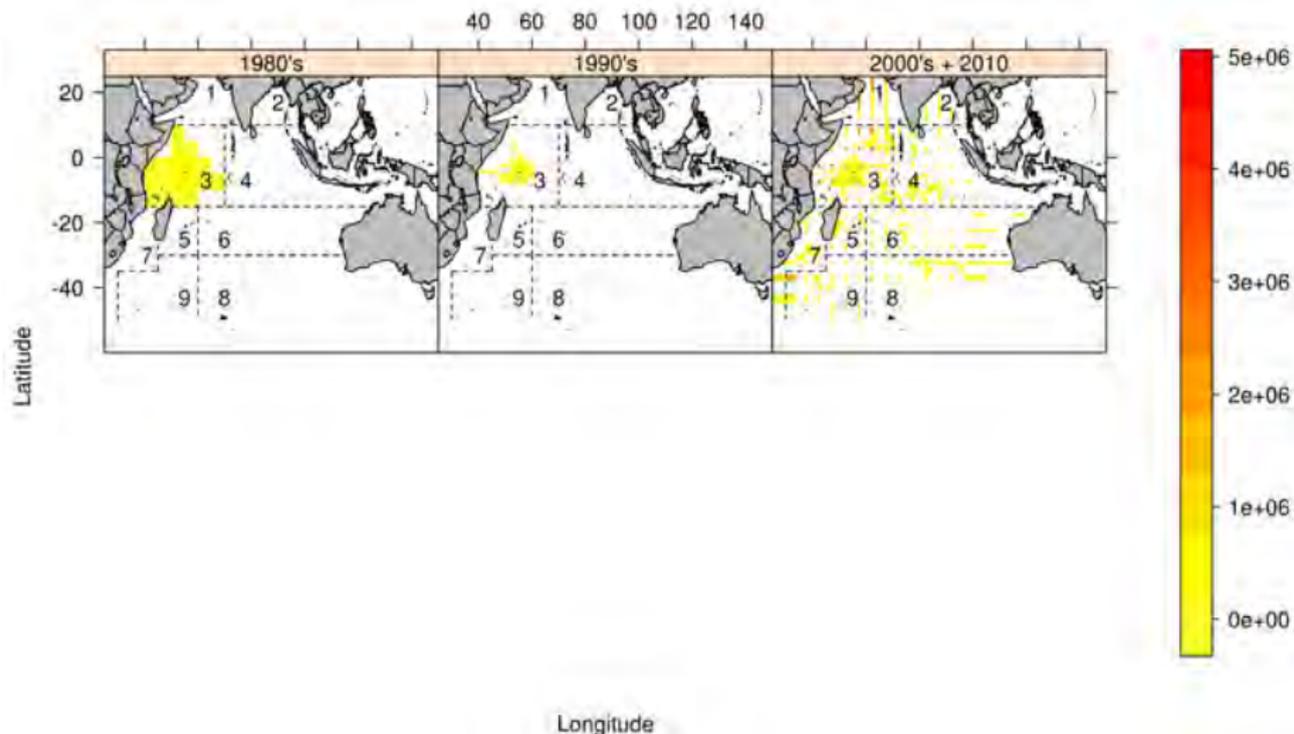
Seychelles Dataset - Sample Size



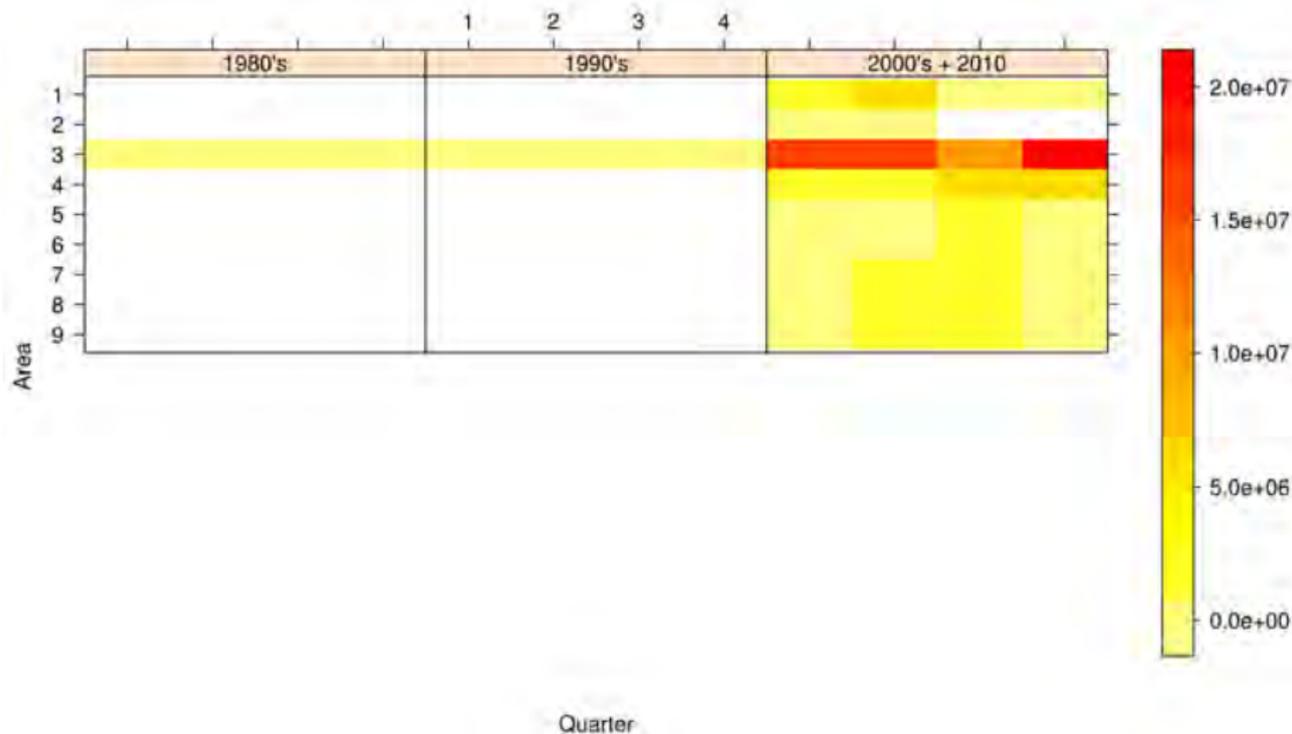
Effort



Effort - number of hooks - Decade x Lat x Lon



Effort - number of hooks - Decade x Quarter x Area



Remarks – LL Seychelles Dataset

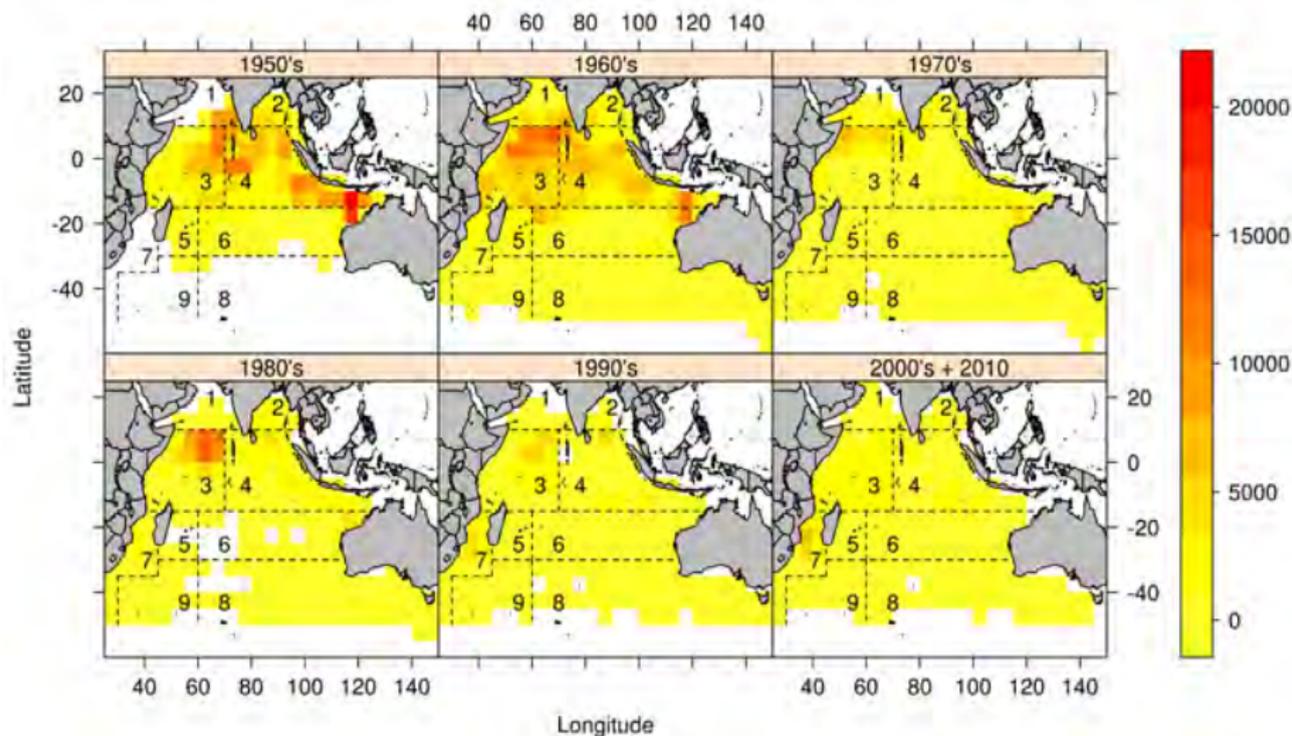
- 1 Sample size is especially large in area 3 in 2000's
- 2 There are no data for several years



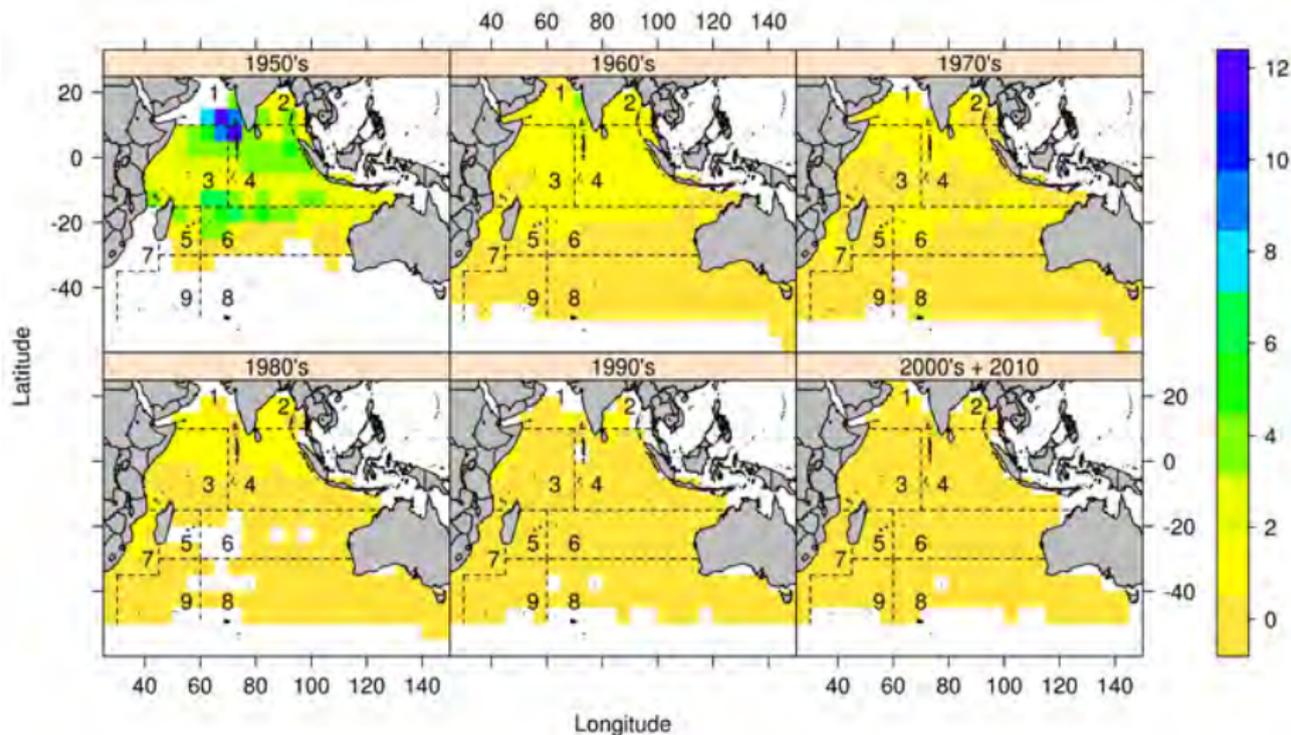
Blue Marlin (BUM)



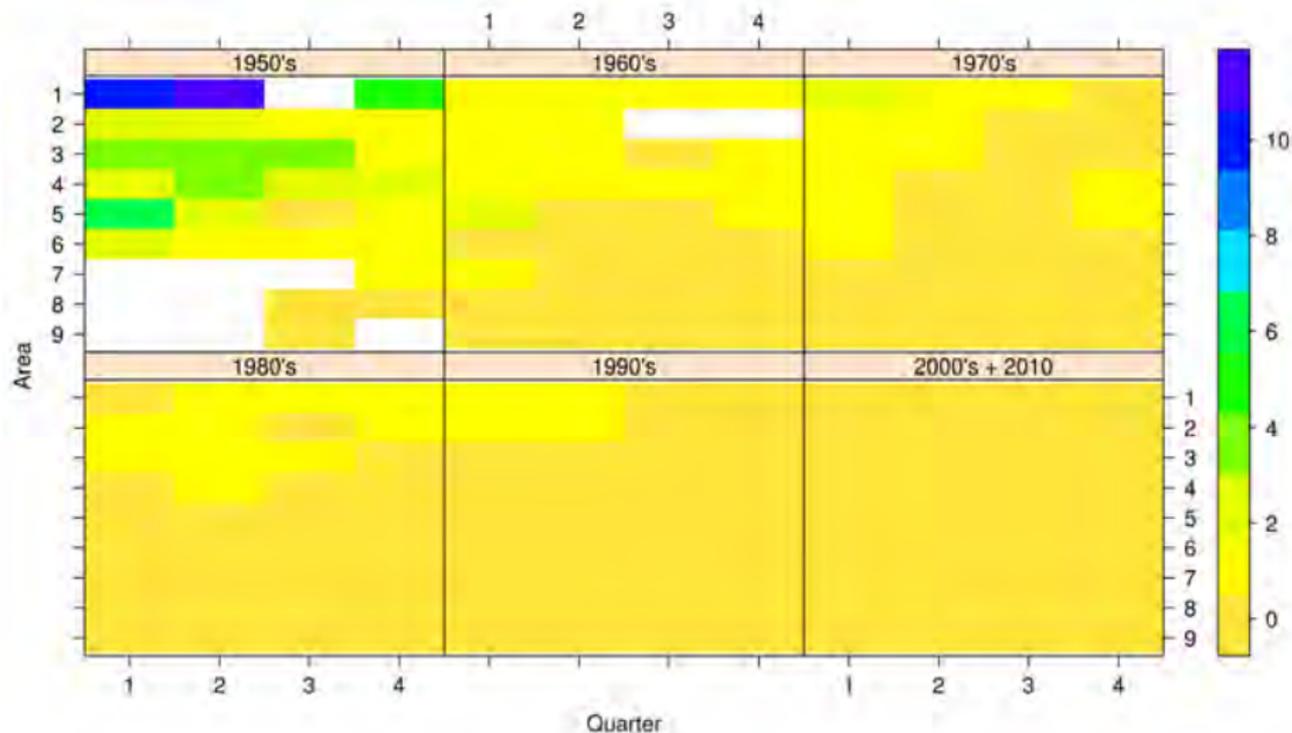
BUM - number of fish - Japan Dataset



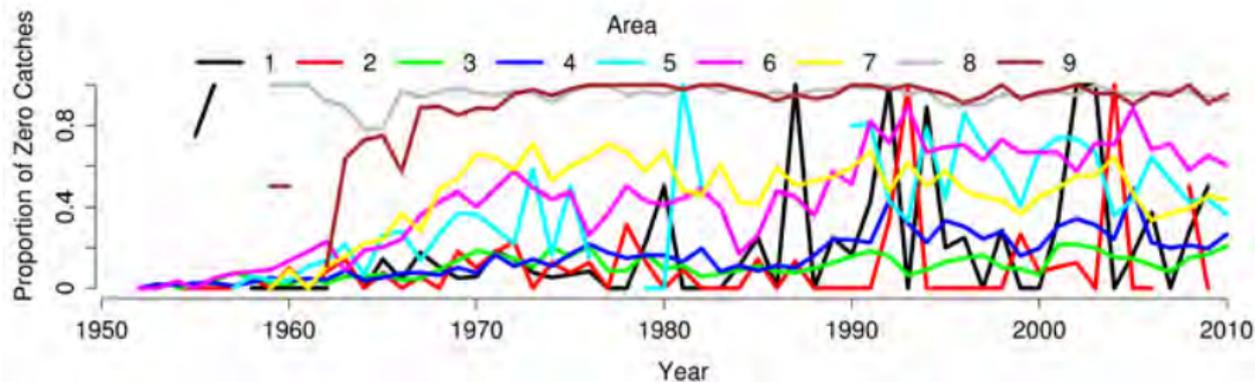
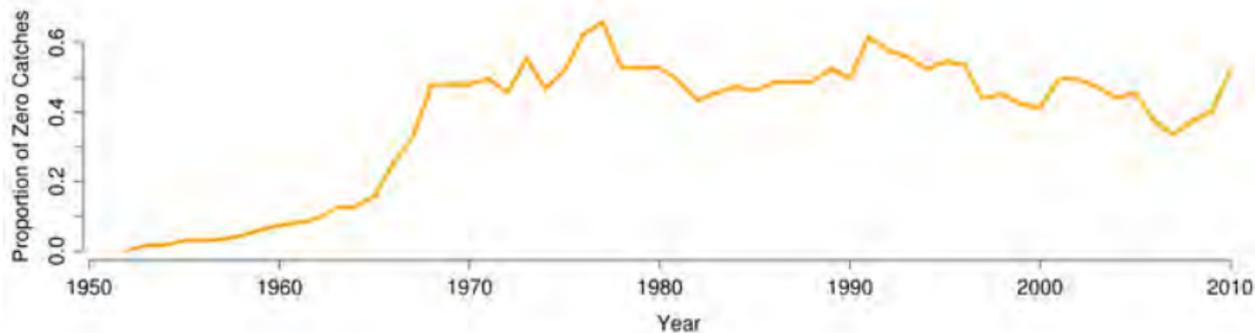
BUM - number of fish/1000 hooks - Decade x Lat x Lon



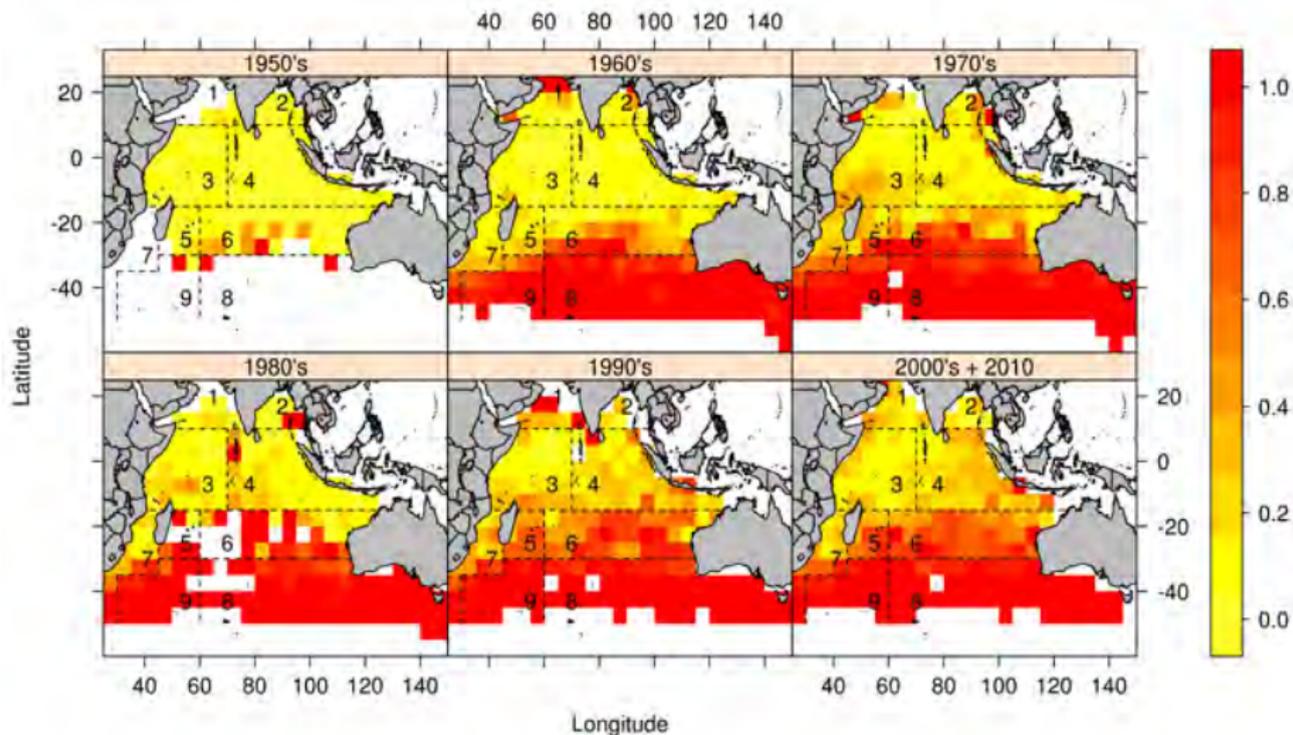
BUM - number of fish/1000 hooks - Decade x Quarter x Area



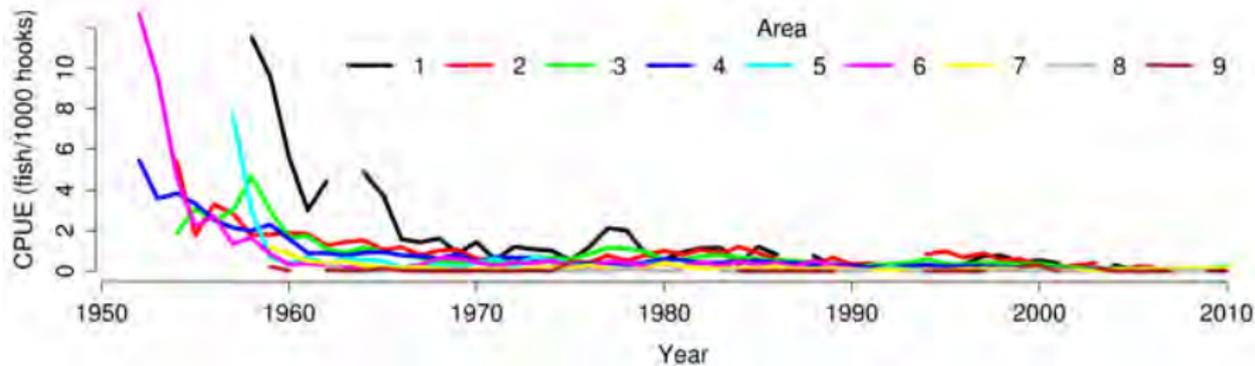
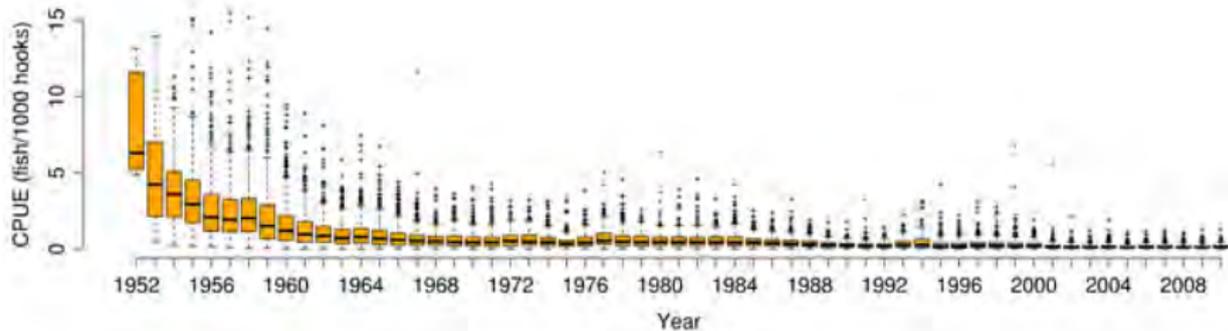
Proportion of Zero Catches



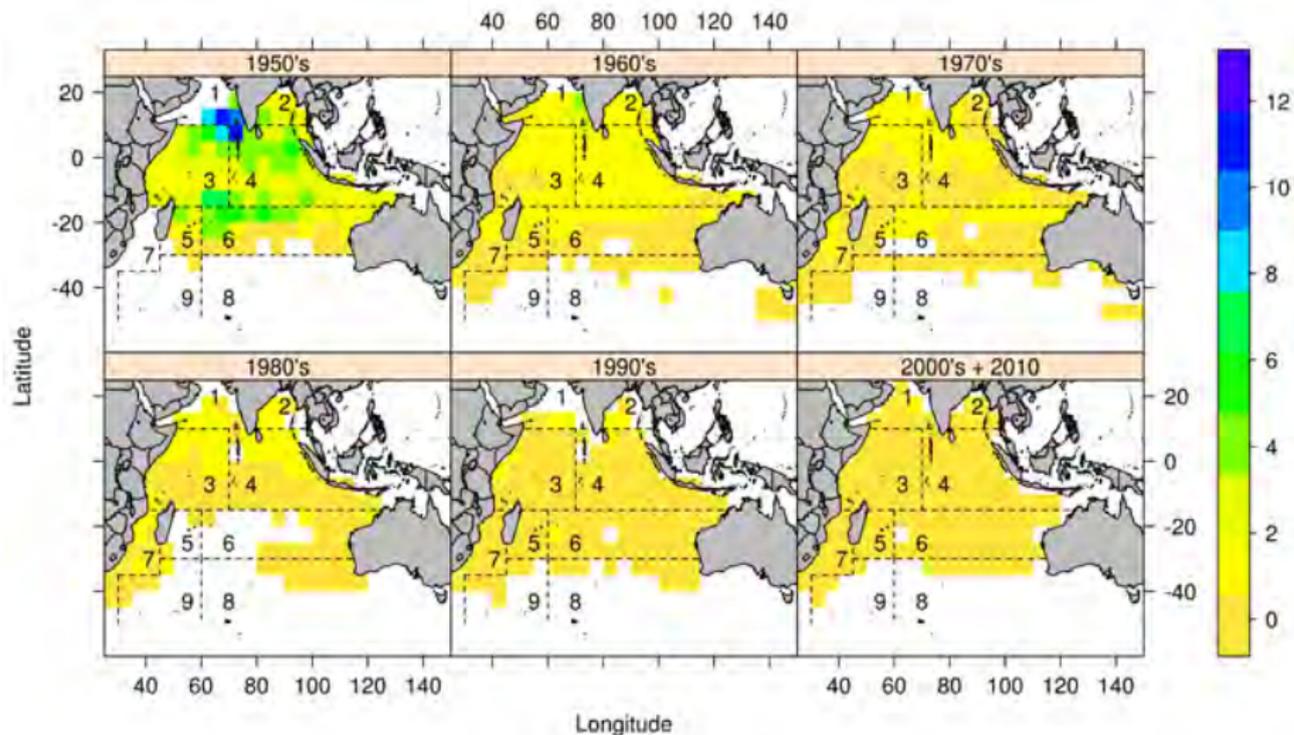
Proportion of Zero Catches



CPUE – Positive Catches



CPUE – Positive Catches

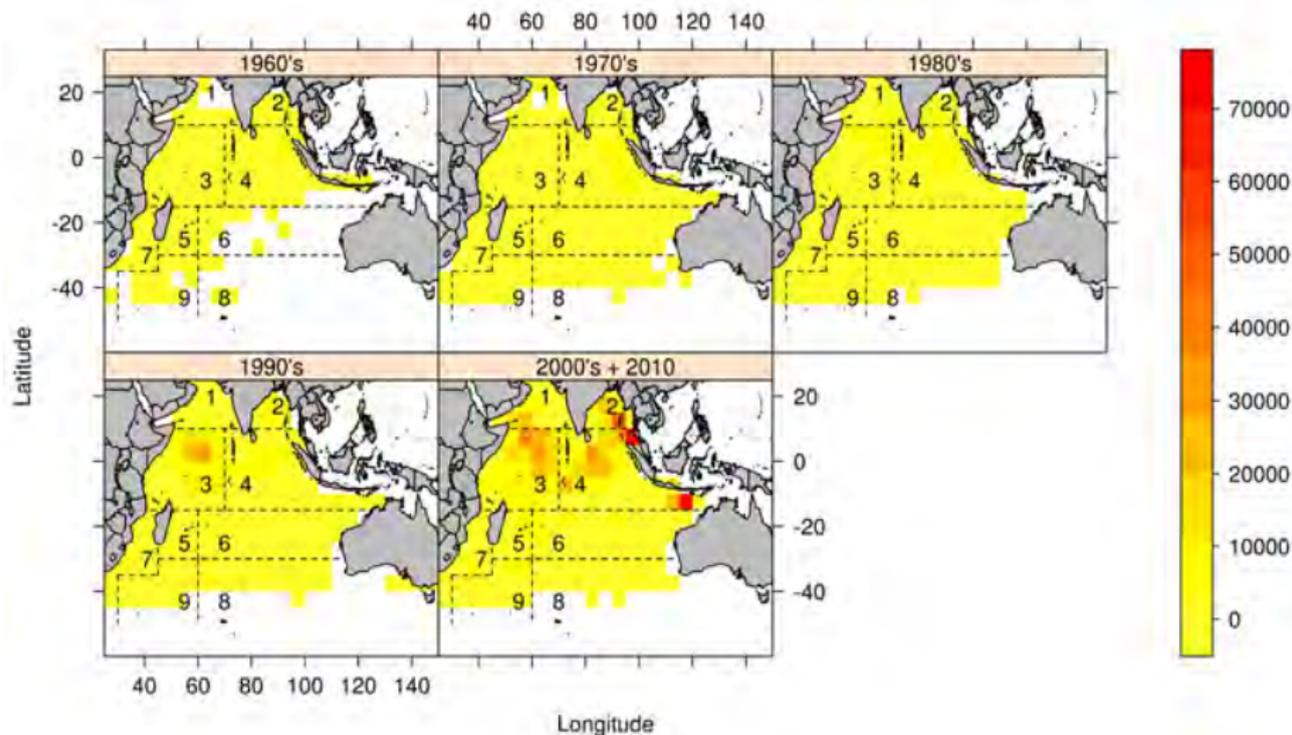


Remarks – BUM Japan Dataset

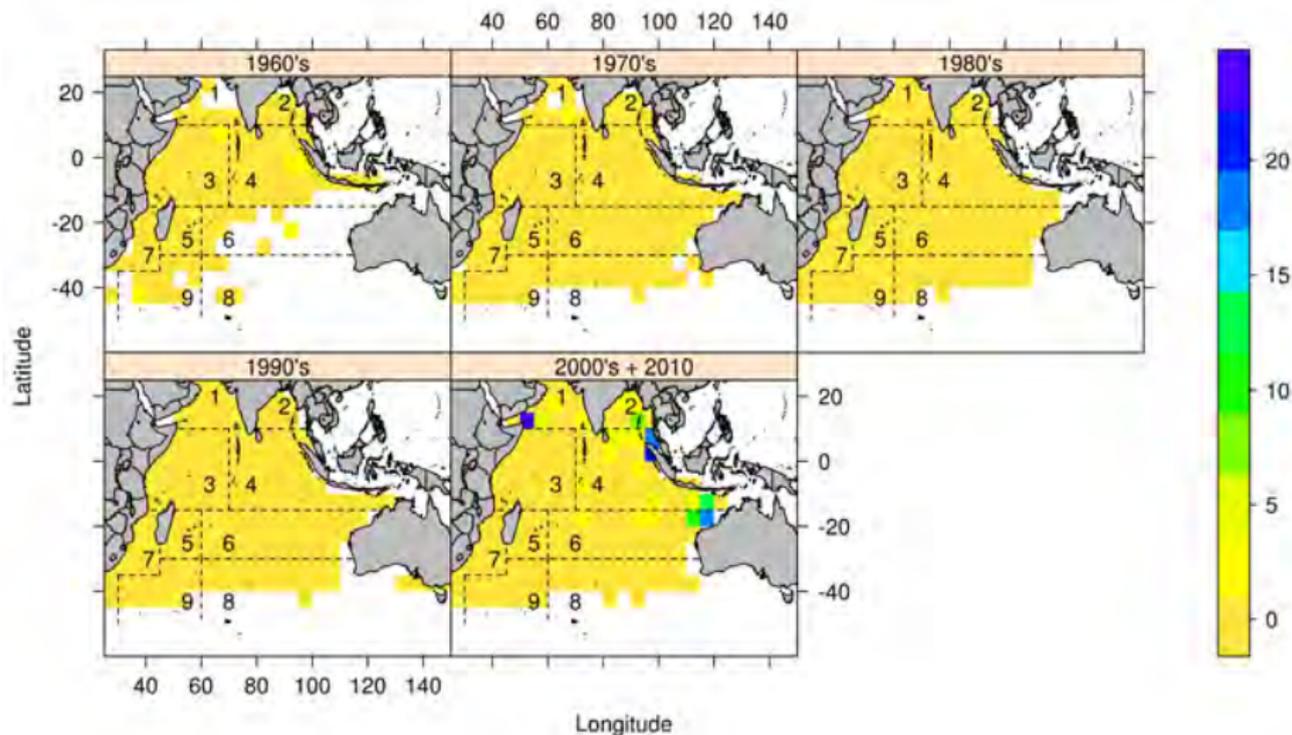
- 1 Catches and catch rates were high in equatorial and tropical oceanic areas (1, 2, 3 and 4) especially in 1950's and 1960's;
- 2 Catch rates were high in the first half of the year (1st and 2nd quarters) close to equator;
- 3 Overall proportion of zero catches is not very high except in south areas (8 and 9);
- 4 Proportion of zero catches increase over the years;
- 5 Area 3 stands as the kernel of positive catch in 2000's;
- 6 Catch rates as calculated for positive dataset decreases quickly in 1950's and 1960's in all areas. They are especially low in 2000's.



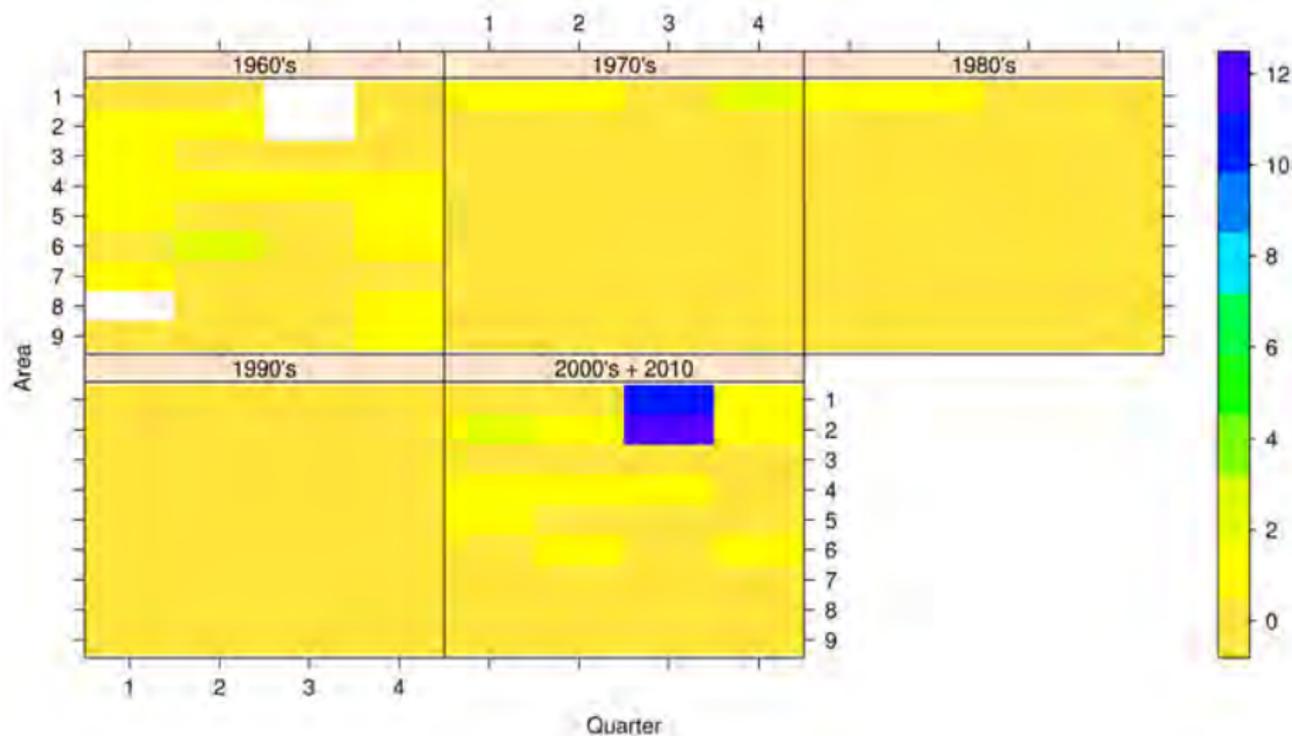
BUM - number of fish - Taiwan Dataset



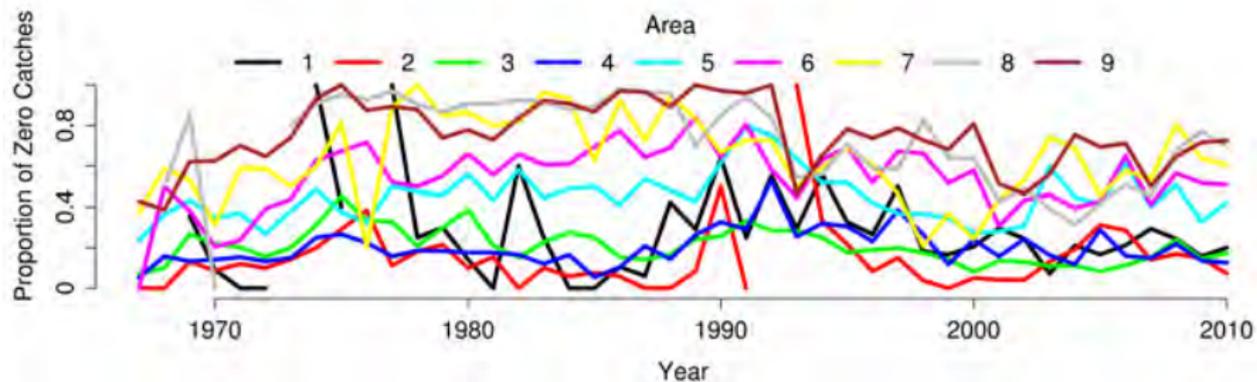
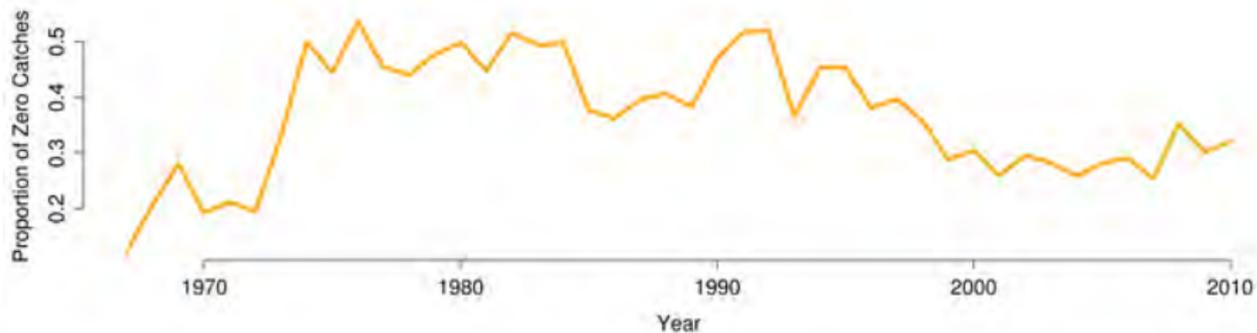
BUM - number of fish/1000 hooks - Decade x Lat x Lon



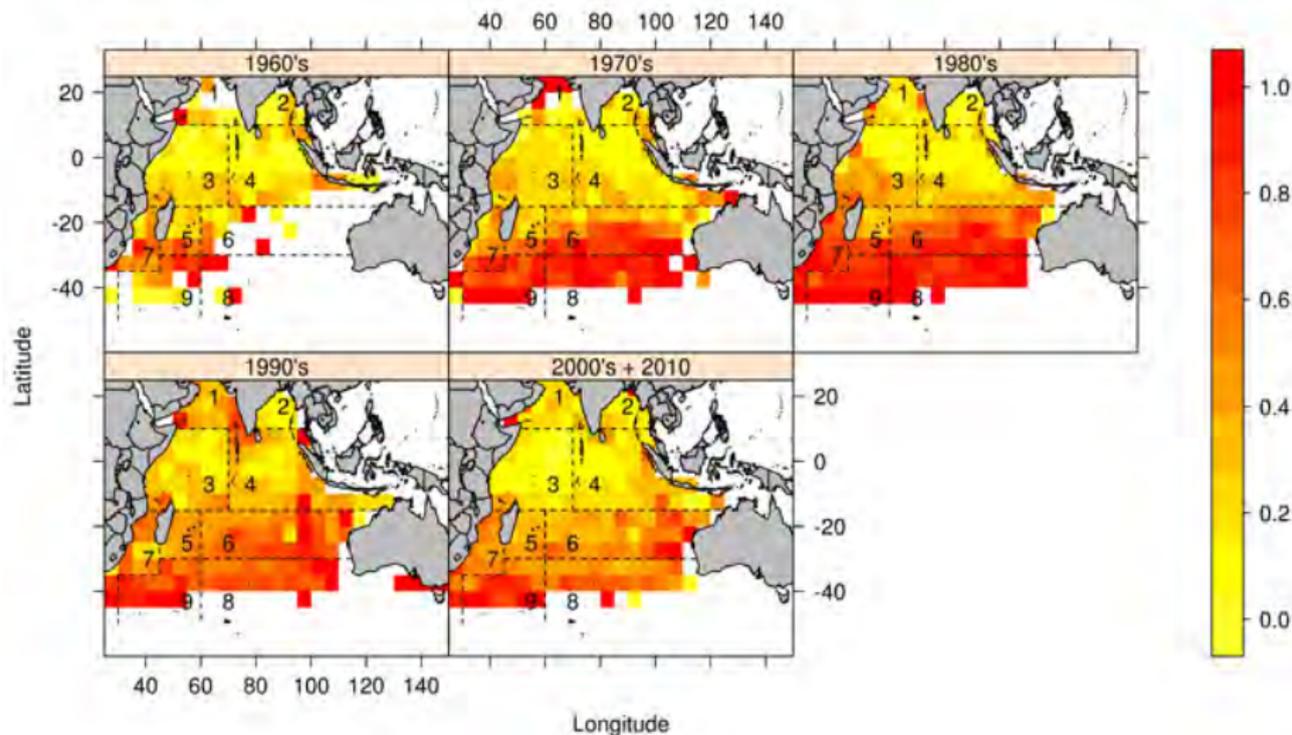
BUM - number of fish/1000 hooks - Decade x Quarter x Area



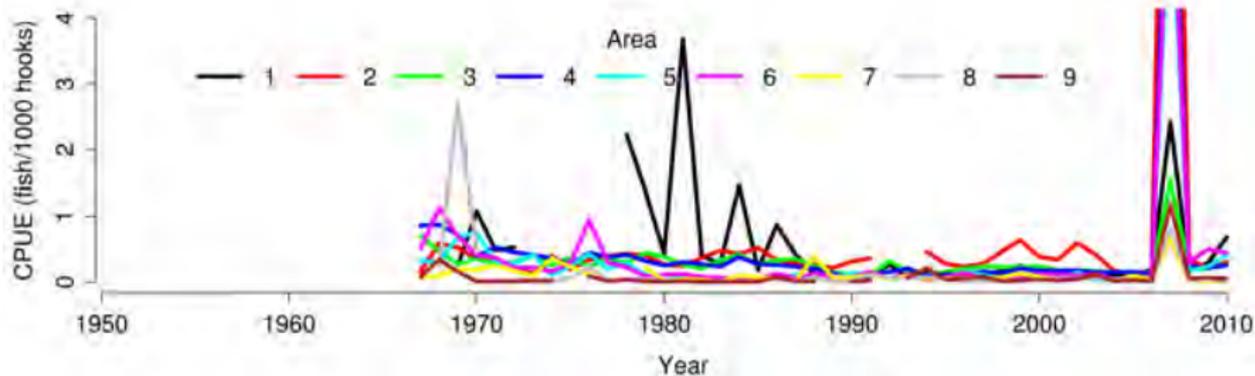
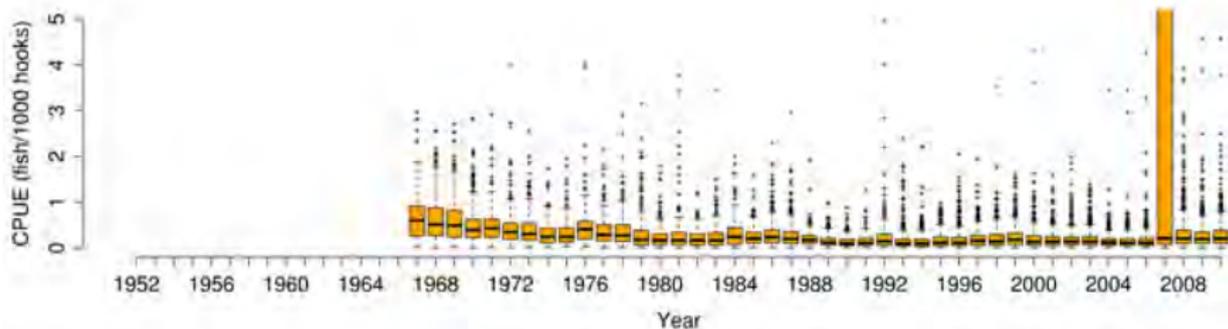
Proportion of Zero Catches



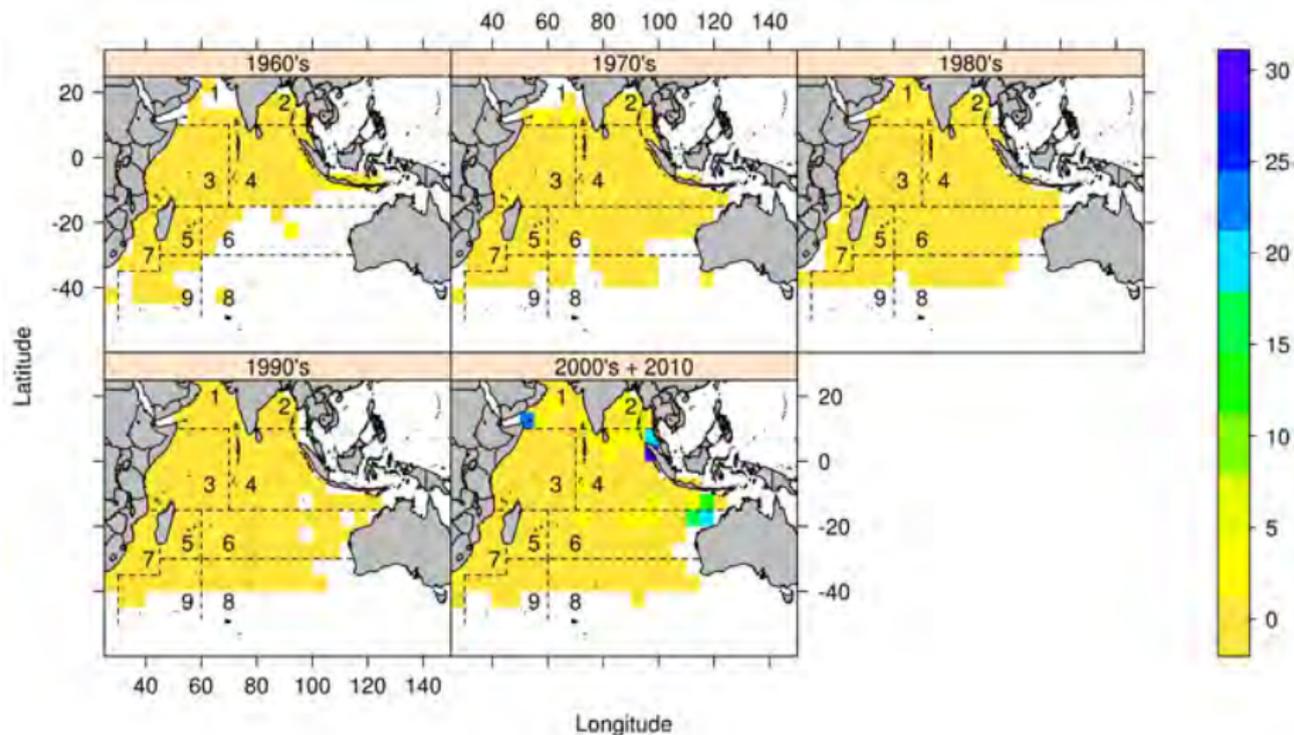
Proportion of Zero Catches



CPUE – Positive Catches



CPUE – Positive Catches

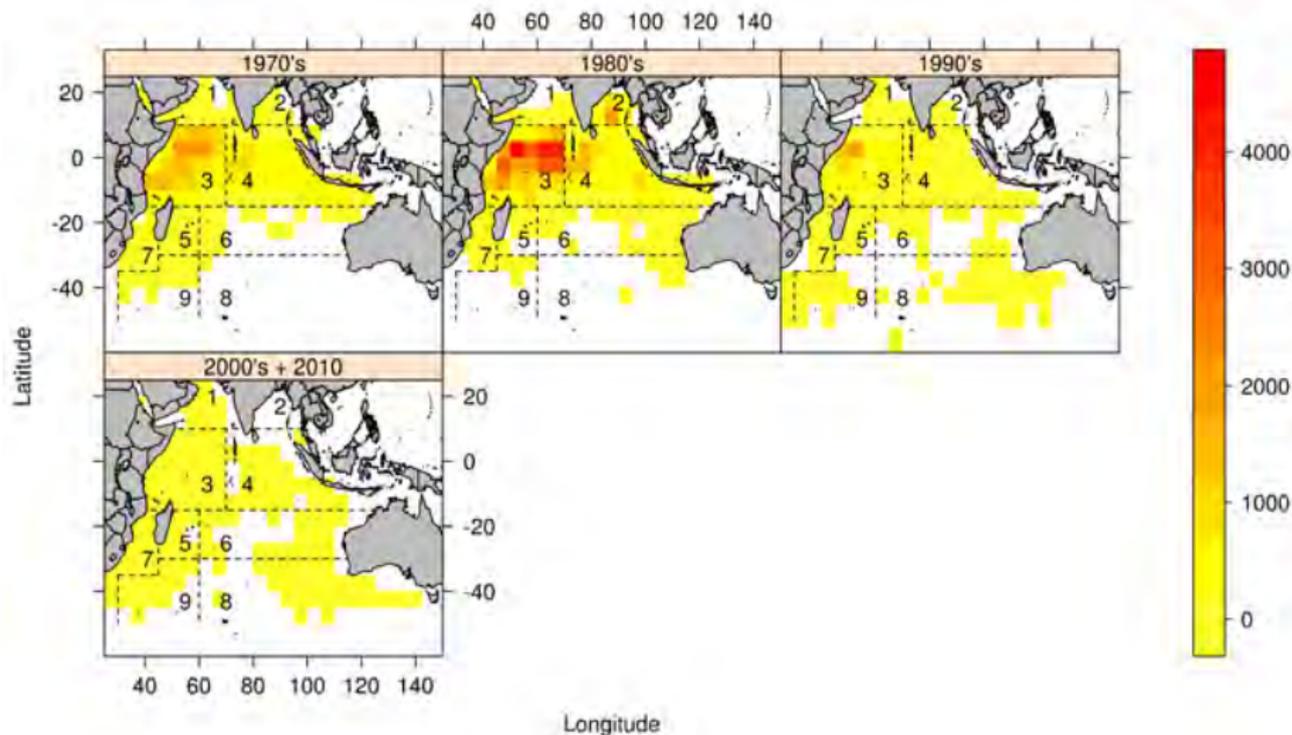


Remarks – BUM Taiwan Dataset

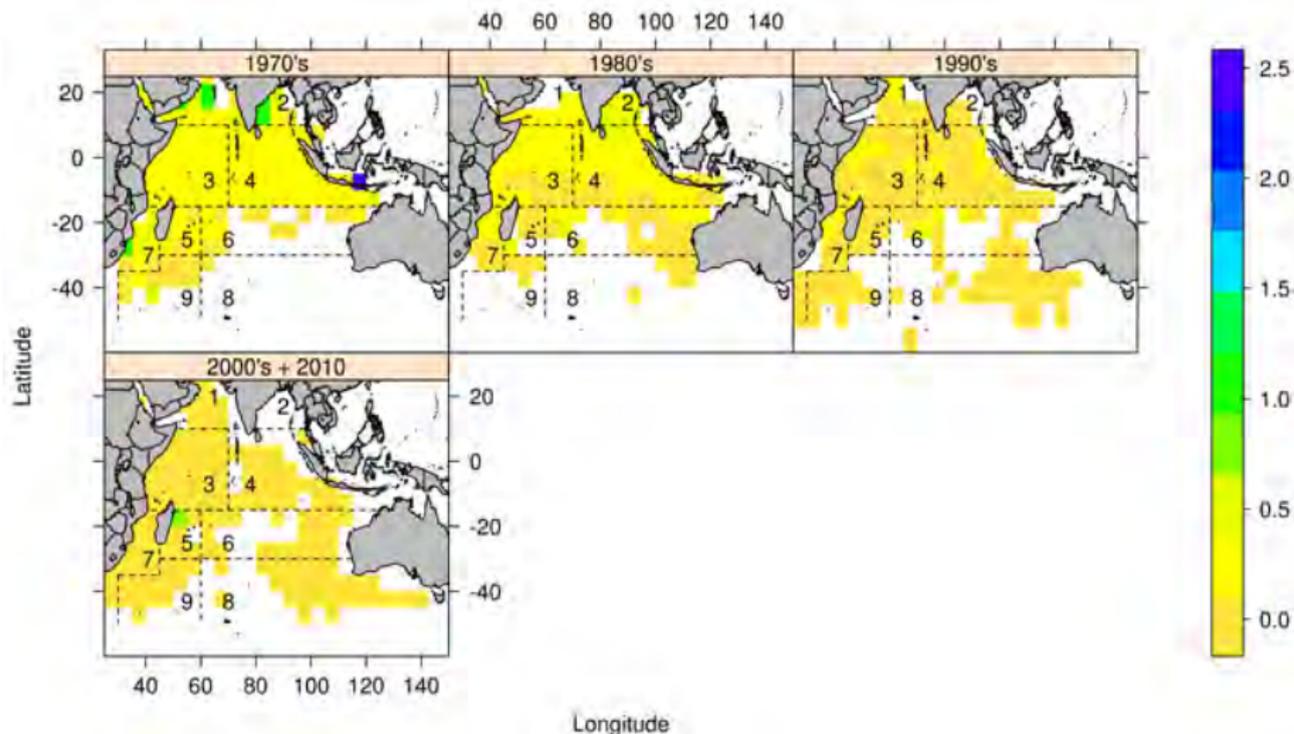
- 1 Catches were high in 2000's in area 3 and in areas 2 and 4 along the east margin of the Indic Ocean
- 2 Similarly catch rates were high in 2000's in areas 2 and 4 along the Vietnam, Indonesia and Australia. Catch rates in area 1 are also noticeable
- 3 Catch rates were especially high in areas 1 and 2 in the 3rd quarter
- 4 The size of the area with high proportion of zero catches increase until 1980's and them decrease until 2000's;
- 5 Catch rates as calculated for positive dataset decreases slightly in 1960's and 1970's but increase in the end of 2000's. Data for 2007 might be revised.



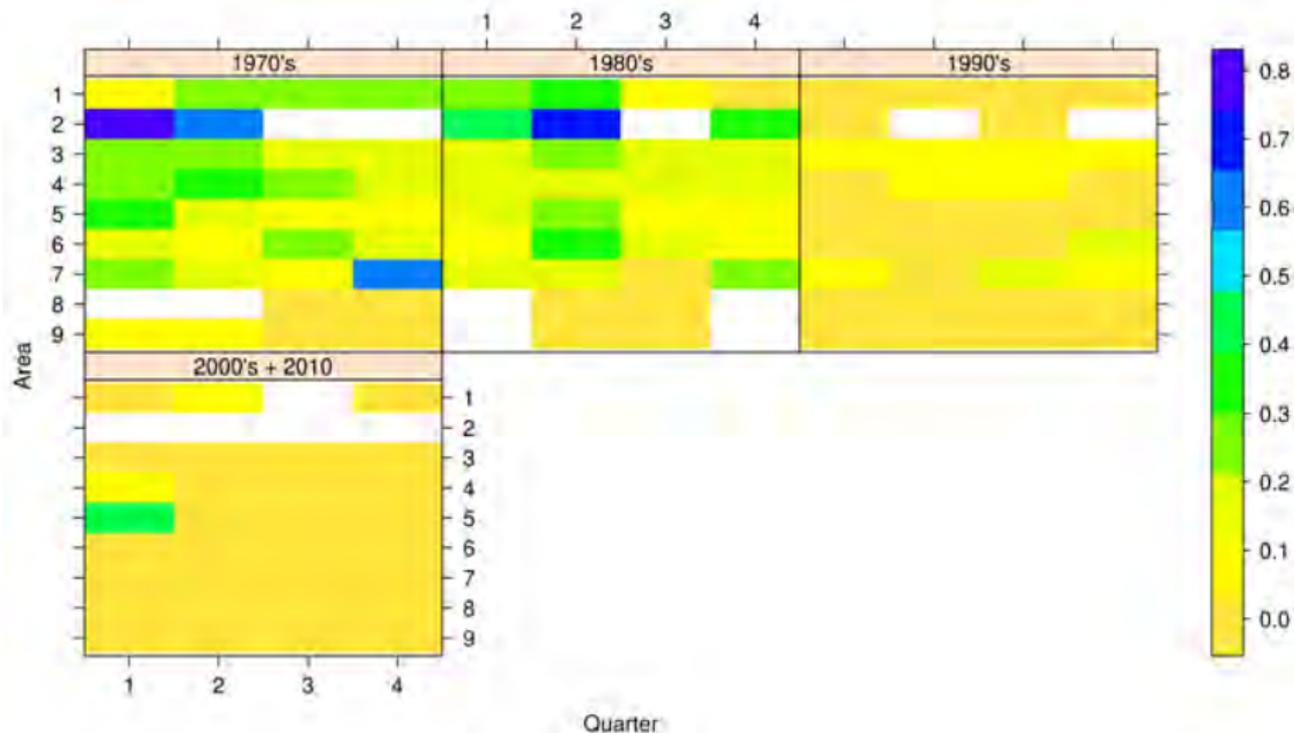
BUM - number of fish - Korea Dataset



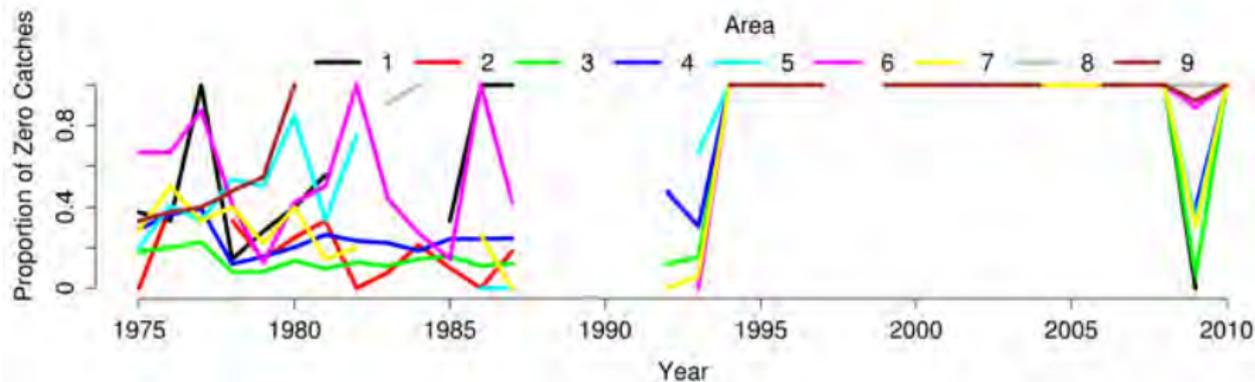
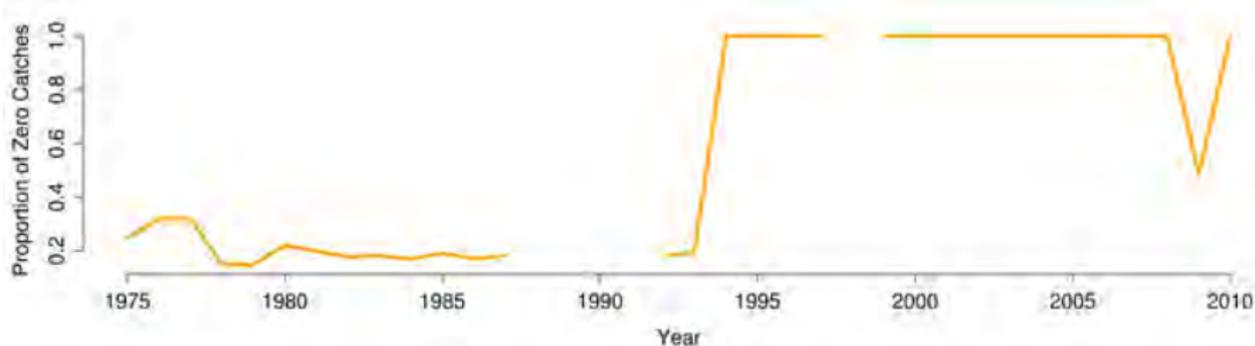
BUM - number of fish/1000 hooks - Decade x Lat x Lon



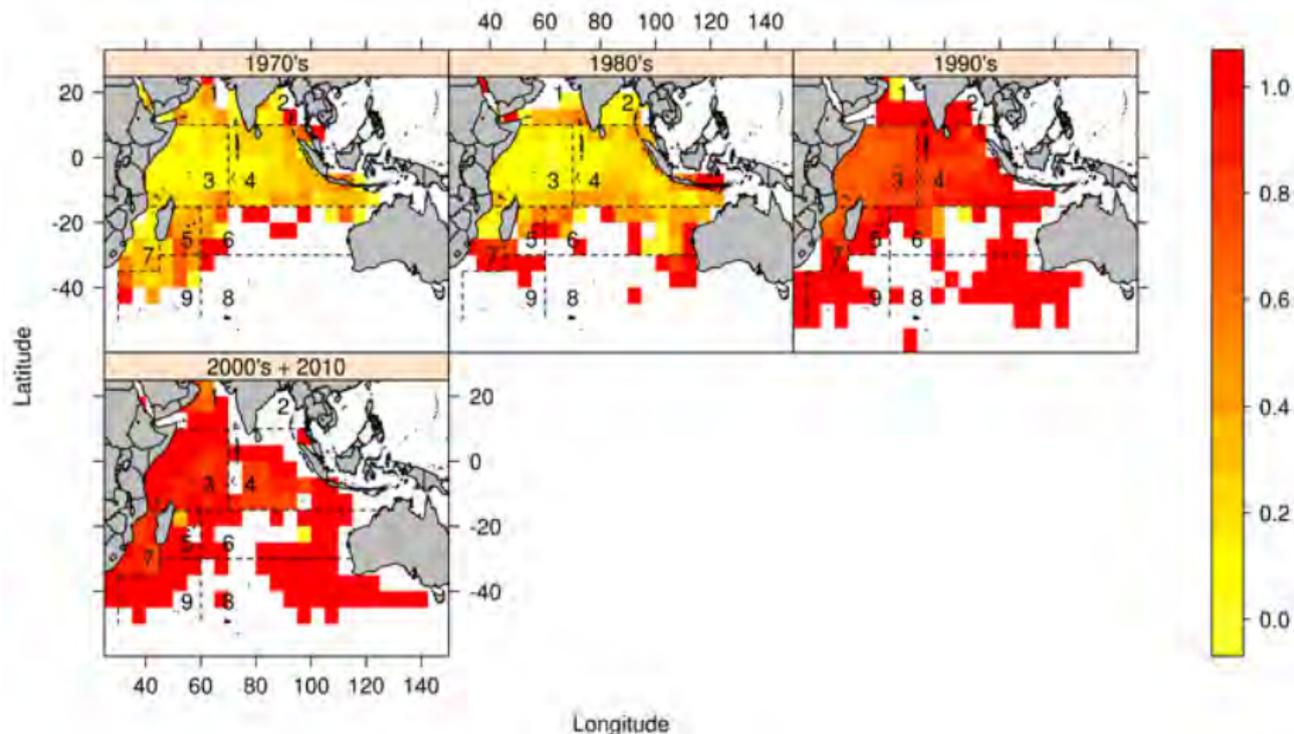
BUM - number of fish/1000 hooks - Decade x Quarter x Area



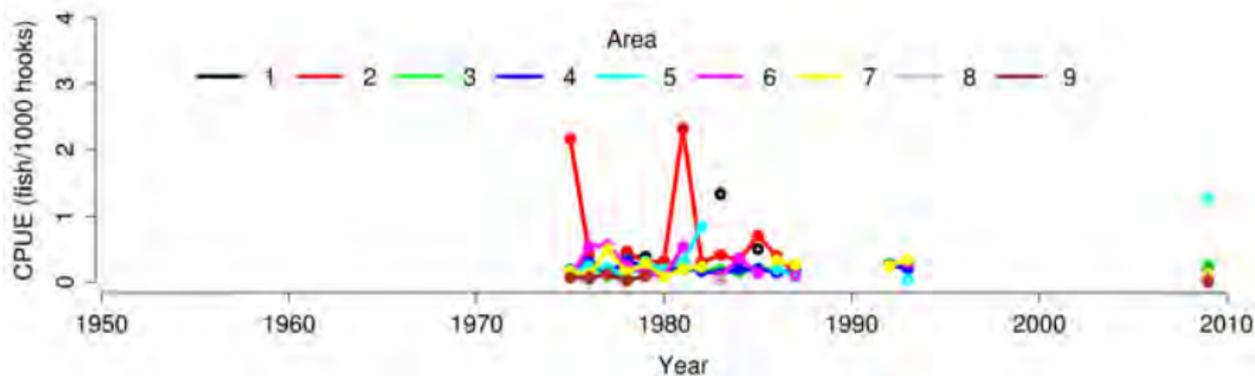
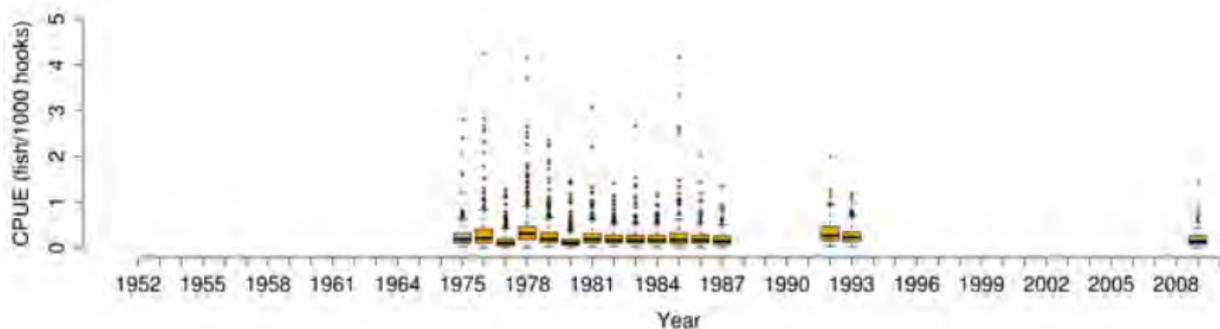
Proportion of Zero Catches



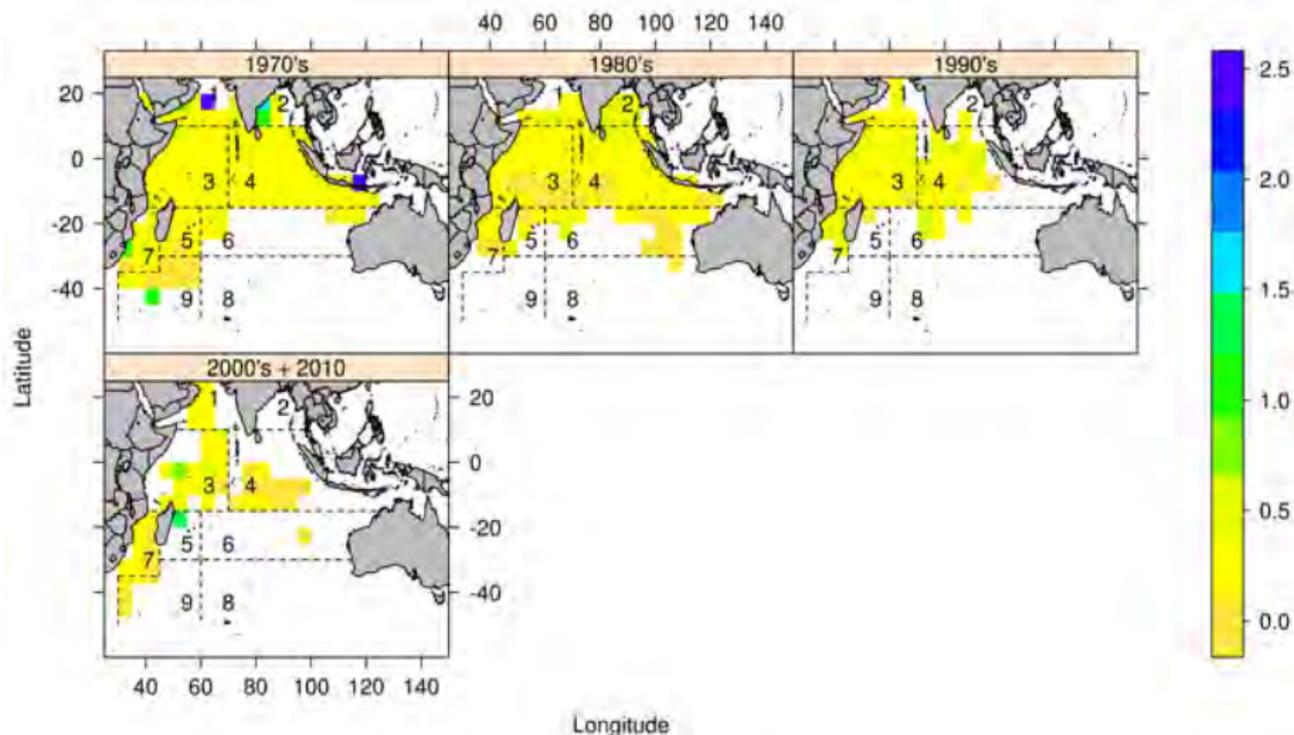
Proportion of Zero Catches



CPUE – Positive Catches



CPUE – Positive Catches

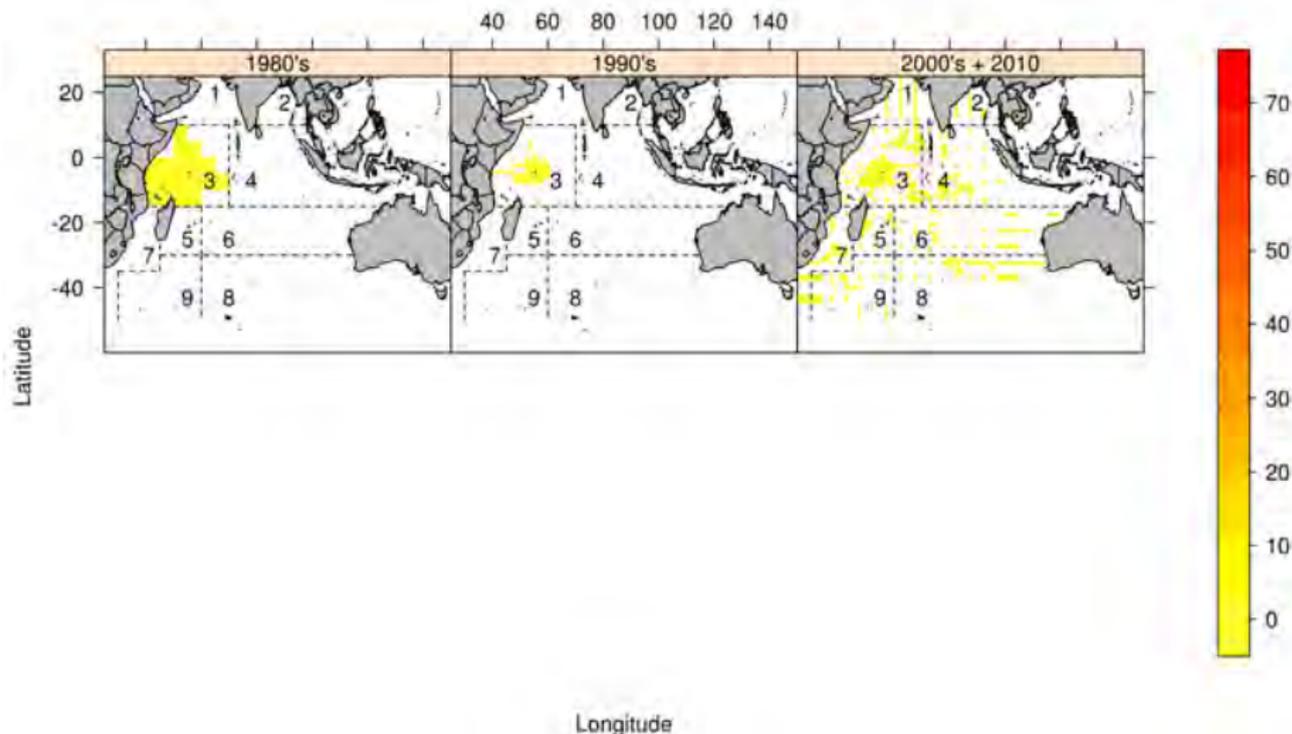


Remarks – BUM Korea Dataset

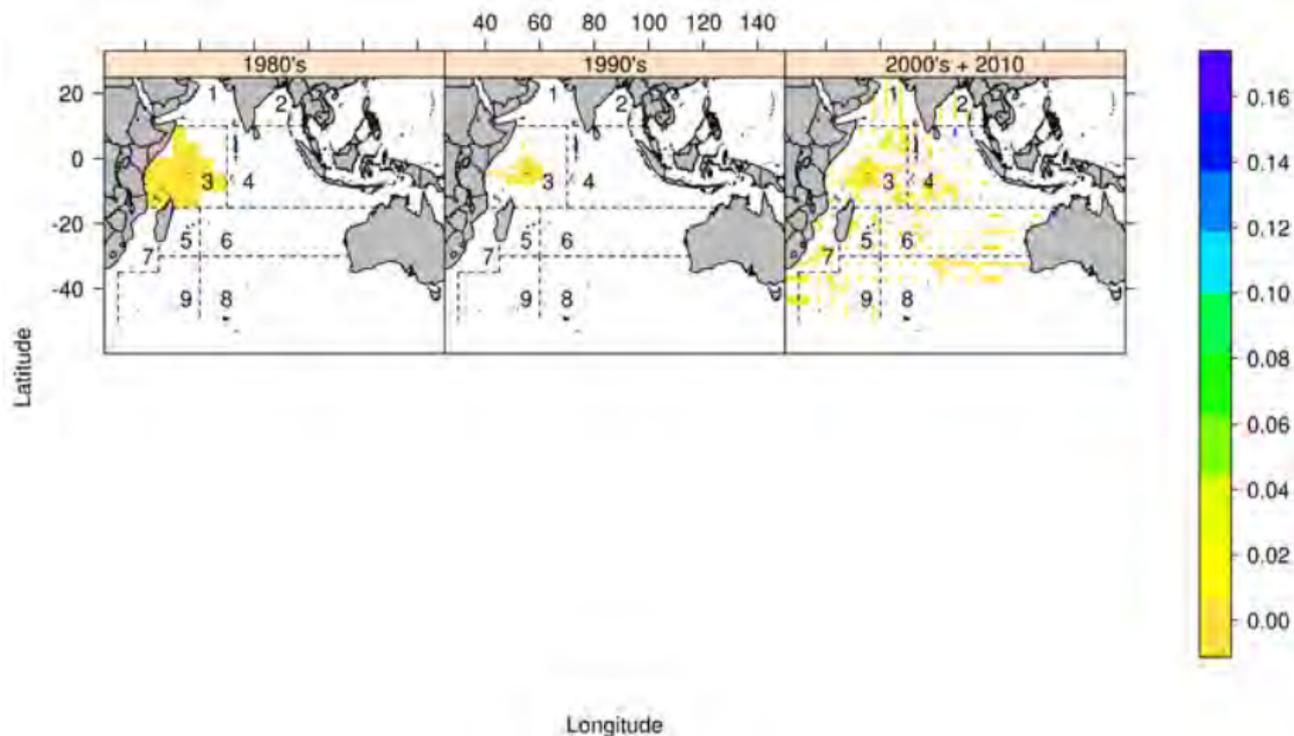
- 1 Catches in 1990's and 2000's were reported in metric tons but in number of fish in the other years;
- 2 Catches were high in 1970's and 1980's in area 3;
- 3 Catch rates were high in 1970's and 1980's in areas 1, 2, 3, 4 and 7 especially in the Indic Ocean margins;
- 4 Catches seem to be higher in the first half of the year in areas 1 to 5 while in the south of Africa (area 7) catch rates were high in the 4th quarter;
- 5 Proportions of zero catches are not high in areas 2, 3 and 4 in 1970's and 1980's. Data are not informative for other areas and years;
- 6 Catch rates as calculated for positive dataset were high in 1970's in the margins of Indic Ocean.



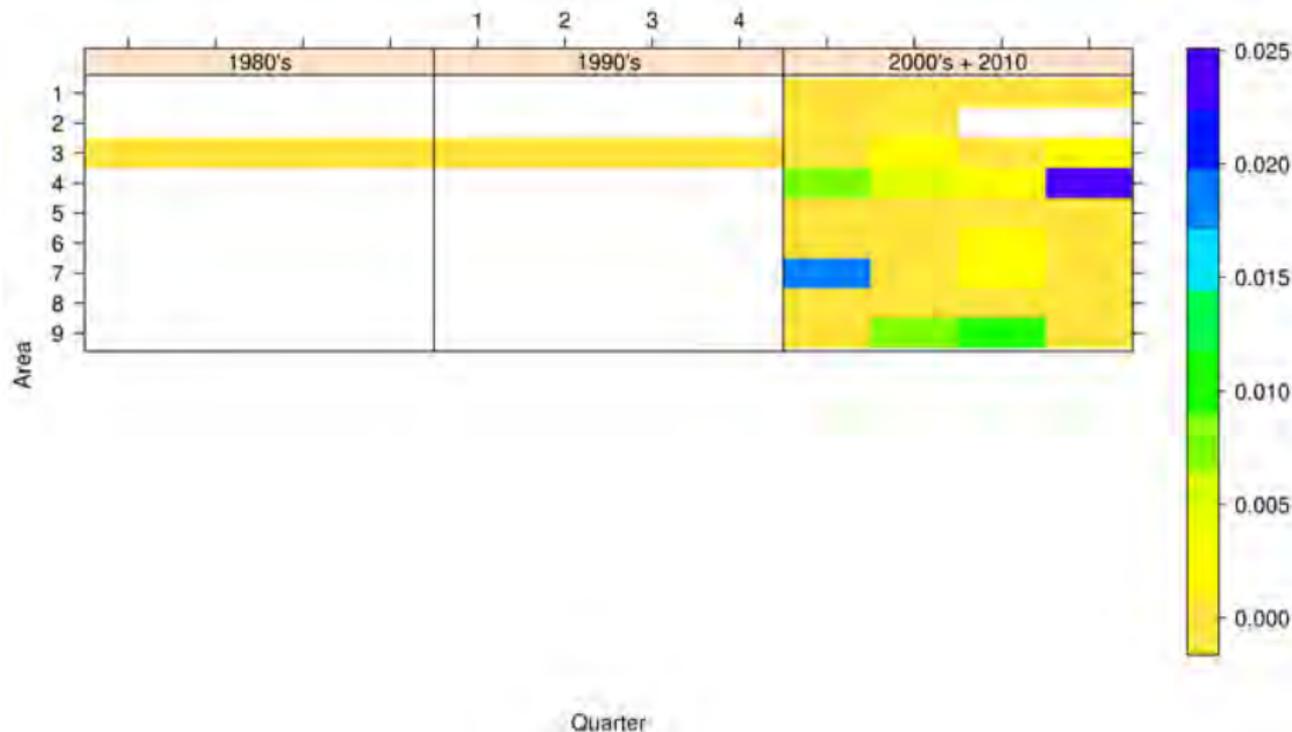
BUM - number of fish - Seychelles Dataset



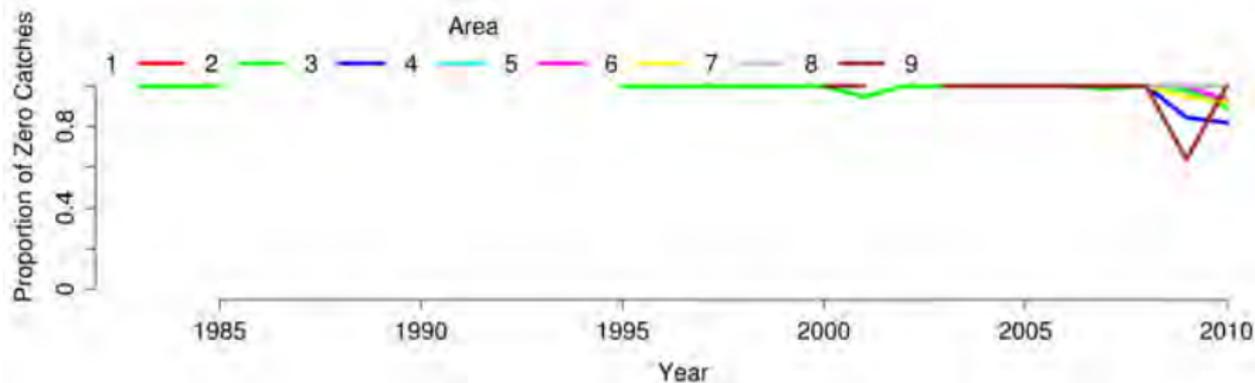
BUM - number of fish/1000 hooks - Decade x Lat x Lon



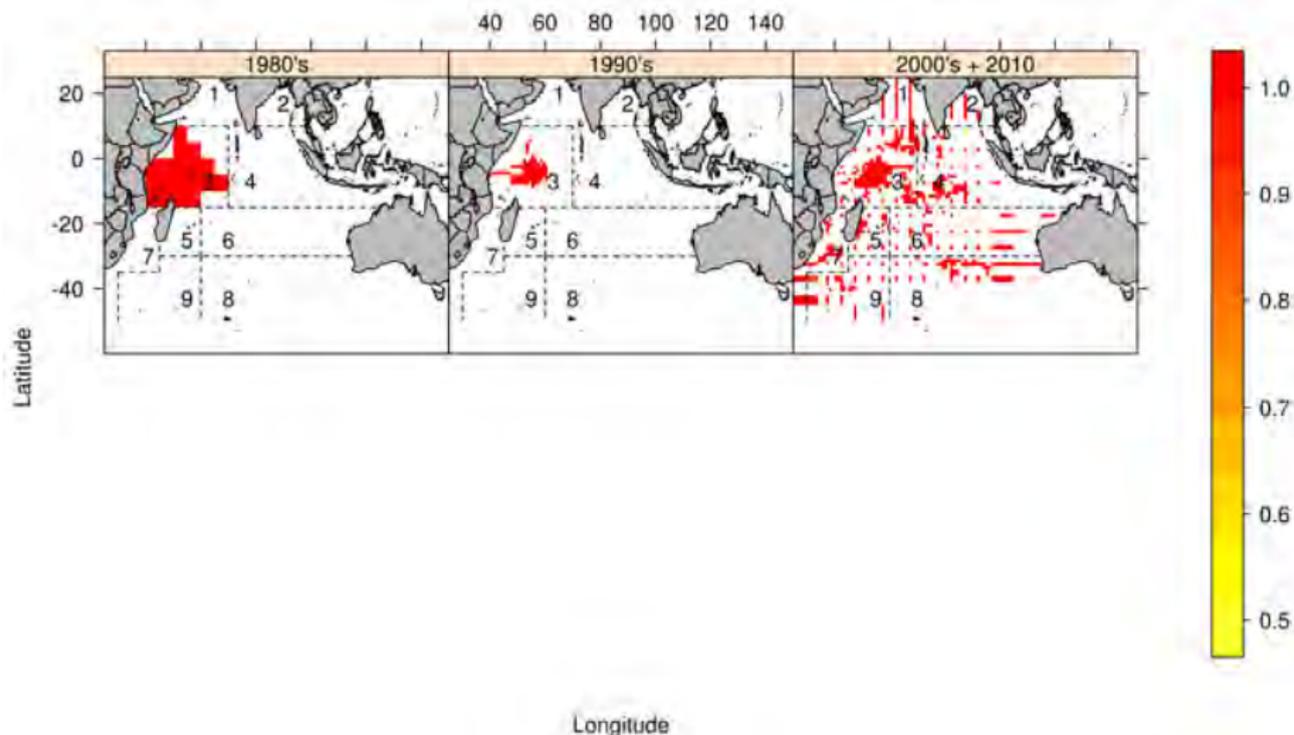
BUM - number of fish/1000 hooks - Decade x Quarter x Area



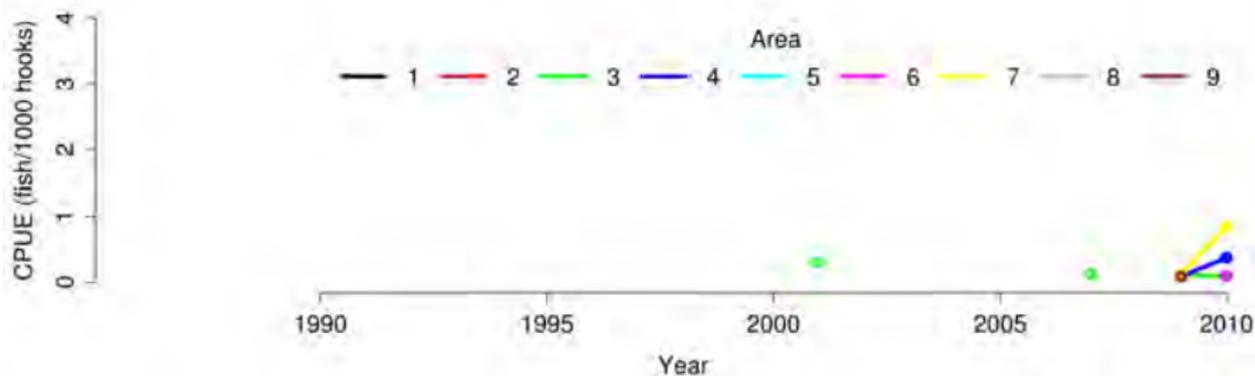
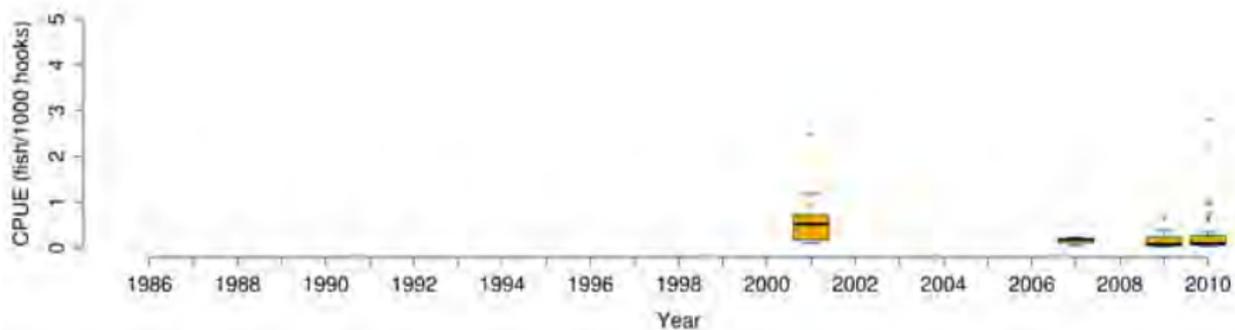
Proportion of Zero Catches



Proportion of Zero Catches



CPUE – Positive Catches



CPUE – Positive Catches



Remarks – BUM Seychelles Dataset

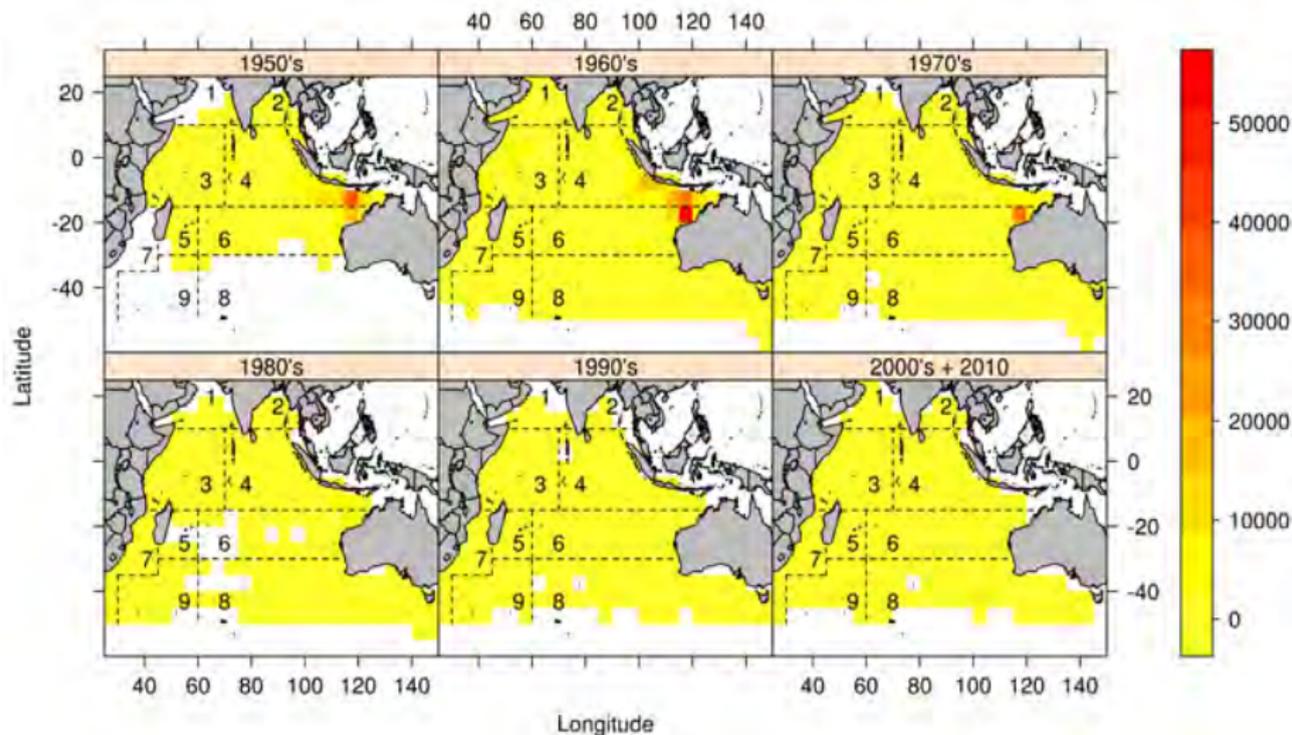
- Time series is not consistent;



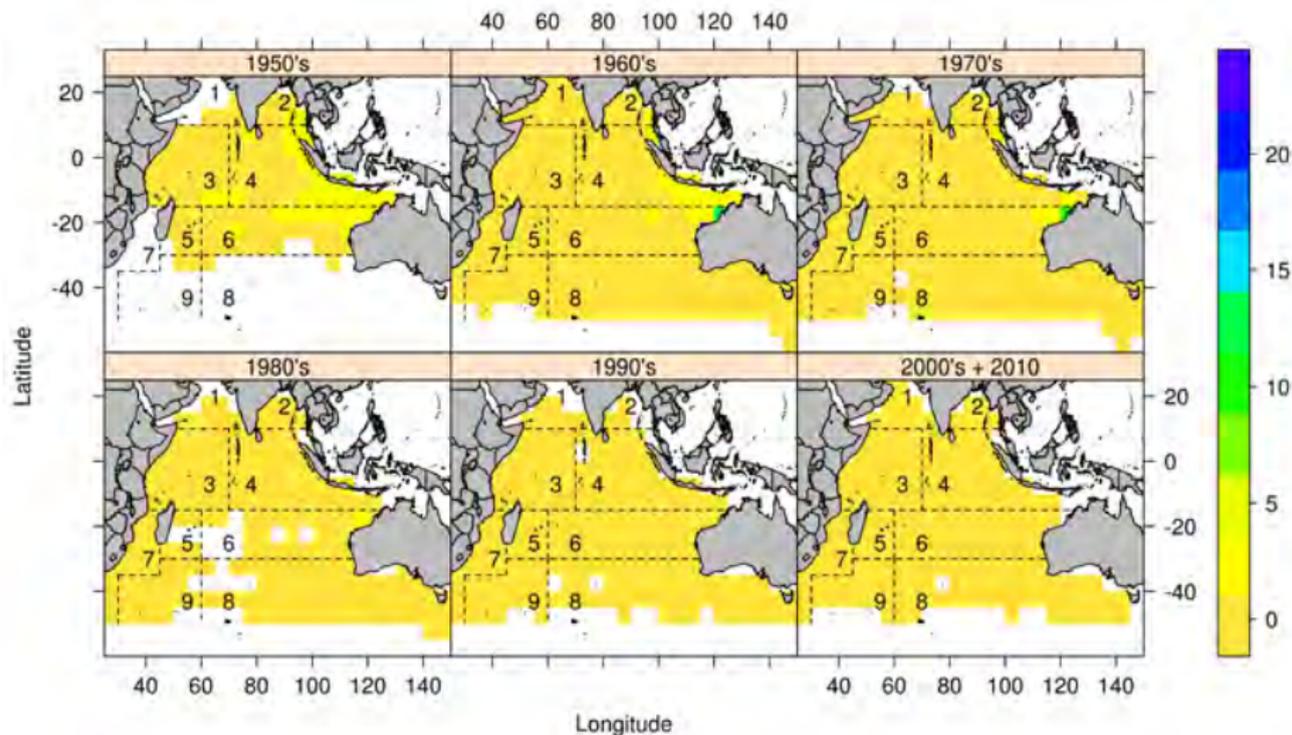
Black Marlin (BLM)



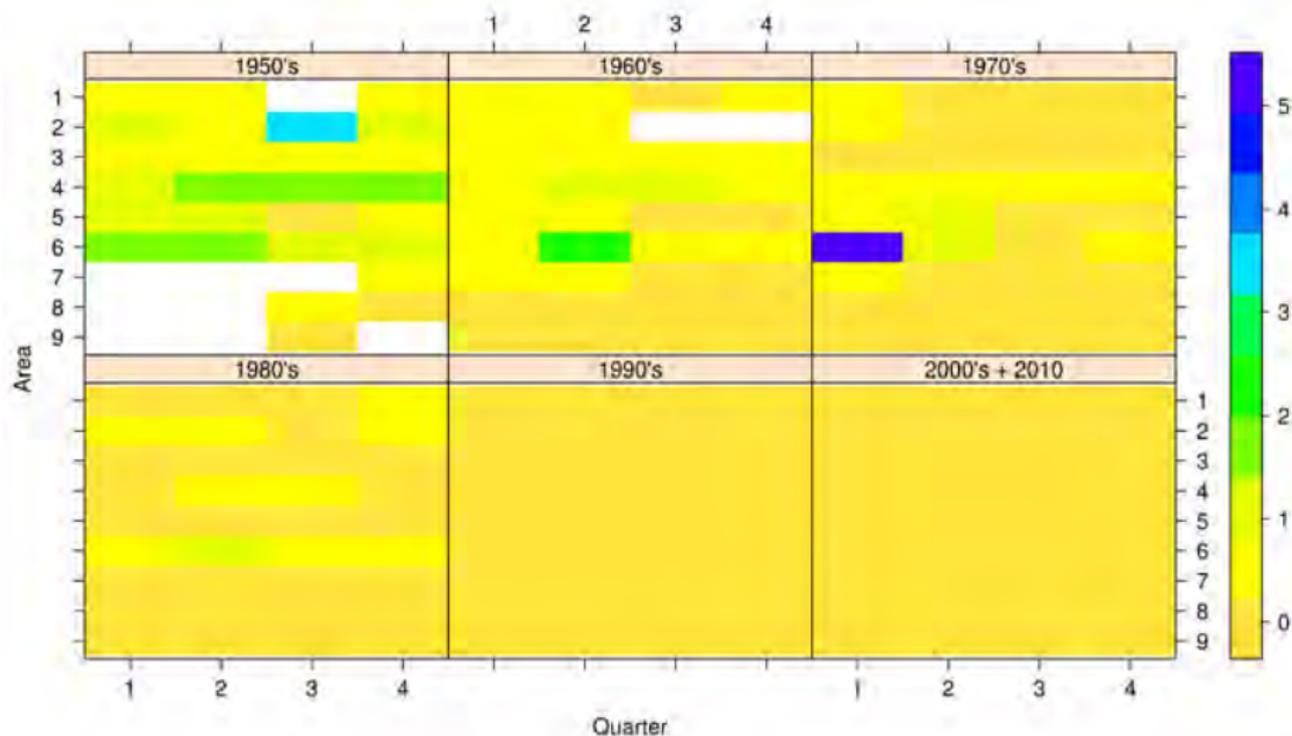
BLM - number of fish - Japan Dataset



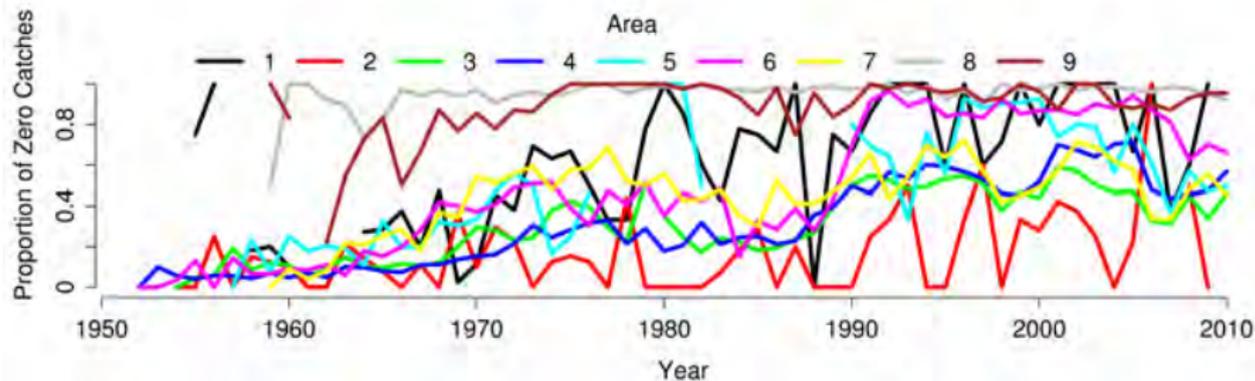
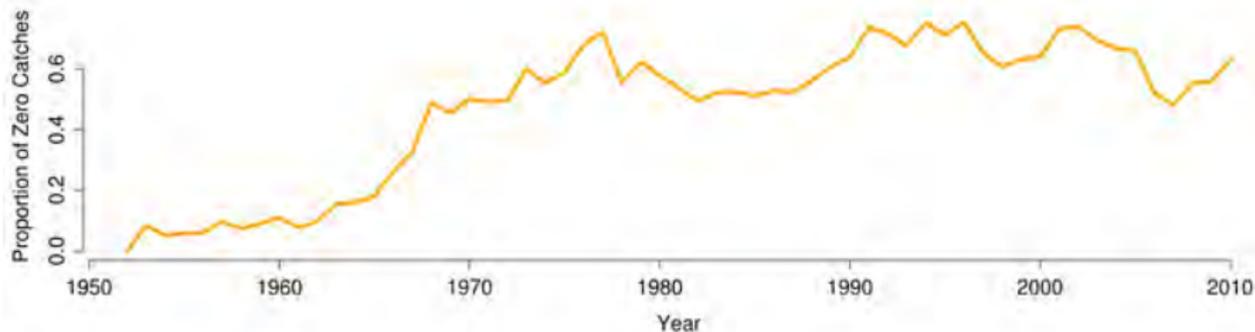
BLM - number of fish/1000 hooks - Decade x Lat x Lon



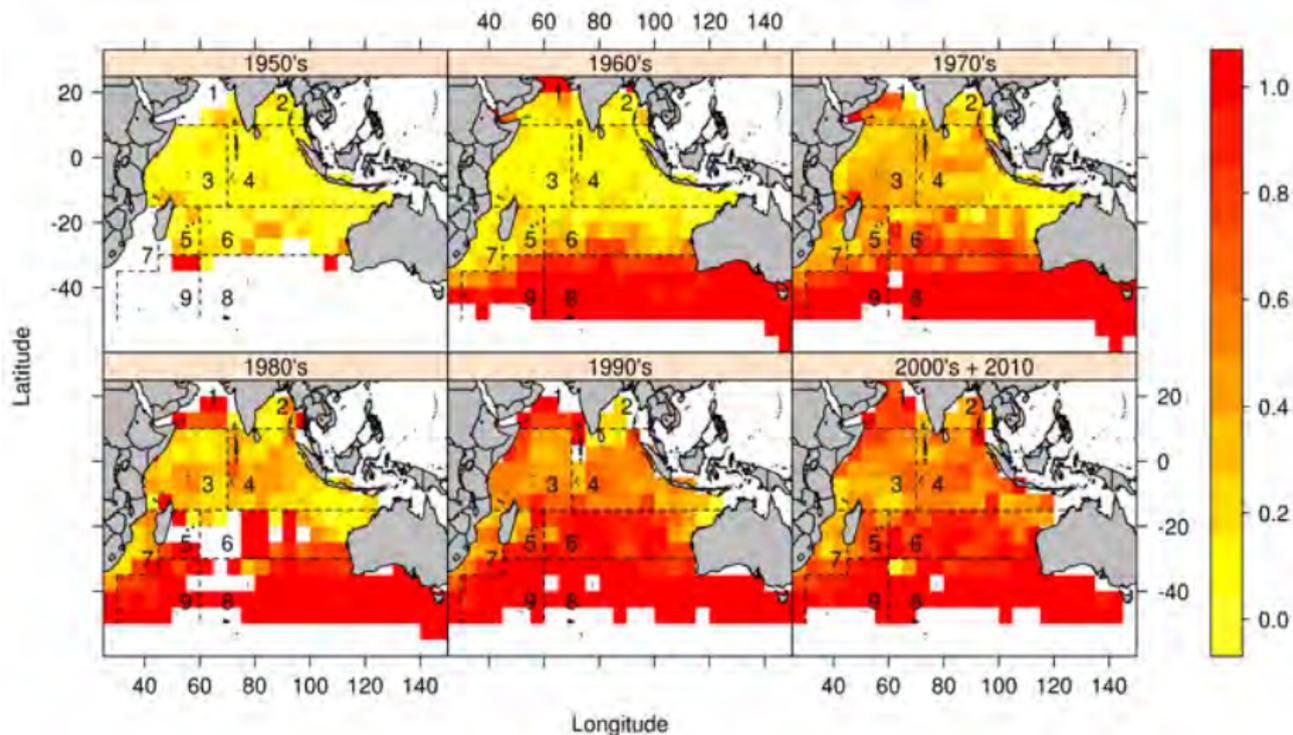
BLM - number of fish/1000 hooks - Decade x Quarter x Area



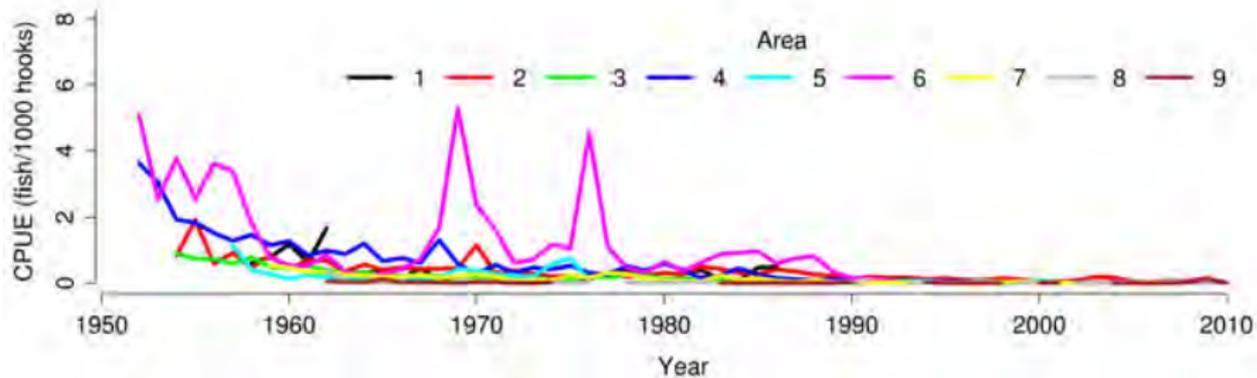
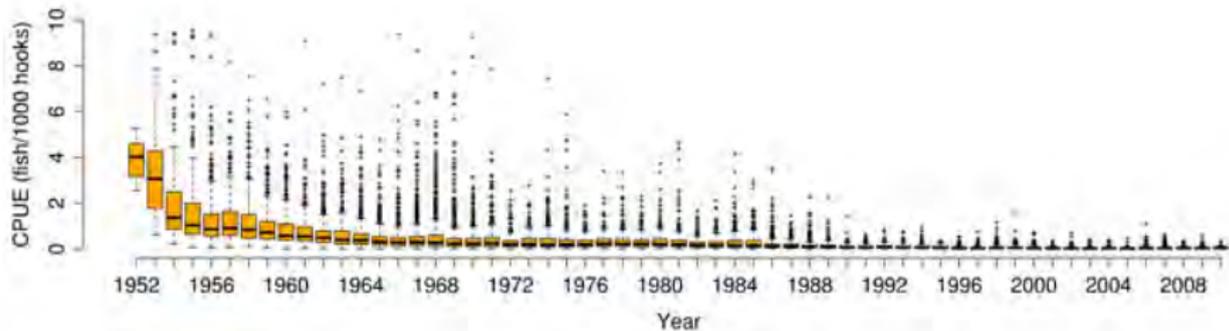
Proportion of Zero Catches



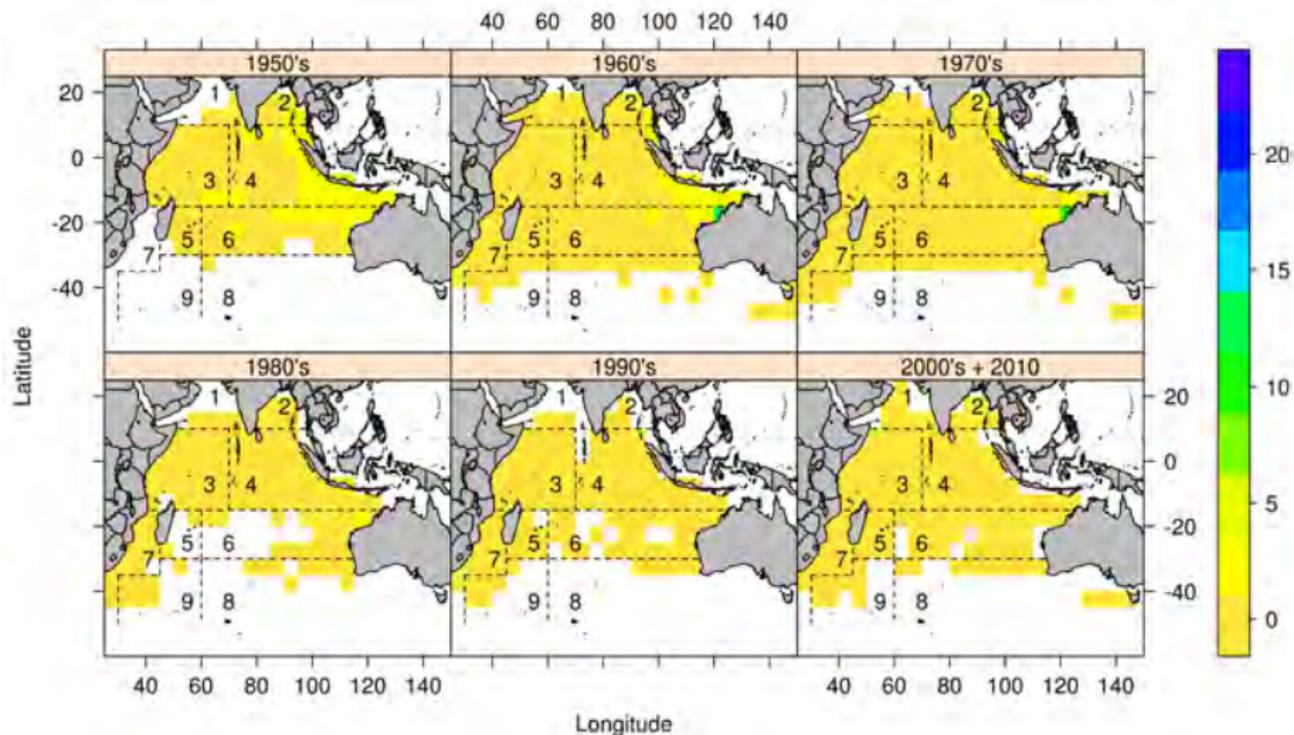
Proportion of Zero Catches



CPUE – Positive Catches



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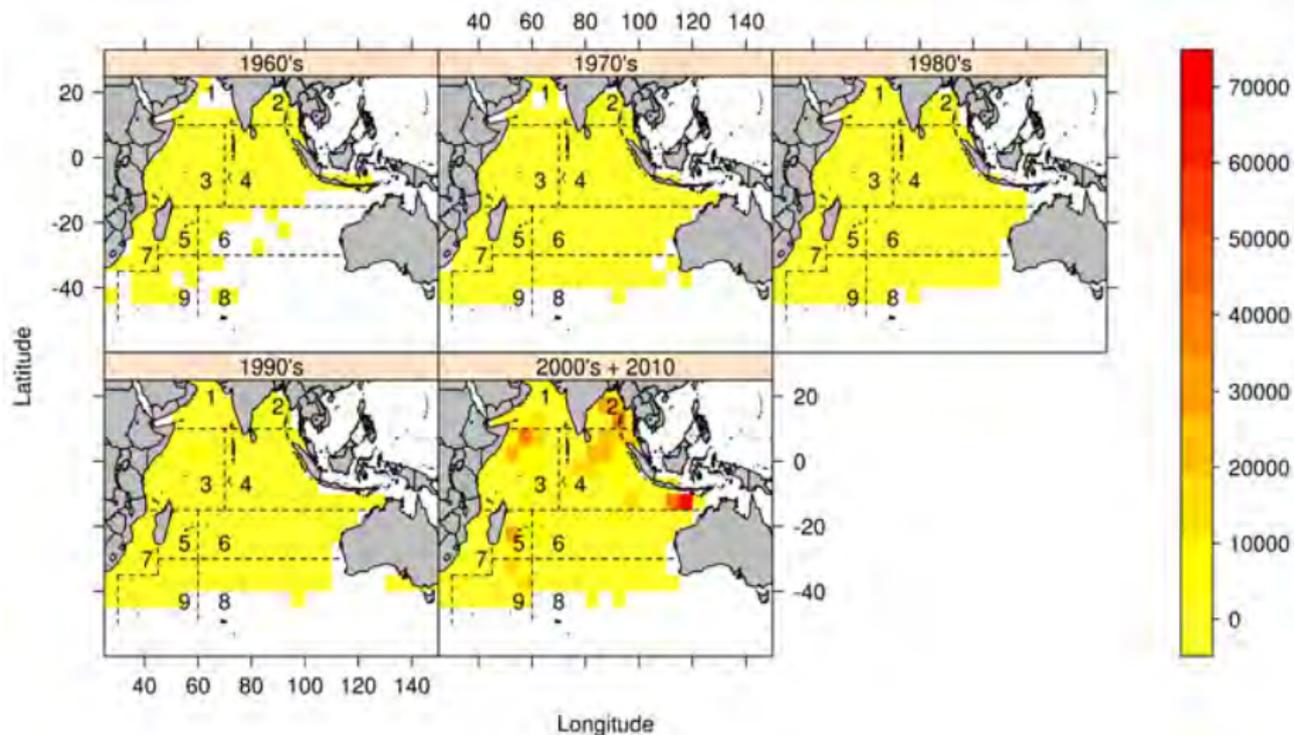


Remarks – BLM Japan Dataset

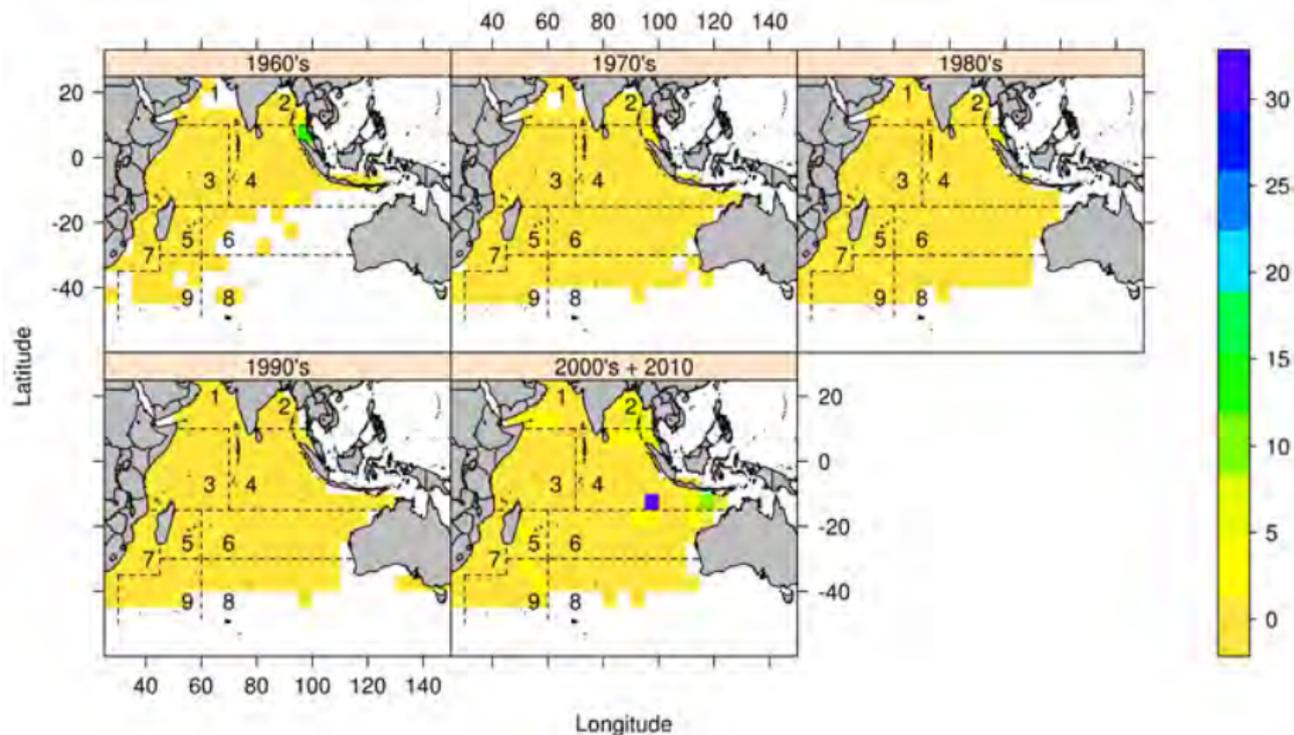
- 1 Catches and catch rates were high in areas 2, 4 and 6 in the east margin of the Indic Ocean in 1950's, 1960's and 1970's;
- 2 Clear seasonal pattern was not apparent in this preliminary analysis;
- 3 Overall proportions of zero catches are very high in areas 8 and 9 and, it has been increasing over the year in areas 3 to 7;
- 4 Area 3 stands as the kernel of positive catch in 2000's;
- 5 Catch rates as calculated for positive dataset decreases quickly in 1950's in all areas. They are especially low in 2000's;
- 6 There are outstanding peaks of mean catch rates in the end of 1960's and the mid of 1970's.



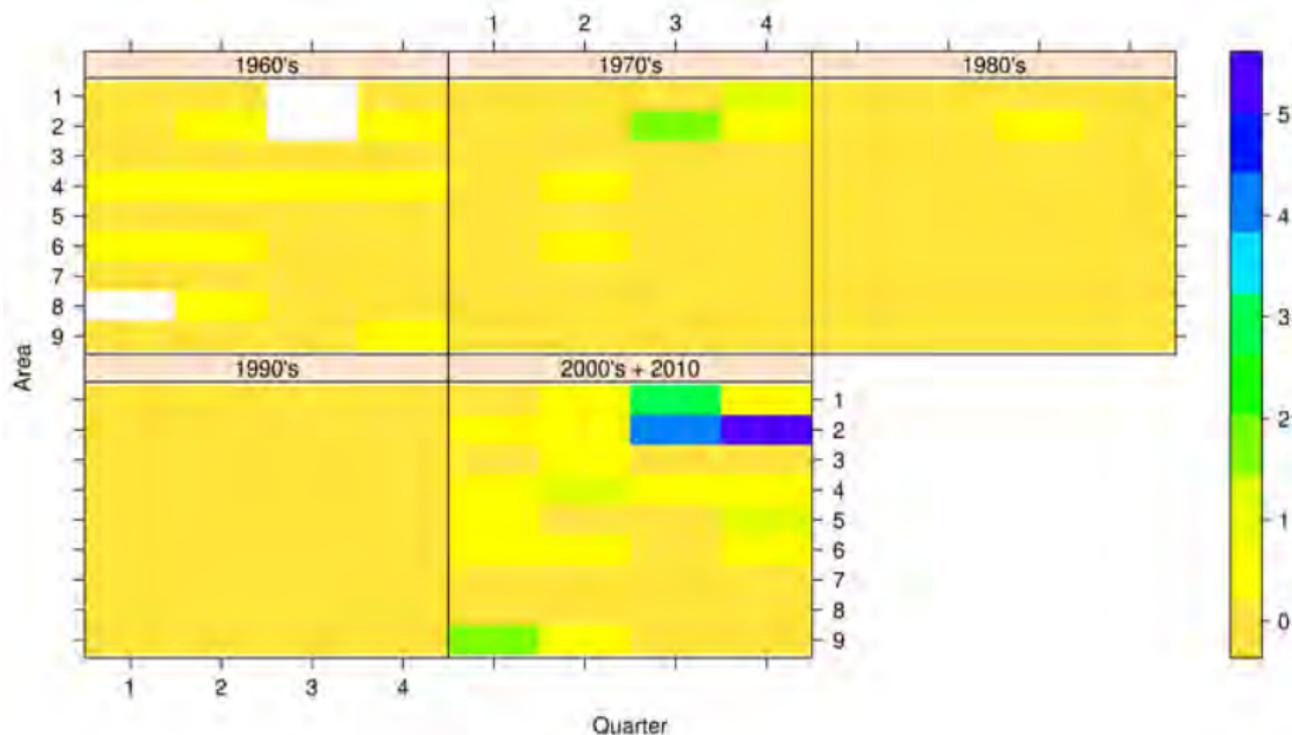
BLM - number of fish - Taiwan dataset



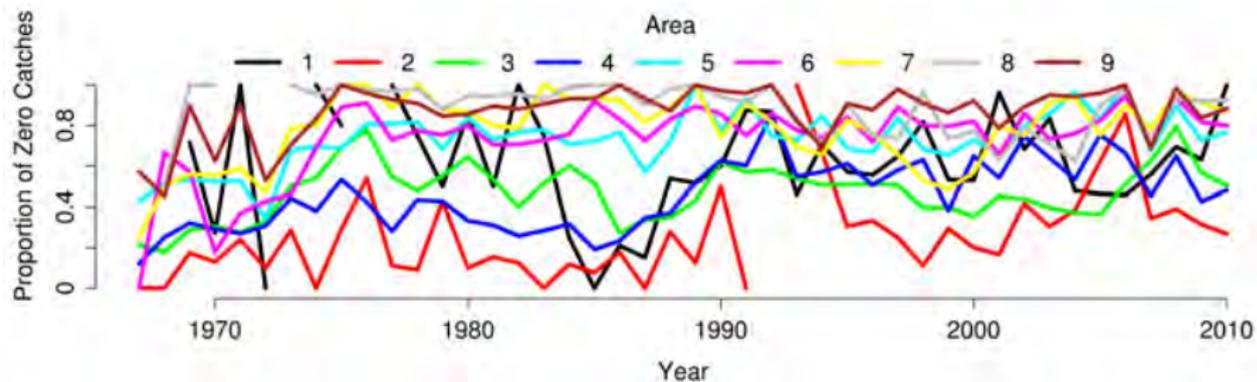
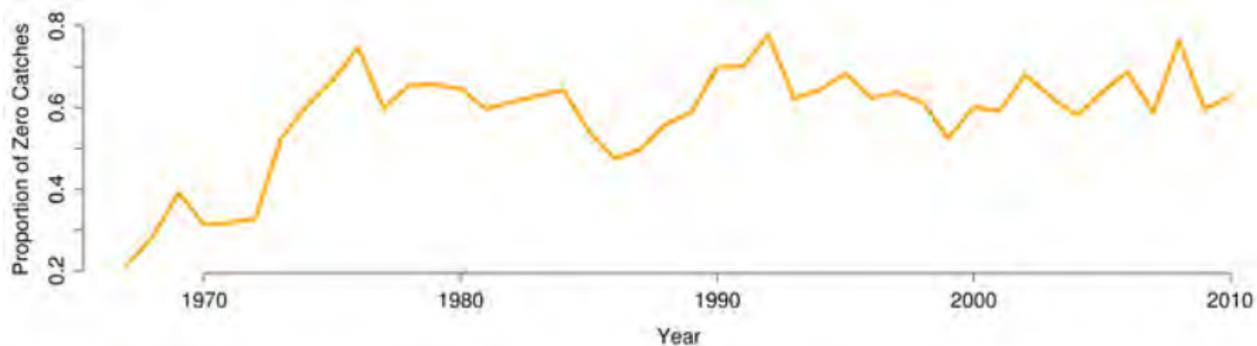
BLM - number of fish/1000 hooks - Decade x Lat x Lon



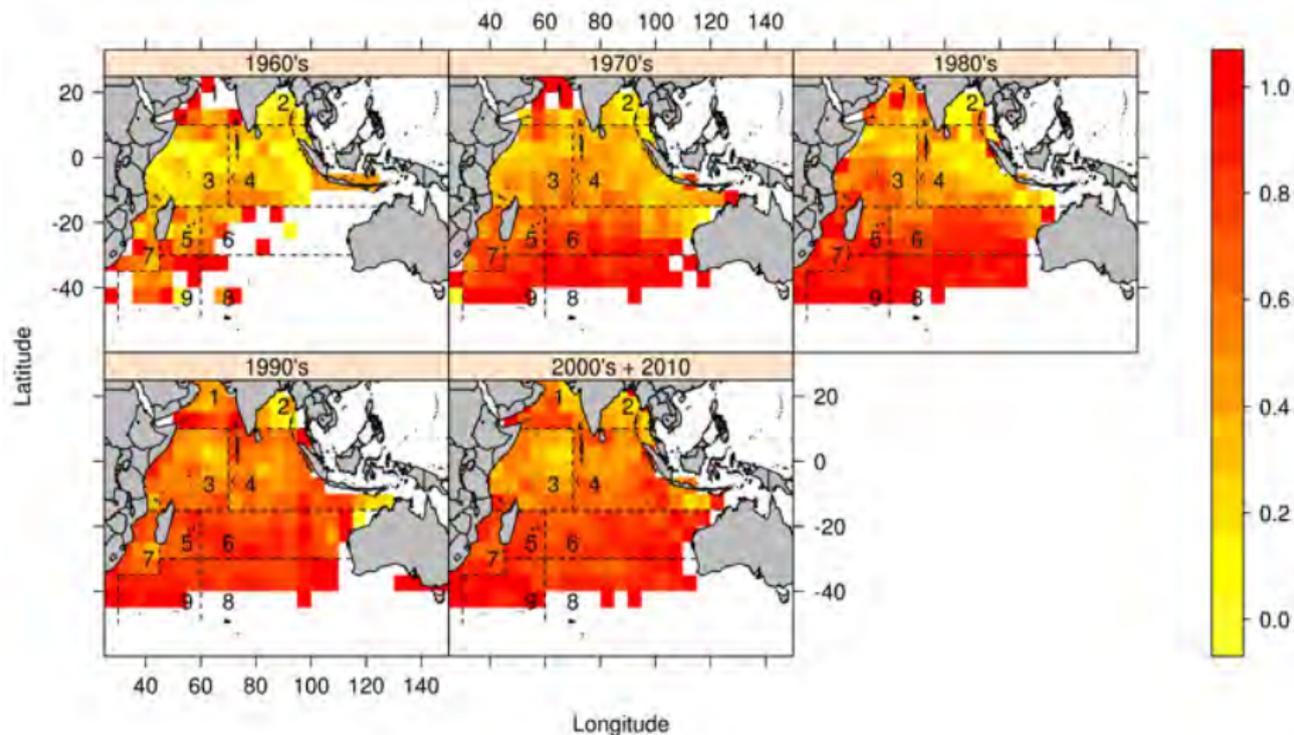
BLM - number of fish/1000 hooks - Decade x Quarter x Area



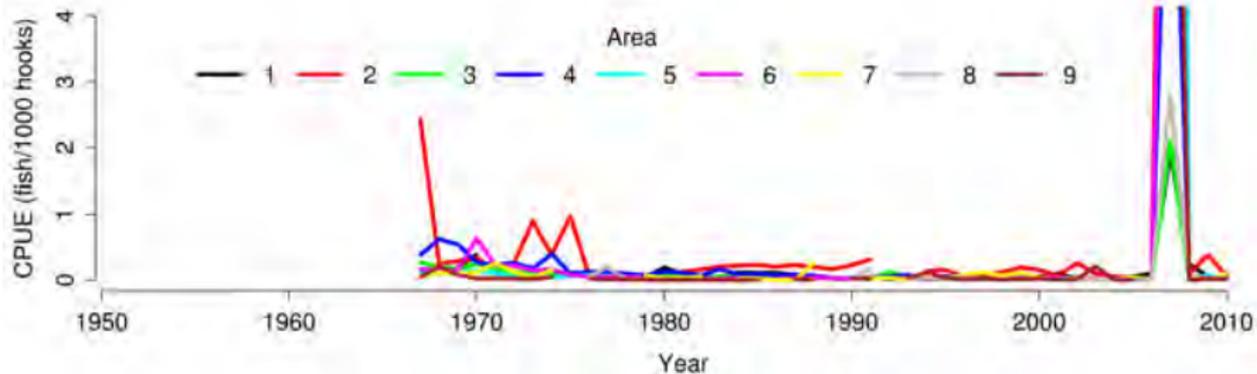
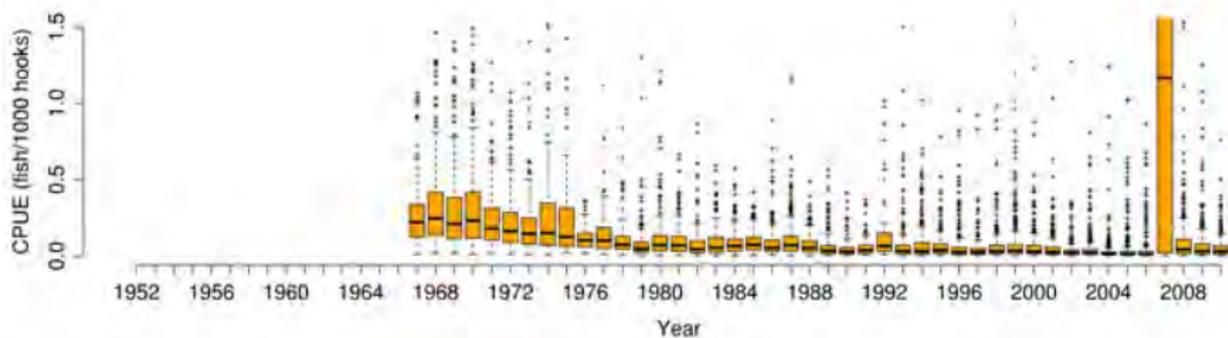
Proportion of Zero Catches



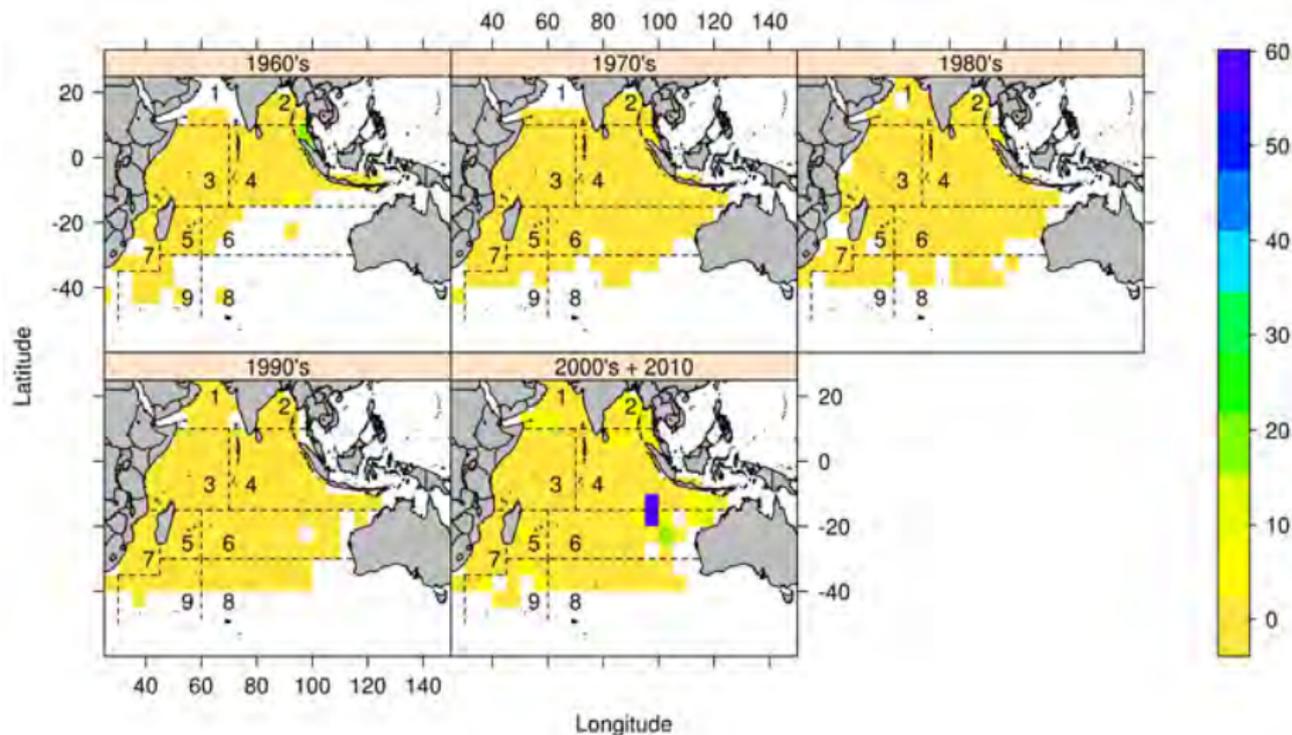
Proportion of Zero Catches



CPUE – Positive Catches



CPUE – Positive Catches

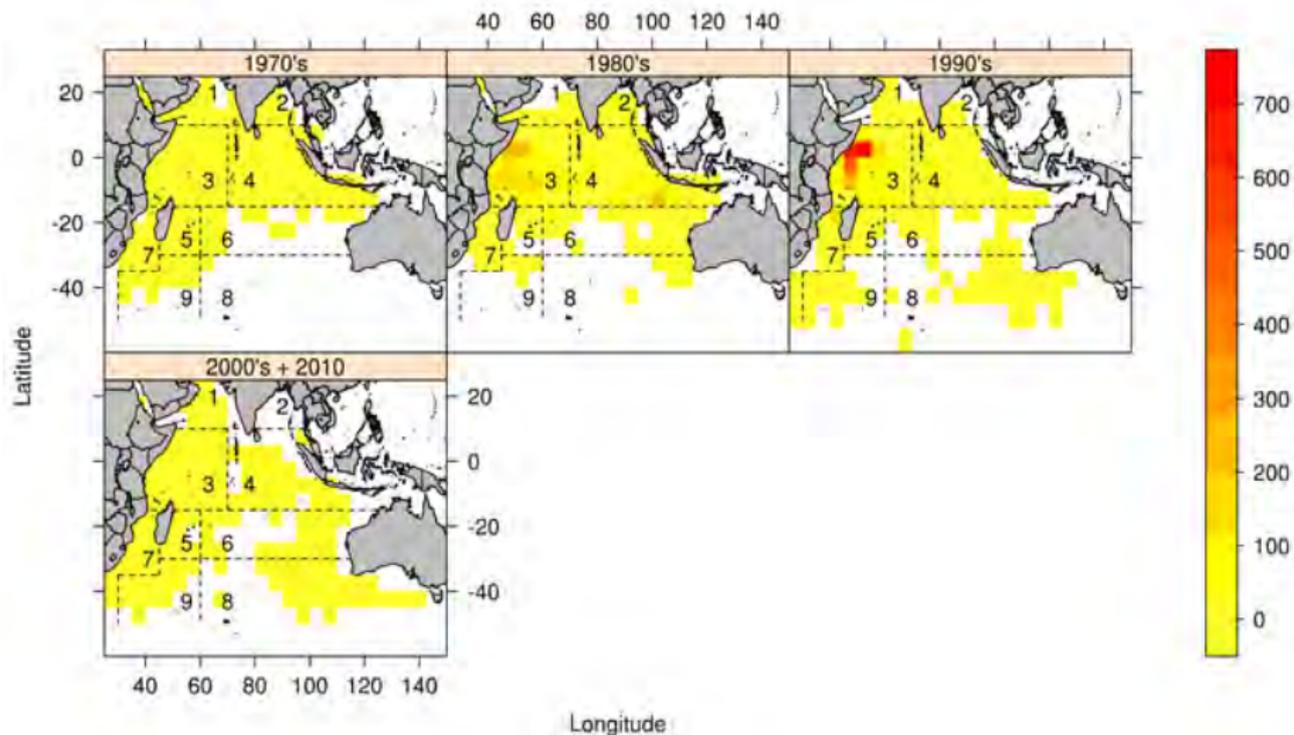


Remarks – BLM Taiwan Dataset

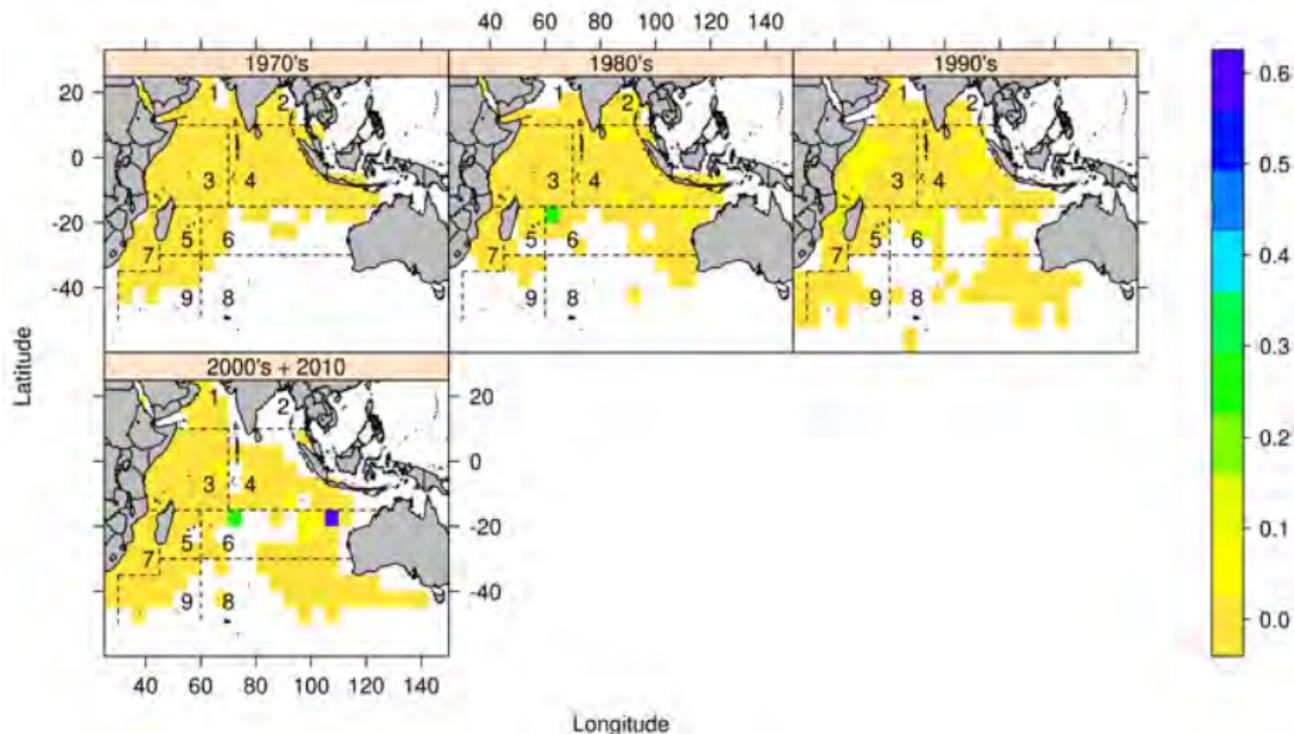
- 1 Catches and catch rates were high in areas 1, 2 and 4 in the margins of Indic Ocean especially in 2000's;
- 2 Catch rates were high in 3rd and 4th quarters in north areas (1 and 2);
- 3 Overall proportions of zero catches increase quickly in 1970's especially in areas 3 and 5. Proportion of zero catches also increase in area 4 in 1980's;
- 4 Catch rates for positive dataset of 2007 should be revised;
- 5 Catch rates as calculated for positive dataset decreases in 1960's and 1970's but they are not too low in the end of 2000's;



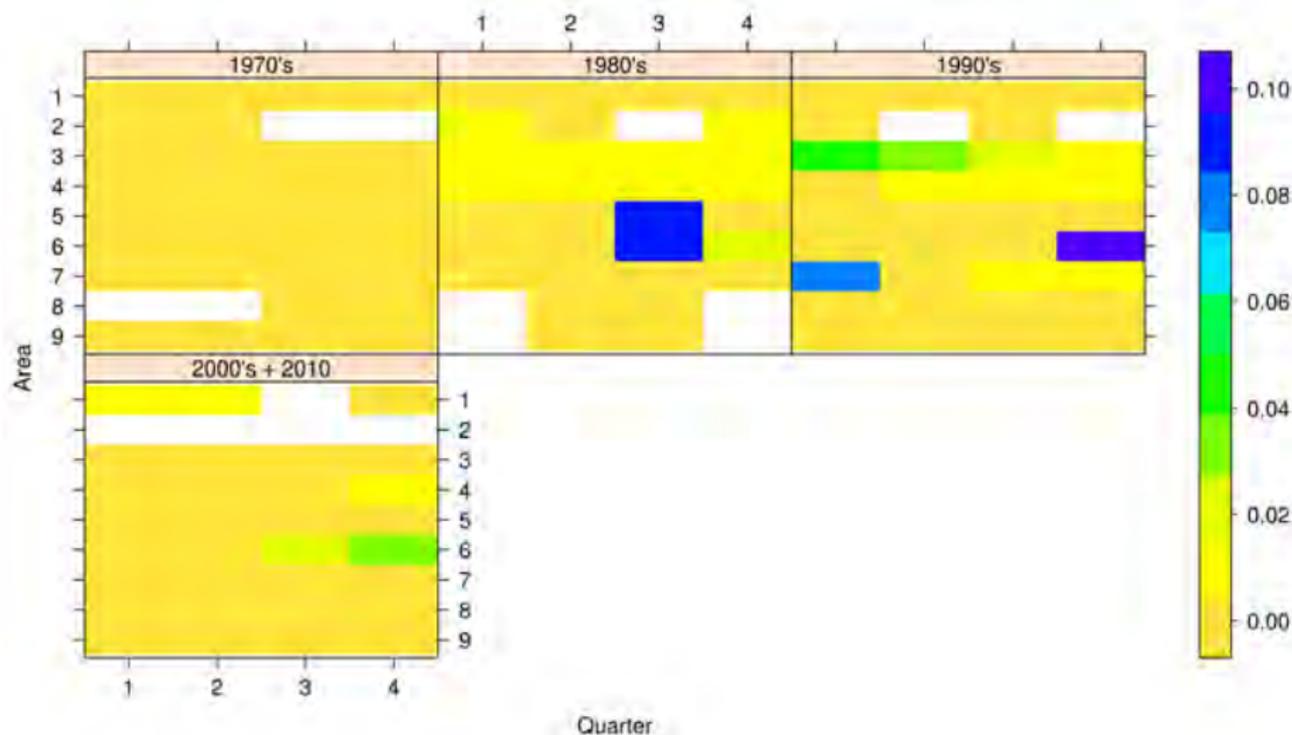
BLM - number of fish - Korea dataset



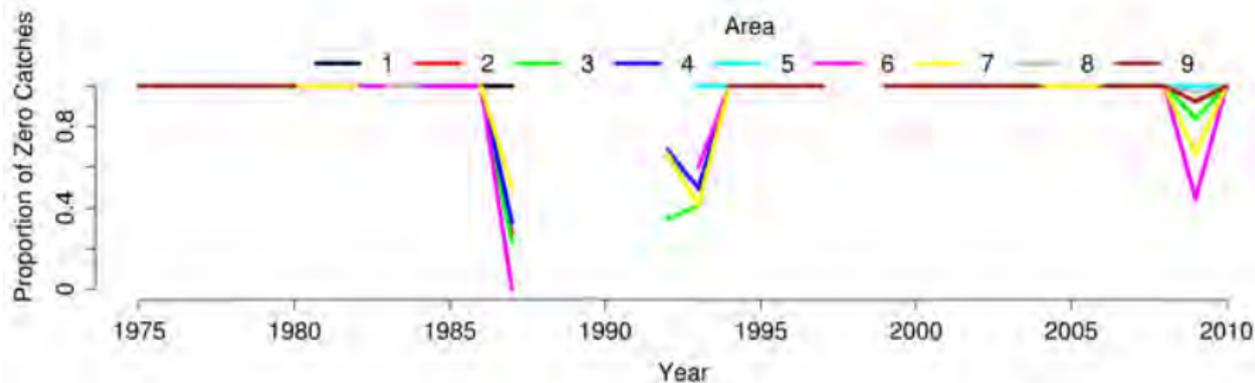
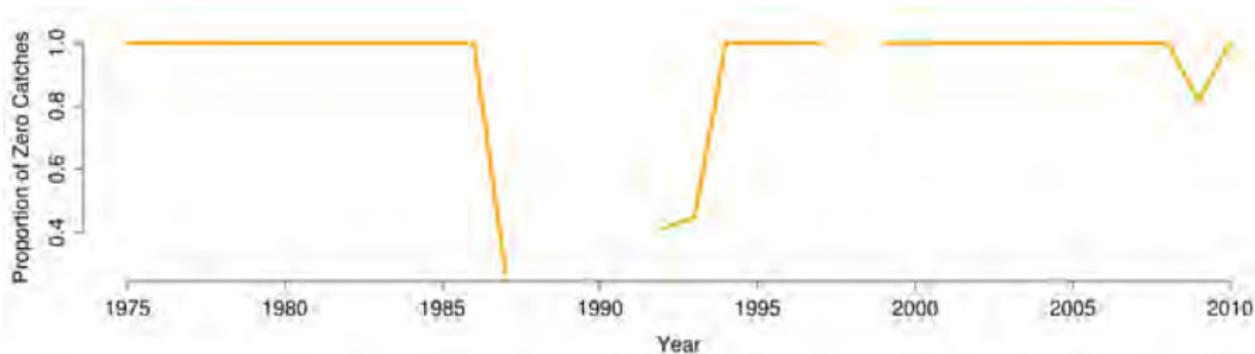
BLM - number of fish/1000 hooks - Decade x Lat x Lon



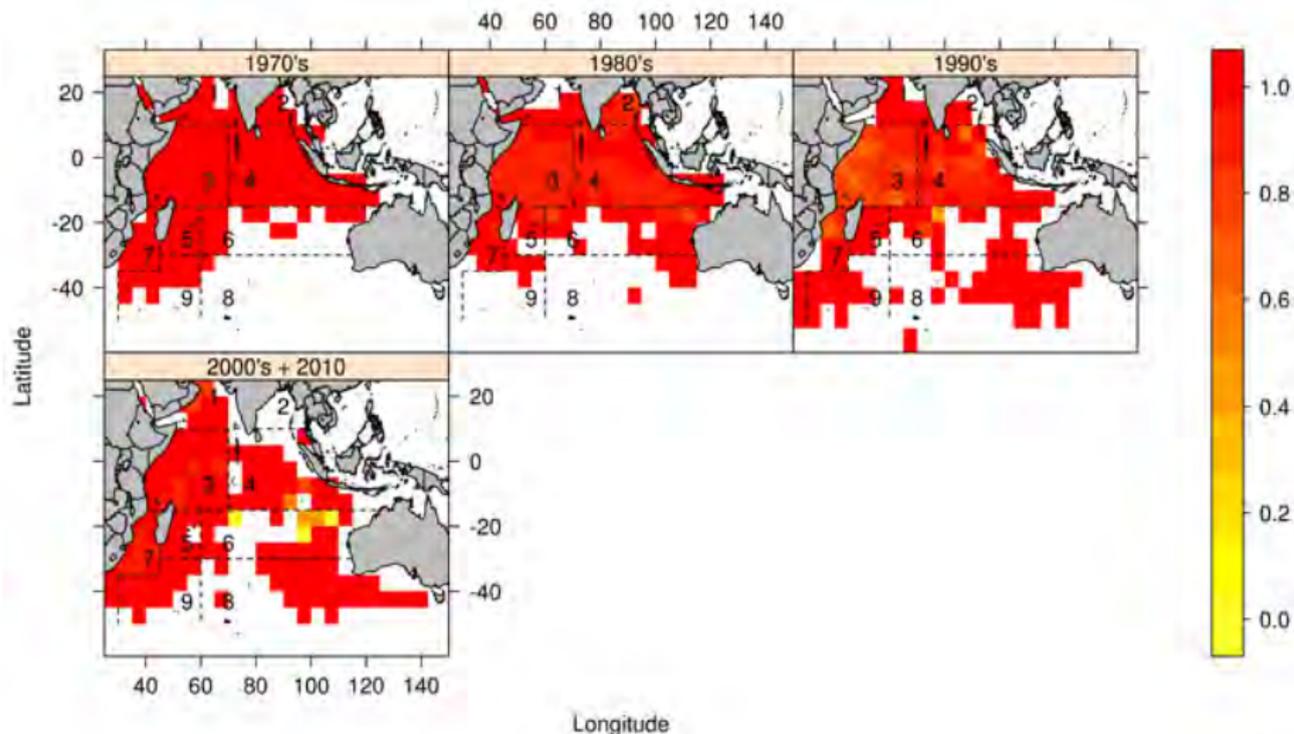
BLM - number of fish/1000 hooks - Decade x Quarter x Area



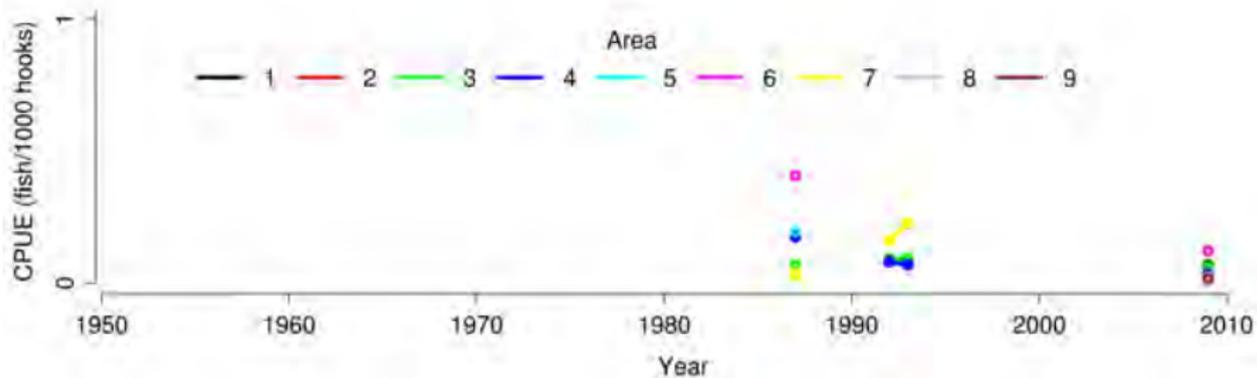
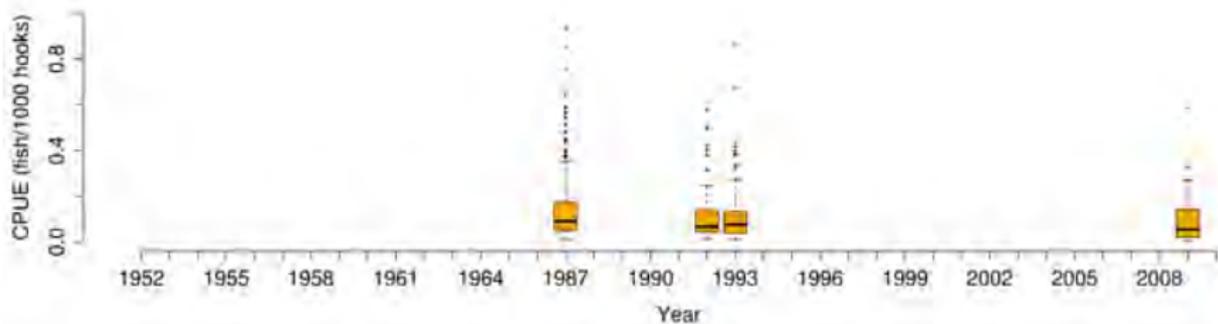
Proportion of Zero Catches



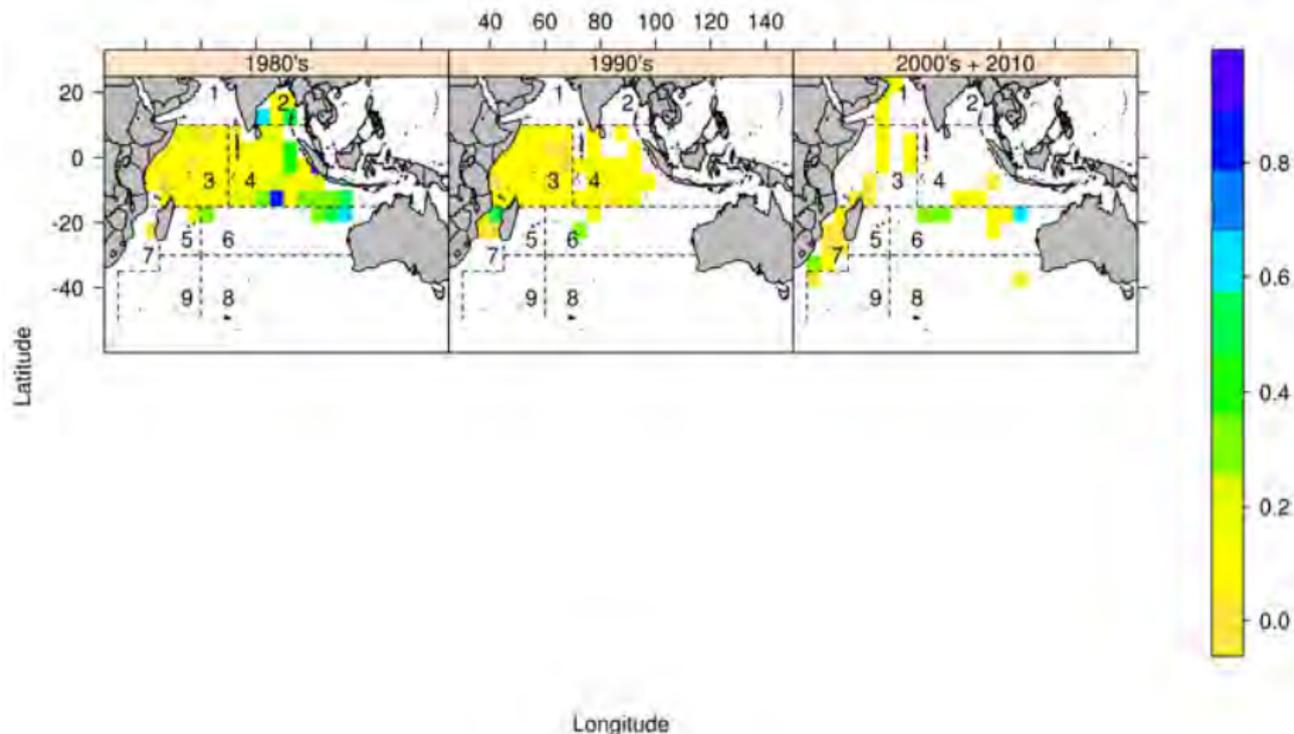
Proportion of Zero Catches



CPUE – Positive Catches



CPUE – Positive Catches

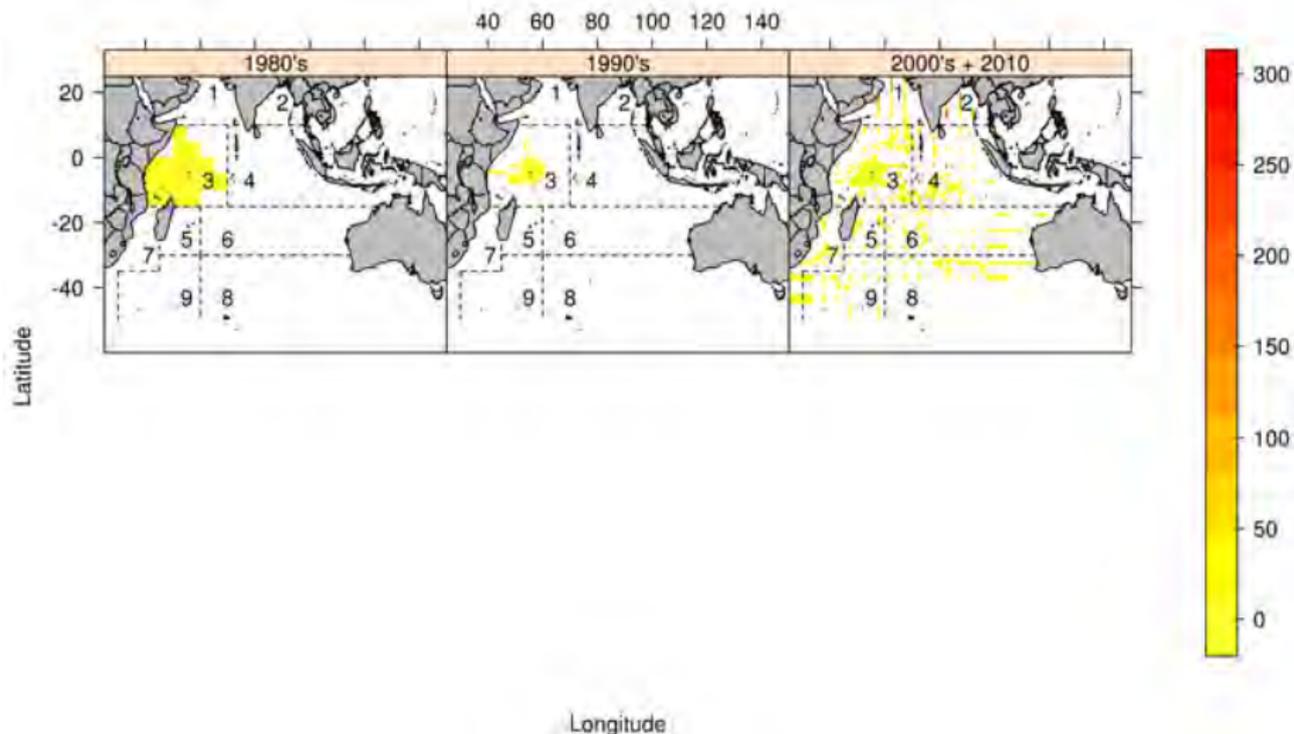


Remarks – BLM Korea Dataset

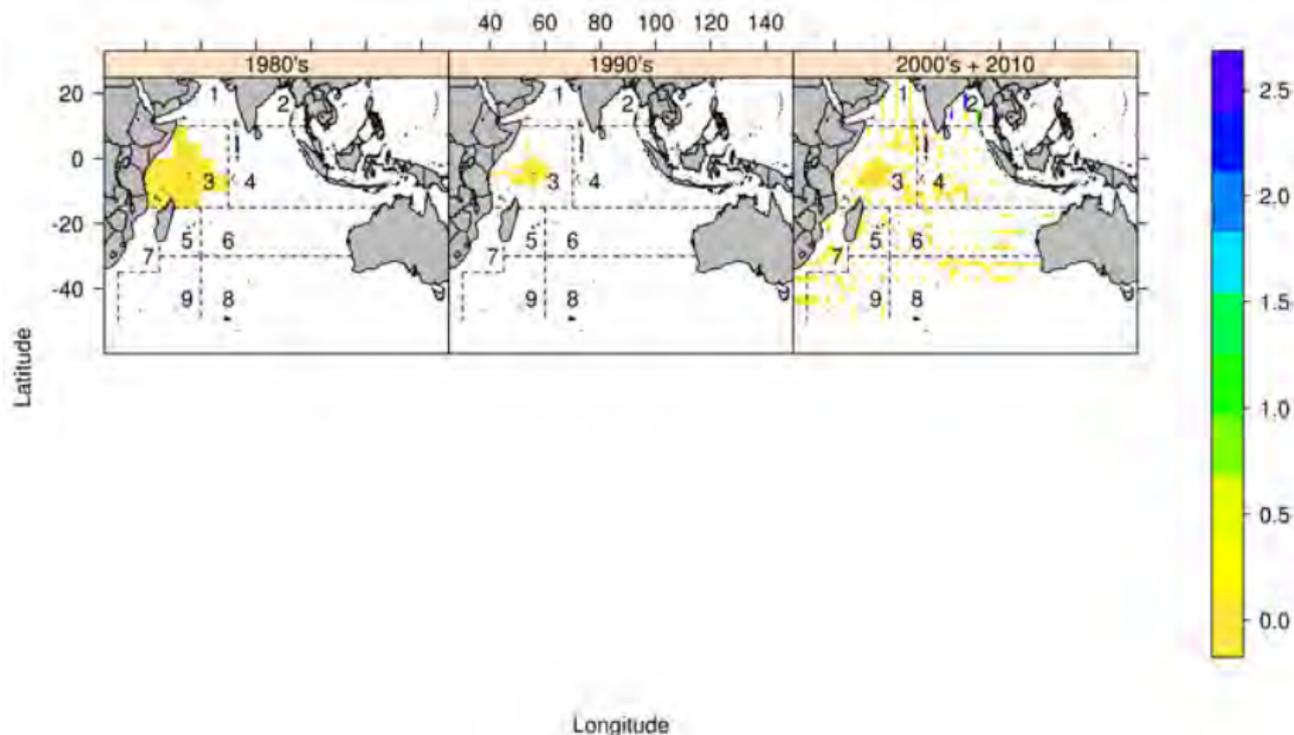
- ① Catches were high in area 3 in 1980's and 1990's;
- ② Catch rates were high in areas 3 (1990's) and 6 (1980's and 1990's);
- ③ Catch rates were high in 3rd and 4th quarters in area 6;
- ④ Data are not informative about the proportion of zero catches and the positive catches.



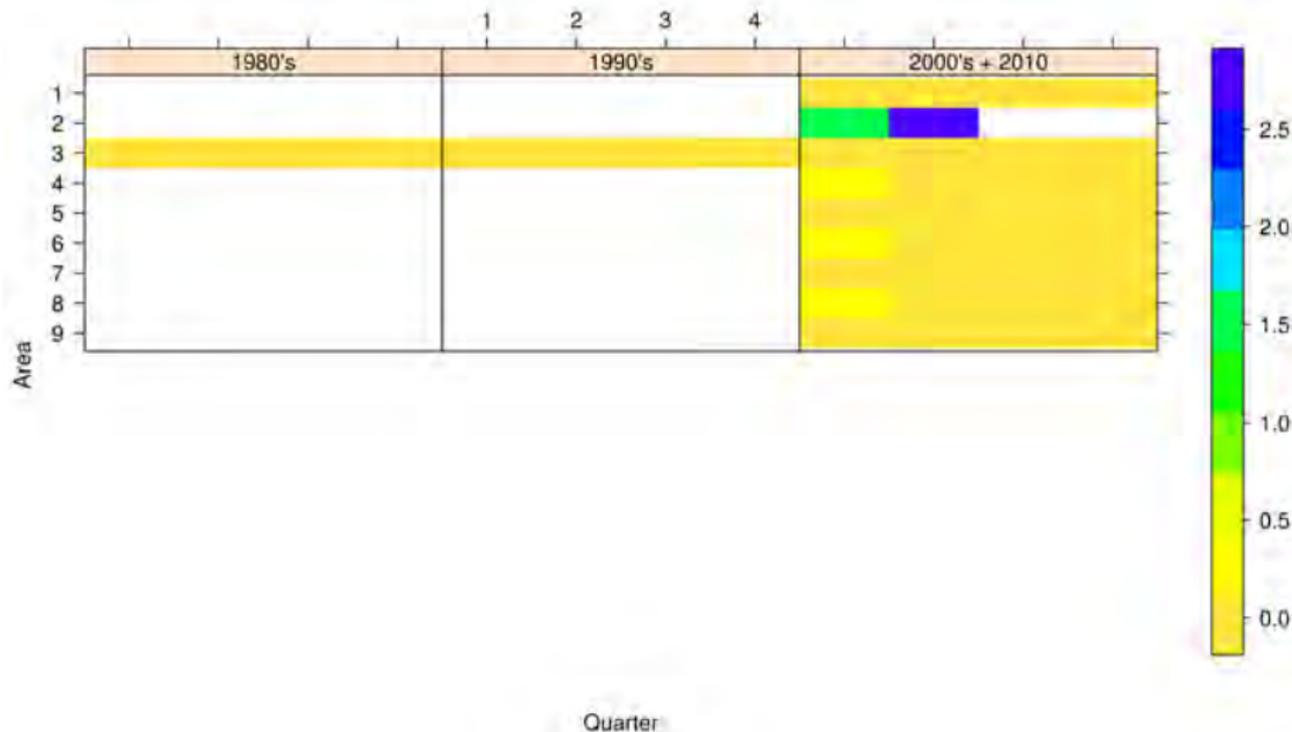
BLM - number of fish - Seychelles dataset



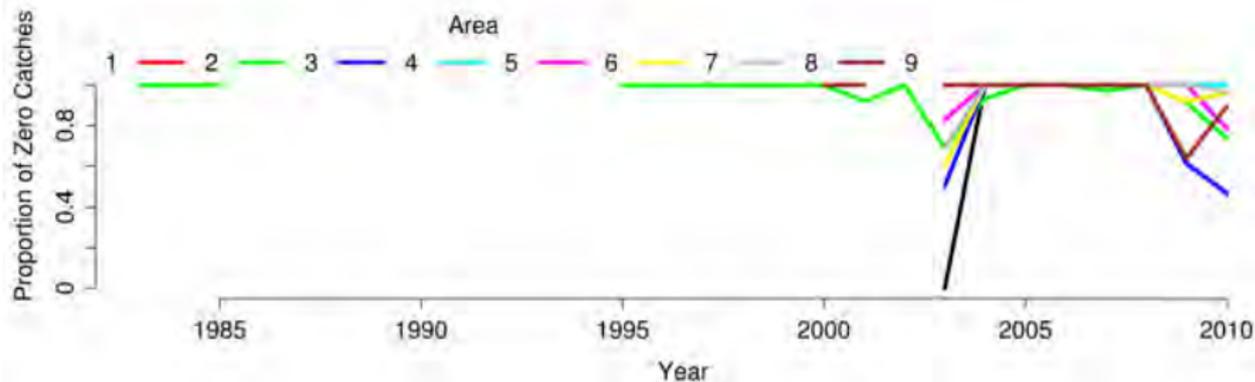
BLM - number of fish/1000 hooks - Decade x Lat x Lon



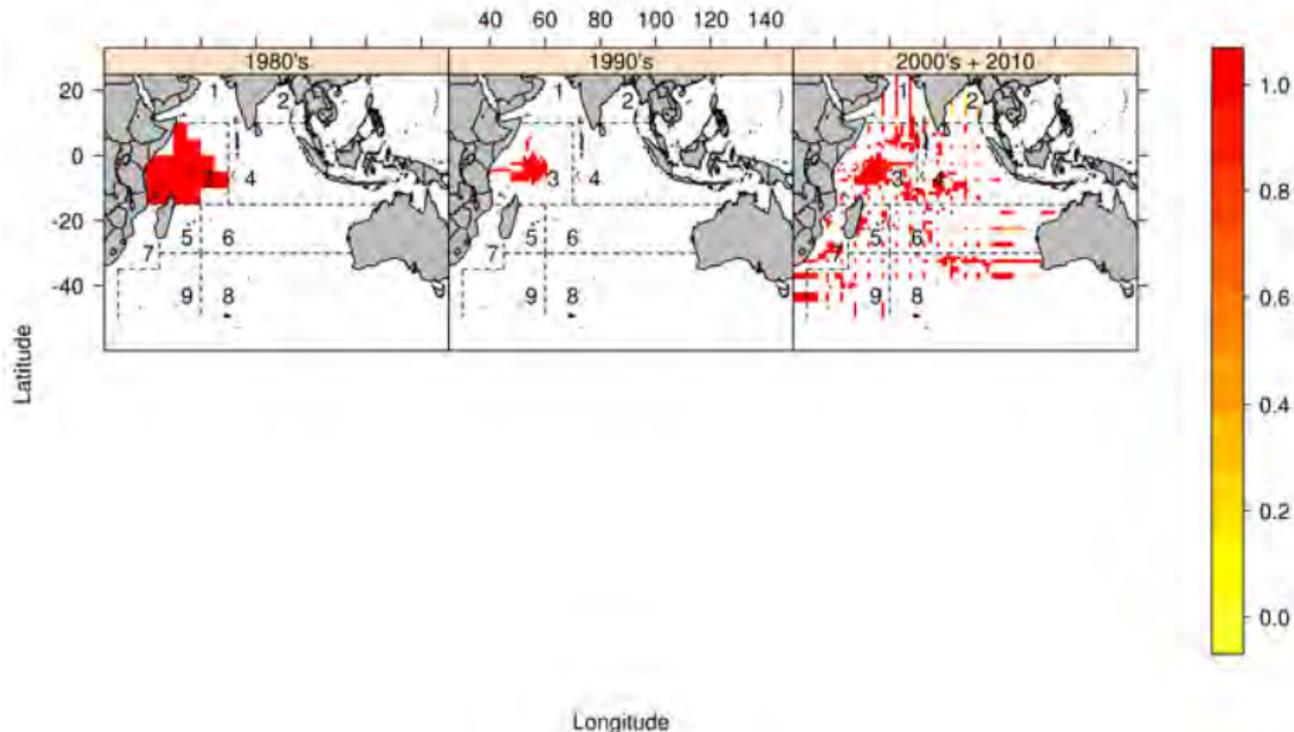
BLM - number of fish/1000 hooks - Decade x Quarter x Area



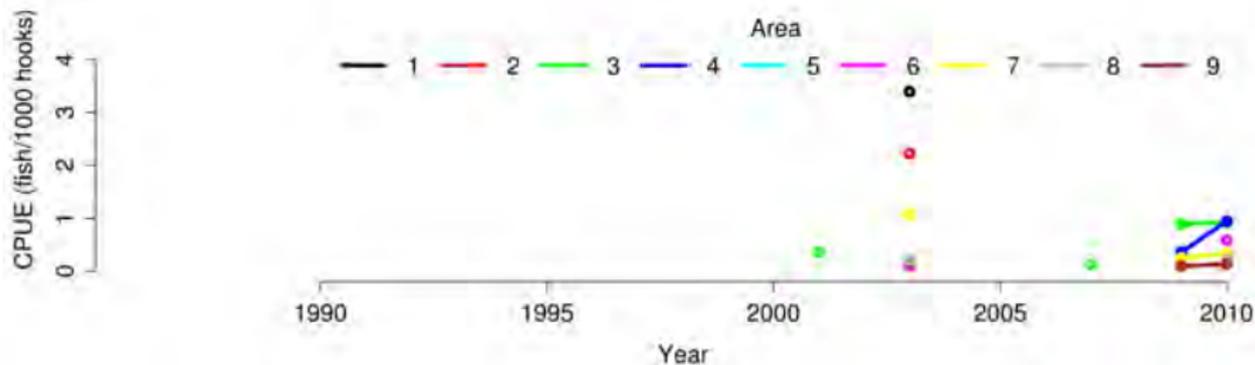
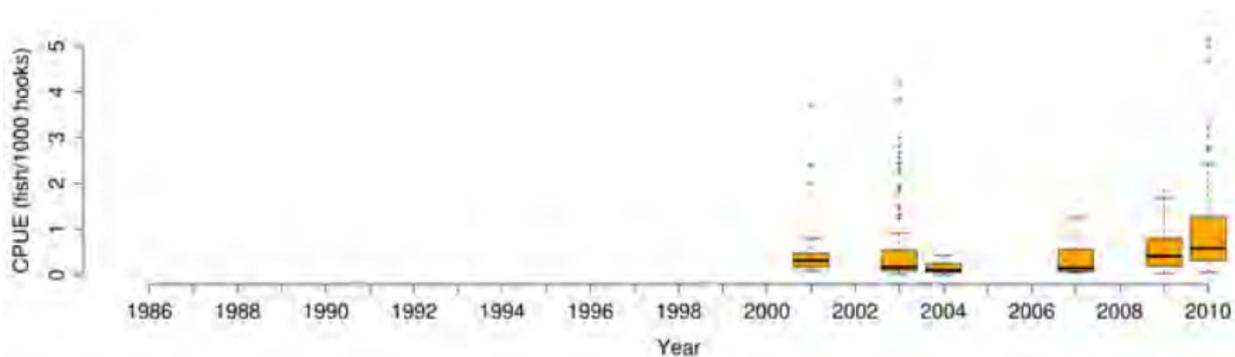
Proportion of Zero Catches



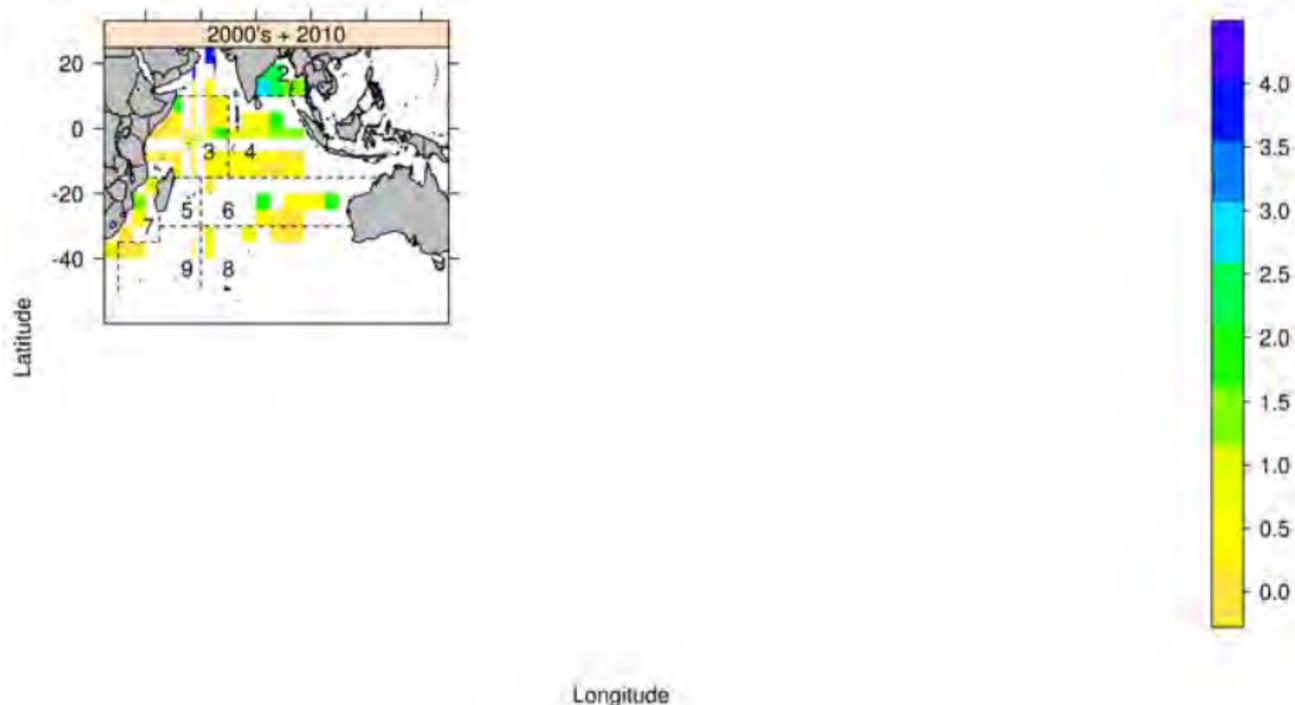
Proportion of Zero Catches



CPUE – Positive Catches



CPUE – Positive Catches



Remarks – BLM Seychelles Dataset

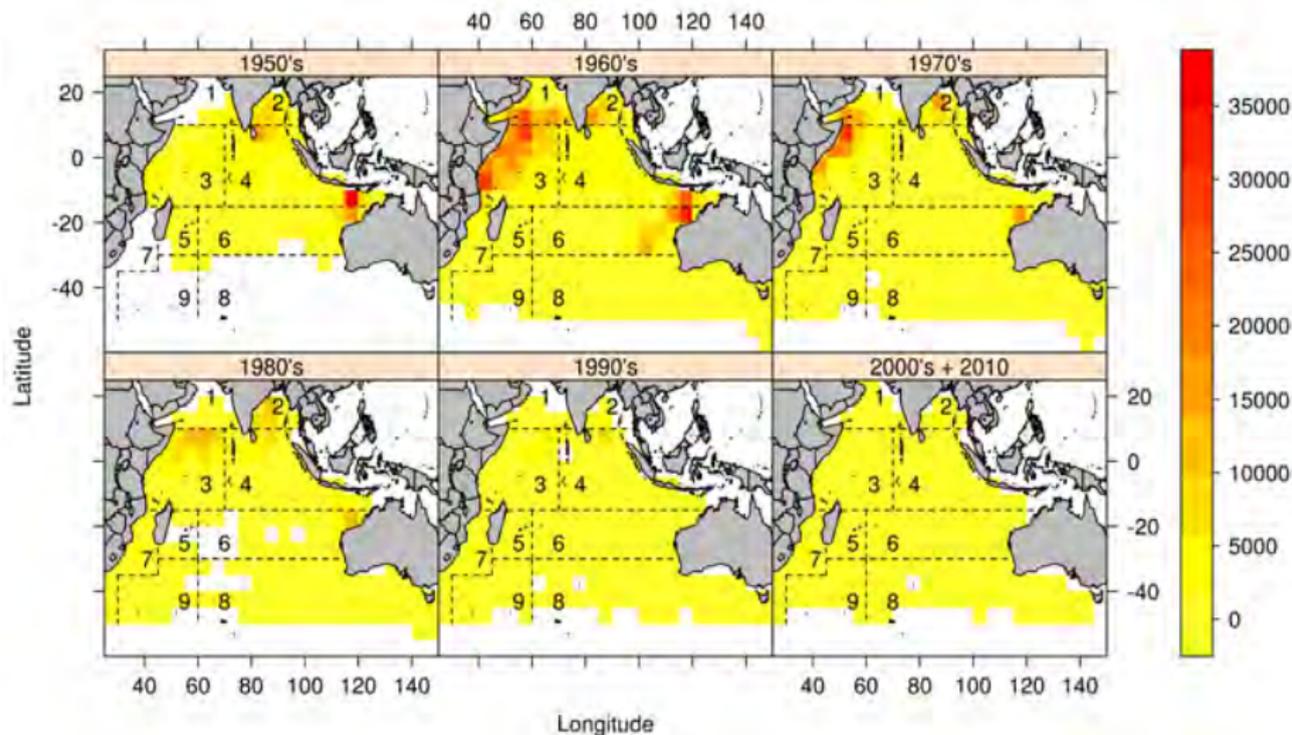
- 1 Catches were high in areas 1 and 2 and in 2000's;
- 2 Catch rates were high in area 2 in the first half of the year;
- 3 Data are not informative about the proportion of zero catches and the positive catches.



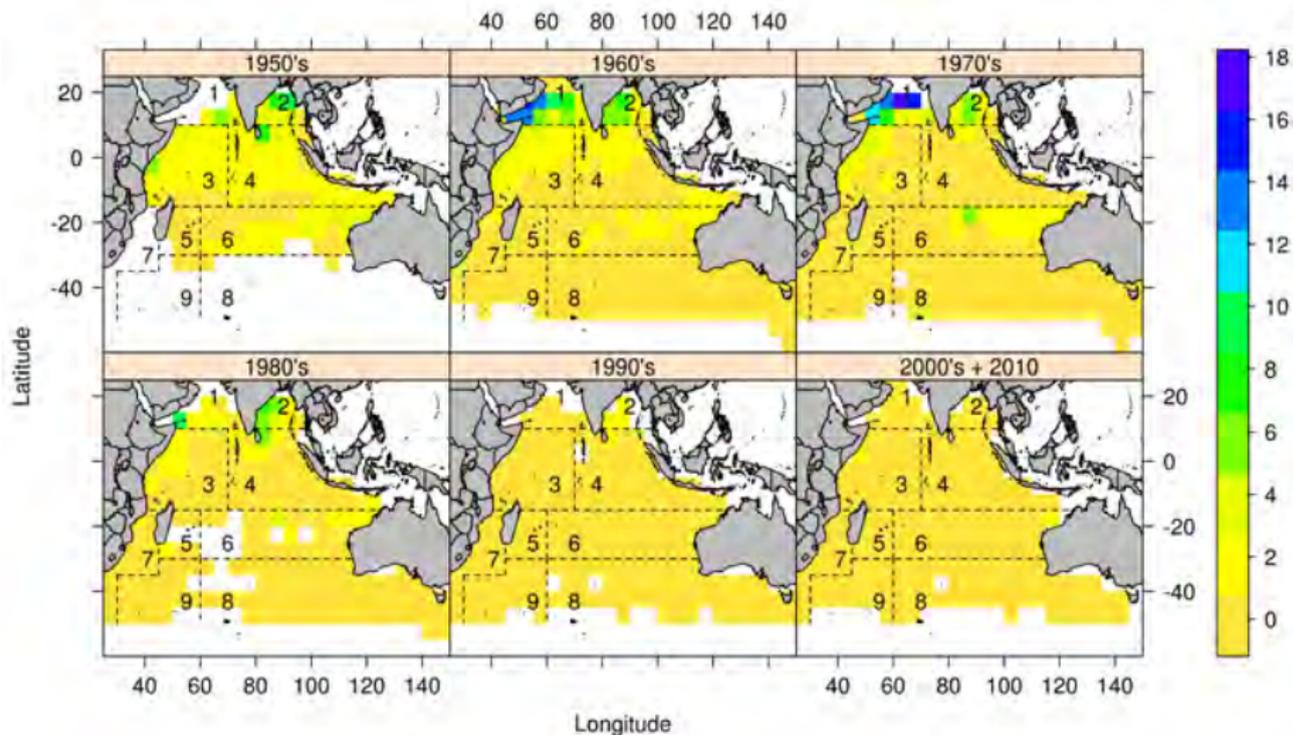
Striped Marlin (MLS)



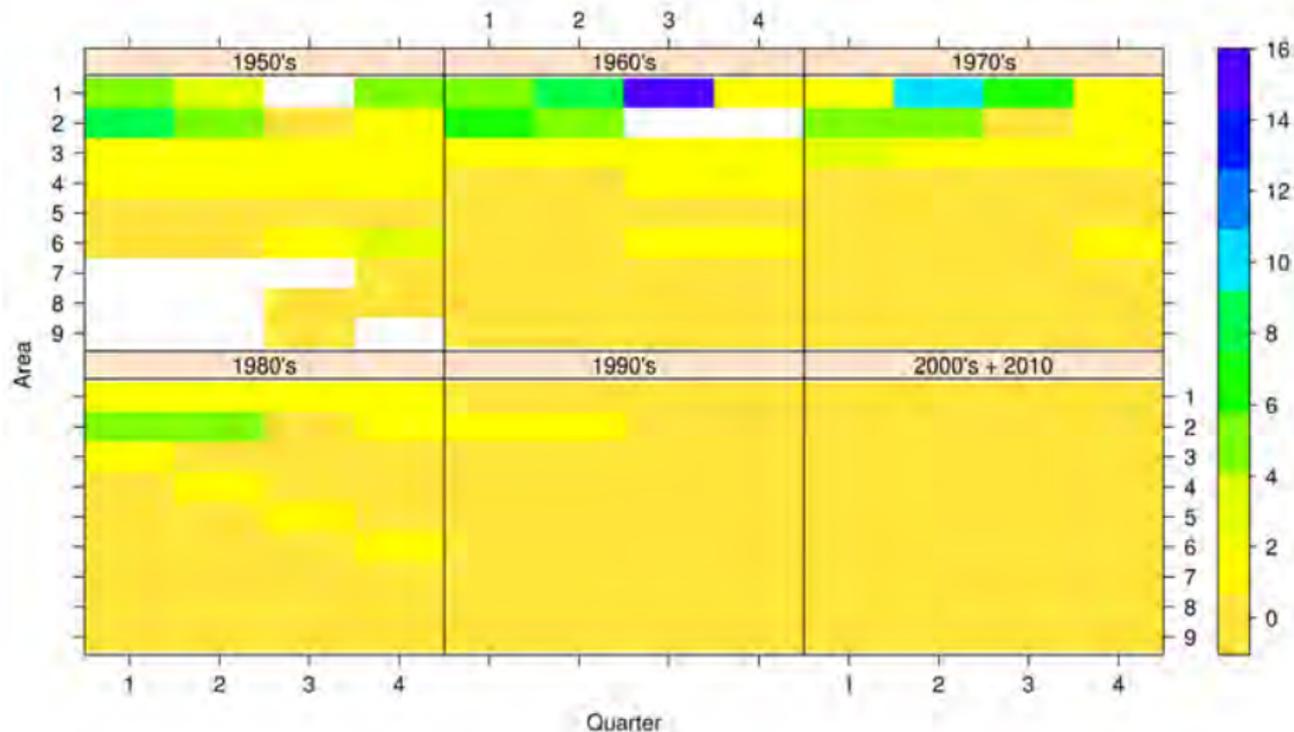
MLS - number of fish - Japan Dataset



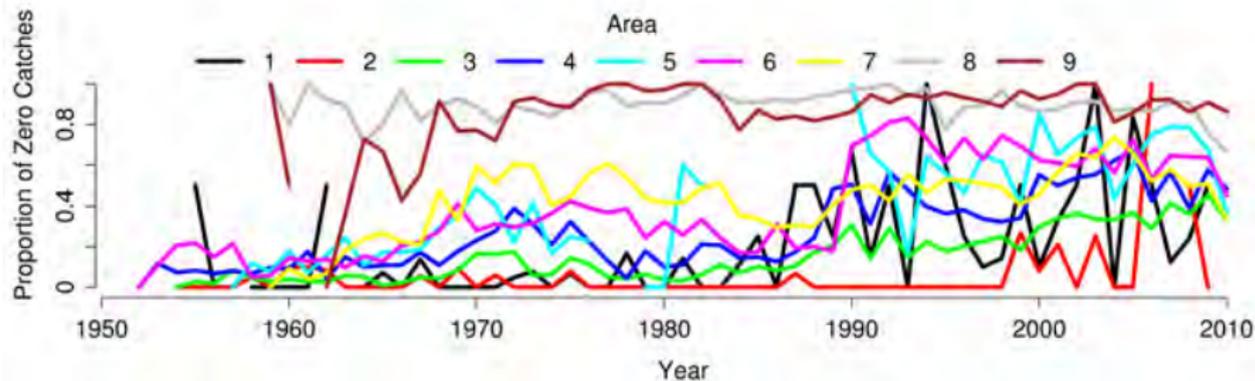
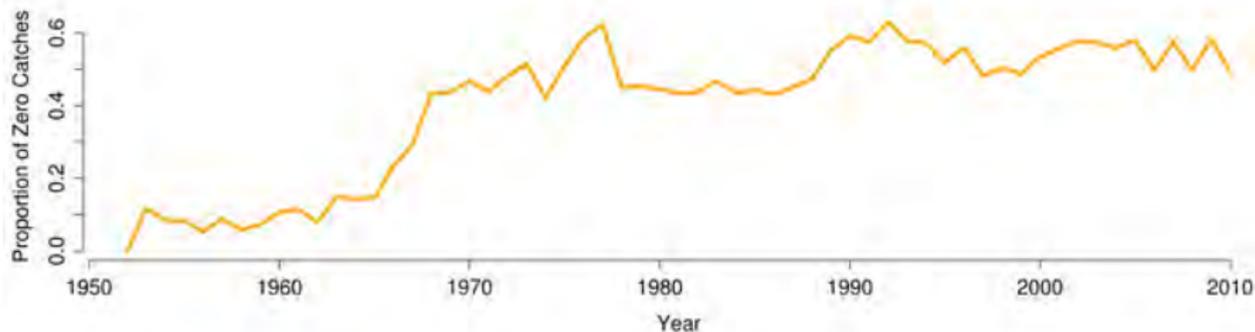
MLS - number of fish/1000 hooks - Decade x Lat x Lon



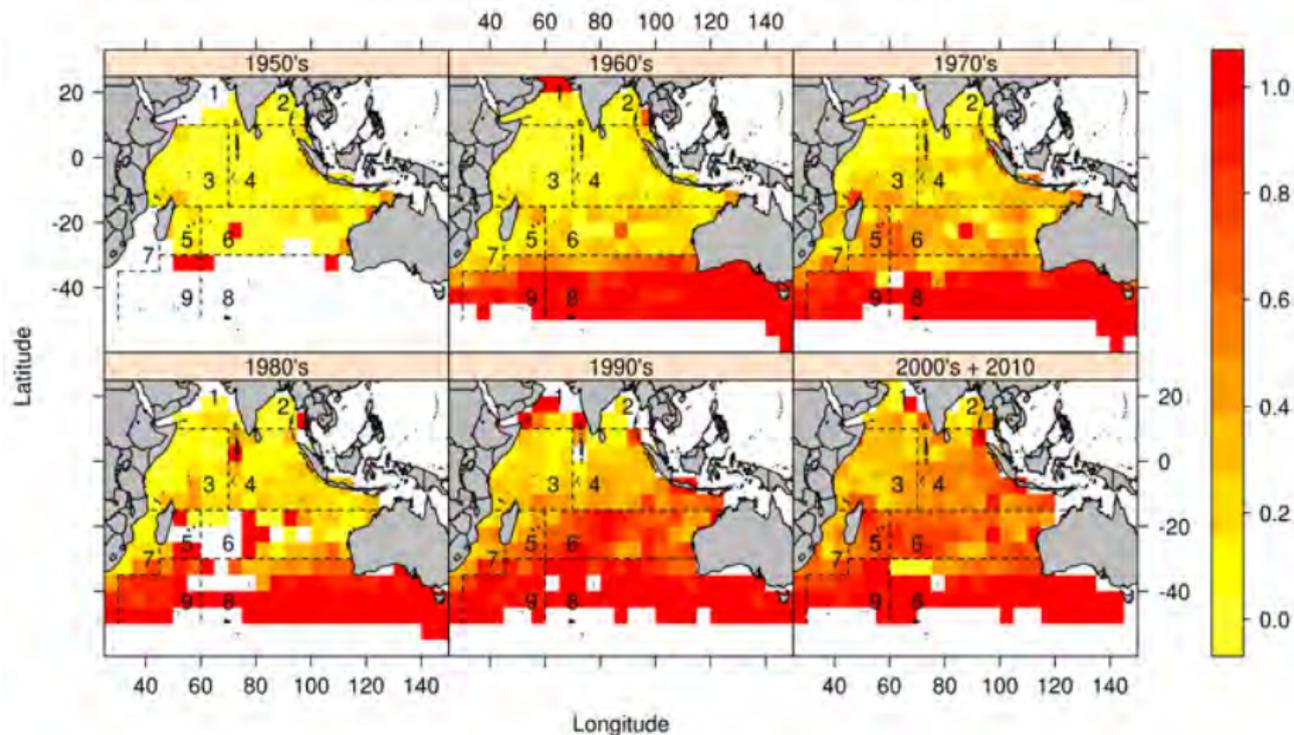
MLS - number of fish/1000 hooks - Decade x Quarter x Area



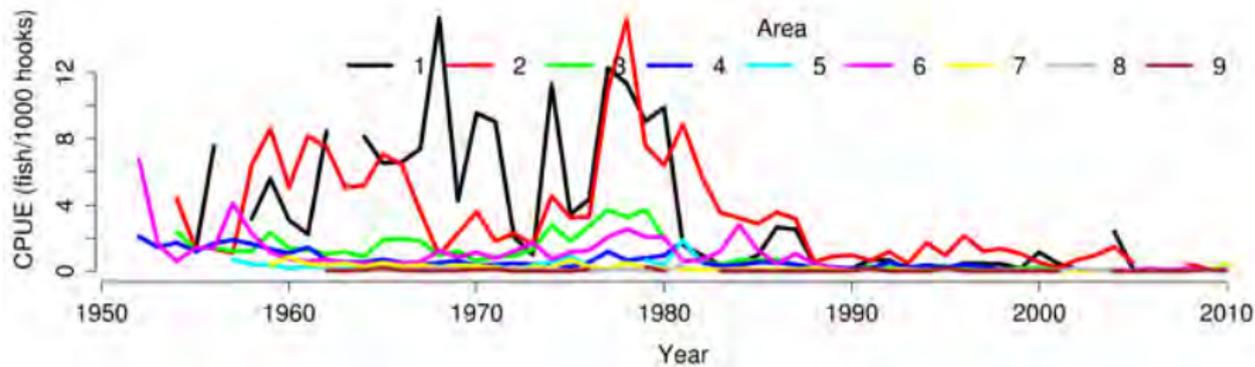
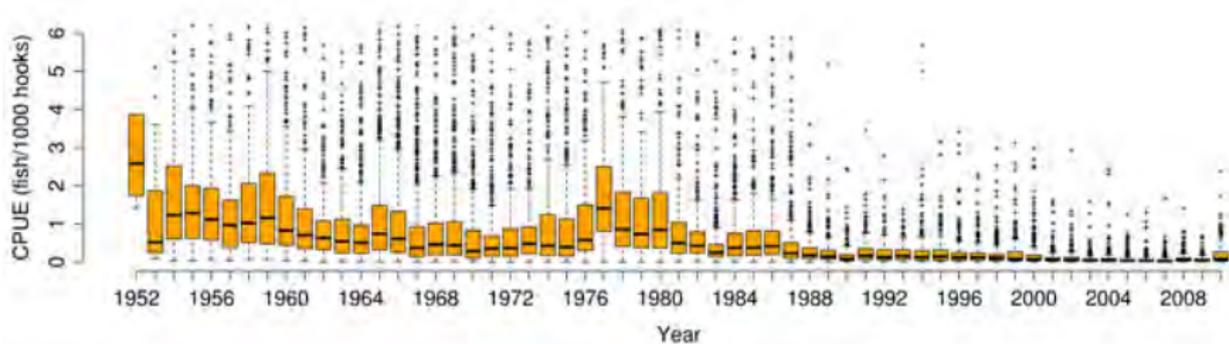
Proportion of Zero Catches



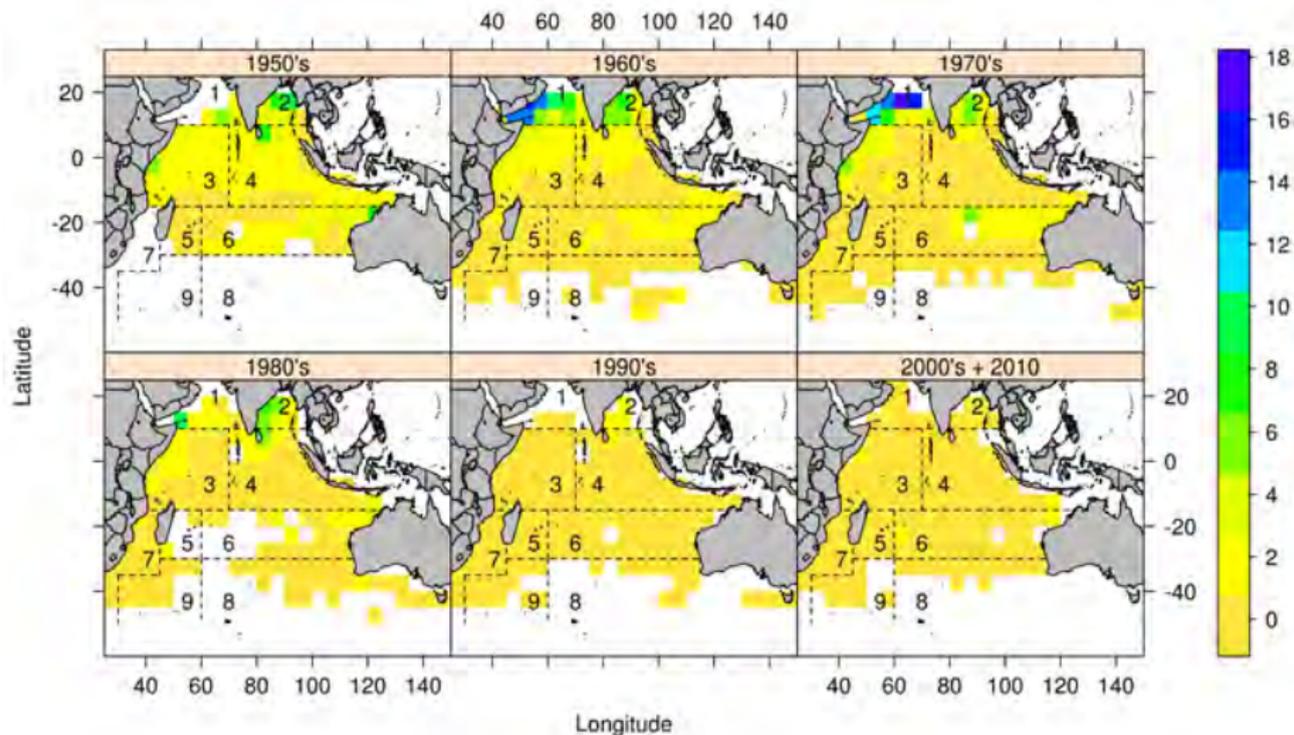
Proportion of Zero Catches



CPUE – Positive Catches



CPUE – Positive Catches

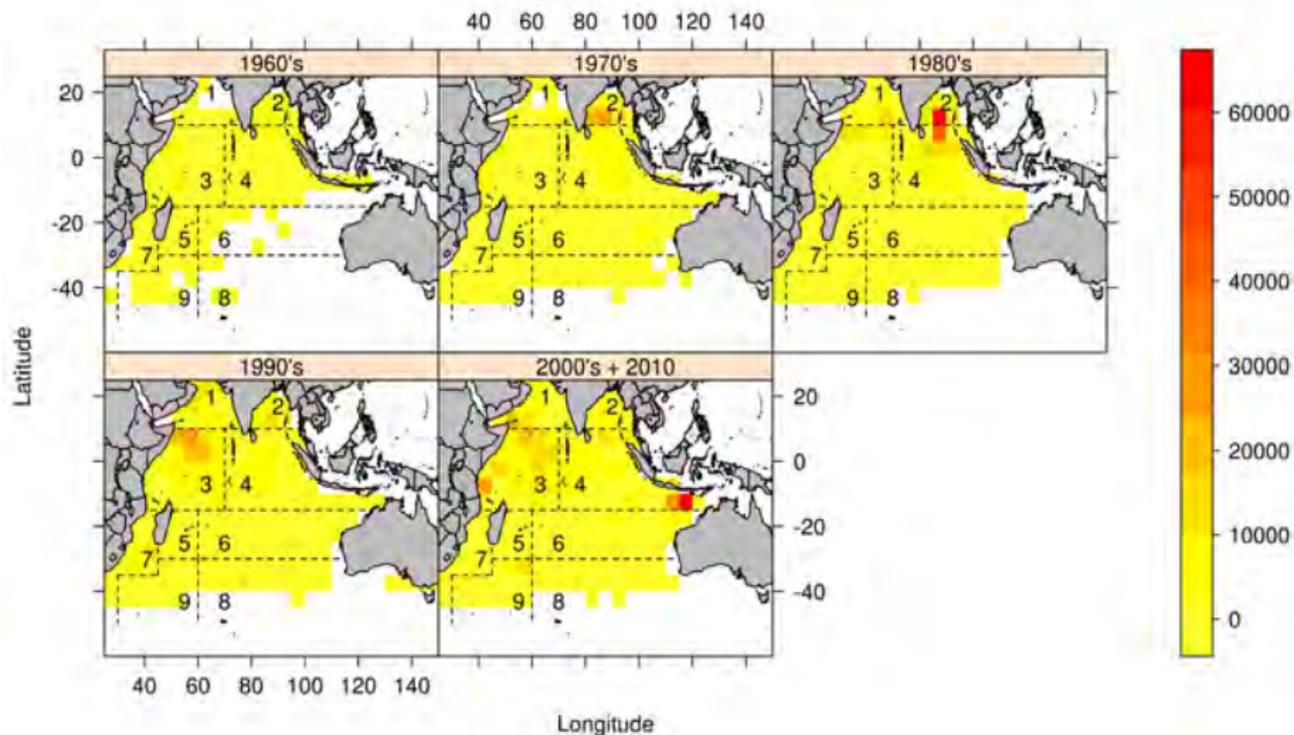


Remarks – MLS Japan Dataset

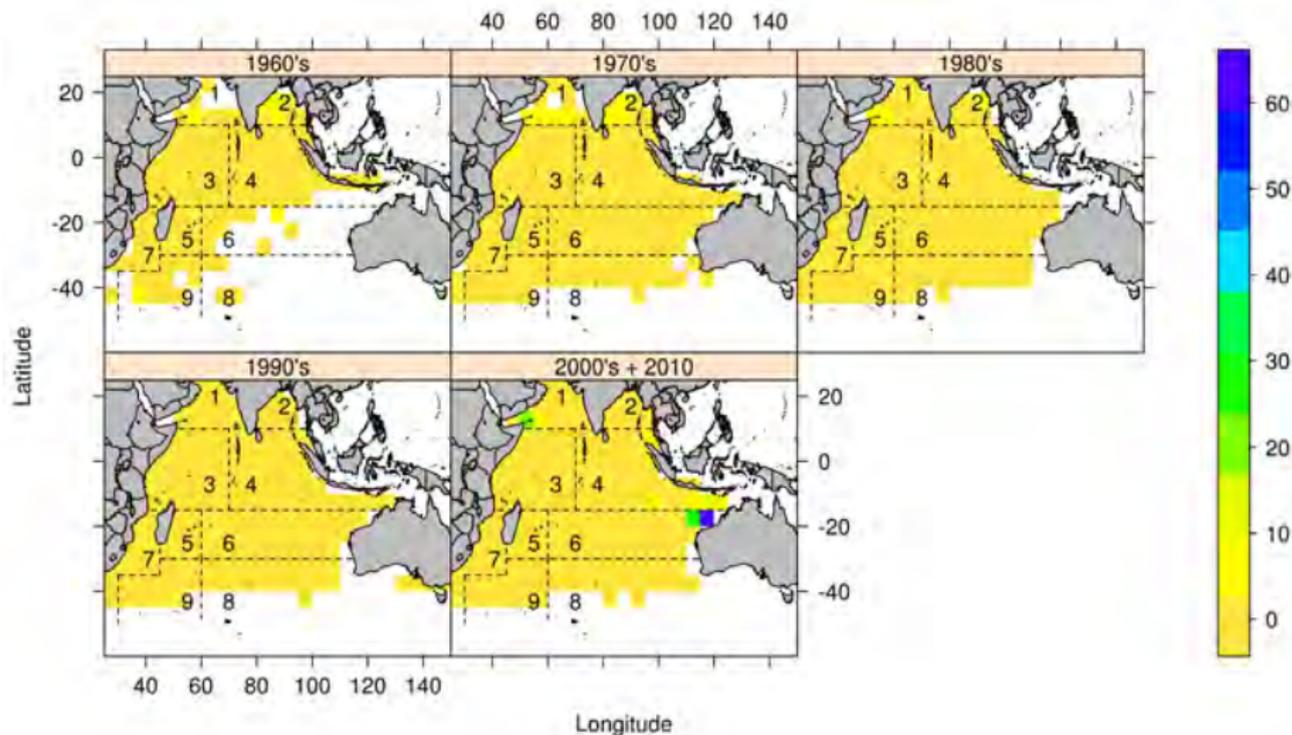
- 1 Catches were high in areas 2, 3, 4 and 6 in 1960's and 1970's especially in the margin of the Indic Ocean;
- 2 Overall catch rates were high in areas 1, 2 and 3 in 1950's, 1960's and 1970's;
- 3 Clear seasonal pattern was not apparent in this preliminary analysis;
- 4 Overall proportions proportions of zero catches are not high except in areas 8 and 9;
- 5 Proportions zero catches increase in 1960's especially in areas 4, 5, 6 and 7. Proportions of zeros also increase quickly in area 6 in the end of 1980's;
- 6 Catch rates as calculated for positive dataset show a slight decreasing trend until the end of 1960's then, there is a peak in the end of 1970's. Finally there is another decreasing trend until the end of 2000's;
- 7 The peak of catch rates calculated for positive dataset is noticeable in areas 1 and 2;
- 8 Catch rates for positive dataset were high in some locations inside areas 1, 2 and 3 in 1950's, 1960's and 1970's.



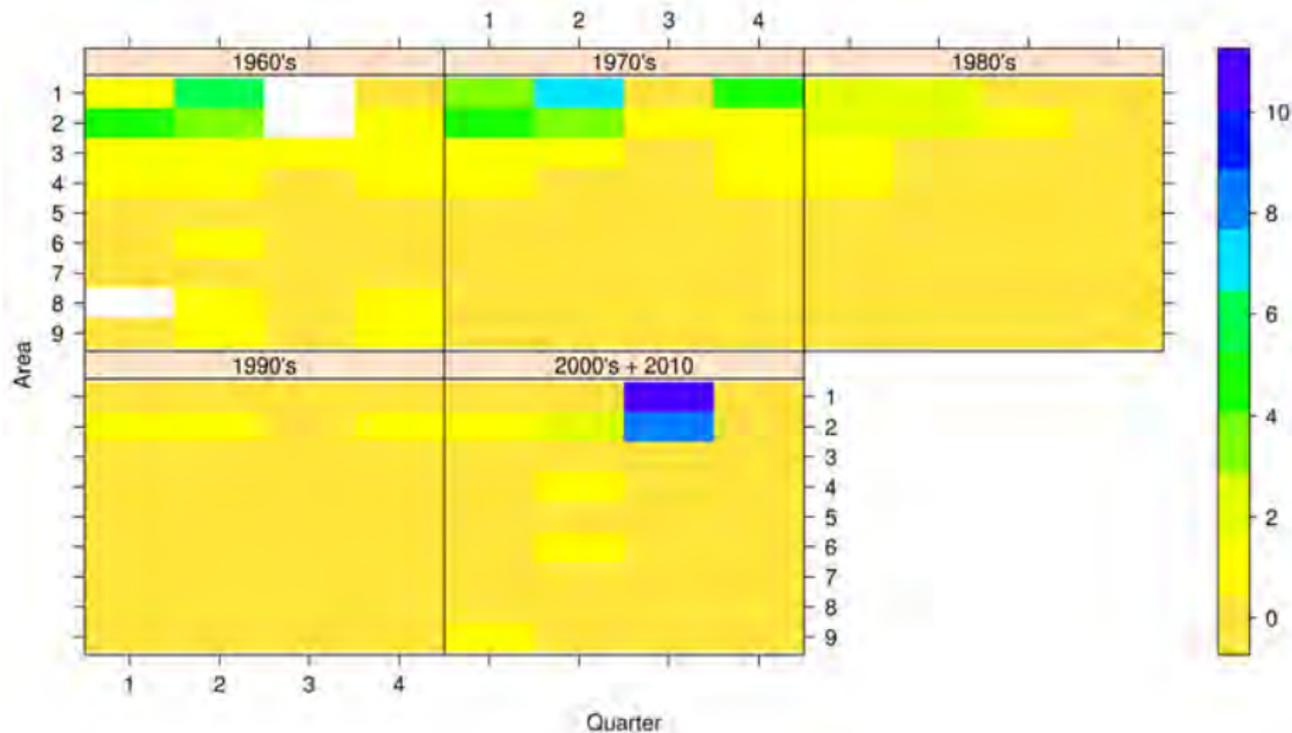
MLS - number of fish - Taiwan dataset



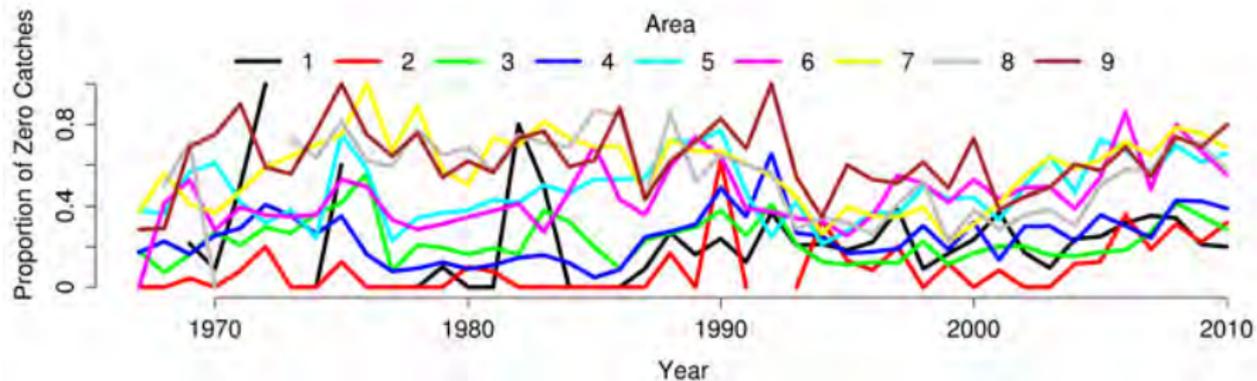
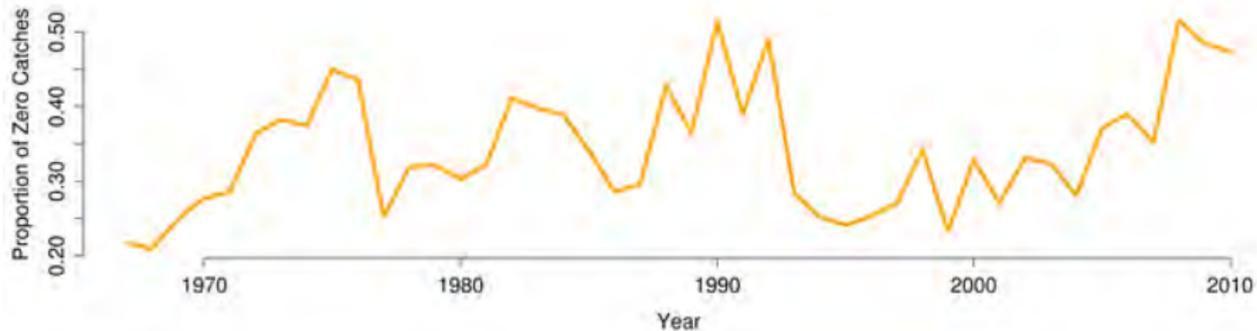
MLS - number of fish/1000 hooks - Decade x Lat x Lon



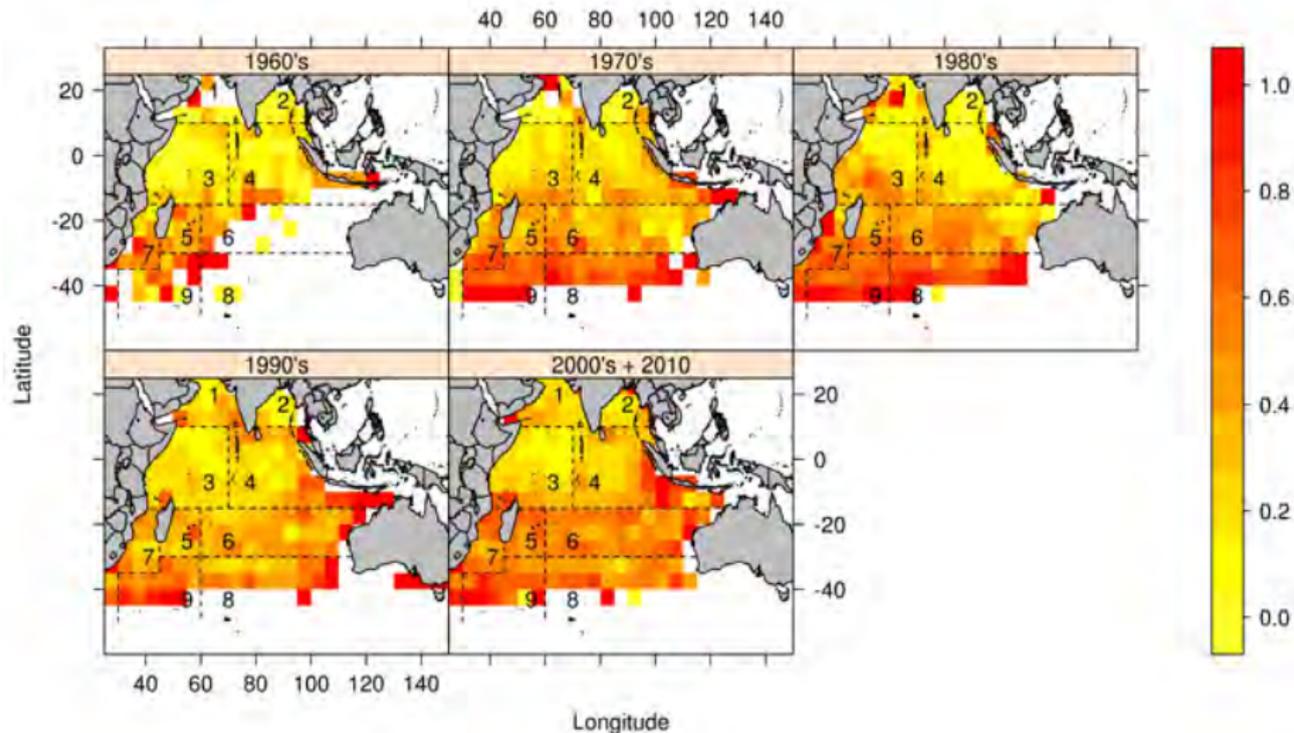
MLS - number of fish/1000 hooks - Decade x Quarter x Area



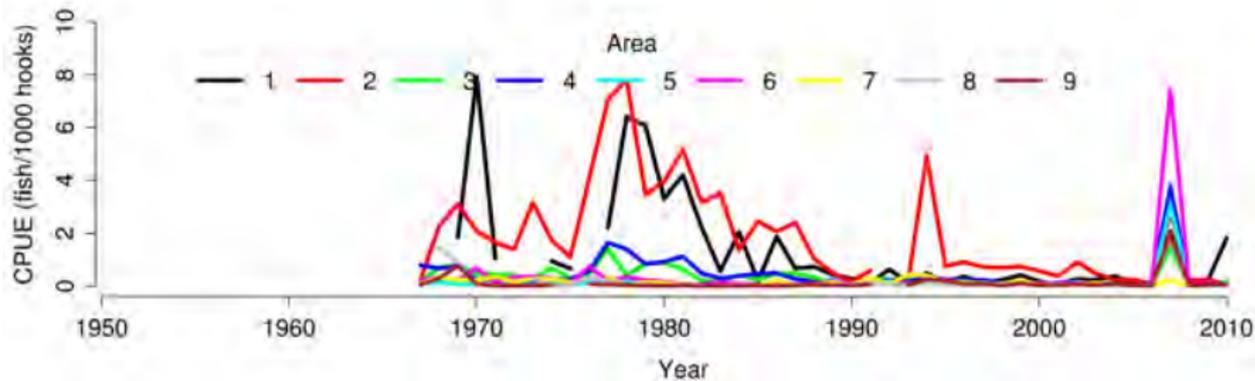
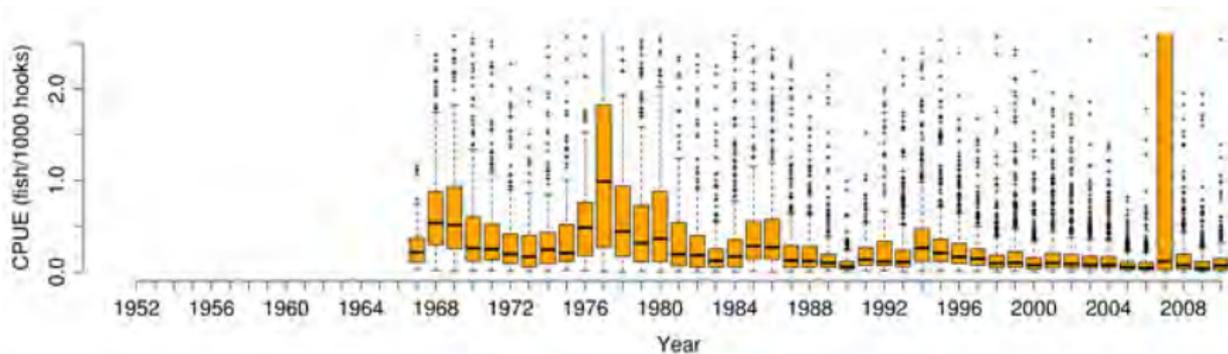
Proportion of Zero Catches



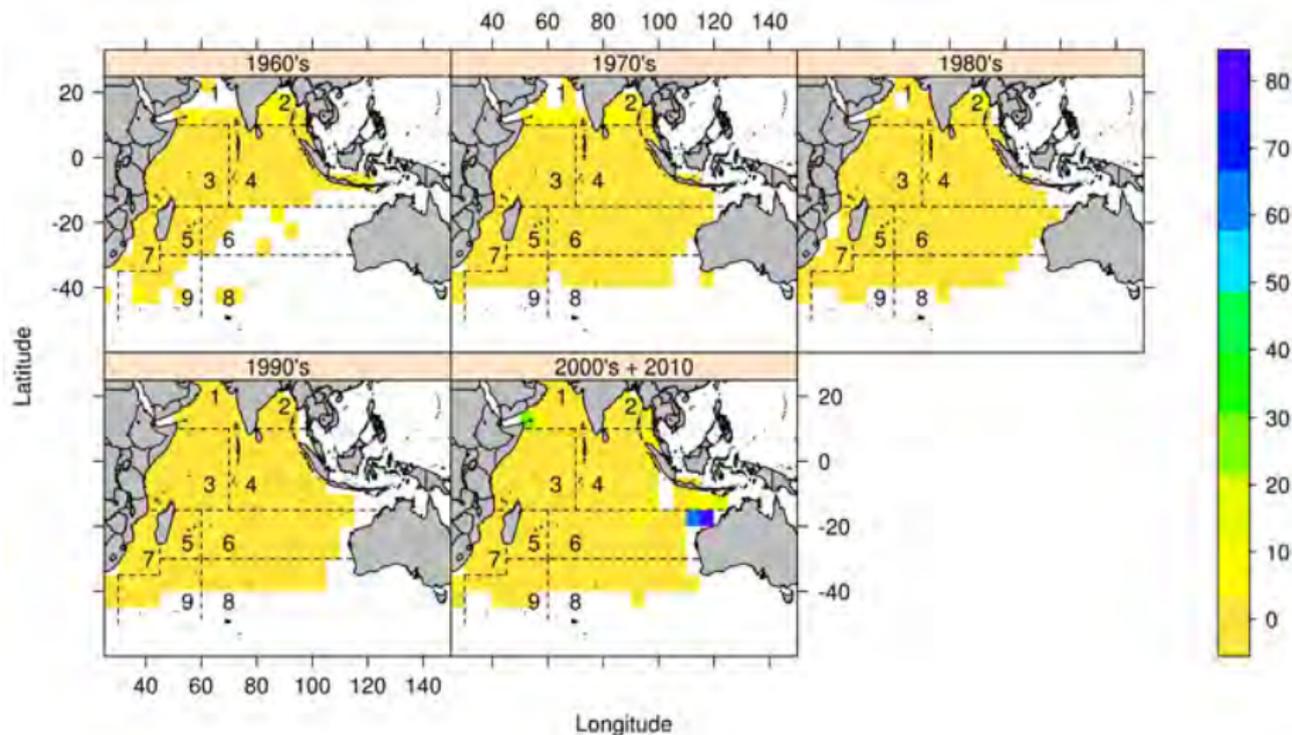
Proportion of Zero Catches



CPUE – Positive Catches



CPUE – Positive Catches

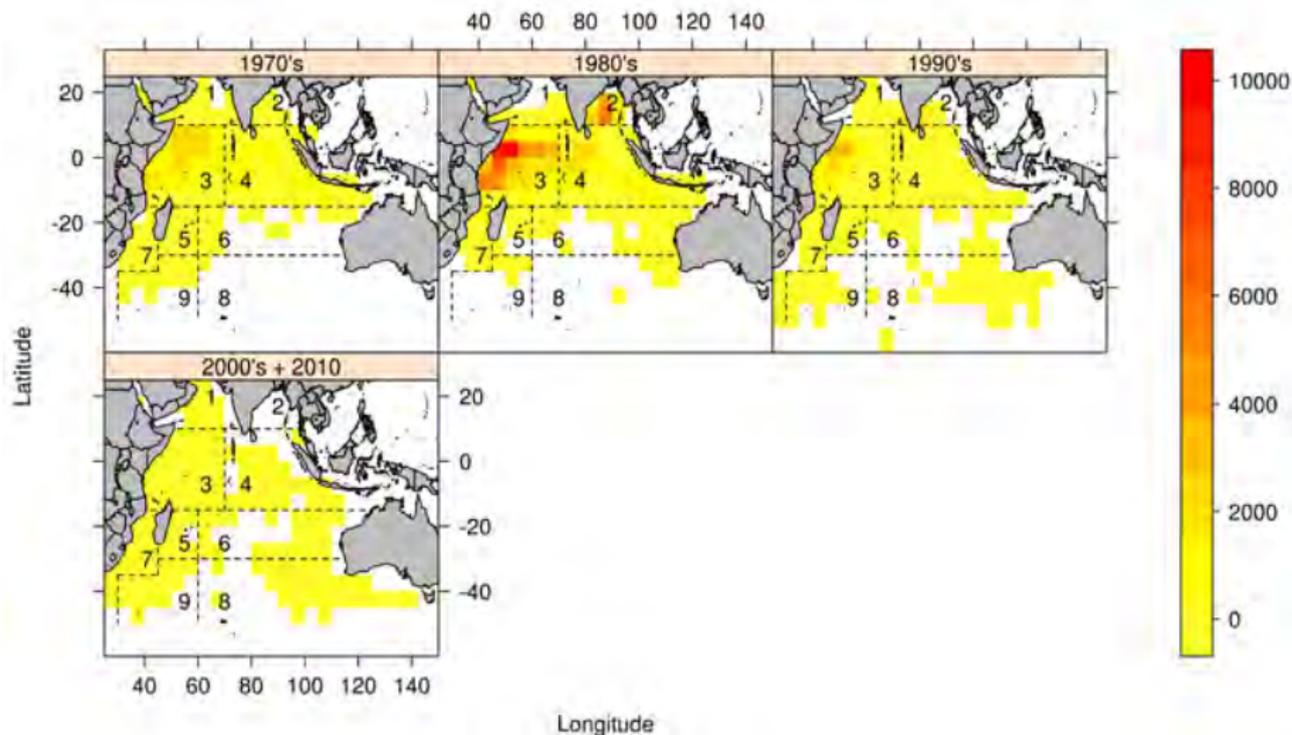


Remarks – MLS Taiwan Dataset

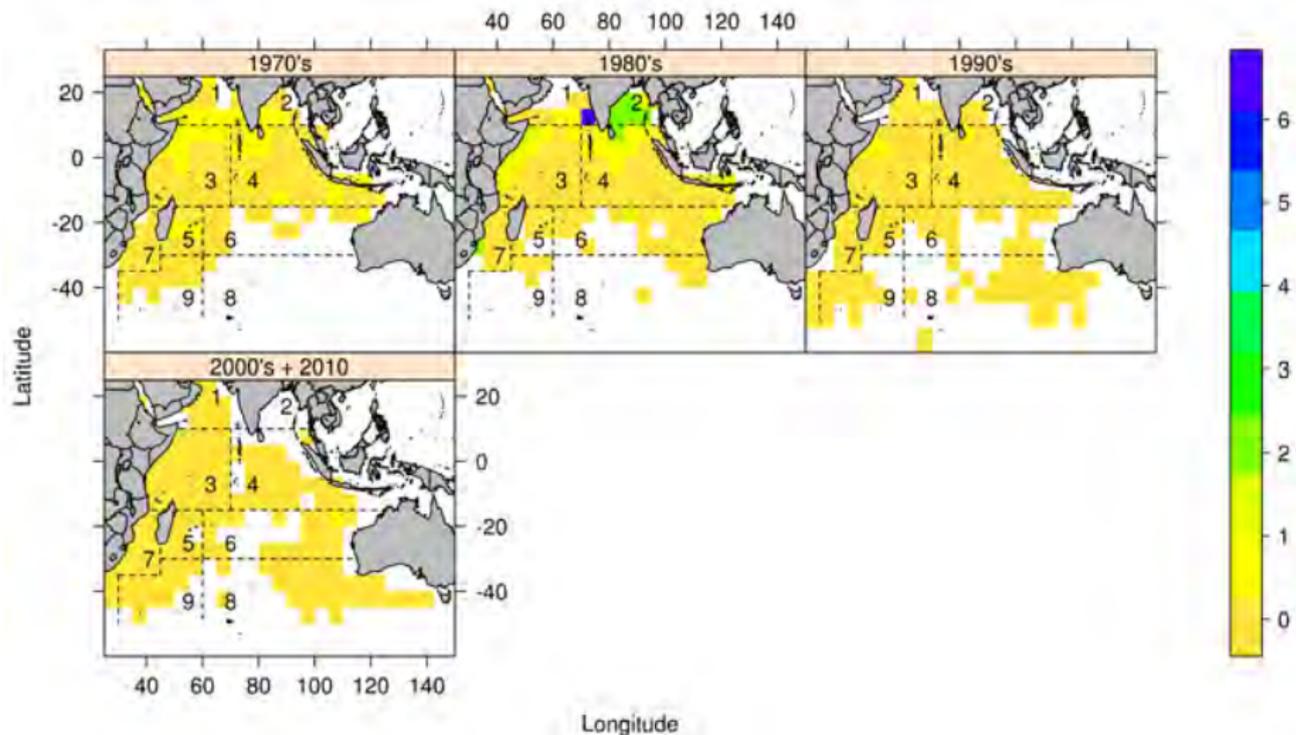
- 1 Catches were high in areas 1, 2, 3 and 4;
- 2 Overall catch rates were also high in areas close to equator but there are a couple of squares with high catch rate in area 6 (2000's);
- 3 Proportions of zero catches increase in 1970's, oscillates around 0.3 until mid 1990's and the increase again in the end of 2000's;
- 4 Catch rates as calculated for positive dataset in 2007 should be revised;
- 5 Overall catch rates for positive dataset decrease until the begin of 1970's, peak in 1977 and then remain close to low values until the end of the time series;
- 6 The peak of catch rates for positive dataset in the end of 1970's is noticeable in areas 1 and 2.



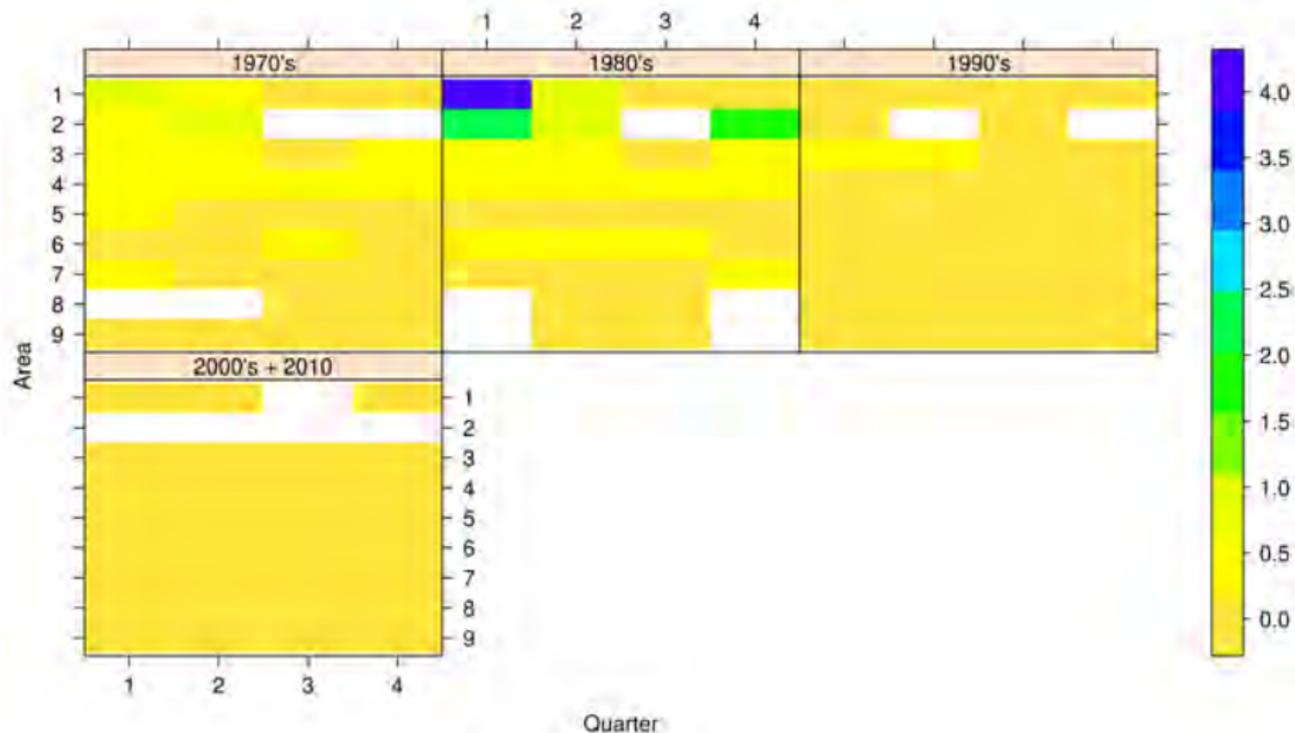
MLS - number of fish - Korea dataset



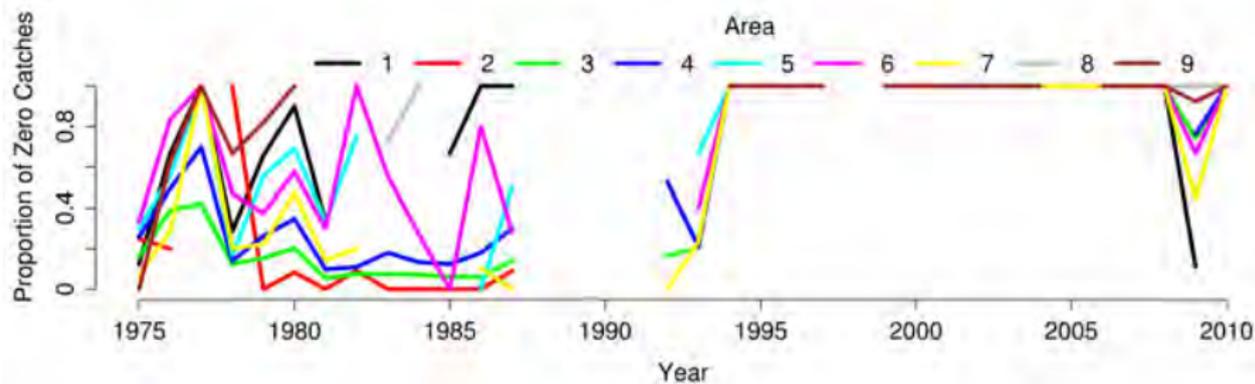
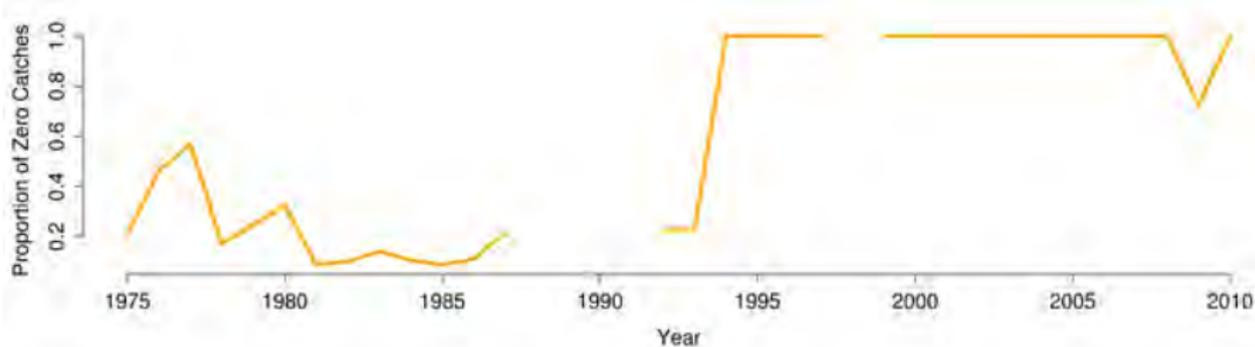
MLS - number of fish/1000 hooks - Decade x Lat x Lon



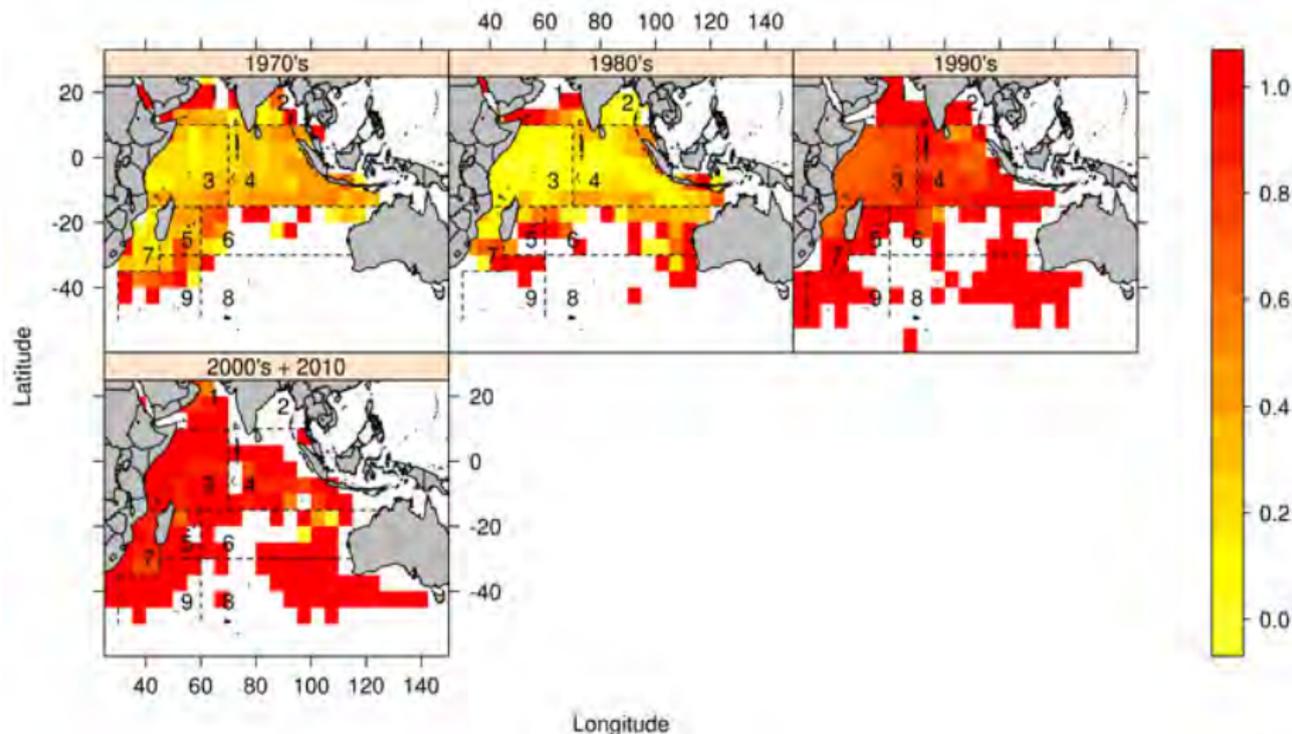
MLS - number of fish/1000 hooks - Decade x Quarter x Area



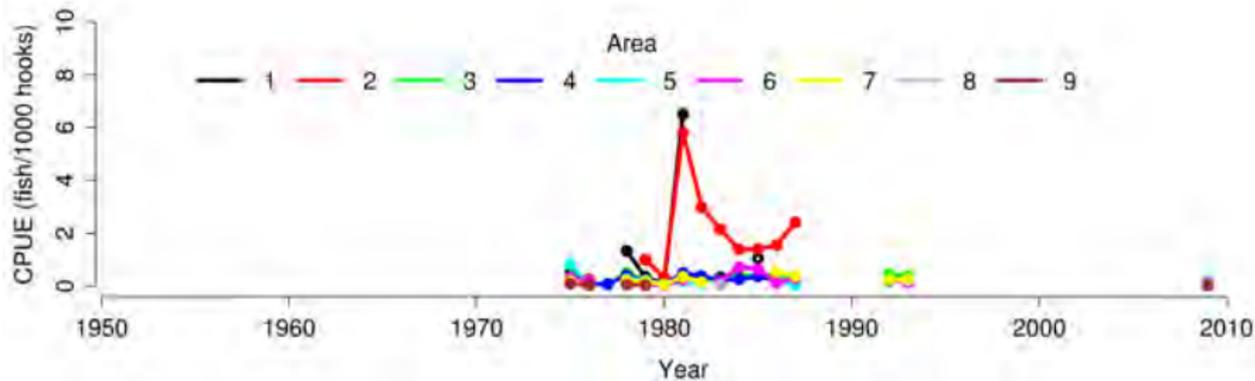
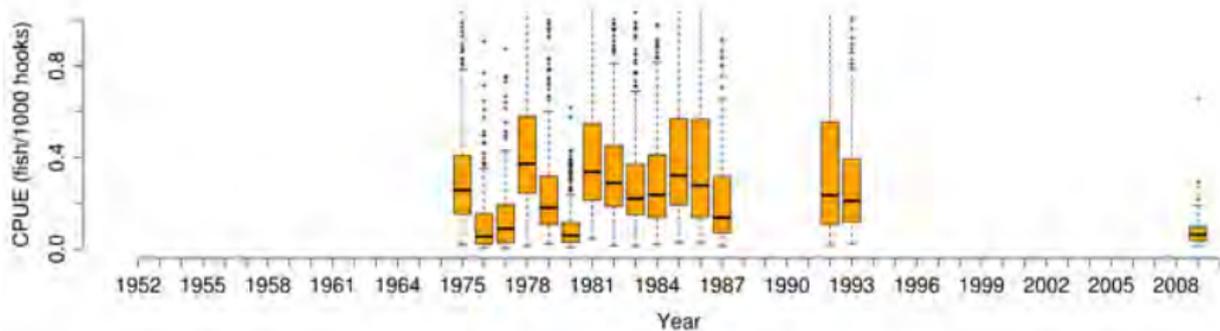
Proportion of Zero Catches



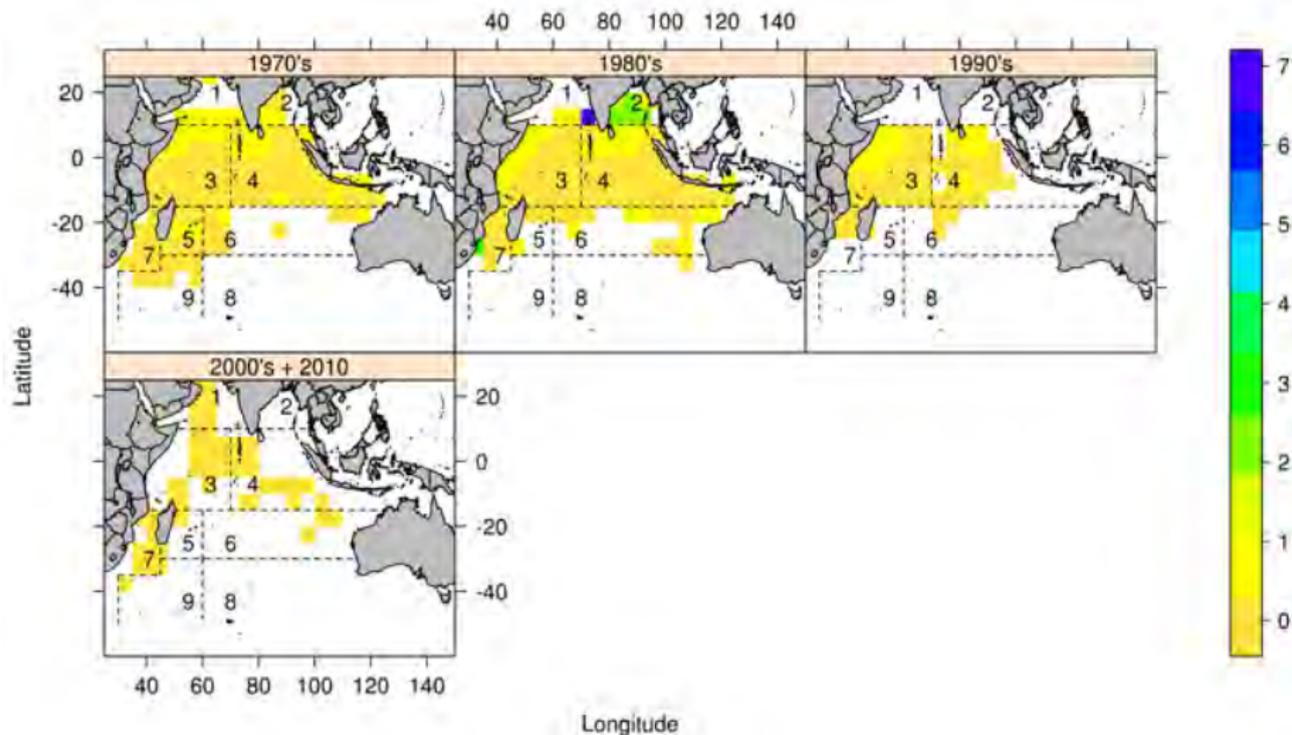
Proportion of Zero Catches



CPUE – Positive Catches



CPUE – Positive Catches

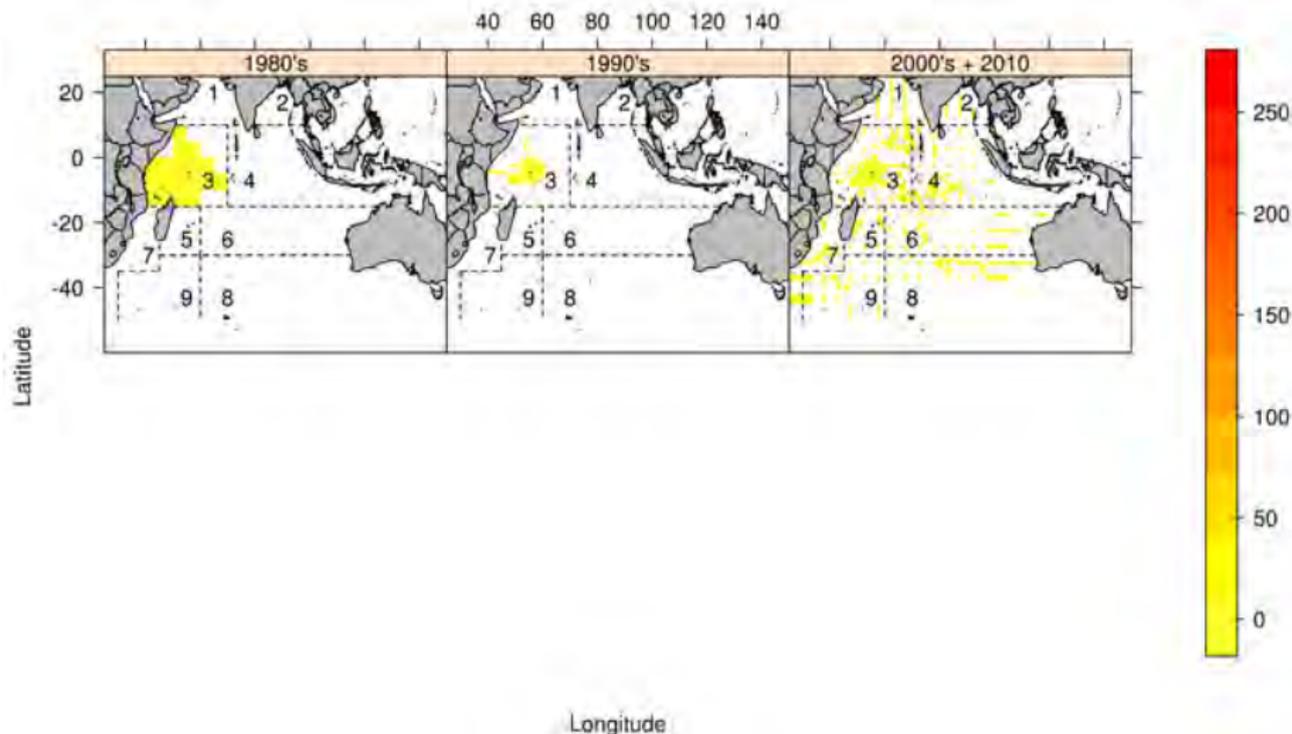


Remarks – MLS Korea Dataset

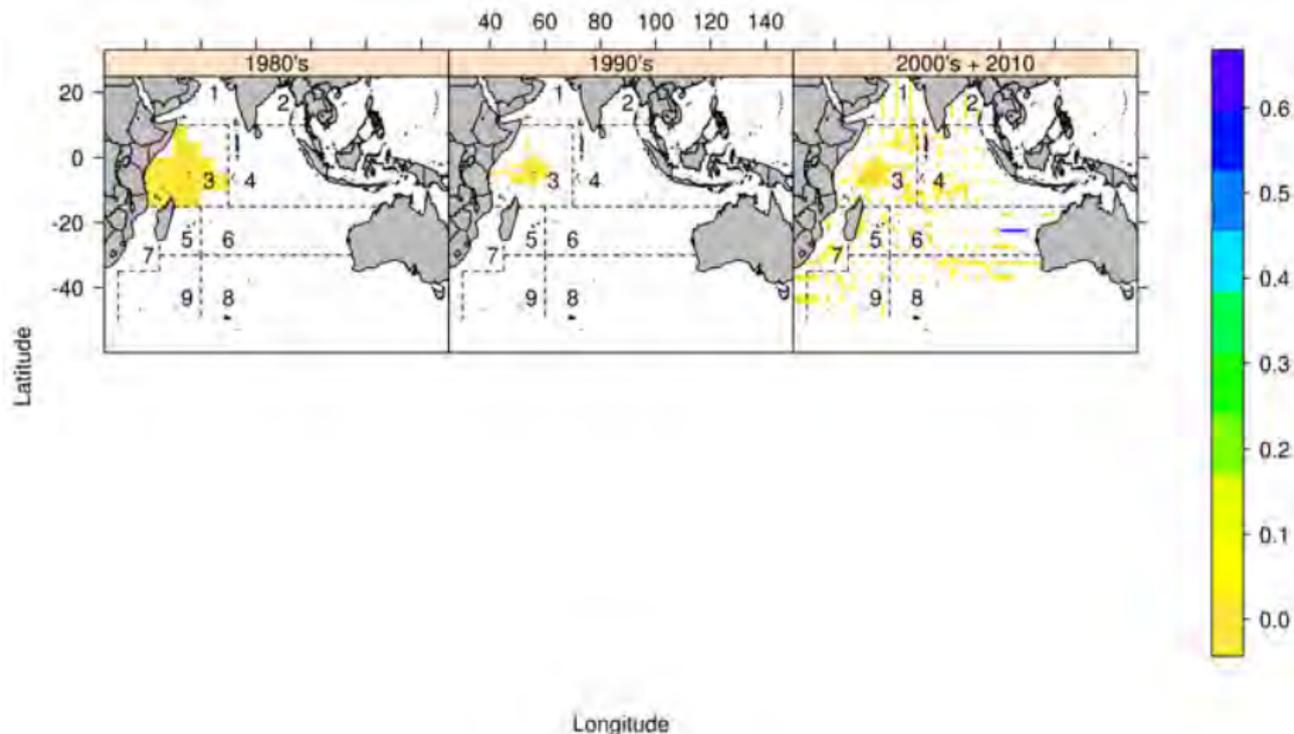
- 1 Catches were high in area 3 in 1980's and 1990's;
- 2 Catch rates were high in areas 1, 2 and 3 in 1970's and 1980's;
- 3 Catch rates were high in 1st quarter in areas 1 and 2;
- 4 Data are not informative about the proportion of zero catches;
- 5 Mean catch rate as calculated for positive dataset show an outstanding peak in the the beginning of 1980's in areas 1 and 2.



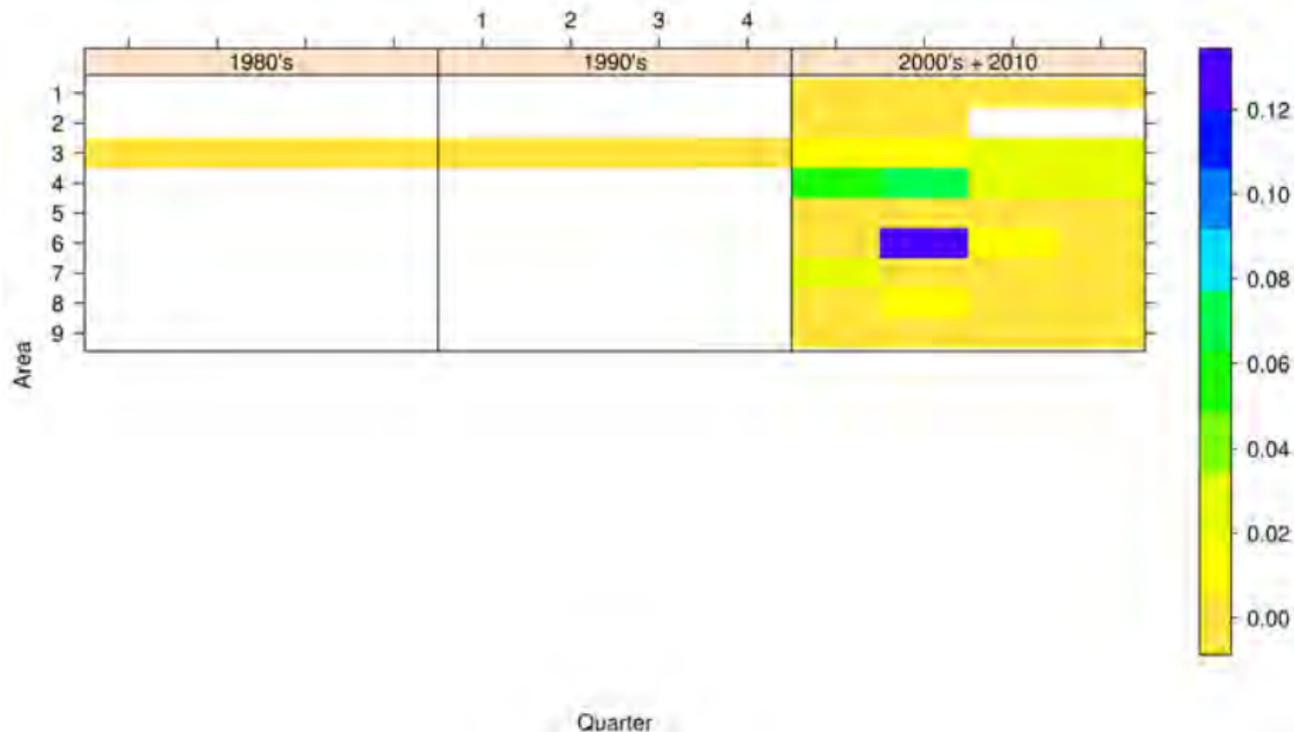
MLS - number of fish - Seychelles dataset



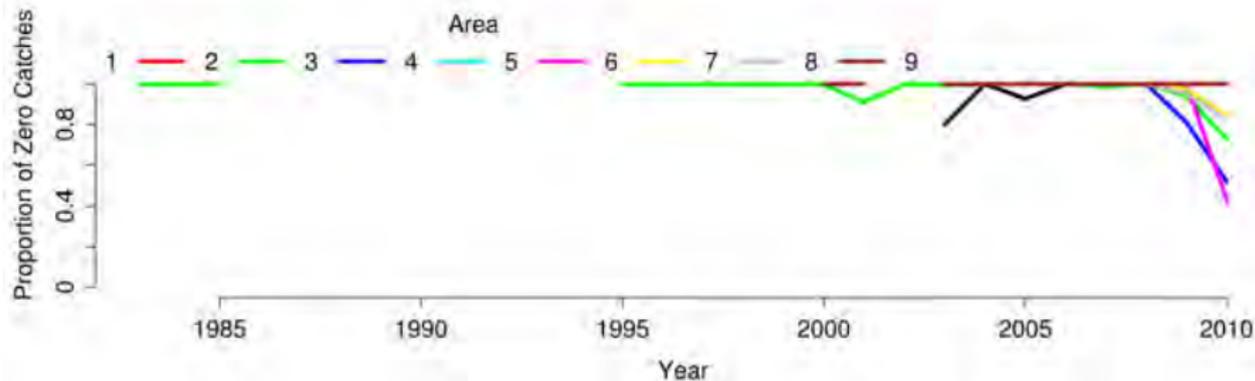
MLS - number of fish/1000 hooks - Decade x Lat x Lon



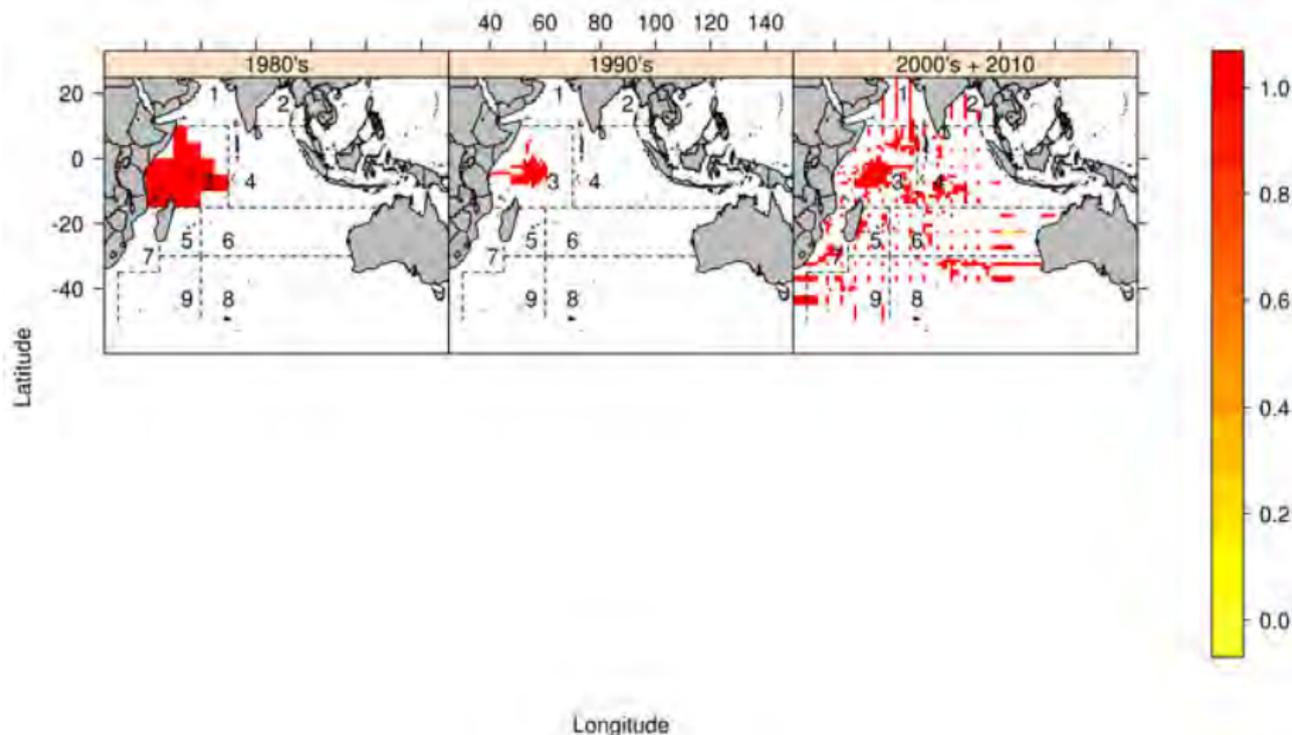
MLS - number of fish/1000 hooks - Decade x Quarter x Area



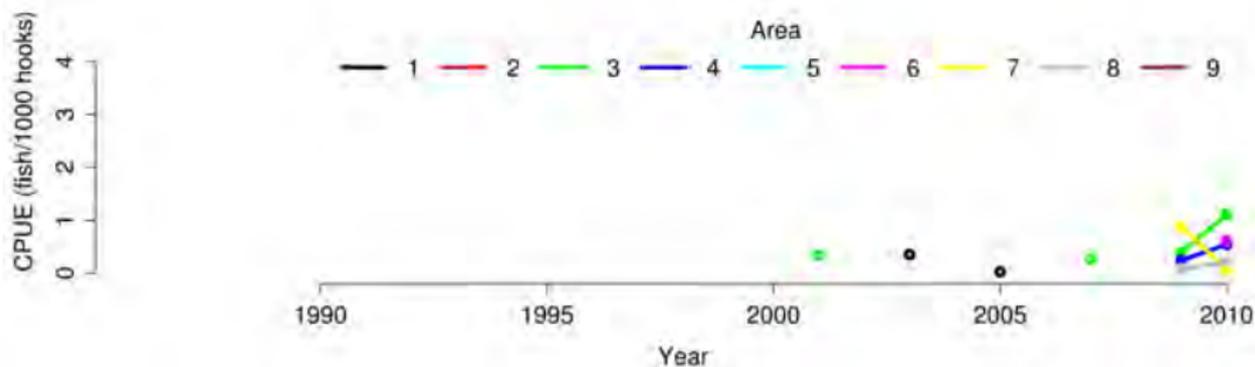
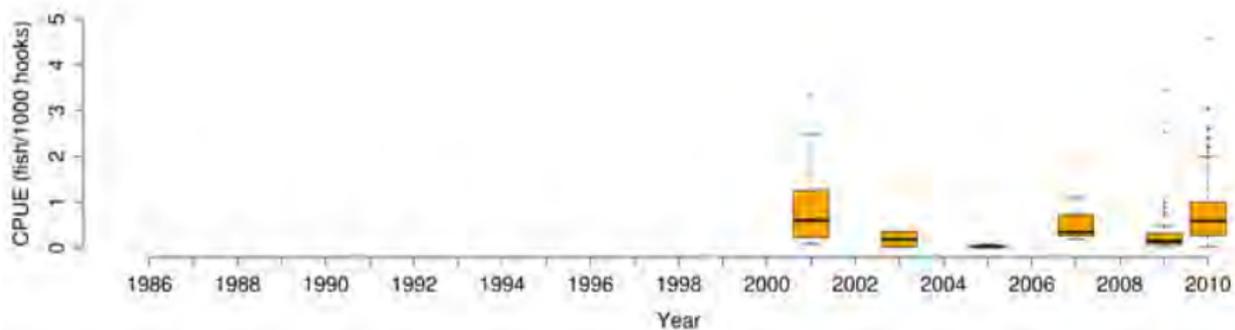
Proportion of Zero Catches



Proportion of Zero Catches



CPUE – Positive Catches



CPUE – Positive Catches



Remarks – MLS Seychelles Dataset

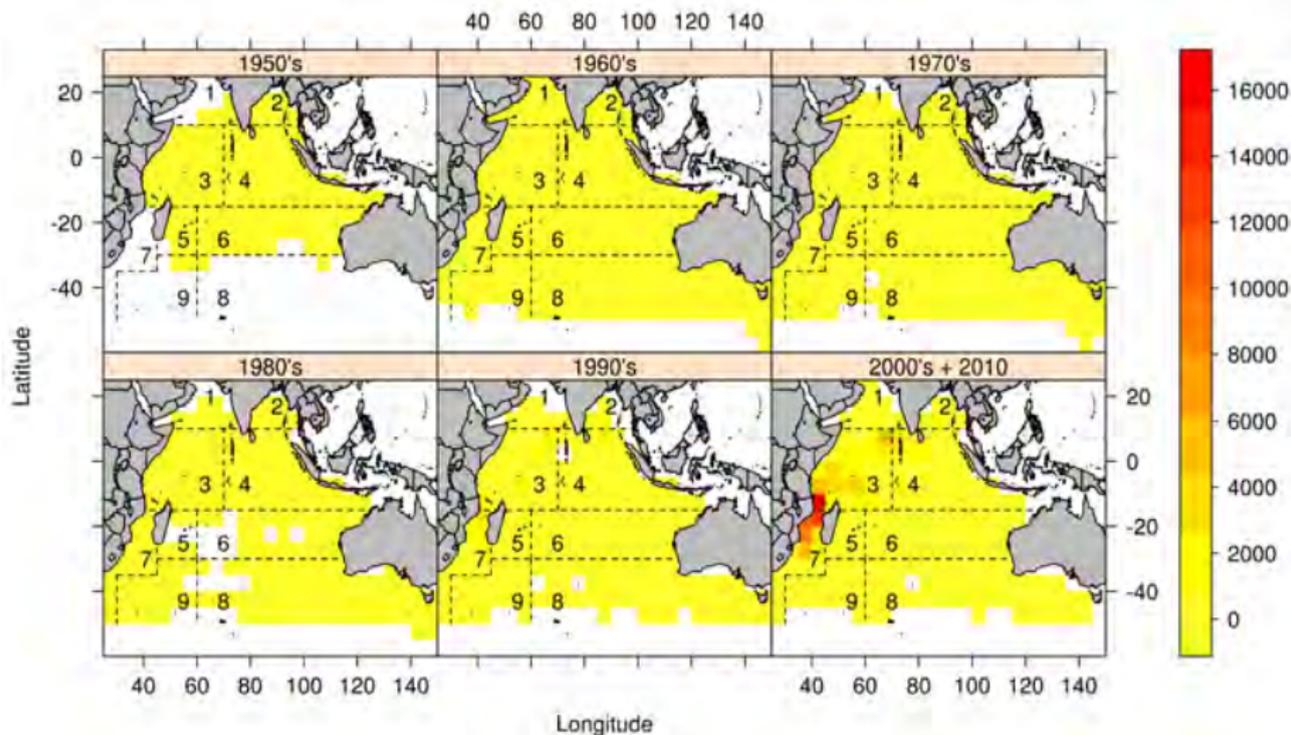
- 1 Catches were high in area 3 in 2000's;
- 2 Catch rates were high in some squares inside areas 3, 4 and 6 in 2000's;
- 3 Data are not informative about the proportion of zero catches.



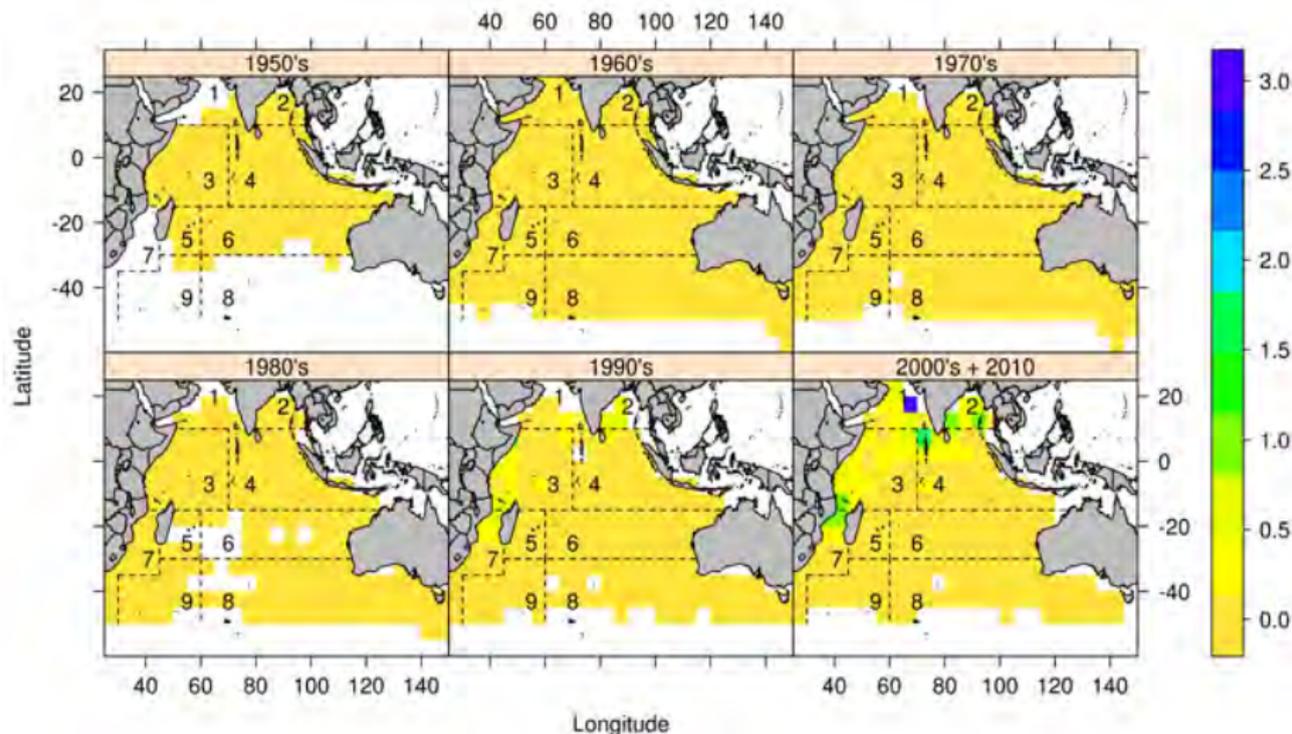
Indo-Pacific Sailfish (SFA)



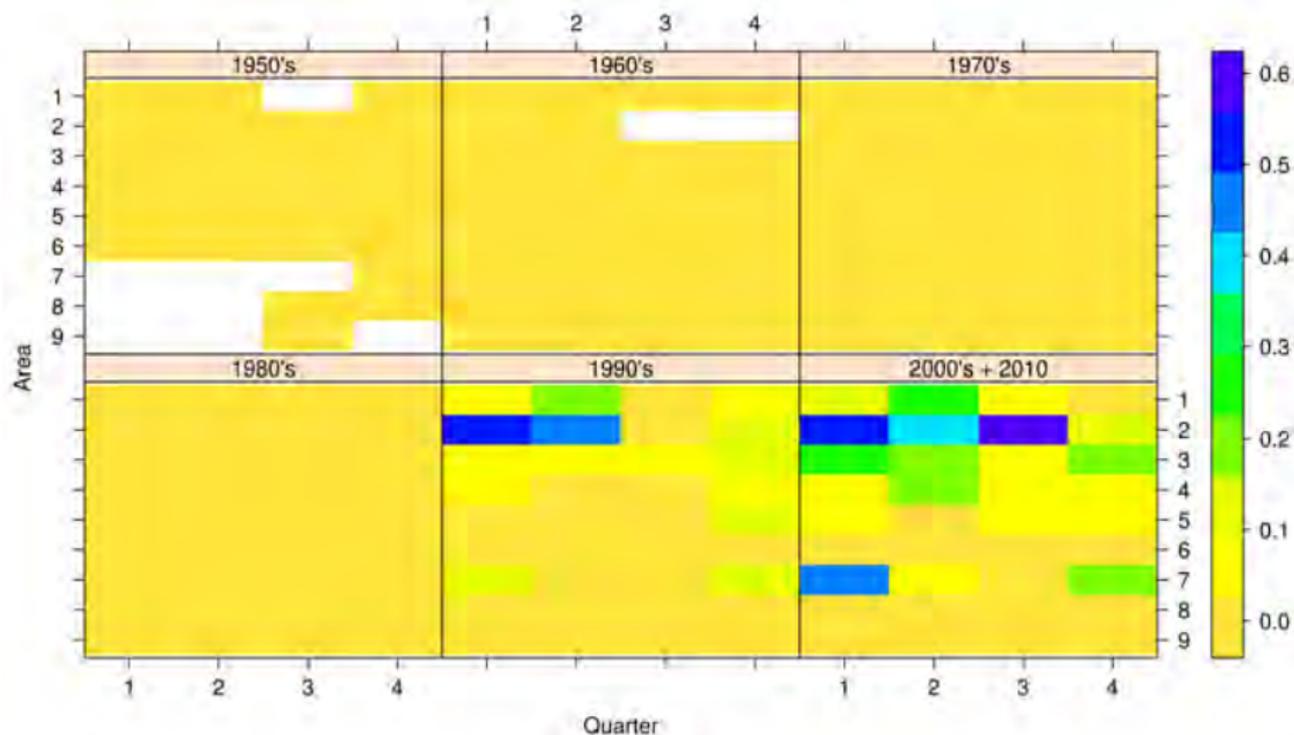
SFA - number of fish - Japan Dataset



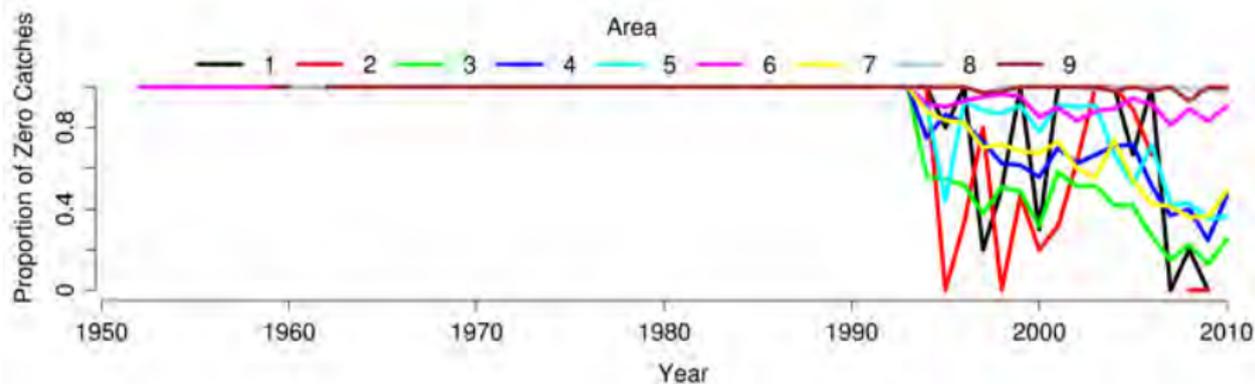
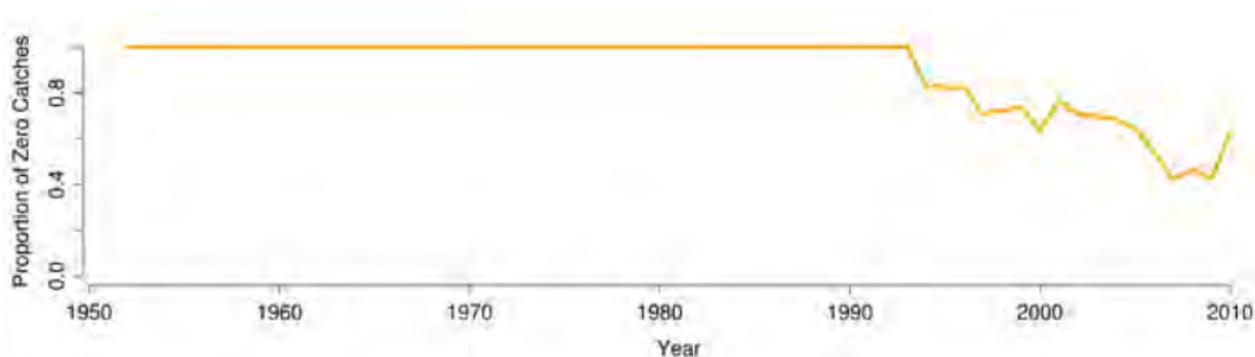
SFA - number of fish/1000 hooks - Decade x Lat x Lon



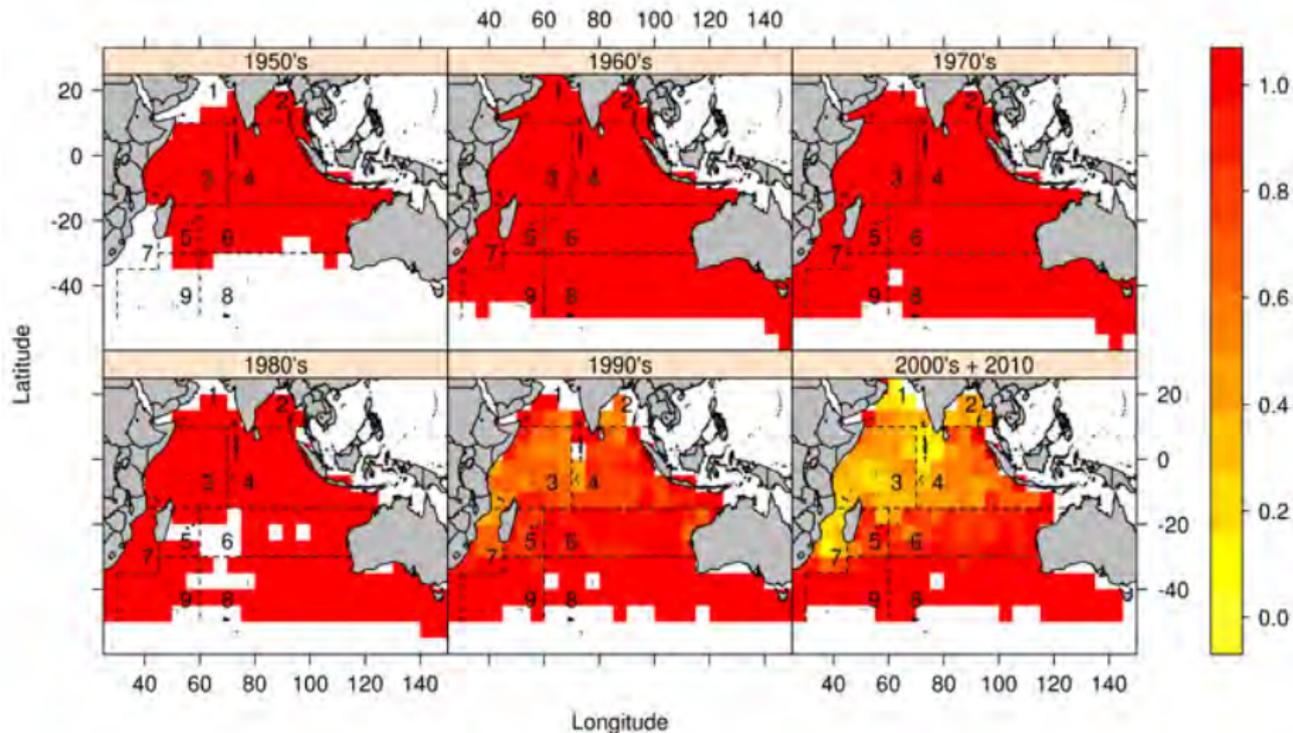
SFA - number of fish/1000 hooks - Decade x Quarter x Area



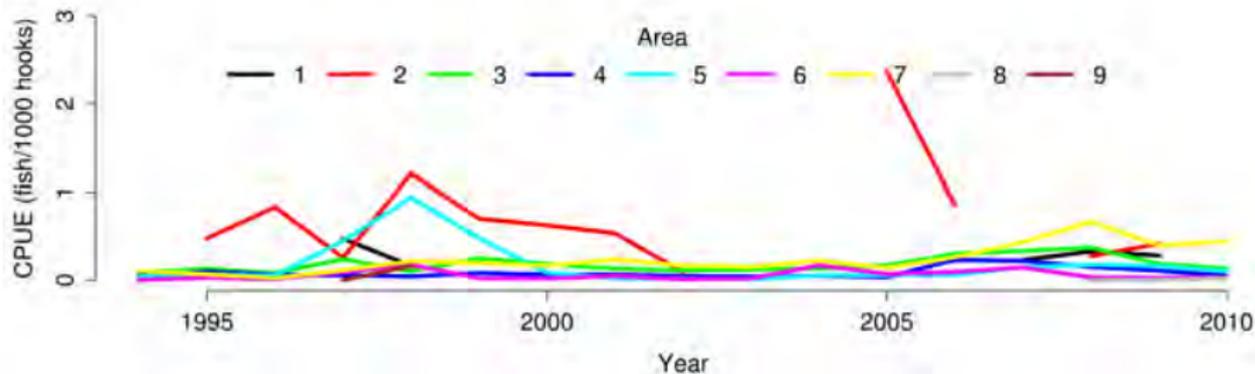
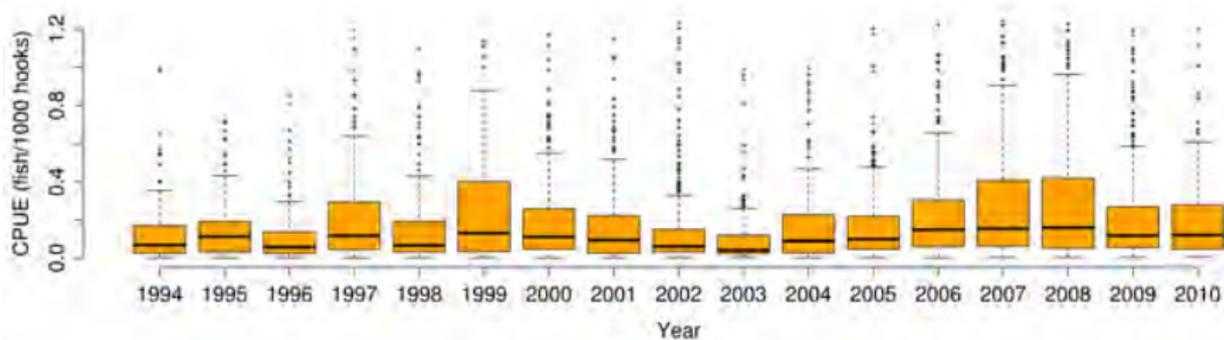
Proportion of Zero Catches



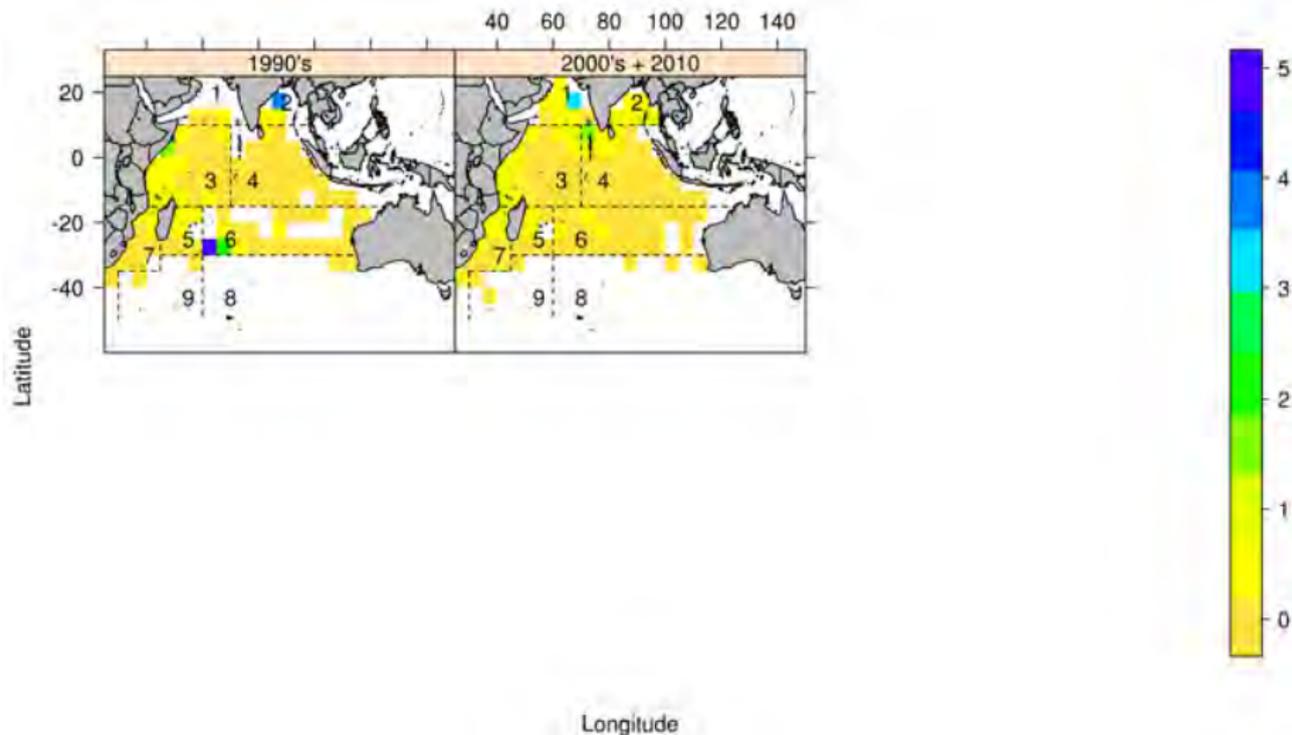
Proportion of Zero Catches



CPUE – Positive Catches



CPUE – Positive Catches

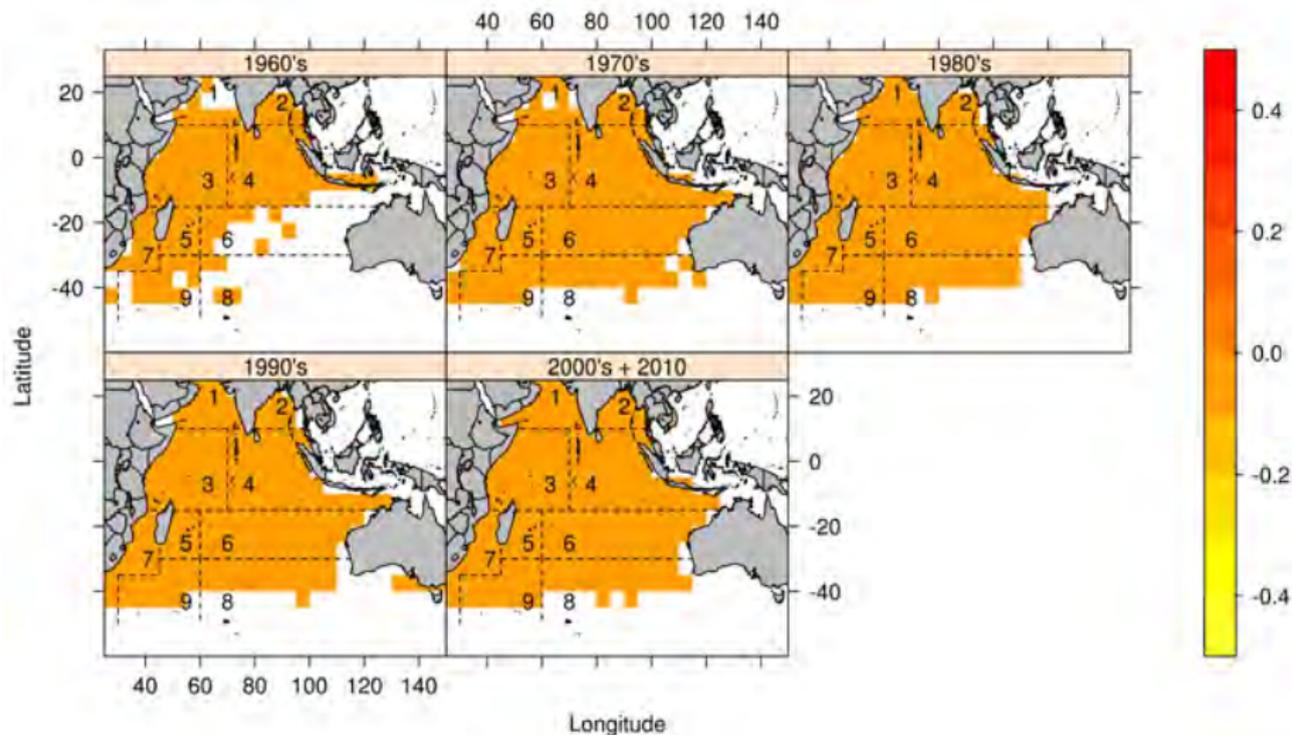


Remarks – SFA Japan Dataset

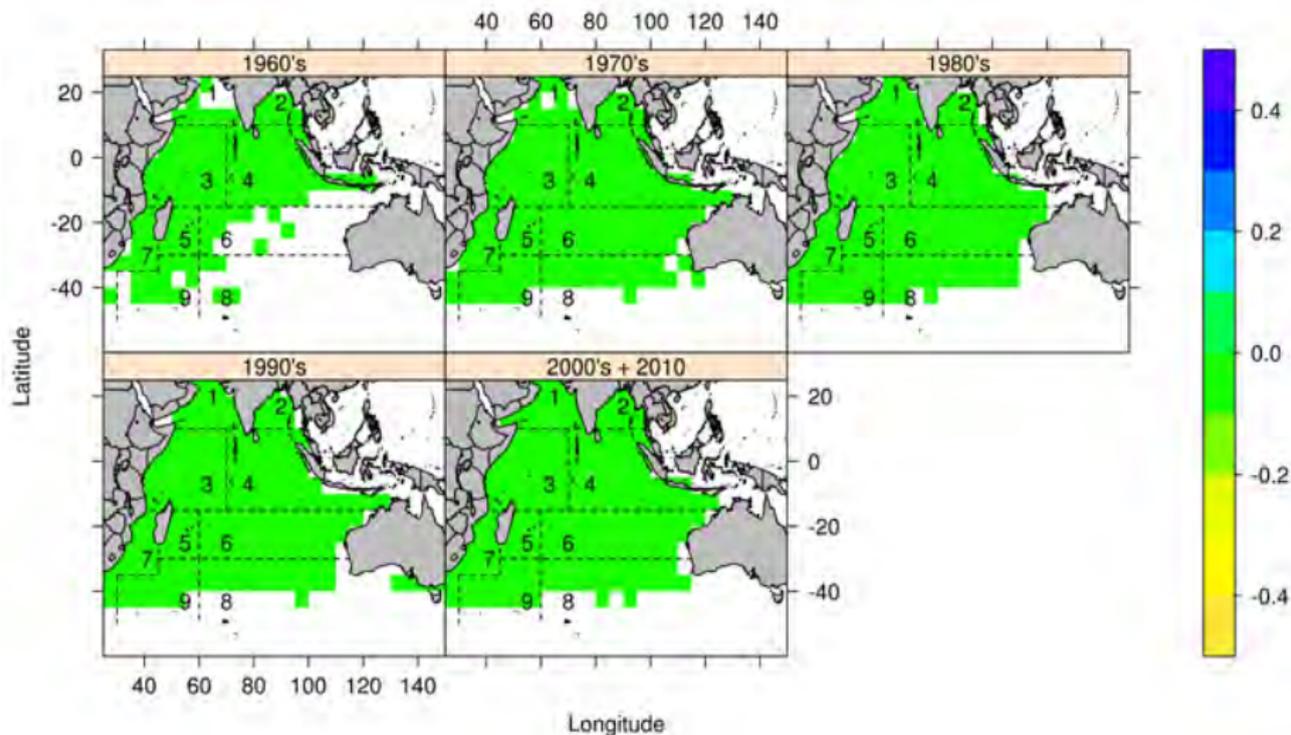
- 1 Catches were high in areas 3 and 7 in 1970's especially between Mozambique and Madagascar;
- 2 Overall catch rates were high in areas 1, 2, 3 and 7 in 2000's;
- 3 Catch rates seem to be high in the 1st and 2nd quarters in north and west margin of the Indic Ocean close to equator (areas 1, 2 and 3) while catch rates were high in the 1st and 4th quarters in the south west margin (area 7);
- 4 Data about proportion of zero catches are not informative before 1990's. Since that decade the proportion of zero catches have decreased especially in areas 3, 4, 5 and 7;
- 5 Catch rates as calculated for positive dataset do not show clear time trend;
- 6 Overall catch rates for positive dataset were high in some squares inside areas 1, 2, 3, 6 and 7 especially in the west margin of the Indic Ocean.



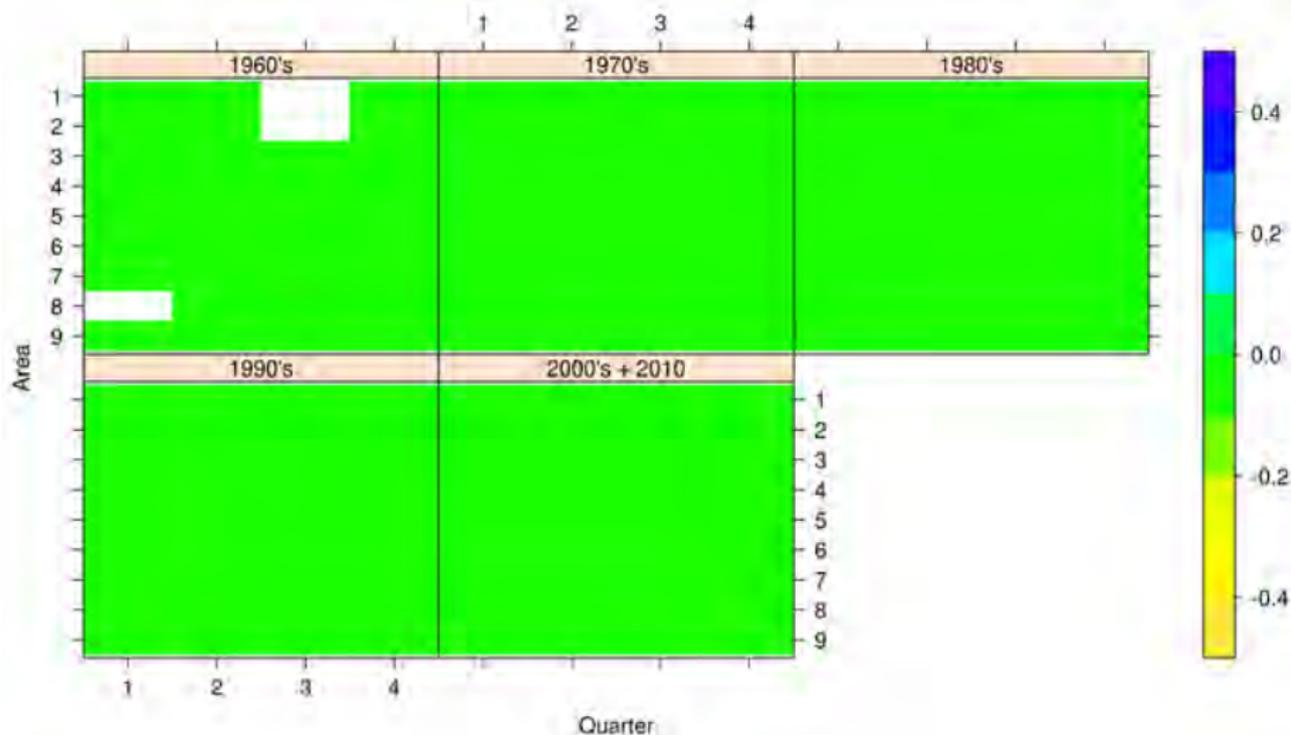
SFA - number of fish - Taiwan dataset



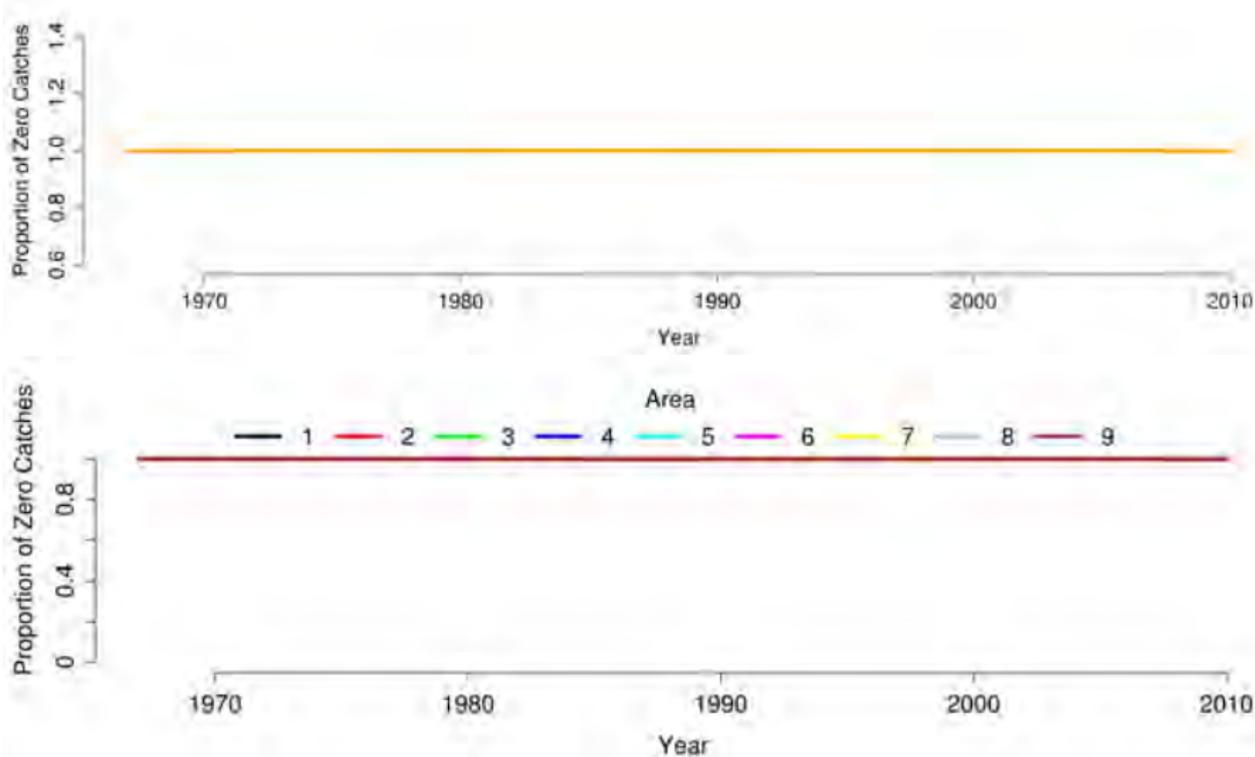
SFA - number of fish/1000 hooks - Decade x Lat x Lon



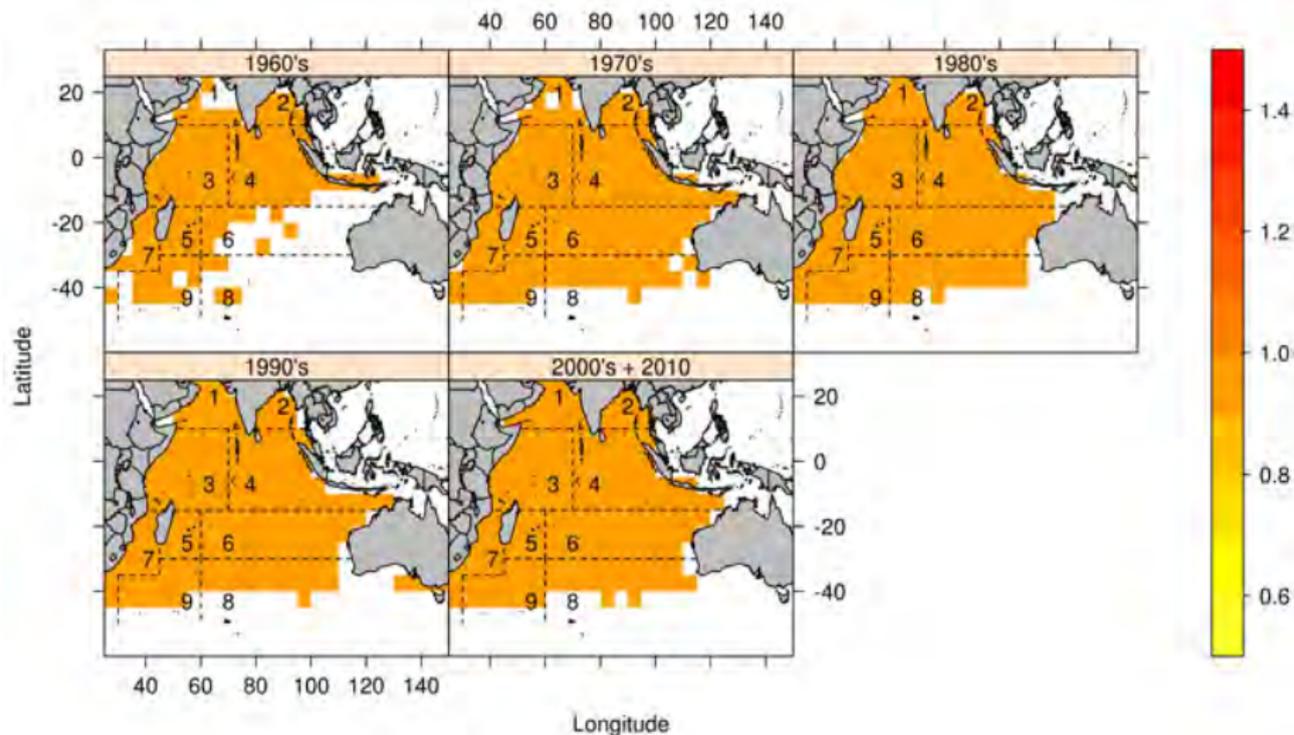
SFA - number of fish/1000 hooks - Decade x Quarter x Area



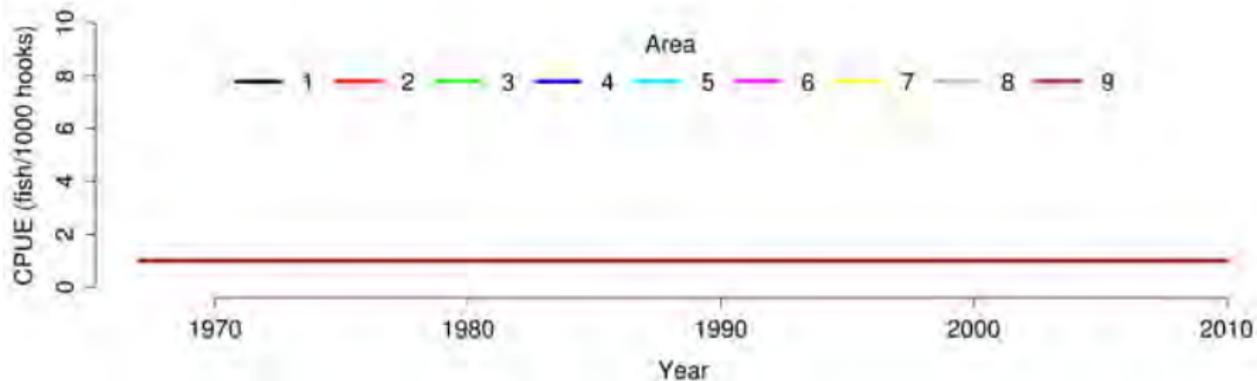
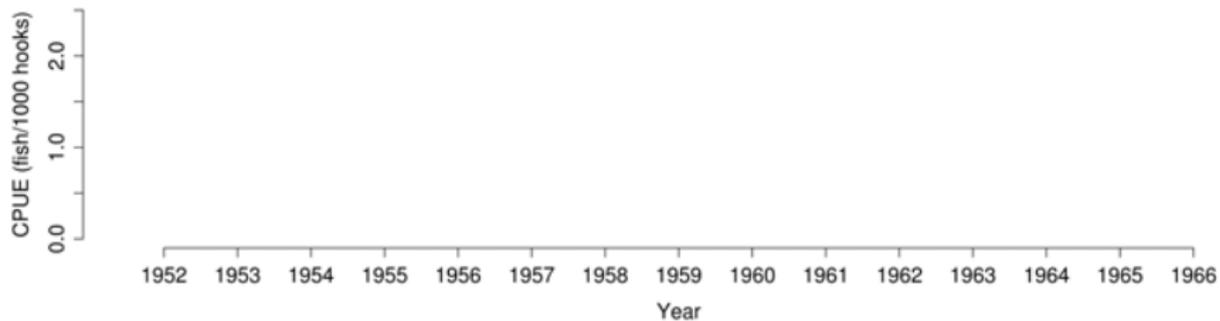
Proportion of Zero Catches



Proportion of Zero Catches



CPUE – Positive Catches



CPUE – Positive Catches

mapalltwnposSFAN0cpue.png

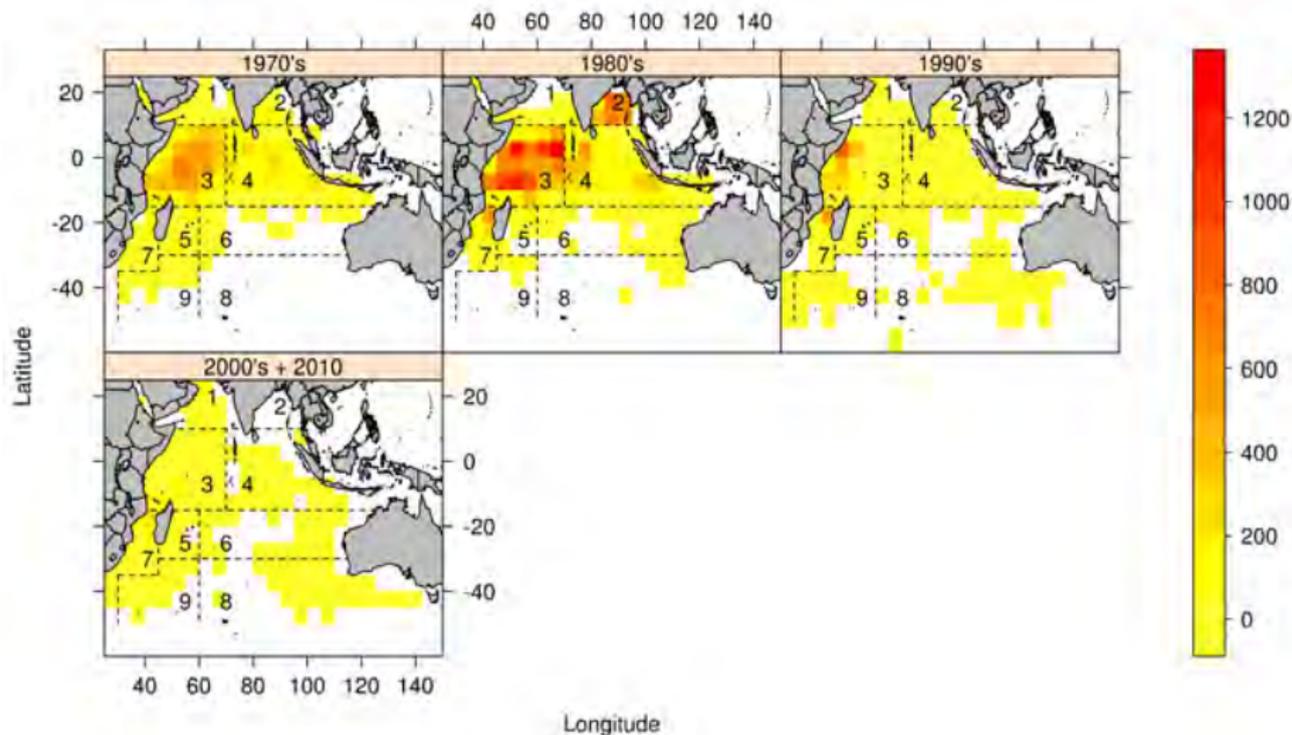


Remarks – SFA Taiwan Dataset

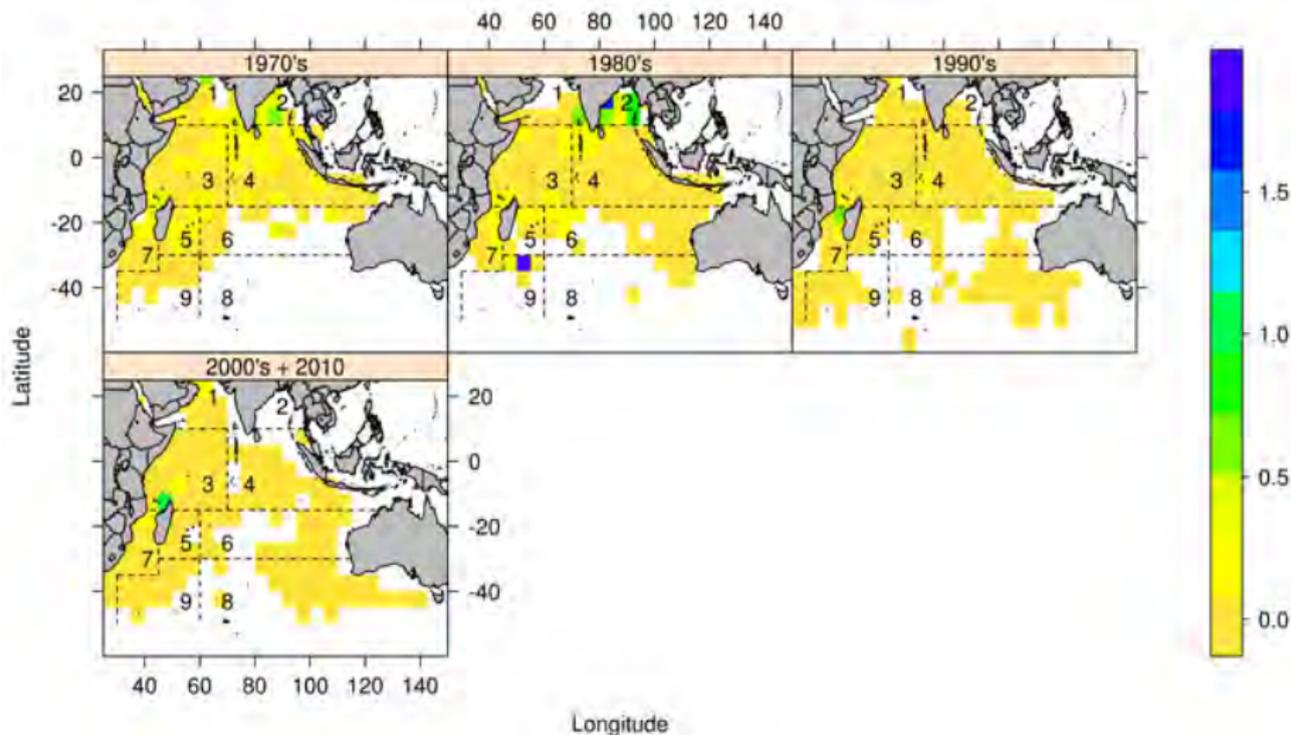
There is not information about catch (number of fish) of Indo-Pacific sailfish.



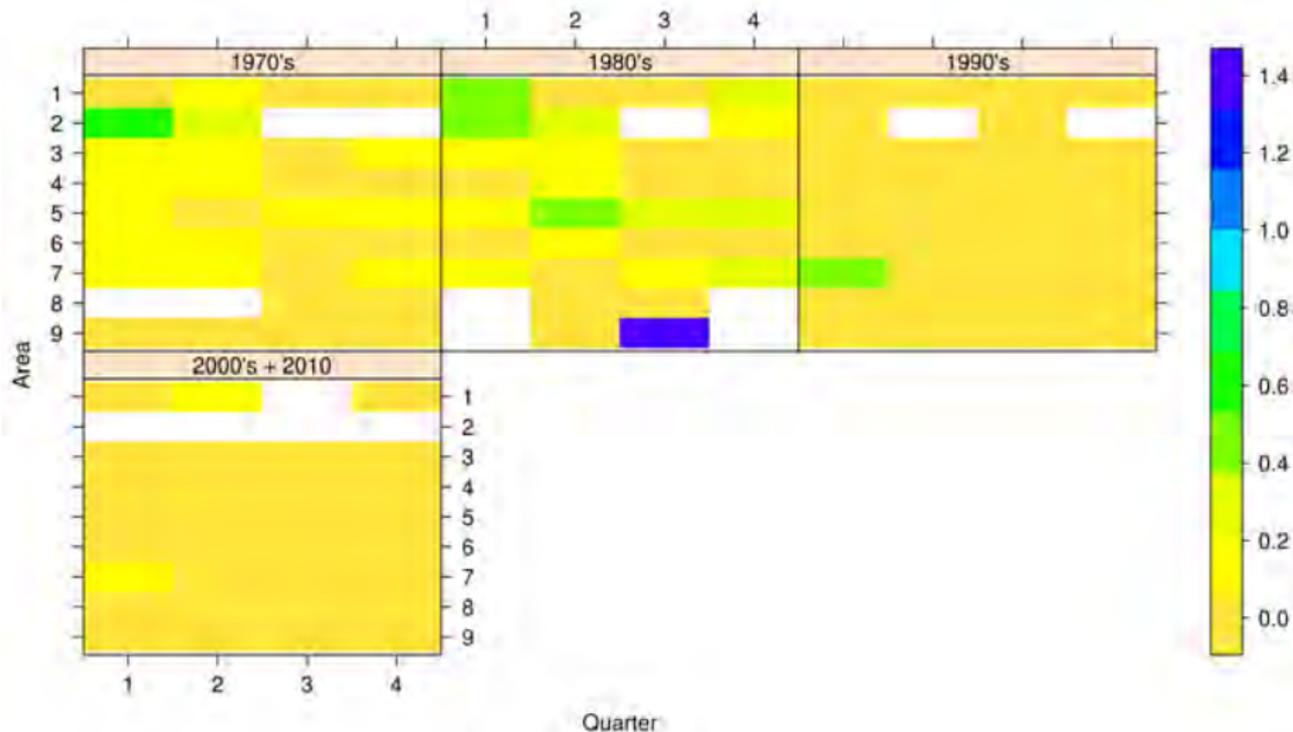
SFA - number of fish - Korea dataset



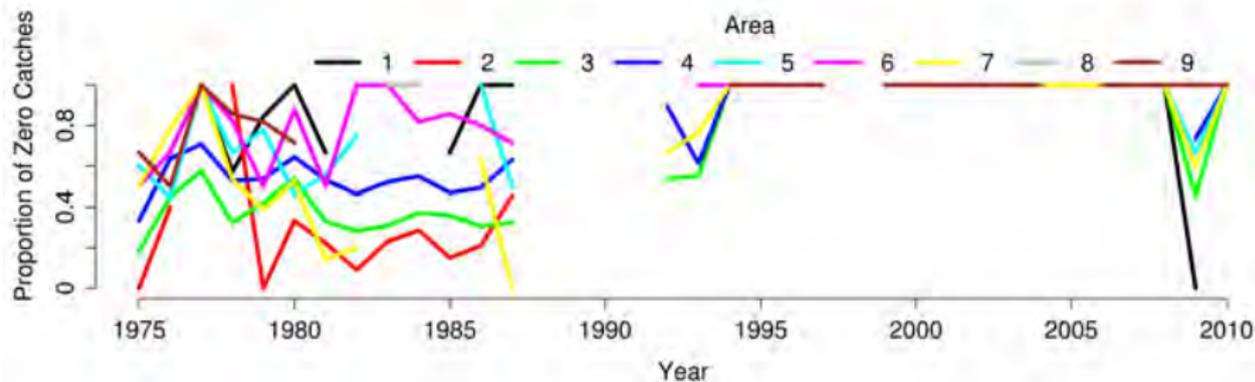
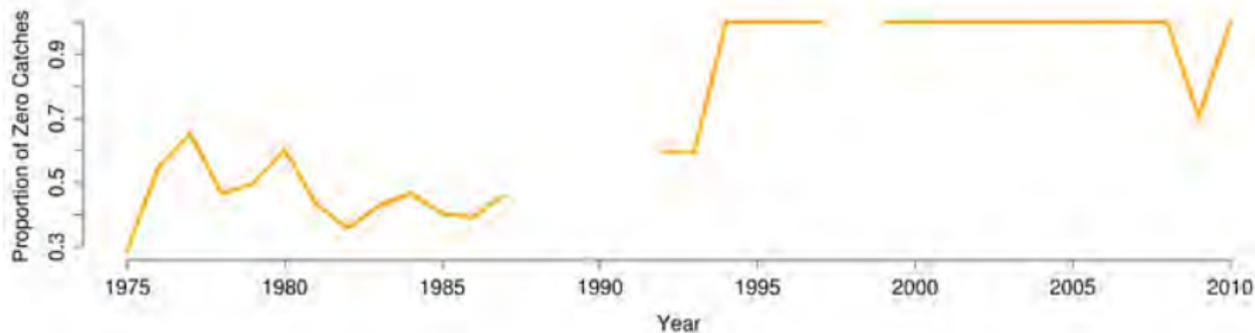
SFA - number of fish/1000 hooks - Decade x Lat x Lon



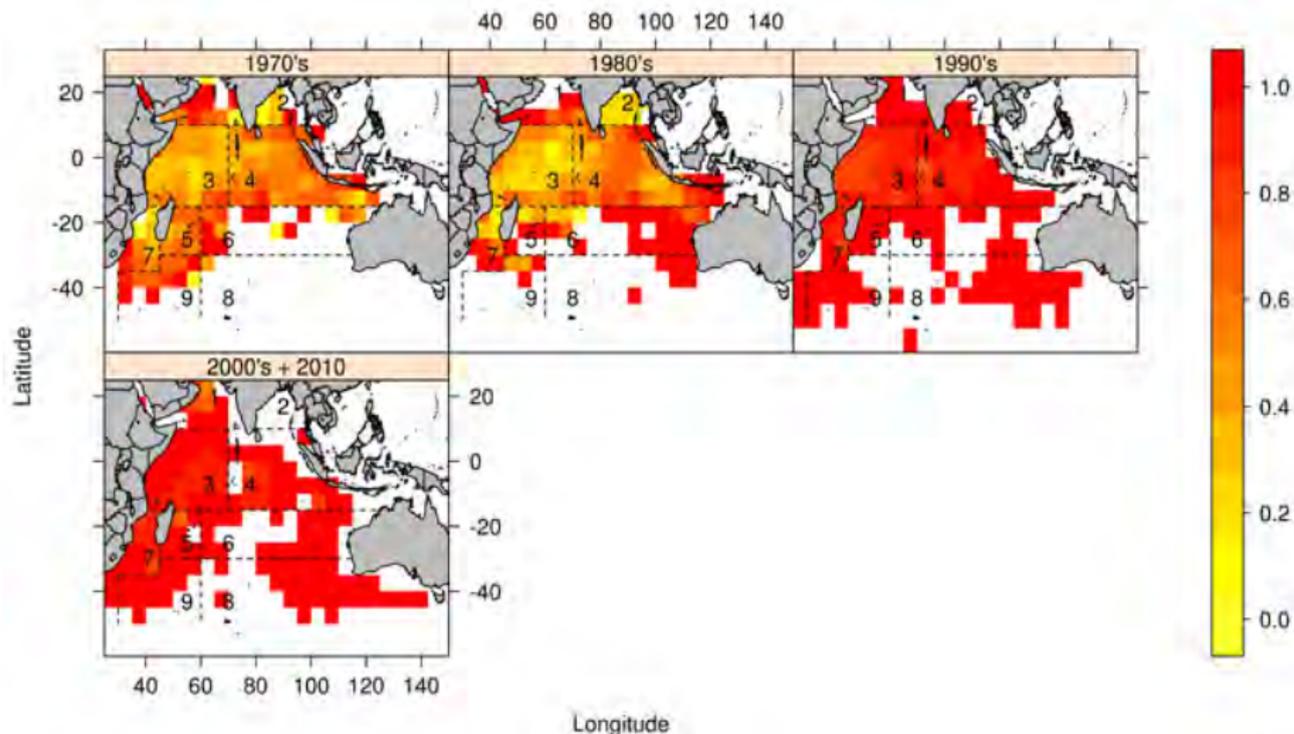
SFA - number of fish/1000 hooks - Decade x Quarter x Area



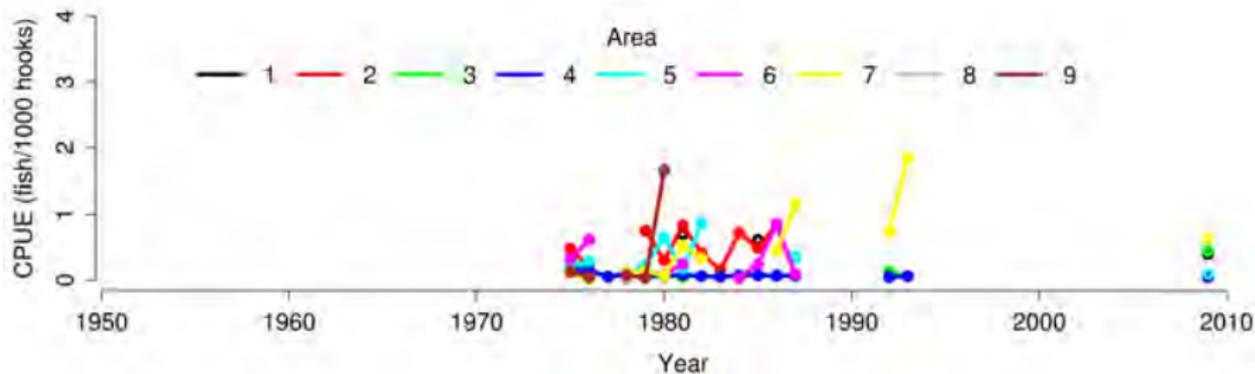
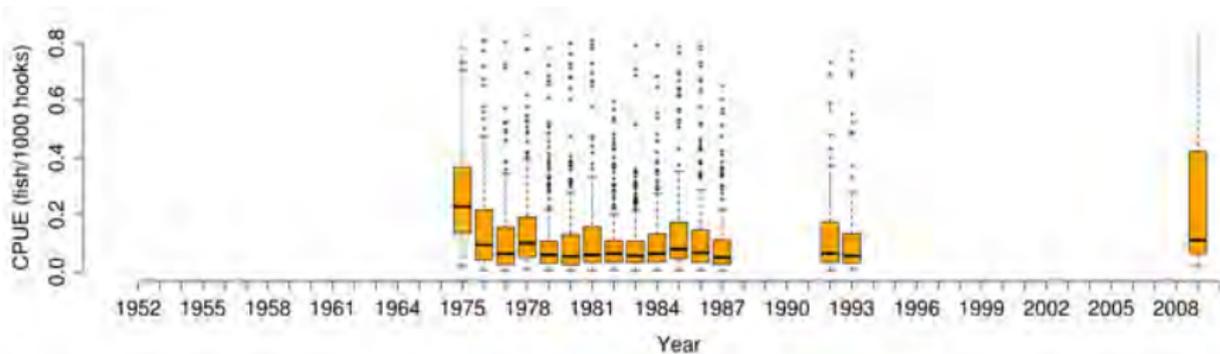
Proportion of Zero Catches



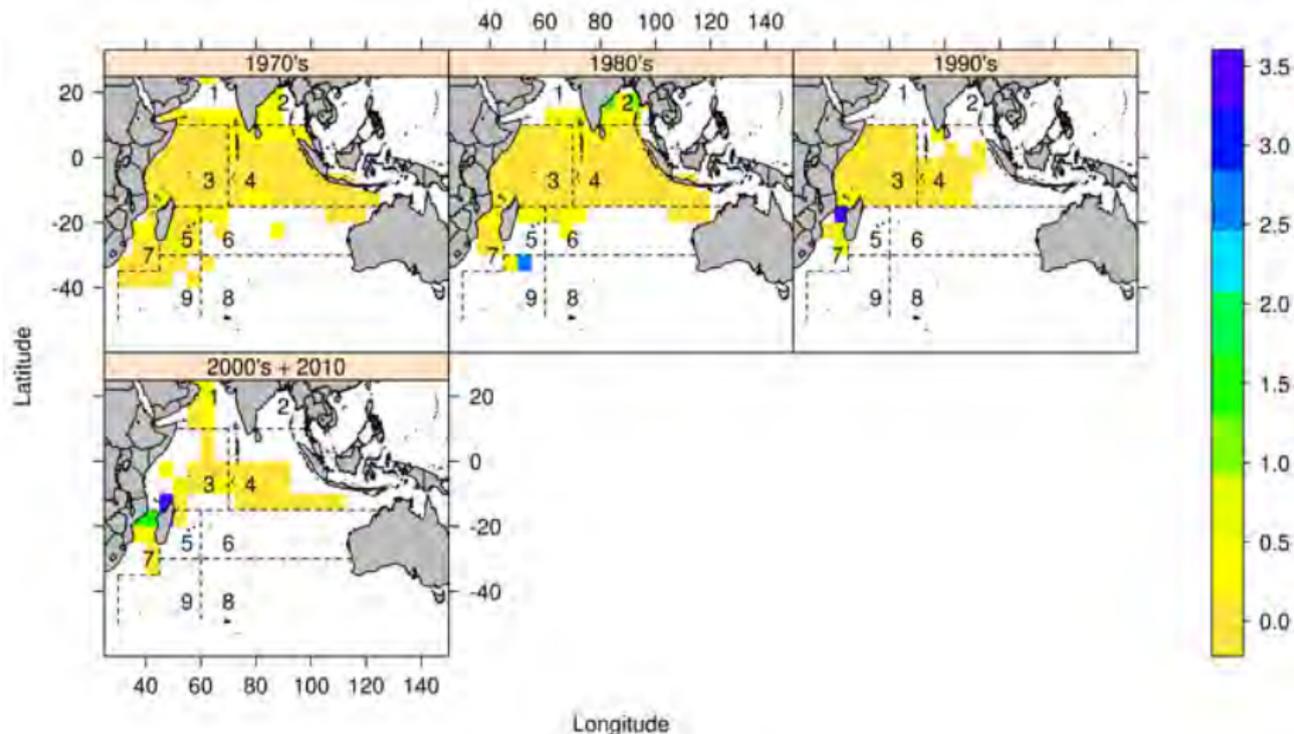
Proportion of Zero Catches



CPUE – Positive Catches



CPUE – Positive Catches

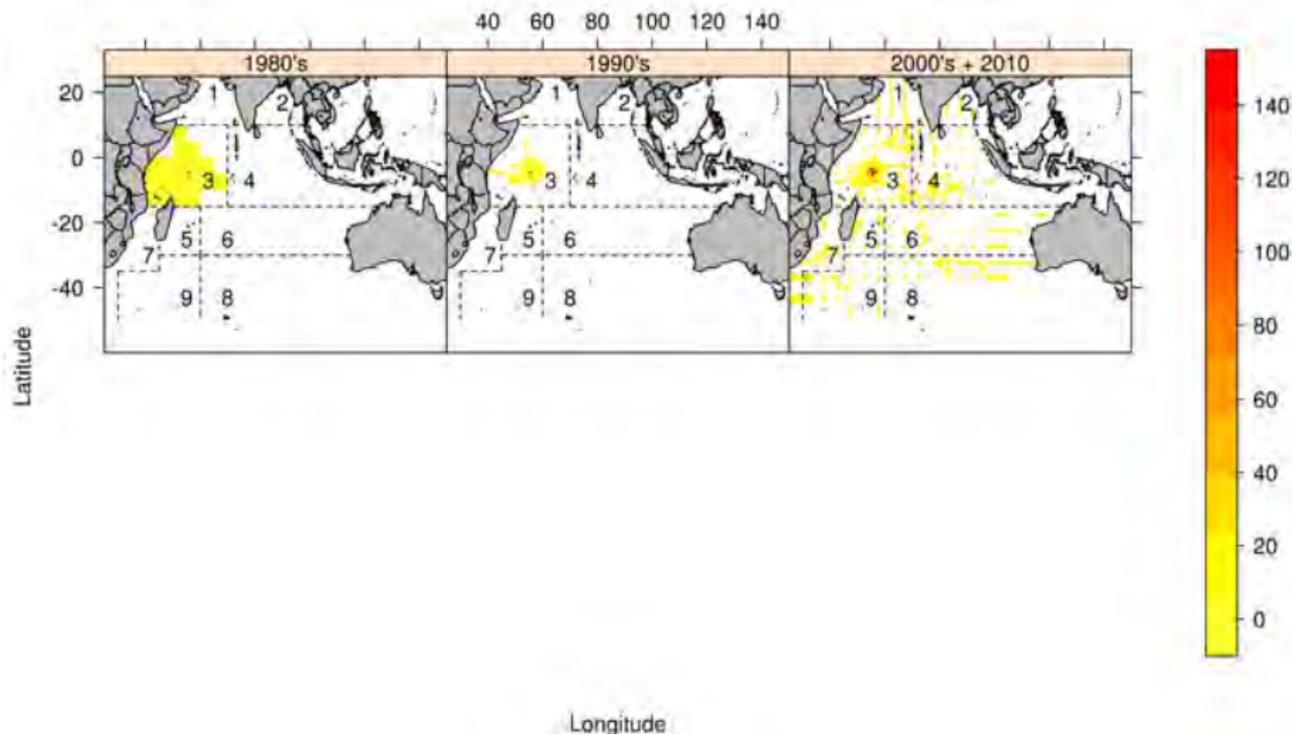


Remarks – SFA Korea Dataset

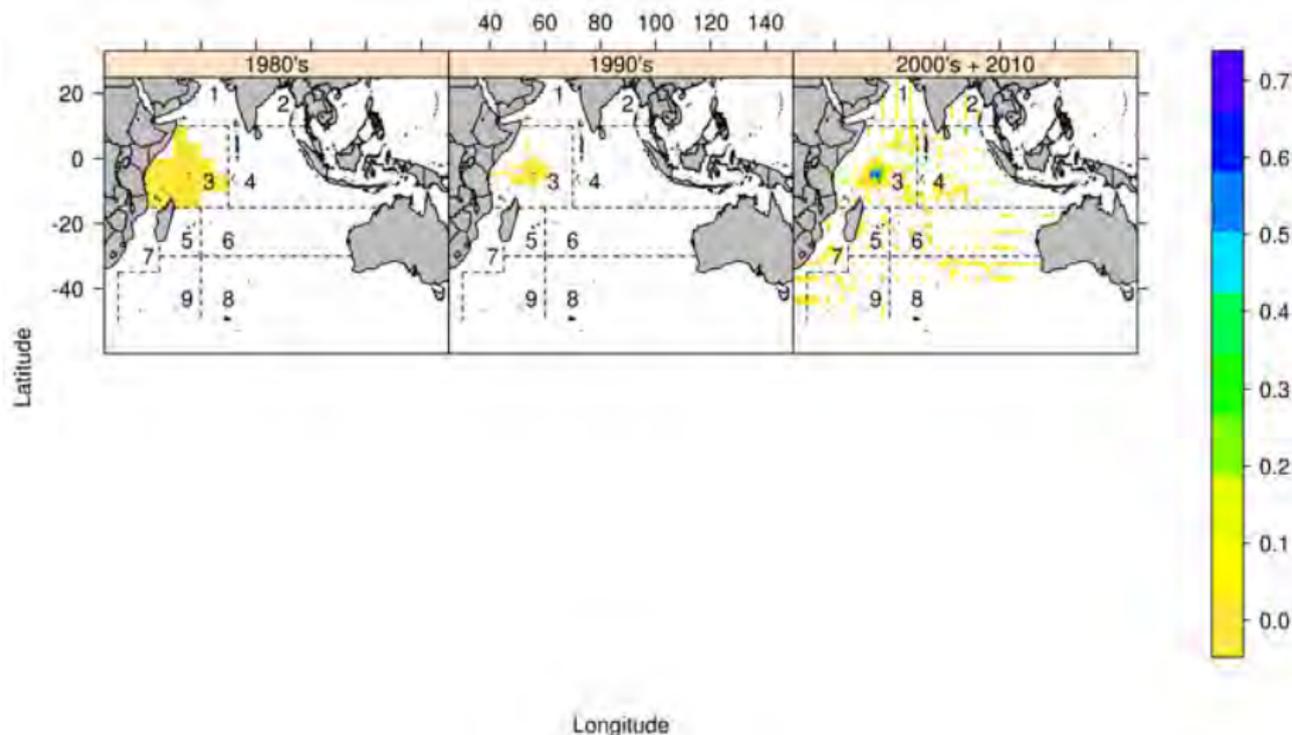
- 1 Data is informative only for 1970's and 1980's;
- 2 Catches were high in areas 2 and 3 especially in 1980's;
- 3 Overall catch rates were high in areas 1, 2, 3, 5 and 7 in 1970's and 1980's. There were also a couple of squares with high catch rate in area 9 in 1980's;
- 4 Proportion of zero catches were close to 0.5 in 1970's and 1980's;
- 5 Catch rates as calculated for positive dataset show a decreasing trend in the end of 1970's.



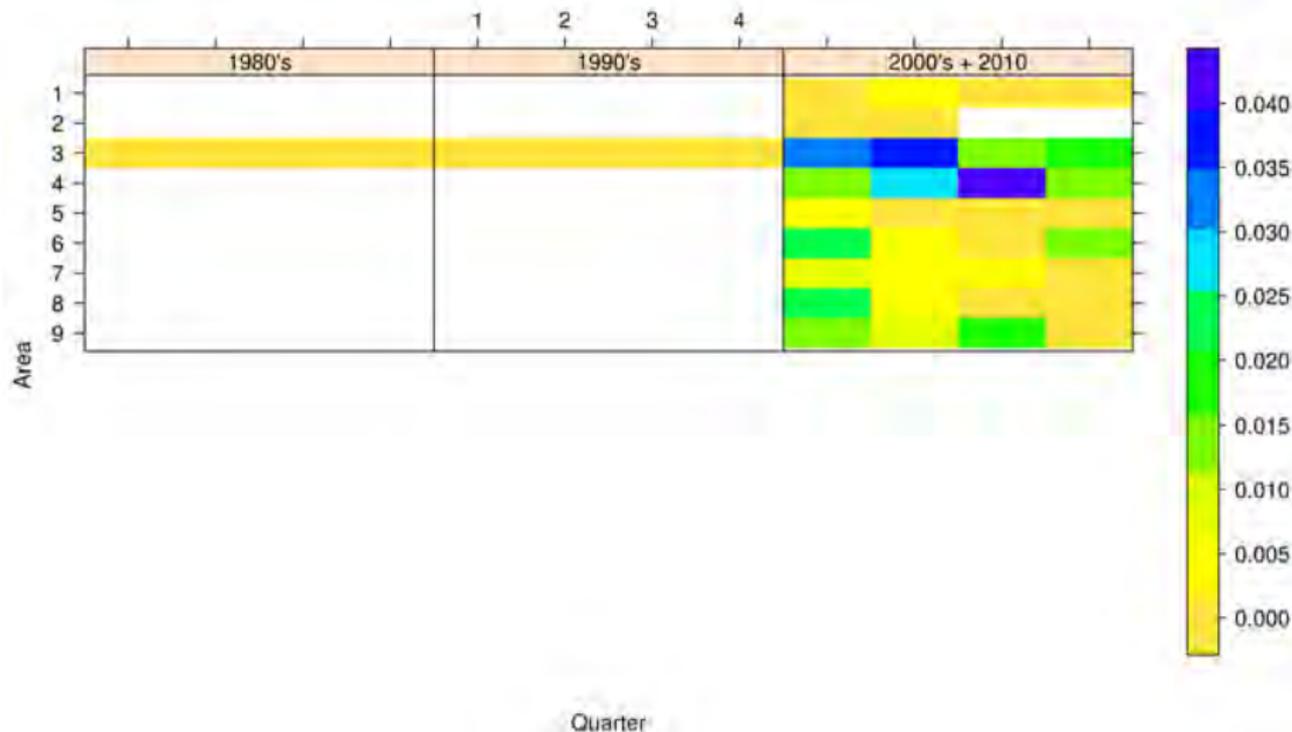
SFA - number of fish - Seychelles dataset



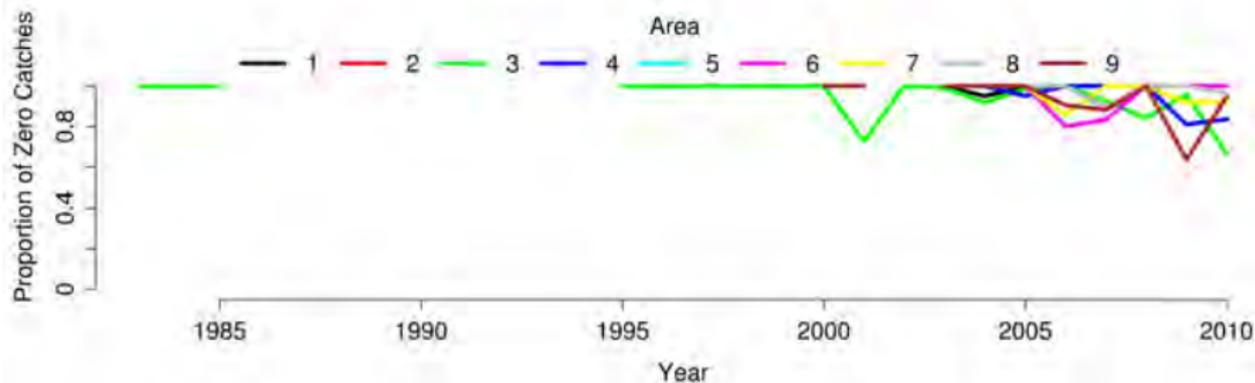
SFA - number of fish/1000 hooks - Decade x Lat x Lon



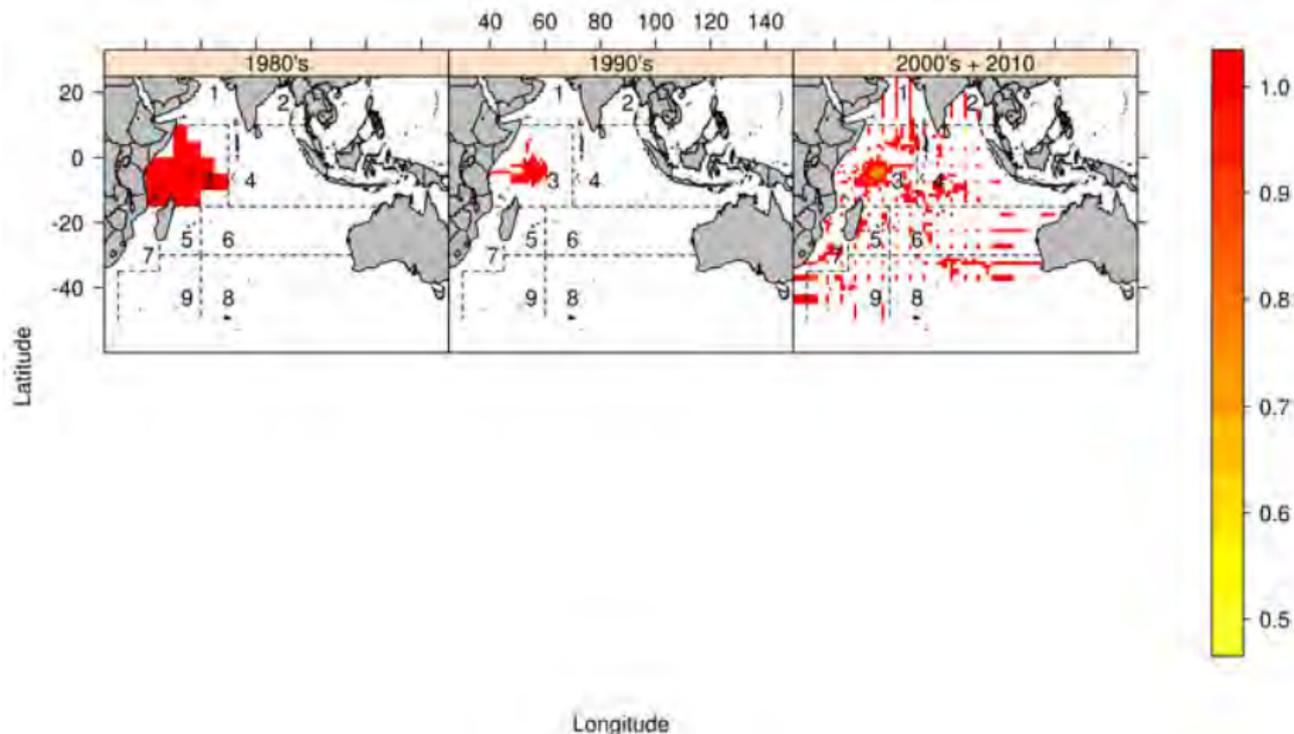
SFA - number of fish/1000 hooks - Decade x Quarter x Area



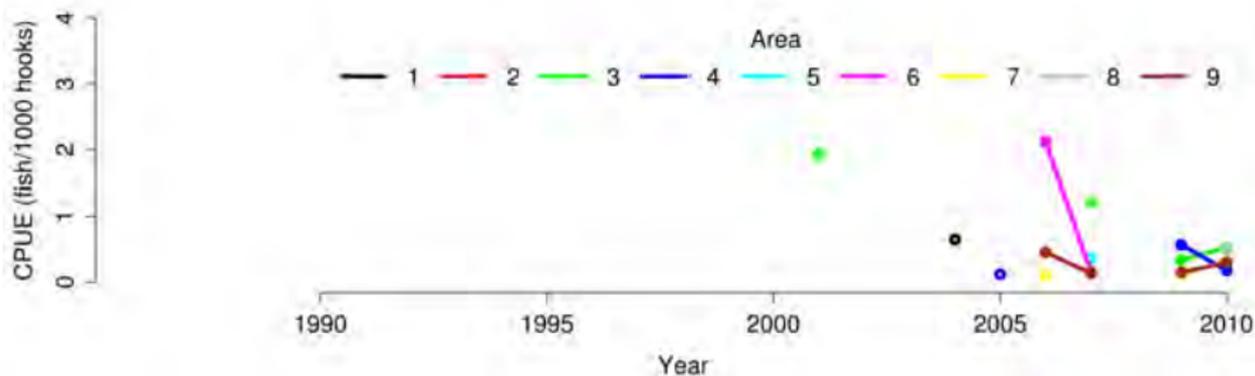
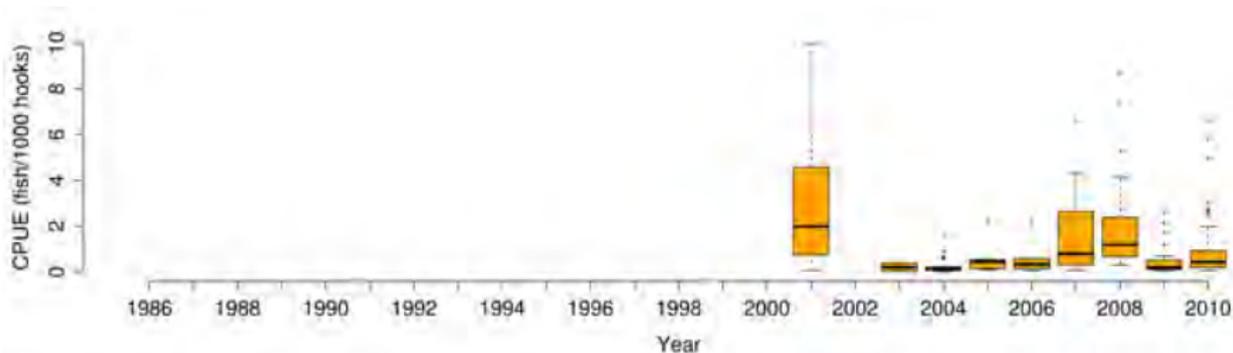
Proportion of Zero Catches



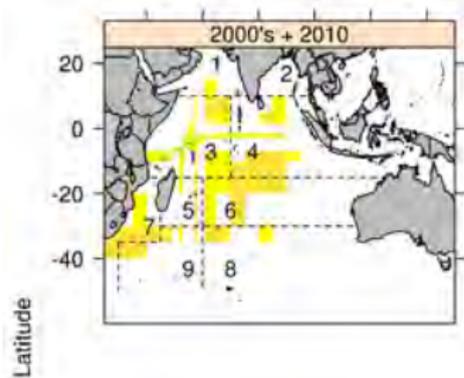
Proportion of Zero Catches



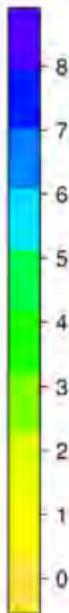
CPUE – Positive Catches



CPUE – Positive Catches



Longitude



Remarks – SFA Seychelles Dataset

- 1 Catches and catch rates were high in area 3 in 2000's;
- 2 Data is not very informative about the proportion of zero catches and the catch rates for positive dataset.



Final Remarks

- 1 Japan and Taiwan are the more consistent longline datasets concerning black, blue and striped marlins;
- 2 Taiwan data for 2007 should be revised;
- 3 There are not evidences of overdispersion due to the excess of zero catches except in the south (areas 8 and 9).

