Executive Summary Of The Status Of The Skipjack Tuna Resource

(11 November 2005)

Draft changes reflecting the work R. Pianet delegated by the Working Party on Tropical Tunas in 2006 to update this skipjack summary for the consideration of the SC in Nov06. Given the number of changes shown, a copy of the text without track changes is also included.

BIOLOGY

Skipjack tuna (*Katsuwonus pelamis*) is a cosmopolitan species ~~forming~~ found~~schools~~ in the tropical and subtropical waters of the three oceans. It generally ~~makes~~ forms large ~~mixed~~ schools ~~and is found~~, often in association with other tunas ~~having~~ of~~a~~ similar size such as juveniles of yellowfin and bigeye. ~~This is specially the case with FADs associated schools exploited by the purse seine fishery where skipjack is largely dominant (60-70% of the total catch).~~

S~~The s~~kipjack ~~tuna resource~~ exhibits characteristics that result in a higher productivity when compared to other tuna species. This species has a short lifespan (probably up to 5 years) and is exploited during a short period (probably less than 3 years), ~~and they are exploited during a short period (probably less than 3 years). The species shows~~ a high fecundity, and spawns opportunistically throughout the year in the whole interequatorial Indian Ocean (north of 20°S, with surface temperature greater than 24°C) when conditions are favorable. ~~As~~ T~~t~~he size at first maturity is about 41-43 cm for both males and females (and as such most of the~~for skipjack, the bulk of their catch~~skipjack taken by the fisheries probably comprises ~~is made on~~ fish~~es~~ that have already ~~spawned~~reproduced).

Little is known about the growth of skipjack, and no new information or document on biology were presented at the working party. It is still a priority to gain more knowledge on the skipjack time-and-space variability in growth patterns.

~~Although three~~No ~~new information or documents on biology were presented on the skipjack growth, it is still uncertain, mainly because its apparent seasonal and geographical variability~~at the working party. ~~However~~ I~~it seems to be closer to the Atlantic estimates than those from the Pacific Ocean. Consequently, it is still a priority to gain more knowledge on the skipjack time-and-space variability in growth patterns.~~

In the absence of any stock structure ~~estimate~~information, a single Indian Ocean stock is assumed. However, ~~it~~ skipjack appears to be less migratory than the other tunas. Given ~~this~~these biological characteristics~~,~~ and ~~; taking into account the biological characteristics of this species and~~ the relatively localised ~~different~~ areas where fishing takes place (Figure 1), smaller management units for skipjack could be considered by managers.

Because of the above~~se~~ characteristics, skipjack tuna ~~resources~~ stocks are considered to be resilient ~~stocks~~ and ~~which are~~ not prone to ~~easily~~ over~~fishing~~ ~~fished~~.

FISHERIES

Catches of skipjack increased slowly from the 1950s, reaching ~~some~~ around 50,000 t at the end of the 1970s, mainly ~~caught~~ due to the activities of~~by~~ baitboats (or pole and line ~~vessels~~) and gillnets. The catches increased rapidly with the arrival of the purse seiners in the early 1980s, and skipjack became one of ~~to become~~ the most important tuna species in the Indian Ocean ~~catches~~. Annual total catches reached around 400,000 t in the mid-1990's and have fluctuated~~s~~ between 500,000 – 580,000 t since 1999 ~~have ranged between 499,000 t and 563,000 t .~~ (Figure ~~1~~ 2 and Table 1).

Preliminary data indicate that catches ~~The catch~~ in 2005 may have been the highest reported in the history of the fishery (~~reached its maximum with~~ 581,700 t~~; however this figure remains provisional and uncertain, as only the catches of purse seiners was effectively known (with 30% increase) at the date of the working group; all other figures being reconducted from previous year~~.

It should be noted that an important ~~part~~amount of the skipjack catch (an average of 75,000 t since 2000) is estimated from ~~aggregated~~ data (mainly from some artisanal fisheries) which do not identify the species in the catch.~~, mainly from some artisanal fisheries;~~ Figure ~~2~~3 ~~shows~~illustrates the evolution of the importance of the catch which ~~have~~has to be ~~desaggregated~~dis-aggregated.

~~Skipjack catches peaked in 2002 at 563,000 t: 246,000 t from the main purse seine fishery, 114,000 t for the Maldivian baitboat fishery and 203,000 t for the other fisheries. The increase in 2002, relative to the previous year, was observed at least for both the purse seine (mainly due to a larger catch on FADs) and the Maldivian baitboat (essentially from an increase in CPUE) fisheries.~~

In recent years, ~~skipjack catches were shared in similar~~the proportions of the catch taken by ~~between~~ the industrial purse seine fishery and the ~~different~~ various artisanal ~~ones~~ fisheries (baitboat, gillnets and others) have been fairly consistent ~~(Figure 2). T~~, t, ~~t~~he majority of ~~this~~ the catch originat~~ingesing from~~ ~~in~~ the western Indian Ocean (Figure ~~1~~32). In general, there is low inter-annual variability in the catches taken in the Indian Ocean ~~when~~ compared ~~with~~ to those taken in ~~similar fisheries in~~ other oceans.

The increase of skipjack catches by purse seiners ~~fisheries~~ is ~~related~~ due to the development of a fishery in association with Fish Aggregating Devices (FADs). C~~; c~~urrently, 80% of the skipjack tuna caught by purse-seine is taken under FADs. Catch rates by purse seiners show an increasing trend in several areas (Figure ~~3~~4 ~~and 5~~) possibly due to an increase in fishing power and to an increase in the number of FADs (and the technology associated with them) in the fishery.

The Maldivian fishery has effectively increased ~~regularly~~ its fishing effort with the mechanisation of its pole and line fishery since 1974, and ~~then~~ the use of anchored FADs since 1981. Skipjack represents some 75% of its total catch, and catch rates have regularly increased since the beginning of the 1980s (Figure ~~4~~5).

Little information is available on the gillnet fisheries (mainly from Sri Lanka, Iran, Pakistan, India and Indonesia). However, it is estimated that the gillnet fisheries ~~which~~ take around 30 to 40 % of the total catch of skipjack~~.~~.

The average ~~size~~ weight of skipjack caught in the Indian Ocean is 2.8~~-~~ kg for purse-seine (2000-2005 average), 3.0 kg for the Maldivian baitboats and 4-5~~–~~ kg for the gillnet (Figure 6). For all fisheries combined, it fluctuates between 3.0-3.5 kg; t~~T~~his is ~~remains relatively large (greater~~ larger than in the Atlantic, but ~~lower~~ smaller than in the Pacific~~) with 2.5 8 kg for purse seine (2000 2005 average), 3.0 kg for the Maldivian baitboats and 4 5 kg for the gillnet (*Figure 5*)~~.

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

During its last ~~No new~~ assessment ~~of skipjack was undertaken during 2004 therefore the current stock status is based on the assessment undertaken~~ in 2003~~.~~

~~T~~, the ~~assessment of skipjack tuna was a priority for the~~ WPTT ~~in 2003. The group~~ analyzed the information available ~~for quantitative stock assessment~~ and considered that ~~there~~ the ~~were large~~ uncertainties in the information were too large ~~needed~~ to conduct a complete assessment of the Indian Ocean skipjack tuna.

Fishery indicators.

As an alternative, the ~~group~~ WPTT decided to analyse ~~different~~ various fishery indicators ~~that~~ to ~~provide~~ gain a general understanding of the ~~estate~~ state of the stock. Several of these indicators were updated in 2006.

1. **Trends in catches**: The trend in catches indicate a large and continuous increase in the catches of skipjack tuna since the mid-1980's (Figure ~~1~~2). This is mainly~~, particularly~~ due to ~~an~~ the expansion of the FAD-associated fishery in the western Indian Ocean ~~Figure 1)~~. There is no sign that the rate of increase in the catches of skipjack is diminishing ~~in recent years~~.
2. **Nominal CPUE Trends:** Figure ~~3~~ 4 shows the catch and nominal CPUE trends of the purse seine fishery for three major skipjack fishing areas: East-Somalia ~~area~~, North-West~~ern~~ Seychelles ~~area~~ and Mozambique Channel. In the Somalia and North-West~~ern~~ Seychelles areas, catches have been variable but generally increasing ~~recently~~. In each of these areas, despite ~~some~~ inter annual ~~with the exception of west Seychelles in 2002 the~~variation, the current nominal CPUE's ~~has~~ are around the same as those of the early 1990's. Since this is a period during which it is believed that effective purse-seine effort has increased substantially (increase of efficiency), it is likely that the true abundance in these areas has decreased. In itself, this is not unexpected given the large increase in catches over that period. However, as these areas may be source of skipjack recruitment to the Maldives artisanal fishery, there is a potential for interactions to occur between these fisheries.~~been relatively stable since the late 1980's. Since this is a period during which is believed that effective purse-seine effort has increased substantially it is likely that the true abundance in these areas has decreased. In itself, this is not unexpected given the large increase in catches over that period.~~

However, as these areas may be source of skipjack recruitment to the Maldives artisanal fishery, there is the potential for an interaction to be occurring between these fisheries. (to be updated)

3. **Average weight in the catch by fisheries:** The Working Party noted that the average weights of the skipjack taken from various areas and gears have remained relatively stablebeen more or less the same since 1991 (Figure 67). Figure 5 6 shows catches at size expressed as average weight from three the major gears,; purse seine, baitboat and gillnet and others, as well as the mean weight for the total catch. The purse seine and the baitboat fisheries take the greatest catch around 40-50 65 cm while catches taken from gillnet fisheries ranges from 70-80 80 cm.

4. **Number of 1° CWP squares visited or fished:** This indicator (Figure 7a) reflects the spatial extension of a fishery. Trends observed in the number of CWP with effort or catch since 1991 suggest that the area exploited by the purse-seine fishery has changed little since 1991, apart in The trend relationship between in the number of one-degree squares visited covered and with catches of skipjack tuna by the main purse-seine fleets suggests that, after the late 1990's, the spatial locationdistribution of the main purse seine catches has remained changed littleat the same average level. In 1998 when, a particularly strong El Niño episode resulted in a much wider spatial distribution of the catchesfishery (.

Length-based cohort analyses.

The WPTT did not develop a formal stock assessment for skipjack tuna. However, a length-based cohort analysis was carried during the meeting to analyze skipjack catches and length frequencies (Figure 8). In the 1980's, The recent period (after 1980) is characterized by a dramaticthere was a marked increase of catches of smaller size fish (40-60 cm) due to the development of the purse seine FAD fishery (Figure 8). Since the 1990's and the largest mode reflects tThe largest mode (60 cm+) reflects the artisanal fisheriesy (essentially mainly the Maldives's pole-and-line) fisheryone) has been responsible for catch of larger (60 cm+) fish (Figure 8). The marked increase in the catch of An increase of catches of large skipjack (60-70 cm) can also be noted for the more recent period (since 2000 2005), is reflected for most gears by anmarked increase of the mean weight of their catches (Figure 86).

The patterns of mean fishing mortality by fish for four length5 years periods (Figure 9) The fishing pattern is shown in *Figure 8*. They reflect illustrate the evolution of the fishery and in highlight particular the increased mortality on due to theboth purse seine and the artisanal componentsfisheries in the recent period. In particular they represent increase of purse seine fishery in the eighties and of the FAD fishery in the nineties.

Interaction between skipjack fisheries and other species.

Purse seiners catch 40-5560 cm skipjack whereas artisanal fisheries catch 60-70 cm fish, thus the fishing pressure applied by purse seiners on smaller size skipjack is likely to affect the catches of larger sized skipjack by the artisanal fisheries. Furthermore, large numbers of juvenile bigeye and yellowfin tuna are caught in the course of purse-seine sets on FADs that target skipjack tuna. However, the fact that skipjack appears to be less migratory than the other tunas should also be considered.

Managers need to be aware that such interactions between fleets, and gears and species have the potential to cause competition and conflict (e.g. the western Indian Ocean purse-seine fishery for small skipjack versus the Maldivian baitboat fishery for larger skipjack; and the purse seine fishery for skipjack which catches juvenile bigeye versus the bigeye longline fishery; the purse seine catch of juvenile yellowfin on FADs versus their catch of large free school yellowfin) and affect the efficacy of management measures aimed at particular fleets or gears in isolation. These interactions have to be taken in account when management decisions are considered. A potential problem in the skipjack fisheries is the interaction between industrial and artisanal fisheries, and more particularly between the western Indian Ocean purse seine fishery and the Maldivian baitboat fishery.

Large numbers of juvenile bigeye and yellowfin tuna are caught in the course of purse-seine sets on FADs that target skipjack tuna.

SKIPJACK TAGGING AND IOTTP

The analysis of skipjack tuna stock status conducted by the WPTT reinforce the previous recommendation that only the results of the large scale tagging programme planned by the IOTC will allow to estimate for skipjack tuna:

- stock structure,
- variability of growth in time and space,

~~•natural mortality at age,~~

~~•stock size,~~

~~•as well as the potential interactions between skipjack tuna fisheries.~~

~~Subsequently, the Scientific Committee recommended to fully incorporate skipjack tuna in the tagging operations that will be planned for the incoming large scale IOTTP tagging programme~~

STOCK ASSESSMENT

No quantitative stock assessment is currently available for skipjack tuna in the Indian Ocean. The range of stock indicators available to the Scientific Committee do ~~The Scientific Committee recognized that, in spite of not having a full stock assessment for skipjack, the analysis of the stock status indicators provided by the WPTT does~~ not ~~show~~ signal that there are any ~~reasons for immediate concern~~problems in the fishery currently.

The SC also note that ~~d two additional arguments in favour of this conclusion. First,~~ in most fisheries, declining catches combined with increasing effort are usually indicators that a stock is being exploited close or above its MSY. In the case of skipjack tuna, catches have continued to increase as effort increased. This ~~can~~is ~~illustated~~illustrated ~~be reflected by~~in ~~the trend of yearly skipjack catches of the Indian Ocean using Relative Rate of Catch Increase (RRCI), a modified version of the Grainger and Garcia index (Figure 9~~10). Furthermore,~~Second,~~ the majority of the catch comes from fish that ~~is~~ are ~~already~~ sexually mature (greater than 40 cm) and therefore likely to have already reproduced.~~, as the fishing pattern by size indicates.~~

The SC noted that, although there might be no reason for immediate concern, it is clear that the catches cannot be increased at the current rate indefinitely. Therefore, it recommends that skipjack be ~~the situation be monitored closely and be~~ reviewed every 2 to 3 years ~~in~~ by the WPTT.

MANAGEMENT ADVICE

~~The Working Party on Tropical Tunas has not made any specific management recommendations for the skipjack stock. However, t~~The high productivity life history characteristics of skipjack tuna suggest this species is resilient and not prone to overfishing, and~~,~~ the stock status indicators~~information presented in the documents reviewed, and the information in the stock status indicators prepared during the meeting~~ ~~suggests~~indicate that there is no need for immediate concern about the status of skipjack tuna.

SKIPJACK TUNA SUMMARY

Maximum Sustainable Yield :	unknown
Current (2005) Catch:	582,000 t (provisional)
Mean catch over the last 5 years (2001-05)	544,000 t
Current Replacement Yield :	-
Relative Biomass (B_{cur}/B_{MSY}) :	unknown
Relative Fishing Mortality (F_{cur}/F_{MSY}):	unknown
Management Measures in Effect :	none

Note: This Executive Summary has been updated to take account of recent catch data. The management advice, and stock assessment results are based on data up to ~~2002~~20042. (evaluation was done in 2003).

Table 1. *Catches of skipjack tuna by gear and main fleets for the period 1956-2005 (in thousands of tonnes).* *Data as of ~~11 July 2006~~9 October 2006.*

Gear	Fleet	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82
Purse seine	France																										0.2	1.0
	NEI-Other																											
	Japan																						0.1	0.9	0.6	0.4	0.1	0.5
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.8	2.7
	Total																						0.1	0.9	0.6	1.4	2.0	4.2
Baitboat	Maldives	9.0	10.0	10.0	10.0	9.0	8.0	8.0	8.0	8.0	14.1	16.9	18.9	17.5	19.6	27.6	28.0	17.5	19.5	22.5	14.9	18.6	13.7	13.2	17.3	22.2	19.6	15.3
	Other Fleets	1.7	1.6	1.7	1.6	1.6	2.1	2.1	2.2	2.3	2.6	2.8	2.7	2.9	3.1	0.3	0.0	0.4	5.0	10.9	2.2	0.1	0.6	0.8	0.4	0.0	0.2	1.3
	Total	10.7	11.6	11.7	11.6	10.6	10.1	10.1	10.2	10.3	16.7	19.7	21.6	20.4	22.7	27.9	28.0	17.9	24.6	33.4	17.1	18.7	14.3	14.0	17.6	22.2	19.9	16.6
Longline	Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gillnet	Sri Lanka	1.3	1.6	1.8	1.9	2.4	3.0	4.5	6.1	5.8	5.6	6.4	7.1	8.0	8.9	6.9	5.0	8.8	10.5	9.3	7.2	12.7	12.6	14.8	12.4	16.3	18.4	18.0
	Indonesia	1.1	1.1	1.1	1.1	1.1	1.4	1.4	1.5	1.6	1.7	1.9	1.8	1.9	2.1	3.8	4.0	6.3	6.9	9.0	16.5	20.9	28.4	22.1	26.8	35.9	40.8	41.0
	Pakistan	0.7	1.9	0.9	0.9	1.1	1.0	1.6	2.4	3.4	3.6	4.9	4.7	4.7	4.3	3.9	3.2	3.8	3.0	4.1	4.5	4.2	3.8	2.2	3.8	1.8	2.7	3.4
	Other Fleets	0.2	0.2	0.2	0.2	0.3	0.4	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.7	0.7	2.9	1.0	1.2	2.4	1.5	1.9	2.6	0.1	1.9	2.6
	Total	3.3	4.7	4.0	4.1	4.9	5.8	7.7	10.2	10.9	11.2	13.2	13.8	14.8	15.4	15.0	12.9	19.7	23.3	23.4	29.5	40.3	46.2	41.0	45.5	54.0	63.8	65.0
Line	Indonesia	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	1.1	1.2	1.7	1.9	2.6	5.1	6.5	1.1	0.9	1.4	1.7	2.5	3.6
	Other Fleets	0.4	0.4	0.4	0.5	0.6	0.7	1.0	1.3	1.2	1.2	1.4	1.5	1.8	1.9	3.1	2.7	3.0	3.5	3.4	3.4	4.6	4.1	4.1	3.8	4.6	5.0	3.2
	Total	0.6	0.6	0.6	0.7	0.8	0.9	1.2	1.5	1.5	1.5	1.7	1.9	2.1	2.3	4.2	3.9	4.7	5.4	6.0	8.5	11.1	5.3	5.0	5.2	6.3	7.5	6.8
All	Total	14.7	16.9	16.3	16.3	16.3	16.8	19.0	22.0	22.9	29.4	34.7	37.3	37.4	40.4	47.3	44.9	42.5	53.3	63.1	55.6	70.8	66.8	61.9	70.0	85.0	94.4	94.2

Gear	Fleet	Av 00/05	Av 56/05	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05
Purse seine	Spain	81.3	24.8		6.4	18.6	19.1	27.9	39.7	63.9	47.9	41.8	46.7	51.3	61.6	69.6	66.3	62.9	58.6	74.3	79.4	68.5	91.3	88.0	64.4	94.3
	France	42.1	17.6	9.4	27.3	29.8	36.1	35.6	36.1	43.1	29.0	39.4	45.0	48.2	58.4	48.7	40.1	31.3	30.3	42.7	39.9	36.3	54.4	38.9	38.0	43.2
	Seychelles	33.8	4.3									1.8	0.6					4.9	10.7	15.8	11.6	26.2	29.9	36.8	30.0	46.0
	NEI-Ex-Soviet Union	18.6	4.3								0.7		10.1	8.7	8.2	18.4	14.7	11.2	10.2	17.3	19.8	21.1	21.0	24.7	17.8	8.5
	NEI-Other	17.6	7.5	0.4	8.2	8.4	6.4	4.8	7.0	7.9	11.0	10.8	10.8	17.4	24.5	22.3	18.4	24.3	31.2	33.4	40.8	26.5	31.9	20.6	4.7	4.0
	Iran, Islamic Republic	7.6	0.9														0.8	1.0	2.0	2.7	1.6	2.9	6.7	6.7	10.7	10.7
	Japan	2.0	3.5	0.6	0.7	0.3	0.6	0.9	2.3	3.4	10.9	15.9	31.7	31.4	20.1	16.1	7.0	6.7	5.7	4.6	2.3	1.8	1.9	2.4	1.5	2.6
	Other Fleets	3.1	2.3	1.5	3.1	3.2	4.4	9.9	7.8	8.3	8.8	13.1	6.4	7.1	6.3	3.9	1.9	3.0	1.2	2.4	1.4	6.4	1.3		0.0	8.0
	Total	206.2	65.2	11.8	45.7	60.4	66.6	79.0	92.8	126.7	108.2	122.8	151.4	163.9	179.2	178.9	149.2	145.4	150.0	193.2	196.9	189.6	238.6	218.3	167.1	217.3
Baitboat	Maldives	103.5	39.8	19.3	32.3	42.2	45.1	42.6	58.2	57.8	60.7	58.3	57.6	58.0	69.0	69.9	66.2	68.1	77.8	92.3	78.8	86.8	113.9	107.5	104.5	104.5
	Other Fleets	3.4	3.1	1.2	1.0	1.0	1.0	1.3	1.7	1.2	1.5	6.7	7.0	13.9	6.8	7.4	7.4	8.7	4.3	7.2	7.5	2.7	3.2	3.1	4.0	4.0
	Total	106.8	42.9	20.5	33.3	43.2	46.1	43.9	59.9	59.0	62.2	65.0	64.6	71.9	75.8	77.3	73.6	76.8	82.1	99.5	86.3	89.5	117.0	110.6	108.5	108.5
Longline	Total	0.3	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.7	0.5	0.5
Gillnet	Sri Lanka	70.6	23.3	16.3	13.3	14.9	14.6	15.3	15.9	17.3	20.5	23.1	27.0	31.5	38.8	40.6	47.3	56.1	56.9	72.5	73.2	68.4	74.2	70.1	70.1	70.1
	Indonesia	69.4	34.4	45.0	49.4	44.1	49.3	27.8	50.2	62.9	46.2	21.7	24.1	26.7	32.2	87.5	98.8	110.6	104.8	111.8	94.8	79.9	60.8	51.3	77.6	77.6
	Iran, Islamic Republic	37.9	5.1							0.3	0.8	1.1	4.3	4.4	7.4	1.1	2.5	8.3	4.7	13.9	18.5	23.2	23.1	36.0	53.6	53.6
	Pakistan	3.4	3.7	1.1	1.2	2.0	1.5	3.7	5.6	7.5	7.6	7.5	6.1	6.9	8.1	7.1	4.4	4.6	4.5	4.8	4.6	3.6	3.3	3.2	3.5	3.5
	Other Fleets	0.6	1.4	2.7	3.6	3.4	4.0	5.6	4.8	6.2	5.8	0.6	0.7	1.2	1.2	1.5	1.1	1.6	0.6	0.7	0.9	0.4	0.5	0.6	0.8	0.8
	Total	181.9	68.0	65.2	67.6	64.4	69.4	52.5	76.5	94.2	80.9	54.1	62.2	70.7	87.8	137.9	154.0	181.1	171.5	203.7	192.1	175.5	161.8	161.2	205.5	205.5
Line	Indonesia	33.6	8.7	3.6	2.7	5.2	1.3	23.0	5.9	4.0	4.8	34.6	25.9	44.9	52.2	0.9	3.4	0.7	0.4	0.0	19.2	29.4	33.2	43.0	31.2	31.2
	Other Fleets	6.3	3.4	3.2	3.1	3.1	3.3	3.2	3.4	5.7	6.2	6.3	4.8	4.6	4.5	4.7	4.4	4.8	4.5	3.5	3.9	4.0	4.7	3.9	9.5	9.5
	Total	39.9	12.1	6.8	5.9	8.3	4.5	26.2	9.3	9.6	11.0	40.8	30.6	49.5	56.6	5.6	7.8	5.4	4.9	3.5	23.1	33.4	37.9	47.0	40.7	40.7
All	Total	544.0	191.3	106.6	153.9	179.0	190.0	204.8	241.9	293.3	266.1	284.2	312.7	362.6	406.7	407.0	392.8	417.7	417.0	509.1	507.6	496.9	563.4	546.4	531.5	581.7

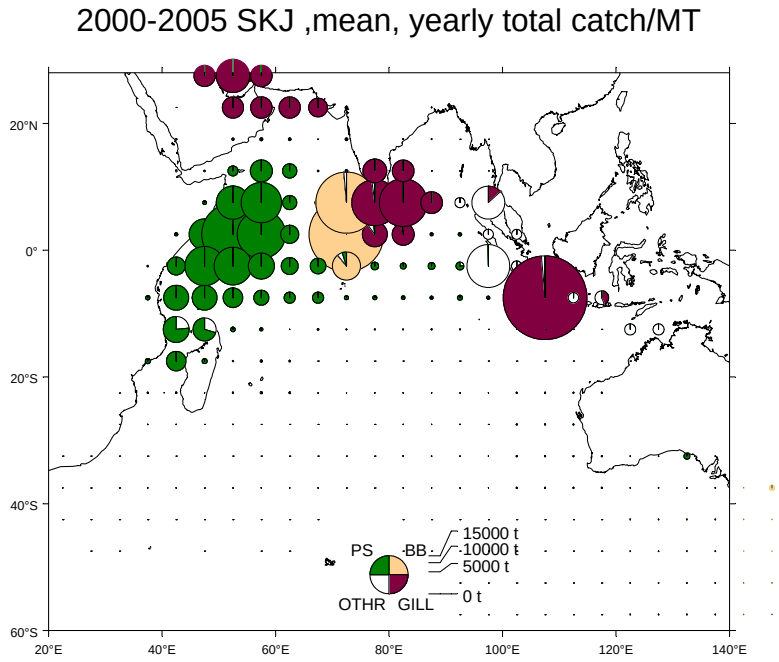

Figure 1 *: Mean spatial distribution of skipjack tuna catches in the Indian Ocean by gear type, 2000-2005. BB = bait boat (pole and line); GILL = gillnet; LL = longline; PS = purse seine. Data as of October 2006*

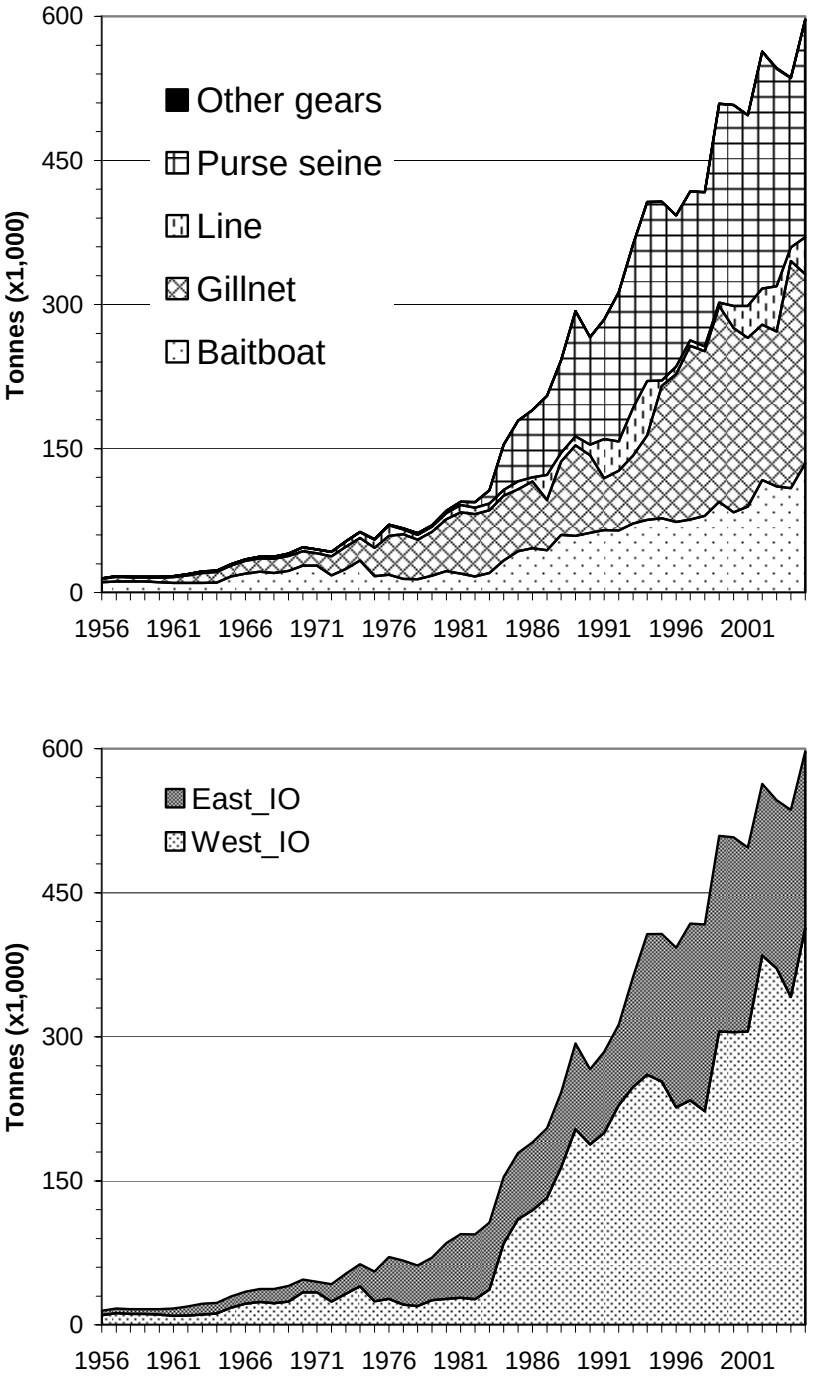

Figure 2: *Yearly catches (thousand of metric tonnes) of skipjack tuna by gear (left) and by area (Eastern and Western Indian Ocean, top right) from 1956 to 2005.* *Data as of October 2006*

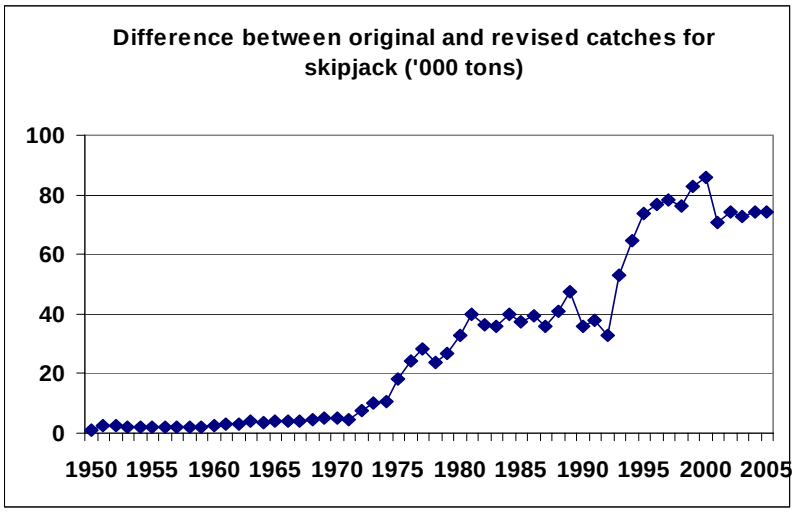

Figure 3: *Total amount ~~QuantitiesTonnage~~ of the ~~of total~~ skipjack catches estimated from ~~coming from~~ aggregated data ~~Areas used for the calculation of the CPUE trends shown in Figure 4~~*

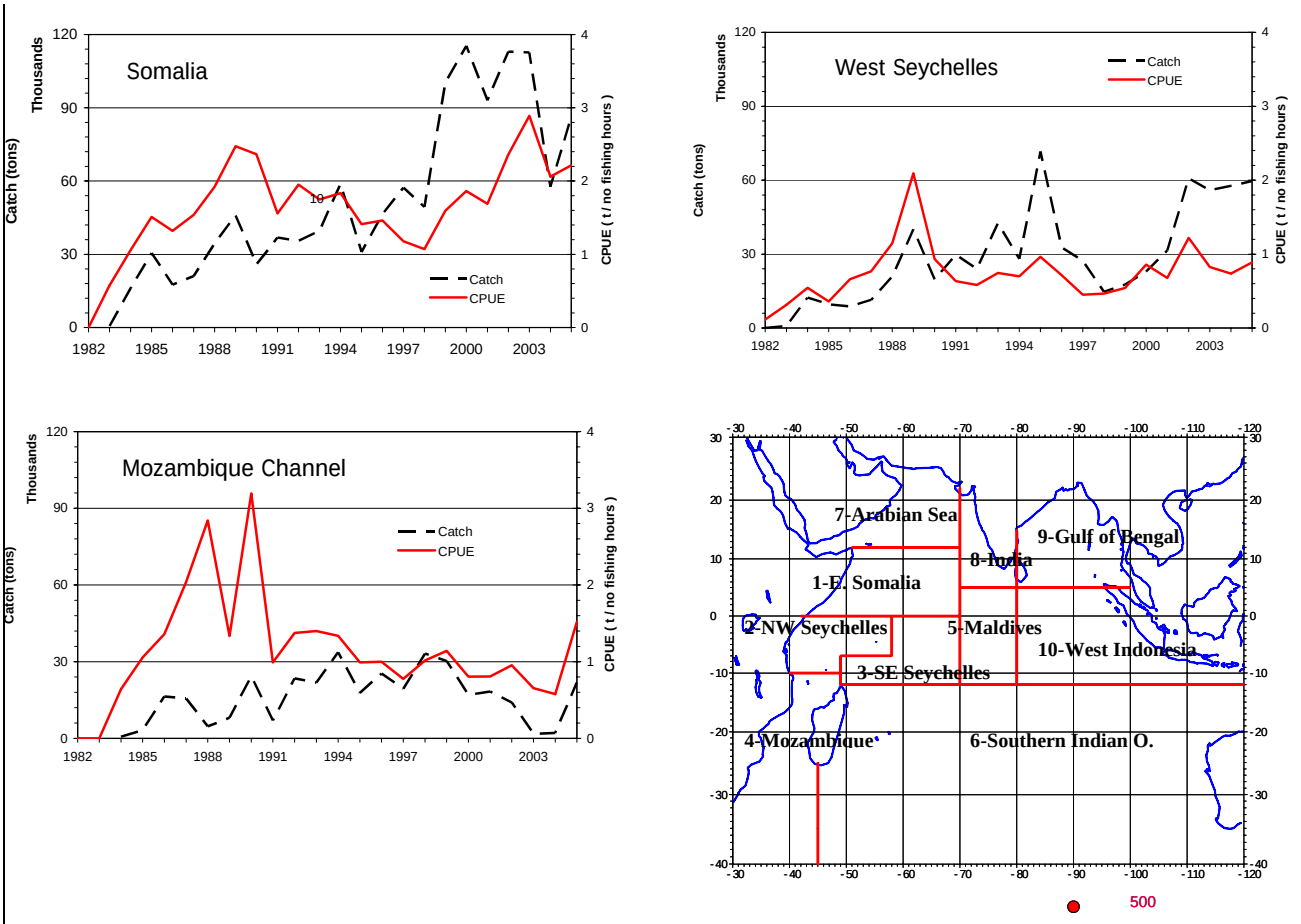

Figure 4: -*Nominal CPUEs for three important purse seine fishing ground areas: East Somalia Basin (top left) (top left panel); Mozambique Channel (top right panel) and North-Western Seychelles (bottom panelleft). Data as of July 2006;*
Areas used for the calculation of the CPUE trends are represented (bottom right).

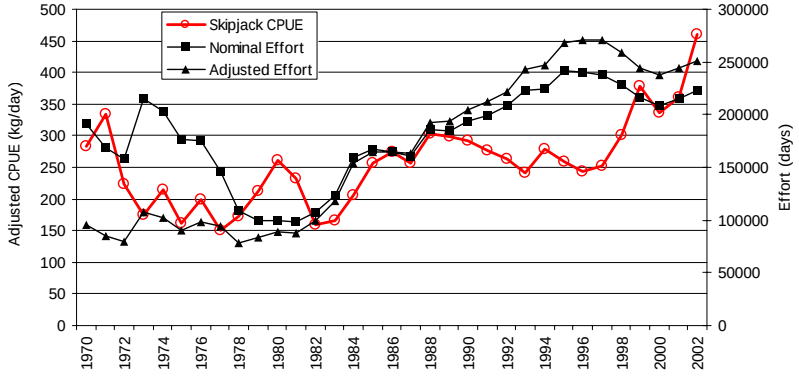

Figure 5. : . *Time series of Maldives CPUE and, the nominal and adjusted effort of the Maldivian baitboats fishery, 1970-2002 (from WPTT-03-23).*

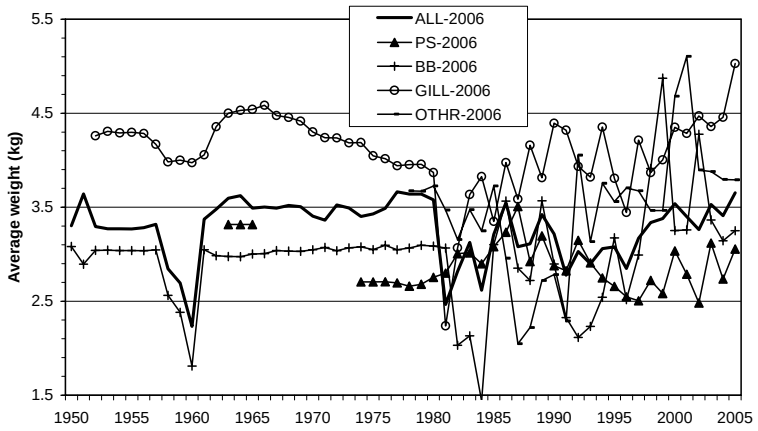

Figure 6. : . *Skipjack tuna average weight in the catch by main gear (from size-frequency data) and for the whole fishery (estimated from the total catch at size), 1950-2005. Data as of June 2006*

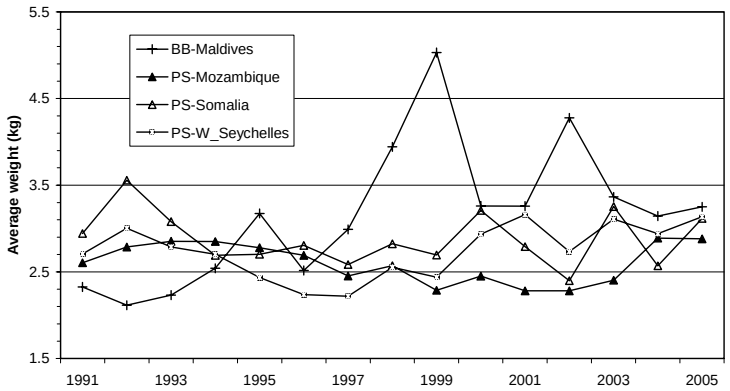

Figure 7. : . *Time series of average weight of skipjack caught by the purse seine and pole and line baitboat fisheries by major areas. (1991—2005). Data as of June 2006*

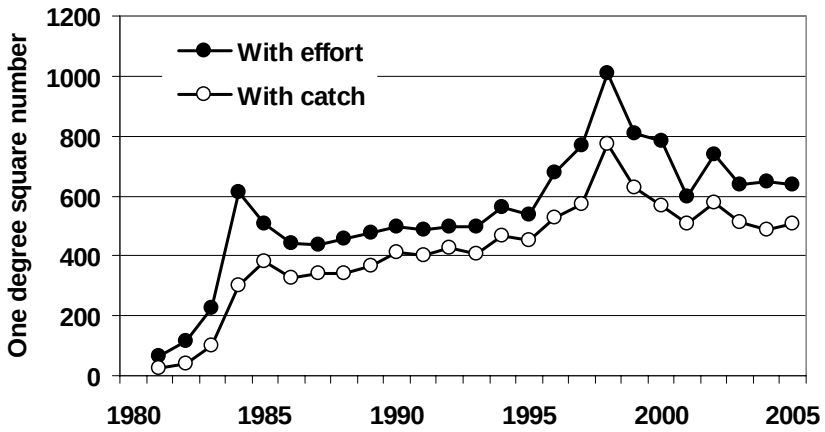

Figure 7a. *Number of one degree CWP squares explored by the purse seine fishery, 1980-2005*

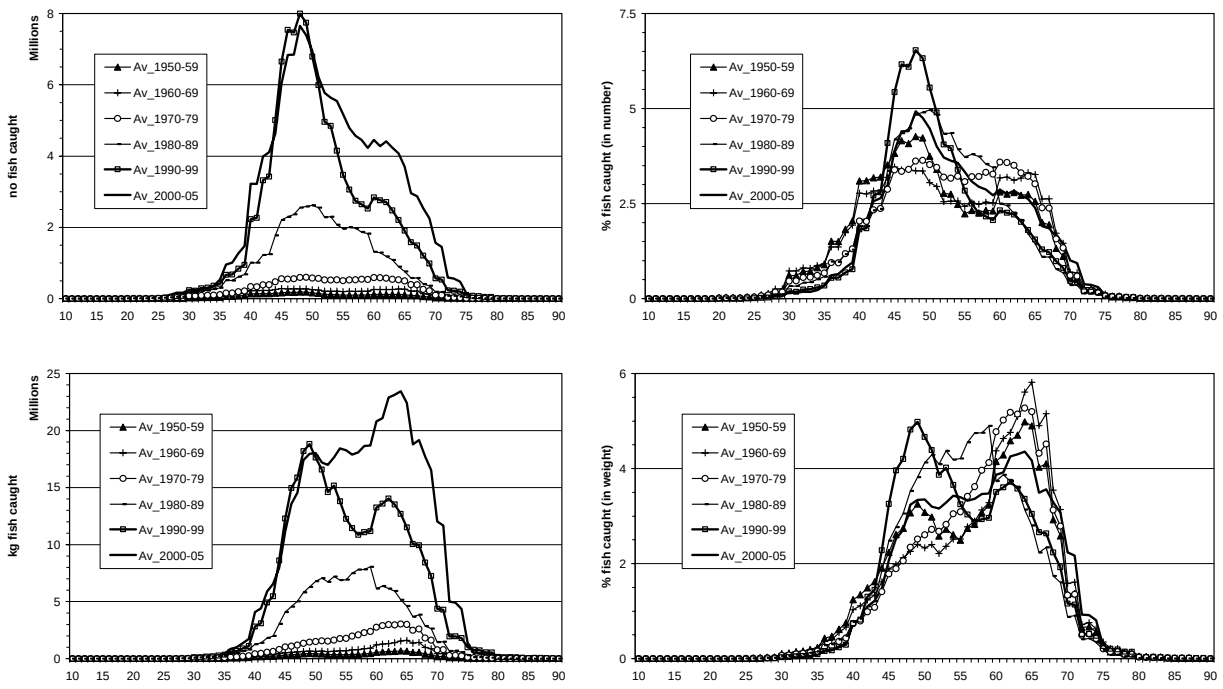

***Figure 8. : ****Catch by size in numbers (top panels) and ~~size frequencies of the yield~~weight (bottom panels) for six ten-year mean~~time~~ periods: 1950-~~19~~59, 1960-69, 1970-79, 1980-~~19~~89, 1990-99 and 2000-2005. Left panels are actual numbers and right panels are in proportions.*
Note the two modes (40-50 and 55-65 cm) that appear in the yield frequencies but which are less visible in the number frequencies. Data as of June 2006

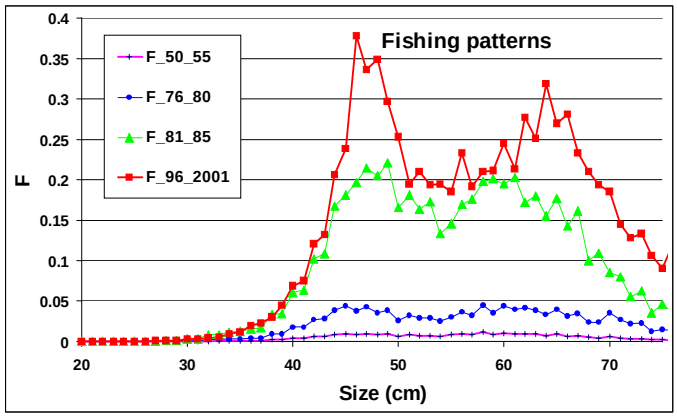

***Figure 9. : ****Estimated fishing mortality by size for four five-year mean periods : ~~(~~1950-~~19~~55, 1976-~~19~~80, 1981-~~19~~85, and 1996-2001~~)~~.*

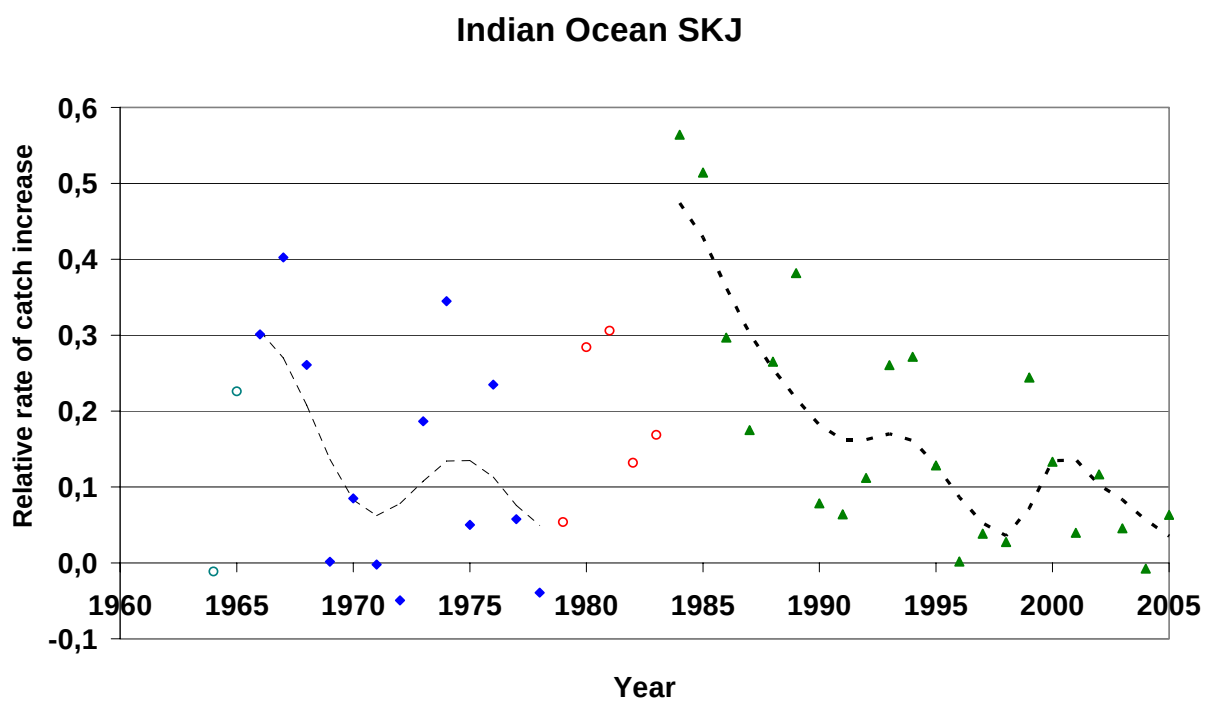

Figure 10: Relative Rate of Catch Increase (RRCI) for skipjack, 1960-2005

Executive Summary Of The Status Of The Skipjack Tuna Resource

(11 November 2005)

Draft changes (NOT SHOWN) reflecting the work R. Pianet delegated by the Working Party on Tropical Tunas in 2006 to update this skipjack summary for the consideration of the SC in Nov06.

BIOLOGY

Skipjack tuna (*Katsuwonus pelamis*) is a cosmopolitan species found in the tropical and subtropical waters of the three oceans. It generally forms large schools, often in association with other tunas of similar size such as juveniles of yellowfin and bigeye.

Skipjack exhibits characteristics that result in a higher productivity when compared to other tuna species. This species has a short lifespan (probably up to 5 years) and is exploited during a short period (probably less than 3 years), a high fecundity, and spawns opportunistically throughout the year in the whole interequatorial Indian Ocean (north of 20°S, with surface temperature greater than 24°C) when conditions are favorable. The size at first maturity is about 41-43 cm for both males and females (and as such most of the skipjack taken by the fisheries probably comprises fish that have already reproduced).

Little is known about the growth of skipjack, and no new information or document on biology were presented at the working party. It is still a priority to gain more knowledge on the skipjack time-and-space variability in growth patterns.

In the absence of any stock structure information, a single Indian Ocean stock is assumed. However, skipjack appears to be less migratory than the other tunas. Given these biological characteristics and the relatively localised areas where fishing takes place (Figure 1), smaller management units for skipjack could be considered by managers.

Because of these characteristics, skipjack tuna stocks are considered to be resilient and not prone to overfishing.

FISHERIES

Catches of skipjack increased slowly from the 1950s, reaching around 50,000 t at the end of the 1970s, mainly due to the activities of baitboats (or pole and line) and gillnets. The catches increased rapidly with the arrival of the purse seiners in the early 1980s, and skipjack became one of the most important tuna species in the Indian Ocean. Annual total catches reached around 400,000 t in the mid-1990's and have fluctuated between 500,000 – 580,000 t since 1999 (Figure 2 and Table 1). Preliminary data indicate that catches in 2005 may have been the highest reported in the history of the fishery (581,700 t).

It should be noted that an important amount of the skipjack catch (an average of 75,000 t since 2000) is estimated from data (mainly from some artisanal fisheries) which do not identify the species in the catch. Figure 3 illustrates the evolution of the importance of the catch which has to be dis-aggregated.

In recent years, the proportions of the catch taken by the industrial purse seine fishery and the various artisanal fisheries (baitboat, gillnets and others) have been fairly consistent, the majority of the catch originating from the western Indian Ocean (Figure 2). In general, there is low inter-annual variability in the catches taken in the Indian Ocean compared to those taken in other oceans.

The increase of skipjack catches by purse seiners is due to the development of a fishery in association with Fish Aggregating Devices (FADs). Currently, 80% of the skipjack tuna caught by purse-seine is taken under FADs. Catch rates by purse seiners show an increasing trend in several areas (Figure 4) possibly due to an increase in fishing power and to an increase in the number of FADs (and the technology associated with them) in the fishery.

The Maldivian fishery has effectively increased its fishing effort with the mechanisation of its pole and line fishery since 1974, and the use of anchored FADs since 1981. Skipjack represents some 75% of its total catch, and catch rates have regularly increased since the beginning of the 1980s (Figure 5).

Little information is available on the gillnet fisheries (mainly from Sri Lanka, Iran, Pakistan, India and Indonesia). However, it is estimated that the gillnet fisheries take around 30 to 40 % of the total catch of skipjack.

The average weight of skipjack caught in the Indian Ocean is 2.8 kg for purse-seine (2000-2005 average), 3.0 kg for the Maldivian baitboats and 4-5 kg for the gillnet (Figure 6). For all fisheries combined, it fluctuates between 3.0-3.5 kg; this is larger than in the Atlantic, but smaller than in the Pacific.

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

During its last assessment in 2003, the WPTT analyzed the information available and considered that the uncertainties in the information were too large to conduct a complete assessment of the Indian Ocean skipjack tuna.

Fishery indicators.

As an alternative, the WPTT decided to analyse various fishery indicators to gain a general understanding of the state of the stock. Several of these indicators were updated in 2006.

5. **Trends in catches**: The trend in catches indicate a large and continuous increase in the catches of skipjack tuna since the mid-1980's (Figure 2). This is mainly due to the expansion of the FAD-associated fishery in the western Indian Ocean. There is no sign that the rate of increase in the catches of skipjack is diminishing.
6. **Nominal CPUE Trends:** Figure 4 shows the catch and nominal CPUE trends of the purse seine fishery for three major skipjack fishing areas: East-Somalia, North-West Seychelles and Mozambique Channel. In the Somalia and North-West Seychelles areas, catches have been variable but generally increasing. In each of these areas, despite some inter annual variation, the current nominal CPUE's are around the same as those of the early 1990's. Since this is a period during which it is believed that effective purse-seine effort has increased substantially (increase of efficiency), it is likely that the true abundance in these areas has decreased. In itself, this is not unexpected given the large increase in catches over that period. However, as these areas may be source of skipjack recruitment to the Maldives artisanal fishery, there is a potential for interactions to occur between these fisheries.
7. **Average weight in the catch by fisheries:** The Working Party noted that the average weights of the skipjack taken from various areas and gears have remained relatively stable since 1991 (Figure 7). Figure 6 shows catches at size expressed as average weight from the major gears, purse seine, baitboat and gillnet and others, as well as the mean weight for the total catch. The purse seine and the baitboat fisheries take the greatest catch around 40-65 cm while catches taken from gillnet fisheries ranges from 70-80 cm.
8. **Number of 1° CWP squares visited or fished:** This indicator reflects the spatial extension of a fishery. Trends observed in the number of CWP with effort or catch since 1991 suggest that the area exploited by the purse-seine fishery has changed little since 1991, apart in 1998 when a particularly strong El Niño episode resulted in a much wider spatial distribution of the fishery. (add figure ?)

Length-based analyses.

The WPTT did not develop a formal stock assessment for skipjack tuna. However, a length-based cohort analysis was carried during the meeting to analyze skipjack catches and length frequencies (Figure 8). In the 1980's, there was a marked increase of catches of smaller size fish (40-60 cm) due to the development of the purse seine fishery. The largest mode (60 cm+) reflects the artisanal fisheries (mainly the Maldives's pole-and-line one). The marked increase in the catch of large skipjack (60-70 cm) since 2000 is reflected for most gears by marked increase of the mean weight of their catches (Figure 6).

The patterns of mean fishing mortality by fish for four 5 years periods (Figure 9) illustrate the evolution of the fishery and highlight the increased mortality due to the purse seine and the artisanal fisheries in the recent period..

Interaction between skipjack fisheries and other species.

Purse seiners catch 40-60 cm skipjack whereas artisanal fisheries catch 60-70 cm fish, thus the fishing pressure applied by purse seiners on smaller size skipjack is likely to affect the catches of larger sized skipjack by the

artisanal fisheries. Furthermore, large numbers of juvenile bigeye and yellowfin tuna are caught in the course of purse-seine sets on FADs that target skipjack tuna. However, the fact that skipjack appears to be less migratory than the other tunas should also be considered.

Managers need to be aware that such interactions between fleets, gears and species have the potential to cause competition and conflict (e.g. the western Indian Ocean purse-seine fishery for small skipjack versus the Maldivian baitboat fishery for larger skipjack; the purse seine fishery for skipjack which catches juvenile bigeye versus the bigeye longline fishery; the purse seine catch of juvenile yellowfin on FADs versus their catch of large free school yellowfin) and affect the efficacy of management measures aimed at particular fleets or gears in isolation. These interactions have to be taken in account when management decisions are considered.

STOCK ASSESSMENT

No quantitative stock assessment is currently available for skipjack tuna in the Indian Ocean. The range of stock indicators available to the Scientific Committee do not signal that there are any problems in the fishery currently.

The SC also note that in most fisheries, declining catches combined with increasing effort are usually indicators that a stock is being exploited close or above its MSY. In the case of skipjack tuna, catches have continued to increase as effort increased. This is illustrated in the trend of yearly skipjack catches of the Indian Ocean using Relative Rate of Catch Increase (RRCI), a modified version of the Grainger and Garcia index (Figure 10). Furthermore, the majority of the catch comes from fish that are sexually mature (greater than 40 cm) and therefore likely to have already reproduced.

The SC noted that, although there might be no reason for immediate concern, it is clear that the catches cannot be increased at the current rate indefinitely. Therefore, it recommends that skipjack be reviewed every 2 to 3 years by the WPTT.

MANAGEMENT ADVICE

The high productivity life history characteristics of skipjack tuna suggest this species is resilient and not prone to overfishing, and the stock status indicators indicate that there is no need for immediate concern about the status of skipjack tuna.

SKIPJACK TUNA SUMMARY

Maximum Sustainable Yield :	unknown
Current (2005) Catch:	582,000 t (provisional)
Mean catch over the last 5 years (2001-05)	544,000 t
Current Replacement Yield :	-
Relative Biomass (B_{cur}/B_{MSY}) :	unknown
Relative Fishing Mortality (F_{cur}/F_{MSY}):	unknown
Management Measures in Effect :	none

Note: This Executive Summary has been updated to take account of recent catch data. The management advice, and stock assessment results are based on data up to 2002. (evaluation was done in 2003).