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EXECUTIVE SUMMARY OF THE STATUS OF THE YELLOWFIN TUNA RESOURCE

BIOLOGY

Yellowfin tuna is a cosmopolitan species distributed mainly in the tropical and subtropical oceanic waters of the three oceans, where it forms large schools. The sizes exploited in the Indian Ocean range from 30 cm to 170 cm fork length. Smaller fish (juveniles) form mixed schools with skipjack and juvenile bigeye tuna and are mainly limited to surface tropical waters, while larger fish are found in surface and sub-surface waters. Intermediate age yellowfin are seldom taken in the industrial fishery, but are abundant in some artisanal fisheries, mainly in the Arabian sea.

Stock structure is unclear, and a single stock is usually assumed for stock assessment purposes. Longline catch data indicates that yellowfin are distributed continuously throughout the entire tropical Indian Ocean, but some more detailed analysis of fisheries data suggests that stock structure may be more complex. A study of stock structure using DNA was inconclusive.

Spawning occurs from December to March in the equatorial area (0-10°S), but the main spawning grounds seem to be between 50° and 70°E. Yellowfin size at first maturity has been estimated at 110 cm, and recruitment occurs in July. Newly recruited fish are primarily caught by the purse seine fishery on floating objects. Males are predominant in the catches of larger fish, but apparently at a larger size (150 cm) than in other oceans.

Several new growth studies were presented to the WPTT. The Working Party identified two hypotheses regarding growth curves: a “slow-growth” hypothesis, assuming a two-stanza growth curve, and a “fast-growth” hypothesis, assuming a constant growth rate . The two-stanza growth curve is in good agreement with growth curves estimated from size frequencies and tagging studies in the Atlantic and western Pacific Oceans.

There are no direct estimates of natural mortality (M) for yellowfin in the Indian Ocean. In stock assessments, estimates from other oceans have been used, mainly based on results from the western Pacific tagging programme. These indicated a higher M on juvenile fish than for older fish.

There is little information on yellowfin movement patterns in the Indian Ocean, and what information there is comes from analysis of fishery data, which can produce biased results because of their uneven coverage. However, there is good evidence that medium sized yellowfin concentrate for feeding in the Arabian sea. Feeding behaviour is largely opportunistic, generally aimed at large concentrations of crustacea in the tropical areas or small mesopelagic fishes in the Arabian sea.

FISHERY

Catches by area, gear, country and year from 1950 to 2003 are shown in Table 1 and illustrated in Figure 1. Contrary to the situation in other oceans, the artisanal fishery component in the Indian Ocean is substantial, taking approximately 20-25% of the total catch.

The geographical distribution of yellowfin tuna catches in the Indian Ocean in recent years by the main gear types (purse-seine, longline and artisanal) is shown in Figure 2. Most yellowfin tuna are caught in Indian Ocean north of 12°S and in the Mozambique Channel (north of 25°S).

Although some Japanese purse seiners have fished in the Indian Ocean since 1977, the purse seine fishery developed rapidly with the arrival of European vessels between 1982 to 1984. Since then, there has been an increasing number of yellowfin tuna caught (*Figure 3*) although a larger proportion of the catches is made of adult fish, when compared to the case of the bigeye tuna purse-seine catch. Purse seine catches of yellowfin with fork lengths between 30 and 180 cm increased rapidly to some 130,000 t in 1993, after which they have fluctuated around that level.

The purse seine fishery is characterized by the use of two different fishing modes: the fishery on floating objects (FADs), which catches mainly small yellowfin in association with skipjack and juvenile bigeye, and a fishery on free swimming school, which catches larger yellowfin on mixed or pure sets. Between 1995 and 2000, the FAD component of the purse seine fishery represented 50-66% of the sets undertaken (65-80% of the positive sets) and took 46-63% of the yellowfin catch by weight (63-76% of the total catch).

The longline fishery started in the beginning of the 1950's and expanded rapidly over the whole Indian Ocean. It catches mainly large fish, from 80 to 160 cm fork length. The longline fishery targets several tuna species in different parts of the Indian Ocean, with yellowfin and bigeye being the main target species in tropical waters. The longline fishery can be subdivided into an industrial (deep-freezing longliners operating on the high seas from Japan, Korea and Taiwan,China) and an artisanal component (ice longliners operating more in coastal waters). The longline catch of yellowfin reached a maximum in 1993 (195 t), it has since declined, and in 2003 was 87,000 t.

Artisanal catches, taken by baitboat, gillnet, troll, handline and other gears, have increased steadily since the 1980s. In 2003, the total artisanal yellowfin catch was 102,000 t, while the catch by the dominant artisanal gear, gillnets, was 82,000 t.

Yellowfin catches in the Indian Ocean were extraordinarily high during 2003 and 2004, while skipjack and bigeye remained at their average levels. Purse seiners currently take the bulk of the yellowfin catch — mostly from the western Indian Ocean. In 2003, their total catch was over 210,000 t — over 35% more than the previous largest purse seine catch, which was recorded in 1995. Longline and artisanal yellowfin catches were also near their highest levels.

Yellowfin catches in number by gear (purse seine, longline and baitboat) are reported in Figure 3. Annual mean weights of yellowfin caught by different gears and by the whole fishery are shown in Figure 4. After an initial decline, mean weights in the whole fishery remained quite stable from the 1970s to the early 1990s. After 1993, mean weights in the catches in the industrial fisheries have declined. Prior to 2003, although total catch in biomass has been stable for several years, catches in numbers have continued to increase, as there has been more fishing effort directed towards smaller fish, as illustrated in Figure 10. As described above, this situation changed during 2003 and 2004; where most of the very large catches were obtained from fish of larger sizes.

AVAILABILITY OF INFORMATION FOR ASSESSMENT PURPOSES

The reliability of the estimates of the total catch has continued to improve over the past few years, on one hand as a result of the catch sampling program being fully operational now, and on the other hand because several national sets of data have recently become available (Oman, Sri Lanka, Iran).

Two documents dealing with these major and rapid changes observed in the yellowfin surface and longline fisheries in 2003 were presented and discussed by the WPTT. This increase has been observed on large adult yellowfin, with a small catch of juveniles.

A number of papers dealing with fisheries data, biology, CPUE trends and assessments were discussed by the WPTT in 2002, and additional data analyses were performed during that meeting. In particular, estimates of annual catches at size for yellowfin were calculated using the best available information. Estimated catches at age calculated using the catch-at-size data and the two hypotheses regarding growth curves (fast *vs* slow growth) are shown in Figure 6. Two sets of natural mortality at age schedules were agreed, both assuming a higher M on juvenile fish.

Standardized CPUE analysis using both Japanese and Taiwanese data were presented and discussed. New analyses were also carried out on these data sets during the meeting, estimating standardised CPUEs for both the whole Indian Ocean and the tropical area (10N – 15S), where the bulk of the catch is taken. All resulting standardized CPUE series are similar. These showed an initial steep decline, over a period when catches were relatively low and stable, followed by stable standardized CPUEs since the late 1970s, a period during which catches have increased strongly following the development of the purse seine fishery. This is illustrated in Figure 5 for the tropical area. The observed pattern of standardised CPUE does not correspond well with the expected response of CPUE to changes in catch and biomass. There are several possible explanations for this, such as changes in catchability or behaviour, or the population existing in two fractions with differential availability to purse seine and longline gears. However, there is no scientific information to judge which, if any, of these explanations is correct.

STOCK ASSESSMENT

No new assessment of yellowfin was undertaken during 2004 therefore the current stock status is based on the assessment undertaken in 2002.

A full assessment was attempted for yellowfin tuna in 2002. Several papers presenting assessment results were discussed by the WPTT, and additional assessments were carried out during the meeting using agreed data sets.

No new stock assessment methods were presented to the WPTT, and assessments were carried out using methods used at previous meetings, including the modified Grainger and Garcia index, the PROCEAN method, ASPM, a multi fleet statistical catch at age model, sequential population analysis (VPA) and a multigear yield-per-recruit analysis. Many new analyses based on agreed sets of data and hypothesis were performed and discussed during the meeting.

Although there were differences in the details of results from the different assessments, the overall picture is consistent. This can be seen in Figures 7 to 10, which illustrate some of the results from the assessments, expressed in relative units to make them directly comparable. There has been a large and steady increase in fishing mortality since the early 1980s, while there is indication that there has been a substantial decline in biomass since the mid-1980s. Estimates of catchability both for purse-seine and longline fleets show a strong increasing trend since the mid-1980s, especially for the purse-seine fleet, as illustrated in Figures 9 and 10. It should be noted that these figures are intended to illustrate general trends, and should not be viewed as depicting precise estimates of changes in efficiency.

It is not currently possible to obtain a reliable estimate of the fishing mortality at MSY (Fmsy), and some assessment runs were unable to produce plausible estimates of MSY. However, in those cases where plausible estimates or indicators of MSY could be obtained, they consistently indicated that current catches are in the vicinity of, or possibly above, MSY. Even if current catches are below MSY, a continuation of the recent rapid increase in catches and effort would mean that the fishery could very soon reach or exceed MSY.

It is also clear from the basic data that, during the early period of the fishery (from the 1950s to the start of the 1980s), the catches were relatively low and stable around 40,000 t. Since the 1980s there has been a rapid increase in the longline and purse seine effort and the total catch reached over 300,000 t in 1992. Since the mid-1990s there has also been an increase in purse seine fishing on floating objects which has led to a rapid increase in the catch of juvenile yellowfin. The rapid expansion, particularly on juvenile fish, is cause for concern, since it displays all the symptoms of a potentially risky situation. The increases in catches in general has not been as a result of geographic expansion to previously unfished areas, but rather as a result of increased fishing pressure on existing fishing grounds.

EXCEPTIONAL CATCHES DURING 2003 AND 2004

Yellowfin catches in the Indian Ocean were extraordinarily high during 2003 and 2004. The year 2003 will be a record year once the catches from all fleets are reported to the IOTC Secretariat. These anomalous catches occurred all over western Indian Ocean, in particular on a small area in eastern Africa, although the anomaly extended over a much wider area, from the Arabian Sea to South Africa, in both industrial (purse seine on free-swimming schools and longline) and artisanal fisheries. The fish caught were of large sizes (100-150 cm FL).The SC discussed two possible hypotheses explaining the observed high catches, noting that it is possible that a combination of factors were responsible for this event. There are two main categories of factors:

Increase in the biomass of the population:

According to this hypothesis, large recruitments to the population in recent years could be responsible for the large increase in yellowfin catches. In these years, environmental conditions favourable to good recruitment may have occurred in the Indian Ocean. But recruitment is not the only process by which the biomass could increase. Additional explanations could be reduced natural mortality during some critical life stage and/or increased growth rates related to favourable environmental conditions.

The SC noted there is no evidence from existing data of unusually large numbers of small fish being caught in the surface fisheries prior to 2003. However, the ability to detect this from purse-seine size-frequency sampling during 1998-2000 may have been reduced due to the low level of sampling from areas traditionally associated with small yellowfin tuna.

An increase in catchability due to a concentration of the resource and an increase in the fishing efficiency:

It is possible that due to some unexplained environmental conditions, large yellowfin tuna aggregated over a relatively small area, so that it became easier to catch them in large quantities. In addition, technological improvements in detection equipment on purse-seiners could have the schools more vulnerable to fishing.

While these factors might explain the high catches of industrial fisheries in a small area off eastern Africa, there are also reports of exceptionally high catches by the commercial and artisanal fisheries from Yemen, Oman, Iran, South Africa and Maldives.

The presence of large concentrations of the crustacean *Natosquilla investigatoris*, reported to have occurred in large quantities in various locations of the Indian Ocean was cited as possible reason for the unusual concentrations of yellowfin tuna, as they were observed feeding voraciously on the *Natosquilla* concentrations. On the other hand, it was also noted that these surface concentrations of prey is more likely to reduce than to increase the availability of fish to the longline fishery.

By the end of 2002, most purse seine vessels had new sonar equipment installed. Apparently these devices enable skippers to locate schools at distances up to 5 km, night and day. This means that schools are more vulnerable to fishing, and catches could be expected to increase.

However, there is no indication of similar increases in efficiency in the Atlantic Ocean, where vessels were also fitted with the same equipment. In addition, the high catches also occurred in artisanal and longline fisheries for which there is no indication of recent technological advances.

MANAGEMENT ADVICE

Considering all the stock indicators and assessments, as well as the recent trends in effort and total catches of yellowfin, the Scientific Committee considered that:

1) Total catches under current (2002) fishing patterns were close to, or possibly above MSY. In these circumstances, any further increase in both effective fishing effort and catch above levels in 2000 should be avoided.
2) The current trend for increasing fishing pressure on juvenile yellowfin by purse seiners fishing on floating objects is likely to be detrimental to the stock if it continues, as fish of these sizes are well below the optimum size for maximum yield per recruit.
3) The Scientific Committee also noted that juvenile yellowfin tuna are caught in the purse-seine fishery that targets primarily skipjack tuna. Some measures to reduce the catches of juvenile yellowfin tuna in the FAD fishery will be accompanied by a decrease in the catches of skipjack tuna.

In interpreting the high catches of 2003 and 2004, the SC noted that if the hypothesis of an increase in biomass is correct, such increase is most likely the result of just two exceptional recruitments and not necessarily a long-term increase in productivity of the stock. Under these circumstances, increased catches from these year classes are unlikely to be detrimental to the stock.

On the other hand, there could be serious consequences if the hypothesis that there was only an increased catchability during 2003 and 2004 is correct. In this case, the very large catches would represent a much higher fishing mortality and, certainly, would not be sustainable. Furthermore, they would lead to a rapid decline of the existing adult biomass of yellowfin tuna and a serious over-exploitation of the stock, according to the status of yellowfin tuna as assessed in 2002. If such is the case, urgent management actions might be needed to reduce fishing mortality, from the 2000 level.

YELLOWFIN TUNA SUMMARY

Maximum Sustainable Yield (MSY)	280,000 - 350,000 t
Current (2003) Catch	400,000 - 450,000 t (predicted)
Mean catch over the last 5 years	326,000 t
Current Replacement Yield	
Relative Biomass B_{cur}/ Bmsy	
Relative Fishing Mortality F_{cur}/Fmsy	
Management Measures in Effect	None

Table 1. Catches of yellowfin tuna by gear and main fleets for the period 1950-2003 (in thousands of tonnes). Data as of 20 November 2004.

Gear	Fleet	Av99/03	Av54/03	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78
Purse seine	Total	154.1	47.8										0.0	0.0	0.0									0.1	0.2	0.2	0.3	0.5
Baitboat	Maldives	13.3	5.7	1.5	2.0	2.0	2.0	2.0	2.0	1.0	1.5	1.5	1.5	1.5	1.0	1.5	1.7	1.7	1.8	2.3	1.4	2.5	6.9	5.0	4.6	5.2	4.9	3.8
	Other Fleets	0.6	0.2																	0.0		0.1	0.6	1.2	0.2			
	Total	13.8	5.9	1.5	2.0	2.0	2.0	2.0	2.0	1.0	1.5	1.5	1.5	1.5	1.0	1.5	1.7	1.7	1.8	2.3	1.4	2.6	7.4	6.2	4.8	5.2	4.9	3.8
Longline	Indonesia	29.6	6.8																				0.1	0.3	0.7	1.0	1.3	1.3
	China																											
	Taiwan,China	21.3	14.1	0.2	0.7	1.1	1.3	1.8	2.4	2.2	2.9	3.5	3.4	2.9	2.2	4.4	3.4	22.7	21.1	14.9	11.9	11.8	5.7	4.4	4.6	3.4	8.1	4.2
	Japan	15.4	16.4	21.7	44.2	59.5	31.9	22.6	22.2	36.1	32.7	44.2	22.0	22.2	24.9	40.8	30.2	48.3	23.1	10.3	13.4	7.9	3.9	4.9	6.4	2.8	2.1	4.6
	Republic of Korea	1.4	6.9												0.1	0.1	0.4	5.2	9.1	5.2	7.4	10.3	10.8	13.1	13.3	13.7	33.0	26.5
	Other Fleets	5.2	2.4											0.3	0.5	0.5	0.1	2.3	0.6	1.9	1.6	1.5	1.1	0.7	0.2	1.1	0.9	0.2
	Total	87.3	55.5	21.9	44.9	60.6	33.1	24.5	24.6	38.3	35.6	47.7	25.4	25.3	27.7	45.7	34.0	78.6	53.9	32.3	34.3	31.5	21.7	23.4	25.3	21.9	45.4	37.0
Gillnet	Sri Lanka	32.2	10.1	0.7	0.7	0.8	1.0	1.1	1.2	1.5	1.8	2.7	3.5	3.4	3.2	3.6	4.1	4.5	5.0	3.9	2.8	4.4	5.3	4.7	3.8	6.9	6.3	6.7
	Oman	7.0	5.1	0.7	0.7	0.5	0.5	0.5	0.7	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.8	0.9	2.9	3.4	3.8	4.0	4.4
	Pakistan	5.1	2.8	0.6	0.6	0.5	1.4	0.7	0.7	0.9	0.8	1.2	1.8	2.5	2.7	3.6	3.5	3.5	3.2	2.9	2.4	2.8	2.2	3.0	3.3	3.1	2.8	1.6
	Indonesia	3.1	1.9	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.6	0.6	1.1	1.1	1.0	1.1	1.6	3.3	4.2
	Other Fleets	2.3	1.7	0.2	0.3	0.4	0.3	0.3	0.3	0.5	0.8	0.2	0.4	0.3	0.3	0.3	0.4	0.4	0.3	0.7	1.4	1.4	5.7	1.8	2.3	4.5	2.7	3.7
	Total	70.5	26.3	2.6	2.7	2.7	3.6	3.1	3.2	3.8	4.4	5.2	6.9	7.4	7.6	8.9	9.4	9.9	10.1	8.8	7.9	10.4	15.2	13.4	13.9	19.9	19.1	20.7
Line	Indonesia	5.7	2.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.5	0.3	0.6
	Comoros	5.5	1.6																	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
	Other Fleets	5.3	2.3	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.5	0.7	0.9	0.8	0.8	0.9	1.1	1.2	1.3	1.3	1.3	1.6	1.8	1.8	1.5	2.3	4.9	3.3
	Total	16.6	6.1	0.4	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.8	1.0	1.0	1.0	1.1	1.3	1.5	1.6	1.6	1.6	1.9	2.2	2.2	2.0	3.0	5.4	4.0
All	Total	342.3	141.7	26.4	49.9	65.7	39.2	30.0	30.3	43.6	42.1	55.2	34.9	35.2	37.3	57.2	46.4	91.6	67.4	45.0	45.2	46.4	46.5	45.4	46.1	50.2	75.1	66.0

Gear	Fleet	Av99/03	Av54/03	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03
Purse seine	Spain	56.3	17.7						11.5	18.4	20.0	26.3	44.9	41.1	43.7	44.0	37.8	47.8	43.1	65.1	59.4	61.0	38.6	51.9	49.4	47.7	53.4	79.0
	France	40.5	16.2			0.2	1.0	10.5	36.7	39.1	43.3	46.8	59.9	38.4	45.3	38.1	45.3	39.5	35.8	39.6	35.6	31.2	22.4	30.8	37.7	34.1	36.4	63.3
	NEI-Other	22.0	6.0					0.7	8.4	9.4	6.3	5.2	7.9	4.5	11.9	11.9	8.1	15.5	19.7	19.3	16.7	21.9	20.3	25.8	27.1	19.4	19.1	18.9
	Seychelles	16.8	1.9													0.4	0.2					2.8	7.4	9.8	11.6	12.9	16.6	33.3
	NEI-Ex-Soviet Union	9.2	2.2												0.8		5.2	8.7	5.8	16.3	13.2	10.2	5.3	11.8	10.9	9.8	6.8	6.8
	Iran, Islamic Republic	4.0	0.8														2.1	3.4	2.7	4.3	1.6	1.9	3.3	2.5	2.2	2.2	5.0	8.3
	Other Fleets	5.3	3.1	0.4	0.5	0.4	0.6	2.1	2.3	2.6	4.7	6.4	6.7	6.7	8.0	11.8	15.3	16.1	10.3	9.5	7.8	6.8	6.4	5.6	5.0	6.9	5.0	3.8
	Total	154.1	47.8	0.4	0.5	0.6	1.6	13.2	58.9	69.5	74.3	84.7	119.5	90.7	109.7	106.2	114.0	131.0	117.5	154.3	134.4	135.8	103.6	138.2	143.9	133.0	142.2	213.3
Baitboat	Maldives	13.3	5.7	4.4	4.4	5.6	4.5	7.7	8.2	6.9	6.2	7.4	5.9	5.5	4.9	7.0	8.0	9.3	12.4	11.8	11.5	12.2	13.0	12.6	10.0	11.1	16.3	16.3
	Other Fleets	0.6	0.2			0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.5	0.5	0.4	0.4	0.5	0.5	0.4	0.5	0.6	0.5	0.6	0.6
	Total	13.8	5.9	4.4	4.4	5.9	4.6	7.7	8.2	6.9	6.2	7.4	5.9	5.5	4.9	7.5	8.5	9.8	12.8	12.2	12.0	12.7	13.4	13.1	10.6	11.6	16.9	16.9
Longline	Indonesia	29.6	6.8	1.4	2.1	2.6	2.7	0.8	0.8	0.8	0.7	1.3	2.3	3.8	4.6	5.5	9.3	10.8	14.8	16.7	31.8	38.2	35.7	41.7	29.6	28.4	24.2	24.2
	China																											
	Taiwan,China	21.3	14.1	3.7	3.8	4.1	4.7	5.6	5.8	7.3	16.2	22.3	22.7	22.4	31.6	30.7	56.0	88.2	34.1	23.1	27.9	18.4	23.4	17.7	17.4	18.9	27.7	24.8
	Japan	15.4	16.4	3.3	3.2	4.9	7.3	7.8	7.9	9.5	10.7	8.3	9.3	4.6	6.3	4.4	5.7	5.7	9.7	8.0	12.8	15.6	16.8	14.7	15.5	14.0	14.0	18.8
	NEI-Fresh Tuna	8.9	4.3											11.9	16.6	14.4	16.7	16.5	23.5	16.5	16.7	22.1	15.9	12.8	12.5	6.9	6.6	5.8
	NEI-Deep-freezing	5.4	2.5							0.1	1.1	1.2	3.4	3.2	6.7	5.9	9.2	23.2	9.7	6.7	11.6	5.6	10.9	8.6	7.1	4.4	3.4	3.4
	Republic of Korea	1.4	6.9	18.0	13.2	12.4	19.3	16.2	10.2	12.5	15.4	13.2	14.1	8.7	7.5	3.2	4.4	4.3	4.0	2.7	4.0	4.2	2.6	1.0	2.0	1.5	0.3	2.1
	NEI-Indonesia Fresh Tuna	0.0	2.0								0.1		2.7	10.3	12.6	12.9	15.6	12.6	16.3	8.9	3.7	4.0	0.3	0.0				
	Other Fleets	5.2	2.4	0.4	0.5	0.4	0.4	0.7	0.7	0.3	1.1	0.6	0.5	0.5	0.1	1.9	20.1	33.7	8.2	4.2	3.8	1.9	2.6	4.6	4.6	4.8	4.2	8.0
	Total	87.3	55.5	26.9	22.8	24.4	34.5	31.1	25.5	30.4	45.3	47.0	55.0	65.3	86.1	78.8	137.0	195.1	120.2	86.8	112.2	109.9	108.2	101.1	88.6	78.8	80.6	87.2
Gillnet	Sri Lanka	32.2	10.1	7.4	8.2	9.4	9.2	8.9	6.3	6.8	7.0	7.3	7.6	8.2	9.4	11.5	13.7	16.4	21.3	18.6	23.4	29.2	28.9	36.7	33.3	27.8	29.9	33.5
	Islamic Republic of Iran	20.8	4.9											1.0	2.3	3.2	12.1	13.3	19.5	22.5	28.5	20.0	18.0	24.3	13.5	18.0	19.0	29.5
	Oman	7.0	5.1	4.1	5.0	4.8	3.5	1.6	4.6	2.3	2.5	5.9	15.6	16.3	14.4	9.0	13.5	11.5	19.2	21.4	11.6	9.9	11.3	7.4	7.1	6.3	5.3	8.8
	Pakistan	5.1	2.8	2.8	1.3	2.0	2.5	0.8	0.9	1.5	2.6	2.4	3.9	8.6	3.3	4.9	3.9	2.6	2.4	2.1	3.3	3.9	3.9	9.4	5.3	4.0	3.3	3.5
	Indonesia	3.1	1.9	4.7	4.3	2.5	3.2	3.1	3.3	4.3	6.2	2.7	4.2	3.3	2.2	0.9	0.9	0.8	1.3	1.3	1.1	2.7	1.5	1.8	5.0	3.1	3.1	2.3
	Other Fleets	2.3	1.7	5.1	4.9	0.9	1.6	0.7	1.1	4.3	1.7	2.0	2.4	2.0	2.5	1.7	1.7	1.7	1.7	1.6	1.7	1.9	1.7	1.8	1.8	1.7	1.8	4.4
	Total	70.5	26.3	24.1	23.7	19.5	20.0	15.2	16.2	19.2	19.9	20.3	33.6	39.3	34.1	31.2	45.9	46.5	65.4	67.6	69.6	67.6	65.3	81.3	66.1	60.8	62.3	81.9
Line	Indonesia	5.7	2.3	0.7	0.5	0.1	0.5	0.4	0.3	1.7	1.1	2.3	1.5	0.2	0.9	9.1	6.5	8.3	7.9	11.2	11.9	4.9	8.9	12.3	1.5	2.3	4.3	8.3
	Comoros	5.5	1.6	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	3.7	3.7	3.7	5.0	5.0	5.9	5.9	5.8	5.6	5.6	5.4	5.9	5.4	5.4	5.4
	Other Fleets	5.3	2.3	2.9	3.2	3.8	3.4	2.9	2.3	2.2	2.1	2.2	2.4	2.3	2.5	3.0	3.4	3.3	3.0	3.1	3.0	3.0	2.7	3.0	4.4	5.4	6.9	6.8
	Total	16.6	6.1	3.7	3.8	4.1	4.1	3.5	2.8	4.0	3.4	4.7	4.1	6.2	7.2	15.8	14.8	16.6	16.8	20.2	20.7	13.4	17.2	20.8	11.9	13.1	16.6	20.5
Other	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	0.0
All	Total	342.3	141.7	59.5	55.2	54.6	64.8	70.7	111.5	130.1	149.1	164.1	218.2	207.0	242.0	239.5	320.2	398.9	332.7	341.0	348.7	339.4	307.8	354.5	321.2	297.4	318.6	419.9

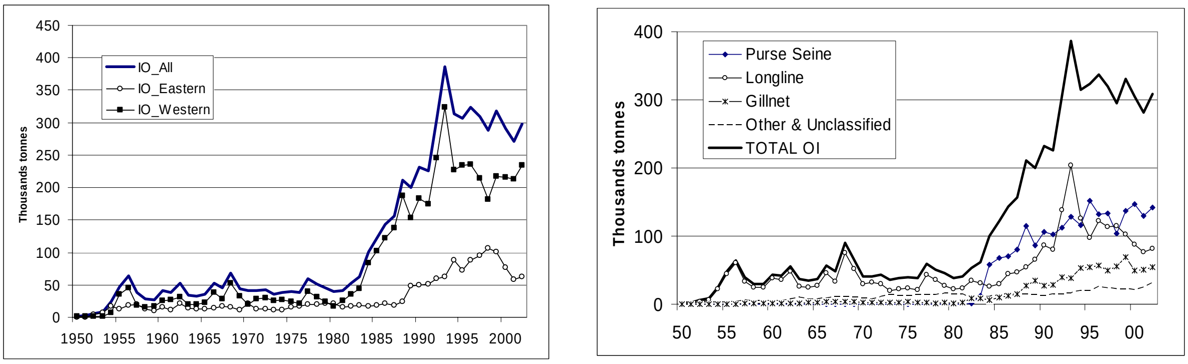

Figure 1. *Yearly catches (thousand of metric tonnes) of yellowfin by area (Eastern and Western Indian Ocean, left) and by gear (longline, purse-seine, artisanal and unclassified, right) from 1950 to 2002.*

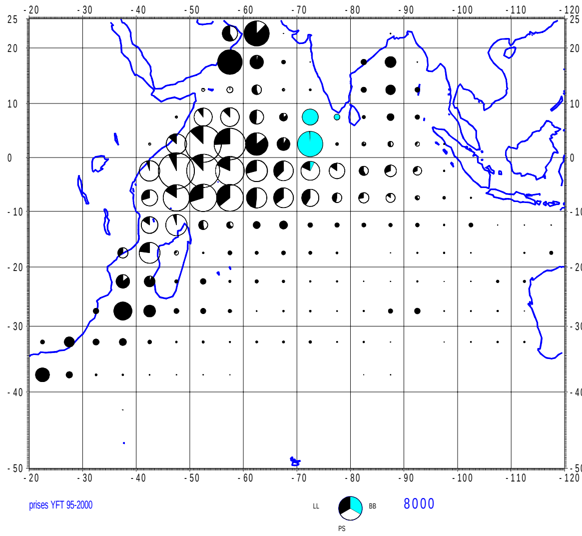

Figure 2. *Average (1995-2000) geographical distribution of yellowfin catches according to the gear (longline, purse-seine and baitboat). The figure is based on available data only, and it does not include catches of important fleets for which spatial distribution is not available.*

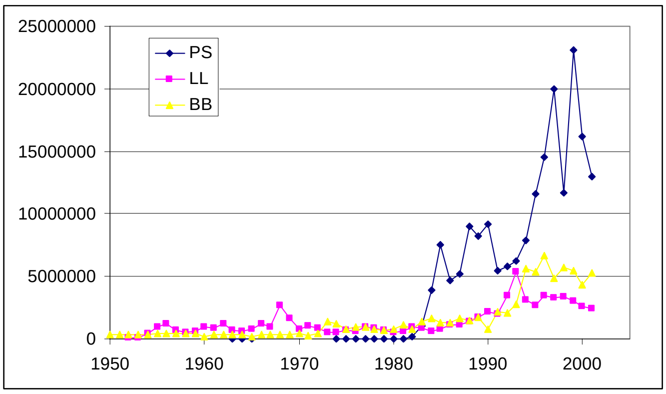

Figure 3. Catch in numbers of yellowfin tuna by gear (PS: purse seine; LL: longline ; BB : baitboat).

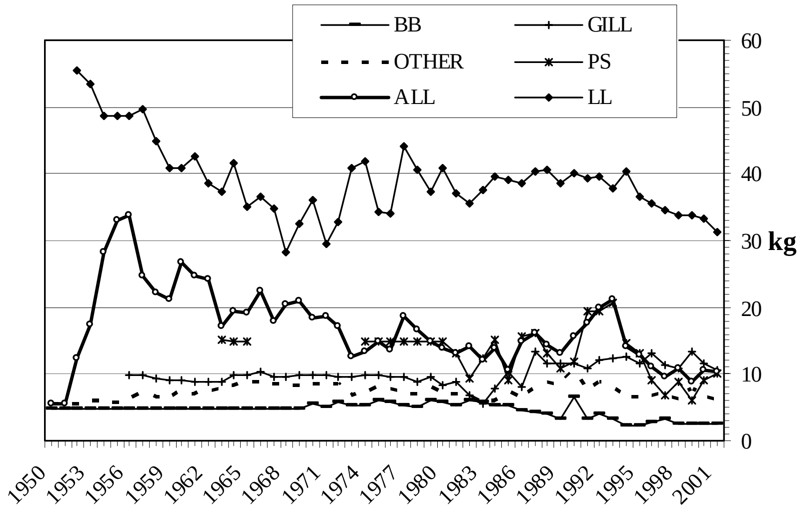

Figure 4. *Yellowfin average weight in the catch by gear (from size-frequency data) and for the whole fishery (estimated from the total catch at size).*

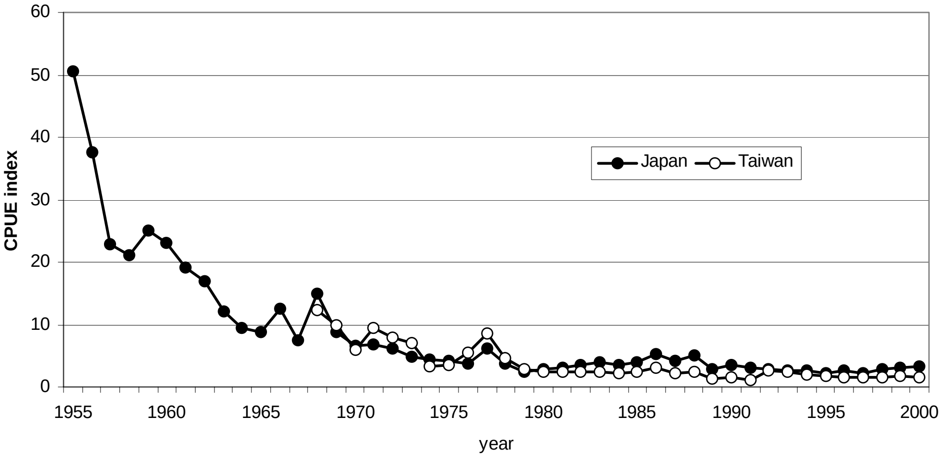

Figure 5. *Yearly standardized CPUE indices based on the Japanese and Taiwan, China longline yellowfin CPUE's in the tropical area (10°N-15°S).*

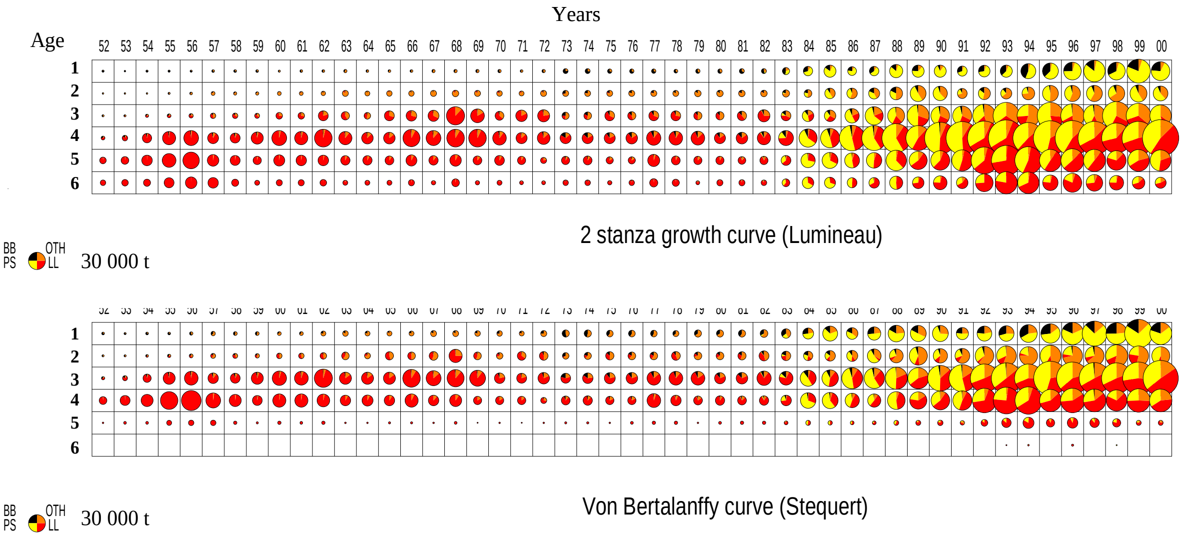

Figure 6. *Catch at age by gear (in weight) according to the two growth hypothesis used by the WPTT: "slow", assuming a two stanzas growth curve (above) and "fast", assuming a constant growth rate (below).*

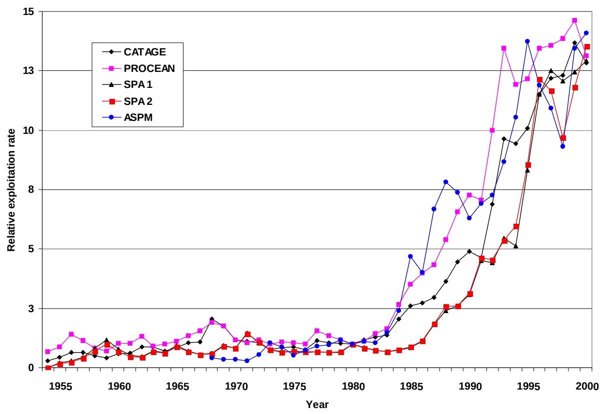

Figure 7. *Relative exploitation rates estimated from the five assessments ran by the WPTT (all have been set at 1 in 1980 selected as the reference year).*

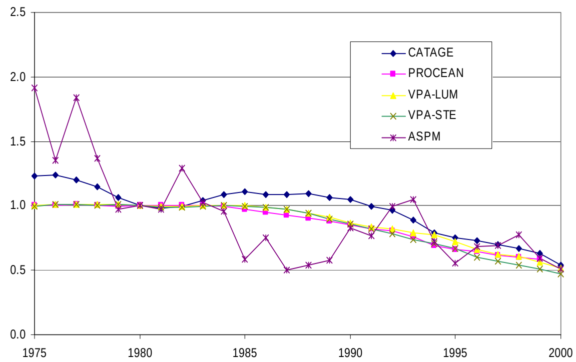

Figure 8. *Trend of the relative biomass estimated from the five assessments ran by the WPTT.*

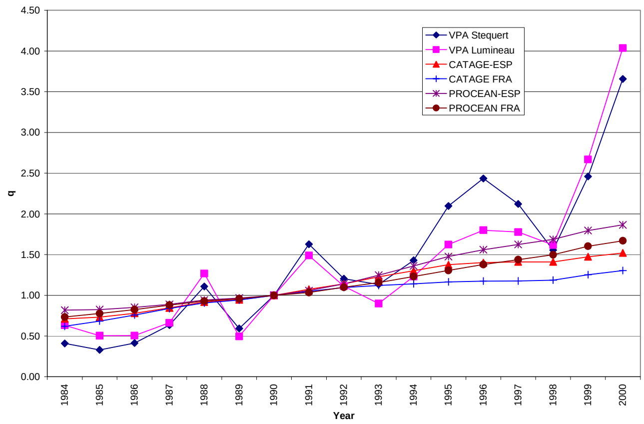

Figure 9. *Average yearly relative catchability coefficients for purse seine fleets estimated from the assessments ran during the meeting; all have been set at one in 1990 selected as the reference year.*

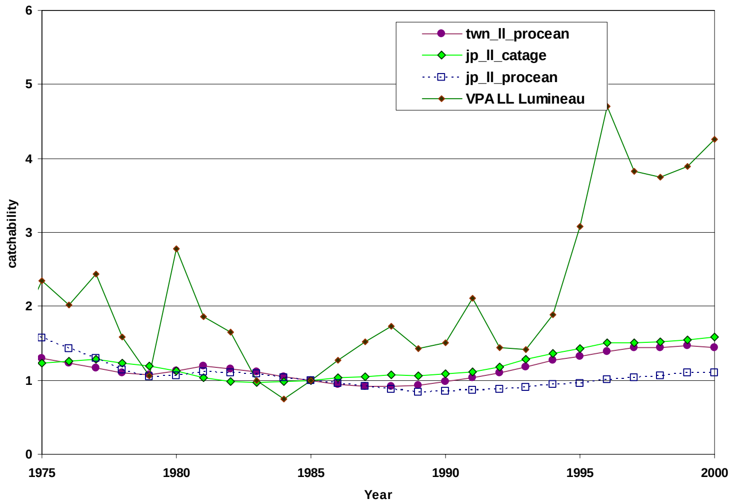

Figure 10. *Average yearly relative catchability coefficients for longline fleets estimated from the assessments ran during the meeting; all have been set at 1 in 1985, selected as the reference year.*