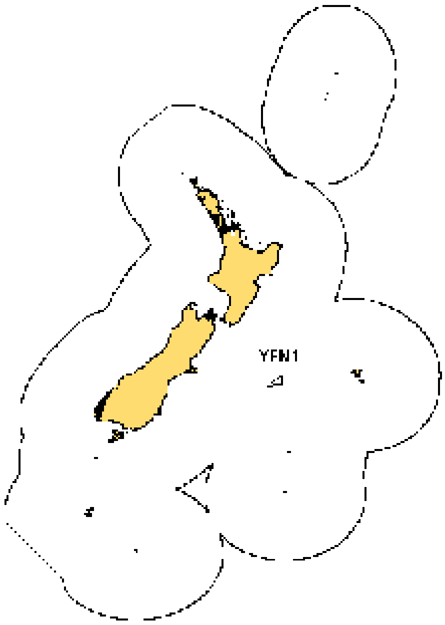
YELLOWFIN TUNA (YFN)

(Thunnus albacares)



1. FISHERY SUMMARY

Yellowfin tuna were introduced into the QMS on 1 October 2004 under a single QMA, YFN 1, with allowances, TACC, and TAC as follows:

Fishstock	Recreational Allowance	Maori customary Allowance	Other mortality	TACC	TAC
YFN 1	60	30	5	263	358

Yellowfin tuna were added to the Third Schedule of the 1996 Fisheries Act with a TAC set under s14 because yellowfin tuna is a highly migratory species and it is not possible to estimate MSY for the part of the stock that is found within New Zealand fisheries waters.

Management of the yellowfin tuna stock throughout the western and central Pacific Ocean (WCPO) will be the responsibility of the Western and Central Pacific Fisheries Commission (WCPFC). Under this regional convention New Zealand will be responsible for ensuring that the management measures applied within New Zealand fisheries waters are compatible with those of the Commission.

At its second annual meeting the WCPFC passed a resolution relating to conservation and management measures for tunas and the key aspects of this resolution are repeated below.

For purse-seine fishing in the area of the Convention bounded by 20N and 20S:

- *CCMs*[1] *shall take necessary measures to ensure that purse seine effort levels do not exceed either 2004 levels, or the average of 2001 to 2004 levels, in waters under their national jurisdiction, beginning in 2006;*
- *The Commission shall implement compatible measures as required under Article 8 of the Convention, to ensure that purse seine effort levels do not exceed 2004 levels on the high seas in the Convention Area or the total fishing capacity will not increase in the Convention Area;*
- *CCMs shall develop management plans for the use of FADs (anchored and drifting) within waters under national jurisdiction which shall be submitted to the Commission.*

[1] CCMs refers to Members and Cooperating Non-Members of the WCPFC

For longline fishing in the Convention area:

- *The catch of bigeye for each CCM for the next 3 years shall not exceed the average annual bigeye catch for the years 2001-2004 or the year 2004 (for China and the USA);*
- *This does not apply to CCMs that caught less than 2,000 tonnes in 2004. Each CCM that caught less than 2,000 tonnes of bigeye in 2004 shall ensure that their catch does not exceed 2,000 tonnes in each of the next 3 years.*

These measures will be reviewed annually and may be adjusted, considering the advice of the Scientific Committee concerning fishing mortality levels associated with maintaining the bigeye and yellowfin stocks at or above B_{MSY} in accordance with Article 5 in the Convention.

(a) Commercial fisheries

Most of the commercial catch of yellowfin takes place in the equatorial western Pacific Ocean where they are taken primarily by purse seine and longline. Commercial catches by distant water Asian longliners of yellowfin tuna, in New Zealand waters, began in 1962. Catches through the 1960s averaged 283 t. Yellowfin were not a target species for these fleets and catches remained small and seasonal. Domestic tuna longline vessels began targeting bigeye tuna in 1990/91 in northern waters of FMA1, FMA2 and FMA9. Catches of yellowfin have increased with increasing longline effort, but as yellowfin availability fluctuates dramatically between years catches have been highly variable between years. In addition small catches of yellowfin are made by pole-and-line fishing (about 4 t per year) and also by trolling (about 14 t per year).

Table 1: Reported total New Zealand domestic landings* and WCPO landings (t) of yellowfin tuna from 1991 to 2005.

Year	NZ landings (t)	WCPO landings (t)	Year	NZ landings (t)	WCPO landings (t)
1991	6	394,610	1999	154	415,634
1992	20	414,640	2000	107	424,743
1993	34	385,004	2001	137	419,197
1994	53	392,660	2002	25	411,347
1995	141	372,943	2003	41	440,303
1996	198	308,637	2004	57	407,002
1997	143	426,092	2005	40	Not available
1998	127	459,149			

Source: Ministry of Fisheries Licensed Fish Receiver Reports, Solander Fisheries Ltd, and the WCPFC Yearbook 2004.

*New Zealand purse seine vessels operating in tropical regions also catch moderate levels of yellowfin tuna when fishing around Fish Aggregating Devices (FADs) and on free schools. These catches are not included here at this time as there are only estimates of catch based on analysis of observer data across all fleets rather than specific data for NZ vessels. Further, bigeye catches are combined with yellowfin catches on most catch effort forms.

Catches from within New Zealand fisheries waters are very small (0.025% average for 1999-2003) compared to those from the greater stock in the WCPO. In contrast to New Zealand, where yellowfin are taken almost exclusively by longline, 50% of the WCPO catches of yellowfin tuna are taken by purse-seine and other surface gears (e.g. ring nets and pole and line).

Table 2: Reported catches or landings (t) of yellowfin tuna by fleet and Fishing Year. NZ: New Zealand domestic and charter fleet, ET: catches outside these areas from New Zealand flagged longline vessels, JPNFL: Japanese foreign licensed vessels, KORFL: foreign licensed vessels from the Republic of Korea, and LFRR: Estimated landings from Licensed Fish Receiver Returns.

	YFN 1 (all FMAs)					
Fish Yr	**JPNFL**	**KORFL**	**NZ**	**Total**	**LFRR**	**NZ ET**
1979/80	10.1			10.1		
1980/81	79.1	29.9		109		
1981/82	89.4	6.7		96.1		
1982/83	22.4	6.6		29		
1983/84	46.1	12.8		58.9		
1984/85	21.3	64.5		85.8		
1985/86	92.5	3.3		95.8		
1986/87	124.8	29		153.8		
1987/88	35.2	37.3		72.5		
1988/89	11.5	1.8		13.3	19	
1989/90	29.1		4.3	33.4	6.3	
1990/91	7.4		10.7	18.1	19.9	
1991/92	0.2		16.1	16.3	11.8	
1992/93			10.1	10.1	69.7	0.2
1993/94			50.5	50.5	114.4	1.5
1994/95			122.2	122.2	193.4	0.3
1995/96			251.6	251.6	156.7	7.4
1996/97			144.1	144.1	105.3	0.2
1997/98			93.6	93.6	174.7	2.3
1998/99			136.1	136.1	100.6	0.3
1999/00			77.8	77.8	168	2.1
2000/01			123.5	123.5	62.5	3.1
2001/02			56.7	56.7	42.1	1.9
2002/03			39.7	39.7	-	2.1
2003/04			21.1	21.1	21.7	36.6
2004/05			36.1	36.1	35.4	6.0

(b) Recreational fisheries

Recreational fishers make regular catches of yellowfin tuna particularly during summer months and especially in FMA1 and FMA2 where the recreational fishery regularly targets yellowfin as far south as the Wairarapa coast.

While the magnitude of the recreational catch is unknown, yellowfin tuna rank as the fifth most commonly tagged and released species in the recreational fishery.

(c) Maori customary fisheries

An estimate of the current customary catch is not available.

(d) Illegal catch

There is no known illegal catch of yellowfin tuna in the EEZ. Estimates of illegal catch are not available, but are probably insignificant.

(e) Other sources of mortality

The estimated overall incidental mortality rate from observed longline effort is 0.22% of the catch. Discard rates are 0.92% on average from observer data of which approximately 25% are discarded dead (usually because of shark damage). Fish are also lost at the surface in the longline fishery, 0.16% on average from observer data, of which 95% are thought to escape alive.

2. BIOLOGY

Yellowfin tuna are epi-pelagic opportunistic predators of fish, crustaceans and cephalopods found from the surface to depths where low oxygen levels are limiting (about 250 m in the tropics but probably deeper in temperate waters). Individuals found in New Zealand waters are mostly adults that are distributed in the tropical and temperate waters of the western and central Pacific Ocean. Adults reach a maximum size of 200 kg and lengths of 239 cm. First maturity is reached at 60 to 80 cm (1 to 2 years old) and the size at 50% maturity is estimated to be 105 cm. The maximum reported age is 8 years. Spawning takes place at the surface at night mostly within 10º of the equator when temperatures exceed 24-25º C. Spawning takes place throughout the year but the main spawning season is November to April. Yellowfin are multiple spawners, spawning every few days throughout the peak of the season.

Natural mortality is assumed to vary with age. A range of von Bertalanffy growth parameters has been estimated for yellowfin in the Pacific Ocean depending on area. These are as follows:

L_∞ (cm)	K	t_0	Country/Area
148.0	0.420		Philippines
162.0	0.660		Mexico
166.0	0.250		Western tropical Pacific
169.0	0.564		Japan
173.0	0.660		Mexico
190.0	0.454		Hawaii
191.0	0.327	-1.02	Japan

Females predominate in the longline catch of yellowfin tuna in the in the EEZ (0.75 males:females).

3. STOCKS AND AREAS

Yellowfin tuna in New Zealand waters are part of the western and central Pacific Ocean stock that is distributed throughout the North and South Pacific Ocean west of about 150º W.

4. STOCK ASSESSMENT

With the establishment of WCPFC in 2004, future (beginning in 2005) stock assessments of the western and central Pacific Ocean stock of yellowfin tuna will be undertaken by the Oceanic Fisheries Programme of Secretariat of the Pacific Community (OFP) under contract to WCPFC.

No assessment is possible for yellowfin within the New Zealand EEZ as the proportion of the greater stock found within New Zealand fisheries waters is unknown and likely varies from year to year.

A summary of the 2005 assessment undertaken by OFP and reviewed by the WCPFC Scientific Committee in August 2005 is provided below.

“The assessment uses the stock assessment model and computer software known as MULTIFAN-CL. The yellowfin tuna model is age (28 age-classes) and spatially structured (6 regions) and the catch, effort, size composition and tagging data used in the model are classified by 19 fisheries and quarterly time periods from 1952 through 2004.

Six independent analyses are conducted to test the impact of using different methods of standardising fishing effort in the main longline fisheries, using estimated or assumed values of natural mortality-at-age, and examining the effect of applying an incremental increase in effective fishing effort to mimic increased fishing efficiency.

The analyses conducted are:

SHBS-MEST	Statistical habitat-based standardised effort for main longline fisheries, M (assumed constant across age-class) estimated.
SHBS-MFIX	Statistical habitat-based standardised effort for main longline fisheries, M-atage assumed at fixed levels.
GLM-MEST	General linear model standardised effort for main longline fisheries, M (assumed constant across age-class) estimated.
GLM-MFIX	General linear model standardised effort for main longline fisheries, M-at-age assumed at fixed levels.
FPOW-MEST	General linear model standardised effort for main longline fisheries, M (assumed constant across age-class) estimated. Fishing power expansions incorporated into longline (1% per year) and purse seine (4 % per year) effort. No other temporal trends in catchability for these fisheries.
FPOW-MFIX	General linear model standardised effort for main longline fisheries, M-at-age assumed at fixed levels. Fishing power expansions incorporated into longline (1% per year) and purse seine (4 % per year) effort. No other temporal trends in catchability for these fisheries.

The order (from best to worst) of the models in terms of their fit to the composite data and prior assumptions was: FPOW-MEST, GLM-MEST, FPOW-MFIX, GLM-MFIX, SHBS-MEST and SHBS-MFIX.

The catch, size and tagging data used in the assessment were the same as those used last year, with the exception that additional recent fishery data (2003 and 2004 for longline, 2003 for Philippines and Indonesia, and 2004 for purse seine) were included. It should be noted that 2004 data are not complete for some fisheries. The estimation of standardised effort for the main longline fisheries using the GLM and SHBS approaches involved a new method of scaling indices of abundance among regions (see Langley et al. 2005 for details). Overall, the new procedure resulted in higher relative abundance in the tropical regions (3 and 4) and lower relative abundance in the northern (1 and 2) and southern (5 and 6) regions compared to the method used in previous years.

The SBHS analyses were slightly more optimistic than the GLM-based analyses with higher recruitment, lower current fishing mortality, and higher current and equilibrium biomass. The models incorporating an incremental increase in fishing power (FPOW) were more pessimistic than the corresponding GLM models, with higher levels of stock depletion and lower yield estimates, although the levels of current biomass and exploitation rates were comparable. Most of the increased decline in longline CPUE in the early years (imposed by the increase in longline fishing power) was explained by higher earlier recruitment compared to the other models. This trend in recruitment also explains the lower values of stock-recruitment steepness for the FPOW model options, which in turn resulted in lower estimates of equilibrium yield (MSY).

The current assessment is more pessimistic than previous yellowfin assessments for the WCPO. The most influential change in the current assessment is likely to be the differences in the relative weightings applied to the different model regions, essentially down-weighting the proportion of the total longline exploitable biomass in the non-equatorial regions. For region 3, recent exploitation rates and levels of fishery impact are similar between the current and previous assessments. However, because the current assessment assumes that this region accounts for a much larger proportion of the total stock biomass, current exploitation rates and overall impacts on the WCPO stock are predicted to be substantially higher than previous assessments (depletion to 40−46% of unexploited biomass in the current GLM-based assessments compared to 51−60% in the equivalent 2004 assessments)."

(a) Estimates of fishery parameters and abundance

There are no fishery-independent indices of abundance for the yellowfin tuna stock. Relative abundance information is available from longline catch per unit effort data, though there is no agreement on the best method to standardise these data and several methods are compared. Returns from a large scale tagging programme undertaken in the early 1990s also provides information on rates of fishing mortality which in turn leads to improved estimates of abundance.

(b) Biomass estimates

Across the five sensitivity analyses considered as plausible, $B_{current}$ (average biomass for 2001-2003) was estimated to be 40 – 58 % (base case of 49%) of B_0 (average unfished biomass) and 93 – 155 % (base case of 132 %) B_{MSY}. These estimates apply to the WCPO portion of the stock or an area that is approximately equivalent to the waters west of 150°W.

(c) Estimation of Maximum Constant Yield (MCY)

No estimates of MCY are available.

(d) Estimation of Current Annual Yield (CAY)

No estimates of CAY are available.

(e) Other yield estimates and stock assessment results

Though no reference points have yet been agreed by the WCPFC, stock status conclusions are generally presented in relation to two criteria. The first reference point relates to "overfished" which compares the current biomass level to that necessary to produce the maximum sustainable yield (MSY). The second relates to "over-fishing" which compares the current fishing mortality rate to that which would move the stock towards a biomass level necessary to produce the MSY. The first criteria is similar to that required under the New Zealand Fisheries Act while the second has no equivalent in our legislation and relates to how hard a stock can be fished.

Because recent catch data are often unavailable, these measures are calculated based on the average fishing mortality/biomass levels in the 'recent past', e.g. 2001-2003 for the 2005 assessment.

Some key reference points are as follows:

CPUE series	MSY	$SSB_{current}/SSB_{MSY}$	Prob($SSB_{current}$ >SSB_{MSY})	$F_{current}/F_{MSY}$	Prob($F_{current}$>F_{MSY})
GLM-MFIX	262 400	1.32	Low (but not reported)	1.22	High (but not reported)

The estimate of MSY is lower than recent catches. This is due to high fishing mortality and fishing down the stock to MSY-levels. In contrast to the 2004 assessment, spawning biomass (SSB) was estimated (point estimate) to be only 1.32 times the level necessary to produce MSY. The ratio larger than 1.0 indicates that the stock has not yet reached an over-fished state. The ratio of $F_{current}$ compared with F_{MSY} (the fishing mortality level that would keep the stock at MSY) is greater than 1.0 indicating that current fishing mortality levels are high and there very high chance that $F_{current}$ is actually greater than F_{MSY} and that over-fishing is occurring.

(f) Other factors

It is thought that large numbers of small yellowfin tuna are taken in surface fisheries in Indonesia and the Philippines. There are considerable uncertainties in the exact catches and these lead to uncertainties in the assessment. Programmes are in place to improve the collection of catch statistics in these fisheries.

5. STATUS OF THE STOCKS

The 1st meeting of the Western and Central Pacific Fisheries Commission provided the following summary on the status of the stock:

> "The 2005 stock assessment is more pessimistic than the 2004 assessment as a result of methodological improvements in the interpretation of catch rate data and the relative abundance of yellowfin tuna across regions. Over fishing is probably occurring in the yellowfin stock in the WCPO ($F_{current}$ / F_{MSY} >1 in the point estimates from the base case and all sensitivity analyses), but the stock is probably not in an over-fished state ($B_{current}$ / B_{MSY} > 1, except in sensitivity analyses involving continuous increases in fishing efficiency). The assessment indicates that the equatorial regions are the most highly impacted, while fishery impacts in the peripheral temperate regions are not large.
>
> The Scientific Committee recommends that fishing mortality for yellowfin tuna be reduced from $F_{current}$ in order to maintain the stock at sustainable levels. Spatial patterns of fishing impacts remain uncertain, but fishing impacts in the western equatorial WCPO have been increasing over recent years and more urgent management actions may be required for this area"

The most recent assessment was undertaken in 2005 and covered the western and central Pacific stock. On a regional level there are concerns relating to the current status of this stock and the level of fishing effort. New Zealand domestic catches represent 0.025% of the total. The stock size is presently above the level necessary to produce the maximum sustainable yield. Current catches from the stock are not sustainable. Current catches will move the stock towards and then below a size that will support the maximum sustainable yield.

6. FOR FURTHER INFORMATION

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