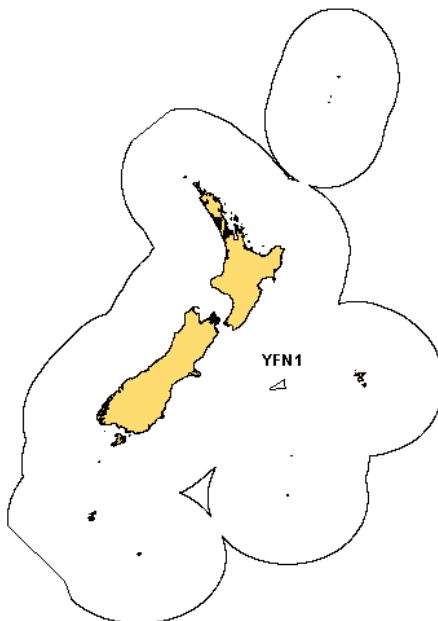


YELLOWFIN TUNA (YFN)

(*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 in Table 1.

Table 1: Recreational and Maori allowances, TACCs and TACs for yellowfin tuna.

<u>Fishstock</u>	<u>Recreational Allowance</u>	<u>Maori customary Allowance</u>	<u>Other mortality</u>	<u>TACC</u>	<u>TAC</u>
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 stock throughout the Western and Central Pacific Ocean (WCPO) is the responsibility of the Western and Central Pacific Fisheries Commission (WCPFC). Under this regional convention New Zealand is 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 (2005) the WCPFC passed a Conservation and Management Measure (CMM) (this is a binding measure that all parties must abide by) relating to conservation and management of tunas. Key aspects of this resolution were presented in the 2006 Plenary document. That measure was reviewed by the Scientific Committee (SC) and further recommendations were made such that at its third annual meeting (2006) the WCPFC passed a new CMM relating to conservation and management of yellowfin tuna (<http://www.wcpfc.org/>). Key aspects of this CMM are summarised as follows:

For hand-line, pole and line, purse seine fisheries north of 20°N or south of 20°S, ring-net, troll and unclassified fisheries Commercial Tuna Fisheries: beginning in 2007, CCMs (Cooperating Non-members, and Participating Territories) shall take necessary measures to ensure that the total capacity of their respective other commercial tuna fisheries for bigeye and yellowfin tuna, including purse-seining, but excluding artisanal fisheries and those fisheries taking less than 2000 t of bigeye and yellowfin, do not exceed the average level for the period 2001-2004 or 2004.

For purse seine (between 20°N and 20°S) fishing effort by their vessels in areas of the high seas does not exceed 2004 levels or the average of 2001-2004.

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 (WPO) 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 FMA 1, FMA 2 and FMA 9 (Table 2). 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 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.

Fish Yr	YFN 1 (all FMAs)		NZ	Total	LFRR	NZ ET
	JPNFL	KORFL				
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
2005/06			9.2	9.2	8.8	0.1

Table 3: Reported total New Zealand within EEZ 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	423 486
1998	127	459 149	2006	14	Not available

Source: Ministry of Fisheries Licensed Fish Receiver Reports, Solander Fisheries Ltd, Anon. 2006 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 (0.02% average for 1999-2005) compared to those from the greater stock in the WCPO (Table 3). 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).

(b) Recreational fisheries

Recreational fishers make regular catches of yellowfin tuna particularly during summer months and especially in FMA 1 and FMA 2 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. Yellowfin tuna are 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 10° of the equator when temperatures exceed 24-25°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 (Table 4).

Table 4: von Bertalanffy growth parameters for yellowfin tuna by country or area.

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 150°W.

4. STOCK ASSESSMENT

With the establishment of WCPFC in 2004, future (beginning in 2005) stock assessments of the WCPO 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 2006 assessment undertaken by OFP and reviewed by the WCPFC Scientific Committee in August 2006 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 2005.

Three independent analyses were 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 were (Hampton et al., 2006):

LOWSAMP	Six-region spatial stratification, general linear model standardised effort for “main” longline fisheries, M -at-age assumed at fixed levels, lower effective sample size applied to the length and weight frequency samples.
HIGHSAMP	Six-region spatial stratification, general linear model standardised effort for “main” longline fisheries, M -at-age assumed at fixed levels, higher effective sample size applied to the length and weight frequency samples. This analysis approximates the base-case model run (GLM-MFIX) from the 2005 assessment. The only significant difference is the parameterisation of the selectivity functions for the principal longline fisheries — allowing a decline in the selectivity for the oldest age classes.

7REGION Seven-region spatial stratification, general linear model standardised effort for “main” longline fisheries, M -at-age assumed at fixed levels, lower effective sample size applied to the length and weight frequency samples.

The LOWSAMP model was adopted as the base case because it was considered that the catch and effort data are more informative than the size-frequency data in the estimation of trends in fishing mortality.”

Other sensitivities included in the 2005 assessment are not reported here (but see the 2006 Plenary document for details).

(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**

These estimates apply to the WCPO portion of the stock or an area that is approximately equivalent to the waters west of 150°W. The trend in biomass for the WCPO is largely driven by the biomass trend from the Tropics i.e. region 3 (Hampton et al., 2006) (<http://www.wcpfc.org/>). “Biomass declines steadily during the early model period, remains relatively stable from the mid 1970s to mid 1990s, and then declines sharply (by about 40%) during the last decade. Depletion has increased steadily over time, reaching a level of 50% of unexploited biomass (a fishery impact of 50%) in 2004. This represents a moderate level of stock-wide depletion that is approaching the equivalent equilibrium-based limit reference point ($B_{MSY}/B_0 = 0.42$). If stock-wide over-fishing criteria were applied at the level of the model regions, it would be concluded that region 3 is over-exploited, region 4 is fully exploited, and the remaining regions are under-exploited.

The reference points that predict the status of the stock under equilibrium conditions are $B_{F_{current}}/B_{MSY}$ (0.91) and $S_{B_{F_{current}}}/S_{B_{MSY}}$ (0.87), which indicate that the long-term average biomass would approximate or fall below that capable of producing MSY at 2001–2004 average fishing mortality. Overall, current biomass exceeds the biomass yielding MSY ($B_{current}/B_{MSY} > 1.0$); i.e. **the yellowfin stock in the WCPO is not in an overfished state**. However, biomass levels in recent years have been declining under increasing levels of fishing mortality, and the probability of the stock becoming overfished is increasing over time. The estimate of $F_{current}/F_{MSY}$ reveals that **overfishing of yellowfin is likely to be occurring in the WCPO**. While the stock is not yet in an overfished state ($B_{current}/B_{MSY} > 1$), further biomass decline is likely to occur at 2001–2004 levels of fishing mortality.

Stock projections for 2006–2010 that attempt to simulate the conservation and management measures adopted at WCPFC2 indicate that the point estimate of B_t/B_{MSY} remains above 1.0 throughout the projection period. However, the increasing uncertainty in the future projections results in a greater probability of the biomass declining below B_{MSY} by the end of the projection period. The projections indicate a strong shift in the spatial distribution of biomass with continued depletion occurring in the equatorial regions.”

(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.

Key reference points are in Table 5.

Table 5: Key reference points for yellowfin tuna.

Model	MSY	$SSB_{current}/SSB_{MSY}$	$Prob(SSB_{current} < SSB_{MSY})$	$F_{current}/F_{MSY}$	$Prob(F_{current} > F_{MSY})$
LOWSAMP	329 600	1.32	Low (but not reported)	1.11	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 2nd meeting of the WCPFC Scientific Committee provided the following summary on the status of the stock:

“The 2006 assessment results were reviewed and confirmed as consistent with the 2005 assessment, although the point estimate for $F_{current}/F_{MSY}$ was slightly more optimistic in this assessment. The assessment using the 6 region model indicates that over-fishing is occurring in the WCPO ($F_{current}/F_{MSY} \geq 1$, with 73% probability), but the stock is not yet in an overfished state ($B_{current}/B_{MSY} > 1$, with 95% probability). The trajectory of these stock status reference points indicates that the stock has been declining rapidly in recent years, and fishing mortality at current levels will probably move the yellowfin stock into an overfished state.

The greatest impact from the fishery is in the equatorial region, while the temperate regions are estimated to be only lightly exploited. Furthermore, the attribution of depletion to various fisheries or groups of fisheries indicates that the Indonesian / Philippines domestic fishery probably has the greatest impact, particularly in the western equatorial region, and is also estimated to impact the other regions, to some extent, through fish movement, although the movement rates out of this region are not estimated to be very large. The purse seine fishery has a lesser, but still substantial effect,

particularly in the equatorial regions. Unlike the case for bigeye, the impact of the longline fishery on yellowfin is relatively small.”

New Zealand domestic catches represent 0.02% of the total WCPO catch (average 1999-2005). 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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