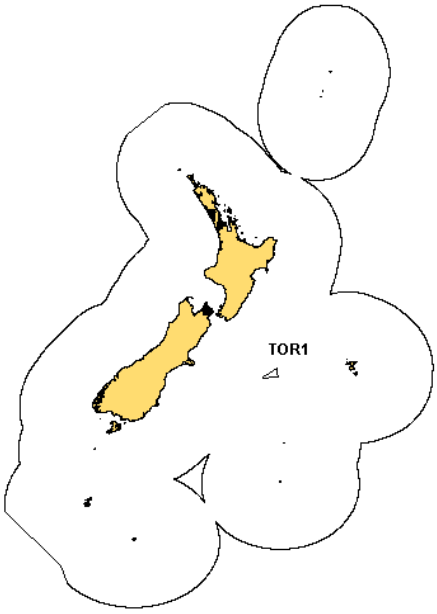
PACIFIC BLUEFIN TUNA (TOR)

(Thunnus orientalis)



1. FISHERY SUMMARY

Pacific bluefin tuna was introduced into the QMS on 1 October 2004 under a single QMA, TOR 1, with allowances, TACC, and TAC in Table 1.

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

Fishstock	Recreational Allowance	Maori customary Allowance	Other mortality	TACC	TAC
TOR 1	1	0.50	2.5	116	120

Pacific bluefin tuna were added to the Third Schedule of the 1996 Fisheries Act with a TAC set under s14 because Pacific bluefin 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.

Pacific bluefin tuna is believed to be a single Pacific-wide stock and is covered by two regional fisheries management organisations, the Western and Central Pacific Fisheries Commission (WCPFC), and the Inter-American Tropical Tuna Commission (IATTC). They will cooperate in the management of the Pacific bluefin tuna stock throughout the Pacific Ocean. Under the WCPFC 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.

1.1 Commercial fisheries

Pacific bluefin tuna was not widely recognised as a distinct species until the late 1990s. It was previously regarded as a sub-species of *Thunnus thynnus* (northern bluefin tuna, NTU). Prior to June 2001, catches of this species were either recorded as NTU or misidentified as southern bluefin tuna. Fishers have since become increasingly able to accurately identify TOR and, from June 2001, catch reports have rapidly increased. Catches of TOR may still be under reported to some degree as there is still some reporting against the NTU code. Recent genetic work suggests that true NTU (*Thunnus thynnus*) are not taken in the New Zealand fishery (see Biology section below for further details).

Pacific bluefin has been fished in the New Zealand EEZ since at least 1960, with some catch likely but undocumented prior to that time. New Zealand catches, while increasing, are small compared to total stock removals (Table 2).

Table 2: Reported total New Zealand landings (t) of Pacific bluefin tuna (includes landings attributed to NTU), 1991 – 2007 and total Pacific Ocean catches.

Year	NZ landings (t)	Total stock (t)	Year	NZ landings (t)	Total stock (t)	Year	NZ landings (t)	Total stock (t)
1991	1.5	13 876	1999	21.2	25 617	2007	13.4	
1992	0.3	12 962	2000	20.9	28 859			
1993	5.6	9617	2001	49.8	17 385			
1994	1.9	14 913	2002	55.4	17 459			
1995	1.8	25 842	2003	40.8	15 920			
1996	4.2	21 978	2004	67.3	21 707			
1997	14.3	22 086	2005	20.1	17 881			
1998	20.4	13 918	2006	21.1				

Source: NZ landings, for 1991-2002 Ministry of Fisheries Licensed Fish Receiver Reports and Solander Fisheries Ltd. 2003-2005 Ministry of Fisheries MHR data. Total Pacific landings for ISC members from ISC/06/PLENARY/14 prepared for ISC-6 March 2006. This covers most catches from this stock, but does not include South Pacific catches by coastal states in the South Pacific.

Catches from within New Zealand fisheries waters are very small compared to those from the greater stock in the Pacific Ocean (0.2% average for 1999-2002 of the Pacific wide catch). In contrast to New Zealand, where Pacific bluefin tuna are taken almost exclusively by longline, the majority of catches are taken in purse seine fisheries in the WCPO (Japan and Korea) and EPO (Mexico). Much of the fish taken by the Mexican fleet are on grown in sea pens.

Prior to the introduction to the QMS, the highest catches have been made in FMA 1 and FMA 2. While it is possible to catch Pacific bluefin as far south as 48ºS, few catches are made in the colder southern FMAs. Although recent catches have occurred in FMA 7 fish have been in poor condition with little commercial value. Catches are almost exclusively by tuna longlines, typically as a bycatch of sets targeting bigeye tuna. Catches by fishing year and fleet are provided in Table 3.

Table 3: Reported catches or landings (t) of Pacific bluefin tuna by fleet and Fishing Year. NZ: New Zealand domestic and charter fleet, ET: catches from New Zealand flagged longline vessels outside these areas, JPNFL: Japanese foreign licensed vessels, KORFL: foreign licensed vessels from the Republic of Korea, and LFRR: Estimated landings from Licensed Fish Receiver Returns.

	TOR 1 (all FMAs)				
Fish Yr	JPNFL	NZ	Total	LFRR/MHR	NZ ET
1979/80	1.5		1.5		
1980/81	5.3		5.3		
1981/82	110.1		110.1		
1982/83	70.1		70.1		
1983/84	47		47		
1984/85	6		6		
1985/86	5.7		5.7		
1986/87	10.6		10.6	0.0	
1987/88	13.5		13.5	0.0	
1988/89	15.1		15.1	0.0	
1989/90	14.7		14.7	0.0	
1990/91	14.5		14.5	1.5	
1991/92	9.1		9.1	0.3	
1992/93	2.1		2.1	5.6	
1993/94	0.1		0.1	1.9	
1994/95			0	1.8	
1995/96			0	4.0	
1996/97		12.5	12.5	13.0	
1997/98		22.5	22.5	20.9	0.4
1998/99		20.6	20.6	17.9	0.1
1999/00		32.6	32.6	23.1	0.1
2000/01		43.9	43.9	51.8	1.0
2001/02		54.4	54.4	53.3	0.0
2002/03		41.6	41.6	39.8	0.0
2003/04		64.3	64.3	58.1	0.0
2004/05		22.9	22.9	22	0.0
2005/06		21.1	21.1	20.3	0.0
2006/07		14.3	14.3	14.4	0.0

1.2 Recreational fisheries

Recreational fishers make occasional catches of Pacific bluefin tuna. In 2004 a target recreational fishery developed off the west coast of the South Island during the hoki spawning ground fishery (August – September). Fish taken in this fishery have been submitted for various world records for this species. Based on reports from this fishery described in various fishing magazines, catches have likely exceeded the allowance of 1 t for this fishery. Due to the small numbers of fish landed, their large individual size, and reporting in the recreational fishing media it is feasible to derive a minimum estimate of recreational harvest of Pacific bluefin tuna. There is no information on the size of catch from the National Surveys of recreational fishers.

1.3 Maori customary fisheries

There is no quantitative information available to allow the estimation of the harvest of Pacific bluefin tuna by customary fishers; however the Maori customary catch of Pacific bluefin is probably negligible because of the species seasonal and offshore distribution.

1.4 Illegal catch

There is no known illegal catch of Pacific bluefin tuna in New Zealand fisheries waters.

1.5 Other sources of mortality

There is likely to be a low level of shark damage and discard mortality of Pacific bluefin caught on tuna longlines that may be on the order of 1-2% assuming all tuna species are subject to equivalent levels of incidental mortality. There have been reports that some fish hooked in the target recreational fishery have been lost due to entanglement of the fishing line with trawl warps. The survival of these lost fish is not known. An allowance of 2.5 t has been made for other sources of mortality.

2. BIOLOGY

Pacific bluefin are epi-pelagic opportunistic predators of fish, crustaceans and cephalopods found within the upper few hundred meters of the water column. Individuals found in New Zealand fisheries waters are mostly adults. Adult Pacific bluefin occur broadly across the Pacific Ocean, especially the waters of the North Pacific Ocean.

There has been some uncertainty among fishers regarding bluefin tuna taken in New Zealand waters. Some fishers believe that three species of bluefin tuna are taken in New Zealand waters with some small catches of true “Northern” Atlantic tuna (*Thunnus thynnus*) in addition to Pacific and southern bluefin tuna. This belief is based on several factors include differences in morphology and the prices obtained for certain fish on the Japanese market.

To address this issue muscle tissue samples were taken from 20 fish for which there was uncertainly as to whether the fish was a Pacific bluefin tuna (*Thunnus orientalis*) or an Atlantic bluefin tuna. A further sample from a fish though to be a southern bluefin tuna was also included. The tissue samples were sequenced for the COI region of DNA, and the sequences compared with COI sequences for the three species of tuna held in GenBank. All of the DNA sequences, except one, matched with sequences for Pacific bluefin tuna. The final sample was confirmed as a southern bluefin tuna. Therefore, based on DNA analysis, there is presently no evidence that Atlantic bluefin tuna are taken in New Zealand waters. Further tissue samples from fish thought by fishers to be NTU will be collected by scientific observers.

Adult Pacific bluefin reach a maximum size of 550 kg and lengths of 300 cm. Maturity is reached at 3 to 5 years of age and individuals live to 15+ years old. Spawning takes place between Japan and the Philippines in April, May and June, spreading to the waters off southern Honshu in July and to the Sea of Japan in August. Pacific bluefin of 270 to 300 kg produce about 10 million eggs but there is no information on the frequency of spawning. Juveniles make extensive migrations north and eastwards across the Pacific Ocean as 1-2 year old fish. Pacific bluefin caught in the southern hemisphere, including those caught in New Zealand waters, are primarily adults.

Natural mortality is assumed to vary from about 0.1 to 0.4 and to be age specific in assessments undertaken by the IATTC. A range of von Bertalanffy growth parameters have been estimated for Pacific bluefin based on length frequency analysis, tagging and reading of hard parts (Table 4).

Table 4: Von Bertalanffy growth parameters for Pacific bluefin tuna.

Method	L infinity	k	t_0
length frequencies	300.0		
scales	320.5	0.1035	- 0.7034
scales	295.4		
tagging	219.0	0.211	

The length weight relationship of Pacific bluefin based on observer data from New Zealand caught fish yields the following:

$$\text{whole weight} = 8.058\, e^{0.015\,\text{length}} \qquad R^2 = 0.895,\ n = 49 \text{ (weight is in kg and length is in cm).}$$

Although the sample size of genetically confirmed Pacific bluefin that has been sexed by observers is small (50 fish), the sex ratio in New Zealand waters is not significantly different from 1:1.

3. STOCKS AND AREAS

Pacific bluefin tuna constitutes a single Pacific-wide stock that is primarily distributed in the northern hemisphere.

In 2006 several Pacific bluefin were tagged using Pop-off Satellite Archival Tags (PSATs), and all tags that have 'reported' to date indicate that these fish likely spend at least three months within the New Zealand EEZ over spring and early summer.

4. STOCK ASSESSMENT

A new assessment using Stock Synthesis was undertaken by the International Scientific Committee for tuna and tuna-like species (ISC). This is summarised in Anon (2008) as follows:

"New age and growth data from otolith annuli were available for inclusion in the assessment. The assessment spans the period 1952-2005 and incorporates troll and longline CPUE indices; a fixed growth curve; age specific natural mortality (fixed) with very high natural mortality for youngest age class; and full maturity at age 5 years. The main fisheries occur around Japan, including longline fisheries in the spawning season, purse-seine fisheries, set net fisheries, and troll fisheries. Recent catches have been dominated by small fish (0+ and 1+ years old) and there have been recent increases in catch by Mexico and Korea. Total annual catches are currently about 23,000 t per year.

Longline CPUE has been strongly influenced by changes in the operation of the fishery, particularly changes in species targeting and areas fished. There is no single CPUE index spanning the entire time period of the model and a number of separate indices, covering different and, in some cases, non overlapping periods are incorporated in the model.

The stock assessment model estimates variable recruitment through the model period, resulting in three major peaks in spawning biomass through the model period. There has been an increase in fishing mortality rates during the last 10 years, principally for the youngest age classes. Sensitivities with respect to the natural mortality schedule revealed recruitment and spawning biomass strongly influenced by the model assumptions. Other key sources of uncertainties are the level of fishing mortality and recruitment estimates for the recent year classes. A retrospective analysis indicated that the model is underestimating the most recent year's (2005) recruitment. This in turn affects the

reliability of the stock projections. Assumptions regarding the magnitude of the 2005 recruitment influence the stock status (spawning biomass) in the medium term. Projections also investigated the affect of increasing or decreasing fishing mortality."

4.1 Estimates of fishery parameters and abundance

None are available at present.

4.2 Biomass estimates

Estimates of current and reference biomass are not available.

4.3 Estimation of Maximum Constant Yield (MCY)

No estimates of MCY are available.

4.4 Estimation of Current Annual Yield (CAY)

No estimates of CAY are available.

5. STATUS OF THE STOCKS

The ISC provided the following conservation advice to the Western and Central Pacific Fisheries Commission and the Scientific Committee believes it appropriate for managers to consider:
Given the conclusions of the May-June 2008 stock assessment with regard to the current level of F relative to potential target and limit reference points, and residual uncertainties associated with key model parameters, it is important that the current level of F is not increased.

a) If F remains at the current level and environmental conditions remain favourable, then recruitment should be sufficient to maintain current yield well into the future.

b) A reduction in F, in combination with favourable environmental conditions, should lead to greater Y/R and SPR and, after some lag, greater sustained yield.

c) Increases in F above the current level, and/or unfavourable changes in environmental conditions, may result in recruitment levels which are insufficient to sustain the current productivity of the stock.

6. FOR FURTHER INFORMATION

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