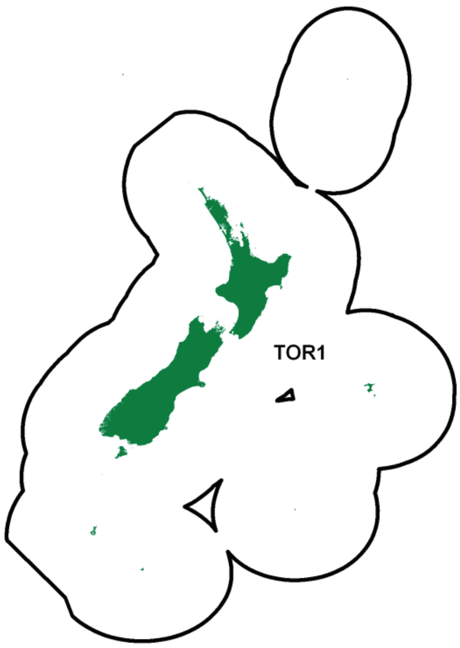
PACIFIC BLUEFIN TUNA (TOR)

(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 Customary non-commercial allowances, TACCs and TACs for Pacific bluefin tuna.

Fishstock	Recreational Allowance	Customary non-commercial 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 is 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). Figure 1 shows the historical landings and domestic longline fishing effort for TOR1.

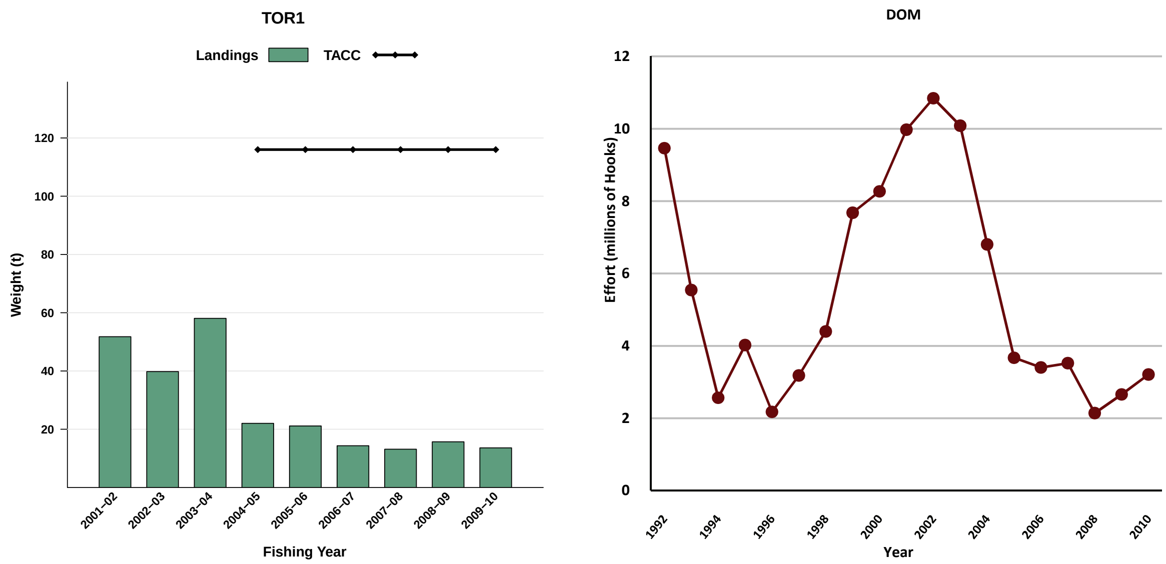


Figure 1: Commercial catch of pacific bluefin tuna from 2001-02 to 2009-10 within NZ waters (TOR1), and Fishing effort (number of hooks set) for all domestic (including effort by foreign vessels chartered by NZ fishing companies) vessels from 1992 to 2010.

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 – present 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	2008	13.0	
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 Western and Central Pacific Ocean (WCPO) (Japan and Korea) and Eastern Pacific Ocean 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, MHR data from 2001-02 to present 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/MHR	Total	LFRR	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	22.9	0.0
2005/06		21.1	21.1	20.3	0.0
2006/07		14.3	14.3	14.4	0.0
2007/08		13.1	13.1	11.9	0.0
2008/09		15.7	15.7	15.5	0.0
2009/10		13.6	13.6	12.4	

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 Customary non-commercial 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 thought 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 in New Zealand waters 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

Stock structure assumptions
Western and Central Pacific Ocean

Stock Status	
Year of Most Recent Assessment	2008

Reference Points	Target: Not established Soft Limit: Not established by WCPFC or IATTC; but evaluated using HSS default of 20%SB_0. Hard Limit: Not established by WCPFC or IATTC; but evaluated using HSS default of 10%SB_0
Status in relation to Target	Although no target has been set for this stock and the stock assessment generated somewhat ambiguous results the stock is about as likely as not to be at or near B_{MSY}.
Status in relation to Limits	Unknown
Fishery and Stock Trends	
Trend in Biomass or Proxy	Biomass in 1995 was estimated to have rebuilt from a historic low in the mid-1980's, but has declined slightly since that time.
Trend in Fishing Mortality or Proxy	F's on recruits (age 0) and on juveniles (ages 1-3) have been generally increasing for more than a decade (1990-2005). The catch (in weight) is dominated by recruits and juveniles (ages 0-3).

Other Abundance Indices	
Trends in Other Relevant Indicator or Variables	Recruitment has fluctuated without trend over the assessment period (1952-2006), and does not appear to have been adversely affected by the relatively high rate of exploitation. Recent recruitment (2005-present) is highly uncertain, making short-term forecasting difficult. In particular, the 2005 year class strength may have been underestimated in this assessment.

Projections and Prognosis	
Stock Projections or Prognosis	Using the new M values, preliminary results of the future stock projection suggest that in the short-term (2009-2010) and under recent levels of F, SSB will decline, but in the longer-term SSB will attain its historical median level.
Probability of Current Catch / causing decline below limits	Soft Limit: Unknown Hard Limit: Unknown

Assessment Methodology		
Assessment Type	Level 1: Quantitative Stock assessment	
Assessment Method	Quantitative assessment in Stock Synthesis.	
Main data inputs	• 1952-2005 (Fishing year, July 1 to June 30) • Quarterly catch time series of 10 fleets • 4 Longline CPUE trends (3 Japan, 1 Chinese-Taipei) • 1 Troll CPUE trend • Growth curve was fixed to new growth curve obtained from Otolith annuli count	
Period of Assessment	Latest assessment: 2008	Next assessment: ?
Changes to Model Structure and Assumptions		
Major Sources of Uncertainty	The assumed natural mortality rate. Recruitment strength (and F on recruits) in the most recent year (2005) of the stock assessment. The assessment is not well documented.	

Qualifying Comments
The assessment is not well documented, and has not had sufficient review by the WCPFC Scientific Committee.

Fishery Interactions
Interactions with protected species are known to occur in the longline fisheries of the South Pacific,

particularly south of 30°S. Seabird bycatch mitigation measures are required in the New Zealand, Australian EEZ's and through the WCPFC Conservation and Management Measure (CMM2007-04). Sea turtles also get incidentally captured in longline gear; the WCPFC is attempting to reduce sea turtle interactions through Conservation and Management Measure (CMM2008-03). Shark bycatch is common in longline fisheries and largely unavoidable; this is being managed through New Zealand domestic legislation and to some extent through Conservation and Management Measure (CMM2008-06).

6. FOR FURTHER INFORMATION

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