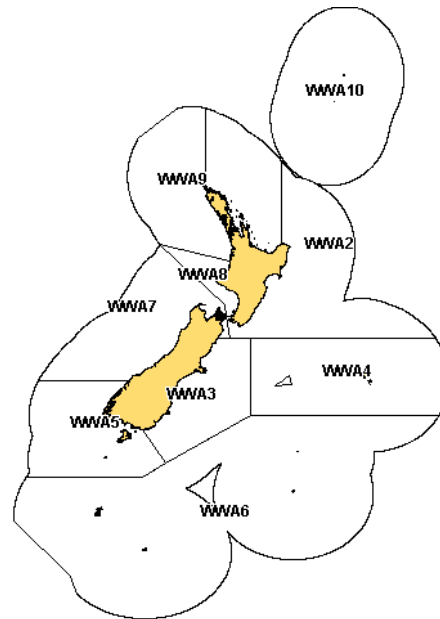


**WHITE WAREHOU (WWA)***(Seriolella caerulea)*  
Warehou**1. FISHERY SUMMARY****1.1 Commercial fisheries**

White warehou are predominantly taken as bycatch from target trawl fisheries on hoki and silver warehou, and to a lesser extent, hake, ling and scampi. White warehou were mostly caught in 150 to 800 m depth by larger vessels owned or chartered by New Zealand fishing companies.

Prior to the establishment of the EEZ on 1 March, 1978, white warehou landings were combined with both silver and blue (or common) warehou as 'warehouses'. An estimate of total white warehou catches for 1970 to 1977 calendar years has been made (Table 1). From 1978–79 to 1982–83 annual catches of up to 900 t during the fishing year were reported, mainly from Southland and the Chatham Rise (Table 2).

Annual catches of white warehou have been variable (i.e., ranging from 315 t in the 1978–79 fishing year to 3694 t in 1996–97, Tables 2 and 3). The main areas of fishing are the Southland area, with some extension into the Sub-Antarctic area since 1990–91, and the Chatham Rise. The annual catch from other fisheries has been relatively small; the west coast South Island catch is usually less than 100 t and the North Island catch rarely exceeds 50 t.

Target fishing on white warehou has been reported from around Mernoo Bank, the Stewart–Snares shelf, Puysegur Bank and on the west coast of the South Island, with the best catch rates recorded in the southern areas. Target fisheries accounted for only 8% of the total white warehou catch for the years from 1988–89 to 1994–95. Most catches are taken from 300–7000 m by bottom trawls targeted at hoki, squid, ling and silver warehou (Bull & Kendrick in prep.).

White warehou was added to the QMS on 1 October 1998. The TACCs for each QMA are given in Table 3. An allowance of 2 t was made for non-commercial catch in each of WWA 2–7 and therefore TACs for these stocks are 2 t higher than the TACCs.

TACCs were increased from 1 October 2006 in WWA 3 to 583 t, in WWA 4 to 330 t, and in WWA 7 to 127 t. In these stocks landings were above the TACC for a number of years and the TACCs have been increased to the average of the previous 7 years plus an additional 10%. Despite this change the catch in WWA 3 in 2006–07 was well above the new TACC.

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**Table 1: Estimated catch (t) of white warehou for years 1970 to 1977.**

Vessel nationality	1970*	1971*	1972	1973	1974	1975	1976	1977
Japanese	17	25	222	447	234	1 453	1 558	334
Russian	na	na	1 300	1 200	1 480	40	440	1 260
Korean	-	-	-	-	-	-	-	400
Total	17	25	1 522	1 647	1 714	1 493	1 998	1 994

\* Japanese data only.

**Table 2: Reported landings (t) of white warehou by fishing year and area, by foreign licensed and joint venture vessels, 1978–79 to 1983–83. The EEZ areas (see Figure 2 of Baird & McKoy 1988) correspond approximately to the QMAs as indicated. Fishing years are from 1 April to 31 March. The 1983–83 is a six month transitional period from 1 April to 30 September. No data are available for the 1980–81 fishing year.**

EEZ area	B	C(M)	C(1)	D	E(B)	E(P)	E(C)	E(A)	F(E)	F(W)	G	H	Total
QMA area	1 & 2	3		4	6			5		7	8 & 9		
1978–79	1	20	10	1	0	5	0	141	86	26	20	6	315
1979–80	2	8	5	230	57	5	4	312	34	97	42	0	795
1980–81	-	-	-	-	-	-	-	-	-	-	-	-	-
1981–82	0	41	2	53	0	2	5	153	27	248	10	1	542
1982–83	0	375	1	88	0	11	0	198	39	137	33	0	882
1983–83	0	167	5	49	0	0	0	12	9	34	24	0	300

Note: The EEZ area E(A) also included part of QMA 5, south of 48°30' S.

**Table 3: Reported landings (t) of white warehou by fishstock and fishing year, 1982–83 to 2006–07. The data in this table has been updated from that published in previous Plenary Reports by using the data through 1996–97 in table 44 on p. 296 of the “Review of Sustainability Measures and Other Management Controls for the 1998–99 Fishing Year – Final Advice Paper” dated 6 August 1998. Data since 1997–98 are based on catch and effort returns. There are no landings reported from QMA 10.**

Fishstock FMA	WWA 1		WWA 2		WWA 3		WWA 4		WWA 5	
	Landings	TAC	Landings	TAC	Landings	TAC	Landings	TAC	Landings	TAC
1982–83	0	-	35	-	179	-	69	-	248	-
1983–84	0	-	28	-	111	-	33	-	282	-
1984–85	0	-	2	-	123	-	39	-	150	-
1985–86	0	-	5	-	589	-	61	-	277	-
1986–87	0	-	10	-	239	-	29	-	167	-
1987–88	< 1	-	9	-	431	-	26	-	113	-
1988–89	6	-	1	-	118	-	43	-	843	-
1989–90	1	-	9	-	484	-	16	-	555	-
1990–91	2	-	12	-	695	-	88	-	568	-
1991–92	6	-	22	-	589	-	113	-	833	-
1992–93	2	-	13	-	281	-	106	-	560	-
1993–94	6	-	34	-	197	-	23	-	1 235	-
1994–95	4	-	41	-	327	-	243	-	1 936	-
1995–96	2	-	68	-	566	-	137	-	1 555	-
1996–97	3	-	89	-	508	-	220	-	2 309	-
1997–98	2	-	31	-	516	-	153	-	1 217	-
1998–99	< 1	4	34	73	398	399	120	220	1 269	2 127
1999–00	< 1	4	48	73	559	399	277	220	1 112	2 127
2000–01	< 1	4	21	73	661	399	303	220	703	2 127
2001–02	0	4	8	73	446	399	262	220	921	2 127
2002–03	< 1	4	20	73	852	399	397	220	1 462	2 127
2003–04	< 1	4	47	73	458	399	365	220	1 141	2 127
2004–05	< 1	4	24	73	347	399	365	220	1 568	2 127
2005–06	< 1	4	35	73	589	399	312	220	1 176	2 127
2006–07	< 1	4	10	73	733	583	304	330	1 484	2 127

Fishstock FMA	WWA 6		WWA 7		WWA 8		WWA 9		Total	
	Landings	TAC	Landings	TAC	Landings	TAC	Landings	TAC	Landings	TAC
1982–83	7	-	24	-	< 1	-	0	-	562	-
1983–84	24	-	29	-	< 1	-	0	-	510	-
1984–85	12	-	15	-	< 1	-	0	-	342	-
1985–86	43	-	81	-	< 1	-	0	-	1 058	-
1986–87	144	-	15	-	< 1	-	0	-	573	-
1987–88	20	-	28	-	< 1	-	0	-	629	-
1988–89	16	-	10	-	0	-	0	-	1 040	-
1989–90	291	-	83	-	0	-	0	-	1 438	-
1990–91	278	-	69	-	1	-	0	-	1 713	-
1991–92	1 028	-	45	-	0	-	0	-	2 636	-
1992–93	645	-	125	-	2	-	0	-	1 734	-

**Table 3** (Continued)

Fishstock FMA	WWA 6		WWA 7		WWA 8		WWA 9		Total	
	Landings	TAC	Landings	TAC	Landings	TAC	Landings	TAC	Landings	TAC
1993–94	592	-	69	-	0	-	0	-	2 156	-
1994–95	185	-	80	-	0	-	0	-	2 816	-
1995–96	50	-	62	-	0	-	0	-	2 440	-
1996–97	494	-	71	-	0	-	0	-	3 694	-
1997–98	126	-	98	-	< 1	-	< 1	-	2 155	-
1998–99	412	490	73	60	< 1	1	0	0	2 306	3 374
1999–00	211	490	153	60	< 1	1	0	0	2 351	3 374
2000–01	119	490	90	60	< 1	1	0	0	1 897	3 374
2001–02	219	490	85	60	< 1	1	< 1	0	1 941	3 374
2002–03	457	490	158	60	0	1	0	1	3 346	3 374
2003–04	211	490	135	60	0	1	0	1	2 357	3 374
2004–05	436	490	123	60	< 1	1	0	1	2 863	3 374
2005–06	250	490	133	60	0	1	0	1	2 495	3 374
2006–07	563	490	121	127	0	1	0	0	3 215	3 735

## 1.2 Recreational fisheries

The recreational take of white warehou is likely to be very small given its distribution and depth preferences. No white warehou were reported from recreational surveys undertaken in 1991 to 1994, although warehou are not always recorded by species.

## 1.3 Customary non-commercial fisheries

No quantitative information is available on the current level of customary non-commercial take.

## 1.4 Illegal catch

Silver warehou were reported as white warehou when the latter was a non QMS species. Compliance investigations in 1988 successfully proved substantial quantities of silver warehou were reported as white warehou, but catch statistics were not altered as a result. The true extent of misreporting is unknown and thus the accuracy of annual catch records cannot be determined.

## 1.5 Other sources of mortality

No information is available on other sources of mortality.

## 2. BIOLOGY

Adult white warehou range between 40–60 cm fork length (FL) and reach a maximum length and weight of 67 cm and 5.7 kg respectively. Sexual maturity is reached at an age of about 3 or 4 years at a length of approximately 38–47 cm. The length at age for the first three years appears to be similar to that described for silver and blue warehou (Horn & Sutton 1995, 1996, Gavrillov 1979).

White warehou were aged by Gavrillov (1979) who gives the maximum age as 12 years. Horn and Sutton (1996) suggested that Gavrillov underestimated the maximum age of silver warehou (as 10–11 years) because he read whole otoliths and scales. They determined a maximum age of 23 years for silver warehou using sectioned otoliths. The maximum age of white warehou is therefore uncertain.

Without validated ageing and population age structures it is not possible to estimate instantaneous, natural or total mortality for white warehou. A range of estimates of natural mortality ( $M$ ) have been derived for silver warehou from the equation:

$$M = \log_e(100)/A_{MAX}$$

where  $A_{MAX}$  is the age reached by 1% of the virgin population (Sparre *et al.* 1989). Maximum age and estimates of  $M$  for silver warehou are 17 years and 0.24 for males and 19 years and 0.27 for females respectively (Horn & Sutton 1996).

Sex ratio data derived from scaled length frequencies appear to show a slight bias towards males. On the Chatham Rise sex ratios vary from 1.0 : 1 to 1.4 : 1 (males to females). In the southern area, ratios

## WHITE WAREHOU (WWA)

vary from 0.7 : 1 to 4.2 : 1, but sample sizes at either extreme of the range are very small. There are insufficient data to enable detection of any changes in sex ratio with season.

Feeding records from the MFish research database show salps as the predominant prey item observed in white warehou stomachs. Occasional records of fish and euphausiids have also been made. Gavrilov and Markina (1979) noted salps (*Iasis*) and the tunicate *Pyrosoma* as major food items.

### 3. STOCKS AND AREAS

The existence of three possible spawning areas for white warehou, (Mernoo Bank, Puysegur Bank and the west coast of the South Island) at the same time of year, suggests the possibility of three separate stocks. Bagley & Hurst (1997) proposed the following Fishstock areas: WWA 1 (QMA's 1, 2, 3 and 4), WWA 5 (QMA's 5 and 6) and WWA 7 (QMA's 7, 8 and 9) for white warehou. TACs were set for each QMA (1–9) in 1998 and are managed separately.

### 4. STOCK ASSESSMENT

No assessments are available for any stocks for white warehou, therefore estimates of biomass and yield are not available.

#### 4.1 Estimates of fishery parameters and abundance

No estimates of fishing parameters are available for white warehou.

Several time series of relative abundance estimates are available from trawl surveys, but these estimates are not reliable indicators of relative abundance because of large fluctuations between years and moderate to high CV's. The use of different vessels, gear and times of the year prior to 1991 also makes it difficult to compare biomass estimates. The larger biomass estimates are generally associated with moderate to high CV's (i.e., over 40%), having resulted from one or two large catches. Smaller biomass estimates have lower CV's, but this could be because the survey missed the main white warehou schools.

#### 4.2 Biomass estimates

No biomass estimates are available for white warehou.

#### 4.3 Estimation of Maximum constant yield (MCY)

MCY cannot be determined. Problems with mis-reporting of white warehou as silver warehou and the lack of consistent catch histories make MCY estimates based on catch data alone unreliable. Also the amount of effort on white warehou relates very closely to effort on other target species such as hoki and silver warehou. Changing fishing patterns such as more targeting of hoki outside the spawning season has occurred in the last 4 to 5 years. Large fluctuations in the availability of white warehou to the trawl, as indicated by trawl surveys, are also likely to apply to commercial fishing operations. Estimates of  $M$  need to be determined.

#### 4.4 Estimation of Current Annual Yield (CAY)

CAY cannot be estimated because of the lack of current biomass estimates.

#### 4.5 Other yield estimates and stock assessment results

There are no other yield estimates or stock assessment results available for white warehou.

#### 4.6 Other factors

As only 8% of the reported catch is from target fishing, most quota allocated under the QMS system covers bycatch of other middle depth fishing activities.

## 5. STATUS OF THE STOCKS

It is not known whether recent catches are sustainable or if they are at levels that will allow the stock to move towards a size that will support the maximum sustainable yield.

TACCs were increased from 1 October 2006 in WWA 3 to 583 t, in WWA 4 to 330 t, and in WWA 7 to 127 t. In these stocks landings were above the TACC for a number of years and the TACCs have been increased to the average of the previous 7 years plus an additional 10%. Despite this change the catch in WWA 3 in 2006-07 was well above the new TACC.

TACCs and reported landings for the 2006–07 fishing year are summarised in Table 4.

**Table 4: Summary of TACCs (t), and reported landings (t) of white warehou for the most recent fishing year.**

Fishstock	QMA	2006–07	2006–07
		Actual TACC	Reported landings
WWA 1	Auckland (East)	1	< 1
WWA 2	Central (East)	2	10
WWA 3	South-east (Coast)	3	733
WWA 4	South-east (Chatham)	4	304
WWA 5	Southland	5	1 484
WWA 6	Sub-Antarctic	6	563
WWA 7	Challenger	7	121
WWA 8	Central (West)	8	0
WWA 9	Auckland (West)	9	0
WWA 10	Kermadec	10	–
Total		3 735	3 215

## 6. FOR FURTHER INFORMATION

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