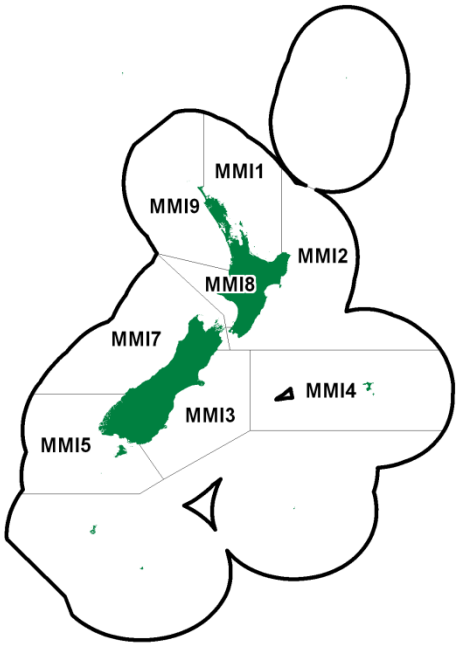
LARGE TROUGH SHELL (MMI)

(*Mactra murchisoni*)



1. FISHERY SUMMARY

This species is part of the surf clam fishery and the reader is guided to the surf clam introductory chapter for information common to all relevant species.

1.1 Commercial fisheries

Large trough shells (*Mactra murchisoni*) were introduced into the Quota Management System on 1 April 2004 with a total TACC of 162 t. No allowances were initially made for customary, recreational, or other sources of mortality; some allowances were introduced for MMI 8 and 7 in 2013 and 2016, respectively. Biomass surveys in QMA 3 supported a TACC increase from April 2010. This increased the TACC for MMI 3 from 3 t to 62 t. A subsequent biomass survey in 2012 supported a TAC increase in MMI 8 from 25 t to 631 t in April 2013. Another biomass survey supported a TAC increase in MMI 7 from 61 t to 144 t in April 2016. The current total TAC is 872 t (Table 1).

Table 1: Current TAC, TACC, and allowances for other sources of mortality for *Mactra murchisoni*.

Fishstock	TAC (t)	TACC (t)	Recreational Allowance (t)	Customary Allowance (t)	Other sources of mortality (t)
MMI 1	2	2	0	0	0
MMI 2	3	3	0	0	0
MMI 3	65	62	0	0	3
MMI 4	1	1	0	0	0
MMI 5	1	1	0	0	0
MMI 7	144	131	1	5	7
MMI 8	631	589	0	10	32
MMI 9	25	25	0	0	0
Total	872	814	1	15	35

All reported landings have been from MMI 3 and MMI 7. Between the 1991–92 and 1995–96 fishing years landings were small and confined to MMI 7. No further landings were reported until 2002–03. Since then the reported total landings have ranged between about 23 t and 77 t, with an equal amount of landings recorded from 2002–03 to 2018–19 coming from each of the two stocks (Table 2).

MMI 3 landings reached the TACC in 2013–14, and again in 2019–20, but decreased to levels well below the TACC in the intervening years. MMI 7 landings were close to the TACC from 2004–05 to 2006–07 but have fluctuated around a lower level since this time; the TACC was increased in 2015. Figure 1 shows the historical landings and TACCs for the two main MMI stocks.

Table 2: TACCs and reported landings (t) of large trough shell by Fishstock from 1991–92 to present from CELR and CLR data. Fishstocks where no catch has been reported are not tabulated. See Table 1 for TACC of stocks not landed.

	MMI 3		MMI 7		Total	
Year	Landings	TACC	Landings	TACC	Landings	TACC
1991–92	0	0	0.35	–	0.35	–
1992–93	0	0	1.54	–	1.54	–
1993–94	0	0	8.33	–	8.33	–
1994–95	0	0	10.43	–	10.43	–
1995–96	0	0	0.14	–	0.14	–
1996–97	0	0	0	–	0	–
1997–98	0	0	0	–	0	–
1998–99	0	0	0	–	0	–
1999–00	0	0	0	–	0	–
2000–01	0	0	0	–	0	–
2001–02	0	0	0	–	0	–
2002–03	0	0	22.62	–	22.62	–
2003–04	0	44	29.68	61	29.68	162
2004–05	0	44	60.02	61	60.86*	162
2005–06	0	44	53.96	61	57.92*	162
2006–07	7.48	44	54.09	61	61.57	162
2007–08	36.90	44	15.04	61	51.94	162
2008–09	32.15	44	6.66	61	38.81	162
2009–10	25.76	44	3.42	61	29.18	162
2010–11	12.60	62	17.43	61	30.03	180
2011–12	0	62	47.34	61	47.34	180
2012–13	44.45	62	32.81	61	77.27	180
2013–14	63.87	62	4.89	61	68.75	744
2014–15	59.00	62	9.69	61	68.64	744
2015–16	46.72	62	23.98	131	71.77	814
2016–17	35.79	62	25.62	131	62.59	814
2017–18	40.39	62	29.43	131	71.87	814
2018–19	29.92	62	32.43	131	62.92	814
2019–20	62.91	62	36.12	131	99.62	814

*In 2004–05 and 2005–06, 0.84 and 3.9554 t respectively were reportedly landed, but the QMA was not recorded. These amounts are included in the total landings for these years.

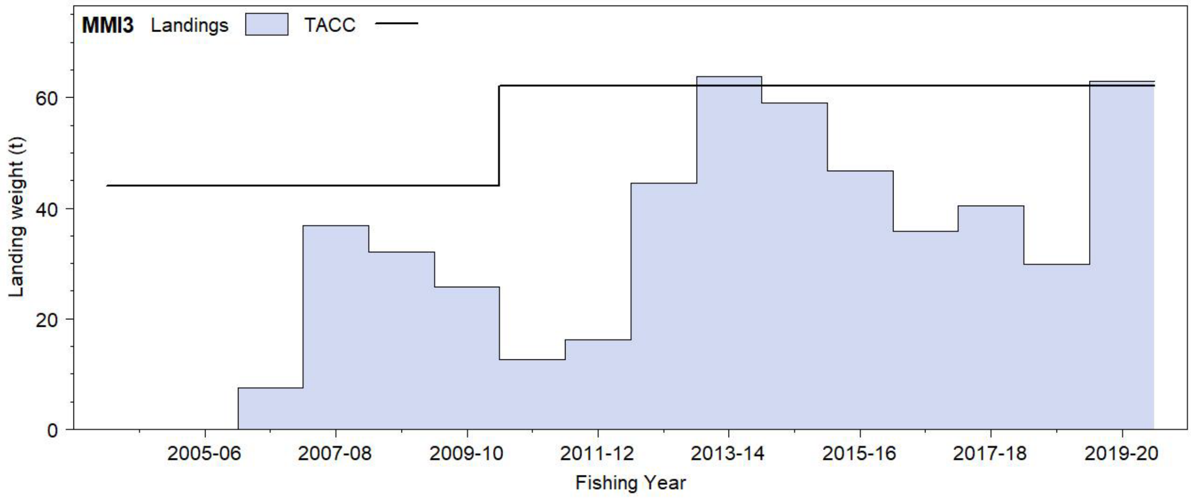


Figure 1: Reported commercial landings and TACC for MMI 3 (South East Coast). Note that these figures do not show data prior to entry into the QMS. [Continued on next page]

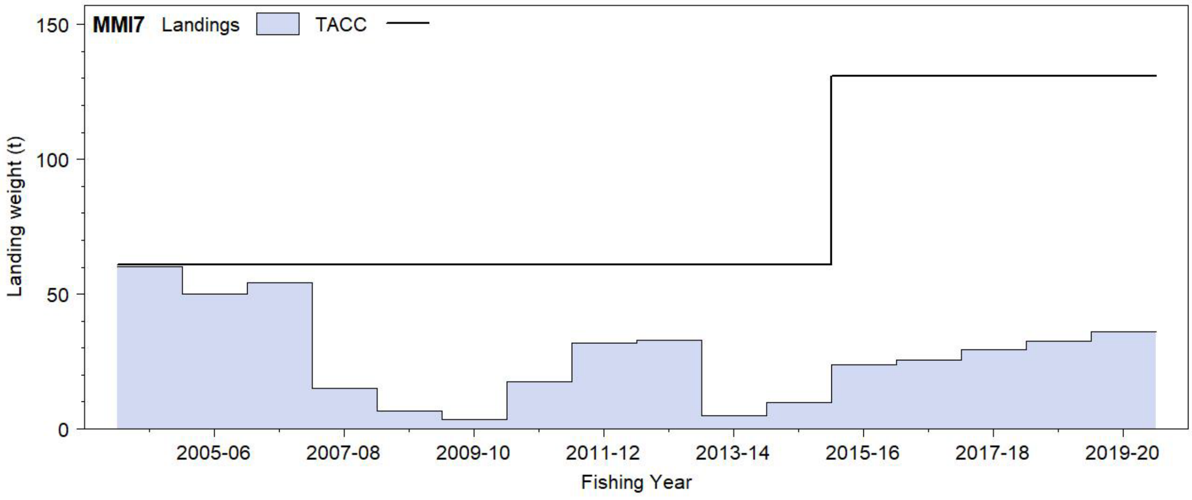


Figure 1: [Continued] Reported commercial landings and TACC for MMI 7 (Challenger). Note that these figures do not show data prior to entry into the QMS.

1.2 Recreational fisheries
Offshore clams such as *M. murchisoni* are likely to have been harvested for recreational use only when washed ashore after storms. There are no estimates of recreational take for this surf clam.

1.3 Customary fisheries
Offshore clams such as *M. murchisoni* are likely to have been harvested for customary use only when washed ashore after storms. Shells of this clam have been found irregularly, and in small numbers, in a few middens (Conroy et al 1993). There are no estimates of current customary catch of this clam.

1.4 Illegal catch
There is no documented illegal catch of this clam.

1.5 Other sources of mortality
There is no quantitative information on other sources of mortality, although this clam is subject to localised catastrophic mortality from erosion during storms, high temperatures and low oxygen levels during calm summer periods, blooms of toxic algae, and excessive freshwater outflow (Cranfield & Michael 2001).

2. BIOLOGY

M. murchisoni is most abundant around the lower half of the North Island and the South Island. It is found most commonly between about 4 m and 8 m in depth. Maximum length is variable between areas, ranging from 63 mm to 102 mm (Cranfield et al 1993). The sexes are separate, they are broadcast spawners, and the larvae are thought to be planktonic for between 20 and 30 days (Cranfield & Michael 2001). Recruitment of spat is to the same depth zone that adults occur in, although recruitment between years is highly variable (Conroy et al 1993).

3. STOCKS AND AREAS

For management purposes stock boundaries are based on FMAs, however the boundaries of stocks of surf clams are likely to be the continuous lengths of exposed sandy beaches between geographical features (rivers, headlands, etc). Circulation patterns may isolate surf clams genetically as well as ecologically.

4. ENVIRONMENTAL AND ECOSYSTEM CONSIDERATIONS

See the introductory surf clam chapter.

5. STOCK ASSESSMENT

5.1 Estimates of fishery parameters and abundance

No estimates of fisheries parameters or abundance are available for this species.

5.2 Biomass estimates

Biomass has been estimated from MMI 2, 3, 7, and 8 at various times between 1994 and 2015 with stratified random surveying using a hydraulic dredge. Survey size has been expressed either as length of beach (Table 3), or as area (Table 4), which makes comparisons difficult.

In both 2012 (FMA 8) and 2015 (Cloudy Bay, FMA 7), White et al (2012, 2015) have conducted a 2-phase stratified random sampling survey. The survey area was stratified by 4 depth strata (0–2 m, 2–4 m, 4–6 m, and 6–8 m, each with respect to Chart Datum). Each station comprised a ~50 m tow, sampling ~80 m^2 of seabed. All commercial species of subtidal surf clams caught were sorted by species. The total weight of each of these species was measured on board. Individuals from each species were collected and measured for shell length along the anterior-posterior axis (to the nearest millimetre). For tows with less than ~500 individuals, the maximum of either 20 individuals or 20% of the total was measured. For tows with higher than ~500 individuals, 10% with an upper limit of ~200 individuals per tow were measured. To subsample large catches and to avoid issues of size sorting inside the dredge, each of the bins was subsampled by tipping one bin into two bins and repeating until the requisite sub sample size was reached. The number and weight of the main bycatch species was also recorded. Both the biomass densities and biomass estimates were calculated for all the commercial species of subtidal surf clams caught.

Table 3: A summary of biomass estimates in tonnes greenweight (with standard deviation in parentheses) from exploratory surveys of Cloudy Bay (Cranfield et al 1994a) and Clifford Bay in Marlborough (Michael et al 1994), and Foxton beach on the Manawatu coast (White et al 2012).

Area	Cloudy Bay (MMI 7)	Clifford Bay (MMI 7)	Foxton Beach (MMI 8)
Length of beach (km)	11	21	46[#]
Biomass (t)	248 (96)	192 (79)	3 603 (342)[#]

[#] Biomass was estimated at Foxton Beach from a mix of a systematic survey to the north and a stratified survey to the south of this location.

Table 4: A summary of biomass estimates in greenweight (t) from the surveys in MMI 2 (Triantifillos 2008b), MMI 3 (Triantifillos 2008a), and MMI 7 (White et al 2015). Note: unless otherwise stated the CV is less than 20%.

Location	Five sites (MMI 2)	Ashley River to 6 nm south of the Waimakariri River (MMI 3)	Cloudy Bay (MMI 7)
Area surveyed (km^2)	28.0	13.4	5.7
Biomass (t)	33.8	444.1	1 008.8

5.3 Yield estimates and projections

Growth and mortality data from Cloudy Bay in Marlborough and the Kapiti Coast in Manawatu (Cranfield et al 1993) have been used in a yield per recruit model to estimate the reference fishing mortality $F_{0.1}$ (Cranfield et al 1994a, Triantifillos 2008a, 2008b). The Shellfish Working Group (SFWG) did not accept these estimates of $F_{0.1}$ because there was considerable uncertainty in both the estimates and the method used to generate them. The *MCY* estimates of Triantafillos (2008a, 2008b) and White et al (2012) using the full range of $F_{0.1}$ estimates from Cranfield et al (1993) are shown in Table 5. The SFWG recommended that *MCY* estimates are adequate to use to inform management decisions relevant to all surf clam fisheries, with the following caveats: 1) due to the uncertainty in $F_{0.1}$ values, for all species other than SAE, the *MCY* estimates should use the $F_{0.1}$ values toward the higher end of the range, and 2) there is a need to account for any substantial catch that has already come out of any surf clam fishery when estimating *MCY*; however there was no consensus on the best way to do this.

Estimates of *MCY* are available from numerous locations (Table 5) and were calculated using Method 1 for a virgin fishery (MPI 2015) with an estimate of virgin biomass B_0, where:

$$MCY = 0.25 * F_{0.1} B_0$$

Table 5: ***MCY*** **estimates (t) for** ***M. murchisoni*** **from virgin biomass at locations sampled around New Zealand (Triantifillos 2008a, 2008b, White et al 2012). The two** $F_{0.1}$ **values, which are subsequently used to estimate** ***MCY*****, are the minimum and maximum estimates from Cranfield et al (1993).**

Location	$F_{0.1}$	*MCY*
Five sites (MMI 2)	0.43/0.57	47.7/63.3
Ashley River to 6 nm south of the Waimakariri River (MMI 3)	0.70/0.89	5.9/7.5
Cloudy Bay (MMI 7)	0.43/0.57	108.4/143.7
46 km of coast north and south of the Manawatu River (MMI 8)	0.70/0.89	630.6/801.7

Estimation of Current Annual Yield (*CAY*)

CAY has not been estimated for *M. murchisoni*.

The SFWG recommended moving all surf clam fisheries away from an *MCY* management strategy and towards an exploitation rate management strategy. The SFWG recognised that an exploitation rate approach is more survey intensive, but better allows for the variable nature of biomass for surf clams because it allows greater flexibility in catch (to take greater landings from available biomass) whilst keeping catches sustainable.

6. STATUS OF THE STOCKS

- **MMI 3-** ***Mactra murchisoni***

Stock Status	
Year of Most Recent Assessment	2008
Assessment Runs Presented	Survey biomass
Reference Points	Target: Not defined, but B_{MSY} assumed Soft Limit: 20% B_0 Hard Limit: 10% B_0 Overfishing threshold: -
Status in relation to Target	Unknown
Status in relation to Limits	Unknown
Status in relation to Overfishing	Unknown

Historical Stock Status Trajectory and Current Status
Unknown

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	Unknown
Recent Trend in Fishing Mortality or Proxy	Landings have been decreasing from 63.87 t in 2013–14 to 29.23 t in 2018–19 and reached the TACC in 2019–20.
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	-

Projections and Prognosis	
Stock Projections or Prognosis	-
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Unknown
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Unknown

Assessment Methodology		
Assessment Type	Level 2 - Partial Quantitative Stock Assessment	
Assessment Method	Absolute biomass estimates from quadrat surveys	
Assessment Dates	Last assessment: 2008	Next assessment: Unknown
Overall assessment quality rank	-	
Main data inputs (rank)	Abundance and length frequency information	
Data not used (rank)		
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	-	

Qualifying Comments
Stock size could fluctuate markedly as a result of catastrophic mortality from a number of causes. There is a need to review fishery parameters for this species.

Fishery Interactions
MMI can be caught together with other surf clam species and non-QMS bivalves.

- **MMI 7**

Stock Status	
Year of Most Recent Assessment	2015
Assessment Runs Presented	Survey biomass
Reference Points	Target: Not defined, but B_{MSY} assumed Soft Limit: 20% B_0 Hard Limit: 10% B_0 Overfishing threshold: -
Status in relation to Target	Very Likely (> 90%) to be at or above the target.
Status in relation to Limits	Very Unlikely (< 10%) to be below the soft and hard limits
Status in relation to Overfishing	Overfishing is Very Unlikely (< 10%) to be occurring

Historical Stock Status Trajectory and Current Status
Unknown

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	Unknown
Recent Trend in Fishing Mortality or Proxy	Landings have been variable but averaged 28.1 t since 2002.
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	-

Projections and Prognosis	
Stock Projections or Prognosis	-
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Current catches are Very Unlikely (< 10%) to cause declines below soft or hard limits in the short to medium term.
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Very Unlikely (< 10%)

Assessment Methodology and Evaluation	
Assessment Type	Level 2 - Partial Quantitative Stock Assessment
Assessment Method	Absolute biomass estimates from quadrat surveys

Assessment Dates	Last assessment: 2015	Next assessment: Unknown
Overall assessment quality rank		
Main data inputs (rank)	Abundance and length frequency information	
Data not used (rank)	-	
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	-	

Qualifying Comments
Stock size could fluctuate markedly as a result of catastrophic mortality from a number of causes. There is a need to review fishery parameters for this species.

Fishery Interactions
MMI can be caught together with other surf clam species and non-QMS bivalves.

- **MMI 8**

Stock Status	
Year of Most Recent Assessment	2012
Assessment Runs Presented	Survey biomass
Reference Points	Target: Not defined, but B_{MSY} assumed Soft Limit: 20% B_0 Hard Limit: 10% B_0 Overfishing threshold: -
Status in relation to Target	Because of the relatively low levels of exploitation of *M. muchisoni*, it is likely that MMI 8 is still effectively in a virgin state, therefore Very Likely (> 90%) to be at or above the target.
Status in relation to Limits	Very Unlikely (< 10%) to be below the soft and hard limits
Status in relation to Overfishing	Overfishing is Very Unlikely (< 10%) to be occurring
Historical Stock Status Trajectory and Current Status	
Unknown	

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	Unknown
Recent Trend in Fishing Mortality or Proxy	Fishing is light in MMI 8.
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	-

Projections and Prognosis	
Stock Projections or Prognosis	-
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Current catches are Very Unlikely (< 10%) to cause declines below soft or hard limits in the short to medium term.
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Very Unlikely (< 10%)

Assessment Methodology and Evaluation	
Assessment Type	Level 2 - Partial Quantitative Stock Assessment
Assessment Method	Absolute biomass estimates from quadrat surveys

Assessment Dates	Latest assessment: 2012	Next assessment: Unknown
Overall assessment quality rank		
Main data inputs (rank)	Abundance and length frequency information	
Data not used (rank)		
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	-	

Qualifying Comments
Stock size could fluctuate markedly as a result of catastrophic mortality from a number of causes. There is a need to review fishery parameters for this species.

Fishery Interactions
MMI can be caught together with other surf clam species and non-QMS bivalves.

For all other MMI stocks there is no current evidence of appreciable biomass.

7. FOR FURTHER INFORMATION

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