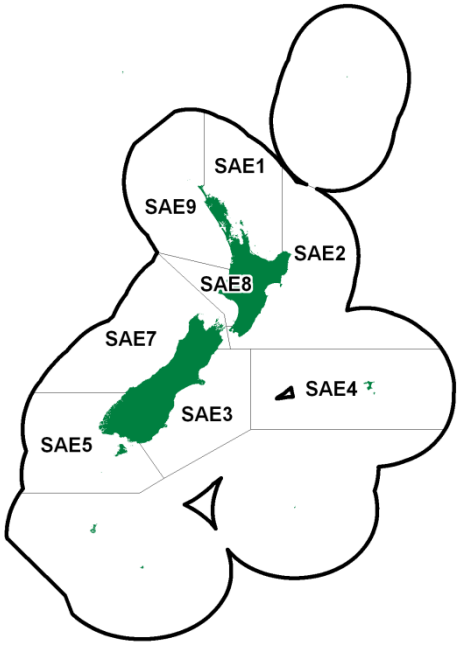
TRIANGLE SHELL (SAE)

(*Spisula aequilatera*)



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.

Triangle shells (*Spisula aequilatera*) were introduced into the QMS on 1 April 2004 with a total TACC of 406 t. No allowances were set for customary, non-commercial, recreational or other sources of mortality. Biomass surveys supported an increase in TAC in SAE 2 and SAE 3 from 1 April 2010 from 1 and 264 t respectively to 132 and 483 t, respectively. A subsequent biomass survey in SAE 8 resulted in a TAC increase in April 2013. This increased the SAE 8 TAC from 8 to 1821 t and the total TAC from 756 to its current level of 2569 t (Table 1).

Table 1: Current TAC, TACC and allowances for other sources of mortality for *Spisula aequilatera*

Fishstock	TAC (t)	TACC (t)	Customary Allowance (t)	Other sources of mortality (t)
SAE 1	9	9	0	0
SAE 2	132	125	0	7
SAE 3	483	459	0	24
SAE 4	1	1	0	0
SAE 5	3	3	0	0
SAE 7	112	112	0	0
SAE 8	1821	1720	10	91
SAE 9	8	8	0	0
Total	2569	2437	10	122

1.1 Commercial fisheries

Apart from a small catch in SAE 2 in 2003–04 and small catches in SAE 3 since 2006–07, all reported landings have been from SAE 7. Between the 1991–92 and 1995–96 fishing years, landings were small and no further landings were reported until 2002–03. Since then landings have increased with a maximum of 52 t in 2002–03. Reported landings and TACCs are shown for the fishstocks with historical landings in Table 2. Figure 1 shows historical landings and TACCs for the two main SAE stocks. Landings are market-driven and have not been constrained by the TACCs.

Table 2: TACCs and reported landings (t) of Triangle shell by Fishstock from 1990–91 to 2012–13 from CELR and CLR data. SAE 1, 4, 5, 8 and 9 have TACCs of 9, 1, 3, 1821 and 8 t, respectively.

	SAE 2		SAE 3		SAE 7		Total	
Fishstock	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
1991–92	0	-	0	-	0.175	-	0.175	-
1992–93	0	-	0	-	0.396	-	0.396	-
1993–94	0	-	0	-	2.846	-	2.846	-
1994–95	0	-	0	-	2.098	-	2.098	-
1995–96	0	-	0	-	0.12	-	0.120	-
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	-	52.146	-	52.146	-
2003–04	0.198	1.0	0	264.0	9.583	112.0	9.781	406.0
2004–05	0	1.0	0	264.0	18.527	112.0	19.364*	406.0
2005–06	0	1.0	0	264.0	28.067	112.0	31.019*	406.0
2006–07	0	1.0	0.608	264.0	45.955	112.0	46.563	406.0
2007–08	0	1.0	3.912	264.0	5.022	112.0	8.934	406.0
2008–09	0	1.0	10.909	264.0	2.506	112.0	13.415	406.0
2009–10	0	1.0	8.619	264.0	1.460	112.0	10.078	406.0
2010–11	0	125.0	4.043	459.0	16.919	112.0	20.962	725.0
2011–12	0	125.0	0	459.0	82.266	112.0	82.266	725.0
2012-13	0	125.0	9.832	459	161.195	112.0	171.027	725.0
2013-14	0	125.0	3.613	459	191.073	112.0	195.316	2 437

*In 2004–05 and 2005–06, 0.837 and 2.952 t respectively were reported landed, but the QMA is not recorded. These amounts are included in the total landings for these years.

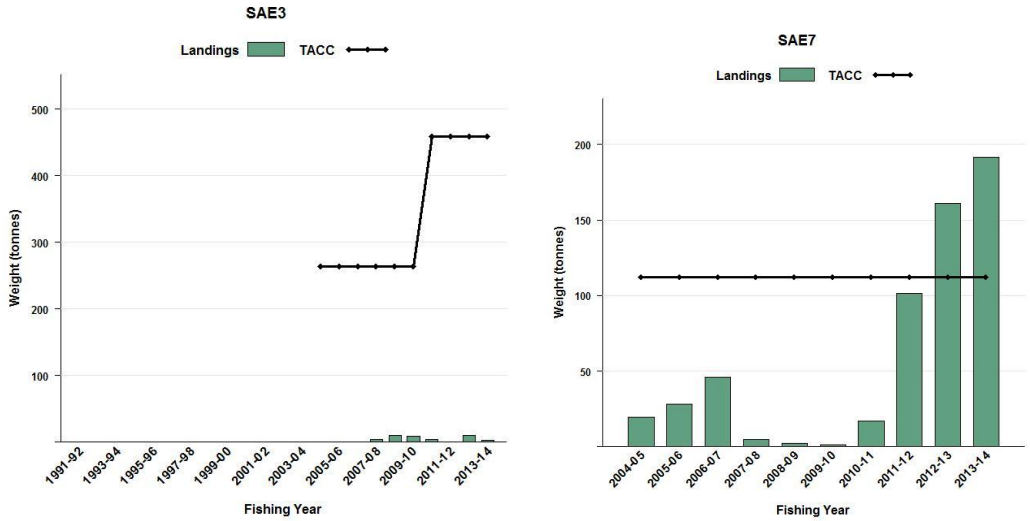


Figure 1: Reported commercial landings and TACC for selected areas.

1.2 Recreational fisheries

There are no estimates of recreational take for this surf clam.

1.3 Customary fisheries

Shells of this species have been found irregularly, and in small numbers in a few middens (Carkeek 1966). There are no estimates of current customary catch of this species.

1.4 Illegal catch

There is no documented illegal catch of this species.

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

S. aequilatera occurs from Bay of Plenty southwards on the east coast of both islands, and on the Wellington-Manawatu coast. No information is available concerning its distribution on the West Coast of the South Island. In the North Island this species is most abundant between 3 m and 5 m depth, and in the South Island between 4 m and 8 m depth. Maximum length is variable between areas, ranging from 39 to 74 mm (Cranfield & Michael 2002). The sexes are separate; they are broadcast spawners; they are reasonably fast growing and reach maximum size in 2–3 years. Nothing is known of their larval life.

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. Early estimates were made of M and $F_{0.1}$ but the SFWG considers that the methods were not well documented, and the estimates should not be used.

5.2 Biomass estimates

Biomass was estimated at one site in each of SAE 3 and SAE 8, and multiple sites within SAE 2 and SAE 7 with stratified random surveying using a hydraulic dredge (Tables 3 and 4).

Table 3: A summary of biomass estimates in tonnes greenweight with standard deviation in parentheses from exploratory surveys of Cloudy Bay (Cranfield et al 1994b) and Clifford Bay in Marlborough (Michael et al 1994), and Foxton beach on the Manawatu coast (White et al 2012). - Indicates where estimates were not generated.

Area	Cloudy Bay (SAE 7)	Clifford Bay (SAE 7)	Foxton Beach (SAE 8)
Length of beach (km)	11	21	46
Biomass (t)	53 (22)	358 (152)	7993 (759)

Table 4: A summary of biomass estimates in tonnes greenweight from the surveys in SAE 2 and SAE 3 (Triantifillos 2008a, Triantifillos 2008b). Unless otherwise stated the CV is less than 20%.

Location	Five sites (SAE 2)	Ashley River to 6 nm south of the Waimakariri River (SAE 3)
Area surveyed (km^2)	28.0	13.4
Biomass (t)	471.1	1567.2

5.3 Yield estimates and projections

Estimation of Maximum Constant Yield (*MCY*)
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 1994b, Triantifillos 2008a, 2008b). The shellfish working group did not accept these estimates of $F_{0.1}$ as there was considerable uncertainty in both the estimate and the method used to generate them. The *MCY* estimates of Triantifillos (2008a and b) and White et al 2012 that use the full range of $F_{0.1}$ estimates from Cranfield et al (1993) are shown in Table 5, but should be interpreted cautiously.

Estimates of *MCY* are available from a number of locations and were calculated using Method 1 for a virgin fishery (Annala et al 2001) with an estimate of virgin biomass B_0, where:

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

Table 5: *MCY* estimates (t) for *S. aequilatera* from virgin biomass at locations sampled around New Zealand (Triantifillos 2008a and b).

Location	$F_{0.1}$	*MCY*
Five sites (SAE 2)	1.12/1.56	131.9/183.7
Ashley River to 6 nm south of the Waimakariri River (SAE 3)	1.06/1.37	415.3/536.8
Foxton beach (SAE 8)	1.06/1.37	2238/3117.2

Estimation of Current Annual Yield (*CAY*)
CAY has not been estimated for *S. aequilatera*.

6. STATUS OF THE STOCKS

- SAE 2, 3, 7 & 8- *Spisula aequilatera*

Stock Status	
Year of Most Recent Assessment	2008 for SAE 2 and 3, 1994 for SAE 7, 2012 for SAE 8.
Assessment Runs Presented	Survey biomass
Reference Points	Target: Not defined, but B_{MSY} assumed Soft Limit: 20% B_0 Hard Limit: 10% B_0
Status in relation to Target	Because of the relatively low levels of exploitation of *S. aequilatera*, it is likely that all stocks are still effectively in a virgin state, therefore they are 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
Historical Stock Status Trajectory and Current Status -	

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	Unknown
Recent Trend in Fishing Mortality or Proxy	Fishing is light in all QMAs other than SAE 7. In SAE 7 it has averaged 23 t since 2002–03.
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	-

Projections and Prognosis	
Stock Projections or Prognosis	-
Probability of Current Catch or TACC causing decline below Limits	For all stocks current catches are Very Unlikely (< 10%) to cause declines below soft or hard limits.

Assessment Methodology		
Assessment Type	Level 2 - Partial Quantitative Stock Assessment	
Assessment Method	Absolute biomass estimates from quadrant surveys	
Main data inputs	Abundance and length frequency information	
Period of Assessment	Latest assessment: 2008 for SAE 2 and 3, 1994 for SAE 7, 2012 for SAE 8.	Next assessment: Unknown
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 the fishery parameters for this species. SAE have slower digging ability relative to PDO therefore are at higher relative risk of mortality during storms.

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

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

7. FOR FURTHER INFORMATION

Annala, J H; Sullivan, K J; O'Brien, C J; Smith, N W M (comps.) (2001) Report from the fishery assessment plenary, May 2001: stock assessments and yield estimates. 515 p. (Unpublished report held in NIWA library, Wellington.)

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Cranfield, H J; Doonan, I J; Michael, K P (1994b) Dredge survey of surf clams in Cloudy Bay, Marlborough. *New Zealand Fisheries Technical Report* 39. 18 p.

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Cranfield, H J; Michael, K P; Stotter, D R (1993) Estimates of growth, mortality, and yield per recruit for New Zealand surf clams. New Zealand Fisheries Assessment Research Document 1993/20. 26 p. (Unpublished document held by NIWA library, Wellington.)

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Haddon, M; Willis, T J; Wear, R G; Anderlini, V C (1996) Biomass and distribution of five species of surf clam off an exposed west coast North Island beach, New Zealand. *Journal of Shellfish Research* 15: 331–339.

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White, W; Millar, R; Breen, B; Farrington, G (2012) Survey of subtidal surf clams from the Manawatu Coast (FMA 8), October–November 2012, Report for the Shellfish Working Group Meeting 19th November 2012, 35 p + Addendum.