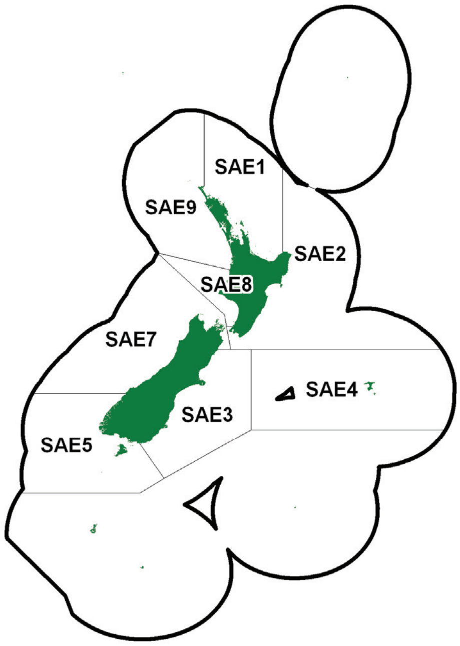
TRIANGLE SHELL (SAE)

(*Spisula aequilatera*)



1. FISHERY SUMMARY

1.1 Commercial fisheries

Triangle shells (*Spisula aequilatera*) were introduced into QMS on 1 April 2004 with a combined TAC and TACC of 406 t. There are no allowances for customary non-commercial, recreational or other sources of mortality. The fishing year is from 1 April to 31 March and commercial catches are measured in greenweight. Apart from a small catch in SAE 2 in 2003–04 and a small catch in SAE 3 in 2006–07, all reported landings have been from SAE 7. Between the 1991–92 and 1995–96 fishing years, landings were small. No further landings were reported until 2002–03, since when estimates have increased from about 2 t to about 45 t. Reported landings and TACCs are shown for the Fishstocks that have landings in Table 1, TACCs for all stocks are shown in Table 2. Figure 1 shows the per-stock catch composition, historical landings and TACC for the two main SAE stocks. Notably, new survey information for QMA 2 and 3 have resulted in increases to a number of surf clam TACC from 1 April 2010, including SAE 2 and 3[1].

Table 1: TACCs and reported landings (t) of Triangle shell by Fishstock from 1990–91 to 2008–09 from CELR and CLR data.

	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	31.865*	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

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

[1] From April 2010 TACC for SAE 2 and 3 are 125 and 459 t, respectively.

Table 2: TACCs (t) of Triangle shell by Fishstock

Fishstock	TACC
SAE 1	9.0
SAE 2	1.0
SAE 3	264.0
SAE 4	1.0
SAE 5	3.0
SAE 7	112.0
SAE 8	8.0
SAE 9	8.0
Total	406.0

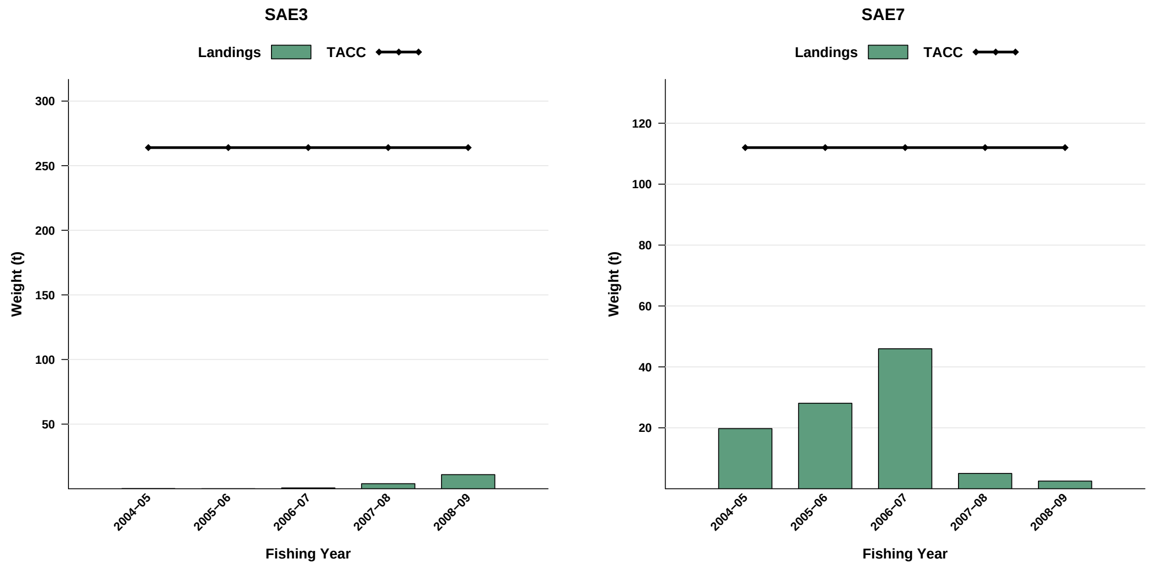


Figure 1: Historical landings and TACC for (Left) SAE3 (South East Coast), and (Right) SAE7 (Challenger). Note that these figures do not show data prior to entry into the QMS.

1.2 Recreational fisheries

Offshore clams such as *S. aequilatera* 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 non-commercial fisheries

Offshore clams such as *S. aequilatera* are likely to have been harvested for customary non-commercial use only when washed ashore after storms. Shells of this clam have been found irregularly, and in small numbers in a few middens. There are no estimates of current customary non-commercial use of this clam.

1.4 Illegal catch

There is no known 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

S. aequilatera occurs mainly around the South Island, but also on the north coast of Stewart Island, and on the east and west coasts of the North Island. It is found from low tide to about 8 m, although juveniles may extend to the mid-tide mark. In the North Island this species is most abundant between 3 m and 5 m, and in the South Island between 4 m and 8 m. Maximum length is variable between areas, ranging from 39 to 74 mm (Cranfield & Michael 2002). The sexes are separate, they are broadcast spawners. Nothing is known of their larval life.

3. STOCKS AND AREAS

For management purposes stock boundaries are based on QMAs, 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). The circulation patterns that maintain the separation of the surf zone habitat to form a self contained ecosystem also retain planktonic larvae of surf clams probably isolating surf clams genetically as well as ecologically.

4. ENVIRONMENTAL EFFECTS OF FISHING

4.1 Sea-bed disturbance
The immediate impact of hydraulic dredging is not discernable a few hours after dredging. The surf zone is a high-energy environment subjected to frequent natural disturbance and high sand mobility. This environment tends to recover faster from disturbance than those in deeper water. Widespread and intensive hydraulic dredging, however, has the potential to adversely modify the environment.

4.2 Incidental catch (fish and invertebrates)
The only significant bycatch associated with surf clams dredging is the echinoid *Fellaster zealandiae* (sand dollar or sea biscuit).

4.3 Incidental catch (seabirds and mammals)
Not relevant to surf clam fisheries.

4.4 Community and trophic structure
The effects dredging for *S. aequilatera* on the community and trophic structure are unknown.

4.5 Spawning disruption
The effects of hydraulic dredging on spawning are unknown.

4.6 Habitats of special significance
Habitats of special significance have not been defined for this fishery.

4.7 Biodiversity
The effect of fishing for this surf clam on the maintenance and healthy functioning of the natural marine habitat and ecosystems is unknown.

4.8 Aquaculture and enhancement
Not relevant to surf clam fisheries.

5. STOCK ASSESSMENT

5.1 Estimates of fishery parameters and abundance
Von Bertalanffy growth parameters for *S. aequilatera* are available from the Kapiti coast. These were estimated with GROTAG using data from mark-recapture experiments (Cranfield & Michael 2001). The estimates and annual mean growth estimates at lengths α and β are shown in Table 3.

Table 3: Mean annual growth estimates (mm/year) at lengths α and β (95% confidence intervals in parentheses), and von Bertalanffy growth parameters from Cloudy Bay and the Kapiti coast. – not estimated.

Site	Mean growth (g_{30})	Mean growth (g_{50})	L_∞	K
Cloudy Bay	22.71 (22.2–23.0)	6.23 (6.0–6.4)	57.6 mm	1.01
Kapiti coast	18.74 (16.4–20.8)	3.5 (0.9–6.0)	–	–

Growth estimates for this species have also been estimated from sequential length frequency distributions using MULTIFAN. Estimates from Cloudy Bay and the Kapiti coast are shown in Table 4.

Table 4: Von Bertalanffy growth parameter estimates from Cloudy Bay and the Kapiti coast estimated using MULTIFAN. (SE in parentheses).

Site	L_∞ (mm)	*K*
Cloudy Bay	60.30 (0.92)	1.01 (0.02)
Kapiti coast	52.10 (0.25)	0.80 (0.03)

Estimates of natural mortality (*M*) ranged from 0.63–0.68 at Cloudy Bay, and from 0.87–0.92 on the Kapiti coast (Cranfield *et al*. 1993).

The maximum age for this species was estimated from the number of age classes indicated in MULTIFAN analyses, and from shell sections. Estimated maximum ages from these methods were respectively 5 and 7 years at both Cloudy Bay, and 3 and 5 years on the Kapiti Coast.

5.2 Biomass estimates

Biomass has been estimated at Cloudy Bay with a stratified random survey using a hydraulic dredge.

Table 5: A summary of biomass estimates in tonnes green weight with standard deviation in parentheses from exploratory surveys of Cloudy Bay, Marlborough (Cranfield *et al*. 1994b), and Clifford Bay, Marlborough (Michael *et al*. 1994), and Foxton beach, Manawatu coast (Haddon *et al*. 1996). – not estimated.

Area	Cloudy Bay	Clifford Bay	Foxton Beach
Length of beach (km)	11	21	27.5
Biomass (t)	53 (22)	358 (152)	29 (–)

5.3 Estimation of Maximum Constant Yield (MCY)

Growth and mortality data from Cloudy Bay, Marlborough and Kapiti Coast, Manawatu have been used in a yield per recruit model to estimate the reference fishing mortality $F_{0.1}$ (Cranfield *et al*. 1994b). Estimates of MCY are available from 13 locations (Figure 2), and were calculated using Method 1 for a virgin fishery (Annala *et al*. 2001) with an estimate of virgin biomass B_0, where

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

These are shown in Table 6.

Table 6: MCY estimates (t) for *S. aequilatera* from virgin biomass in 450 m transects at locations sampled around New Zealand (data from Cranfield *et al*. 1994b).

Location	$F_{0.1}$	MCY
Matakana	1.12	0.03
Ohope	1.12	4.584
Nuhaka	1.12	0.050
Waitarere	1.12	0.028
Otaki	1.12	0.133
Peka Peka	1.12	0.181
Fence	1.06	0.002
Wairau	1.06	0.040
Leithfield	1.06	8.336
Waikuku	1.06	8.638
Kainga	1.06	5.140
Te Waewae	1.06	0.266
Oreti	1.06	0.397

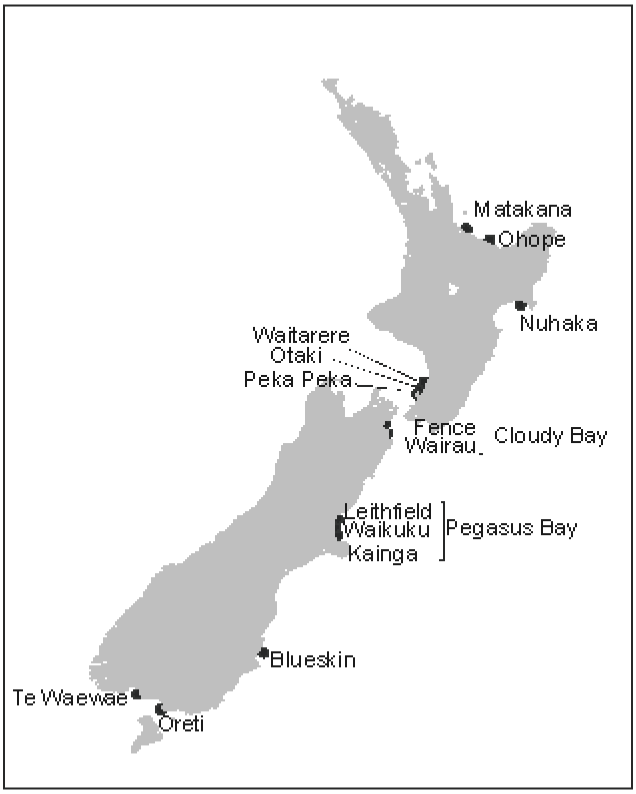


Figure 2: Location of sites surveyed.

5.4 Estimation of Current Annual Yield (CAY)

CAY has not been estimated for *S. aequilateralis*.

6. STATUS OF THE STOCKS

Because of the relatively low levels of exploitation of *S. aequilatera*, it is likely that all stocks are still effectively in a virgin state. Because recruitment is variable and natural mortality caused by storm events may be high, biomass is likely to be highly variable.

7. FOR FURTHER INFORMATION

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