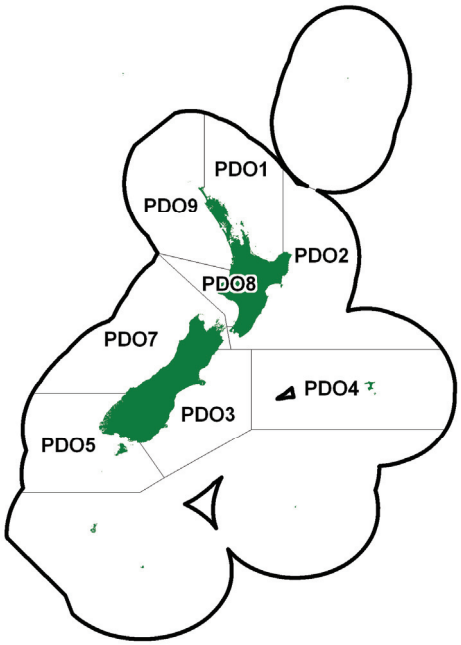
# DEEPWATER TUATUA (PDO)

(*Paphies donacina*)
Tuatua




## 1. FISHERY SUMMARY

### 1.1 Commercial fisheries

Deepwater Tuatua (*Paphies donacina*) were introduced into Quota Management System on 1 April 2004 with a combined TAC and TACC of 168 t. No allowances were made 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. Landings have only been reported from PDO 3, PDO 5, PDO 7 and PDO 8. Between the years 1992–93 and 1995–96, reported landings ranged from a few kgs to about 6 t. No further landings were reported until 2002–03, since when reported total landings have ranged between 2 and 23 t. Landings and TACCs are shown for fishstocks with historical landings in Table 1, while Figure 1 depicts the historical landings and TACC for the two main PDO stocks. Notably, new survey information for QMA 2 and 3 have resulted in increases to a number of surf clam TACCs from 1 April 2010, including PDO 2[1].

**Table 1: TACCs and reported landings (t) of Deepwater Tuatua by Fishstock from 1991–92 to 2008–09 from CELR and CLR data. PDO areas where catch has never been reported are not tabulated. PDO 1, 4 and 9 all have TACC of 1 t and PDO 2 has a TACC of 5 t.**

| | PDO 3 | | PDO 5 | | PDO 7 | | PDO 8 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| Fishstock | Landings | TACC | Landings | TACC | Landings | TACC | Landings | TACC | Landings | TACC |
| 1992–93 | 0 | – | 0 | – | 0.289 | – | 0 | – | 0.294 | – |
| 1993–94 | 0 | – | 0.005 | – | 3.384 | – | 0 | – | 3.384 | – |
| 1994–95 | 0 | – | 0 | – | 5.036 | – | 0 | – | 5.036 | – |
| 1995–96 | 4.439 | – | 0 | – | 1.668 | – | 0 | – | 6.107 | – |
| 1996–97 | 0 | – | 0 | – | 0 | – | 0 | – | 0 | – |
| 1997–98 | 0 | – | 0 | – | 0 | – | 0 | – | 0 | – |
| 1998–99 | 0 | – | 0 | – | 0 | – | 0 | – | 0 | – |
| 1999–00 | 0 | – | 0 | – | 0 | – | 0 | – | 0 | – |
| 2000–01 | 0 | – | 0 | – | 0 | – | 0 | – | 0 | – |
| 2001–02 | 0 | – | 0 | – | 0 | – | 0 | – | 0 | – |
| 2002–03 | 0 | – | 0 | – | 2.253 | – | 0 | – | 2.253 | – |
| 2003–04 | 0 | 108 | 0 | 1 | 10.144 | 50 | 0 | 1 | 10.144 | 168 |
| 2004–05 | 0 | 108 | 0 | 1 | 12.532 | 50 | 0 | 1 | 12.691 | 168 |
| 2005–06 | 0 | 108 | 0 | 1 | 10.627 | 50 | 0.148 | 1 | 13.729 | 168 |
| 2006–07 | 1.17 | 108 | 0 | 1 | 19.995 | 50 | 0 | 1 | 21.16 | 168 |
| 2007–08 | 3.17 | 108 | 0 | 1 | 21.145 | 50 | 0 | 1 | 24.315 | 168 |
| 2008–09 | 4.09 | 108 | 0 | 1 | 4.320 | 50 | 0 | 1 | 8.41 | 168 |

*In 2004–05 and 2005–06 0.16 and 2.953 t respectively were reportedly landed, but the QMA is not recorded. These amounts are included in the total landings for those years.

[1] From April 2010 TACC for PDO 2 is 466t.

### 1.2 Recreational fisheries

Estimates of recreational landings of tuatua were made between 1991 and 1994 and ranged from 237 t in FMA1 in 1993-4 to zero tones in most FMA in most years. The survey did not specify the species of tuatua landed, and most of the catch is thought to comprise the intertidal tuatua *P. subtriangulata* (Cranfield & Michael 2001). On beaches where *P. donacina* extends to just below low water, some recreational catch occurs, during low spring tides.

### 1.3 Customary non-commercial fisheries

*P. donacina* is an important handpicked resource of local iwi, especially in Pegasus Bay, Canterbury. 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

*P. donacina* 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 4 m, although juveniles may extend to the mid-tide mark. Maximum length is variable between areas, ranging from 73 to 109 mm (Cranfield & Michael 1993). The sexes are separate, they are broadcast spawners, and the larvae are thought to be planktonic for between 18 and 21 days (Cranfield & Michael 1993). Recruitment of spat is greatest near the high tide mark, although recruitment between years is highly variable.

## 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 *P. donacina* 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 *P. donacina* 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 2

**Table 2: 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 ($g_{50}$) | Mean growth ($g_{58}$) | Mean growth ($g_{77}$) | Mean growth ($g_{80}$) | $L_\infty$ | $K$ |
|---|---|---|---|---|---|---|
| Cloudy Bay | 10.26 (9.7–10.8) | | – | 1.41 (1.1–1.7) | 84.8 mm | 0.33 |
| Kapiti coast | – | 2.31 (–) | 1.97 (–) | | – | – |

Estimates of natural mortality (*M*) at Cloudy Bay ranged from 0.26–0.32 (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 10 and 17 years at Cloudy Bay.

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

**Table 3: 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), Rabbit Island Nelson (Michael & Olsen 1988), and Foxton beach, Manawatu coast (Haddon *et al.* 1996).**

| Area | Cloudy Bay | Clifford Bay | Foxton Beach | Rabbit Island |
|---|---|---|---|---|
| Length of beach (km) | 11 | 21 | 27.5 | 8 |
| Biomass (t) | 154 (60) | 284 (123) | 171 | 108 |

### 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 9 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 4.


**Figure 2: Location of sites surveyed.**

**Table 4: MCY estimates (t) for *D. anus* from virgin biomass in 450 m transects at locations sampled around New Zealand (data from Cranfield *et al.* 1994b).**

| Location | $F_{0.1}$ | MCY |
|---|---|---|
| Nuhaka | 0.36 | 2.830 |
| Waitarere | 0.36 | 0.052 |
| Otaki | 0.36 | 2.307 |
| Peka Peka | 0.36 | 1.328 |
| Fence | 0.36 | 0.028 |
| Wairau | 0.36 | 0.019 |
| Leithfield | 0.36 | 1.521 |
| Waikuku | 0.36 | 2.341 |
| Kainga | 0.36 | 2.005 |

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

CAY has not been estimated for *P. donacina*.

## 6. STATUS OF THE STOCKS

Because of the relatively low levels of exploitation of *P. donacina*, 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

Annala JH., Sullivan KJ., O'Brien CJ., Smith NWM. (comps.) 2001. Report from the fishery assessment plenary, May 2001: stock assessments and yield estimates. 515 p. (Unpublished report held in NIWA library, Wellington).

Brierley P. (Convenor) 1990. Management and development of the New Zealand sub–tidal clam fishery. Report of the surf clam working group, MAF Fisheries (unpublished report held in NIWA library, Wellington). 57 p.

Cranfield HJ., Michael KP. 2001. The surf clam fishery in New Zealand: description of the fishery, its management, and the biology of surf clams. New Zealand Fisheries Assessment Report 2001/62. 24 p.

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Haddon M., Willis TJ., Wear RG., Anderlini VC. 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.

Marsden ID. 2000. Variability in low tide populations of tuatua, *Paphies donacina*, in Pegasus Bay, Canterbury, New Zealand. New Zealand Journal of Marine and Freshwater Research 34:359–370.