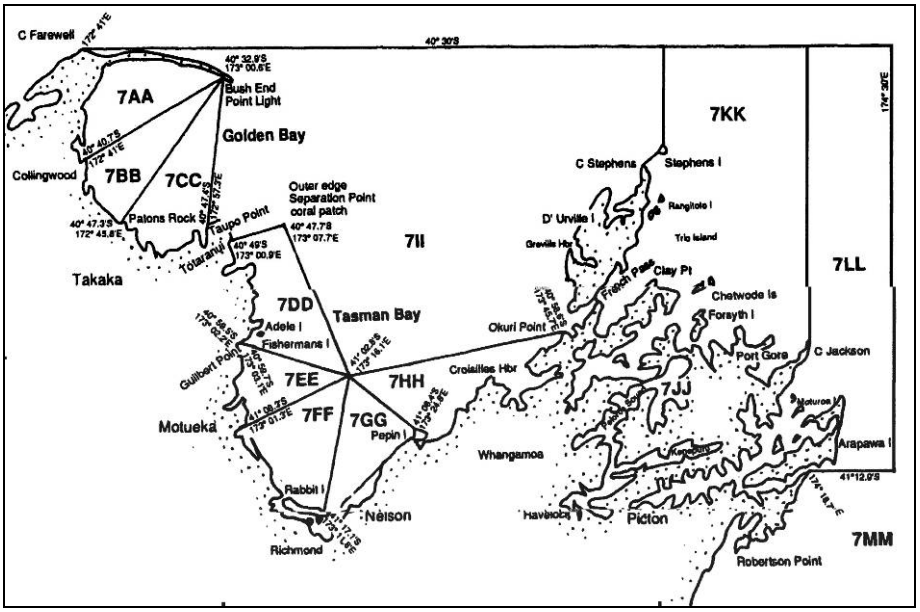
DREDGE OYSTERS (OYS7) – Nelson/Marlborough

(*Tiostrea chilensis*)



1. FISHERY SUMMARY

(a) Commercial fishery

The dredge oyster *Tiostrea chilensis* is widespread throughout New Zealand and is the target of commercial fisheries in Foveaux Strait and (in the past) the Nelson/Marlborough (Challenger) fishery area. Dredge oysters are landed as a bycatch of the Chatham Islands scallop fishery.

Dredge oysters in the Nelson/Marlborough area were first exploited in 1845. From 1963 to 1981 oysters were landed mainly as bycatch, firstly by the green-lipped mussel (*Perna canaliculus*) dredge fishery and subsequently by the scallop (*Pecten novaezelandiae*) fishery (Drummond, 1994a). In 1981 the Challenger scallop fishery was closed, and commercial dredge operators targeted oysters.

Shellfish dredging in Tasman Bay, Golden Bay, and the Marlborough Sounds is a multi-species fishery with oysters, scallops, and green-lipped mussels caught together. Until 1999, oyster and scallop seasons did not overlap, preventing both species being landed together. Since then a relaxation of seasonal restrictions has meant there is now potential for overlap. A recent demand for green-lipped mussels has allowed the dredge oyster fishery to continue increasing the bycatch of green-lipped mussels (R. Mincher, pers. comm.).

In 1983, fishery regulations and effort restrictions were updated (Drummond, 1994a). Fishery regulations included a minimum size (legal sized oysters could not pass through a 58 mm internal diameter ring), an open season (1 March to 31 August), area closures, and a prohibition on dredging at night. A 500 t (green weight) catch restriction was implemented for Tasman Bay in 1986 and extended to include Golden Bay in 1987 (Drummond, 1987). The 500 t catch restriction was revoked in 1996 and a TACC of 505 t set when oysters were brought in to the Quota Management System (Annala et al., 1998). The commercial oyster season was extended to 12 months from the 1999–2000 fishing year. Fishers have been required to land all legal sized oysters, but approval has recently been given to return such oysters to the sea as long as they are likely to survive.

From 1980, catches of oysters, scallops, and mussels from Tasman Bay, Golden Bay, and the Marlborough Sounds were recorded on weekly dredge forms for each Shellfish Management Area. In 1992, the Nelson-Marlborough scallop and dredge oyster statistical areas were established (see area map) by adopting the scallop reporting areas for both fisheries. The oyster season ran over 1 March to 31 August until 1999 and these data are presented by calendar year. Thereafter reported landings are given by fishing year, 1 October to 30 September. Data from 1989–1999 show oysters landed out of season and these data have been included in the summaries shown in Tables 1–3. Most of the catch comes from Tasman Bay, with small landings from Golden Bay.

Table 1: Reported and adjusted catch and landings (t) in the Challenger fishery, 1963–1988 (from Annala et al., 2001).

Year	Reported catch	Adjusted catch	Year	Reported catch	Adjusted catch	Year	Reported catch	Adjusted catch
1963	3	3	1972	65	82	1981	389	492
1964	6	8	1973	190	240	1982	432	546
1965	0	0	1974	78	99	1983	593	750
1966	24	33	1975	136	172	1984	259	328
1967	44	57	1976	392	496	1985	405	512
1968	69	87	1977	212	268	1986	527	667
1969	22	28	1978	40	51	1987	380	–
1970	74	94	1979	83	105	1988	256	–
1971	34	43	1980	160	202			

Table 2: Reported landings (t) in the Challenger fishery for the 1989–1999 oyster seasons (1 March to 31 August). Reported catch 1 is landed green weight from (Annala et al., 2001) and reported catch 2 summarised from LFRR information.

Year	Reported catch 1	Reported catch 2	Year	Reported catch 1	Reported catch 2
1989	530	–	1995	694	745
1990	208	175	1996	580	674
1991	185	206	1997	444	600
1992	279	294	1998	456	404
1993	476	497	1999	335	332
1994	584	598			

Table 3: Reported landings (t) in the Challenger fishery after October 1999 (QMR) when the fishing season was extended to a full year (1 October–30 September). Reported catch 1 is landed green weight.

Fishing year	Reported catch 2
1999–2000	140
2000–2001	25
2001–2002	1.4
2002–2003	183.0
2003-2004	97.5
2004-2005	146.8
2005-2006	170.9

(b) Recreational fishery

The recreational daily bag limit for oysters in the Challenger fishery area is 50 per person. Oysters that cannot pass through a 58 mm internal diameter solid ring are deemed legal size. There is no longer a recreational season for dredge oysters in the Challenger area. Oysters must be landed in their shells. Recreational fishers take oysters in Tasman and Golden Bays by diving and dredging. No data on the size of the recreational catch are available, but catches are thought to be small.

(c) Maori customary fisheries

There are no data available on Maori customary catch. Kaitiaki are being established throughout the Challenger area and estimates of customary harvest can be expected in the future.

(d) Illegal catch

There are no data available on illegal catch.

(e) Other sources of mortality

The Nelson/Marlborough area occasionally experiences blooms of diatoms, which result in an anaerobic slime that smothers benthic fauna (Bradford, 1998; Mackenzie et al., 1983; Tunbridge, 1962). The level of dredge oyster mortality from this source is unknown.

Bonamia exitiosus caused catastrophic mortality in the Foveaux Strait oyster fishery and is endemic in oysters in the Challenger area (M. Hine, pers. comm.). *Apicomplexan* has also been identified in poor condition oysters dredged from Tasman Bay. The level of mortality caused by disease is unknown.

Drummond & Bull (1993) reported low incidental mortality from dredging. No other data are available on incidental mortality of oysters caused by fishing.

2. BIOLOGY

The biology of *T. chilensis* was summarised by Handley and Michael (2001). Most of the parameters required for management purposes are based on the Foveaux Strait fishery described by Cranfield and Allen (1979). See also the OYS 5 report.

Oyster stocks in the Challenger area are generally low and seasonally variable suggesting high variability in recruitment (Osborne, 1999). Challenger oysters are reported to spawn at temperatures above 14°C. In Tasman and Golden Bay, significantly smaller and less developed larvae have been collected in the plankton than those collected from Foveaux Strait, implying Challenger oysters appear to release their larvae into the plankton for longer periods (Cranfield & Michael, 1989). The distances that the larvae could disperse have been estimated at 20 km in 5–12 days. These planktonic larvae may then be concentrated in patches by oceanographic conditions giving rise to substantial spatfalls in areas where suitable settlement surfaces allow.

The variability in shell shapes and high variability in growth rate between individuals, within areas, within the Challenger, and between years require careful consideration in describing growth. Assuming minimum legal size equals 58–65 mm in diameter, data from Drummond (1994b) infer Tasman Bay oysters could grow to legal size in two to three years.

3. STOCKS AND AREAS

No information is available on the stock structure, genetic makeup or biological variation of oysters within the Challenger fishery area.

4. STOCK ASSESSMENT

(a) Estimates of fishery parameters and abundance

Surveys of oysters have been carried out in 1961, 1969–75, 1984–86, 1989 and 1998–2004. However, the results from the early surveys are not directly comparable.

Estimates of the numbers of recruits (oysters unable to pass through a 58 mm ring) and pre-recruits (less than 58 mm) from Tasman Bay Golden Bay and the Marlborough Sounds since 1998 are shown in Table 4.

Table 4: Relative estimates (millions) uncorrected for dredge efficiency of recruited and pre-recruit of oysters in Tasman and Golden Bays from comparable surveys (1998–2004).

	Tasman Bay				Golden Bay			
Year	Recruits	CV	Pre-recruits	CV	Recruits	CV	Pre-recruits	CV
1998	28.7	7.3	30.4	10.1	1.4	13.3	0.4	18.7
1999	24.7	8.6	39.6	13.6	1.9	23.7	1.2	24.8
2000	21.8	8.9	33.5	9.9	1.0	14.3	0.5	17.6
2001	17.8	9.0	23.1	9.1	0.4	20.1	0.4	28.1
2002	15.9	10.6	24.5	11.2	0.4	21.4	0.3	27.1
2003	12.4	9.7	34.3	13.4	0.4	27.1	0.4	27.6
2004	10.9	6.7	16.1	8.1	0.4	25.4	0.2	18.8

The number of recruited dredge oysters in the Marlborough Sounds was estimated at 0.04 million in 2003 and 2004. Estimates of pre-recruits were 0.14 million and 0.18 million in 2003 and 2004, respectively.

(b) Biomass estimates

Estimates of the biomass of oysters in both Tasman Bay and Golden Bay (made from surveys of oysters and scallops combined) show a general decline from 1998 to 2002 (Table 5).

Table 5: Estimates of relative biomass (t) of recruited oysters from Tasman and Golden Bays, 1998–2004.

	Tasman Bay		Golden Bay			
Year	Biomass (t)	CV	Biomass (t)	CV	Total biomass (t)	References
1998	2 214	7.3	113	11.5	2 327	Osborne (1999)
1999	2 012	8.1	151	22.1	2 163	Breen & Kendrick (1999)
2000	1 810	8.8	86	15.4	1 895	Breen (2000)
2001	1 353	9.7	25	20.3	1 378	Horn (2001)
2002	1 134	10.0	28	21.9	1 162	Horn (2002)
2003	1 019	10.0	23	26.6	1 042	Horn (2003)
2004	894	6.9	28	22.4	921	Horn (2004)

(c) Estimates of Maximum Constant Yield (MCY)

Drummond (1994) estimated a MCY of 300 tonnes using method 4 in Annala et al. (2001), but Osborne concluded that catch levels in Challenger appear to be driven by the economics of the catch rates (Osborne, 1999). She used equation 2 of Annala et al. (2001) to estimate MCY (Table 6):

$$MCY = 0.5F_{0.1}B_{av}$$

Where B_{av} = 1974 tonnes (from relative biomass estimates from CSEC surveys). These estimates are not corrected for dredge efficiency (assumed to be 100%) and are likely to be conservative. For M of 0.1–0.3, yields range from 286–543 t. Osborne (1999) considered a MCY of 500 t 'safe' based on the 100% dredge efficiency used to estimate biomass.

Table 6: Estimates of $F_{0.1}$ and MCY for M 0.1–0.9. MCY 1 was estimated using $F_{0.1}$ 1 from Osborne (1999), MCY 2 from $F_{0.1}$ 2 estimated from von Bertalanffy growth parameters estimated by Osborne (1999) , growth data Drummond, (1994b) and Foveaux Strait oyster size weight data, and MCY 3 from $F_{0.1}$ 3 estimated von Bertalanffy growth parameters from GROTAG using the same growth and size weight data.

M	$F_{0.1}$ 1	MCY 1	$F_{0.1}$ 2	MCY 2	$F_{0.1}$ 3	MCY 3
0.1	0.29	286	0.17	168	0.22	217
0.2	–	–	–	–	0.38	375
0.3	0.45	444	0.38	375	0.55	543
0.4	–	–	–	–	0.71	701
0.5	0.67	661	0.62	612	0.88	869
0.6	–	–	–	–	1.04	1 026
0.7	0.93	918	0.89	878	1.21	1 194
0.8	–	–	–	–	1.37	1 352
0.9	1.22	1 204	1.19	1 175	1.54	1 520

(d) Estimation of Current Annual Yield (CAY)

In 2001, CAY was estimated using Method 1 (Annala et al., 2001) assuming dredge oysters are landed over the year and $F_{0.1}$ estimated by the three methods and the 2001 estimate of biomass (Table 7).

$$CAY = F_{ref} / (F_{ref}+M) * (1 - e^{-(Fref+M)}) * B_{beg}$$

Table 7: Estimates of $F_{0.1}$ and CAY for M 0.1–0.9. CAY 1 was estimated using $F_{0.1}$ 1 from Osborne (1999), CAY 2 from $F_{0.1}$ 2 estimated from von Bertalanffy growth parameters estimated by Osborne (1999) using growth data (Drummond, 1994b) and Foveaux Strait oyster size weight data, and CAY 3 from $F_{0.1}$ 3 estimated von Bertalanffy growth parameters from GROTAG using the same growth and size weight data.

M	$F_{0.1}$1	CAY 1	$F_{0.1}$2	CAY 2	$F_{0.1}$3	CAY 3
0.1	0.29	331	0.17	205	0.22	259
0.2	–	–	–	–	0.38	397
0.3	0.45	436	0.38	380	0.55	511
0.4	–	–	–	–	0.71	591
0.5	0.67	544	0.62	514	0.88	658
0.6	–	–	–	–	1.04	704
0.7	0.93	632	0.89	614	1.21	744
0.8	–	–	–	–	1.37	771
0.9	1.22	698	1.19	688	1.54	794

The risk to the stock associated with harvesting at the estimated CAYs cannot be determined.

(e) Other yield estimates and stock assessment results

There are no other yield estimates and stock assessments

(f) Other factors

The challenger dredge oyster fishery is thought to be recruitment-limited. Drummond (1994a) Stead (1976) and Tunbridge (1962) attributed the lack of dense aggregations of oysters in the Challenger fishery (compared to Foveaux Strait) to habitat limitations.

Growth is thought to be highly variable, but commercial densities of oysters can develop quickly with good settlement and favourable growing conditions. Recent declines in biomass and catch suggest that caution should be exercised.

5. STATUS OF THE STOCKS

In Tasman Bay, biomass estimates derived from annual surveys decreased steadily from 2214 t in 1998 to 894 t in 2004. In Golden Bay, biomass estimates decreased from 113 t in 1998 to 25 t in 2001, and have remained relatively constant (23–28 t) since then.

For Nelson/Marlborough dredge oysters it is not known if recent catch levels or the current TACC are sustainable or at levels that will allow the stock to move towards a size which will support the MSY.

TACC and reported landings for the 2005/06 fishing year are summarised in Table 8.

Table 8: Summary of TACC (t) and reported landings (t) for the 2005-06 fishing years.

QMA	TAC	Actual TACC	Reported commercial landings
OYS 7	_	505	170.9

6. FOR FURTHER INFORMATION

Annala, J. H.; Sullivan, K. J.; O'Brien, C. J.; Iball, S. D. (1998). Report from the Fishery Assessment Plenary, May 1998: stock assessments and yield estimates. Wellington, Ministry of Fisheries. 409 p.

Annala, J. H.; Sullivan, K. J.; O'Brien, C. J.; Smith, N. W. M. (2001). Report from the Fishery Assessment Plenary, May 2001: stock assessments and yield estimates. Wellington, Ministry of Fisheries. 515 p.

Bradford, E. (1998). Harvest estimates from the 1996 national marine recreational fisheries surveys. Wellington, Ministry of Fisheries. 27 p.

Breen, P. A. (1998). Possible harvest strategies for the Challenger dredge oyster fishery. NIWA client report WLG98/29.

Breen, P. A. (2000). Survey of Scallops and oysters in Golden Bay, Tasman Bay, and the Marlborough Sounds in May-June 2000. National Institute of Water and Atmospheric Research Ltd. Client Report WLG00/52.

Breen, P. A.; Kendrick, H. T. (1999). Survey of Scallops in Golden Bay, Tasman Bay, and the Marlborough Sounds in June 1999. National Institute of Water and Atmospheric Research Ltd. Client Report

Cranfield, H. J.; Allen, R. A. (1977). Fertility and larval production in an unexploited population of oysters, *Ostrea lutaria* Hutton, from Foveaux Strait. *New Zealand Journal of Marine and Freshwater Research 11*: 239–253.

Cranfield, H. J.; Allen, R. L. (1979). Mark-recapture surveys of the Foveaux Strait dredge oyster (*Ostrea lutaria*) population. *Rapports et Procès-verbaux des réunions. Conseil Permanent International pour l'Exploration de la Mer 175*: 63–69.

Cranfield, H. J.; Michael, K. P. (1989). Larvae of the incubatory oyster *Tiostrea chilensis* (Bivalvia: Ostreidae) in the plankton of central and southern New Zealand. *New Zealand Journal of Marine and Freshwater Research 23*: 51–60.

Drummond, K. (1987). The Nelson Marlborough dredge oyster (*Tiostrea lutaria*) fishery. MAF Fisheries unpublished report.

Drummond, K. (1994a). Draft New Zealand Fisheries Assessment Document 1994. The Challenger dredge oyster *Tiostrea chilensis* fishery. MAF Fisheries unpublished report.

Drummond, K.; Bull, M. (1993). Oyster enhancement research trials. MAF Fisheries internal memorandum, 18 August, Unpublished.

Drummond, K. L. (1994b). Report on Tasman Bay dredge oyster productivity trials. MAF Fisheries Central Region Internal Report.23.

Dunn, A.; Michael, K. P.; Hine, P. M.; Andrew, N. L.; Diggles, B. K.; Cranfield, H. J. (2000). Analysis of a survey of the prevalence and intensity of *Bonamia* sp. in Foveaux Strait oysters. *New Zealand Fisheries Assessment Report 2000*: 28 p.

Horn, P.L. (2001). Survey of scallops and oysters in Golden Bay, Tasman Bay, and the Marlborough Sounds, in May 2001. Report prepared for Challenger Scallop Enhancement Company Ltd. NIWA Client Report CSE01403. 32 p.

Horn, P.L. (2002). Survey of scallops and oysters in Golden Bay, Tasman Bay, and the Marlborough Sounds, in May 2002. Report prepared for Challenger Scallop Enhancement Company Ltd. NIWA Client Report CSE02403. 29 p.

Horn, P.L. (2003). Survey of scallops and oysters in Golden Bay, Tasman Bay, and the Marlborough Sounds, in May–June 2003. NIWA Client Report NEL2003-014. 34 p.

Horn, P.L. (2004). Survey of scallops and oysters in Golden Bay, Tasman Bay, and the Marlborough Sounds, in May–June 2004. NIWA Client Report NEL2004-008. 42 p.

Mackenzie, A. L.; Gillespie, P. A.; Grant, W. D.; Juniper, S. K.; Chang, H.; Bradstock, M. (1983). An ecological investigation of a slime associated phytoplankton bloom in Tasman Bay, New Zealand. *Pacific Science Association 15th Congress: programme, abstracts and congress information / Pacific Science Association.* 155.

Osborne, T. A. (1998). Relative Biomass of Oysters in Golden and Tasman Bays, 1998. Osborne Research Company Ltd. Client Report ORCO Report 1003.

Osborne, T. A. (1999). Nelson Dredge Oyster Stock Assessment. Osborne Research Company Ltd. Client Report ORCO Report 7.

Stead, D. H. (1976). The Dredge Fishery for Scallops, Mussels, and Oysters in Golden Bay and Tasman Bay: Survey Results 1969–1975. Fisheries Management Division, Ministry of Agriculture and Fisheries, New Zealand.

Tunbridge, B. R. (1962). Occurrence and distribution of the dredge oyster (*Ostrea sinuata*) in Tasman and Golden Bays. *Fisheries Technical Report (6)* 42 p.

Westerkov, K. (1980). Aspects of the biology of the dredge oyster *Ostrea lutaria* Hutton, 1873. Thesis. University of Otago.