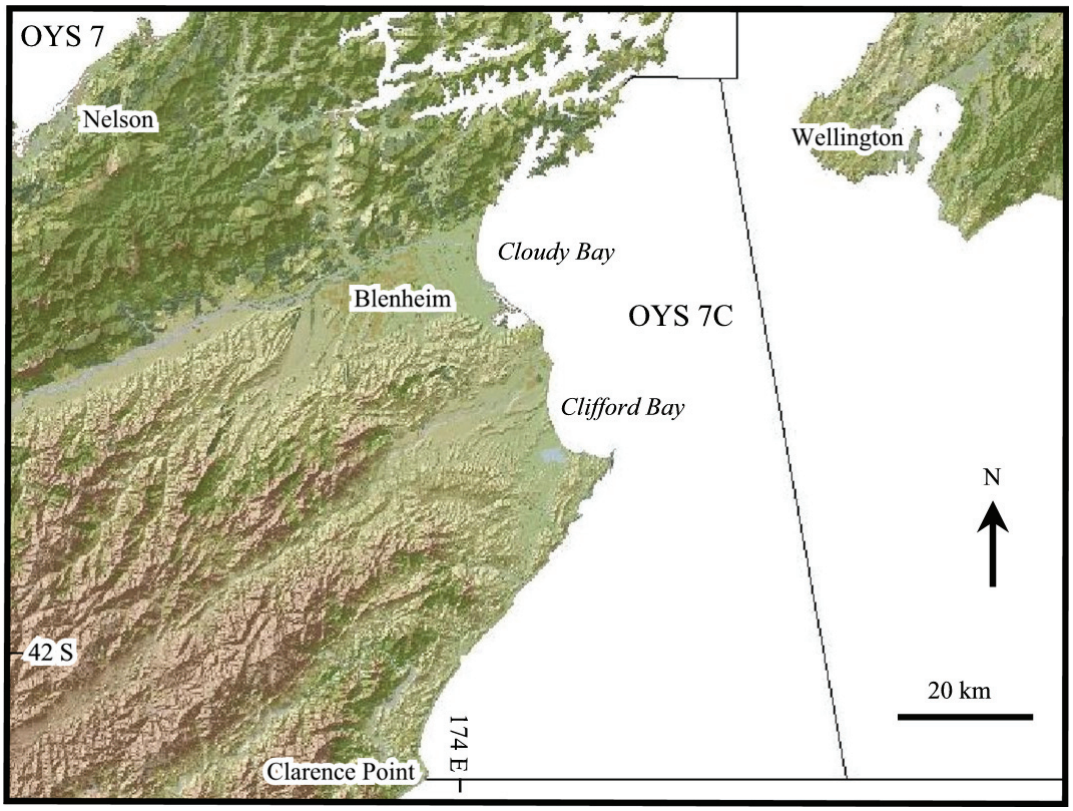
DREDGE OYSTERS (OYS 7C) – Challenger Marlborough

(Ostrea chilensis)



1. FISHERY SUMMARY

1.1 Commercial fishery

Area OYS 7C encompasses an area from West Head, Tory Channel in the north to Clarence Point in the south including Cloudy Bay and Clifford Bay. OYS7 and OYS 7C are considered as separate fisheries on the basis of differences in habitat and environmental parameters.

There is historical evidence of limited exploitation of oyster beds within Port Underwood as early as the 1800's (K. Wright pers comm. in Drummond 1994). Limited fishing under a special permit took place south of Tory Channel on the east coast of the South island in 1990 and 1991.

Oysters in the area Clarence Point to West Head, Tory Channel, were introduced into the QMS as OYS 7C in October 2005 with a TAC of 5 t and a TACC of 2 t. The TAC was increased to 50 t and the TACC to 43 t as from 1 October 2007. A further increase has been approved beginning 1 October 2009. The TAC will be 72 t, with a TAC of 63 t and an increase in the other mortality allowance to 7 t. The fishing year runs from 1 October to 30 September. Since 2005 catch has been reported via Monthly Harvest Returns shown in Table 1. During the 2007-08 season fishing took place over 30 fishing days from December to February and in 2008-09 fishing took place from January to April. The historical landings and TACC for OYS7C are depicted in Figure 1.

Table 1: Reported landings (t) in the OYS 7C fishery since October 2005 (QMS). Reported catch is landed green weight summarised from Monthly Harvest Returns.

Fishing year	TAC	TACC	Reported Catch (MHR)
2005–06	5	2	0.082
2006–07	5	2	0
2007-08	50	43	40.9
2008-09	50	43	38.2*

*At time of writing MHRs for April 2009 had not been furnished to the Ministry of Fisheries and industry sources reported that the total catch for 2008-09 was 43 tonnes (pers. comm. Mitch Campbell, Challenger Oyster Management Company Ltd).

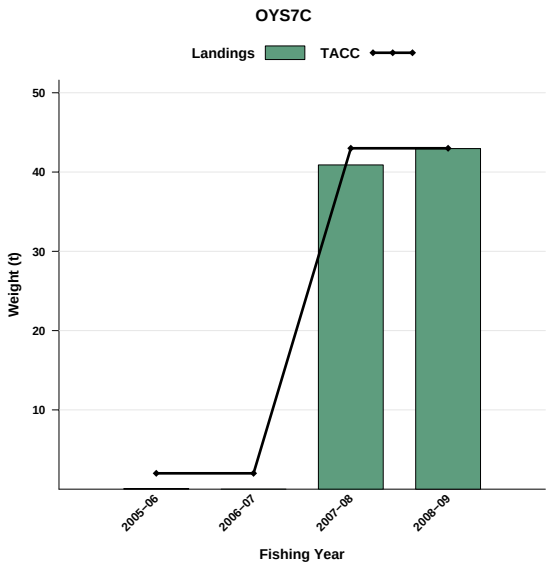


Figure 1: Historical landings and TACC for OYS7C (Challenger Marlborough). Note that this figure does not show data prior to entry into the QMS.

1.2 Recreational fishery

The recreational catch allowance for OYS 7C is 1 tonne. 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. The recreational season for dredge oysters in the Challenger area is all year round. Oysters must be landed in their shells. There is no data available on the recreational catch within OYS 7C.

1.3 Customary non-commercial fisheries

The customary catch allowance for OYS 7C is 1 tonne. There are no data available on the customary non-commercial catch.

1.4 Illegal catch

There are no data available on illegal catch.

1.5 Other sources of mortality

Bonamia exitiosa caused catastrophic mortality in the Foveaux Strait oyster fishery and is endemic in oysters in the Challenger area (Hine pers. comm.). The level of mortality caused by disease is unknown. Allowance for 5 t of incidental mortality (dredge mortality, disease mortality and illegal harvest) is included in the TAC.

2. BIOLOGY

There are no known biological studies of *O. chilensis* specific to the OYS 7C area. In the absence of area-specific estimates for OYS 7C, parameters required for management purposes in that area are based on the Foveaux Strait fishery (see the OYU 5 report) described by Cranfield and Allen (1979) or the OYS 7 (Tasman Bay) fishery. The biology of oysters in the neighbouring area OYS 7 (Tasman and Golden Bay) was summarised by Handley and Michael (2001), and further biological data was presented in Brown *et al.* (2008).

The variability in shell shapes and high variability in growth rate between individuals, between areas within the Challenger fishery, 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. Osborne (1999) used results from a MAF Fisheries study conducted in Tasman Bay between 1990-1994 to construct a von Bertalanffy equation describing oyster growth in the Challenger fishery. Brown *et al.* (2008) estimated von Bertalanffy growth parameters based on limited data for oysters up to 2.3 yrs old. These data indicated

that 77% of three year old oysters and 82% of 4 year old oysters would attain lengths greater than the minimum legal size of 58 mm length at the start of the fishing season. Von Bertalanffy growth parameters from studies in Tasman Bay are shown in Table 2. Estimates of instantaneous natural mortality (M) of Tasman Bay oysters from Drummond (1993, 1994) and of Foveaux oysters (Dunn *et al*. 1998b, MFish 2008) considered in estimating yield in the OYS 7C fishery (Brown & Horn 2007) are also provided in Table 2. Estimates of *M* based on experimental data from Foveaux and Tasman Bay ranged from 0.042 (Dunn et al 1998b) to 0.92 (Drummond et al. 1994). However, after some discussion the Shellfish Working Group concluded that those figures were not realistic, and that *M* was likely to lie between 0.1 and 0.3.

Table 2: Estimates of biological parameters from OYS 7 and OYU 5 considered in estimating yield for OYS 7C.

1. Natural Mortality (M)

Area	Estimate	Source
Tasman Bay	0.92	Drummond (1994)
Tasman Bay	0.2	Drummond (1993)
Foveaux Strait	0.042	Dunn et al. (1998b)
Foveaux Strait	0.1	Allen (1979)

2. Von Bertalanffy growth (change in diameter mm) parameter estimates from OYS 7. t_0 not provided by Osborne (1999).

K	L_{inf}	t_0	Source
0.597	85.43	-	Osborne (1999)
0.99 +/- 0.16 (sd)	67.52	0.11	Brown et al. (2008)

3. STOCKS AND AREAS

Fishing within OYS 7C has been limited to parts of Clifford Bay, Cloudy Bay and immediately south of Tory Channel, and commercial oyster fishing has not extended south of Cape Campbell. The OYS 7C stock can be considered biologically isolated from the Foveaux Strait population on the basis of geographical distance. However, the population in OYS 7 and OYS 7C are likely to be genetically linked because of gene flow between the different stocks. Oysters in OYS 7C (Cloudy Bay/Clifford Bay) and OYU 5 (Foveaux) both comprise rather discrete patches of oysters on a predominantly sandy substrate whereas OYS 7 (Tasman Bay) oysters tend to be more uniformly distributed at a lower density on muddy habitat. Environmental factors such as hydrodynamics, seasonal water temperature and riverine inputs differ substantially among the OYS 7, OYS 7C and OYU 5 areas and are likely to influence the biological characteristics of those oyster populations. Oysters in OYS 7C are generally more abundant and occur at higher density than in OYS 7 (Brown & Horn 2007).

4. STOCK ASSESSMENT

4.1 Estimates of fishery parameters and abundance

A survey of oysters carried out in 2007 (Brown & Horn 2007) estimated the number of recruits (oysters unable to pass through a 58 mm ring) and pre-recruits (less than 58 mm) from Clifford and Cloudy Bay. Dredge efficiency was assumed to be 100% for the purposes of the survey.

Table 3: Estimate of number of recruit and pre-recruit oysters from Brown & Horn (2007).

Year	Area (Ha)	Recruit No. estimate	CV %	Pre-recruit No. estimate	CV %
2007	43 709	19.5 Million	19	14 Million	19

4.2 Biomass estimates

The recruited biomass (≥58 mm) of oysters in Cloudy Bay and Clifford Bay was estimated in a survey carried out in 2007 (Brown & Horn 2007).

Table 4: Estimate of relative recruited oyster (≥58 mm) biomass (t) in OYS 7C (Brown & Horn 2007).

Year	Area (Ha)	Biomass estimate	CV %
2007	43 709	1 778	19

4.3 Estimates of Maximum Constant Yield (MCY)

For new fisheries where there are insufficient data to conduct a yield per recruit analysis, yield can be estimated using the formula from Mace (1988) recommended by the Ministry of Fisheries (MFish 2008) for calculation of Maximum Constant Yield (MCY).

$$MCY = 0.25MB_0$$

where B_0 is an estimate of virgin recruited biomass (here assumed to equal the recruited biomass estimate from the survey, divided by dredge efficiency) and *M* is an estimate of natural mortality.

There have been no studies to estimate *M* and dredge efficiency specifically within OYS 7C, so the most relevant figures available are those from studies in Foveaux Strait and Tasman Bay. Available estimates of M and dredge efficiency from those fisheries range widely. For example, estimates of *M* have ranged from 0.042 in Foveaux Strait (Dunn et al 1998b) to 0.92 ± 0.48 in Tasman Bay (Drummond 1994). Existing dredge efficiency estimates for similar dredge types within the OYS 7 fishery in Tasman Bay are also uncertain, ranging from 36% (Drummond 1987) to 64% (Bull 1989). Furthermore, the applicability of estimates from these studies in Tasman Bay to the fishery in Cloudy Bay is uncertain given that dredge specifications are slightly different and performance on the substrate in Cloudy Bay may also differ.

A range of MCY estimates are given in Table 5 using values for dredge efficiency of 100% and 64% (Bull 1989), and values for *M* ranging from 0.042 to 0.9 taken from studies conducted in the Foveaux and Nelson-Marlborough oyster fisheries.

Where B_0 = 1778 tonnes (Brown & Horn 2007).

Table 5: Estimates of MCY for *M* of 0.042–0.9. MCY 1 was estimated using Dredge efficiency of 64% from Bull (1989) and MCY 2 using dredge efficiency of 100%.

M	MCY 1	MCY 2
0.042	29	19
0.1	69	44
0.2	139	89
0.3	208	133
0.4	278	178
0.5	347	222
0.6	417	267
0.7	486	311
0.8	556	356
0.9	625	400

4.4 Other Yield Estimates

Incidental mortality of oysters caused by the dredge method is poorly known for this fishery but is thought to be low based on studies in other oyster fisheries. If it is not low, however, incidental mortality would make estimates of yield that assume <100% dredge efficiency optimistic. If 100% dredge efficiency is assumed, then incidental mortality should be assumed to have, at most, a small impact.

4.4.1 Estimation of Current Annual Yield (CAY)

No biomass surveys have been conducted since the TAC was raised from 5 t to 50 t in 2007 so CAY for 2009 cannot be estimated. However a retrospective CAY can be calculated using the estimated relative biomass of 1778 t (B_{BEG}) from the 2007 survey of Brown & Horn (2007) and the formula from the 'Methods of Estimating CAY' section in Ministry of Fisheries (2008)(Table 6**).** In the absence of an estimate for F_{REF}, *M* is used instead following methods in Ministry of Fisheries (2008).

$$CAY = \frac{F_{ref}}{F_{ref} + M}(1 - e^{-(F_{ref}+M)})B_{beg}$$

Table 6: Estimates of CAY for M of 0.042–0.9. CAY 1 was estimated assuming dredge efficiency of 64% from Bull (1989) and CAY 2 assuming dredge efficiency of 100%.

M	CAY 1	CAY 2
0.042	112	72
0.1	252	161
0.2	458	293
0.3	627	401
0.4	765	490
0.5	878	562
0.6	971	621
0.7	1047	670
0.8	1109	710
0.9	1159	742

4.6 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 a scarcity of suitable settlement surface. Challenger Oyster Management Company initiated habitat enhancement trials in 2008, aimed at boosting productivity of the fishery (Brown et al. 2008).

Dredging for oysters will have an impact on the soft sediment habitats within Cloudy and Clifford Bays, and will affect both the dredge oyster beds and other species found in association with these beds. In addition, various areas within the fishery (mainly around coastal rocky reefs) are understood to support a range of sensitive invertebrate species including soft corals, large erect and divaricating bryozoans, starfish, horse mussels, and crabs. The impacts of dredging are likely to be more severe on these habitats than on soft sediments, and will increase with increasing fishing effort, but there is insufficient information to quantify the degree of impact under any given TAC. Although the fishery has been subject to little commercial dredging, the habitat where dredge oysters occur is likely to have been modified by bottom trawling.

Industry has proposed to voluntarily restrict fishing to two discrete areas to mitigate the effects of fishing. These areas are where oyster densities are highest. By-catch of benthic invertebrates was collected during the biomass survey and could be analysed to help to determine the distribution of sensitive habitats.

7. STOCK STATUS

TACC and reported landings for the 2008–09 fishing year are summarised in Table 7.

Table 7: Summary of TACC (t) and reported landings (t) for the 2008–09 fishing year for OYS 7C.

QMA	TAC	TACC	Reported commercial landings
OYS 7C	50	43	43.0

Stock Structure Assumptions

Oysters in OYS 7C (Cloudy Bay/Clifford Bay) form discrete patches on a predominantly sandy substrate. The stock is likely to be biologically isolated from the Foveaux Strait population on the basis of geographical distance. The populations in OYS 7 and OYS 7C are very likely genetically linked because they share boundaries.

Stock Status	
Year of Most Recent Assessment	2009
Reference Points	Target: Not established Soft Limit: 20% B_0 Hard Limit: 10% B_0

Status in relation to Target	Unknown
Status in relation to Limits	Close to virgin size and Exceptionally Unlikely (<1%) to be below the Soft Limit.

Fishery and Stock Trends	
Recent trend in Biomass or Proxy	The fishery is new and no biomass trend has been established. Only one biomass survey has been conducted prior to the increase in TAC in 2007. Stocks are likely to be close to virgin biomass (B_0) because the area has been commercially fished for only two seasons at the increased TAC.
Recent trend in Fishing Mortality or Proxy	Exploitation rate is 2.5% per year (assuming 100% dredge efficiency) at the current TACC.
Other Abundance Indices	
Trends in Other Relevant Indicator or Variables	

Projections and Prognosis	
Stock Projections or Prognosis	Quantitative stock projections are unavailable. The FAWG was asked to evaluate the implications of raising the TACC by 15–20 t. It was considered Very Unlikely (< 10%) that an increase in the TACC of this amount would cause the biomass to decline below the Soft Limit in the next 3 to 5 years.
Probability of Current Catch / TACC causing decline below Limits	Soft Limit: Unknown Hard Limit: Unknown

Assessment Methodology		
Assessment Type	Level 2: Partial Quantitative Stock Assessment: periodic random stratified dredge surveys.	
Assessment Method	Yields are estimated as a proportion of the survey biomass for a range of assumed values of natural mortality and dredge efficiency.	
Main data inputs	Biomass survey: 2007	
Period of Assessment	Latest assessment: 2009	Next assessment: Unknown
Changes to Model Structure and Assumptions		
Major Sources of Uncertainty	There has been only a single biomass survey of this Fishstock and repeat surveys should be scheduled at regular intervals. Natural mortality (M) and dredge efficiency are poorly known but are integral parameters of the method used to estimate yield.	

Qualifying Comments
Some of the surveyed area was not actively fished up to 2009. There are areas of potential oyster habitat which are not fished due to sanitation concerns and substrate which is marginal for fishing.

Fishery Interactions

6. FOR FURTHER INFORMATION

Allen, R. L.1979 A yield model for the Foveaux Strait oyster (*Ostrea lutaria*) fishery. *Rapports et Proces-verbaux des reunions. Conseil Permanent International pour l'Exploration de la mer* 175: 70-79A

Bull, M. F. (1989. Dredge Oyster Survey, Tasman Bay. October-November, 1989. MAFFish Central Region unpublished report.

Brown S., Horn, P. L. 2007. Survey of scallops and oysters in Golden Bay, Tasman Bay, and the Marlborough Sounds, in May 2007. NIWA Client Report NEL2007-012. 41p.

Brown S., Campbell M., Handley S., Michael K., Cairney D., Bradley A., Moremede S. 2008. Challenger oyster enhancement research programme. NIWA Client Report NEL2008-032. 77p.

Cranfield HJ., Allen RL. 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.

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 KL. 1994b. Report on Tasman Bay dredge oyster productivity trials. MAF Fisheries Central Region Internal Report.23.

Dunn, A.; Doonan, I.J.D.; Cranfield, H.J.; Michael, K. P.; Stotter, D. R. (1998):Modelling Growth of the Foveaux Strait Oyster (Tiostrea chilensis). Final research report for Ministry of Fisheries Research Project OYS9701, December 1998, 16p.

Dunn, A.; Cranfield, H.J.; Michael, K. P.; (1998b):Estimates of natural mortality of the Foveaux Strait Oyster (Tiostrea chilensis). Final research report for Ministry of Fisheries Research Project OYS9701, December 1998, 12p.

Handley S., Michael, K. 2001. Research plan for the Challenger dredge oyster fishery: A summary of existing knowledge and options for further research. NIWA client report no. CSE01402. 42 p.

Mace P. M. 1988 The relevance of MSY and other biological reference points to stock assessments in New Zealand. New Zealand Fisheries Assessment Research Document 1988/30. xxp.

Ministry of Fisheries Science Group; (2008) Report from the Fishery Assessment Plenary, May 2008: stock assessments and yield estimates.Part 1 Wellington, Ministry of Fisheries. 348p.

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

Osborne TA. 1999. Nelson Dredge Oyster Stock Assessment. Osborne Research Company Ltd. Client Report ORCO Report 7.

Stead DH. 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.

Sullivan KJ., Mace P.M, Mcl. Smith N.W.,Griffiths M.H., Todd P.R., Livingston M.E., Harley S.J., Key J.M., Connell A.M.. 2005. Report from the Fishery Assessment Plenary, May 2005: stock assessments and yield estimates. Wellington, Ministry of Fisheries. 364p

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