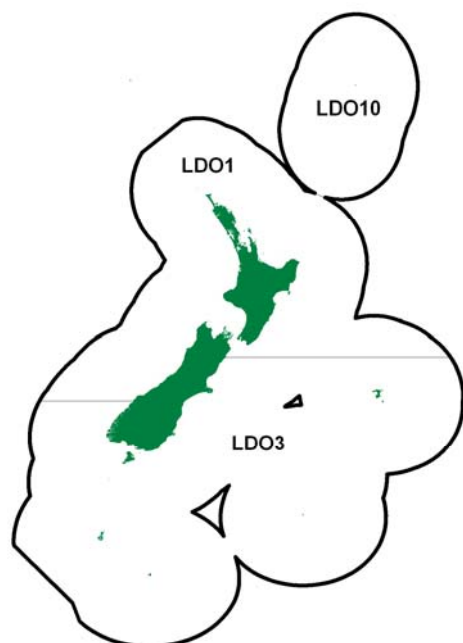


## LOOKDOWN DORY (LDO)

*(Cyttus traversi)*

## 1. FISHERY SUMMARY

Lookdown dory was introduced into the Quota Management System (QMS) on 1 October 2004 with the allowances, TACs and TACCs in Table 1. It is currently managed as three stocks: LDO 1 which comprises FMAs 1-2 and 7-9; LDO 3 which comprises FMAs 3-6; and LDO 10 (Kermadec region).

**Table 1: Recreational and customary non-commercial allowances, TACCs and TACs, by Fishstock, for lookdown dory.**

Fishstock	Recreational Allowance	Customary non-commercial Allowance	TACC	TAC
LDO 1	0	0	168	168
LDO 3	0	0	614	614
LDO 10	0	0	1	1
Total	0	0	783	783

### 1.1 Commercial fisheries

Reliable landings data are available from 1989-90 onwards, after the introduction of Catch Landing Returns (CLRs) in the previous year (Table 2). Annual landings are also available from Licensed Fish Receiver Returns (LFRRs), and these agree well with CLR figures in most years (within 10%), but differ by 20-27% in 4 of the 12 years with comparable data (Table 3). Total landings (CLR) have increased steadily from 127 t in 1989-90 to 760 t in 2001-02. Estimated catch as a percentage of recorded landings were moderate in the early 1990s at 60-70%, but subsequently declined to around 30%. Lookdown dory will often not be included within the top five species in a trawl haul, but the reason for the declining percentage of landings recorded as catch is unknown.

Since entering the QMS, catches in LDO 1 have exceeded the TACC slightly in some years (Table 2). The TACC in LDO 3 has never been caught. This probably reflects the reduction in the size of the trawl fishery on the Chatham Rise where the greatest proportion of lookdown dory has been taken as bycatch. No catch has been reported from LDO 10. Figure 1 shows the historical landings and TACC values for LDO 1 and LDO 3.

There is a seasonal pattern of catch of lookdown dory on the west coast South Island in relation to target fishing for spawning hoki and hake in winter. Catches elsewhere are also dependent on fishing activity in target fisheries but, other than a slight decline in winter months in relation to the shift in area of operation of the hoki fleet, they tend to be less seasonal.

**Table 2: Reported domestic landings (t) of lockdown dory by Fishstock and TACC from 2004-05 to 2015-16.**

Fishstock FMA	LDO1 1,2,7,8&9		LDO3 3,4,5&6		LDO10 10		Total	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
2004-05	110	168	272	614	0	1	382	783
2005-06	180	168	290	614	0	1	470	783
2006-07	147	168	284	614	0	1	431	783
2007-08	174	168	256	614	0	1	430	783
2008-09	144	168	315	614	0	1	459	783
2009-10	161	168	274	614	0	1	435	783
2010-11	165	168	216	614	0	1	380	783
2011-12	153	168	229	614	0	1	382	783
2012-13	185	168	309	614	0	1	494	783
2013-14	204	168	256	614	0	1	460	783
2014-15	207	168	357	614	0	1	564	783
2015-16	166	168	342	614	0	1	507	783

**Table 3: Reported landings and estimated catch (t) of lockdown dory by fishing year. Also, percentage of landings recorded as catch in the catch effort databases.**

Year	Landings (CLR)	Landings (LFRR)	Estimated catch (t)	% of CLR landings recorded as estimated catch
1989-90	127	161	80	63
1990-91	164	182	105	64
1991-92	249	216	177	71
1992-93	275	264	159	58
1993-94	188	226	117	62
1994-95	283	277	125	44
1995-96	260	276	107	41
1996-97	354	426	173	49
1997-98	564	557	265	47
1998-99	625	640	228	36
1999-00	637	605	215	34
2000-01	694	504	157	23
2001-02	760	-	254	33

-, data not available

Lookdown dory is generally caught by bottom trawling in depths of 200 to 800 m mainly as bycatch in the hoki fishery, but also in a variety of other target fisheries such as barracouta, hake, ling, scampi, squid and jack mackerel. A small amount of target fishing is reported from FMA 7. Most of the catch has come from FMA 3 (east coast South Island), FMA 4 (Chatham Rise), and FMA 7 (west coast South Island) (Table 4). Landings from around the North Island have been restricted mostly to a few tonnes each year from FMAs 1, 2, 8 and 9. In FMA 5 (Southland) and FMA 6 (Sub-Antarctic) landings have been in the order of 10-30 t over the past six years. 123 kg of lockdown dory were reported to have been caught from outside the New Zealand EEZ in the 2012-13 fishing year.

**Table 4: Reported historic landings (rounded to nearest tonne) of lockdown dory by FMA and fishing year 1989-90 to 2003-04.**

Year	FMA 1	FMA 2	FMA 3	FMA 4	FMA 5	FMA 6	FMA 7	FMA 8	FMA 9	FMA 10
1989-90	2	1	40	20	12	2	51	-	-	-
1990-91	3	4	46	59	10	11	33	< 1	-	-
1991-92	1	2	96	75	17	3	55	-	-	-
1992-93	1	4	63	112	10	2	83	-	-	-
1993-94	< 1	2	62	50	4	3	67	-	< 1	-
1994-95	1	6	73	108	7	3	85	-	< 1	-
1995-96	2	4	99	78	11	3	62	-	< 1	-
1996-97	7	10	108	110	11	7	100	< 1	< 1	-
1997-98	5	8	159	272	11	25	82	-	< 1	-
1998-99	3	3	161	295	21	17	124	< 1	10	-
1999-00	3	5	161	295	21	17	124	< 1	10	-
2000-01	2	6	203	318	24	25	111	< 1	4	-
2001-02	10	10	181	331	26	28	170	3	2	-
2002-03	8	8	261	365	48	32	167	1	2	-
2003-04	13	8	135	210	22	24	113	3	1	-

## 1.2 Recreational fisheries

There is no quantitative information on recreational harvest levels of lockdown dory. Due to the offshore location and depth distribution of lockdown dory recreational catch is thought to be negligible.

## LOOKDOWN DORY (LDO)

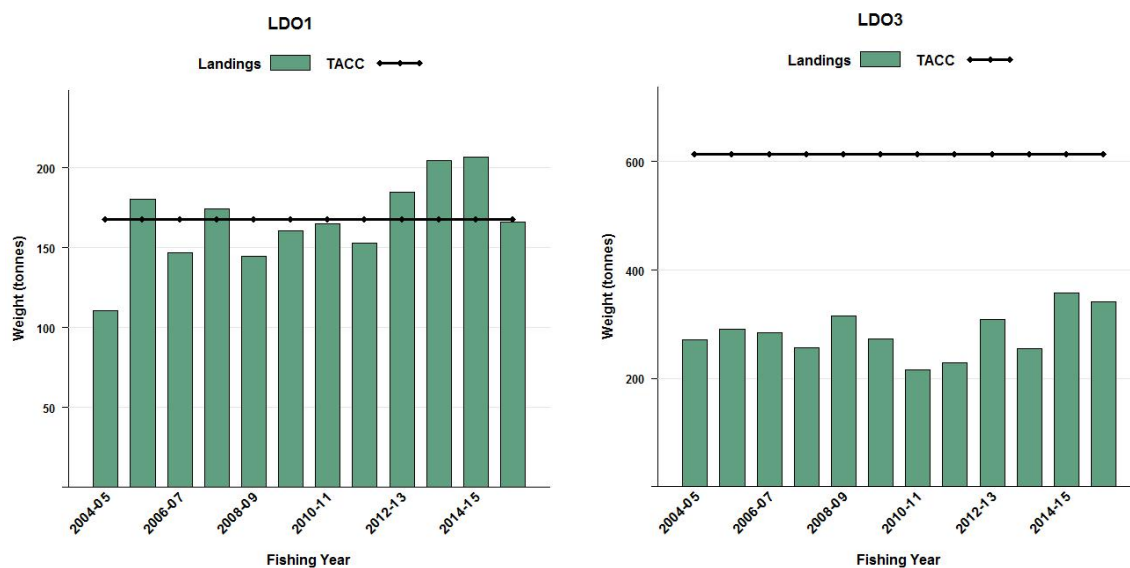


Figure 1: Reported commercial landings and TACC for the two main LDO stocks. Left to right: LDO1 (Challenger, Central, Auckland), and LDO3 (South East Chatham Rise, South East Coast, Sub Antarctic, Southland). Note that this figure does not show data prior to entry into the QMS.

### 1.3 Customary non-commercial fisheries

An estimate of current catch is not available but given the offshore location and depth distribution of lockdown dory customary non-commercial catch is thought to be negligible.

### 1.4 Illegal catch

Estimates of illegal catch are not available.

### 1.5 Other sources of mortality

There is no quantitative information on the level of other sources of mortality.

## 2. BIOLOGY

Lookdown dory (*Cyttus traversi*) belongs to the family Zeidae. This family includes 13 species in seven genera distributed among the Atlantic and Pacific Oceans and the Mediterranean Sea. Lookdown dory also occurs in Australian waters, mostly east and south of Tasmania (where it is known as king dory), and also in South Africa. It is widely distributed throughout New Zealand waters with most records from the Chatham Rise. The geographical and depth distribution of immature (< 33 cm) fish is similar to that of adults (Hurst et al, 2000).

It is one of the less abundant members of a loosely associated group of about 23 common species, which together form the upper slope assemblage of New Zealand's continental shelf (Francis et al, 2002). The main species in this group are hoki, javelin fish, ling, pale ghostshark, sea perch, hake, and longnose spookfish (chimaerid). It was identified as a key species characterising the demersal fish community 350-550 m on the Chatham Rise (Bull et al, 2001).

Juveniles are found in surface waters up to a length of approximately 12 cm (May & Maxwell 1986), at which stage a metamorphosis occurs associated with the transition from a pelagic to a demersal habitat (James 1976). Adults are most common between 400 to 600 m, but have a wide depth range, from 50 to 1200 m (Anderson et al, 1998). Immature fish less than 33 cm have a similar geographical and depth distribution to adults (Hurst et al, 2000, O'Driscoll et al, 2003). The main prey of lookdown dory are natant decapod crustaceans, followed by euphausiid, mysid, galatheid, and nephropsid crustaceans, and fish (Clark & King 1989, Forman & Dunn, 2010). Lookdown dory is likely to be prey of larger fish and have occasionally been recorded in the stomachs of large ling.

Trawl survey catch distribution across the Chatham Rise is fairly even, with females ranging from 10 to 55 cm total length, and males ranging from 10 to 45 cm. Lookdown dory show early signs of

ripening to spawn in the January surveys (Livingston et al, 2002). Catch distribution across the Sub-Antarctic is patchier than across the Chatham Rise, particularly during autumn surveys (O’Driscoll & Bagley 2001). Lookdown dory appear to grow larger in the SubAntarctic than on the Chatham Rise with females ranging from 12 to 60 cm total length, and males ranging from 12 to 45 cm.

There are no known aggregations or migrations associated with spawning lookdown dory. Around the North Island, female lookdown dory were reported to mature at about 35 cm (May & Maxwell 1986). Ripe specimens are usually seen in autumn and winter but have also been observed in summer (Clark & King 1989). Livingston et al, (2002) reported early signs of ripening in January Chatham Rise trawl surveys. Observer records from the east coast South Island and Chatham Rise show that ripe females are more common in summer months and spent females are more common in winter (MacGibbon et al, 2012). Females on the west coast South Island are mostly resting, immature or spent in winter. Although most spawning takes place in autumn and winter it is likely that it is not a discrete event but occurs over much of the year. Research data from other areas are sparse, but show the presence of fish in spawning condition in most months of the year.

Although there are no published studies of validated age and growth of lookdown dory, preliminary work in Australia suggests this species may live to over 30 years (Stewart & Smith 1992). Tracey et al (2007) attempted to use lead-radium techniques to validate ageing by zone counts of otoliths but were unsuccessful. Based on unvalidated zone counts, they observed maximum ages of 38 and 25 years for males and females respectively for New Zealand lookdown dory from the Chatham Rise. Von Bertalanffy growth parameters are given in Table 5 and length-weight parameters are given in Table 6.

**Table 5: Summary of von Bertalanffy growth parameters for Chatham Rise lookdown dory. Source : Tracey et al, 2007. NB : Ageing in this study used unvalidated methods.**

Sex	N	$L_{\infty}$	SE	95% CI	K	SE	95% CI	$t_0$	SE	95% CI
All	382	50.72	2.53	(45.75, 55.68)	0.058	0.007	(0.044, 0.073)	-3.53	0.67	(-4.84, -2.21)
Males	191	38.78	1.68	(35.49, 42.06)	0.074	0.011	(0.053, 0.095)	-4.28	0.87	(-5.97, -2.57)
Females	191	69.94	5.71	(58.75, 81.13)	0.039	0.006	(0.027, 0.051)	-3.90	0.72	(-5.31, -2.49)

**Table 6: Length-weight parameters for Chatham Rise and SubAntarctic lookdown dory.**

Fishstock	Estimate				Source
1. Weight = a(length) <sup>b</sup>	(Weight in g, length in cm total length)				
FMA 3 & 4	Females		Males		Tracey et al ( 2007)
	a	b	a	b	
	0.022	2.98	0.025	2.96	
FMA 5 & 6	Sexes combined				Bagley et al, (unpublished data)
	a	b			
	0.022		3.02		

### 3. STOCKS AND AREAS

A catch-effort characterisation carried out in 2010 (MacGibbon et al, 2012) identified three main fishing areas where lookdown dory are caught. These are the east coast South Island (FMA 3), Chatham Rise (FMA 4), and west coast South Island (FMA 7). It was found that these are still the main relevant fishing areas when this work was updated in 2012 (Ballara 2013, submitted).

There is little information on stock structure, recruitment patterns, or other biological characteristics on which to base any biological fishstock boundaries. MacGibbon et al (2012) found both sexes grow to a larger size in the SubAntarctic compared with the Chatham Rise suggesting the possibility of different stocks. There is also a difference in abundance between males and females in both areas with females nearly always outnumbering males (Figure 2).

## LOOKDOWN DORY (LDO)

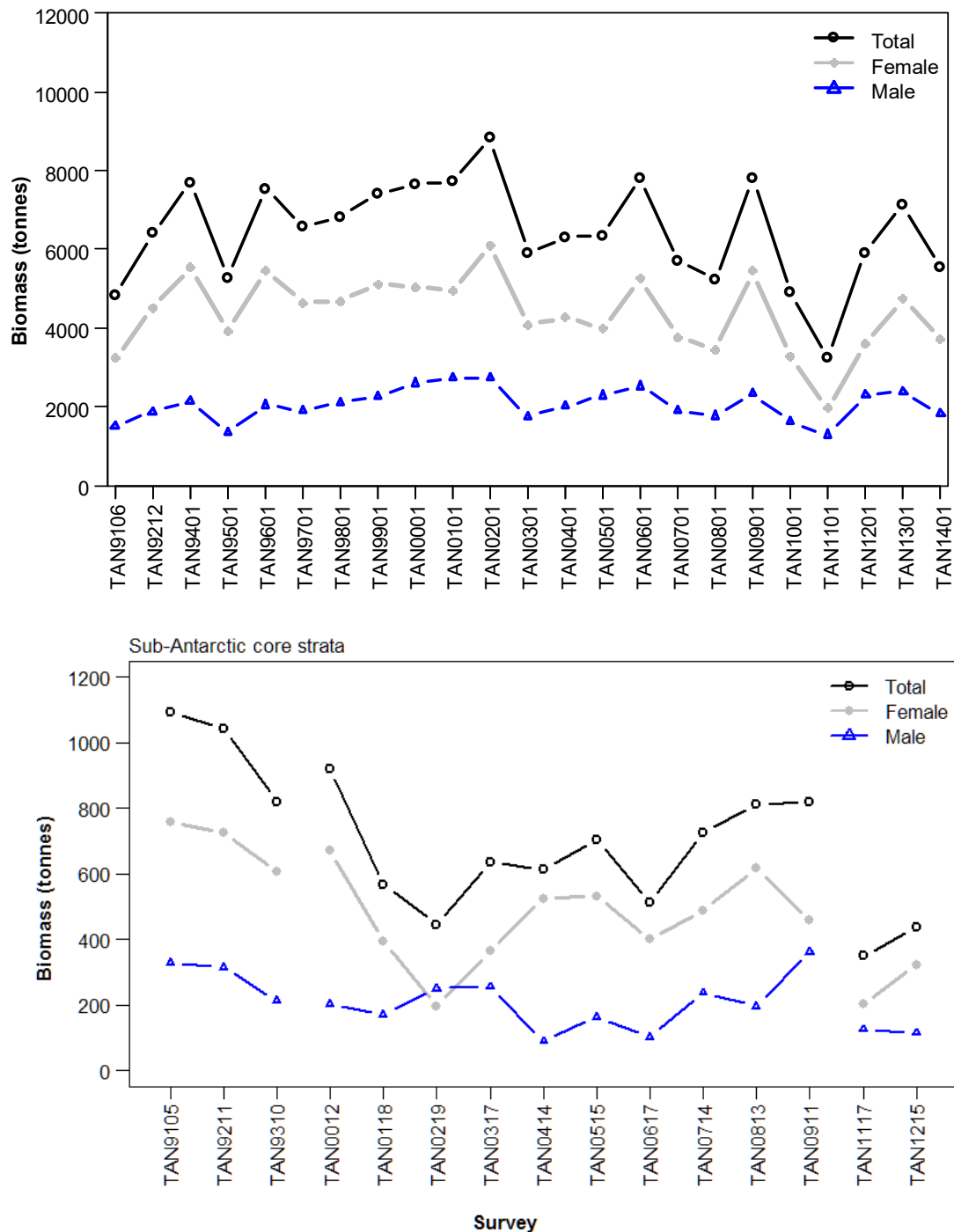


Figure 2: Doorspread biomass estimates of lockdown dory by sex from the Chatham Rise 1991 to 2014 (upper) and SubAntarctic 1991 to 1993 and 2000 to 2012 (lower), from *Tangaroa* surveys.

## 4. STOCK ASSESSMENT

In December 2013 the Middle Depths Working Group agreed that for the west coast South Island (FMA 7, which accounts for the vast majority of the LDO 1 catch), acceptable methods of monitoring abundance are relative biomass estimates from the west coast South Island winter trawl survey carried out by R.V. *Tangaroa*. Catch-per-unit-effort indices from daily processed commercial catches and from the scientific observer programme were also accepted as indices of abundance for the west coast of the South Island.

The Middle Depths Working Group agreed in February 2011 that relative biomass estimates of lockdown dory from middle depth trawl surveys on the Chatham Rise and the Sub-Antarctic were suitable for monitoring major changes in lockdown dory abundance for LDO 3. Standardised CPUE

indices from a mixed target species trawl fishery on the ECSI and Chatham Rise area were not accepted by the Working Group.

#### 4.1 Estimates of fishery parameters and abundance

Lookdown dory biomass is usually in the top 10 species on the Chatham Rise and CVs are relatively precise (usually < 15%) (Table 7). Females have consistently comprised more of the biomass than males (Figure 2). Biomass indices on the Sub-Antarctic have higher but still acceptable CVs (generally < 30%). Relative biomass has been lower in the last two surveys. Biomass indices from the west Coast South Island are considerably lower than those for the Chatham Rise and SubAntarctic but are still thought to be reliable measures of abundance.

**Table 7: Biomass indices (t) and coefficients of variation (cv) for lookdown dory from *Tangaroa* trawl surveys (Assumptions: areal availability, vertical availability and vulnerability = 1). NB: estimates are for the core strata only for the respective time series.**

Trip code	Date	Reference	Biomass (t)	% c.v.
Chatham Rise*				
TAN9106	Dec 1991–Feb 1992	Horn (1994a)	4 797	5.6
TAN9212	Dec 1992–Feb 1993	Horn (1994b)	6 439	5.2
TAN9401	Jan 1994	Schofield & Horn (1994)	7 664	7.2
TAN9501	Jan–Feb 1995	Schofield & Livingston (1995)	5 270	6.5
TAN9601	Dec 1995–Jan 1996	Schofield & Livingston (1996)	7 540	8
TAN9701	Jan 1997	Schofield & Livingston (1997)	6 568	7.6
TAN9801	Jan 1998	Bagley & Hurst (1998)	7 019	6
TAN9901	Jan 1999	Bagley & Livingston (2000)	7 417	8.2
TAN0001	Dec 1999–Jan 2000	Stevens et al (2001)	7 655	7
TAN0101	Dec 2000–Jan 2001	Stevens & Livingston (2002)	7 713	6.5
TAN0201	Dec 2001–Jan 2002	Stevens & Livingston (2003)	8 821	11.1
TAN0301	Dec 2002–Jan 2003	Livingston et al (2004)	5 853	7
TAN0401	Dec 2003–Jan 2004	Livingston & Stevens (2005)	6 304	8
TAN0501	Dec 2004–Jan 2005	Stevens & O'Driscoll (2006)	6 351	9.3
TAN0601	Dec 2005–Jan 2006	Stevens & O'Driscoll (2007)	7 818	8.5
TAN0701	Dec 2006–Jan 2007	Stevens et al (2008)	5 714	7.7
TAN0801	Dec 2007–Jan 2008	Stevens et al (2009a)	5 230	9.3
TAN0901	Dec 2008–Jan 2009	Stevens et al (2009b)	7 789	8.7
TAN1001	Jan 2010	Stevens et al (2011)	4 896	9.7
TAN1101	Jan 2011	Stevens et al (2012)	3 257	21.4
TAN1201	Jan 2012	Stevens et al (2013)	5 913	13.2
TAN1301	Jan 2013	Stevens et al (2014)	7 141	11
TAN1401	Jan 2014	Stevens et al (2015)	5 560	6.9
SubAntarctic				
TAN0012	Nov–Dec 2000	O'Driscoll et al (2001)	877	15.2
TAN0118	Nov–Dec 2001	O'Driscoll & Bagley (2003a)	566	19.7
TAN0219	Nov–Dec 2002	O'Driscoll & Bagley (2003b)	446	22.1
TAN0317	Nov–Dec 2003	O'Driscoll & Bagley (2004)	636	23.7
TAN0414	Nov–Dec 2004	O'Driscoll & Bagley (2006a)	614	27.9
TAN0515	Nov–Dec 2005	O'Driscoll & Bagley (2006b)	703	19.1
TAN0617	Nov–Dec 2006	O'Driscoll & Bagley (2008)	509	35.3
TAN0714	Nov–Dec 2007	Bagley et al (2009)	725	20
TAN0813	Nov–Dec 2008	O'Driscoll & Bagley (2009)	811	24.7
TAN0911	Nov–Dec 2009	Bagley & O'Driscoll (2012)	820	25.1
TAN1117	Nov–Dec 2011	Bagley et al 2013	327	34.9
TAN1215	Nov–Dec 2012	Bagley & et al 2014	436	29.1
WCSI core				
TAN0007	Jul–Aug 2000	O'Driscoll et al (2004)	169	14.4
TAN1210	Jul–Aug 2012	O'Driscoll et al (2013) Ballara, S.L.;	155	11.9
TAN1310	Aug 2013	O'Driscoll et al (2014) Ballara, S.L.;	198	11.7
WCSI all				
TAN1210	Jul–Aug 2012	O'Driscoll et al (2013) Ballara, S.L.;	181	10.8
TAN1310	Aug 2013	O'Driscoll et al (2014) Ballara, S.L.;	228	12.1

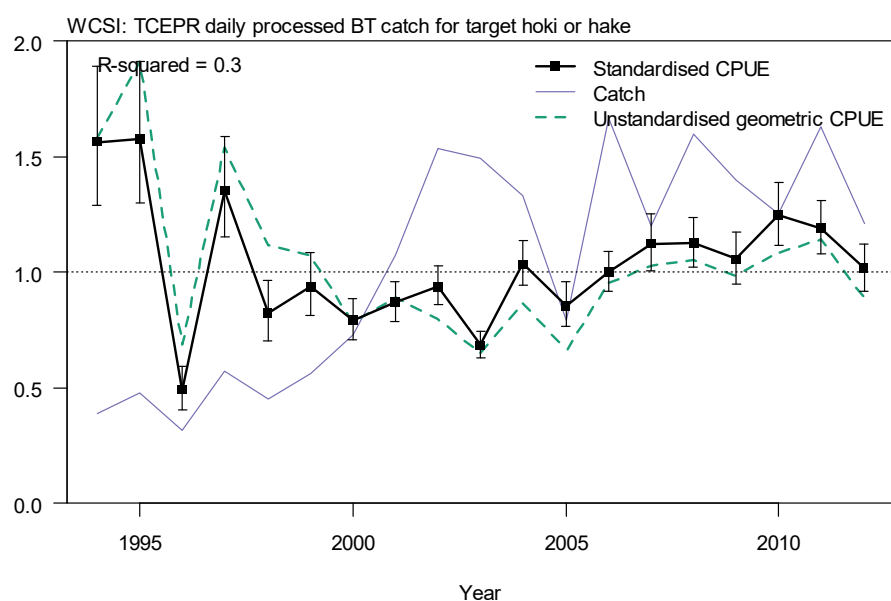
Length frequencies of Chatham Rise lookdown dory suggest that recruitment is variable (MacGibbon et al, 2012, Ballara, submitted). Generally, when a strongly recruiting year class is present, the male

## LOOKDOWN DORY (LDO)

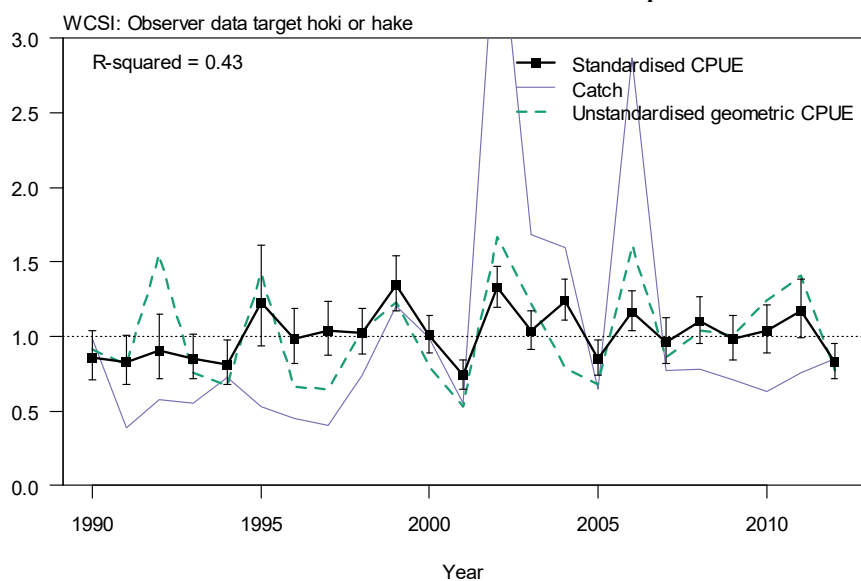
length frequencies are often bimodal and females show two or three modes. Length frequency plots show that females are usually more numerous than males with a mean ratio for the time series of 1.15 females to every male (range 0.98-1.52). Males don't grow as large as females, with few males growing larger than 40 cm.

Length frequencies from the summer Sub-Antarctic series are less informative and no tracking of cohorts is possible. Overall, scaled population numbers are much lower for both sexes here than on the Chatham Rise but, again, females are more numerous than males with a mean ratio for the time series of 1.8 females for every male (range 0.55-3.9). Females also grow to a larger size than males and both sexes grow to a larger size on the Sub-Antarctic than on the Chatham Rise, which suggests that it may be a separate biological stock. This could also potentially be due to real differences in fishing pressure.

CPUE indices for lockdown dory on the WCSI were developed using the daily processed catch data and a smaller subset of observed vessels in the hoki and hake target fisheries. Both series show a similar trend, flat since 1995 (Figures 3 and 4).



**Figure 3: Log normal CPUE indices for WCSI daily processed catch, bottom trawl target hoki or hake, showing catches (scaled to same mean as indices), and lognormal standardised and un-standardised indices. Bars indicate 95% confidence intervals. Year defined as June–September.**



**Figure 4: CPUE lognormal indices for WCSI observer programme data, target hoki or hake, bottom and midwater trawl, showing catches (scaled to same mean as indices), and lognormal standardised and un-standardised indices. Bars indicate 95% confidence intervals. Year defined as June–September.**

**4.2 Yield estimates and projections**

MCY cannot be estimated.

CAY cannot be estimated.

**4.4 Other yield estimates and stock assessment results**

No information is available.

**5. STATUS OF THE STOCK**

There are no known sustainability concerns in the lockdown dory fishery. For LDO 1, the area which accounts for the vast majority of the lockdown dory catch is thought to be well monitored by trawl surveys which are currently too short to suggest any pattern, but CPUE indices suggest that abundance has been stable since the mid-1990s. For LDO 3, trawl surveys on the Chatham Rise and Sub-Antarctic indicate abundance has fluctuated in both areas

**LDO 1**

- **LDO 1 (west coast South Island, west and east coast North Island)**

<b>Stock Status</b>									
Year of Most Recent Assessment	2013								
Assessment runs presented	-								
Reference Points	Target: Not established but 40% $B_0$ assumed Soft Limit: 20% $B_0$ Hard Limit: 10% $B_0$ Overfishing threshold: -								
Status in relation to Target	Unknown								
Status in relation to Limits	Unknown for Soft limit Unlikely (< 40%) to be below the Hard Limit								
Status in relation to Overfishing	-								
<b>Historical Stock Status Trajectory and Current Status</b>									
<table border="1"> <caption>WCSI all strata Biomass Data</caption> <thead> <tr> <th>Survey</th> <th>Biomass (tonnes)</th> </tr> </thead> <tbody> <tr> <td>TAN0007</td> <td>~170</td> </tr> <tr> <td>TAN1210</td> <td>~185</td> </tr> <tr> <td>TAN1308</td> <td>~230</td> </tr> </tbody> </table>		Survey	Biomass (tonnes)	TAN0007	~170	TAN1210	~185	TAN1308	~230
Survey	Biomass (tonnes)								
TAN0007	~170								
TAN1210	~185								
TAN1308	~230								
<p><b>Doorspread biomass estimates for lockdown dory (error bars are ± two standard deviations) from the winter WCSI <i>Tangaroa</i> surveys 2000, and 2012–2013.</b></p>									



## LOOKDOWN DORY (LDO)

<b>Fishery and Stock Trends</b>	
Recent Trend in Biomass or Proxy	Within LDO 1, FMA 7 biomass indices from the trawl survey time series are similar for 2000 and 2012, with an increase in 2013. This time series is only three points, but is thought to cover an appropriate depth and geographical range for lockdown dory. CPUE indices have been relatively flat since the mid-1990s.
Recent Trend in Fishing Mortality or Proxy	Unknown
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	-

<b>Projections and Prognosis</b>	
Stock Projections or Prognosis	Stock size is unlikely (< 40%) to change much at current catch levels in FMA 7.
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: Unknown Hard Limit: Unlikely (< 40%)
Probability of Current Catch or TACC causing Overfishing to continue or to commence	-

<b>Assessment Methodology</b>		
Assessment Type	Level 2: Partial quantitative stock assessment	
Assessment Method	Evaluation of agreed CPUE indices and trawl survey indices thought to index abundance within FMA 7 of LDO 1. The vast majority of the LDO 1 catch is taken in FMA 7, catches in other areas of LDO 1 are minor.	
Assessment dates	Latest assessment: 2013	Next assessment: 2016
Overall assessment quality rank	-	
Main data inputs (rank)	-	
Data not used (rank)	-	
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	-	

<b>Qualifying Comments</b>

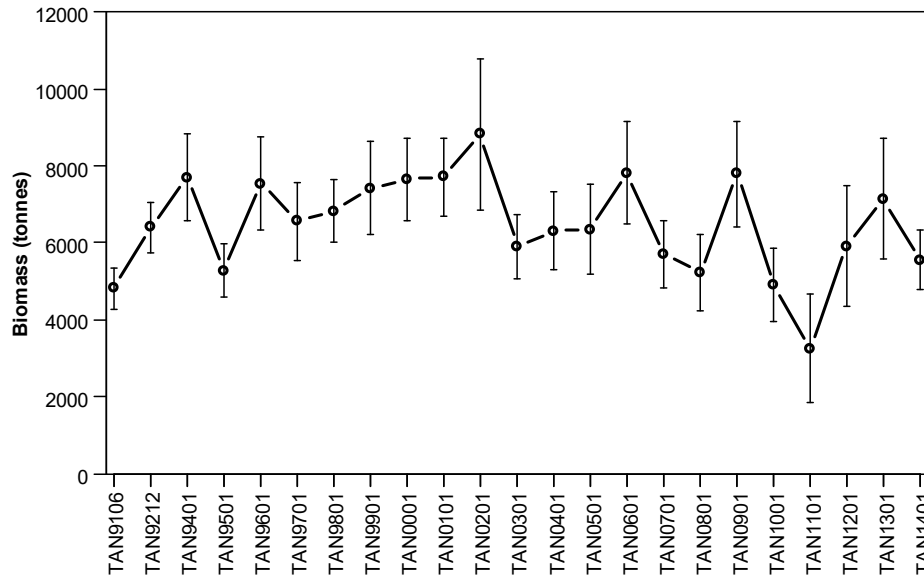
<b>Fishery Interactions</b>
In LDO 1, lockdown dory are taken primarily as bycatch in the bottom trawl west coast South Island hoki and hake target fisheries. Smaller catches are reported by midwater trawl. Interactions are the same as those for the hoki fishery. The east coast North Island scampi fishery also catches lockdown dory. A variety of other target fisheries also report catching lockdown dory but in very small amounts. A small amount of lockdown dory is targeted on the west coast of the South Island by smaller trawlers.

- **LDO 3 (Chatham Rise & Sub-Antarctic)**

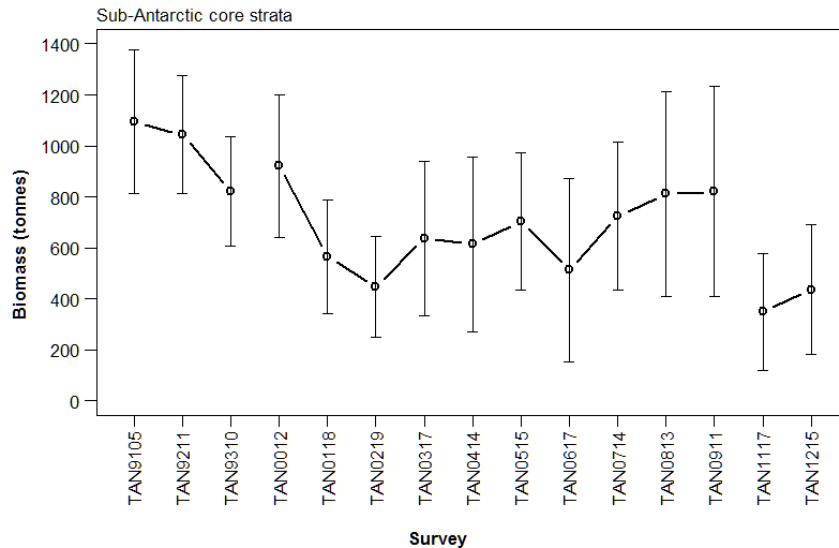
<b>Stock Status</b>	
Year of Most Recent Assessment	2013
Reference Points	Target: Not established but 40% $B_0$ assumed

	Soft Limit: 20% $B_0$ Hard Limit: 10% $B_0$ Overfishing threshold: -
Status in relation to Target	Unknown
Status in relation to Limits	Unknown for Soft limit Unlikely (< 40%) to be below the Hard Limit
Status in relation to Overfishing	-

**Historical Stock Status Trajectory and Current Status**



Doorspread biomass estimates of lookdown dory (error bars are ± two standard deviations) from the Chatham Rise, from *Tangaroa* surveys from 1991 to 2013.



Doorspread biomass estimates of lookdown dory (error bars are ± two standard deviations) from the SubAntarctic, from *Tangaroa* surveys from 1991 to 1993, 2000 to 2009, and 2011–12.

**Fishery and Stock Trends**

Recent Trend in Biomass or Proxy	Within LDO 3, FMAs 3 & 4 biomass indices have been fairly flat throughout the time series of Chatham Rise trawl surveys with the exception of 2010 and 2011 which show a decline. The 2012–14 surveys are more in line with previous years. For FMAs 5 & 6 biomass indices from the Sub-Antarctic series declined to 2002, steadily increased until 2009, and has dropped to the lowest estimates in the time series in 2011 and 2012.
Recent Trend in Fishing Intensity or Proxy	Unknown

## LOOKDOWN DORY (LDO)

Other Abundance Indices	-
Trends in other Relevant Indicators or Variables	-

<b>Projections and Prognosis</b>	
Stock Projections or Prognosis	Stock size is Unlikely (< 40%) to change much at current catch levels in FMAs 5 & 6.
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: Unknown Hard Limit: Unlikely (< 40%)
Probability of Current Catch or TACC causing Overfishing to continue or to commence	-
<b>Assessment Methodology</b>	
Assessment Type	Level 2: Partial quantitative stock assessment
Assessment Method	Evaluation of agreed trawl survey indices thought to index FMA 3 & 4, and FMA 5 & 6 abundance
Assessment Dates	Latest assessment: 2013      Next assessment: 2016
Overall assessment quality rank	-
Main data inputs (rank)	-
Data not used (rank)	-
Changes to Model Structure and Assumptions	-
Major Sources of Uncertainty	-

<b>Qualifying Comments</b>
There is some indication that lockdown dory on the Chatham Rise may be a different stock to the Sub-Antarctic (i.e. different maximum sizes, evidence of some spawning activity in the Sub-Antarctic, as well as more extensively on the Chatham Rise)

<b>Fishery Interactions</b>
In LDO 3 lockdown dory are mainly caught as bycatch in the hoki target bottom trawl fishery but also in many other middle depth fisheries. Interactions are the same as those for the hoki fishery.

## 7. FOR FURTHER INFORMATION

- Anderson, O F; Bagley, N W; Hurst, R J; Francis, M P; Clark, M R; McMillan, P J (1998) Atlas of New Zealand fish and squid distribution from research bottom trawls. *NIWA Technical Report 42*. 303 p.
- Anderson, O F; Gilbert, D J; Clark, M R (2001) Fish discards and non-target catch in the trawl fisheries for orange roughy and hoki in New Zealand waters for the fishing years 1990–91 to 1998–99. *New Zealand Fisheries Assessment Report 2001/16*. 57 p.
- Bagley, N W; O'Driscoll, R L (2012) Trawl survey of middle depth species in the Southland and Sub-Antarctic areas, November–December 2009 (TAN0911). *New Zealand Fisheries Assessment Report 2012/05*. 70 p.
- Ballara, S L (2014). Fishery characterisation and standardised CPUE analyses for lockdown dory, *Cyttus traversi* (Hutton, 1872) (Zeidae), 1989–90 to 2011–12. *New Zealand Fisheries Assessment Report 2014/62*.
- Bull, B; Livingston, M E; Hurst, R J; Bagley, N (2001) Upper-slope fish communities on the Chatham Rise, New Zealand, 1992–99. *New Zealand Journal of Marine and Freshwater Research 35* (3): 795–815.
- Clark, M R; King, K J (1989) Deepwater fish resources off the North Island, New Zealand: results of a trawl survey, May 1985 to June 1986. *New Zealand Fisheries Technical Report 11*. 56 p.
- Forman, J S; Dunn, M R (2010) The influence of ontogeny and environment on the diet of lockdown dory, *Cyttus traversi*. *New Zealand Journal of Marine and Freshwater Research*. 44: 329–42.
- Francis, M P; Hurst, R J; McArdle, B; Bagley, N W; Anderson, O F (2002) New Zealand demersal fish assemblages. *Environmental Biology of Fishes 62*(2): 215–234.
- Hurst, R J; Bagley, N W; Anderson, O F; Francis, M P; Griggs, L H; Clark, M R; Paul, L J; Taylor, P R (2000) Atlas of juvenile and adult fish and squid distributions from bottom and midwater trawls and tuna longlines in New Zealand waters. *NIWA Technical Report 84*. 162 p.
- James, G D (1976) *Cyttus traversi* Hutton: Juvenile form of *C. ventralis* Barnard and Davies (Pisces: Zeidae). *Journal of the Royal Society of New Zealand 6*(4): 493–498.
- Livingston, M E; Bull, B; Stevens, D W; Bagley, N W (2002) A review of hoki and middle depth trawl surveys of the Chatham Rise, January 1992–2001. *NIWA Technical Report 113*. 146 p.
- Livingston, M E; Clark, M; Baird, S J (2003) Trends in incidental catch of major fisheries on the Chatham Rise for fishing years 1989–90 to 1998–99. *New Zealand Fisheries Assessment Report 2003/52*. 74 p.
- Livingston, M E; Stevens, D W (2005) Trawl survey of hoki and middle depth species on the Chatham Rise, January 2004 (TAN0401). *New Zealand Fisheries Assessment Report 2005/21*. 62 p.

- MacGibbon, D J; McGregor, V; Hurst, R J (2012) Fishery characterisation and standardised CPUE analyses for lookdown dory, *Cyttus traversi* (Hutton, 1872) (Zeidae), 1989–90 to 2008–09. *New Zealand Fisheries Assessment Report 2012/07*. 143 p.
- May, J L; Maxwell, J G H (1986) Trawl fish from temperate waters of Australia. CSIRO Division of Fisheries Research, Tasmania. 492 p.
- Nelson, J S (1994) *Fishes of the world*. Third edition. J. Wiley, New York. 600 p.
- O'Driscoll, R L; Bagley, N W (2001) Review of summer and autumn trawl survey time series from the Southland and Sub-Antarctic area 1991–98. *NIWA Technical Report 102*. 115 p.
- O'Driscoll, R L; Booth, J D; Bagley, N W; Anderson, O F; Griggs, L H; Stevenson, M L; Francis, M P (2003) Areas of importance for spawning, pupping or egg-laying, and juveniles of New Zealand deepwater fish, pelagic fish, and invertebrates. *NIWA Technical Report 119*. 377 p.
- Stevens, D W; O'Driscoll, R L; Ldroit, Y; Ballara, S L; MacGibbon, D J; Horn, P L (2015) Trawl survey of hoki and middle depth species on the Chatham Rise, January 2014 (TAN1401). *New Zealand Fisheries Assessment Report 2015/19*. 119 p.
- Stewart, B D; Smith, D (1992) Development of methods to age commercially important dories and oreos. *Newsletter of the Australian Society for Fish Biology* 22 (2): 53–54.
- Tracey, D M; Horn, P L; Andrews, A H; Marriott, P M; Dunn, M R (2007) Age and growth, and an investigation of age validation of lookdown dory (*Cyttus traversi*). Final Research Report for Ministry of Fisheries Project LDO2004-01 Objective 1. 36 p. (Unpublished report held by MPI Wellington.)