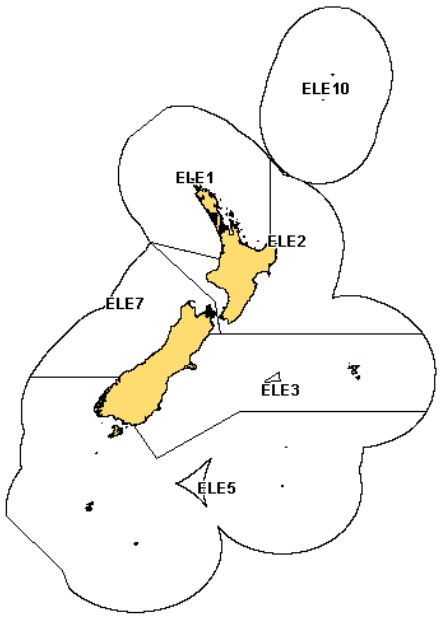
ELEPHANT FISH (ELE)

(*Callorhinchus milii*)
Reperepe



1. FISHERY SUMMARY

1.1 Commercial fisheries

From the 1950s to the 1980s, landings of elephantfish of around 1000 t were common. Most of these landings were from the area now encompassed by ELE 3 but fisheries for elephantfish also developed on the south and west coasts of the South Island in the late 1950s and early 1960s, with average catches of around 70 t per year in the south (in the 1960s to the early 1980s) and 10-30 t per year on the west coast. Total annual landings of elephantfish dropped considerably in the early 1980s (between 1982–83 and 1994–96 they ranged between 500 and 700 t) but later increased to the point that they have annually exceeded 1000 t since the 1995–96 fishing season. Reported landings since 1936 are shown in Tables 1 and 2.

Table 1: Reported total landings of elephantfish for calendar years 1936 to 1982. Sources: MAF and FSU data.

Year	Landings (t)	Year	Landings (t)	Year	Landings (t)	Year	Landings (t)	Year	Landings
1936	116	1944	270	1952	459	1960	1163	1968	862
1937	184	1945	217	1953	530	1961	983	1969	934
1938	201	1946	235	1954	853	1962	1156	1970	1128
1939	193	1947	188	1955	802	1963	1095	1971	1401
1940	259	1948	230	1956	980	1964	1235	1972	1019
1941	222	1949	310	1957	1069	1965	1111	1973	957
1942	171	1950	550	1958	1238	1966	1112	1974	848
1943	220	1951	602	1959	1148	1967	934	1975	602

Year	Landings
1976	705
1977	704
1978	596
1979	719
1980	906
1981	690
1982	661

The TACC for ELE 3 has, with the exception of 2002-03, been consistently exceeded since 1986-87. The ELE 3 TACC was consequently increased to 500 t for the 1995–96 fishing year, and then

increased twice more under an Adaptive Management Programme (AMP): initially to 825 t in October 2000 and then to 950 t in October 2002. This new TACC combined with the allowances for customary and recreational fisheries (5 t each), increased the new TAC for the 2002–03 fishing year in ELE 3 to 960 t. In ELE 3 fishing is seasonal, mostly occurring in spring and summer in inshore waters. Most of the recent increase in catch from the ELE 3 fishery has been taken as a bycatch of the RCO 3 trawl fishery (Raj & Voller, 1999). During 1989–90 to 1997–98, the level of elephantfish bycatch from the RCO 3 fishery increased from around 50 t to 300 t (Raj & Voller, 1999). There was also a steady increase in the level of ELE 3 bycatch from the FLA 3 trawl fishery, with catches increasing from around 50 t in 1994–95 to 150 t in 1997–98. The fishery in ELE 5 is mainly a trawl fishery targeted at flatfish and to a lesser extent giant stargazer. Very little catch in ELE 5 is taken by target setnet fisheries. The ELE 5 TACC was increased from 71 t to 100 t under an AMP in October 2001. The TACC was further increased under the AMP to 120 t in October 2004.

Table 2: Reported landings (t) of elephantfish by Fishstock from 1983–84 to 2005–06 and actual TACCs (t) from 1986–87 to 2006–07.

Fishstock	ELE 1		ELE 2		ELE 3		ELE 5		ELE 7	
FMA (s)	1 & 9		2 & 8		3 & 4		5 & 6		7	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
1983–84*	<1	–	5	–	605	–	94	–	60	–
1984–85*	<1	–	3	–	517	–	134	–	50	–
1985–86*	<1	–	4	–	574	–	57	–	46	–
1986–87†	<1	10	2	20	506	280	48	60	29	90
1987–88†	<1	10	3	20	499	280	64	60	44	90
1988–89†	<1	10	1	22	450	415	49	62	43	100
1989–90†	<1	10	3	22	422	418	32	62	55	101
1990–91†	<1	10	5	22	434	422	55	71	59	101
1991–92†	<1	10	11	22	450	422	58	71	78	101
1992–93†	<1	10	5	22	501	423	39	71	61	102
1993–94†	<1	10	6	22	475	424	46	71	41	102
1994–95†	<1	10	5	22	580	424	60	71	39	102
1995–96†	<1	10	7	22	688	500	72	71	93	102
1996–97†	<1	10	9	22	734	500	74	71	94	102
1997–98†	<1	10	12	22	910	500	95	71	66	102
1998–99†	<1	10	9	22	842	500	129	71	117	102
1999–00†	<1	10	6	22	950	500	105	71	87	102
2000–01†	2	10	7	22	956	825	153	71	90	102
2001–02†	<1	10	9	22	852	825	105	100	88	102
2002–03†	1	10	9	22	950	950	106	100	59	102
2003–04†	<1	10	10	22	984	950	102	100	42	102
2004–05†	<1	10	13	22	972	950	125	120	74	102
2005–06†	<1	10	14	22	1023	950	147	120	76	102
2006–07	<1	10	17	22	960	950	151	120	116	102

Fishstock	ELE 10			
FMA (s)	10		Total	
	Landings	TACC	Landings	TACC
1983–84*	0	–	765	–
1984–85*	0	–	704	–
1985–86*	0	–	681	–
1986–87†	0	10	584	470
1987–88†	0	10	610	470
1988–89†	0	10	543	619
1989–90†	0	10	510	623
1990–91†	0	10	553	636
1991–92†	0	10	597	636
1992–93†	0	10	606	638
1993–94†	0	10	568	639
1994–95†	0	10	684	639
1995–96†	0	10	862	715
1996–97†	0	10	912	715
1997–98†	0	10	1 082	715
1998–99†	0	10	1 098	715
1999–00†	0	10	1 148	715

Table 2 (*Continued*):

Fishstock	ELE 10			
FMA (s)	10		Total	
	Landings	TACC	Landings	TACC
2000–01†	0	10	1 207	1 040
2001–02†	0	10	1 053	1 057
2002–03†	0	10	1 125	1 194
2003–04†	0	10	1 139	1 194
2004–05†	0	10	1 184	1 214
2005–06†	0	10	1 260	1 214
2006–07	0	10	1 244	1 214

1.2 Recreational fisheries

Catches of elephantfish by recreational fishers are low compared to those of the commercial sector. Recreational fishing surveys carried out by the Ministry of Fisheries in the early 1990s estimated the recreational catch of elephantfish in the South region of ELE 3 in 1991–92 at 3000 fish, 1000 fish in the central region of ELE 7 in 1992–93, and no catch was reported in the North region in 1993–94 (Teirney *et al*. 1997). The national diary survey of recreational fishers in 1996 estimated that recreational catches of elephantfish were less than 500 fish in ELE 2, 1000 fish in ELE 3 and less than 500 fish in ELE 7 (Bradford 1998). Estimates from the 1999–00 recreational survey were 1000 fish in ELE 2, 2000 fish in ELE 3 and less than 500 in ELE 7 (Boyd & Reilly 2002). Owing to biases inherent to telephone vs. face-to-face interviews, the 1999–00 estimate is regarded to be the most accurate.

1.3 Customary non-commercial fisheries

Quantitative information on the current level of customary non-commercial catch is not available.

1.4 Illegal catch

There are reports of discards of juvenile elephantfish by trawlers from some areas. However, no quantitative estimates of discards are available.

1.5 Other sources of mortality

The significance of other sources of mortality has not been documented.

2. BIOLOGY

Elephantfish are uncommon off the North Island and occurr south of East Cape on the east coast and south of Kaipara on the west coast. They are most plentiful around the east coast of the South Island.

Males mature at a length of 50 cm fork length (FL) at an age of 3 years, females at 70 cm FL at 4 to 5 years of age. The maximum age cannot be reliably estimated, but appears to be at least 9 years and may be as high as 15 years. The M value of 0.35 used is based on unvalidated ageing work indicating a maximum age of 13 years. This results from use of the equation $M = \log_e 100/\text{maximum age}$, where maximum age is the age to which 1% of the population survives in an unexploited stock.

Mature elephantfish migrate to shallow inshore waters in spring and aggregate for mating. Eggs are laid on sand or mud bottoms, often in very shallow areas. They are laid in pairs in large yellow-brown egg cases. The period of incubation is at least 5–8 months, and juveniles hatch at a length of about 10 cm FL. Females are known to spawn multiple times per season. After egg laying the adults are thought to disperse and are difficult to catch; however, juveniles remain in shallow waters for up to 3 years. During this time juveniles are vulnerable to incidental trawl capture, but are of little commercial value.

Biological parameters relevant to the stock assessment are shown in Table 3. Provisional von

Bertalanffy growth curves based on MULTIFAN are available for Pegasus Bay and Canterbury Bight in 1966–68 and 1983–88. Because the growth curves were based on a MULTIFAN analysis of length-frequency data, the ages of the larger fish were probably underestimated and the growth curves are only reliable to about 4–5 years. Fish appeared to grow faster in the 1980s than in the 1960s.

Table 3: Estimates of biological parameters for elephant fish.

Fishstock	Estimate				Source
1. Natural mortality (M)					
All	0.35				Francis (1997)
2. Weight = a (length)^b (Weight in g, length in cm fork length)					
		Both sexes			
	a	b			
ELE 3	9.1-3	3.02			Gorman (1963)
3. von Bertalanffy Growth Function					
		Pegasus Bay 1966–68		Canterbury Bight 1966–68	
	Males	Females	Males	Females	Francis (1997)
K (yr^{-1})	0.231 ± 0.002	0.096 ±0.001	0.089 ± 0.002	0.060 ± 0.001	
L_∞ (cm)	74.7 ± 0.12	156.9 ± 1.38	141.5 ± 2.28	203.6 ± 3.2	
t_0 (yr)	-0.78 ± 0.008	-0.87 ± 0.006	-0.96 ± 0.008	-1.06 ± 0.009	
		Pegasus Bay 1983–84		Canterbury Bight 1988	
	Males	Females	Males	Females	
K (yr^{-1})	0.473 ± 0.009	0.195 ±0.008	0.466 ± 0.008	0.224 ± 0.001	
L_∞ (cm)	66.9 ± 0.52	113.9 ± 2.89	62.7 ± 0.23	94.1 ± 0.26	
t_0 (yr)	-0.24 ± 0.017	-0.53 ± 0.023	-0.38 ± 0.015	-0.69 ± 0.006	

3. STOCKS AND AREAS

There are no new data that alter the stock boundaries given in previous assessment documents.

There is only limited information available to support existing stock boundaries. Results from tagging studies conducted during 1966–69 indicate that elephantfish tagged in the Canterbury Bight remained in ELE 3. Separate spawning grounds to maintain each 'stock' have not been identified. The boundaries used are related to the historical fishing pattern when this was a target fishery.

4. STOCK ASSESSMENT

There are no new data which would alter the yield estimates given in the 1996 Plenary Report. The yield estimates are based on commercial landings data only and have not changed since the 1988 Plenary Report.

4.1 Estimates of fishery parameters and abundance

4.1.1 Trawl survey biomass indices

Indices of relative biomass are available from recent trawl surveys (Table 4, Figure 1). These have not been used to estimate absolute biomass or yields as historically, these trawl surveys have given variable abundance and high CV's for elephantfish, and probably have not monitored their biomass very well. A pilot survey off the east coast of the South Island was undertaken in the summer of 1996–97 and was repeated in 1997–98, 1998–99, 1999–00 and 2000–01. This survey was initiated for several reasons, including a need to better survey elephantfish in ELE 3 in view of the recent TACC increase. In February 1999, the Inshore Fishery Assessment Working Group concluded that it was not clear whether the East Coast South Island (ECSI) trawl survey was adequately sampling elephantfish, as the commercial fishery for this species included depths <10 m and the *Kaharoa* is unable to trawl in such areas. Subsequently, in 1999–00 and 2000–01 the commercial vessel *Compass Rose* carried out surveys (concurrently) with the *Kaharoa* in which it fished areas inside 10 m. In 2001 the Inshore FAWG recommended that the east coast South Island trawl survey be discontinued due to the extreme variability in the catchability of the target species. A workshop (May 2006) to review the monitoring of inshore finfish concluded that the ECSI winter survey series

should be reinstated, as based on simulations using existing data, it was predicted to provide useful relative biomass estimates for many species (excluding elephantfish). The workshop concluded that ELE 3 relative biomass should be estimated using industry run "hybrid" surveys.

Table 4: Relative biomass indices (t) and coefficients of variation (CV) for elephant fish for east coast South Island (ECSI) – summer and winter, west coast South Island (WCSI) and the Stewart-Snares Island survey areas*.

Region	Fishstock	Year	Trip number	Biomass estimate	CV (%)
ECSI(winter)	ELE 3	1991	KAH9105	300	40
		1992	KAH9205	176	32
		1993	KAH9306	481	33
		1994	KAH9406	152	33
		1996	KAH9606	858	30
		2007	KAH0705	1 034	32
ECSI(summer)	ELE 3	1996–97	KAH9618	1127	31
		1997–98	KAH9704	404	18
		1998–99	KAH9809	1718	28
		1999-00	KAH9917	1097	25
		1999–00	COM9901	802	73
					(inside 10m)
				475	79
		2000-01	KAH0014	693	18
		2000-01	CMP0001	1229	29
					(inside 10m)
				84	23
WCSI	ELE 7	1992	KAH9204	38	42
		1994	KAH9404	167	33
		1995	KAH9504	85	35
		1997	KAH9701	94	33
		2000	KAH0004	42	63
Stewart-Snares	ELE 5	1993	TAN9301	219	33
		1994	TAN9402	177	47
		1995	TAN9502	69	49
		1996	TAN9604	137	46

*Assuming areal availability, vertical availability and vulnerability equal 1.0. Biomass is only estimated outside 10 m depth except for COM9901 and CMP0001. Note: because trawl survey biomass estimates are indices, comparisons between different seasons (e.g., summer and winter ECSI) are not strictly valid.

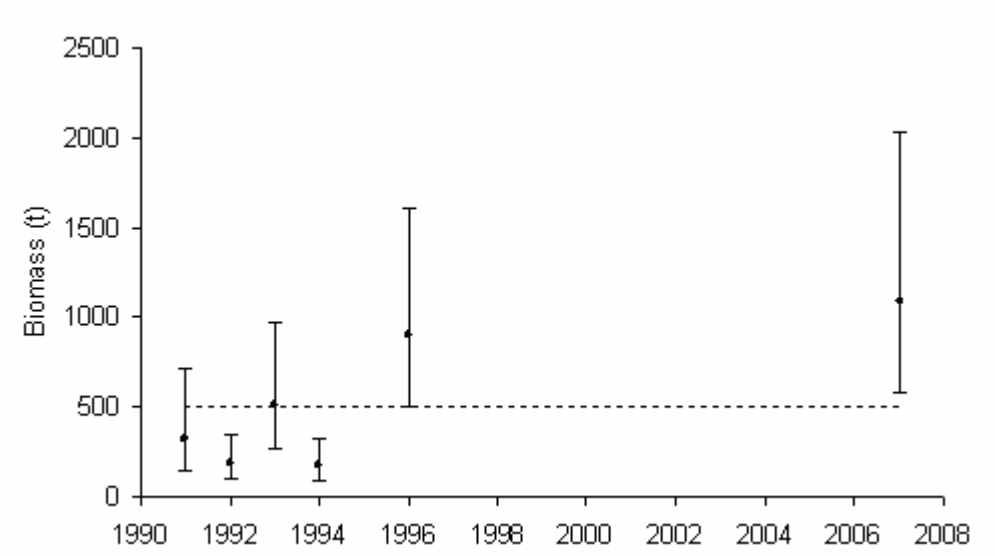


Figure 1: Elephantfish biomass ±95% CI (estimated from survey CV's assuming a lognormal distribution) and the time series mean (dotted line) estimated from the East Coast South Island trawl survey.

4.1.2 CPUE biomass indices

ELE 3 is monitored using standardized CPUE, based on non-zero catches recorded by bottom trawl fishery targeting RCO, as an index of relative abundance (Figure 2). The CPUE trend was updated to 2005–06 as part of the ELE 3 AMP in 2007 (Starr *et al*. 2007a).

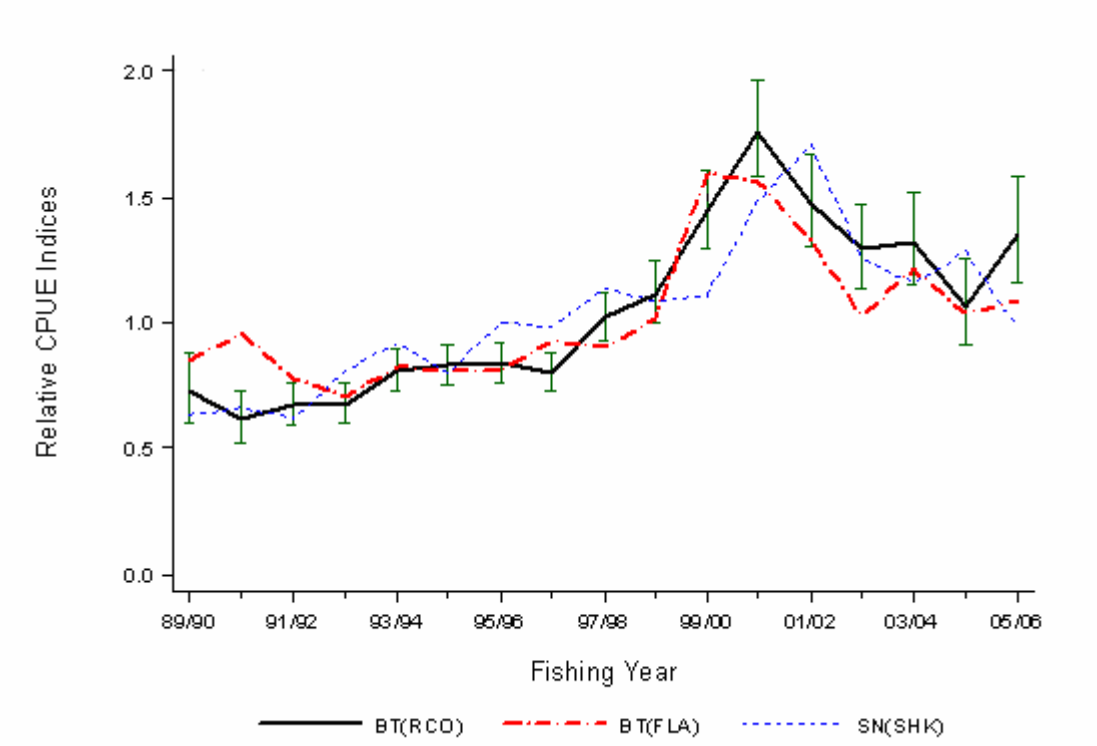


Figure 2: Comparison of the lognormal indices from three independent CPUE series for ELE 3: target RCO bottom trawl [BT(RCO)], target FLA bottom trawl [BT(FLA)] and target shark setnet [SN(SHK)] (Starr *et al*. 2007a).

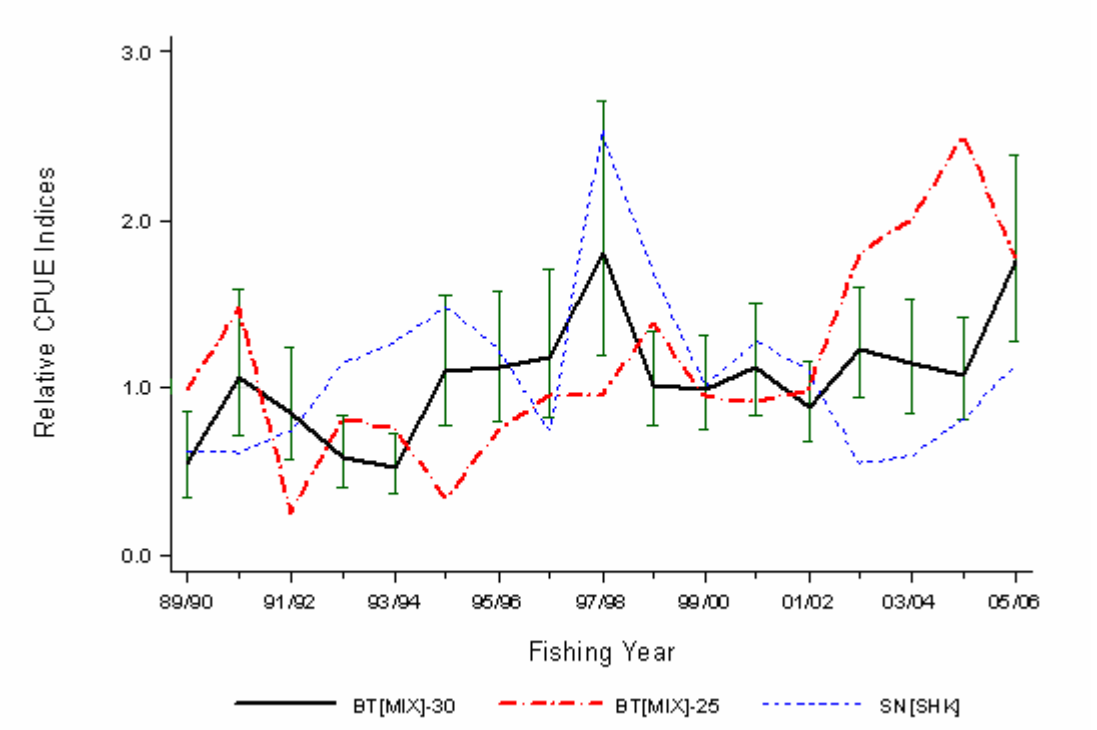


Figure 3: Comparison of the lognormal indices from three different standardised models derived from catch/effort data for the by-catch ELE 5: a) BT(MIX)-30: flatfish bottom trawl fishery in Area 025 (western Foveaux Strait); a) BT(MIX)-25: flatfish bottom trawl fishery in Area 025 (eastern Foveaux Strait); c) SH(SHK): target school shark setnet fishery operating in both Area 025 and 030. (Starr *et al*. 2007b).

4.2 Biomass Estimates

Estimates of current and reference absolute biomass are not available.

4.3 Estimation of Maximum Constant Yield (MCY)

MCY was estimated from the equation MCY = cY_{AV} (Method 4). The value c was set equal to 0.7 based on the estimate of M = 0.35. Mean catches for the years 1983–84 to 1985–86 were used to estimate MCY because the fishery appeared to stabilise after an earlier period of decline.

(i) South–East (Coast) and South–East (Chatham Rise) (ELE 3)

MCY = 0.7 * 565.5 t = 396 t (rounded to 400 t).

(ii) Southland and Sub–Antarctic (ELE 5)

MCY = 0.7 * 94.9 t = 66 t (rounded to 70 t).

(iii) Challenger/Central (Plateau) (ELE 7)

MCY = 0.7 * 52.3 t = 37 t (rounded to 40 t).

The estimate of M is uncertain and recruitment variability may be low, so the estimate of c is uncertain. The MCY estimates are considered approximate and are probably conservative.

The level of risk to the stock by harvesting the population at the estimated MCY value cannot be determined.

4.4 Estimation of Current Annual Yield (CAY)

CAY cannot be determined.

Yield estimates are summarised in Table 5.

Table 5: Yield estimates (t) for elephant fish.

Parameter	Fishstock	Estimate
MCY	ELE 3	400
	ELE 5	70
	ELE 7	40
	Total	510
CAY	All	Cannot be determined

4.5 Other yield estimates and stock assessment results

No other yield estimates are available.

4.6 Other Factors

The amount of quota allocated was below historic catch levels and has reduced elephantfish mainly to a trawl bycatch for inshore vessels. On the east coast of the South Island the availability of elephantfish since the start of the QMS appears to have been high, and many individual fishers have exceeded their quotas. As a result, deeming and bycatch trading of this species has increased.

Target fishing for elephantfish using setnets has decreased since the introduction of the QMS. The distribution of the target trawl species such as red cod, barracouta and flatfish influences the likelihood of fishers encountering elephantfish.

5. ANALYSIS OF ADAPTIVE MANAGEMENT PROGRAMMES (AMP)

The Ministry of Fisheries revised the AMP framework in December 2000. The AMP framework is intended to apply to all proposals for a TAC or TACC increase, with the exception of fisheries for which there is a robust stock assessment. In March 2002, the first meeting of the new Adaptive Management Programme Working Group was held. Two changes to the AMP were adopted:

- a new checklist was implemented with more attention being made to the environmental impacts of any new proposal;
- the annual review process was replaced with an annual review of the monitoring requirements only. Full analysis of information is required a minimum of twice during the 5 year AMP.

ELE 3

The ELE 3 TACC has been increased twice under AMP management: from 500 to 825 t in October 2000 and from 825 to 950 t in October 2002.

Full-term Review of ELE 3 AMP in 2007

In 2007 the AMP FAWG reviewed the performance of the AMP (Starr et al., 2007). This report was not updated in 2008. In 2007 the Working Group noted:

Fishery Characterization

- The ELE 3 TACC was increased from 500 t to 825 t in October 2000. An additional allowance of 5 t was made for customary and recreational use, bringing the total TAC to 830 t per year. The TACC was again increased to 950 t in October 2002 in response to ongoing difficulties with limiting catches within the TACC.
- After an initial period of low catches from 1936 till 1950, ELE 3 catches increased rapidly, and catches over 1000 t per year (probably under-estimated) were common in the 1950s and 1960s. Catches then declined steadily to ~500 t by the time ELE 3 was introduced into the QMS in 1986–87.
- Since then, catches have increased rapidly, exceeding the TACC throughout the past two decades, and reaching similar levels to the 1950s by 1997–98. As a result of increasing TACCs under the AMP, the level of overcatch has decreased, and has averaged 3% over the past four fishing years.
- Management efforts to control this overcatch have likely affected the accuracy of reported and landed catch. In particular, anecdotal reports indicate that significant dumping of elephantfish probably occurred as a consequence of high deemed values for this fishery after 2000–01 and the elimination of the bycatch trade-off scheme in 1997–98. Deemed values were subsequently decreased from October 2005 onwards to encourage accurate reporting.
- 83% of the ELE 3 catch is taken by multi-species bottom trawls, and the remaining 17% by setnets. The trawl catch is primarily taken in the Canterbury Bight, with smaller catches in Pegasus Bay area. The setnet catch is mostly taken south of the Banks Peninsula in the Bight.
- The elephantfish fishery is seasonal, with trawl and setnet catches mainly being taken from October - March, mainly as a result of a summer fishery in Area 22. Trawl catches have tended to extend further into the fishing year since 1997–98, particularly in other areas.
- ELE are caught in a range of target fisheries. The trawl catch is primarily made while targeting red cod, barracouta, elephantfish and flatfish, with a significant increase in targeting for elephantfish from 2001–02 onwards. Setnet catches are made in the multispecies shark fishery targeting rig, school shark and elephantfish. Recreational catches are poorly estimated, but probably < 5 t.

CPUE Analysis

- The 2001 Working Group concluded that the most suitable CPUE index for ELE 3 was provided by non-zero catch records in the red cod targeted trawl fishery. Additional analyses conducted since 2005 include two other fisheries: the flatfish targeted trawl fishery and the shark-targeted setnet fishery.
- CPUE for these fishery definitions were standardised using a lognormal model based on non-zero catches. In additional, a binomial model was used to investigate the effect of changing proportion of non-zero catches.
- The three standardised CPUE series provide fairly similar and consistent trends, all showing a steady increase in CPUE from 1989–90 to somewhere around 1999–00 to 2001–02, followed by a decline in catch rates to the present time, possibly with some levelling off over the past two or three years.
- Offsets in the maximum catch rate peaks in these three fisheries may be related to the flatfish fishery taking smaller fish in shallower water, and the selectivity of the setnet fishery for larger (older) fish.
- Standardisation has little effect on the nominal CPUE from the flatfish fishery. However, it does have a strong effect on catch rates in the red cod fishery since 2002–03, converting the steep increase in unstandardised CPUE into a level trend, suggesting increasing effects of targeting on elephantfish and the effect of a trend towards longer tows in recent years.
- Standardisation of the setnet fishery converts the strongly fluctuating unstandardised data into a smoother trend quite similar to the other two series. The three series in combination provide a consistent picture of catch rates in this fishery.
- The Working Group noted fleet behaviour changes at the time of management changes in 2000–01 to 2001–02, with increases in factors such as trip length, tow duration and number of tows, which contribute to the increase in non-zero catches. The Working Group noted that these behaviour changes all confirm an increase in targeting on ELE after 2000. Vessels are therefore acting as proxies for effort, which does not enter this model. The Working Group again proposed that the binomial component of the models be accorded little weight.
- The progression in CPUE peaks across the fisheries is consistent with the biology of the species and what is know about mean sizes caught in these fisheries. In general, the Working Group concluded that they had more confidence in the CPUE trends prior to 2000, but less confidence in trends thereafter.

Trawl Surveys

- A series of winter trawl surveys were as conducted off the ECSI from 1991 till 1996, and a series of summer surveys from 1996–97 to 2000–01, for a range of species, including elephantfish.
- Results of these surveys were highly variable, suggesting unrealistically high inter-annual changes in abundance. These changes appear to have resulted more from annual changes in catchabilities of elephantfish and other species. Length-frequency distributions of fish in these surveys also showed high inter-annual variability, which is unlikely to reflect actual changes in the population structure.
- Estimates of abundance from these surveys widely straddle the CPUE abundance indices, alternately greatly exceeding or being well below CPUE estimates in alternate years.
- The 2001 FAWG meeting concluded that the summer ECSI survey was not reliably monitoring elephantfish, showing changing catchabilities that exceeded likely changes in abundance. The Working Group recommended that the summer trawl survey be discontinued.

Logbook Programme

- A logbook programme was introduced into QMA3 in 1994–95 to cover the three main target shark species (SPO, SCH and ELE) in the setnet fishery. A bottom trawl logbook

programme was initiated by the SEFMC in mid 2002, primarily as part of the AMP proposal for an increase TACC for ELE 3.

- The setnet logbook programme has achieved good levels of coverage, covering >40% of catch in 1995–96 and from 1998–99 to 2001–02, with a peak of 63.5% coverage in 00/01. However, coverage decreased substantially to 11.6% in 2004–05, and has since increased again to 21.4%. Apart from 1997–98 (when coverage levels were minimal) the number of sharks sampled has generally exceeded 600 per year, with a peak of 1 671 sharks sampled in 2000–01.
- Setnet logbooks have provided good coverage by area and season, with particularly good coverage of the main Canterbury Bight fishing area. The programme has never achieved good coverage of the Kaikoura area, but ELE catches have always been small in that area.
- Bottom trawl logbook coverage has been poor (1.6% - 4.4%) in all years except 2003–04, when a concerted effort achieved 19.6% coverage. Despite this poor coverage, 2 000 – 2 500 sharks have been sampled from 2002–03 onwards, with 7 239 sampled in 2003–04.
- Trawl logbook coverage has also focussed in the Canterbury Bight, and has never attained good seasonal coverage.
- These logbooks have provided good length-frequency samples, indicating similar length-frequency distributions in all years from 1995–96 to 2004–05, with consistently lower mean size for males (45 cm – 70 cm) than females (55 cm – 85 cm). The sex ratio is also skewed ~70% to females.
- There are no indications of any decline in mean size or decrease in proportions of larger sharks in the setnet fishery. The Working Group questioned the substantial increase in the apparent size of both males and females in 2005–06 samples. The Working Group could not determine if this resulted from a change in sampling procedures, misinterpretation of instructions, or a shift in the fishery to different depths or areas.
- Sex ratios in the trawl fishery averaged ~50:50, and length frequencies show higher inter-annual variability, but with no clear apparent trends.

Effects of Fishing

- A general overview of the effects of setnet and trawl fishing along the South Island East Coast is presented under AMP reviews for SPO 3, SCH 3 and GUR 3.
- No additional information was presented on specific effects of the ELE 3 fishery.

Conclusions

- Continuing catch increases since 1989–90, sustained high catches, increasing CPUE after the low point of 1989–90 and absence of evidence of declines in mean size all indicate that the fishery is not having a substantial impact on the abundance of the ELE3 stock.
- However, there are indications of increased targeting on elephantfish, since 2000–01. There are also concerns that other fleet behavioural changes in response to management actions may have reduced the extent to which CPUE reflects abundance since 2000–01. There is lower confidence in recent CPUE estimates.
- Catches at the current TACC level are likely to be sustainable in the short to medium-term. However, it is not known whether current catches are sustainable in the long-term.

ELE 5

The ELE 5 TACC for was increased from 71 t to 100 t under an AMP in October 2001. The TACC was further increased under AMP Management to 120 t in October 2004.

Review of ELE 5 AMP in 2007

The AMP FAWG reviewed the ELE 5 AMP (Starr *et al*. 2007b). This report was not updated in 2008. In 2007 the Working Group noted:

Fishery Characterization

- The ELE 5 TACC was increased from 71 t to 100 t in October 2001. Allowances of an additional 5 t each for recreational and customary use brought the total TAC to 110 t. The TACC was again increased to 120 t in October 2004 as a result of ongoing difficulties with limiting catches within the TACC. An additional 16 t allowance for recreational and customary fishing brought the TAC to 136 t.
- Catches remained below the TACC until 1995–96, and then escalated rapidly to almost double the TACC level by 2000–01. Following increase in the TACC under the AMP in 2001, catches dropped and remained at about the TACC level from 2002–03 to 2004–05, attaining the new AMP TACC level in 2004–05. Catches in 2005–06 have again exceeded the TACC by 27 t, but are still below the highest reported level of 154 t in 2000–01.
- The ELE 5 fishery would have had similar problems to the ELE 3 fishery, where management efforts to control overcatch have likely affected the accuracy of reported and landed catch. In particular, anecdotal reports indicate that significant dumping of elephantfish probably occurred as a consequence of high deemed values after 2000–01.
- 87% of the ELE 5 catch is taken in the bottom trawl fishery, mainly as a bycatch in the flatfish or stargazer targeted fishery, a further 12% is caught in the multi-species shark-targeted (SPO, SCH, ELE) setnet fishery.
- Almost all the trawl and setnet ELE 5 landings come from the Western Foveaux Strait (Area 30) and Eastern Stewart Island (Area 25). The flatfish targeted trawl fishery occurs across both areas, whereas stargazer, and to some extent elephantfish targeting, occurs mainly in the western Strait. In the setnet fishery, more rig targeting occurs east of Stewart Island, with school shark and elephantfish targeting being more prevalent in the Western Strait.
- The setnet fishery is strongly seasonal, occurring mainly from November – February. The trawl fishery also used to be a predominantly summer fishery, but switched to a year-round fishery in 1998–99.
- ELE 5 trawl catches are mostly made in a fairly narrow, shallow depth range from ~40 m – 100 m.

CPUE Analysis

- Previous standardised CPUE analyses have been conducted using data from the flatfish targeted trawl fishery. However, noting loss of data from key fishing months in earlier years, the 2006 Plenary report concluded that this was not a reliable index of abundance for ELE 5.
- With 4 years additional data, three different fishery definitions were used in standardised CPUE analyses in 2007: the flatfish targeted trawl fishery in area 30, the flatfish trawl fishery in area 25 and the multi-species shark-targeted (SPO, SCH, ELE) setnet fishery.
- CPUE for these fishery definitions were standardised using a lognormal model based on non-zero catches. In additional, a binomial model was used to investigate the effect of changing proportion of non-zero catches.
- The two bottom trawl standardised series showed different trends. Area 30 showed a strong peak in 1994–95, followed by a decline to 1998–99 and a stable trend thereafter at about historic CPUE levels. Area 25 shows a generally increasing trend to a peak in 2003–04, with a decline thereafter. The setnet index is essentially stable at the average level across the period, but with a peak in 1997–98.
- The overall impression of the three indices overlaid is of quite strongly fluctuating CPUE around a fairly stable long-term average level. It appears that these standardised series may be reflecting inter-annual changes in availability or targeting in these fishery components, rather than actual abundance.
- The working group noted a very strong seasonal signal in the trawl indices, with summer catches being 6 times the winter catches. This raises the question as to whether the summer fishery dominated index is an index of abundance, or just an index of strongly targeted effort on a dense near-shore summer aggregation. In contrast, the setnet fishery does not

show a strong seasonal signal, possibly because catch levels for elephantfish are low and that this species is only taken as bycatch.

- Trends in the two trawl areas appear to contradict each other, with differences between the two areas difficult to understand. The working group raised questions regarding whether apparent changes in targeting reflected actual targeting changes, or simply changes in reporting of target, in which case stargazer would also be part of the fishery. The working group therefore requested that the analysis be repeated using all vessels which caught either ELE or STA in the flatfish fisheries in areas 25 and 30.
- The re-analysis of a mixed species target trawl CPUE was presented to the AMP FAWG at a subsequent meeting, based on data from a suite of common core vessels which fished in both Area 025 and 030. The analysis concentrated on targeted flatfish, stargazer and elephantfish, with each area analysed independently. Standardised CPUE indices in these two fisheries then showed similar trends, with the trend in stat area 30 being more optimistic. A scatter plot of the vessel coefficients also showed a reasonable level of consistency in these coefficients across the two analyses.

Trawl Surveys

- Four trawl surveys were conducted on the plateau extending southwest off the South Island from 1993 to 1996, targeted at the 6 main commercial species: barracouta, blue warehou, gemfish, ling, school shark and stargazer.
- The depth range of the surveys was generally deeper than optimum ranges for elephantfish, and the surveys are not expected to have provided reliable estimates of ELE abundance in the area. The estimates of ELE abundance from these surveys show high variance and no trend.

Logbook Programme

- A setnet logbook programme was introduced into FMA3 in 1994–95 for SPO, SCH and ELE, but primarily in support of the SPO 3 AMP. This programme was extended to area 5 in 1995–96. Most of the logbook sets in the Southland were targeting school shark.
- A trawl logbook program was implemented in 2002 in support of the ELE 3 AMP, and extended to FMA5 when the ELE 5 TACC was increased in October 2004.
- However, coverage has been poor, with sampling of ELE 5 only being reported in 1995–96 and 1998–99. Coverage of the setnet catch in these years was only 5.2% and 2.8% respectively, with 46 and 20 elephantfish being sampled.
- Despite the low coverage, setnet logbooks obtained reasonable representation of the main fishing areas in those 2 years, although good seasonal coverage was only achieved in 1998–99.
- Coverage by the trawl logbooks has also been inadequate, increasing from 4.4% in 2002–03 to 12.9% in 2004–05, but decreasing again to only 2.3% in 2005–06. The number of elephantfish sampled has been better, increasing from 411 to 706 fish per year by 2004–05, but decreasing to 60 fish last year.
- Sex ratios in the setnet logbook samples showed about 80% females, and larger mean size for females. Size compositions were similar between the two years sampled, although sample numbers are too low to place any reliance on these.
- Trawl logbooks have achieved reasonable representation of areas and across the seasons in only one of the four years sampled.
- In marked contrast to the setnet fishery, trawl samples contained, on average, about 54% males. Size composition of males and females shows inter-annual variations, with a shift to larger fish in 2003–04. However, given the poor seasonal coverage, these differences are likely to result from seasonal sampling differences.
- Analysis of males by size in the trawl samples provided a good maturity ogive, indicating size-at-50% maturity at ~50 cm to 55 cm.

Effects of Fishing

- A general overview of the effects of setnet and trawl fishing along the South Island south coast is presented under the AMP reviews for SCH 5, which is essentially the same fishery as the ELE 5 fishery. No additional information was presented on specific effects of the ELE 5 fishery.
- The Working Group noted that logbook information indicated that some trawling and/or setnet activity occurred in the Foveaux Strait dredge oyster fishery area. The specific extent of overlap, and the potential effect of the SCH 5 fisheries on the oyster fishing area, should be evaluated and reported.
- The Working Group also noted that white sharks had recently been accorded protected status. Any available information on interactions with white sharks by e.g., the setnet fishery should be reported, and whether the industry has implemented any measures to reduce and report such interactions.

Conclusions

- The 2006 Plenary report notes that, at the time of the increases in TACC under the AMP, there was a "*reasonable probability that the stock was above the size that would support the MSY. However, it is not known if current catch levels and current TACCs are sustainable*". The results of this year's CPUE analysis do not provide any basis for changing those conclusions.

6. STATUS OF THE STOCKS

No estimates of current and reference biomass are available.

ELE 2

It is not known if recent catch levels or the current TACC are sustainable. The state of the stock in relation to B_{MSY} is unknown.

ELE 3

ELE 3 is currently being managed within an AMP that is monitoring a CPUE index derived from elephantfish landings in the red cod bottom trawl fishery. Before the introduction of the QMS, elephantfish off the south east coast of the South Island were considered severely overfished, and TACs were initially set at low levels to facilitate stock recovery. Based on the observed catches, and on the increasing biomass trend from the CPUE analysis, it now appears that this stock has rebuilt considerably since the mid-1980s. The TACC for ELE 3 was increased to 950 t for the 2002–03 fishing year under the AMP. Recent (2004/05 to 2006/07) catch levels have substantially exceeded the TACC and the MCY; but the MCY estimate is probably conservative. Trawl targeting on ELE has increased significantly over the past five years. However, CPUE has remained high and the current TACC and catches are probably sustainable in the short- to medium-term. It is not known whether current catches are sustainable in the long-term. The state of the stock in relation to B_{MSY} is unknown.

ELE 5

Before the introduction of the QMS, elephantfish in Southland were considered severely overfished, and TACs were initially set at low levels to facilitate stock recovery. The TACC for ELE 5 was increased twice within the AMP - first to 100 t in October 2001 and then to 120 t in October 2004 - as there was a reasonable probability that the stock was above the size that would support the MSY. However, it is not known if recent catch levels and current TACCs are sustainable. The state of the stock in relation to B_{MSY} is unknown.

ELE 7

In ELE 7 catches since 1987–88 have been above the MCY and below the TAC. It is not known if recent catch levels and current TACCs are sustainable. The state of the stock in relation to B_{MSY} is unknown.

TACCs and reported landings are summarised in Table 6.

Table 6: Summary of yields (t), TACCs (t), and reported landings (t) for elephant fish for the most recent fishing year.

Fishstock	QMA		MCY	2006–07 Actual TACC	2006–07 Reported landings
ELE 1	Auckland (East) (West)	1 & 9	–	10	<1
ELE 2	Central (East) (West)	2 & 8	–	22	17
ELE 3	South-East (Coast) (Chatham)	3 & 4	400	950	960
ELE 5	Southland and Sub-Antarctic	5 & 6	70	120	151
ELE 7	Challenger	7	40	102	116
ELE 10	Kermadec	10	–	10	0
Total			510	1214	1244

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