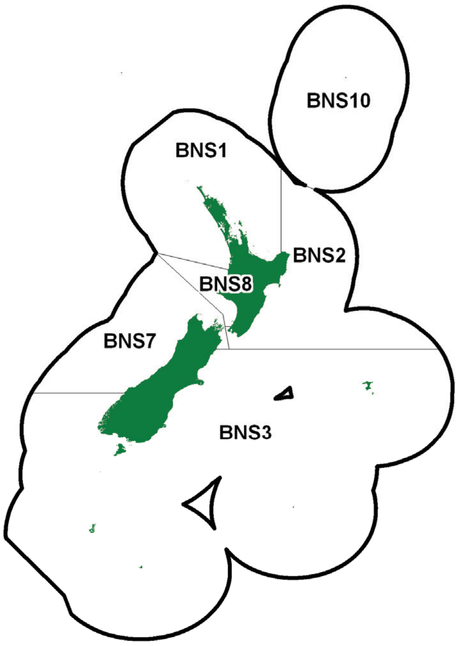
BLUENOSE (BNS)

(Hyperoglyphe antarctica)
Matiri



1. FISHERY SUMMARY

1.1 Commercial fisheries

The most important domestic bluenose trawl fisheries occur off the Wairarapa Coast (BNS 2), where bluenose was a major bycatch in the alfonsino and gemfish target trawl fisheries, and has been increasingly targeted in recent years. There is substantial targeting of bluenose by the line fishery in the Bay of Plenty and off Northland (BNS 1). Line fisheries for bluenose also exist in BNS 2 north and east of East Cape and to the west of Cook Strait in BNS 7 and BNS 8. About half of the BNS 2 catch is taken by longline and the remainder by bottom trawl. After 2001 a targeted fishery for bluenose developed on the Chatham Rise using both trawl and line gear. About two thirds of BNS 3 landings are taken as a bycatch in the hoki bottom trawl and ling longline fisheries. Bluenose supports a small target line fishery off the Wairarapa Coast and a small amount of target setnet fishing for bluenose occurs in the Bay of Plenty and off the east and south coasts of the South Island.

Prior to 1981, bluenose were sometimes recorded as bonita, or mixed with hapuku/bass/groper, and not reported separately as bluenose, so landings data for this early period are inaccurate. Landings before 1986–87 have been grouped by statistical area that approximates the current QMAs. Total annual bluenose landings were relatively constant at an average level of 1406 t from 1984 to 1989–90, and then rose to an average 2324 t from 1992–93 to 1995–96. Total landings from 2002–03 to 2004–05 exceeded 3000 t, but dropped to 2475 t in 2005–06 and 2046 t in 2008–09.

TACCs were first established for bluenose upon establishment of the QMS in 1986–87, with TACCs for all bluenose stocks totalling 1350 t. In the past 15 years, all bluenose Fishstocks have been managed, for at least some of the time, under Adaptive Management Programmes (AMPs). BNS 3 was the first stock to enter an AMP in October 1992, with a TACC increase from 175 t to 350 t. This was further increased within the AMP to 925 t in October 2001, plus an additional transitional 250 t of ACE provided to Chatham Islands fishers in 2001–02 and 2002–03 only. BNS 7 (TACC increase from 97 t to 150 t) and BNS 8 (TACC increase from 22 t to 100 t) entered AMPs in October 1994. BNS 1, the second largest bluenose fishery, entered an AMP in October 1996, with a TACC increase from 705 t to 1000 t. BNS 2, the largest bluenose fishery, was the most recent entry into an AMP in October 2004, with a TACC increase from 873 t to 1048 t. TACC's for all bluenose stocks were reduced on 1 October 2008: 786 (BNS 1), 902 (BNS 2), 505 (BNS 3), 89 (BNS 7) and 43 (BNS 8).

Reported landings and TACCs since 1981 are given in Table 1, while the historical landings and TACC for the main BNS stocks are depicted in Figure 1.

Table 1: Reported landings (t) of bluenose by Fishstock from 1981 to 2008–09 and actual TACCs (t) from 1986–87 to 2008–09. QMS data from 1986-present.

Fish stock	BNS 1		BNS 2		BNS 3		BNS 7		BNS 8	
FMA (s)	1 & 9		2		3, 4, 5 & 6		7		8	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
1981*	146		101		36		12			
1982*	246		170		46		22			
1983†	250		352		51		47		1	
1984†	464		810		81		30		1	
1985†	432		745		73		26		1	
1986†	440		1 009		33		53		1	
1986–87	286	450	953	660	93	150	71	60	1	20
1987–88	405	528	653	661	101	166	104	62	1	22
1988–89	480	530	692	768	90	167	135	69	13	22
1989–90	535	632	766	833	132	174	105	94	3	22
1990–91	696	705	812	833	184	175	72	96	5	22
1991–92	765	705	919	839	240	175	62	96	5	22
1992–93	787	705	1 151	842	224	350	120	97	24	22
1993–94	615	705	1 288	849	311	350	79	97	27	22
1994–95	706	705	1 028	849	389	357	83	150	79	100
1995–96	675	705	953	849	513	357	140	150	70	100
1996–97	966	1 000	1 100	873	540	357	145	150	86	100
1997–98	1 020	1 000	929	873	444	357	123	150	67	100
1998–99	868	1 000	1 002	873	729	357	128	150	46	100
1999–00	860	1 000	1 136	873	566	357	114	150	55	100
2000–01	890	1 000	1 097	873	633	357	87	150	14	100
2001–02	954	1 000	1 010	873	733	925+	70	150	17	100
2002–03	1 051	1 000	933	873	876	925+	76	150	66	100
2003–04	1 030	1 000	933	873	915	925	117	150	96	100
2004–05	870	1 000	1 162	1 048	844	925	94	150	42	100
2005–06	699	1 000	1 136	1 048	536	925	84	150	20	100
2006–07	742	1 000	957	1 048	511	925	164	150	50	100
2007–08	585	1 000	1 055	1 048	660	925	145	150	53	100
2008–09	627	786	864	902	444	505	80	89	31	43

Fish stock	BNS 10			
FMA (s)	10		Total	
	Landings	TACC	Landings	TACC
1981*	0		295	
1982*	0		484	
1983†	0		701	
1984†	0		1 386	
1985†	0		1 277	
1986†	0		1 536	
1986–87	7	10	1 411	1 350
1987–88	10	10	1 274	1 449
1988–89	10	10	1 420	1 566
1989–90	0	10	1 541	1 765
1990–91	12	10#	1 781	1 831
1991–92	40	10#	2 031	1 837
1992–93	29	10#	2 335	2 016
1993–94	3	10#	2 323	2 023
1994–95	0	10	2 285	2 161
1995–96	0	10	2 351	2 161
1996–97	9	10#	2 846	2 480
1997–98	30	10#	2 613	2 480
1998–99	2	10#	2 775	2 480
1999–00	0	10#	2 731	2 480
2000–01	0	10#	2 721	2 480
2001–02	0	10#	2 784	3 048
2002–03	0	10	3 002	3 058
2003–04	0	10	3 091	3 058
2004–05	0	10	3 012	3 233
2005–06	0	10	2 475	3 233
2006–07	0	10	2 425	3 233
2007–08	0	10	2 498	3 233
2008–09	0	10	2 046	2 335

* MAF data, † FSU data, # Includes exploratory catches in excess of the TAC, + An additional transitional 250t of ACE was provided to Chatham Islands fishers, resulting in an effective commercial catch limit of 1 175t in 2001–02 and 2002–03.

As a result of these TACC increases under AMPs, the combined total TACC for all bluenose stocks increased from an initial 1350 t in 1986–87 to 3233 t by 2004–05. Catch performance against this TACC has varied, with the combined TACC being under-caught by an average 9% (average landings 1504 t / year) over 1987–88 to 1990–91, over-caught by an average 11% (average landings 2501 t /

year) over 1991–92 to 2000–01, and under-caught by an average 18% (average landings 2637 t / year) since 2003–04. 2006–07 landings (2425 t) were 75% of the combined TACC of 3233 t.

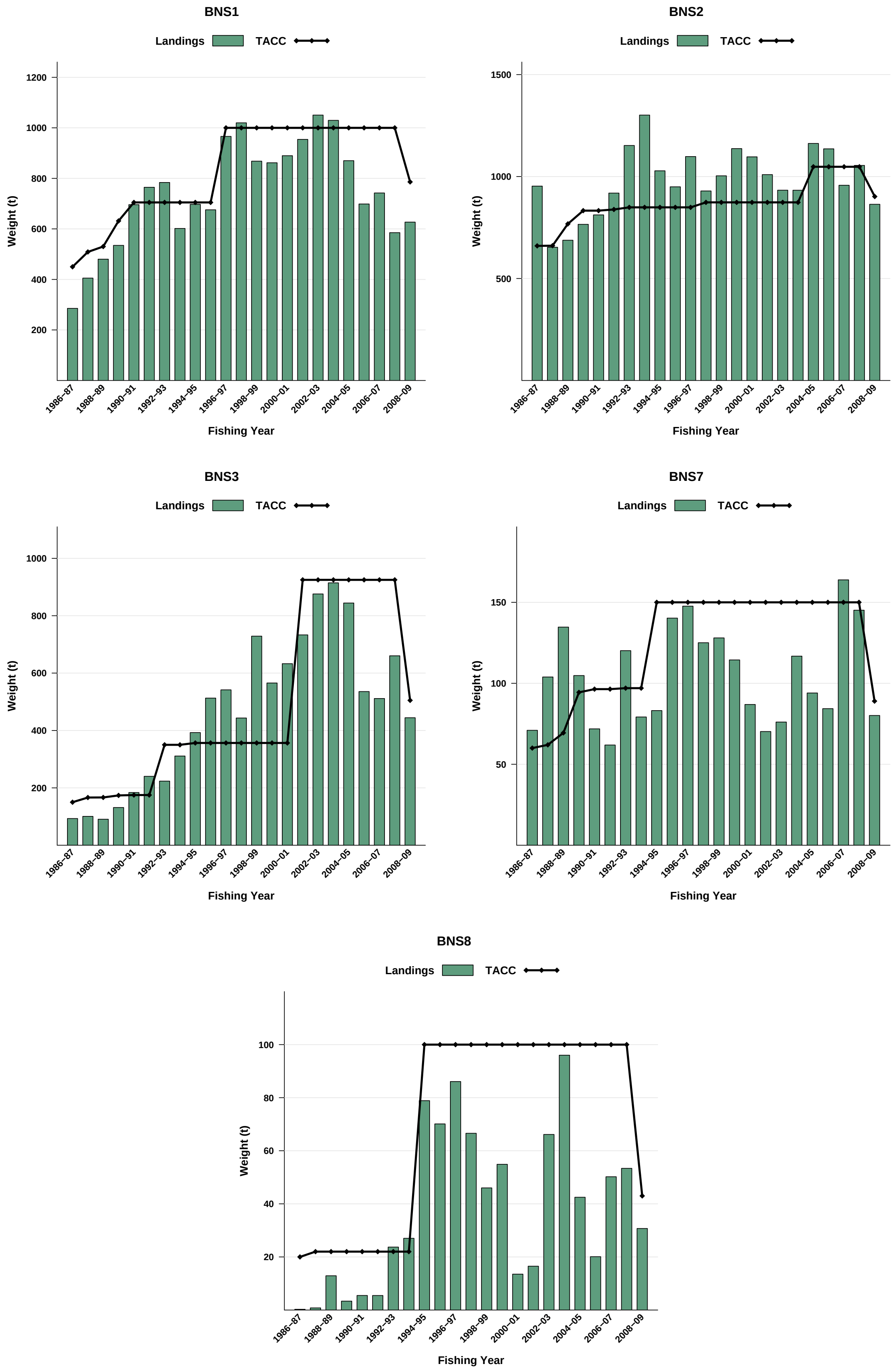


Figure 1 [Continued]: Historical landings and TACC for the five main BNS stocks. From top left: BNS1 (Auckland East), BNS2 (Central East), BNS3 (South East Coast), and BNS7 (Challenger), BNS8 (Central Egmont). Note that these figures do not show data prior to entry into the QMS.

1.2 Recreational fisheries

The annual recreational catch of BNS 1 was estimated from diary surveys to be 2 000 fish in 1993–94 (Teirney *et al*. 1997), 5000 fish in 1996 (Bradford 1998) and 11,000 fish in 1999–00 (Boyd & Reilly 2005). The Recreational Working Group has concluded that the methodological framework used for telephone interviews produced incorrect eligibility figures for the 1996 and previous surveys. Consequently the harvest estimates derived from these surveys are considered to be unreliable. This group also indicated concerns with some of the harvest estimates from the 2000–01 survey. The group recommended: "*that the harvest estimates from the diary surveys should be used only with the following qualifications: a) they may be very inaccurate; b) the 1996 and earlier surveys contain a methodological error; and, c) the 2000 and 2001 harvest estimates are implausibly high for many important fisheries.*"

Minor recreational catches of bluenose are landed in other areas.

1.3 Customary non-commercial fishing

No quantitative information on the level of customary non-commercial take is available.

1.4 Illegal catch

No quantitative information on the level of illegal catch is available.

1.5 Other sources of mortality

No information is available on any other sources of bluenose mortality.

2. BIOLOGY

Depth distribution

The depth distribution of bluenose extends from near-surface waters to about 1 200 m. Research trawl surveys record their main depth range as 250–750 m, with a peak at 300–400 m, and they regularly occur to about 800 m (Anderson *et al*. 1998). Commercial catches recorded in logbook programmes implemented for some of the bluenose stocks under AMPs, and TCEPR data for these fisheries, confirm that bluenose catches range in depth from <100 m to about 1 000 m, depending on target species, but with a strong peak around 400 m for bluenose targeted fishing by any method.

The depth distribution of bluenose changes with size, with small juveniles known to occur at the surface under floating objects (Last *et al*. 1993, Duffy *et al*. 2000). Larger juveniles probably live in coastal and oceanic pelagic waters for one or two years. Fish 40–70 cm in length are caught between 200 m and 600 m, while larger fish, particularly those larger than 80 cm, are more often caught deeper than 600 m. A sequential move to deeper waters as bluenose grow has been confirmed by analysis of the stable radio-isotope ratios in otolith sections. Oxygen isotope ($\delta^{18}O$) ratios of bluenose otolith cores confirm residence of juvenile fish within surface waters. Changes in oxygen isotope ratios across otolith sections indicate changes in preferred mean depth with age of each fish (Horn *et al*. 2008). That study hypothesised that the larger adults may be distributed below usually fished depths on underwater topographic features, but potentially available to fisheries as a result of regular vertical feeding migrations. The largest adults appear to reside in 700–1000 m; i.e. deeper than most trawl or longline fishing for bluenose occurs. However, adult bluenose are also known to associate closely with underwater topographic features (hills and seamounts), which would facilitate diurnal migrations into shallower depths to feed.

Age and growth

Recent ageing validation work by Horn *et al.* (2008) substantially revised estimates of maximum age and size at maturity for bluenose. Radiocarbon (^{14}C) levels in core micro-samples from otoliths that had been aged using zone counts were compared with a bomb-radiocarbon reference curve which provided independent estimates of the age of the fish. This study estimated a maximum age for bluenose in the range of 50–60 years, approximately twice the previously quoted maximum age estimate. More recent work has extended the maximum age to 71 years (Horn & Sutton in press). This maximum age is consistent with the recently developed maximum age of 85 years for the closely related barrelfish (*Hyperoglyphe perciformis*) in the western North Atlantic, also determined, in part, using the bomb chronometer method (Filer & Sedberry 2008). Previous under-estimates of bluenose ages appears to have resulted from the incorrect interpretation of paired, fine 'split rings' as single growth zones, when they probably represent two separate growth zones.

Growth curves for bluenose have not yet been updated using this new validated zone-count methodology, and additional ageing work needs to be done to generate new growth estimates.

The updated estimate of maximum age of 71 years determined by Horn & Sutton (in press) results in an estimate of natural mortality $M = 0.06$ for a lightly exploited population ($p = 0.01$), and an estimate of $M = 0.05$ for a moderately exploited population ($p = 0.03$), using the method of Hoenig (1983). This range is substantially lower than previous estimates of M for bluenose reported in Plenary reports, such as the 2004 estimate of 0.18 based on a maximum age of 25 years (Paul *et al*. 2004), or the earlier estimate of 0.3 based on a maximum age of 15 years (Horn & Massey 1989).

Instantaneous total mortality was estimated for five BNS 1 line fishery samples (Horn & Sutton in press). The best estimates of Z ranged from 0.13 to 0.17, indicating that F was probably lower than M. This result would be unexpected given recent strong declines in bluenose CPUE and the dramatic increase in targeting beginning in the mid 1980s. It was concluded that Z was underestimated, probably because the sampled fishing grounds did not hold closed populations, resulting in large or old fish being over-represented in the catch.

Maturity and reproduction

Little is known about the reproductive biology of bluenose. The otolith age validation study by Horn *et al.* (2008) estimated an age-at-maturity of 10 years. However, maturity ogives derived from age bluenose caught in BNS 1 from January to May indicated that ages at 50% maturity were about 15 and 17 years for males and females, respectively (Horn & Sutton in press). Data from commercial logbook programmes implemented under AMPs indicate that bluenose sampled in QMAs 1, 3, 7 and 8 mature at between 60 cm and 65 cm. Analysis of gonad maturity stage proportions for bluenose sampled by commercial logbook programmes in BNS 1 and BNS 7&8 indicate that spawning probably extends from spawn January to April annually. These logbook programmes have sampled reproductively active fish across the eastern North Island BNS 1 area from Bay of Plenty to North Cape, and across the inshore BNS 7&8 region from Cape Egmont in the north around to Jackson's Bay in the south (excluding the central section from Cape Farewell to near Cook Canyon). However, no distinct spawning grounds have yet been identified for this species in New Zealand waters. Biological parameters relevant to stock assessment are summarised in Table 2.

Table 2: Estimates of biological parameters for bluenose.

Fishstock		Estimate				Source
1. Natural mortality (M)						
BNS		0.06*				Revised estimate from 2009; see text.
2. Weight = a(length)^{b} (Weight in g, length in cm fork length).						
		Both sexes				
BNS 2	a = 0.00963	b = 3.173				Horn (1988a)

3. Von Bertalanffy growth parameters

	Females			Males		
	K	t_0	L_∞	K	t_0	L_∞
BNS 2†						

† Recent age validation studies show previous growth parameter estimates to be incorrect, see text.

3. REVIEW 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 AMP 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.

With the move towards fisheries plans, it has been decided that no new AMPs will be implemented, but that stocks will remain under existing AMPs until such time as they are incorporated into fisheries plans. The distinction between medium-term and full-term AMP reviews has been replaced with full reviews of each AMP stock every two years, while the AMPs still operate. Full-term reviews of all bluenose stocks were conducted in 2006, and so all bluenose AMPs were again fully reviewed in 2008 (Starr *et al*. 2008a,b,c; Jiang & Bentley 2008). Key results of these reviews are summarised here for each stock.

3.1 AMP fishery characterizations

BNS 1

Based on total accumulated landings from 1989–90 to 2006–07, 86% of BNS 1 are caught using bottom longline (BLL), and a further 5% by Dahn line. Relatively small amounts are caught using midwater trawl (MWT), bottom trawl (BT), setnet (SN) or trot line (TL). BNS 1 landings have been evenly distributed from north of the Hauraki Gulf (East Northland) to the Bay of Plenty. Less than 10% of landings have come from the West Coast North Island (WCNI) region, and only negligible amounts from the Hauraki Gulf. The majority of the midwater and bottom trawl landings of BNS 1 all come from the Bay of Plenty, although there has been an increase in the last two fishing years in the East Northland bottom trawl catch of BNS 1.

Bottom longline effort appears to have increased in 2004–05 in both the Bay of Plenty and East Northland, even as landings dropped. Bottom trawl effort appears to be declining in the Bay of Plenty in recent years. Recent BNS targeted bottom longline effort (number of hooks) has stayed relatively constant in the Bay of Plenty. Bottom longline catches are mainly made in summer and autumn months, but there are usually significant landings at the end of the fishing year. Fishermen who target bluenose also target tuna and the bluenose fishery tends to occur when tuna are less abundant, or after tuna fishing has ceased.

The BNS 1 BLL fishery is almost entirely targeted at BNS, with less than 10% of landings from sets targeted at hapuku/bass. Dahn lining is also primarily a bluenose target fishery, although with relatively more targeting towards hapuku/bass. Midwater trawl fishing for BNS 1 is almost all targeted at bluenose or alfonsino, while bottom trawl catches of BNS 1 are more widely distributed among a range of target fisheries, including alfonsino, gemfish, scampi and hoki. Most BNS taken while target fishing for BYX has been taken using bottom trawls, including sporadic BT landings of bluenose on the WCNI.

BNS 2

The two trawl methods (midwater and bottom trawl) have predominated in this fishery since its beginning up to 2003–04, after which line methods, particularly bottom longline, have exceeded the combined trawl methods in importance. Over the history of the fishery, midwater trawl catches have accounted for 41% of the total catch, followed by BLL (39%) and BT (15%). Midwater trawl landings dominated the fishery until 2002–03, and exceeded bottom trawl landings until 2006–07. The midwater trawl fishery has mainly targeted area 014, with catches declining rapidly after 2001–02, causing the total catch to decline below the TACC for the first time since 1990–91. In contrast, bottom longline catches increased steadily since 1996–97, exceeding the midwater trawl catch from 2003–04 onwards, and accounting for 70% of landings in 2006–07. Bottom trawl catches from area 014 have varied without trend. Bottom trawl catches reached almost 35% of the total catch in 1996–97, but have since declined significantly. Despite this decline, bottom trawl catches in 2006–07 exceeded midwater trawl landings for the first time since 1989–90.

In recent years there has been increased bluenose targeting. On average, target catches have contributed 42% of the BNS 2 total, with 35% taken by fisheries targeting alfonsino and the remainder while targeting other species (orange roughy, gemfish and hoki). Most targeted BNS 2 catches have been made by bottom longline, with a steady increase in bluenose 2 targeting since 2000–01, and a decline in bycatches.

There has been a clear shift in effort from the trawl to bottom longline fisheries since the late 1990's. Since then, both hours fished and number of vessels have decreased in the trawl fisheries. In contrast, although the number of bottom longline vessels has only increased slowly, there has been a steady increase in number of hooks in the bottom longline fishery, with rapid increase after 2002–03. This increase in hook numbers has been associated with shifts in targeting in some areas, with a significant effort increase targeting BNS in area 013, and a substantial reduction in hook numbers targeting ling in areas 014 and 015. For most fishing years, catch from the first half of the fishing year (October - March) constituted 60%–70% of the total annual catch. Prior to 1993–94 there were also significant catches from August and September, but these have since declined.

BNS 3

Reported catches exceeded the TACC prior to first entry into an AMP in 1991–92, and then from 1994–95 to 2000–01, prior to the increase in the effective commercial catch limit to 1 175t in 2001–02. Since then, the catch has remained below the TACC of 925t, reaching a peak of 915t in 2003–04. Catches declined sharply after that, to 511 t by 2006–07. Assessment of the BNS 3 stock is complicated by the fact that several bycatch and target BNS fisheries have developed across QMA 3 since the introduction of BNS 3 into the QMS, many with small and sporadic catches. These fisheries include:

- An auto-longline bycatch fishery for ling which covers all the waters from the western Chatham Rise to the sub-Antarctic;
- A large bycatch bottom trawl fishery for hoki on the Chatham Rise;
- A mid-water and bottom trawl bycatch fishery for alfonsino on the Chatham Rise;
- The scampi trawl fishery on both the western and eastern Chatham Rise.
- A target line fishery for bluenose and the hapuku/bass species on the northern Chatham Rise;
- A target line fishery primarily using Dahn line gear in Fiordland; and
- A target bottom trawl fishery on the Chatham Rise.

BNS 3 is the third most important of the bluenose stocks after BNS 2 and BNS 1, contributing about 20% of the total BNS catch over 1989–90 to 2006–07. This catch is primarily taken by bottom longline and bottom trawl, each taking about 40% of the total historic catch. 10% has been taken by setnet, with Dahn line, target line and mid-water trawl taking the remainder. 56% of BNS 3 catches come from the eastern Chatham Rise, with the remaining catches distributed across QMA 3, except for sub-Antarctic and southern South Island, where negligible catches are made. Most bottom longeline BNS 3 landings were caught in the east Chatham-Rise, peaking in the early 2000s. A reasonable amount of BNS is also caught off the SW South Island. Significant bottom longline effort in west Chatham Rise and sub-Antarctic is largely targeted at other species (such as ling), and BNS bycatches in these areas are small.

Bottom trawl and mid-water trawl BNS 3 catches are mostly made on the east Chatham-Rise, although effort in both fisheries extends across much of the Rise. Much of this effort is targeted at other species, with BNS being taken as a minor bycatch. Setnet BNS catches are made in inshore FMA 3, but this fishery has declined. In contrast, a new Dahn line fishery has developed off the SW South Island since the advent of the BNS 3 AMP. Bottom longline BNS catches are spread throughout the year, peaking during the autumn spawning season. BT catches are mainly made in the first half of the fishing year. Dahn line catches are mainly made in the second half of the fishing year, and setnet and mid-water trawl catches show no seasonal patterns.

BNS 3 catches are made in association with a wide range of target species. Line methods mainly target BNS, hapuku/bass and ling. Alfonsino, bluenose and hoki targeted trawls account for 90% of the bottom trawl bluenose landings. Bottom longline targeting differs between regions, with ling being the main declared target on the Chatham Rise and the sub-Antarctic ocean. The only area with a long-term targeted bluenose longline fishery has been a small fishery off the SW South Island. However, several regions show development of targeted bottom longline BNS fisheries in recent years, including NE, SE and SW South Island and both ends of the Chatham Rise. Prior to this, the bottom longline fishery off the Chatham Islands targeted ling and hapuku/bass. Bottom trawl catches are made primarily in alfonsino or bluenose targeted trawls on both ends of the rise, but with the development of a targeted bottom trawl BNS fishery on the east Chatham-Rise since the second TACC increase in 2000–01.

BNS 7 and 8

Catches in BNS 7 fluctuated around the TACC from 1986–87 to 1996–97, declined steadily to 70t in 2001–02, and then increased to slightly exceed the TACC in 2006–07. Prior to the increase in TACC in 1994-95, BNS 8 catches were very low, only reaching the TACC in 1992–93 and 1993–94. Catches increased to 79t when the TACC was increased in 1994–95 but, since then, have fluctuated well below the TACC, except for 2003–04 when landings were only 4 t below the TACC. BNS 7 & 8 are the least important of the BNS fishing areas, contributing only 2 600t, or < 6% of the total bluenose catch, over 1989–90 to 2006–07.

Bottom longlining accounted for 62% of the total BNS 7 landings and 94% of BNS 8 landings since 1989–90. Midwater and bottom trawling have landed about 30% of the total BNS 7 landings but less than 0.5% of the BNS 8 landings. Small quantities of BNS 7 are taken by bottom trawl or Dahn line, with minor landings of BNS 7 or 8 made by other methods. 70% of BNS 7 landings come from the central west coast of the South Island (Areas 033 and 034), with relatively less BNS 7 from northern South Island. Over 75% of BNS 8 landings come from the combined Areas 041 and 801 in the northern Taranaki bight, with the remainder coming from the southern Taranaki bight, south of Cape Egmont.

BNS 7 bottom longline landings show no seasonal pattern. Midwater trawl landings are confined to the last three months of the fishing years, coinciding with the winter hoki spawning fishery. The majority of BNS 7 bottom trawl landings are made at the end of the fishing year, also probably as a bycatch in the winter hoki fishery. There is no clear pattern in the seasonal landings of bluenose in the BNS 8 bottom longline fishery. The BNS 7 and BNS 8 line fisheries mainly target bluenose, and in BNS 7 secondarily target ling and hapuku/bass while, in BNS 8, ling is not targeted and hapuku/bass is relatively more important. BNS 7 trawling primarily targets hoki, which accounts for nearly 90% of the total midwater and bottom trawl landings. BNS 7 bottom trawl fishing which takes bluenose also targets orange roughy, barracouta and jack mackerel.

3.2 Effects of fishing under AMP Programmes

Bluenose fisheries overlap with a range of endemic seabirds including black petrel, *Procellaria parkinsoni*, Flesh-footed shearwater *Puffinus carneipes*, and grey-faced petrel *Pterodroma macroptera gouldi*. However, the bluenose longline fishery appears to have a low incidence of seabird interactions due to the weighting and rapid sinking of the bottom longlines used. The greatest concern regarding BNS 1 has been for any possible interactions with black petrels which has a stable but small population estimated at between 2 750 and 5 000 breeding pairs. The BNS 3 FMA includes two important breeding and feeding areas for New Zealand seabirds (the Chatham Rise and sub-Antarctic), raising concerns at possible interactions with fisheries. however, over the three year period since 2004–05, only 2 albatrosses and 13 petrels have been reported caught in the BNS 3 area., FMA 7 and FMA 8 appear to support lower numbers of seabirds and the tuna longline fishery in this area has a relatively low incidence of seabird interactions south of 38°S). In 2004–05, 23 sets were observed in the bluenose targeted BLL fishery off the east and west coasts of the North Island (FMAs 8 and 2), during which no seabird captures were observed.

No known/observed interactions with marine mammals have been recorded for the BNS 1, BNS 7 or BNS 8 longline fisheries, although observer coverage has been very low. Trawling rarely interacts with fur seals on the South Island east coast. Less than 1% of observed tows caught fur seals in 2001–02 or 2002–03. Only one capture of a Hector’s dolphin was reported by a fisherman in the red cod trawl fishery in QMA 3 in the 1997 - 98 fishing year. Inshore setnets pose the most serious risk to dolphins, but only about 9% of the BNS 3 TACC is caught by setnets. Setnet BNS catches have not increased under the AMP, and have declined steadily since 1995–96.

The draft Hector's and Maui Dolphin Threat Management Plan (TMP) was released for consultation at the end of 2007. This plan proposes an extension to the existing Banks Peninsula marine mammal sanctuary, which would increase protection of these mammals in the area. New seabird sustainability measures designed to reduce interactions with seabirds have also been gazetted. From 1 June 2008, trawlers may not discharge offal on more than one occasion per tow or during shooting or hauling. From 1 September 2008, bottom longliners must use a tori line and can only fish during the day if they are using approved line weighting. No offal or fish can be discharged during line setting, and offal or fish can only be discharged when hauling provided the discharge is on the opposite side of the vessel to the hauling point.

Much of the bluenose fishing in all fished areas is conducted using bottom longlines or Dahn lines, neither of which is considered to have serious impacts on seabed habitats or biological diversity. In contrast, bottom trawling is known to damage fragile seabed ecosystems, such as cold water corals, sponges or bryozoan communities. Targeted trawl fishing for bluenose, which are typically associated with underwater features likely to support such vulnerable marine ecosystems, is therefore potentially of concern. Analysed catch distribution data indicate that there has been increased effort on specific areas of the Chatham-Rise under this AMP, but that these are small compared to the total trawled area.

4. STOCKS AND AREAS

Stock boundaries are unknown, but similarity in trends in catch and CPUE across fisheries occurring in each of the five New Zealand BNS QMAs suggests the possibility that there may be a single BNS stock across all these areas, or of some close relationship between stocks in these QMAs. Tagging studies have shown that bluenose are capable of extensive migration, i.e., from the Wairarapa coast to Kaikoura, Bay of Plenty, and North Cape (Horn 2003). There is a possibility that the long period of relatively stable CPUE observations in the face of increasing catches before the period of decline may be evidence of hyper-stability caused by the replenishment of adult stocks on specific areas or features.

Recent increases in BNS targeting in some areas and increasing catches, could have exceeded the replenishment rate, causing the rapid and synchronous declines observed since 2001–02. Alternatively, there could be a simultaneous drop in recruitment due to coincident environmental factors. An environmental mechanism simultaneously affecting availability or catchability of BNS across all QMAs is considered to be less likely than the possibility of a single stock, or of correlated recruitment across sub-stocks in the various areas. The synchronous recent declines in BNS CPUE were probably caused by high F's and a possible coincidental decline in recruitment.

5. STOCK ASSESSMENT

5.1 AMP Assessments of bluenose Fishstocks

In 2008, the AMP Working Group conducted full reviews of all bluenose Fishstocks. These reviews initially included separate CPUE abundance index standardisations for each Fishstock (Ministry of Fisheries 2008, Report from the Fisheries Assessment Plenary, May 2008). However, close coincidence between trends in the indices for all bluenose Fishstocks led the AMP Working Group to conclude that there was a likelihood that all bluenose may constitute a single New Zealand-wide stock. Stock assessment advice was presented on the basis of an overview of CPUE trends across all of the bluenose Fishstocks.

5.2 Overview of bluenose Fishstocks

An overlay plot of the six standardised CPUE indices considered to be most reliable and representative of the BNS 1, BNS 2, BNS 3 and BNS 7&8 fisheries is shown in Figure 2. Each of the

CPUE analyses are based on a suite of core vessels selected so that there was continuity of effort in the fishery over the entire time period in the analysis, including the period of the decline. Each of these indices is also shown separately, together with an index of the associated catch history, in Figure 3.

Whereas most indices show high variability, but little trend, over the period 1989–90 to 2000–01, all indices show markedly similar declines in the period beginning 2001–02. Linear regressions through declines in each index over the most recent six years are shown in Figure 4. For the six most reliable CPUE series (Figure 2 and Figure 3), declines appear to have started around 2001–02 to 2002–03, with the indices declining 43%–79% (mean 64%) over the six years from 2001–02 to 2006–07 (Table 3).

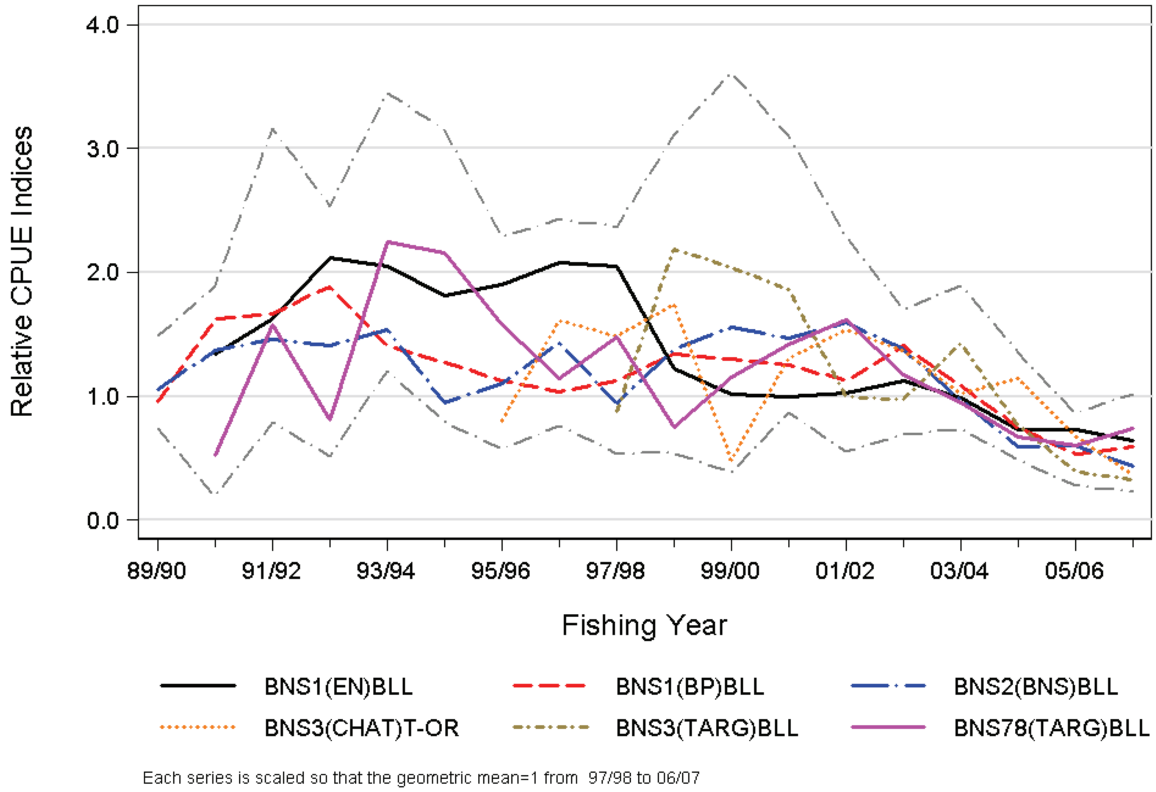


Figure 2: Overlay plots of relative CPUE indices from six bluenose fisheries operating in five New Zealand QMAs, standardised to the 1997–98 to 2006–07 geometric mean.

High variability in the earlier period of these fisheries is primarily seen in areas 7&8, where catch and effort were sporadic and low. In most areas, there have been steady increases in BNS catch in the period preceding the declines, attributable to the AMP TACC increase, and there has also been a general increase in the amount of target fishing for BNS throughout the entire New Zealand EEZ, particularly from around 2000 in BNS 2 and BNS 3.

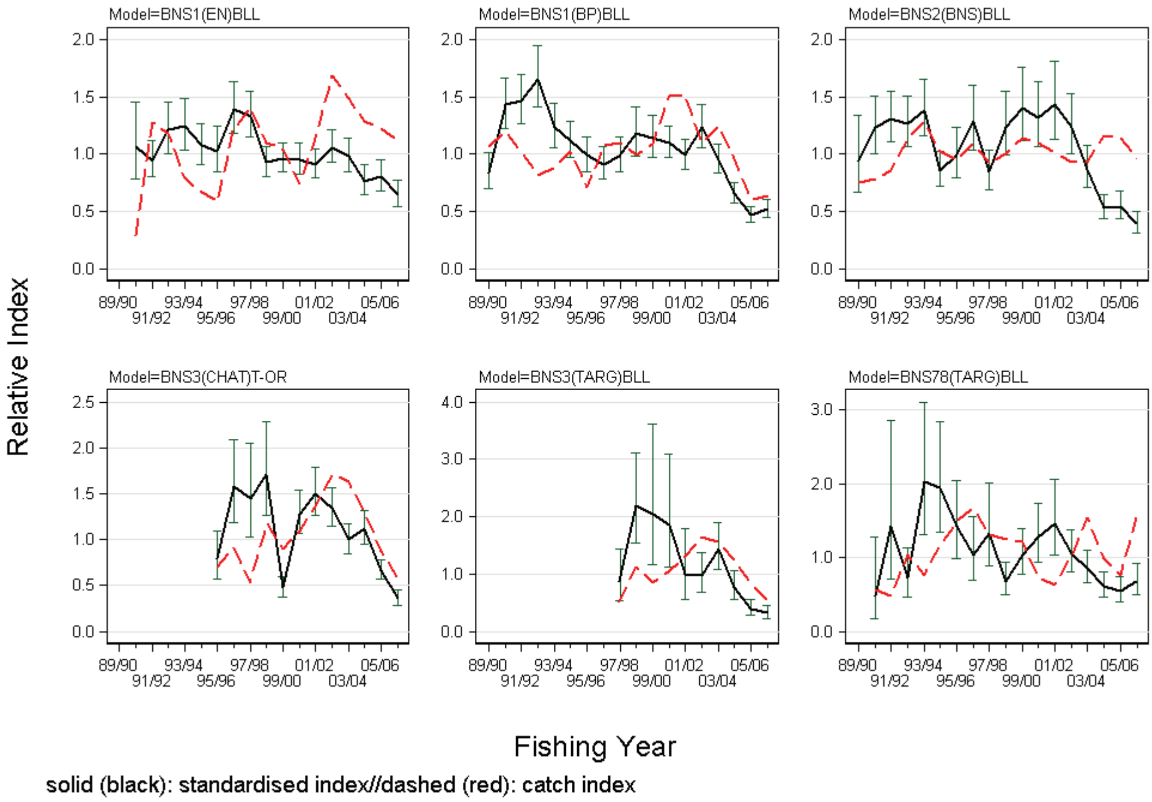


Figure 3: Comparison plots of standardised CPUE indices with catch histories for the six main bluenose fishery definitions used for determining standardised CPUE indices in five New Zealand QMAs shown in Figure 1. Bars show 5% and 95% bounds by fishing year for each standardised index. (All indices standardised so that the geometric mean = 1)

The decline in CPUE in BNS 3 appears to coincide with the TACC increase in 2001–02. The steep decline in the East Northland fishery between 1997–98 to 1998–99 coincides with the entry of BNS 1 into the AMP in 1996–97 and the accompanying TACC increase. However, the Bay of Plenty fishery was stable up to around 2003–04 as was the East Northland fishery after the first decline. There was a long period of catches in excess of the TACC in BNS 2, beginning in the early 1990s. However, the decline in BNS 2 CPUE coincides closely with the increase 2003–04 increase in the BNS 2 TACC. The increased TACCs substantially pre-dated the decline estimated for BNS 7&8.

Table 3: Estimates of CPUE decline over the most recent six years for the six CPUE models fitted to the years 2001–02 to 2006–07 (Figure 2) were obtained from the end points of linear models (Figure 3).

CPUE Model	Change (% over 6 years)
BNS1(EN)BLL	-43 %
BNS1(BP)BLL	-61 %
BNS2(BNS)BLL	-79 %
BNS3(CHAT)T-OR	-71 %
BNS3(TARG)BLL	-67 %
BNS78(TARG)BLL	-64 %
Average	-64 %

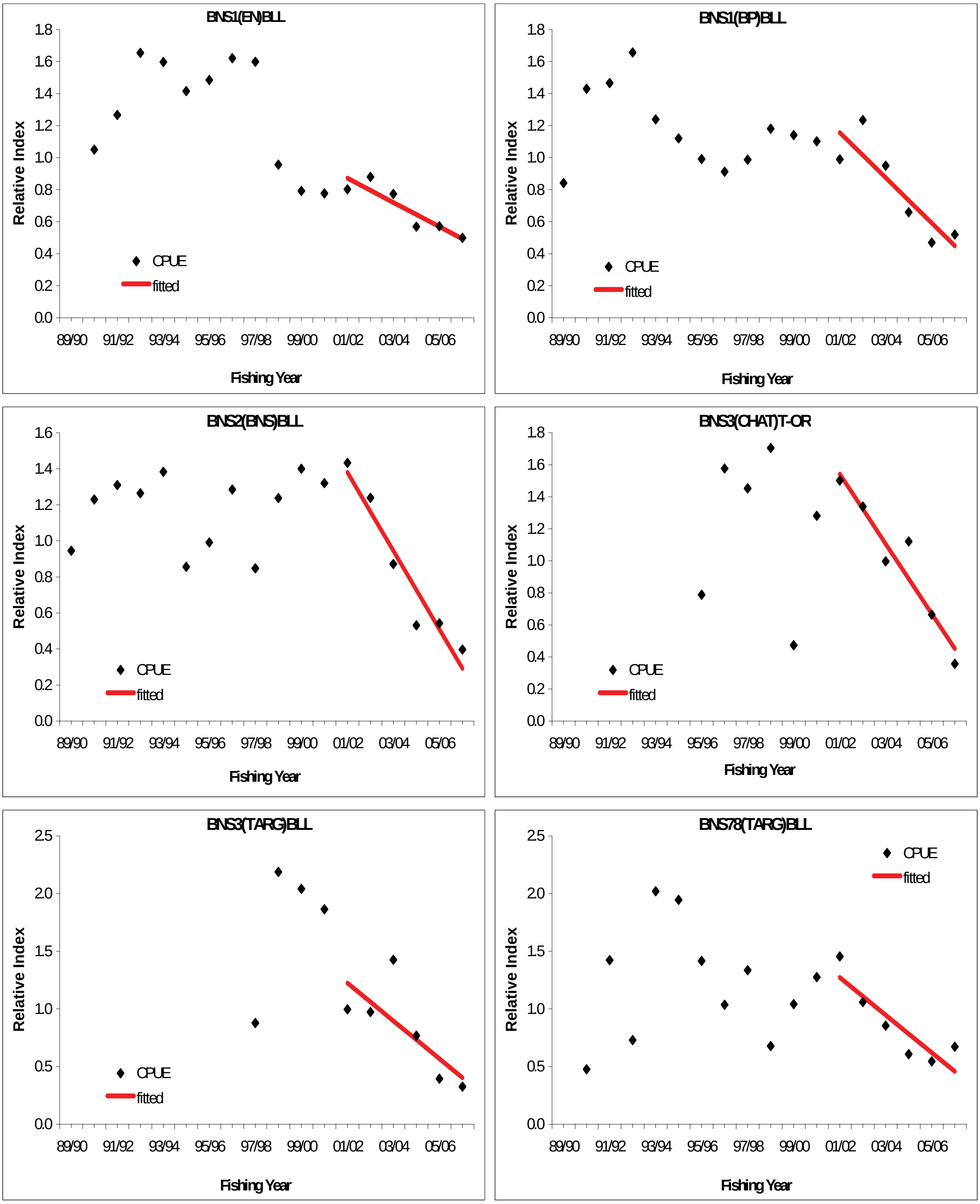


Figure 4: Plots of the six main standardised CPUE series for BNS from five BNS QMAs with linear regressions fitted to the period of recent declining catch rate.

There has been a decline in the mean length of bluenose in both of longline fisheries operating in FMA 1 for males (Figure 5). A similar decline can be seen in the male length data collected from the Chatham Rise, although mean lengths for females appear to be more variable in all areas and show less of a trend (Figure 6). Declining mean lengths combined with declining CPUE are indicative of an abundance decline probably caused by the loss of the larger fish in the population. There has been no decline in the mean lengths of bluenose sampled on the west coast of the South Island.

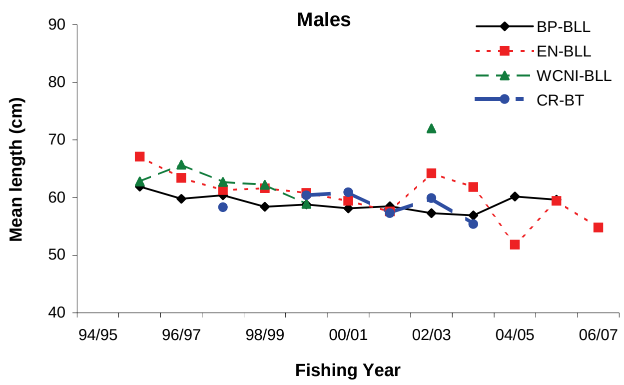


Figure 5: Mean length by year across four of the Industry BNS logbook programmes for males.

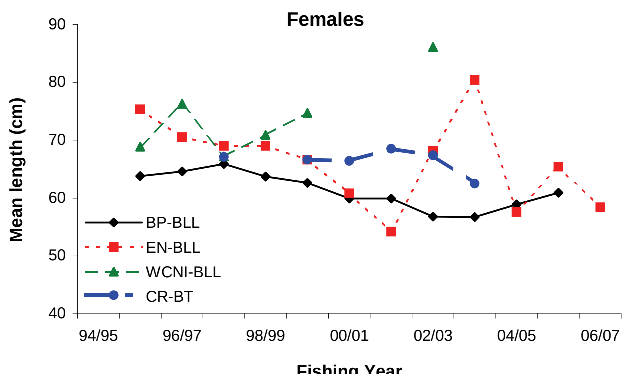


Figure 6: Mean length by year across four of the Industry BNS logbook programmes for females.

In 2009, a mean standardised CPUE index across all the above BNS Fishstocks was calculated from the individual CPUE indices in Figure 1 to provide an overall abundance index for a possible New Zealand wide stock. This shows high catch rates during development and exploratory stages of these fisheries from 1989-90 to 1993-94, stable abundance and catches over the period 1994-95 to 2001-02, followed by a 60% decline in CPUE to 2006-07 (see state of stock summary table in section 6).

5.3 Estimation of Maximum Constant Yield (MCY)

Previous estimates of MCY are not considered reliable, and new MCY estimates have not been produced.

5.4 Other yield estimates and stock assessment factors

The previous estimate of $F_{0.1}$ = 0.36 for BNS 2, which assumed an *M* of 0.3, is incompatible with revised estimates of *M* = 0.08 generated using the revised maximum age of 60 years from Horn *et al.* (2008). $F_{0.1}$ for all BNS stocks is likely to be similar to, or slightly greater than, this revised estimate of *M* (Mace 1988).

5.5 Other factors

The fishing industry has noted that there have been recent changes in bluenose fishing patterns in some QMAs, including changes in quota holdings, company structures and vessel operators. The industry reports that the shift from trawl fishing to longlining for fresh markets has resulted in catch and effort being more evenly distributed through the year. Some of the larger autolining vessels introduced more recently may also not be as efficient as traditional longliners. The industry has also noted increasing *Orca* predation on longline bluenose catches. These factors may have influenced catch rates and total catches in some areas, and contributed to some extent to the observed CPUE declines.

6. STATUS OF THE STOCKS

CPUE has previously not been considered to be a reliable indicator of abundance of BNS stocks. However, close coincidence observed in declining trends in most CPUE indices in recent years has increased confidence in their value as indices. Standardised CPUE series, based on data from six fisheries which span most of major fisheries taking BNS in the NZ EEZ, have declined an average of 64% over the period 2001–02 to 2006–07 (Table 3).

If this decline is indicative of the overall abundance of bluenose in these areas, then BNS abundance could have declined by more than 50% across all areas over these six years. If there has been replenishment of the features being fished in the period prior to the decline, the overall decline in abundance could be even larger. Although factors other than abundance may have contributed to the declines in CPUE and catches, current BNS catches and TACCs do not appear to be sustainable.

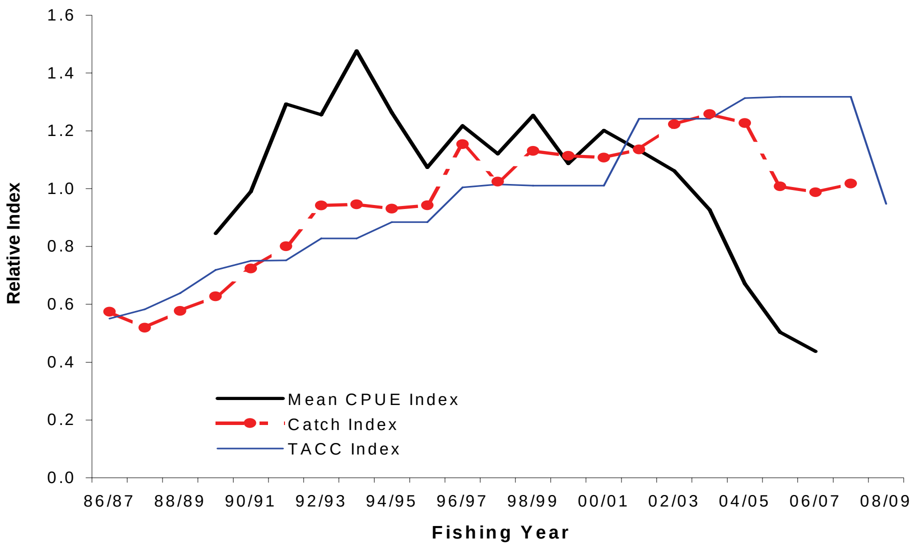
There is currently no stock assessment available for any BNS stock to allow estimation of B_{MSY} and B_{CURR}. Further, uncertainty regarding the extent of the stock which is contributing to the bluenose fisheries in the various QMAs makes it difficult to estimate B_{MSY} for these stocks. The current status of the bluenose populations in each of the BNS QMAs relative to B_{MSY} is unknown.

The concurrent decline of six independent CPUE series covering all the main NZ EEZ bluenose fisheries may indicate that there is a single New Zealand stock of bluenose. The Plenary noted that declines in CPUE have been observed even in areas that are relatively lightly fished such as BNS 7 and BNS 8. The existence of a single NZ-wide bluenose stock declining in all areas would imply not only that current catches are unsustainable, but that the overall combined TACC is also unsustainable.

Stock Status	
Year of Most Recent Assessment	2008 (CPUE analysis)
Reference Points	Target: Not established Soft Limit: Not established Hard Limit: Not established
Status in relation to Target	Unknown
Status in relation to Limits	Unknown

Fishery and Stock Trends	
Trend in Biomass or Proxy	CPUE, considered to be a proxy for stock abundance, has been declining simultaneously in all five New Zealand BNS QMAs since 2001–02.
Trend in Fishing Mortality or Proxy	The simultaneous declines in CPUE observed in all BNS Fishstocks suggest that exploitation rates are high.

Historical CPUE, Catch and TACC Trajectories



Plot of the mean CPUE index derived from the six standardised CPUE indices available for BNS for the period 1989–90 to 2006–07. Similar indices for catch and TACC are also plotted, with catches updated to 2007–08 and the TACC updated to 2008–09. All three series have the same mean for the period 1989–90 to 2006–07.

Other Abundance Indices	-
Trends in Other Relevant Indicator or Variables	Levels of recent recruitment are unknown.

Projections and Prognosis	
Stock Projections or Prognosis	Quantitative stock projections are unavailable. It is very likely that CPUE will continue to decline under average levels of removal over the years 2005-2006 - 2007-08. Given that the new combined TACC is only 6% below the 2005-2006 to 2007-2008 average catch, it is Likely (> 60%) that the stock will continue to decline at the current TACC.

Probability of Current Catch / TACC causing decline below Limits	Soft Limit: Unknown Hard Limit: Unknown

Assessment Methodology		
Assessment Type	Level 2: Standardised CPUE abundance index.	
Assessment Method	Evaluation of agreed standardised CPUE indices which reflect changes in abundance.	
Main data inputs	- Catch and effort data derived from Ministry of Fisheries compulsory logbooks. - Length frequency data summarised from logbooks compiled under the industry Adaptive Management Programme. - Recent validation of species maximum age.	
Period of Assessment	Latest assessment: 2008	Next assessment: 2011
Changes to Model Structure and Assumptions	The five BNS Fishstocks all declined from 43–79% in the 6 years since 2001–02. This suggests that the standardised CPUE series may be an appropriate index of BNS abundance and that these five Fishstocks may be linked.	
Major Sources of Uncertainty	No formal stock assessment is available for any of the BNS Fishstocks. Therefore, the stock status of bluenose is unknown and quantitative projections are not available. It is not known if CPUE has continued to decline since 2006–07, the final year from the most recent analysis.	

Qualifying Comments
There is a possibility that the long period of relatively stable CPUE observations in the face of increasing catches before the period of decline may be evidence of hyper-stability caused by the replenishment of adult stocks on specific areas or features. Recent increases in BNS targeting in some areas and increasing catches may have exceeded the replenishment rate, causing rapid and synchronous declines in CPUE in all bluenose Fishstocks since 2001–02. Alternatively, there could have been a simultaneous drop in recruitment due to coincident environmental factors. An environmental mechanism simultaneously affecting availability or catchability of BNS across all Fishstocks is considered to be less likely than the possibility of a single stock, or of correlated recruitment trends across sub-stocks. The synchronous recent declines in BNS CPUE are most likely the result of high levels of exploitation and possible coincident declines in recruitment.

Fishery Interactions
Bluenose are taken in conjunction with alfonsino in target midwater trawl fisheries directed at the latter species and in target bluenose bottom trawl fisheries. These fisheries are frequently associated with undersea features. Bluenose are also taken by target bottom longline fisheries throughout the NZ EEZ. Other commercially important species taken when longlining for bluenose are ling, hapuku and bass.

Bluenose TACCs and landings by BNS stock for the most recent fishing year are summarised in Table 4.

Table 4: Summary of TACCs (t) and reported landings (t) for bluenose for the most recent fishing year.

Fish stock	QMA		2008–09 TACC	2008–09 Reported Landings
BNS 1	Auckland (East) (West)	1 & 9	786	627
BNS 2	Central (East)	2	902	864
BNS 3	South-East (Coast) (Chatham), Southland and Sub-Antarctic	3, 4, 5, 6	505	444
BNS 7	Challenger	7	89	80
BNS 8	Central (West)	8	43	31
BNS 10	Kermadec	10	10	0
Total			2 335	2 046

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