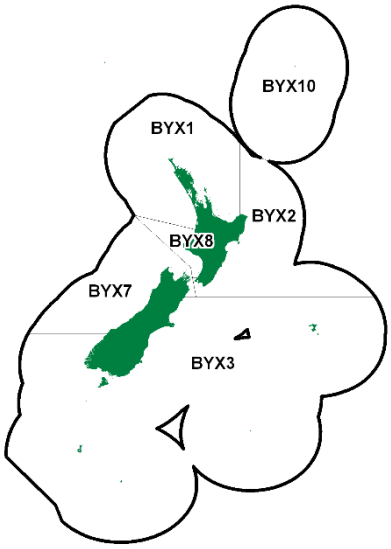
ALFONSINO (BYX)

(*Beryx splendens*, *B. decadactylus*)



1. FISHERY SUMMARY

Alfonsino was introduced into the Quota Management System (QMS) on 1 October 1986. Current allowances, TACCs and TACs are shown in Table 1.

Table 1: Recreational and Customary non-commercial allowances, TACCs and TACs for alfonsino by Fishstock for 2021–22.

Fishstock	Recreational Allowance	Customary non-commercial allowance	TACC	TAC
BYX 1	2	2	300	304
BYX 2	-	-	1 575	1 575
BYX 3	-	-	1 010	1 010
BYX 7	-	-	80.5	80.5
BYX 8	-	-	20	20
BYX 10	-	-	10	10

1.1 Commercial fisheries

Alfonsino has supported a major mid-water target trawl fishery off the east coast of the North Island since 1983 and is a minor bycatch of other trawl fisheries around New Zealand. The original gazetted TACs were based on the 1983–84 landings except for BYX 10 which was administratively set. Recent reported domestic landings and actual TACCs are shown in Table 2, while Figure 1 shows the historical landings and TACC values for the main BYX stocks.

Alfonsino landings in New Zealand consist almost entirely of one species, *Beryx splendens*: the other species, *B. decadactylus*, is thought to make up less than 1% of landings. Before 1983 alfonsino were virtually unfished, but two main fisheries now exist in New Zealand. The first to develop was the lower east coast North Island fishery (BYX 2), which developed in the mid-1980s. The other is the eastern Chatham Rise fishery (BYX 3), which developed in the mid-1990s. Alfonsino are caught throughout the New Zealand EEZ but only in small quantities outside of the east coast North Island and eastern Chatham Rise fisheries.

In BYX 1, alfonsino is mainly caught as a target species by bottom trawl within QMA 1. A smaller amount is taken as bycatch by bottom longline in the bluenose target fishery. The TACC for BYX 1 was increased for the 2001–02 fishing year from 31 t to 300 t when it was included in the adaptive management programme, and allocated 2 t for both customary and other mortality increasing the TAC to a total of 304 t. The new TACC was attained for the first time in 2004–05 and has been under-caught since then.

Table 2: Reported domestic landings (t) of alfonsino by Fishstock from 1985–86 to present and actual TACCs (t) from 1986–87 to present. QMS data from 1986–present. [Continued on next page]

Fishstock	BYX 1		BYX 2		BYX 3		BYX 7	
FMA (s)	1 & 9		2		3, 4, 5 & 6		7	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
1985–86*	11	-	1 454	-	3	-	1	-
1986–87	3	10	1 387	1 510	75	220	4	30
1987–88	8	27	1 252	1 511	101	1 000	2	30
1988–89	6	27	1 588	1 630	64	1 000	4	30
1989–90	24	31	1 496	1 274	147	1 007	21	80
1990–91	17	31	1 459	1 274	202	1 007	26	81
1991–92	7	31	1 368	1 499	264	1 007	2	81
1992–93	6	31	1 649	1 504	113	1 007	12	81
1993–94	7	31	1 688	1 569	275	1 007	31	81
1994–95	11	31	1 670	1 569	482	1 010	59	81
1995–96	11	31	1 868	1 569	961	1 010	66	81
1996–97	39	31	1 854	1 575	983	1 010	77	81
1997–98	14	31	1 652	1 575	1 164	1 010	67	81
1998–99	37	31	1 658	1 575	912	1 010	13	81
1999–00	25	31	1 856	1 575	743	1 010	24	81
2000–01	25	31	1 665	1 575	890	1 010	21	81
2001–02	123	300	1 574	1 575	1 197	1 010	10	81
2002–03	136	300	1 665	1 575	1 118	1 010	7	81
2003–04	219	300	1 468	1 575	884	1 010	11	81
2004–05	300	300	1 669	1 575	1 067	1 010	14	81
2005–06	195	300	1 633	1 575	1 068	1 010	7	81
2006–07	66	300	1 644	1 575	945	1 010	21	81
2007–08	154	300	1 532	1 575	1 030	1 010	32	81
2008–09	172	300	1 589	1 575	895	1 010	18	81
2009–10	185	300	1 643	1 575	1 016	1 010	21	81
2010–11	48	300	1 686	1 575	1 084	1 010	17	81
2011–12	45	300	1 603	1 575	1 037	1 010	14	81
2012–13	22	300	1 605	1 575	1 013	1 010	39	81
2013–14	29	300	1 551	1 575	930	1 010	58	81
2014–15	53	300	1 617	1 575	997	1 010	26	81
2015–16	24	300	1 573	1 575	1 104	1 010	27	81
2016–17	22	300	1 611	1 575	991	1 010	29	81
2017–18	73	300	1 692	1 575	754	1 010	12	81
2018–19	11	300	1 514	1 575	807	1 010	11	80
2019–20	3	300	1 673	1 575	713	1 010	3	81
2020–21	10	300	1 594	1 575	427	1 010	6	81
2021–22	10	300	1 631	1 575	565	1 010	5	81

Fishstock	BYX 8		BYX 10		Total	
FMA (s)	8		10			
	Landings	TACC	Landings	TACC	Landings	TACC
1985–86*	0	-	0	-	1 469	-
1986–87	1	20	0	10	1 470	1 800
1987–88	1	20	0	10	1 364	2 598
1988–89	0	20	1	10	1 663	2 717
1989–90	< 1	20	0	10	1 688	2 422
1990–91	0	20	0	10	1 664	2 423
1991–92	< 1	20	< 1	10	1 641‡	2 648
1992–93	< 1	20	< 1	10	1 780‡	2 653
1993–94	< 1	20	0	10	2 001‡	2 718
1994–95	< 1	20	0	10	2 223‡	2 721
1995–96	< 1	20	0	10	2 906‡	2 721
1996–97	< 1	20	0	10	2 953‡	2 727
1997–98	< 1	20	0	10	2 898‡	2 727
1998–99	3	20	0	10	2 624‡	2 727
1999–00	< 1	20	0	10	2 648‡	2 727
2000–01	< 1	20	0	10	2 601‡	2 727
2001–02	< 1	20	0	10	2 904‡	2 925
2002–03	< 1	20	0	10	2 927‡	2 925
2003–04	2	20	0	10	2 584‡	2 925
2004–05	2	20	0	10	3 052‡	2 925
2005–06	< 1	20	0	10	2 903‡	2 925
2006–07	< 1	20	0	10	2 677‡	2 925
2007–08	< 1	20	0	10	2 748‡	3 000
2008–09	< 1	20	0	10	2 674‡	3 000
2009–10	< 1	20	0	10	2 865‡	3 000
2010–11	< 1	20	0	10	2 836‡	2 996
2011–12	< 1	20	0	10	2 699‡	2 996
2012–13	< 1	20	0	10	2 679‡	2 996
2013–14	< 1	20	0	10	2 568‡	2 996
2014–15	< 1	20	0	10	2 693‡	2 996
2015–16	< 1	20	0	10	2 729‡	2 996
2016–17	< 1	20	0	10	2 653‡	2 996

Table 2 [Continued]:

Fishstock FMA (s)	BYX 8 8		BYX 10 10		Total	
	Landings	TACC	Landings	TACC	Landings	TACC
2017–18	< 1	20	0	10	2 531‡	2 996
2018–19	< 1	20	0	10	2 342‡	2 986
2019–20	< 1	20	0	10	2 392‡	2 996
2020–21	< 1	20	0	10	2 038‡	2 996
2021–22	< 1	20	0	10	2 211‡	2 996

*FSU data.
‡ Excludes catches taken outside the New Zealand EEZ.

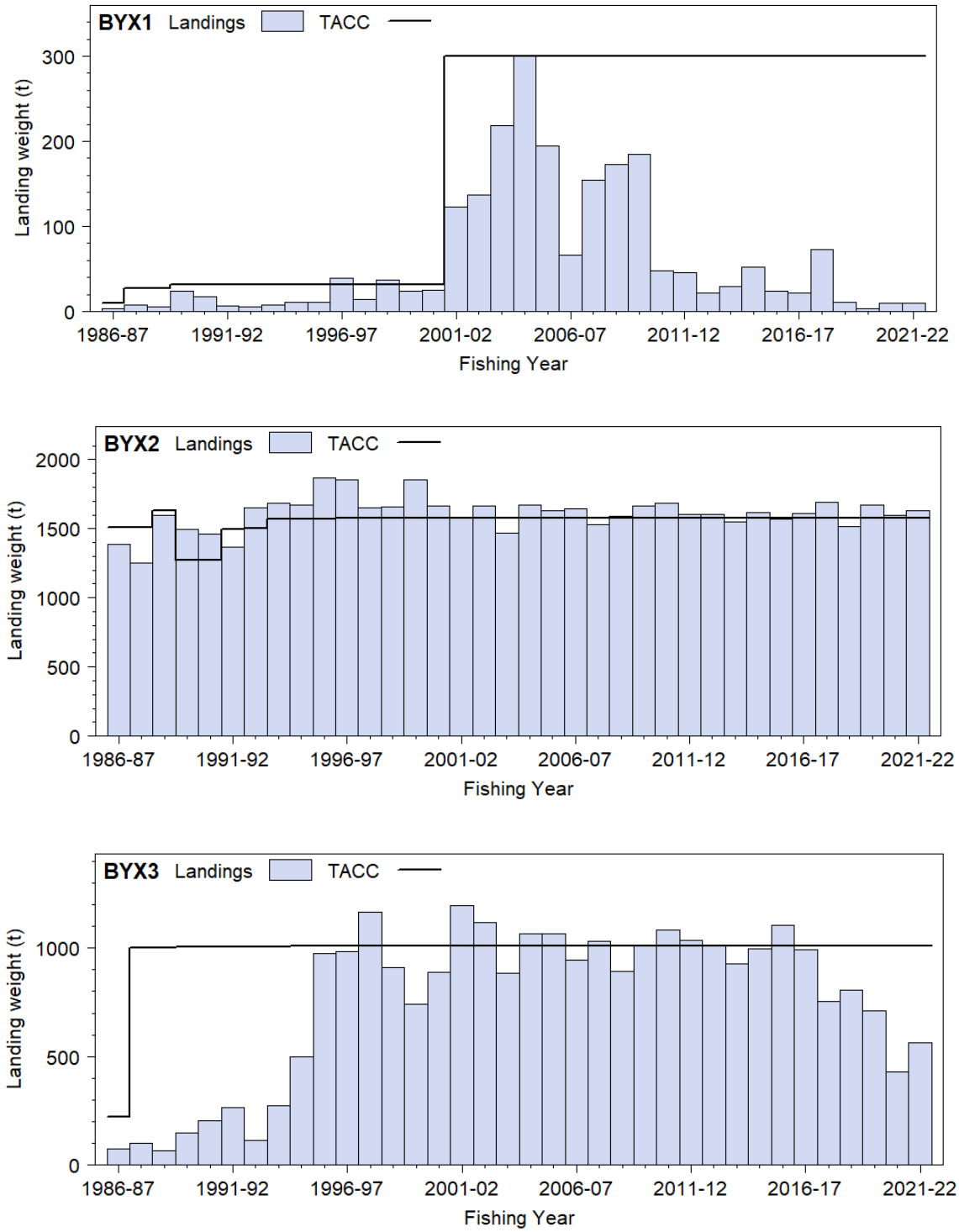


Figure 1: Reported commercial landings and TACC for the four main BYX stocks. Above: BYX 1 (Auckland) BYX 2 (Central East), and BYX 3 (South East Coast, South East Chatham Rise, Sub Antarctic, Southland). Note that these figures do not show data prior to entry into the QMS. [Continued on next page]

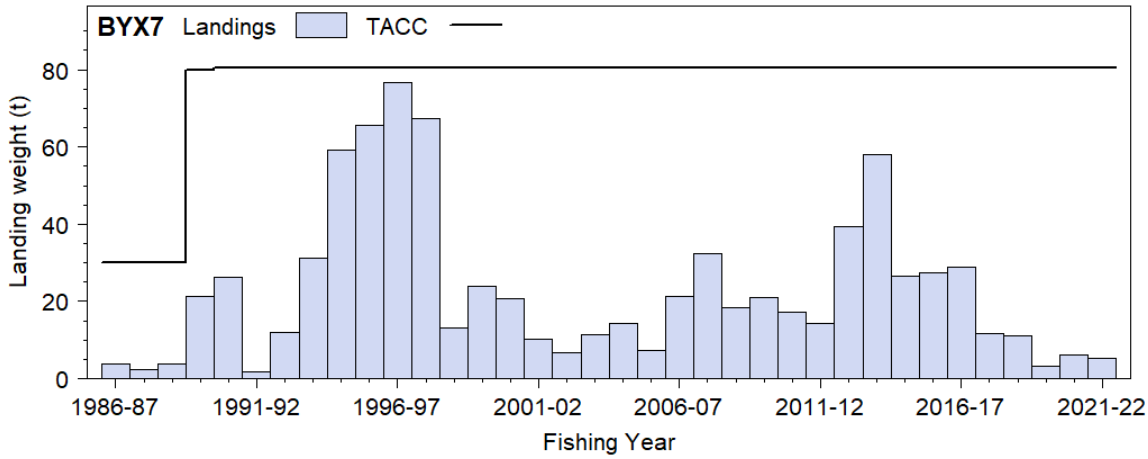


Figure 1 [Continued]: Reported commercial landings and TACC for the four main BYX stocks. BYX 7 (Challenger). Note that these figures do not show data prior to entry into the QMS.

BYX 2 has historically been the major alfonsino fishery in the New Zealand EEZ. Prior to 1983, alfonsino was virtually an unfished resource. The domestic BYX 2 target fishery was developed during 1981, and was concentrated on the banks and seamount features off the east coast of the North Island, between Gisborne and Cape Palliser. Major fishing grounds included the Palliser Bank, Tuaheni Rise, Ritchie Banks and Paoanui Ridge. In more recent years, the alfonsino catch and effort has decreased from these areas, and an increasing proportion of the annual catch has been taken from the Madden Banks and Motukura Bank. Landings fluctuate around the TACC, which has been set at 1575 t since the 1996-97 fishing year.

In BYX 3 catches of alfonsino were low in the early 1990s and were mainly bycatch of the hoki fishery. The TACC for BYX 3 was increased for the 1987–88 fishing year from 220 t to 1000 t but annual landings remained low until 1993–94. However, the discovery of new grounds in the mid-1990s saw the rapid development of a target alfonsino fishery, most notably south-east of the Chatham Islands in Statistical Area 051. Annual landings were close to 1000 t from the early 2000s to 2016–17, but declined to around 500 t in 2020–21 and 2021–22. The vast majority of the BYX 3 alfonsino catch is targeted now, followed by bycatch in fisheries for orange roughy, bluenose, hoki and hake. Catches are made all year round but decrease during the winter months. Catches of alfonsino in the Southland and Sub-Antarctic regions of BYX 3 are negligible.

Catches of alfonsino in BYX 7 are small. They are mainly taken by vessels midwater trawling for spawning hoki in Statistical Areas 034 and 035 in winter. There is essentially no targeting of alfonsino in BYX 7. The TACC was increased from 30 t to 80 t in 1989 but the TACC has never been caught. Annual landings have been less than 15 t since 2017–18.

Landings have been reported from BYX 8 in only a few years. No targeting has ever been reported from this area. All catch has been from midwater trawls targeting jack mackerel and bottom longline targeting bluenose.

Catches of alfonsino from BYX 10 (Kermadec Region) are negligible. Apart from 1 t in 1989, and less than 1 t in each of 1992 and 1993, there have been no reported landings of alfonsino from this area.

1.2 Recreational fisheries

Occasional catches of alfonsino have been recorded from recreational fishers.

1.3 Customary non-commercial fisheries

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

1.4 Illegal catch

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

1.5 Other sources of mortality

No qualitative information is available.

2. BIOLOGY

In New Zealand waters, most "alfonsino" landings are alfonsino *B. Splendens*, with landings of the red bream *B. decadactylus* accounting for less than 1% of the catch. These species are primarily associated with undersea structures such as the seamounts that occur off the east coast of the North Island and on the Chatham Rise, in depths from 300–600 m. They can be found all around New Zealand waters but occur in greatest numbers along the lower east coast North Island and south-east Chatham Rise. These two areas are essentially where the commercial fisheries for alfonsino in New Zealand are confined.

Alfonsino are widespread in tropical, subtropical and temperate waters from the Atlantic, Pacific, and Indian Oceans (Busakhin 1982). They have been recorded in depths ranging from 10–1200 m but are most commonly found at 200–800 m, on or close to the seabed, often in association with seamounts and other underwater features (Maul 1981, Vinnichenko 1997a, Vinnichenko 1997b).

Stock structure is not currently known for New Zealand alfonsino. Horn & Massey (1989) found substantial differences in length frequency distributions between commercially-caught alfonsino from the Palliser bank compared with those from other locations on the east coast North Island. These differences suggest that there may be some age-specific migration occurring.

It has been suggested that alfonsino could comprise widespread populations in large oceanic eddy systems (Alekseev et al 1986). If New Zealand alfonsino form part of such a system then the east coast North Island may be a vegetative, non-reproductive zone where fish grow and mature before leaving for a possible reproductive zone further east of the mainland (Horn & Massey 1989).

Alfonsino from Japan, northwest of Hawaii, and in the northeast of the Atlantic are known to spawn from August to October (Masuzawa et al 1975, Uchida & Uchihama 1986). In the southeast Atlantic, alfonsino spawn from January to March (Alekseev et al 1986) and from November to February in New Caledonian waters (Lehoday & Grandperrin 1994, Lehoday et al 1997). In New Zealand waters it has been suggested that alfonsino spawn from July to August (Horn & Massey 1989). This was based on observations of fish caught commercially from the lower east coast North Island that were ripening to spawn. However it is not known when and where spawning of alfonsino occurs in New Zealand waters. No running ripe fish were observed in regular samples taken over a 14-month period off the lower Wairarapa coast (Horn & Massey 1989).

Masuzawa et al (1975) estimated that the fecundity of a 40 cm female alfonsino from Japan to be 300 000–500 000 eggs. The fecundity of New Zealand alfonsino however has not been established because a full size range of ripening fish has not been observed (Horn & Massey 1989). Because of this the size and age at maturity cannot be determined precisely for either sex.

Tagging has been unsuccessful for alfonsino (Horn 1989). Being a moderately deepwater fish means that bringing them to the surface is not a viable option due to sudden and usually fatal changes in temperature, light, and particularly pressure. Horn (1989) evaluated the use of detachable hook tags using drop lines to tag alfonsino without bringing them to the surface. Only a small proportion of alfonsino tags were returned by commercial fishermen. This was thought to be due to a combination of low numbers being tagged to begin with (the tagging programme essentially targeted bluenose), low recapture rates, the loss of tags (either before or during capture by commercial fishermen), and possibly low rates of observation by fishermen.

Massey & Horn (1990) examined otoliths from commercially caught alfonsino from various alfonsino fishing grounds of the lower east coast of the North Island (BYX 2) from November 1985 to December 1986. They found evidence that one opaque and one hyaline zone (one 'ring') were formed annually (as did Lehodey & Grandperrin (1996)). They investigated the validity of zone counts by measuring the position of each ring and comparing it to the position of successive ring groups. They calculated the 'marginal index' of each otolith which was defined as the distance from the outer edge of the last hyaline ring to the otolith edge divided by the width of the last complete opaque and hyaline ring. They plotted the mean marginal indices of fish for each month over the study period and found that the index in every fishing ground dropped dramatically from June to December. This drop in mean marginal index meant that for most fish opaque material has started forming in June, and that the hyaline margin is probably laid down from March to May for most fish. Subsequent ageing has also shown the progression of relatively strong year classes between consecutive years of sampling, thus providing further support for the ageing method.

Massey & Horn (1990) observed very few fish younger than three years of age, and believed that full recruitment to the commercial fishery probably occurs at around five years of age. Size-at-sexual maturity is probably about 30 cm fork length (FL) at 4 to 5 years of age. Juvenile fish have been recorded in the pelagic and epipelagic zones in the North Pacific and Indian Oceans. Alfonsino less than 20 cm FL are seldom recorded in New Zealand waters. Differences in length-frequency distributions between fishing grounds off the east coast North Island suggest that some age-specific migration occurs. Fish probably recruit to these grounds at 28–31 cm FL.

Von Bertalanffy growth parameters were derived for alfonsino from BYX 2 by Stocker & Blackwell (1991) (Table 3). They found that females attain a larger size than males and are also larger at corresponding ages. Massey & Horn (1990) presented von Bertalanffy parameters separately by sex for three fishing grounds off lower east coast North Island.

Stocker & Blackwell (1991) used 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. Using a maximum age of 20 years, they estimated M for both sexes as 0.23 for BYX 2.

Length-weight relationships are presented in Table 3. Parameters for the Chatham Rise are those reported by O'Driscoll et al (2011) for all fish from the summer Chatham Rise trawl survey time series from 1992–2010.

Table 3: Estimates of biological parameters for alfonsino.

Fishstock							Estimate	Source
1. Natural mortality (M)								
BYX 2							0.23	Stocker & Blackwell (1991)
2. Weight = a(length)^b (Weight in g, length in cm fork length).								
							Both Sexes	
							a	b
BYX 2							0.0226	3.018	Stocker & Blackwell (1991)
BYX 3							0.019	3.049	O'Driscoll et al (2011)
3. Von Bertalanffy growth parameters								
	Females			Males				
	L_∞	k	t_0	L_∞	k	t_0		
BYX 2	57.5	0.08	-4.10	51.1	0.11	-3.56		Stocker & Blackwell (1991)

Horn et al (2010) examined stomach contents from *Beryx splendens* caught on three consecutive summer trawl surveys of the Chatham Rise (2005–2007). They found that alfonsino were moderately selective feeders that fed primarily in the mesopelagic layers. The most common prey items were crustaceans and mesopelagic fishes. By mass, the most important were prawns from the genus *Sergestes*, followed by the myctophid fish *Lampanyctodes hectoris,* and then prawns from the genus *Pasiphaea.*

Smaller crustaceans such as euphasiids and amphipods are most important in the diet of smaller alfonsino (17–26.5 cm fork length). Larger prawn species and mesopelagic fishes were more important for larger alfonsino (27–42 cm fork length). Horn et al (2010) postulated that they are selective feeders based on the observation that prey items such as squid and salps would be relatively abundant where alfonsino feed on the Chatham Rise, but are rarely taken.

3. STOCKS AND AREAS

No information is available as to whether alfonsino is a single stock in New Zealand waters. Overseas data on alfonsino stock distributions suggest that New Zealand fish could form part of a widely distributed South Pacific stock.

4. STOCK ASSESSMENT

4.1 Estimates of fishery parameters and abundance

i) BYX 1

Starr et al (2010) presented CPUE analyses from the bycatch of alfonsino in the east Northland and Bay of Plenty target longline fisheries for bluenose and hapuku. The two series showed no sign of decline up to 2007–08, but the indices were based on only 12% of the BYX catch from the area. The analyses have not been updated, and the catch of BYX has decreased to below 50 t since 2010–11.

ii) BYX 2

A biomass index derived from a standardised CPUE (log linear, kg/day) analysis of the target trawl fishery represented by seven core vessels (Blackwell 2000) was calculated for BYX 2. However, the analysis was very uncertain, and the model accounted for only 25% of the variance in catch rates. The results of the standardised analysis were not accepted by the Inshore WG as indices of abundance.

The age composition of the commercial landings in BYX 2 was determined in 1998–99, 1999–00, and 2000–01 and 2002–03, 2003–04 and 2004–05. The commercial catch is dominated by 5–11 year old fish. Without linking age structure to specific fishing grounds the age structure of the catch is unlikely to monitor changes in the population.

iii) BYX 3

The potential to monitor trends in abundance using catch and effort data from the target BYX 3 fishery was investigated by Langley & Walker (2002b). However, it was concluded that the high variation in catch rates, the relatively small number of catch and effort records, and the complex nature of the fishery precluded the development of a reliable CPUE index.

4.2 Biomass estimates

Estimates of current biomass are not available.

4.3 Yield estimates and projections

4.3.1 Other yield estimates and stock assessment factors

Long-term sustainable yield using an $F_{0.1}$ fishing strategy was estimated for BYX 2 using the simulation model with alternative estimates of M. $F_{0.1}$ has been estimated as 0.25 and 0.32 for M = 0.2 and M = 0.23, respectively, for both sexes combined in BYX 2 (Stocker & Blackwell 1991). The biomass at this long-term equilibrium yield is about 35% B_0 and the $F_{0.1}$ yield is about 8–9% B_0.

4.4 Other factors

The most recent assessment for BYX 2 was based upon the historical fishery areas. In recent years the fishery has expanded to new areas not previously fished. Subsequent CPUE analyses have been rejected by Working Groups and it is no longer thought possible to monitor abundance in BYX 2 using trawl CPUE.

Current data on alfonsino movements are inconclusive. It is not known whether the fish on the east coast of the North Island spend some part of their life cycle in other New Zealand waters, or whether the east coast-Chatham Rise region is just one of several pre-reproductive regions. It is possible that the domestic trawl fishery may be exploiting part of a wider South Pacific stock. Catches may be maintained due to the discovery of new grounds. However, the potential for increased catches may be constrained by the availability of BNS 3 quota to cover likely bluenose bycatch.

5. STATUS OF THE STOCKS

Stock Structure Assumptions
No information is available as to whether alfonsino is a single stock in New Zealand fishery waters. Overseas data on alfonsino stock distributions suggest that New Zealand fish could form part of a widely distributed South Pacific stock. In addition to alfonsino (*Beryx splendens*) the BYX Fishstock includes landings of the red bream (*B. decadactylus*), however, red bream makes up less than 1% of the total landings.

BYX 1
Under the adaptive management programme the TACC was increased to 300 t in 2001−02, and catches increased for the next 9 years in the target trawl fishery. However, catches have been below 50 t since 2010–11 as target fishing in this fishery has waned.

BYX 2
Annual landings from 1986 to 2014–15 have remained reasonably stable at or above the level of the TACC. However, as the fishing grounds have extended throughout this time, it is not known if the recent catch levels or the current TACCs are sustainable.

BYX 3
Alfonsino on the Chatham Rise (BYX 3) were lightly fished prior to 1995–96 when catches increased to near the TACC, due to the development of new fishing grounds. Catch has fluctuated around the TACC until 2016–17, but has declined since then. It is not known if the recent catch levels or the current TACCs are sustainable.

6. FUTURE RESEARCH CONSIDERATIONS

Neither CPUE nor trawl surveys are likely to provide an index of alfonsino abundance. The best method to determine the status of the stocks and to continue monitoring is likely to be a catch-at-age sampling programme. A large proportion of the alfonsino catch from the two main fisheries is still landed green which would allow for a land-based shed sampling programme for either area, although at-sea observer-based sampling would allow for the detection of any differences in sub-regions within the main fishery areas.

7. FOR FURTHER INFORMATION

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