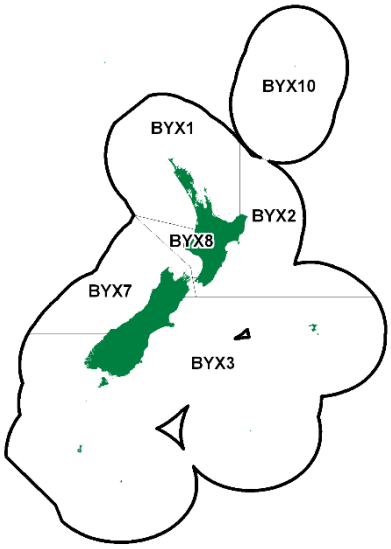
ALFONSINO (BYX)

(*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 2022–23.

Fishstock	Recreational Allowance	Customary non-commercial allowance	TACC	TAC
BYX 1	2	2	300	304
BYX 2	-	-	1 575.8	1 575.8
BYX 3	-	-	1 010.4	1 010.4
BYX 7	-	-	80.5	80.5
BYX 8	-	-	20	20
BYX 10	-	-	10	10

1.1 Commercial fisheries

Alfonsino has supported a target trawl fishery off the east coast of the North Island since the early 1980s (Horn 1988) 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. Reported domestic landings and 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 (Horn 1988). 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 1981 to present and TACCs (t) from 1986–87 to present. Source: Horn (1988) 1981–1984; 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
1981†	0	-	0	-	0	-	0	-
1982†	0	-	154	-	0	-	0	-
1983†	15	-	766	-	0	-	1	-
1984†	15	-	1 814	-	10	-	19	-
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
2022–23	23	300	1 561	1 575	264	1 010	4	81

Fishstock	BYX 8		BYX 10		Total	
FMA (s)	8		10			
	Landings	TACC	Landings	TACC	Landings	TACC
1981†		-		-	67#	-
1982†		-		-	154#	-
1983†		-		-	870#	-
1984†		-		-	1899#	-
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

Table 2 [Continued]:

Fishstock	BYX 8		BYX 10			
FMA (s)	8		10			Total
	Landings	TACC	Landings	TACC	Landings	TACC
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
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
2022–23	< 1	20	0	10	1 852‡	2 996

† Calendar year
# Includes landings with no area recorded
* FSU data.
‡ Excludes catches taken outside the New Zealand EEZ.

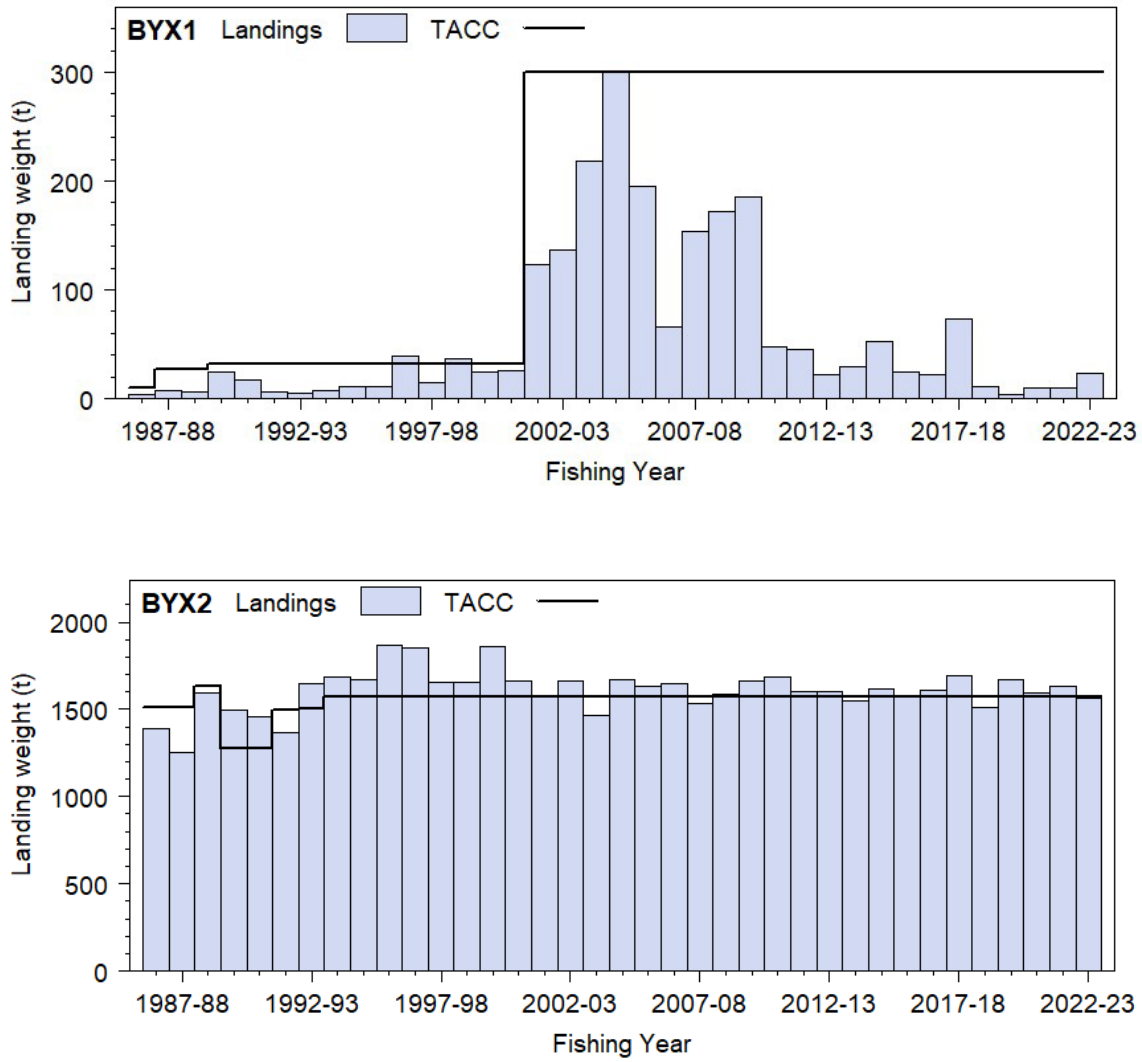


Figure 1: Reported commercial landings and TACC for the four main BYX stocks. Above: BYX 1 (Auckland) and BYX 2 (Central East). Note that these figures do not show data prior to entry into the QMS. [Continued on next page]

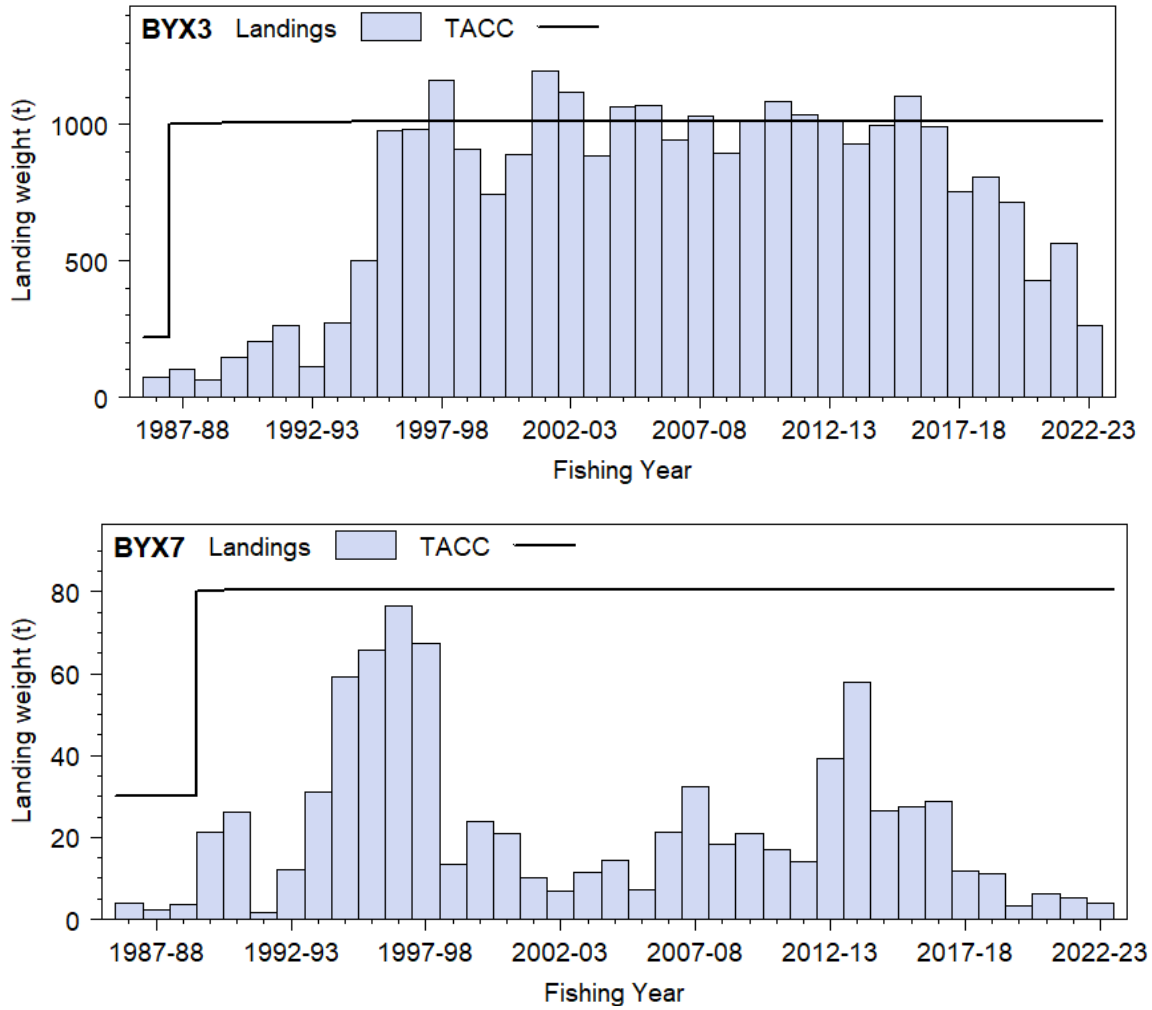


Figure 1 [Continued]: Reported commercial landings and TACC for the four main BYX stocks. BYX 3 (South East Coast, South East Chatham Rise, Sub Antarctic, Southland) and BYX 7 (Challenger). Note that these figures do not show data prior to entry into the QMS.

BYX 2 has been the major alfonsino fishery in the New Zealand EEZ. 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. Key fishing grounds include the Palliser Bank, Tuaheni Rise, Ritchie Banks and Paoanui Ridge. Landings have fluctuated 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 and orange roughy fisheries. 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 264 t in 2022–23. The vast majority of the BYX 3 alfonsino catch is now targeted. 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.

A catch limit agreement between the four major quota owners of BYX 3 was introduced from 2020–21; this involves transferring 50% of available ACE to Commercial Fisheries Services Ltd. The annual amounts shelved (Table 3) vary due to ACE carry forward provisions.

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.

Table 3: ACE shelved by the four major quota owners of BYX 3.

Fishstock FMA (s)	BYX 3 3, 4, 5 & 6 ACE shelved
2020–21	463.6
2021–22	455.9
2022–23	512.0
2023–24	545.0

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 (Horn 1988). 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 eastern 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.

Fish older than 15 years of age were rare in Massey & Horn's samples. More older females than males were found in all areas, with maximum ages of 16.8 years for females and 16 years for males. Blackwell et al (2002) found relatively strong year classes of alfonsino from BYX 2 at ages 5 and 6 (the 1994 and 1993 year classes) in 1998-99 progressed through three years of samples, but that an indication in 1998-99 of a relatively strong year class at age 8 (the 1991 year class) was not apparent in the two subsequent years. The progression of relatively strong year classes between consecutive years of sampling, has been considered to provide 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 4). 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) assumed natural mortality rates (*M*) of either 0.2 or 0.23 in early assessments for BYX 2. The estimate of *M* for both sexes as 0.23 has been attributed to use of a maximum age of 20 years in the equation $M = \log_e 100$/maximum age, where maximum age is the age to which 1% of the population survives in an unexploited stock. However, the rationale for the choice of 20 years is not given.

An initial study of bomb radiocarbon ageing for 12 alfonsino otoliths from the Indian Ocean has suggested that whole otolith ageing may underestimate the age of fish older than 10 years (Andrews 2023). Use of transverse sections for zone counts from larger otoliths, together with further comparisons between fine scale ring counts and bomb radiocarbon data, has been recommended. The initial sample had one fish with an initial estimated age of 25 years, but where the otolith mass and bomb radiocarbon signal suggested an age around 70 years. Subsequent reading of fine scale zones in an otolith section suggested an age of 61 years.

Length-weight relationships are presented in Table 4. 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 4: 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 was dominated by 5–11 year old fish. Without linking age structure to specific fishing grounds the age structure of the catch was considered 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.

iv) BYX 2 and BYX 3

Middleton et al (in prep.) used density-based clustering of tow start locations to identify spatial clusters of effort by the trawl fisheries landing alfonsino from BYX 2 and BYX 3. CPUE models were investigated using the clusters as the spatial strata. Neighbouring areas tended to have more similar trends so four regions were defined as groupings of fishery clusters: the east coast north region contained clusters between East Cape and Hawke Bay, the east coast south region contained clusters between the south of Hawke Bay and the North Island south coast, the Chatham Rise north region included clusters identified towards the eastern end of the north Chatham Rise, and the Chatham Rise southeast region contained clusters to the south east of the Chatham Islands.

The fleet that targets alfonsino is relatively small and a model was fitted for the BYX 2 and 3 fisheries with common vessel effects and with the four regions as the spatial strata, using data from both midwater and bottom trawling to accommodate the fact that the BYX 3 fishery transitioned after 2005 from primarily using bottom trawls to mainly midwater trawling. The model had reasonable diagnostics, but residual implied coefficients by area showed varying trends between regions (Figure 2).

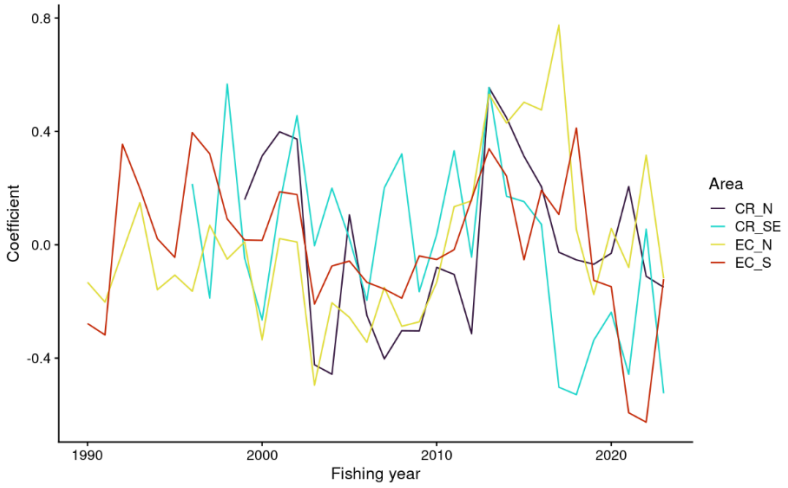


Figure 2: Residual implied coefficients for area-year in a Weibull model of positive catch from bottom and midwater trawls in BYX 2 and BYX 3. Events were included that took place within four regions: EC_N = east coast north region; EC_S = east coast south region; CR_N = Chatham Rise north region; CR_SE = Chatham Rise southeast (see text).

The Deepwater Fisheries Assessment Working Group concluded that there was evidence of different trends in the abundance of alfonsino in different areas of the BYX 2 and BYX 3 fisheries, and that it was not possible to use the model to assess abundance at the stock level. Observer data from the fishery were sparse. Commercial grade data provided somewhat more extensive compositional data, but were insufficiently detailed to assist in the interpretation of the regional abundance trends.

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

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. Measures taken by vessels to avoid bluenose bycatch are unlikely to be fully captured in the available effort data.

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 have remained reasonably stable around the level of the TACC. However, 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 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

In 2024 the Deepwater Fisheries Assessment Working Group advised:

- that comprehensive biological sampling of the alfonsino fishery should be undertaken to interpret varying abundance trends and understand stock structure over the fishery. Shore based sampling may be adequate as long as data are collected at the appropriate spatial scale (e.g. the spatial clusters identified in the 2023 CPUE analysis);

- revisiting ageing protocols for alfonsino taking into account the results of the bomb radiocarbon study contracted by SIOFA; and

- reviewing the collection of biological data and otoliths from alfonsino to inform population structure.

7. FOR FURTHER INFORMATION

Alekseev, F E; Alekseeva, E I; Trunov, I A; Shlibanov, V I (1986) Macroscale water circulation, ontogenetic geographical differentiation and population structure of alfoncino, *Beryx splendens* Lowe, in the Atlantic Ocean. *International Council for the Exploration of the Sea [ICES]* No 10. 16 p.

Andrews, A H (2023) Age, growth, and lifespan investigations of Splendid Alfonsino (Beryx splendens) of the Indian Ocean using bomb radiocarbon dating. Final report for SIOFA project SER2022-BYS2. 23 p.

Blackwell, R (2000) Alfonsino (*Beryx splendens*) abundance indices from standardised catch per unit effort (CPUE) analysis for the east coast North Island (BYX 2) midwater trawl fishery 1989–90 to 1997–98. *New Zealand Fisheries Assessment Report 2000/53*. 40 p.

Blackwell, R G; Horn, P L; McMillan, P J (2002) Commercial catch sampling of alfonsino, bluenose, gernfish and rubyfish in QMA 2 in 2000-01. Final Research Report for Ministry of Fisheries Research Project INS2000/01. 24 p.

Busakhin, S V (1982) Systematics and distribution of the family Berycidae (Osteichthyes) in the World Ocean. *Journal of Ichthyology (22)*: 1–21.

Horn, P L (1988) Alfonsino. New Zealand Fisheries Assessment Research Document 1988/7. 21 p. (Unpublished document held by NIWA library, Wellington.)

Horn, P L (1989) An evaluation of the technique of tagging alfonsino and bluenose with detachable hook tags. *N.Z. Fisheries Technical Report No. 16*. 15 p.

Horn, P L; Forman, J; Dunn, M R (2010) Feeding habits of alfonsino *Beryx splendens*. *Journal of Fish Biology 76*: 2382–2400.

Horn, P L; Massey, B R (1989) Biology and abundance of alfonsino and bluenose off the lower east coast, North Island, New Zealand. *New Zealand Fisheries Technical Report No. 15*. 32 p.

Langley, A D (1995) Analysis of commercial catch and effort data from the QMA 2 alfonsino-bluenose trawl fishery 1989–94. New Zealand Fisheries Assessment Research Document 1995/18. 12 p. (Unpublished document held by NIWA library, Wellington.)

Langley, A D; Walker, N (2002a) Characterisation of the alfonsino (*Beryx splendens*) fishery in BYX 3. *New Zealand Fisheries Assessment Report 2002/29*. 49 p.

Langley, A D; Walker, N (2002b) CPUE analysis of the target BYX 3 alfonsino fishery and associated bluenose catch. *New Zealand Fisheries Assessment Report 2002/24*. 45 p.

Lehodey, P; Grandperrin, R (1994) A study of the fishery and biology of *Beryx splendens* (alfonsino) in New Caledonia. *SPC Fisheries Newsletter 71*: 30–36.

Lehodey, P; Grandperrin, R; Marchal, P (1997) Reproductive biology and ecology of a deep demersal fish, alfonsino *Beryx splendens*, over the seamounts off New Caledonia. *Marine Biology 128(1)*: 17–27.

MacGibbon, D G (2015) Fishery characterisation and standardised CPUE analyses for alfonsino, *Beryx splendens*, 1989–90 to 2013–14. *New Zealand Fisheries Assessment Report 2015/78*. 238 p.

Massey, B R; Horn, P L (1990) Growth and age structure of alfonsino (*Beryx splendens*) from the lower east coast, North Island, New Zealand. *New Zealand Journal of Marine and Freshwater Research 24*: 121–136.

Masuzawa, T; Kurata, Y; Onishi, K (1975) Results of group study on a population of demersal fishes in waters from Sagami Bay to Southern Izu Islands: population ecology of Japanese alfonsino and other dernersal fishes. *Japan Aquatic Resources Conservation Association Fishery Research Paper No 28*. 105 p.

Maul, G E (1981) Berycidae. In: Fiches FAO d'Identification des espèces pour les besoins de la pêche. Atlantique centre-est. Fonds D´epôt-FAO. Ottowa, Canada.

Middleton, D A J; Tornquist, M; Neubauer, P (in prep.) Characterisation and CPUE for the alfonsino fishery in BYX 2 and BYX 3 from 1990 to 2023.

Northern Inshore Fisheries Company Ltd. (2001) Proposal to increase the TACC for BYX 1 -- final 30/04/01.

O'Driscoll, R L; MacGibbon, D; Fu, D; Lyon, W; Stevens, D W (2011) A review of hoki and middle-depth trawl surveys of the Chatham Rise, January 1992–2010. *New Zealand Fisheries Assessment Report 2011/47*. 814 p.

Seafood Industry Council (SeaFIC) (2003) BYX 1 performance report to the 2003 Adaptive Management Programme Working Group.

Seafood Industry Council (SeaFIC) (2004) Report to the Adaptive Management Fishery Assessment Working Group: Performance of the BYX 1 Adaptive Management Programme. AMP-WG-2004/06. (Unpublished report held by FNZ.)

Seafood Industry Council (SeaFIC) (2005) Report to the Adaptive Management Fishery Assessment Working Group: Performance of the BYX 1 Logbook Programme. AMP-WG-2005/05. (Unpublished report held by FNZ.)

Starr, P J; Kendrick, T H; Bentley, N (2010) Report to the Adaptive Management Programme Fishery Assessment Working Group: Characterisation, CPUE analysis and logbook data for BYX 1. Document 2010/04-v2, 86 p. (Unpublished report held byFNZ) (http://cs.fish.govt.nz/forums/thread/3874.aspx)

Starr, P J; Kendrick, T H; Lydon, G J (2006) 2006 Report to the Adaptive Management Programme Fishery Assessment Working Group: Full Term Review of the BNS 1 Adaptive Management Programme. AMP-WG-2006/03. 59 p. (Unpublished report available from Seafood New Zealand, Wellington.)

Stocker, M; Blackwell, R (1991) Biomass and yield estimates for alfonsino in BYX 2 for the 1991–92 fishing year. New Zealand Fisheries Assessment Research Document 1991/12. 12 p. (Unpublished document held in NIWA library, Wellington.)

Uchida, R N; Uchihama, J H (1986) Fishery atlas of the northwestern Hawaiian Islands. *NOAA Technical Report NAPS No 38*. 142 p.

Vinnichenko, V I (1997a) Russian investigations and deep water fishery on the Corner Rising Seamount in Subarea 6. *NAFO Scientific Council Studies (30)*: 41–49.

Vinnichenko, V I (1997b) Vertical daily migrations of the slender alfonsino *Beryx splendens* (Berycidae) at the underwater rises of the open North Atlantic. *Journal of Ichthyology (37)*: 438–444.