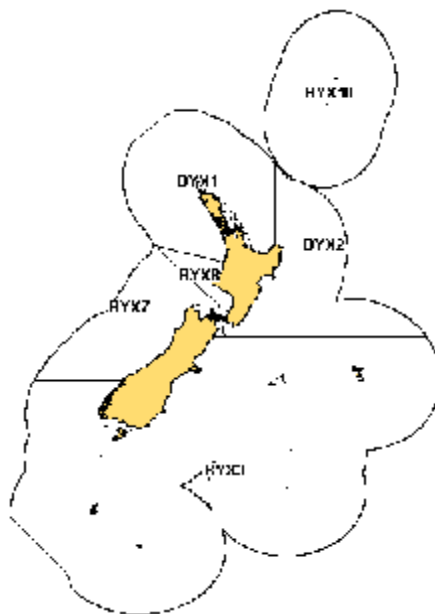


ALFONSINO (BYX)

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



1. FISHERY SUMMARY

(a) Commercial fisheries

The alfonsino fishery is essentially confined to BYX 2 & 3. Alfonsino has supported a major mid-water target trawl fishery off the lower 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 TACs are shown in Table 1.

Table 1: Reported domestic landings (t) of alfonsino by Fishstock from 1985–86 to 2004–2005 and actual TACs (t) from 1986–87 to 2004–2005.

Fishstock FMA (s)	BYX 1		BYX 2		BYX 3		BYX 7		BYX 8		BYX 10		Total	
	Landings	TAC	Landings	TAC	Landings	TAC	Landings	TAC	Landings	TAC	Landings	TAC	Landings	TAC
1985–86*	11	–	1454	–	3	–	1	–	0	–	0	–	1469	–
1986–87†	3	10	1387	1510	75	220	4	30	1	20	0	10	1470	1800
1987–88†	8	27	1252	1511	101	1000	2	30	1	20	0	10	1364	2598
1988–89†	6	27	1588	1630	64	1000	4	30	0	20	1	10	1663	2717
1989–90†	24	31	1496	1274	147	1007	21	80	<1	20	0	10	1688	2422
1990–91†	17	31	1459	1274	202	1007	26	81	0	20	0	10	1664	2423
1991–92†	7	31	1368	1499	264	1007	2	81	<1	20	<1	10	1641 ‡	2648
1992–93†	6	31	1649	1504	113	1007	12	81	<1	20	<1	10	1780 ‡	2653
1993–94†	7	31	1688	1569	275	1007	31	81	<1	20	0	10	2001 ‡	2718
1994–95†	11	31	1670	1569	482	1010	59	81	<1	20	0	10	2223 ‡	2721
1995–96†	11	31	1868	1569	961	1010	66	81	<1	20	0	10	2906 ‡	2721
1996–97†	39	31	1854	1575	983	1010	77	81	<1	20	0	10	2953 ‡	2727
1997–98†	14	31	1652	1575	1164	1010	67	81	<1	20	0	10	2898 ‡	2727
1998–99†	37	31	1658	1575	912	1010	13	81	3	20	0	10	2624 ‡	2727
1999–00†	25	31	1856	1575	743	1010	24	81	<1	20	0	10	2648 ‡	2727
2000–01†	25	31	1665	1575	890	1010	21	81	<1	20	0	10	2601 ‡	2727
2001–02†	123	300	1574	1575	1197	1010	10	81	<1	20	0	10	2904 ‡	2925
2002–03†	136	300	1665	1575	1118	1010	7	81	<1	20	0	10	2927 ‡	2925
2003–04†	219	300	1468	1575	884	1010	11	81	2	20	0	10	2584 ‡	2925
2004–05†	300	300	1669	1575	1067	1010	14	81	2	20	0	10	3052 ‡	2925

* FSU data.

† QMS data.

‡ Excludes catches taken outside 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 include 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.

An increasing amount of alfonsino is taken as bycatch in the gemfish trawl fishery which has exploited new grounds in QMA 2. Alfonsino is also taken as bycatch in the orange roughy and hoki fisheries in QMA 2.

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. The new TACC was attained for the first time in 2004/05.

The TAC for BYX 2 was reduced from 1630 to 1274 t during the 1989–90 fishing year but has increased since then to 1575 t as a result of decisions by the Quota Appeal Authority. The TAC for BYX 2 was consistently overcaught by up to 300 t between 1992–93 and 2000–01, only in 2001–02 were the landings less than the TAC, and this was by only 1 t. The TAC was again over caught in the 2002–03 fishing year.

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. Since 1995–96, landings have exceeded 900 t, reaching a peak of 1197 t in 2001–02 (187 t over the TAC). The 2002/03 catch of 1118 was also substantially larger than the 1010 t TACC. The marked increase in BYX 3 landings since 1994–95 (Table 1) is due mainly to the development of a target trawl fishery exploiting new grounds in BYX 3, and the discovery of new grounds south-east of the Chatham Islands (where a longline fishery for alfonsino, groper and ling has developed). Currently, most of the BYX 3 catch is taken from the target bottom trawl fishery, operating on a complex of underwater features to the south-east of the Chatham Islands. The target fishery is comprised of a small number of vessels targeting alfonsino during the summer period. The remainder of the BYX 3 catch is taken as a small bycatch of the hoki, orange roughy, and hake target trawl fisheries. The target trawl fishery has an associated bycatch of bluenose (Langley and Walker, 2002).

Fishing new grounds in BYX 7 resulted in increased catches in the mid 1990's and total landings of up to 77 t were recorded in 1996–97. More recently, landings in this region have declined somewhat, with a total of 14 t reported in 2004–05.

(b) Recreational fisheries

Occasional catches of alfonsino have been recorded from recreational fishers.

(c) Maori customary fishing

No quantitative information on the level of Maori customary fishing is available.

(d) Illegal catch

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

(e) Other sources of mortality

No qualitative information is available.

2. BIOLOGY

Both species of *Beryx* occur throughout the world's tropical and temperate waters, in depths from 25 to 1200 m. In New Zealand waters, most "alfonsino" landings are of alfonsino *B. splendens* and landings of the red bream *B. decadactylus* account for less than 1% of this catch. Red bream is taken mainly in BYX 1 but the biology of this species is poorly known. For the purposes of yield assessment, productivity parameters for alfonsino have been based on *B. splendens*. These species are primarily associated with undersea structures such as the seamounts that occur off the lower east coast of the North Island and on the Chatham Rise, in depths from 300–600 m.

Alfonsino have a maximum recorded age of 17 years and females grow faster than males. Pre-spawning alfonsino have been recorded in New Zealand waters but spawning grounds are unknown. Summer-autumn spawning activity has been noted in the North and South Atlantic and North Pacific Oceans. Juvenile alfonsino have been reported from near New Caledonia, associated with oceanic gyre systems. It is likely that the New Zealand stocks utilise similar pelagic water systems for reproduction and juvenile development. 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 a size of 28–31 cm FL.

Estimates of M from catch curve analysis are not available due to the likelihood that age-specific migration precludes the sampling of the whole population. M was estimated using 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, M equalled 0.23.

Biological parameters relative to the stock assessment are shown in Table 2.

Table 2: 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)							
BYX 2	a = 0.0226 b = 3.018						Stocker & Blackwell 1991
3. von Bertalanffy growth parameters							
	Females			Males			
	K	t ₀	L _∞	K	t ₀	L _∞	
BYX 2	0.08	-4.10	57.5	0.11	-3.56	51.1	Stocker & Blackwell 1991

3. STOCKS AND AREAS

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

There are no new data which would alter the yield estimates given in the 1996 Plenary Report. Yield estimates are based on commercial CPUE data.

(a) Estimates of fishery parameters and abundancei) BYX 2

A biomass index derived from a standardised CPUE (log linear, kg/day) analysis of the target trawl fishery represented by 7 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.

ii) BYX 3

The potential to monitor trends in abundance using catch and effort data from the target BYX 3 fishery has recently been investigated (Langley and Walker, 2002). 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.

(b) Biomass estimates

Biomass estimates are discussed in the section on estimation of MCY. Estimates of current biomass are not available.

(c) Estimation of Maximum Constant Yield (MCY)i) BYX 2

MCY was estimated using the equation $MCY = 2/3 MSY$ (Method 3). MSY was estimated using an age structured model which incorporates a Beverton and Holt stock recruitment relationship with assumed steepness of 0.95 (Stocker & Blackwell, 1991). Implicit in the analysis is the assumption that BYX 2 comprises a single stock. Although this assumption may not be strictly correct, the model provides an indicative estimate of yield for BYX 2.

Two values of M (0.20 and 0.23) were used. Two formulations of the catchability coefficient (q) were used (ln q and q). The results using the two formulations were either identical or very similar, so only the results using q are shown here.

The estimates of MCY are shown in Table 3.

Table 3: Estimates of B_0 , MCY, long-term equilibrium biomass using an $F_{0.1}$ strategy ($B_{0.1}$), and long-term equilibrium yield using an $F_{0.1}$ strategy ($F_{0.1}$ yield); all values in t; figures in parentheses are the 50% confidence intervals.

M	B_0	MCY	$B_{0.1}$	$F_{0.1}$ yield
0.20	19 000 (17 000–21 000)	1 110 (980–1 200)	6 600 (5 900–7 300)	1 480 (1 320–1 640)
0.23	17 500 (15 500–19 500)	1 200 (1 050–1 330)	6 000 (5 310–6 680)	1 610 (1 430–1 800)

These estimates of MCY have not changed since the 1991 Plenary Report.

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

ii) Other areas

MCY cannot be determined.

(d) Estimation of Current Annual Yield (CAY)

No estimates of current biomass are available for any stock and it is not possible to estimate CAY.

(e) 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 the two estimates of M (Table 3). $F_{0.1}$ 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 and 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 .

(f) Other factors

The current assessment for BYX 2 is based upon the historical fishery areas. In recent years the fishery has expanded to new areas not previously fished.

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 expected to increase in BYX 3 due to the discovery of new grounds. However, the potential for expansion may be constrained by availability of BNS 3 quota to cover likely bluenose by-catch.

Yield estimates are summarised in Table 4.

Table 4: Yield estimates (t).

Parameter	Fishstock	Estimate
MCY	BYX 2	1110–1200
$F_{0.1}$ yield	BYX 2	1320–1800
CAY	All	Cannot be determined

5. ANALYSIS OF ADAPTIVE MANAGEMENT PROGRAMMES

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

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

BYX 1

BYX 1 TACC was increased from 31t to 300 t under the AMP in October 2001.

Full-term Review of BYX 1 AMP in 2006

In 2004 the AMP FAWG reviewed the performance of the AMP after 4 years in its current 5-year term (Starr *et al.* 2006). The WG noted:

Characterisation

- BYX 1 was assumed to have been only lightly exploited and near virgin level when it was introduced into the AMP in Oct 2001. Annual catches remained well below the new TACC of 300t until 2004/05 when the TACC was caught in full for the first time.
- The BYX 1 fishery is a developing fishery that involves discovering and exploiting new grounds. The majority of the commercial catch since the TACC increase has been based on a targeted fishery using bottom and mid-water trawls near the outer margins of the BNS 1 EEZ.
- Based on trends in catch and effort, it appears that this species can be fairly easily targeted or avoided by fishing operations.
- Owing to the developing nature of the fishery, catches have been unevenly distributed in space and time, with the result that a meaningful CPUE analysis has not been possible.
- Although the bottom longline catch has been consistent over time and season, this fishery is a by-catch of the bluenose longline fishery and comprises a very small proportion of overall BYX 1 catch.

CPUE analysis

- CPUE was standardised for the first time.
- Two CPUE series, one from the developing target trawl fishery and one based on bycatch in the bottom longline fishery for bluenose and hāpuka/bass, were investigated in each of the Bay of Plenty and East Northland fisheries in search of credible indices of BYX1 abundance.
- Owing to small and infrequent catches in the longline fishery the variance of the associated indices was unacceptably large.
- Catch history in the target fishery was too short and catches too small in earlier years for the resulting index to be useful at this stage. This data set did however show the most promise and could in future provide an acceptable index. Future analyses should however be based on the catch, effort and positional data collected for each trawl (available because the fishery uses TCEPR forms), rather than collapsing information into trip strata.
- The use of a plus group to include all non-core vessels was not acceptable. It would be better to drop non-core vessels and associated data from the analysis.

Effects of fishing

- Given the developing nature of the BYX1 fishery, bottom trawling is expected to have an impact on the benthos of new fishing grounds. Mid-water trawling, on the other hand, is expected to have a low impact.
- Future presentations should include detailed information on gear configuration to both inform CPUE analysis and provide for a better qualitative understanding of the potential impact on the environment.
- Observer coverage is considered necessary to evaluate the potential impact of bottom trawling.

Log Book Programme

- This programme, first introduced in 2001/02, aims to record detailed catch and effort data and biological information (length and sex) from every bottom trawl targeting alfonsino in BYX 1.
- Despite the target of 100% coverage, only 13% of the targeted trawl catch was covered by logbook returns.
- Annual patterns in spatial coverage also poorly reflected those of the catch.

Conclusion

- Future characterisation analyses should provide more detail on gear configuration with fine spatial information as this would both inform the CPUE analysis and facilitate the qualitative assessment of the impact BYX 1 bottom trawling may have on the environment.
- BYX 1 was assumed to have been only lightly exploited and near the virgin level when it was first introduced into the AMP in Oct 2001. Annual catches were well below the 300t TACC until 2004/05. On account of low catches, the large size of the area and the developing nature of the fishery, the impact of the fishery on the resource is assumed to have been negligible. BYX 1 in all probability remains above B_{msy} and near its virgin level.
- Standardised CPUE from the target fishery showed the most promise/potential as an index of abundance. Future analyses should be based on TCEPR details and core vessels only.
- Logbook coverage was unacceptably low.
- Rates of benthic non-fish by-catch by bottom trawling should be recorded via a dedicated observer programme.
- The 500 otoliths which have been collected should be aged to provide some indication of productivity.

6. STATUS OF THE STOCKS**BYX 1**

BYX 1 appears to be near its virgin size as it has been lightly fished. Although the TACC for BYX 1 was increased to 300 t from 1 October 2001 under the Adaptive Management Programme, it remained substantially undercaught until 2004/05.

BYX 2

For BYX 2, the current TACC (1575 t) is within the range of $F_{0.1}$ yield estimates of 1320–1800 t calculated in 1991. This $F_{0.1}$ estimate was based upon a CPUE index in the target trawl fishery, and therefore may be an under-estimate for the entire fishery. Annual landings from 1986 to 1994–95 remained generally stable, within the estimated range of $F_{0.1}$ yield. Landings since 1995–96 have sometimes been slightly outside the range of $F_{0.1}$ estimates, as a result of expansion of the fishery into other areas. Therefore, recent catch levels and the current TACC appear sustainable. However, it is not known if recent catch levels and the current TACC will allow the stock to move towards a size that will support the MSY.

BYX 3

Alfonsino on the Chatham Rise (BYX 3) were lightly fished prior to 1995–96 and recent catches, although greatly increased, have been less than the TACC. BYX 3 catches have increased in recent years due to development of new fishing grounds. The stock can probably support higher catch levels in the short to medium term. It is not known if the recent catch levels or the current TACC are sustainable or would allow the stock to move towards a size that would support the MSY.

Summary of yield estimates (t), TACCs (t) and reported landings (t) for Alfonsino for the most recent fishing year.

Fishstock	QMA	MCY	$F_{0.1}$ yield	2004–2005	2004–2005
				Actual TACC	Reported landings
BYX 1	Auckland (East) (West)	1 & 9	–	300	300
BYX 2	Central (East)	2	1110–1200	1575	1669
BYX 3	South–East (Coast) (Chatham), Southland and Sub–Antarctic	3, 4, 5, & 6	–	1010	1067
BYX 7	Challenger	7	–	81	14
BYX 8	Central (West)	8	–	20	2
BYX 10	Kermadec	10	–	10	0
Total				2996	3052

7. FOR FURTHER INFORMATION

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