

COUNTRY NOTE ON NATIONAL FISHERIES MANAGEMENT SYSTEMS -- NEW ZEALAND

Summary

1. This paper provides an overview of New Zealand's management of commercial fisheries. It is New Zealand's country note contribution to the OECD Fisheries Committee's review of the use of management instruments/incentives in OECD countries. This review forms part of the Committee's further examination of economic aspects relating to the transition to sustainable fisheries.

2. Part I of this paper briefly describes New Zealand's commercial fisheries¹. Part II describes the regime used to manage fisheries and information is provided on objectives, management instruments and institutional arrangements. This part outlines the Quota Management System (QMS), which is New Zealand's preferred way of managing commercial fisheries and is used to manage most stocks in New Zealand fisheries waters.

3. Part III assesses the attributes of the property rights that are a component of the QMS. Quota shares are allocated to fishers when a stock becomes subject to the QMS. Each quota share is an ownership right in perpetuity and each year it generates an Annual Catching Entitlement (ACE). Quota shares are considered to demonstrate certain attributes of property rights – exclusivity, duration, quality of title, transferability, divisibility and flexibility. Opportunities exist for improving flexibility in use of the catching entitlements generated by quota shares. New Zealand is implementing an approach that enables quota share owners to act collectively and to propose legally recognised fisheries plans. This approach means quota share owners will be able to shape the management of the fishery, which should lead to more efficient use of resources and increases in fishery and quota share value.

4. Annex 1 provides information on some of the more valuable species managed in the QMS.

I. Fisheries Sector

5. New Zealand fisheries waters comprise the exclusive economic zone, the territorial sea, internal waters and freshwater or estuarine waters where fish, aquatic life or seaweed is found. This fisheries jurisdiction is amongst the largest in the world, covering some 4.5 million square kilometres. The marine waters are characteristically very deep with 72% is waters more than 1 000 metres, 22% between 200 and 1 000 metres and only 6% less than 200 metres. Most commercial caught fish are in waters shallower than 1 200 metres.

6. A wide diversity of marine species live in New Zealand fisheries waters – including approximately 1 200 species of fish, 2 400 species of molluscs, 2 000 species of crustaceans, 600 species of echinoderms and 900 species of seaweed. Around 130 species are fished commercially. Around 750 000 tonnes greenweight of seafood is harvested annually. Seventy percent of this seafood is taken from

¹ The paper focuses on management of the commercial marine capture fishery within New Zealand fisheries waters; other significant sectors, such as non-commercial marine capture (e.g., recreational) and aquaculture, are not discussed in this paper.

deepwater and mid-water stocks, 11% from pelagic stocks and 10% from farmed species. Inshore fishing provides the base for the majority of owner-operator fishing businesses.

7. The seafood industry creates about NZD 1.4 billion (USD 650 million) in annual exports and NZD 150 million (USD 70 million) in annual domestic sales and contributes NZD 1.7 billion (USD 790 million) to the Gross Domestic Product (1.8% of New Zealand's total GDP). A total of 26,620 full-time equivalent people are employed directly and through flow-on effects (see Table 1).

Table 1. New Zealand Seafood Industry: 2000

	Fishing	Processing	Total
<i>Output (USD million)</i>			
Direct	325	520	845
Indirect	241	671	911
Induced	98	219	317
Total	664	1 410	2 074
<i>Value Added (USD million)</i>			
Direct	113	140	254
Indirect	116	283	399
Induced	47	105	152
Total	276	529	805
<i>Employment (FTEs)</i>			
Direct	4 650	5 870	10 520
Indirect	2 650	8 770	11 420
Induced	1 410	3 240	4 650
Total	8 710	17 880	26 590

Source: McDermott Fairgray Group Ltd (2000), Report to the New Zealand Seafood Industry Council.

8. Hoki, squid, southern blue whiting and jack mackerels provide the largest volumes of catch in the marine capture fishery (see Table 2). Hoki, rock lobster, orange roughy and squid are the most valuable.

Table 2. New Zealand Fisheries Species: 2002

Species	Volume (tonnes)	Landed Value (USD million)
Hoki	196 000	53
Squid	48 173	23
Southern Blue Whiting	32 500	2
Jack Mackerels	28 085	4
Ling	19 562	16
Oreos	18 721	9
Orange Roughy	14 381	27
Hake	14 103	11
Snapper	6 328	12
Rock Lobster	3 238	56

Source: Ministry of Fisheries.

II. Management Regime

Objectives

9. The sustainable utilisation of New Zealand's fisheries resources contributes to a range of social, economic and environmental outcomes. The overall objective for fisheries is to: "maximise the value New Zealanders obtain through the sustainable use of fisheries resources and the protection of the aquatic environment". Three strategies support this achievement of this objective:

- a) Protect the health of the aquatic environment
- b) Enable people to get best value from the sustainable and efficient use of fisheries
- c) Ensure that obligations to Maori (New Zealand's indigenous people) are met.

10. These three strategies drive the implementation of fisheries management frameworks constructed under the Fisheries Act 1996. The third objective is an ongoing obligation that must be met. The first two strategies are derived from the purpose of the Fisheries Act 1996, which is "to provide for the utilisation of fisheries resources while ensuring sustainability". In the Act, "ensuring sustainability" is defined as "maintaining the potential of fisheries resources to meet the reasonably foreseeable needs of future generations" and "avoiding, remedying or mitigating the adverse effects of fishing on the aquatic environment." "Utilisation" is defined as "conserving, using, enhancing and developing fisheries resources to enable people to provide for their social, economic and cultural well-being".

Management Instruments

11. Guided by the purpose and principles in the Fisheries Act 1996, fisheries management decision makers aim to ensure sustainability and provide for the utilisation of fisheries resources. Where required, limits are set on harvests and those harvests are allocated amongst sectors. The preferred means of managing fisheries is using the Quota Management System (QMS). Since the QMS was introduced in 1986 with an initial 29 species or species groups, its coverage has steadily grown and it is now used to manage 95 species or species groups (a further 15 species or species groups are being considered for QMS management from October 2005). The QMS now manages over 90% of the commercial fishery harvest.

12. New Zealand fisheries waters are divided into Fisheries Management Areas (FMAs) – see Figure 1. Fisheries management occurs at the stock level. A stock is the basic management unit for the management of fish, aquatic life and seaweed. A stock can be across a number of FMAs, like the main hoki stock, which comprises FMAs 1 to 9. Or it can be part of an FMA, like orange roughy stock (ORH2B), which occupies part of FMA2.

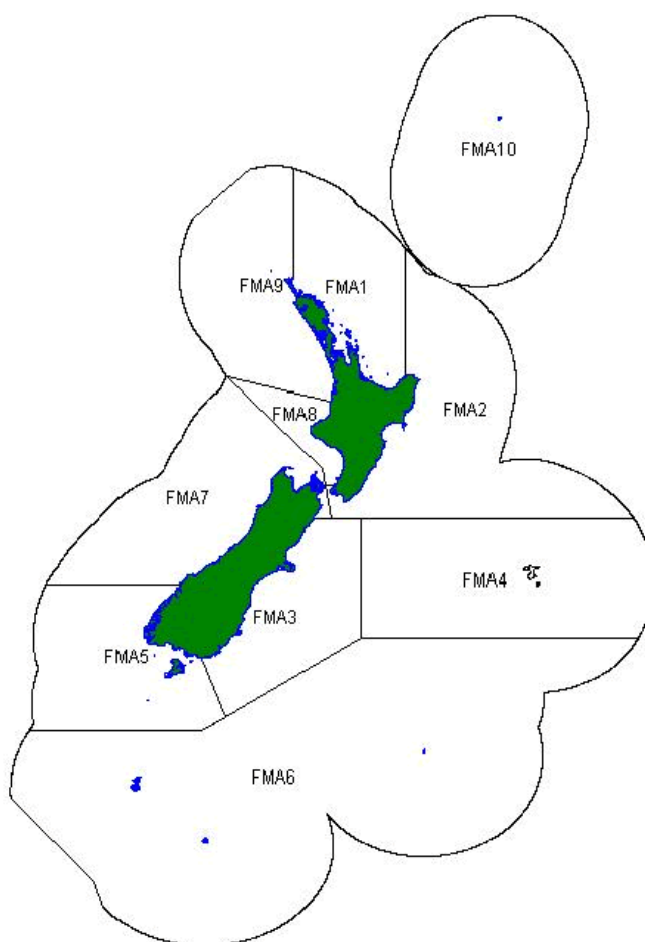
13. Each stock has a Total Allowable Catch (TAC). The TAC is an assessment of the total amount of catch that can be sustainably taken from a stock in any one year. The Minister of Fisheries sets the TAC with reference to the maximum sustainable yield (MSY). A TAC might be set that enables a stock to be fished down to the sizes that support MSY. Or it might be set at a level that enables a stock to be rebuilt to the sizes that support MSY. Some exceptions to this management target are provided for in law:

- a) Stocks where it is not possible, due to biological characteristics, to estimate MSY
- b) Stocks with a national allocation under an international agreement
- c) Stocks managed on a rotational or enhanced basis
- d) Highly migratory stocks

14. The Minister can also consider an alternative to MSY if he or she receives a suitable proposal from quota share owners in the relevant stock. Such proposals are subject to strict conditions including, *inter alia*, representation, research and information. The proposals must relate to stocks that are an incidental bycatch of a target species and maintain the stock above level that ensures its long-term viability.

15. Other sustainability measures include controls to avoid or mitigate bycatch of protected species. Technical measures, such as area closures and gear restrictions are also used.

Figure 1. New Zealand Fisheries Management Areas



16. Each QMS stock has a TACC. The Minister of Fisheries sets the TACC for a particular fishing year, after first making allowance for recreational, Maori customary fishing and all other sources of fishing.

17. The TACC is divided into quota shares, which can be owned by individuals or companies². The TACC is divided into quota shares, which can be owned by individuals or companies. Each quota share generates an Annual Catch Entitlement (ACE) at the beginning of each fishing year. ACE therefore represents the amount of a particular species a fisher can physically catch in a particular fishing year. Both ACE and quota shares are freely tradable.

18. For all QMS stocks, the commercial fisher must balance the catch with ACE or pay a “deemed value” for the fish. A deemed value is an administrative fee set at a level designed to encourage fishers to acquire ACE to cover their catch. A commercial fisher will be liable for deemed values for any catch in excess of ACE held on a monthly basis. A deemed value demand may be satisfied by acquiring ACE or by paying the amount demanded. If a person does not take one of these courses of action, his or her commercial fishing permit can be suspended. Permits are not transferable and to go fishing without one is a serious criminal offence. This catch-balancing regime is administrative in nature, but set within a criminal offence regime.

19. Restrictions are placed on the amount of quota that can be held by any one person, including their associates (see Table 3). There are no aggregation limits on the ownership of ACE.

Table 3: Quota Share Aggregation Limits

Aggregation limits	Species
45 per cent	Alfonsino, barracouta, blue warehou, gemfish, hake, hoki, jack mackerel, ling, orange roughy, oreos, packhorse rock lobster, red cod, silver warehou and squid
10 per cent	Spiny rock lobster for any Quota Management Area
20 per cent	Paua for any Quota Management Area
20 per cent	Bluenose
35 per cent	All other species

20. Any person wishing to harvest fish, aquatic life or seaweed for sale must hold a commercial fishing permit. A fishing permit gives its holder the authority to take fish, aquatic life or seaweed, excepting:

- a) Species that, due to management concerns, are subject to a moratorium on the issuing of new permits. This moratorium is considered necessary to restrict expansion of catch and effort in species until they can be moved into the QMS.
- b) Species protected by harvest prohibitions set out in fisheries and other marine protection legislation (e.g., protected species).

21. Commercial fishing vessels must also be registered under the Fisheries Act 1996. Vessel numbers are not restricted. New Zealand commercial fishers – through vessel charter arrangements – can employ foreign flagged fishing vessels to harvest fish. To do so, consent is required from the Ministry of Fisheries and the vessel must be registered.

² Overseas persons may own quota shares and annual catch entitlements, but they must first obtain consent from the Government.

22. A person wanting to go commercial fishing for hoki, for example, would be required to hold a commercial fishing permit and use a registered fishing vessel. The hoki caught would need to be no more than the amount of ACE he or she owns. If catch exceeds ACE, the fisher will receive a deemed value charge.

Institutional Arrangements

23. There are three tiers of government in New Zealand: central, regional and local. Fisheries management is the preserve of central government and the Ministry of Fisheries administers the Fisheries Act 1996³. The Ministry employs around 340 people in offices round New Zealand.

24. The Ministry is responsible for doing activities (grouped together into “outputs”) for the Minister of Fisheries. Each year these outputs are negotiated with the Minister as part of the budget and planning process. The outputs reflect what the Minister and the Ministry think should contribute towards the objectives and strategies for fisheries (discussed above). These outputs are grouped into classes with the following headings (percentage of 2003-2004 budget shown in brackets):

- a) Policy Framework (6%)
- b) Fisheries Information and Management (38%)
- c) Regulatory Management (12%)
- d) Fisheries Access and Administration (13%)
- e) Enforcement of Fisheries Policies (26%)
- f) Prosecution of Offences (5%)

25. The Ministry contracts the provision of certain services within these output groupings. For example, research services providers conduct a large proportion of stock assessment and biodiversity research under contract for the Ministry. Some fisheries administration activities (e.g., vessel registrations) have been devolved completely out of the Ministry and are conducted by approved delivery organisation according to standards set by the Minister. Here the Ministry only conducts a performance-monitoring role.

26. The setting of management measures (discussed above) and decisions on the level and extent of the Ministry’s fisheries services are subject to consultation with fisheries stakeholders (commercial, customary Maori, recreational, environmental). This consultation occurs as a matter of good administrative practice, and for many decisions is required by the Fisheries Act 1996. Consultation is beneficial and can lead to improved decisions on management and fisheries services provision.

27. Improving value in the fishery means providing opportunities and institutional arrangements for stakeholder-led management. Fisheries management agencies generally do not have the information to manage all aspects of fisheries so as to maximise fishery value. Stakeholders are often better placed to determine the type of utilisation and protection that will maximise certain types of value in the fishery, provided they face the full cost of their actions. In particular, stakeholders often have better information

³ Other laws relating to management of marine life are the: (i) Resource Management Act 1991, which is New Zealand’s main environmental and planning law and is mainly administered by regional councils; (ii) Marine Reserves Act 1971, which provides for the establishment of marine reserves and specified areas in the territorial sea, seabed and foreshore to managed for scientific study and to preserve the marine habitat; (iii) Marine Mammals Protection Act 1978, which provides for the conservation, protection and management of marine mammals; (iv) Wildlife Act 1953, which protects certain marine species. The latter three laws are administered by the Department of Conservation.

about the likely costs and benefits of fisheries management, as well as an interest in selecting the management approaches that are either more cost-effective or are expected to give greater return.

28. New Zealand is therefore moving to an approach where fisheries management will be conducted in a planning framework that provides for stakeholder-led management. Specific management plans will be developed for each fishery. These plans will be the means of meeting standards that come from the Government's objectives for fisheries (discussed above) and will apply to key components (e.g., stock yields, biodiversity, and participation). Management plans to meet these standards can come in two forms:

- a) Stock strategies, which are developed by the Ministry and specify management objectives for the stocks, management instruments, and research, compliance, and administration services. Stock strategies are being developed for all major fisheries or groups of fisheries.
- b) Fisheries plans, which can be developed and, for the most part, implemented by plan proponents. Through this approach stakeholders can have a greater influence over the management of the fishery covered by the plan. The Ministry's roles will be in assessing whether the proposed plan should be approved, and monitoring the implementation of the plan developed by stakeholders and which provide scope for stakeholders to propose innovative management tailored to the particular characteristics of a fishery.

29. Fisheries plans will be the important means of unlocking the benefits of collective stakeholder-led management. The expected benefits are:

- a) Enabling stakeholder participation. A fisheries plan can enable collective stakeholder-led management. This gives stakeholders the opportunity to increase value in the fishery.
- b) Integrating fisheries management. A fisheries plan can provide an integrated approach to fisheries management by specifying the management objective(s) for a fishery or group of fisheries and the corresponding implementation strategies to achieve the objective(s). A fisheries plan allows for alignment of a range of services required in a fishery, including rules, regulatory measures, administration, research and enforcement.
- c) Increasing stakeholder certainty. A fisheries plan can increase stakeholder certainty about management of the fishery. For instance, a plan may contain rules to manage the interaction between different fisheries sectors, or it may contain contingency strategies to deal with foreseeable variations. In addition, the adoption of a multi-year fisheries plan increases certainty to commercial stakeholders (and the Government) about the quantity, cost and timing of services. For the commercial sector this enables better business planning since there is greater certainty about the cost of fisheries management, including cost recovery levies for any fisheries services provided by Government.

III. Property Rights in the Quota Management System

30. The majority of the New Zealand commercial fishery is managed using the QMS. This part discusses the nature of the property rights created by the QMS. Discussion focuses primarily on the property rights attributes of quota shares, though ACE are also referred to.

31. Exclusivity: Quota owners receive ACE commensurate with their ownership of quota shares in the TACC. Quota shares are multiplied by the TACC to give the quantity of ACE that each quota owner may use or sell. The system attributes quota owners with strong and exclusive rights to the resource. The strength of those exclusive rights is linked to the extent to which the civil penalties (e.g., deemed values) discourage those that do not own ACE from catching the stock concerned. The level of exclusivity created by the QMS can be considered to be high.

32. Duration: Quota shares are allocated in perpetuity once a stock enters the QMS. The level of duration created by the QMS can be considered to be high.

33. Quality of title: Quota shares may be freely bought and sold and their ownership is recorded on a public registry. All catches and landings of the QMS stocks must be recorded and reported (regardless of whether ACE for that stock is owned by the fisher). The civil penalty regime is used to ensure catches are kept within ACE. The quality of title created by the QMS can be considered to be high.

34. Transferability: Quota shares may be freely bought and sold. Some restrictions are imposed on who may own quota shares and how much may be owned by any one entity or its associates. Overseas persons require specific consent if they wish to own quota shares (and ACE). Aggregation limits restrict how many quota shares any one entity and its associates may own (see Table 3). Consent may be obtained for ownership of quota shares in excess of these limits. The catching right generated by quota shares (ACE) is not subject to aggregation limits. Despite these constraints on who may participate in quota share trading, there are no restrictions (other than normal contractual requirements) on the activity of trading in quota. The level of transferability created by the QMS can be considered to be high.

35. Divisibility: Each TACC has a 100 million quota shares. It is not possible to own a portion of a quota share. The smallest quantity of ACE that can be owned is 1 kilogramme. The lower limits on divisibility are extremely small quantities. As such, they do not negatively affect divisibility and the level of this attribute created by the QMS can be considered to be high.

36. Flexibility: Quota share and ACE owners have a high degree of flexibility to determine how they wish to maximise the value of their property rights. Technical measures are still used extensively in New Zealand commercial fisheries, constraining the activities of ACE owners and possibly impeding further rent creation. New Zealand legislation and recent changes to institutional arrangements enable quota share owners to propose management approaches that augment rent creation off their property rights. Fisheries plans are a means for quota share owners to act collectively to shape the management of a fishery. Such approaches should improve planning and resource use and should lead to increases in economic rents. The level of this flexibility can therefore be considered to be high, but with scope for improvement.

ANNEX 1. EXAMPLES OF THE FISHERIES MANAGED IN THE QMS

Ninety-five species or species groups are managed in the QMS. This annex provides a brief description of some of the more valuable species managed in the QMS.

Hoki (*Macruronus novaezelandiae*)

<i>Size:</i>	60-100cm; may reach 140cm
<i>Maximum age:</i>	20-25 years
<i>Growth rate:</i>	fairly rapid, reaching sexual maturity between 4-5 years
<i>Similar species:</i>	grenadier family, lyconoid hake
<i>Also known as:</i>	blue hake, blue grenadier, whiptail hake
<i>Prey:</i>	small mid-water fish, crustaceans, squid
<i>Distribution:</i>	offshore demersal or deep-water
<i>Catching method:</i>	trawl
<i>Common bycatch:</i>	frostfish, ghost shark, gemfish, hake, jack mackerel, ling, ribaldo, silver warehou, and white warehou
<i>Depth:</i>	10-900m, with the greatest abundance found between 400-800m

Initially an undervalued fishery, hoki has grown to become New Zealand's largest export species by value and volume. Hoki is the first white fish in the world to achieve Marine Stewardship Council eco-label.

The fish are caught at depths of around 400-700m by mid-water and bottom trawl. The busiest catching months are during the spawning season of June-September in the Cook Strait and off the West Coast South Island (WCSI). The main fishery for hoki operates on the WCSI spawning aggregations. The spawning season for hoki is concentrated from mid-July to late August in most years, but may extend from late June to early September. Since the early 1990s, an increasing proportion of the catch has been taken before the spawning season, particularly on the Chatham Rise.

Between 1986-1990, surimi vessels dominated the overall catch, taking approximately 60% of the annual catch of the west coast of the South Island. However, since 1991 the surimi component of the catches has decreased and processing to head and gut, or to fillet product has increased. Although a greater proportion of the total catch is still taken during the spawning season, the hoki fishery now operates throughout the year, producing high quality fillet product from both spawning and non-spawning fisheries.

Recently the TAC and TACC for hoki have decreased and some fishing effort for hoki has been forced to move to other fisheries. This reactive management measure has been attributed to an increase in water temperature, affecting recruitment.

Exports of hoki are New Zealand's largest, at 16.5% of total exports by weight and 14% by value. The major markets are the United States, China, Australia and Korea. Export figures for hoki include minced and meal blocks.

Orange roughy (*Hoplostethus atlanticus*)

<i>Size:</i>	30-40cm; may reach 50cm
<i>Maximum age:</i>	120-130 years
<i>Growth rate:</i>	slow growing and long-lived
<i>Similar species:</i>	common roughy, silver roughy, giant sawbelly
<i>Also known as:</i>	nikorota
<i>Prey:</i>	prawns, squid, mysids, amphipods, euphysiids
<i>Distribution:</i>	offshore demersal or deep-water
<i>Catching method:</i>	trawl
<i>Common bycatch:</i>	cardinal fish, oreo dories, ribaldo
<i>Depth:</i>	700-1 500+metres

This species is one of the deepest fisheries in the world. Spawning occurs once each year between June and early August in several areas within New Zealand fisheries waters, from the Bay of Plenty in the north to Auckland Islands in the south. Spawning occurs in dense aggregations at depths of 700-1,000m and is often associated with ocean-floor features, such as pinnacles and canyons.

Fecundity is relatively low, with females carrying on average about 40,000-60,000 eggs. The eggs are large (2-3mm in diameter), are fertilised in the water column, and then drift upwards towards the surface and remain planktonic until they hatch close to the bottom after about 10 days. Details of larval biology are poorly known.

Exports of orange roughy are approximately 1.5% of total exports by weight and 6% by value and are mostly exported to China and the United States.

Ling (*Genypterus blacodes*)

<i>Size:</i>	80-120cm; may reach 160cm
<i>Maximum age:</i>	30 years
<i>Growth rate:</i>	moderately fast
<i>Similar species:</i>	cusk eels
<i>Also known as:</i>	kingklip
<i>Prey:</i>	crustaceans (munida), scampi, small fish
<i>Distribution:</i>	central to outer shelf demersal
<i>Catching method:</i>	long-line and trawl
<i>Common bycatch:</i>	bluenose, hāpuku & bass, hoki, jack mackerel, ribaldo, silver warehou
<i>Depth:</i>	200-800m

Ling appear to be mainly bottom dwellers, however, they may at times be caught well above the bottom when, for example, feeding on hoki during the hoki spawning season. Female ling generally grow faster and larger than males, but maturity rates differ among areas. Ling appear to grow fastest off the west coast of the South Island, and slowest on the Southern Plateau.

The known spawning grounds for ling are the Chatham Rise, Campbell Plateau, and Puysegur Bank during September, October and November, the Bounty Platform between October and December, and off the west coast of the South Island between July and September. Spawning grounds are also located on the Auckland Island shelf and the Cook Strait.

The principal grounds for smaller domestic vessels are off the west coast of the South Island and off the east coast of both main islands south of East Cape. For large trawlers the main sources of ling are Puysegur Bank and the slope of the Stewart-snares shelf and water in the Auckland Islands area.

Exports of ling are about 2.5% of total exports by weight and 3% by value and the main markets are Hong Kong, Japan and China.

Jack mackerel (*Trachurus declivis*, *Trachurus novaezelandiae*, *Trachurus symmetricus murphyi*)

<i>Size:</i>	30-40cm
<i>Maximum age:</i>	25 years
<i>Growth rate:</i>	highly variable, depending upon area
<i>Similar species:</i>	slender mackerel, koheru, blue (English) mackerel
<i>Also known as:</i>	horse mackerel
<i>Prey:</i>	pelagic crustaceans, squid, small fishes
<i>Distribution:</i>	central to outer shelf pelagic
<i>Catching method:</i>	purse seine, bottom and mid-water trawl
<i>Common bycatch:</i>	blue mackerel, ghost shark, kahawai, pilchards, snapper, tarakihi, trevally
<i>Depth:</i>	0-150m
<i>Temperature:</i>	warmer than 13°C

In New Zealand, jack mackerel consists of three species, and catch records do not distinguish among them. These three species have different geographical distributions, but their ranges overlap. Jack mackerels are known to spawn during summer and spring in the North and South Taranaki Bights with additional sites elsewhere. Jack mackerels are presumed to be off the seafloor at night, but surface schools can also be quite common during the day.

Jack mackerel were added to the QMS on 1 October 1996. Since then, they have become an increasingly significant commercial fishery. Broadly speaking, jack mackerels are taken by trawlers operating in central and north-western New Zealand waters.

Exports of jack mackerel reach approximately 6.5% of all exports by weight and 1.5% by value. Jack mackerel is exported to many parts of the world, mostly Africa, Europe, Asia and the Pacific.

Paua (*Haliotis iris*, *Haliotis australis*)

<i>Size:</i>	minimum legal size for harvesting is 125mm shell length for black-footed paua and 80mm for yellow-footed paua
<i>Growth rate:</i>	Slow and variable
<i>Also known as:</i>	Blackfoot, abalone
<i>Prey:</i>	only plant materials
<i>Distribution:</i>	down to 6m around the coastline of New Zealand
<i>Catching method:</i>	free diving, by hand (using a rounded stainless steel knife)
<i>Common bycatch:</i>	none
<i>Depth:</i>	shallow waters (generally less than 6m)

Paua are herbivores that can form large aggregations on reefs in shallow subtidal coastal habitats. Movement is over a sufficiently small spatial scale that the species may be considered sedentary. Paua are broadcast spawners and spawning is thought to be annual. Habitat related factors are an important source of variation in the post-settlement survival of paua. Growth, morphometrics, and recruitment can vary over short distances and may be influenced by factors such as wave exposure.

The commercial fishery for paua dates from the mid-1940s when the shell was marketed and the meat generally discarded. Both meat and shell were sold from the late 1950s. Since the 1986-87 fishing season, the fishery has been managed with an ITQ system and a TACC for each Quota Management Area (QMA).

Fishers gather paua by hand while free diving (use of underwater breathing apparatus is not permitted). Most of the catch is from the Wairarapa coast southwards: the major fishing areas are in the South Island, Steward Island and the Chatham Islands. Virtually the entire commercial fishery is for the black-footed paua. The yellow-footed paua is less abundant than the black-footed and is caught only in small quantities.

There is a large recreational fishery for paua. There is also an important customary use of paua by Maori for food, and the shells have been used extensively for decorations and fishing devices. Illegal fishing of paua is prevalent in some parts of the New Zealand coastline.

Exports of paua are approximately 4% by value and 0.2% by weight, being the highest value export at NZ 67.55 per kilo. Paua is exported mostly to the United States, Australia, parts of Asia and South America.

Spiny rock lobster (*Jasus edwardsii*)

<i>Size:</i>	minimum legal size for harvesting is 54mm for males and 60mm for females (tail width)
<i>Maximum age:</i>	can live for over 30 years
<i>Growth rate:</i>	fairly rapid (reach sexual maturity at 7-10 years). Grows by moulting shell.
<i>Similar species:</i>	green or packhorse lobster (larger)
<i>Also known as:</i>	red lobster
<i>Prey:</i>	shellfish, crabs, small fish and sea urchins
<i>Distribution:</i>	widespread around New Zealand, especially in rocky coastal areas where there are plenty of places to shelter
<i>Catching method:</i>	crayfish pots, free diving, by hand
<i>Common bycatch:</i>	none

Young rock lobsters moult several times a year, while adults moult annually. Mature males moult between October and December, and females between February and May. Mating occurs within a few weeks of the female moult. Females can bear hundreds of thousands of eggs (each egg is only about 1mm in diameter). Immediately after mating the eggs are attached to fine hairs (setae) under the tail. The female carries them for up to six months before they hatch, and uses a small extra claw on their rear pair of legs to care for her eggs.

The eggs hatch into spider-like larvae that drift freely as part of the plankton in open waters for at least 9-12 months. Those larvae that survive may move a long way with ocean currents, returning to inshore areas to settle on the bottom as transparent pueruli. At this stage they are 5cm long and look like miniature adults, but unlike adults they are able to swim forward. Before they find shelter, many are eaten by bottom feeding fish, such as dogfish and blue cod.

Rock lobsters were brought in to the QMS in 1990 as there was a danger that the fishery might collapse through overfishing. Illegal fishing is a big problem, and poachers are estimated to steal about 450 tonnes of rock lobster each year. Most of the commercial catch is from baited pots. There are only a few commercial divers, all operating on the Chatham Islands.

Rock lobster fetches the second highest price after paua at \$49.18 per kilo. Exports of rock lobster account for 8% of the total by value, and 0.5% by weight. The main overseas markets are Taiwan, Hong Kong, Japan and the United States.

Arrow squid (*Nototodarus gouldi*, *N. sloanii*)

<i>Size:</i>	25-35cm
<i>Maximum age:</i>	1 year
<i>Growth rate:</i>	very rapid
<i>Similar species:</i>	broad squid, warty squid, flying squid
<i>Prey:</i>	not known
<i>Also known as:</i>	Squid, calamari, wheketere
<i>Catching methods:</i>	jig, trawl
<i>Common bycatch:</i>	barracouta, jack mackerel, hoki, warehou, ling, southern blue whiting
<i>Depth:</i>	500m (mostly prevalent less than 300m)

Arrow squid are mainly caught around the coast of the South Island and off the Auckland Islands, usually by bottom trawling but sometimes by jigging. Squid jigging is done at night using specialised boats. Powerful lights shine on the water to attract squid. Lures are set through a pulley arrangement and automatically jigged up and down in the light beams. When the machine controlling the line senses a squid has grabbed the lure, the line is hauled in. Lure hooks are barb-less, so that as lures are pulled in over a set of end rollers, the squid fall off into collecting areas.

Squid are a favoured food of seals and sea lions, which sometimes accidentally get caught in trawl nets. To stop this happening, companies have developed a code of practice for catching squid by trawl in these areas. They have also built special mechanisms into their nets to help seals escape if they do accidentally get caught.

Arrow squid live for about one year, spawn and then die. It is likely spawning occurs in spring and autumn, but little else is known. In that case, any TAC set is only nominal and fishing effort is not restrained by it. The main effects on the success of a squid fishing season will be the timing of the hoki fishery and the bycatch of seals and sea lions.

Almost all arrow squid is exported frozen. In the year ending June 2004 squid exports have more than doubled and are the second largest export after hoki. Squid accounted for 20.5% of total exports by weight and 13% by value.