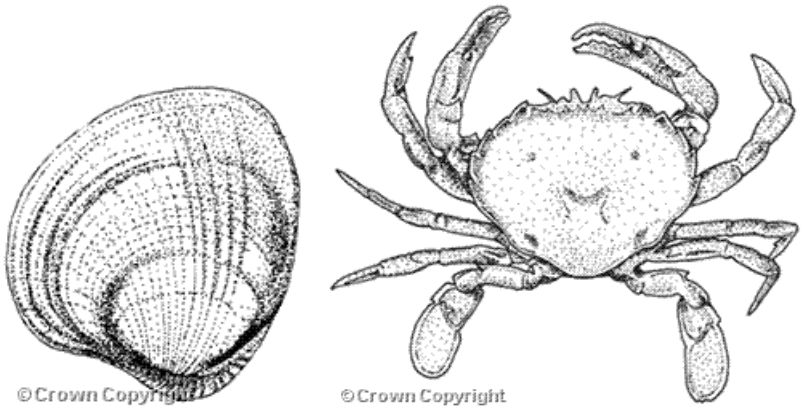
Ministry of Fisheries
Te Tautiaki i nga tini a Tangaroa

Fisheries Plan

North-East Shellfish



September 2007

Cockle (COC 1A, COC 1B, COC 1C)

Deepwater (King clam) (PZL 1)

Dredge oyster (OYS 1)

Green lipped mussel (GLM 1)

Horse mussel (HOR 1)

Kina (SUR 1A, SUR 1B)

Knobbed whelk (KWH 1)

Mud snail (ACR 1)

Octopus (OCT 1)

Pacific oyster (POY1)

Paddle crab (PAD 1)

Pipi (PPI 1A, PPI 1B, PPI 1C)

Rock oyster (ROY 1)

Scallop (SCA 1A, Tauranga Harbour)

Sea cucumber (SCC 1A, SCC 1B)

Surf clam (BYA 1, DAN 1, DSU 1, MDI 1, MMI 1, PDO 1, SAE 1)

Tuatua (TUA 1A, TUA1B)

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Introduction

PURPOSE OF THE PLAN

1 The North-East Shellfish Plan is a Ministry of Fisheries (MFish) led plan that considers the fisheries management issues relating to the shellfish fisheries of New Zealand's North-East coast; Fisheries Management Area 1.

2 This plan is being developed pursuant to Section 11A of the Fisheries Act 1996, and is to assist MFish in achieving the purpose of the Act:

> *To provide for the utilisation of fisheries resources while ensuring sustainability.*

3 The plan is to assist MFish by providing a platform to achieve the key outcome of its Statement of Intent (July 2006- June 2011) for the shellfish fisheries of the North-East coast:

> *The value New Zealanders obtain through the sustainable use of fisheries resources and protection of the aquatic environment is maximised*.

Process

4 Through this plan MFish wishes to identify the values tangata whenua and stakeholders place on the shellfish resources of the North-East coast and then, through a collaborative process, determine how to balance these different interests so that the value of the fisheries can be maximised. A key purpose of the plan is to set objectives that reflect these values and then put in place processes and procedures to achieve them. It is recognised that collective agreement may not be possible in all situations. In these cases MFish will perform an adjudicating role.

5 Once a final draft plan is agreed, it will be opened for public submissions. Ultimately, the final plan can be approved by the Minister of Fisheries under s 11A of the Fisheries Act 1996.

6 Once approved, the North-East Shellfish Plan will guide MFish in its decision making processes for the sustainable management of the shellfish resources of the North-East coast of New Zealand and their aquatic environment. The plan may also contain direction in terms of other legislative processes where these may impact on fisheries matters or fisheries habitats.

7 The first section of this plan sets out the current situation of the fishery and sets the scene for the development of the later stages of the plan which will address management objectives and management responses.

SCOPE OF THE PLAN

Geographic Area of Plan

8 The North-East Shellfish Plan covers the inshore component of Fisheries Management Area 1, being more or less those parts of New Zealand's exclusive economic zone (EEZ) and territorial sea which extends from mean high water springs out to the 200nm limit, and extends from North Cape to Cape Runaway as described in the First Schedule of the Fisheries Act 1996 (see Figure 1).

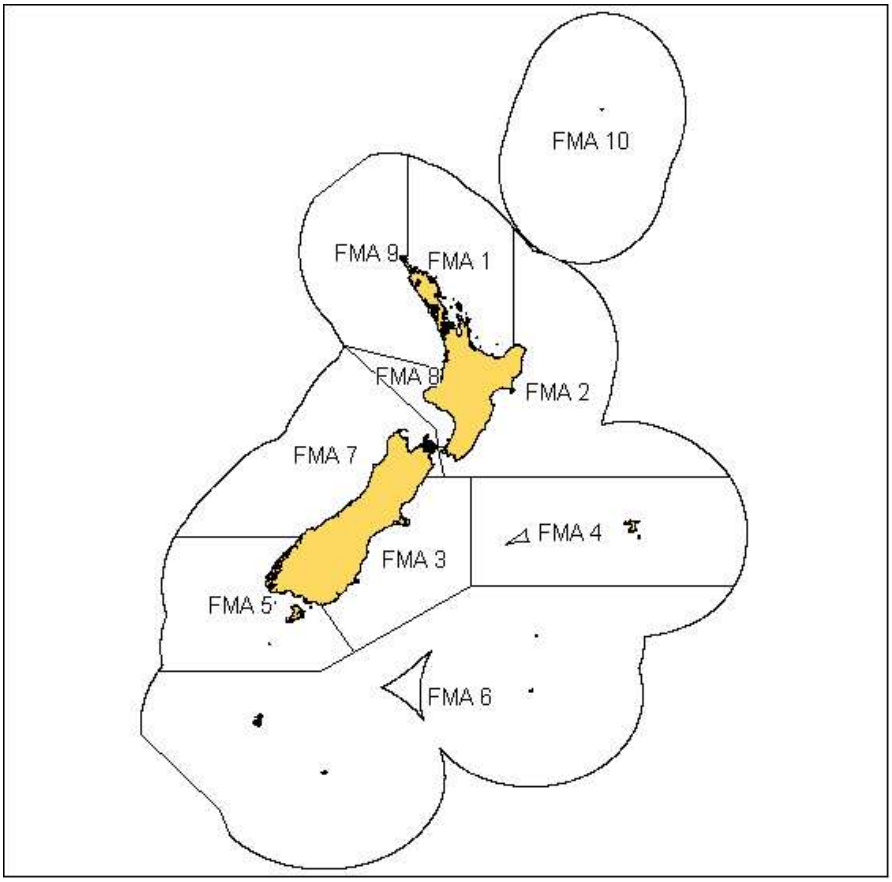

Figure 1: Fisheries Management Areas.

Species Included in the Plan

9 Although referred to as the North-East Shellfish Plan, the plan includes a range of invertebrate species. Importantly, the plan addresses 21 species managed within the Quota Management System (QMS) (see Table 1). Within this group there are a smaller number of key species that form the main focus of the plan; cockle, green-lipped mussel, kina, pipi and tuatua.

10 The plan also includes a few species that are managed outside the QMS, which have potential Maori cultural, recreational or commercial interest.

11 Part of the scallop (*Pecten novaezelandiae*) fishery is contained within this plan. The scallop fishery from Town Point, Maketu to Cape Runaway and the scallop fishery within Tauranga Harbour are addressed in this plan. The scallop fishery from North Cape to Cape Rodney is addressed in the Northland Scallop Fishery Plan and the scallop fishery from Cape Rodney to Town Point, Maketu is addressed in the Coromandel Scallop Fishery Plan.

12 A number of important shellfish species are excluded from this plan. Paua (*Haliotis* spp) and lobster (spiny lobster *Jasus edwardsii*, packhorse crayfish *Sagmariasus verreauxi*,) are addressed in a separate fisheries plan. Deep water species such as scampi and squid are addressed in the deep water fisheries plans.

Table 1. Species covered by this plan.

Common Name	Scientific Name	Maori name	Stock
Cockle	*Austrovenus stutchburyi*	Huangi, Tuangi	COC 1A, COC 1B, COC 1C
Deepwater (King) clam	*Panopea zelandica*		PZL 1
Dredge oyster	*Ostrea chilensis*	Purimu	OYS 1
Green lipped mussel	*Perna canaliculus*	Kutae	GLM 1
Horse mussel	*Atrina zelandica*		HOR 1
Kina	*Evechinus chloroticus*	Kina	SUR 1A, SUR 1B
Knobbed whelk	*Austrofusus glans*		KWH 1
Mud snail	*Amphibola crenata*	Waikaka, pupu	ACR 1
Octopus	*Pinnoctopus cordiformis*	Wheke	OCT 1
Pacific oyster	*Crassostrea gigas*	-	POY
Paddle crab	*Ovalipes catharus*	Papaka	PAD 1
Pipi	*Paphies australis*	Pipi	PPI 1A, PPI 1B, PPI 1C
Rock oyster	*Saccostrea glomerata*	Tio repe	ROY
Scallop	*Pecten novaezelandiae*	Tipa, Tupa	SCA 1A, Tauranga Harbour
Sea cucumber	*Stichopus mollis*	Rori	SCC 1A, SCC 1B
Surf Clams		Purimu	
Frilled venus shell	*Bassina yatei*		BYA 1
Ringed dosinia	*Dosinia anus*		DAN 1
Silky dosinia	*Dosinia subrosea*		DSU 1
Trough shell	*Mactra discors*		MDI 1
Large trough shell	*Mactra murchisoni*		MMI 1
Deep water tuatua	*Paphies donacina*		PDO 1
Triangle shell	*Spisula aequilatera*		SAE 1
Tuatua	*Paphies subtriangulata*	Tuatua	TUA 1A, TUA 1B

Oceanography of the North-East Coast

13 The North-East coast is a relatively sheltered ‘lee shore’ in an area dominated by westerly winds. The continental shelf is relatively narrow (10 -20km) in the north, extending to 70-100km wide in Bream Bay and the Hauraki Gulf, then constricting to around 70km in the Bay of Plenty. Figure 2 shows the bathymetry of the north east coast.

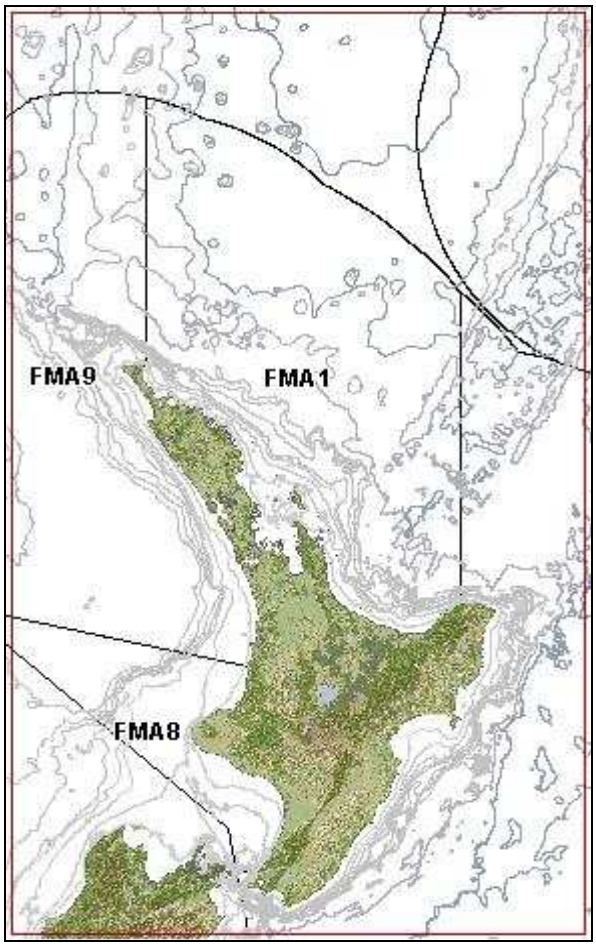

Figure 2: Bathymetry of the North-East coast.

14 The shellfish fauna of the coast are largely determined by sediment type and water depth. The coast has many harbours and embayments. Typically the upper sections of these harbours and estuaries are settlement zones and are characterised by fine muddy sediments. Such areas tend to hold species that are tolerant of those conditions. As the harbours and estuaries open and become subjected to greater wave activity and tidal movement, the muddy finer sediments give way to sands. Pipi and cockle are found in these areas. The many open sandy beaches offer good habitat for tuatua, surf clams and paddle crab. Kina and green lipped mussel are found on the reef systems.

15 The area is influenced by the East Auckland Current which brings warm subtropical waters down the North-East coast. Generally this lies well offshore, but its influence is increased during summer when north easterly winds drag the warm waters closer to the coast.

16 Primary production of the North-East coast is influenced by both wind and rain. In situations where there are extended periods of strong north westerly winds, typical of El Nino conditions, warmer surface waters are pushed offshore. Cooler nutrient rich water is upwelled to replace this. These events are characterised by cold near-shore waters often accompanied by isolated phytoplankton blooms. Periods of La Nina are characterised by strong north easterly winds which push warm nutrient poor waters inshore (down welling). These weather patterns can have strong influences on the productivity of shellfish resources. Closer to shore and especially in estuaries and embayments, productivity is often dominated

by rainfall events which wash nutrients from the land into the sea. A diagram showing the effects of upwelling and down welling on the North-East coast is given in Figure 3.

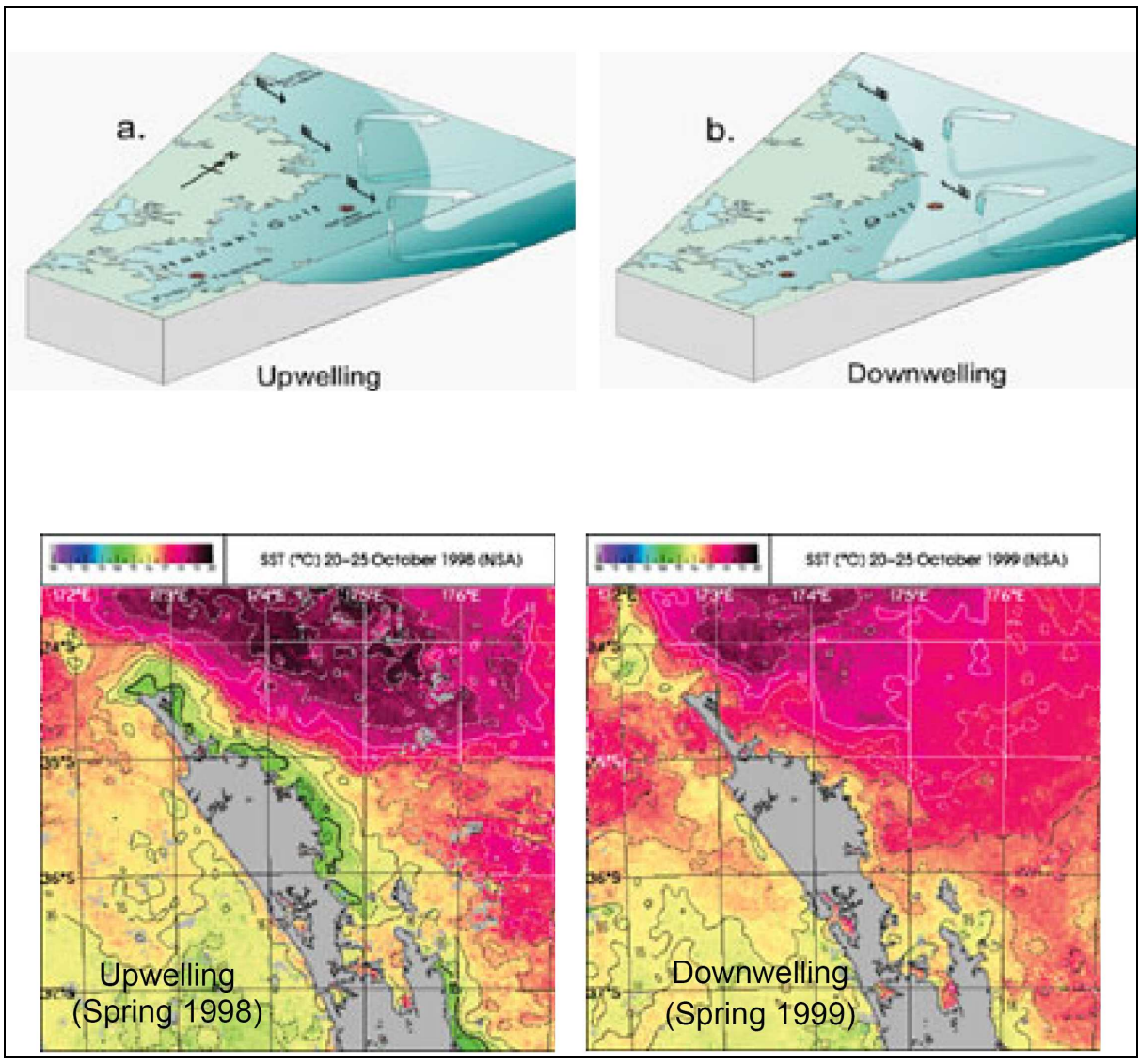

Figure 3: Effect of El Nino and La Nina on the North-East coast (Source: Environment Waikato Technical Report 02/09, Auckland Regional Council Technical Publication 182).

17 The Marine Environments Classification System (MEC) uses a series of physical and chemical characteristics (for example, water depth, exposure and salinity, amongst others) to identify areas of similar character and therefore potential similar habitat distributions. A map showing the 40 class MEC for the North-East coast is given in Figure 4.

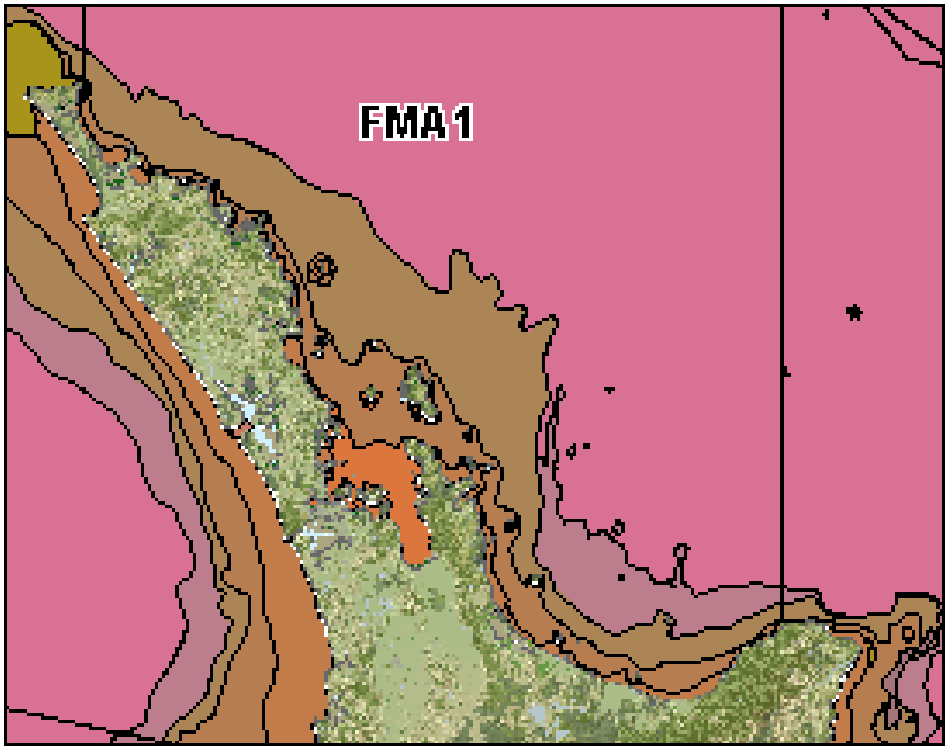

Figure 4: 40 class MEC for the North-East coast.

The Quota Management System at a Glance

18 The purpose of the Fisheries Act is to "provide for the utilisation of fisheries resources while ensuring sustainability." In order to achieve the sustainable management of fish stocks, 1986 the Government introduced the Quota Management System (QMS). QMS management requires that a total harvest limit for a stock is set and allowances provided for the interests of the commercial, customary and recreational sectors.

19 Species occur in geographically isolated and biologically distinct populations. Prior to establishing harvest limits, MFish establishes Quota Management Areas (QMA) for each stock within the QMS. This enables an appropriate level of management, and hence enables MFish to better achieve the purpose of the Act.

20 For many of the species covered by this plan, the scale of their QMA is at the same scale as FMA 1. However, for kina and sea cucumber, there are two QMAs with the division being at Te Arai Point, Pakiri. Others such as pipi and cockle are managed such that the commercial fishery is largely contained within a specific, smaller QMA. These stocks are managed through three QMAs.

21 Within each of the QMAs MFish establishes a Total Allowable Catch (TAC). This is the amount of fish, usually expressed in tonnes, that is available for human use, including fishing-related mortality. In setting the TAC the Minister must ensure that the amount of fish left in the ocean is sufficient to maintain the stock, maintain ecological processes and the general health of the marine environment.

22 The TAC is then divided into the amount that is available for customary, recreational and commercial fishing plus an allowance is made for all other sources of fishing-related mortality. The commercial allowance is known as the Total Allowable Commercial Catch

(TACC). The process for the allocation of the TAC is addressed in the chapter entitled, "Obtaining the Best Value from the Sustainable Use of Fisheries.

Brief Overview of Species and Fisheries

23 This section provides a brief overview of the biology and habitat of each species and gives a thumbnail description of their fishery.

24 **Cockles** are a shallow-burrowing suspension feeding bivalve. Cockles are found in soft mud to fine sand substrates on protected beaches and enclosed shores. They tend to be more abundant in sandier substrates. They are found from the lowest high water neap tide mark to the lowest part of the shore, but may extend to 20m in water depth.

25 Sexes are separate. Maturity occurs at about 18mm shell length. Cockle spawn from spring through summer. The planktonic larval stage lasts 3 weeks. Larval settlement is low in situations where adult densities are high and where adult densities are low. In some areas where shellfishing closures have been initiated, monitoring has shown little recruitment. It is unknown if this is due to the absence of the settlement stimuli created by an absence of adult cockles, environmental issues or a combination of both. Over fishing may pose a significant threat to recruitment.

26 Juvenile and small animals are quite mobile, however, animals over 25mm shell length appear largely sessile. Cockle growth rates are variable. Some studies suggest cockles take 4-5 years to reach 30mm, whereas more recent studies have suggested about 2 years. This variability may be density related, with individuals in areas of lower density growing faster.

27 Densities can be very high. Densities of $4500/m^2$ have been recorded. In the Pauatahanui Inlet it is estimated that cockles filter 1.6 million cubic metres of water each tidal cycle and therefore may perform important ecological services. Cockles are an important food source for harbour and estuarine fish, crabs, and seabirds.

28 Cockles support important customary and recreational fisheries. The commercial cockle fishery in is centred on Snake Bank in Whangarei Harbour with a TACC of 364 tonnes. A small commercial fishery occurs in Ohiwa Harbour.

29 Cockle stocks are separated into three QMAs, COC 1A, COC 1B and COC 1C. The separation of COC 1B and COC 1C occurs at Te Arai Point.

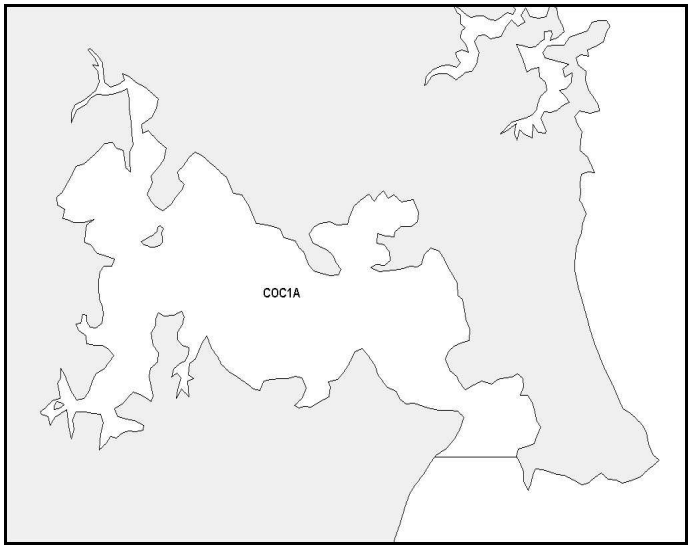

Figure 5: Quota Management Area COC 1A.

30 **Deepwater (King) Clam**. Deepwater clams are also known as geoduc and geoduck. There are two species in New Zealand, *Panopea zelandica* and *P. smithae*. Both are endemic. Both species are similar and hard to distinguish. Only *P. zelandica* is managed within the QMS.

31 Deepwater clams are active deep-burrowing filter feeding bivalves. They are widely distributed around New Zealand. Although distributions may overlap, *P. zelandica* tends to be in shallower water (5 to 25m) whereas *P. smithae* lives mainly at greater depths (to 130m).

32 Deepwater clams are single sex (dioecious) broadcast spawners (release reproductive products into the water column). It is believed they spawn in late summer and probably have a plankton larval life of two to three weeks. It is likely that recruitment is highly variable between years. There is a lack of growth data, however, assuming observed growth rings are annual, it is likely that they grow rapidly to 10 years of age, then slow, but continue to grow in weight.

33 *P. zelandica* lives buried up to 40cm in the sand. Harvest is generally by UBA and water jets. If displaced they cannot re-imbed themselves. Some by-catch from trawl nets has occurred in some areas, species unidentified. There is no reported harvest in the north east coast, although some investigative research has been undertaken in the Bay of Plenty. There is no commercial fishery in FMA 1. There is no information on customary or recreational interest.

34 There is one stock within the north east coast.

35 **Dredge oyster** is the only one of three oysters included in the QMS. Dredge oysters are present in many harbours along the north east coast. Whilst dredge oysters form a significant fishery in the Foveaux Strait they appear to be of little interest to commercial, recreational of customary fishers in the North-East coast.

36 **Green-lipped mussel** is an endemic species. It is found throughout New Zealand, but is most common in central and northern areas. It is naturally absent from the Chatham Islands and off-shore islands. Green-lipped mussels are found in open coastal areas between the mid littoral and depths of over 5m. Green-lipped mussels have a maximum shell length

of 240mm. Green-lipped mussels are filter feeders. They are dioecious broadcast spawner. Most spawning occurs in late spring to autumn. They are sexually mature after the first year. Females produce up to 100 million eggs per season.

37 Little is known of larval settlement. Settlement is highly variable. The planktonic stage (pediveligers) settles after about 3-5 weeks or about 220 to 350µm in length. From settlement, the larvae are known as spat.

38 Spat usually settle and drift a number of times before final settlement where they grow into adults. Generally they cease drifting when they reach 6mm in length. Mussel spat settle on hard structures, rocks, wharf piles, but may settle over bottom sediments. Green-lipped mussel is a very common aquaculture species, however information on age, growth and mortality of wild populations is scarce.

39 Green-lipped mussels support very important customary and recreational fisheries. There is little by way of a commercial fishery for green-lipped mussel in the North-East coast, what there is, is mainly a by-catch of the trawl and dredge fisheries. Historically there were significant beds in the Firth of Thames that were the subject of a dredge fishery that peaked at more than 2000 tonnes per annum in 1961 and ceased in 1966. These beds have not rebuilt.

40 There is one QMA or stock for green-lipped mussel for the North-East coast.

41 **Horse mussel** is an endemic species. They are distributed widely in muddy-sandy substrates. They occur from low intertidal in sheltered waters to 50 metres depth on open coasts. Horse mussels are often found in groups or clumps up to 10 square metres in area. Horse mussels are New Zealand's largest bivalve with shell reaching 400mm in length.

42 Horse mussels are dioecious broadcast spawners. They are thought to spawn during summer. There is no information on size or age at first spawning. Their pelagic larva are free swimming for several days to weeks. Nothing is known of primary settlement locations. Recruitment is often sporadic. There is little information on age, growth and mortality. It is known that they grow rapidly for the first two to four years and have a potential maximum age of 15 years. Widespread unexplained die-offs which result in large numbers of dead animals and shells being washed upon beaches are common.

43 Horse mussel beds form biogenic reefs (reefs made up from living things) where the exposed shells form important habitats for encrusting species and refugia for a variety of marine life. Horse mussel beds are recognised as areas of high biodiversity.

44 There is no target commercial fishery. Horse mussels are caught as a bycatch of trawl and dredge fisheries. There appears little customary or recreational interest.

45 There is one QMA or stock for horse mussel for the North-East coast.

46 **Kina** are found throughout New Zealand including the sub Antarctic islands. Kina are most common in water less than 10m depth, however, this is dependent on the depth distribution of their main prey items.

47 Kina have an annual reproductive cycle. They spawn from November to March. Size at maturity varies from 30mm to 75mm in diameter. Settlement is likely to be sporadic among years, locations and habitats.

48 Kina form very important customary and recreational fisheries. Commercial fisheries based on the sale of roe are established in the North-East coast.

49 There are two stocks for kina in the North-East coast; SUR 1A is from North Cape to Te Arai Point and SUR 1B from Te Arai Point to Cape Runaway.

50 **Knobbed Whelk** or turreted whelk is a widely distributed gastropod that belongs to the sub-family Buccininae. It can be found from the low tide mark to around 600m water depth. This carnivorous whelk grows up to 5cm long, and occurs throughout New Zealand where it is found on sandy/silt/mud substrate. There is very little published about the biology of this species; most references being identification notes or records of occurrence. The knobbed whelk is a scavenger that buries in the substrate when not feeding.

51 Baited whelk pots are used to target them. Knobbed whelks are also taken as a by-catch in the scallop, dredge oyster and bottom trawl fisheries. There have been few reported commercial landings of knobbed whelk from the North-East coast. Recreational and customary fisheries are thought to be small or non-existent.

52 There is one QMA for knobbed whelk on the North-East coast.

53 **Mud Snails** are found on tidal mudflats, in the upper part of the inter-tidal zone and are submerged for only around one hour at each high tide. Mud snails eat twice their own weight in mud every hour. There is no commercial harvesting of mud snail. Mud snail is an important species to Maori. There may be some limited recreational harvesting. Mud snails are managed outside the QMS.

54 **Octopus** is widely distributed around New Zealand in a depth range from low water to 400 metres. They are more abundant in the south than the north. Octopi are landed as a by-catch from other fisheries and are mainly caught by bottom trawling and in rock lobster pots. Across New Zealand they are mainly taken in fisheries targeting rock lobster, blue cod and snapper. Octopus is valued by customary fishers, however, there is no information on the level of this interest. There is no information on recreational fishing interest. Octopi are managed outside the QMS.

55 **Pacific and Rock Oysters** are the main oysters harvested on the north east coast. The importance of the rock oyster has declined since the late 1960s with the introduction of the Pacific oyster. This oyster now dominates customary and recreational harvest and is the subject of a successful aquaculture industry.

56 Sexes are dioecious broadcast spawners. The main spawning time is November to March. The growth of Pacific oysters is such that in some locations it dominates intertidal communities and is often regarded as a pest. There is no commercial harvest of wild populations of rock or Pacific oysters.

57 **Paddle crabs** are found off sandy beaches and in harbours and estuaries throughout New Zealand. They are abundant from the intertidal zone to at least 10 m depth, although they do occur in much deeper water. Paddle crabs are versatile opportunistic carnivores. They feed mainly on molluscs (in particular tuatua, toheroa and pipi), crustaceans, polychaetes, fish and occasionally on algae.

58 Mating occurs from winter through to spring. Females can only mate in the soft shell stage. Eggs are incubated by the female until they are ready to hatch. It is thought female

crabs migrate to deeper water to spawn (September to March). Females may have multiple spawnings. Females produce more eggs per spawning in colder climates (up to 2.2 million eggs), but have fewer spawning per year. Paddle crabs are relatively fast growing reaching a carapace width of 100mm in 3 years.

59 Paddle crabs are of commercial, recreational and customary interest. They are usually caught in pots or as by-catch in set nets. There is one QMA for paddle crab on the north east coast.

60 **Pipi** are a common burrowing bivalve that is found throughout New Zealand including the sub Antarctic islands. Pipi are characteristic of protected beaches, bays and estuaries where they occur intertidally and extend to between 7 and 10 metres water depth.

61 Pipi are broadcast spawners, spawning from November to March. Size at maturity varies from 30mm to 75mm but is generally around 40mm. Pipi develop from egg to settlement in about 3 weeks. Once settled they are thought to be relatively sedentary, but some research has shown them to retain a level of mobility. Settlement is likely to be sporadic among years, locations and habitats. Growth rates are variable. Studies suggest they reach about 30mm in year one, 50mm in three years, with growth being very slow thereafter.

62 Pipi are an important food source for harbour and estuarine fish, crabs, and seabirds. Pipi are likely to play an important role in stabilising sandy beaches and banks by reducing the transport of finer sediment material and may assist in maintaining water quality through their filter-feeding activity. A reduction in pipi biomass may have implications on associated and dependent species, and on the physical aquatic environment, particularly if localised depletion of discrete pipi populations occurs.

63 Pipi form an important customary and recreational fishery. Pipi stocks are separated into three areas PPI 1A (Whangarei Harbour), PPI 1B (North Cape to Te Arai Point), and PPI 1C (Te Arai Point to Cape Runaway). The only commercial fisheries are at Mair Bank, Whangarei Harbour and in Ohiwa Harbour.

64 **Scallop** is an endemic species to New Zealand. It is a functional hermaphrodite, common in sheltered to exposed habitats. Spawning occurs from spring through summer. Most scallops are mature at the end of their first year, however, they contribute little to the spawning pool. Scallop veliger larvae are planktonic for 3 weeks then settle on filamentous material. The main settlement period is January in northern areas. Settlement is highly variable. There are possible links between settlement and environmental and climatic conditions. When they are approximately 5mm in length they release and move to the adult habitat, usually lying in depressions on the sea floor. Growth rates are highly variable and appear linked to food availability. The legal harvestable size of 100mm is attained in 18 months to 2 years in favourable locations, but may take longer. Although adult scallops can swim, however research shows migration is limited.

65 The scallop fisheries included in this plan are SCA 1A, the fishery to the east of Town Point, Maketu to Cape Runaway and the Tauranga Harbour fishery. SCA 1A is dominated by customary and recreational catch, but has a 1 tonne TACC. The Tauranga Harbour fishery is solely a non-commercial fishery and is managed outside the QMS. Non-commercial harvest is by diving and dredge. The commercial fishery is a dredge fishery.

66 **Sea Cucumbers,** of which there are about 100 species in New Zealand, are all

aggregated under the quota code SCC. *Stichopus mollis* is the main harvested species.

67 Sea cucumbers are found throughout New Zealand in waters between 5-40 metres deep. Habitats are highly variable ranging from rocky shores to sandy substrates. They are described as common in FMA 1.

68 Sea cucumbers live on the surface of the seabed and are mobile. They are detritus feeders, taking in sediments and digesting the organic components. Little is known of the biology of sea cucumbers. They have an annual reproductive cycle, spawning during summer (Nov to Feb). They are broadcast spawners. They have a pelagic free-swimming larval stage of between 3 and 4 weeks. It is suggested that in sheltered bays where there is little water movement, the populations could be largely self seeding. This raises concerns about local depletion. Recruitment is patchy and variable. Adults are generally 18-20cm in length and 180g in weight. It is thought they mature at 2 years, and have a life span of 5-15 years.

69 Interest in sea cucumber from a customary or recreational fishing perspective is low. There is developing commercial interest. There are two QMAs for the north east coast separated at Te Arai Point.

70 **Surf clams** include seven species: deepwater tuatua, *Paphies donacina*, triangle shell *Spisula aquilatera*, large trough shell *Mactra murchisoni*, trough shell *M. discors*, ringed dosinia *Dosinia anus*, silky dosinia *D. subrosea* and frilled venus shell *Bassina yatei*. Each species has a separate TAC.

71 They are found in and immediately beyond the surf zone of exposed sandy beaches and are generally distributed down to depths of 10 metres, although this varies between species and locations. Due to the dynamic nature of the environment, surf clams tend to be deeply buried. Harvesting requires specialised dredge systems. These dredges are not thought to have significant impacts on the environment due to its naturally dynamic nature.

72 The three families of surf clams dominate in different regions of New Zealand. The Venerids (*Dosinia*) dominate the northern beaches with *D. anus* and *D. subrosea* being most plentiful in northern areas. Whilst present on most exposed beaches, initial studies suggest the eastern Bay of Plenty may have potentially viable commercial stocks.

73 Surf clams are dioecious broadcast spawners. Spawning is likely to occur from spring through summer. Larvae are in the plankton between 18 and 30 days. Recruitment is likely to be highly variable both temporally and by location. It is believed spat settle near shore and migrate seaward as they mature. Mark and recapture experiments show growth rates to be highly variable and may change with depth. Like many invertebrates, larger sizes are attained in colder climates.

74 Surf clam populations are subject to localised catastrophic mortality as a result of erosion during storms, and other natural events.

75 There is no current commercial fishing for surf clams in FMA 1 and it is believed they do not form significant recreational or customary fisheries. The QMAs for surf clam cover the entire FMA 1.

76 **Tuatua** is widespread throughout New Zealand in suitable sandy and soft-bottom habitats. They are more common in the North Island than the South. The species is generally

found in the intertidal and upper subtidal zones of semi exposed to exposed beaches. Tuatua commonly occur in areas mixed with other surf clam species.

77 Tuatua are broadcast spawners, with a spawning peak in summer. Larvae spend 2 to 3 weeks in a planktonic state prior to settlement. Tuatua recruitment is highly variable, both spatially and temporally.

78 Tuatua support important customary and recreational fisheries. Tuatua resources in FMA 1 are subject to high harvest pressures, particularly near population centres and are adversely affected by land use activities in particular, sedimentation. There is no commercial fishery within FMA 1.

79 There are two QMAs for tuatua along the North-East coast with the division being at Te Arai Point.

Section 1: The Current Situation

80 This section sets out some key information on the current state of North-East coast shellfisheries. The information is set out in a format that follows the three key outcomes of MFish's Statement of Intent.

- Health of the aquatic environment is protected
- Best value is able to be realised
- Credible fisheries management.

Insert para here about the 'fourth SOI outcome delivering on obligations to Maori – see guidelines

THE HEALTH OF THE AQUATIC ENVIRONMENT IS PROTECTED

81 The purpose of the Fisheries Act is to provide for the utilisation of fisheries resources while ensuring sustainability. "*Ensuring sustainability*" is defined as:

> *(a) Maintaining the potential of fisheries resources to meet the reasonable foreseeable needs of future generations; and*
>
> *(b) Avoiding, remedying or mitigating any adverse effects of fishing on the aquatic environment*.

82 Furthermore, Section 9 of the Fisheries Act requires decision makers to:

> *take into account the following environmental principles:*
>
> *(a) Associated or dependent species should be maintained above a level that ensures their long- term viability*
>
> *(b) Biological diversity of the aquatic environment is maintained;*
>
> *(c) Habitat of particular significance to fisheries management should be protected.*

83 In support of these requirements, MFish's Statement of Intent (SOI) July 2007 to June 2012, establishes a series of national fisheries outcomes. The overall goal of the SOI is:

> *The value New Zealanders obtain through the sustainable use of fisheries resources and protection of the aquatic environment is maximised.*

84 The following contributing outcome is specific to environmental issues:

- *The health of the aquatic environment is protected*

85 Historically, fisheries management in New Zealand has largely been conducted on a species by species basis. The environmental principles, together with the purpose of the Fisheries Act 1996 (to provide for the utilisation of fisheries while ensuring sustainability) indicate a direction towards a more ecosystem-based approach to managing fisheries.

86 The following sections outline how management approaches protect the health of the aquatic environment.

Harvest Strategies

87 Harvest strategies are intended to be used to ensure that management of fisheries resources meets the primary objective of the Fisheries Act; to provide for the utilisation of resources while ensuring sustainability.

88 The Fisheries Act requires the Minister to maintain stocks at or above a level that can produce Maximum Sustainable Yield (MSY). MSY is the largest average annual yield (catch) that can be produced over a prolonged period of time while maintaining the stock's productive capacity. B_{MSY} is the average stock biomass or level that can produce the MSY

89 Harvest strategies are based on the basic biological characteristics of a species and its ability to withstand harvest pressure. Generally fast growing highly productive fisheries are more robust to fishing pressure than slow growing species with low productivity.

Productivity

90 Shellfish species have different rates of growth, reproduction and natural mortality, all of which affect their ability to withstand fishing pressure. Table 2 below shows the key productivity features, where known, for shellfish species found on the North-East coast.

91 Whilst the above biological characteristics are important in assessing the productivity and resilience of invertebrate species, environmental factors play a significant role. The majority of invertebrates are broadcast spawners. They simply cast reproductive products into the ocean. After a period of time the larvae settle into suitable substrates. Climatic and oceanographic conditions driven by climate patterns, including the southern oscillation (El Niño and La Niña), play a significant role in locating suitable substrates and subsequent recruitment.

Table 2: Key biological characteristics of North-East shellfish species.

Species	Natural mortality rate (M)	Fecundity	Maturity age or length	Maximum age or length	Growth
Cockle	0.3	-	18mm	>35mm	Fast
Deepwater (King) clam	0.14 - 0.26	-	<61mm	34 years	Fast initially, then slow
Dredge oyster	0.1	Low	42 - 50mm (Otago)	46 years	Slow
Green-lipped mussel	-	High	40 - 50mm	240mm	Fast
Horse mussel	-	-	-	400mm 5 - 15 years	Fast
Kina	-	-	30-75mm	20 years +	Moderate
Knobbed whelk	-	-	-	-	-
Octopus	-	High	1 - 5 years	3 - 5 years	Fast
Paddle crab	-	-	-	130mm - 150mm	Fast
Pipi	0.3 - 0.5	High	40mm	10 years approx?	Fast
Scallop	0.50	Very High	60mm	6 - 7 years	Fast
Sea cucumber	-	-	180 - 200mm	5 - 15 years	-
Surf clams *Bassina yatei* *Dosinia anus* *Dosinia subrosea* *Mactra discors* *Mactra murchisoni* *Paphies donacina* *Spisula aequilatera*	 - 0.15 - 0.30 - 0.30 - 0.45 0.40 - 0.50 - 0.70 - 0.90	-	-	-	-
Tuatua	-	High	-	5 years +	Fast

Sustainability Indicators

92 MFish monitors the sustainability of resources through biomass surveys, harvest surveys, and catch monitoring. As stated previously, the Minister must manage stocks "at or above B_{MSY}". Whilst intuitively simple, determining B_{MSY} can be difficult. MFish uses two common reference points; Maximum Constant Yield (MCY) and Current Annual Yield (CAY).

93 Fish stock abundance or biomass are usually measured across the entire Quota Management Area, however, as most shellfish are sedentary and interest is at the local level, shellfish biomass surveys are undertaken at the local level. It is important to recognise that whilst local depletions may occur, this does not necessarily mean that the stock overall is being managed in an unsustainable manner.

94 Biomass surveys are usually only undertaken on resources subject to commercial or high customary and/or recreational pressure. Generally, regular biomass surveys have only been undertaken for the commercial cockle and pipi fisheries and for intertidal shellfisheries (cockle and pipi) at high-use locations. For most other stocks there is insufficient information to make confident decisions on sustainable harvest levels. For these species the TAC levels are set conservatively. A number of the species are currently of low interest to all sectors; king clam and surf clams. These stocks are likely to be at or near unfished levels.

95 In 1999 MFish commenced a programme to determine the distribution, abundance and size frequency of selected shellfish species at beaches within the Auckland Fisheries Management Area. Reports written in 2005 reviewed the survey information for 16 beaches on the North-East coast over a period from 1992 to 2005. The report commented that cockle and pipi populations appear to be naturally highly variable and that such changes can occur rapidly. An example of this was Mangawhai where the population fluctuated from 50 million to around 25 million then back to 50 million in 5 years.

96 The report concluded that for most beaches there appears to have been a decline in population since the earlier surveys. At Umupuia the decline in cockle has been significant, from 60-90 million in the early 2000s to around half than number after three years. Much of this decline is attributed to harvest pressure. Similar changes were found for the Waiotahi pipi population. However, in this latter population, flooding in 2003 and 2004 may have had a significant effect. Whangamata pipi also showed a strong decline. The population estimate of pipi at Whangamata was 6 million in 2002 and had reduced to 2.4 million in 2004. The population trends obtained from the survey are show in Table 3.

Table 3: Population trends for cockle and pipi at 16 locations on the North-East coast.

Beach/Location	Cockle		Pipi	
	Population Trend	Median Trend	Population Trend	Median Trend
Waiotahi	decreasing	decreasing	no change	increasing*
Umupuia	decreasing	no change	NA	
Te Haumi	increasing	no change	no change	decreasing
Eastern**	NA		NA	NA
Ngunguru	NA		NA	NA
Ohiwa	NA		NA	NA
Waikawau**	NA		no change	increasing
Mangawhai	no change	no change	no change	increasing
Okoromai	no change	no change	NA	
Otumoetai	no change	no change	increasing	decreasing
Little Waihi	no change	decreasing	increasing	decreasing
Pataua	no change	no change	NA	
Tairua	no change	no change	no change	no change
Whangamata	no change	no change	decreasing	no change
Whangapoua	no change	no change	no change	no change
Whangateau	no change	no change	NA	

* Since the 2000 survey. ** Subject to shellfish harvesting closure

Information Status

97 MFish contracts research providers to undertake projects that provide information on the status of stocks within the North-East shellfish fishery. Table 4 shows how these stocks are assessed, any recent and current research, and requirements for the future.

Table 4: The 2007-08 Inshore Shellfish Fisheries Medium Term Research Plan as it applies to North-East stocks.

Fish Stock	Assessing Stock Status	Recent & Current Research	Research Requirements
COC 1A	Recorded landings 1986/87 – 2002/03. QMS introduction October 2002. TACC estimates from CAY strategy, estimated annually from pre-season biomass surveys (CAY where Fref estimates are based on YPR and SSBPR modelling). Periodic biomass estimates 1982 to 2003. COC2001/01 concluded that a length-based model did not provide a reasonable description of observed data. Frequency of biomass surveys (annual or two yearly) dependent on results of immediate past survey.	COC2004/01 – Biomass survey and yield estimate completed March 2005 COC2006/01 – Biomass survey and yield estimates to be undertaken in March 2007.	2007/08 - Biomass survey and yield estimates (according to CAY management strategy) identified in 06/07 MTRP.
GLM 1	Fish stocks monitored by comparison of annual landings against TACC.	No current research.	2007/08 - No research requirements identified. Any development of these fisheries would require research.
HOR 1	Fish stocks monitored by comparison of annual landings against TACC.	No current research.	2007/08 - No research requirements identified. Development of fisheries would require research.
KWH 1	Fish stocks monitored by comparison of annual landings against TACC.	No current research.	2007/08 - No research requirements identified. Any development of these fisheries would require research.
PAD 1	Fish stocks monitored using comparison of annual landings with the TACC.	No current research.	2007/08 – No research requirements identified. Further development of these fisheries would require a research component.
PPI 1A	Fish stocks monitored by: TACC estimates from CAY strategy, estimated from periodic pre-season biomass surveys (CAY where Fref estimates are based on YPR and SSBPR modelling). Frequency of biomass surveys dependent on results of immediate past survey. 2004 survey estimated CAY at 720 – 2218 t.	PPI2004/01 – Stock assessment of Mair Bank pipi	2007/08 - No research requirement identified.
PZL 1	Fish stocks monitored by comparison of annual landings against TACC.	No current research.	2007/08 - No research requirements identified. Any development of these fisheries would require research.
SCA 1A	Fish stocks monitored by comparison of annual landings against TACC.	No current research.	2007/08 – No research requirements identified. Any development of these fisheries would require research.

SCC 1A and SCC 1B	Fish stocks monitored by comparison of annual landings against TACC.	No current research.	2007/08 – No research requirements identified. Any development of these fisheries would require research.
SUR 1A and SUR 1B	Recorded annual landings for all North Island FMA stocks from 1983 to 2003. Fish stocks monitored using comparison of annual landings with TACC.	No current research.	2007/08 – no research identified. Any development of these fisheries would require research component.
Surf clams	Fish stocks monitored by comparison of annual landings against TACC.	No current research.	2007/08 - No research requirements identified. Any development of these fisheries would require a research. Proposal for SUR2 currently being evaluated.
BYA 1			
DAN 1			
DSU 1			
MMI 1			
MDI 1			
PDO 1			
SAE 1			
TUA1	Fish stocks monitored by comparison of annual landings against TACC.	No current research.	2007/08 - No research requirements identified. Any development of these fisheries would require research.

Setting the Total Allowable Catch (TAC)

98 The TAC establishes the amount of a stock available for human extraction. Stocks within the QMS can be managed either under section 13 or section 14 of the Fisheries Act 1996. Stocks managed under section 13 must be maintained at or above a level that can produce the MSY for that stock. All the stocks included in this plan which are managed under s13.

99 The Minister must set the TAC such that the stock biomass is maintained at or above the B_{MSY}. In determining this, the Minister must ensure that the level of harvest is sustainable, that is the level of the TAC is such that sufficient stock is left to maintain the stock, maintain ecological processes and maintain the general wellbeing of the marine ecosystem.

100 The setting of the TAC requires a high level of understanding of the stock, the biological characteristics of the species and its contribution to the marine ecology. The information in the preceding section describes how MFish uses the biological characteristics of the stocks to measure the biomass and determine yields of stocks in specific locations. MFish has limited information on the total stock size for many species.

101 MFish has excellent information on commercial catch levels, locations and the likes. However, it has a low level of information on the catch taken by the recreational and customary sectors. Whilst a number of recreational surveys have been undertaken, the information gathered is often thought to be uncertain. MFish is striving to find ways to improve the level of information on these sectors' catches.

102 Given these constraints, MFish uses a variety of information sources to make its TAC decisions; biomass surveys, existing harvest levels, harvest trends, population trends and

population dynamics. These all contribute to an understanding of sustainable levels of harvest.

103 When setting or varying a TAC, the Minister of Fisheries must take into account a number of specific and generic provisions of the Fisheries Act 1996. These are largely described in sections 11, 12, 13 and 14 of the Act, and include:

- Existing levels of commercial, recreational and customary catch
- The sustainability of the stock (including the maximum sustainable yield and the stock's long-term viability)
- Interdependence of stocks
- Social, cultural and economic factors
- Environmental and information principles
- International obligations
- The Treaty of Waitangi (Fisheries Claims) Settlement Act 1992
- Effects on the aquatic environment
- Other Crown statutory plans, policy statements, and management strategies.

104 In addition, in making any TAC decisions relating to stocks within the Hauraki Gulf Marine Park, the Minister must also have regard to Sections 7 and 8 of the Hauraki Gulf Marine Park Act.

105 The first stocks covered by this plan to be introduced to the QMS were paddle crab and Snake Bank cockle in 2002. Since then, 26 FMA 1 stocks addressed by this plan have had TACs set. None of the TACs for the stocks covered by this plan have been changed since they were first established.

106 There is a significant number of stocks within the North-East shellfish fishery for which the stock sustainability status and biomass is unknown. Accordingly, cautious TAC limits have been set for these stocks.

107 Table 5 provides an overview of the TAC and stock assessments for the species covered by this plan. Of particular note is the column which describes whether the stock is at or above B_{MSY}.

Table 5: The current management regime for North-East inshore shellfish stocks, the date they were introduced to the Quota Management System (QMS) and the current Total Allowable catch (TAC) and biomass state.

Stock	Current management regime	Introduced to QMS	TAC (tonnes)	At or above B_{MSY}
COC 1A	Section 13	1 October 2002	400	Unknown
COC 1B	Section 13	1 October 2005	46	Unknown
COC 1C	Section 13	1 October 2005	72	Unknown
GLM 1	Section 13	1 October 2004	415	Unknown
HOR 1	Section 13	1 April 2004	14	Unknown
KWH 1	Section 13	1 October 2006	3	Unknown (Near virgin biomass)
PAD 1	Section 13	1 October 2002	250	Unknown
PPI 1A	Section 13	1 October 2004	250	Unknown
PPI 1B	Section 13	1 October 2005	160	Unknown
PP I1C	Section 13	1 October 2005	243	Unknown
PZL 1	Section 13	1 October 2006		Unknown (Near virgin biomass)
OYS 1	Section 13	1 October 2005	4	Unknown
SCA 1A	Section 13	1 April 2006	8	Unknown
SCC 1A	Section 13	1 April 2004	7	Probably above B_{MSY} (Near virgin biomass)
SCC 1B	Section 13	1 April 2004	8	Probably above B_{MSY} (Near virgin biomass)
SUR 1A	Section 13	1 October 2003	172	Unknown
SUR 1B	Section 13	1 October 2003	324	Unknown
Surf Clams				
BYA 1	Section 13	1 April 2004	1	Above B_{BMSY} (Near virgin biomass)
DAN 1	Section 13	1 April 2004	7	Above B_{BMSY} (Near virgin biomass)
DSU 1	Section 13	1 April 2004	1	Above B_{BMSY} (Near virgin biomass)
MMI 1	Section 13	1 April 2004	2	Above B_{BMSY} (Near virgin biomass)
MDI 1	Section 13	1 April 2004	1	Above B_{BMSY} (Near virgin biomass)
PDO 1	Section 13	1 April 2004	1	Above B_{BMSY} (Near virgin biomass)
SAE 1	Section 13	1 April 2004	9	Above B_{BMSY} (Near virgin mass)
TUA 1A	Section 13	1 October 2005	84	Unknown
TUA 1B	Section 13	1 October 2005	126	Unknown

Associated or Dependent Species

108 Section 9(a) of the Fisheries Act requires MFish to take account of the need to maintain associated or dependent species above a level that ensures their long-term viability. Associated or dependent species are defined in the Act as "any non-harvested species taken or otherwise affected by the taking of any harvested species." The Act defines "harvested species" as any species that may be taken lawfully. Associated or dependent species include

protected species such as marine mammals and seabirds, but also include species for which no authorisation to harvest is held.

Protected Species

109 Protected species such as dolphins, whales, seabirds, marine reptiles, black coral, and white sharks are all found in the east coast of the North Island. However, none of these species are believed to be impacted by the shellfish fishing activities in the area.

Non-Protected Species and Ecological Services

110 Non-protected species may be affected by harvest activities either directly through accidental harvest and disturbance or indirectly, through flow-on effects of fishing activities. Many of the species covered by this plan are harvested by hand as opposed to bulk harvesting methods and as a result, the potential for direct effects is likely to be low.

111 Indirect effects would most likely result from species interactions. Generally such interactions are hard to identify and very hard to predict.

112 In terms of ecological services, it is known that cockles filter large volumes of water each tidal cycle and contribute to the maintenance of water quality in some areas. A significant reduction in the cockle population would likely alter this. The consequences of such actions are unknown.

Maintaining Biological Diversity on the North-East Coast

113 Maintaining the biological diversity of the aquatic environment is the second environmental principle of Section 9. Biodiversity is defined as variability among living organisms, including the diversity within species, between species and of ecosystems. The obligations under s 9 support the broader New Zealand Biodiversity Strategy, which has four key outcomes for marine biodiversity:

- Natural marine habitats and ecosystems are maintained in a healthy functioning state.
- A full range of marine habitats, and ecosystems of indigenous biodiversity is protected.
- There are no human-induced extinctions of marine species.
- Marine biodiversity is appreciated, and any harvesting or marine development is done in an informed, controlled and ecologically sustainable manner.

114 MFish has established a Biodiversity Research Programme which incorporates a biodiversity research plan entitled “Biodiversity Medium Term Research Plan 2006/07 to 2010/11”.

115 In order to maintain biodiversity, New Zealand is establishing a series of specific area controls which are dedicated towards achieving biodiversity outcomes. Outside of these areas, biodiversity is also managed through specific provisions within broad application legislation, for example the Fisheries Act.

Marine Protected Areas

116 A key method of protecting biodiversity is the establishment of marine protected areas. The Government, in December 2005, released the “Marine Protected Areas Policy and Implementation Plan”. This plan provides overlying guidance for regional strategies that will

address local biodiversity protection mechanisms. More recently the government has consulted in a proposed marine protected areas classification and protection standard.

117 The Government aims to protect 10% of New Zealand's marine environment by 2010. Marine reserves are established under the Marine Reserves Act 1971 and can provide absolute protection to all marine life within the reserve. Marine reserves while established for the purpose of retaining marine areas in unmodified states for scientific research are seen as one key mechanism to achieve biodiversity outcomes. Table 6 lists the marine reserves established within FMA 1. The location of these reserves is shown in Figure 6.

Table 6: Marine Reserves on the North-East coast.

Name of reserve	Location	Area (ha)	Established
Poor Knights Islands Marine Reserve	Whangarei	2 400	1981
Whangarei Harbour Marine Reserve	Whangarei Harbour	254	2006
Cape Rodney to Okakari Point Marine Reserve	Leigh	518	1975
Long Bay Okura Marine Reserve	Auckland	980	1995
Motu Manawa (Pollen Island) Marine Reserve	Waitemata Harbour	500	1995
Te Matuku Marine Reserve	Hauraki Gulf	690	2005
Te Whanganui-A-Hei Marine Reserve	Mercury Bay	900ha	1992
Tuhua –Mayor Island Marine Reserve	Mayor Island	1 060ha	1993
Te Paepae o Aotea (Volkner Rocks)	Whakatane	267	2006

118 An application for a marine reserve on the North-East coast of Great Barrier Island is currently under consideration.

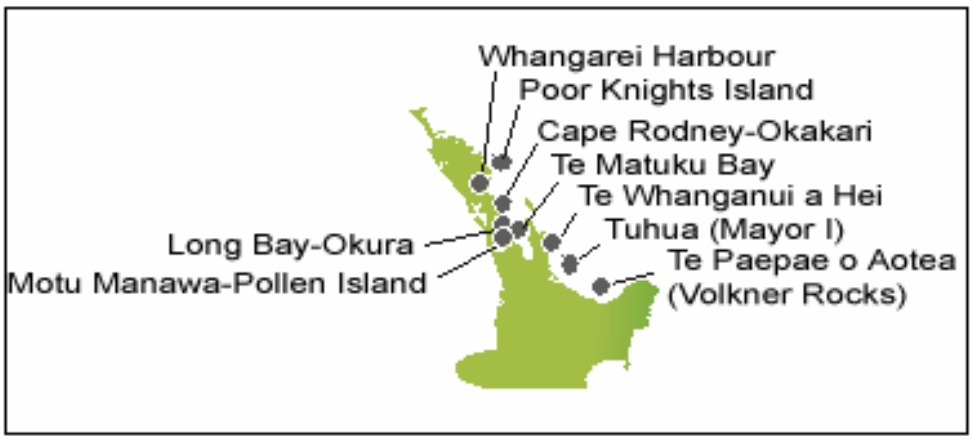

Figure 6: Marine reserves in Fisheries Management Area 1.

119 FMA 1 also has three marine parks. Unlike marine reserves, marine parks offer differing levels of protection. The Mimiwhangata Marine Park prohibits commercial fishing and places equipment restrictions on recreational fishers in order to protect reef fish species. However, the taking of non-reef fish species as well as crayfish and invertebrates is provided for. The Tawharanui Marine Park has fisheries controls that protect all fish stocks within the park. Both the above restrictions are effected through fisheries regulations. An application is currently before the Director General of Conservation to turn the Tawharanui Marine Park

into a marine reserve.

120 The third marine park is the Hauraki Gulf Marine Park. This is established under the Hauraki Gulf Marine Park Act 2000 and extends from approximately Mangawhai in the north to the north end of Waihi Beach in the south and from mean high water springs to the limit of the territorial sea. The Hauraki Gulf Marine Park provides no specific protection to marine life. Table 7 lists the marine parks along the North-East coast.

Table 7: Marine parks along the North-East coast.

Name of Marine Park	Location	Area	Established
Mimiwhangata Marine Park	Mimiwhangata	2 000ha	1983
Tawharanui Marine Park	Omaha	588ha	1981
Hauraki Gulf Marine Park	Hauraki Gulf	1 390 000ha	2000

121 As part of its marine protection programme, the government is considering how well other mechanisms such as cable protection areas which prohibit fishing may add to its biodiversity outcomes.

Protecting Biodiversity Outside of Marine Protected Areas

122 Even when the government achieves its target of 10% of the sea being protected by 2010 this still means that 90% of the marine environment will not be subject to any form of area specific protection. In areas outside of marine protected areas, fisheries controls, whether legislative or non legislative, are a key means of maintaining or protecting biodiversity and productive and healthy marine ecosystems.

123 There is growing awareness of the effects of fishing on the environment. MFish is implementing the Strategy for Managing the Environmental Effects of Fishing (SMEEF). The SMEEF is being implemented to deliver on the general obligation to avoid, remedy or mitigate the adverse effects of fishing on the aquatic environment. Under SMEEF MFish will identify habitats or species at risk from fishing, and establish environmental performance standards to manage these effects.

124 There are a number of mechanisms within the Fisheries Act 1996 that although not designed to deliver biodiversity outcomes, may contribute to the protection of marine biodiversity. These include mātaitai reserves and taiapure-local fishery areas, seasonal closures and area closures. However, the level to which these achieve this outcome will be dependent on the controls associated with each area.

125 MFish is developing a benthic impacts standard to provide baseline requirements on fishing activities that damage or have the potential to damage benthic communities.

126 The Convention on Wetlands, signed in Ramsar, Iran, in 1971, commonly called the Ramsar convention, is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. Within the area of this plan, the intertidal area at the southern end of the Firth of Thames has been identified as a wetland of international significance under this convention. The significance of this area is largely due to its importance for migratory wading birds. To date there has been no fishery management response to this status.

Habitats of Particular Significance to Fisheries Management

127 Section 9 of the Fisheries Act requires decision makers to take into account the principle that habitats of particular significance to fisheries management should be protected. Habitats of particular significance to fisheries management are those habitats that are of great importance to fisheries.

128 Historically, habitat protection has not been addressed in traditional fisheries management, which has tended to be more species focussed. However, a healthy habitat is essential for healthy productive fisheries. MFish has a direct role in managing the effects of fisheries activities on, for example, the benthos as a key habitat for many species. Currently MFish has limited information on what habitats are of particular significance to fisheries management. Table 8 highlights the likely key locations of such areas. However, it is acknowledged that more information is required to fully understand this requirement. Accordingly, a research programme to identify habitats of particular significance to fisheries management has been established.

Table 8: Shellfish species and their natural habitats.

Stock	Location	Intertidal / Subtidal
Cockle	Sheltered beaches / enclosed shores - down to 20m depth (though this is rare)	Intertidal/ subtidal
Deepwater Clam	Depths of 5-25m in sand and mud off sandy ocean beaches	Subtidal
Dredge Oyster	Harbour areas	Subtidal
Green-lipped Mussel	Hard shore intertidal and subtidal areas	Intertidal and subtidal
Horse Mussel	Muddy-sand in the lowest intertidal and subtidal shallows of mainly sheltered waters	Subtidal
Kina	Waters less than 10m deep	Subtidal
Knobbed Whelk	In sand, silt and mud from low water to a depth of 600m	Subtidal
Octopus	From low water to a depth of 400m	Subtidal
Paddle Crab	Off sandy beaches, in harbours and estuaries, to depth of 10m	Subtidal
Pipi	Sheltered beaches, bays and estuaries - from beach to depth of 7m+	Intertidal and subtidal
Sea Cucumber	Mainly within sheltered environments	Subtidal
Surf Clam	In and just beyond the surf zone on exposed sandy beaches down to depths of 10m	Subtidal
Tuatua	Sandy and soft bottom habitats with other surf clam species	Intertidal and subtidal

129 It is well known that some habitats are particularly important to fisheries. Sea grass areas are recognised as areas of high biodiversity and for being important as refugia for juvenile fish. .

130 Some of the species included in this plan form biogenic reefs which act as substrates and habitats for other species. Horse mussels are recognised as forming a three dimensional habitat that provides substrates for other species and refugia for juvenile fish. In some locations, Pacific oysters can form reef structures that may also be important as refugia for other species.

Impacts of Catchment Activities

131 Another key area for protecting habitats of significance to fisheries is the management of land-use activities. It is well recognised that sediment generated by land-use activities and increase freshwater run-off may alter marine habitats and hence affect fisheries.

132 Studies in the Mahurangi Harbour, north of Auckland, have documented changes in the structure of benthic sediments, generally an increase in fine sediments over time. Significant changes have been observed in the ecology of the harbour as a result of this sedimentation. Decreases in abundance and loss of diversity of intertidal invertebrate populations (particularly sediment intolerant species - wedge shell, cockle, and horse mussel) have been detected since 1994. Studies by NIWA in the Whangamata Estuary shows sedimentation rates of 5mm per year compared to pre-human rates of 0.1 to 0.2mm per year. It is probable that similar sedimentation effects are occurring in many other estuaries along the North-East coast which have similar catchment characteristics and activities.

133 Although more localised, sediment contamination by heavy metals and organic pollutants is an issue primarily around highly urbanised areas, such as the Auckland urban area, but it may also be an issue in rural areas around certain, often historical industries, such as the gold mining industry in Coromandel.

134 Responsibility for the management of the discharge contaminants into the environment rests with regional councils under the Resource Management Act.