

Ecological Upshot of Seven Centuries' Harvesting of Bay of Islands' Fish and Shellfish

by John Booth

Few things about the undersea today fuel passions quite as acutely as the state of, and especially our access to, kai moana – particularly its fish and its shellfish (molluscs, crustaceans and echinoderms). To many Maori living in remote shore settlements, harvests from the sea remain family-sustaining, pursued using a blend of handed-down practice and contemporary technology. To commercial fishers, it's the reason to be up before sunrise, spirits stirred by bounteous visions invariably unfulfilled.

For recreationalists, really – there's nothing much more to existence. Even sunshine's second. And of course, a day's fishing doesn't come off a man's life.

All this fishing activity takes place within the realm of the commons, where there are no pegs to denote clear-cut ownership. Because such fervour over seafood has existed essentially since humans first reached these shores, leading to all manner of pressures on resources, we might expect to find changes over time in the characteristics of Bay of Islands' fish and shellfish stocks – possibly even local extinctions. Not only can an intertidal pipi bed be overfished, but decades of data from all over the world's motu show how even the deepest and most remote of fish stocks can, surprisingly quickly, be modified by fishing – sometimes catastrophically – with flow-on effects to the broader ecology.

Pre-Contact Fishing

Maori were downright prodigious consumers of kai moana, so much so that missionary William Colenso was moved to refer to them as 'true Ichthyophagi'. They devoured them raw, dried, steamed, baked, smoked, as soup – but interestingly, not salted. Accordingly, it would be remarkable if pre-European Maori fishing pressure hadn't – if nothing else – knocked-about at least some of the local shallow-water fish and shellfish stocks of the Bay of Islands.

Middens widespread around the Bay of Islands contain food remnants and the bits and pieces associated with preparing, cooking and eating food set within the context of the peoples' living arrangements of the time. Their contents – particularly the shellfish and bones – provide our most potent insight into the resources available during each period of occupation. However, because people seldom consume the foods available to them in proportion to which they occur, the middens provide more a harvest record rather than saying anything categorical about natural abundance.

A small handful of early sites of occupation with dates attached have been identified in the Bay of Islands, and Mangahewa Bay, on the northwest corner of Moturua Island, may be the earliest-settled. After Archaeological Site Q05/682, at the mouth of the trickle near the southwest corner of the bay, was recognised as being

in jeopardy through erosion, a mission was mounted, in May 1981, to learn as much as possible before the setting disappeared altogether. This excavation has not been formally written up, but field notes describe a deep horizon of subsistence living, with all the variety and complexity – and questions – you might expect when you drill down centuries into others' backyards.

There are working areas where fishhooks were manufactured; the posthole of a house is the tomb for a kiore rat; a human burial. Food remains, from tuatara to land snail to cockle; bird bones petite to those of moa; and marine mammal. And it is the only site in the Bay of Islands known to contain the Cook Strait limpet, a gastropod today unknown from the Bay of Islands and all other east-coast Northland harbours and shores.



Mangahawea Bay on Moturua Island is largely protected from the open sea by Rangiatea and Motuoi Islands. (Photo: Dean Wright Photography)

So, just when was Mangahawea first occupied? The one radiocarbon date, from the earliest occupation layer, is 1066 Before Present. Although coinciding uncannily, it might seem, with the Norman Invasion of England, it in fact dates (after the necessary corrections) to between

1268 and 1356 AD, meaning incontrovertibly it's an Early-Period (pre-1450) site.

Archaeologist Leigh Johnson described the setting for yet another ancient site on Moturua Island, at Opunga Bay. (1) Once again we find ourselves within an idyllic island-landscape, this one more sheltered from the elements and today marred only by stark architecture imposed between the luscious lip of a sand beach and the graceful curve of the bush-covered backdrop.

And Polynesians had entered this panorama by the 1400s, soon to establish their reminder of home in the form of the paper mulberry, or aute, that the French would find growing here in 1772. Most of the midden bones were sea mammal – particularly fur seals. But there were birds too – petrel, and a large moa; and snapper bones. Pipi were the most abundant shellfish, but there was a wide variety of both bivalves and gastropods.



The flats of Opunga Bay (main beach to lower left) had been settled by the 1400s at which time Moturua Island was mantled with primary bush; Hahangarua (bay at right) was gardened at about the same time. Today the backdrop is regenerating native bush dominated by manuka and kanuka. (Photo: Salt Air)

Early habitation was also revealed at Wairoa Bay, across the other side of the Bay of Islands – right next to where Te Puna Mission Station once stood, and now overlooked by a giant Norfolk pine.

Archaeologist Simon Best used just five 0.5 to 2.0-metre-diameter holes within a modest-sized rectangle, joined to the beach by a narrow trench, to bring to life a captivating pageant of living in Wairoa Bay. (2) It started in the early part of the last millennium and culminated in a late 1900s rubbish-filled dunny-hole.

The earliest of these is of special interest, in that not only is it likely to be the first or one of the first visits to the beach, but that various activities can be identified, in a discrete feature not more than two square metres in area and 50 mm deep. A minimum number of four snapper were consumed, three of these quite large in size, along with the leg of a small moa and part of a dog, and together with a few shellfish. The feature could well represent just one meal and the activities that were carried on around it, that took place some 600 years ago.



Wairoa Bay, near Marsden Cross, is sheltered from open waters by Te Pahi Islands. (Photo: Salt Air)

Clendon Cove is yet another location to present a tantalising sequence of human occupation. Working backwards, it's today a shoreline owned by the

Swiss-Italian millionaire who helped bank-roll Team New Zealand in its recent America's Cup defeats; the American Consul to New Zealand, James Reddy Clendon, bought 1200 hectares of land here in 1830 for a 6-pound carronade (a short, wide-barrelled ship's gun) and 5 muskets, together worth 16 pounds; and Marc-Joseph Marion du Fresne's hapless crew fetched-up here in 1772 during their quest for kauri spars.

But the earliest gem was revealed by a farmer cultivating a paddock behind the beach. To me it has credentials equivalent to some of the fabulous bog-finds of Britain: a cache of ancient toki (adzes), possibly from the first few decades of Polynesian settlement in New Zealand.



Early-Period basalt adzes revealed on the flats of Clendon Cove, (all but the right-hand-most item) are safely housed in the Russell Museum.

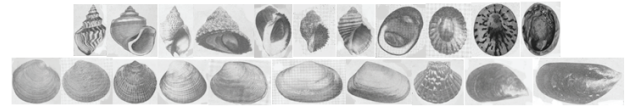
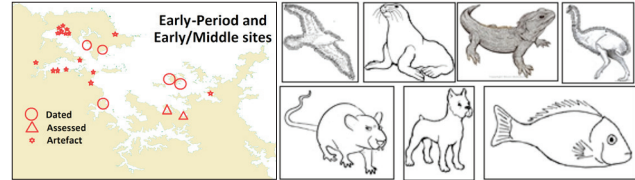
(Photo: John Booth)



*Clendon Cove, the toki-find being near the centre of the bay in the foreground. The width of this bay would have made it amenable for the comings and goings of double-hulled sailing vessels.
(Photo: Dean Wright Photography)*

For the Bay of Islands then, five of the 20-or-so dated sites are 15th Century or earlier (one of them lining up within cooey of what is now considered the first decade of settlement – the 1280s); still others have features of the Early or Early-Middle periods; and various ancient artefacts have been found scattered around the Bay's shores.

All these early communities – and others, for sure, unrevealed – were likely part of a patchwork of subsistence living, sites being occupied until the resources immediately at hand had become difficult to procure, and with others visited only seasonally. (3)



Early sites, either dated (O), exhibiting distinctive features such as moa bone (Δ), or where ancient stone artefacts have been found (), together with the variety of animals found in the associated middens.*

Whereas a small, typically transient population likely characterised early settlement in the Bay of Islands, this was certainly not true of society by the Late Period (1650-1800). When James Cook and the first French turned up, a large population was hunkered down. From the French accounts there were several thousand people living about just the Rawhiti coastline in 1772, let alone around the wider bay, and in the hinterland.

Six dated sites in the Bay of Islands are centred on the intervening era, the Middle Period (1450-1650). Not surprisingly, there is 'smudging' evident in their faunal signatures, for this was the time of change towards a narrower range of seafoods. Half the dated sites have all the characteristics of the Late Period, dominated as they are by cockles – yet in fact pre-1650. The remainder are characterised by the presence of several other shellfish species as well, and so are similar to the Early-Period middens.

The dozen or so dated sites centred on the Late Period were overwhelmingly dominated by cockles, pipi being the next most frequent item. There are, however, few archaeological reconstructions around them, perhaps because predominance of just a couple of species of shellfish was never going to ignite imaginations and draw out the eloquence of archaeologists quite like moa or mammal remains.

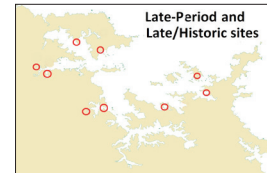
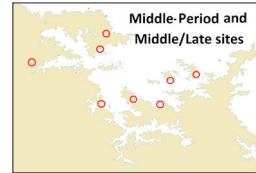
One of the best studied is Rangitane – the level-topped, 100-metre-high hill that robs parts of Kerikeri of its earliest sun every day. Great volumes of cockles were lugged up the slopes whole (along with firewood, and probably hangi stones too), rather than being processed on the shore below, and shell samples dated to between 1620 and 1770.



*Rangitane overlooking Kerikeri Inlet is steadily being encroached by residential development.
(Photo: John Booth)*

It may be that the site was occupied intensively at that time, or that the terraces and midden patches relate to a series of different settlements that extended over a longer time period ... Storage pits were where kumara and other foods were stored over winter. Consequently, Rangitane was part of a larger system, involving the cultivation of kumara and other crops nearby, the harvesting of shellfish from the Kerikeri Inlet and collection of stones

and firewood for cooking. Other activities may also have taken place on the terraces, and the residents may also have had a fortified pa site close at hand. (4)



By the Late Period (1650-1800) the variety of animal-food types had shrunk to just a handful, with greater emphasis now on gardening.

It's time to attempt tentative conclusions around the impacts pre-European Maori may have had on the abundance and diversity of the fish and shellfish stocks of the Bay of Islands – and particularly whether there has been any lasting legacy attributable to their harvestings.

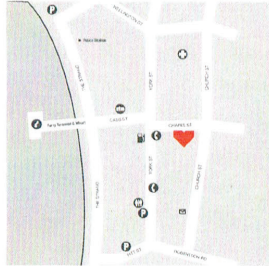
The suggestion has been that Early-Period human populations of the Bay of Islands were small and the sites of occupation impermanent. Therefore harvesting could have had only minimal impact – localised and none with potential to endure – on any of the productive (highly fecund, fast-growing and early-maturing) shellfish or fish species, or on those widespread and abundant. But for fishes with low productivity (few offspring, slow-growing, late-maturing and long-lived) and which lived their lives in one place, it could have been a different story. We now know that even low levels of artisanal fishing can critically impact such stocks. The one fish

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which could conceivably have been locally extirpated in the region is the highly territorial and slow-growing hapuku, or groper. Once common in shallow waters, fishing pressure continues to this day to banish them to deeper and deeper places.

And whereas most of the shellfish in the early middens were species highly fecund and abundant, the in-your-face exception was the Cook Strait limpet, a species whose preferred waters are cool and well south. Unlike most other shellfish, which produce millions of gametes each year, this limpet with modest numbers of eggs is thought to have restricted dispersal potential. Further, it may not even breed in northern waters, recruitment to its remaining outposts resulting instead from intermittent delivery of larvae from the south. Middens show this large (reaching 70-millimetres length), easily accessed (intertidal), open-coast limpet must have been present in reasonable numbers along the east Northland coast pre-1450 and then become extinct (or – and much less likely because other open-reef species continued to be harvested – no longer sought as food). That climatic change could have led to the extirpation of this species from northern waters doesn't cut the mustard, because the first part of the last millennium was actually warmer than the middle centuries. It's very likely, therefore, that populations of the Cook Strait limpet that had established themselves over the millennia in the northeast were quite quickly harvested to local extinction by the first settlers.

By 1650 human populations had burgeoned and become less itinerant, and fishing had become firmly focused around cockles and snapper. Could Maori have severely knocked down these stocks? After all, closure in recent times of some of the cockle beaches near Auckland has

failed to lead to recovery; and northeast Northland's snapper biomass is well below optimal levels.

The first Europeans were privileged 'to catch prehistory alive', and we're fortunate to have their detailed accounts of the fish and shellfish resources of the Bay of Islands. When James Cook entered the Bay of Islands on 29 November 1769, he was overwhelmed by the population – and especially the fishing opportunities and fishing prowess of the locals. The picture he painted, as did the French soon after, is one of bounteous fish and shellfish resources despite 500 years of continuous occupation. 'Catching fish for food presented no real problem for Maori [and] signifies that a ready supply of protein for their diet was simply there for the taking without too much difficulty', (5) almost all fish being caught within 100 metres of the shore.

But for neither cockles nor snapper is there evidence of flagrant despoilment. Although the extent of the great cockle middens in the Kerikeri and Waikino—sufficiently large to be later mined for agricultural lime; and the sheer dimensions of the Maori seines (some more than 1500 metres long) were arguably evidence of something more than mere artisanal harvesting in at least parts of the Bay of Islands during the Late Period, it seems no scales were irrevocably tipped. This was probably because for easily accessible and highly sought species, there was active management of stocks to prevent abundance and mean-size from plummeting. Indeed, archaeologist Foss Leach concluded that, in the face of significant and sustained Maori fishing, average snapper size actually increased over time, with the archaeological specimens being much larger than those in the modern catch. (5)

So, it seems, pre-European Maori left no boot-prints on Bay of Islands' fish and shellfish resources that endure to this day – apart from extirpating the Cook Strait limpet, and probably assisting hapuku to deeper waters.

Post-Contact Fishing

Traditional practices survived for many decades in the more remote of Maori communities, but it didn't take long for western approaches to fisheries harvesting and management to emerge as front-runner. And the first kai moana in the Bay of Islands to be commercially fished in a fully contemporary sense was the rock oyster.

Abundant oysters for the taking were always going to tempt the colonists – afterall, this shellfish was right up there among the fashionable cuisine of 19th Century England. And for more than a hundred years, rock oysters chipped from hard surfaces at the one time satisfied people's gastronomic propensities and exasperated administrators. By the late 1860s heavy harvesting of this easily accessed resource was taking its toll on the Bay of Islands stocks, spurred on by an enthusiastic Auckland market. In October 1882, the Northern Luminary bemoaned how Bay of Islands oysters were being shipped out 'without any regard being taken for future supplies'. To get around the rules, in an ongoing game of cat-and-mouse harvesters argued how oysters growing on mangroves couldn't possibly be rock oysters, and how oysters deliberately smeared with sediment had to be mud (dredge) oysters. In desperation the export of 'rock, shore, drift or mangrove oysters, or by whatever name they may be locally known' was prohibited, and it was only after imposition of a shilling a hundredweight duty – and the Sydney market being flooded with Queensland oysters – that exports plummeted. (6)

The story of the northern rock oyster from the late 1880s to 1907 was, however, a litany of beds opened/beds stripped/beds closed. Because of this, and with typhoid deaths in Auckland attributed to oysters, the Government itself in 1907 took over the whole business of commercial oystering. Between 1912 and 1973 the Marine Department marketed an average of about 2000 sacks (each containing 90 dozen oysters) of Bay of Islands oysters each year, the peak reaching close to 6000, in 1914. And at the same time it entered a period of fantastical physical and biological intervention.

In this first serious attempt at marine fishery enhancement in New Zealand, oyster-spat settlement rocks were distributed widely about the Bay, sufficient perhaps to upset the rotation of Earth.

Within the last year or two [of 1922]... the Australian system has been introduced with very promising results. This consists of the building of rock walls, which extend in orderly rows from about 2 ft below high-water mark to 2 ft above low water. The rocks are placed in triangular position, one resting lengthwise on top of two others, so that the water washes in and out between them quite freely. When spawning time comes, the oyster spat flowing on the surface of the waves attaches itself to the underside of the rocks, which are allowed to remain in that position until the spat is sufficiently developed to be able to withstand the heat of the sun. The rocks are then turned, and the upper surface in turn also becomes covered with spat... Sheltered portions of the Bay of Islands, Whangarei and Whangaroa are stated to be showing very good results. (7)



*Large area of newly laid-out rocks
in the lower reach of Kerikeri Inlet in 1922.*

*(Photo: Auckland Weekly News,
Sir George Grey Special Collections, Auckland
Libraries AWNS-19210224-40-4)*

Then, in the 1920s, all-out war was once again declared – this time against those marine snails which drill oysters. Decimating young shellfish in particular, the borers leave one part of the shell adhering to the rock and onto which new oyster spat will fix – but apparently not survive.

Contractors were paid one shilling per thousand to remove the snails, and for the next quarter of a century, an average of about a million oyster borers were despatched each year. Numbers peaked at 7.5 million in 1941; just counting off that number continuously takes you, at one a second, 87 days. Oyster borers had not been under such pressure since the heyday of the hangi.

The snails were what we know today as the oyster borer (typically up to 2 centimetres long) and – much less abundant and lower down the shore – the white rock shell (7 centimetres). They have perfected the habit of shell-boring, often revealed as a minute, neatly drilled hole which takes anywhere between 45 minutes and two days to accomplish.



*Oyster borers (2 centimetres long)
feeding on oyster spat. (Photo: John Booth)*

Managing in this manner a wild stock that everyone wanted a share of, and which occupied an easily accessed band of the intertidal around many of the hard shores of the Bay of Islands, was unlikely to ever succeed commercially. Accordingly, the first trial rock oyster farm was established on leased shore in Orongo Bay, in the mid-1960s; the next one, set up at Te Tii soon after, was followed by a flood of new applicants. Feral oysters were picked for transfer to the farms, and soon spat caught from the wild on sticks in harbours to the south were being trucked north.

These small oysters, mainly from Mahurangi a little north of Auckland, were distributed the length and breadth of Northland – an entirely satisfactory way to also disseminate unwanted organisms, which is how the Pacific oyster so promptly gained its foothold throughout much of the region.

The Pacific oyster is a species that grows quarter again heavier in half the time than the native one, and is harvestable in a little over a year compared with three years. It was first officially registered on spat sticks at

Mahurangi in 1970, its arrival possibly connected to ships bringing the Nippon clip-ons (the outrigger lanes) for the Auckland Harbour Bridge in the late 1960s, or to the emptying of ships' ballast tanks off Northland. In any event, by 1977 most commercial growers had changed to Pacifics, and in no time, it seems, hard shores through much of the Bay of Islands were peppered with the spat.

It's hard to see how the removal for sale or slaughter of tens of millions of oysters and oyster borers would have had any long-term impact on the marine ecology of the Bay of Islands. But the ecological consequences of the addition of great masses of rock onto various soft shores, and the transfer of original boulders down shores, remain to this day. Although some of the rock has broken up or been moved in the intervening decades, it still imposes itself on the intertidal of parts of the Bay, having already crushed and asphyxiated the original incumbents and provided settlement surfaces for species (such as oyster borers) that would not normally have lived there. And the slowing of water flow promoted accumulation of sediment.



*Many of the oyster groynes clearly visible in this 1971 aerial in Kerikeri Inlet had been removed by 2009.
(Photos: NZ Aerial Mapping; Ocean Survey 20/20)*

One fish in particular to compare favourably with canned imports was the grey mullet. Extraordinarily

abundant along Northland's west coast and its harbours, mullet were also plentiful in the tidal reaches of east coast inlets, and specialised 'mulleties' were developed from which to net them. And the first substantial canning operation in the Bay of Islands was Masefield Brothers', established on Kororareka Beach in 1889 and operating until 1906. Their most popular products were Star-brand one-pound tins of mullet – but also kippered (split butterfly fashion, and salted, then smoked) mullet and snapper – 'sold throughout New Zealand as well as the South Seas and Great Britain'. (8)



*Masefield's canning factory and wharf at the north end of Russell Beach, with a mulletie alongside to the right by the loading jib.
(Photo: Alexander Turnbull Library, Ref: 1/2-052135-F)*

In about 1891, on the other side of the Bay, another cannery started, and this one lasted longer.

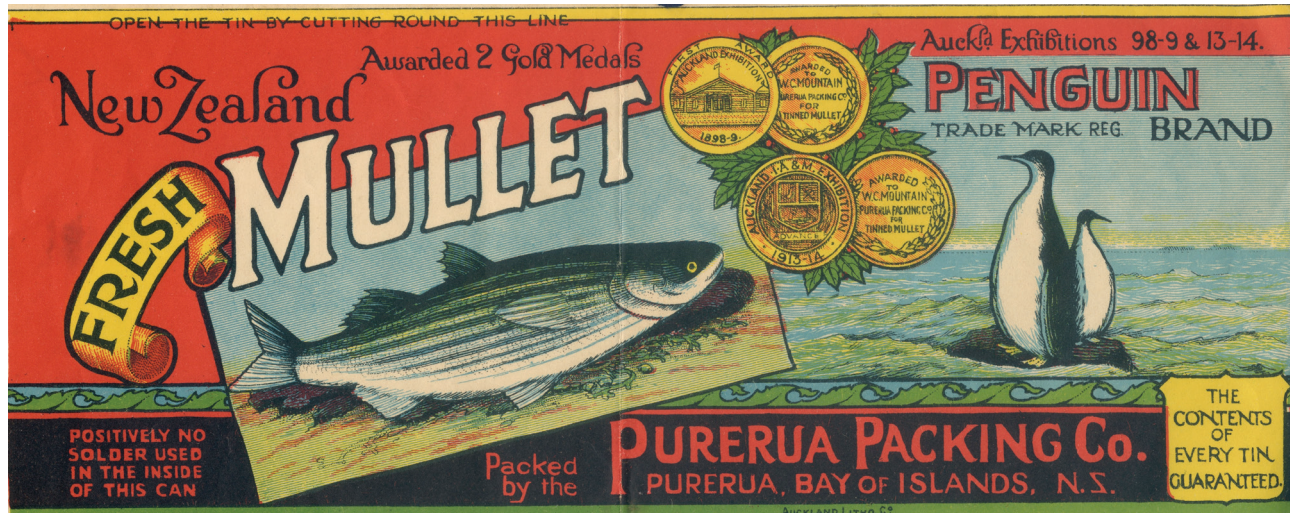
George Mountain, the kid of a convicted horse-stealer who had ended up across the ditch in confinement for

his troubles, established a factory on the northwest side of the Bay at Purerua, but it wasn't until his son Walter C. established the Penguin brand that medals were won in London, and the enterprise really took off. (9)

Most fish were netted in Kerikeri and Te Puna inlets, a couple of boats being engaged all year round. 'They

would go out fishing all night, have a few hours' sleep the next morning, and then dispose their catch to the factory... and would take fish and crayfish to Russell to catch the Clansman for the Auckland market'. (10)

Closure of the factory, in 1935, was due to the scarcity of mullet, the depression, and the high cost of importing the sheet-tin from England.



Purerua Packing Co's Penguin 'fresh' grey mullet was – of course – canned, 'every tin guaranteed'.

Auckland Litho. Co's eye-catching label rewards close scrutiny, including the over-portly penguins and mischievous reversal of 'Z' in 'NZ'. (Russell Museum)

And what of the ecological implications of this harvesting? The fishing pressure would probably have done little more than to reduce abundance and mean size of grey mullet in some inlets, though with some flow-on implications for the broader ecology. Small commercial fisheries for grey mullet in Bay of Islands' coves and estuaries continue to this day, taking perhaps 20 tonnes all up each year.

Not until the dawn of the 20th Century did any meaningful sense around the scale of the commercial catches of the Bay of Islands begin to emerge, for, from 1904, fishers had to provide for the first time details of their fish caught. Reporting was at first sporadic, nevertheless between 1906 and 1930 the main fish by weight for the Bay of Islands were identified as being snapper, grey mullet and flounder. It was not until 1931 that annual

tables of landings data species-by-species were being routinely published, although at first they were at best the lower bounds of actual landings. Set-netters and liners dominated the early commercial fleet in the Bay of Islands – just as they do today. During the 1920s and 1930s, there were also at times similar numbers of row boats (presumably hand-liners), meaning a total of 30-60 vessels fishing the Bay and its immediate environs. And after the war, a swag of rock lobster vessels joined the fishing fleet. In this manner, then, commercial fishing in the Bay of Islands continued, vessel numbers reaching a peak of around 100. Then came the monumental changes in fisheries management of the 1980s.

Centred on a campaign of effort reduction aimed at conserving stocks, Controlled Fisheries turned out in the end to be more about shoring up access to the fish stocks for select quarters of the industry. With the full support of the Federation of Commercial Fishermen, the Ministry of Agriculture and Fisheries began to weed out part-time commercial fishermen. A full-time fisherman was one who fished all year-round, or for a specified season. Income from fishing had to be at least ten grand a year, and 80% of annual income had to be derived from fishing. (6)

Bay of Islands Fishermen's Association was right up there in the fray. So keen was it for the numbers of fishers to be reduced, that in March 1983 it asked for action immediately the new Fisheries Act came into force, on 1 October that year:

It [the Fishermen's Association] calculated that the average catch for [Bay of Islands'] 70 boats fishing for snapper was 7.14 t a year. If the top ten boats were excluded, the average was only 4.26 t. With the cost of

running a boat 40 percent of receipts, even 7.14 t left only \$177 a week, less than the average wage and no return for a fisherman's investment in boat and gear. Working days had increased by 4 hours to 16-20 hours a day, which meant fishermen had to live on their boats.... The Fishermen's Association suggested compensation payments be split 50:50 between the government and the fishermen, with those who remained having the right to sell their licences. (6)

But this flurry of management intervention was itself overtaken when, on 1 October 1986, the entire New Zealand fin-fishery – inshore and deepwater – came under the Quota Management System, and with it came the instruments of Total Allowable Catches, and Individual Transferrable Quotas based on the average catch of each fisher for the years 1981-83. Managers at last had a tool with teeth, and New Zealand's Quota Management System went on to become the envy of many nations. Rock lobsters came under the Quota Management System in 1990; and today virtually all commercial and potentially commercial fish, invertebrates and seaweeds are subject to it.

We are now able to draw together for the Bay of Islands fishery information for the entire period 1931 to the present, the main points being as follows:

- Up until the late 1970s, the mainstay species in terms of weight – albeit with modest annual landings (up to 80 tonnes of each species) – were flounder, grey mullet, hapuku and snapper;
- Leading up to the management changes of the 1980s, snapper landings rose to 400 tonnes;
- Parore and yellow-eyed mullet put on a bit of a show soon after World War II, the latter netted in large quantities (up to 60 tonnes a year) near Opuia in particular;

- Pelagic species such as blue and jack mackerel and skipjack tuna were first fished in the 1990s, after which large catches (thousands of tonnes) were made along open coasts;
- The only invertebrate of significance has been the red rock lobster, fished to any extent only since World War II, with recent local catches averaging about 10 tonnes a year.

Today, just a handful of commercial fishers routinely work the waters of the Bay of Islands. Their main finfish by weight are flounder, garfish, grey mullet, kahawai, pilchard, snapper and trevally – totalling a few dozen tonnes across the board each year and caught using set nets and beach seines. The main invertebrates taken within and near the Bay of Islands are potted or dived-for – particularly rock lobsters, but also kina. However, from time to time, visiting vessels line, net, trawl or purse seine in or near the Bay. The scale of these catches – apart from those purse-seined – are probably modest.

Of course, the ecological consequences of fishing extend well beyond simply the removal of biomass. Apart from flow-on ecological effects of removing the species, the fishing method itself can be destructive. Fortunately, such techniques as lining and potting have relatively little physical impact on the seafloor, and sometimes non-target individuals can be returned to the sea undamaged. Even beach seines and drag nets are not thought of as particularly destructive: they just don't have the weight to rip up the seafloor, and unwanted fish and invertebrates can often be liberated. And purse seines, although potentially removing great quantities of fish in one go, tend to end up with little by-catch.

On the other hand, set nets typically take out a lot more fish by species and size than ever intended. But it's

bottom trawling and Danish seining we need to watch. Both involve heavy weights dragged across often-fragile seafloors, and each is indiscriminate in their catches. Both methods are permitted – and pursued – seaward of the line Cape Wiwiki-Okahu-Cape Brett.

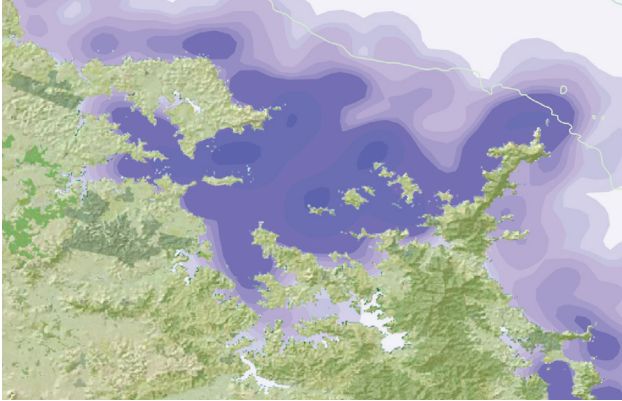


Trawling is indiscriminate in what it catches and can damage the seafloor (Photo: The Fishing Website)

Commercial fishing pressure in and near the Bay of Islands may (apart from purse-seining) be modest today, but the same cannot be said of the amateur fishery: during summer in particular, hundreds of small boats fish the Bay, probably more than matching the earlier commercial fishing pressure.

During 2004-05, greatest recreational fishing activity in northern parts of the Bay was centred north of Moturoa Island and near the Nine Pin; for the southern part, Whale Rock and an area north of Motuarohia were key. During 2011-12, the hotspots also included waters southeast of Moturoa Island. Boat numbers, though, are only part of the story, and we must await the results

of recent Ministry for Primary Industries surveys for enlightenment around catch rates and numbers by species. In an altogether separate survey of recreational fishing in the Bay of Islands, in 2013, snapper was by far the most-sought and most-caught fish, followed by kahawai, tarakihi, john dory, and kingfish. (11)



The intensity of colour denotes the relative level of recreational fishing activity, Bay of Islands, 2004-05. (Source: NABIS on Ministry for Primary Industries website)

Fishery stock assessments take into account all fishing – commercial, recreational, customary and estimated illegal. And all exploited coastal fish have declined dramatically in abundance since colonisation using every acceptable measure, many species now well below their optimal stock size.

For snapper, overfishing meant that abundance declined dramatically throughout New Zealand during the 1970s and 1980s. Bay of Islands is in the East Northland substock of the SNA 1 fishery, for which the spawning stock biomass experienced a long, steep decline, from 50,000 tonnes in 1960 to about a quarter of that (and about 20% of the unfished state) by 1985. The story

has been remarkably similar for trevally in TRE 1, the current biomass now even less than 20% of the unfished state. In fact, by the mid-1980s decline in biomass to levels less than one quarter of the virgin biomass has been a feature of many predatory fish species in the north of New Zealand. And for rock lobsters in CRA 1, the vulnerable biomass collapsed to one quarter of its original, from 3,000 tonnes in the mid-1940s to just 750 tonnes in the early 1970s.

And with reduced stocks, and with the larger individual fish and lobsters – the main predators of the kina – gone, widespread, shallow-reef kina barrens have appeared. (12)

Rounding-up

Now we must decide where responsibility settles for the complete loss of fish and shellfish from certain parts of the Bay, and for the worryingly low biomass of some of our key fish species.

For the intertidal rocky-shore shellfish, the Bay today is very different to what pre-European Maori knew and what James Cook had encountered in 1769. Arrival of the fast-growing Pacific oyster, which enthusiastically colonised more widely than the native one ever could, has literally changed the face of the place. Such has been the scale of the invasion that, whereas it used to be a crime for you or me to harvest a single rock oyster, we may now each take 250 a day – the largest bag limit for any kai moana. Blue mussels still pepper intertidal shores in this geographic outpost (their main rohe is around Cook Strait). No doubt, though, their abundance – and that of the green-lipped mussel (which extends subtidally) – is a mere shadow of what it used to be. But that's not to say either species is under any real threat.

Numerically, cockles have had immense presence in the lives of the people of the Bay of Islands from first settlement and they still flourish in abundance on soft, sheltered shores. They remain as popular as ever, perhaps in part because they're easily accessed and readily harvested by the very young to the old. For certain, harvesting pressure will mean individual cockles today are smaller on average than when harvesting began. But far greater impact on them will have come about through areas of previous habitat having been swamped with the fine sediment resulting from forest removal and increased pastoral farming. They are far less abundant in now-muddy, mangrove-dominated upper inlets—fine for mudsnails but not for cockles.

Pipi are even less tolerant of silt than cockles, preferring coarse sand and even lightly gravel shores. They seem never to have been as attractive to pre-European Maori as cockles, archaeologist Glenis Nevin having observed how pipi tended to occur in middens in proportion to their nearby abundance whereas cockles were typically overrepresented. (13) Perhaps the most potent evidence of ecological change over time among pipi beds is to be found near the entrance to Kawakawa River, where Glenis reported giant pipi middens associated with a shoreline now dominated by mangroves. Beneath the mangrove mud she found asphyxiated layers of pipi, probably once again casualties of siltation. Nevertheless, pipi still thrive in many other parts of the Bay of Islands.

Tuatua are – and probably always have been—confined to Long Beach, and particularly Oke Bay. They require the clean sand typical of exposed fine-sand beaches. But the scallop grounds may be among the more transformed ecosystems of the Bay of Islands. Scallops have become largely confined to the clear, near-

oceanic waters of Ipipiri, yet they were once common elsewhere, including in the northwest off Rangihoua and Onewhero; on the western side of Motuarohia; and in Maunganui Bay. Today's main Ipipiri scallop beds lie off Urupukapuka Island and near Rawhiti, and coincide with areas of rhodolith/dog-cockle habitat – a structurally complex but vulnerable environment. The natural ecological balance of these grounds has been turned on its head through heavy recreational harvesting of scallops to the exclusion of all other species, and – in places – by the use of recreational dredges which break up the natural accretions of calcareous algae and destroy habitat complexity.

Horse mussel beds have been important to natural functioning of ecosystems throughout the Bay of Islands, providing structural complexity and hosting for food and shelter a wide variety of other invertebrates and also fishes and seaweeds. Although still common in pockets here and there, horse-mussel spread and density today are probably a ghost of what existed before the place started to seriously silt up, and before scallop dredges were being towed back and forth.



Horse mussels provide structural complexity on otherwise featureless flats. (Photo: NIWA)

Although it's likely thousands of tonnes of snapper were removed over the centuries by Northland pre-European

Maori, it was only when the commercial-scale harvesting techniques of the colonists were in place that things really took a turn for the worse. Localised depletion of snapper and similar-such fish species accelerated in the first half of the 20th Century, as boat numbers increased and efficiency improved. Accordingly, individual-fish-size decreased over time. For example, whereas for pre-European Maori, more than a third of snapper in middens were longer than 50 centimetres, by 1990 only one in six of the commercial longliner catch in northeast New Zealand was made up of snapper this size; and in recent years, this figure has dropped to one in twenty-five. (14)

Conclusions

Pre-European Maori had relatively little impact on the fish and shellfish stocks of the Bay of Islands (although almost certainly they were responsible for extirpation of a species of limpet on the edge of its distributional range, and they may have helped banish hapuku towards deeper waters). The more significant damage to the kai moana stocks came with the heavy and ever-growing commercial fishing pressure of the first three-quarters of the 20th Century. One upshot of this has been the loss of vast areas of shallow-water kelp forest to the kina (sea urchins) which had become freed from their main predators. Also, siltation resulting from forest clearance and pastoral farming smothered shores and forced shellfish such as cockles and pipi out of upper reaches of inlets.

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