Wrecked Reefs

by John Booth

Just *where* does the buck stop for shallow-reef kelp loss in the Bay of Islands?

It has crept up on us. The process has been slow and steady – measured in decades. It's only when we're confronted with then-and-now photographs that the scale of injury becomes apparent.

Most of the shallow-reef kelp (to around 6-metres depth) in the main basin of the Bay of Islands has gone. The full implications of this loss of biological diversity are poorly understood, but are potentially enormous.

'But why worry? There's plenty more kelp deeper down. And there's certainly nothing wrong with the local fishery – never been better. What's the fuss?'

Kelps are highly productive, fixing carbon, fuelling the ecosystem, and providing habitat for all manner of animals and plants. Shallow forests provide areas for spawning and larval settlement, and shelter for juveniles, by reducing exposure to water movement and predation. Most rock lobster postlarvae settle out of the plankton among shallow-reef kelp, and juvenile snapper are strongly associated with it. The loss of vast areas of the shallow-water kelp community is likely to have led to a multitude of cascading consequences, most of them not yet even recognised let alone understood.

Ruined Reefs

Harvest pressure on fish stocks in northeast New Zealand has become so intense as to have had catastrophic impact on marine ecosystems – particularly the shallow-reef kelp communities, which in many places have been overgrazed by sea urchins.

Whereas the reason for the emergence of 'urchin/kina barrens' in northern New Zealand was for a time contested, there is now consensus that these barrens are a direct result of the overharvesting of keystone predators (predators whose impact on the ecosystem is disproportionately large relative to their abundance) such as snapper and red rock lobsters. Reductions in the proportions of large individuals of these predatory species – the ones capable of preying on kina – have led to burgeoning kina populations and to the widespread loss of shallow-reef kelp forests.(1) Resulting urchin barrens such as these are a world-wide phenomenon, and one surprisingly difficult to reverse.(2)

The loss of the shallow-reef kelp forests throughout the main basin of the Bay of Islands has been extensive, and among the most severe in the entire country. Twenty-nine discrete locations were distinguished for which there was a series of aerial images, from the 1950s/1960s, through to 2009, in which the extent of seaweed cover could be clearly discerned (Figures 1-3).

Figure 1. Today, the reef off Te Akeake, the northwest extremity of Urupukapuka Island, displays a fringe of kelp at low tide level, and then again from about 6-metres depth, with virtually all kelp between having been grazed back to the bedrock. Loss of kelp was apparent in 1971, and most was gone by 1980. (Photos: NZ Aerial Mapping; Salt Air)

For most parts the reduction in kelp cover over the past six decades has been monumental: loss of kelp was obvious by the 1970s, although some kelp forests seem to have persisted until quite recently. And no evidence has been found for any kelp recovery since 2009.

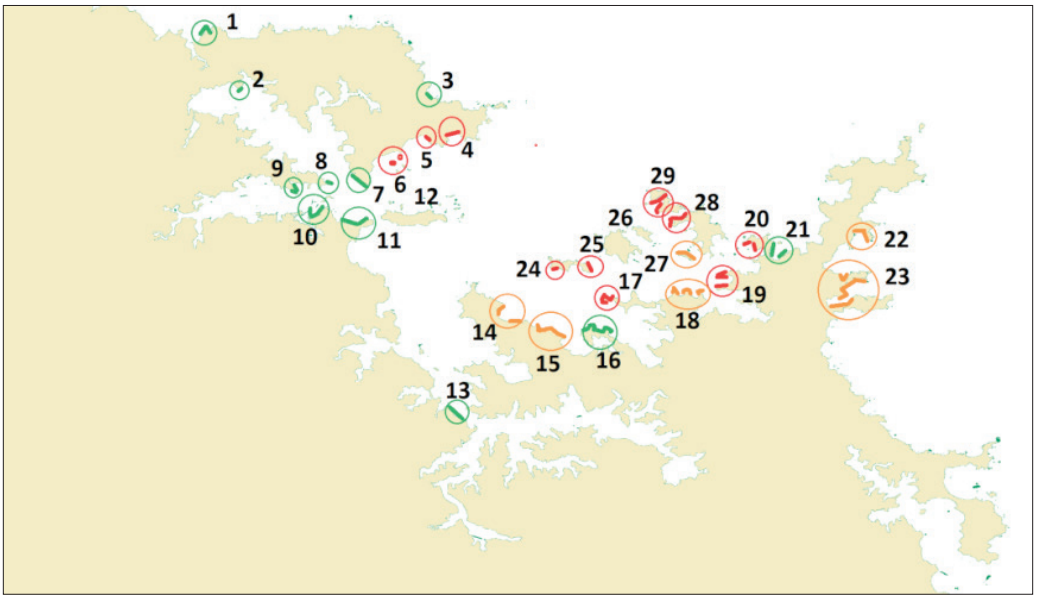

Figure 2. Changes in kelp cover between the 1950s/early 1960s and 2009. For each site there were at least four aerial images, each separated by at least a decade, and among which at least two of the early images showed extensive dark shadows associated with reef (usually kelp but possibly sometimes dark-coloured rock). The previously existing dark shadows had largely vanished by the 1970s (red), or certainly by the 2000s (orange); green indicates little apparent change in the intensity or extent of shadow (although thinning of kelp was sometimes obvious), most often seen near inlets where waters are presumably too fresh for kina.

It's no coincidence that the 1970/80s was the period of fish-down for what had until then been a relatively lightly exploited resource. The fishing pressure led to significant reductions in the proportions of large individual-fish. Today, the commercial fishing pressure is much lower, but, it appears, has been largely replaced by the recreational effort. The Bay of Islands presents an extreme and extensive example of ecological overfishing, the main predators of sea urchins having been fished too hard.

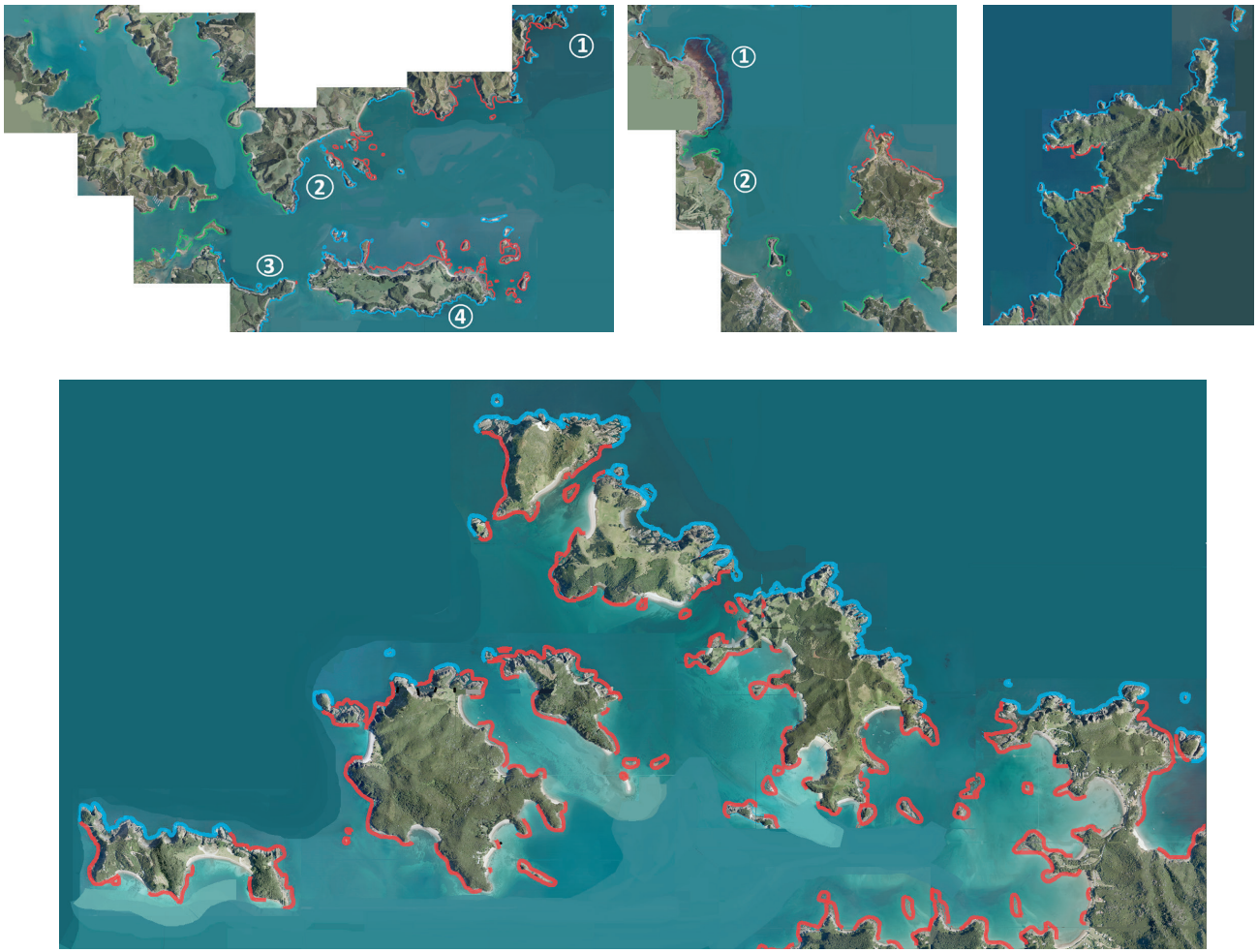

Figure 3. Urchin barrens (red) are now widespread in the Bay of Islands, particularly in the main basin – based on 2009 Ocean Survey 20/20 aerial photographs.(3) What appear to be intact kelp forests persist mainly near inlets (green). At top left, the reef was too steep to assess, or was in shadow (1); or the reef itself appeared dark, most probably for reasons other than kelp cover (2-4). At top centre, the reef itself appeared dark, but not necessarily because of kelp cover (1 and 2). At top right, open shores were often too steep to assess, or were in shadow (blue).

Who's buck?

Fishing pressure derives from all users – commercial, recreational and customary, so we're all responsible for the sad state of the Bay's shallow-reef kelp.

From the early/mid 1900s, commercial harvesting steadily increased, to peak just ahead of introduction of the Quota Management System, in 1986 (Figure 4), when close to 200 vessels fished out of the Bay of Islands.(4) Since then, commercial fishing pressure has dropped to a handful of vessels, but recreational pressure has increased astronomically. And customary harvesting has been – and remains – locally important, with perhaps 10 t a year across all species.

Typically, a fish population exploited for the first time provides high catch rates, and yields a broad size- (and age-) distribution of individuals. Catch rates usually remain high during the fish-down phase (often with serial depletion of localised groupings of individuals), with both the mean size and the proportion of large individuals declining only slowly. After fish-down, the fishery becomes largely dependent on only a few year classes, with catch rates stabilising at a level much lower than when fishing began.

All exploited coastal finfish species around New Zealand have declined dramatically in abundance since colonisation using every acceptable measure. In northern New Zealand, many predatory finfish species (as well as the red rock lobster) had by the mid-1980s declined in biomass to less than one quarter of their virgin state (2015 Plenary Report).(5) And for almost all the highly sought species, the status of the Bay of Islands component is inextricably linked to that of the underlying stock. The East Northland snapper substock of SNA 1 is overfished, with most fish not much larger than the minimum legal size (MLS). Although the CRA 1 red rock lobster stock is not considered overfished, most lobsters locally caught – recreationally and commercially – are at or only a little above MLS, which is consistent with heavy fishing pressure.(5)

It's now clear that today's remaining inshore fish populations are able to support only modest levels of fishing pressure; this pressure is maintained by a small commercial fleet which is emphatically trumped by that of hundreds of recreational fishers and their vessels.

Commercial fisheries

How have the commercial fisheries fared over time? Harvest trajectories of the principal finfish species (as well as others of interest) for the Bay of Islands area are shown in Figure 4. (Unfortunately, the associated fishing effort data, which would lead to more-useful catch per unit effort curves, are not available.)

Only one invertebrate has been of significance – the red rock lobster; recent Rock Lobster Statistical Area 904 (Takou Bay to Bream Bay) landings have remained steady at 13 +/- 3 t each year.

Today, just a small handful of commercial fishers routinely fish the waters within the Bay of Islands (waters inshore of a line from Tikitiki to Motukokako). The 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 harvested using set nets and beach seines. Also, red rock lobster are potted.

However, from time to time, visiting vessels line, net and trawl within the Bay of Islands for such fish as snapper, trevally, flatfish and grey mullet, and purse seine pelagic species like skipjack tuna and mackerels near the entrance to the Bay. General spatial overviews of this fishing catch and effort in Statistical Area 003, and within the Bay itself, at fine scale for the lining (surface, bottom and trot lines), netting (set and drift) and trawling (bottom, midwater, single and pair) vessels for recent fishing years are shown in Figure 5. Almost certainly, these data are for visiting vessels, ones obliged to furnish more detailed locational data than the smaller, local inshore ones. The total number of fishing events each year amounts to an average of around a dozen net-sets and fewer than a dozen trawls, and around 50 long-line-sets. The lines and nets will have taken essentially only finfish, whereas trawls may have also taken significant quantities of such invertebrates as arrow squid.

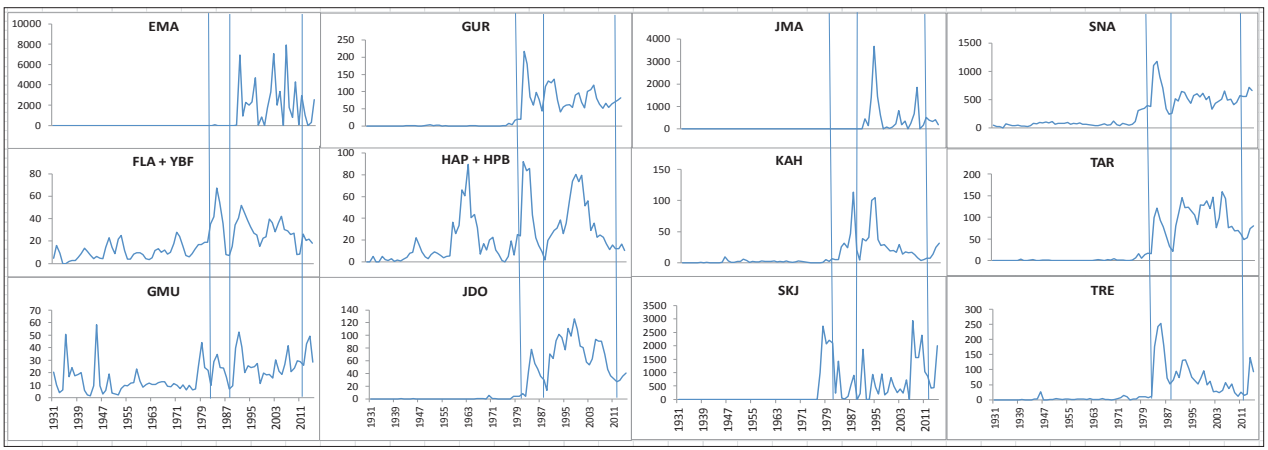

Figure 4. Indicative annual commercial catches/landings (tonnes greenweight) of principal finfish species (as well as others of interest) for the northeast of the North Island centred on the Bay of Islands, 1931-2015. For some species, no landings were reported before 1983. The vertical lines separate very different areas and/or sources of fishery reporting. Values for 1931-82 for the Russell Port of Landing (Nine Pin to Cape Brett, and subsequently referred to in the record as 'Bay of Islands'), can at best be considered a lower bound of the true landings.(6) Values for 1983-88 are the estimated catches for Statistical Area 003 (which extends about 200 km, from near Taupo Bay to Waipu Cove) from the Ministry of Primary Industries' new_fsu database at 17 July 2013, but are considered incomplete. Values for 1989 to 2012 are the estimated catches for General Statistical Area 003 from the Ministry of Primary Industries' (MPI) catch-effort database at 17 July 2013. Values for 2013 to 2015 are the estimated catches (all methods) for General Statistical Area 003 from MPI's NABIS website (7) at 21 August 2016. (EMA, blue mackerel; FLA, flounder; GMU, grey mullet; GUR, red gurnard; HAP, hapuku; HPB, hapuku/bass; JDO, john dory; JMA, jack mackerel; KAH, kahawai; PAR, parore; SCH, school shark; SKJ, skipjack; SNA, snapper; TAR, tarakihi; TRE, trevally; YBF, yellow-belly flounder; YEM, yellow-eyed mullet.)

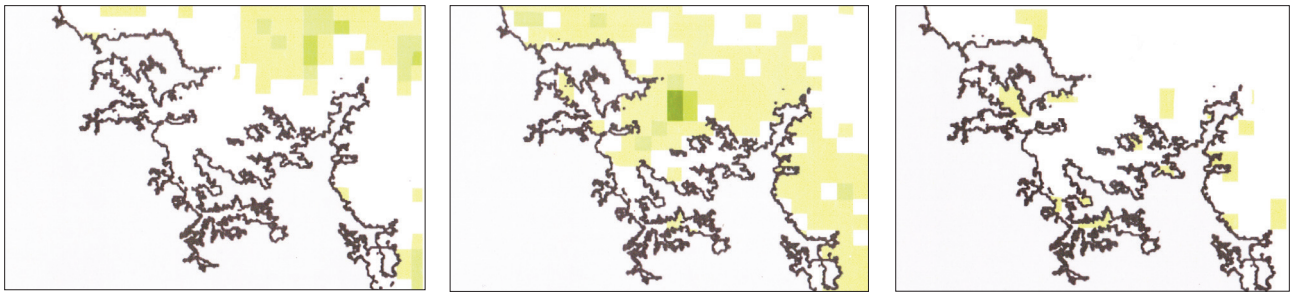

Figure 5. Spatial pattern of average annual number of fishing events (from left, trawl, longline, then set net) starting in each 1-nautical mile grid for 1 October fishing years 2007/08 to 2012/13 in and near the Bay of Islands. The five categories, from lightest green, are 0-1 event, >1-2 events, >2-3 events, >3-5 events and >5 events.(8) Note that these do not include the fishing activities of the small local fleet of small vessels, most of which are focused on inner reaches of the Bay.

Recreational fishery

The Bay of Islands has long been known for its recreational fishing opportunities – not only for gamefish but also for other fishes such as snapper and kahawai, as well as dive-quarry like rock lobsters and scallops. The east coast of the North Island Hauraki Gulf north is among the most-intensively fished parts of the country recreationally, and, in turn, the Bay of Islands is arguably the shore north of the Hauraki Gulf most heavily fished by recreational fishers (Figure 6).

Figures 6 and 7 demonstrates how intense recreational fishing in the Bay of Islands area is compared with the only commercial fishing data available at a fine scale (Figure 5). Although the measures of effort are very different, and the effort associated with the handful of locally-based commercial vessels is not included in Figure 5, the impression is that the recreational fishing effort far exceeds that of the commercial fleet. For example, in 2004-05, whereas the recent commercial fishing map indicates in the order of only an average 50 longline events each year, the corresponding recreational values were on the order of 100-150 events; the picture was similar for 2011-12 (Figure 6).

A further study, in 2013-14, gave results entirely consistent with the above: Bay of Islands (Section 4 Figure 7) had nominally the greatest boat-fishing effort (3600 vessels), followed by the Whangarei area.(11)

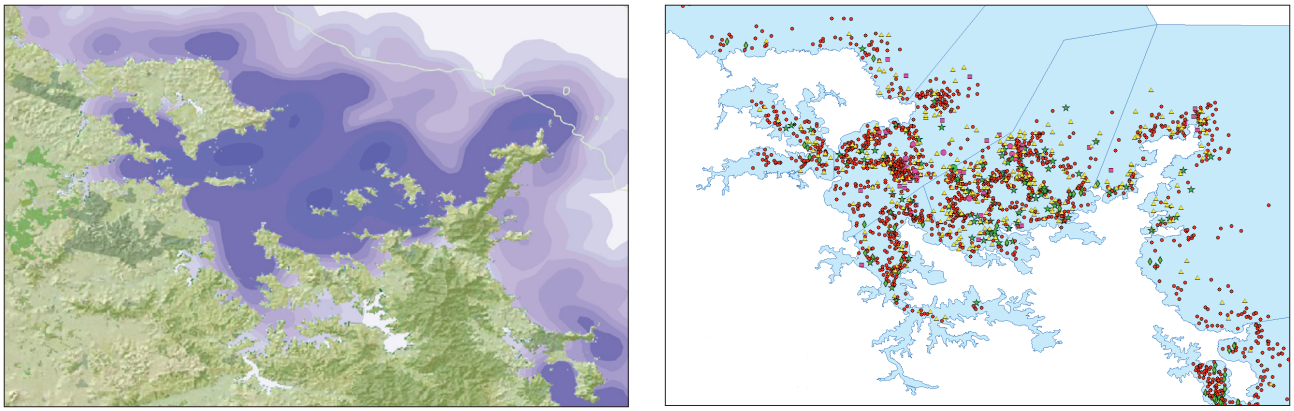

Figure 6. Left: Distribution of stationary vessels recreationally fishing (vessels per km²), 1 December 2004 to 30 November 2005, North Cape to Cape Rodney.(9) For the Bay of Islands, the areas with most-intense fishing activity (dark blue) contain 100-150 vessels per km²; the lightest-blue contours represent 0-0.1 vessels per km². Right: Distribution of stationary vessels recreationally fishing, 1 April 2011 to 31 March 2012.(10)

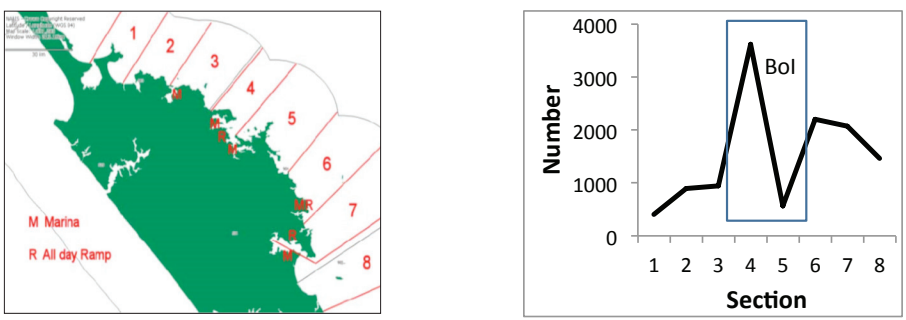

Figure 7. Survey sections (left), and nominal numbers of fishing vessels, 2013-14, (right, with Bay of Islands sections boxed).(11)

Commercial versus recreational harvests

There is clearly a lot of recreational effort going in, but how do recreational harvests compare with those commercial?

For East Northland (North Cape to Cape Rodney), estimated recreational harvests of snapper are highly significant, in some years almost equalling the commercial landings; for kahawai they usually far exceed the commercial harvest (Figure 8). And for the

Bay of Islands itself, the estimated recreational harvests of these species are also significant, even though the Bay makes up less than 10% of the coastline of East Northland. And for rock lobsters, once again, the Bay of Islands recreational harvest is a significant constituent of the East Northland landings, and the recreational catch of lobsters in the Bay of Islands is high relative to the commercial catch (Figure 8).

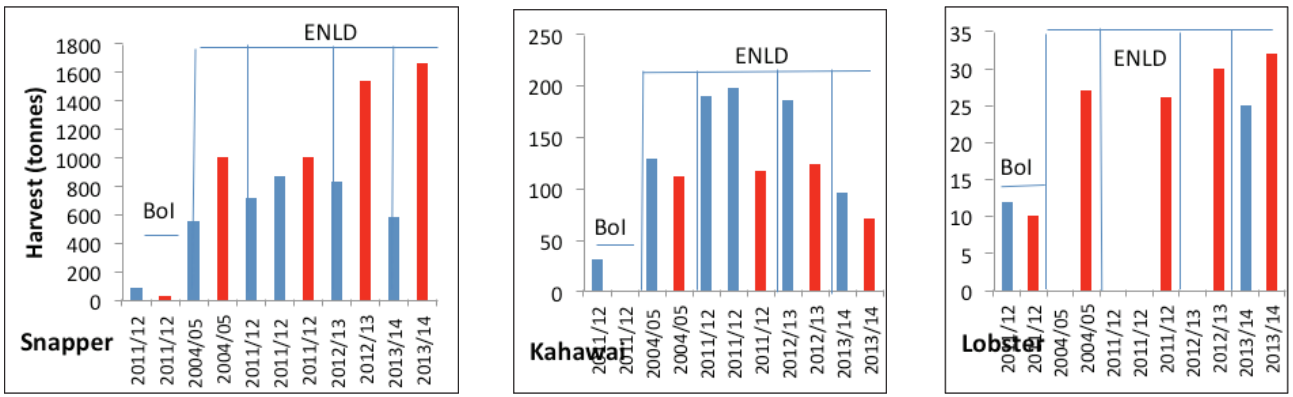

Figure 8. Estimated commercial (red) and recreational (blue) harvests of the two most-caught fish in the Bay of Islands, snapper (left) and kahawai (middle), and rock lobster (right), compared with those of East Northland (North Cape to Cape Rodney).(12)
(There were no known commercial harvests of kahawai within the Bay of Islands in 2011/12.)

Conclusions

Sea urchins (kina) have eaten out much of the shallow-water kelp of the Bay of Islands, defiling the Bay's essential life force. This a potent example of ecological overfishing. Similar destruction has taken place in many other parts of New Zealand, as well as overseas. The experience is that sea urchins increase in abundance as their key predators become overfished; the urchins consume or destroy the kelp over the band of their depth distribution; and this leads to the collapse of natural functioning of the shallow-water reef ecosystems.

So, just where does the buck stop? It certainly does not lie entirely with the commercial sector. In fact, we are all responsible for destruction of our shallow-reef kelp. And 'the tragedy of the commons', where none of the competing groups wants to be the one to take the rap, ensures no change to the status quo. In scraps like this it requires the fisheries managers at the Ministry for Primary Industries to urgently take the bull by the horns and effect the rebuild of stocks of the key predators. A start has been made with snapper, but it is not envisaged

that the East Northland substock will be rebuilt to the target 40% of the virgin state until at least 2040.(13)

In the meantime there is something we can do. We can see to the establishment of no-take marine refuges in the Bay of Islands, and in other parts of Northland. The experience at Leigh and elsewhere(1) is that once fishing pressure on the predators of sea urchins is removed, the full kelp canopy returns.

No-take reserves typically lead to the return of fully functioning kelp ecosystems, the dependent life forms and ecological processes – the sea's mauri – restored.(1) Tools such as rahui, mataitai, taiapure – or elimination of just commercial fishing – simply don't cut the mustard because they can't be guaranteed to retain the very high levels of harvest control necessary, or remain in place long enough, for fully functioning natural ecosystems to emerge. Top predators take decades to resume their roles, and even modest levels of fishing make recovery impossible.

Unless fishing pressure is urgently reduced, there will be further loss of our shallow-water kelp, especially in outer parts of the Bay. Is it fair and reasonable that we leave our mokos the awful legacy of barren reefs?

As a stop-gap measure, let's get some no-take marine refuges established in the Bay of Islands.

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