Fundamental problems in NZ's Fisheries Management

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The health of our marine ecosystem, its resilience in the face of global climate change, and effectiveness of our fisheries management are profoundly compromised by the processes used to assess stocks and set TACs.

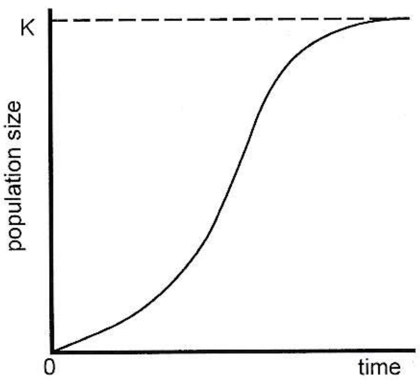
Problems with TAC setting process

Total Allowable Catches (TACs) are based on single species management, and a philosophy of maximum sustainable yield (MSY). Managing to reach MSY is the central goal in NZ's fisheries Act. The Maximum Annual Yield (MAY) and Maximum Constant Yield (MCY) reference points routinely used in NZ fisheries management are different interpretations of MSY.

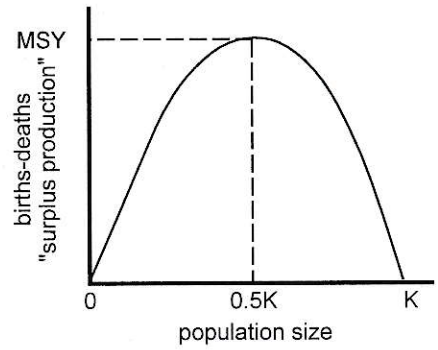
What is MSY?

Underlying almost all fisheries management is the idea that populations of fish grow over time according to an approximately S-shaped curve (a) reaching a maximum when limited by some resource (e.g. space, food). The slope of curve (a) gives the rate at which the population grows (i.e. births – deaths). The "yield" curve (b) shows this against population size. The peak of this curve is defined as maximum sustainable yield.

(a)

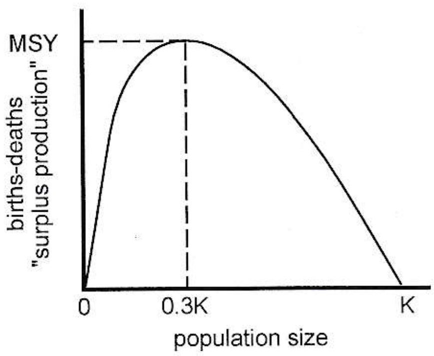


(b)

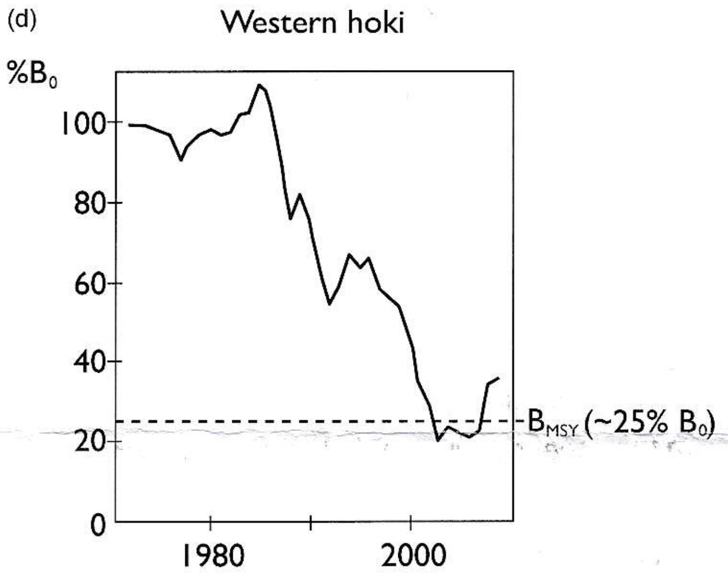


Because many fish have impressive reproductive capacity, the yield curve (b) is generally considered to be skewed to the left (c).

(c)



The aim of conventional fisheries management is to reduce a fish population to the point which gives MSY. In fisheries, this is known as B_{msy} (the biomass at which MSY occurs). Hence, to fish this population at the "right" level, about 70% of the population has to be removed.



To give a NZ example, the B_{msy} level for Hoki is considered to be around 25% of B_{zero}. Therefore, to fish Hoki at the "right" level, 75% of the original population must be removed.

Fisheries Managers would consider plot (d) to represent a near-ideal fishery.

Removing 75% of the population cannot be done without ecological consequences. What did that 75% of the original Hoki population eat? What ate them? In almost all marine ecosystems, competitors will flourish as the target species declines, and will inhibit the bounce-back that is assumed to happen when fishing pressure is relaxed.

Intense fishing pressure also tends to make marine food webs simpler. As species high in the food web are fished down, faster breeding competitors, usually smaller, take their place. Alternatively, prey species may increase in abundance dramatically as predation on them is reduced. In some cases, this can result in a "trophic cascade", a topical example of which has occurred in Hauraki Gulf waters. As snapper have been overfished, their predation on urchins (especially juveniles) has declined. Increasing urchin populations have increased grazing pressure on kelp, which has resulting in "urchin barrens". Removal of this kelp forest habitat reduces 3-dimensional habitat complexity, and decreases habitat for kelp-associated fish. In short, Managing fisheries to reach a target stock level of B_{msy} means that these fish stocks no longer play the ecological role they used to.

It is becoming increasingly clear that intact, complex, ecosystems are more productive, better at providing ecosystem services (such as maintaining water quality) and more resilient in the face of environmental change. That food web complexity results in stability is a biological demonstration of what economists call the "portfolio" effect, in which spreading risk via having a diverse investment portfolio is the safest way to ensure long term financial gain.

In addition, fishing pressure usually changes the population's size structure to the detriment of large fish, which make a disproportionate contribution to reproduction.

Perhaps most important, at low stock levels, only bulk fishing methods (e.g. trawling, gillnetting) remain economically efficient. This is a catch-22 because trawling has significant impacts on habitat and both gillnetting and trawling have significant impacts on protected species (including seabirds and marine mammals). Neither of these methods maximise fish quality.

If fish stocks are maintained at higher levels, hook-based methods, fish traps and other more selective fishing methods are economically efficient, and result in much higher quality of catch. This allows a much higher value to be gained for each fish caught. The higher levels of labour needed in these selective fishing methods will provide more jobs in fishing and increase the profit margin per fish caught. Importantly, these fishing methods have much lower environmental impacts than gillnetting and trawling, and what impacts they do have are easier to mitigate.

The fundamental problem is that our focus on managing fish as single species or stocks assumes that fish respond to fishing pressure in a way that is divorced from their environment, and from the other species in it. There are no genuine multispecies fisheries models used in New Zealand

Problems with information to support stock assessments
Most inshore fish stocks have insufficient data for detailed stock assessment.

- Most species/stocks have no independent research. Quantitative stock assessments exist for a minority of stocks, and most of those rely mainly or exclusively on data that come directly from industry. This is a substantial risk. North Atlantic cod were fished to the point of collapse partly because fisheries managers believed the catch and fishing effort data from the fishing industry rather than independent scientific data. The cod collapse led to very large economic costs. We can't afford to repeat this kind of mistake in New Zealand.

- Even for the most information-rich inshore fish species, stock assessments are highly likely to be biased. This is because (a) pre-QMS catch-effort returns were of such poor quality that the data cannot be trusted, and (b) far more fish are killed in fishing than are recorded as catch. Under-reporting, discarding and high-grading are obvious but understudied problems in NZ fisheries, are incentivised by the QMS and have remained hidden due to exceptionally low levels of observer coverage. In addition, some fishing methods have significant cryptic, or unobserved mortality (esp. dredging). The combined effect is that estimates of original population size, a vital piece of information for evaluating current stock status, are biased low because they cannot include all the catch. This results in an excessively optimistic impression of current stock levels. This is the shifting baseline problem. Very few people realise just how prolific New Zealand's waters used to be.

- There is a lack of appropriate spatial structure in stock assessments. Fish populations do not reproduce everywhere. It is impossible to set high levels of catch that are safe without knowing where the sources of new recruits are.

Together these issues mean that we should view current assessments of inshore fish stocks with considerable skepticism. Most are likely to be biased, presenting a more optimistic view of stock status than is realistic.

This problem is worse in our inshore fisheries than in our offshore fisheries because the latter have developed more recently, are more easily monitored, and have had much higher observer coverage.

How could we do better?
Solution: an Ecosystem approach

1. Fish stocks need to be maintained at much higher levels to ensure that their ecological function is maintained.
2. Significant areas of our coastal and deep-water space must be left unfished. The areas must include some of the "best bits" - not just the leftovers. While this will have short-term costs, it will have considerable long-term benefits in fisheries sustainability and in ecosystem resilience.
3. Bycatch of unwanted or protected species needs to be immediately reduced to demonstrably sustainable levels (i.e. so that recovery is not impeded). Real progress needs to be made towards a goal of zero bycatch. Specific, measurable targets and timelines are needed in order to make progress towards reducing bycatch.
4. All catch needs to be retained, and valued.
5. There will need to be a substantial investment in marine science. Doing Ecosystem based fisheries management (EBFM) properly will require more information, on target and non-target species, and on ecosystem responses.
6. We must acknowledge that ecosystem responses may be nonlinear. Tipping points are real, impossible to predict, and avoiding them is crucial. For this reason, management must be more precautionary and more ecologically focused.

New Zealand has the good fortune to have no “straddling” stocks (the same fish stock present in the waters of several nations). As a first world nation, we can afford to manage our fisheries properly. If we did we would reap the economic benefits of maximising value per fish caught. We also have a highly educated and conservation–aware populace. And, unlike third world countries, we have an outstanding social welfare system. No fisher’s family will starve if he is unable to fish.

A reputation of leading the World in sustainable fisheries management will be a substantial marketing advantage, not just for fish exports but also other products.

Fundamentally... What do we want our fisheries to look like in 20 years?
Surely we want

- More fish in the sea
- To make more money from each fish caught
- To minimise bycatch and ensure recovery of protected species
- To do this, using far less fuel – because fuel will get more expensive

Meeting these goals will have the following benefits:

- It will be easier to catch fish
- Implementation of genuinely selective, sustainable, low-bycatch fishing methods
- Revitalisation of small-scale local fishing communities
- Quality will be favoured over quantity; Fish will become a premium product
- High-bycatch and fuel-hungry fishing methods would be phased out, with government incentivising the transition to environmentally sustainable fishing methods
- Healthier and more resilient marine environment.

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References to scientific papers supporting the above, and suggested further reading, are available on request.