

Developing a Decision Support system to manage fisheries externalities in New Zealand's Exclusive Economic Zone

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Outline

- Introduction
- The Decision Support Framework
- Biophysical environmental externalities in NZ Fisheries
- Instruments for internalising externalities
- Evaluation criteria
- Judging the effectiveness of instruments
- The remaining challenge
- The Decision Support System

The Problem

- NZ has 4th largest EEZ in world
- ITQ system introduced in 1986
- Does not address environmental externalities
- Increasing focus on management of marine environment rather than fisheries *per se*
- New Fisheries Act 1996 is wide ranging and now requires management of adverse effects on the aquatic environment

SECT. 8. PURPOSE--

(1) The purpose of this Act is to provide for the utilisation of fisheries resources while ensuring sustainability.

(2) In this Act--

"Ensuring sustainability" means--

(a) Maintaining the potential of fisheries resources to meet the reasonably foreseeable needs of future generations; and

(b) Avoiding, remedying, or mitigating any adverse effects of fishing on the aquatic environment:

"Utilisation" means conserving, using, enhancing, and developing fisheries resources to enable people to provide for their social, economic, and cultural wellbeing.

SECT. 9. ENVIRONMENTAL PRINCIPLES--

All persons exercising or performing functions, duties, or powers under this Act, in relation to the utilisation of fisheries resources or ensuring sustainability, shall take into account the following environmental principles:

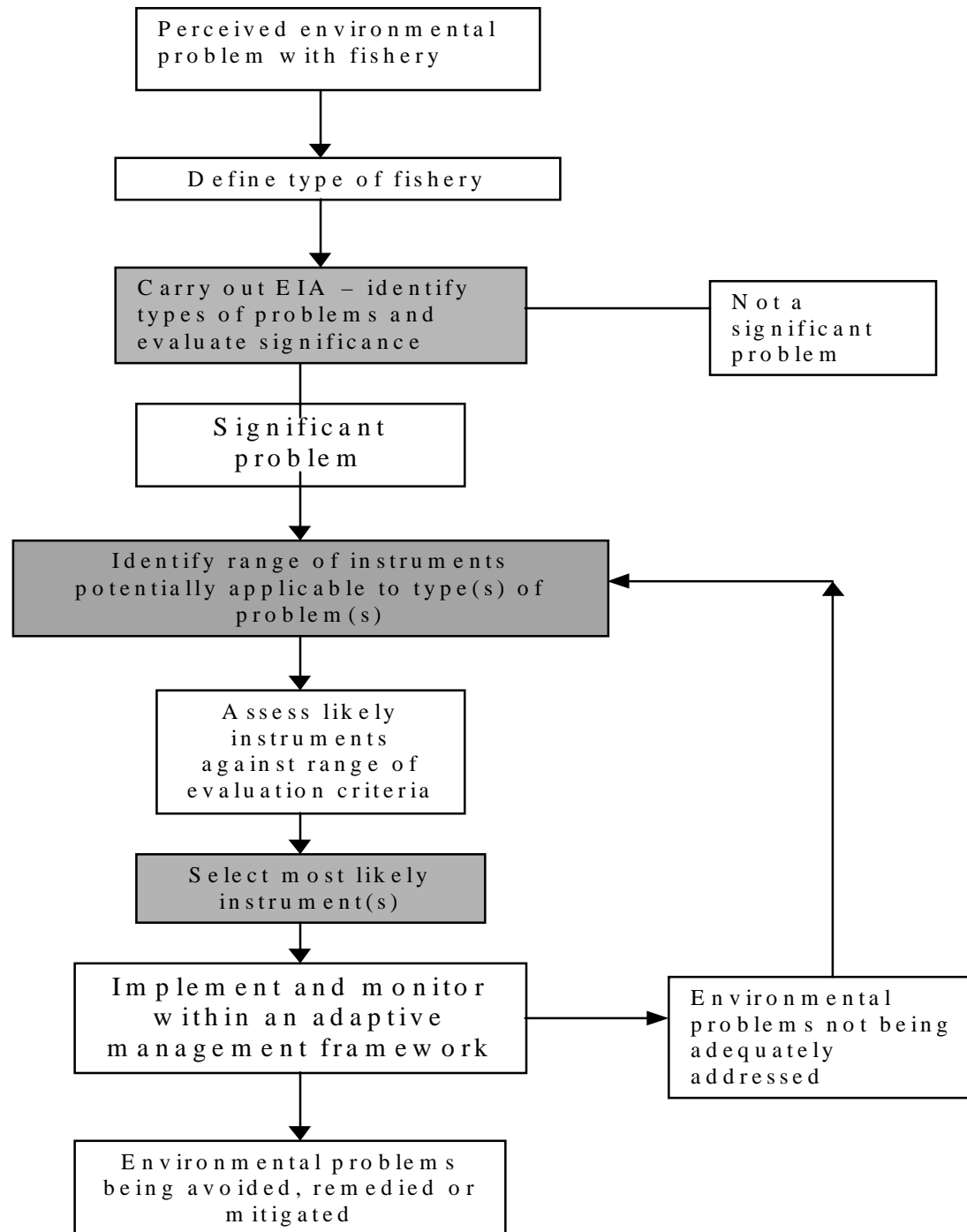
- (a) Associated or dependent species should be maintained above a level that ensures their long-term viability:
- (b) Biological diversity of the aquatic environment should be maintained:
- (c) Habitat of particular significance for fisheries management should be protected.

SECT. 10. INFORMATION PRINCIPLES--

All persons ... shall take into account the following information principles:

- (a) Decisions should be based on the best available information:
- (b) Decision makers should consider any uncertainty in the information available in any case:
- (c) Decision makers should be cautious when information is uncertain, unreliable, or inadequate:
- (d) The absence of, or any uncertainty in, any information should not be used as a reason for postponing or failing to take any measure to achieve the purpose of this Act.

The Decision Support Framework



Biophysical environmental externalities in NZ Fisheries

Fisheries with ‘significant’ externality problems are:

Any bottom dredging fishery on a non silt/sand substrate, e.g., oyster and scallop;

Any bottom trawl fishery on a non silt/sand substrate, e.g., snapper and orange roughy;

Long line fisheries where there is the presence of non target fish species or seabirds in high numbers at the same fishing water level, e.g., tuna;

Mid water trawl fisheries where marine mammals are present in ‘significant’ numbers, e.g., southern squid

Instruments for internalising externalities

Instruments are clumped in the following areas:

- Regulatory
- Financial systems
- Voluntary approaches
- Legal remedies
- Education information supply

Regulatory

Instrument	Main world uses	Current NZ uses	Applicability to fishing
No take zones	Protect juveniles, spawning areas etc		No fishing in specified zones means externalities not created
Marine Reserves	Protect juveniles, spawning areas etc protect habitat	Banks Peninsula, Long Bay etc	Area set aside for preservation of marine species
Closed seasons, areas	Protect juveniles, spawning areas etc	Near sub Antarctic islands.	No fishing during designated times and /or in prescribed areas.
Size or sex selectivity	Direct effort away from specified ages, sex individuals	Rock lobster, size requirement	Requirement for fishers to return to sea all prohibited catch
Bycatch Reduction Devices (BRD)	Reduce rate of bycatch of fish and other species		Vary technology used while fishing to reduce rate of bycatch of fish or other species
Technology ban	Prevent externalities associated with specific harvesting technologies	Drift netting ban	Reduce bycatch by only allowing techniques which cause few externalities
Input limitations	Reduce externalities associated with number of potlifts, boat days etc		Reduce volume of fishing activity and associated externalities
Catch limitations	Reduce externalities associated with effort	Foveaux Strait oysters	Limit total harvesting and associated externalities
Retention and utilisation requirements	Reduce dumping of target and non -target species	CAAQ, FA AQ	Allow non target catch to be landed, not dumped

Financial systems

Instrument	Main world uses	Current NZ uses	Applicability to fishing
Taxes	Provide incentive to reduce, eg, pollution		Apply tax to variable inputs, boats, outputs, to reduce profits and externalities
Subsidies	Reduce costs of inputs	R&D assistance	Reduce costs of developing BRD
Environmental performance bonds	Provide financial incentive to avoid creating externalities	Mining, biodiversity protection	Provide incentive to not damage habitat or marine ecosystem
Financial inducements	Bribe to behave in desired way		Financial reward if do not create environmental externalities
<i>Rights based</i>			
IQ, ITQ, IVQ CDQ, Share fisheries	Reduce race to fish	NZ QMS	Creation of rights reduces need to race, provides incentive to maintain asset, so less externalities created

Voluntary approaches

Instrument	Main world uses	Current NZ uses	Applicability to fishing
Co management	Right holders draw up operating systems	Challenger Scallop	Peer agreements reduce externalities
Codes of practice	Agreed behaviour which limits externalities	HSNO, Agchem	Industry develop, adopt, codes which limit or preclude externalities
Accredited environmental management systems	Industry develops systems - externally audited prior to accreditation	Marine Stewardship Council, ISO 14001	Industry develop, adopt, systems with environmental policy which aims to limit or preclude externalities
Conservation easements	Negotiated agreements which restrict a parties behaviour	QEII Trust, Ducks Unlimited	Negotiated agreement to not take certain actions eg create externalities

Legal and Education

Legal Remedies			
Instrument	Main world uses	Current NZ uses	Applicability to fishing
Tort law	Liability for pollution damages	RMA is a 'strict liability' law	Potential damages claims provide incentive to avoid creating externalities
Education Information supply			
Instrument	Main world uses	Current NZ uses	Applicability to fishing
Publications, guides, kits, etc	numerous	Numerous, e.g., biodiversity protection	Informed people change behaviour, not create externalities
Informal regulation including environmental reporting	Toxics Release Inventory and corporate environmental reporting		Information release plus community pressure, modifies firm behaviour

Evaluation criteria

- Environmental
- Treaty of Waitangi
- Economic
- Socio-cultural
- Management

Environmental criteria: The Policy Instrument(s) safeguards the life supporting capacity of the marine environment in a healthy functioning state.

The policy instrument:

- contributes to maintaining 'utilised' fish stocks above a level that ensures their long-term viability
- assists with avoiding, remedying, or mitigating any adverse effects of fishing on the aquatic environment
- ensures fishing related mortality of marine mammals or other wildlife is below a maximum allowable fishing-related mortality level (s15 of the Fisheries Act 1996)
- will seek to support aims of the NZ Biodiversity strategy which are relevant to implementing the Environmental Principles of the Fisheries Act, specifically:
 - it will help ensure natural marine habitats and ecosystems are maintained in a healthy functioning state; and
 - it contributes to ensuring there are no human induced extinctions of marine species.
- protects habitat of particular significance for fish

Treaty of Waitangi criteria: The policy instrument(s) chosen will protect Mäori customary fishery rights and practices.

Economic criteria: The Policy Instrument(s) maintains the economic viability of the fishery and downstream economic activities.

- * The policy instrument is the most efficient way to achieve the desired environmental objective
- * The policy instrument forces the person causing the environmental externality to face all (or more) of the costs that they impose on the environment or on others
- * Windfalls and wipeouts will be avoided as far as practicable
- * The policy instrument minimises transaction costs
- * The policy instrument does not result in undesirable changes in market power, either for buyers or seller

Socio-cultural criteria: The Policy Instrument(s) will not have undesirable social/cultural impacts on fisheries dependent communities.

Evaluation criterion:

- The policy instrument(s) will not have adverse social impacts on fisheries dependent communities.

Evaluation criterion:

- The policy instrument will protect access by recreational fishers to adequate fish stocks to satisfy their needs

Evaluation criteria:

- The policy instrument(s) will safeguard the needs of future generations.

Management criteria: The Policy Instrument(s) is capable of being implemented within existing management constraints.

The policy instrument(s) is/are easy to introduce and readily modified

The policy instrument(s) is/are low cost to administer

The policy instrument(s) does not require specific infrastructure that is not available at an acceptable price or in reasonable time

Application of the the policy instrument(s) requires low levels of information about the state of the fishery, the activities of the fishing companies and the effectiveness of the internalisation mechanism

The policy instrument's performance falls within optimal operating conditions

The policy instrument(s) do not make unacceptable demands upon the skill, capability, safety, and health of fisheries management staff

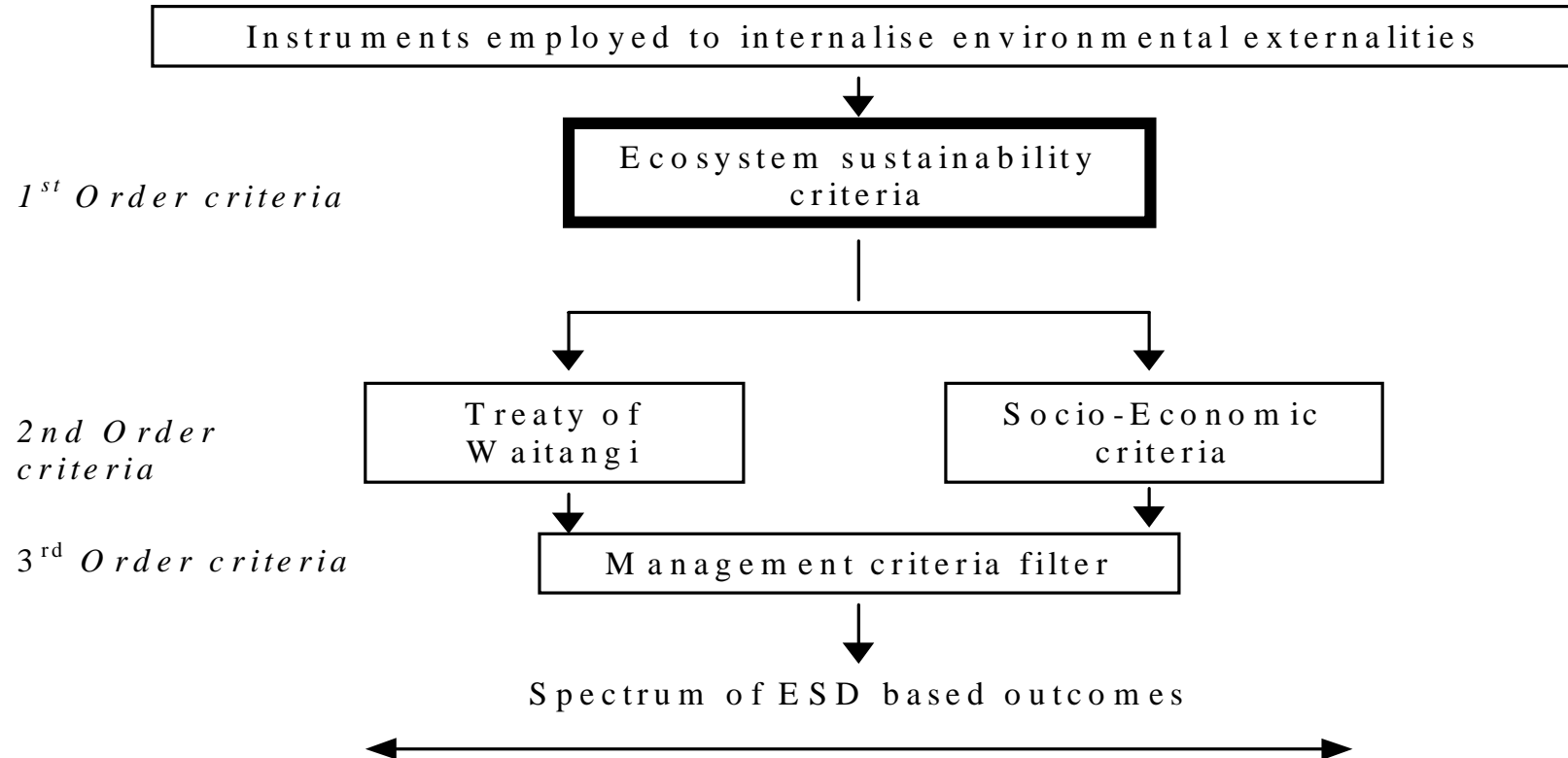
Judging the effectiveness of instruments

Type of fishing activity	Impact classification			
	Bottom/sea bed disturbance	Non-fish bycatch	Non-target fish bycatch	Pollution
• Trawl netting	✓	✓	✓	✓
• Seining	✓	✓	✓	✓
• Set netting	✗	✓	✓	✓
• Dredging	✓	✗ ¹	✓	✓
• Line fishing	✗	✓	✓	✓
• Pot fishing	✗	✗	✓	✓
• Diving	✗	✗	✗	✓
TOTAL POSSIBLE IMPACTS	3	4	6	7

KEY: ✓ Fishing activity can cause a significant environmental impact
 ✗ Fishing activity unlikely to cause a significant environmental impact

This matrix allows us to target the selection of instruments to particular types of fisheries associated with particular types of impacts. In the highlighted case we know that longlining for tuna can cause albatross mortality. The question then is what instruments are best to address this problem?

Stepwise filtering process:



Effectiveness of instruments against evaluation criteria

Impact class	Instrument	ESD criteria	ToW criteria	Economic criteria	Socio-cultural criteria	Management criteria
Non-fish bycatch.	No Take Zones	100% in No Take area. Displaced fishing to other regions may result in bycatch #	Could negatively impact on tangata whenua if they line fish species in the Zone	If No Take zone can be substituted by another fishing area, economic cost may be slight, and vice versa.	Likely high recreational costs in some areas	Requires monitoring to see if zero take occurs.
	BRD	Change the size of hooks #	Unknown	Cost of BR device		Monitoring to gauge impact of BRD, and if being used.
	Technology ban/ codes of practice	Effectiveness will depend on uptake of ban, codes #	nil	Cost depends on amount it reduces profits		Monitoring
	Taxes, on variable inputs, boats, output, catch – Conservation Services Levy	Effectiveness will depend on fishers responsiveness to tax, and the tax level	Some impact if tangata whenua line fish that species	Cost depends on amount it reduces profits		Need to estimate tax driver, eg variable inputs, to levy tax

The remaining challenges

- The next task is to make all of this manageable from the perspective of a policy analyst.
- An electronic Decision Support System provides a means of doing this.
- In developing this DSS there are 3 major issues:
 1. Gaining information about impacts of fishing at each site
 2. Lack of knowledge of the relative and absolute effectiveness of instruments
 3. How to deal with multiple problems and synergy between instruments.
- We therefore see this as an adaptive learning approach.

The Decision Support system

- For a specific fishery, and environmental externality, follow a multi-stage process
 - Reduce range of solutions
 - Detailed application to subset of solutions
- Few criteria assessed at the first stage
- Few solutions assessed at later stages
- Weighted matrix approach
- Outputs
 - Overall score for each relevant instrument
 - Qualitative summary

Decision Support system, continued

- Information requirements
 - Environmental Impacts of fishing
 - Source ‘science’
 - Relative importance of impacts
 - Source, managers and/or community
 - Effectiveness of instruments
 - Source, managers and /or community
- Consider if combined use of instruments will produce higher score

Decision Support system, continued

- Researchers provide indicative ratings, to generate scores for relevant instruments
- DSS users adjust the ratings, generate new scores based upon expert knowledge and adaptive learning.

More information

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