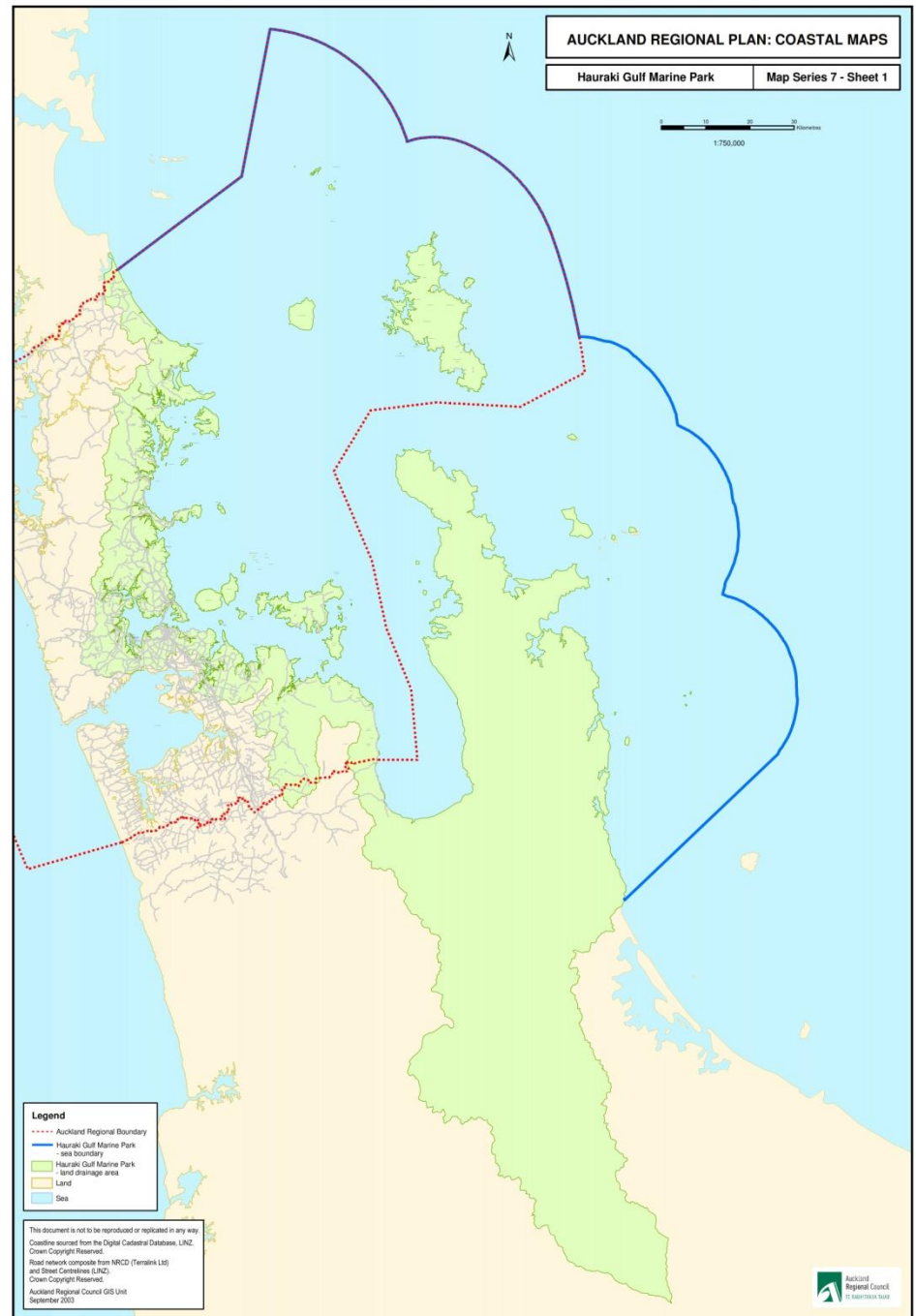


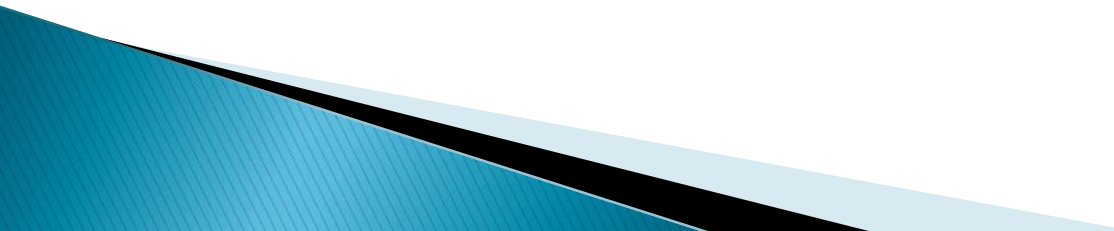
# Effects of Aquaculture – another perspective

Barry Weeber

# Hauraki Gulf Marine Park

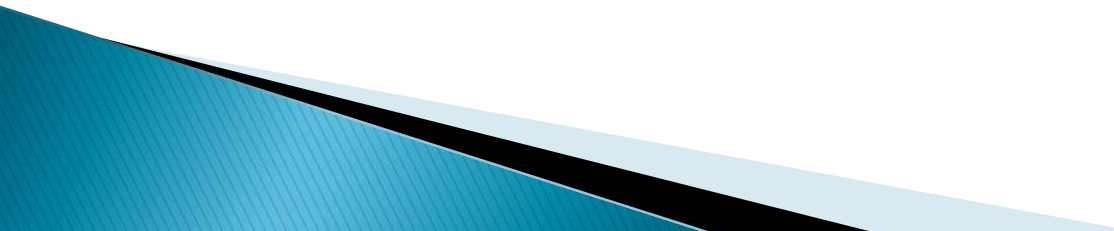


# Techniques of assessment

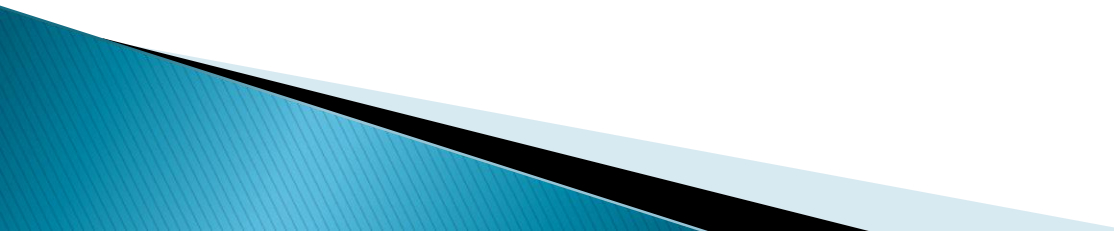
- ▶ Introduce the Forest and Bird Best Fish Guide;
  - ▶ Look at approaches, tools and criteria;
  - ▶ Some examples in the Hauraki Gulf Marine Park.
  - ▶ Some Information sources that are relevant to considerations
- 

# Ecological effects


Need to consider and assess:

- ▶ the effects of different type of aquaculture – feed vs non-feed;
  - ▶ Cumulative effects of activities on habitats, species, and other activities;
  - ▶ What is the real footprint of a marine farm;
  - ▶ Biosecurity aspects cannot be ignored;
  - ▶ Environmental considerations are wider than pure ecosystem effects.
- 

# Feed vs Non-feed aquaculture

- ▶ Direct effects of adding feed into the marine environment, including benthic impacts;
  - ▶ Indirect impacts of feed production including where any fishmeal or fish oil came from and how sustainable were those species and the sustainability of soy or other material used;
  - ▶ Potential for feed to add new pathogens from other seas to the New Zealand coastal areas and species;
- 

# Best Fish Guide

- ▶ First guide produced in 2004
  - ▶ The 2013–14 was the sixth guide
  - ▶ First guide with aquaculture assessment
  - ▶ Criteria was developed after reviewing ecological assessments globally and with a input from external peer reviewers
  - ▶ Criteria has been assessed before each guide was produced and last version was responded to a review by the Marine Sciences Society Executive
  - ▶ Aquaculture criteria involved extensive review and consultation
- 

# How sustainable is New Zealand Seafood?

(Ecological Assessments)



## **Best fish** guide 2012–2013



**Forest & Bird**  
GIVING NATURE A VOICE

## Aquaculture **Best fish** guide 2013



**How it works**  
(Assessment Methodology)

PART **A**

.....  
**How sustainable is New Zealand aquaculture**  
(Ecological Assessment)

PART **B**



**Forest & Bird**  
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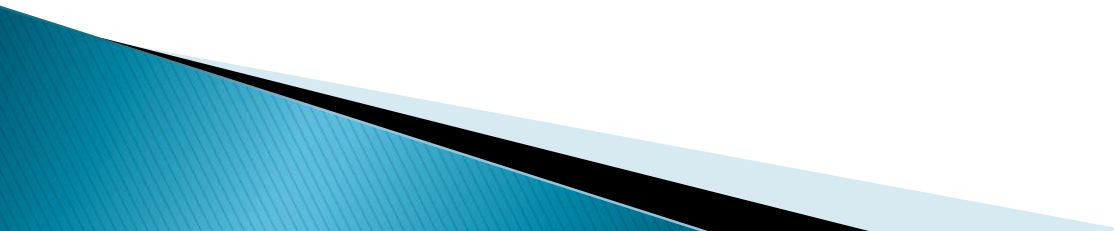
# Aquaculture issues

**Table 1: Aquaculture issues and the New Zealand legislation involved and the criteria used in this guide**

Issue	Legislation	Criterion
Marine spatial planning	Resource Management Act	5.4, and 5.7
Environmental Assessment	Resource Management Act	5.2
Protection of vulnerable habitats	Resource Management Act	5.2
Effects on wild fishing interests	Fisheries Act 1996	partly 5.6
Sustainability of fish food	Fisheries Act 1996 if from NZ	5.1
Water quality	Resource Management Act	5.4
Discharges to the marine environment	Resource Management Act	5.4
Effects on marine mammals	Marine Mammal Protection Act and Resource Management Act	5.5
Effects on seabirds	Wildlife Act and Resource Management Act	5.5
Diseases and alien species	Biosecurity Act	5.3
Introduction of new species	Hazardous Substances and New Organisms Act	5.3, 5.6
Sustainability of fish larvae and spat	Fisheries Act 1996	5.6
Effect on genetic diversity	Fisheries Act 1996 and the Resource Management Act	5.6
Sale of fish product	Fisheries Act 1996 and the Biosecurity Act	NA



# Criteria assessment

- ▶ Taking a precautionary approach to the information
  - ▶ Assessing marine farming in regional grouping assessments
  - ▶ Using the best available information – including MPI and DoC reports, regional councils reports and plans
  - ▶ Including international information on species affected eg IUCN or DOC threatened species assessment and CITES or CMS listings.
  - ▶ Using a seven step level for each of the assessment criteria
- 

# Ecological Criteria and weighting

**Table 2 Weighting of criterion**

<i>Weighting constant</i>	<i>Criterion</i>
3	Biosecurity issues (criterion 5.3)
2	Status and sustainability of fish feed (criterion 5.1)
2	Effect on farm waste on water quality and benthic impacts (criterion 5.4);
1	Effect on Landscape, Amenity, Ecologically Sensitive Areas and Natural Character (criterion 5.2)
1	Effect on genetic diversity - Sourcing of spat and larvae for on-growing (criterion 5.5)
1	Effect on protected and threatened species (criterion 5.6)
1	Effectiveness of management (criterion 5.7)



# Best Fish Guide in 2013–14

- Includes both  
aquaculture and  
wild fisheries

## Seafood Choices — Ecological Rankings

### BEST CHOICE

Green-lipped mussels (all regions)	✓	Pilchards
Pacific oysters ③		Anchovies
Paau ①		Kina
Albacore tuna		Yellowed-eyed mullet
Cockles		Rock lobster
Kahawai		Salmon ④
Blue cod		Skipjack tuna
Trevally		Packhorse lobster
Garfish		Kingfish
Sprats		Salmon ⑤
Grey mullet		Blue moki
Butterfish		Paau
John dory		Pacific oysters ①
Paddle crabs		Red gurnard
Tarakihi		Blue mackerel
Leather jacket		Trumpeter
Silver warehou		Hoki
Queen scallops		Red cod
Yellowfin tuna		Southern blue whiting
Salmon ③ ④		Antarctic toothfish
White warehou		Stargazer
Alfonsino		Groper
Swordfish		Hake
Ribaldo		Frostfish
Ling		Red snapper
Gemfish		Spiny dogfish
Blue warehou		Oysters
Elephantfish		Eels
Scallops		Rubyfish
School shark		Pacific bluefin tuna
Dark ghost shark		Bigeye tuna
Patagonian toothfish		Sea perch
Flatfish		Striped marlin
Scampi		Lookdown dory
Rig		Barracouta
Pale ghost shark		Bluenose
Moonfish		Skates
Jack mackerel		Black cardinal fish
Arrow squid		Rays bream
Blue shark		Southern bluefin tuna
Mako shark		Snapper
Oreos		Orange roughy
Porbeagle shark	✗	

### WORST CHOICE

Visit [www.bestfishguide.org.nz](http://www.bestfishguide.org.nz) for recipes and to  
download the free Best Fish Guide mobile phone app.

# Effects on marine mammals and seabirds

**Table 8: Affected species to type of activities.** Based on Lloyd, 2003

Activity	Sharks	Marine mammals	Seabirds
Land-based	None	None	Unknown?—
Marine:			
• Inter-tidal	Minimal	Minimal	Minimal
• Inshore	Moderate	Moderate	Minimal to Moderate
• Off-shore	Higher	Higher	Minimal to Moderate

# Issues with protected species and threatened species

**Table 9: Issues affecting protected species and threatened species.** Based on Lloyd, 2003

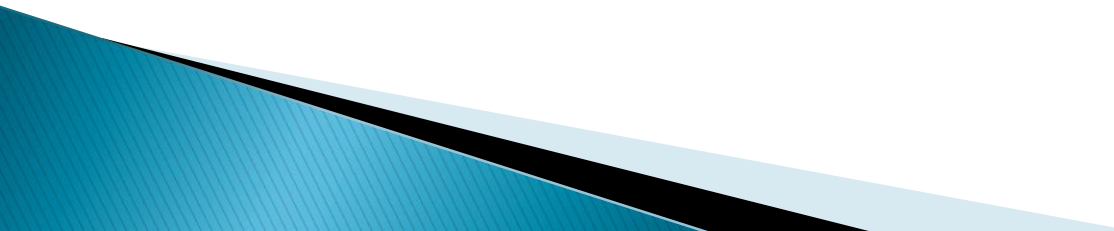
Issue	Feature	Impact level
Entanglement with	Farm structures Spat catching structures Litter from farms	Low-moderate e.g. mussel farms
Ingestion of	Litter from farms	Low
Changed prey abundance due to:	Phytoplankton depletion Changes in Benthos Changed macro-species assemblages Harvest of natural spat fall	Low to high
Changed foraging success due to	Farm structures	Low
Exclusion by	Farm structures Reduced foraging success or prey availability Disturbance (noise or boat activity)	Low to moderate Egg mussel farms, salmon farms and oyster farms
Facilitate spread of	Pathogens Pest species (e.g. toxic blooms and <i>Undaria</i> )	Low to moderate
Creation of resting places	On floats Within farms	Positive e.g. mussel farm

# Entanglement and exclusion

- ▶ **Entanglement:** Bryde's whales, a threatened species, has been entangled in mussel spat collecting lines in the Hauraki Gulf (Lloyd, 2003). Entanglements are the biggest potential threat to whales from large offshore farms established on traditional migratory routes eg southern rights and humpback.
- ▶ **Habitat exclusion:** Displacement of dolphins or other protected or threatened species has not been researched in this area. Dolphins that are hunting collaboratively for schooling fish (e.g. dusky and common dolphins) may be adversely affected (Lloyd, 2003).



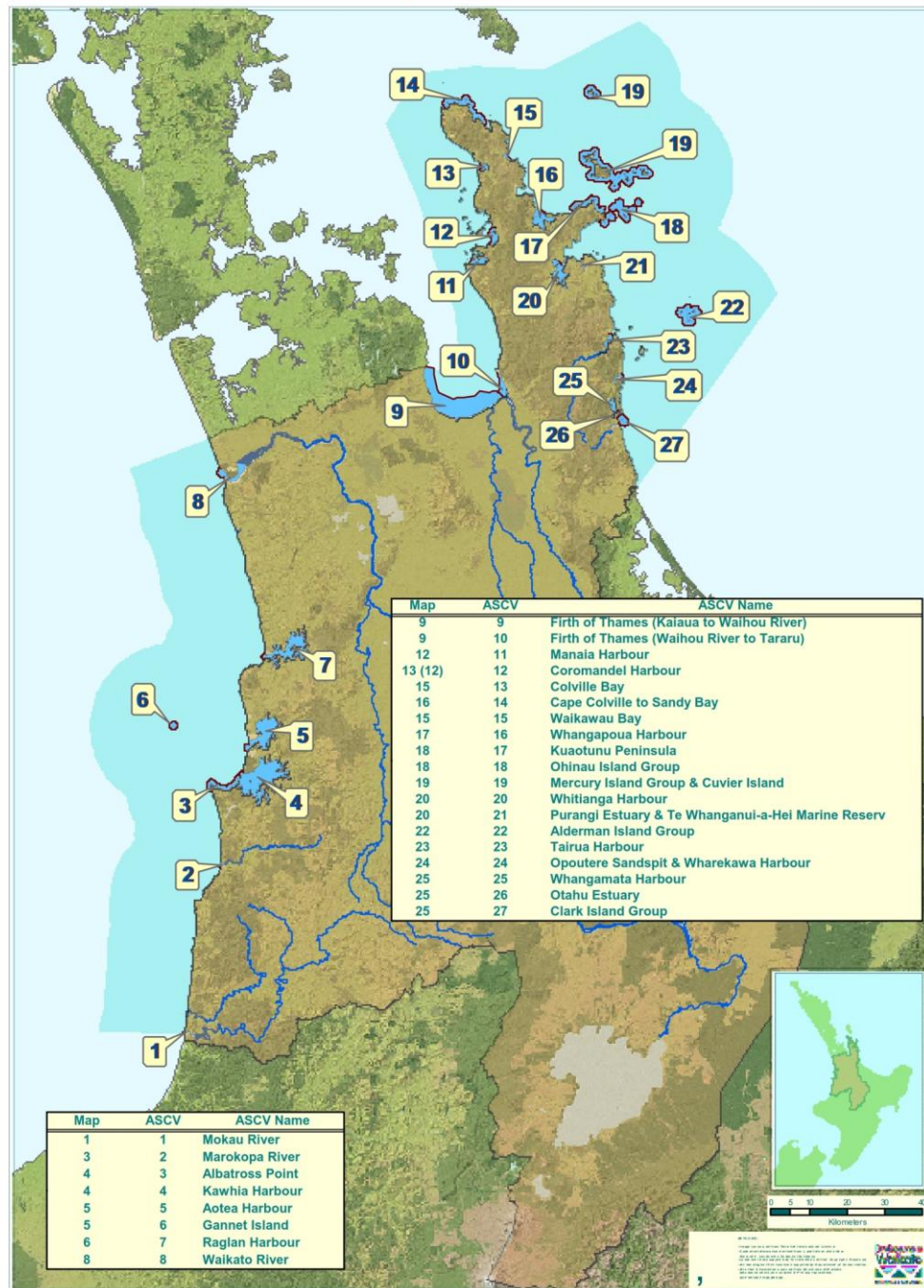
# Significant Areas

- ▶ Identification of significant areas are important factors to consider in looking at managing ecological impacts of activities;
  - ▶ Areas significant for wildlife including seabirds, marine mammals and threatened species.
  - ▶ Ecologically (and culturally and environmentally) significant areas are in most cases poorly assessed.
- 



# Areas of Significant Conservation value (ASCV) in Waikato Coastal Plan

General Map 6: Overview of ASCV



# ASCV Examples

MAP	ASCV	SITE	CONSERVATION VALUES
12	11	Manaia Harbour	<ul style="list-style-type: none"> <li>• Site of significance to Hauraki iwi.</li> <li>• Unmodified representative estuarine system.</li> <li>• Saltmarsh, eel grass and mangrove communities.</li> <li>• Resident and frequenting rare and threatened waders and coastal bird species.</li> </ul>
13	12	Inner Coromandel Harbour	<ul style="list-style-type: none"> <li>• Site of significance to Hauraki iwi.</li> <li>• Resident rare and threatened wading and coastal bird species.</li> <li>• Saltmarsh, eel grass and mangrove communities.</li> </ul>
15	13	Colville Bay	<ul style="list-style-type: none"> <li>• Site of significance to Hauraki iwi.</li> <li>• Significant breeding site for NZ dotterel.</li> <li>• Resident and frequenting threatened and rare waders, coastal and freshwater bird species.</li> <li>• Nationally significant archaeological sites.</li> </ul>
15	15	Waikawau Bay and Estuary	<ul style="list-style-type: none"> <li>• Site of significance to Hauraki iwi.</li> <li>• Representative estuarine system with largely unmodified coastal forest, mangrove and saltmarsh communities.</li> <li>• Resident and frequenting rare and threatened wading and coastal bird species.</li> <li>• Nationally important seascape.</li> <li>• Adjoining Waikawau Farm Park recreational reserve.</li> <li>• Regionally significant dune system fronting Waikawau Bay.</li> </ul>

# Significant areas for wading birds

## Example of significant areas for wading birds from Auckland Coastal Plan



# Examples of significant areas





# Proposed Auckland Unitary Plan

Proposed Auckland Unitary Plan (notified 30 September 2013)



Layers

Current Layer Transparency: Zones

Opaque 0% 50% 100% Transparent

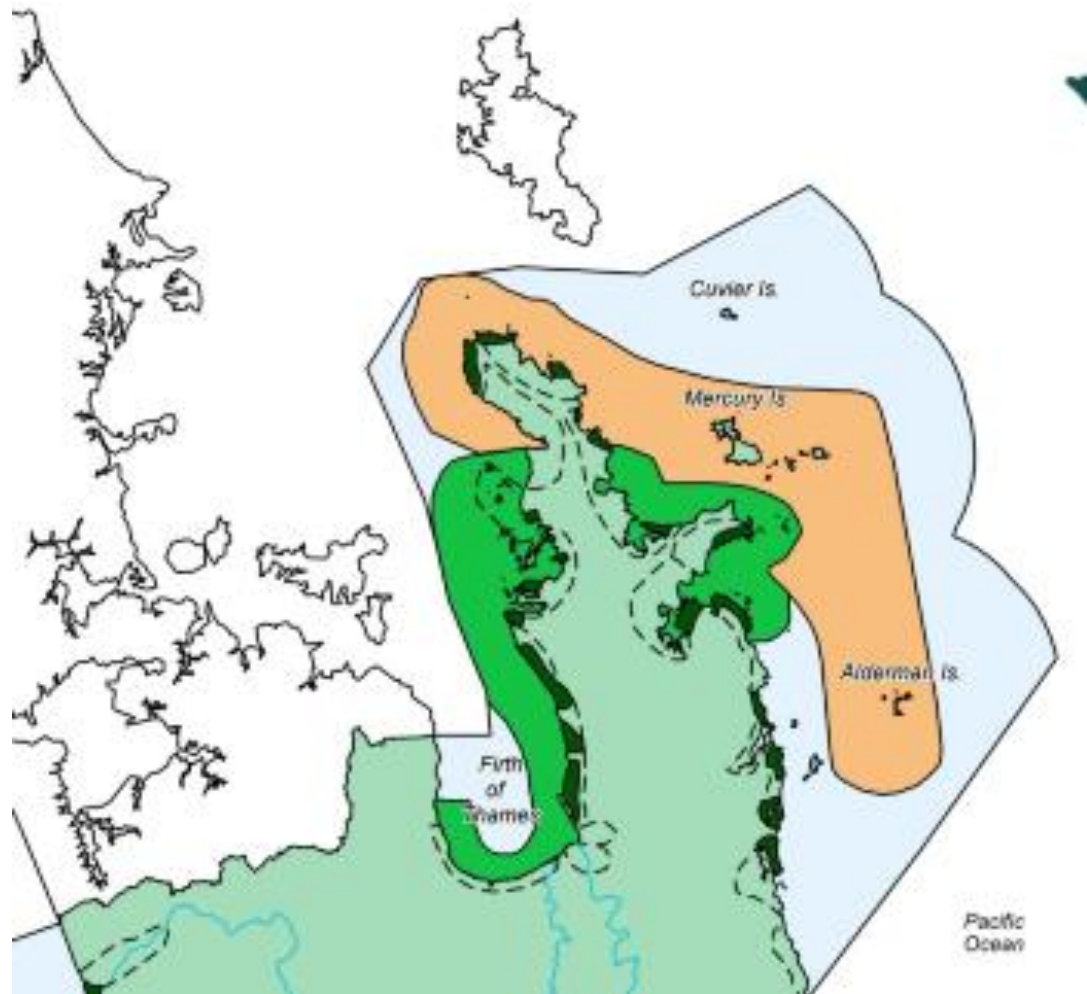
Layer Visibility

- ☐ Rural Urban Boundary [100%]
- ☒ **NonStatutoryInformation**
  - ☐ Address
  - ☒ Indicative Coastline
  - ☒ Macroinvertebrate Community Index
  - ☐ Soil Types
  - ☐ Flood Hazards
  - ☐ Auckland Council Boards
  - ☐ Maori Land
  - ☐ Treaty Settlement alert layer
  - ☒ Hauraki Gulf Marine Park
- ☒ **Zones**

[view the full legend >>](#)

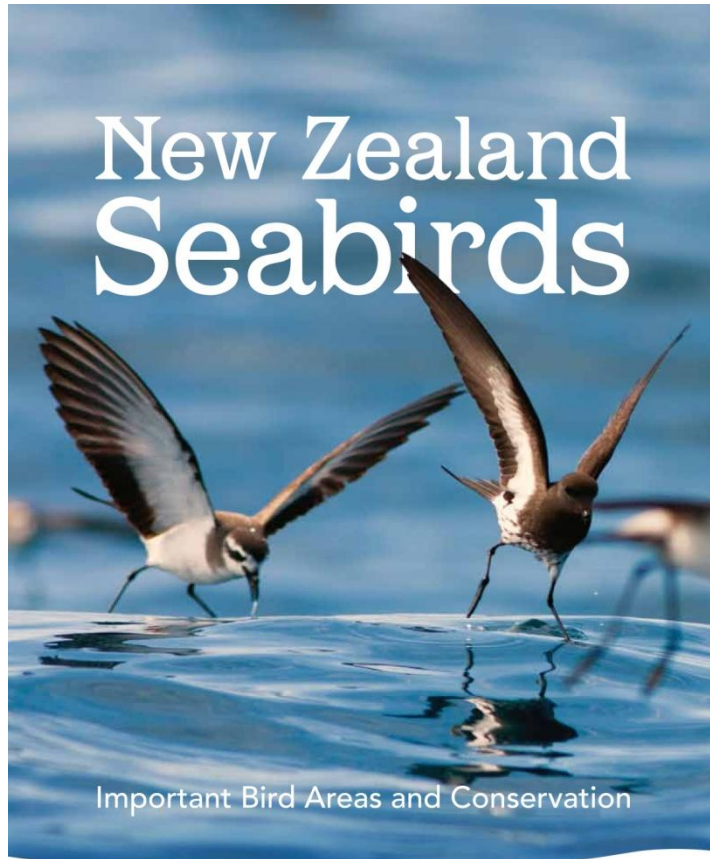
# Landscape assessment

## Waikato Regional Coastal Plan





# Important Bird areas



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## 3 Important Areas for New Zealand Seabirds

**Sites at Sea**  
Seaward extensions,  
pelagic areas



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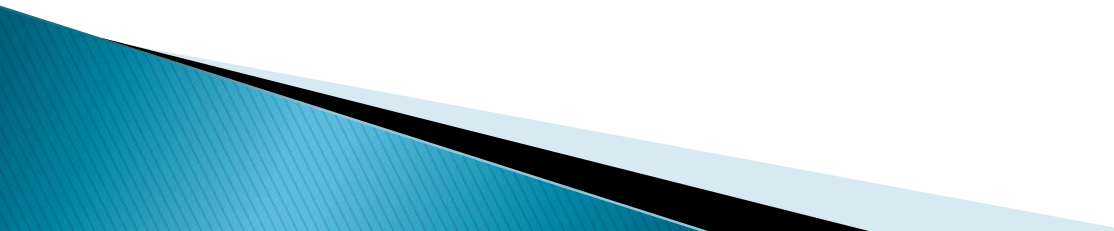


# Global Criteria for Marine IBAs

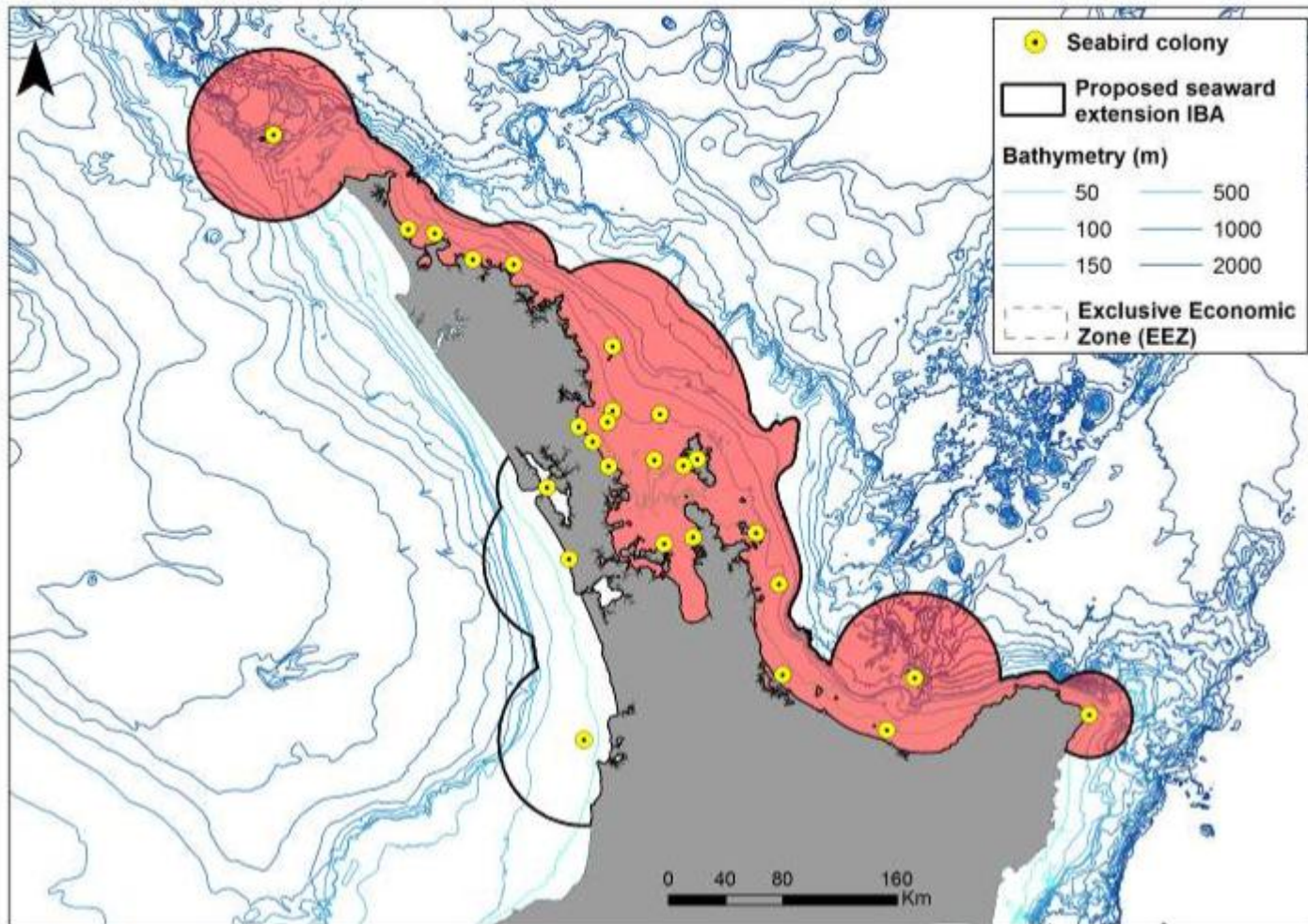
Global IBA criteria have been applied in the marine environment:

- ▶ A1 Regular presence of threatened species
- ▶ A4 More than 1% of global population regularly occurring.
- ▶ There are four aspects of the annual cycles of seabirds where they are most likely to occur in IBA threshold numbers.

These are:

- ▶ 1. Seaward extensions to breeding colonies
  - ▶ 2. Coastal congregations of non-breeding seabirds
  - ▶ 3. Migration hotspots and pathways
  - ▶ 4. Important areas for pelagic species.
- 

# Important Bird Areas – Pelagic



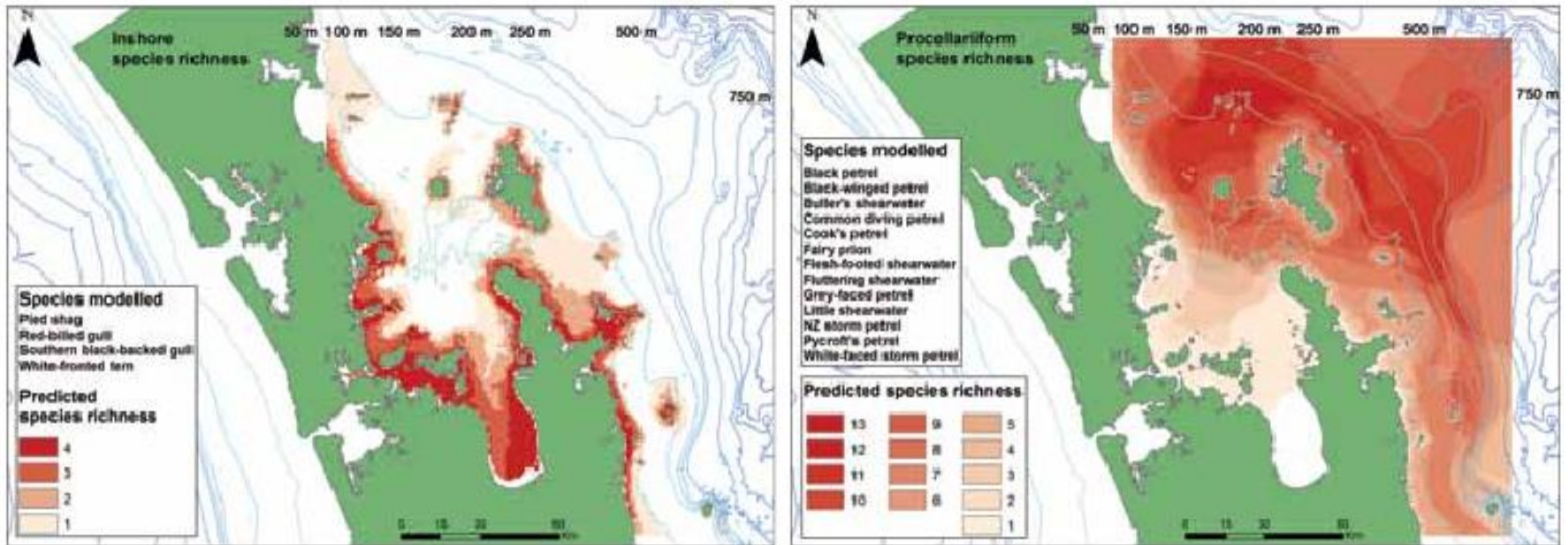
# IBA Some key species

## IBA trigger species:

Species	Tracking	Supporting data	Activity	IBA	IUCN
Buller's Albatross <sup>1</sup>			Passage to colony	A1	VU
Black Petrel <sup>1</sup>	GLS, GPS	Observations	Foraging, passage	A1, A4ii	VU
Buller's Shearwater <sup>2</sup>	GLS	Observations	Foraging, congregations, passage	A1, A4ii	VU
Flesh-footed Shearwater <sup>2</sup>		Observations	Foraging, congregations, passage	A4ii	LC
Fluttering Shearwater <sup>2</sup>	GLS	Seaward extension (30km), observations	Foraging, congregations, passage	A4ii	LC
Cook's Petrel <sup>1</sup>	GLS	Observations	Passage, congregations	A1, A4ii	VU
Pycroft's Petrel <sup>1</sup>	GLS	Observations	Passage	A1, A4ii	VU
Grey-faced Petrel <sup>1</sup>	GLS, GPS	Observations	Passage	A4ii	LC
Fairy Prion <sup>2</sup>		Seaward extension (135km), observations	Foraging, congregations, passage	A4ii	LC
White-faced Storm Petrel		Observations, seaward extension (35km)	Foraging	A4ii	LC
NZ Storm Petrel		Observations, seaward extension (35km)	Foraging	A1, A4ii	EN
Common Diving Petrel <sup>2</sup>	GLS	Observations, seaward extension (20km)	Foraging	A4ii	LC
Australasian Gannet	GPS	Observations, seaward extension (60km)	Foraging	A4ii	LC
NZ Fairy Tern <sup>3</sup>		Seaward extension (5km)	Foraging (in-shore)	A1, A4ii	VU
Species group (multiple species including a number not listed above)		Observations		A4iii	




# Assessment of inshore and pelagic seabirds



Predicted species richness modelling for 19 Hauraki Gulf breeding seabird species from at-sea observations. From: Miller, M.G.R., Gaskin, C.P. (unpubl.). Hauraki Gulf Seabird Modelling Report, prepared for Hauraki Gulf Spatial Planning. Waikato Regional Council.

# Biosecurity Aspects of aquaculture

- ▶ Disease effects on non-farmed marine species – the transfer of disease to the wild;
  - ▶ Introduction of alien species into the marine environment – including the spread or introduction of alien species to the wild eg salmon;
  - ▶ Effect of farms creating conditions in the surrounding marine area that conducive to the spread of diseases and parasites;
  - ▶ Farms acting as a reservoir for diseases or parasites to spread to the surrounding marine area;
  - ▶ Movement of larvae, juvenile or adult species spreading diseases and parasites between areas as a result of movements associated with aquaculture operation eg oyster farms;
  - ▶ Movement of farming material between areas resulting in the spread of diseases, parasites or invasive species e.g. Undaria.
- 

# Marine Biosecurity

Waikato Pest Management Strategy (section 14) acknowledges the problem and costs of taking action in the marine environment:

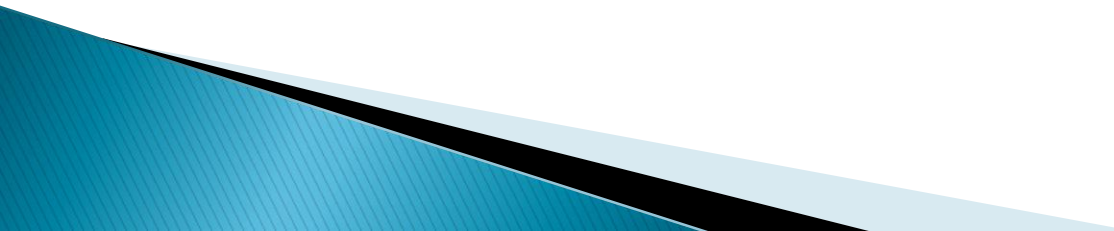
- ▶ *“marine response effort that highlighted the extreme challenges associated with marine biosecurity. The response was to Mediterranean fan worm (Sabella) in Coromandel harbour. The techniques needed in this response were not well-tested, the costs high, the level of MPI responsibility unclear, and the skills needed were in short supply. Waikato Regional Council recognises the importance of marine biosecurity, but this response effort confirms the council’s reservations about capacity and cost.”*
- ▶ *The council also is working with the marine farming industry to address biosecurity issues through Resource Management Act consent conditions.*

# Spread of alien species

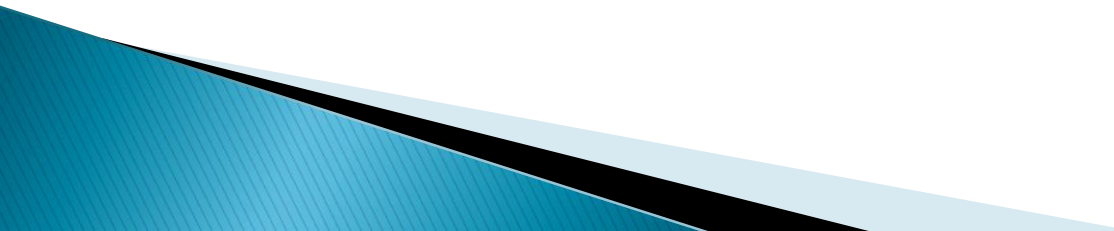
- ▶ Exotic pest species found on mussel longlines include the ascidian *Ciona intestinalis*, macroalga *Undaria pinnatifida*, and mussels *Mytilus galloprovincialis*.
- ▶ *The spread of alien algae Undaria has been related to movement of marine farming gear and spat eg:*
  - Northern North Island: in Coromandel and Great Barrier (2006).



# Other biosecurity aspects

- ▶ Marine farms providing staging posts for the movement of mammalian predators to pest free islands;
  - ▶ For example how far can stoats, rats, etc swim.
- 

# Feed aquaculture

- ▶ Different impacts of feed vs non-feed on benthos eg shell drop from mussel farms vs feed material impacts on benthos.
  - ▶ Impacts below the farm on benthic species both infauna and epifauna;
  - ▶ What is the recovery period for benthic species below a farm once it is removed eg if rotational system was applied.
  - ▶ Nitrogen limits in the Firth of Thames.
- 

# Limits on nitrogen

- ▶ **Policy – Limits on Fed Aquaculture**
- ▶ Manage fed aquaculture by:
  - ▶ a) within the Firth of Thames, limiting the total net discharge of nitrogen from fed aquaculture to a maximum of 300 tonnes of nitrogen per year;
  - ▶ b) within the Wilson Bay marine farming zone (as identified in Map 11 and Schedule 6 in Appendix III), restricting fed aquaculture to Area C and giving preference to the use of this area for fed aquaculture; and
  - ▶ c) within the Coromandel marine farming zone (as identified in Map 13 and Schedule 6 in Appendix III), limiting the total net discharge of nitrogen from fed aquaculture to a maximum of 800 tonnes per year and an associated maximum of 13,600 tonnes of feed discharged per year.
- ▶ Waikato Coastal Plan – Policy 6.1.1.B

# Some issues to consider

Research on the impacts of marine farming needs to be related to the:

- ▶ type of farming – feed vs non-feed;
  - ▶ Placement of farm eg depth, water movement;
  - ▶ Species being farmed; and
  - ▶ Importance of the area and use by other species
  - ▶ Baseline information on areas before marine farms and clear monitoring of farms and cumulative effects with other activity needs to considered.
- 