

The potential environmental impacts of aquaculture

Shane Kelly



Introduction

- Large body of research on the effects of aquaculture
- Potential effects well known, and in general terms, reasonably well understood
- Environmental context and local application
- Cumulative impacts

Challenges

- Utilisation of finite resources:
 - Space
 - Assimilative capacity
- Increasing competition among resource users
- Rapid commercial and human timeframes
- Slow and creeping environmental responses



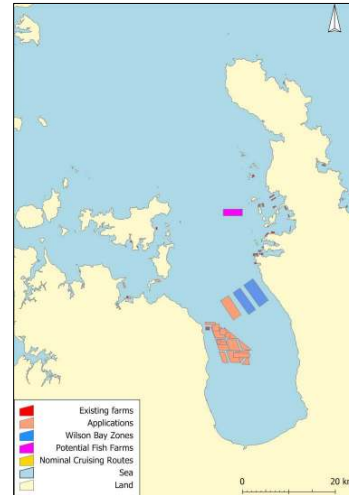
Talk overview

- Examples of some issues
- Cumulative impacts case study: Firth of Thames
 - Prompt thinking about:
 - broader context,
 - environmental limits, and
 - dealing with cumulative impacts
 - Not an assessment of actual impacts
 - Other past and present impacts
 - Additional impacts of aquaculture



Context

- Firth of Thames long history of shellfish aquaculture with small mussel and oyster farms, and Wilson Bay Zones A and B
- High demand for more space and desire to farm new species: particularly fish
- Aquaculture Legislation Amendment Bill (No 3): new species and extensions to existing farms in Waikato, removal of AMAs, processing of frozen applications, provision for excluded areas.
- Aquaculture Ministerial Advisory Panel considering the establishment of a fish farming zone



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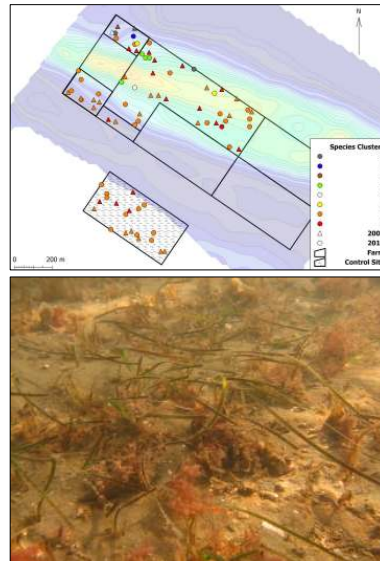
What are the impacts of aquaculture?

- Many, but -
- Species, location and farm specific
- Examples of some common issues:
 - Benthic Impacts
 - Phytoplankton depletion
 - Nutrients
 - Landscape and natural character

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Benthic Impacts

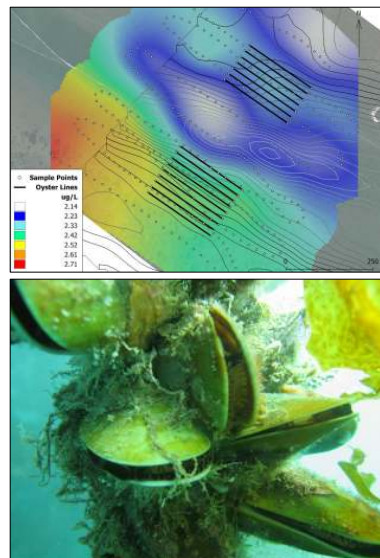
- Causes and potential impacts well understood.
- Deposition of organic material, shading, change species composition and sediment characteristics
- Tools available to assess
- Managed through site selection, farm design and stocking rates.
- Acceptance of some effects



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Phytoplankton depletion

- Causes well understood
- Natural variability
- Tools available to assess
- Implications for farm and ecosystem productivity
- May offset adverse impacts of nutrients
- Managed through site selection, farm size and design, and stocking rates



Nutrients



- Greater issue in fed species
- Causes well understood
- Metabolic waste and decomposition of food
- Assessment tools still being developed
- Long term and compounding effects uncertain
- Managed through site selection, farm size and design, species and stocking rates



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Landscape and natural character

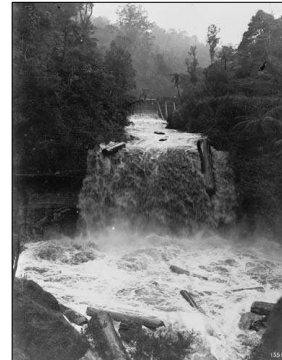
- Causes and potential impacts well understood
- Tools available to assess
- Human subjectivity
- Managed through site location, farm size and design.
- Acceptance of some effects.



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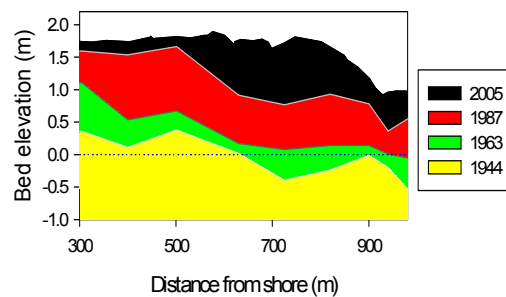
Case Study: Cumulative impacts and Aquaculture in the Firth of Thames

- Hauraki Plains contained largest wetland in NZ
- Kahikatea logged, land drained and converted to dairy farms
- Mining generated sediment and contaminants
- Ohinemuri and Waihou Rivers declared as sludge channels by proclamation
- Kauri logged and dams used to flush logs down rivers



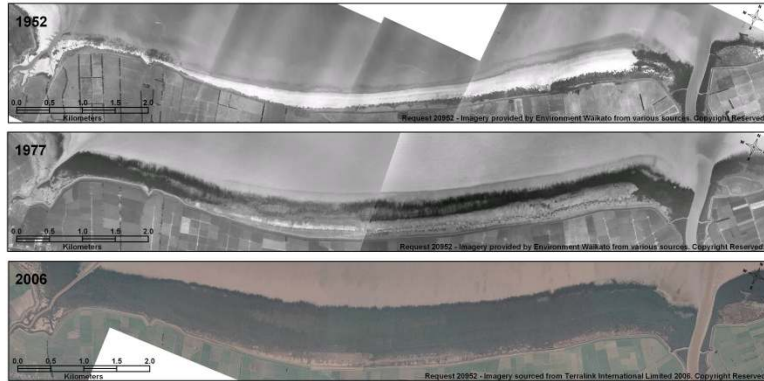
Sediment accumulation

- Sediment accumulation in southern FoT
 - 800 m band were bed raised 1-1.5 m
- Change from sandy-mud to muddy sand



Swales, A., Bell, R.G., Ovenden, R., Hart, C., Horrocks, M., Hermanspahn, N., Smith, R.K. (2007) Mangrove-habitat expansion in the Southern Firth of Thames: sedimentation processes and coastal-hazards mitigation Environment Waikato Technical Report 2008/13, Environment Waikato, Hamilton

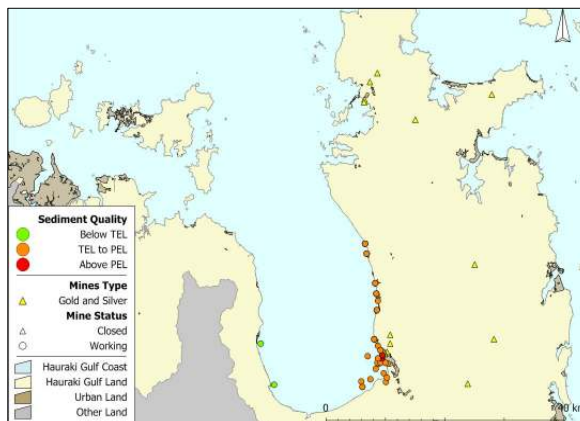
Mangrove expansion



Swales, A., Bell, R.G., Ovenden, R., Hart, C., Horrocks, M., Hermanspahn, N., Smith, R.K. (2007) Mangrove-habitat expansion in the Southern Firth of Thames: sedimentation processes and coastal-hazards mitigation Environment Waikato Technical Report 2008/13, Environment Waikato, Hamilton



Sediment contamination

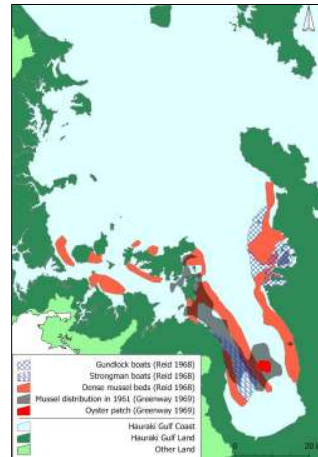


Kim, N. (2007) Trace elements in sediments of the lower eastern coast of the Firth of Thames. Environment Waikato Technical Report 2007/08, Environment Waikato, Hamilton



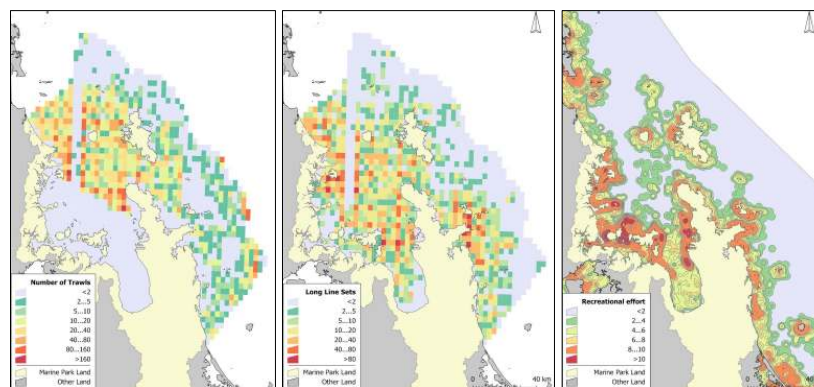
Mussel dredging

- Elimination of mussel beds
 - Highest secondary productivity rates
 - supported 200 – 16,000 tonnes of small predatory fish per year
 - Possibly filtered FoT in < 1 day c.f. 2 years today.



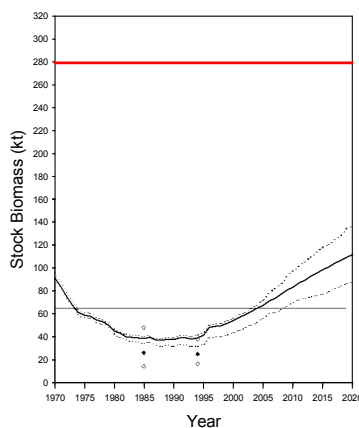
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Fishing



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Hauraki Gulf Snapper



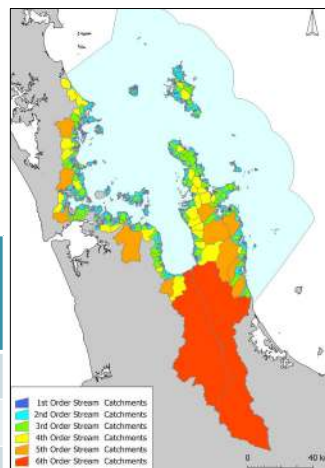
Ministry of Fisheries Science Group (2009) Report from the mid-year Fishery Assessment Plenary, November 2009: stock assessments and yield estimates. Unpublished report held in NIWA Greta Point library, Wellington, Ministry of Fisheries, Wellington



Nutrients: Extent and trends

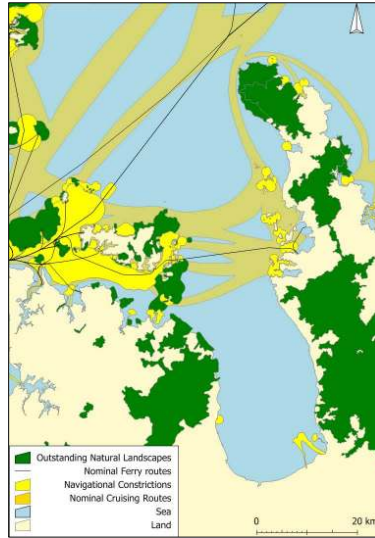
- FoT nutrient loads changed from predominantly oceanic to riverine
- ~ 90% of Waikato nutrient load comes from Waihou and Piako Rivers
- N loads increasing by 1%(W) and 3.4% (P) per year

Food conversion ratio	Tonnes of fish	Farm:River DIN	Farm:Ocean DIN
1.7	4000	10%	62%
1.7	8000	20%	124%
1.3	4000	8%	15%
1.3	8000	47%	95%

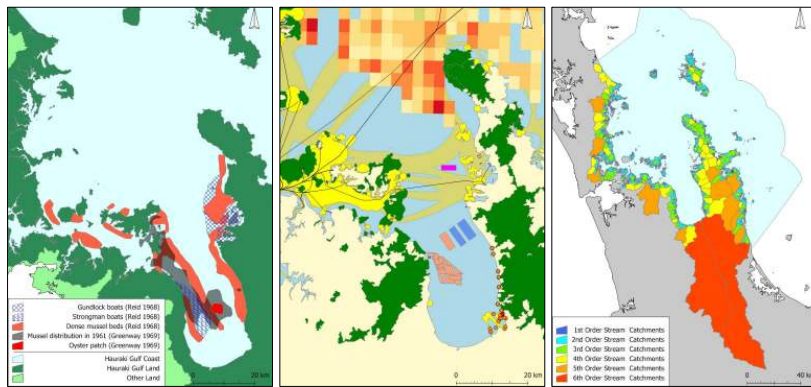


Zeldis, J., Broekhuizen, N., Forsythe, A., Morrissey, D., Stenton-Dozey, J. (2010) Waikato marine finfish farming: Production and ecological guidance. Client Report for MFish Aquaculture Unit CHC2010-147, NIWA, Christchurch

Landscape and boating



Cumulative effects, the shifting baseline, and environmental limits



Implications

- Aquaculture is one of the most highly regulated industries in NZ (but controls will be loosened)
- Most effects are well understood (but there are a few exceptions)
- History of research, innovation and adapting farm practices to address environmental issues
- Despite this, some environmental impacts are inevitable
- Aquaculture is competing for the same, limited set of resources as other users
- Increasing demand for natural resources is coupled with their creeping loss



Environmental Challenges

Experience has shown that environmental change is commonly unidirectional

How can the combined impacts of aquaculture, dairy, fishing, development and other activities be managed?

How can competing demands be environmentally accommodated?

