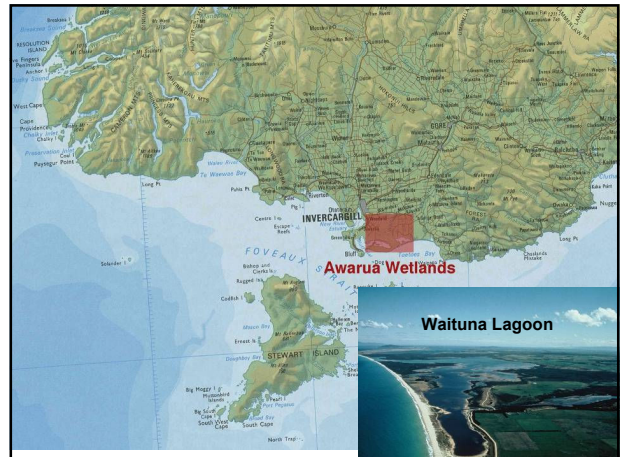
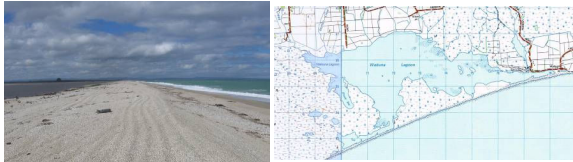


Status and Vulnerability of Macrophyte Populations in Waituna Lagoon: Finding the right balance

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Background



- Waituna Lagoon is a macrophyte dominated shallow (depth rarely exceeds 2 m) coastal lake
- Intermittently opened to the sea by digger
- Macrophyte community is dominated by *Ruppia* species
- Fairly unique to NZ
- Other aquatic plants include; *Myriophyllum*, Charophyte species, and filamentous algae (*Bachelotia* and *Enteromorpha*)

What is *Ruppia*?

- An aquatic plant known as horse's mane
- Two species in the lagoon – *megacarpa* and *polycarpa*
- Salt tolerant genera
- Keystone species in Waituna for its role in:
 - Regulating water quality
 - Habitat for fish and invertebrates
 - Food for grazing birds



Vulnerability to environmental changes

- Studies have shown that optimal macrophyte survival is dependent on:
 - High light environment
 - Salinity of between 4 and 8 ppt for seedling establishment and growth
 - High water levels (protect from desiccation, wind)
 - Low phytoplankton biomass
 - Low suspended sediment concentrations

Conditions in Waituna Lagoon

- Changes in land use in the catchment has resulted in increasing loads of nutrients and sediment to the lagoon
 - Decrease light penetration in the water column (turbidity)
 - Increase growth of phytoplankton / nuisance algae
- Lagoon is opened more frequently and for longer duration
 - Subject *Ruppia* to higher salinity
 - Flushes excess nutrients and sediments
 - Lowers water level, tidal fluctuations

Risk

Loss of macrophytes with a subsequent shift of the lagoon to a phytoplankton dominated state

Schallenberg & Tyrell (2006) found that a maintenance of a high light environment is essential for macrophyte survival

Recommendations:

- Examine water levels in relation to opening regime
- Manage water quality
- Investigate salinity and light requirements of *Ruppia* in Waituna
- Monitor macrophyte distribution and status

Aim

- The overall project aim is to maintain and enhance the *Ruppia*-dominated macrophyte beds
 - Thus, the aim is to describe the status of macrophyte beds and in particular *Ruppia*
 - And to explore optimal growing conditions and the vulnerability of *Ruppia* to environmental changes in Waituna Lagoon

Monitoring Methods

- 2007 – aerial photography and randomised survey sites
- 2009 – Survey using 10 transects across the lagoon with 47 sites total (4 sub samples per site)
 - Measurements included:
 - Macrophyte cover abundance and height
 - Secchi disc clarity
 - Sediment type
 - Depth to sulphide layer
 - Water depth
 - Salinity
 - Temperature

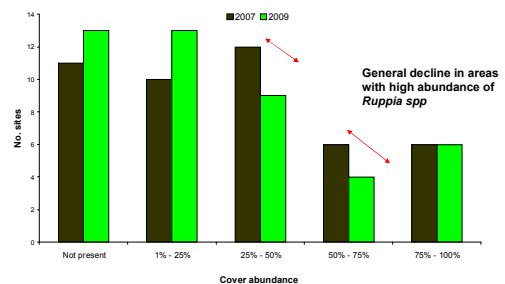
Methods

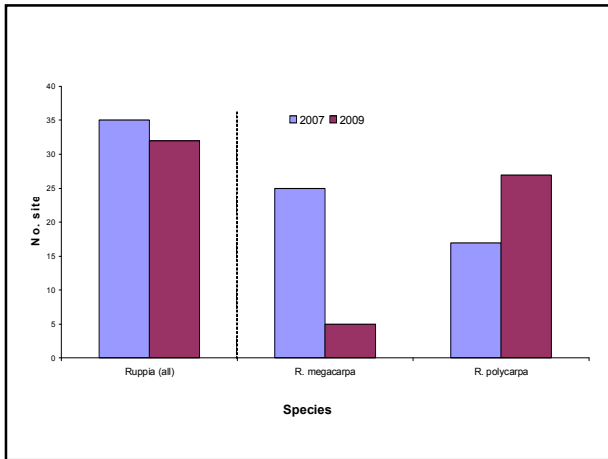
- A Garden hoe brought the macrophyte samples to the surface
- Each sample was photographed



Results – Status of the Macrophyte beds

- 2007
 - High abundance of both *Ruppia* species with *megacarpa* dominating deep waters (1-2 m) and *polycarpa* in shallower waters (0.5-1 m)
 - Low presence of *Myriophyllum*
- 2009
 - Big decrease in *megacarpa* abundance
 - Increasing dominance of *polycarpa*
 - Increased presence of *Myriophyllum*



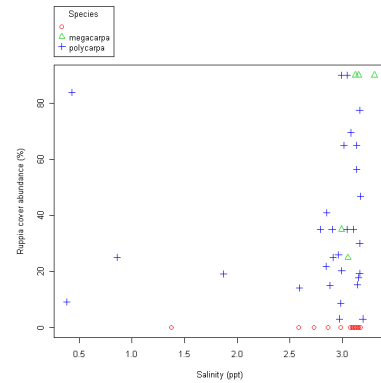
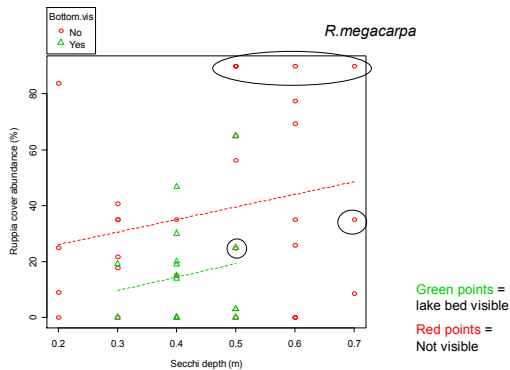
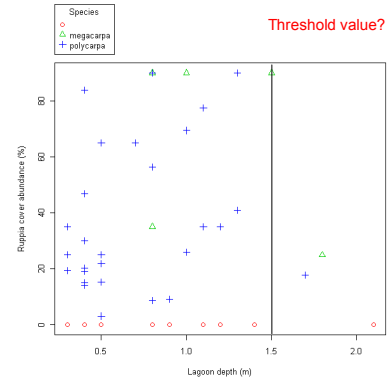


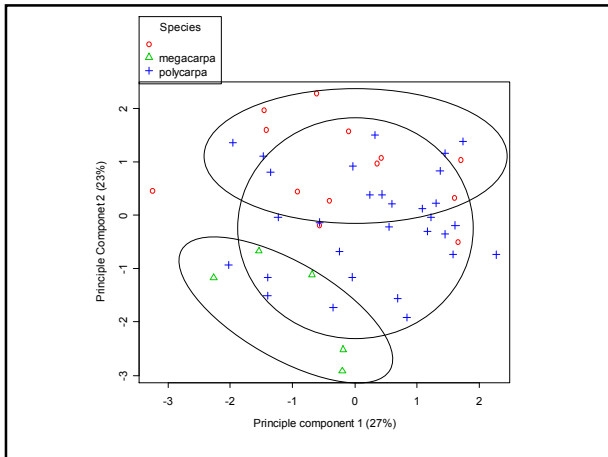
What may have caused these changes?

- 2007
 - Filamentous algae only present in few localised areas
 - Clean substrate with little anoxic sediments
 - High water clarity (1.5-2 m)
- 2009
 - Increased growth of *Bachelotia* and *Enteromorpha*
 - Eutrophic sediments
 - Low water clarity (0.2-0.7 m)

Environmental conditions

- What are the physical variables driving the abundance of *Ruppia* in Waituna Lagoon?
 - Water depth (m)
 - Secchi depth (m)
 - Salinity
 - Combination of variables?





Discussion & Conclusions

- There has been a shift in conditions in Waituna since 2007 with an increase in nuisance algae, and poorer water and sediment quality
- Decline in condition of *Ruppia* beds evident by the decreasing overall abundance since 2007
- *Ruppia* in Waituna Lagoon is vulnerable to shifts in environmental condition
- Data so far is not giving a clear picture of what *Ruppia* requires

Finding the Right Balance

- **Project aim is to maintain and enhance the *Ruppia*-dominated macrophyte beds**
- How will we do this?

Which areas of the lagoon can support *Ruppia*?

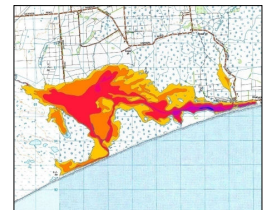
Filters (stressors)

- Water depth
- Salinity
- Light limitation (water clarity)
- Competition (macrophytes, algae)
- Herbivory (e.g. birds)

Ecosystem model



Drive management and restoration goals



Future Work...

- **Develop an ecosystem model**
- **Yearly macrophyte monitoring during optimal growing conditions**
- **Continuous data logging in the lagoon during different lagoon conditions**
 - E.g. Post closing and during infilling of the lagoon
- **Examine the biological influences**
 - Biotic competition?

Acknowledgements

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