

Bio-manipulation for lake restoration

Mary de Winton

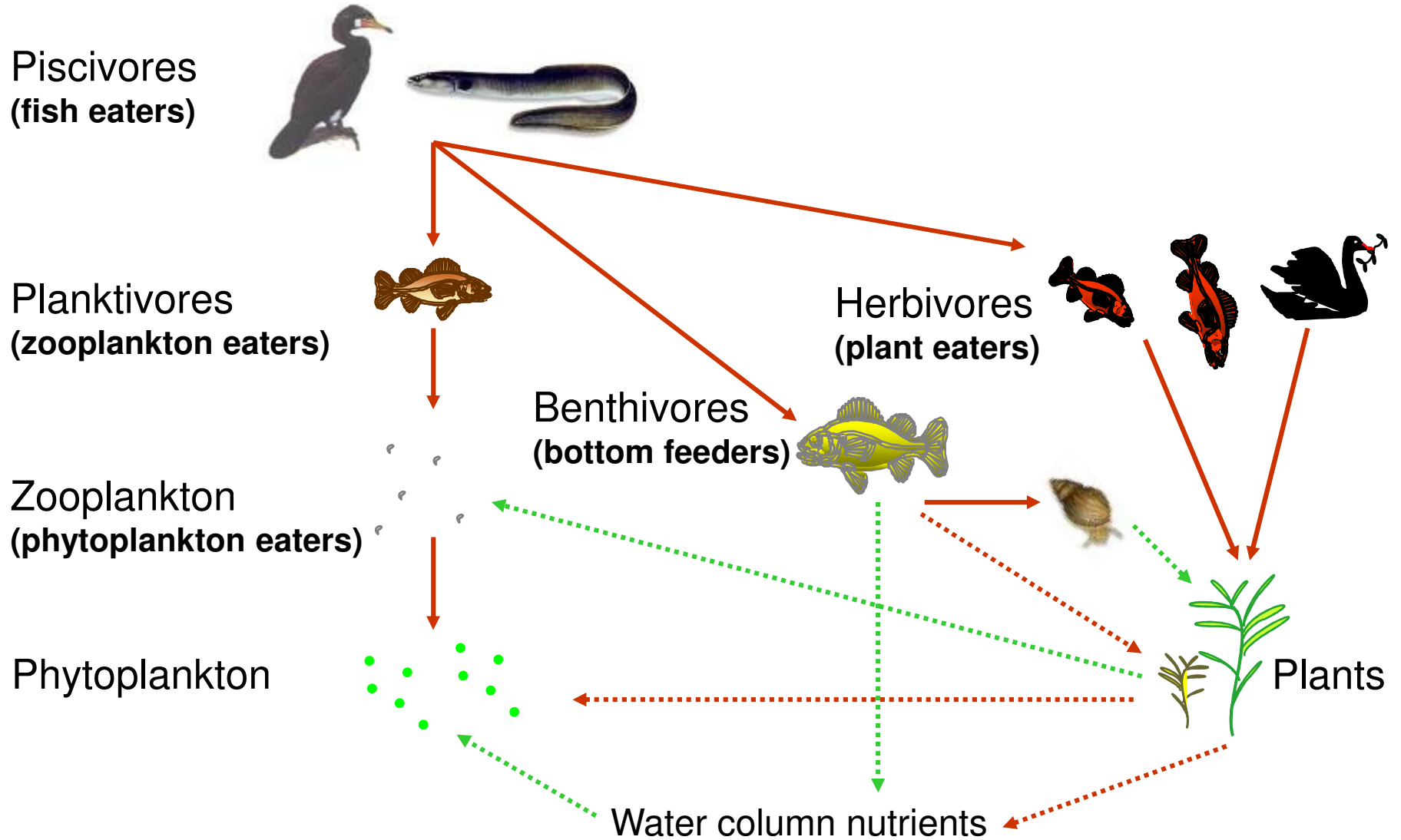
Piet Verburg



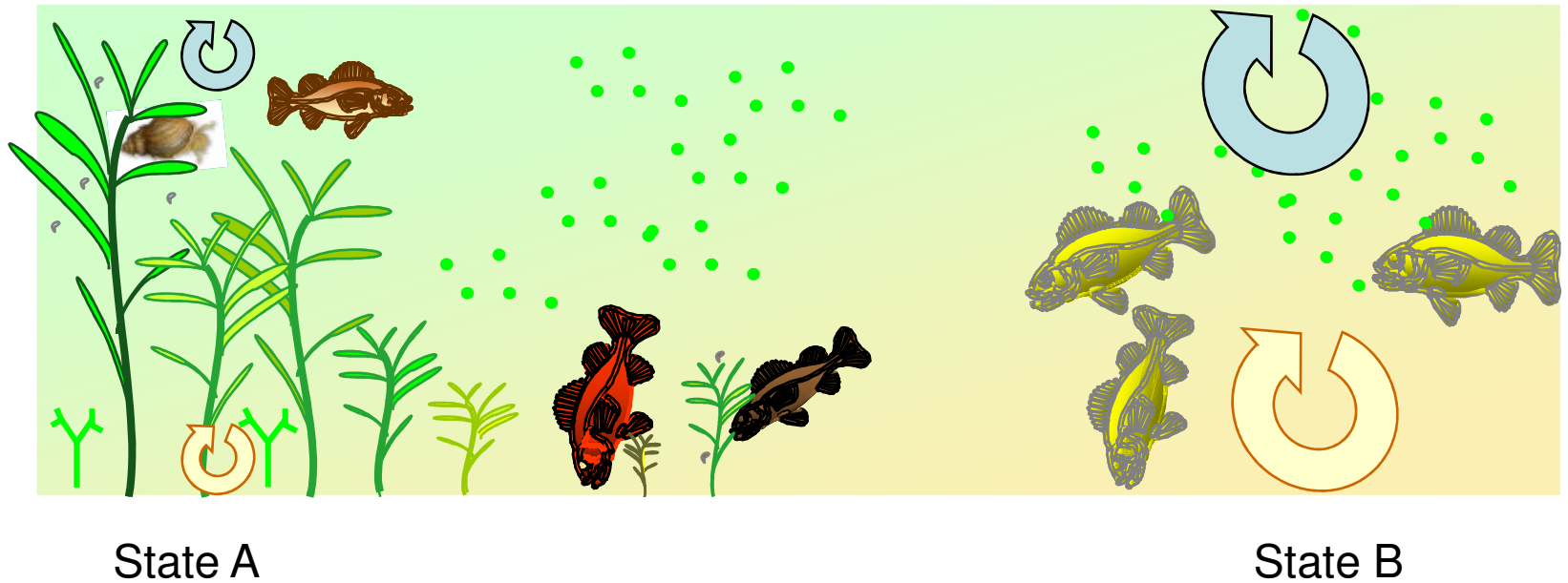
Biomanipulation definition

- Adjusting the biological community (often fisheries) to achieve a desired outcome
- Desired outcome includes
 - Reduced phytoplankton blooms (especially cyanobacteria)
 - Less turbid water
 - Submerged plants for stability
 - Removal of pest species

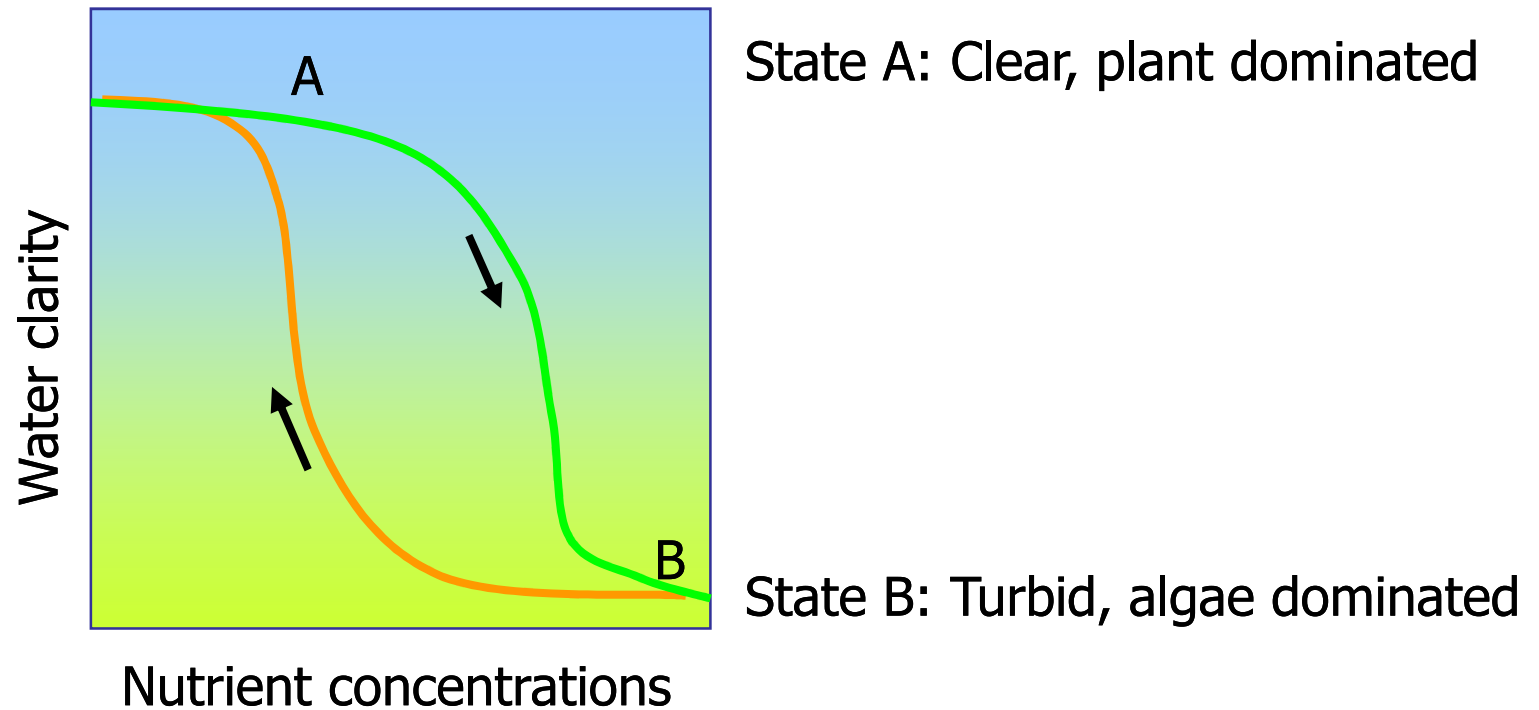
Food chain



Changes in shallow, nutrient rich lakes



Acting with nutrient management



Biomanipulation a tool to help force lake back to state A

Enhancing piscivores?

- Few large piscivores (long fin eel, large perch, brown trout, shag)
- Not suited to turbid shallow lake conditions (e.g. visual predators)
- Populations lag behind prey numbers



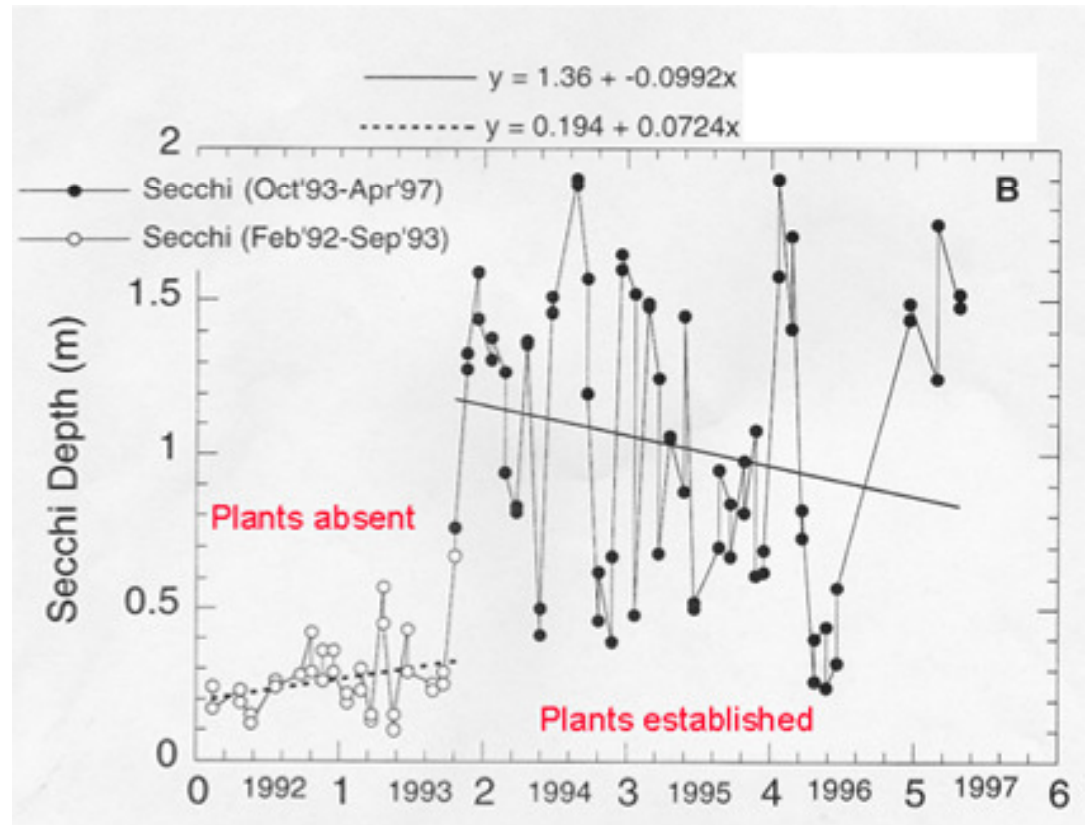
Enhancing phytoplankton grazers?

- Lack large zooplankton? (exotic species?)
- Vegetation refuge OR reduce planktivorous fish?
- Latter looks promising (Lower Karori Reservoir)
- Silver carp not proven.....
- Freshwater mussels as biofilters?



Lake Omapere

Role for mussels in clearing of waters?



Lake Omapere mussels at densities that could filter the entire lake volume within 24 hrs

Lake Rotoroa estimated 6 mussels per m² required for volume and area

= at least 3 million!

Not enough information on mussel recruitment

Reducing coarse fish?

- Fishing pressure required? (i.e. extent, ongoing)
- Feasibility of eradication? (rotenone)
- Anecdotal evidence of success



Lake Rotomanuka

**Vegetation decline (late 1990's)
Rudd, catfish, goldfish**

**Light for plant growth to 2-4 m, but plants
only to <0.3 m**

**Fish exclosures to test plant
establishment with & without fish access**





Native pondweeds added inside & outside exclosures



Pondweeds inside grew to surface within 4 months, none survived outside

Plants disappeared when some exclosures were removed



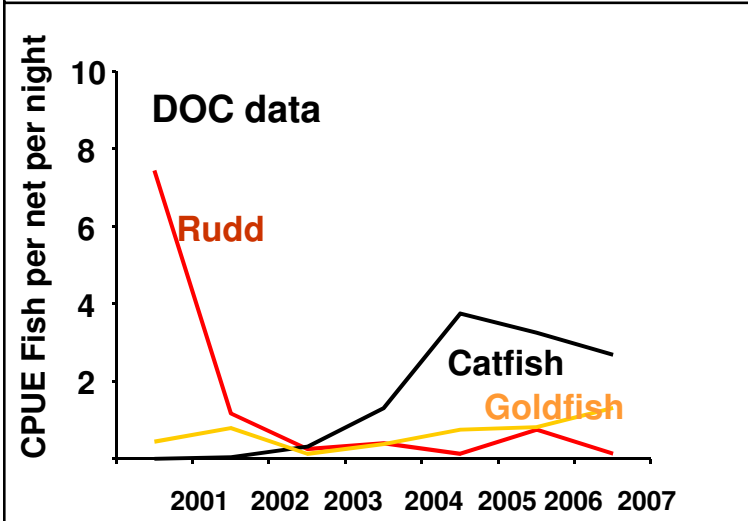
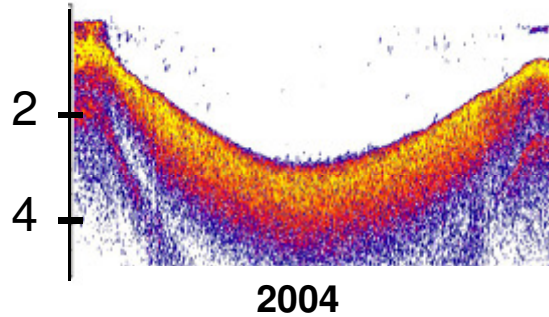
Exclosure plants still growing & seeding

Lake Serpentine South

Few submerged plants
Rudd, catfish and goldfish present

Sonar trace doesn't detect plants

DOC & EW fishing reduced rudd population (DOC data)

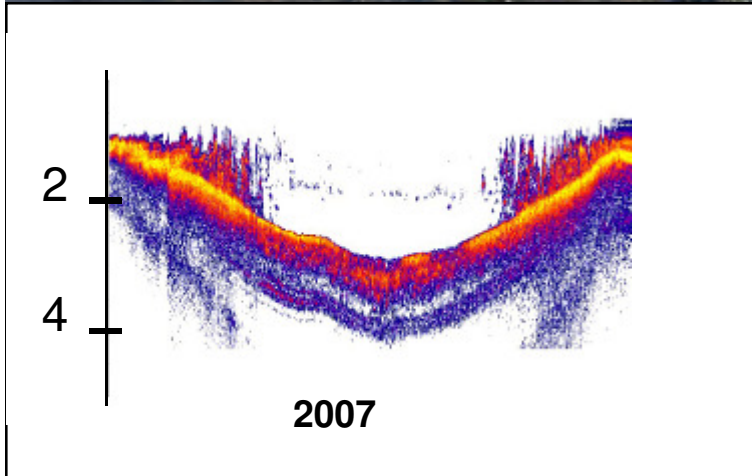




Native pondweeds recovered 4-5 years after fishing began



Seasonally surface reaching & seeding

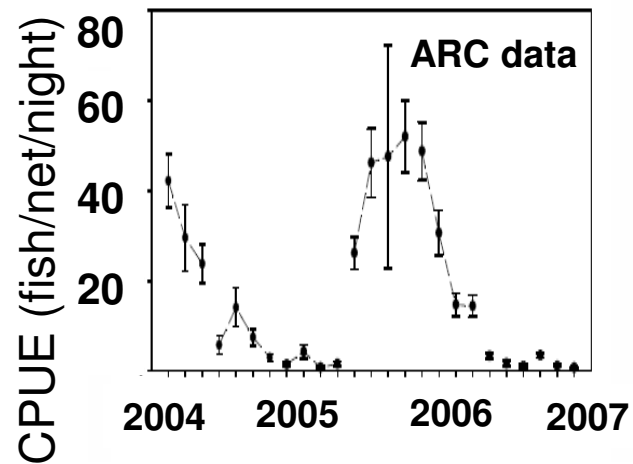


Repeat sonar trace detects dense, tall beds

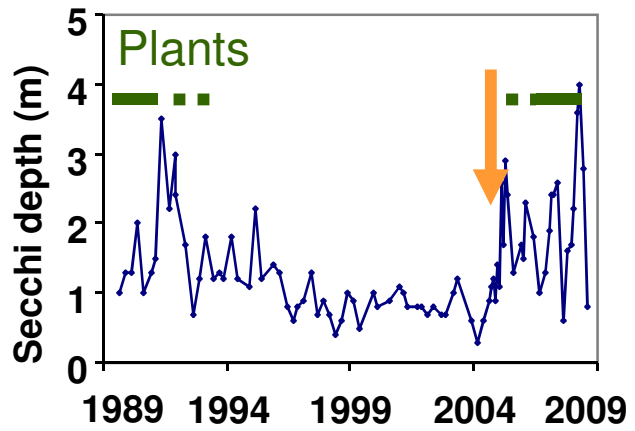
Lake Wainamu

**Vegetation lost between 1995 and 1999
Perch abundant, goldfish and rudd
common**

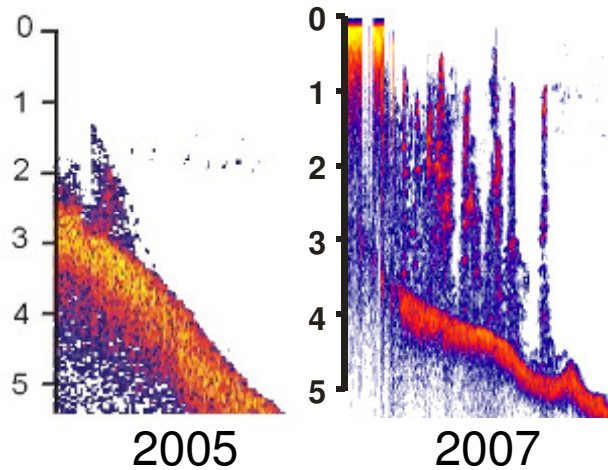
**Community group guided by ARC starts
intensive netting to improve water quality**



9908 exotic fish removed (ARC data)



Water clarity improved after fishing (ARC data)

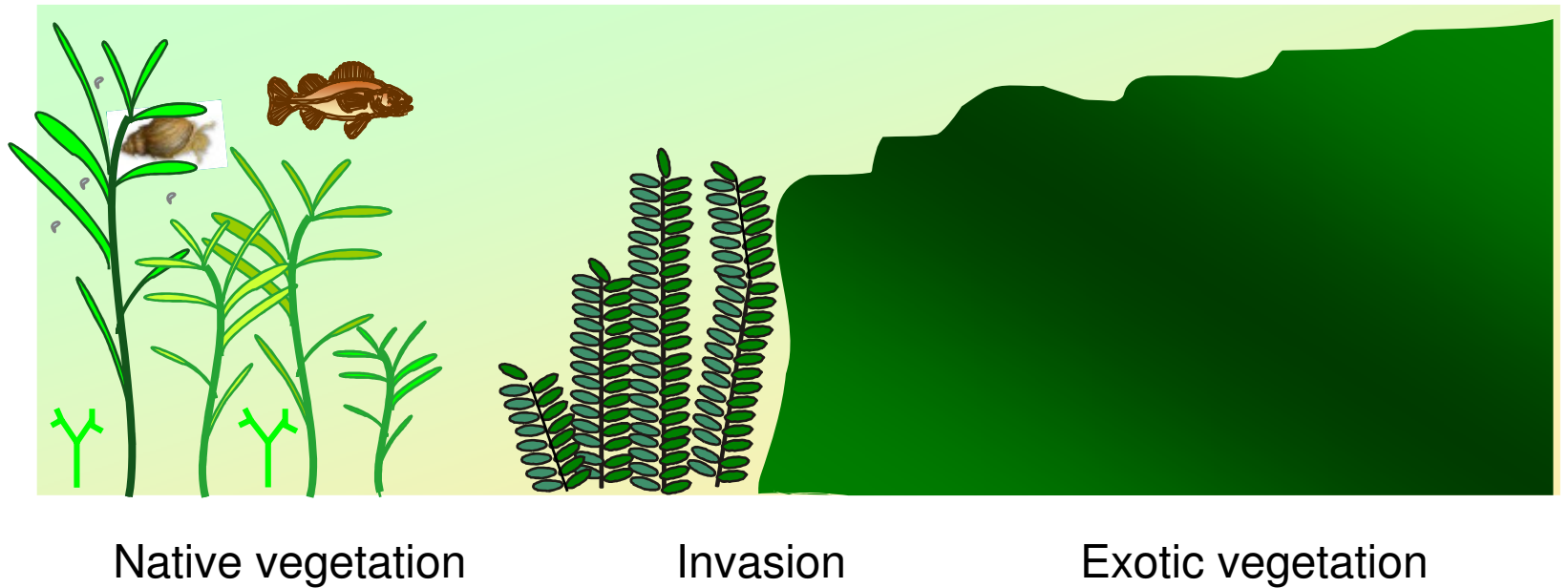


Submerged plants recolonised over 2005 to 2007



BUT dominated by exotic weed egeria

Changes in shallow, nutrient rich lakes



Enhancing herbivores?

Grass carp can remove submerged vegetation within 2 years

Difficult to remove, live for 15 years+

Still not widely used in lakes



NZ biomanipulation

- Biomanipulation compliments nutrient management
- Fish control might improve water quality & submerged plants recovery
- Mechanisms?
- Biomanipulation outcomes uncertain, no guarantee

Adaptive management to learn from success & failures?

Acknowledgements

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