

Year 11 Earth and Environmental Science
Human Impacts @ Penrith Lakes
(Introduced Species – includes Depth Study modelling)

Key inquiry question : How do introduced species affect the Australian environment and ecosystems?

Students:

- outline the biotic and abiotic effects of introduced species
- conduct an investigation into a local introduced species, including:
 - reason for introducing the species
 - biotic and abiotic effects of the species
 - area affected by the species
 - human impacts that favour the introduced species
 - control or mitigation methods
 - economic impact of the species
 - different views about the value of and/or harm caused by the introduced species
- analyse ways in which human activity can upset the balance of ecosystems and favour introduced species
- describe ways in which introduced species contribute to the decline or extinction of native Australian species

Student Name: _____

Case Study: Introduced species at Yarramundi Lagoon

Investigation into a local introduced species. Primary research is undertaken in a kayak.



Working Scientifically

An investigation into Salvinia (*Salvinia molesta*) at Yarramundi Lagoon

Preamble: The newspaper headlines below indicate a problem in the past for Yarramundi Lagoon. It was infested with the 'green monster', *Salvinia*.

Your task is to assess if *Salvinia* is currently a threat to the Lagoon. This requires a knowledge of 'favourable' conditions for *Salvinia* to thrive (see information at the bottom of the page). Conditions may be the result of human activity and/or related abiotic factors.

Paddling around the lagoon you are to gather data on the distribution and abundance of *Salvinia*, other biotic species, abiotic measures and human impacts.

Inquiry question : *Is salvinia currently a threat to the Yarramundi Lagoon ecosystem?*

Battling the monster
'a green monster ... never to be overcome.
Clearing the river of salvinia weed'
Penrith Press, Friday, June 25, 2004

Dynamic Duo!
'The harvesters are... to move to ... hotspots
such as Penrith .. and Yarramundi'
Gazette, Wednesday, May 5, 2004

RIVER UNDER REPAIR
Salvinia weed shocks minister
Gazette, Wednesday, April 21, 2004

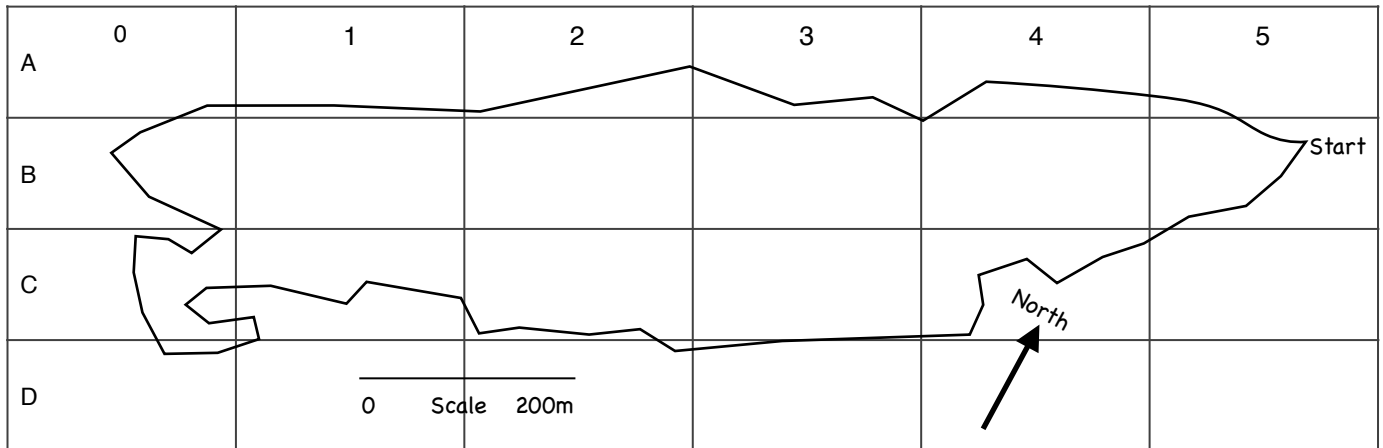
Weed problem grows
'Yarramundi has been choked by a vigorous
weed ... salvinia ... it may only be a matter of
time before entire stretches of the river in
Penrith become a thick carpet of green'
Western Weekender, June 26, 2004

Green monster's back
'Weed was as thick as carpet from
Yarramundi Lagoon to Penrith weir'
Gazette, June 22, 2005

Preferred abiotic conditions for <i>Salvinia</i> growth (not all factors need to be present)	
Phosphate	Greater than 2 ppm.
Temperature	Between 20°C and 30°C. Not less than 10°C or greater than 40°C
pH	Between 6 and 7.7
Conductivity (Salts)	Less than 1000 ppm. Low salt content but can tolerate brackish water.
Light	High light intensity - above 10.000 lux
Flow rate	Still or slow moving water

Primary Data Sheet 1

1. Paddle and Observation: Using the sketch map of Yarramundi Lagoon and the key, mark in features observed on your kayak trip.



KEY		
Salvinia - S = 1-10 plants	Approx. Depth (m): <1 1 2 >2	Emergent plants - ep
Submerged plants - sp	Floating attached plants - fa	Other free floating plants - ff

2. Measuring abiotic data : Use the following instruments to conduct abiotic tests. Record results. Use these results to determine a 'threat' point score and rating.

Abiotic Factor	Instrument	Abiotic Factor	Instrument
Phosphate	Test tablet kit (ppm)	Conductivity	Total Dissolved Solids Scan (ppm)
Water Temperature	Thermometer (°C)	Light	Lux Meter
pH	Universal indicator paper (a number)	Flow rate	Observation (use your eyes)

Salvinia Threat Assessment Sheet									
Phosphate (nutrients): _____ ppm					Conductivity (salts): _____ ppm				
0 - 0.05	>0.05 - 1	>1 - 1.5	>1.5 - 2	>2	<500	501-600	601-750	751-1000	>1000
8	6	4	2	0	0	1	2	3	4
Water Temperature: _____ °C					Light : _____ Lux				
< 10	10-19	20 - 30	30 -40	>40	< 900	901-5000	5001-10000	10001-30000	> 30000
8	4	0	4	8	4	3	2	1	0
pH: _____					Flow Rate : Observation				
< 5.9	5.5 - 5.9	6.0 - 7.7	7.7 - 8.4	>8 .4	Still	Little Flow	Steady Flow	Fast Flow	Rapid
4	2	0	2	4	0	1	2	3	4

Salvinia Alert (Threat) Rating	
Total Point Score	Alert Rating
24 - 32	Low
18 - 23	Moderate
12 - 17	High
7 - 11	V. High
0 - 6	Extreme

Total salvinia threat point score =

Primary Data Sheet 2

- Using a dip net, sweep the edge of the lagoon to collect water bugs.
- Did you catch any of the water bugs pictured below? Tick the box if found.



1. Damselfly Nymph



2. Gambausia



3. Freshwater Shrimp



4. Caddisfly Larve



5. Backswimmer



6. Water Spider



7. Dragonfly Nymph



8. Water Beetle



9. Tadpole



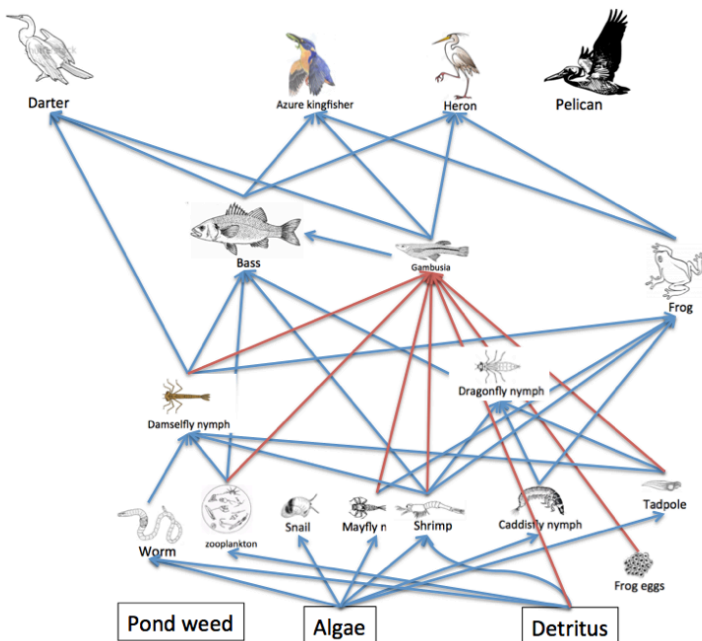
10. Water Boatman

One of the above water bugs was introduced by humans to control mosquitos in Australia. This vertebrate eats a large range of invertebrates. It can live in poor quality water e.g. low oxygen. It breeds quickly with 'live births' (not eggs). A female can produced up to 100 young at a time. The babies can swim. It is higher order consumer. In relatively shallow water it has very few predators.

Which water bug do you think was introduced? _____

How could this vertebrate upset the balance of the Yarramundi freshwater ecosystem?

A Freshwater Food Web



A Local Extinction Event

The introduced species above had a preference for feeding on frog spawn and tadpoles in Australia. It is believed to be responsible for the decline or extinction of many frog species in local areas where it is found.

Around Yarramundi and Penrith Lakes it is believed to be responsible for extinction of the Green and Gold Bell Frog (pictured).



Secondary Data Sheet

Read the quotes about salvinia from local newspapers. Match the quotes with the categories at the bottom of the page.

Quote A - Penrith Press (PP)

'Reducing environmental flows risked killing the river altogether. The reduction would impact water quality with higher nutrient and bacterial concentrations.'

Quote C - HG

'This insidious problem is displacing native wildlife.'

Quote B - Hawkesbury Gazette (HG)

'It took 3 mechanical harvesters 6 months to clean up the noxious weed and chemical spraying to rid the residual.'

Quote D - HG

'Boating, swimming and fishing are becoming difficult, and even drinking water supplies are under threat.'

Quote H - PP

'Booms have been placed across the river.'

Quote E - PP

'The situation is worsened by rising imports of exotic water plants for aquariums and garden ponds. There is also illegal growing of alien water plants.'

Quote F - HG

'River damming, over-extraction of water and treated effluent discharge, fertiliser run-off and soil erosion help turn the river and wetlands into a nutrient-rich soup.'

Quote J - ISC

'Salvinia was a perfect harbour for mosquitoes bearing deadly diseases.'

Quote K - PP

'The foreign pest is already building up at Yarramundi and other stretches of the Hawkesbury River. Last summer's disaster ... invaded a 30 km stretch of river 1 m deep.'

Quote I - HG

'Sydney Water is the biggest polluter of the Hawkesbury Nepean. People have to stop blaming the farmers.'

Quote G - HG

'Weed invasion of the river is now driving tourists away from our waterways.'

Quote L - PP

'The salvinia weevil, which eats the weeds, had not been particularly successful.'

Quote N - HG

'Salvinia 'mats' shade out any submerged plant life and impedes oxygen exchange, making the water unsuitable for fish and other animals.'

Quote M - PP

'Salvinia moves into new catchments by human activity e.g. boating.'

Quote P - ISC

'Salvinia is not only efficient at removing nutrients from water but also in removing heavy metals, making it potentially useful in a variety of wastewater applications'

Quote Q - GISD

'Salvinia was introduced through the aquarium trade in the early 1950's.'

Quote O - ISC

'Potential uses for salvinia include compost and mulch, and as a supplement to livestock feed.'

Quote Source Key -

PP = Penrith Press Newspaper

HG = Hawkesbury Gazette Newspaper

GISD = Gobar Invasive Species Database - Website

ISC = Invasive Species Compendium - Website

Salvinia Secondary Data Sheet (Note: there is a lot more research that can be explored as follow up)

Quote/s	Category	Quote/s	Category
	Reason/s for introducing salvinia		Control or mitigation methods for salvinia
	Biotic and abiotic effects of salvinia		Economic impact of salvinia
	Area affected by salvinia		Different views about the value caused by salvinia
	Human impacts that favour salvinia		Other? _____ (you can add)