

# Spread and invasiveness of the recently introduced Chinese mystery snail (*Bellamya chinensis*) in riverine ecosystems in the Netherlands

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# Introduction

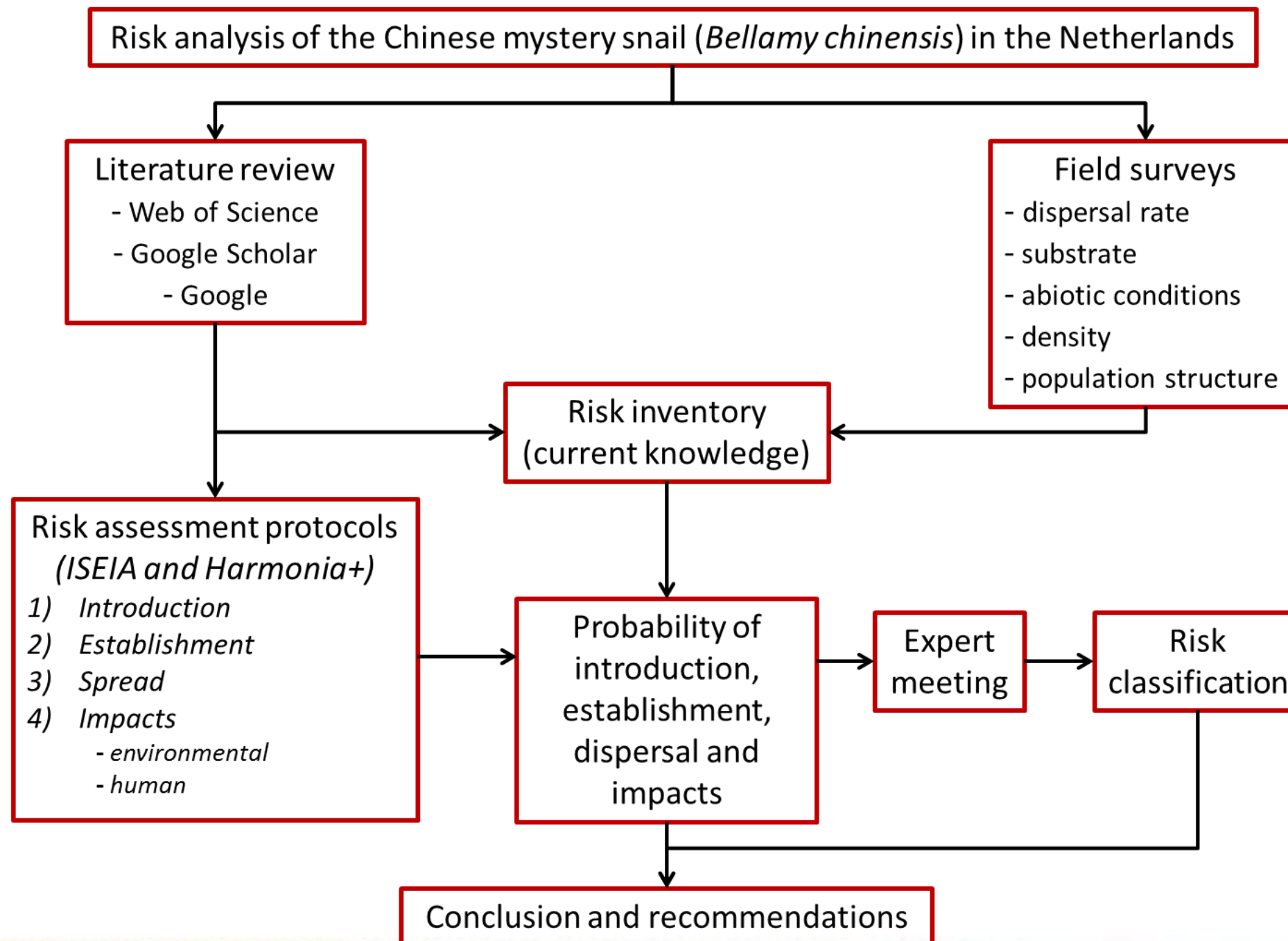
- 2008 Chinese mystery snail (*Bellamyia chinensis*)
  - Origin: Eastern Asia (e.g., China, Taiwan, Japan)
  - Introduced: United States (32 states); Canada (Quebec)
- Dispersal vectors
  - Recreational boats
  - Waterfowl
  - Aquatic mammals
  - Aquarium and ornamental trade



# Introduction

- Human mediated dispersal →
  - ↑ likelihood new introductions Netherlands/Europe
- Risk assessments
  - Policy tool to identify species impacts and invasiveness
  - Takes the four main stages of invasion into account:
    - 1) Entry; 2) Establishment; 3) Spread; 4) Impacts
- Aim:  
Acquire relevant information on the four stages of *B. chinensis* invasion, subsequently perform a risk assessment using the acquired information

# Material and methods



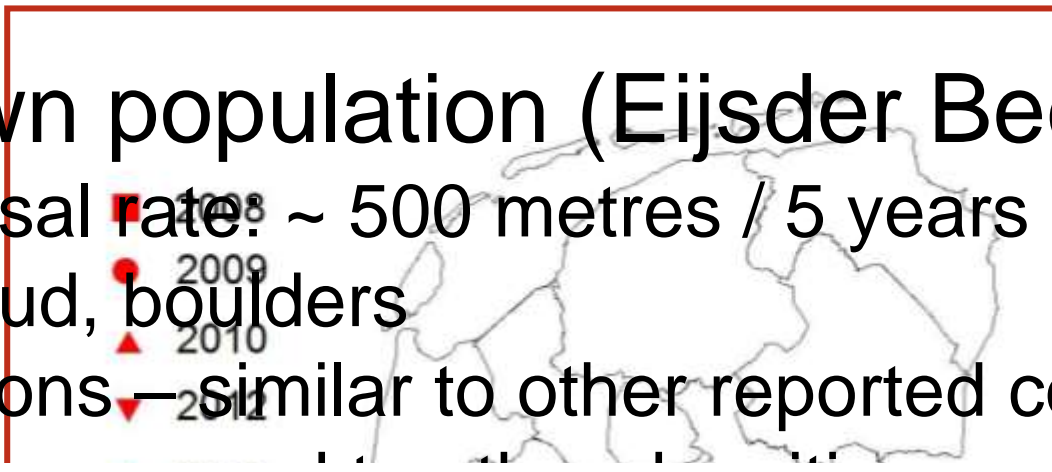


# Results – field survey

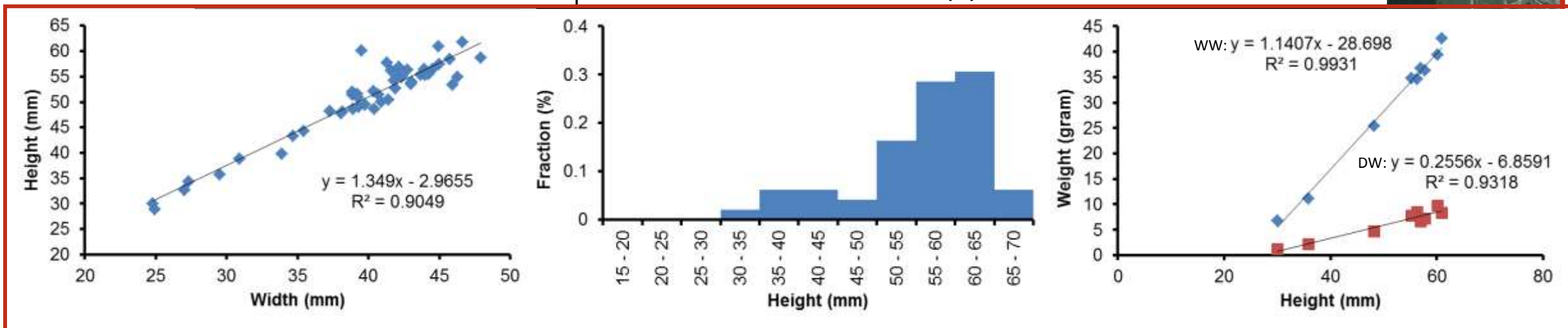
- Overview of distribution in the Netherlands (11 sites)

- Largest known population (Eijsder Beemden)

- Natural dispersal rate: ~ 500 metres / 5 years
- Substrate – mud, boulders
- Abiotic conditions – similar to other reported corals



Location	United States of America	The Netherlands	Reference
PC			
	Estimated density (snails/m <sup>2</sup> )	Estimated population size / surface	



# Results – literature study

- Species description
  - Height up to 70 mm, lifespan up to five years
  - Facultative filter feeder, detritivore, browses on microalgae
  - Mostly sandy to muddy substrates
  - Internal fertilization, parthenogenesis?
  - High fecundity (27.2 – 65 young per year)
- Ecological effects
  - Trematode infection ↓ in North America
  - Crayfish attack protection ↑ compared to native species
  - Native snail species abundance ↓
  - Filtration rate ↑ ; alteration of microbial community
  - N:P ratio may increase (low excretion of P)
  - Food source for (native)crayfish, rats and other mammals

# Results – literature study

- **Socio-economic effects**
  - Cultured for the food market
  - May clog water intake pipes
  - Fishing nets can become clogged
  - Dead or decaying shells → nuisance
- **Public health effects**
  - Intermediate host for echinostoma
  - Infection through consumption
  - Echinostamiasis: diarrhoea, abdominal pain and anorexia
  - No reported infections from North America
  - Though, consumption takes place

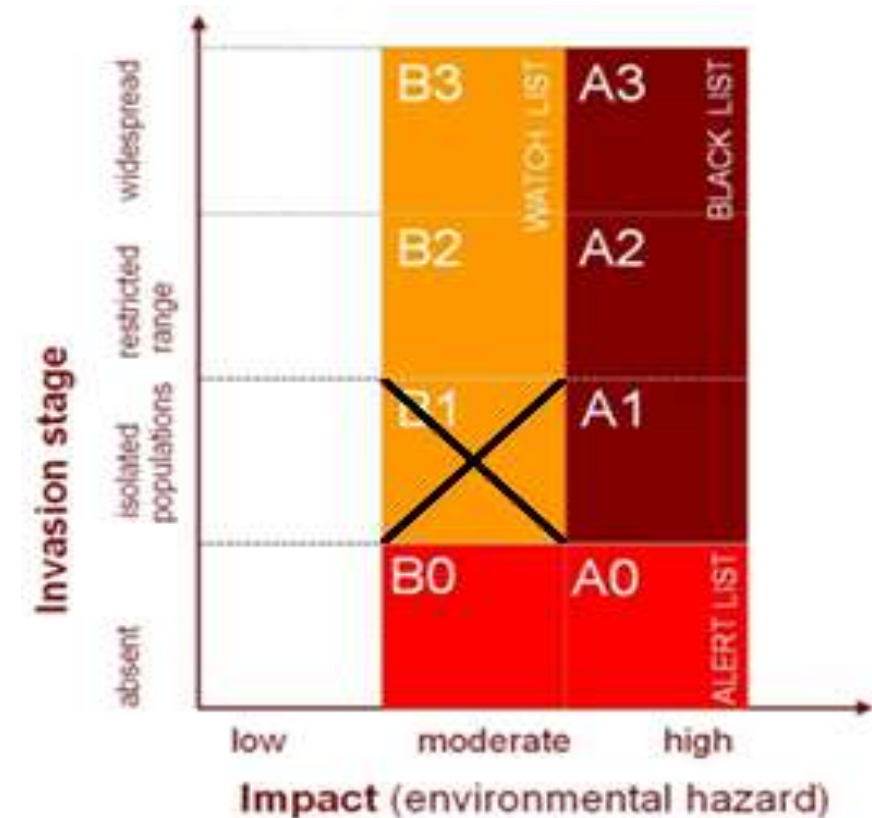




# Results – risk assessment

- ISEIA

Dispersion potential or invasiveness		<u>2</u>
Colonisation of high conservation value habitats		<u>3</u>
Adverse impacts on native species		<u>3</u>
1) Predation/Herbivory	2	
2) Interference and exploitation competition	3	
3) Transmission of diseases to native species	2	
4) Genetic effects	DD	
Alteration of ecosystem functions		<u>2</u>
1) Modification of nutrient cycling or resource pools	2	
2) Physical modifications of the habitat	2	
3) Modifications of natural succession	2	
4) Disruptions of food webs	2	
<b>Sum of assessments:</b>		10
<b>Invasion stage:</b>		Isolated populations
<b>Classification:</b>		B1 (watch list)



- Risk classification individually → meeting to form consensus
- Score: high (3), medium (2), low (1), data deficient (0)



# Results – risk assessment

1: maximum score for each category;  
 2: introduction x establishment x spread; 3; average for each category

- Harmonia+

	Risk classification	Risk score	Certainty	Certainty score <sup>3</sup>
Introduction <sup>1</sup>	High	1.00	High	0.67
Establishment <sup>1</sup>	High	1.00	High	1.00
Spread <sup>1</sup>	Medium	0.50	Medium	0.50
Environment <sup>1</sup>	Medium	0.50	Medium	0.50
Plant impact <sup>1</sup>	Low	0.00	High	1.00
Animal impact <sup>1</sup>	Low	0.00	Low	0.33
Human impact <sup>1</sup>	Low	0.25	Low	0.33
Other <sup>1</sup>	Low	0.00	High	1.00
Invasion score <sup>2</sup>	High	0.79		
Impact score	Medium	0.50		
Risk score	Medium	0.40		

- Risk classification together
- Score: risk score and certainty score (scale from 0 – 1)



# Discussion

- Preliminary ISEIA risk score of 10:
  - Moderate impact
  - Isolated populations
- Harmonia+ risk score is medium
- New York invasiveness assessment
  - *B. chinensis*: 83 / 100 points → invasiveness rank: very high
- Early invasion stage
  - Re-evaluation when more data available

# Conclusion

- *B. chinensis* has a medium risk
- Management is needed
  - Pathway management: aquarium trade + food market
  - Public health: outreach preparation, consumption and risks
  - Elimination and control measures
    - Copper sulphate (applied, no full eradication)
    - Drawdowns (not successful, tolerant to desiccation)
    - Manual removal (Missouri, decreased abundance)
- Future research
  - Environmental impacts (dispersal potential, ecosystem alteration)
  - Human health and animal impacts
  - Management options



Thanks for your attention – Questions?

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