Using risk perception to determine if *Didymosphenia geminata* poses a risk to Tasmania, Australia

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Risk Perception

- People perceive things differently
- Lots of different models and disciplines
  - Environmental psychology
  - Conservation psychology

Risk perception

- Why care?
  - Reduce and mitigate risk
  - Understand the drivers
    - Why do people ignore quarantine?
    - Why do people spread diseases?
  - Cause behavioural change
    - Reduce risky behaviours
    - Education (people can be unaware; or just don't care)
    - Increase risk management efficacy

Risk perception

- What controls our perceptions
  - Douglas and Wildavsky (1982) – 4 types of indiviuals:
    - Egalitarians - technology and the environment
    - Individualists - war and other threats to the markets
    - Hierarchists - law and order
    - Fatalists – associate with none of the above

Risk perception

- What controls our perceptions
  - Sjoberg's (2000) psychometric model
    - New-old
    - Dread
    - Number of exposed individuals
    - Morality (questionable)

Risk perception

- What controls our perceptions
  - Value-Belief-Norm Theory (VBN)
    - Personal values
    - General set of beliefs or worldviews
    - Awareness of consequences
    - Ascription of responsibility
    - Personal norms

Risk perception

- What controls our perceptions
  - Leiserowitz (2005) public risk perception
    - Imagery
    - Trust
    - Values
    - Worldview
    - Personal experience
    - Emotion

Risk perception in biosecurity

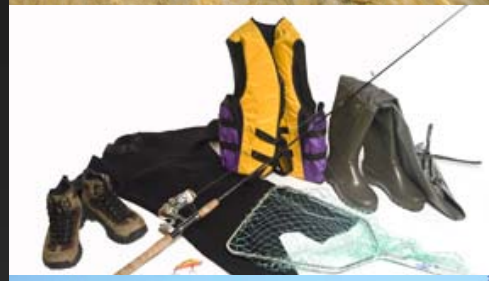
- Test case: *Didymosphenia geminata*
  - Freshwater diatom
  - Introduced to New Zealand in 2004
  - Not introduced to Australia (yet)
    - Concern introduction to Australia from NZ
  - NZ and Tasmania (Australia) are linked:
    - Socially – people travel between the regions for recreational activities; and
    - Environmentally – similar environments and ecological niches

Risk model

- Determine the likelihood that *D. geminata* could arrive in Tasmania
  - Surveyed airport arrivals
- Determine the consequence of such an arrival
  - Surveyed recreational users (fishers, hikers, kayakers)
- Derive a risk rating

Likelihood

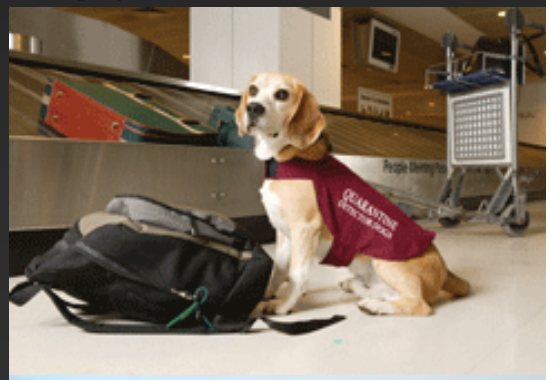
- $L = ((P_{RE}) \times (P_{RA})) - (P_M)$
  - Where
    - L = likelihood
    - P_{RE} = probability of risk region exposure
    - P_{RA} = probability of risk activity
    - P_M = probability of mitigation (equipment cleaning activity)



Descriptor	Description	Probability
Rare	Incursion only in exceptional circumstances	>1%
Unlikely	Incursion could occur but not expected	1-4%
Possible	Incursion could occur	5-24%
Likely	Incursion probable in most circumstances	25-50%
Almost certain	Incursion expected in most circumstances	>50%

Likelihood

- Questionnaire 1
  - Launceston Airport (northern Tasmania)
    - >900,000 people into Tasmania per annum
    - Response of 194 people during our sampling period
  - Public (arrivals)
  - Targeted questions related to
    - Travel overseas in past fortnight?
    - Visited risk locations (global)?
    - Undertook risk activities?
    - Cleanliness of equipment?



Consequence (risk perception)

- Utilised perception
- Targeted 3 user groups:
  - Fishers
  - Hikers
  - Kayakers

Descriptor	Impact
Insignificant	
Concern	There is minimal (<10%) concern about *Didymosphenia* entering Tasmania's environment
Behaviour Modification	If *Didymosphenia* was introduced in an area <10% of people would change their behaviour
Minor	
Concern	There is an increase (<20%) in concern about *Didymosphenia* entering Tasmania's environment
Behaviour Modification	If *Didymosphenia* was introduced in an area <20% of people would change their behaviour
Moderate	
Concern	There is an increase (<30%) in concern about *Didymosphenia* entering Tasmania's environment
Behaviour Modification	If *Didymosphenia* was introduced in an area <30% of people would change their behaviour.
Major	
Concern	There is an increase (<70%) in concern about *Didymosphenia* entering Tasmania's environment
Behaviour Modification	If *Didymosphenia* was introduced in an area, <70% of people would change their behaviour.
Catastrophic	
Concern	There is an increase (>70%) in concern about *Didymosphenia* entering Tasmania's environment
Behaviour Modification	If *Didymosphenia* was introduced in an area, >70% of people would change their behaviour.

Consequence (risk perception)

- Questionnaire 2
  - Liawenee, Cradle Mountain- Lake St Clair National Park, & electronic surveys
  - Questions related to
    - Level of concern about *Didymosphenia* in Tasmania
    - Change in behaviour if *Didymosphenia* was introduced

Risk rating

- R= L x C
- Where R= Risk; L= Likelihood; C= Consequence

Likelihood	Consequence				
	Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Rare	Negligible	Low	Low	Medium	Medium
Unlikely	Negligible	Low	Medium	High	High
Possible	Negligible	Low	High	High	Extreme
Likely	Negligible	Medium	High	Extreme	Extreme
Almost certain	Negligible	Medium	Extreme	Extreme	Extreme

Risk outcomes: likelihood

- N = 194 respondents (air travellers)
- Travelled overseas in past fortnight **25 respondents**
- Visit risk locations **(16/25 = 0.64)**
- Undertook risk activities **(12/16 = 0.06195)**
- Undertook risk activities at risk region **(2/16 = 0.0103)**

- $L = ((P_{RE}) \times (P_{RA})) - (P_M)$
  - ((0.64*0.06195) - 0) = 0.039648 (~4%)
  - Therefore probability = Unlikely

Descriptor	Description	Probability
Rare	Incursion only in exceptional circumstances	>1%
Unlikely	Incursion could occur but not expected	1-4%
Possible	Incursion could occur	5-24%
Likely	Incursion probable in most circumstances	25-50%
Almost certain	Incursion expected in most circumstances	>50%

Risk outcomes: consequence

- N = 200 respondents (recreational users)
- Risk perception of *Didymosphenia* in Tasmania (Concern)= **catastrophic**
- Change in behaviour if *Didymosphenia* was introduced (Behavioral change) = **moderate – major**
- Total consequence = **moderate - catastrophic**

Concern of *Didymosphenia*

Group	n*	Actual threshold values*	Consequence
Fish/hike/kayak	193	0.8705	Catastrophic
Fishers	117	0.8376	Catastrophic
Hikers	62	0.9032	Catastrophic
Kayakers	14	1	Catastrophic

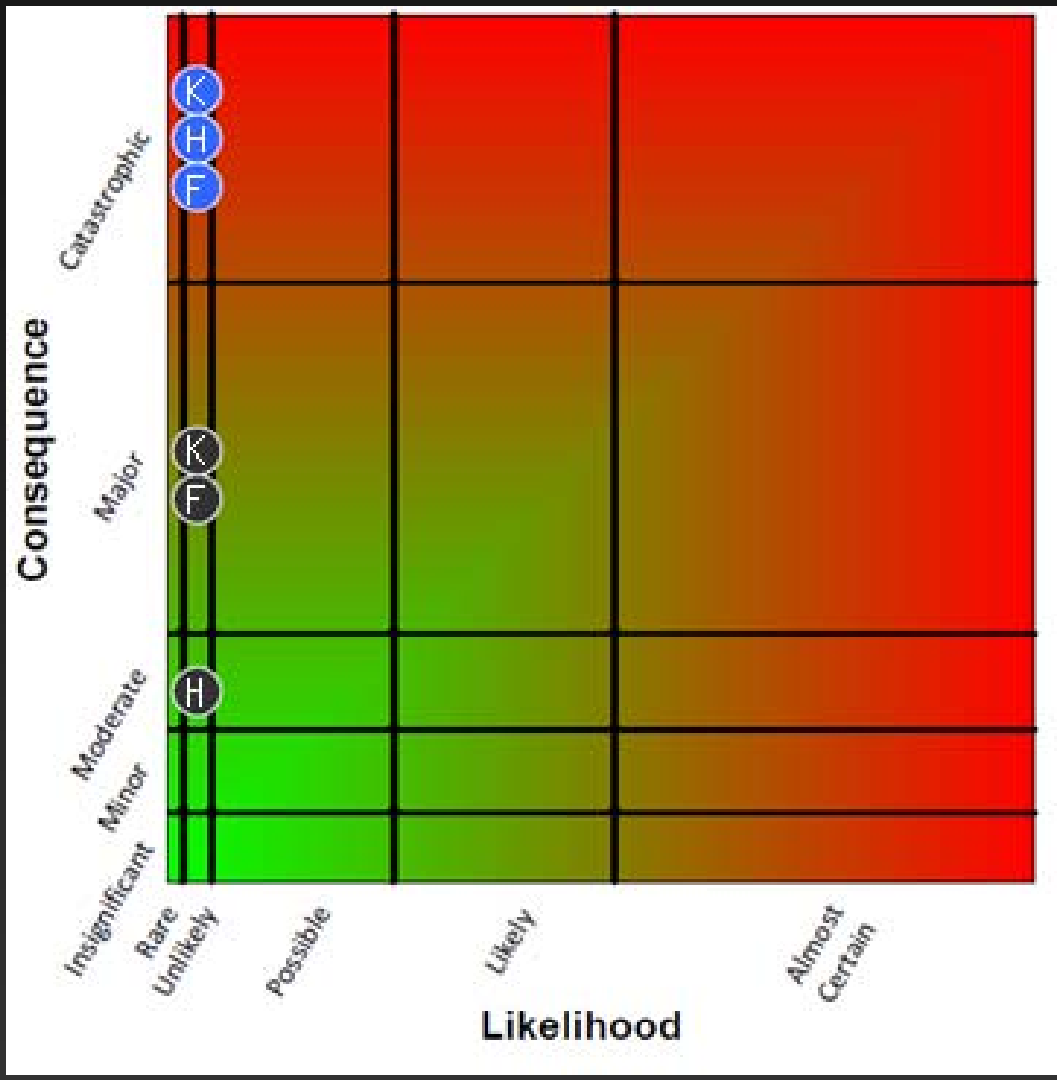
*Respondents who chose 'medium' were removed from the assessment

Behavioural change

Group	n	Return to site?		Probability of Behaviour change (Not returning)	Consequence
		No	Yes		
Fish/hike/kayak	184	94	90	0.5109	Major
Fishers	112	67	44	0.5982	Major
Hikers	56	16	40	0.2857	Moderate
Kayakers	16	11	5	0.6875	Major

Derived risk

- Total risk of *Didymosphenia* entering Tasmania = medium-high

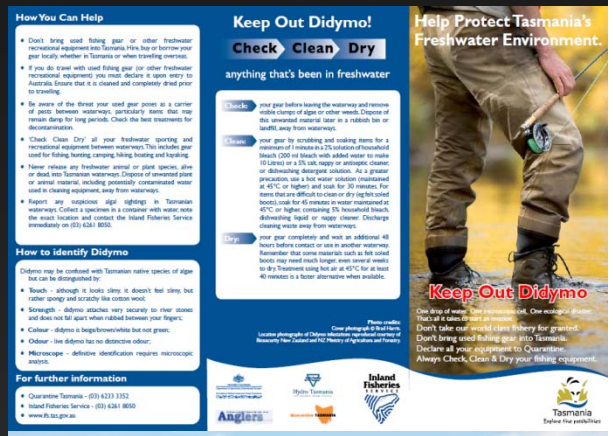


	Likelihood	Consequence	Total Risk
Total risk*	**Unlikely**	**Major- Catastrophic**	**High**
Fishers	Unlikely	Major- Catastrophic	High
Hikers	Unlikely	Moderate- Catastrophic	Med-High
Kayakers	Unlikely	Major- Catastrophic	High

Risk management factoids

- Annual incursion risk (gross estimate)
  = 4,676 people [4% of total entries into Tasmania]
- Total survey numbers n=391
- 31 respondents had never heard of introduced species
  - 1 out of 12
- 907,200 travel into Tasmania
  - 75,600 have no knowledge

Ignorance = vectors for *Didymosphenia*



Risk mitigation: communication

- Air and ferry travellers
  - Targeted by quarantine upon entry
- Fishers
  - Targeted by Inland Fisheries and Quarantine with annual information flyers and surveys that arrive with fishing licences
  - Perceive themselves as linked to the threat
- Kayakers
  - Not targeted but should be
  - Perceive themselves as linked to the threat

Risk mitigation: communication

- Hikers
  - Not targeted
  - Major problem user group
  - Less likely to change behaviours after an incursion
  - Don’t perceive themselves as linked to the threat
    - Terrestrial user group that “gets wet”
    - *Didymosphenia* incursion won’t stop their activities
      - You can still hike if a river or lake is closed
      - No consideration of water in ditches, on shoes, gaitors etc

Risk mitigation: communication

- Quarantine needs to improve targeting hiker equipment, especially boots
- Recreational user groups need to be made aware of problem
- Play on emotions and world beliefs
  - Education
  - Awareness raising
  - Linking incursions to consequence to all user groups

Questions?


PROTECT
OUR WATERWAYS
CHECK CLEAN DRY
NEW ZEALAND. IT'S OUR PLACE TO PROTECT.
BIOSECURITY NEW ZEALAND


WHAT WILL IT TAKE FOR YOU TO DO YOUR BIT?


HELP IT'S WHAT WE NEED MOST.


IF YOU ARE MOVING ITEMS BETWEEN WATERWAYS, YOU MUST
CHECK CLEAN DRY
CHECK:
CLEAN:
Non-absorbent items
Absorbent items require longer soaking times to allow thorough saturation.
Freezing any item until solid will also kill didymo.
DRY:
BIOSECURITY NEW ZEALAND


IF YOU ARE MOVING ITEMS BETWEEN WATERWAYS, YOU MUST
CHECK CLEAN DRY
CHECK: Before you leave a river or lake, check items and leave debris at site. If you find any later, treat and put in rubbish. Do not wash down drains.
CLEAN: Soak items in 5 percent dishwashing detergent for as long as it takes for the solution to thoroughly saturate the item, plus for at least an additional minute.
DRY: Items must be completely dry for at least 48 hours before use in another waterway.
BIOSECURITY NEW ZEALAND