Assessing risks to inform AIS management

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What is risk assessment and why is it important?

- Which AIS should be prioritized for management?
- Where should management focus?
- What is the risk of _____?

*Risk assessment is central to decision making concerning AIS*
Outline

• Introduction to risk assessment
  – How it informs AIS decision making
• Invasive Asian carp example
• Bait harvest example
• Questions and discussion
Risk analysis

Risk Assessment
  Analytically-based

Risk Management
  Policy-based

Risk Communication
Simple definition of risk

Risk = Exposure x Consequence
Simple definition of risk

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Simple definition of risk

Risk = Exposure \times \text{Consequence}
Ecological Risk Assessment (ERA) for AIS

**Problem Formulation**
- What is the context?
- What could cause harm? (stressor = AIS)
- What is valued in the uninvaded system? (e.g., species or recreational use)
- How could they interact? (risk pathways)

**Analysis**
- Exposure Analysis: Likelihood of introduction, establishment, or spread of AIS
- Effects Analysis: Probability and severity of consequences

**Risk characterization**
- Characterize risk and summarize findings for decision making
How is ERA used to inform AIS decision making?

- Risk is a product of: Exposure & Effect
- Identifies points for management
  - Pathways for introduction
  - Susceptible environments
- Prompts discussion about what change is undesirable
- Helps determine research needs

Diagram:
- Likelihood of introduction
- Magnitude of ecological consequences
Risk assessment best practices

• Right participation
  – What is valued?
  – What are risk pathways?
  – Are the results trusted?
• Correct scope (spatial & temporal)
• Properly deal with uncertainty
• Right scale of ERA
  – Formal risk assessment by agency
  – Less formal brainstorming of stressors, valued entities, risk pathways
Invasive Asian carp

- Asian carp = Bighead, silver, black, grass
- Bighead and silver escaped to wild in 1970s
  - Imported to southern US for aquaculture
- Bighead and silver carp disrupt ecosystems by consuming plankton & macroinvertebrates
- Silver carp jump up to 10 feet when startled
- 2014 MN findings in Mississippi river
  - Cottage Grove (silver & bighead), Lake Pepin (bighead), Hastings (silver), mouth of St. Croix (bighead)
ERA and invasive Asian carp

• Existing work has largely focused on potential spread (exposure) and not consequences (effects)
  – What are potential adverse effects given establishment?
  – What waterways, species, and areas of the state are of most concern?
  – What management should be pursued?

• Create robust list of potential adverse effects to analyze
  – Conduct focus groups with managers and stakeholders
Risk assessment

• A structured process for supporting decision making
Risk assessment characteristics

- Participatory – stakeholders, deliberative
- Evidence-based – analytic

NRC 1996
Risk assessment characteristics

- Participatory – stakeholders, deliberative
- Evidence-based – analytic
- Policy informative – relevant
- Generates new information – priorities, gaps
- Never-ending – iterative (but with endpoints)
Example: bait harvest

• AIS movement during bait harvest in infested waters

• Can we refine policies governing this activity?
  – Without increasing AIS risk or difficulty of enforcement
  – While simplifying operations and applying statewide
Bait harvest in infested waters

• Convene stakeholders
• Model bait harvest processes
  – identify activities with risk of AIS transfer, and how to mitigate
Example: communications plan

• How can I design an effective outreach campaign to help prevent the spread of aquatic invasive species?
Risk assessment to inform outreach

• How could risk assessment inform a communications plan?
  – Convene stakeholders
  – Brainstorm and prioritize AIS hazards
    • Develop models for exposure for high-priority hazards
Establishment of zebra mussels in lake

- Adults present, dense
- Physical conditions
- Ecological conditions

- ZMs survive
- People introduce adult ZMs
- People introduce juvenile ZM
- Natural transport introduces ZM juveniles
- Upstream established ZM
Establishment of zebra mussels in lake

- Adults present, dense
- Physical conditions
- Ecological conditions

Intermediate steps to establishment

- ZMs survive
- People introduce adult ZMs
- People introduce juvenile ZM
- Natural transport introduces ZM juveniles
- Upstream established ZM
Establishment of zebra mussels in lake

- Adults present, dense
  - ZMs survive
    - People introduce adult ZMs
    - People introduce juvenile ZM

- Physical conditions

- Ecological conditions
  - Natural transport introduces ZM juveniles
    - Upstream established ZM

Consider mitigating factors – riffles, wetlands?
Establishment of zebra mussels in lake

- Adults present, dense
  - ZMs survive
    - People introduce adult ZMs
      - People introduce juvenile ZM
        - Natural transport introduces ZM juveniles
          - Upstream established ZM
    - Physical conditions
    - Ecological conditions
Conclusions

• ERA is a useful tool at a variety of scales
  – Identify potential risk pathways
  – Identify most consequential potential adverse effects

• Key points to keep in mind
  – Participation, scope, uncertainty, scale
Questions?

Acknowledgements