Getting to a decision: Using structured decision making to gain consensus on approaches to invasive species control

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Making decisions

• Decision-making requires:
  – clear objectives
  – information to base decisions on

• Once decisions are made, they must be defensible
Invasive species

- Cause ecological, economic, cultural damage
- Control can be extremely costly
- BC has Early Detection, Rapid Response plan
- Rapid response planning is case-specific
  - Depends on:
    - Species
    - Local conditions
    - Objectives
    - Public buy-in
Structured decision making

• Based on decision analysis
  – Tells you best option given objectives
• An organized approach to address problems
  – Engages stakeholders and experts
  – Ensures everyone is working from the same series of rules (models)
  – Builds rationale for making decisions
Steps

1. Clarify the decision context
2. Determine objectives
3. List control options
4. Identify alternate states of nature
5. Estimate consequences
6. Evaluate trade-offs
7. Implement and monitor
Case study: smallmouth bass in Cultus Lake

• Cultus Lake:
  – Within Soowahlie traditional territory
  – Popular for recreation
  – Endangered sockeye
  – Threatened pygmy sculpin
  – Smallmouth bass first seen in 2018
    • Stomach contents revealed sculpin and sockeye
    • predators
1. Clarify decision context

• Open discussion about Cultus Lake
  – History
  – First Nation values
  – Fish community
  – Community groups, stewards
  – Timing of smallmouth bass introduction
2. Objectives

• What do participants want to see at the ‘end’?
• Can include anything
  – Economic
  – Biologic
  – Social
  – Technical
• Group by primary and secondary
• Each are weighted
## 2. Objectives

| Objective                                      | Weight |
|-----------------------------------------------|--------|
| Low final abundance                           |        |
| Likelihood of extirpation                     | 0.12   |
| Few nests observed                            | 0.18   |
| Public participation                          |        |
| Use volunteer anglers                         | 0.13   |
| Use volunteers looking for nests              | 0.10   |
| Impact on other species                       |        |
| Non-species at risk                           | 0.06   |
| Species at risk                               | 0.13   |
| Public awareness                              | 0.27   |
3. Control options

- Consider discrete biological stages
- List anything that comes to mind
  - List gets shorter when you consider parameters and objectives
- Consider combinations of controls
4. Alternate states of nature

- Current abundance is unknown
- Assume current abundance is
  - 100
  - 500
  - 1000
5. Estimate consequences

- Use $PVA_{INVAS}$ to determine outcomes (van Poorten et al. 2019)
- Parameterize
  - Scenarios
  - Biology
  - Controls
- Takes time
- Forces careful consideration
6. Evaluate trade-offs

• Run population model using each control option under parameter uncertainty

• Evaluate output against objectives
| Action | Starting abundance: 100 | Starting abundance: 500 | Starting abundance: 1000 | Expected value |
|--------|------------------------|------------------------|-------------------------|----------------|
| do nothing | 0.7922 | 0.1244 | 0.0335 | 0.3167 |
| Destroy nest with eggs | 0.8609 | 0.2258 | 0.0853 | 0.3906 |
| Destroy nest with larvae | 0.8547 | 0.2102 | 0.066 | 0.377 |
| Target adults on nest | 0.7837 | 0.1412 | 0.0307 | 0.3185 |
| Short set gill net | 0.7801 | 0.1262 | 0.0331 | 0.3131 |
| Angling | 0.7856 | 0.1341 | 0.0351 | 0.3184 |
| Destroy nest with eggs; Destroy nest with larvae; Target adults on nest | 0.896 | 0.3566 | 0.1315 | 0.4614 |
| Destroy nest with eggs; Destroy nest with larvae; Target adults on nest; Angling | 0.9051 | 0.3593 | 0.1442 | 0.4695 |
| Destroy nest with eggs; Destroy nest with larvae; Target adults on nest; Short set gill net | 0.8936 | 0.3423 | 0.1349 | 0.4569 |
| Destroy nest with eggs; Destroy nest with larvae; Target adults on nest; Short set gill net; Angling | 0.8953 | 0.337 | 0.1351 | 0.4558 |
| Destroy nest with eggs; Destroy nest with larvae (volunteer); Target adults on nest | 0.9076 | 0.3882 | 0.1557 | 0.4838 |
| Destroy nest with eggs; Destroy nest with larvae (volunteer); Target adults on nest; Angling | 0.9104 | 0.3872 | 0.1702 | 0.4893 |
| Destroy nest with eggs; Destroy nest with larvae (volunteer); Target adults on nest; Short set gill net | 0.9123 | 0.393 | 0.1617 | 0.489 |
| Destroy nest with eggs; Destroy nest with larvae (volunteer); Target adults on nest; Short set gill net; Angling | 0.9178 | 0.4036 | 0.1651 | 0.4955 |
| Destroy nest with eggs; Destroy nest with larvae (volunteer); Target adults on nest; Short set gill net; Angling | 0.8982 | 0.3586 | 0.1352 | 0.464 |
| Destroy nest with eggs; Destroy nest with larvae; Short set gill net | 0.7889 | 0.1383 | 0.0281 | 0.3184 |
| Destroy nest with eggs; Destroy nest with larvae (volunteer); Angling | 0.9158 | 0.4008 | 0.164 | 0.4936 |
| Destroy nest with eggs; Destroy nest with larvae (volunteer); Angling | 0.8978 | 0.3613 | 0.119 | 0.4594 |
| Destroy nest with eggs (volunteer); Destroy nest with larvae; Angling | 0.9125 | 0.4093 | 0.1681 | 0.4986 |
| Destroy nest with eggs (volunteer); Destroy nest with larvae; Angling | 0.7901 | 0.117 | 0.0308 | 0.3126 |
6. Implement and monitor

- Implement control
- Monitor the population
- Evaluate as data come in
- Re-evaluate
Value of Structured Decision Making

• Agreement on objectives
• Clear direction on next steps
• Ecology weighted against other objectives  
  – Clear, defensible, documented decisions
• Buy-in from participants and their agencies
Questions?

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