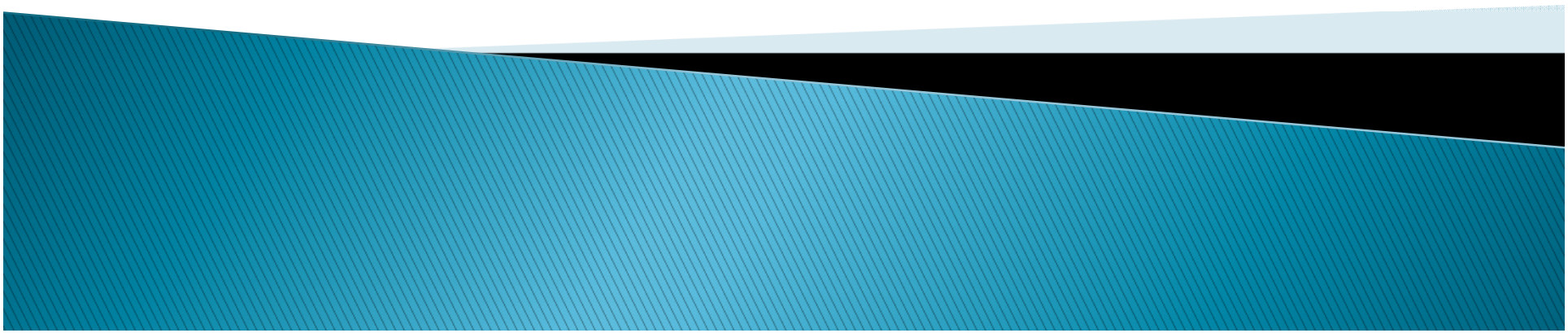
Expert Elicitation



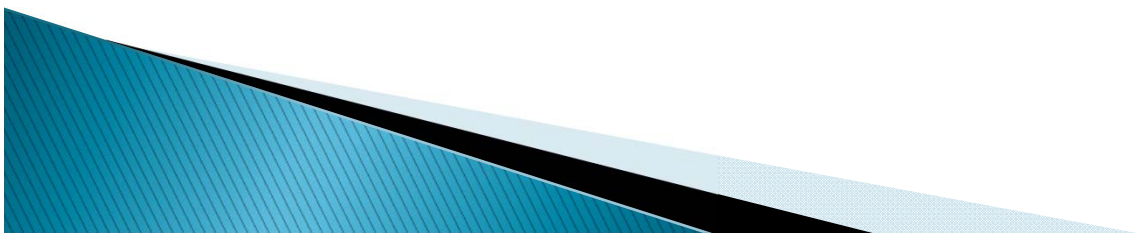
Situation:

- You have incomplete or inadequate data
- You're unsure of which models to use or how to parameterize them
- There are all kinds of other uncertainties
- You need to make a decision anyway

?

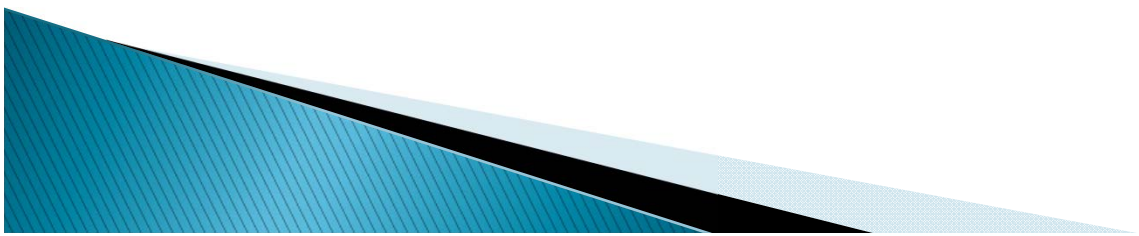
Expert elicitation to the rescue!

- Good for informing decision-making when:
  - Empirical data are missing or incomplete
  - Uncertainties are large
  - More than one conceptual model can explain existing data
  - Technical judgments are needed to evaluate assumptions



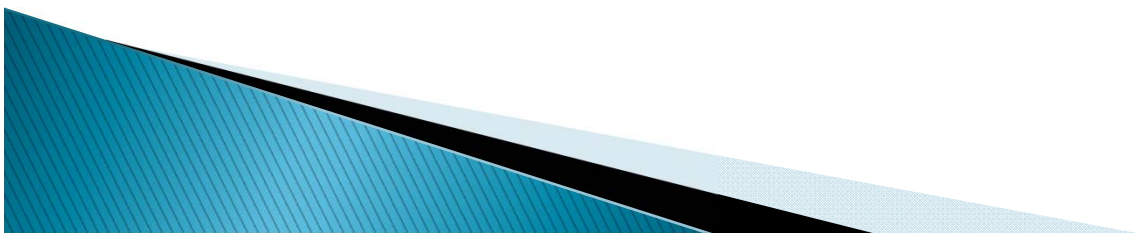
Other benefits

- Can take advantage of integrated and contextual knowledge and understanding
- Generates buy-in, ownership
- Can be rapid, relatively low cost



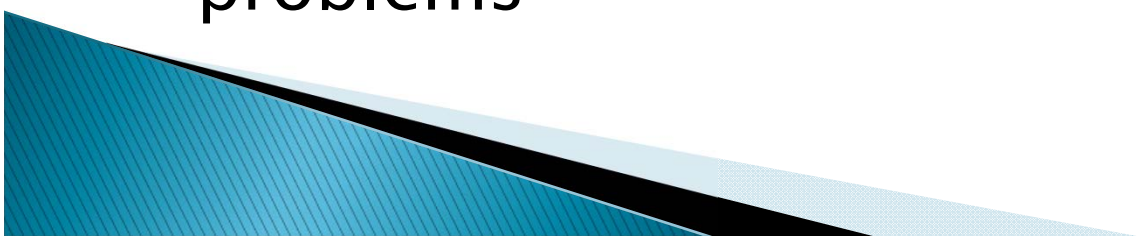
History

- Legally defensible examples
  - ESA: listing species and critical habitat designation
  - CERCLA: ecological risk assessment
  - NRDA: injuries to resources
- Not necessarily legal-quality examples
  - State-level: identifying habitat acquisitions
  - Developing adaptation options



A few cautions

- If you're trying to quantify subjective judgment, you need a solid process
- Cutting corners leads to shoddy results
- Beware expert overconfidence and other common errors made by experts
- Won't solve political or value-dependent problems



General approach

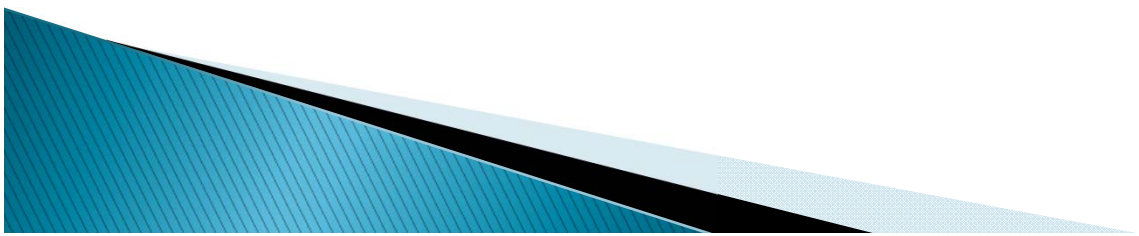
- Pre-elicitation:
  - Define problem
  - Structure problem/question
  - ID and select experts
  - Develop protocol
  - Develop briefing book
- Elicitation (Individual or group)
  - Motivate and train experts
  - Encode judgments
  - Verify judgments
- Post-elicitation
  - Document it all

Climate change example: NEAFWA

- Northeast Association of Fish and Wildlife Agencies Regional Habitat Model
- Objective: map geographical variation in habitat vulnerability across 13 NE States
- Combined EE with formal modeling

NEAFWA model

- Six major elements
  - Assessment of vulnerability to climate change
  - Assessment of vulnerability to non-climate stressors
  - Interaction potential
  - Assessment of overall future vulnerability
  - Confidence evaluation
  - Narratives



NEAFWA process: panel formation

- 40 participants from states, feds, and NGOs
- Wildlife biologists, ecologists, habitat specialists, regulators
- Given education in likely future climates in NE, how species/systems already reacting

NEAFWA process: panel tasks

- Review and comment on draft model
- Help finalize model
- Participate in habitat work groups
- Review and critique model runs from Manomet
- Help produce consensus habitat VAs

Climate change example: Climate Ready Estuaries "EE-type exercise"

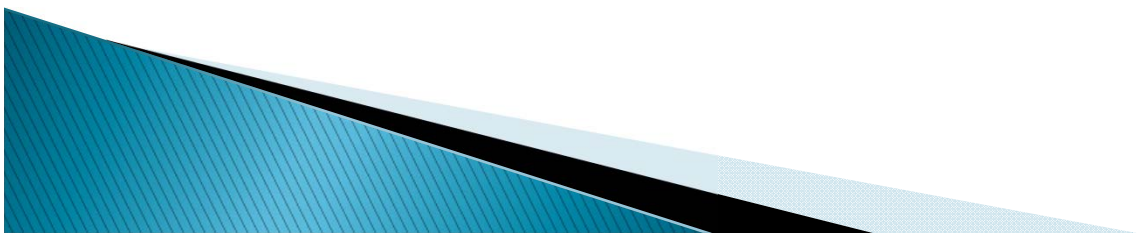
- Piloted in two locations: SF Bay, MA Bay
- Wanted qualitative judgments on:
  - Relative influences of physical and ecological variables that regulate key climate-sensitive processes
  - Sensitivities of influences under current and future climate change scenarios
  - Degree of confidence in judgments about relationships
  - Options for adaptation

Characterizing influences

- How well do we ***understand*** each influence?
  - Influence Types: Direct or Inverse
  - Influence Degrees: Proportional or Disproportional
- How ***sensitive*** is each influence?
  - Low Sensitivity: Disproportionately Weak Response
  - Medium Sensitivity: Proportionate Response
  - High Sensitivity: Disproportionately Strong Response
- What influences have the greatest relative impact on the endpoint? (***importance***)

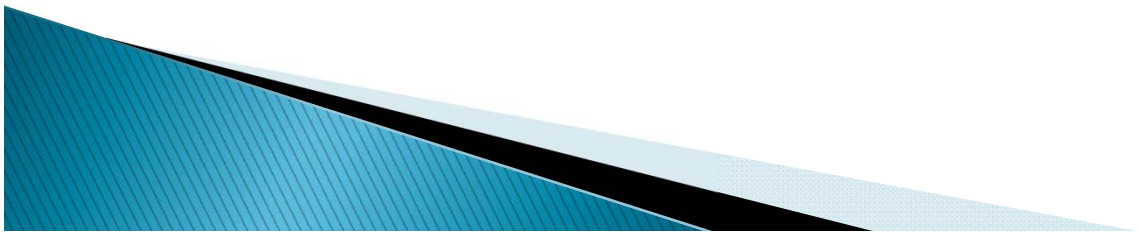
CRE Process: panel formation

- Created 2 expert panels for each site:
  - community interactions group
  - sediment retention group
- 7 experts each, mix of academia, NGOs, feds
- Elicited opinions in a 2-day workshop



CRE Process: panel tasks

- Individually evaluate “straw dog” influence diagrams showing key process variables, interrelationships (influences)
  - characterized type, sensitivity of each influence
- Discuss as group, generated “consensus” diagrams
- ID most likely management options



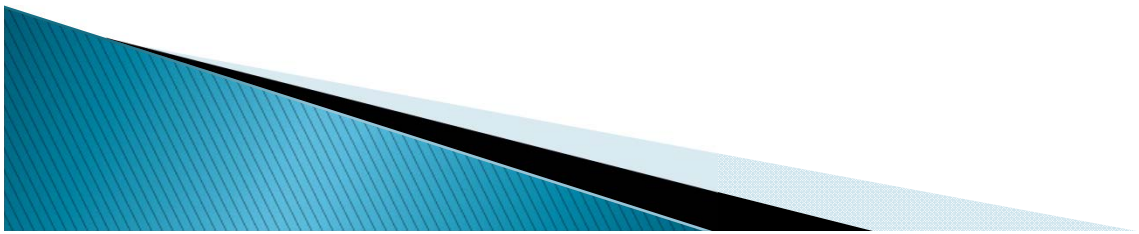
CRE Conclusions

- Look at all types of information when analyzing management paths: influences, sensitivity, importance
- Based on expert judgment, can ID “top pathways” for which there are available adaptation options.
- Variation between participants was greater than between scenarios

"The process of expert elicitation must never be approached as a routine procedure amenable to cookbook solutions … Each elicitation problem should be considered a special case and be dealt with carefully on its own terms."

Morgan and Henrion 1990

And yet …

Commonalities

- Capture expert assumptions, thought process
  - NEAFWA: Excel model
  - CRE: influence diagrams
- Evaluate confidence
  - NEAFWA: condensed 5-point IPCC scale to 3
  - CRE: reflect agreement and availability of evidence
- Focus on transparency