Risk-informed Decision Making

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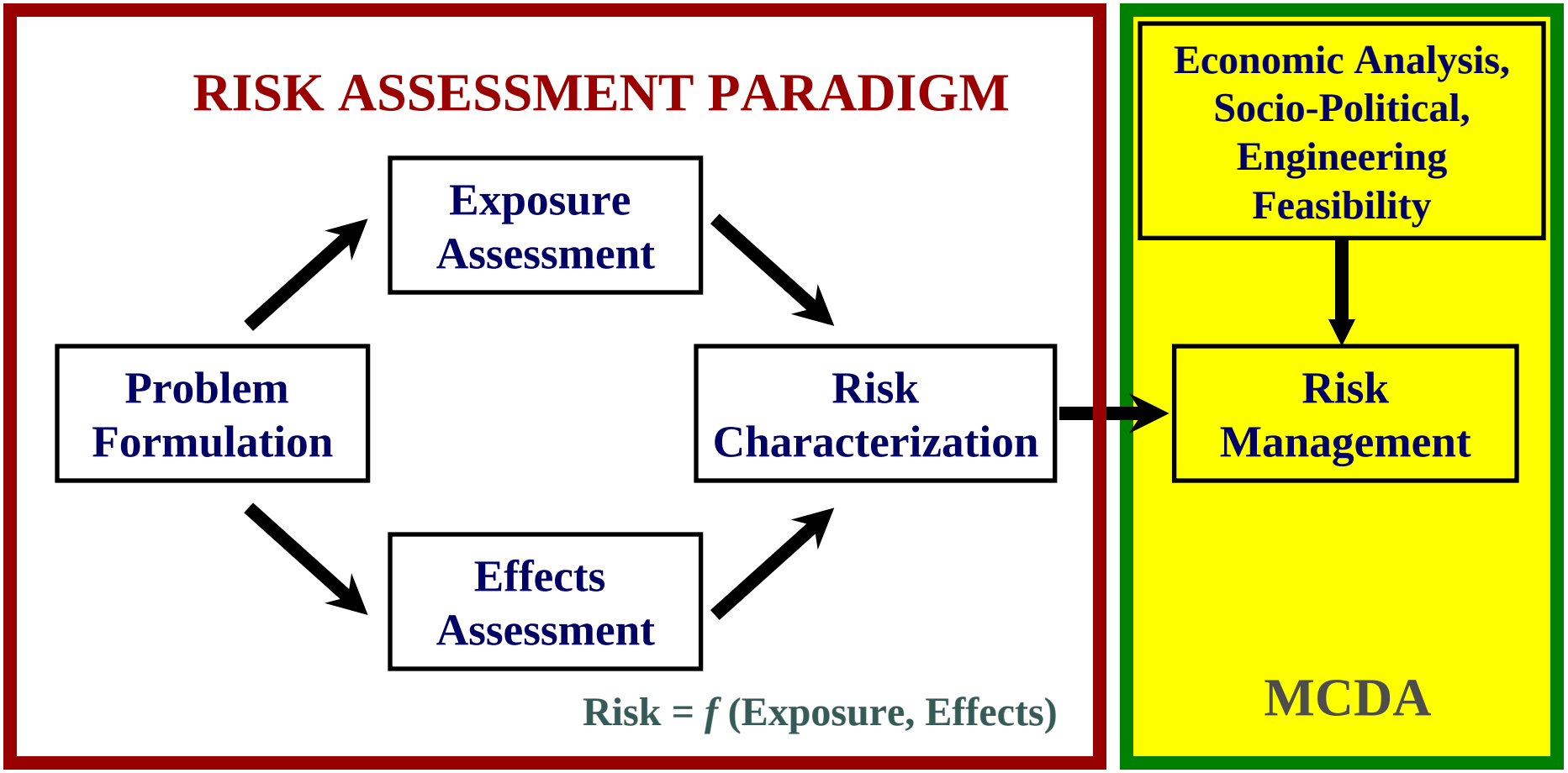
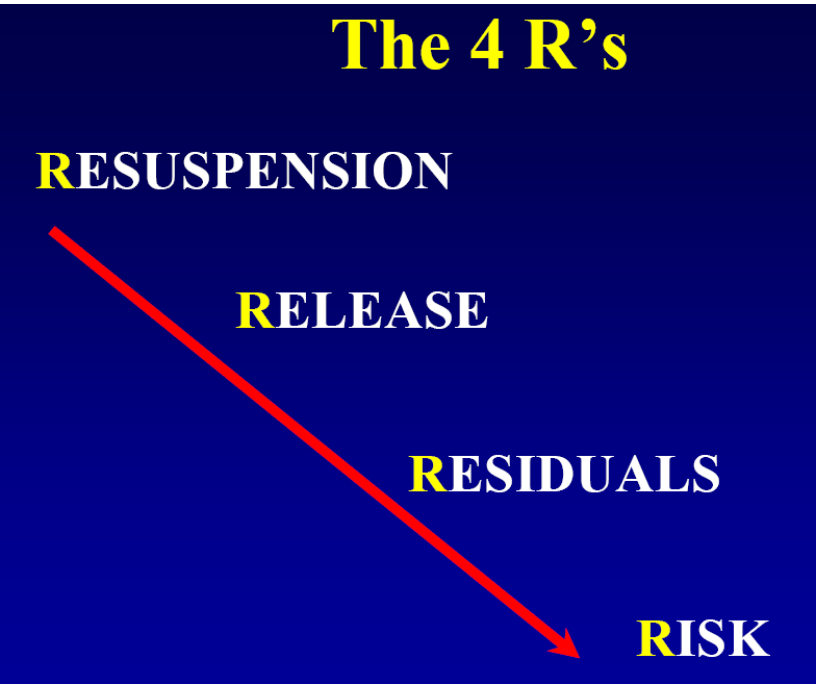
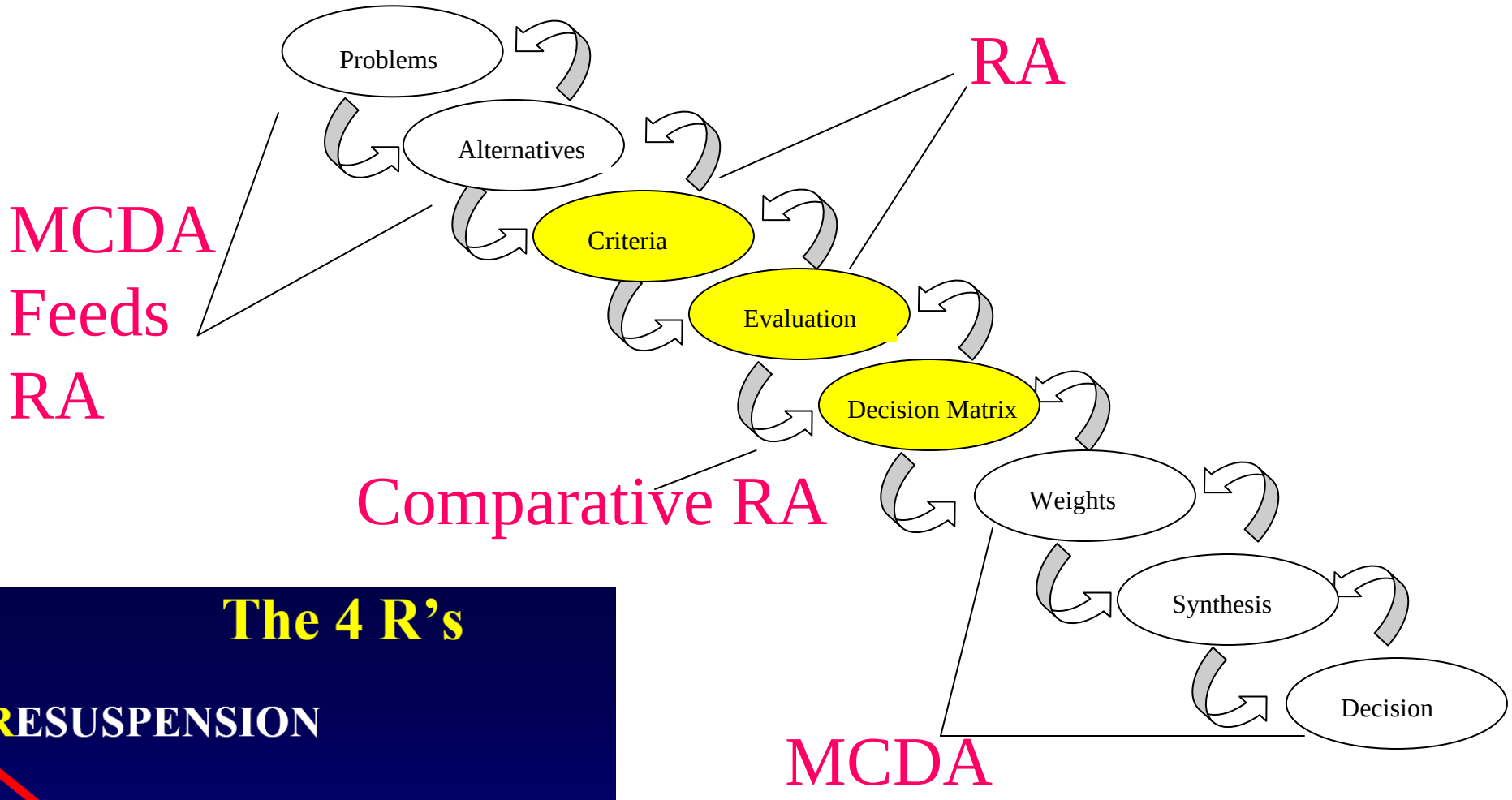
RISK FRAMEWORK







Decision Framework

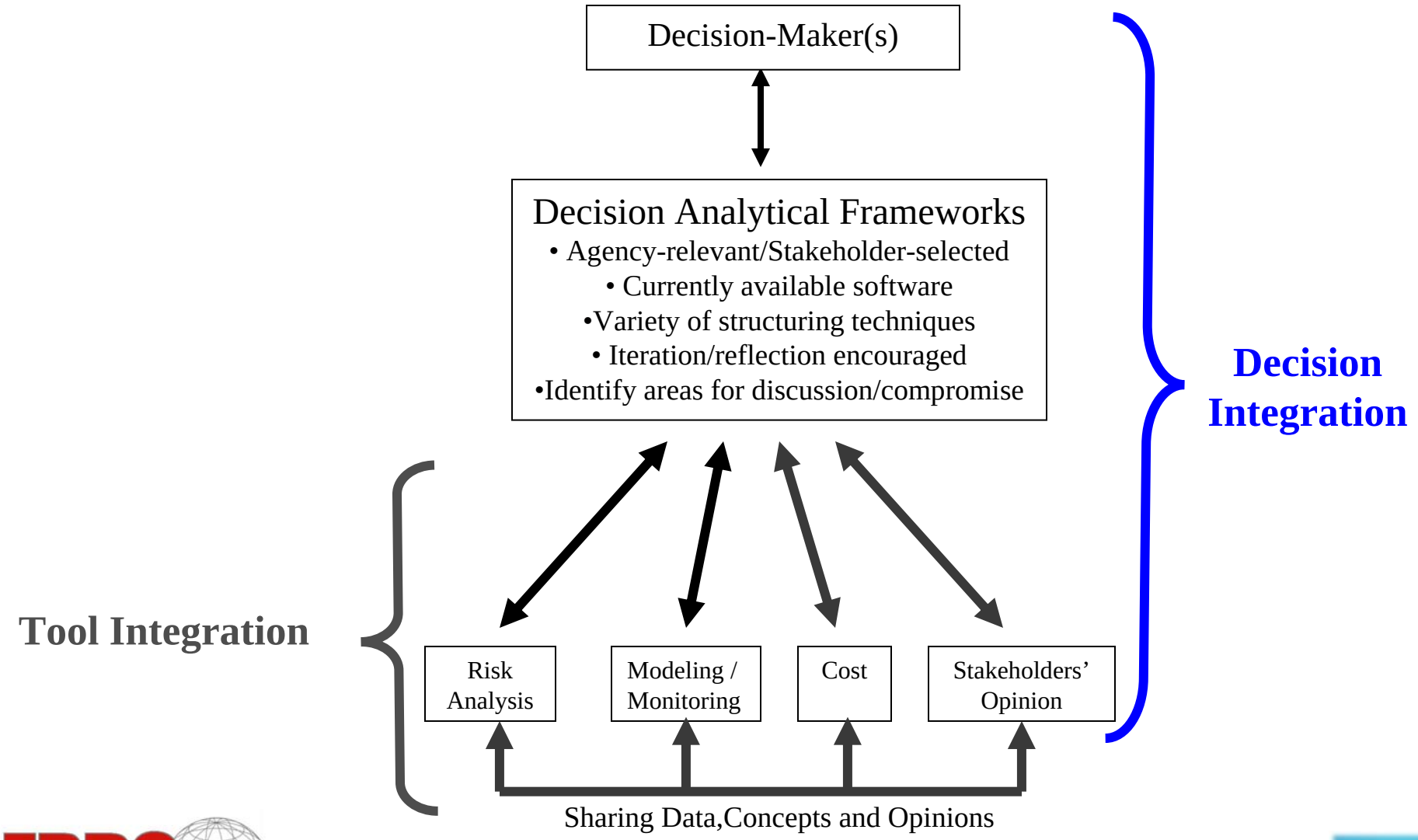
Presentation -- Overview

- **Using Risk Assessment in Decisions**
  - MCDA Approach
  - Application to Toddaho
- **Conclusions**

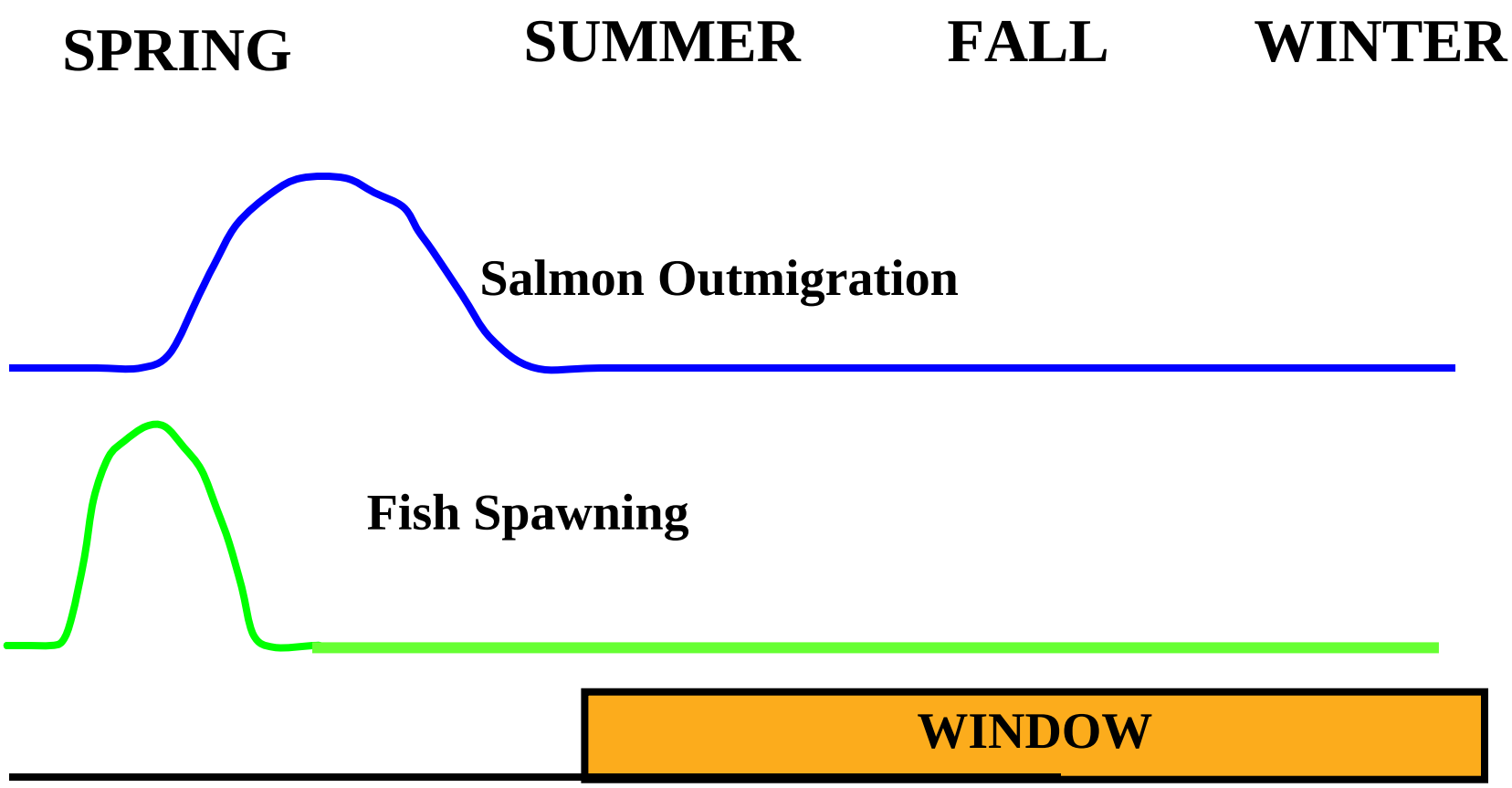
Main Points

- **Risks and benefits associated with alternative resuspension management strategies can be quantified using MCDA.**
- **Model, Parameters and Scenario uncertainty and variability associated with predicting efficiency of dredging alternatives as well as stakeholder value judgment are important to consider**
- **Challenges of risk assessment and planning require coupling traditional risk assessment and planning with MCDA to support dredging decisions**

Evolving Decision-Making Processes



Toddaho Environmental Window



Environmental Window

- Provides protection for juvenile salmon by eliminating TSS during migration
- Provides protection for fish spawning by eliminating TSS during spawning season
- Provides protection for fish spawning by eliminating deposition during spawning season

Toddaho Scenario Info

Dredging Scenario	Production (cy/day)	Dredging Duration (days)*	Dredging Costs**
Hopper w/ OWP	12,000	4	$280,000
Clamshell w/ OWP	3,000	16	$350,000
Clamshell w/ CDF	3,000	16	$540,000
Restricted Clamshell w/ OWP	2,000	24	$450,000
Clamshell with Silt Curtain & OWP	2,400	20	$510,000
Clamshell with Silt Curtain & CDF	2,400	20	$700,000

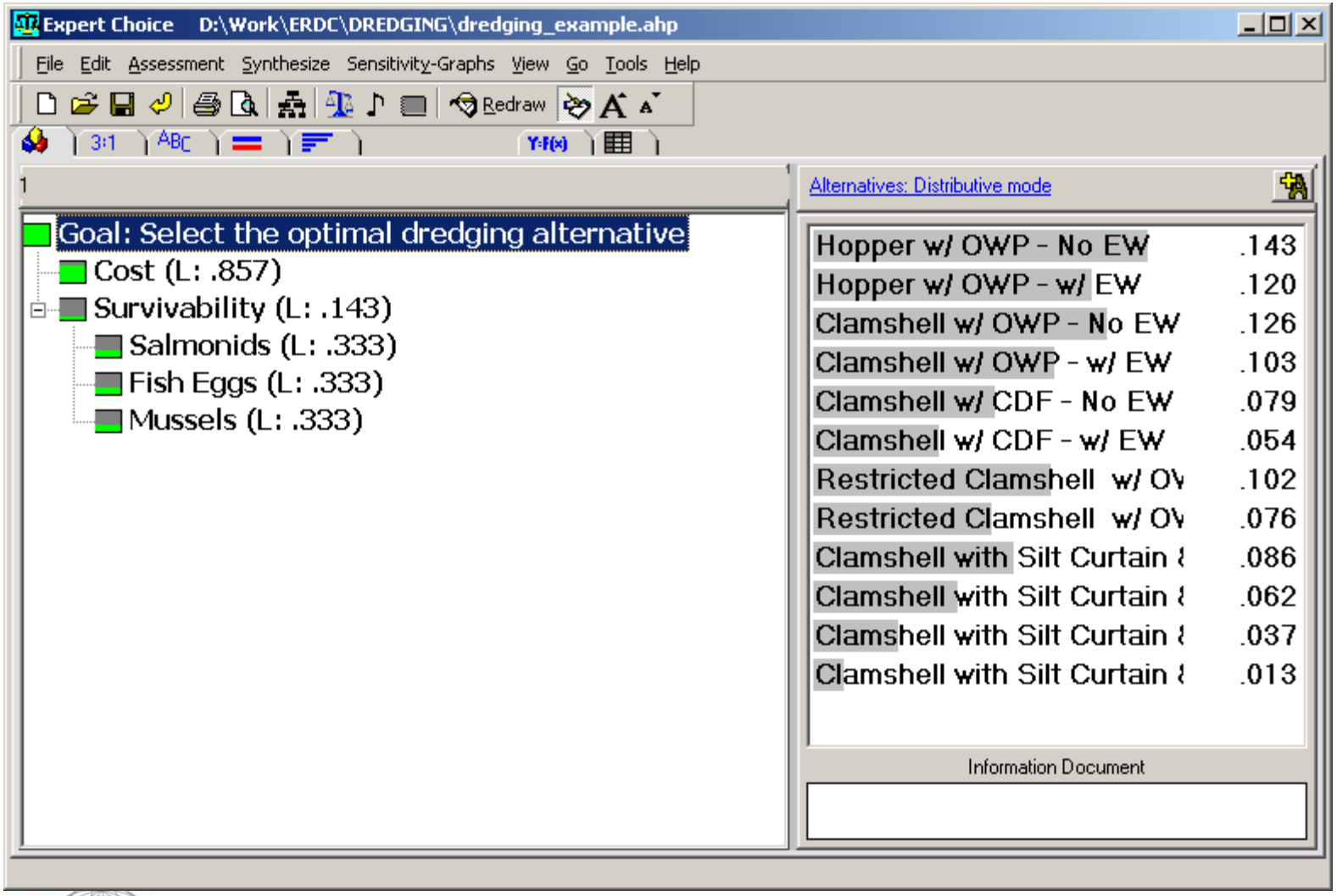
* Days without downtime

** Environmental window would add $100,000 to cost due to scheduling, and greater equipment capitalization

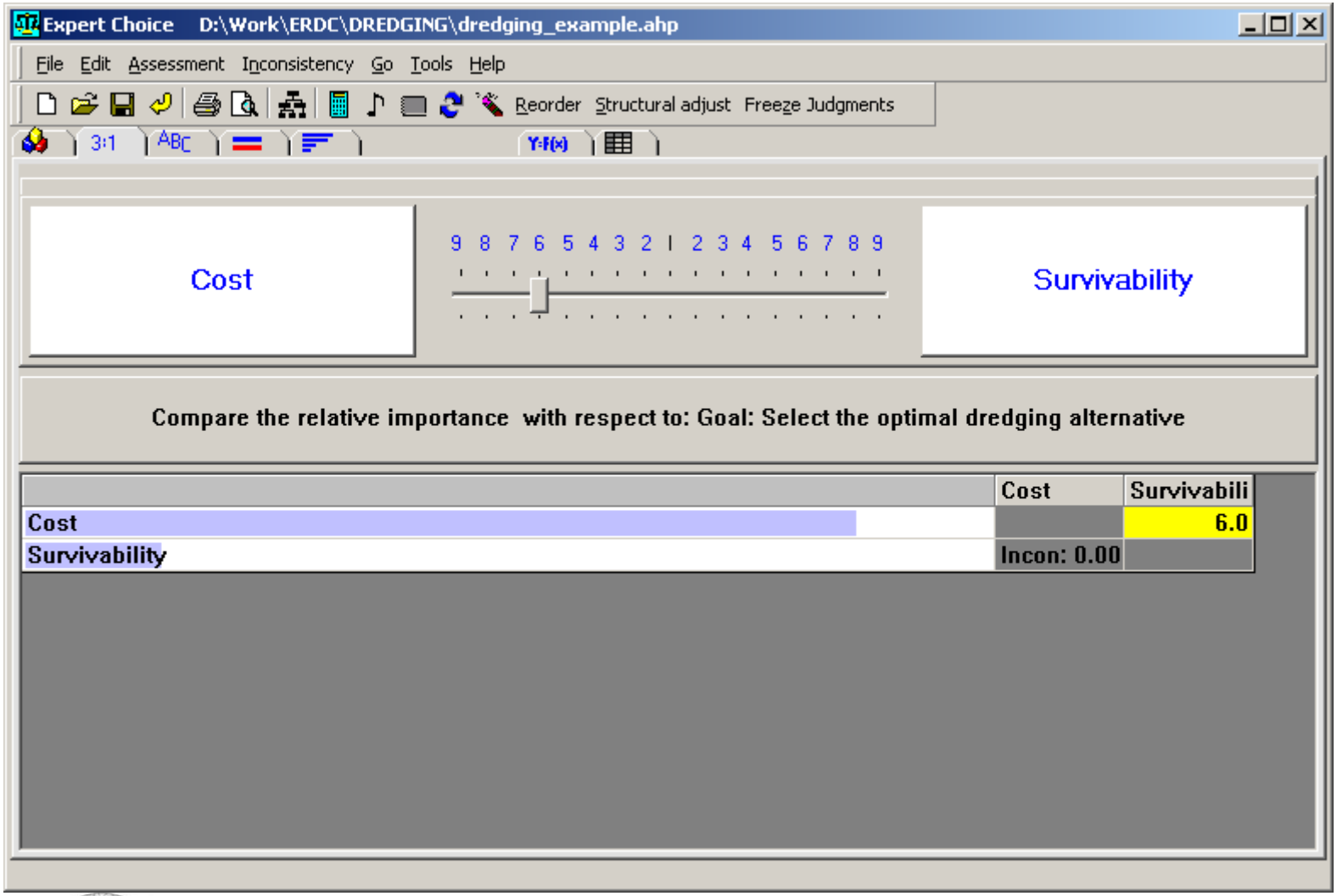
Risk Criteria

Alternative	Relative Costs	Survivability, %		
		Salmonids	Fish Eggs	Mussels
Hopper w/ OWP	**No EW:** 35 **w/ EW**: 48	95 100	40 100	100 100
Clamshell w/ OWP	**No EW:** 44 **w/ EW**: 56	60 100	90 100	100 100
Clamshell w/ CDF	**No EW:** 67 **w/ EW**: 80	60 100	96 100	99 99
Restricted Clamshell w/ OWP	**No EW:** 56 **w/ EW**: 69	85 100	93 100	100 100
Clamshell with Silt Curtain & OWP	**No EW:** 64 **w/ EW**: 76	95 100	94 100	100 100
Clamshell with Silt Curtain & CDF	**No EW:** 88 **w/ EW**: 100	95 100	99 100	99 99

Assessment Criteria



Criteria Weights



Metric Assessment by Criteria

Expert Choice D:\Work\ERDC\DREDGING\dredging_example.ahp

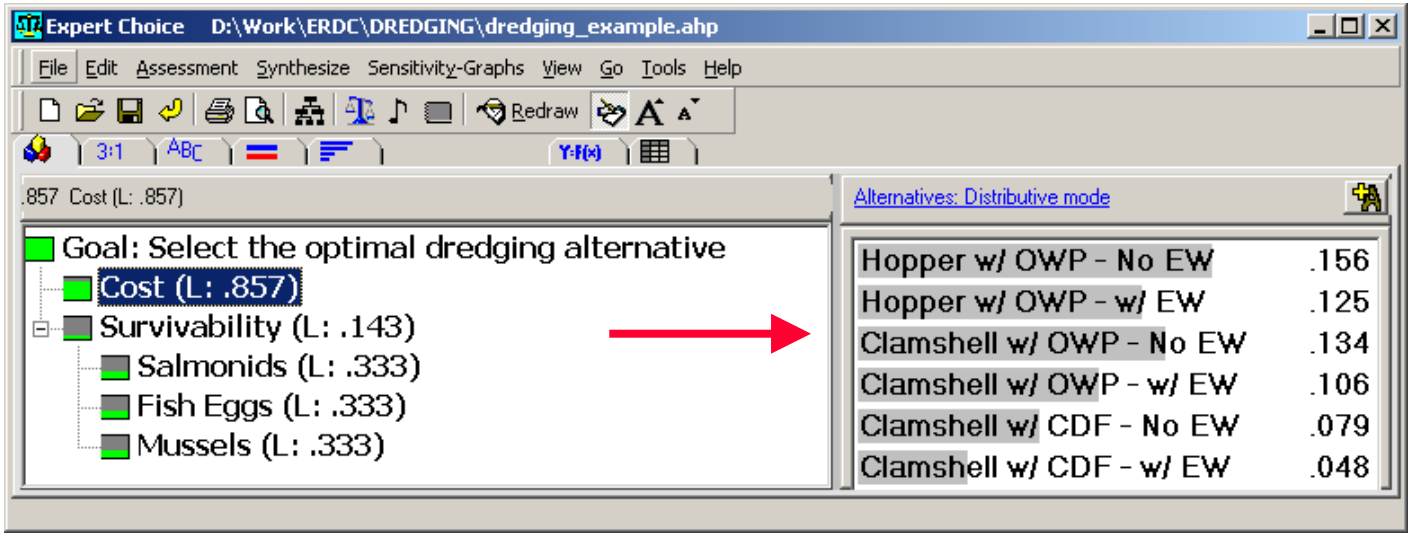
File Edit Assessment View Go Plot Tools Formula Type Help

Freeze Judgments Redraw

Low	High	Curvature
0.	100.	Linear

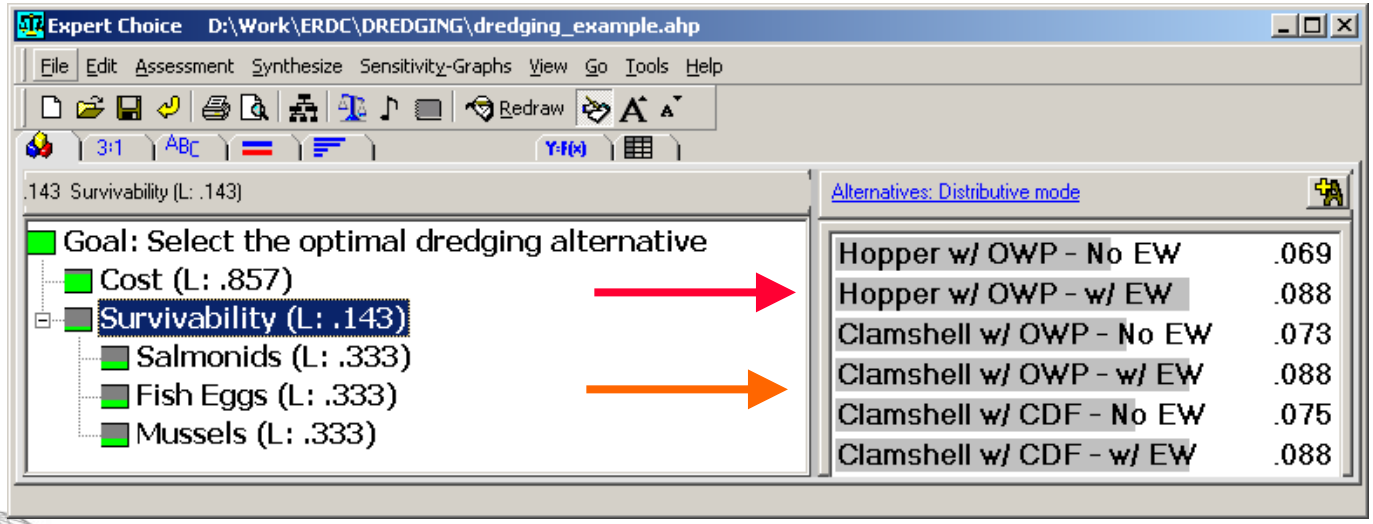
Alternative	DECR Cost (L: .857)	INCR Survivability Salmonids (L: .333)	INCR Survivability Fish Eggs (L: .333)	INCR Survivability Mussels (L: .333)
Hopper w/ OWP - No EW	35	95	40	100
Hopper w/ OWP - w/ EW	48	100	100	100
Clamshell w/ OWP - No EW	44	60	90	100
Clamshell w/ OWP - w/ EW	56	100	100	100
Clamshell w/ CDF - No EW	67	60	96	99
Clamshell w/ CDF - w/ EW	80	100	100	99
Restricted Clamshell w/ OWP - No EW	56	85	93	100
Restricted Clamshell w/ OWP - w/ EW	69	100	100	100
Clamshell with Silt Curtain & OWP - No EW	64	95	94	100
Clamshell with Silt Curtain & OWP - w/ EW	76	100	100	100
Clamshell with Silt Curtain & CDF - No EW	88	95	99	99
Clamshell with Silt Curtain & CDF - w/ EW	100	100	100	99

Results for Different Stakeholders

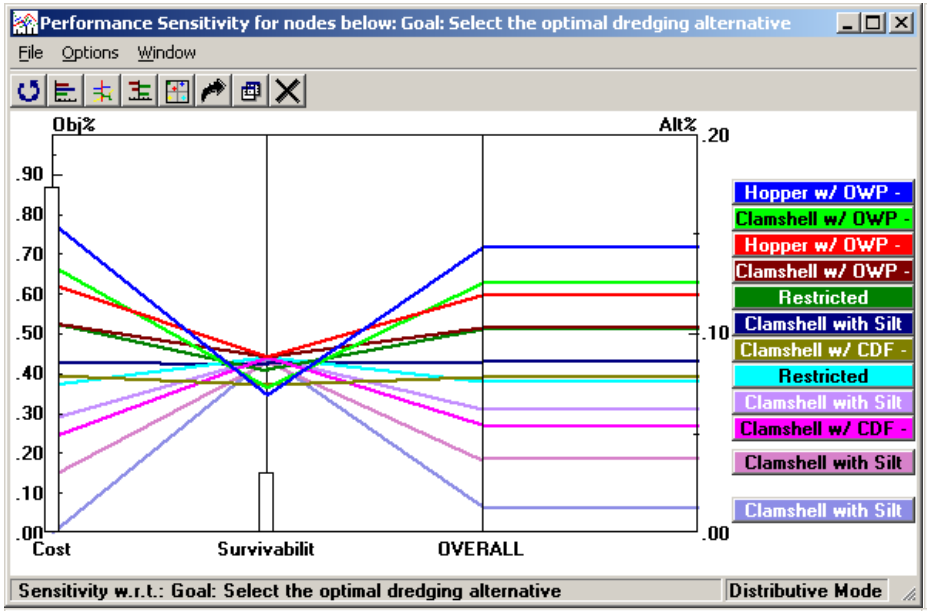


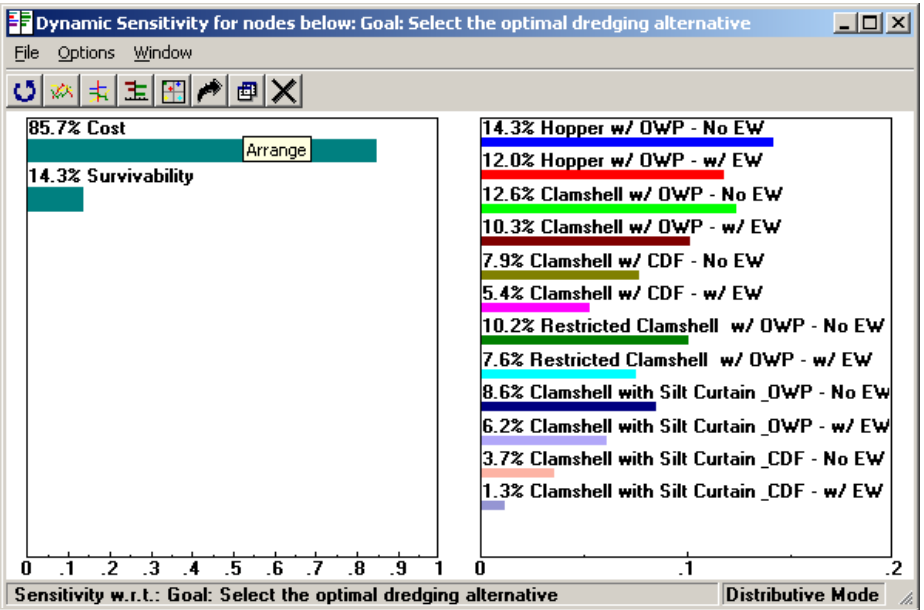
Regulatory Community

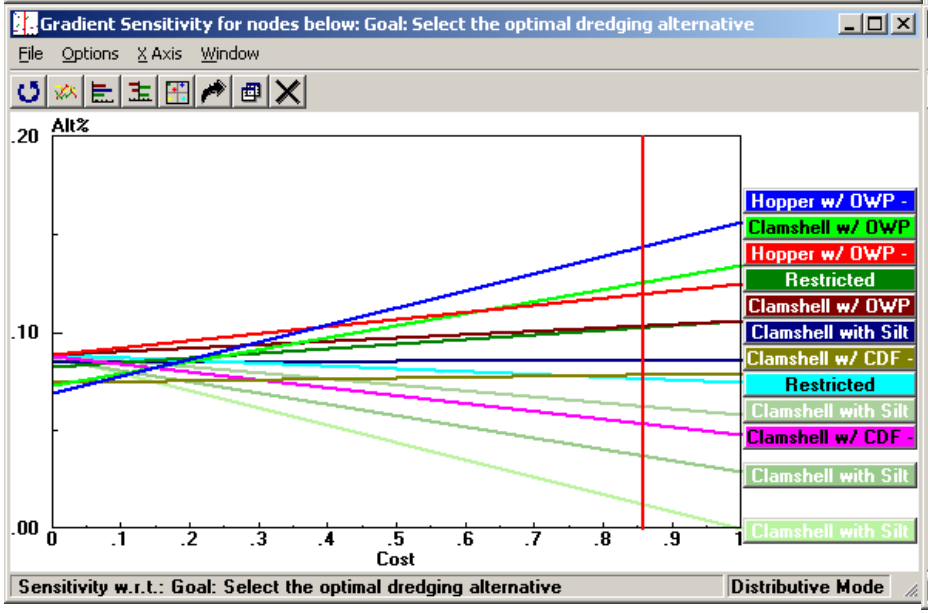
Public

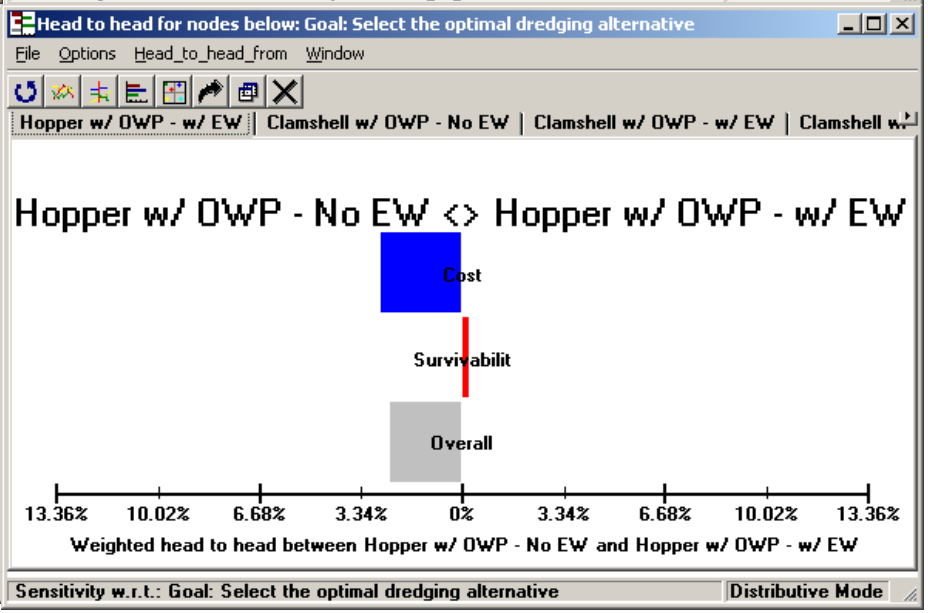


Sensitivity Analysis









Results

- **Balanced weighting** would yield selection of **Clamshell Dredging with OWP** as the optimal alternative
- **High weighting of cost and indirect costs/ schedule** yields selection of **Hopper Dredging** as the optimal alternative
- **High weighting of environmental resource protection** yields selection of **Hopper Dredging with OWP during an Environmental Windows** as the optimal alternative

Summary

- Clamshell dredging with open water placement without controls was selected as the optimal alternative
- Adaptive management will be used to address uncertainties concerns
- Monitoring within a adaptive management framework will be used to ensure ecological risks are acceptable

Questions?