THE IMPORTANCE OF IMPOUNDMENTS TO WILDLIFE

MANAGING NOW AND INTO THE FUTURE

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Importance to Wildlife:

- Bird nesting habitat
- Shorebird spring and southbound foraging habitat
- Red Knot roosting in the spring
- Waterfowl wintering habitat
- Waterfowl breeding habitat spring/summer
- wading bird foraging during the summer
- Fish nursery habitat
- Plant and shallow water habitat diversity

Other Functions:

- Waterfowl hunting
- Birding use
- Furbearer trapping
- Flood hazard reduction
- Mosquito control

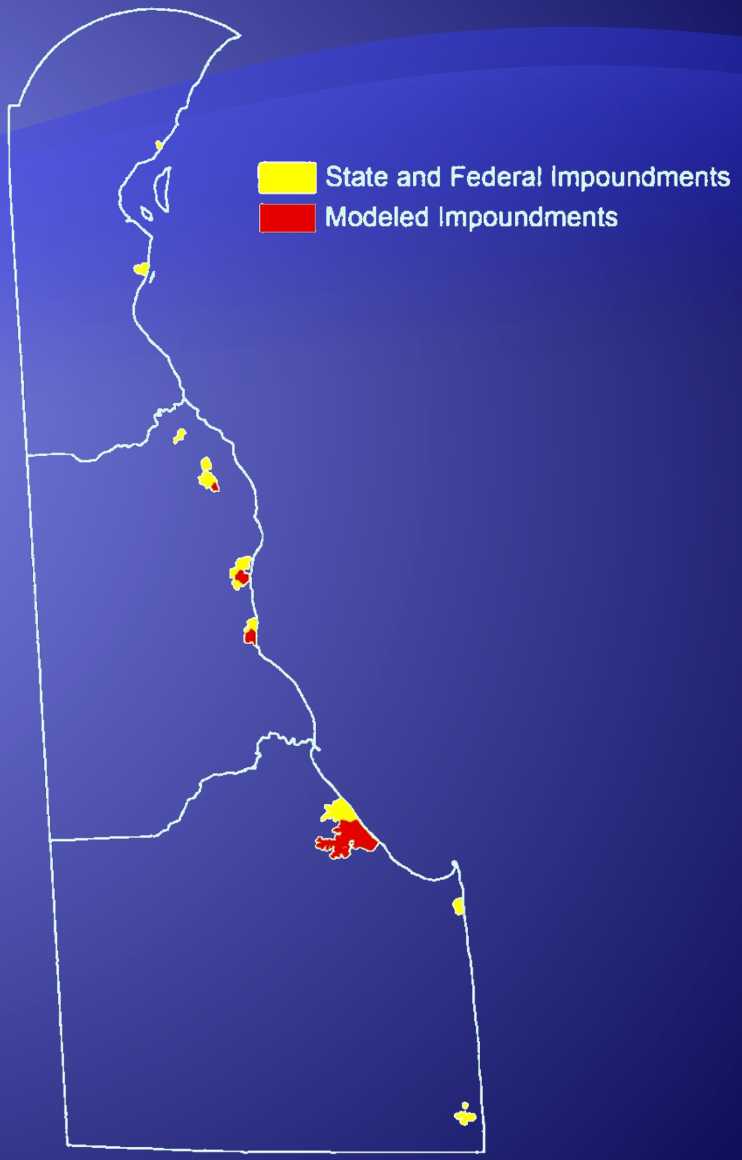
Value of Impoundments

- Valuable to wildlife – Ecological function
- Socially and economically important
- A valuable tool in sea level rise adaptation

Goal

Manage and maintain a coordinated system of coastal impoundments in Delaware for wildlife, fish, and human use while incorporating the impact of sea level rise on their sustainability.

DELAWARE IMPOUNDMENTS



Scope:

- Manage annually to maintain a desired level of habitat to meet multiple resource objectives.
- Manage over the long-term to anticipate value and function in the face of sea level rise.
  - Evaluated "Current" and "Accelerated" rates of sea level rise.

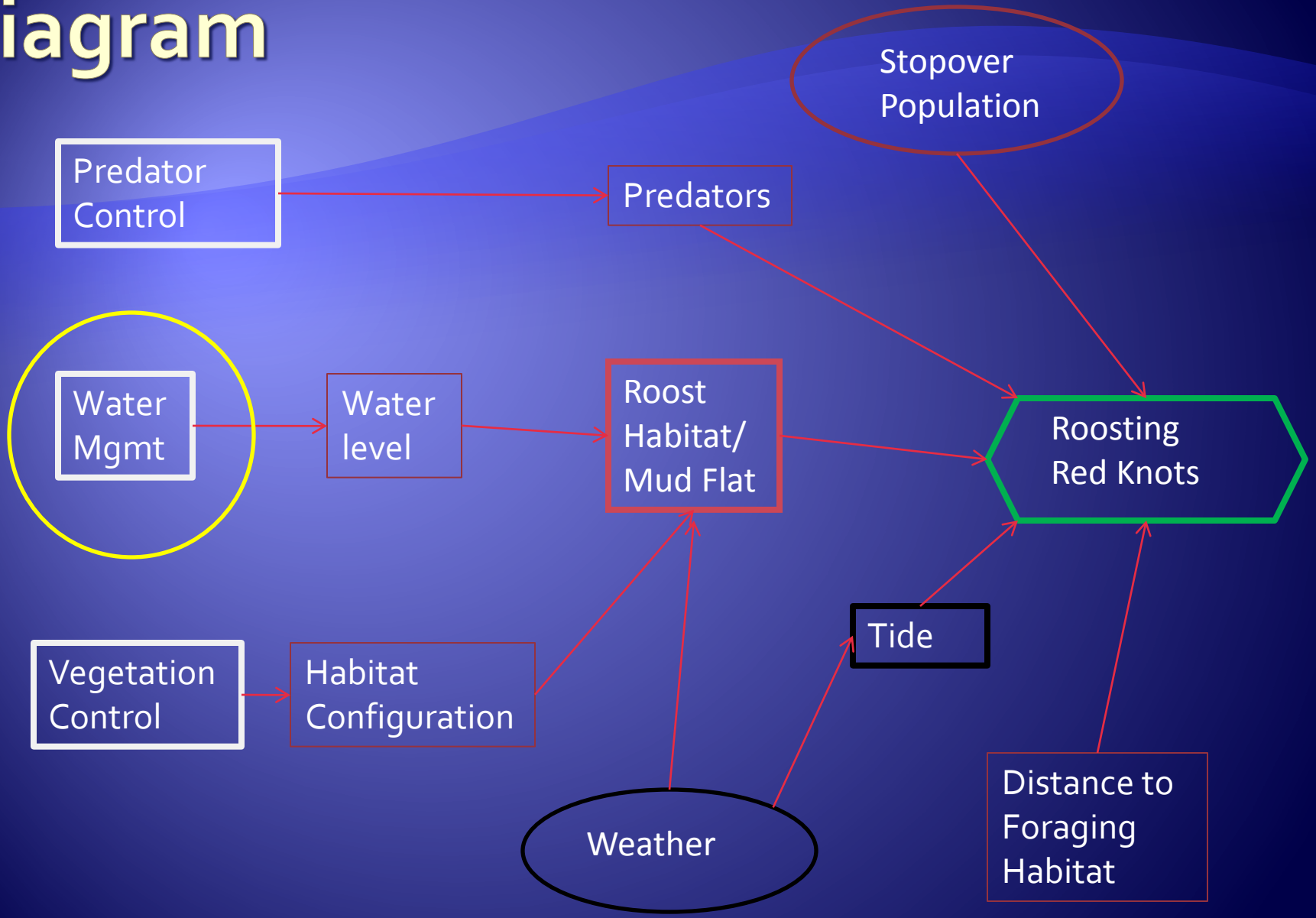
Approach:

- Develop a decision tool that will provide a set of management options that maximizes ecological benefit.
- Incorporate annual management routines
- Incorporate long-term management actions

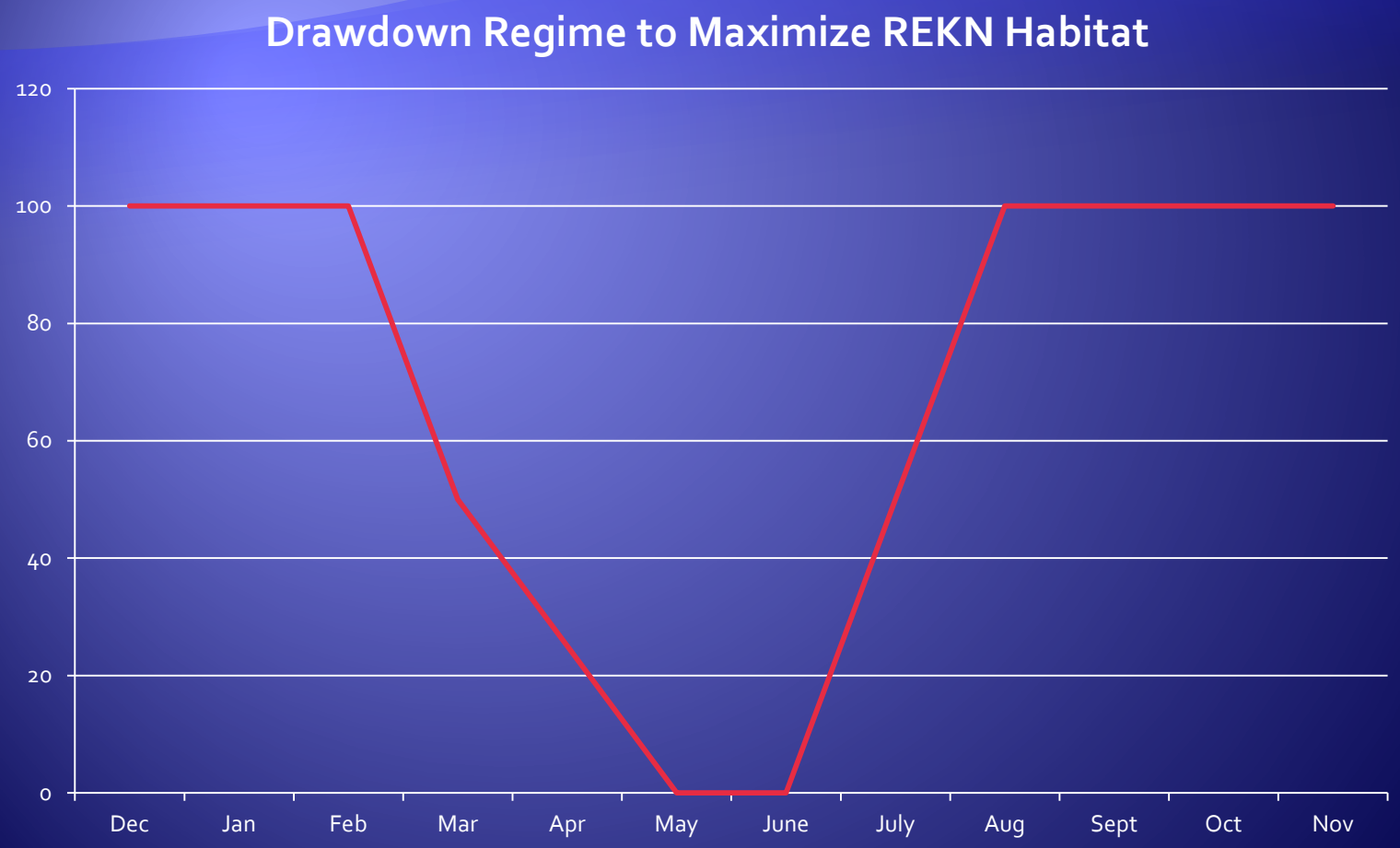
Initial Objectives:

- Wintering Waterfowl Habitat
- Red Knot roosting habitat (spring)
- Fish Nursery Habitat
- Mosquito Control*

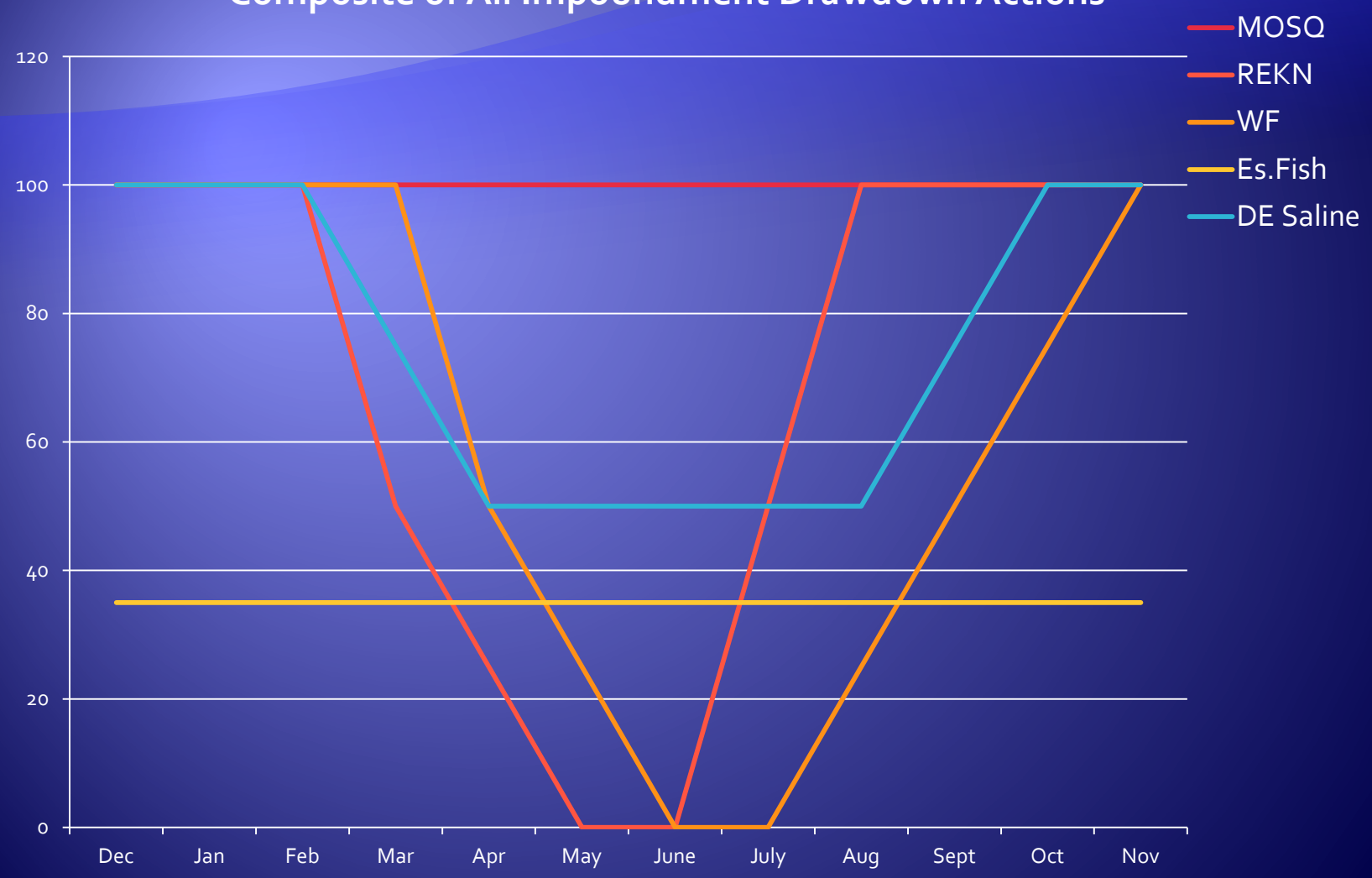
Consequences – Influence Diagram



Management Actions - Annual



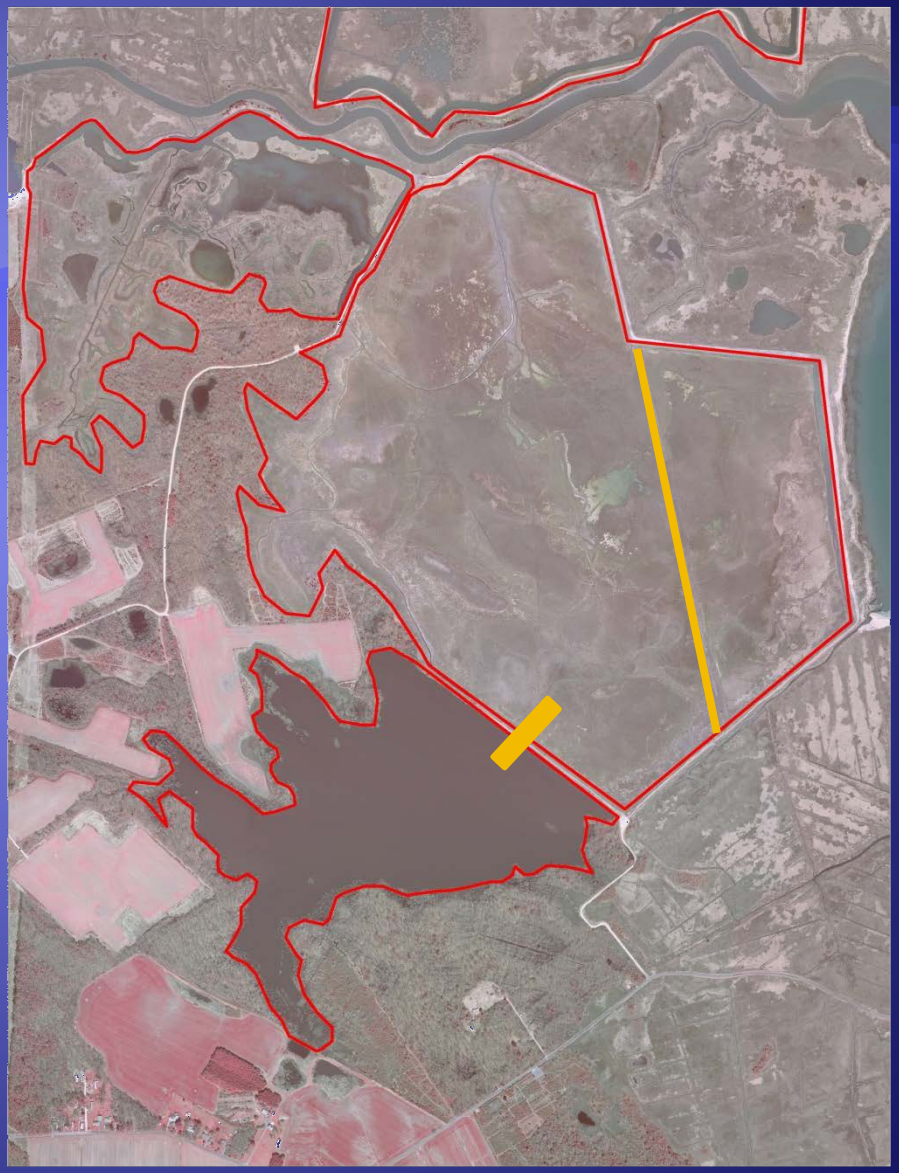
Composite of All Impoundment Drawdown Actions



Management Actions - Decades

- Raise levees and water control structures
- Raise elevation with thin soil application
- Revert
- Retreat

Action: Retreat



How Do We Decide?

- Each action has a benefit
- Benefit is determined by:
  - Species response
  - Uncertainty
  - Species weighting
- Each action has a cost

Consequences – Predictions and Uncertainty

Uncertainty

Impoundment	Action Plan	Sea Level Δ	Base Cost (k)	Add. Cost (k)	REKN 10yr	REKN 20yr	REKN 30yr
Primehook - Unit 3	Action 1 ("WF")	Accelerated Rate	22.5	na	75	50	0
Primehook - Unit 3	Action 1 ("WF")	Current Rate	22.5	na	100	75	50
Primehook - Unit 3	Action 2 ("REKN")	Accelerated Rate	15	na	225	150	0
Primehook - Unit 3	Action 2 ("REKN")	Current Rate	15	na	300	225	150
Primehook - Unit 3	Action 3 ("DE Saline")	Accelerated Rate	10	na	50	0	0
Primehook - Unit 3	Action 3 ("DE Saline")	Current Rate	10	na	50	50	15
Primehook - Unit 3	Act.4: Raise levee, replace WCS +WF	Accelerated Rate	22.5	1200	100	75	50
Primehook - Unit 3	Act.4: Raise levee, replace WCS +WF	Current Rate	22.5	1200	100	100	100
Primehook - Unit 3	Act.5: Raise levee, replace WCS +REKN	Accelerated Rate	15	1200	300	235	150
Primehook - Unit 3	Act.5: Raise levee, replace WCS +REKN	Current Rate	15	1200	300	300	300
Primehook - Unit 3	Act.6: Raise levee, replace WCS +DNREC	Accelerated Rate	10	1200	50	40	25
Primehook - Unit 3	Act.6: Raise levee, replace WCS +DNREC	Current Rate	10	1200	50	50	50

Tradeoffs/Optimization

- Value Function to Normalize Species Scores
- Multiply Normalized Score by Objective Weight
- Summed Weighted Scores Across Objectives to Obtain Total Benefit for Each Action
- Constrained Total Benefit by Cost
- Optimized by Linear Programming

Results:

Management Action	Decision	Benefit	Cost
Unit 3 Action 1	0	0.442	22.50
Unit 3 Action 2	1	0.485	15.00
Unit 3 Action 3	0	0.178	2.00
Unit 3 Action 4	0	0.436	20.00
Unit 3 Action 5	0	0.268	10.00
Raymond Action 1	0	0.019	2.00
Raymond Action 2	0	0.182	2.00
Raymond Action 3	0	0.144	1.00
Raymond Action 4	1	0.353	2.00
Raymond Action 5	0	0.146	1.00
Logan South Action 1	0	0.304	10.00
Logan South Action 2	0	0.329	10.00
Logan South Action 3	0	0.149	2.50
Logan South Action 4	1	0.450	15.00
Logan South Action 5	0	0.256	13.00
Little Creek Action 1	0	0.232	5.00
Little Creek Action 2	0	0.276	5.00
Little Creek Action 3	0	0.143	1.25
Little Creek Action 4	1	0.379	7.50
Little Creek Action 5	0	0.246	6.50
	Total:	1.67	39.5
	Constraint:		40

Max Benefit

Value of Structured Approach to Decision Making:

- Flexibility
- Transparent
- Adaptive
- Incorporates cost constraints
- Provides a suite of actions that maximizes benefit

Thank you:

- National Fish and Wildlife Foundation
- Delaware State-wide Impoundment Management Team