Ecological risk assessment of multiple hatchery programs in the Upper Columbia Watershed using a Delphi approach

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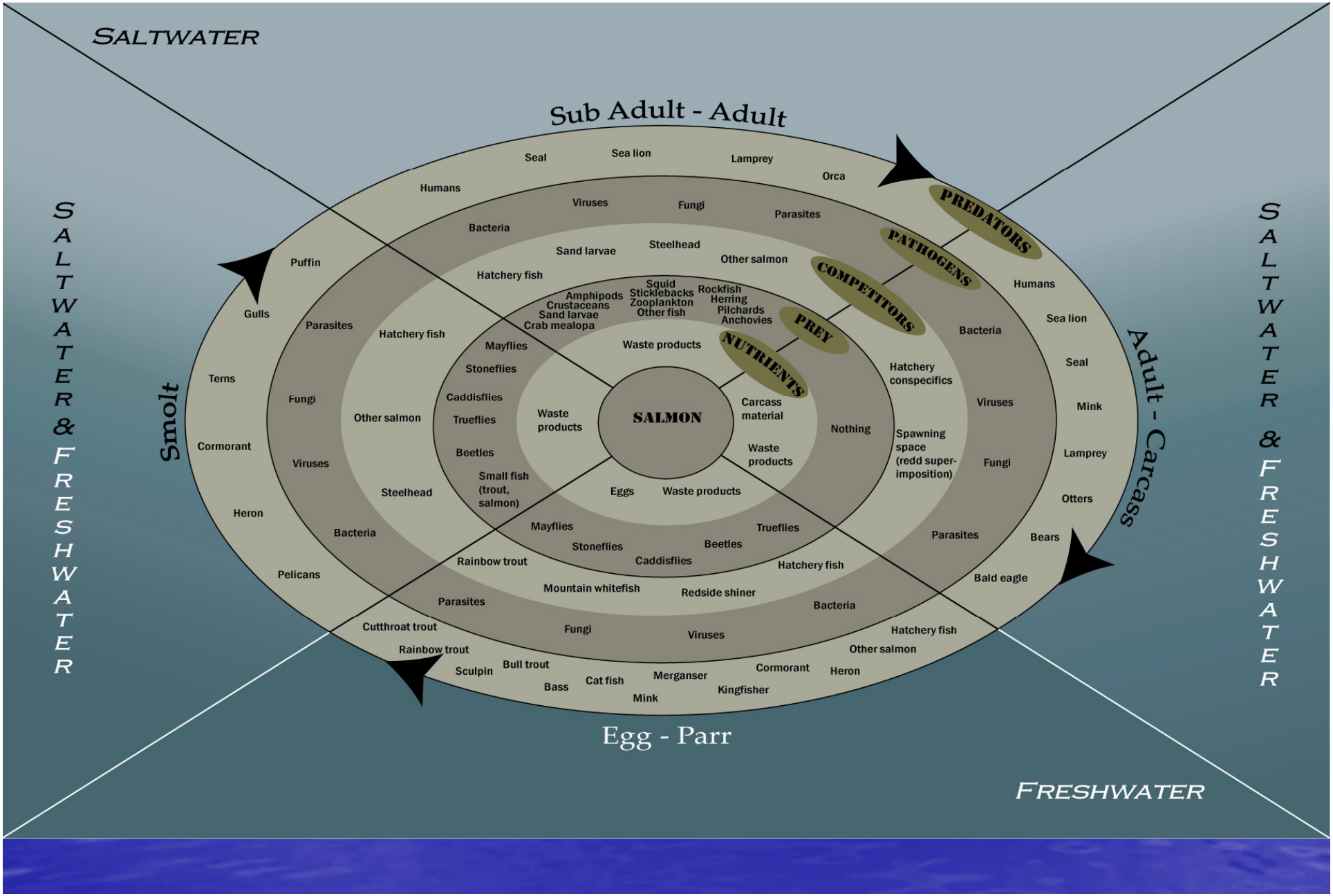
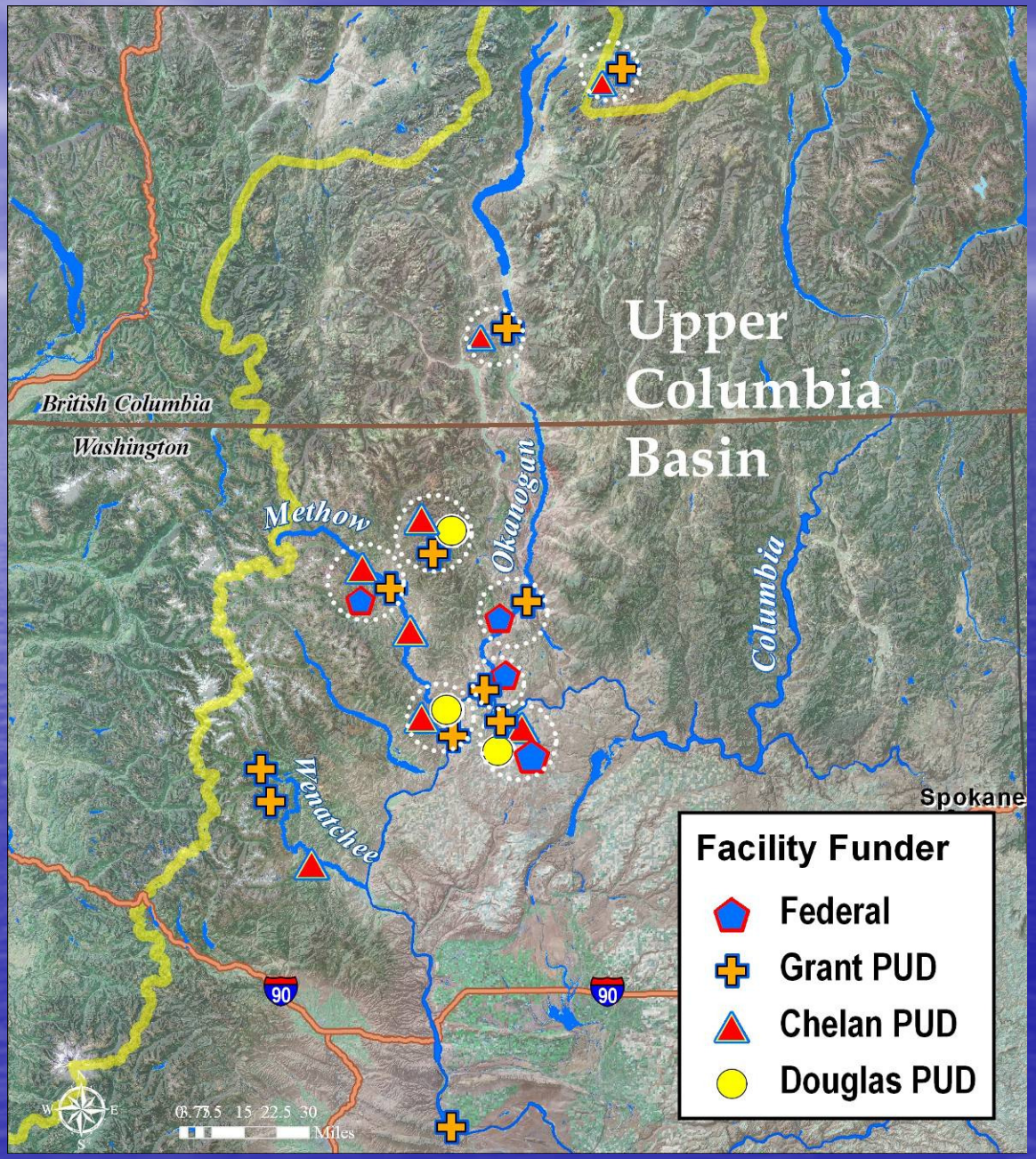
This is Not Mine
If I catch you and your Dog it's a
$250.00 Fine
Ellensburg Municipal code # 5.30.320
Have a nice walk

Ecological Interactions Between Salmon and Other Species




Upper
Columbia
Basin
British Columbia
Washington
Methow
Okanogan
Columbia
Wenatchee
Spokane
90
90
Facility Funder
Federal
Grant PUD
Chelan PUD
Douglas PUD
0 7.5 15 22.5 30
Miles

Approach

- Modification of Delphi approach (Pearsons and Hopley 1999) and modeling approach (Busack et al. 2005)

Methods

1. Hatchery Committees - Identify NTTOC and containment objectives
2. Local experts – Populate Hatchery, NTTOC, and Interaction templates
3. Global and local experts – Populate Risk template (Delphi)
4. Technical Team - Estimate program and cumulative risk and scientific uncertainty (Delphi and PCD Risk 1)

NTTOC (natural origin)	Objective
Spring Chinook	VL (<5%)
Summer Chinook	L (<10%)
Steelhead	VL (<5%)
Sockeye	L (<10%)
Cutthroat	Mod (<41%)
Pacific Lamprey	VL (<5%)

Context of Assessment

- Spatial scale
  - To the river mouth except for Columbia River releases
- Temporal scale
  - 2013-2023
  - From day of release to river mouth
- Hatchery program level
- Risks to naturally produced NTTOC

Hatchery Template

- Species
- Release location
- Release time
- Minimum, mean, and maximum values
  - Number released
  - Mean FL, Min FL, and CV
  - Survival to mouth
  - Residence time
  - % residuals

NTTOC Template

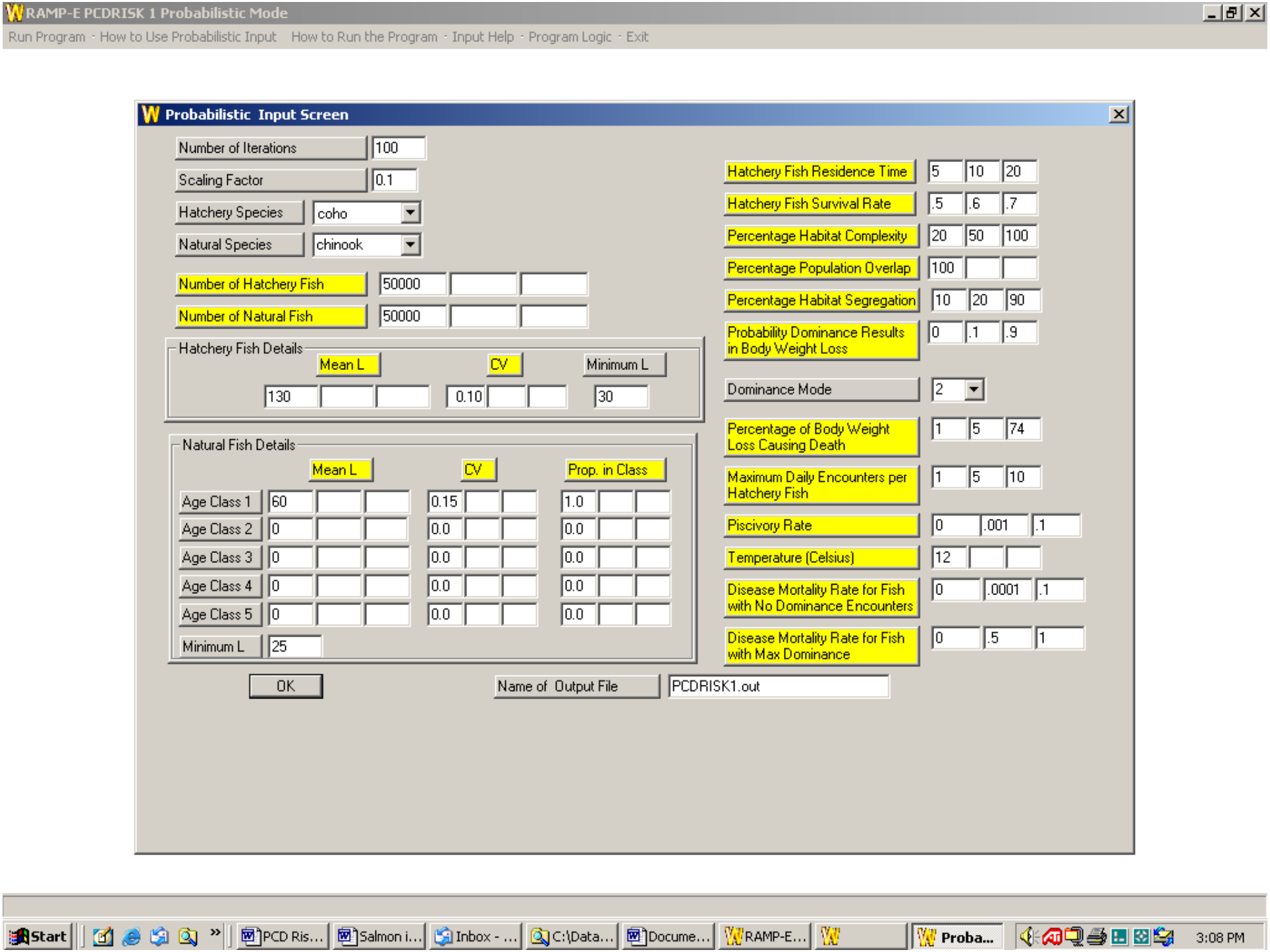
- NTTOC
- Minimum, mean, and maximum values
  - Abundance
  - Mean length and CV for each age class
  - Proportion of fish in each age class

Interactions Template

- Minimum, most likely, maximum values
  - % habitat complexity
  - % population overlap
  - % habitat segregation
  - Probability dominance results in body weight loss
  - Dominance mode
  - % of body weight loss that results in death
  - Maximum daily encounters per hatchery fish
  - Piscivory rate
  - Temperature
  - Disease mortality rate for fish with no dominance encounters
  - Disease mortality rate for fish with maximum dominance

Risk Assessment Template (Delphi)

- Interaction strength for each ecological mechanism x NTTOC metric cell (abundance, size, distribution)
- % impact to NTTOC abundance, size, and distribution


RAMP-E PCDRISK 1 Probabilistic Mode
Run Program - How to Use Probabilistic Input How to Run the Program - Input Help - Program Logic - Exit
Probabilistic Input Screen
Number of Iterations
100
Scaling Factor
0.1
Hatchery Species
coho
Natural Species
chinook
Number of Hatchery Fish
50000
Number of Natural Fish
50000
Hatchery Fish Details
Mean L
CV
Minimum L
130
0.10
30
Natural Fish Details
Mean L
CV
Prop. in Class
Age Class 1
60
0.15
1.0
Age Class 2
0
0.0
0.0
Age Class 3
0
0.0
0.0
Age Class 4
0
0.0
0.0
Age Class 5
0
0.0
0.0
Minimum L
25
OK
Name of Output File
PCDRISK1.out
Hatchery Fish Residence Time
5
10
20
Hatchery Fish Survival Rate
.5
.6
.7
Percentage Habitat Complexity
20
50
100
Percentage Population Overlap
100
Percentage Habitat Segregation
10
20
90
Probability Dominance Results in Body Weight Loss
0
.1
.9
Dominance Mode
2
Percentage of Body Weight Loss Causing Death
1
5
74
Maximum Daily Encounters per Hatchery Fish
1
5
10
Piscivory Rate
0
.001
.1
Temperature (Celsius)
12
Disease Mortality Rate for Fish with No Dominance Encounters
0
.0001
.1
Disease Mortality Rate for Fish with Max Dominance
0
.5
1
Start
PCD Ris...
Salmon i...
Inbox - ...
C:\Data...
Docume...
RAMP-E...
Proba...
3:08 PM

Risk Assessment and Uncertainty

Panelist	NTT 1	NTT 2	NTT 3
Herman	1	100	0
Peduncle	40	90	0
Fin	90	95	10
Gill	20	100	5
Beth	50	95	0
Risk (mean)	40	96	3
Uncertainty (SD)	34	4	4

Cumulative Risk (e.g. additive ass.)

Hatchery Program	NTT 1	NTT 2	NTT 3	Total
1	5	20	1	26
2	20	5	10	35
3	10	1	5	16
4	5	1	1	7
All	40	27	17	84

Relationship between Delphi and PCD Risk

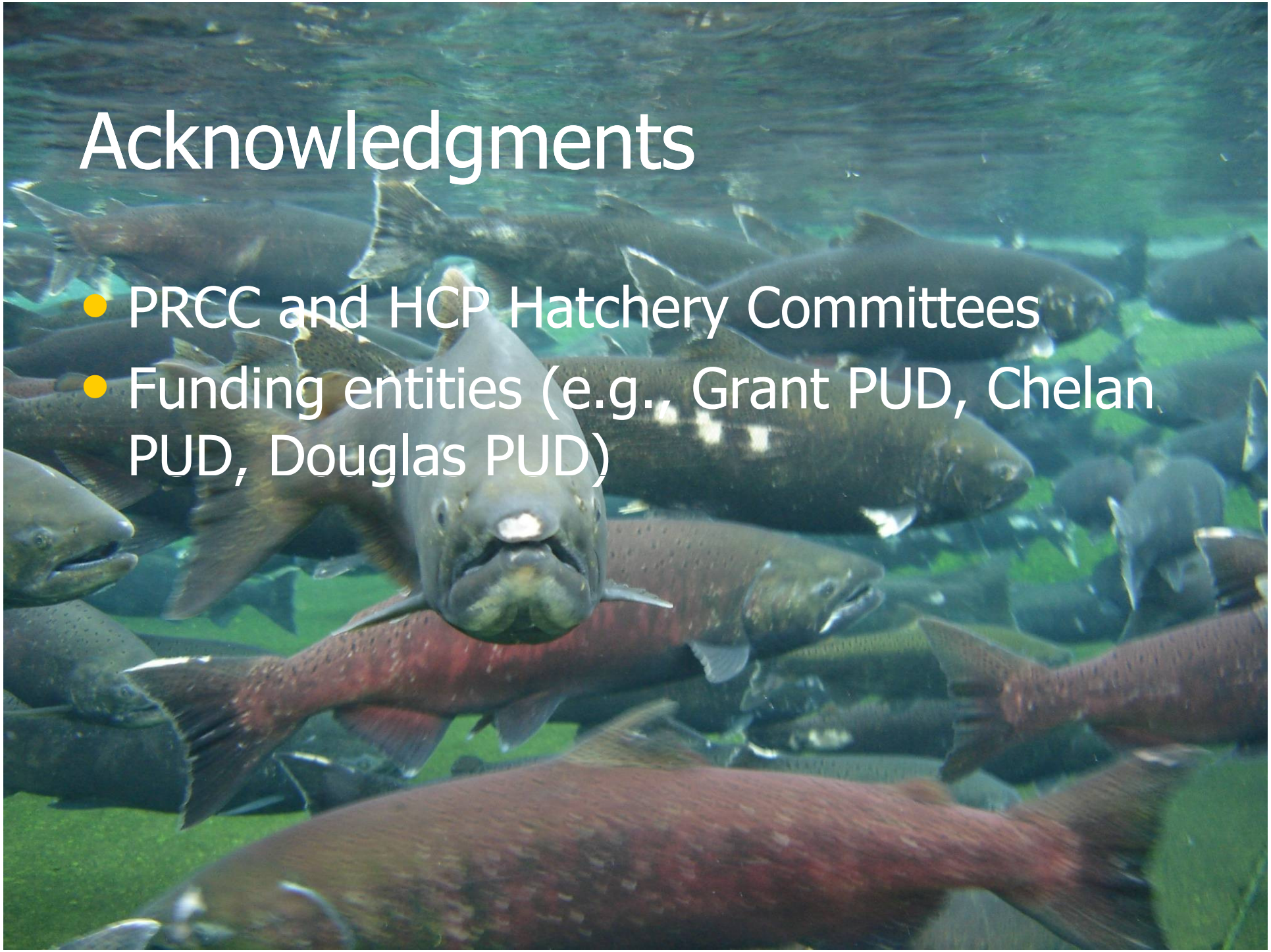
- Determine if relationships exist between Delphi and model results
- Allows for updating of risks without having to convene experts again (e.g., change in program, new data available)
- Allows for comparison to other areas

Lessons Learned

- Big time - Time investment increases with number of hatchery programs, NTTOC, experts, and amount of unconsolidated data that is available
- Uncomfortable - assumption rich even in areas with much data
- Data scarcity for non salmon/steelhead (e.g., Pacific lamprey, cutthroat)

Next Steps

1. Conduct risk assessment
2. Use risk assessment to reduce risk and adapt monitoring efforts if necessary
3. Monitor and evaluate
4. Adaptive management



Acknowledgments

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