Assessing and Reducing Ecological Risks of Hatchery Operations Using PCD Risk 1

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Approaches to Ecological Risk Assessment

- SIWG (1984) Interactions table
- WDFW's BRAP (1992)
- Expert-based Approach (e.g., Pearsons and Hopley 1999)
- Risk-based research (e.g., Sharpe et al. 2008)

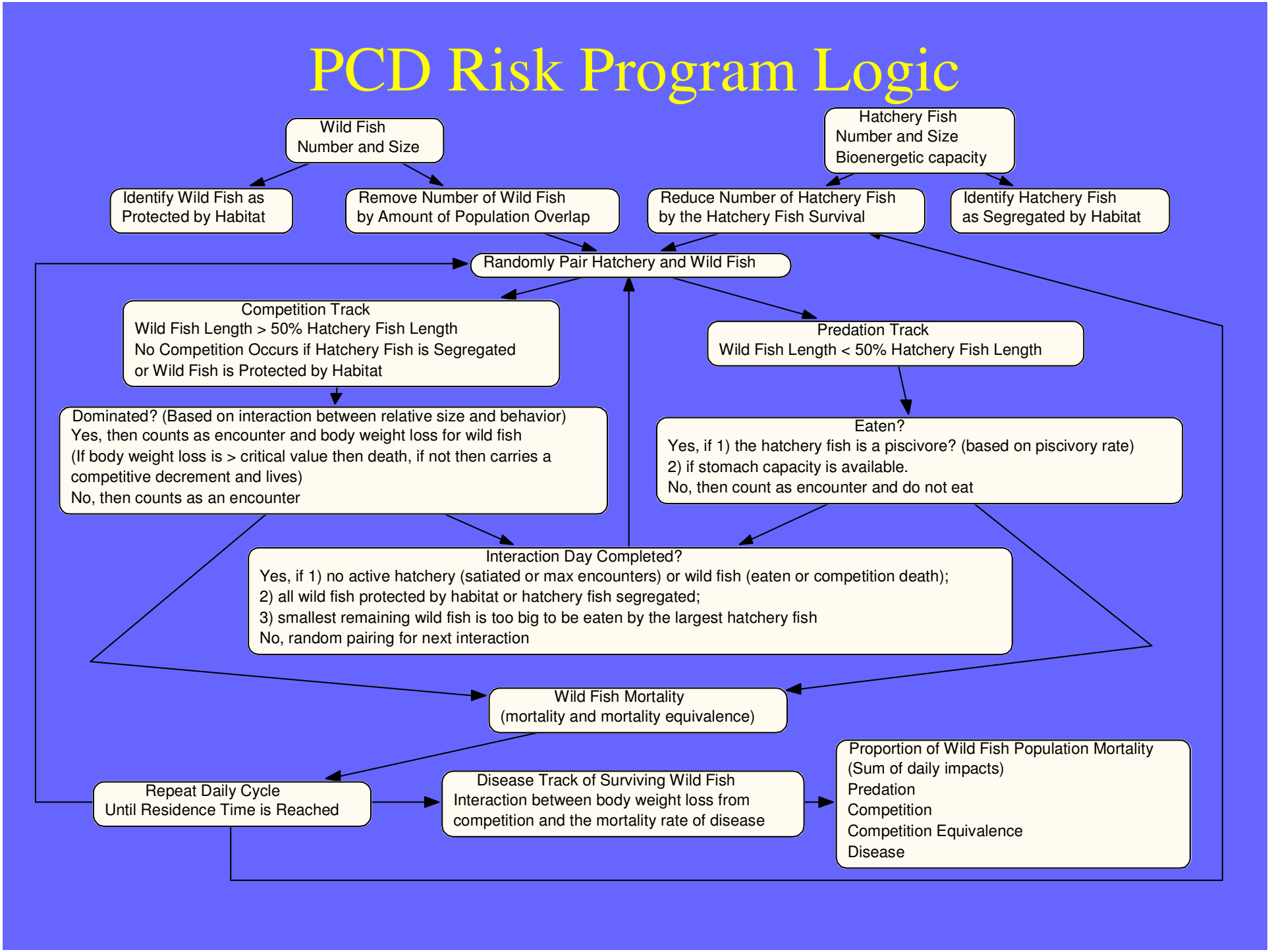
Approaches to Ecological Risk Reduction

- Size, time, and place of release
- Adaptive stocking
- Residualism reduction methods
- Disease guidelines
- Interactions indices

PCD RISK 1

- Individual-based model, simulates predation, competition, and disease impacts in freshwater on natural-origin (NO) juveniles caused by hatchery-origin (HO) juveniles
- Simulates impacts from single HO species on single NO species
- Assumes the groups are continuously accessible to each other under specified conditions, over specified time period
- Uses replicate runs to simulate uncertainty

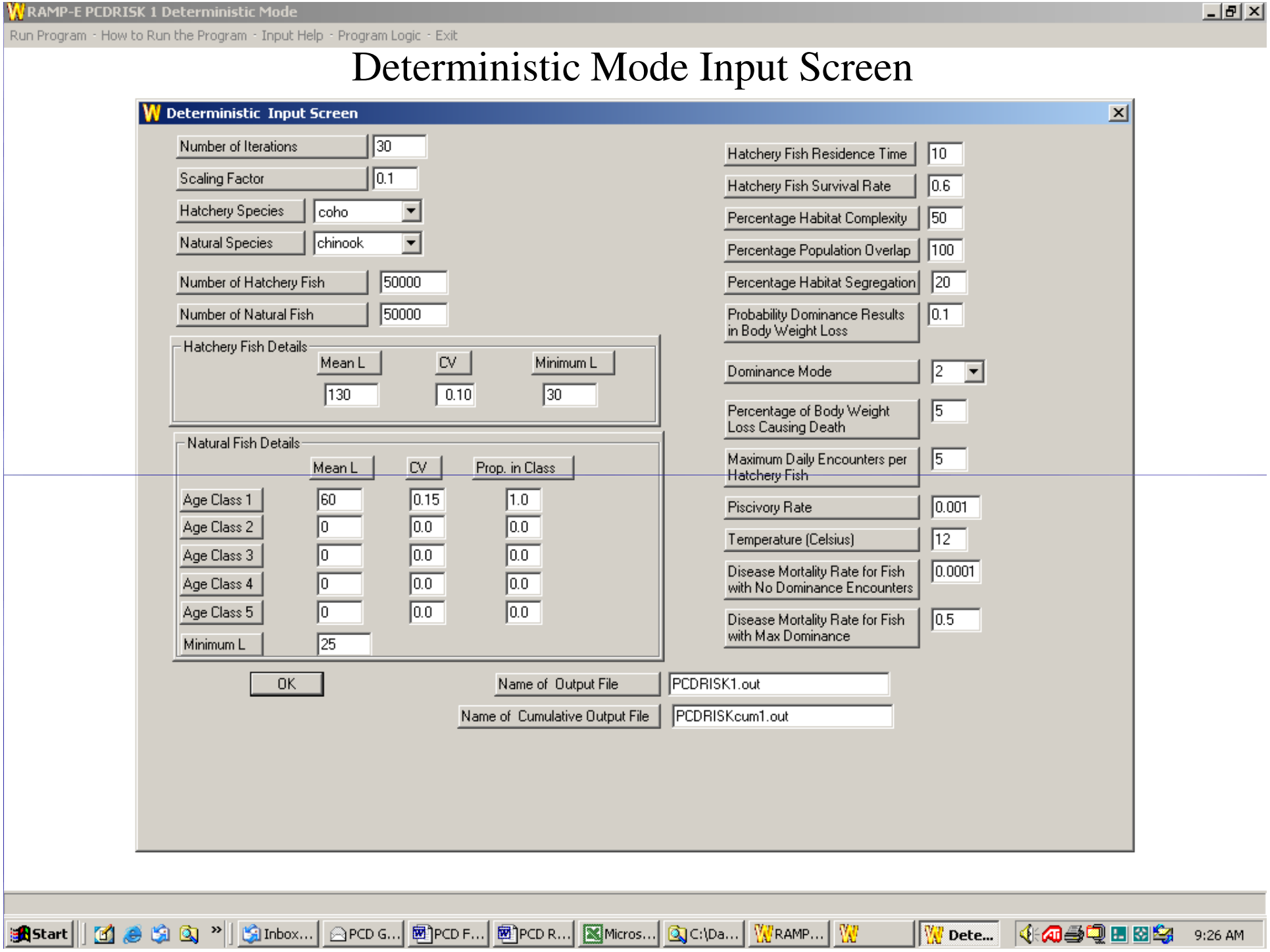
PCD Risk Program Logic



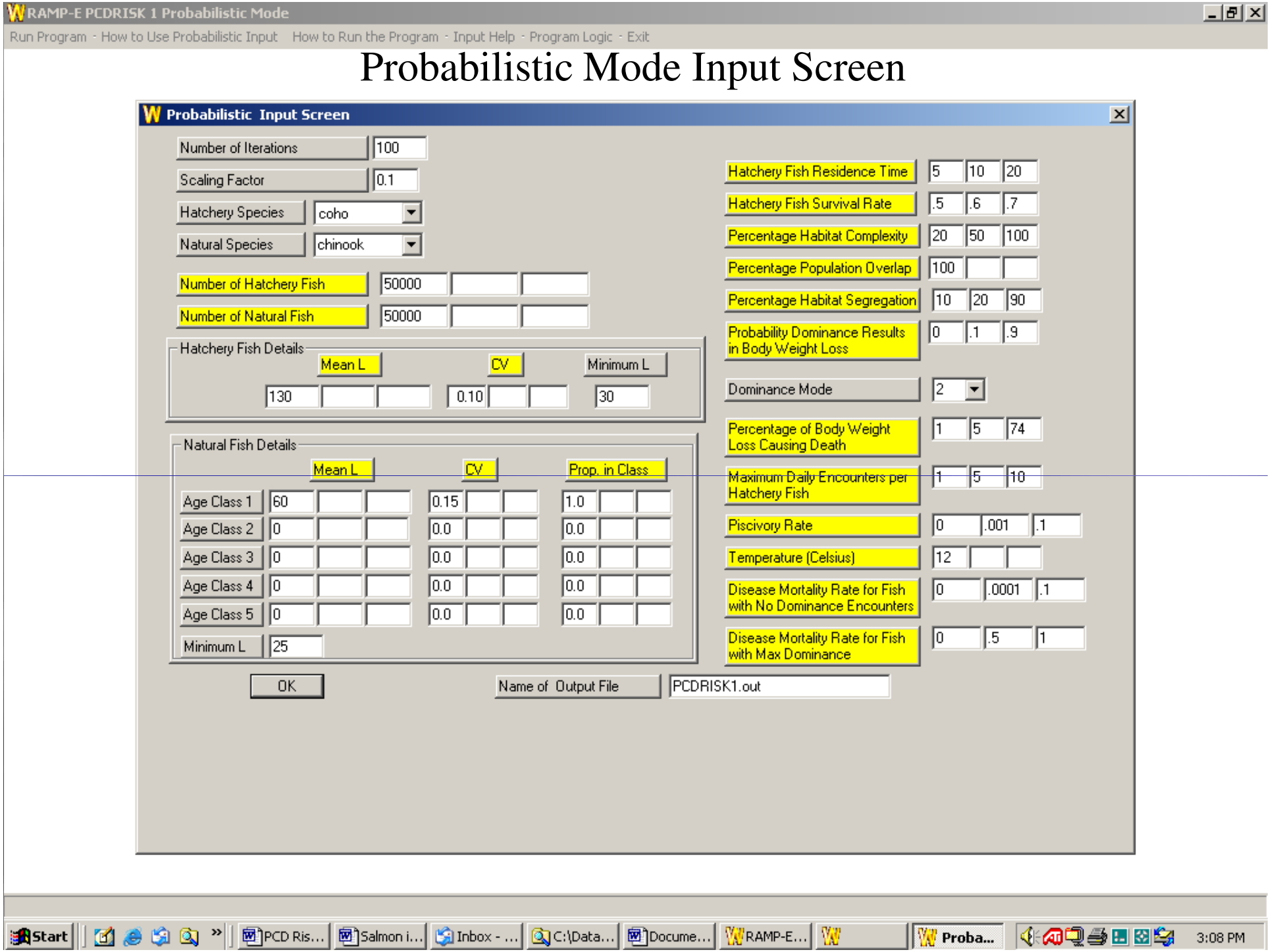
Effect of Increases in Key Variables on Impacts

- Number of hatchery fish – increase
- Size of hatchery fish – increase or decrease
- Hatchery fish residence time – increase
- Population overlap – increase
- Habitat complexity – decrease
- Habitat segregation – decrease
- Daily encounters - increase
- Piscivory rate – increase
- Temperature - increase

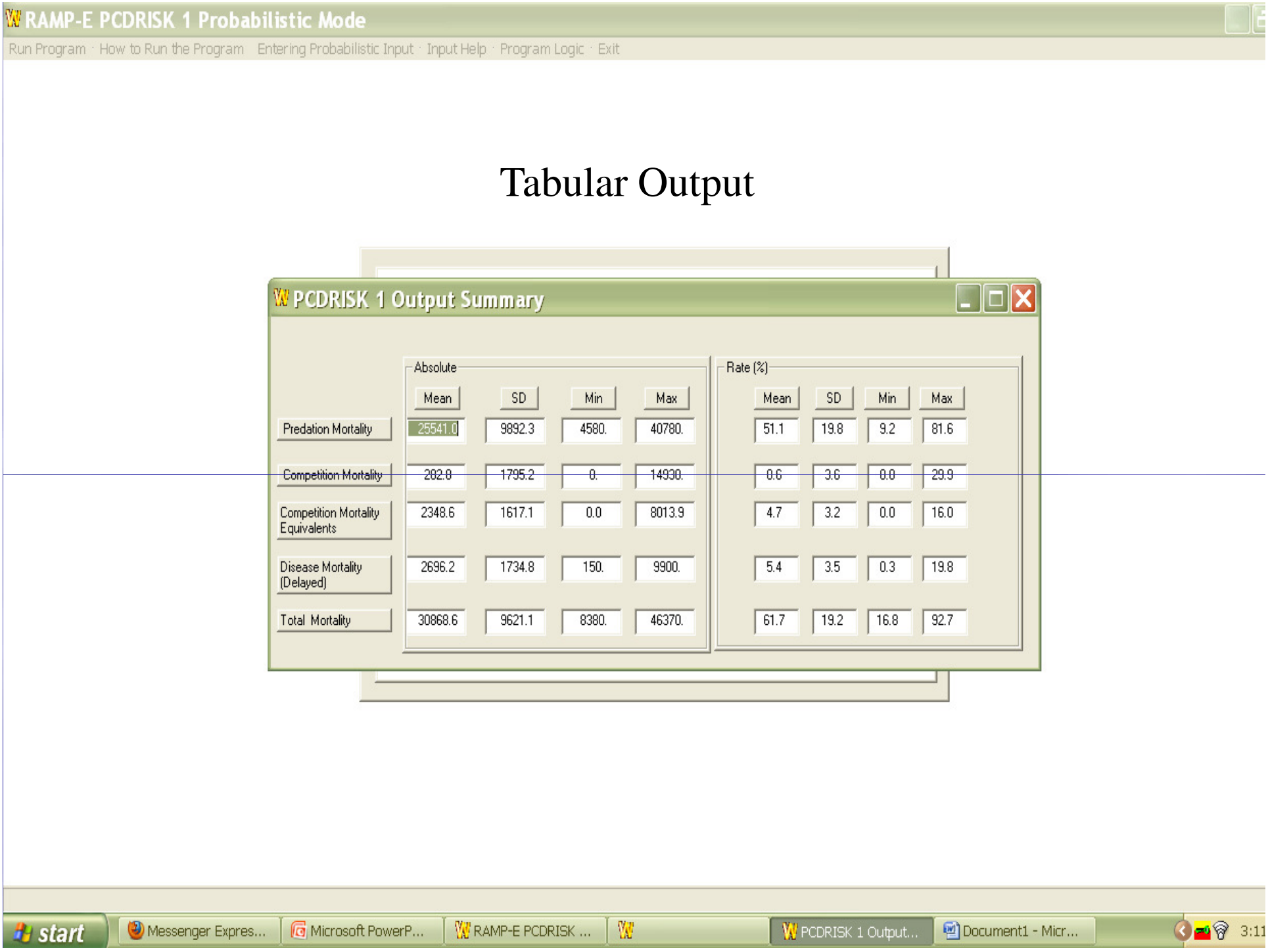
Deterministic Mode Input Screen



Probabilistic Mode Input Screen

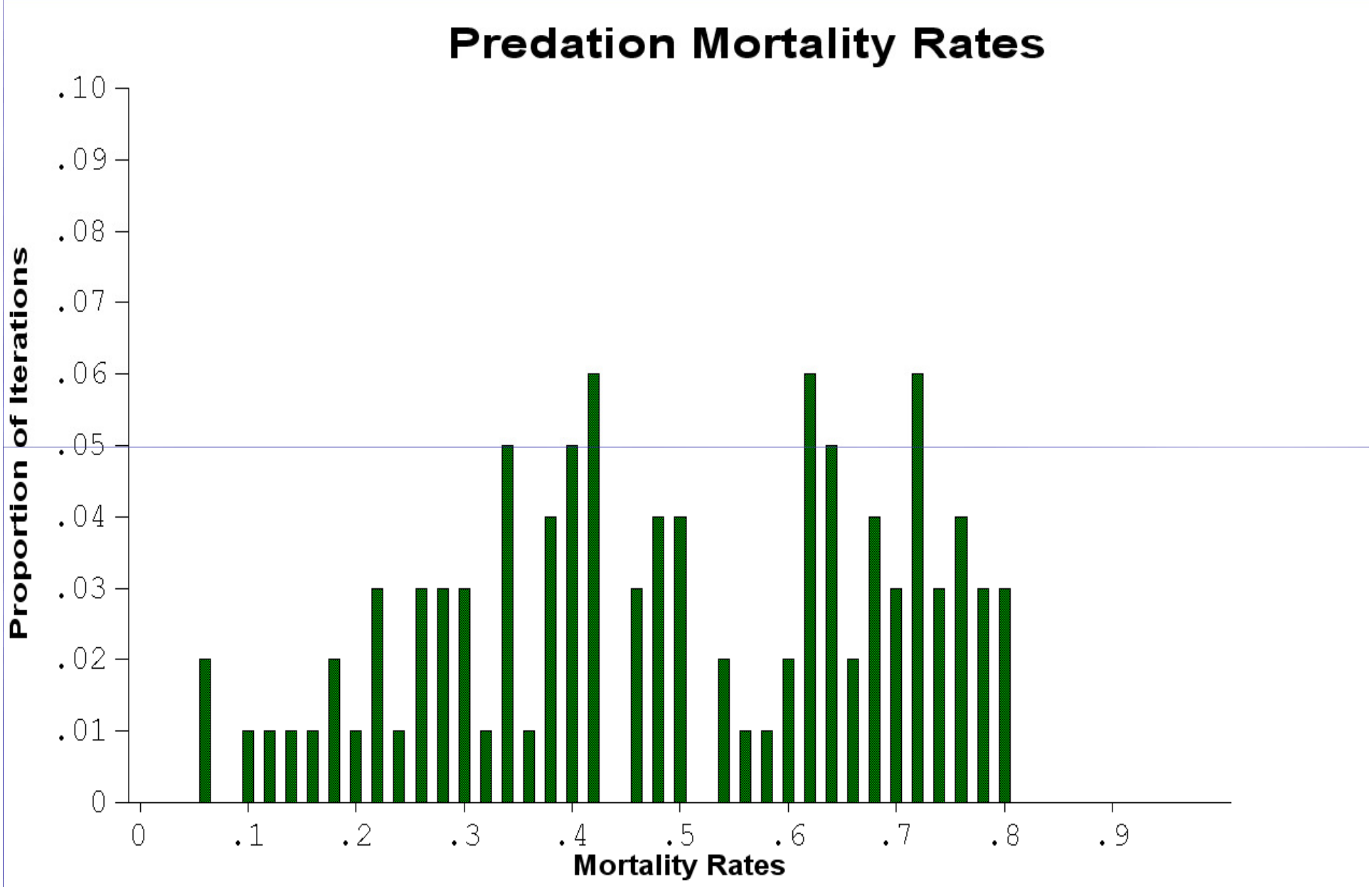


Tabular Output



RAMP-E PCDRISK 1 Probabilistic Mode

Run Program · How to Run the Program · Entering Probabilistic Input · Input Help · Program Logic · Exit



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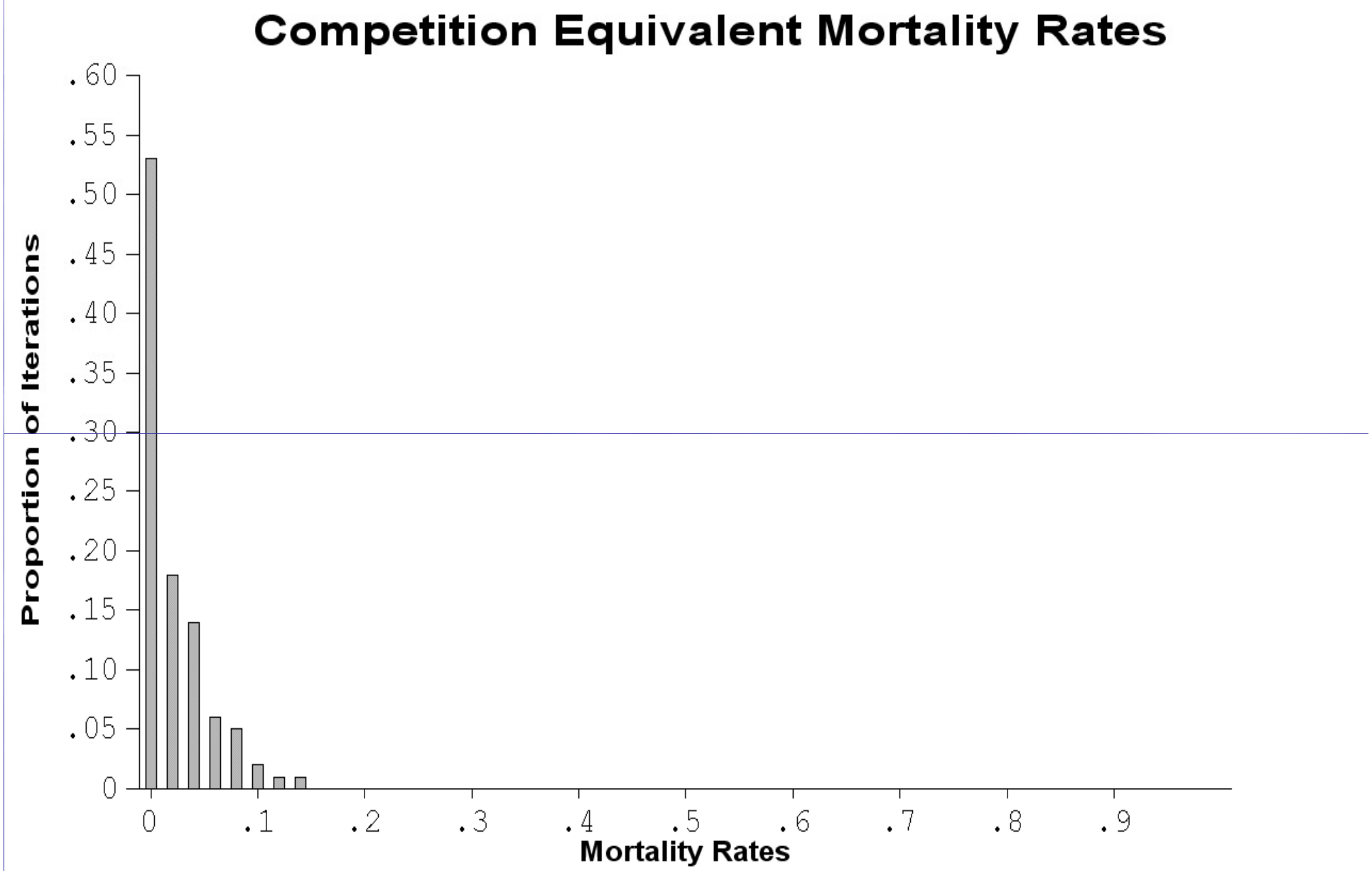
RAMP-E PCDRISK 1 Probabilistic Mode

Run Program · How to Run the Program · Entering Probabilistic Input · Input Help · Program Logic · Exit



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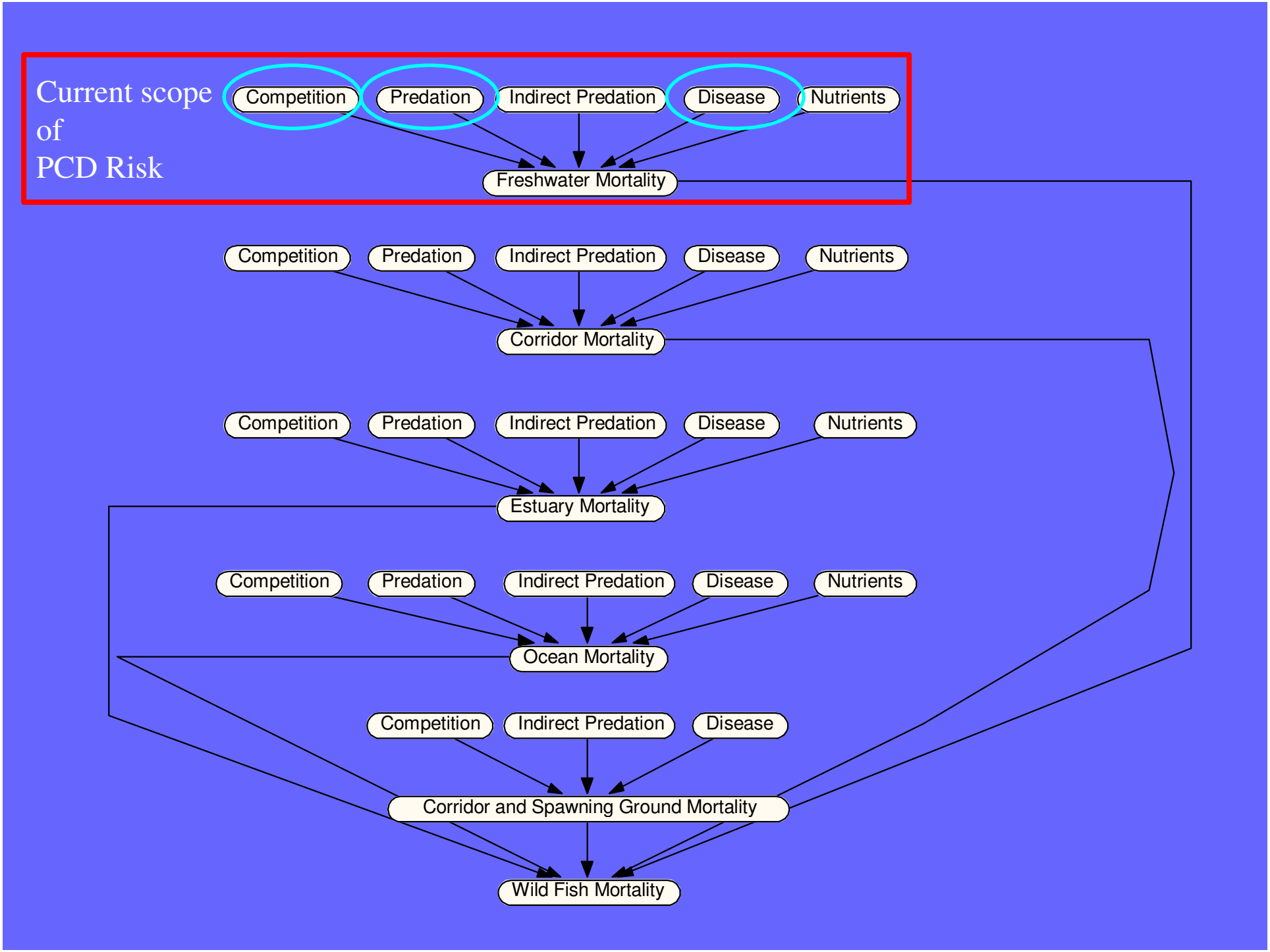
PCD Risk Strengths

- Easy to use
- Transparent and repeatable
- Science-based and reviewed by experts
- Uses readily available data
- Provides outputs that are useful to decision makers
- Very flexible, allowing a variety of scenarios to be examined
- Free

PCD Risk Caveats

- Untested empirically
- Heavy burden on the user for providing inputs when little empirical data is available (disease)
- Assumes no exploitative competition, no compensatory survival, fish <50% the hatchery fish length do not experience competition
- Not an ecosystem model (does not include many indirect interactions that could occur)
- Does not include other mechanisms and environments


Current scope of PCD Risk
Competition
Predation
Indirect Predation
Disease
Nutrients
Freshwater Mortality
Competition
Predation
Indirect Predation
Disease
Nutrients
Corridor Mortality
Competition
Predation
Indirect Predation
Disease
Nutrients
Estuary Mortality
Competition
Predation
Indirect Predation
Disease
Nutrients
Ocean Mortality
Competition
Indirect Predation
Disease
Corridor and Spawning Ground Mortality
Wild Fish Mortality

Qualifications

- Model is a greatly simplified mathematical approximation of nature
- Mechanisms of impact don't always express themselves in measurable impacts
- Model does not replace real data collection. Model outputs are only hypotheses which can (and should) then be tested

PCD RISK 1
Availability

Downloadable from the BPA website

ftp://ftp.bpa.gov/pub/efw-RAMP/

Future Directions

- Empirically test model outputs
- Develop indirect predation and nutrient dynamics model
- Develop models for estuary, ocean, and spawning grounds
- Integrate ecological, genetic, and facilities risks and potential benefits into single model
- Other ideas from this meeting

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