Great Lakes Binational Ecological Grass Carp Risk Assessment

U.S. Fish & Wildlife Service

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Great Lakes Fishery Commission

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OUTLINE

1. Grass Carp Risk Assessment – background & process
2. Risk Assessment Results
   - Arrival
   - Survival
   - Establishment
   - Spread
   - Ecological Consequences
   - Overall Risk

Grass Carp Risk Assessment
Project Background

- Initiated and led by DFO (Asian Carp Program), coordinated by the Great Lakes Fishery Commission (GLFC), and in collaboration with the U.S. Geological Survey (USGS) and U.S. Fish and Wildlife Service (USFWS).
- Binational risk assessment Writing Team (DFO, GLFC,USGS, USFWS, U of T) established 2014.
- Contributors to scope, research & peer-review RA
  - Federal, State and Provincial agencies in the Great Lakes basin, and international academic institutions.
- Risk assessment released January 2017: Cudmore et al. (2017)

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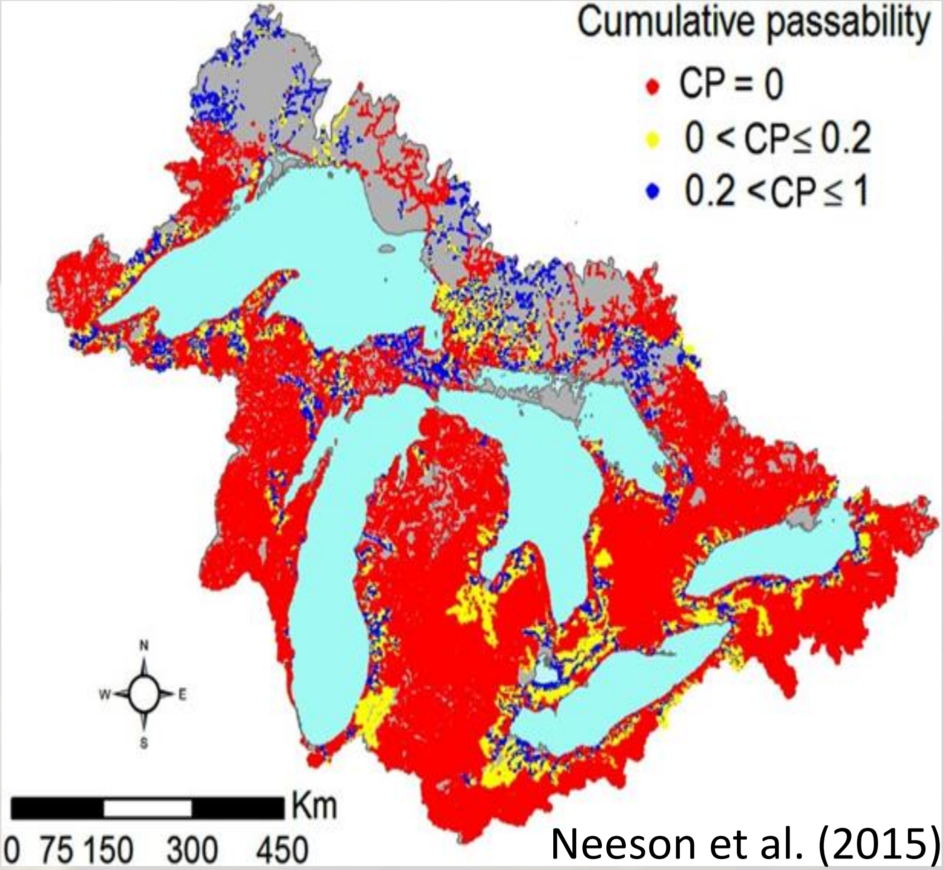
Grass Carp Risk Assessment
Scope

- **Ploidy**: triploid (sterile) & diploid (fertile) fish.
- **Spatial scale**: Great Lakes basin, on a lake-by-lake-basis.
- **Temporal scale**: 5, 10, 20, and 50 years from the baseline year (i.e., 2014).



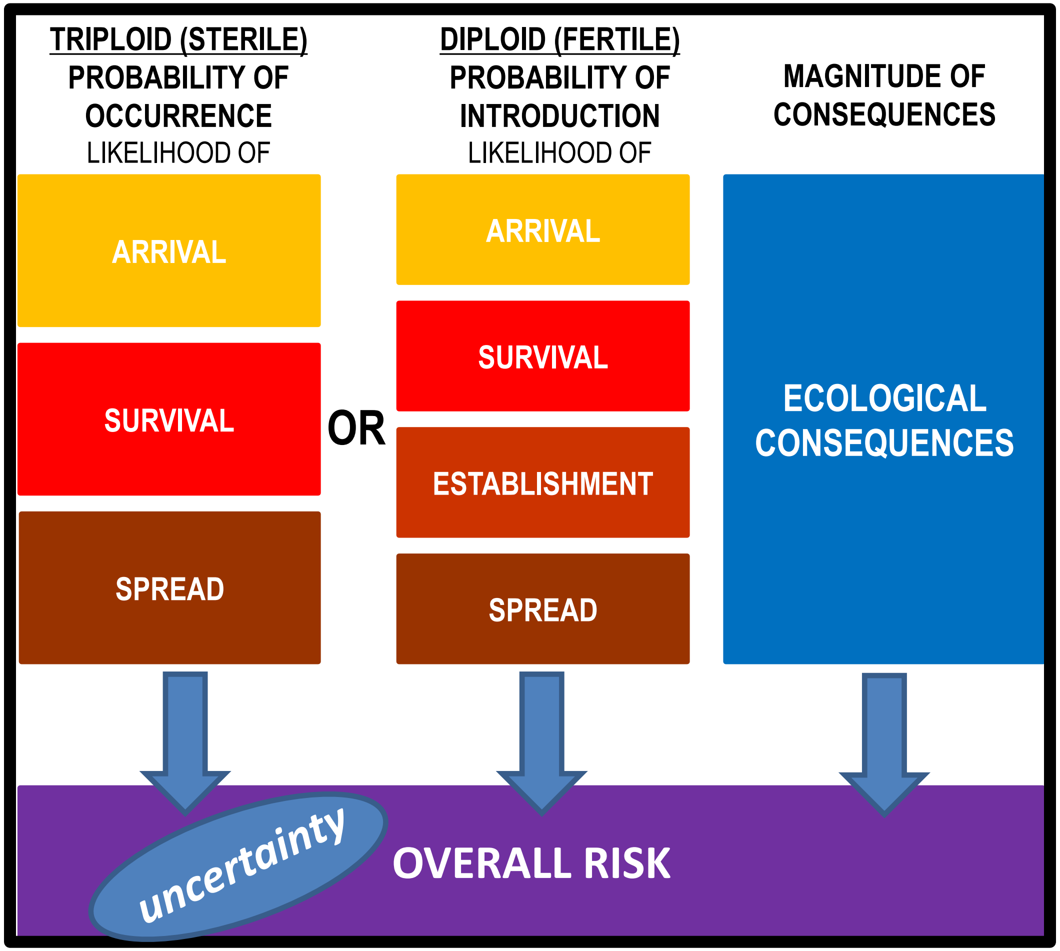
Neeson et al. (2015)

Grass Carp Risk Assessment

Purpose

Provide a binational, science-based assessment of the current level of risk (and associated uncertainty) to the Great Lakes and transfer that information to inform decisions around the management and prevention of Grass Carp.

Process



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Arrival
Key Findings

- GC has arrived to the GL basin; invasion process has begun for:
  - Lakes Michigan & Erie: sterile and fertile GC
  - Lake Ontario: fertile GC
- Most likely point of direct (physical connections) arrival for sterile and fertile GC is through the CAWS to Lake Michigan.
- Most likely vector of arrival for Lake Erie is human-mediated release (bait for sterile & stocking for fertile).
- Likelihood of Arrival lower for lakes Ontario, Superior and Huron.

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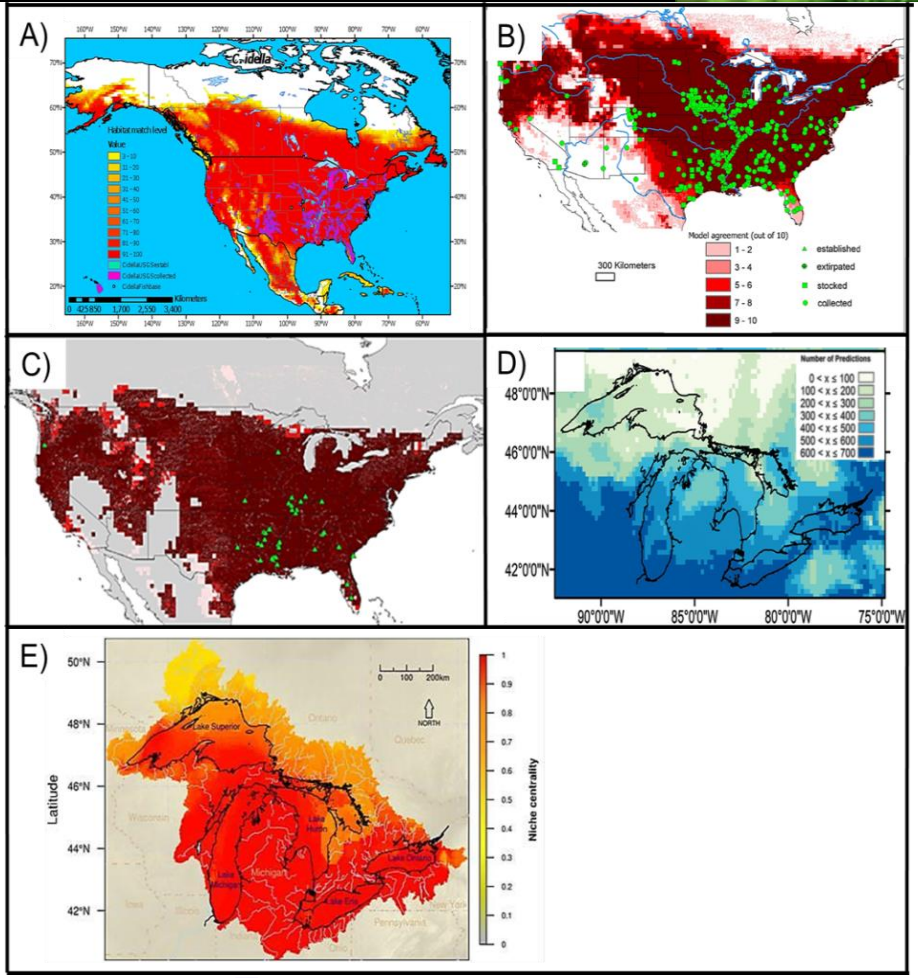
Survival
Key Findings

- Enough food and suitable thermal habitat exists throughout all five Great Lakes for GC to survive and overwinter.
- Predation and disease are not limiting factors.
- No known factors to preclude survival.



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Establishment

Key Findings

- Both suitable spawning and nursery habitat are present in each GL (Canadian and US studies).
- Positive population growth would occur in GL.
  - Requires few individuals if older age classes introduced.
- No known impediment to survival of early life stages.
  - Overwinter survival of YOY less probable in northern latitudes.
- Likelihood of establishment is *Very Likely* by 10 years for lakes Erie, Michigan, Huron & Ontario; Lake Superior remains *Low* at 50 years.

NOTE: Sterile GC not expected to establish

- Ranked *Very Unlikely* with *High* certainty.

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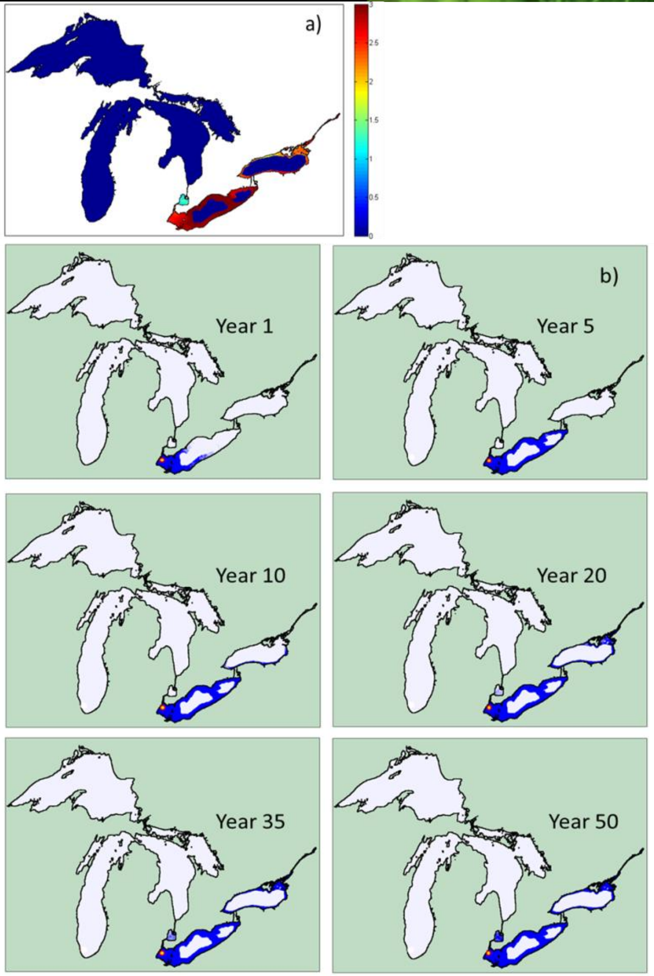
Spread
Key Findings

- Spread to other Great Lakes in basin a concern based on arrival to lakes Michigan and Erie.
- Fish can pass freely across Erie, Huron and Michigan.
- Movement influenced by habitat & food availability; especially across Michigan, Huron & Erie
- Following introduction into a single lake (lakes Michigan or Erie), GC expected to spread to other lakes within 5-10 years; likelihood of spread greatest for Lake Huron.
- Movement between Huron & Superior is possible; movement between Erie & Ontario less likely.



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Ecological Consequences
Key Findings

- Substantial reductions in <u>peak</u> submerged aquatic vegetaiton (SAV) predicted.
- Adult GC are herbivorous and would not compete directly with GL fishes; larval and juvenile forms (up to 4-6 weeks) will directly compete.
- Consumption of SAV by GC may lead to consequences to the biotic community:

  <u>FISH:</u>
  - 33 of 136 GL fishes may experience high negative consequences (e.g., Largemouth Bass, Northern Pike, Bowfin); 85% of which may experience consequences across all life stages.
  - 33 of 136 GL fishes may experience moderate negative consequences (e.g., Walleye, White Sucker, Spotted Sucker, Yellow Perch).
  - Low or unknown consequences for 70 species (e.g., White Perch, Ruffe, Logperch)

  <u>BIRDS:</u>
  - 8 of 47 Canadian GL bird species may experience high negative consequences (e.g., Canvasback, Sora, Least Bittern);
  - 29 Canadian GL bird species may experience moderate negative consequences (e.g., Mallard, Belted Kingfisher, Black Tern).

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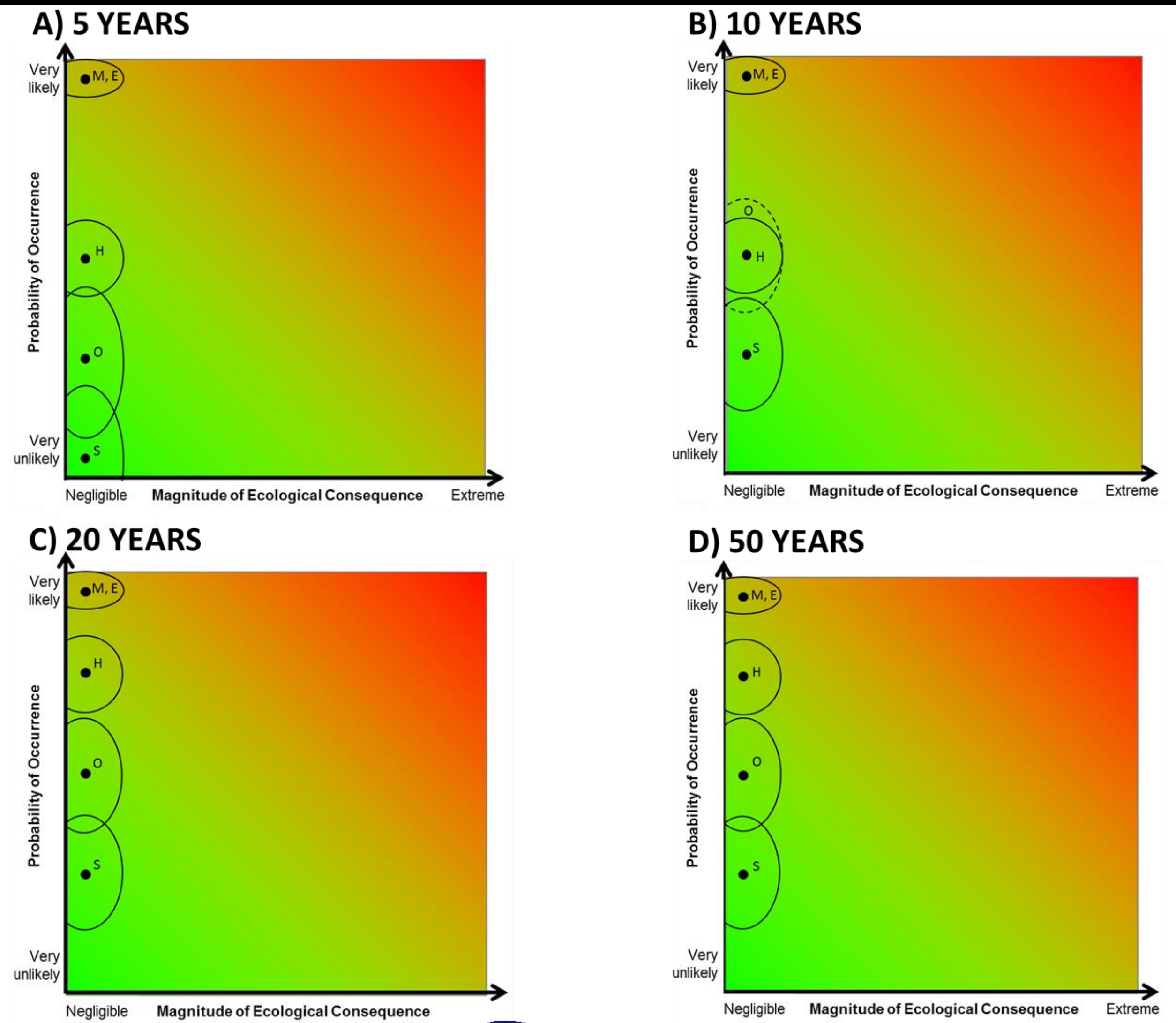
Overall Risk

<u>Sterile:</u>

- Probability of Occurrence Very Likely for lakes Michigan and Erie
- Ecological consequences negligible for all lakes and time periods.
- Overall risk *Low* for all lakes for all time periods.



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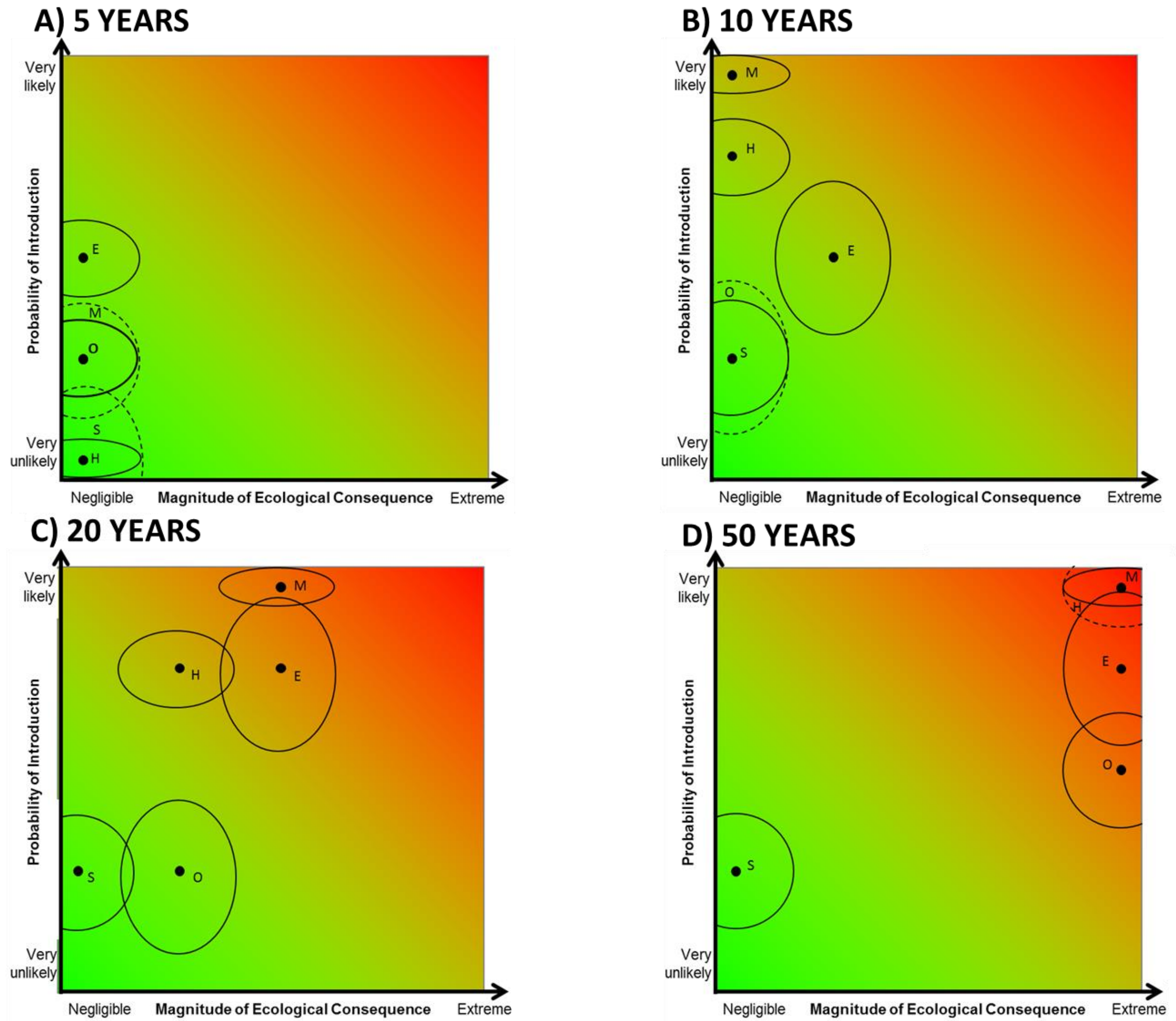
Overall Risk

<u>Fertile:</u>

- Overall risk *Low* for all lakes at 5 years.
- Overall risk increases to *High* for Lake Ontario and *Extreme* for lakes Michigan, Erie and Huron at 50 years.
- Lake Superior remains *Low* risk.



Overall Risk

- Lakes Erie & Michigan are at greater risk relative to other lakes.
- If the rate of arrival increases, the onset and magnitude of risk will increase.
- Regulations and enforcement of regulations are two important factors that may affect the likelihood of arrival to the other lakes in the basin.
- Ecological consequence is relative to the invasion process; consequences increase with abundance, therefore, preventing introduction & establishment is critical.
- Immediate preventative actions would be most effective, especially in conjunction with management activities where GC has arrived, to reduce the probability of establishment and delay or reduce subsequent ecological consequences.

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Questions?

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Grass Carp Risk Assessment
Likelihood as Probability Categories

Likelihood	Probability Category
Very Unlikely (VU)	**0**-0.05
Low (Lo)	0.05-0.4
Moderate (M)	0.4-0.6
High (H)	0.6-0.95
Very Likely (VLi)	0.95-**1.0**

Grass Carp Risk Assessment

Ecological Consequence Ratings

Consequence Rating	Description
Negligible (N)	Undetectable changes in the structure or function of the ecosystem. *(No detectable change in composition of submerged aquatic vegetation)*
Low (Lo)	Minimally detectable changes in the structure of the ecosystem, but small enough that it would not change the functional relationships or survival of species. *(Detectable change in composition of SAV through to a <10 % decrease in vegetation)*
Moderate (M)	Detectable changes in the structure or function of the ecosystem. *(10–24% decrease in SAV at 5 Grass Carp per hectare)*
High (H)	Significant changes to the structure or function of the ecosystem leading to changes in the abundance of resident species and generation of a new food web. *(25–49% decrease in SAV at 10 Grass Carp per hectare)*
Extreme (E)	Restructuring of the ecosystem leading to severe changes in abundance of ecologically important species (those considered dominant or main drivers in the ecosystem) and significant modification of the ecosystem. *(>50% decrease in SAV at 15 Grass Carp per hectare)*

Grass Carp Risk Assessment

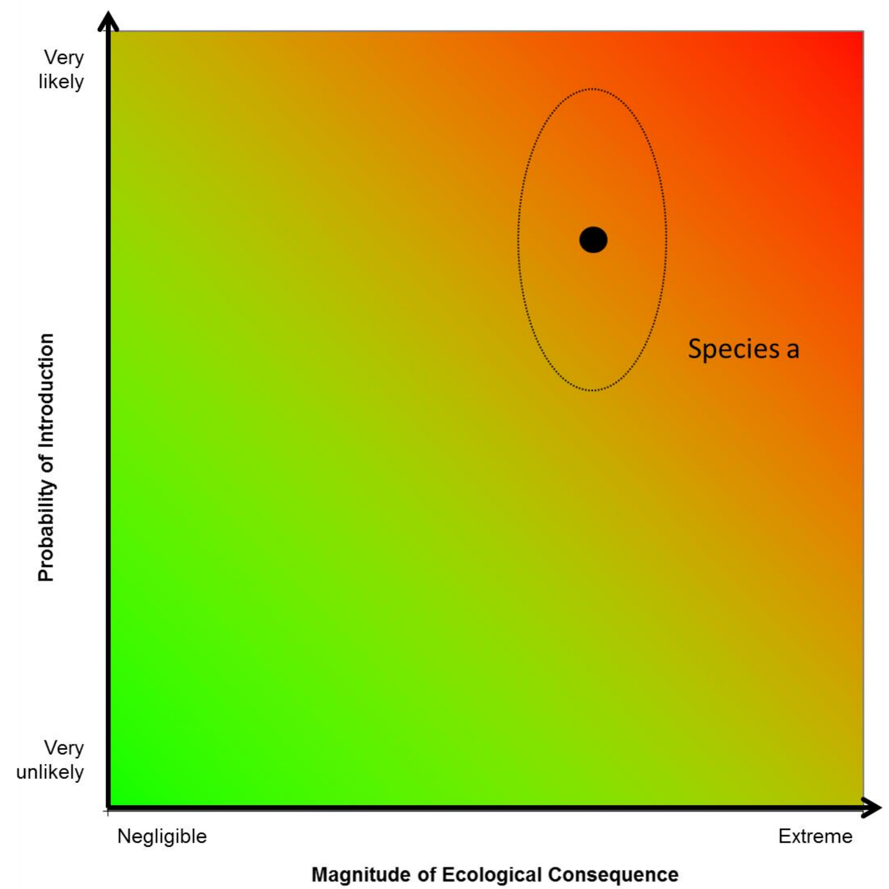
Relative Certainty Categories

	Certainty Category
± 90%	**Very low** certainty (VLo) (e.g. little to no information to guide assessment)
± 70%	**Low** certainty (Lo) (e.g. based on ecological principles, life histories of similar species, or experiments)
± 50%	**Moderate** certainty (M) (e.g. inference from knowledge of the species)
± 30%	**High** certainty (H) (e.g. primarily peer reviewed information)
± 10%	**Very high** certainty (VH) (e.g. extensive, peer-reviewed information)

Grass Carp Risk Assessment
Process

Overall Risk

- The Probability of Occurrence (sterile) or Probability of Introduction (fertile) and the Magnitude of Ecological Consequences were combined into a risk matrix.
- Ellipse size denotes certainty of data.
- Assessed at 5, 10, 20 and 50 years from the baseline (i.e., 2014) for each lake.



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