Use of hydroacoustics as a tool to assess pelagic prey fish in Lake Superior

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Outline

1) Define high priority research questions that are being addressed using acoustics.

2) Overview why we trust acoustics.

3) Share results of three recent acoustic studies.

Priority research questions of Lake Superior Fisheries Managers

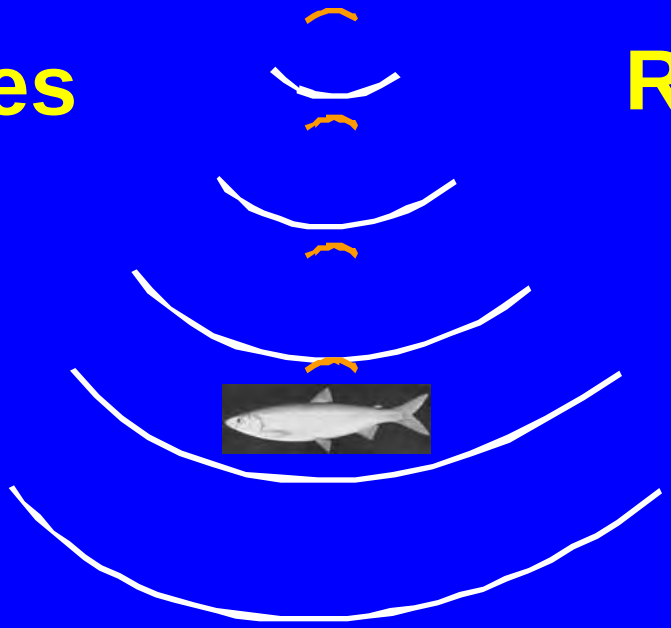
1) What is the present lake-wide biomass of prey fishes in Lake Superior?

2) What is the sustainable level of harvest of cisco?

3) What is the ecology of cisco in their first year of life?

Acoustic fish assessment

Emitted waves



Returning echoes

- Fish abundance and biomass
- Acoustic size-structure of the pelagic fish.

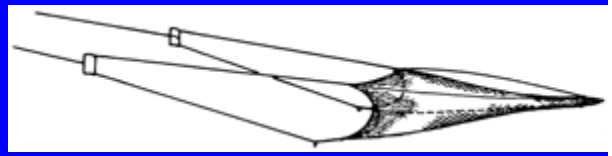
Acoustic detectability

Why we trust acoustics

1) Acoustics is a well established scientific tool.

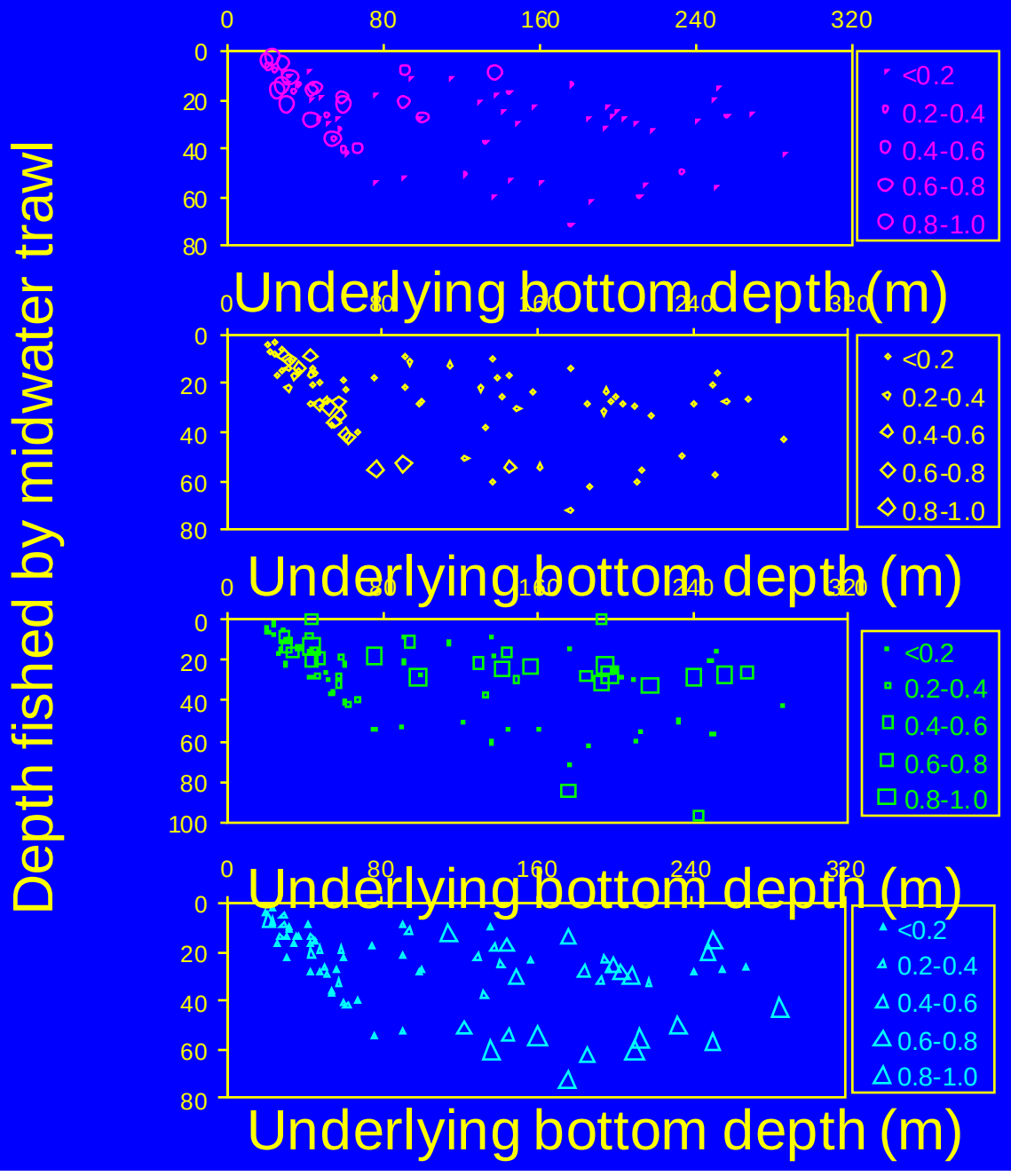
2) Acoustic users perform standard tests to calibrate their sounders.

3) Acoustics cannot discern species, so we use midwater trawl samples to interpret our acoustic data.

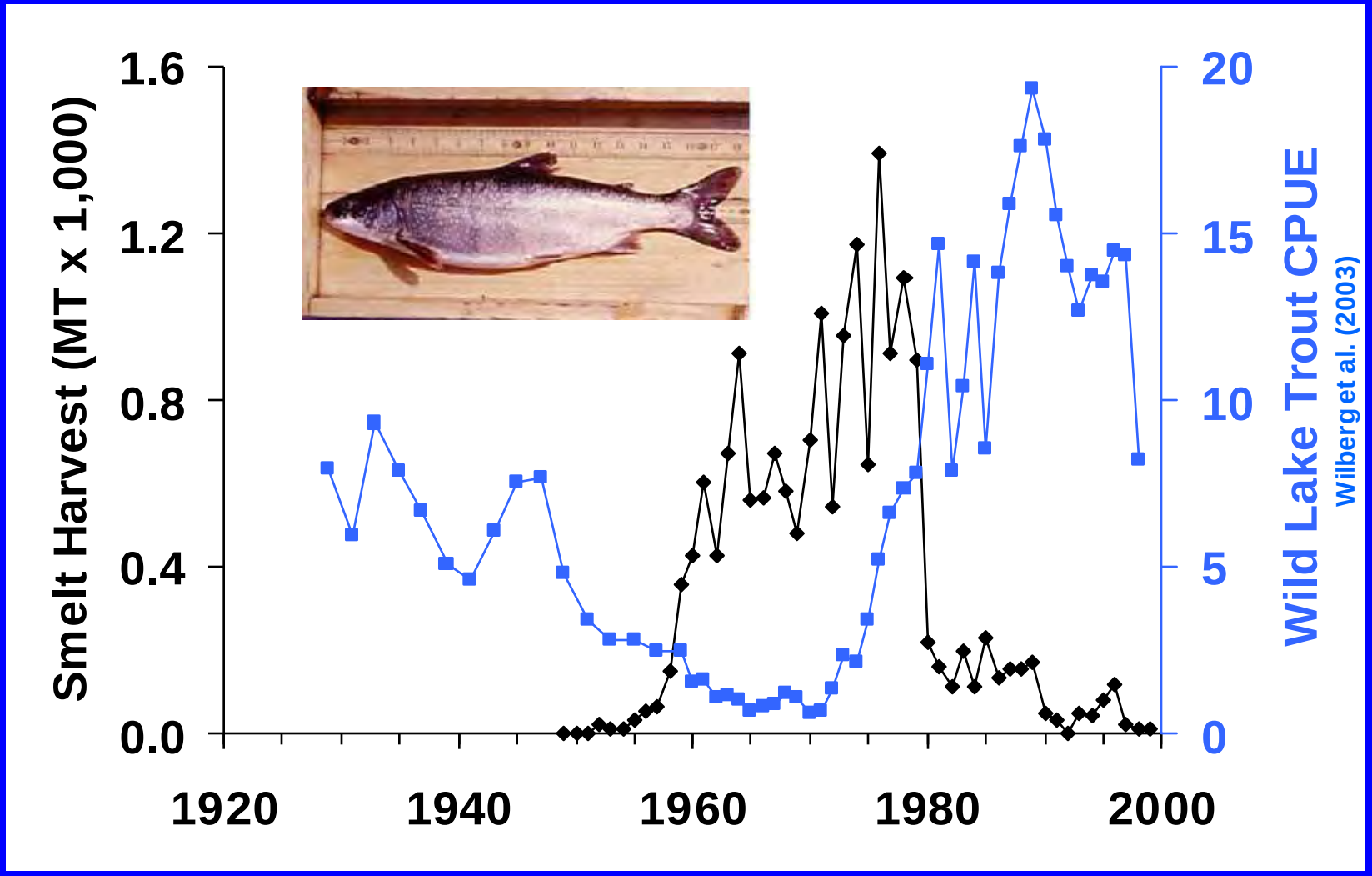


4) Recent work has shown pelagic species in Lake Superior exhibit predictable distribution patterns.

Summer distributions (2003-2006)



What is the present lake-wide biomass of prey fishes in Lake Superior?

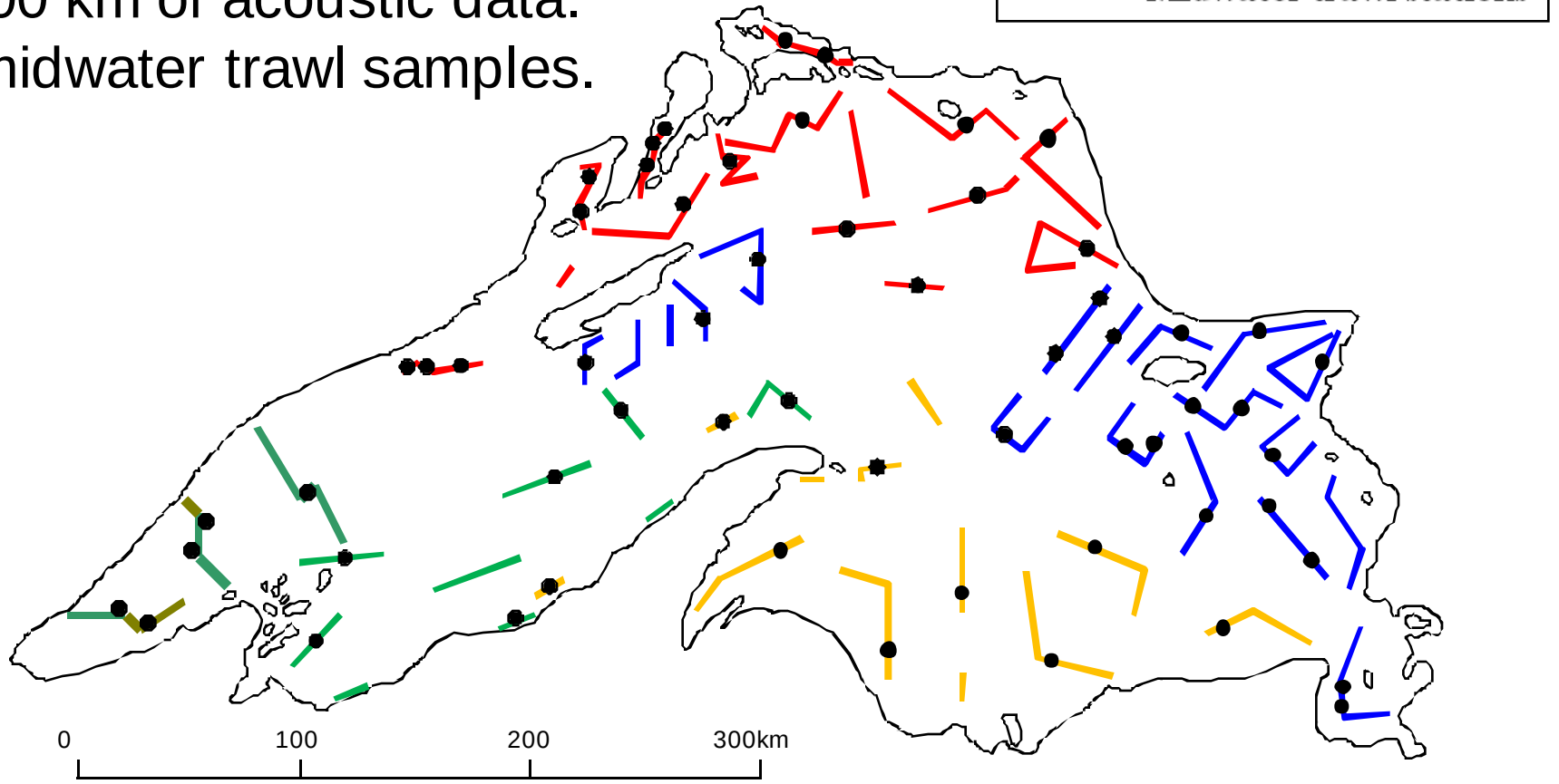


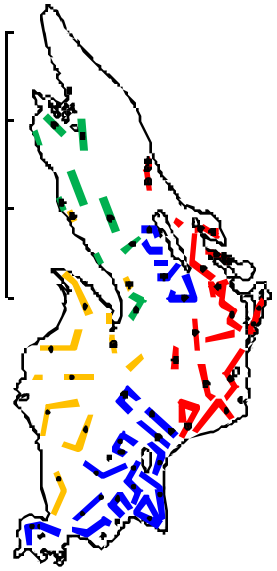
What is the present lake-wide biomass of prey fishes in Lake Superior?

Total Effort

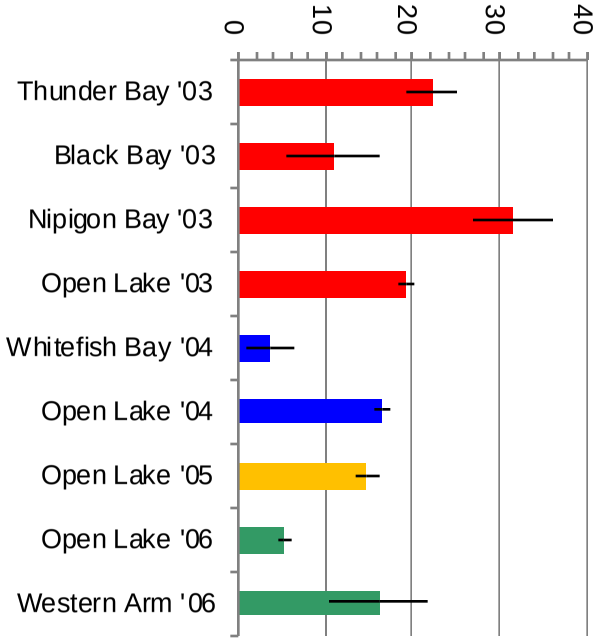
2,500 km of acoustic data.

52 midwater trawl samples.

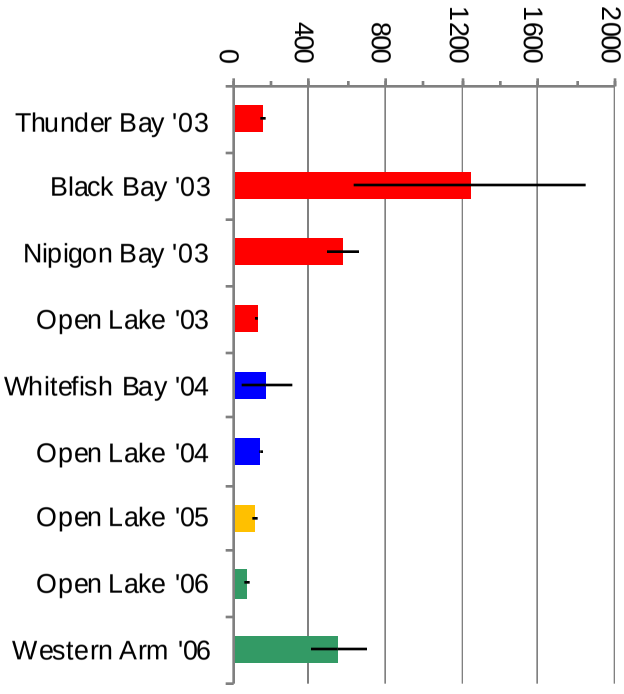




Biomass (kg/ha)

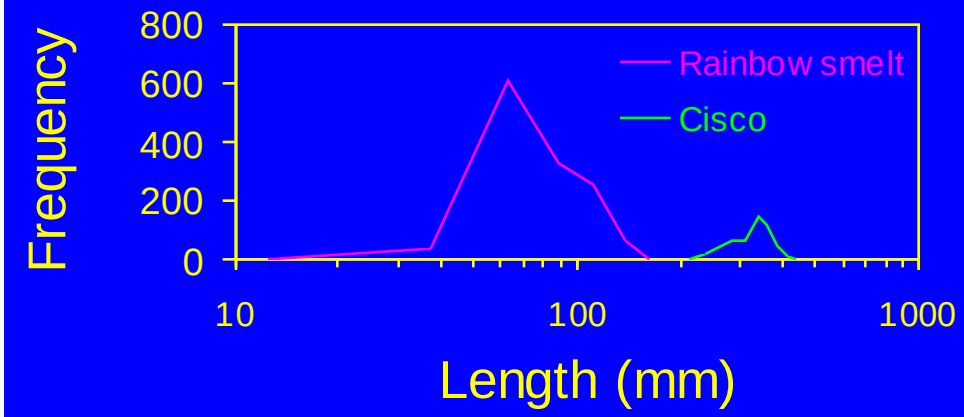


Density (#/ha)

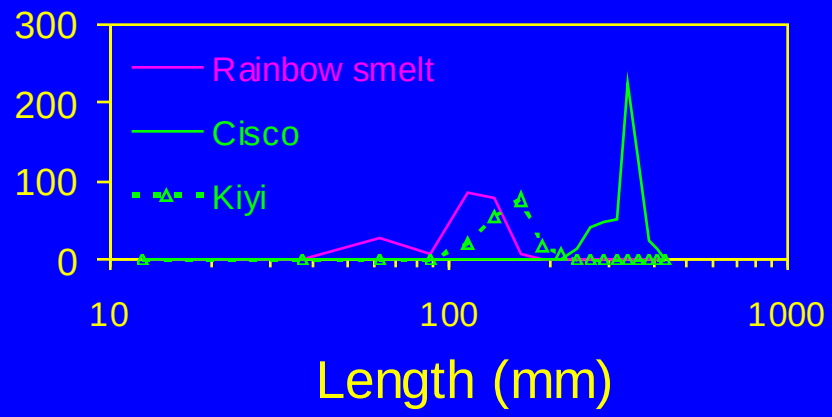


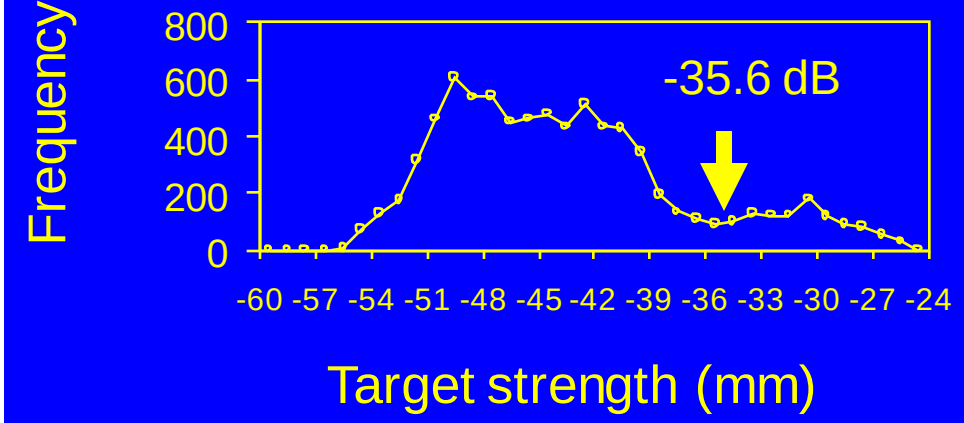
What is the sustainable level of harvest of cisco?

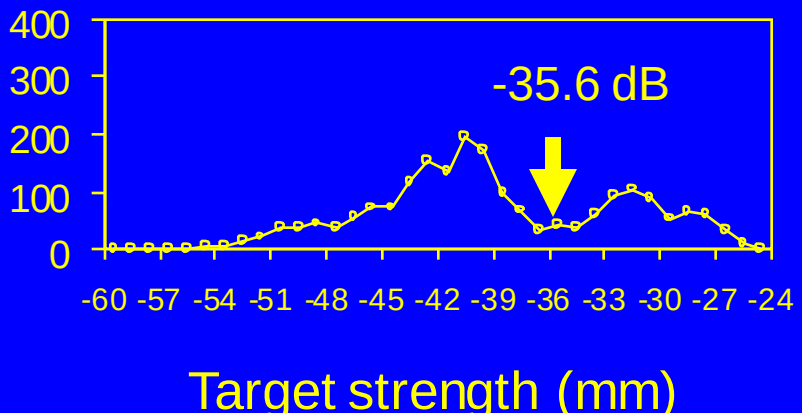
Nearshore <80 m



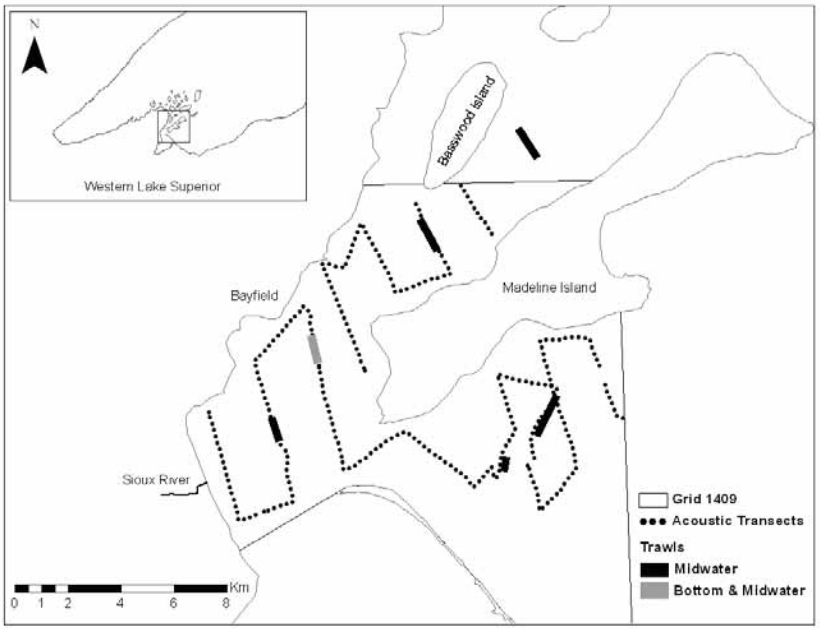
Offshore > 80 M







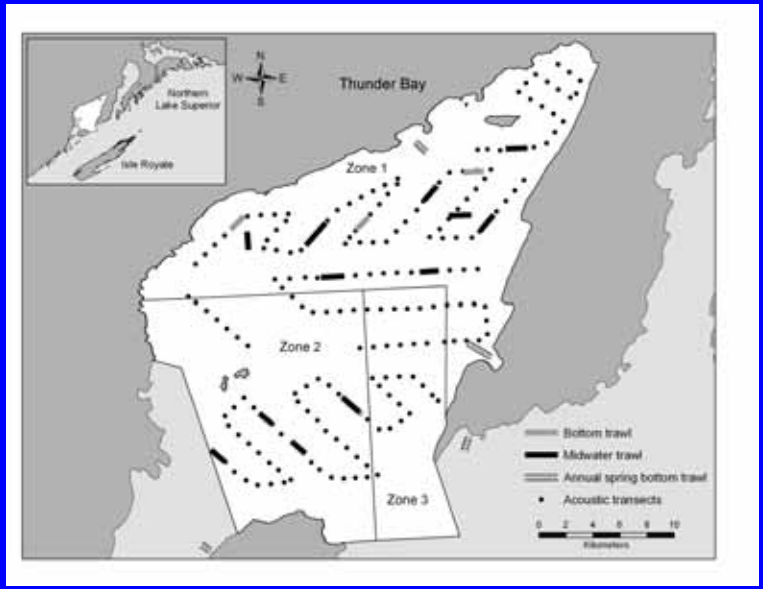
November 2004 pilot study

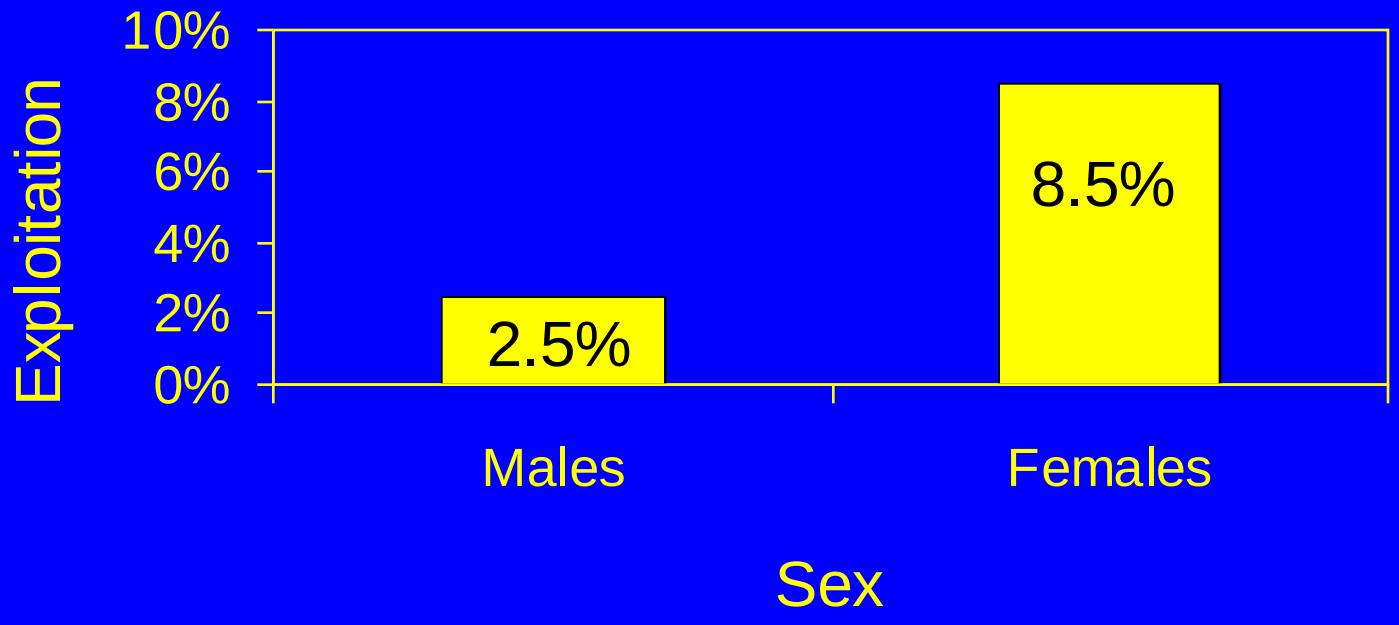


Density of spawning cisco was 13.3 ± 3.2 /ha

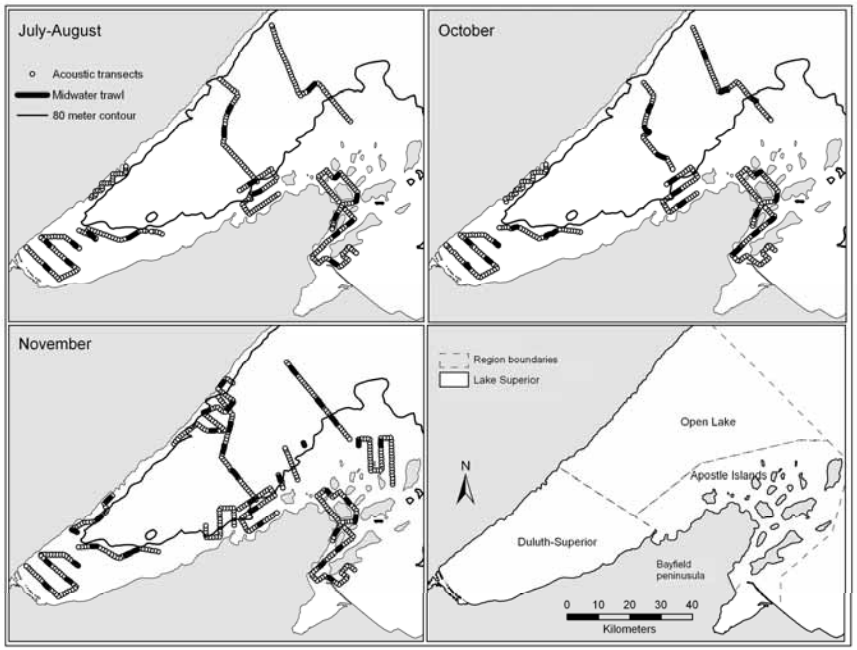
Exploitation from November roe fishery was 2.3%.

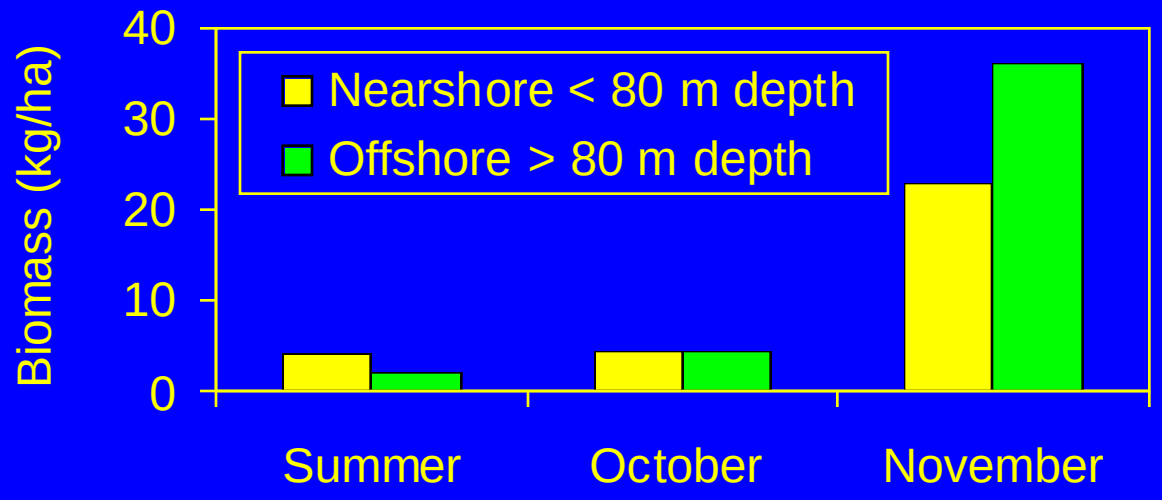
November 2005 Thunder Bay





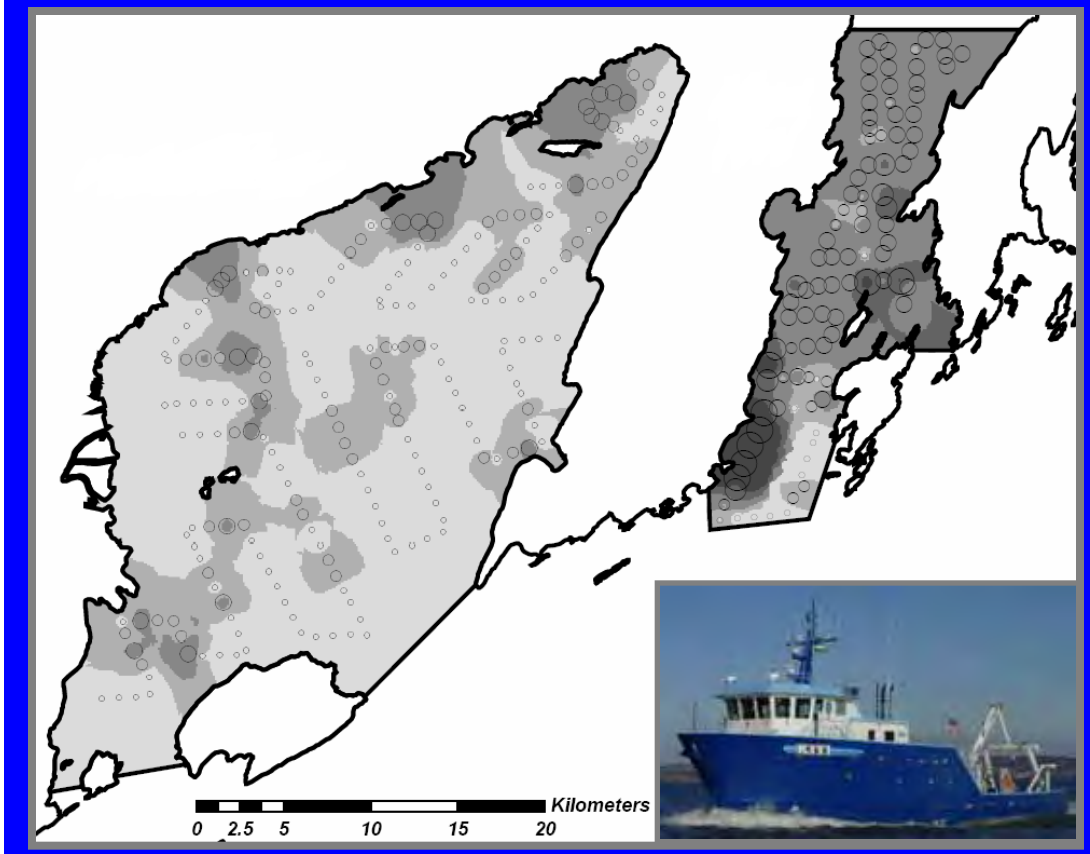
2006 surveys



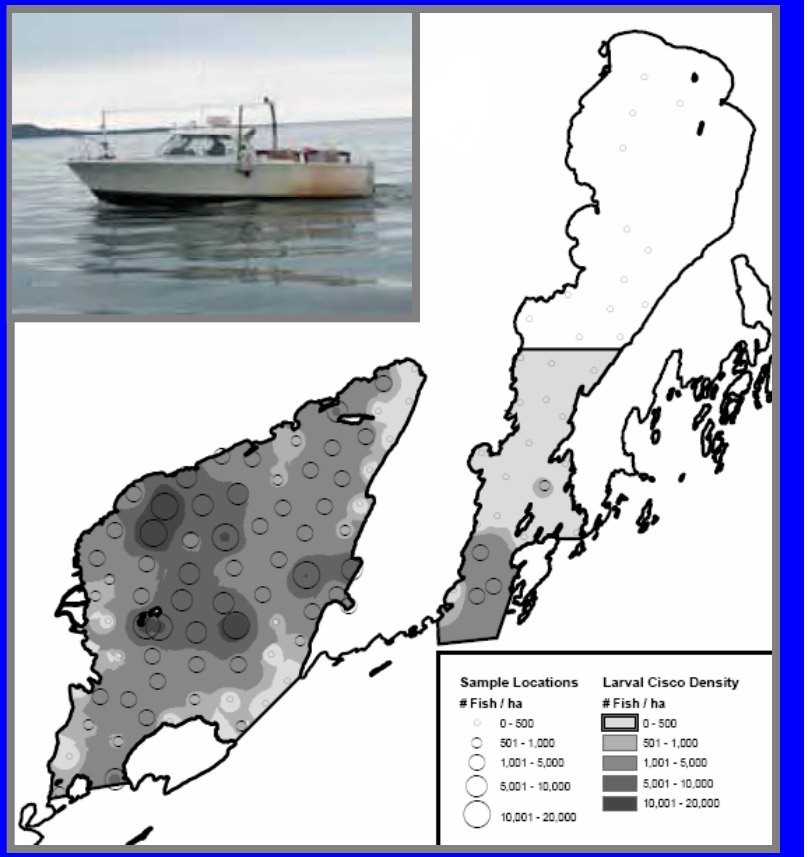


What is the ecology of cisco in their first year of life?

Rainbow Smelt Densities

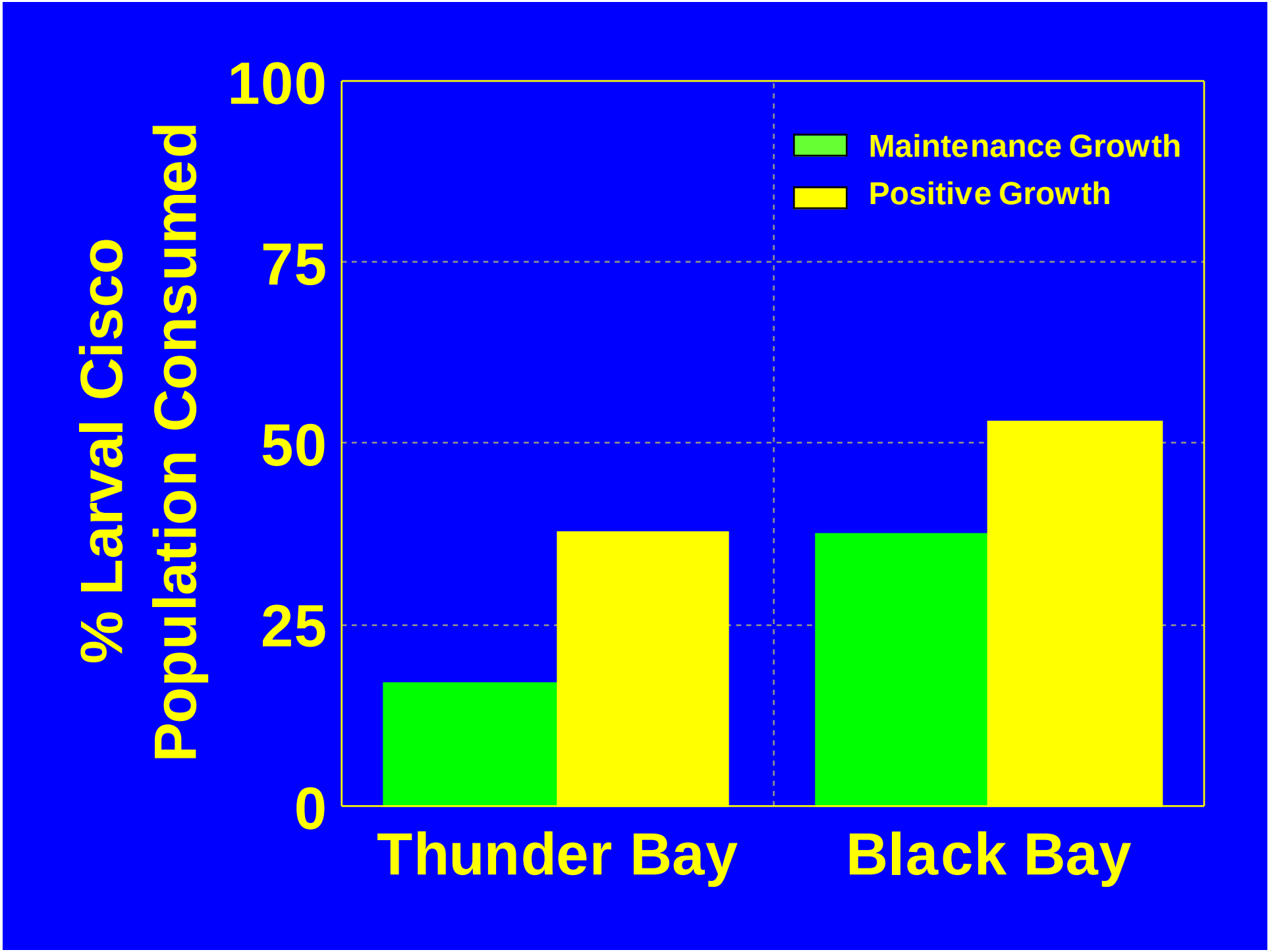


Larval Cisco Densities



TRAWL PROCESSING

Photographs by Gary Cholwek (2006)


% Larval Cisco Population Consumed
100
75
50
25
0
Maintenance Growth
Positive Growth
Thunder Bay
Black Bay

Conclusions

1) Acoustics is not a new method, rather new and exciting applications are constantly emerging.

2) Important prey species of lake trout (i.e., rainbow smelt, cisco, kiyi and bloater) can be assessed by combining acoustics and midwater trawl methods.

3) The pelagic fish community of Lake Superior is simple and species distribution patterns are predictable.

4) Acoustics is being coupled with other tools to address high priority research questions, and these important questions are being answered.