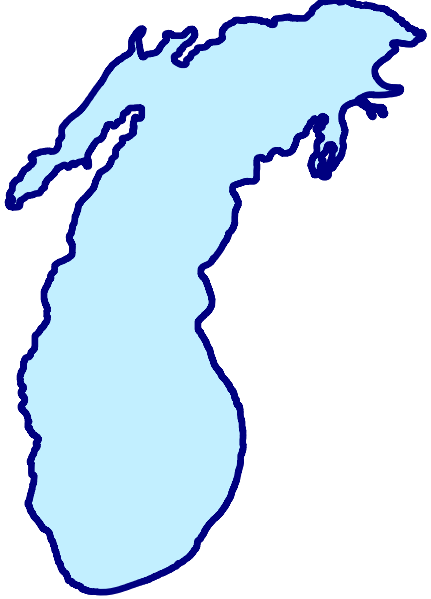
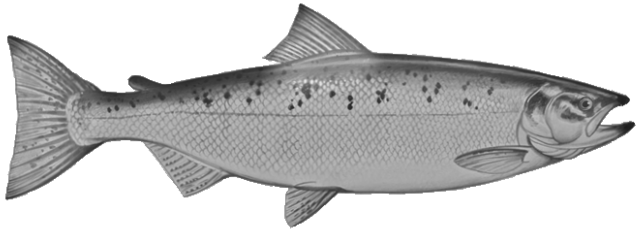


Salmonid Working Group



Indiana Dept. of Natural Resources

Wisconsin Dept. of Natural Resources

Randy Claramunt - Michigan DNR
Brian Breidert - Indiana DNR
Dave Clapp - Michigan DNR
Rob Elliott - US Fish and Wildlife
Chuck Madenjian - US Geological Survey
Scott Hansen – Wisconsin DNR
Steve Robillard - Illinois DNR
Dave Warner – US Geological Survey
Greg Wright - CORA

Chippewa-Ottawa Treaty Fishery Management Authority

Illinois Dept. of Natural Resources

USGS science for a changing world

MICHIGAN STATE UNIVERSITY

Great Lakes Fishery Commission
Lake Michigan Committee

Sea Grant Michigan

University of MICHIGAN

SWG Report: Red Flags Analysis

Recommendation to the Lake Committee

Summary Table
Percentage of Variables
Triggering Red Flags

Level I

Level II

Selected Variables

20-80th Percentile
Last year's value

40-60th Percentile
3 of 5 years

Salmonid Working Group

Randy Claramunt - Michigan DNRE
Brian Breidert - Indiana DNR
Dave Clapp - Michigan DNRE
Rob Elliott - US Fish and Wildlife
Chuck Madenjian - US Geological Survey
Paul Peeters - Wisconsin DNR
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Indiana Dept. of Natural Resources
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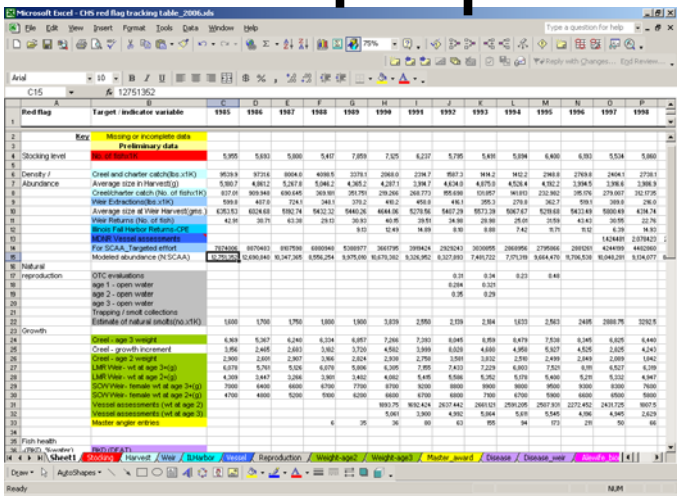
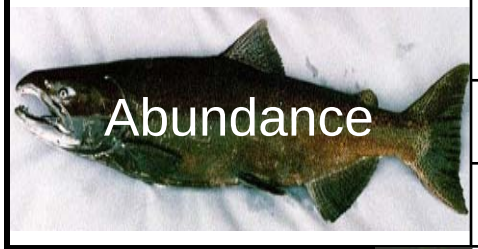
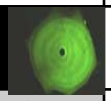
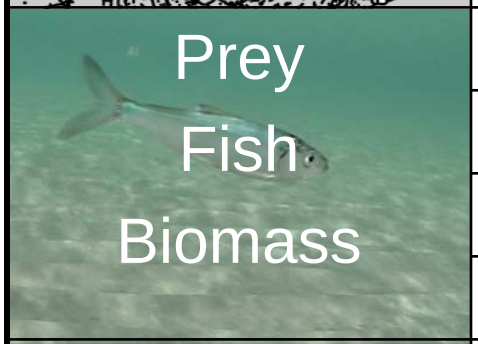
Sport Fish Restoration
U.S. Fish & Wildlife Service
Michigan DNRE
University of Michigan
USGS science for a changing world
Michigan State University
Great Lakes Fishery Commission
Lake Michigan Committee
NOAA
Sea Grant Michigan

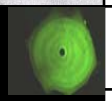
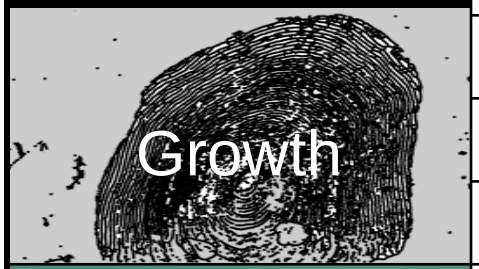
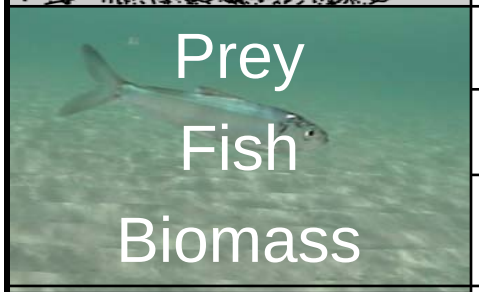


RESULTS FROM RED FLAGS ANALYSIS OF 2009 DATA

Variable	Index	Level I	Level II
 Abundance	Catch rate (charter)	No	Yes
	Age-1 abundance	Yes	Yes
	Weir returns (MI only)	Yes	Yes
Reproduction 	OTC / Total	No / Yes	Yes / Yes
Growth	Creel wt at age 2	No	No
	Creel wt at age 3	Not used	Not used
	Weir wt at age 3	Yes	Yes
	Standard wt	No	Yes
 Prey Fish Biomass	Acoustic	No	Yes
	Bottom trawl	No	Yes
	Coho length index	No	Yes
	Predator diet data	NA	NA
Ecosystem Health	Salmonine composition	NA	NA
	Visual signs of disease	No	No
	Muscle Plug Index	NA	NA

Summary a Year Ago

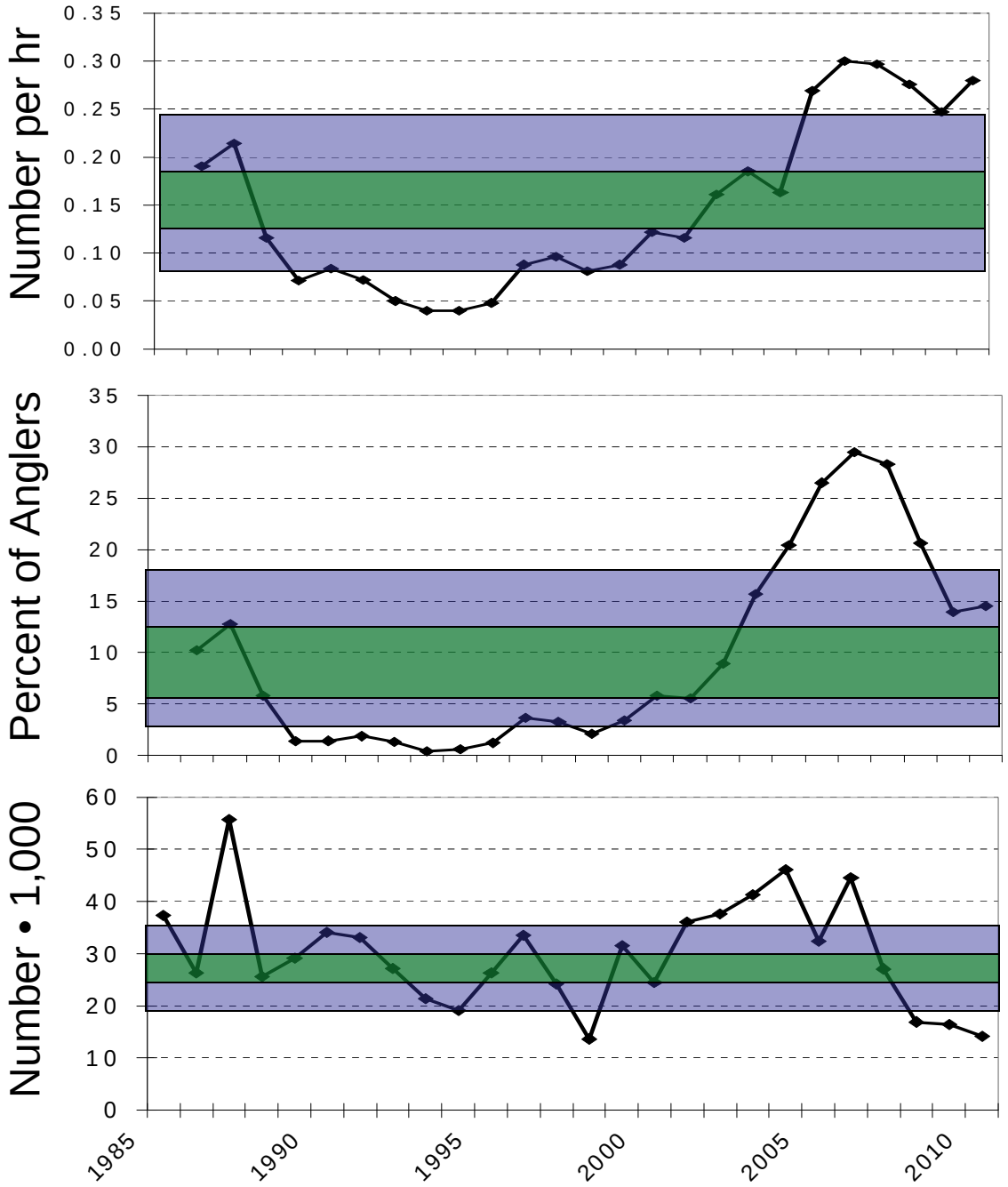
- Stocking adjusted according to changes in fish community / productivity / stressors
- Regulations changed to be more consistent with management strategy
- Prey fish populations responding to reduced predation pressure, but…
- Because of poor prey fish recruitment, salmon recruitment has reached very low levels (suggesting a continued decrease in salmon abundance in 2010)
- SWG No Recommendation / LMTC discussions

Variable	Index	Level I	Level II
Abundance	Catch rate (charter)		
	Angler success		
	Weir returns (MI only)		
 Recruitment	Percent wild from OTC		
	Total smolt abundance		
	Age-1 abundance		
 Growth	Creel wt at age 2		
	Weir wt at age 3		
	Standard wt		
 Prey Fish Biomass	Acoustic		
	Bottom trawl		
	Coho length index		
Ecosystem Health	Visual signs of disease		
	Egg thiamine levels		
	Salmonine composition		

Chinook salmon catch rates (charter)

Angler Success (Harvest > 3 Chinook salmon per day)

Michigan Weir Returns



Variable	Index	Level I	Level II
Abundance	Catch rate (charter)	Yes	Yes
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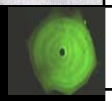 Recruitment	Percent wild from OTC		
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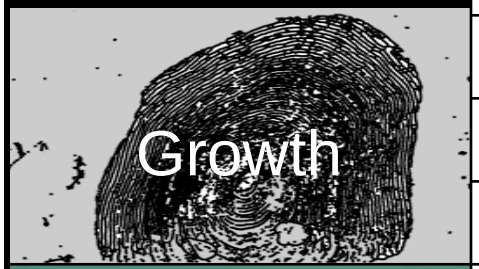 Growth	Creel wt at age 2		
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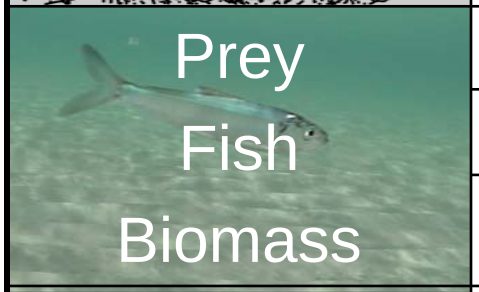
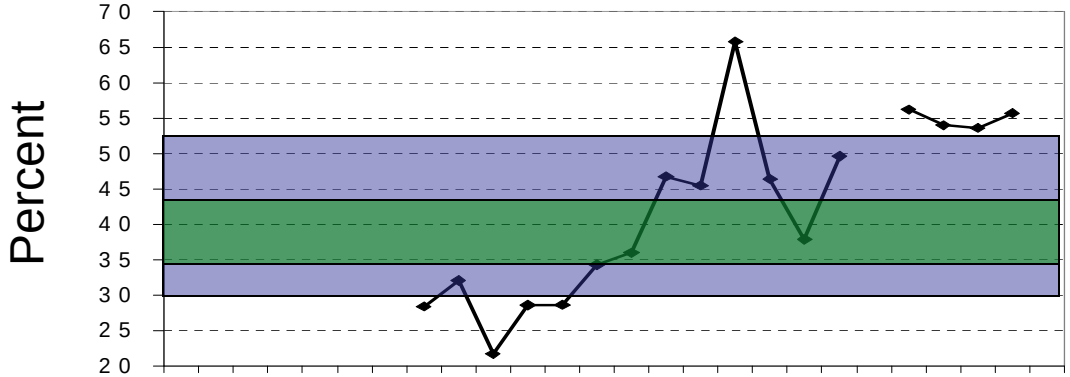
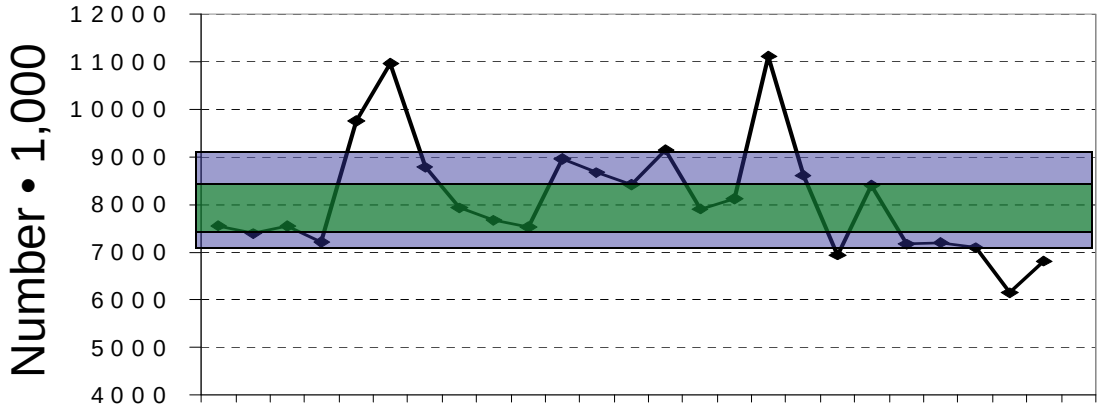
 Prey Fish Biomass	Acoustic		
	Bottom trawl		
	Coho length index		
Ecosystem Health	Visual signs of disease		
	Egg thiamine levels		
	Salmonine composition		

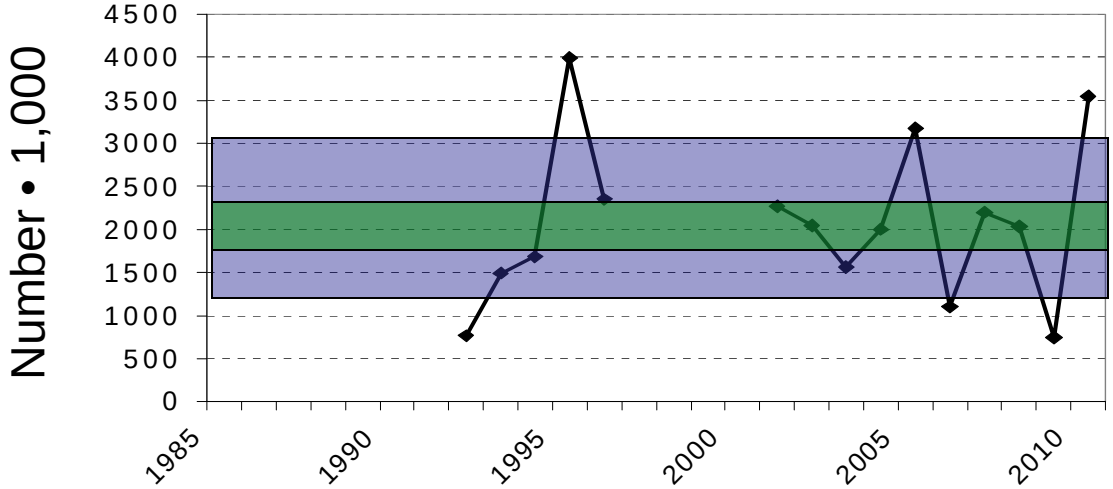
Percent wild Chinook salmon (OTC and marking estimates)



Total smolt abundance

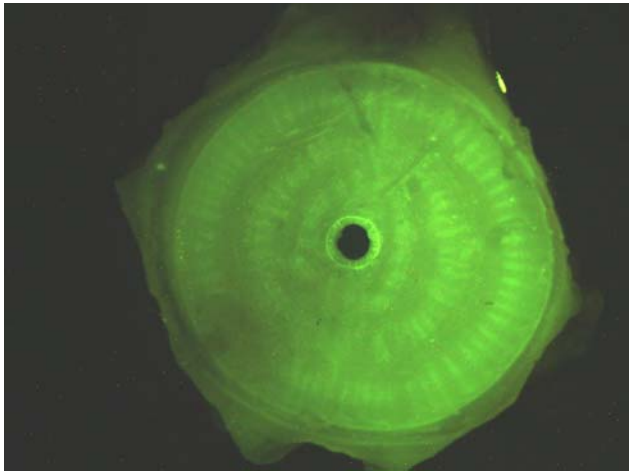


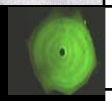
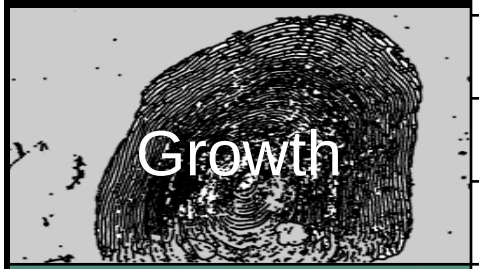
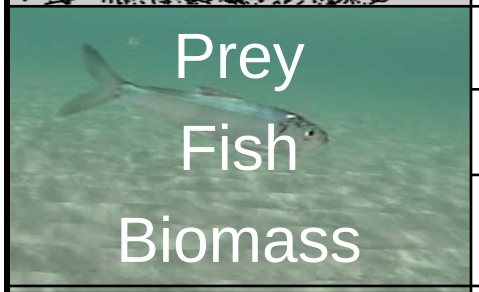
Age-1 Chinook salmon abundance



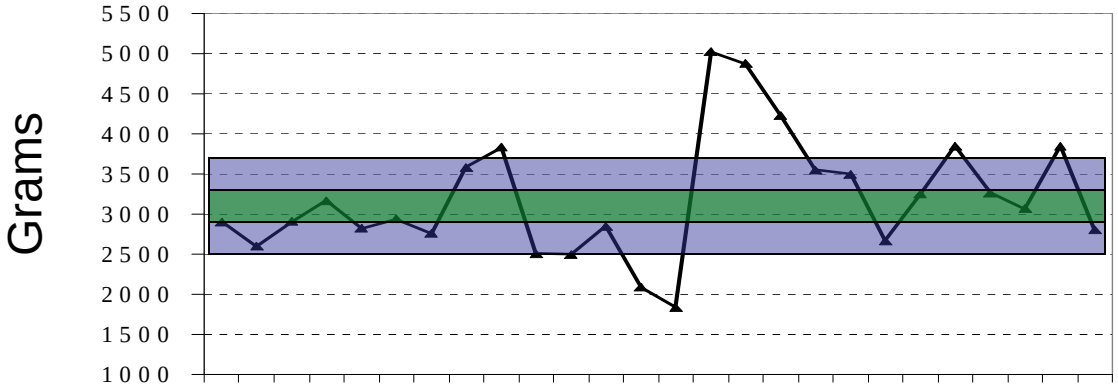
OTC Project Objectives

Collection Year	Year Class				
	2006	2007	2008	2009	2010
2007	56.2				
2008	82.9	54			
2009	66.5	62.8	53.6		
2010	76.8	62.5	67.9	55.7	
2011	Age-5	Age-4	Age-3	Age-2	Age-1

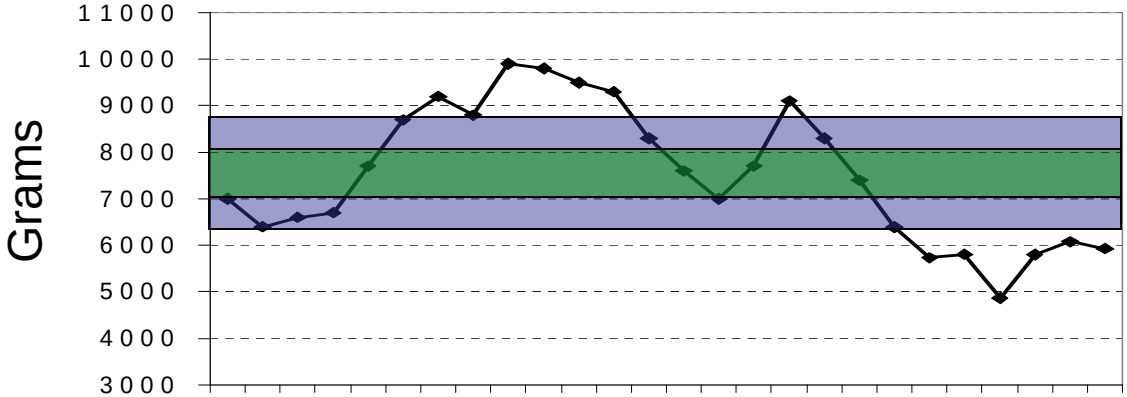


Variable	Index	Level I	Level II
Abundance	Catch rate (charter)	Yes	Yes
	Angler success	No	Yes
	Weir returns (MI only)	Yes	Yes
 Recruitment	Percent wild from OTC	Yes	Yes
	Total smolt abundance	Yes	Yes
	Age-1 abundance	Yes	Yes
 Growth	Creel wt at age 2		
	Weir wt at age 3		
	Standard wt		
 Prey Fish Biomass	Acoustic		
	Bottom trawl		
	Coho length index		
Ecosystem Health	Visual signs of disease		
	Egg thiamine levels		
	Salmonine composition		

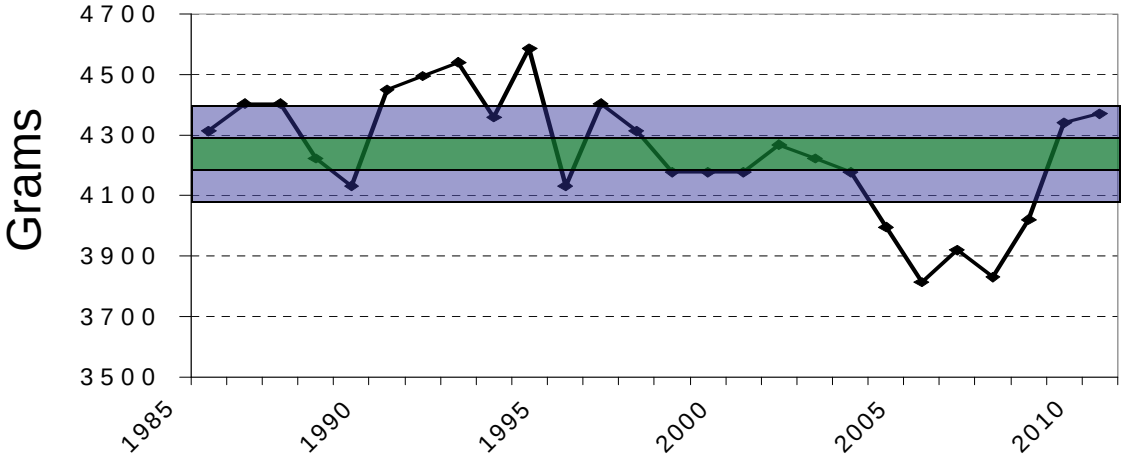
Weight at age 2
(June-July fishery)

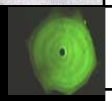
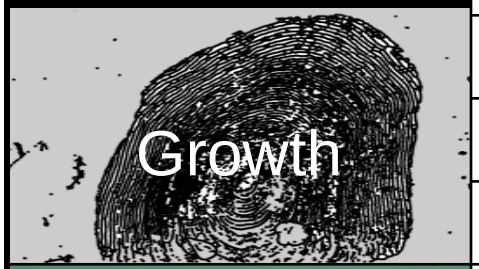
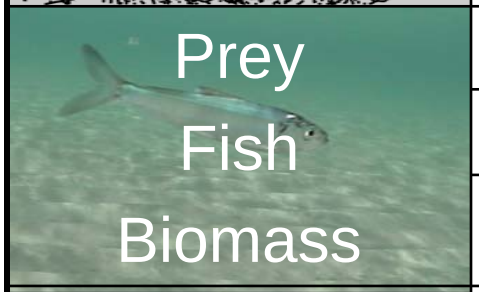


Weight at age 3
(Strawberry Creek weir)

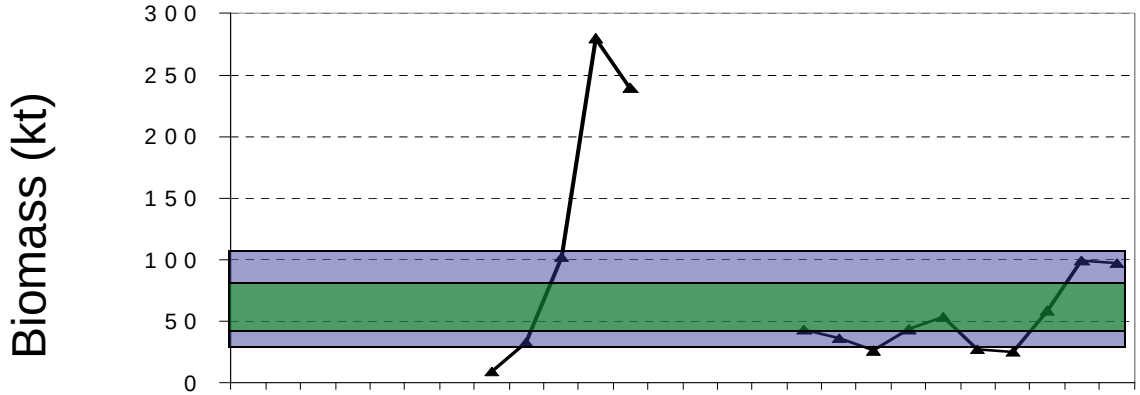


Standard weight
(Strawberry Creek weir)

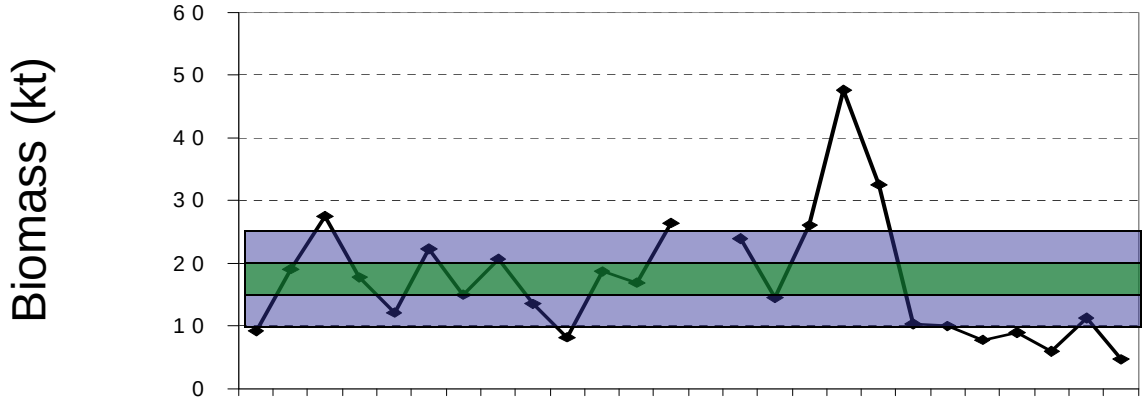


Variable	Index	Level I	Level II
Abundance	Catch rate (charter)	Yes	Yes
	Angler success	No	Yes
	Weir returns (MI only)	Yes	Yes
 Recruitment	Percent wild from OTC	Yes	Yes
	Total smolt abundance	Yes	Yes
	Age-1 abundance	Yes	Yes
 Growth	Creel wt at age 2	No	Yes
	Weir wt at age 3	Yes	Yes
	Standard wt	No	Yes
 Prey Fish Biomass	Acoustic		
	Bottom trawl		
	Coho length index		
Ecosystem Health	Visual signs of disease		
	Egg thiamine levels		
	Salmonine composition		

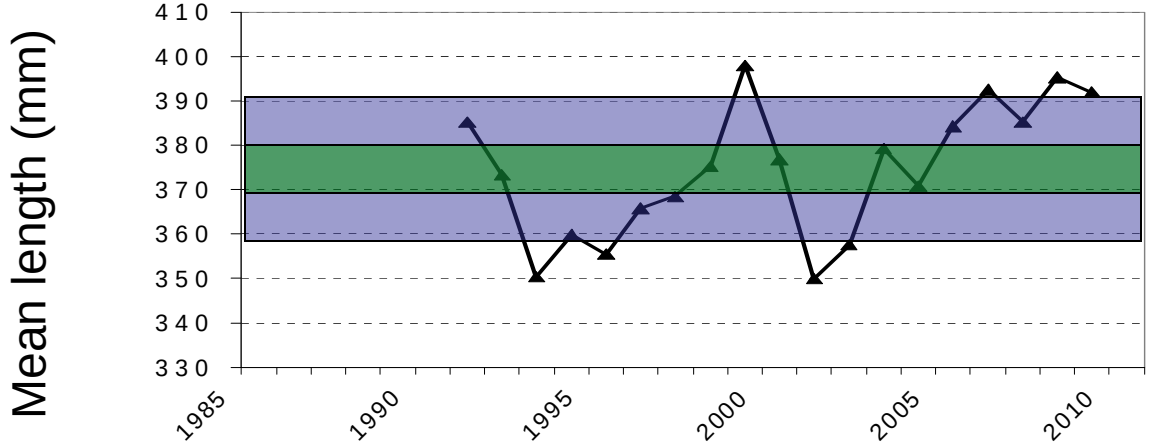
Acoustic survey
(alewife biomass)

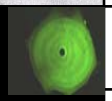
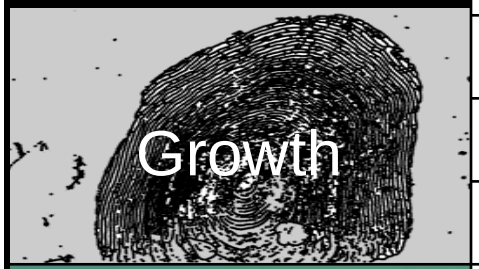
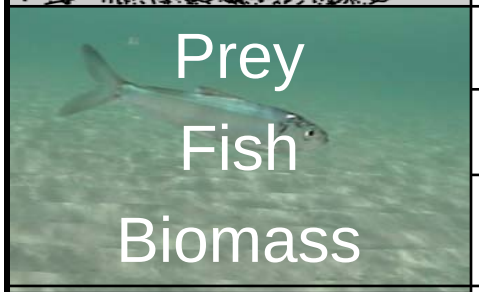


Bottom trawl
(alewife biomass)



Coho salmon
(mean length index)

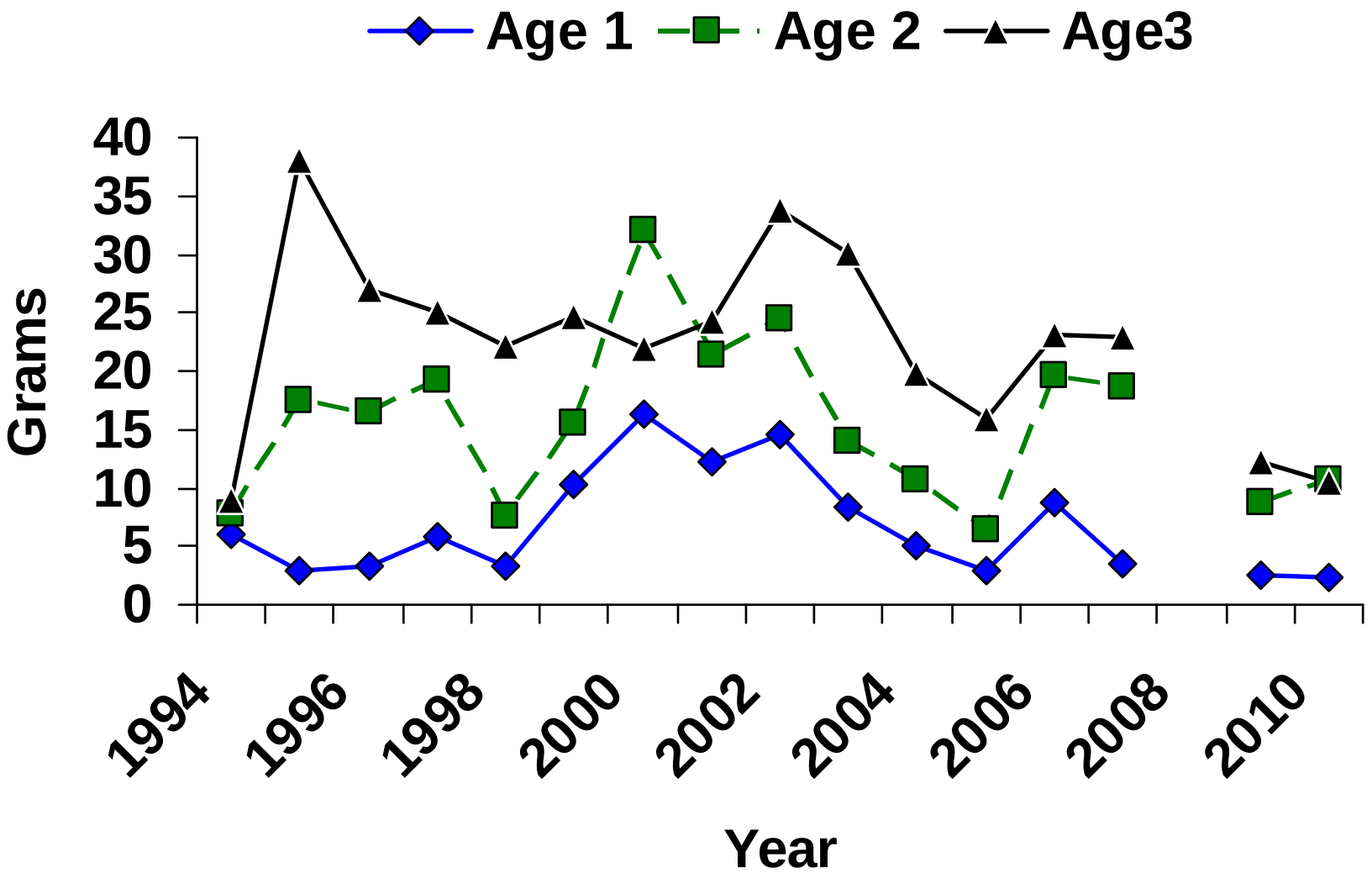


Variable	Index	Level I	Level II
Abundance	Catch Rate (Charter)	Yes	Yes
	Angler success	No	Yes
	Weir Returns (Mi only)	Yes	Yes
 Recruitment	Percent wild from OTC	Yes	Yes
	Total smolt abundance	Yes	Yes
	Age-1 abundance	Yes	Yes
 Growth	Creel wt at age 2	No	Yes
	Weir wt at age 3	Yes	Yes
	Standard wt	No	Yes
 Prey Fish Biomass	Acoustic	No	Yes
	Bottom trawl	Yes	Yes
	Coho length index (diet data?)	No	Yes
Ecosystem Health	Visual signs of disease		
	Egg thiamine levels		
	Salmonine composition		

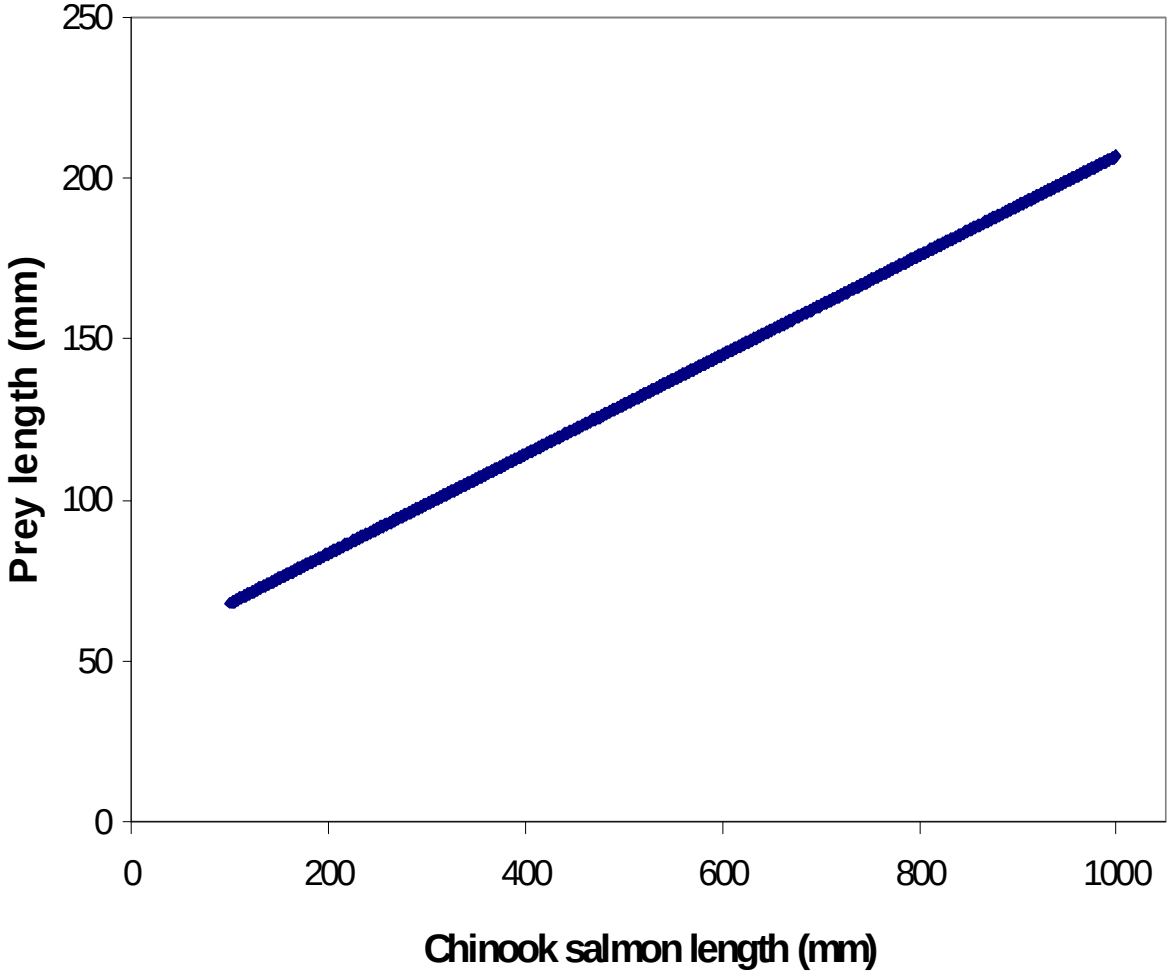
Objectives of diet study
(Greg Jacobs USGS)

- Quantify proportion of diet items
- Quantify selectivity of prey species and size
  - Test for a relationship between predator size and maximum prey size
  - Test for variation in selectivity by location and time
- Quantify changes in diet and selectivity between 1994-1996 and 2009-2010.
  - Test for differences in seasonal and overall diet between time periods
- Identify top-down vs. bottom-up effects
  - Compare effect of predation pressure with effect of Lake Michigan food web changes

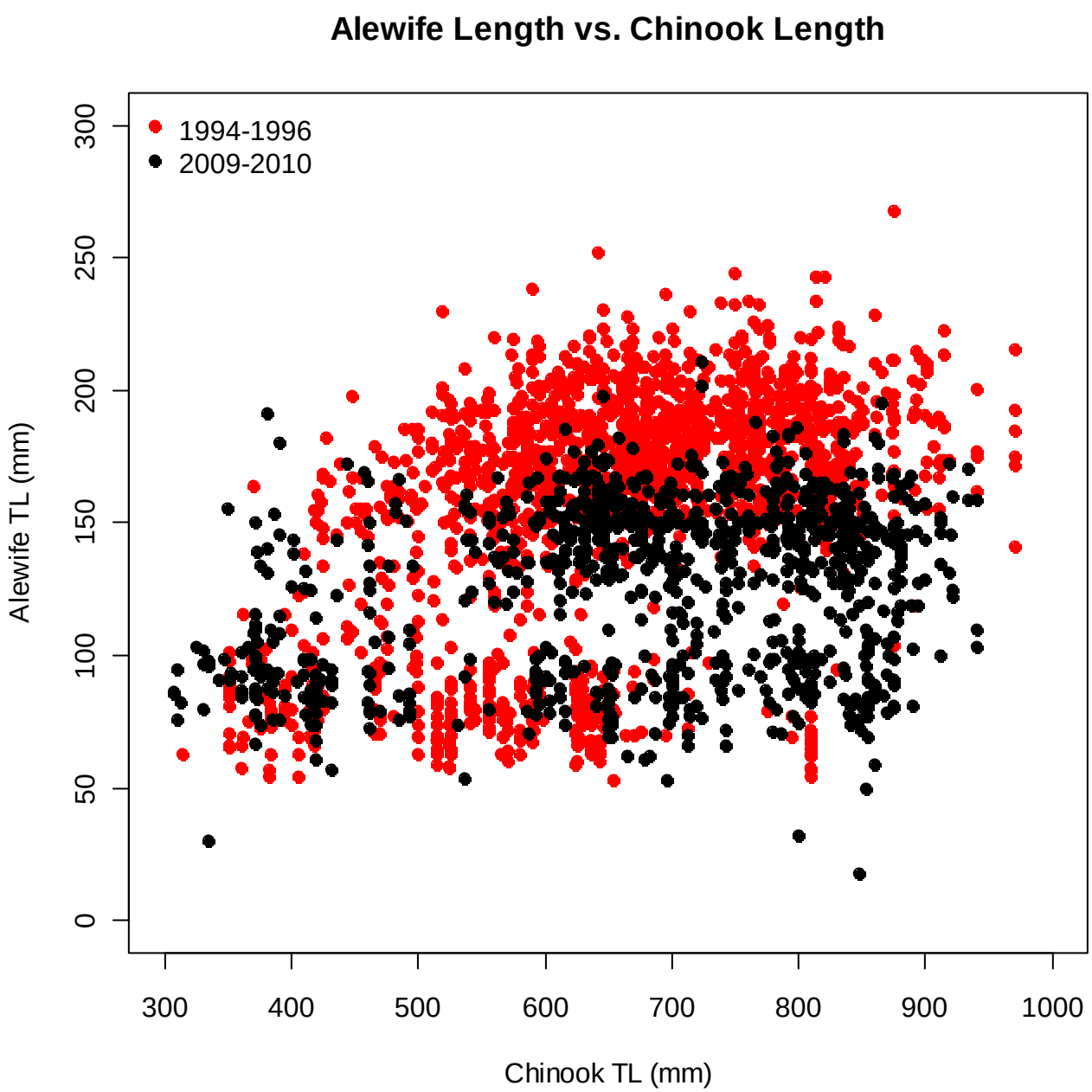
Chinook salmon diets

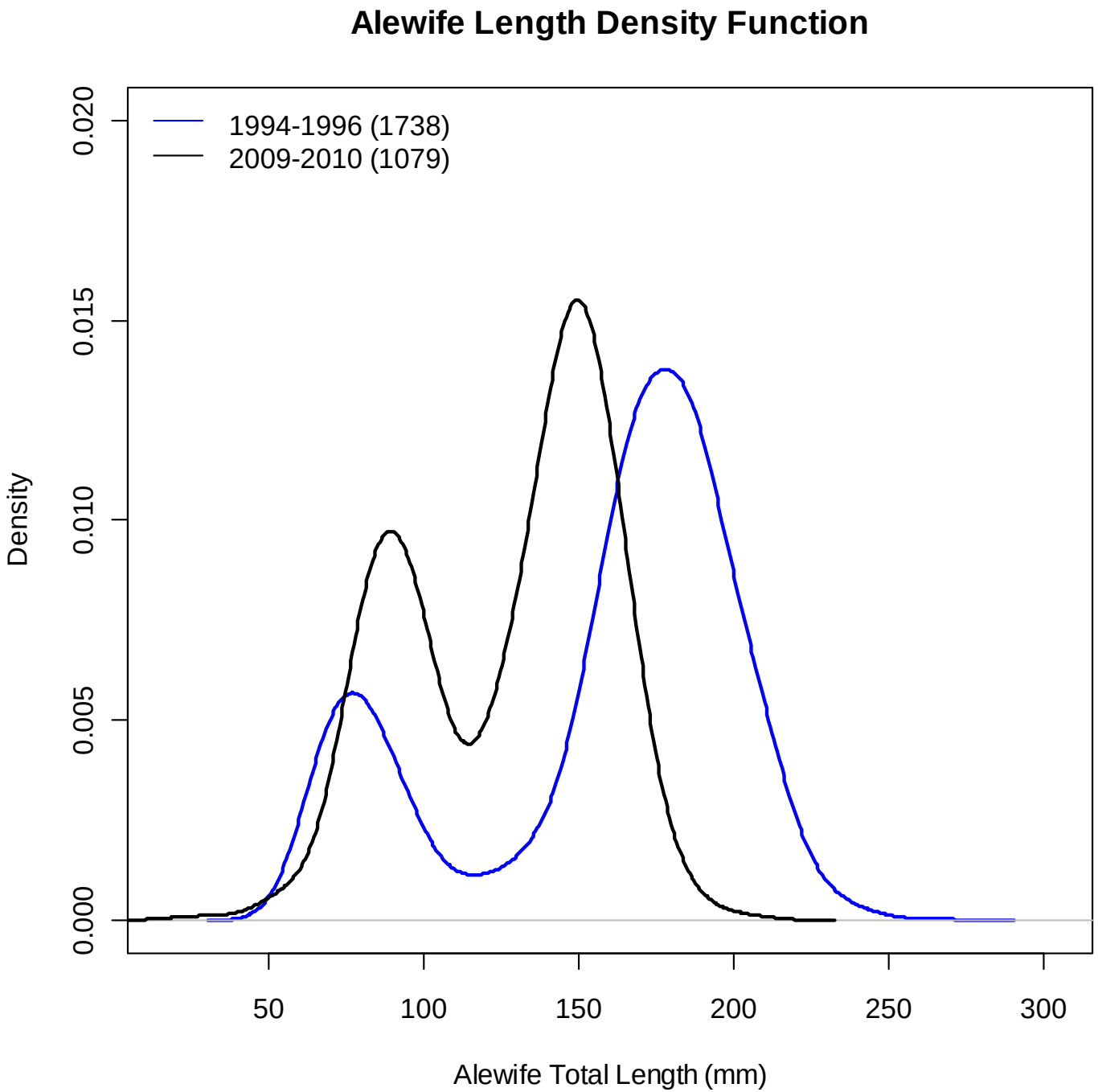


Chinook salmon – prey relationship 1994-2004



Year	R2	P
1991	0.397	0
1992	0.273	0
1993	0.463	0
1994	0.21	0
1995	0.292	0
1996	0.402	0
1997	0.097	0.036
1998	0.151	0.001
1999	0.255	0
2000	0.146	0.001
2001	0.013	0.314
2002	0	0.966
2003	0.012	0.44
2004	0.188	0
All	0.29	0


Alewife Length vs. Chinook Length
1994-1996
2009-2010
Alewife TL (mm)
0
50
100
150
200
250
300
300
400
500
600
700
800
900
1000
Chinook TL (mm)

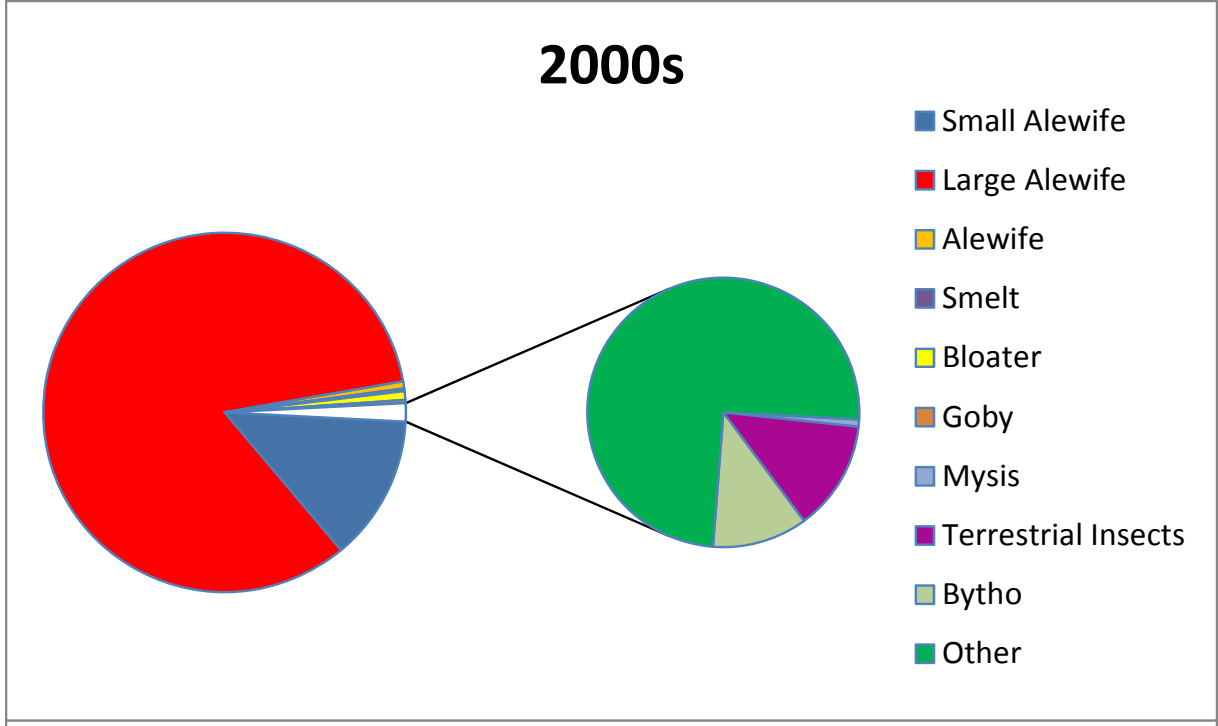

Alewife Length Density Function
1994-1996 (1738)
2009-2010 (1079)
Density
0.000
0.005
0.010
0.015
0.020
50
100
150
200
250
300
Alewife Total Length (mm)

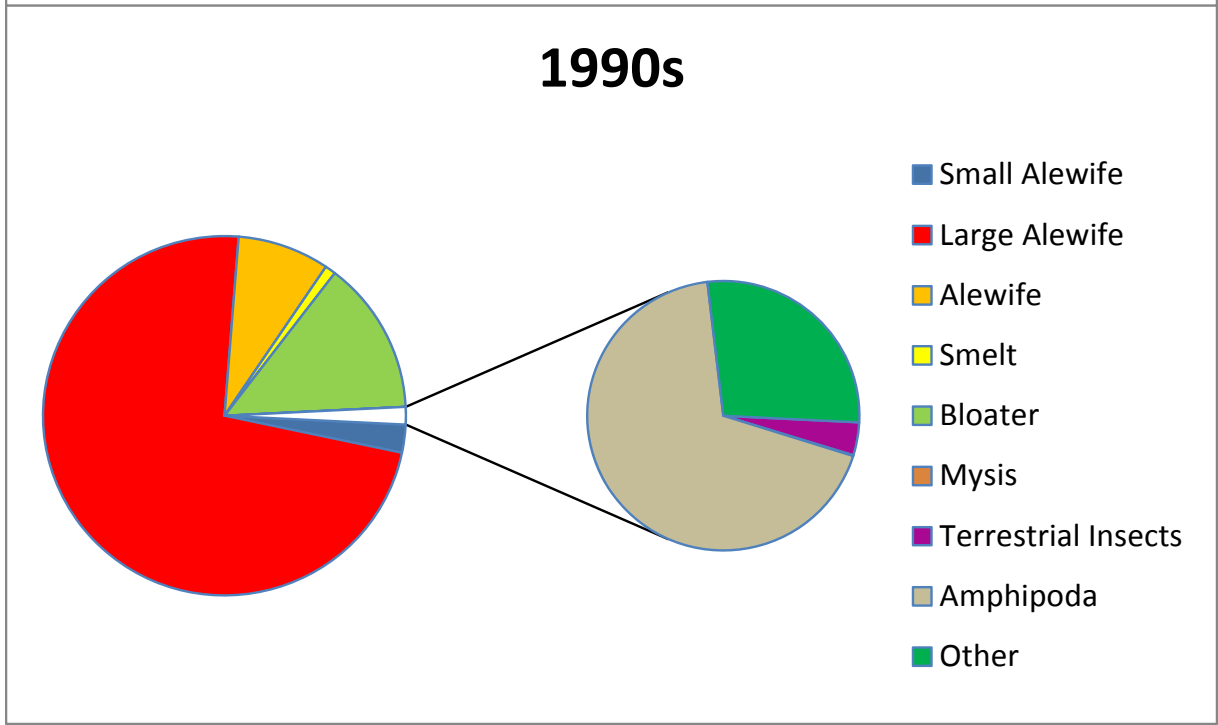
Salmon diet Composition

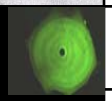
Salmon diet summary:

-Fewer prey consumed
-Prey size is lower
-Abundance of other prey is reduced

***Continued impacts from bottom-up influences**





Variable	Index	Level I	Level II
Abundance	Catch rate (charter)	Yes	Yes
	Angler success	No	Yes
	Weir returns (MI only)	Yes	Yes
 Recruitment	Percent wild from OTC	Yes	Yes
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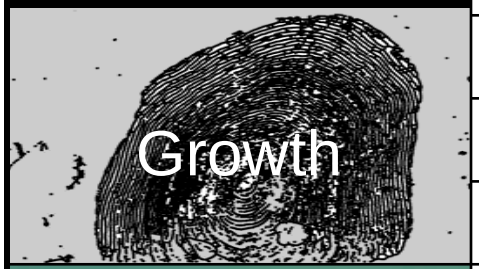 Growth	Creel wt at age 2	No	Yes
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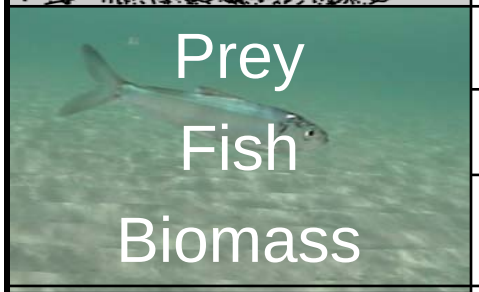
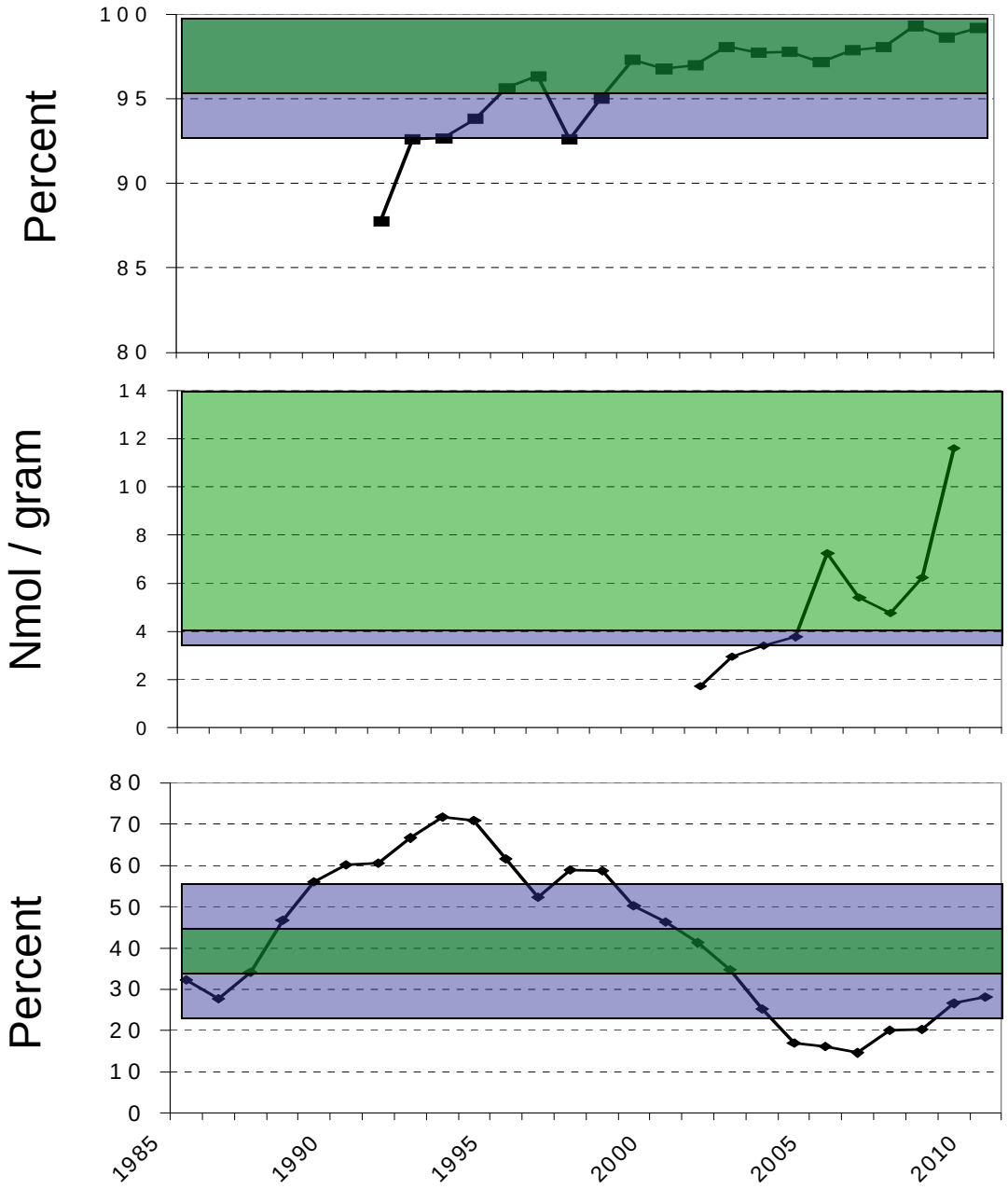
 Prey Fish Biomass	Acoustic	No	Yes
	Bottom trawl	Yes	Yes
	Coho length index (diet data?)	No	Yes
Ecosystem Health	Visual signs of disease		
	Egg thiamine levels		
	Salmonine composition		

Signs of disease at weirs
(Chinook salmon-
percent healthy)

Egg thiamine
Concentration
(lake trout eggs)

Salmonine composition
(percent non-Chinook)



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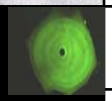
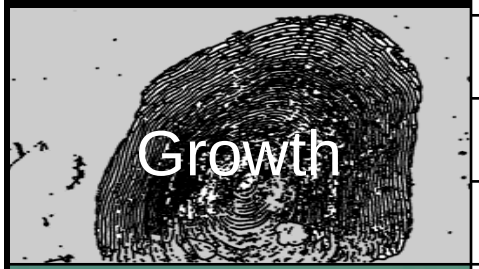
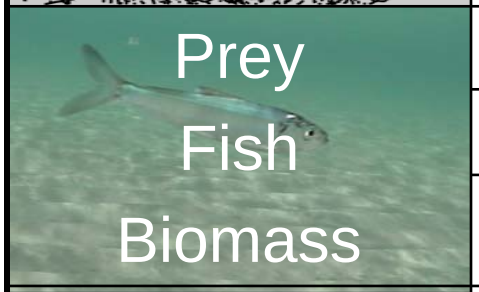
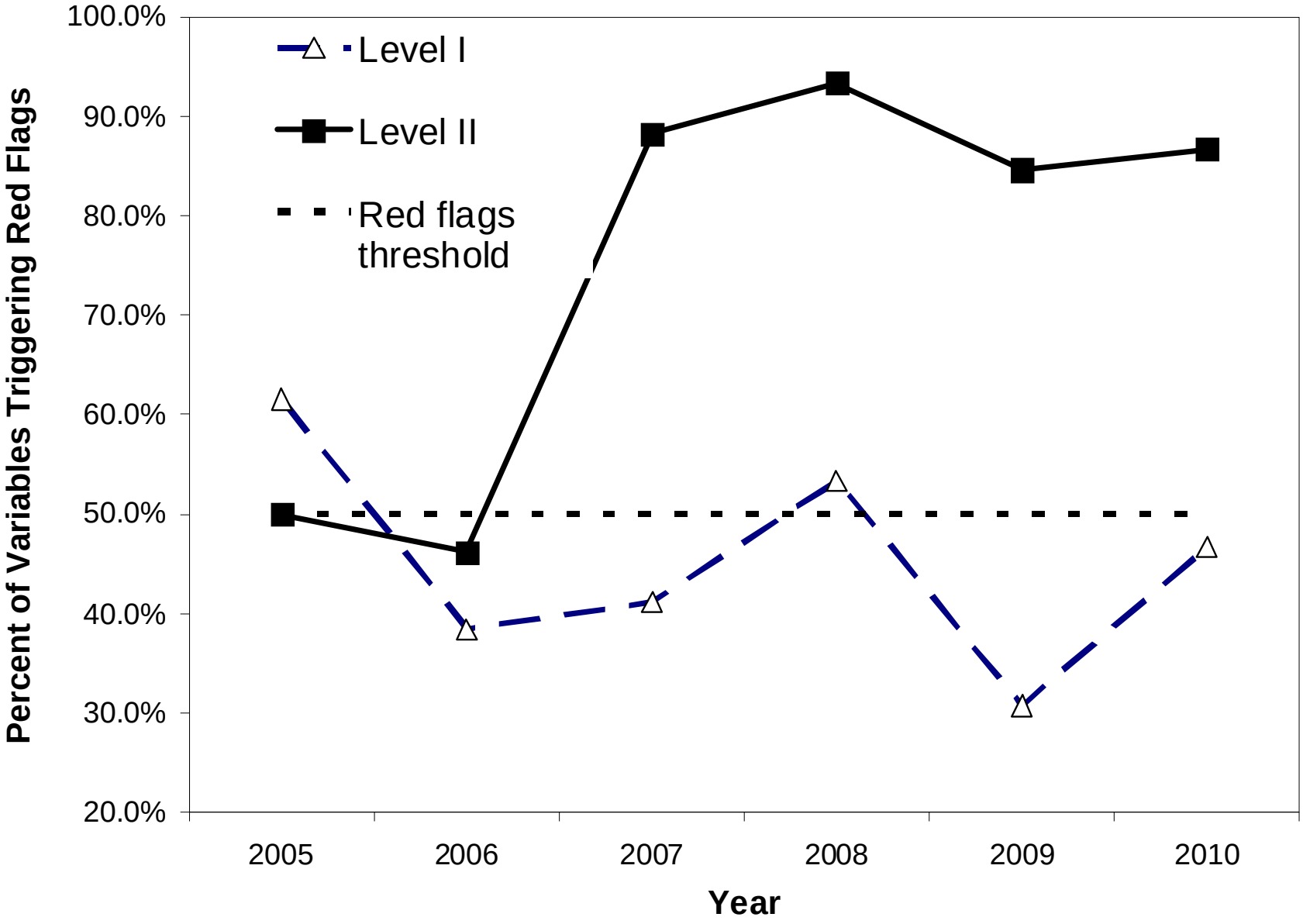
	Angler success	No	Yes
	Weir returns (MI only)	Yes	Yes
 Recruitment	Percent wild from OTC	Yes	Yes
	Total smolt abundance	Yes	Yes
	Age-1 abundance	Yes	Yes
 Growth	Creel wt at age 2	No	Yes
	Weir wt at age 3	Yes	Yes
	Standard wt	No	Yes
 Prey Fish Biomass	Acoustic	No	Yes
	Bottom trawl	Yes	Yes
	Coho length index (diet data?)	No	Yes
Ecosystem Health	Visual signs of disease	No	No
	Egg thiamine levels	No	No
	Salmonine composition	No	Yes

Summary for Lake Michigan Salmonines

- Level I – 46% of the variables triggered red flags (<50% threshold)
- Level II – 86.7% of the variables triggered red flags (>50% threshold)
- Managing for Level II (trend indicator) may not be possible as the ecosystem is not “stable”
- Overall status:
  - Natural reproduction is high (>50%)
  - Survival to age-1 is highly variable
  - Prey fish, growth, and diets low, but 2010 YOY alewife estimate is very high
- DA and Red Flag Review are critical

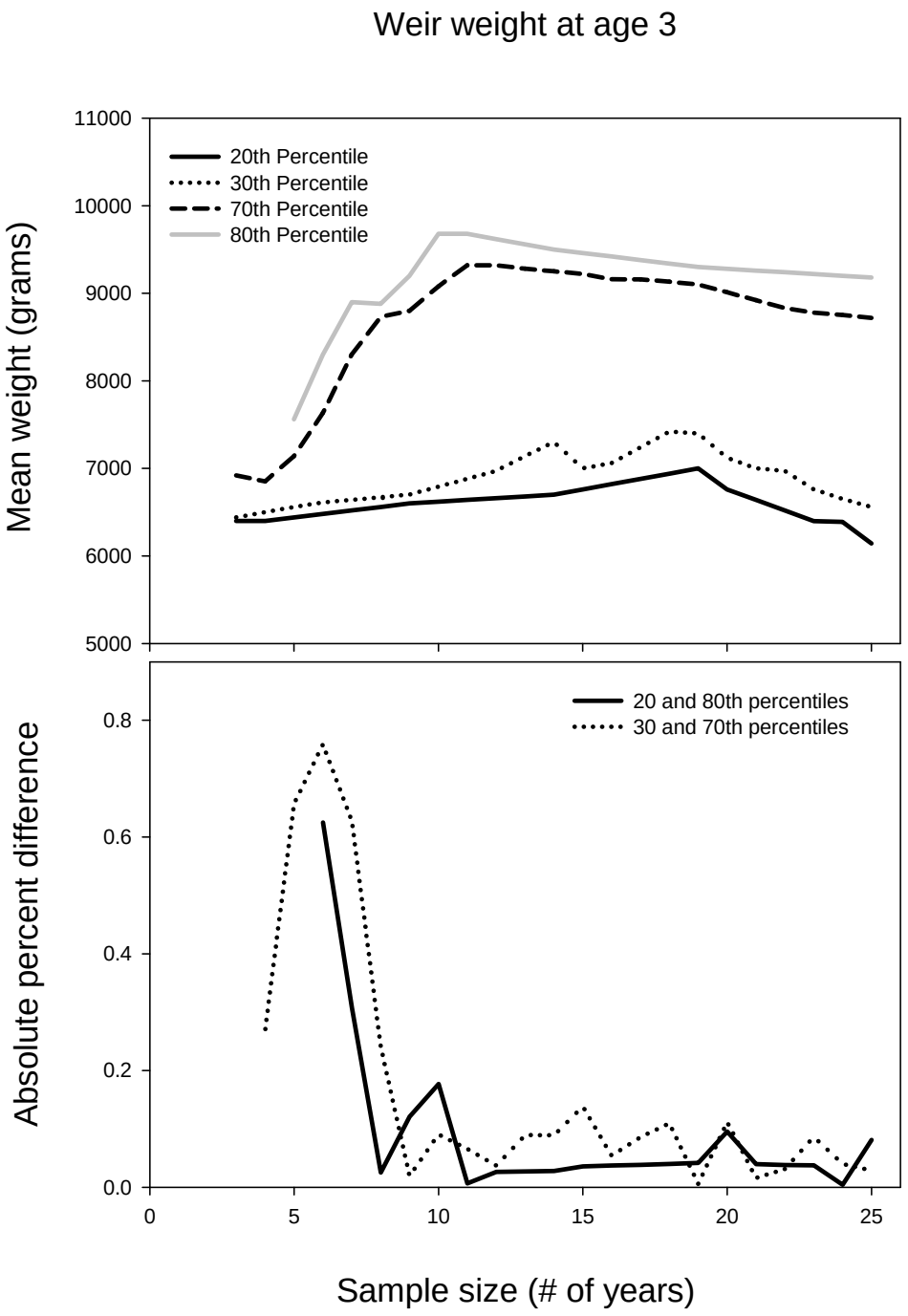
SOL 2005 – 2010 Red Flags



SWG Red Flags Review

- Update Red Flag variables
  - PREY FISH: Diet index
  - ECOSYSTEM HEALTH: Lake trout egg thiamine levels
- Five categories, 3 variables per category, 2 evaluation levels (LI=20-80, LII=40-60)
- Evaluation of levels / benchmarks

Why do the management benchmarks (e.g., percentiles) need to be estimated every year?

- Dynamic or fixed benchmarks?
- Sensitivity of adding another year of data
- Retrospective test of each variable
  - Mean
  - RSE
  - Percentile values
  - Change in the percent difference

Red Flags Review 1985-2009