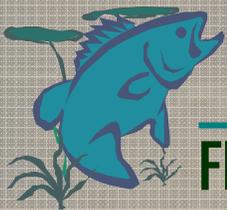


Lake Michigan Salmon Stocking Strategy Process Stakeholder Meetings

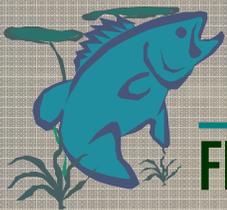


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Collaborative Process

- The stocking reductions in 1999 and 2006 were determined by agencies and brought to the public for comment.
- This process involved stakeholders from the beginning.

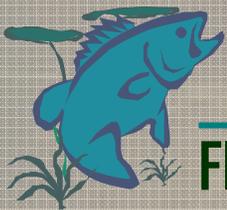


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Establishment of Goals and Objectives (Work Shop 1)

- Stakeholder Meetings
 - April 2011 in Michigan
 - June 2011 in Wisconsin
- Stakeholders represented various Lake Michigan angling organizations from Indiana, Illinois, Wisconsin, and Michigan.
- Both Stakeholders and Agencies Stated Goals and Objectives



Core Stakeholder Group

- Jeff Sadula, Calumet harbor Sport Fish Association (Illinois)
- Ed Makauska, Trollers Unlimited (Illinois)
- Bill Meier, Salmon Unlimited (Illinois)
- Mike Ratter, Salmon Unlimited (Indiana)
- Mike Ryan, Great Lakes Fishery Commission Advisor (Indiana)
- Jeff Guerra, Michiana Steelheaders (Indiana)
- John Robertson, Michigan United Conservation Clubs (Michigan)
- Denny Grinold, Great Lakes Fishery Commission Advisor (Michigan)
- Dennis Eade, Michigan Steelheaders (Michigan)
- Todd Pollesch, Great Lakes Fishery Commission Advisor (Wisconsin)
- John Hanson, Great Lakes Sport Fish Federation (Wisconsin)
- Duane Nadolski, Great Lakes Sport Fish Federation (Wisconsin)



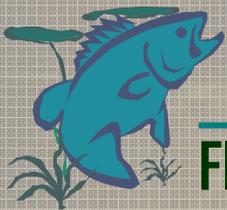
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Work Shop 2 Overview

November 5th Portage, Indiana

- Discussed How Managers Make Decisions
- Reviewed Chinook salmon abundance, natural reproduction, growth, condition, and health
- Reviewed prey abundance and forecasts
- Learned about the Lake Michigan Decision Analysis Model
- Developed scenarios to evaluate and refine the model



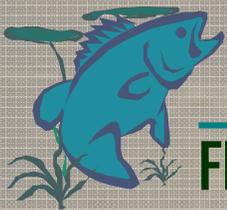
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Work Shop 3 Overview

January 23rd Chesterton, Indiana

- Reviewed Lake Michigan Decision Analysis Model outcomes
- Discussed model outcomes
- Began discussions about stocking strategies

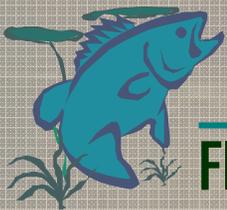


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Next Steps

- Communicate the State of Lake Michigan to the Public
- Further Discussion of the proposed stocking options
- Assist agencies in making an informed decision to meet fishery goals and objectives
- Conduct workshops (Benton Harbor and Wisconsin) to gather public comments
- **Focus on the concept of a particular stocking option NOT tactical decisions**



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Lake Michigan Salmon Stocking Strategy Process Summary of Stakeholder Meetings

Collaborative Process

- The stocking reductions in 1999 and 2006 were determined by agencies and brought to the public for comment.
- This process involved stakeholders from the beginning.

Workshop 1 - Stakeholder Meetings

- April 2011 in Michigan, June 2011 in Wisconsin

Workshop 2 Overview - Stakeholders

- November 5th Portage, Indiana

Workshop 3 Overview - Stakeholders

- January 23rd Chesterton, Indiana



Lake Michigan Salmon Stocking Strategy Process Summary of Stakeholder Meetings

Workshop 4 – Stakeholders and public

- April 14, 2012, Benton Harbor, MI

Workshop 5

Milwaukee WI – May 1

Green Bay WI - May 8

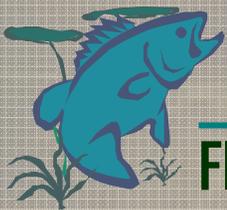
- Reviewed information, presented stocking options, received Feedback, presented link to online survey for further comments

Workshop 6

Milwaukee WI – August 9

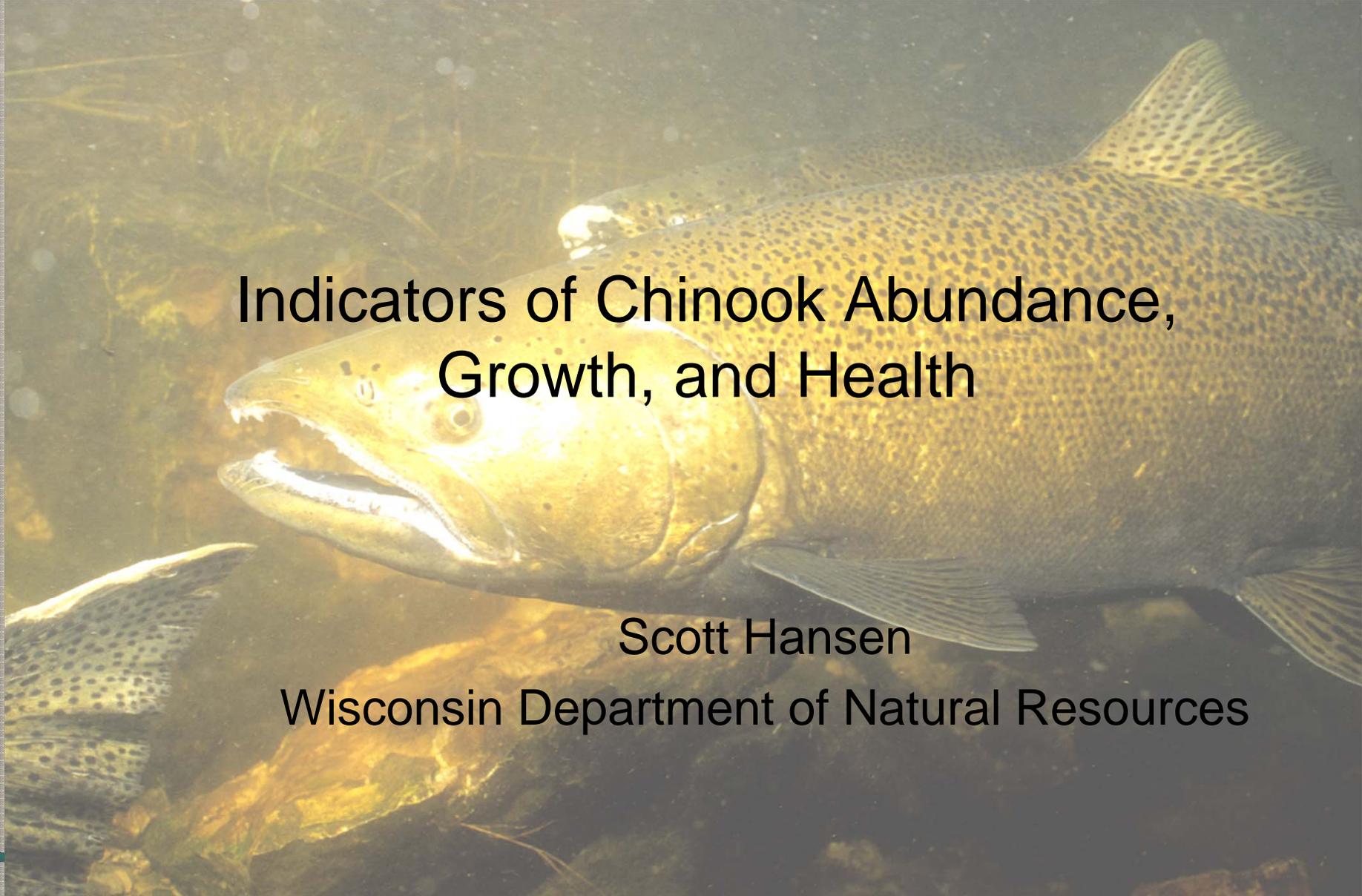
Green Bay WI - August 7

- Presented Lake Michigan Committee proposal to reduce Chinook salmon stocking, received feedback and comments



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An underwater photograph of a large Chinook salmon swimming towards the left. The fish has a golden-brown body with numerous dark spots. Its mouth is slightly open, showing its teeth. The background is a murky, greenish-brown water with some aquatic plants visible.

Indicators of Chinook Abundance, Growth, and Health

Scott Hansen

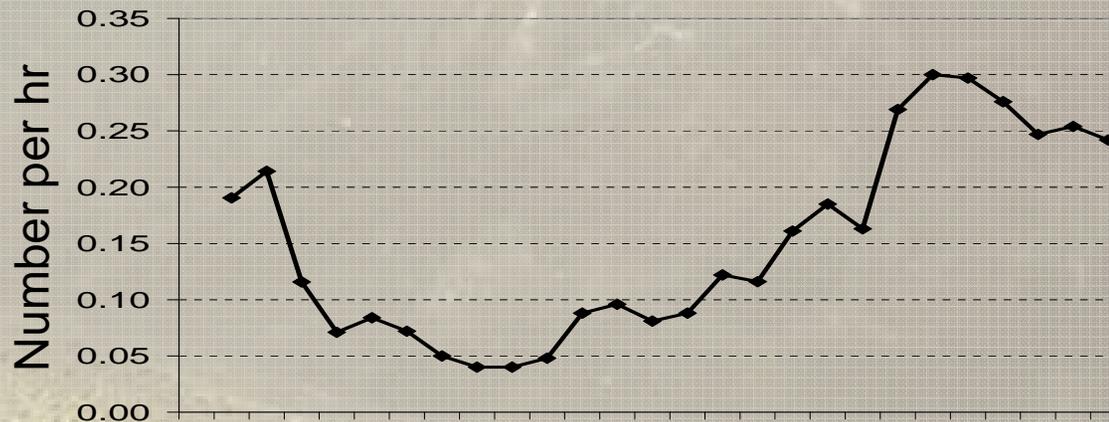
Wisconsin Department of Natural Resources



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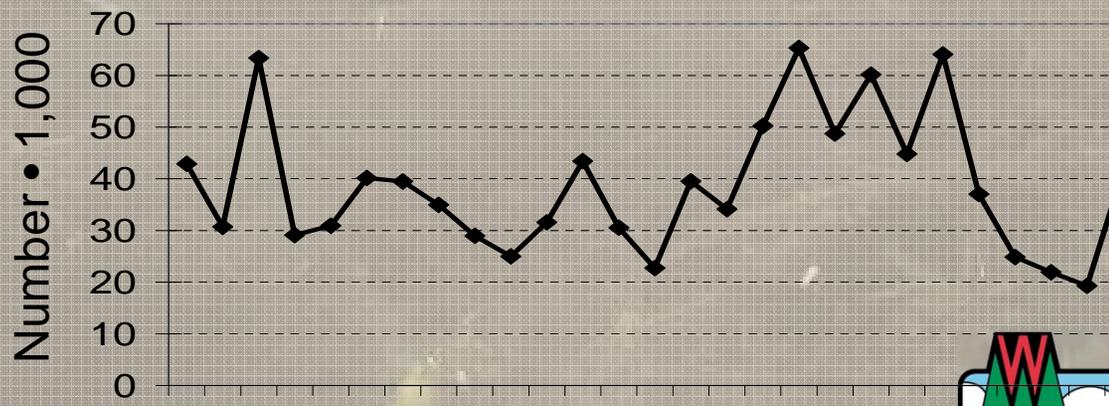
Chinook salmon catch rates (MI charter)



Angler Success (Harvest > 3 Chinook salmon per day MI)



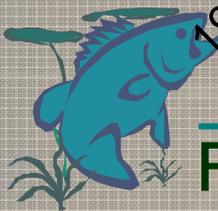
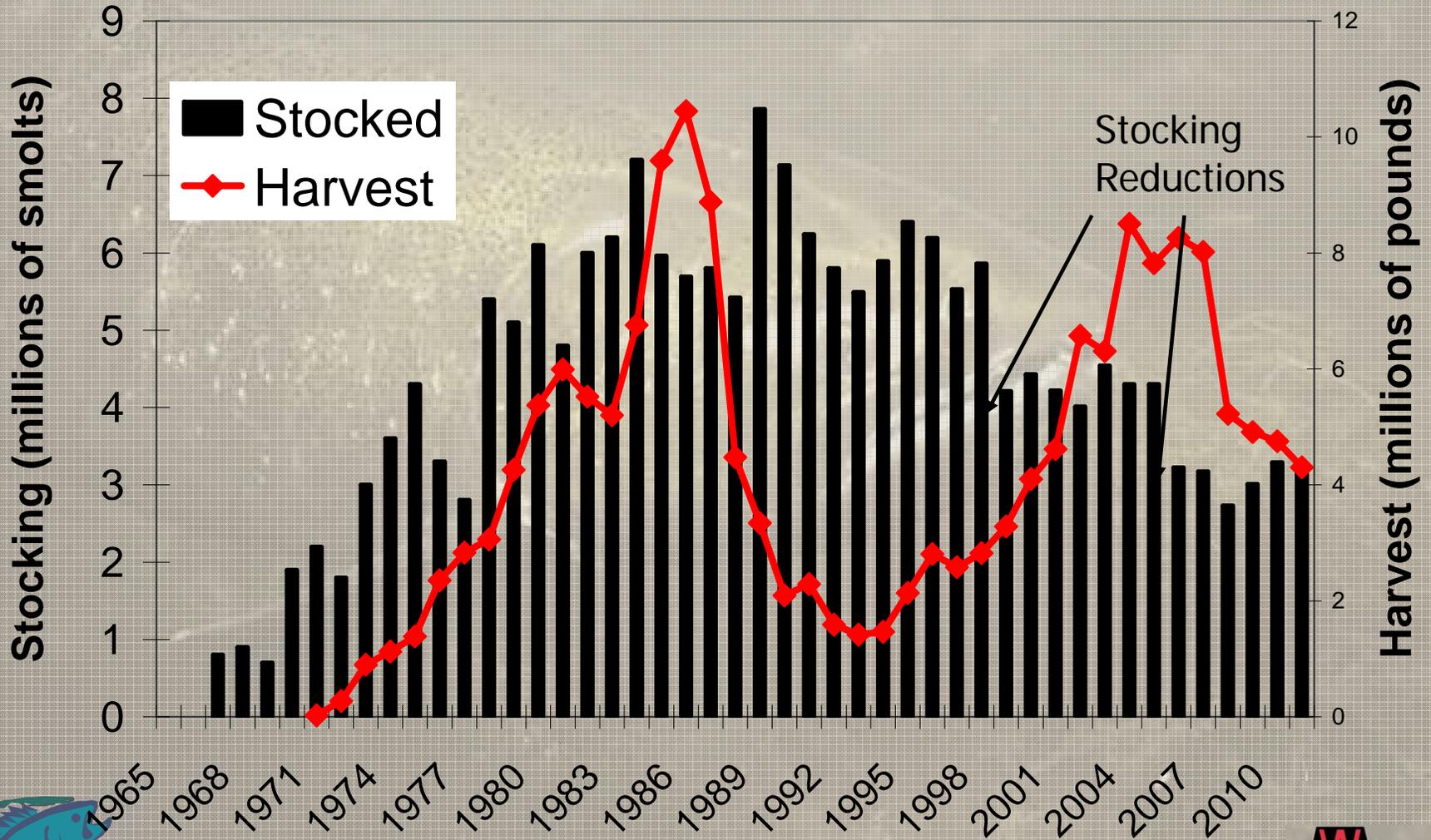
Michigan/Wisconsin Weir Returns



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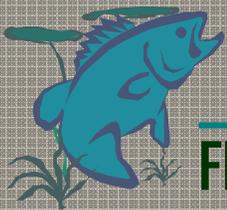
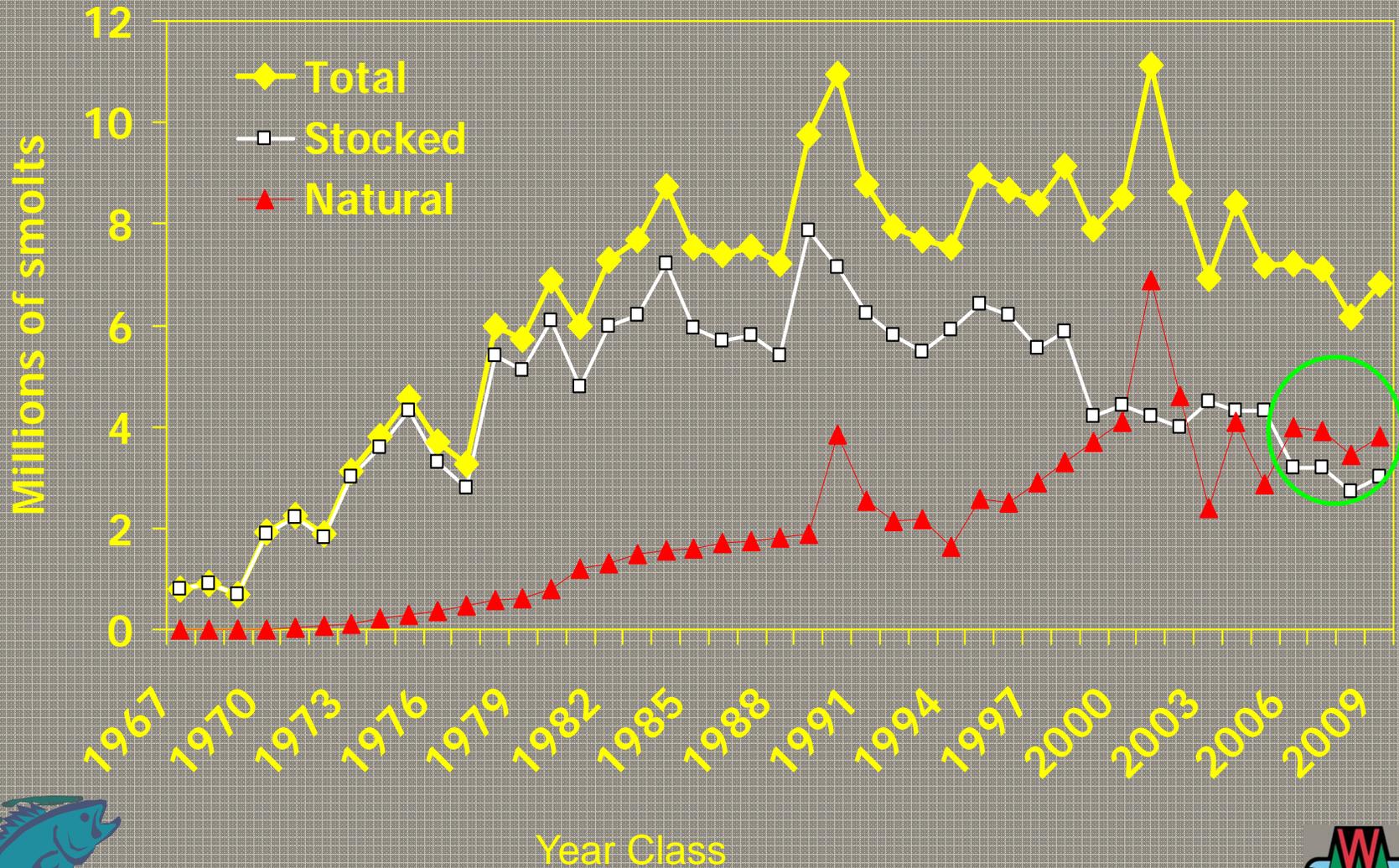
Lake-wide Stocking and Harvest (Chinook salmon only)



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Estimated Chinook Salmon Recruitment in Lake Michigan, 1967-2009



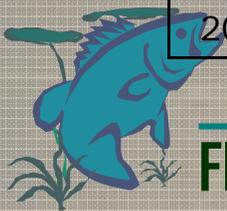
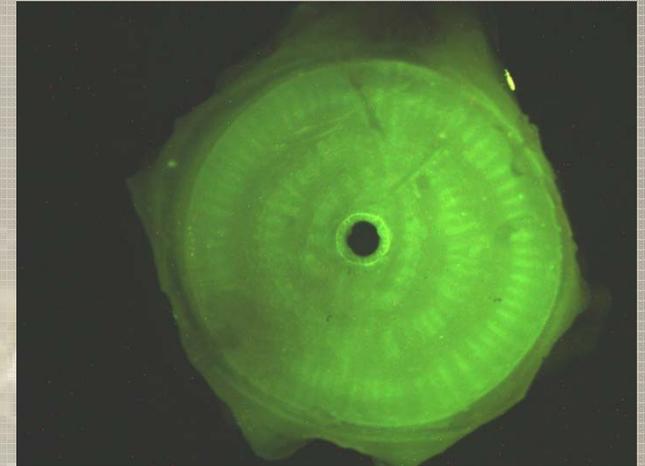
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OTC Project Results

Collection Year

	Year Class				
	2006	2007	2008	2009	2010
2007	56.1				
2008	82.9	55.3			
2009	65.7	62.3	53.5		
2010	67.2	61.5	69.1	54.5	
2011	Age-5	Age-4	Age-3	Age-2	Age-1

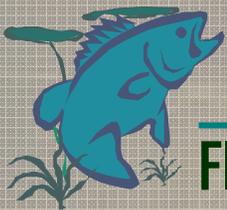


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Growth/Condition Indices

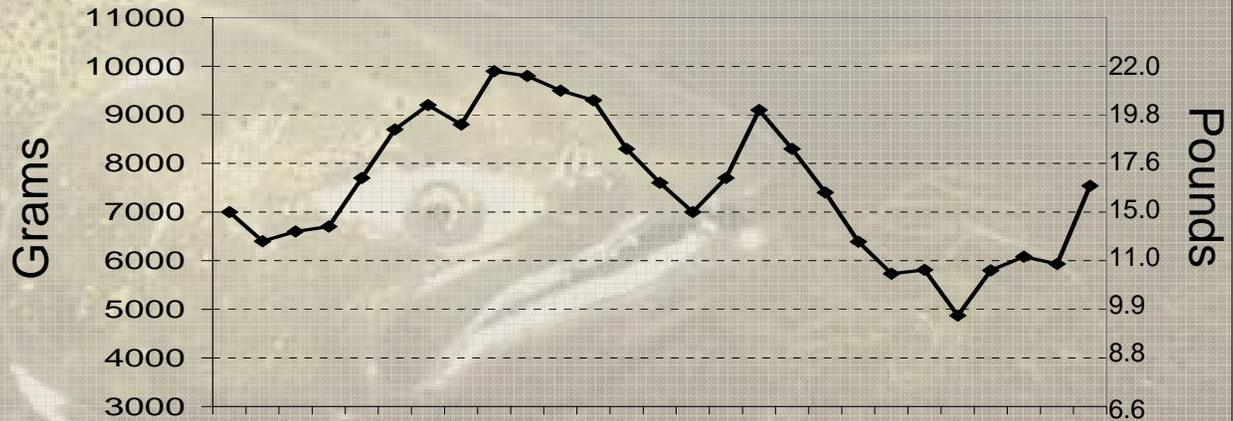
- Salmon growth and condition
 - Index of forage availability and pred/prey balance
 - Provides information to aid stocking decisions
 - Several “Red Flags” indices:
 - Creel weight at age 2+
 - Weir weight at age 3+
 - Weir standard weight of a 30” Chinook



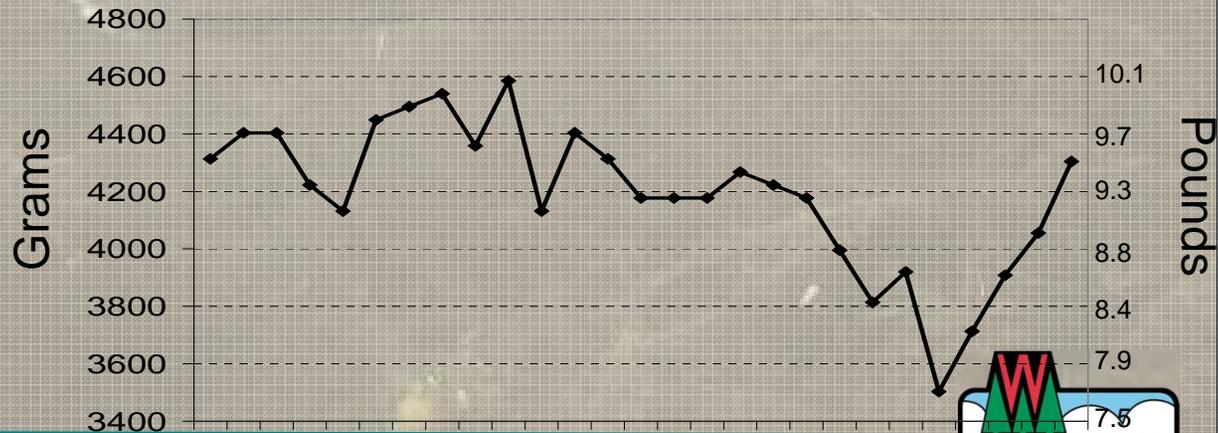
**Weight at age 2
(June-July MI fishery)**



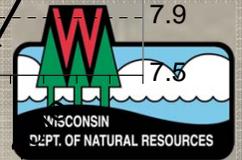
**Weight at age 3
(Strawberry Creek weir)**



**Standard weight
(Strawberry Creek weir)**



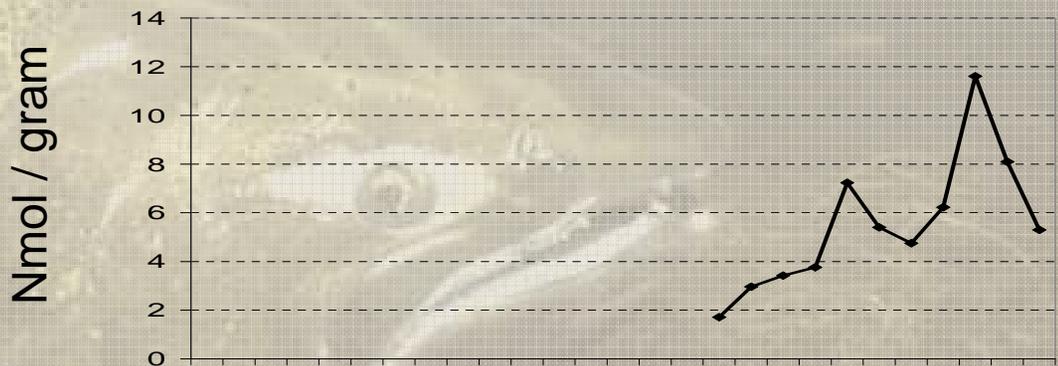
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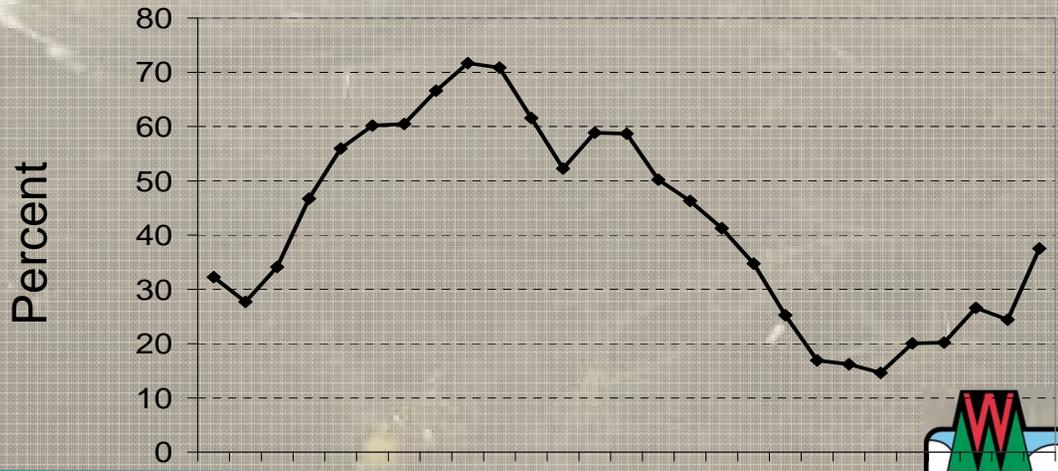
Signs of disease at weirs
(percent healthy)



Lake Trout egg thiamine
concentration



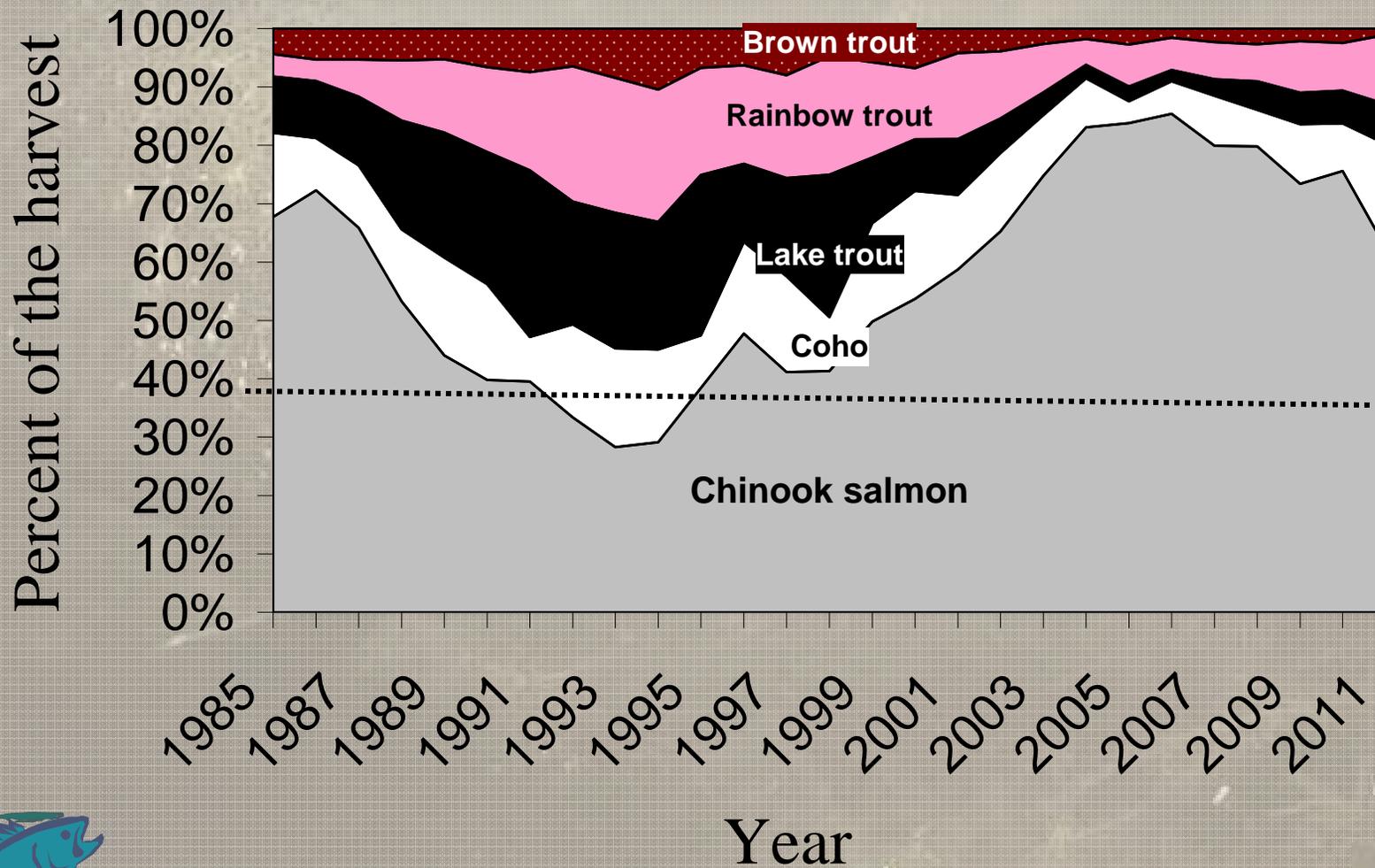
Salmonine composition
(percent non-Chinook)



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Salmonid Community Composition



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Summary

- Natural reproduction is high (> 50%)
- 2011 alewife recruitment low
- Catch rates recently stabilized (MI waters)
 - Lower Chinook harvest in WI in 2011
- Improving size at age
 - 2010 alewife year class assimilated well into population
- Disease incidence very low
- Salmonine composition improved





Lake Michigan 2011

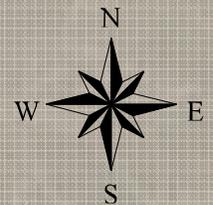
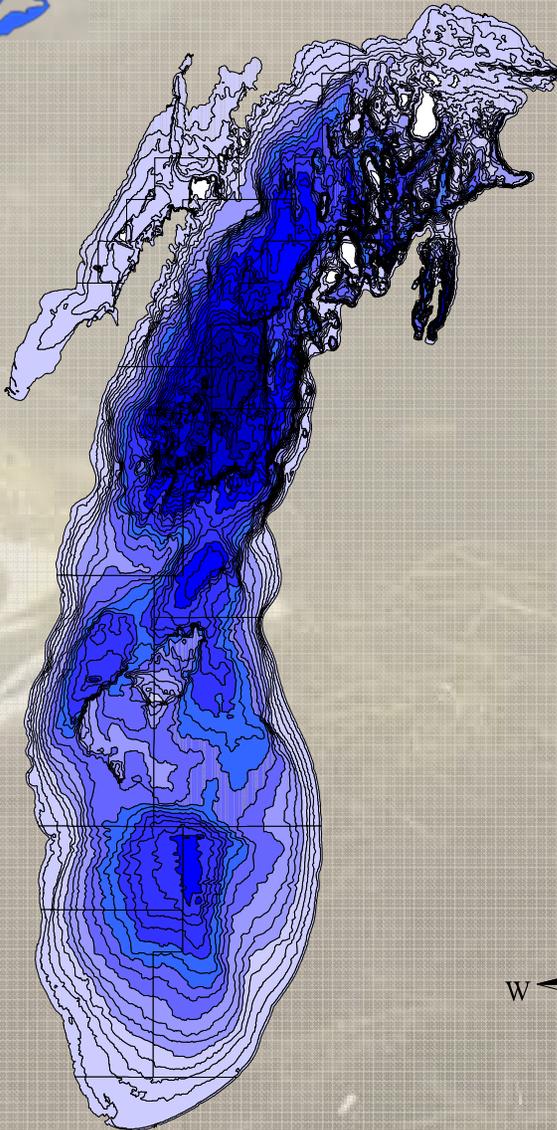
Status and Trends of Prey Fish Populations

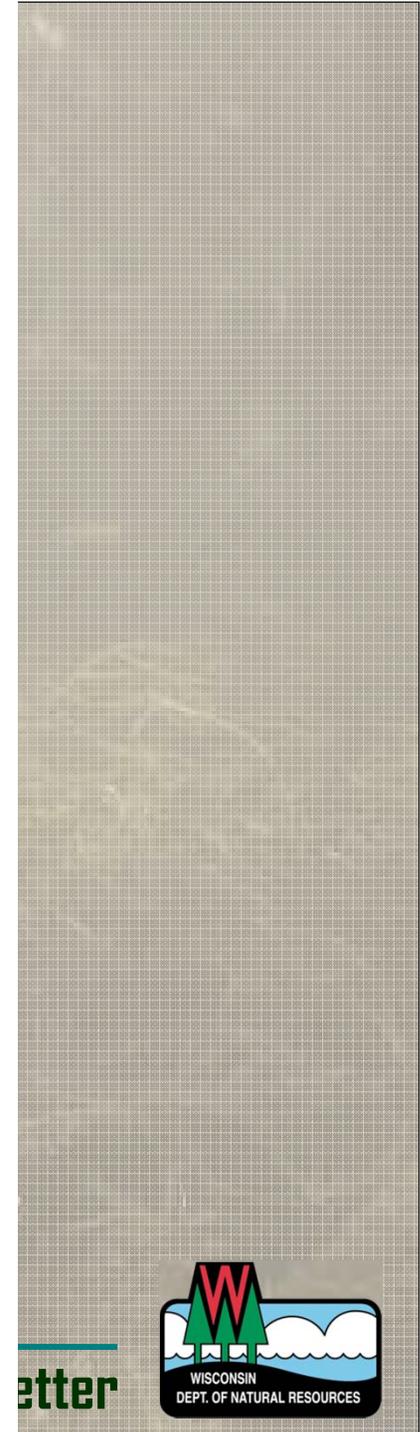
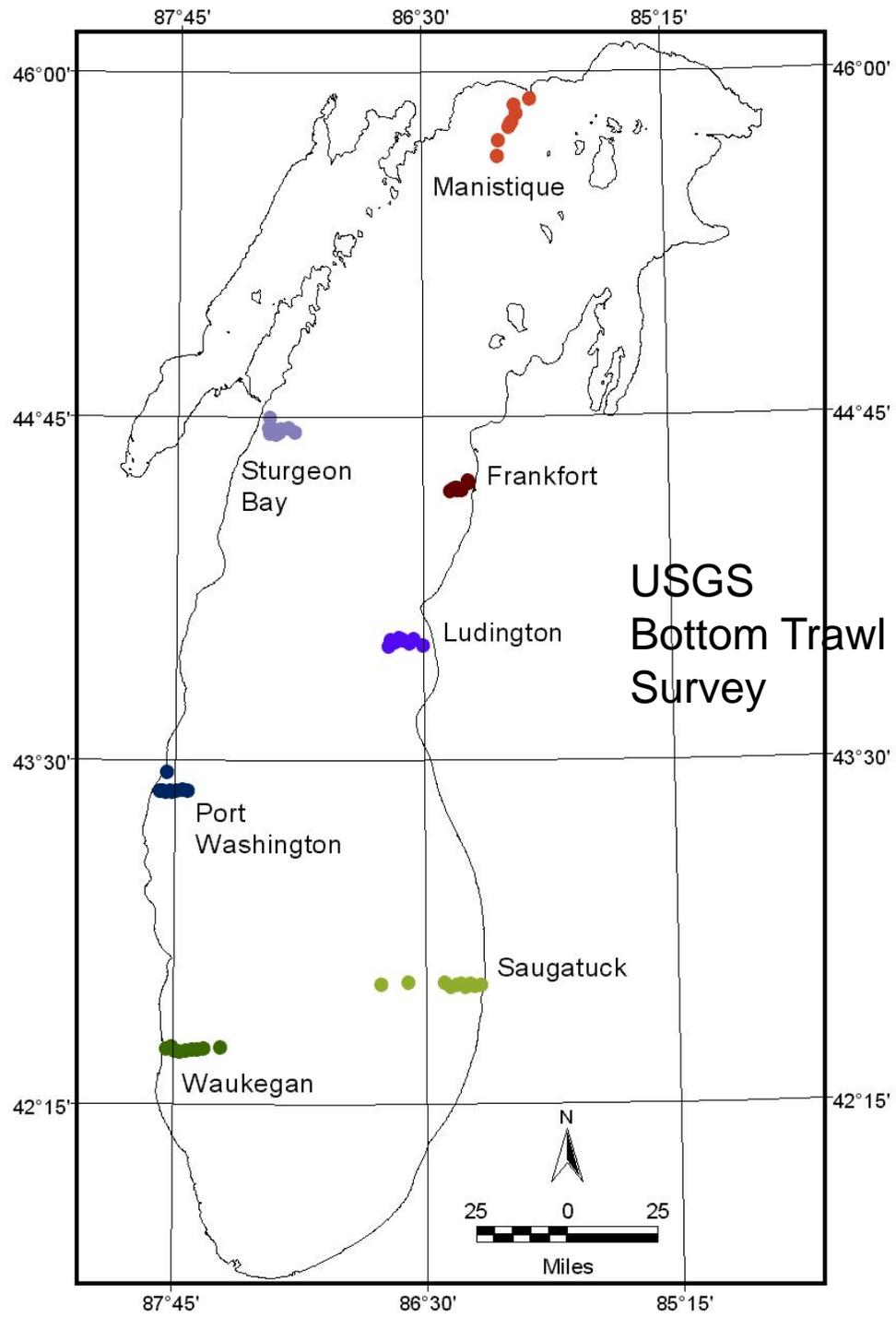
Chuck Madenjian, Bo Bunnell,
Tim Desorcie, Margi Chriscinske,
Melissa Kostich, and Jean Adams

USGS Great Lakes Science Center

Ann Arbor, MI

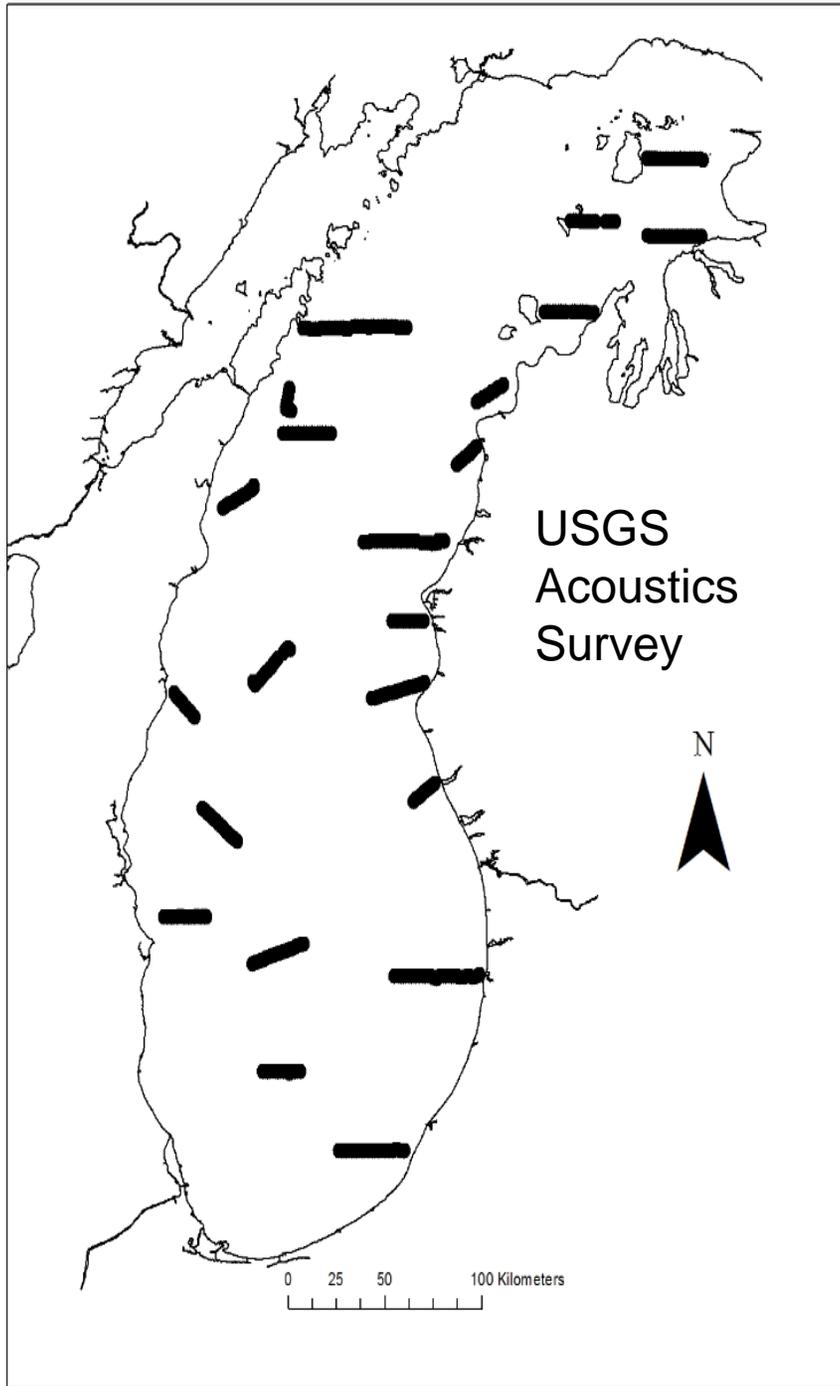
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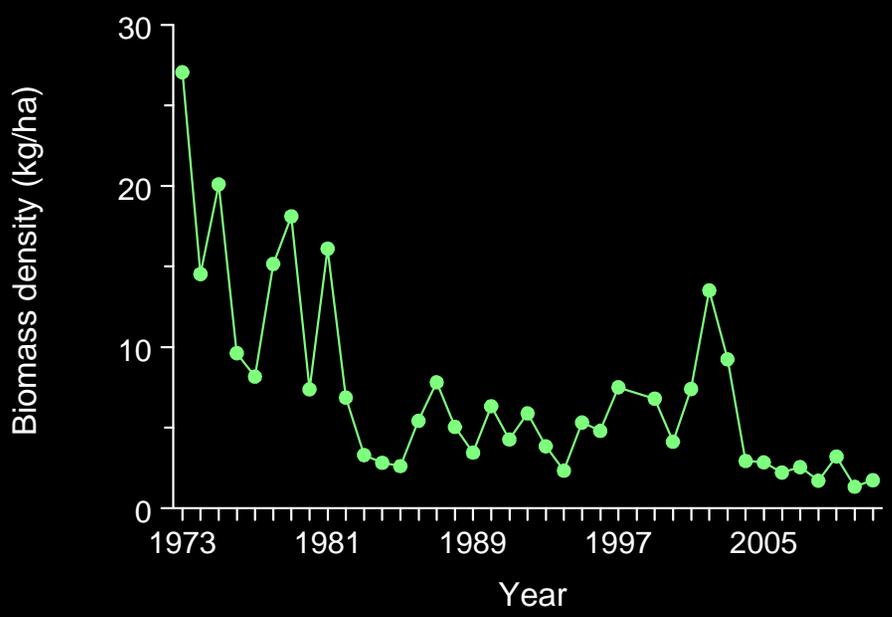
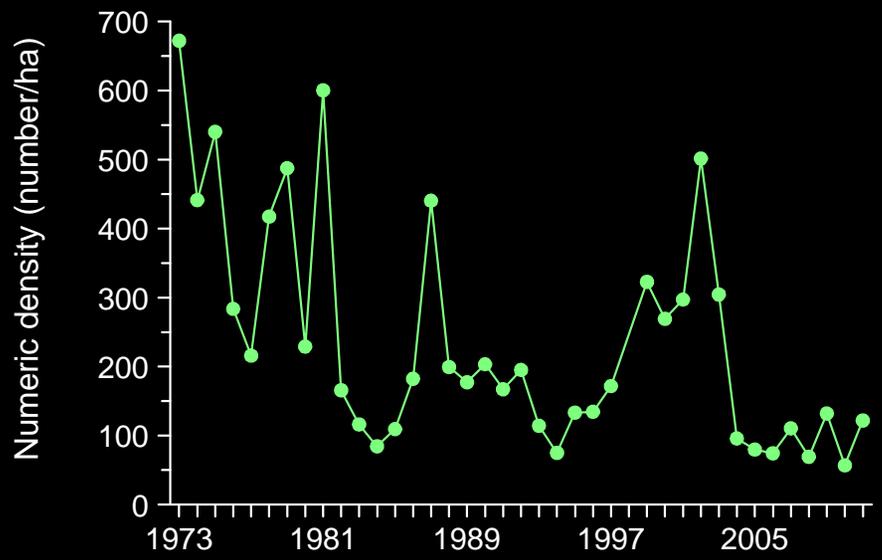
FISHERIES MAN



ing better



Adult alewife

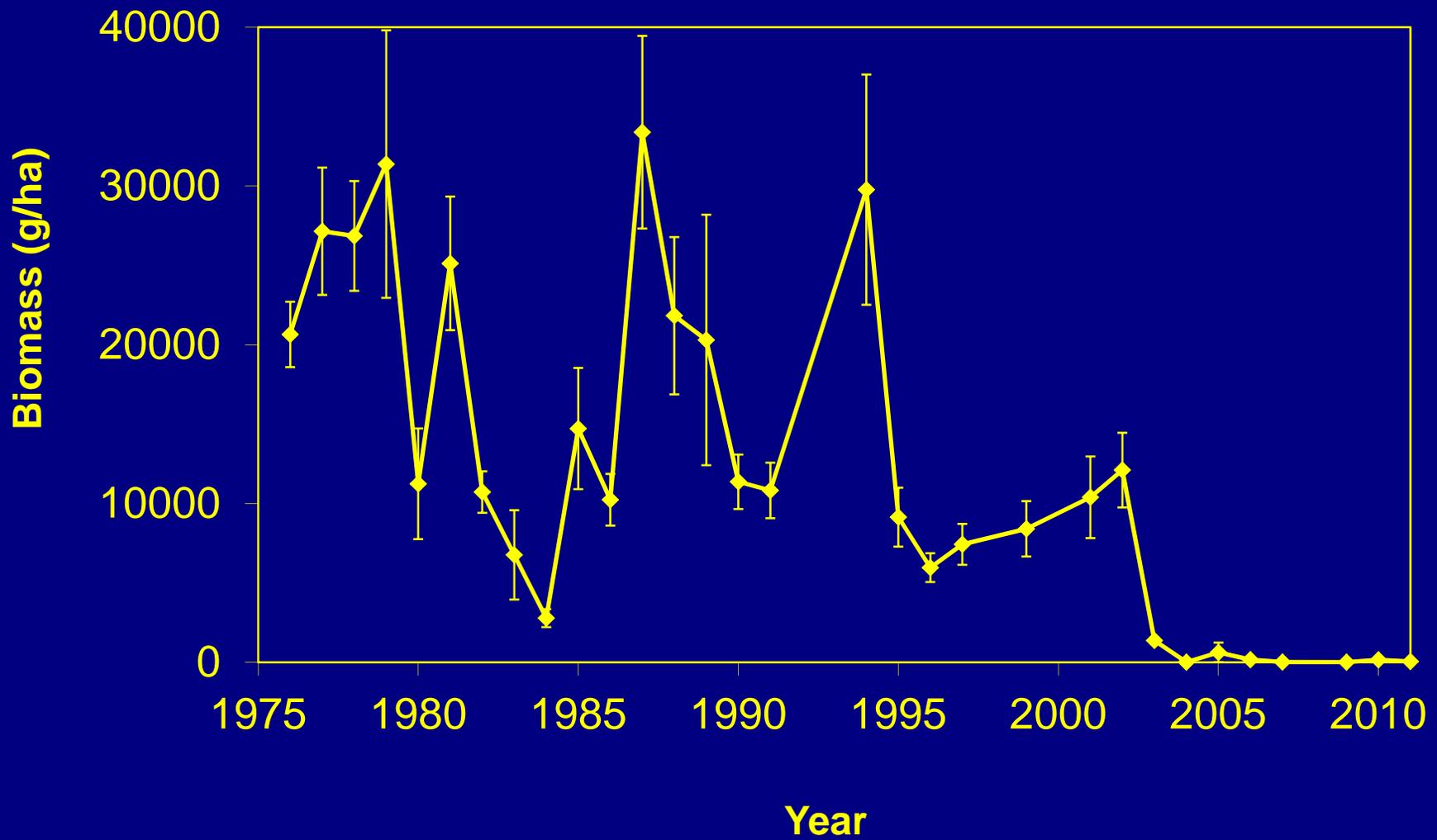


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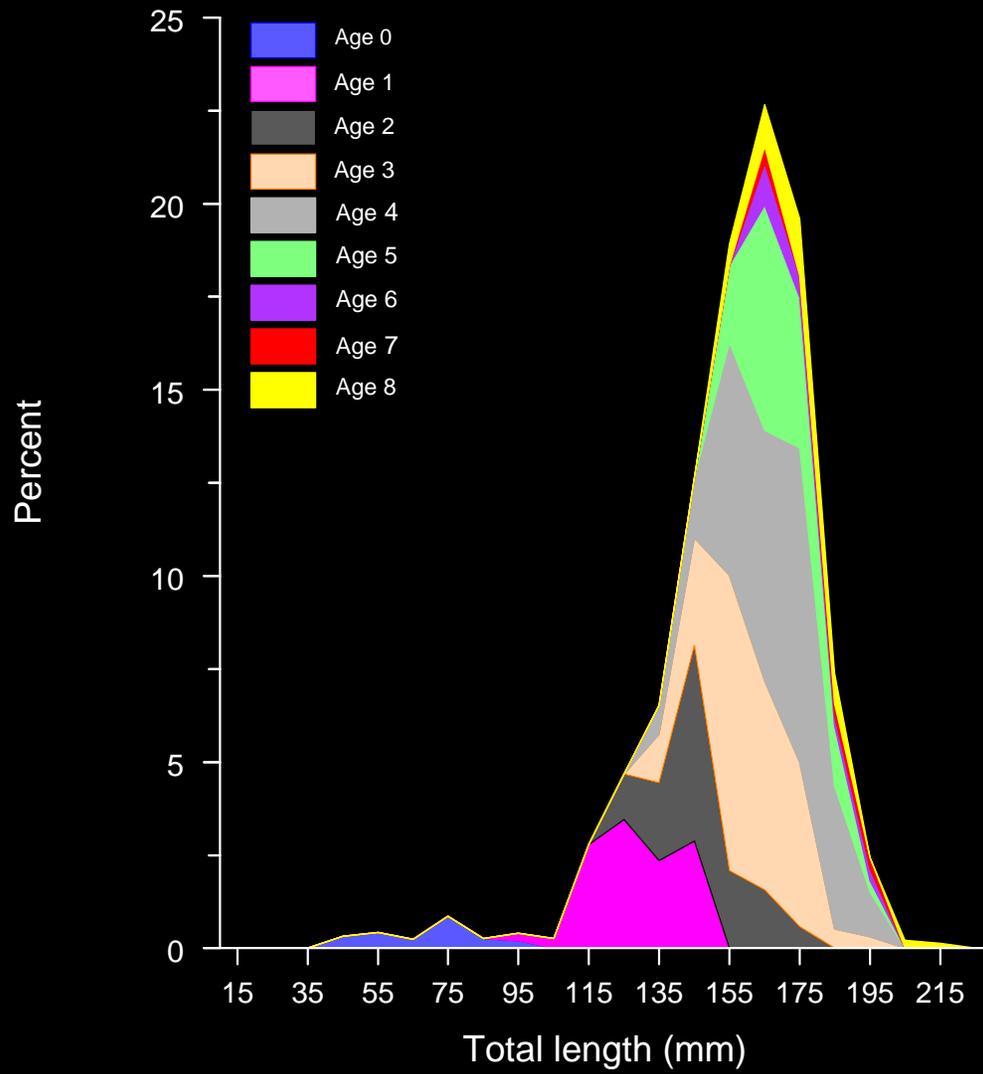


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Lake Huron



2006

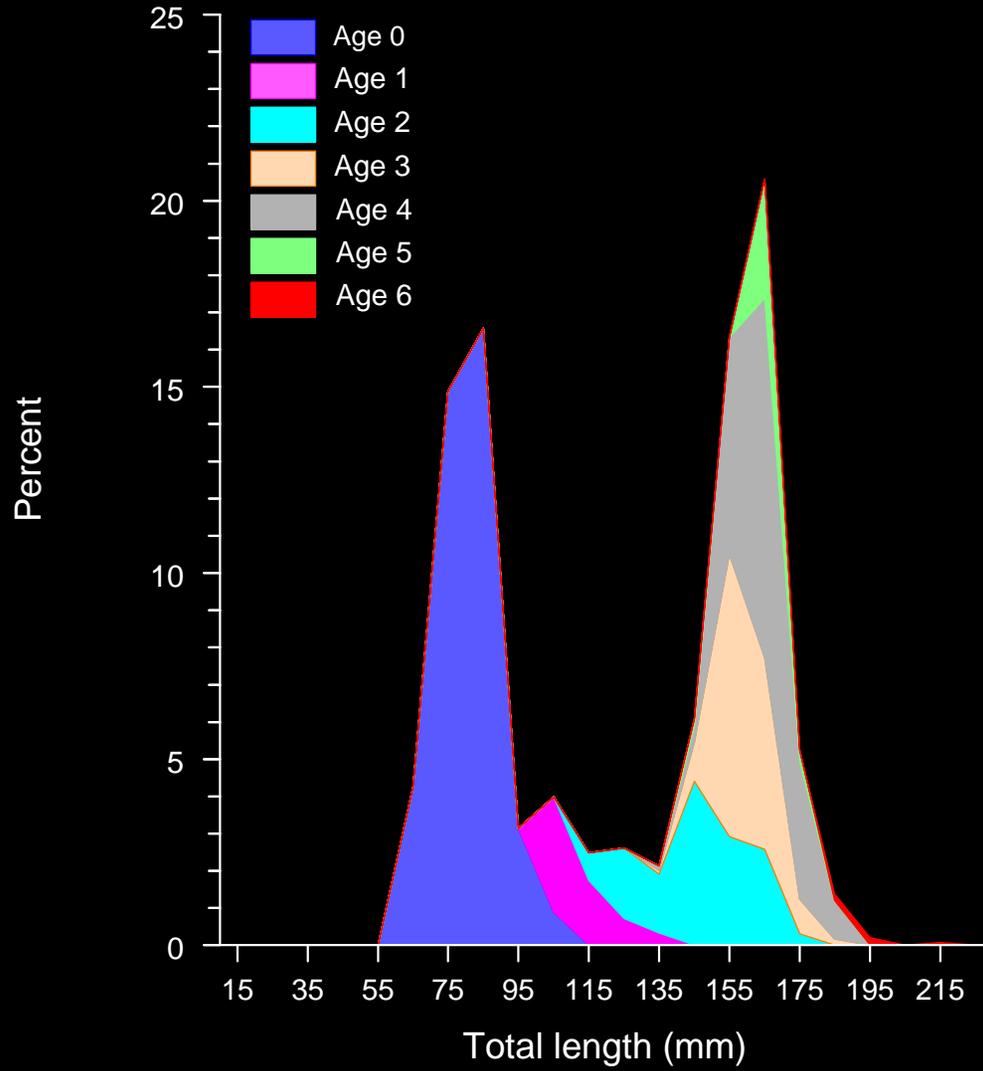


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Alewife length-age distribution, 2009



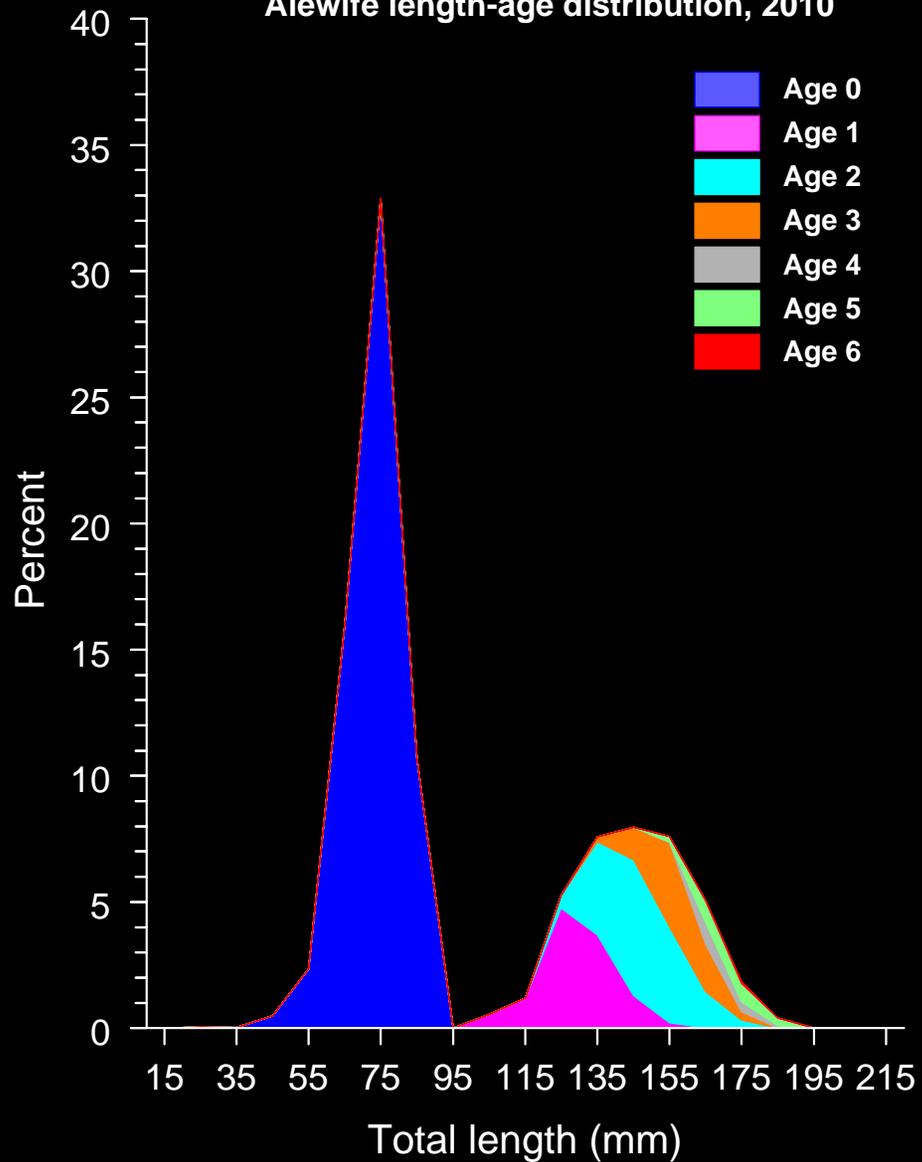
FISHERIE

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WISCONSIN
DEPT. OF NATURAL RESOURCES

Alewife length-age distribution, 2010

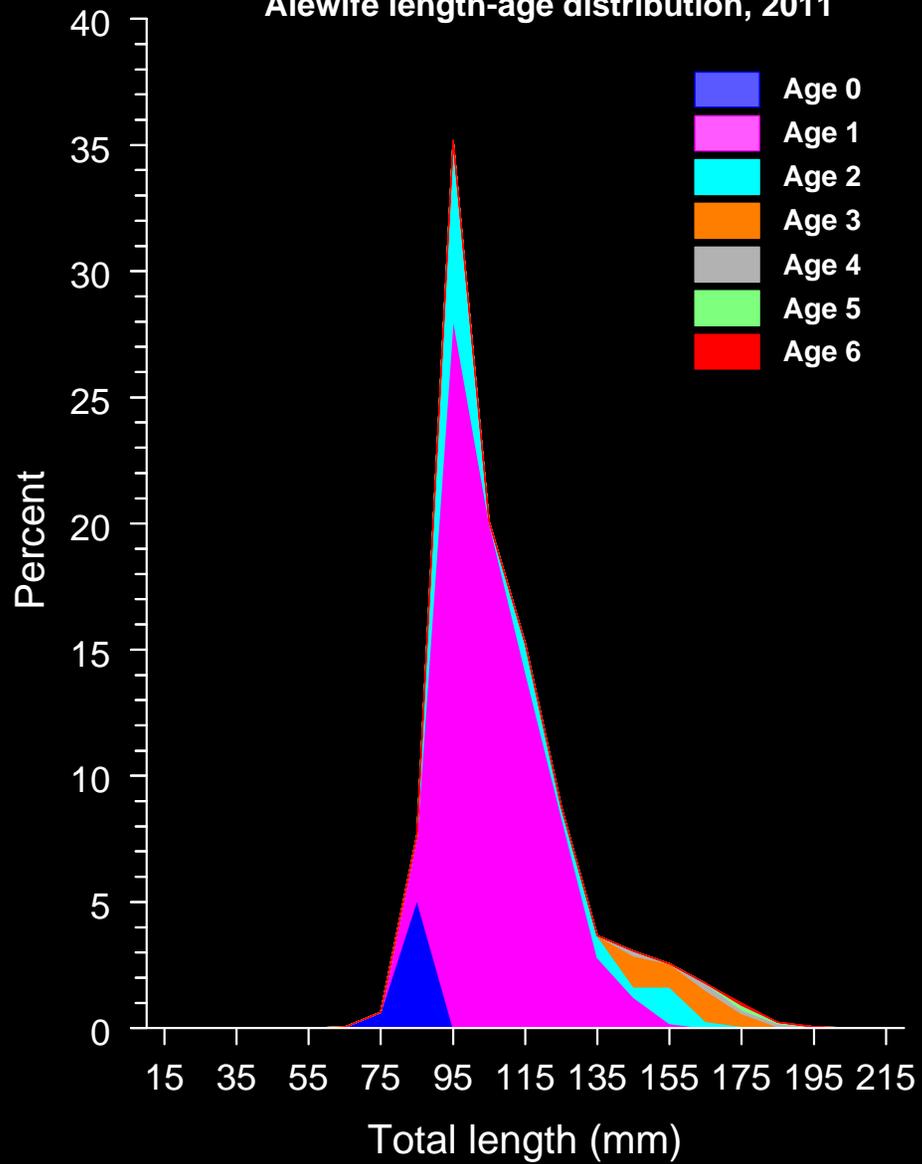


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Alewife length-age distribution, 2011

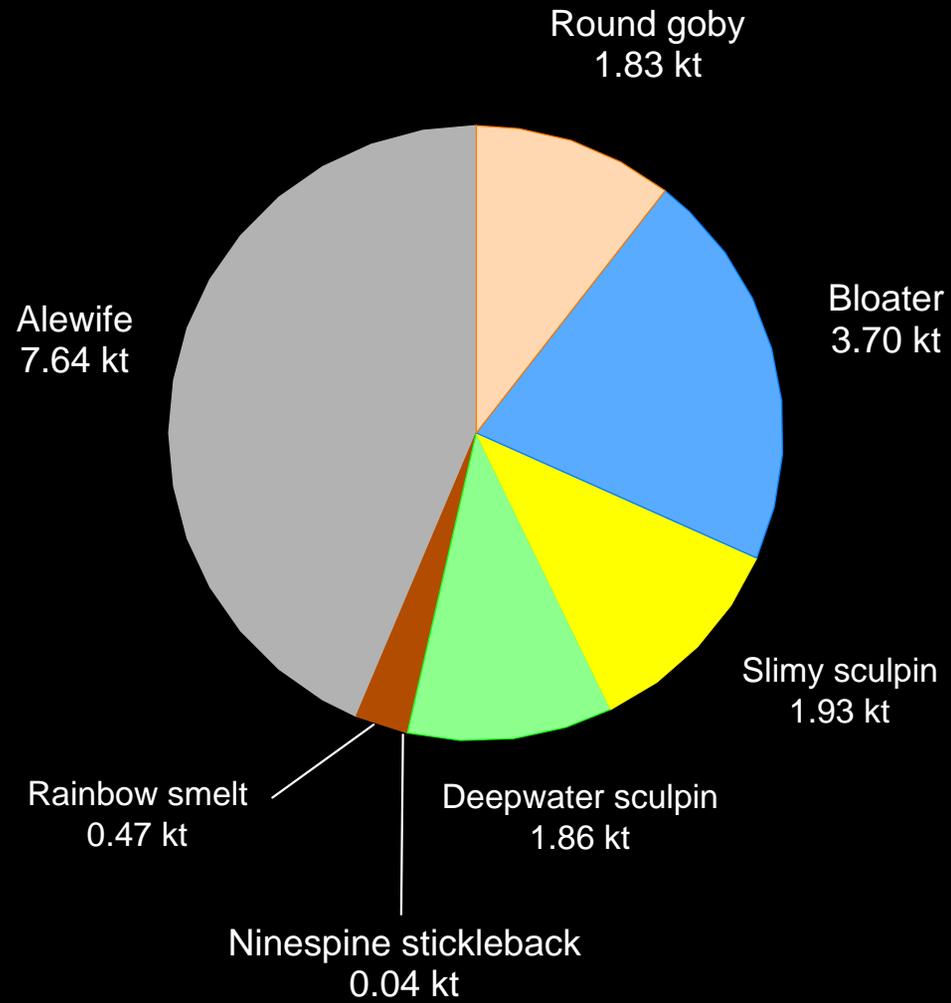


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Lake Michigan, 2011

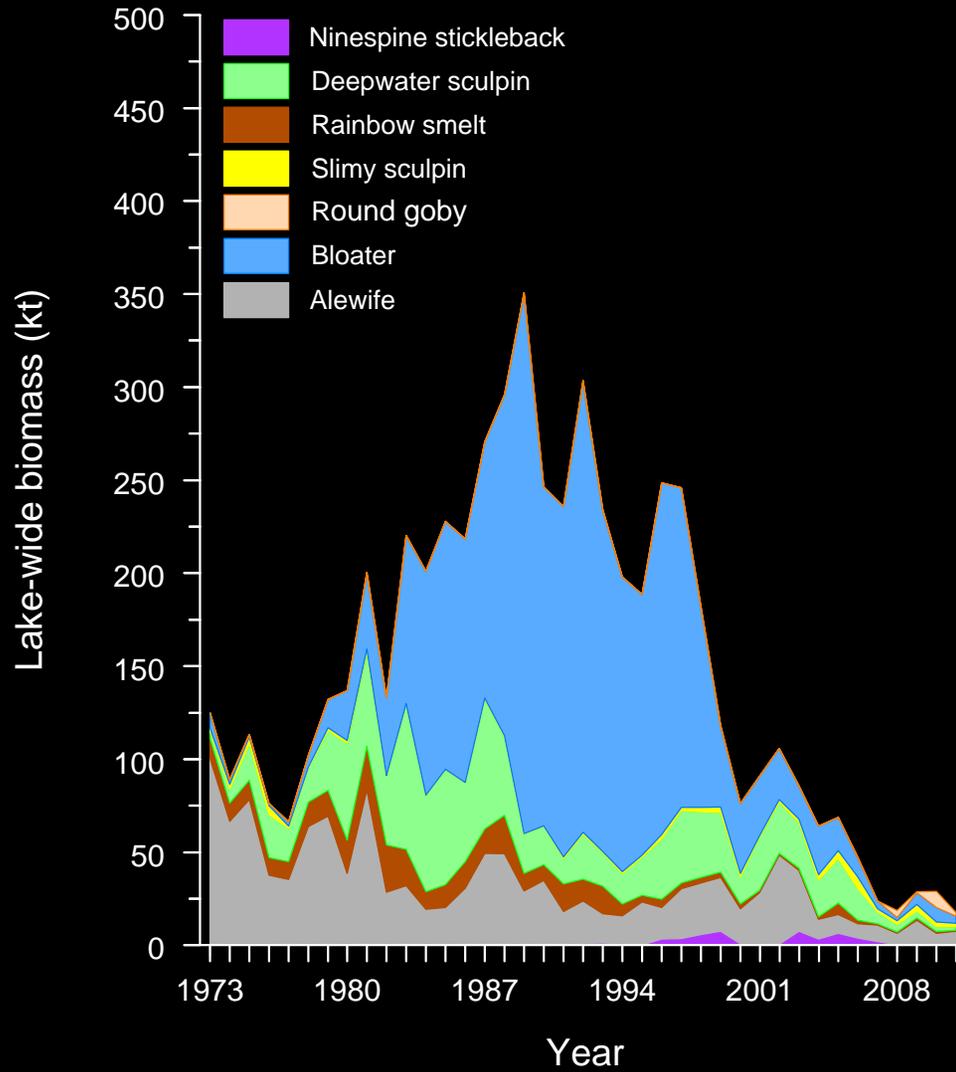


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Lake Michigan, 1973 - 2011



FISHERIE

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Conclusions and prognosis

- Total prey fish biomass, as estimated by the bottom trawl, in 2011 was 17.47 kt, the lowest value in the time series
- Total prey fish biomass has remained below 30 kt since 2007
- Two factors contributing to low prey fish biomass: prolonged period of low bloater recruitment and intensified predation by Chinook salmon on alewives
- Adult alewife biomass density has remained low for an eight-year period and age distribution has been truncated during the past three years; characteristics similar to Lake Huron alewife population prior to collapse during 2003-2004



Conclusions and prognosis (continued)

- Whether or not alewife population collapses in Lake Michigan depends on several factors: Chinook salmon abundance, alewife year-class strength in 2012, environmental effects on alewife survival
- To quantify bottom-up effects, additional years of surveillance and additional analyses needed
- Prey fish biomass in 2011 was far below FCO
- Whether prey fish biomass will ever exceed 100 kt in the near future will depend on the ability of the bloater population to recover



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Searching for a good stocking policy for Lake Michigan salmonines

Dr. Michael L. Jones and Iyob Tsehaye
Quantitative Fisheries Center, Fisheries and Wildlife
Michigan State University



Lake Michigan Decision Analysis - 2012

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Decision Analysis



Structured, formal method for comparing alternative management actions

Main components:

- Specify objectives
- Identify management options
- Assess knowledge and account for uncertainties
- Use model to forecast possible outcomes



Lake Michigan Decision Analysis - 2012

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The Big Question

How many salmon and trout should we stock into Lake Michigan each year?

- more stocking leads to greater harvest, and thus benefits - unless...
- too much stocking leads to poor feeding conditions and increased mortality, but
- too little stocking may lead to negative effects of alewife on other species



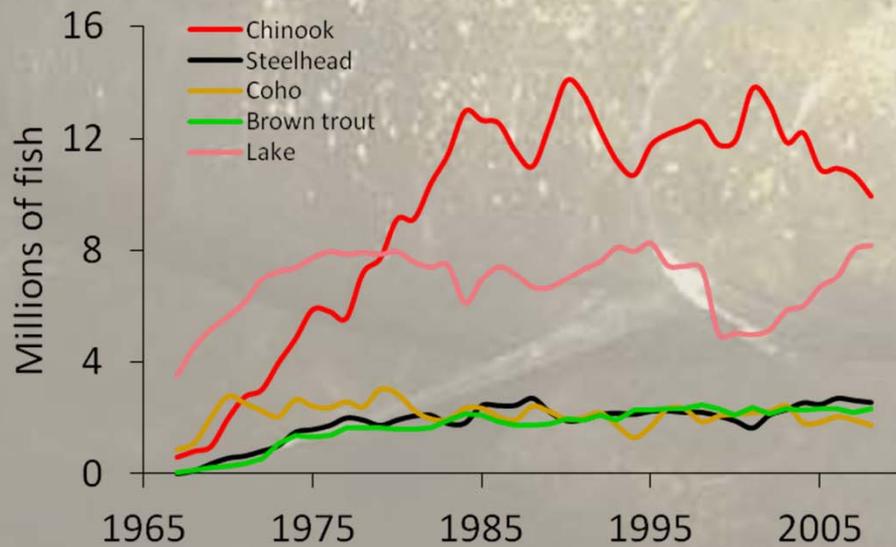
How many salmon and trout are out there?

- Total salmonine numbers have remained relatively stable since 1990
- Reduced Chinook stocking has been offset by increased wild fish production
- More recently, improved survival of older Chinook salmon has also offset reduced stocking

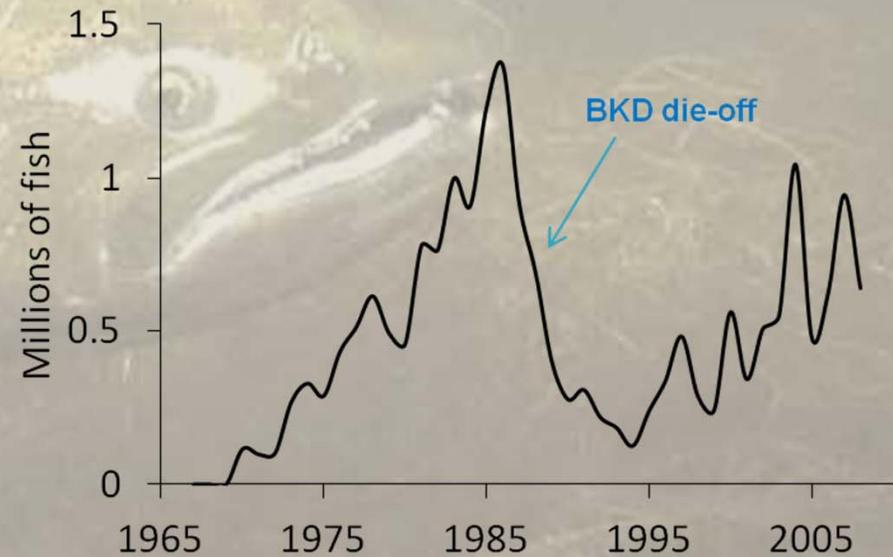


How many salmon and trout are out there?

Salmonine abundance



Age-3 Chinook numbers



How much do they eat?

- Total consumption has remained fairly stable for last decade
- Chinook salmon have accounted for more than half of total demand consistently since 1980
- Large alewife accounted for more than 40% of total prey consumed since 1980, except in the late 1980s when small alewife dominated



What happens to salmon and trout feeding when prey numbers are low?

- Chinook salmon consumption has declined when alewife abundance declined
- Chinook salmon size and condition decrease
- Similar, but weaker pattern for lake trout



Policy simulation model



Accounts for uncertainties:
key uncertainties concern prey recruitment (supply) and predator feeding (demand)



Lake Michigan Decision Analysis - 2012

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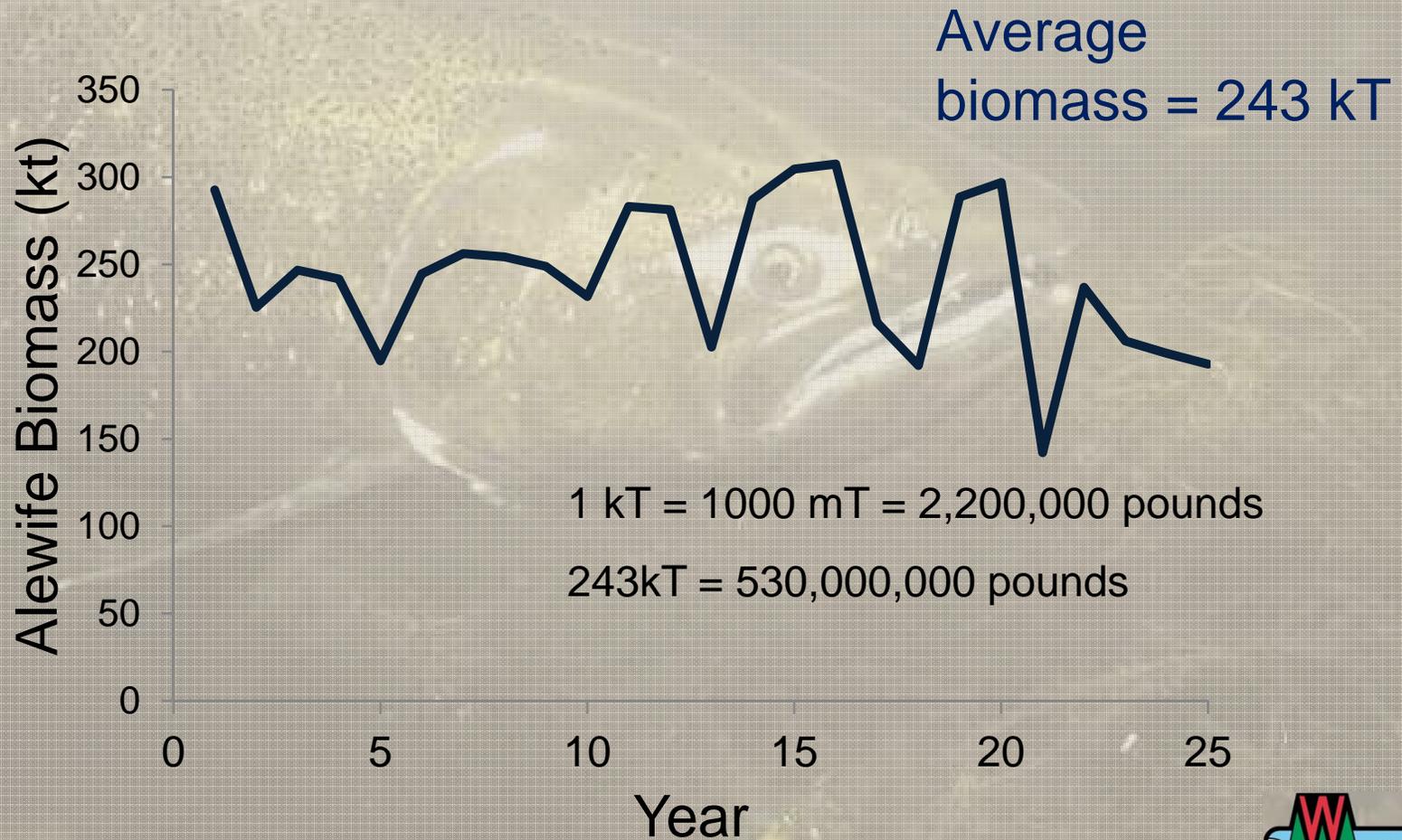


Model results

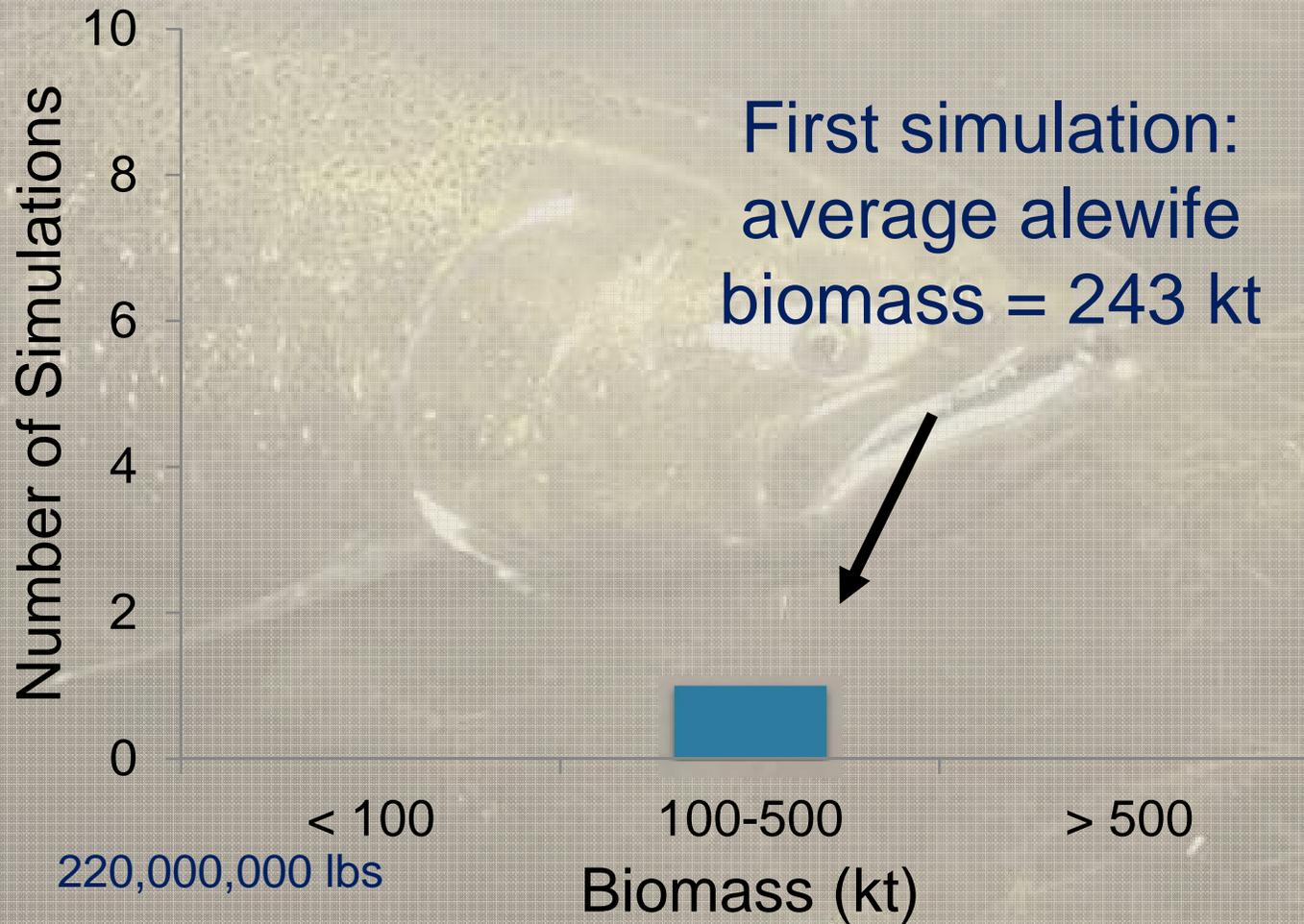
- The model forecasts possible future changes in fish populations and harvest, given a stocking policy
- There are many possible futures, so we need to look at the range of possible (likely) outcomes
 - This range tells us what we think is most likely, but also what might happen
 - Mainly we're interested in how likely it is that bad things will happen
- Here's how it works...



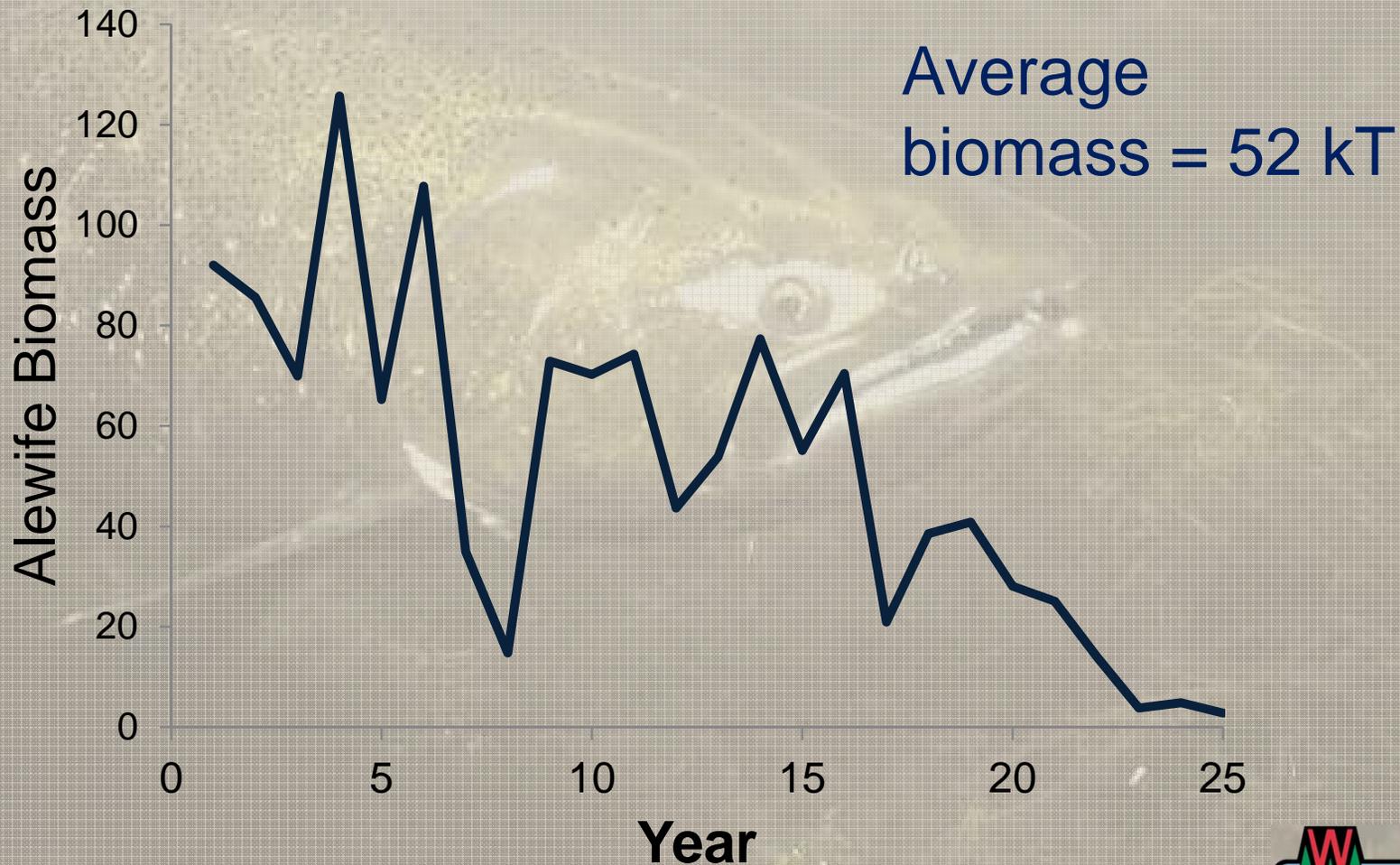
Generating results: First simulation



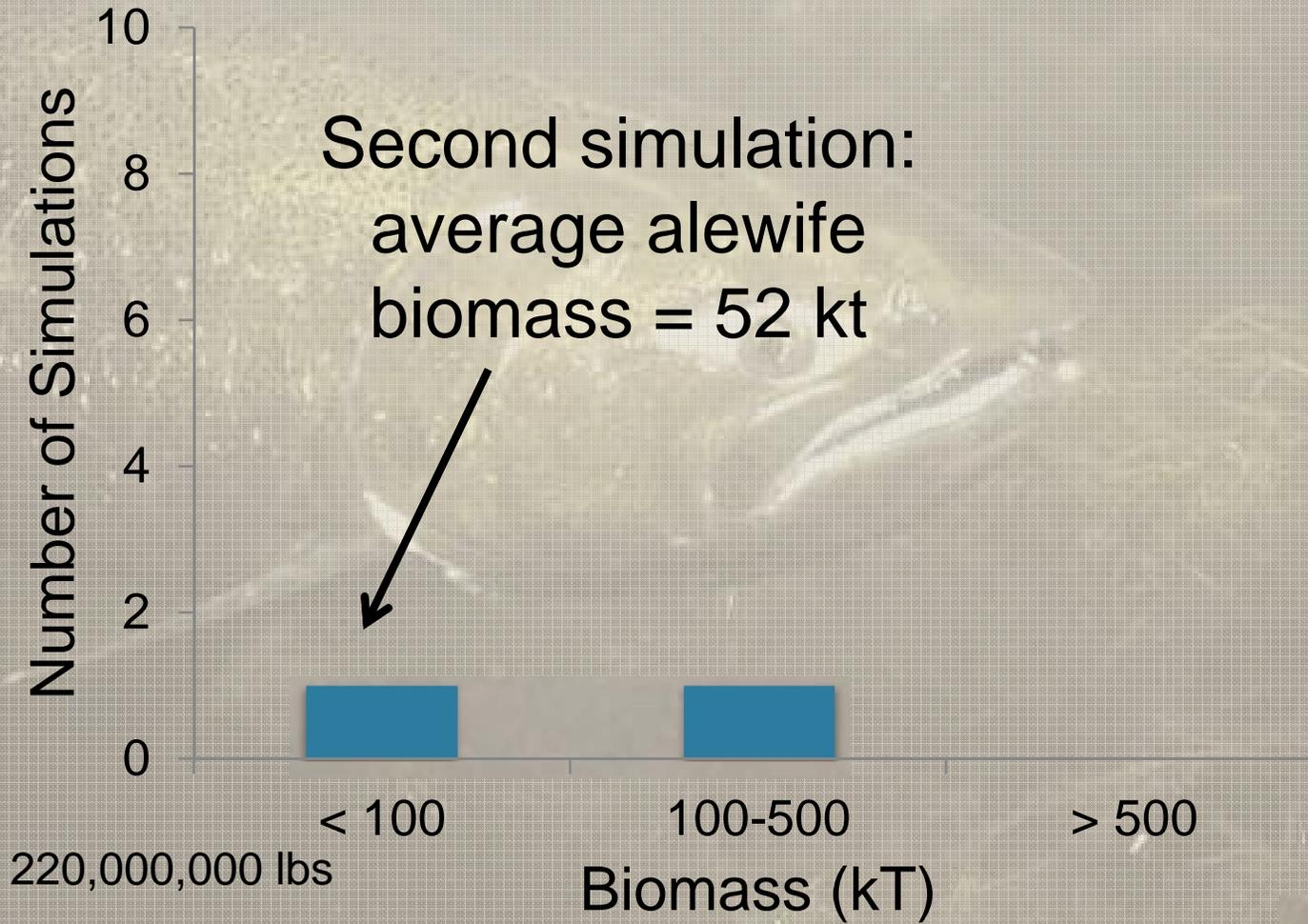
Generating results



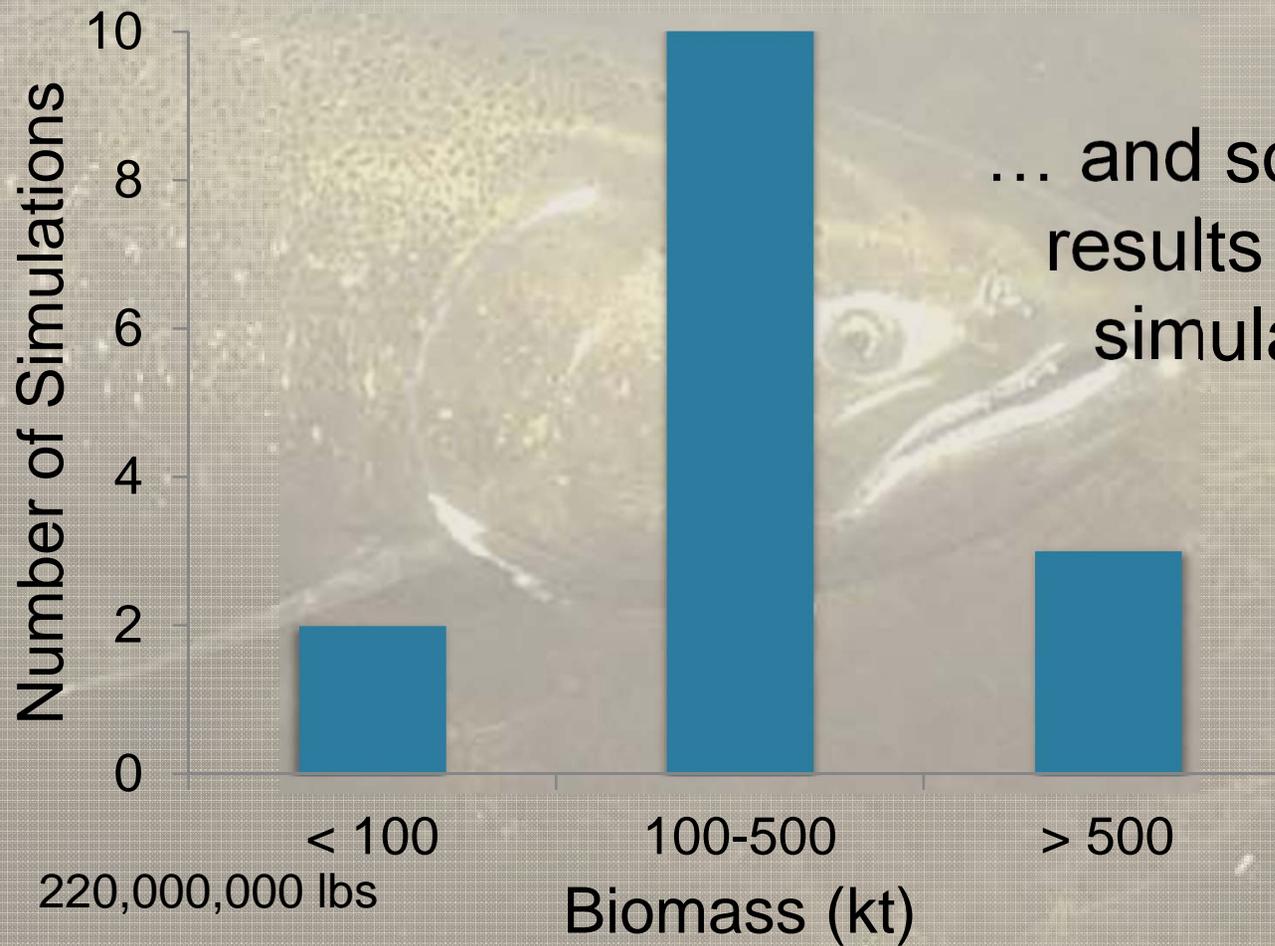
Generating results: Second simulation



Generating results



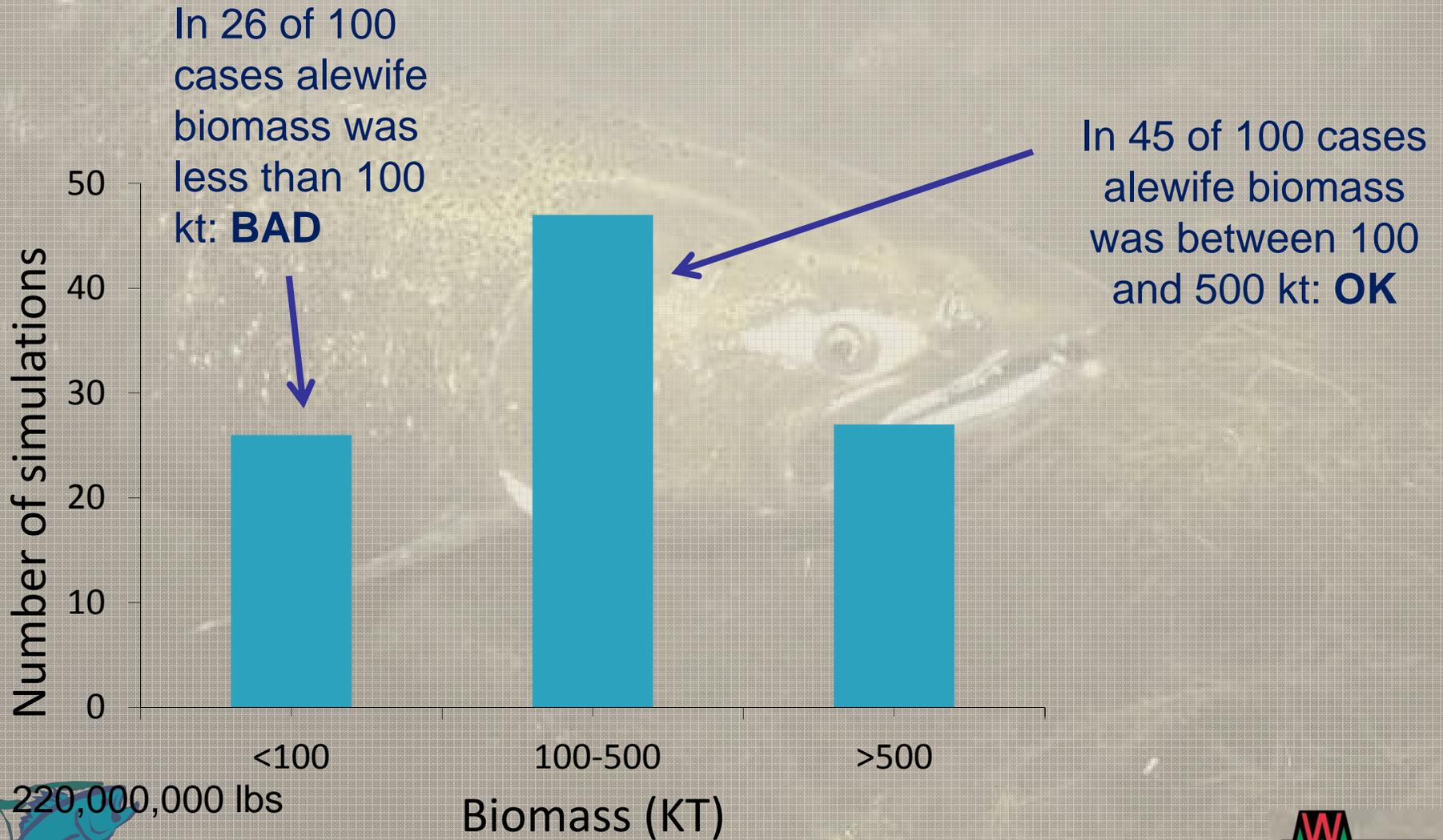
Generating results



... and so on (e.g., results after 15 simulations)



An example result: Status quo policy



Evaluating Options



Lake Michigan Stocking Strategies public meeting

April 14, 2012

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Evaluating Options

- Each of the 4 options lowers risk using different species mixes
- All involve stocking reductions for 2013
- Public feedback, model outputs, and field data for determination of management strategy



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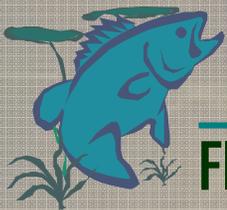
Stocking Options

Option 1 - 50% reduction in Chinook salmon, then evaluate after 5 years

Option 2 - 50% reduction in Chinook salmon, alter Chinook stocking based on feedback policy

Option 3 - 30% reduction in Chinook salmon and 10% others (except lake trout), alter stocking based on feedback policy

Option 4 - 30% reduction in Chinook salmon and 10% others, alter stocking based on feedback policy



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Feedback Policy

- Based on weight of age-3+ Chinook salmon
- Chinook salmon weight strongly influenced by abundance of alewife
- Weight below 15.4 lbs - reduce stocking
- Weight above 17.6 lbs - increase stocking
- Potentially adjustments every 3 years



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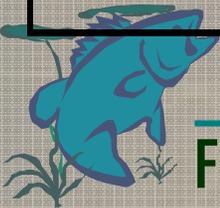


Model output for Option 1

- 50% reduction in Chinook salmon, then evaluate after 5 years

Probability

	Low Alewife biomass	Low Chinook weight (<13 lbs)	Low Chinook harvest	Low Chinook catch rates (<8 / 100 hrs)
Option 1	14%	23%	21%	19%
Status Quo	23%	35%	20%	20%

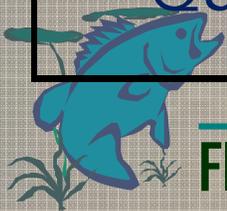


Model output for Option 2

- 50% reduction in Chinook, use Chinook weight as feedback to determine actions (3 year interval)

Probability

	Low Alewife biomass	Low Chinook weight (<13 lbs)	Low Chinook harvest	Low Chinook catch rates (<8 / 100 hrs)
Option 2	12%	20%	21%	19%
Status Quo	23%	35%	20%	20%

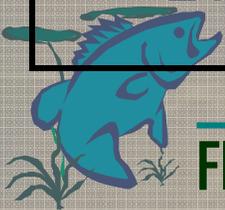


Model output for Option 3

- 30% reduction in Chinook and 10% others (excluding LAT), use Chinook weight as feedback to determine actions (3 year interval)

Probability

	Low Alewife biomass	Low Chinook weight (<13 lbs)	Low Chinook harvest	Low Chinook catch rates (<8 / 100 hrs)
Option 3	4%	12%	10%	9%
Status Quo	23%	35%	20%	20%

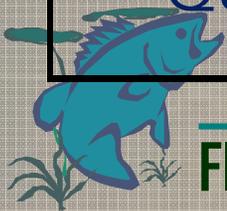


Model output for Option 4

- 30% reduction in Chinook and 10% all others, use Chinook weight as feedback to determine actions (3 year interval)

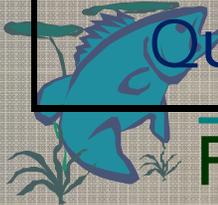
Probability

	Low Alewife biomass	Low Chinook weight (<13 lbs)	Low Chinook harvest	Low Chinook catch rates (<8 / 100 hrs)
Option 4	3%	11%	7%	6%
Status Quo	23%	35%	20%	20%



Comparison of Options

	Low Alewife biomass	Low Chinook weight (<13 lbs)	Low Chinook harvest	Low Chinook catch rates (<8 / 100 hrs)
Option 1	14%	23%	21%	19%
Option 2	12%	20%	21%	19%
Option 3	4%	12%	10%	9%
Option 4	3%	11%	7%	6%
Status Quo	23%	35%	20%	20%



Lake Michigan Salmon Stocking Strategy Process Online Survey results

OPTION 1: 50% reduction in Chinook salmon stocking for 2013.

Average Rating: FAIR (1.97) (Poor = 1, Fair = 2, Neutral= 3, Good = 4, Excellent = 5)

Ranking: 69% WORST, 11% BEST (Worst = 1, Best = 4)

OPTION 2: 50% reduction in Chinook salmon stocking for 2013.

Average Rating: between FAIR and NEUTRAL (2.61)

Ranking: 2% WORST, 20% BEST

OPTION 3: 30% reduction in Chinook salmon stocking and 10% reduction in coho salmon, steelhead, and brown trout stocking for 2013.

Average Rating: NEUTRAL (2.96)

Ranking: 8% WORST, 15% BEST

OPTION 4: 30% reduction in Chinook salmon stocking and 10% reduction in coho salmon, steelhead, brown trout, and lake trout stocking for 2013.

Average Rating: between NEUTRAL and GOOD (3.28)

Ranking: 20% WORST, 54% BEST



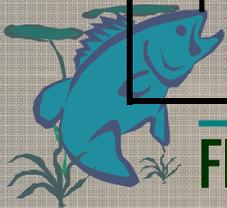
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Lake Michigan Salmon Stocking Strategy Process Online Survey results

Rate your level of comfort with the four options (Poor = 1, Fair = 2, Neutral= 3, Good = 4, Excellent = 5)

	Average rating	IL	IN	MI	WI	
Option 1	1.97	1.84	2.09	2.21	1.54	FAIR
Option 2	2.61	2.33	3.12	2.95	1.95	FAIR to NEUTRAL
Option 3	2.96	3.46	2.44	2.83	2.80	NEUTRAL
Option 4	3.28	3.25	3.00	3.12	3.69	NEUTRAL to GOOD



Lake Michigan Salmon Stocking Strategy Process Online Survey results

Rank the four options below (Worst = 1, Best = 4)

	Average rating	IL	IN	MI	WI
Option 1	1.68	1.61	1.84	1.88	1.27
Option 2	2.56	2.30	2.78	2.80	2.25
Option 3	2.77	3.11	2.56	2.54	2.92
Option 4	3.00	3.01	2.84	2.78	3.54



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Lake Michigan Salmon Stocking Strategy Process - Approved

50% reduction in Chinook salmon lakewide

- Michigan will take larger percentage (66.8%)
- Wisconsin's reduction will be 37.8%

Wisconsin will reduce Chinook salmon stocking to **723,700** fish starting in 2013

Can reduce stocking of coho, rainbow, brown or lake trout in coming years to limit reductions in Chinook stocking

Will use the weight of female age 3+ Chinook salmon at Strawberry Creek Weir as the feedback to adjust stocking levels up or down in the future.



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Lake Michigan Salmon Stocking Strategy Process Approved Detail

Use 2012 stocking quotas as the base for all future changes to stocking numbers

2012 CURRENT STOCKING PLANS BY WISCONSIN

	Brown trout	Chinook	Coho	Rainbow	Steelhead
WI	672,000	1,164,000	500,000	120,000	510,000

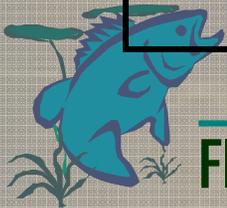


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Lake Michigan Salmon Stocking Strategy Process Approved Detail

Chinook Salmon	2012 Plan	2013 Plan	%Reduction
WI	1,164,000	723,700	37.8
IL	250,000	230,000	8.0
IN	225,000	200,000	11.1
MI	1,688,500	560,000	66.8
TOTALS	3,327,500	1,713,700	48.5
MI stocking in Natural Reproducing streams = 405,000			



Lake Michigan Salmon Stocking Strategy Process Approved Detail

- Results from online survey indicate a strong desire from Wisconsin anglers to reduce other species
- Option 4 had the highest rating of any option
- Option 4 was ranked the best option



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Lake Michigan Salmon Stocking Strategy Process Approved Detail

Chinook salmon equivalents may be used instead of Chinook salmon for the reductions

- Wisconsin must take at least a 30% reduction in Chinook salmon (349,200)
- The remaining reductions can be taken in Chinook salmon or other species based on the following equivalent table. (~90,792)

Chinook salmon equivalents	
1 Chinook salmon =	2.2 Brown Trout
	3.2 Coho Salmon
	2.4 Rainbow Trout
	2.3 yearling Lake Trout
	5.8 fall fingerling Lake Trout



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Lake Michigan Salmon Stocking Strategy Process Approved Detail

Female age 3+ Chinook salmon from Strawberry Creek Weir, Wisconsin will be the feedback parameter

- Ask Lake Michigan Technical Committee and Salmonid Working Group to look at that parameter and suggest others if appropriate
- Basically, increase stocking when weights above 19.8 lbs (9 kg) or decrease when weights below 15.4 lbs (7 kg) – 3 year average
- Between 19.8 and 15.4 lbs, look at trends and adjust if needed



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Lake Michigan Salmon Stocking Strategy Process Approved Detail

Reductions in Lake Trout can *occur*

- Limit reductions to secondary sites (i.e. near shore sites)
- Risk that if these fish are not produced it may be hard to get them back
- Maximum = 250,000 fingerlings
- Maximum = 150,000 yearlings
- 108,000 chinook salmon equivalents



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Lake Michigan Salmon Stocking Strategy Process Next Steps

- Create options for specific reductions by county
- Create presentations and develop options at October LMFT meeting
- Present information to Lake Michigan Fisheries Forum in December
- Receive public comment on options and make decision by January 1, 2013



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Lake Michigan Salmon Stocking Strategy Process

- Comments and Questions?
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