

Red Flags – Abundance Indicators and Natural Reproduction

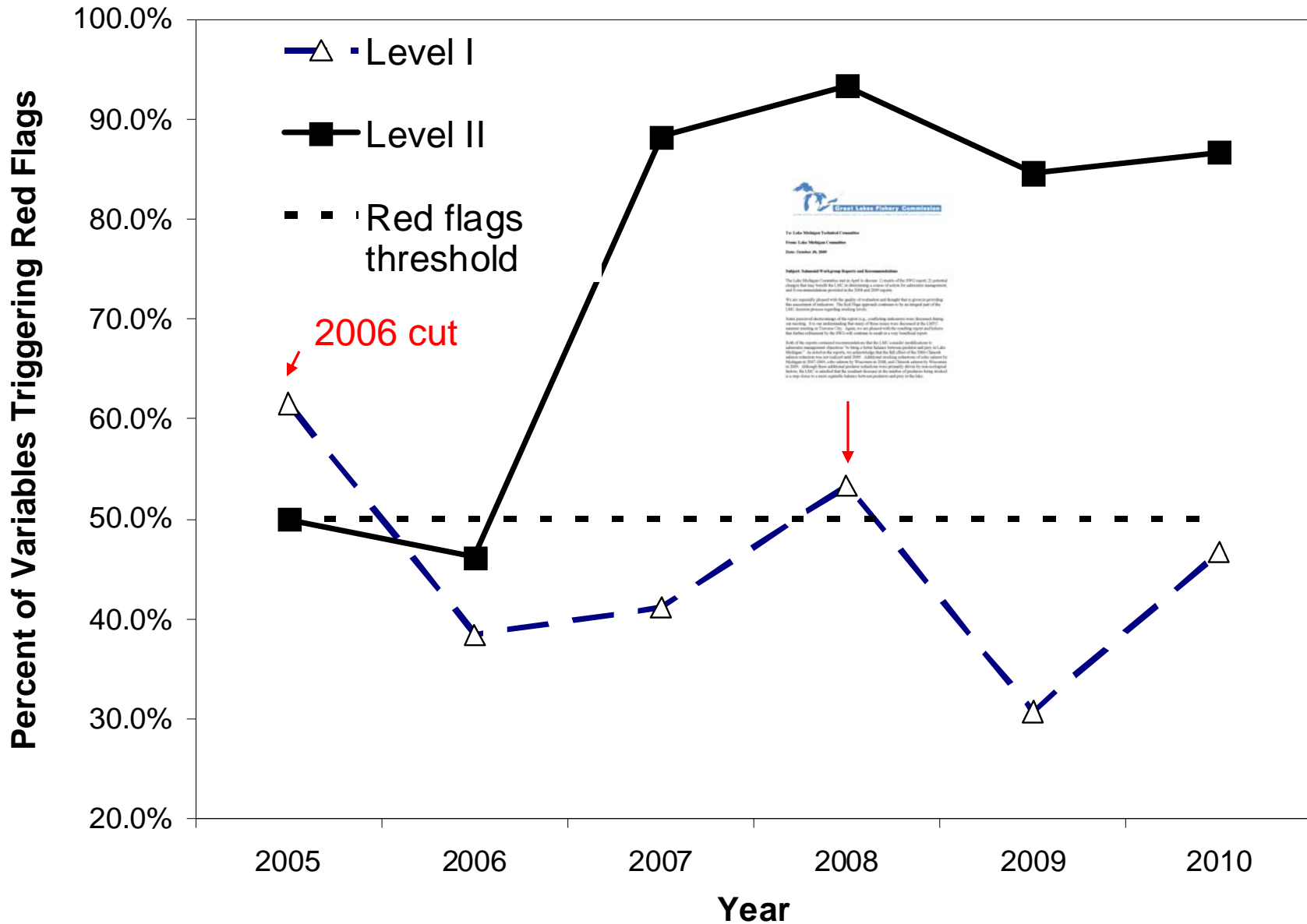


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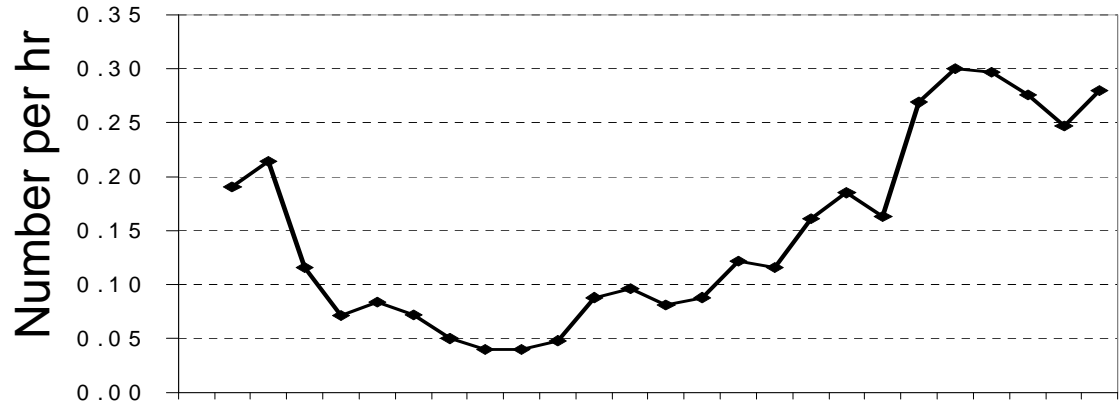
Outline

- Preface on the Salmonid Working Group
- Review Red Flags purpose and approach
- Three presentations:
 - Abundance and natural reproduction
 - Growth, condition, and health (Hansen)
 - Prey abundance and forecast (Warner)
- Discussion

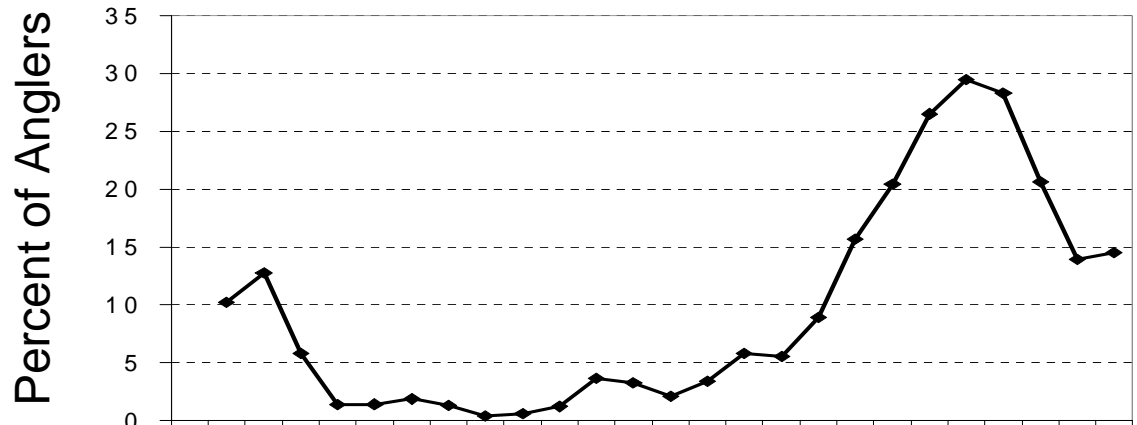
SOL 2005 – 2010 Red Flags



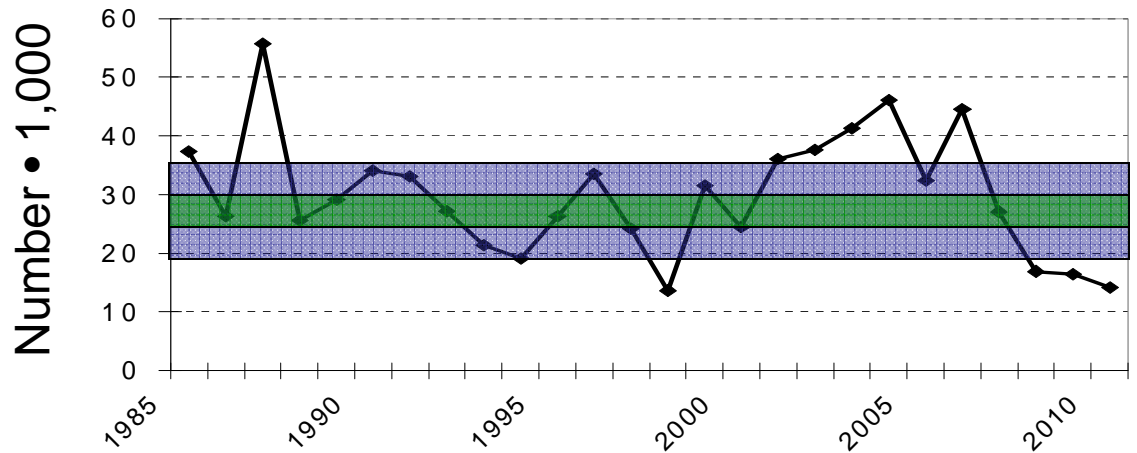
Chinook salmon catch rates
(charter)








Angler Success
(Harvest > 3 Chinook
salmon per day)



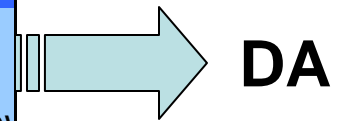
Michigan Weir Returns



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

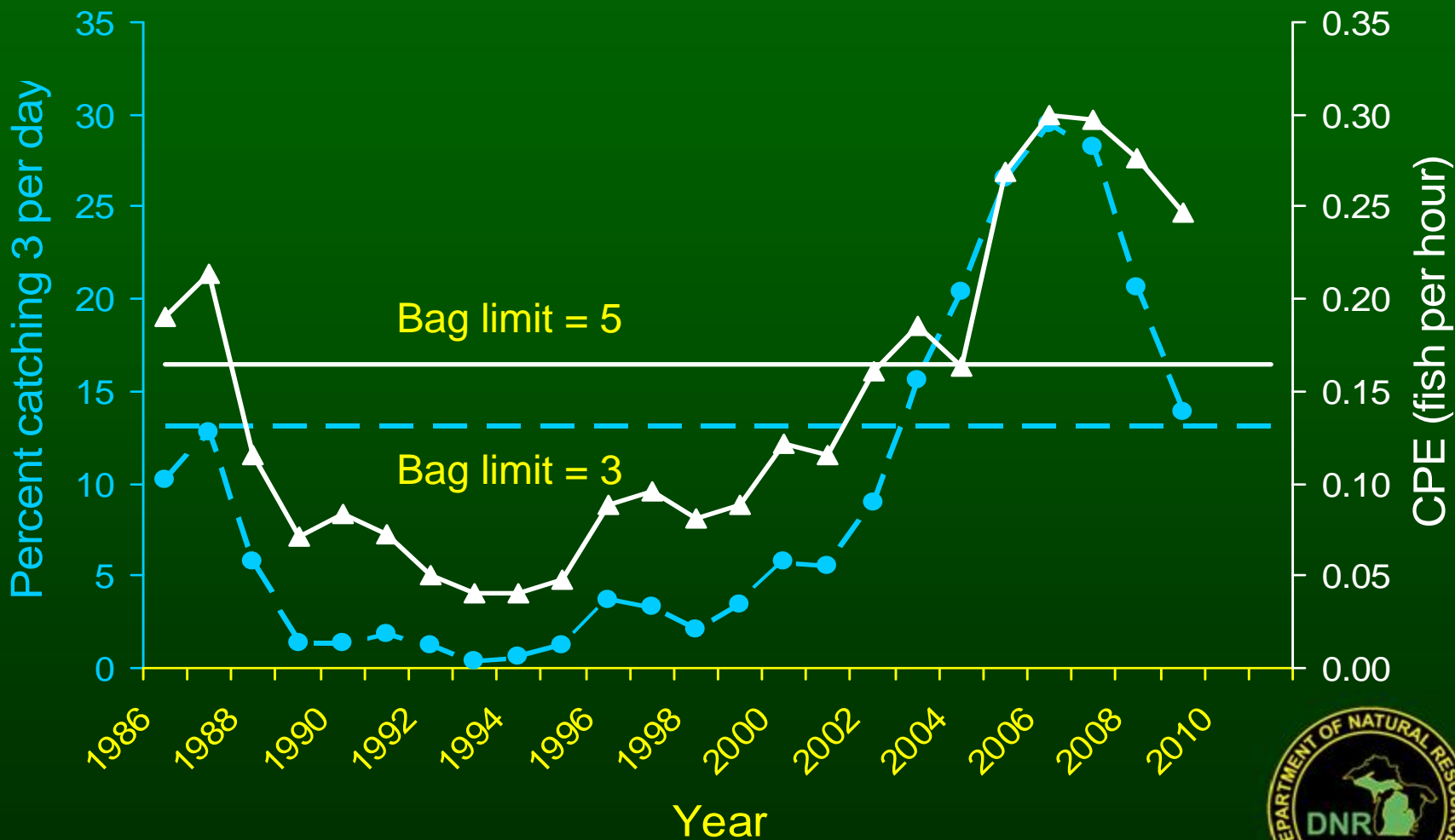
Red Flag Category	Biological Indicator variable
	Key Missing or incomplete data
	Preliminary data
<u>Stocking level</u>	No. of fishx1K
	Composition of the harvest non-CHS
<u>Density / Abundance</u>	Creel and charter catch(lbs.x1K)
	Creel/charter catch (No. of fishx1K)
	Creel CPE (Michigan waters only)
	Michigan Charter CPE (n / hr)
	Weir Extractions(lbs.x1K)
	Average size at Weir Harvest(gms.)
	Weir Returns (No. of fish)
	MICH_Weir Returns (No. of fish)
	Illinois Fall Harbor Returns-CPE
	MDNR Vessel assessments
	For SCAA_Targeted effort
	Modeled abundance (N:SCAA)
	Age-1 CHS predicted from age-0 alev
	Angler Success (catch 3 or more)
<u>Natural reproduction</u>	OTC evaluations
	age 1 - open water
	age 2 - open water
	age 3 - open water
	Egg weight index
	Trapping / smolt collections
	Estimate of natural smolts(no.x1K)
	Total recruitment

System / Health Indicator



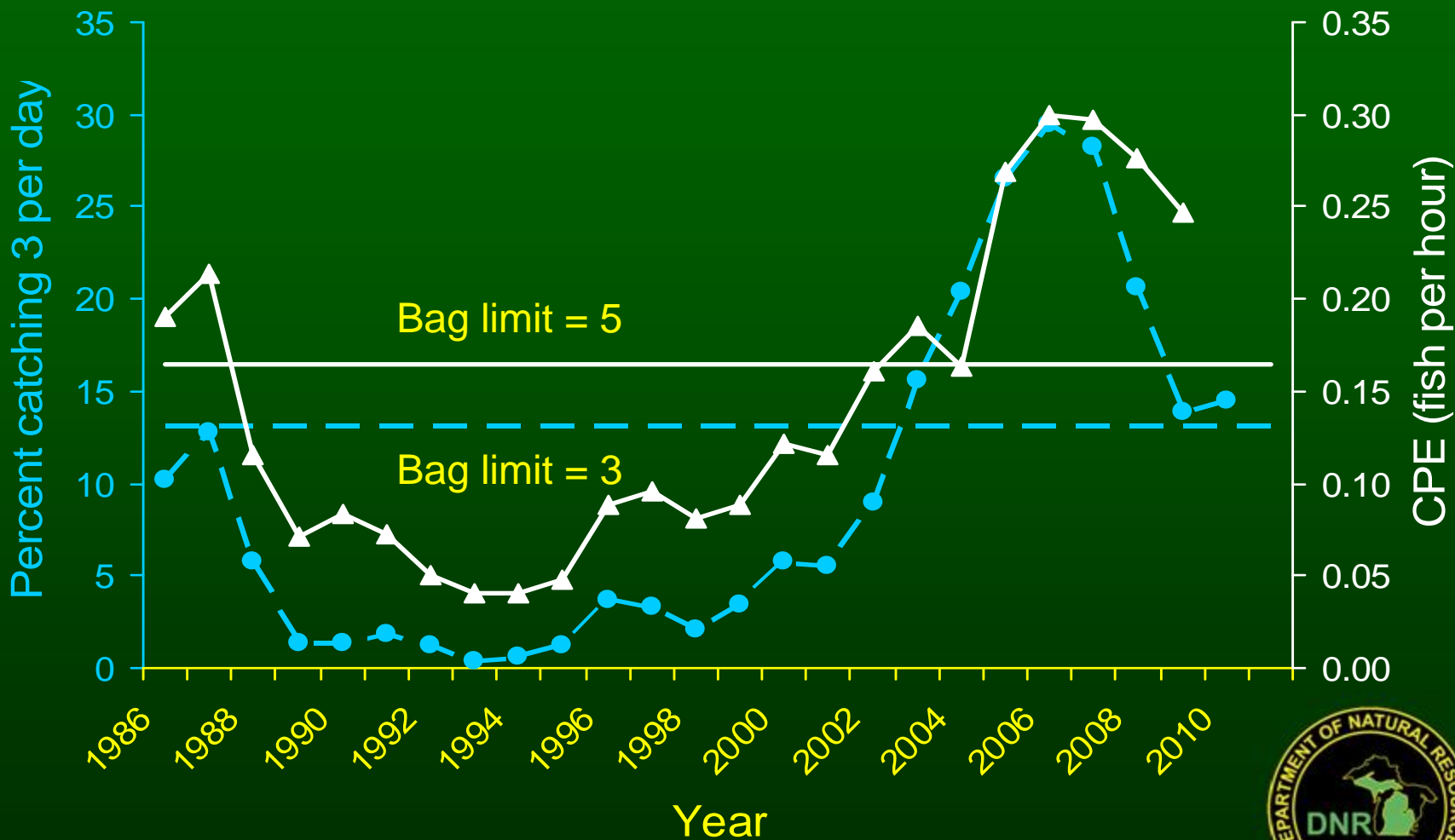
Percent of charter anglers catching 3 Chinook salmon per day and catch rate (fish/hour) of Chinook salmon

● Bag limits - - - Bag benchmark (13.1%) ▲ CPE — CPE benchmark (0.165)



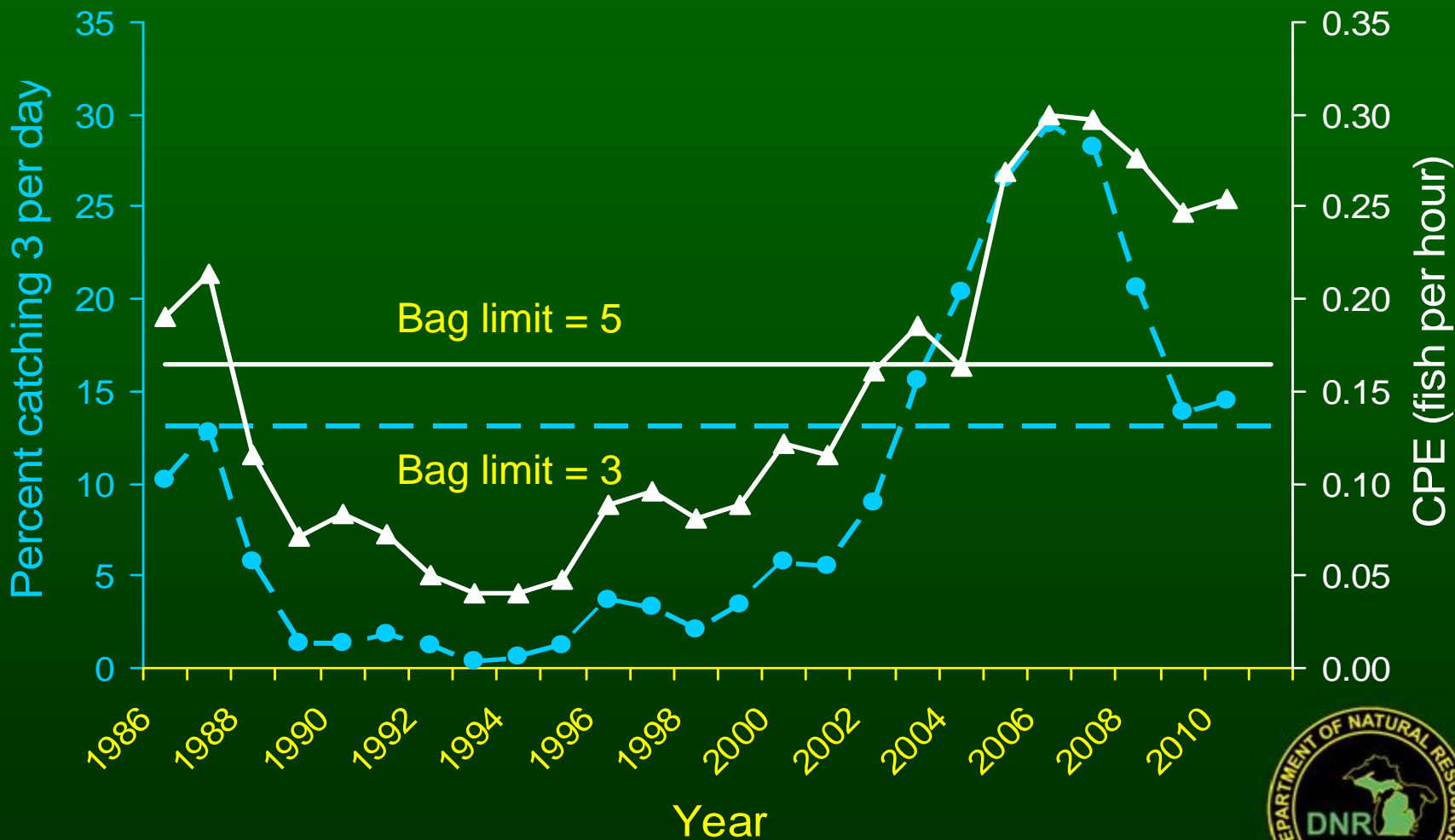
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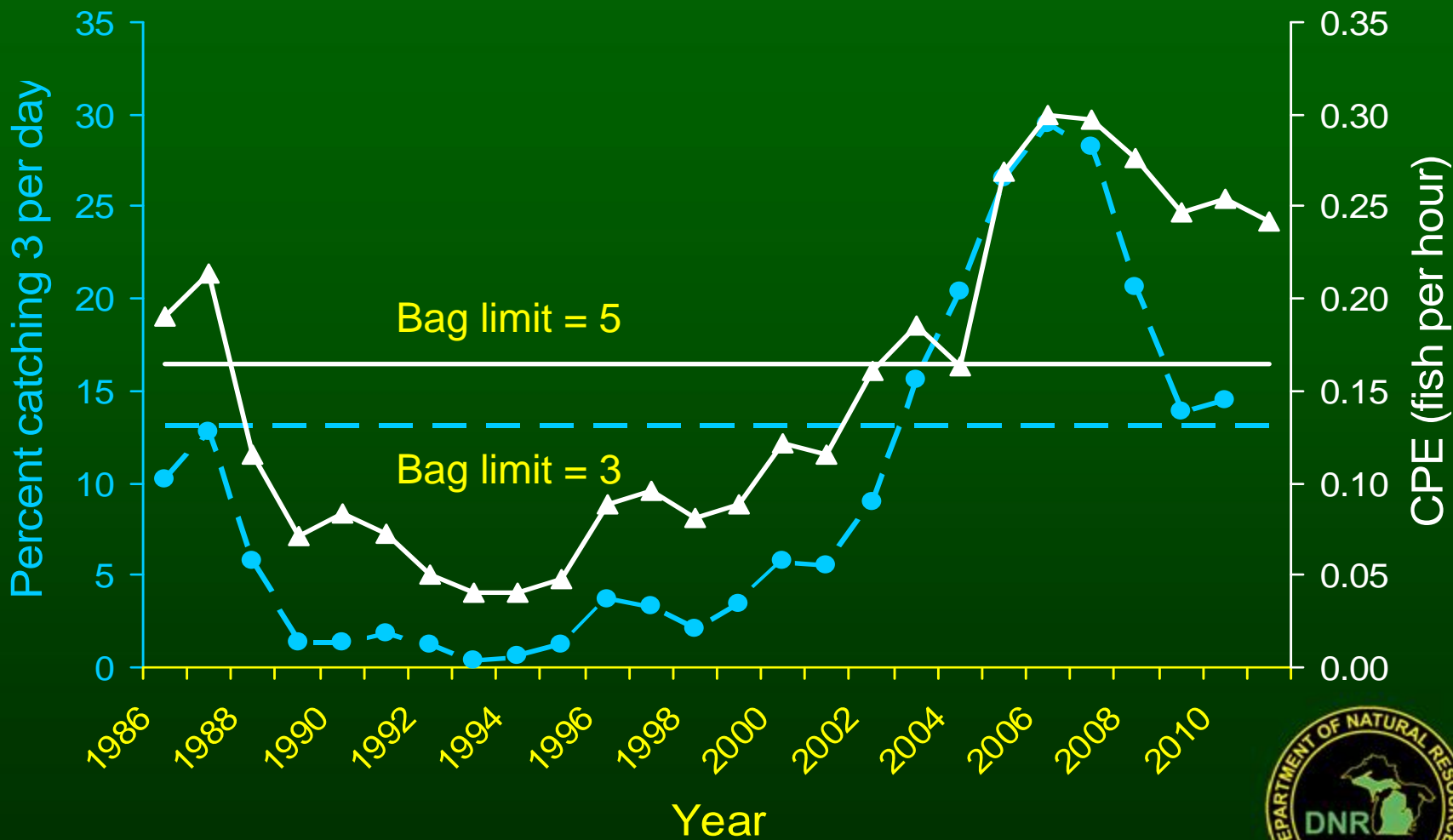
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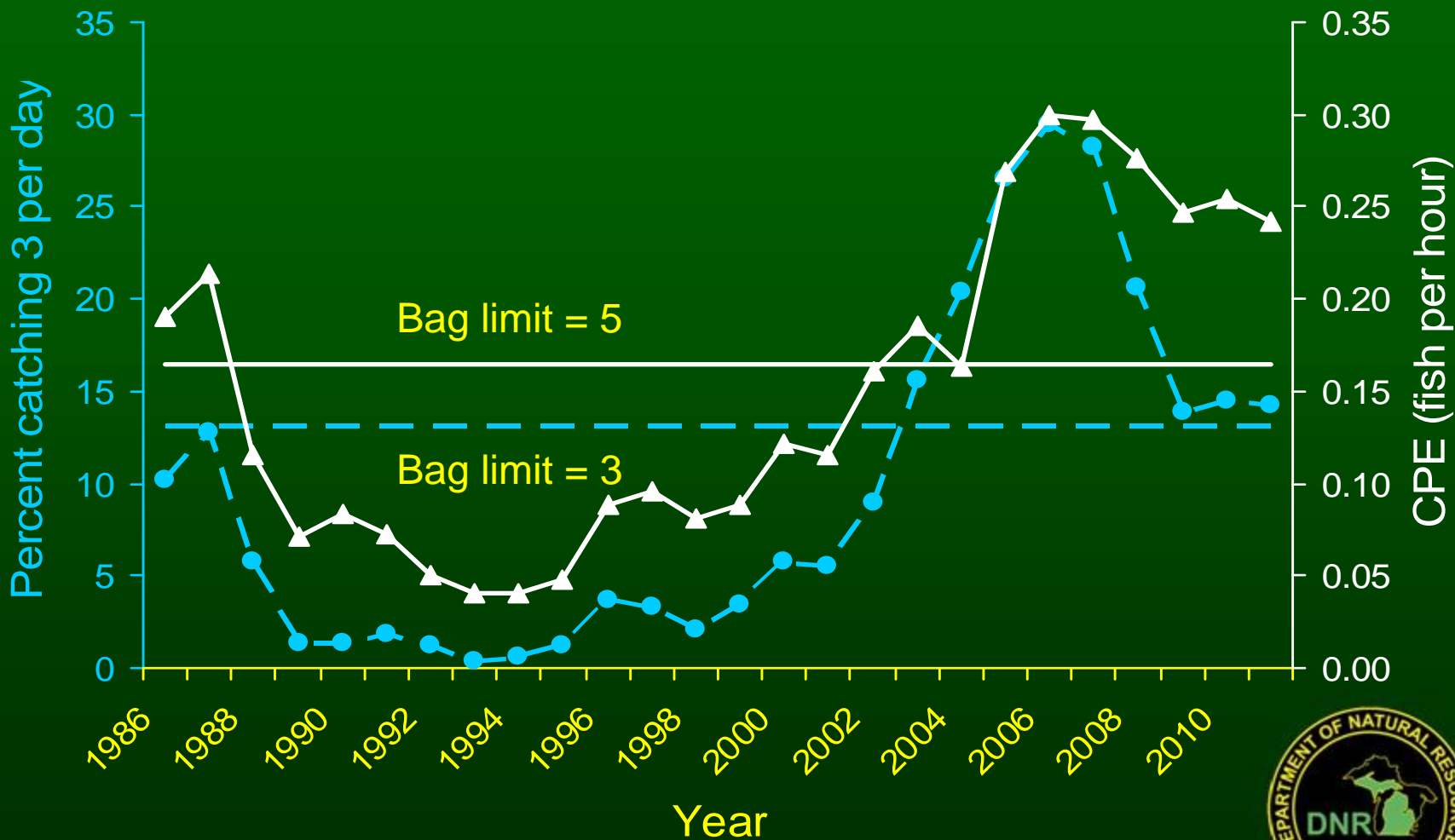
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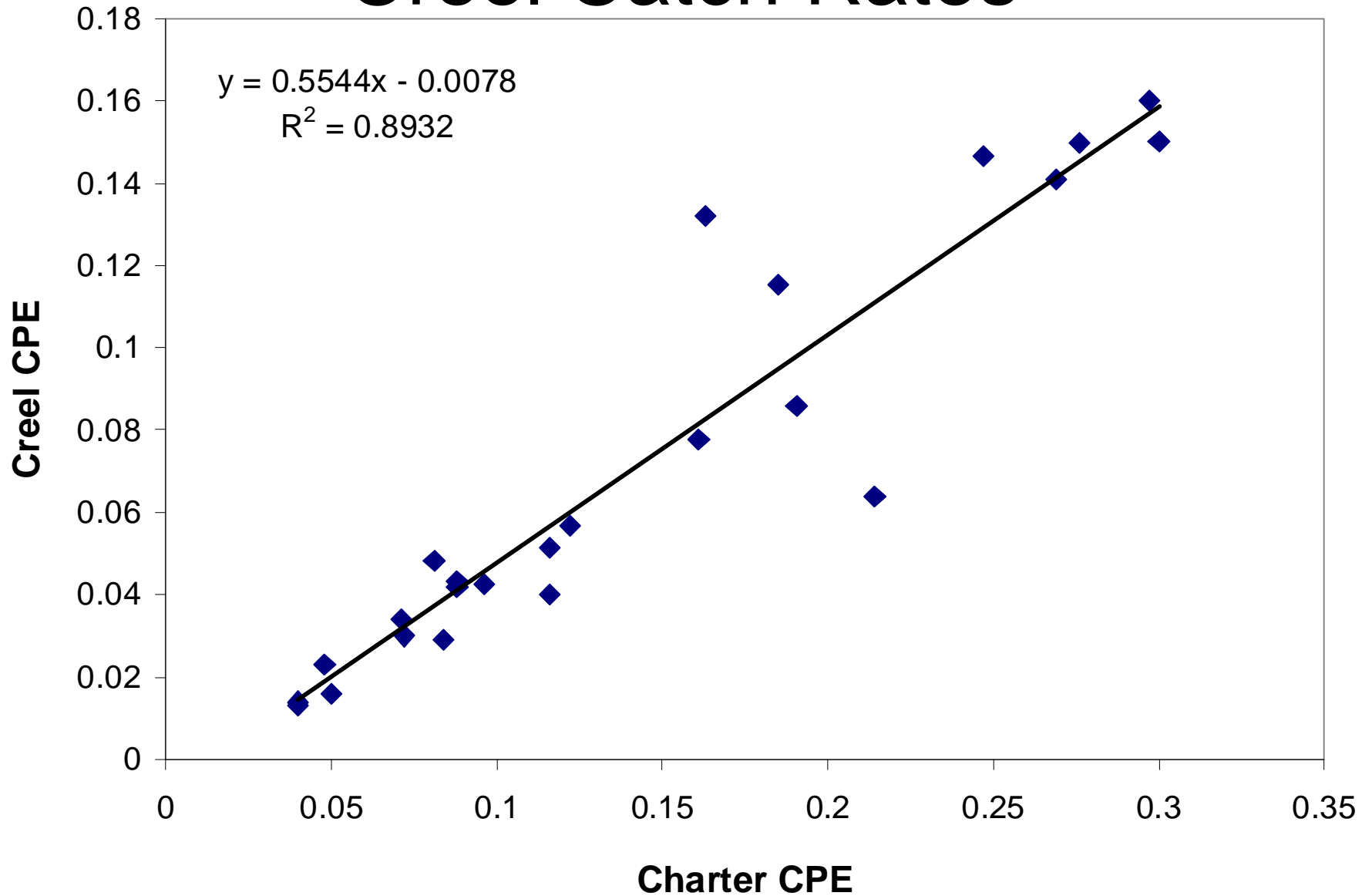


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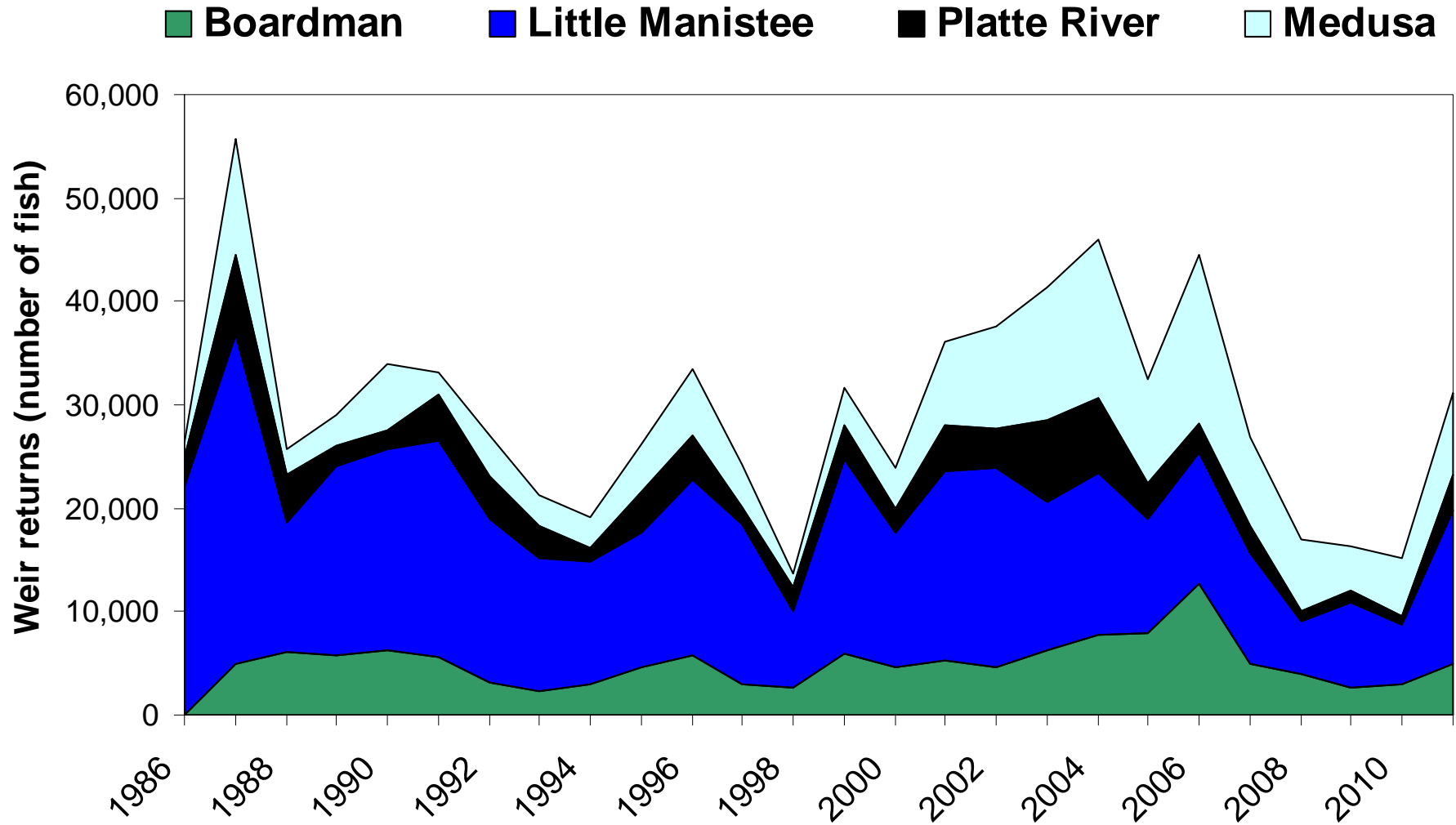
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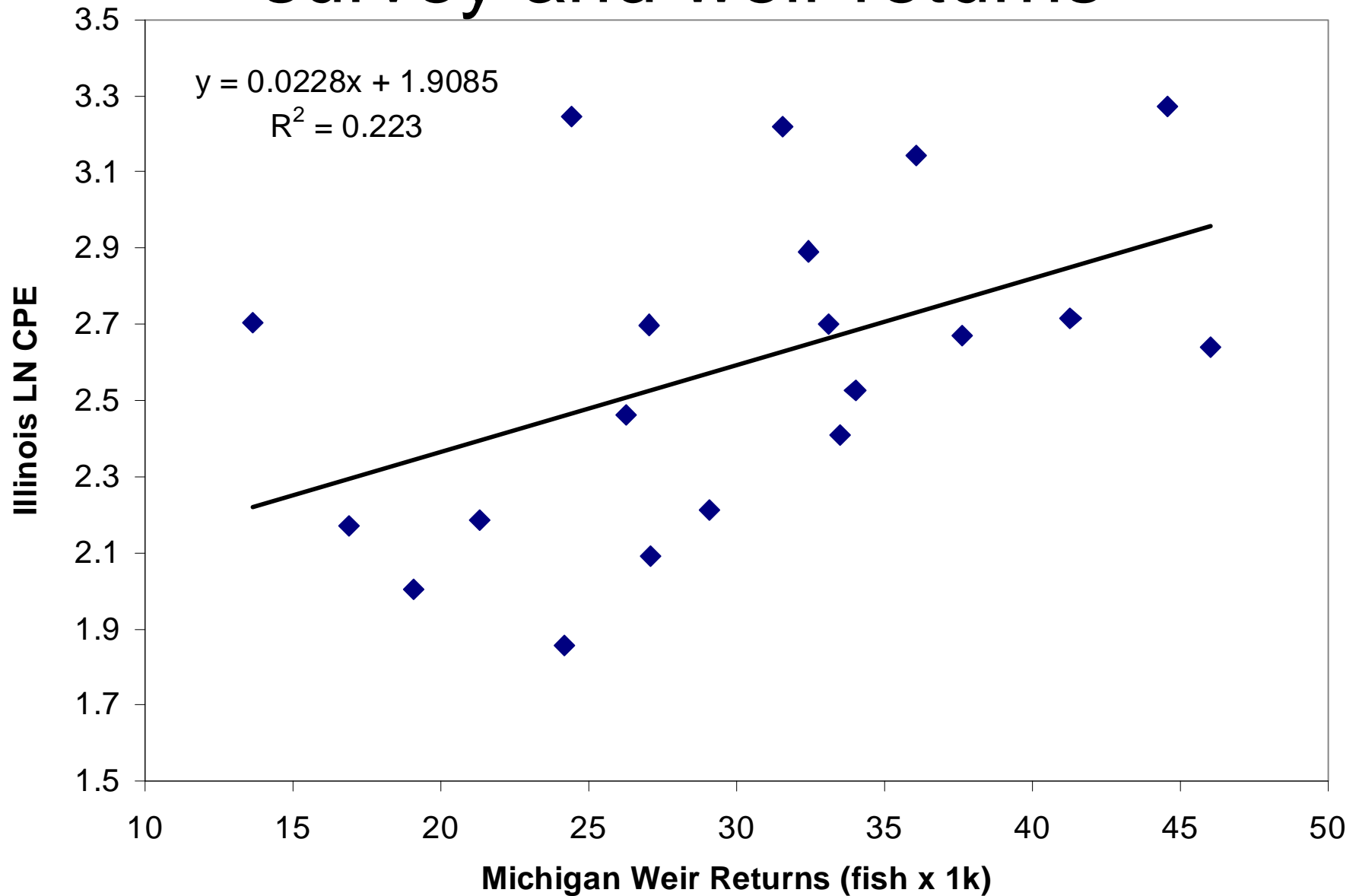
Relationship between Charter and Creel Catch Rates



Michigan Weir Returns

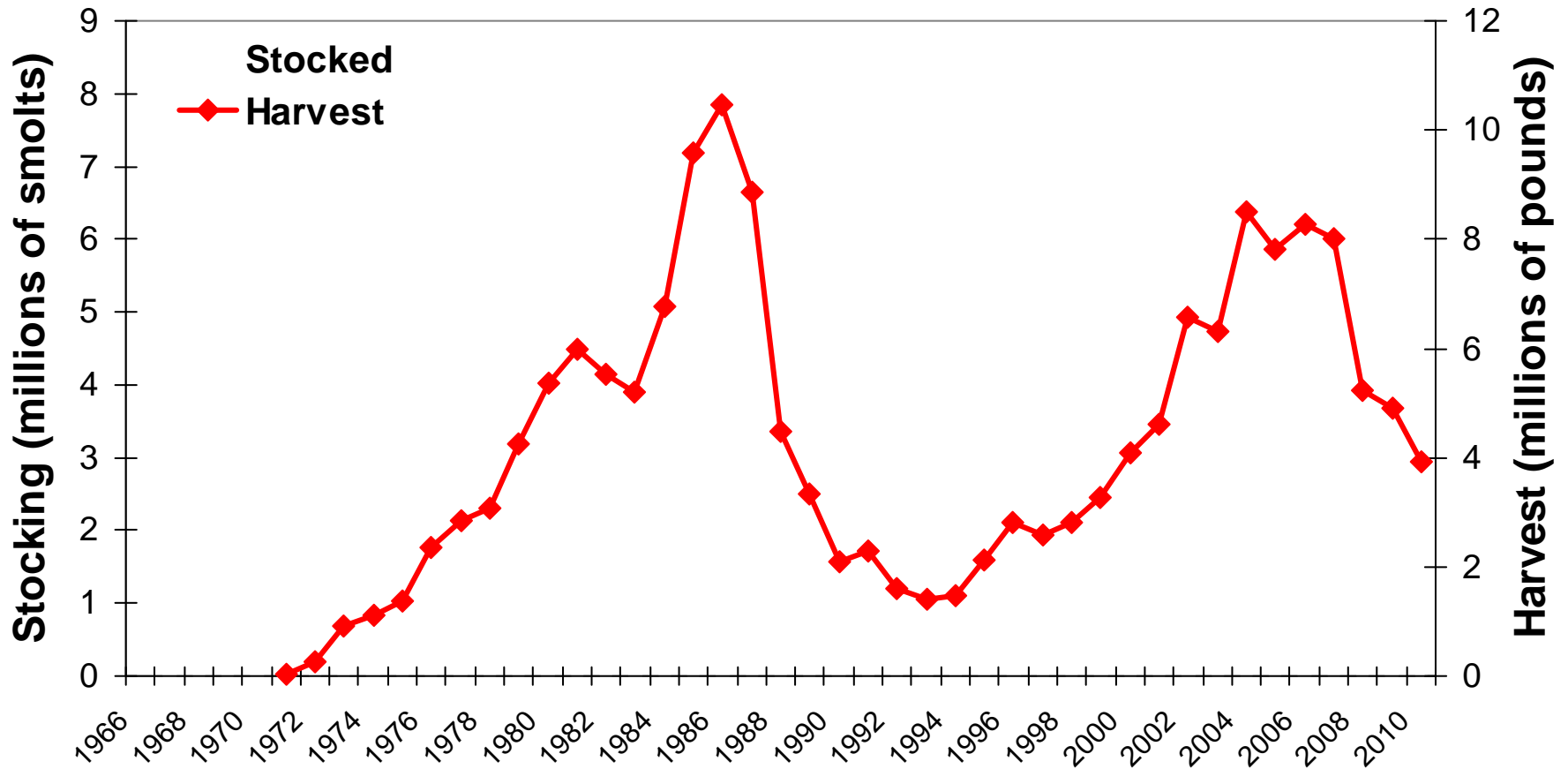


Relationship between Illinois fall survey and weir returns



Lake-wide Stocking and Harvest

(Chinook salmon only)

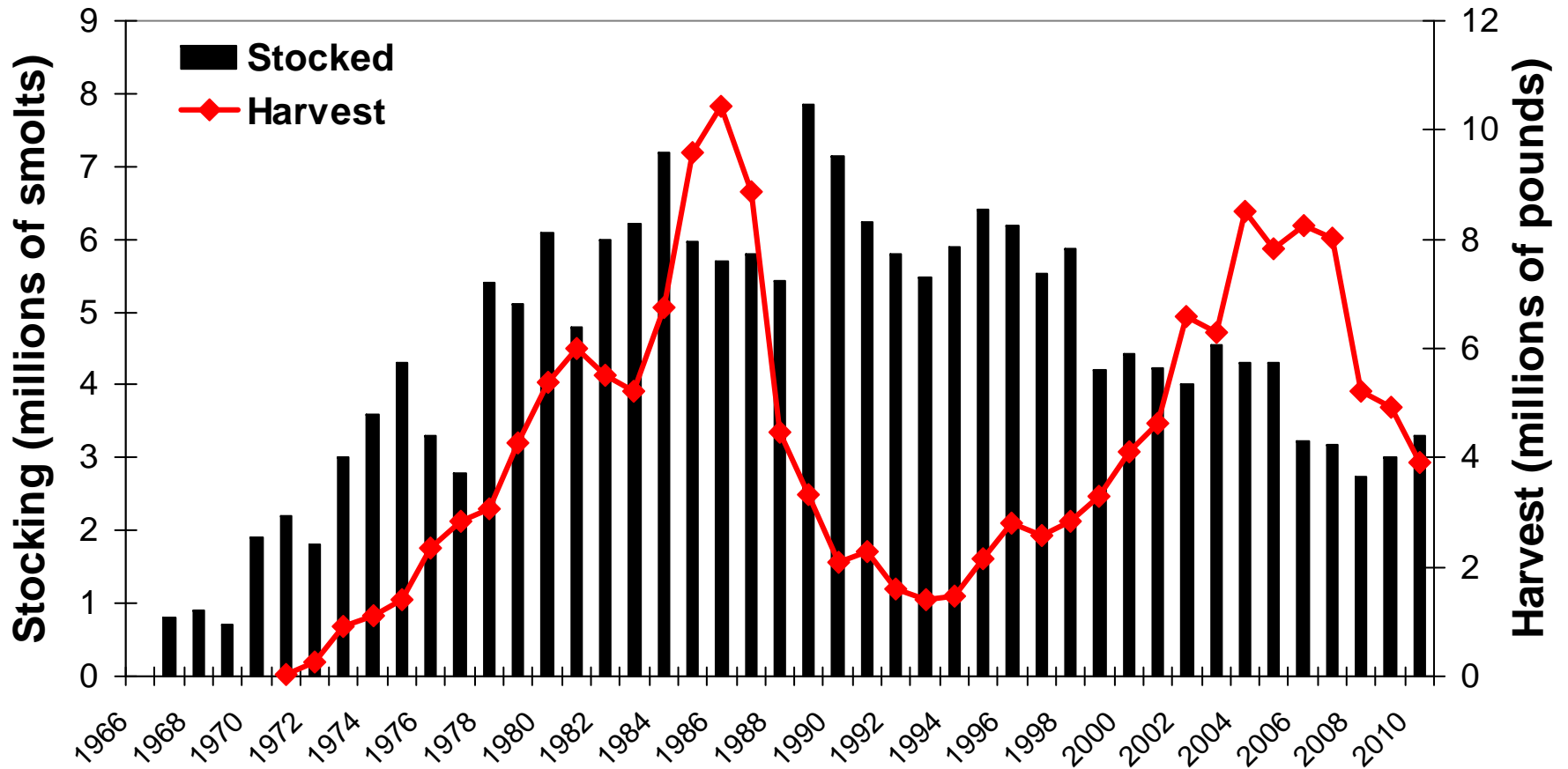


Chinook salmon abundance

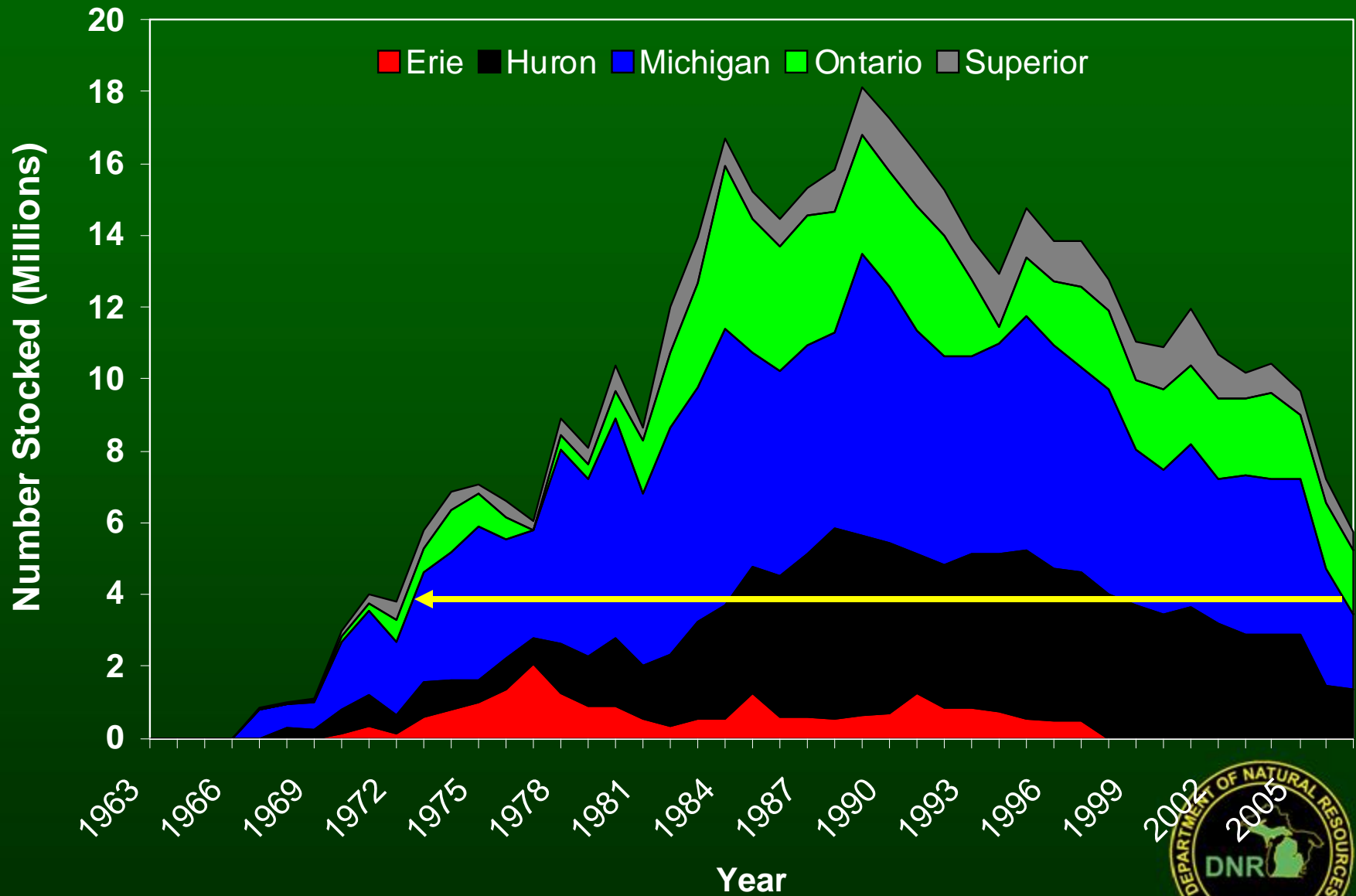
- Observed decline in the early 1990's
- Recovery in the late 1990's to all time record catch rates during 2000 – 2005
- Moderate decline since 2007, in part a response to stocking reduction in 2006
- Natural reproduction???

Lake-wide Stocking and Harvest

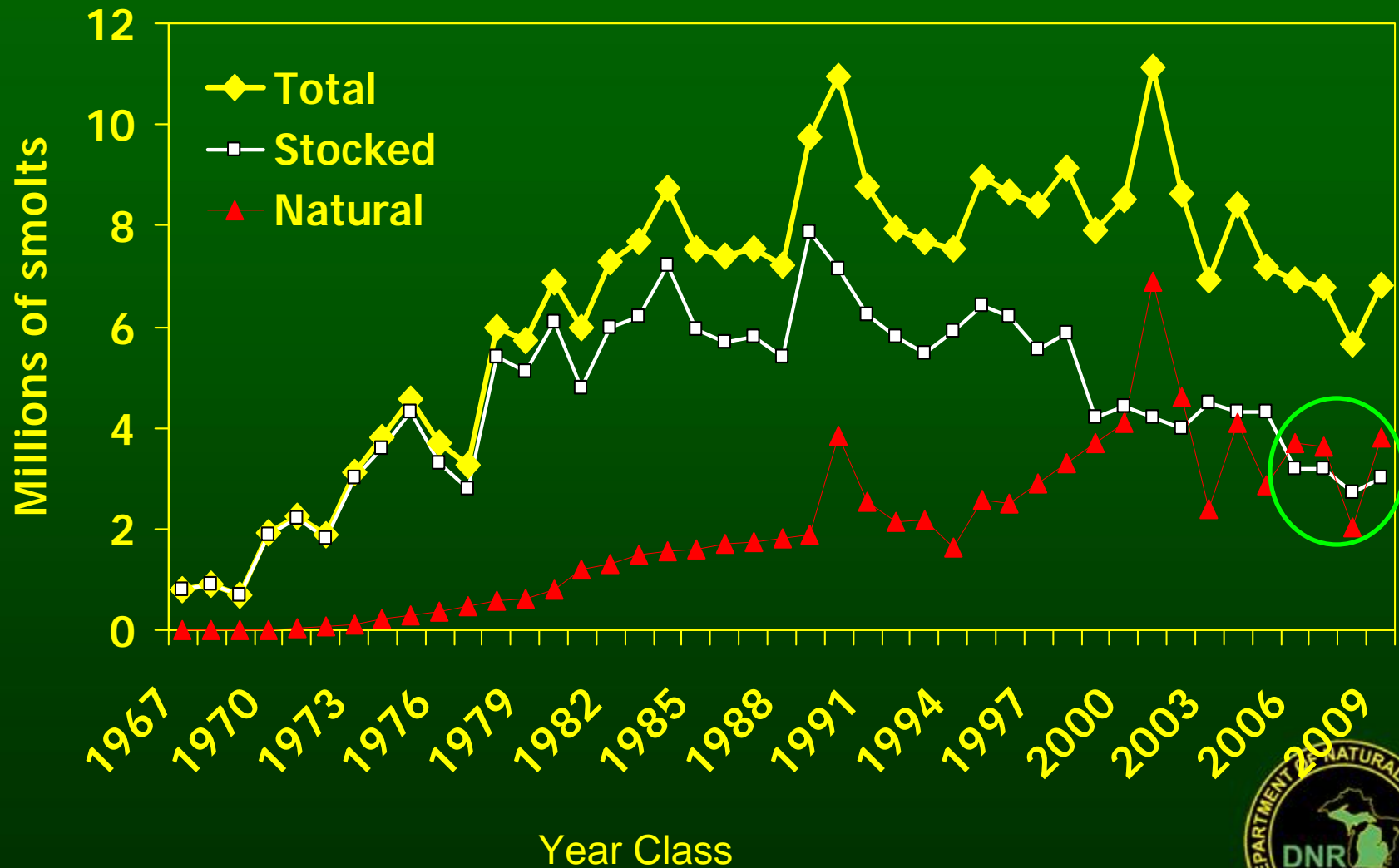
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Chinook Salmon Stocking

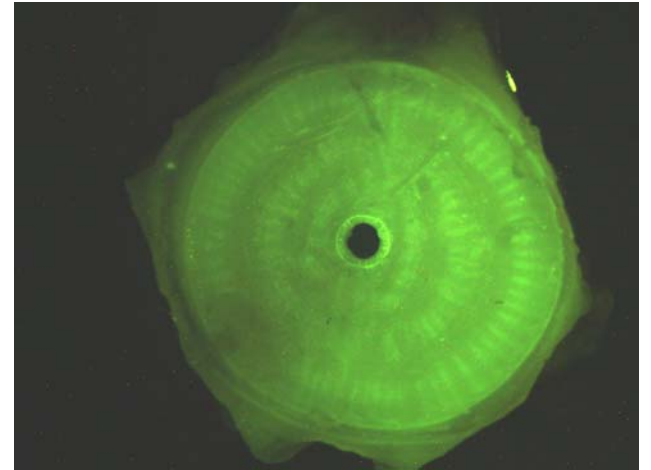


Estimated Chinook Salmon Recruitment in Lake Michigan, 1967-2009

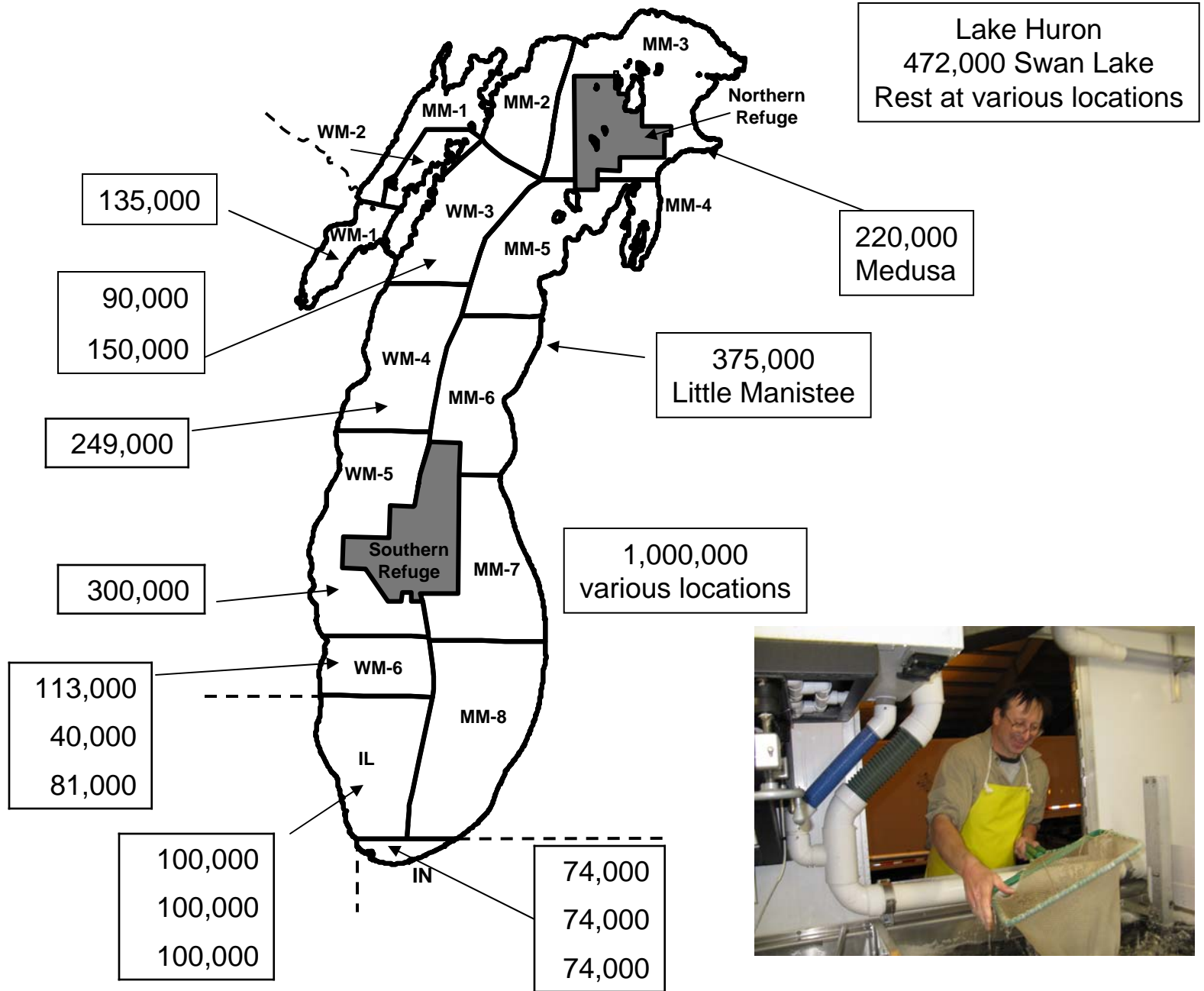


OTC Project Objectives

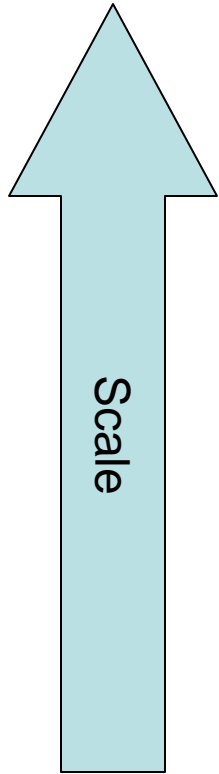
Collection Year	Year Class				
	2006	2007	2008	2009	2010
2007	56.2				
2008	82.9	54			
2009	66.5	62.8	53.6		
2010	76.8	62.5	67.9	55.7	
2011	Age-5	Age-4	Age-3	Age-2	Age-1



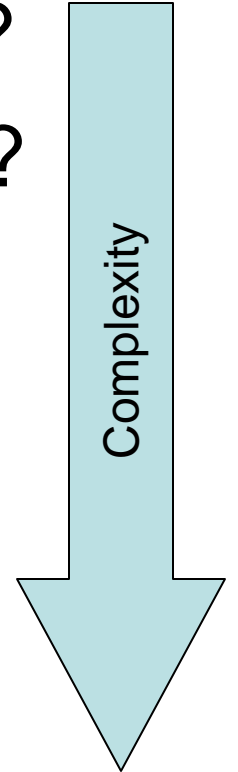
2011 Chinook Salmon CWT design



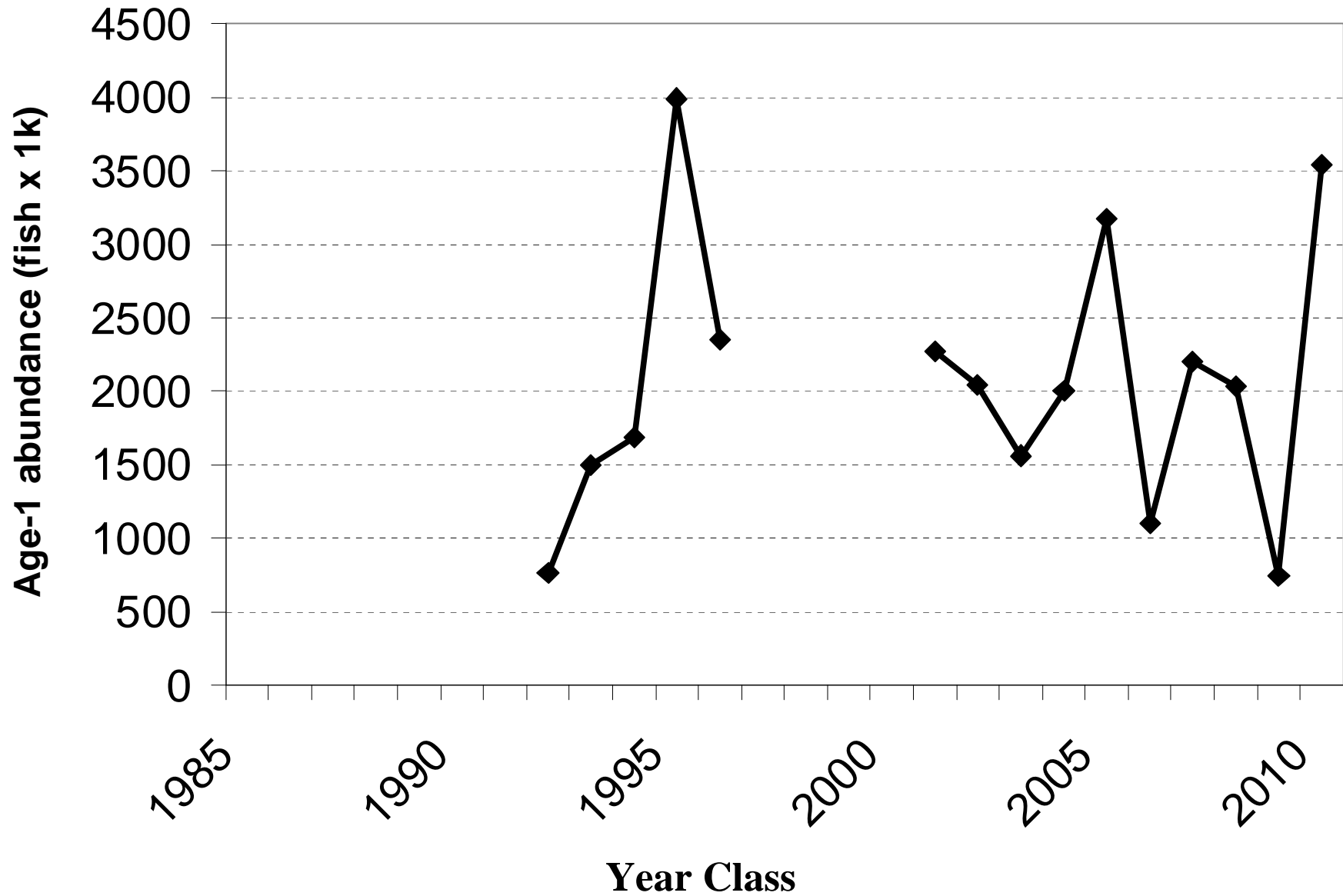
Priority Question (s):



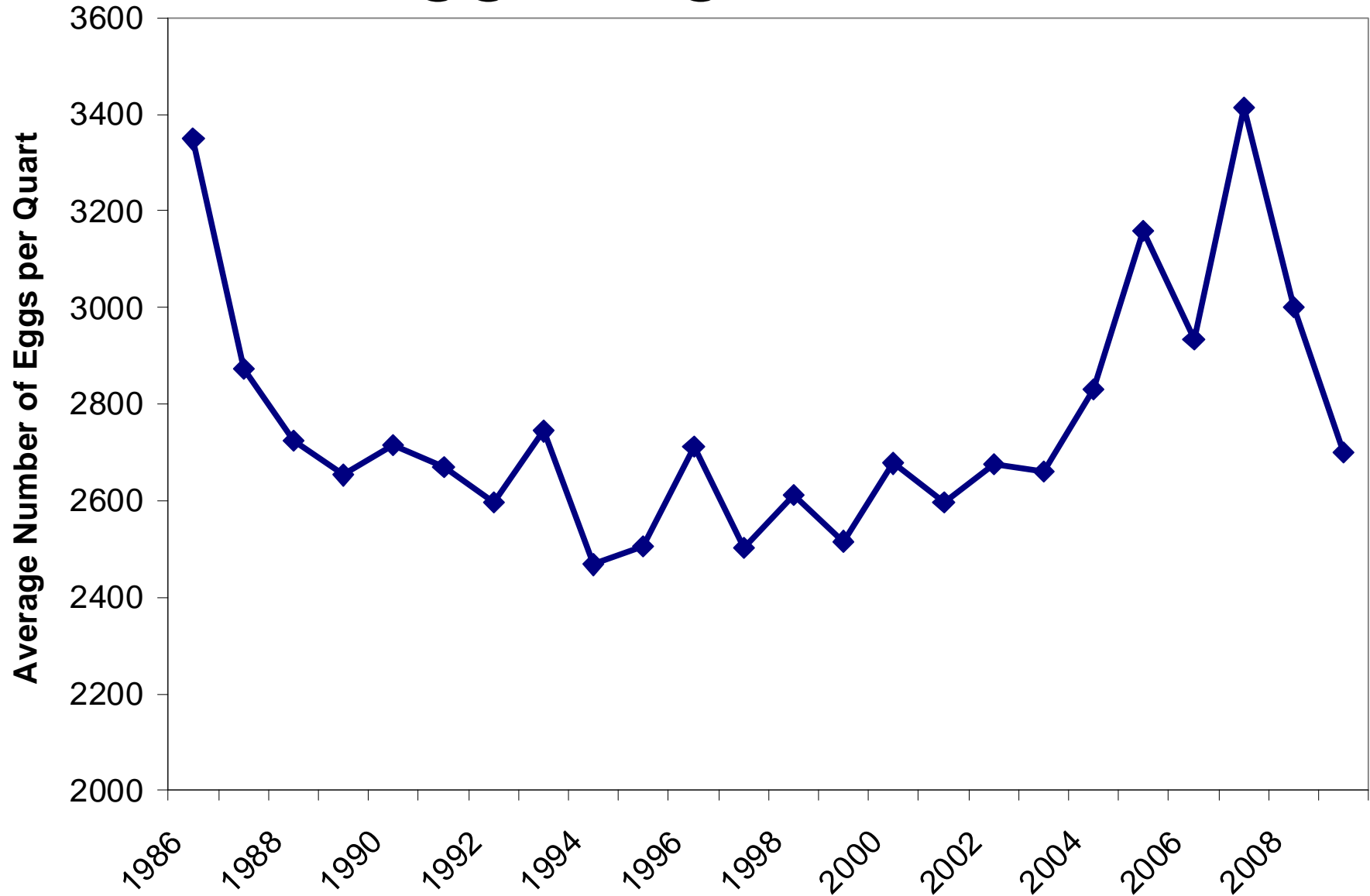
- What is....lakewide smolt production?
-contribution / movement by lake?
-variation by lake-region?
-individual stream production?
-stocking site comparison?
-life history / mechanistic differences by source?
-others?



Age-1 Chinook Salmon Numbers



Egg weight index



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 alewife YOY high, predict a response from salmon in 2011