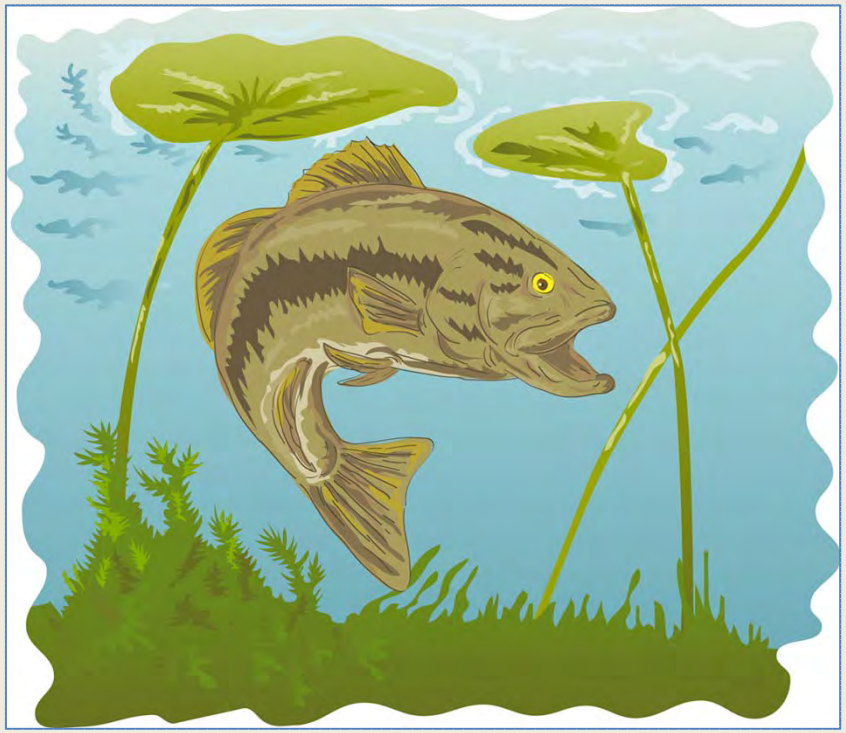
Effects of habitat and spring fishing on nesting largemouth and smallmouth bass

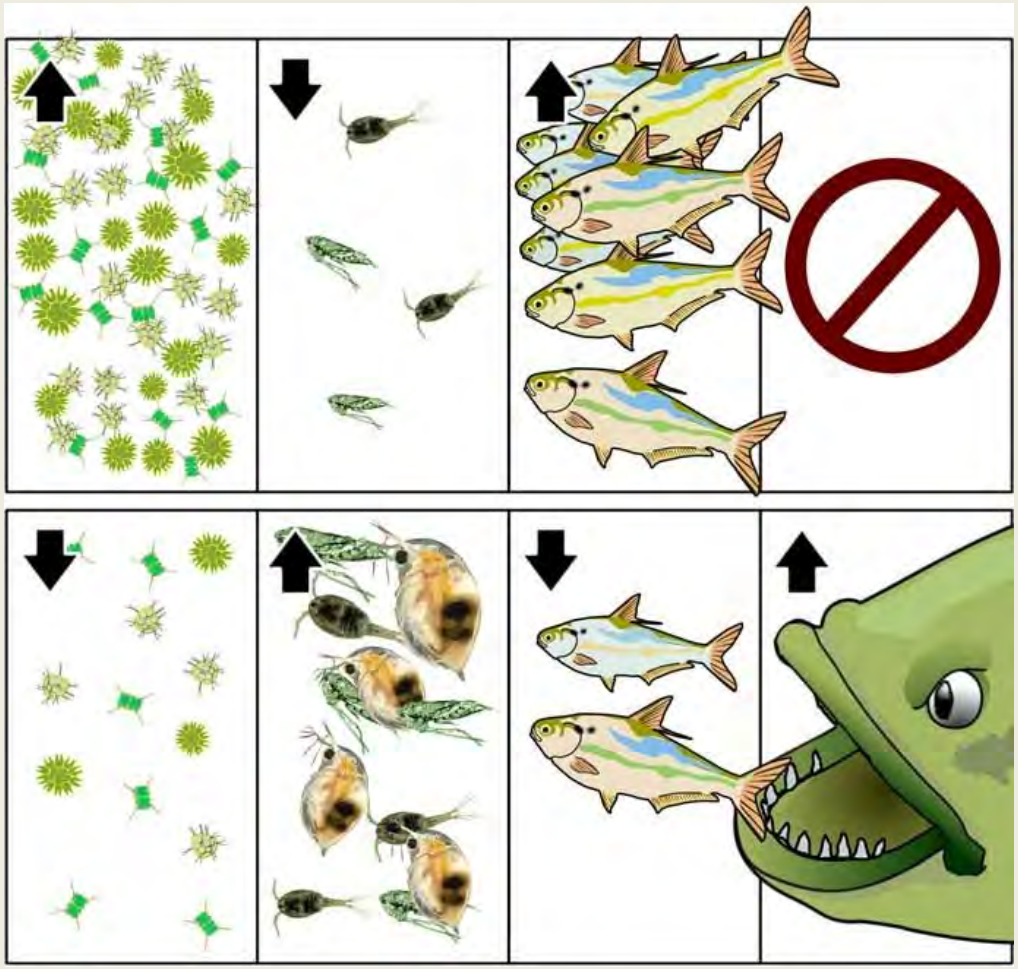


Dr. Mary Tate Bremigan

Collaborators:

Dr. Kim Scribner, Dr. Jan Michael Hessenauer, Hiedi Ziegenmeyer, Jason Smith, Darrin McCullough

Ecological, Social, and Economic Importance of Bass



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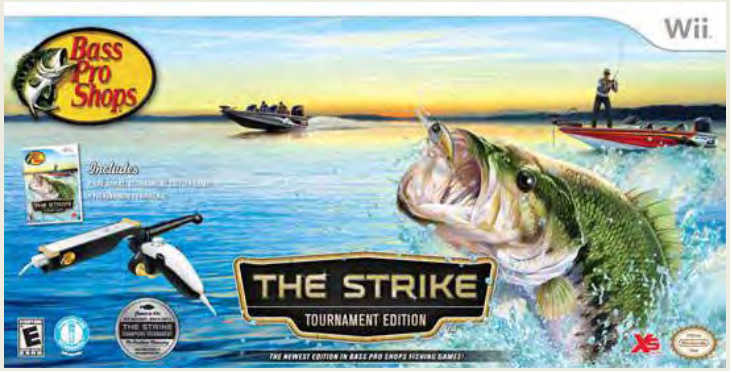
Ecological, **Social, and Economic** Importance of Bass

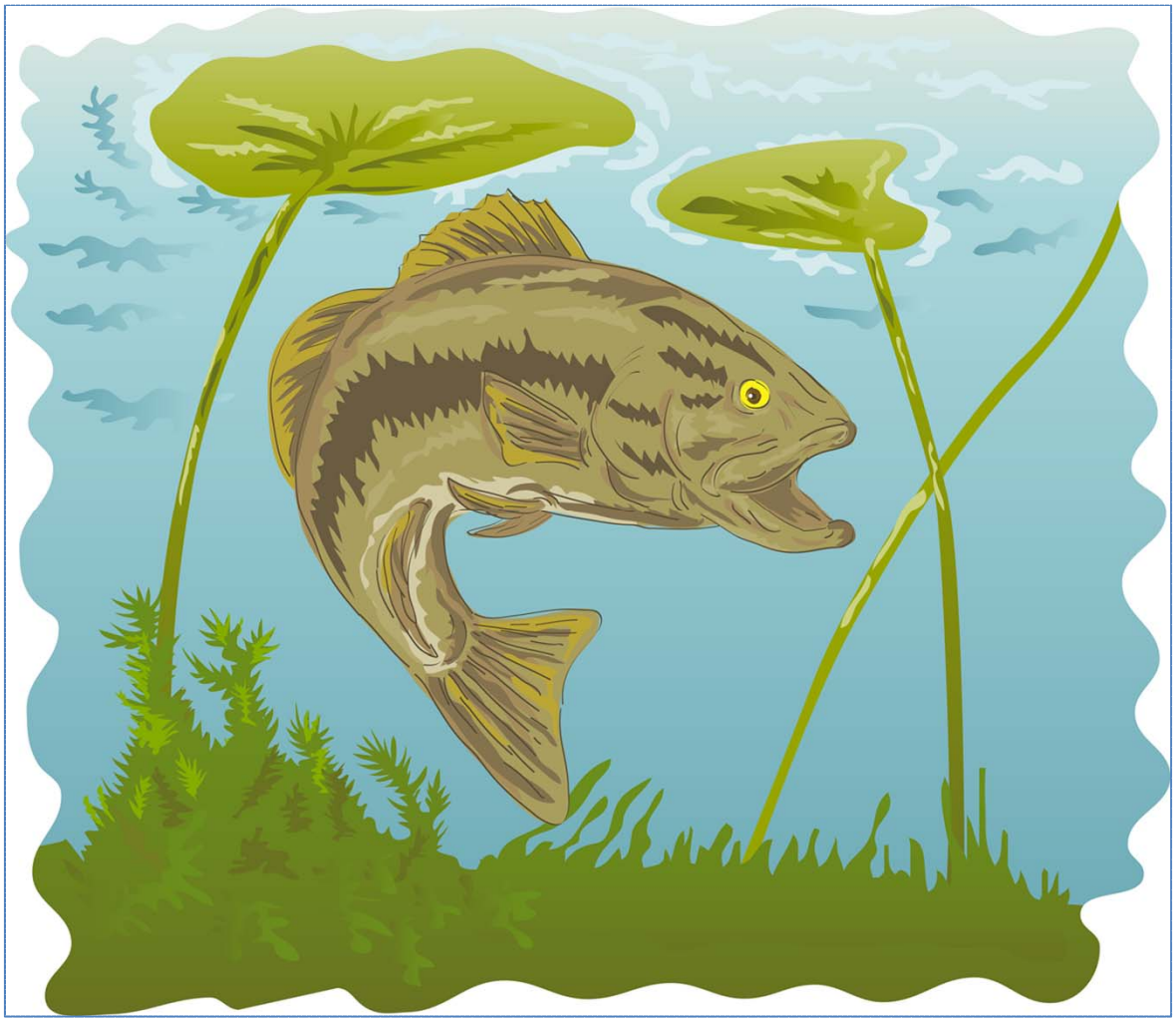


http://cdn.goodmenproject.com/wp-content/uploads/2015/06/David-Gross-5-300x1691.jpg

http://www.gamefaqs.com/wii/641658-bass-pro-shops-the-strike-tournament-edition/images/1235154

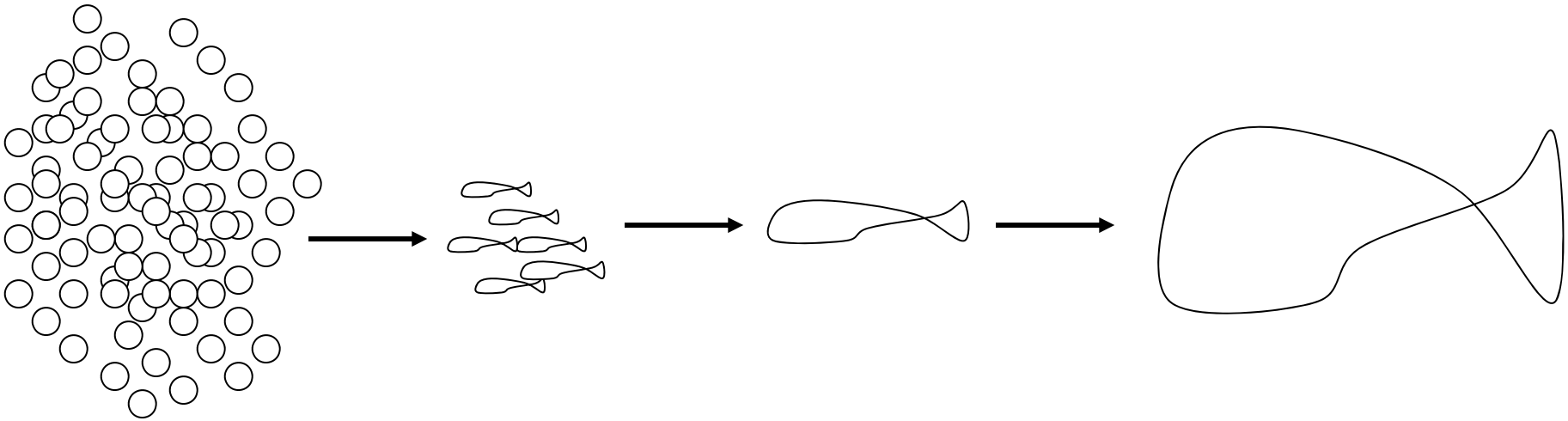
http://cdn2-b.examiner.com/sites/default/files/styles/image_content_width/hash/ff/30/ff3097896cb68421879fdde5118e2667.jpg?itok=zlVhEPLb

How do we manage for sustainable bass populations?



Introduction

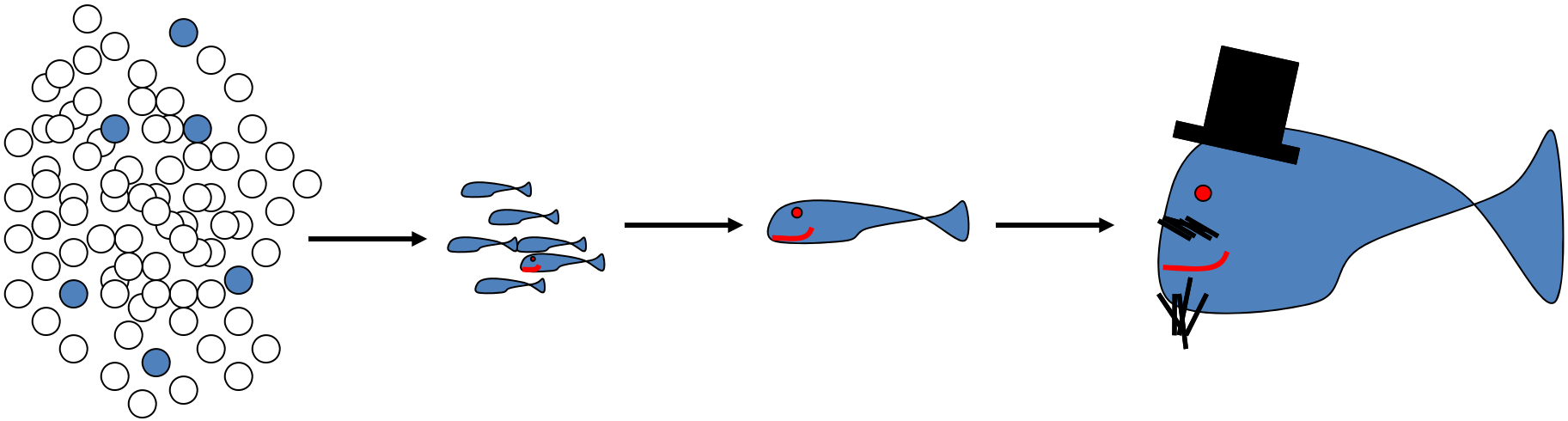
The abundance of large, adult fish is often ‘set’ early in life. Hence, we often emphasize the ‘early life history’ of fish, and reproductive dynamics of fish populations.



How Many Survive each life stage?

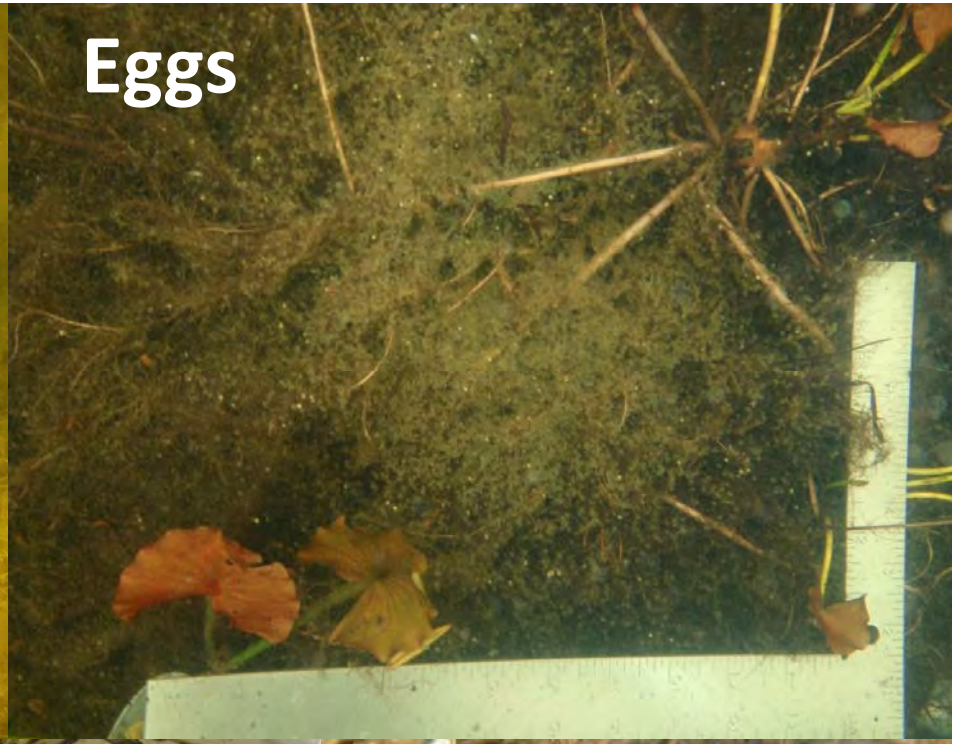
Introduction

The abundance of large, adult fish is often ‘set’ early in life. Hence, we often emphasize the ‘early life history’ of fish, and reproductive dynamics of fish populations.

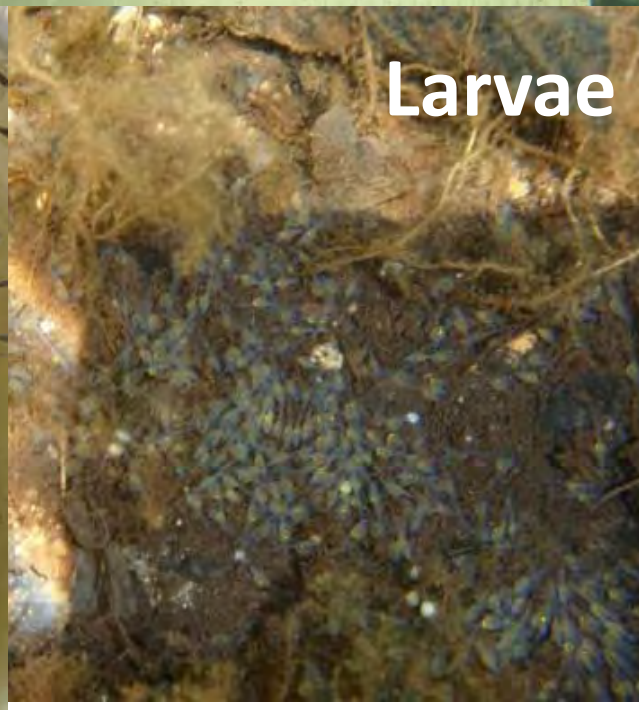


Which ones are the survivors?


Nesting Male


Eggs


Fry


Larvae


Summer Age-0 (YOY)
7
8
9

Questions

From eggs through their first summer of life….

How many bass survive?

Which ones survive?

What's the importance of:

- nest and shoreline habitat
- nesting male behavior
- angling during nesting

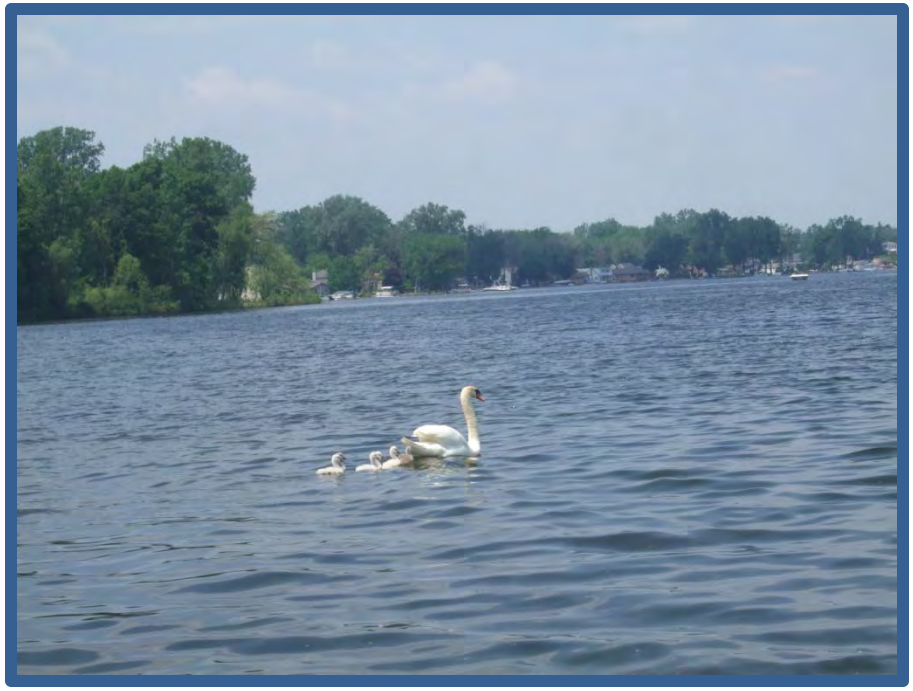
Our study systems….

Lake	County	Anticipated Angling Pressure	Area (ha)	Max Depth (m)	% Developed Shoreline
Warner	Barry	low	16	16	8.06
North	Washtenaw	medium	91	18	61.86
Chemung	Livingston	high	126	21	71.01
Woodland	Livingston	high	104	11	76.21

Introduction

Warner Lake

Lake Chemung



Introduction

From eggs through their first summer of life….

How many bass survive?

Which ones survive?

What's the importance of:

- nest and shoreline habitat
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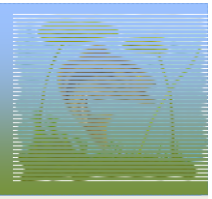
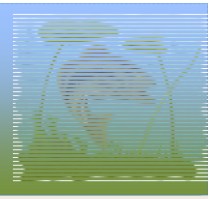
Asking 'How Many?'



Life Stage	Methods	How Many – P1
Adults		
Nests: eggs/larvae		
Successful Nests: fry		
Summer/Fall Age-0		
Spring 1+		

Asking 'How Many?'



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Spring 1+		*No Data*

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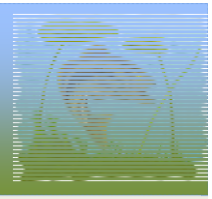
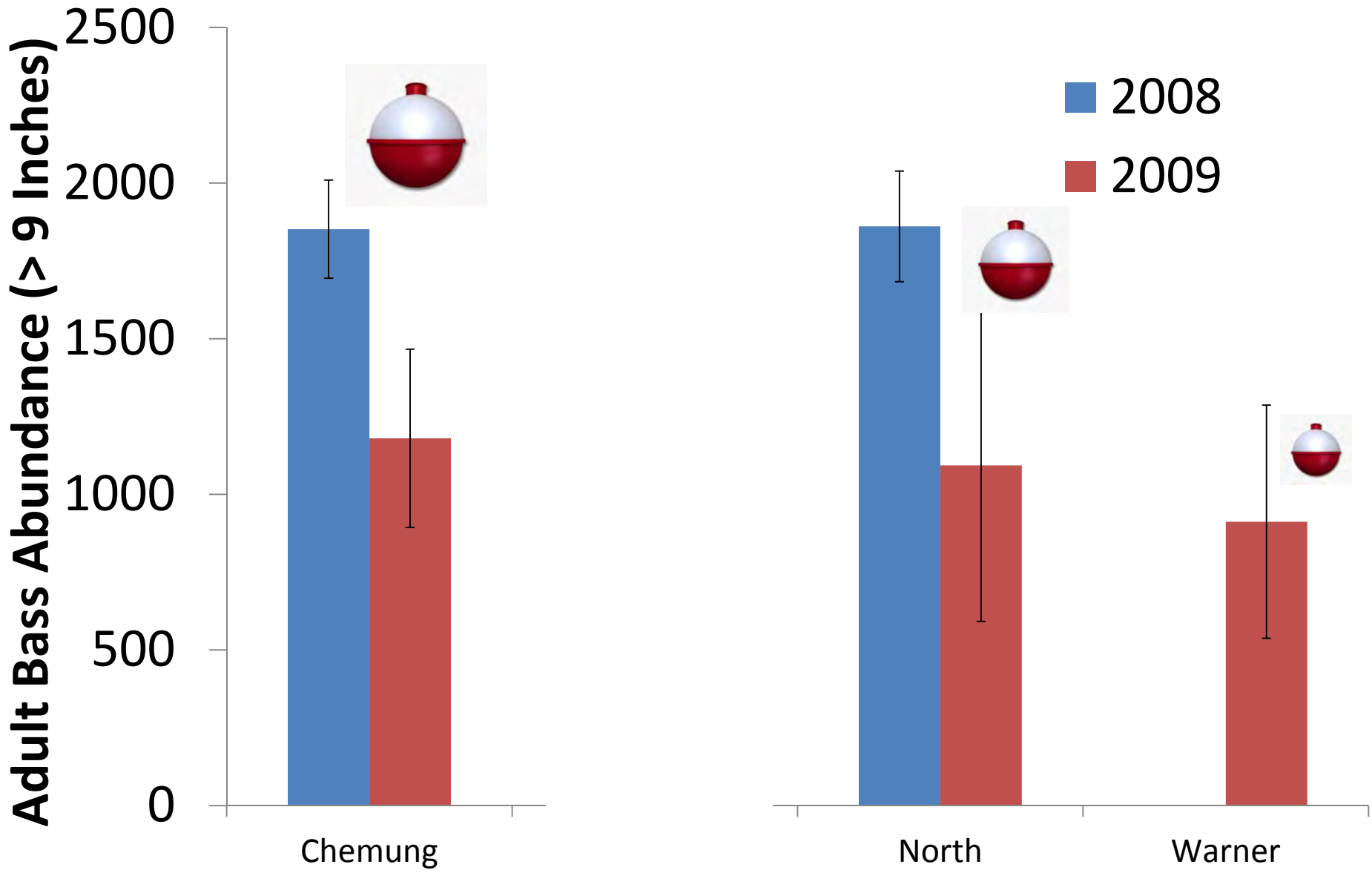


Life Stage	Methods	How Many – P1
Adults	Electrofishing – Mark/ReCap	
Nests: eggs/larvae		
Successful Nests: fry		
Summer/Fall Age-0		
Spring 1+		*No Data*

Late September….with Fisheries Division, MDNR… Mark-Recapture Population Estimates

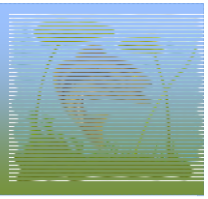
How Many Adults?



Asking 'How Many?'

Life Stage	Methods	How Many – P1
Adults	Electrofishing – Mark/ReCap	~450-900 males >9"
Nests: eggs/larvae		
Successful Nests: fry		
Summer/Fall Age-0		
Spring 1+		*No Data*

Asking 'How Many?'



Life Stage	Methods	How Many – P1
Adults	Electrofishing – Mark/ReCap	~450-900 males >9"
Nests: eggs/larvae	Snorkel Surveys	
Successful Nests: fry		
Summer/Fall Age-0		
Spring 1+		*No Data*

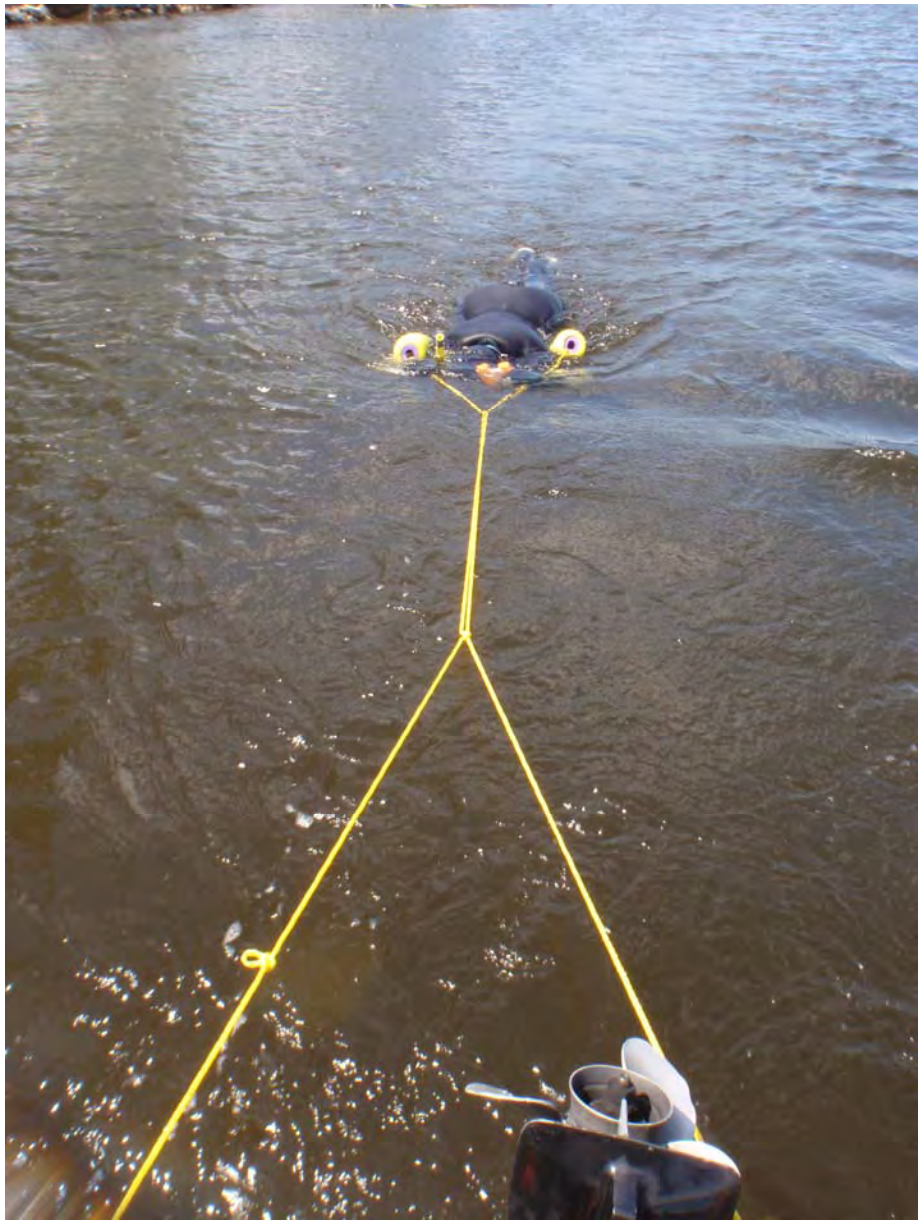
How Many Nests?

Snorkel Surveys:

2x/week in May – June

ID and GPS per nest

Note stage of offspring



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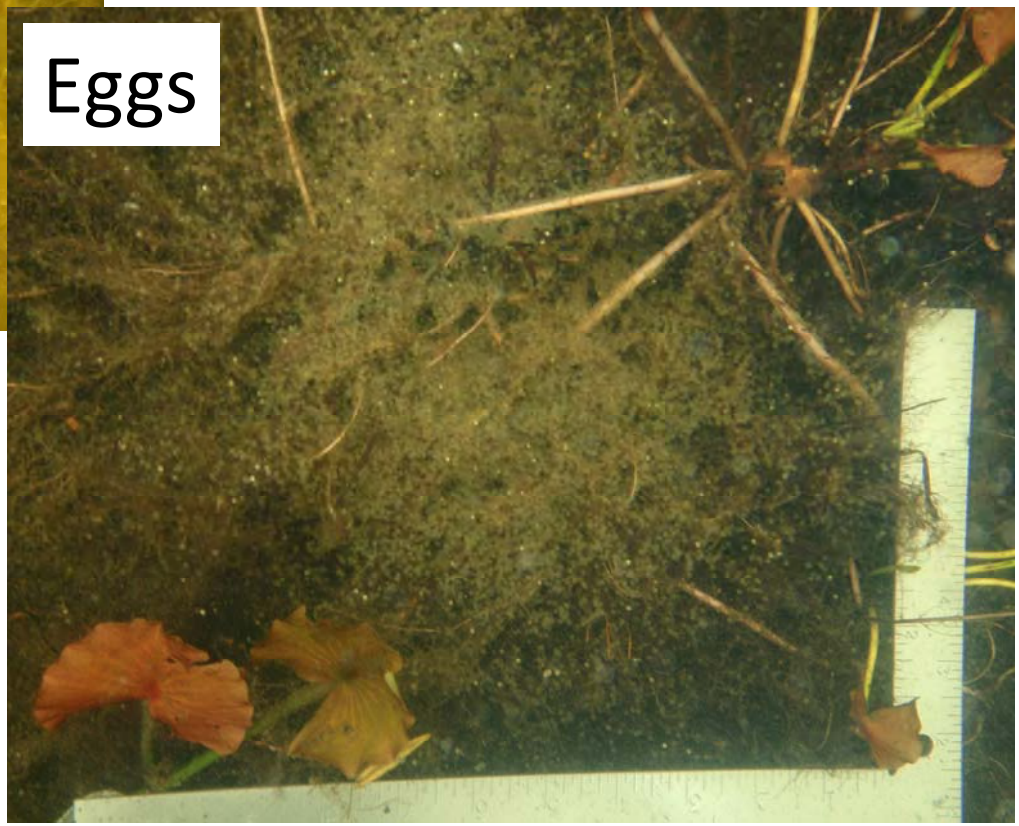

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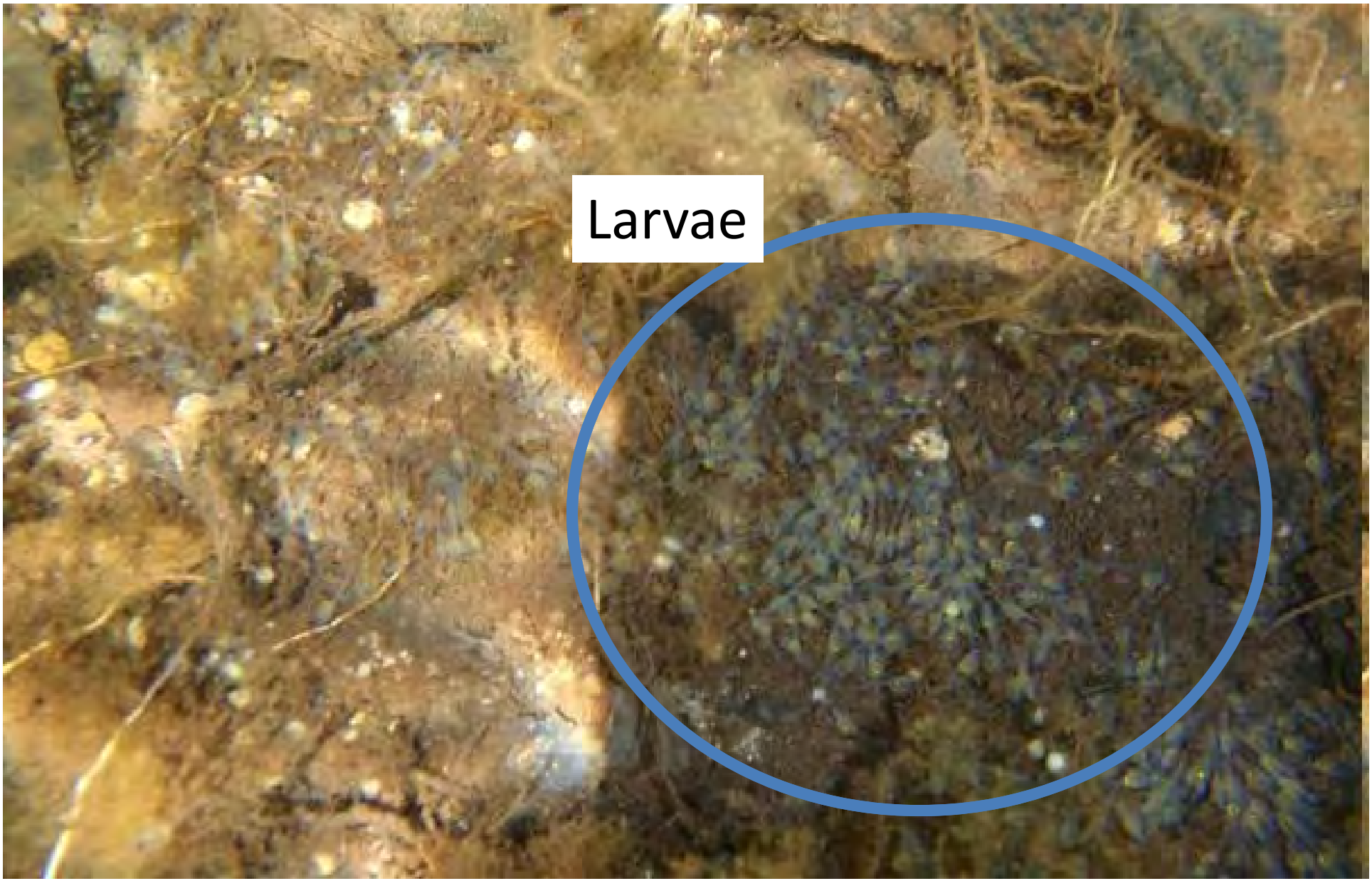
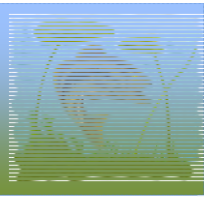


Lake Chemung Nests 2009

Snorkel Survey Results

	2009			2010		
	WR	NT	CMG	WR	NT	CMG
# Nests as Egg/LV	18	43	66	26	25	86

Asking 'How Many?'



Life Stage	Methods	How Many – P1
Adults	Electrofishing – Mark/ReCap	~450-900 males >9"
Nests: eggs/larvae	Snorkel Surveys	18 – 86 nests seen per lake
Successful Nests: fry		
Summer/Fall Age-0		
Spring 1+		*No Data*

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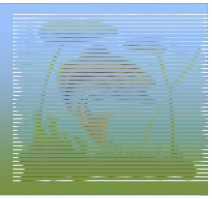

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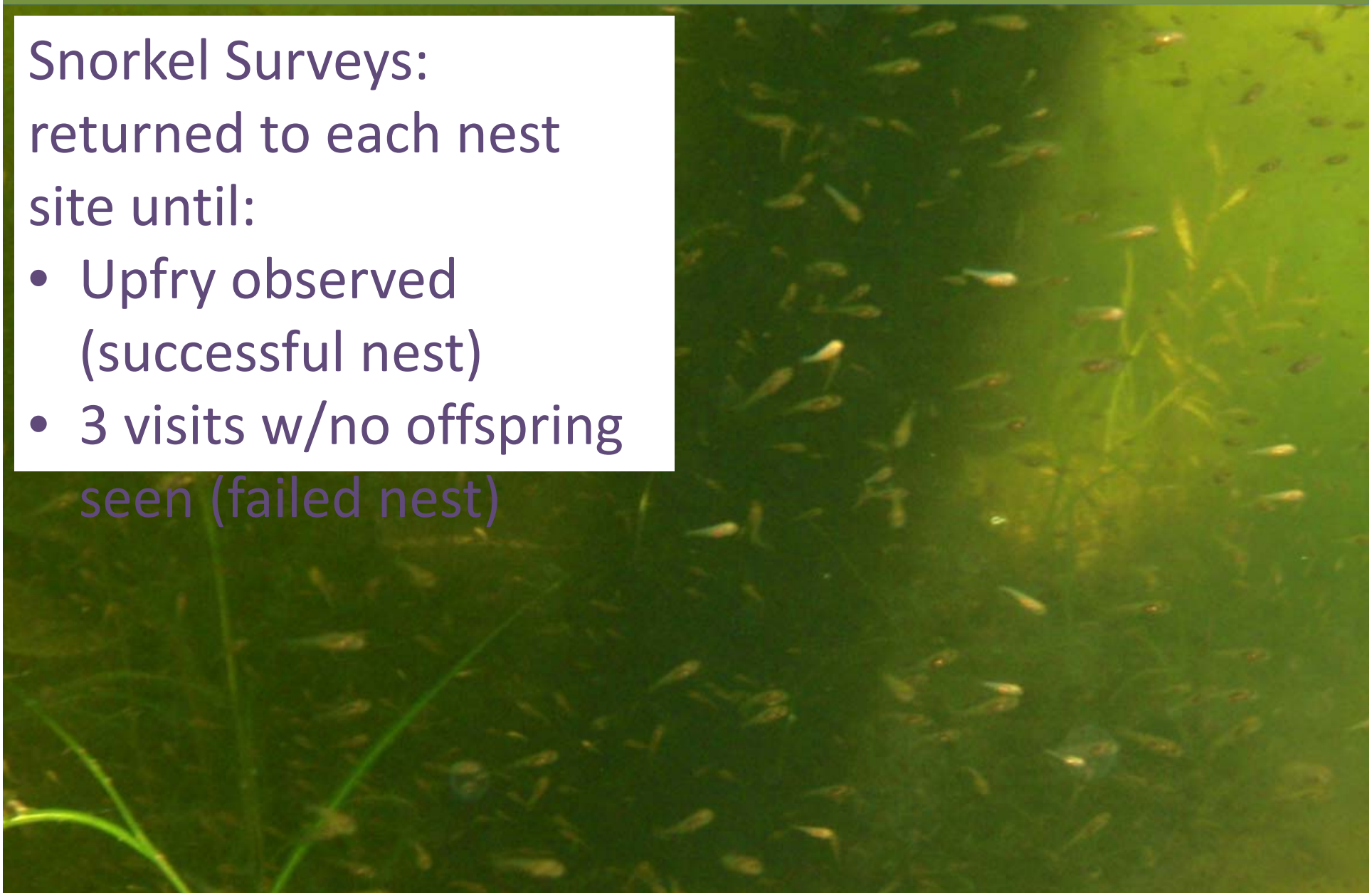
Successful Nests: fry	Snorkel Surveys	
Summer/Fall Age-0		
Spring 1+		*No Data*

How Many Sucessful Nests?



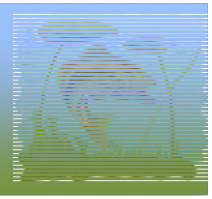
Snorkel Surveys: returned to each nest site until:

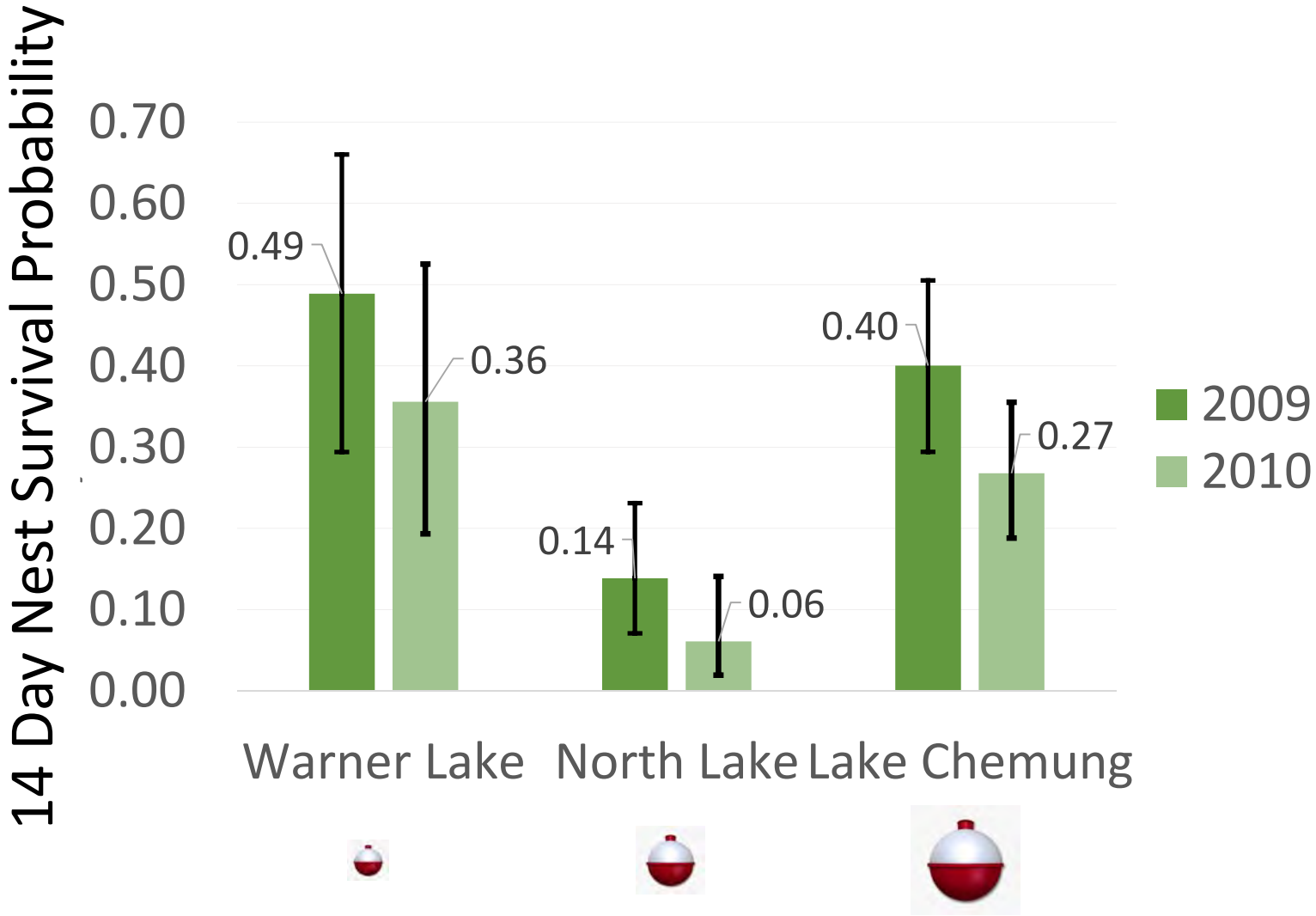
- Upfry observed (successful nest)
- 3 visits w/no offspring seen (failed nest)

Snorkel Survey Results

	2009			2010		
	WR	NT	CMG	WR	NT	CMG
# Nests as Egg/LV	18	43	66	26	25	86
% Nests to Fry	72%	33%	47%	46%	12%	35%
Total # Nests w/Fry	30	22	91	19	7	54

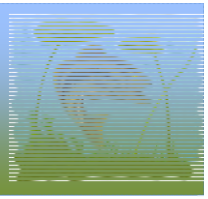
How Many Successful Nests?





Darrin McCullough, Undergraduate Research

Asking 'How Many?'



Life Stage	Methods	How Many – P1
Adults	Electrofishing – Mark/ReCap	~450-900 males >9"
Nests: eggs/larvae	Snorkel Surveys	18 – 86 nests
Successful Nests: fry		ranged 3->30%
Summer/Fall Age-0		
Spring 1+		*No Data*

How many fry are in a successful nest's fry ball?

Asking 'How Many?'

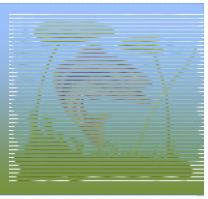
Sampling bass 'fry balls'

Sampling bass 'fry balls'

Fry counts per nest group ranged ~250 – 4,000 fry.

Goal: predict fry ball abundance by estimating individual fry size and relative size of the 'fry ball'.

Asking 'How Many?'



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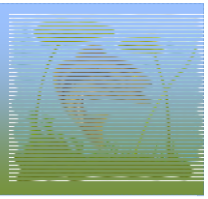
Successful Nests: fry	Snorkel Surveys	Nest 'survival' ranged ~5->50%
Summer/Fall Age-0	Mini-fykes, Seine, Electrofishing	
Spring 1+		*No Data*

Asking 'How Many?'



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Successful Nests: fry	Snorkel Surveys	Nest 'survival' ranged ~5->50%
Summer/Fall Age-0	Mini-fykes, Seine, Electrofishing	Stay tuned!
Spring 1+		*No Data*

Questions

From eggs through their first summer of life….

How many bass survive?

Which ones survive?

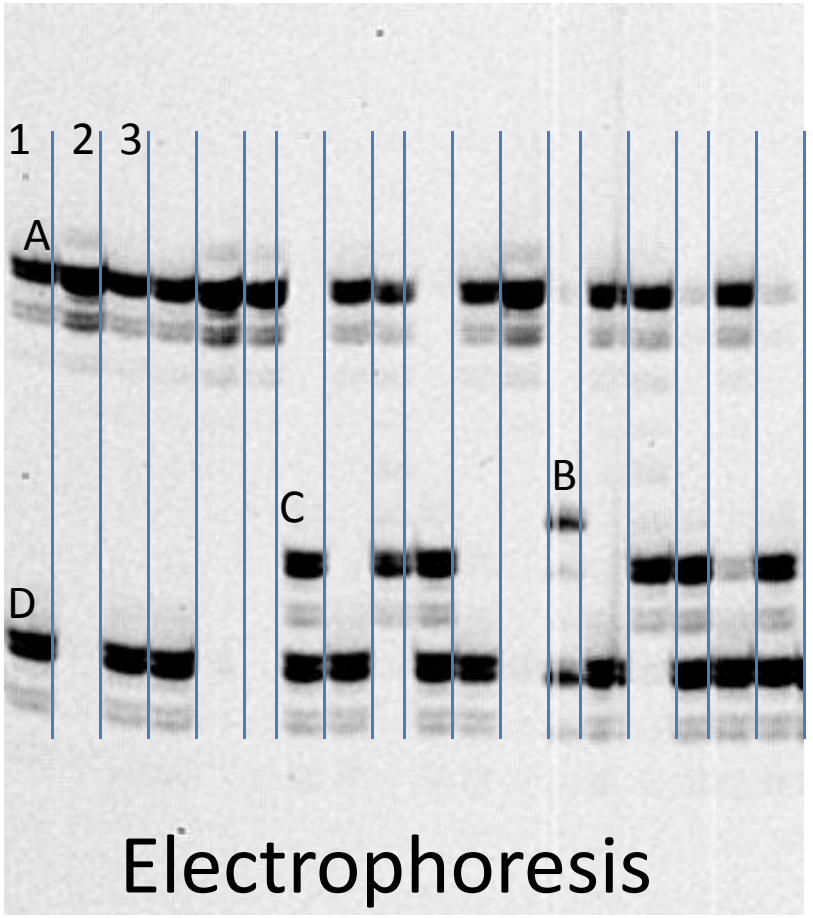
What's the importance of:

- nest and shoreline habitat
- nesting male behavior
- angling during nesting

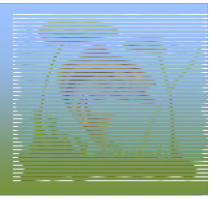
Double-checking 'How Many Nests' AND Asking 'Which Nests Contribute?'

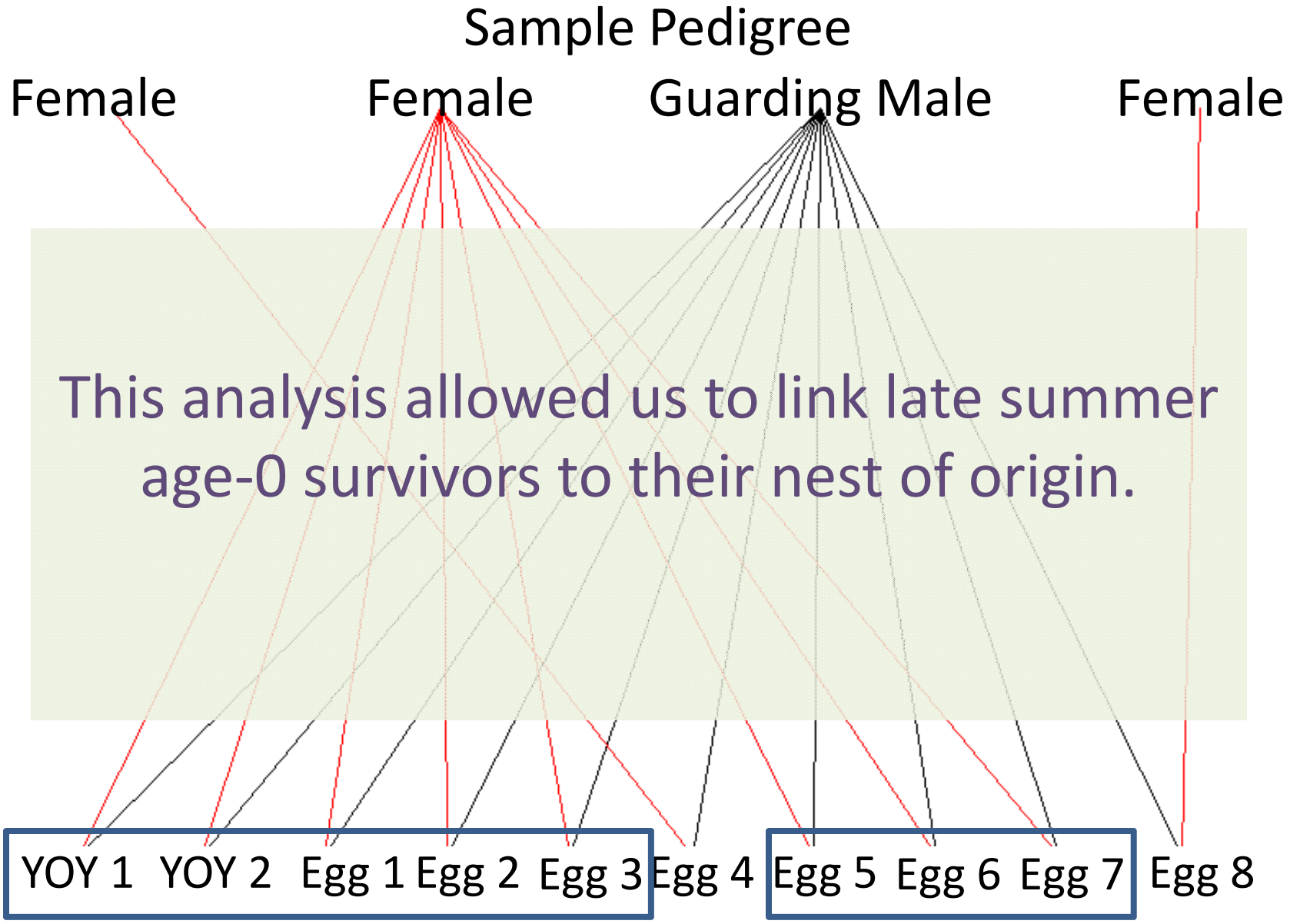
Extract DNA

PCR

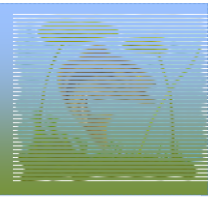


Asking 'Which Nests Contribute?'



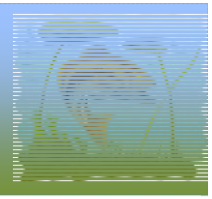


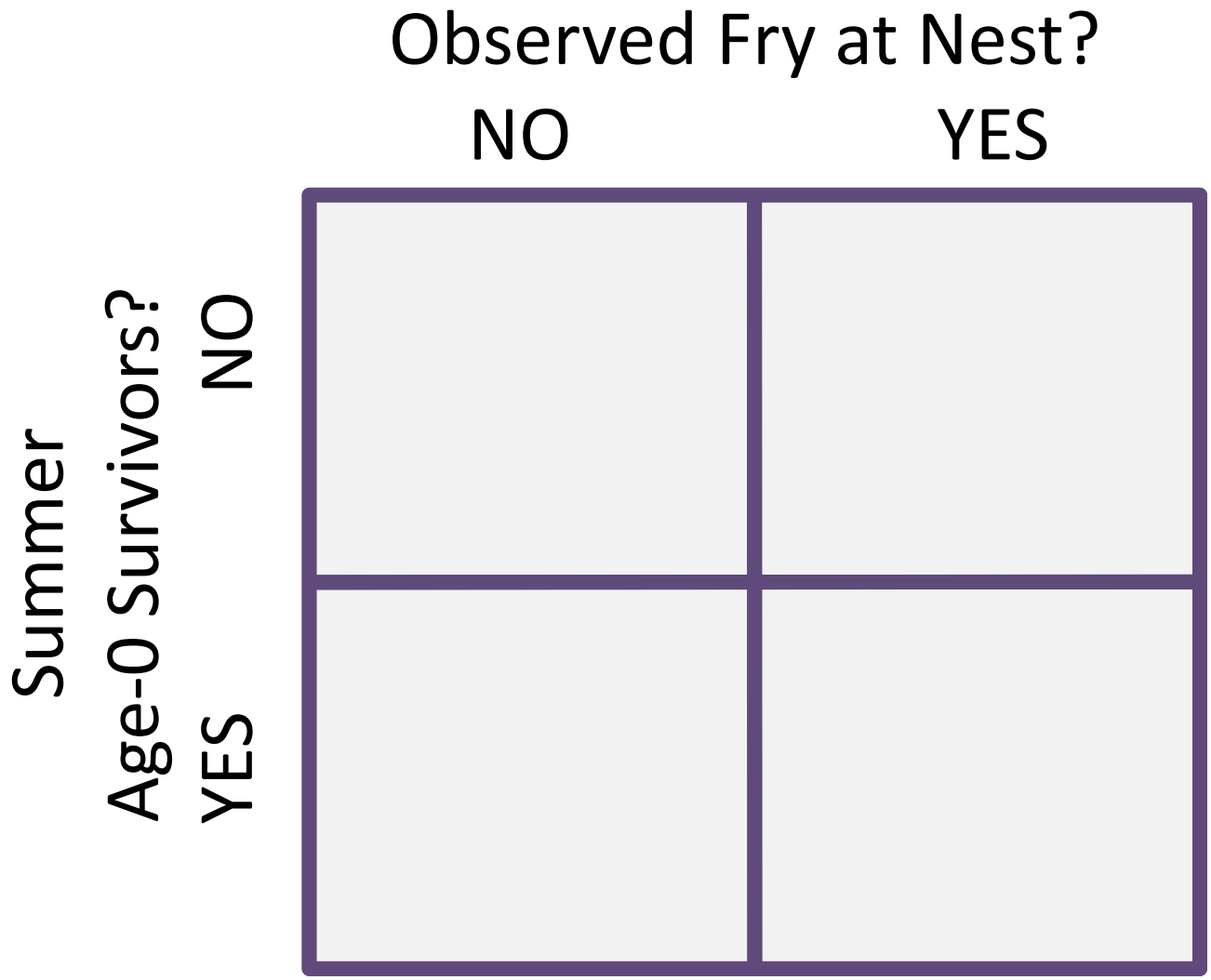
Double-checking 'How Many Nests?'



Life Stage	How Many – P1	How Many – P2
Adults	~700 adult males in Wr 2010	
Nests: eggs/larvae	33 observed nests in WR 2010	
Successful Nests: fry	15 observed nests in WR 2010	
Summer/Fall Age-0		
Spring 1+		

Double-checking 'How Many Nests?'





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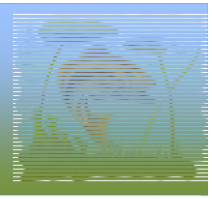

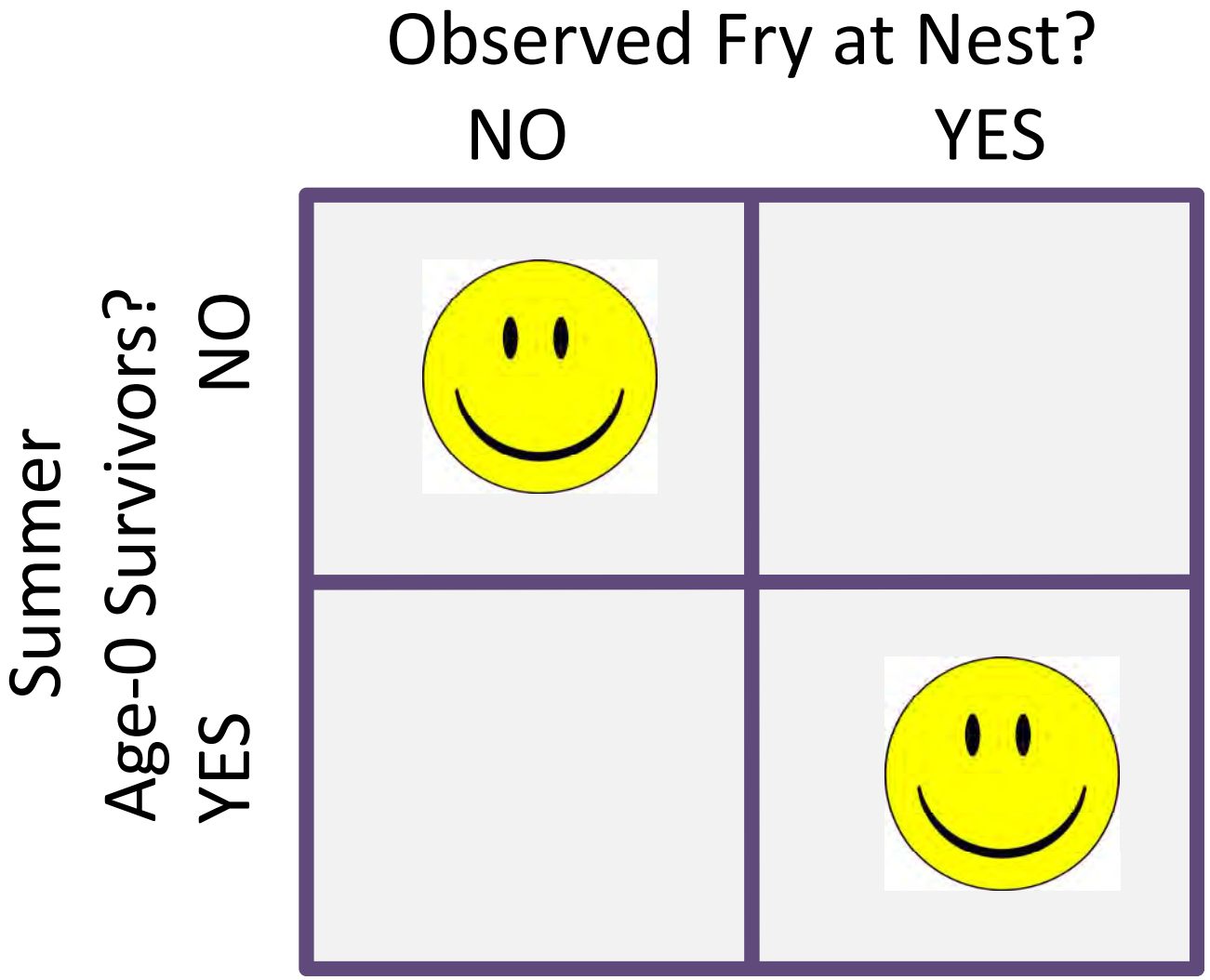

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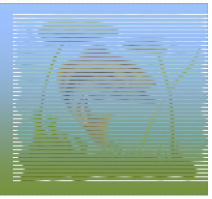

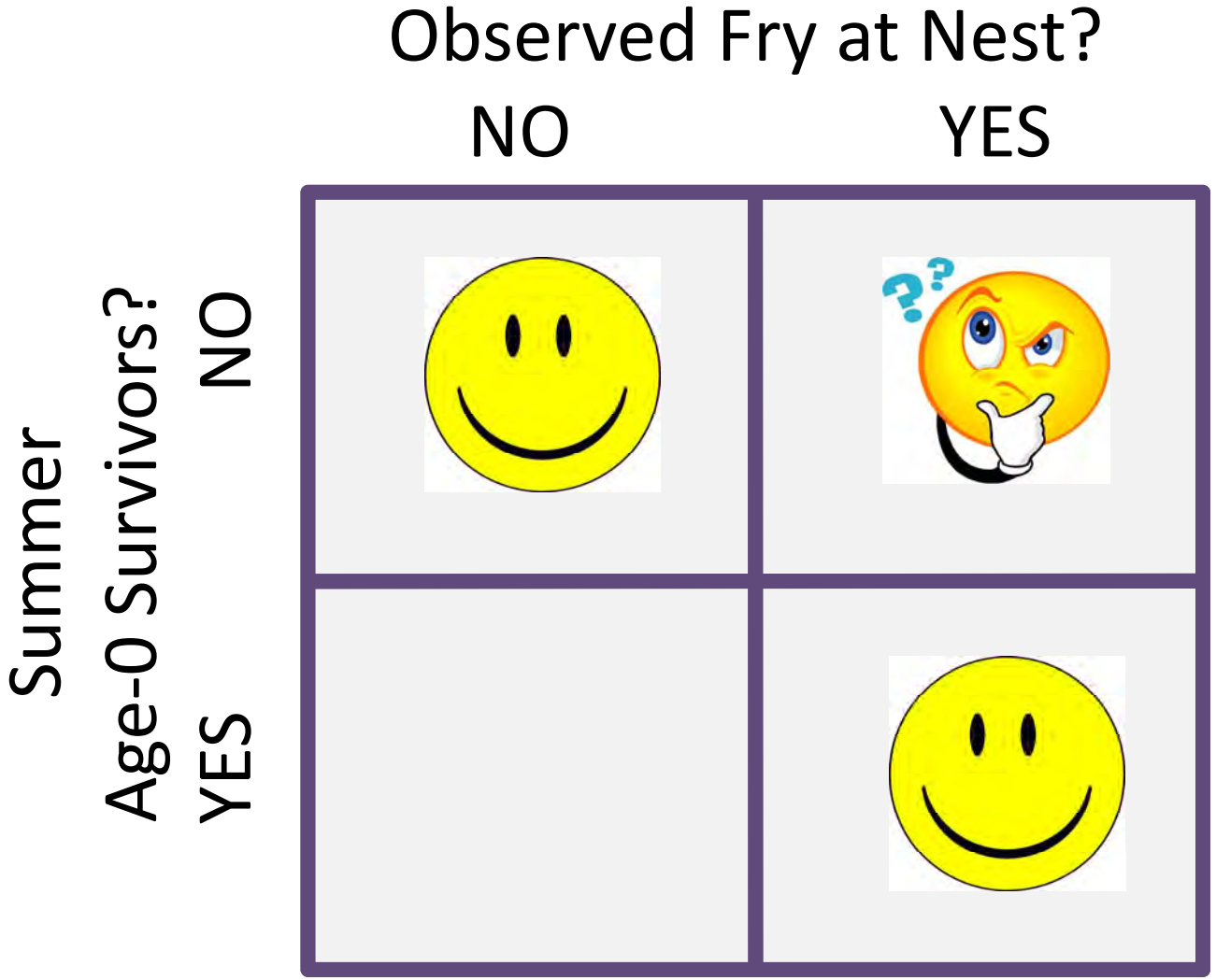

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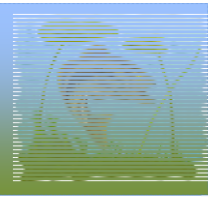

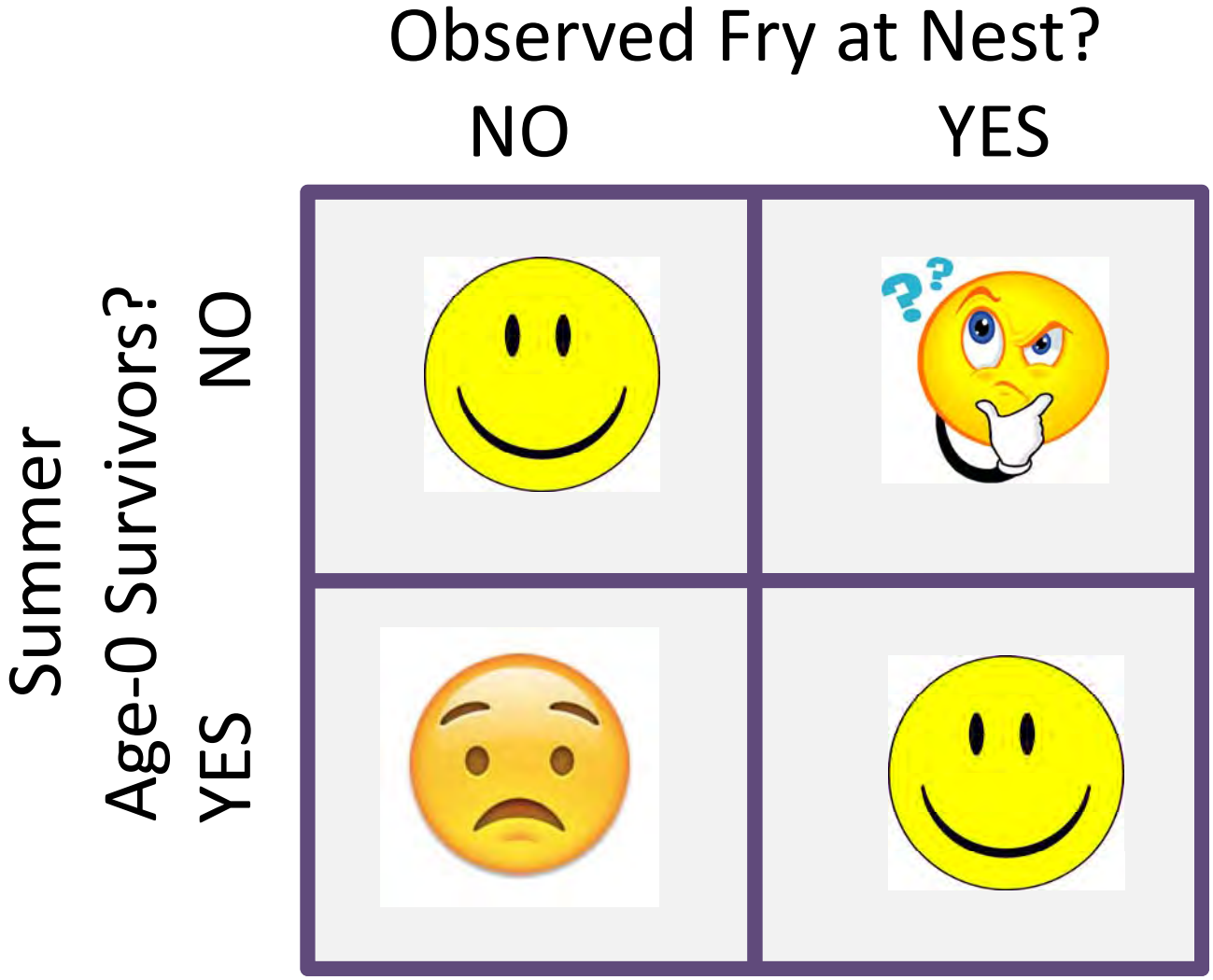

Double-checking 'How Many Nests?'

Of 33 nests observed, and 98 age-0 fish in Warner Lake, 2010

Summer Age-0 Survivors?	Observed Fry at Nest? NO	Observed Fry at Nest? YES
NO		
YES		

Hessenauer et al. 2014

Double-checking 'How Many Nests?'

Of 33 nests observed, and 98 age-0 fish in Warner Lake, 2010

Summer Age-0 Survivors?	Observed Fry at Nest? NO	Observed Fry at Nest? YES
NO	8 nests	
YES		

Hessenauer et al. 2014

Double-checking 'How Many Nests?'

Of 33 nests observed, and 98 age-0 fish in Warner Lake, 2010

Summer Age-0 Survivors?	Observed Fry at Nest? NO	Observed Fry at Nest? YES
NO	8 nests	
YES		9 nests

Hessenauer et al. 2014

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NO	8 nests	10 nests
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Hessenauer et al. 2014

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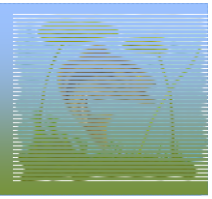

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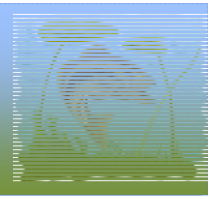

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NO	8 nests	10 nests
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N=34 age-0 fish

Hessenauer et al. 2014

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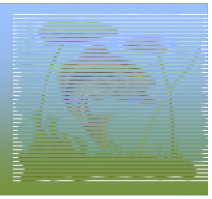

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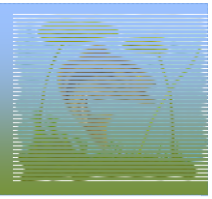
NO	8 nests	10 nests
YES	15 'nests'	6 nests
YES		9 nests

N=64 age-0 fish

N=34 age-0 fish

Hessenauer et al. 2014

Double-checking 'How Many Nests?'



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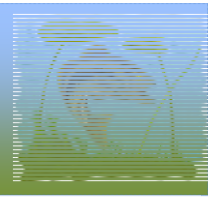
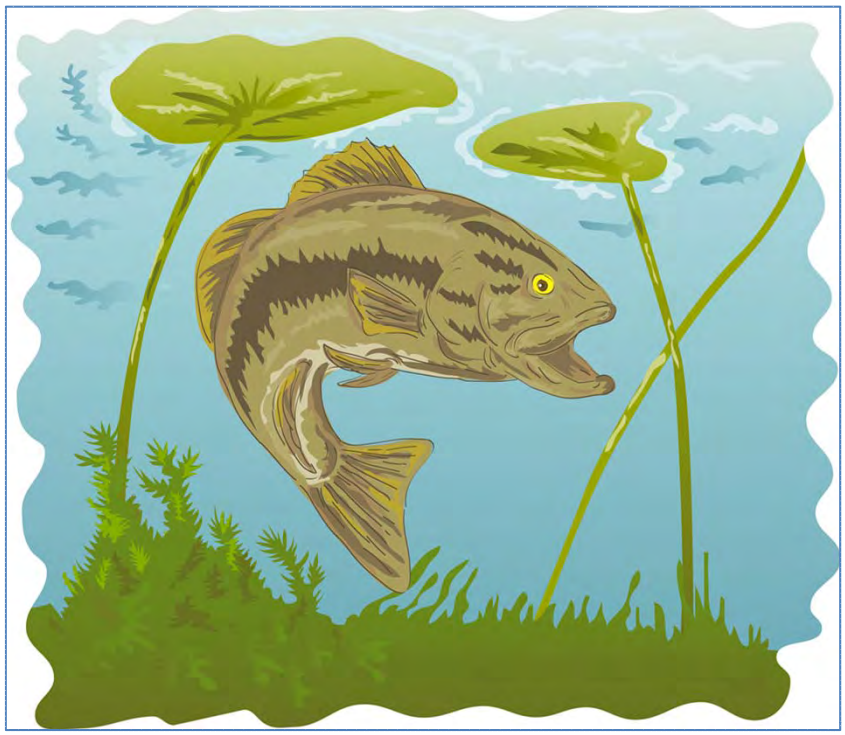
Spring 1+		

Double-checking 'How Many Nests?'



Life Stage	How Many – P1	How Many – P2
Adults	~700 adult males in Wr 2010	
Nests: eggs/larvae	33 observed nests in WR 2010	
Successful Nests: fry	15 observed nests in WR 2010	Genetics: 30 ~~nests in WR 2010~~
Summer/Fall Age-0		
Spring 1+		

Questions So Far?



Introduction

From eggs through their first summer of life….

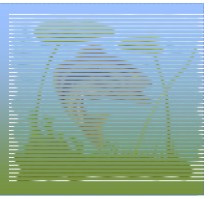
How many bass survive?

Which ones survive?

What's the importance of:

- nest and shoreline habitat
- nesting male behavior
- angling during nesting

Asking 'Which nests contribute?'

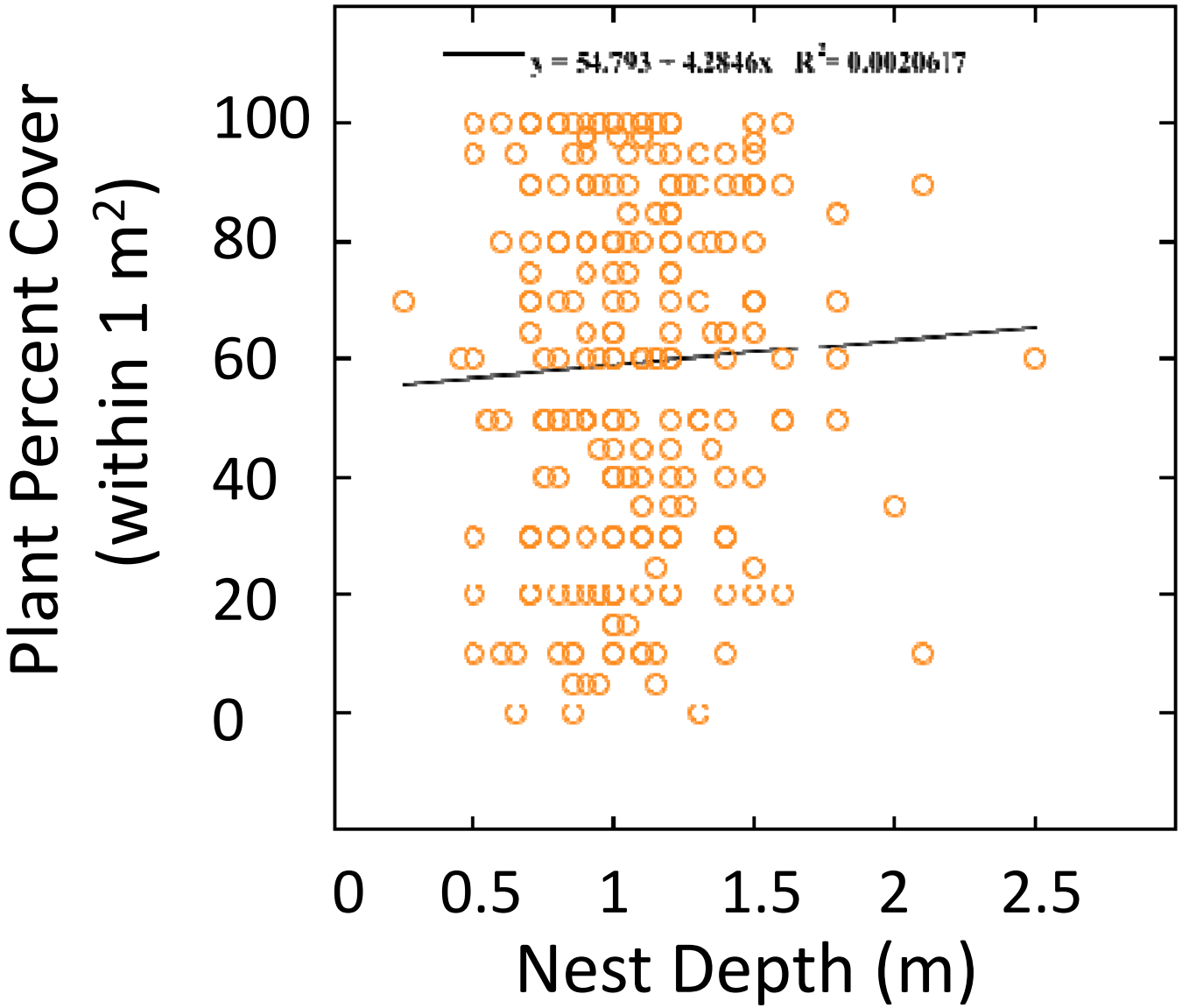


Nest Attributes	Methods	Observations
Habitat	Temperature, Nest Site, Shoreline	
Egg abundance		
'Dad' traits		
Fishing		

Asking 'Which nests contribute?'

- Monitored nest habitat features
  - Nest depth
  - Substrate
  - Plant cover
  - Woody material
  - Development type

Asking 'Which nests contribute?'



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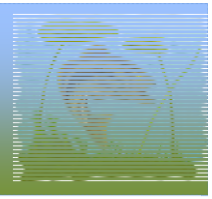

Nest Attributes	Methods	Observations
Habitat	Temperature, Nest Site, Shoreline	Substantial variation in nest conditions
Egg abundance		
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Fishing		

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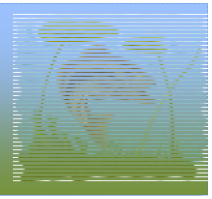

Nest Attributes	Methods	Observations
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Asking 'Which Nests Contribute?'

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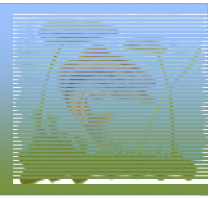

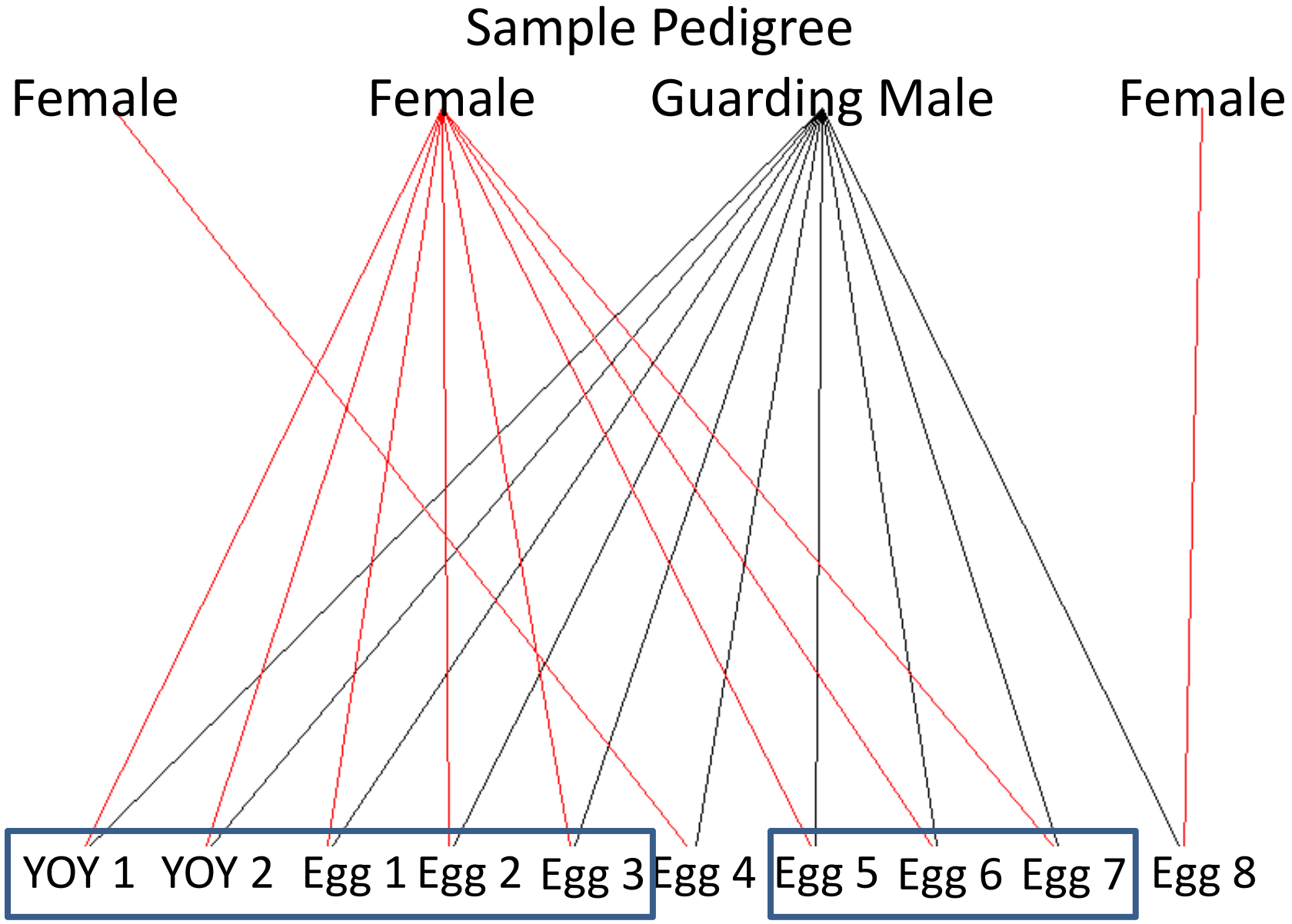

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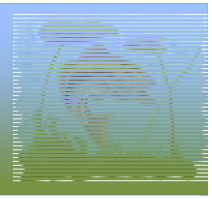

Pedigree Category	# of Nests	% of Nests
Monogamy	6	19%
Polygamy	9	29%
Promiscuity	16	52%

'Guarding Male' typically sired 93% of offspring/nest

One female typically provided 71% of eggs/nest

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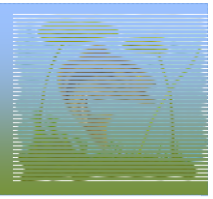
Asking 'Which nests contribute?'



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Habitat	Temperature, Nest Site, Shoreline	Substantial variation in nest conditions
Egg abundance	Photo Estimate Technique, Genetic Pedigrees	1,400–13,000 eggs/nest (SMB&LMB) typ. >2 parents
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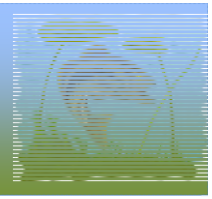

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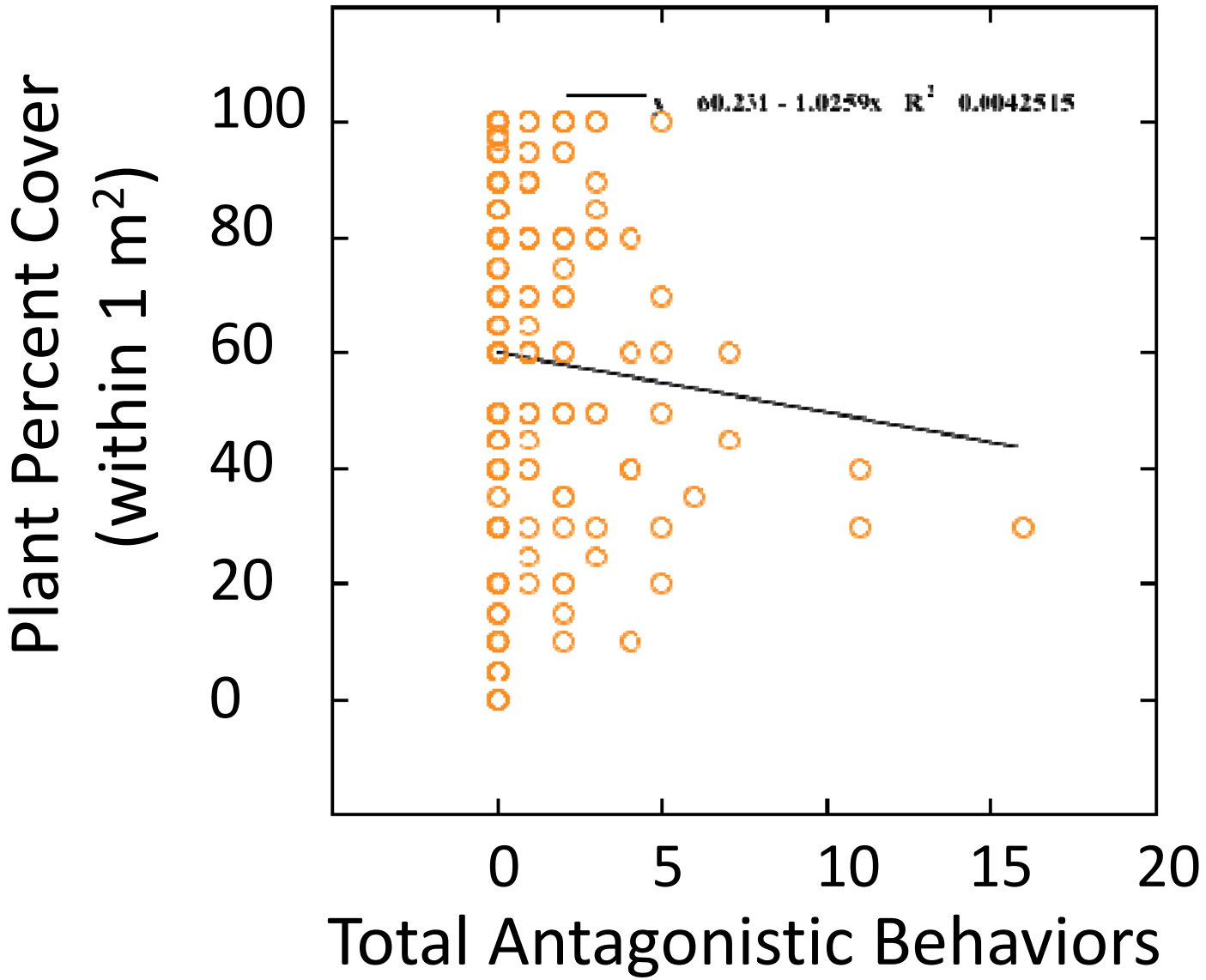

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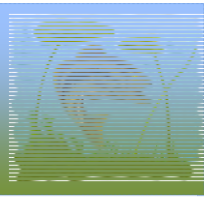

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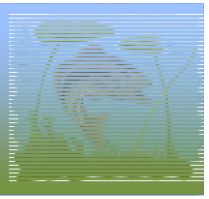

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Fishing	Monitor Fishing, Experiment	

Questions

From eggs through their first summer of life….

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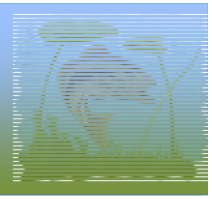

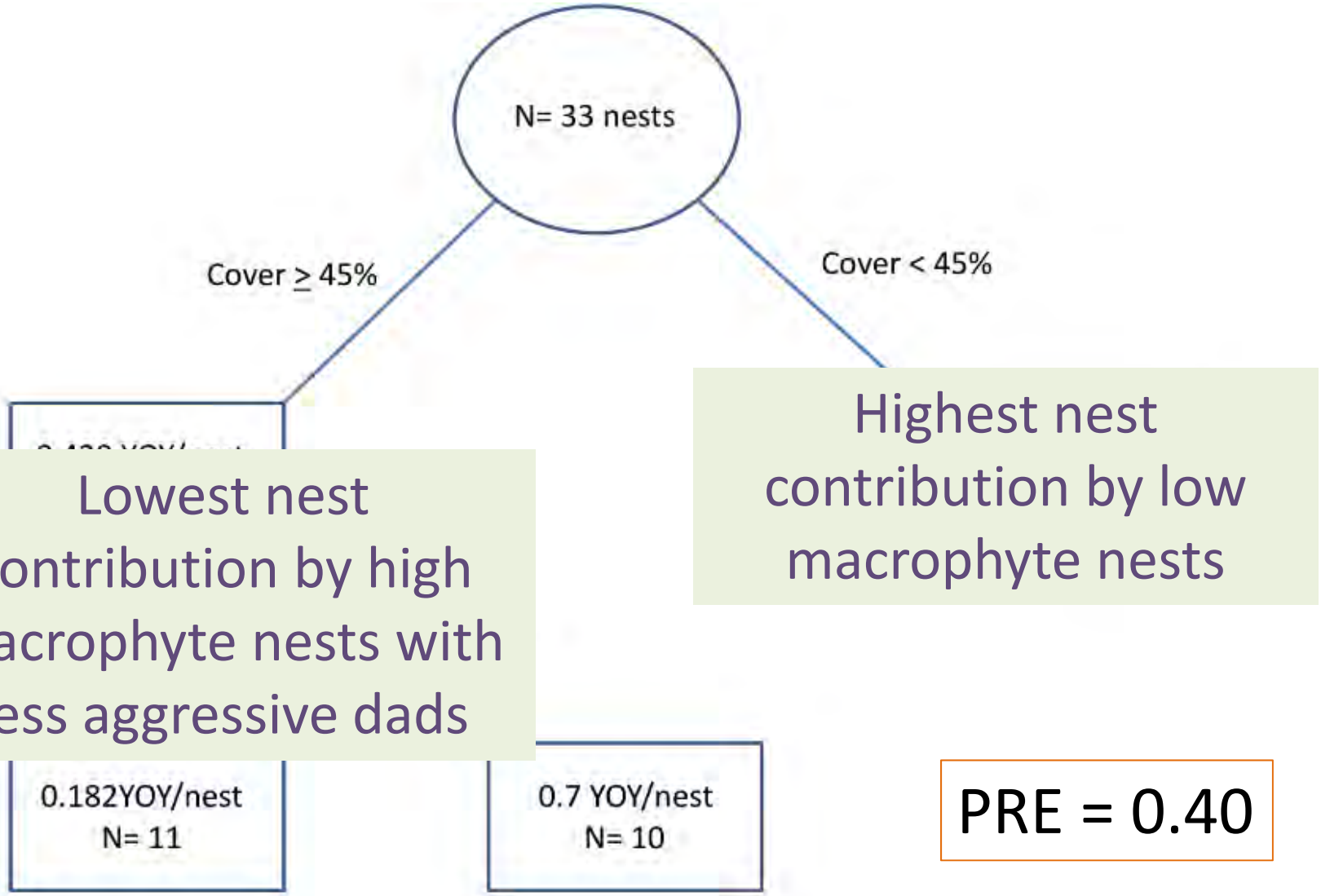

Lowest nest contribution by high macrophyte nests with less aggressive dads

Highest nest contribution by low macrophyte nests

PRE = 0.40

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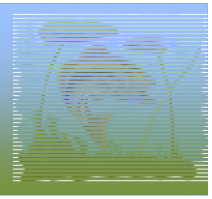
Asking 'Which nests contribute?'



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Fishing	Fishing Experiment	

Fishing Experiment

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Asking 'Which nests contribute?'

Fishing Experiment

- Nests assigned into treatments:
- Control, Treatment
- 4 lures, 3 casts each:

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Fishing Experiment Results

- 33 nests sampled Warner Lake 2010
- 98 YOY sampled via fyke netting, electrofishing
  - 34 assigned to nest
- Fished 9 nests
  - 5 bass captured
  - 4 bass not captured

- No nest predation observed
- Bass back to nest <5 min

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Asking 'Which nests contribute?'

Fishing Experiment Results

	Control	Not Caught	Caught	F	p
N	7	4	5	-	-
# of YOY	1.28 (0.57)	0.75 (0.48)	0.4 (0.4)	0.79	0.47

3X difference

Power ~ 0.20

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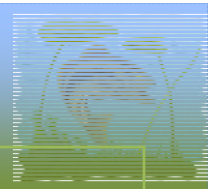
Asking 'Which nests contribute?'



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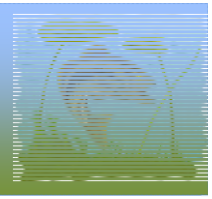
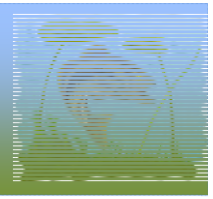
Fishing	Fishing Experiment	Trend: higher contribution by un-fished nests.

In Summary: How Many?



- Percent of adult males that build nests: ~10-20%
- Number of eggs per nest: varies ~10 fold
- Percent of nests producing fry: ranges 5-50%
- Number of fry per successful nest: varies >10 fold
- Contribution of individual nests to summer age-0: varies >10 fold

In Summary: Which ones contribute?



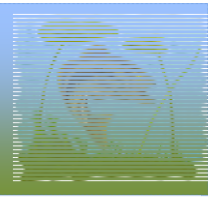
Development of genetic analysis:

- Will improve nest observation techniques
- Allows us to link nest of origin to individual survivors

Asking which nests contribute age-0 reveals:

- Important role of habitat and male behavior
- Trend toward negative effect of spring fishing

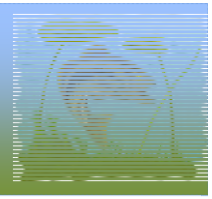
Future Directions



Simulation modeling:

- Predict effects of habitat, male behavior, fishing, and summer dynamics on individual nest contribution
- Ask questions about potential genetic effects of fishing on bass populations
- Continue to inform Fisheries Division decisions about sport fishing regulations

Acknowledgements



Michigan State University, Department of Fisheries and Wildlife, Ball Fellowship

Fisheries Division, Michigan Department of Natural Resources

Center for Water Sciences, Michigan State University