Black Rockfish maturity influenced by marine heat waves

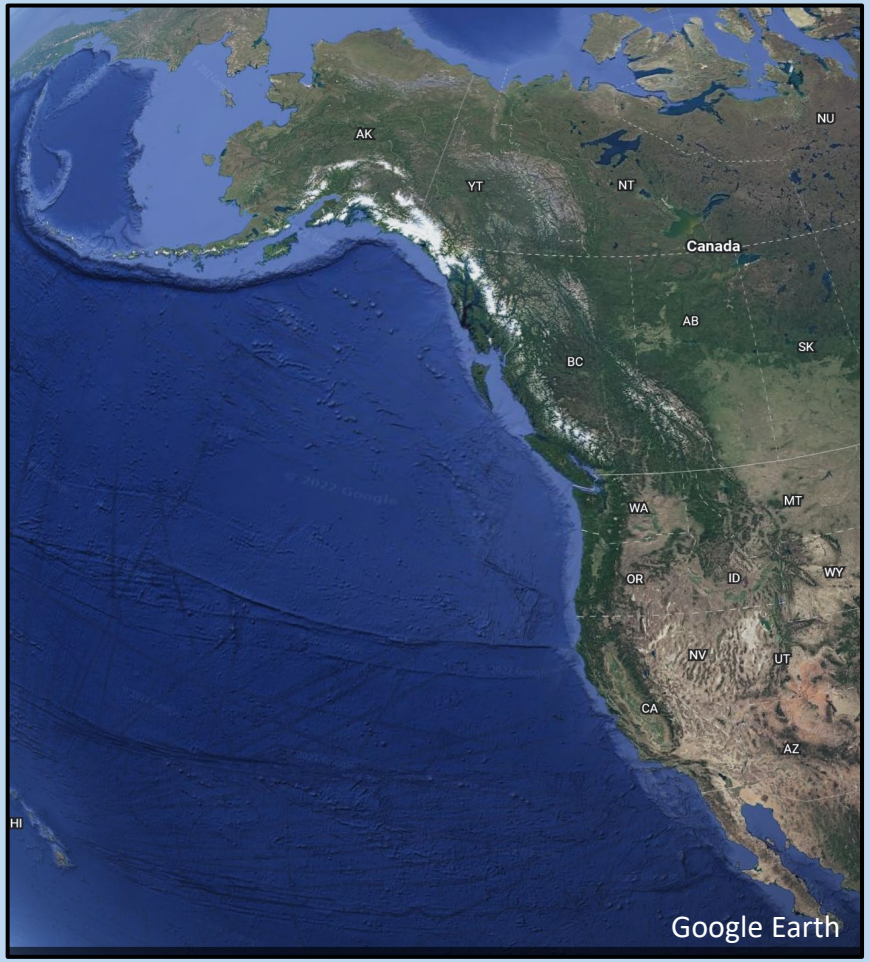
Claire Rosemond, Melissa Head, and Scott Heppell

Fisheries in a Changing World
Western Groundfish Conference
April 2023

Black Rockfish (*Sebastes melanops*)

Dynamic ecosystems

Distribution



Marine heat waves

prolonged periods of warmer than normal sea surface temperature

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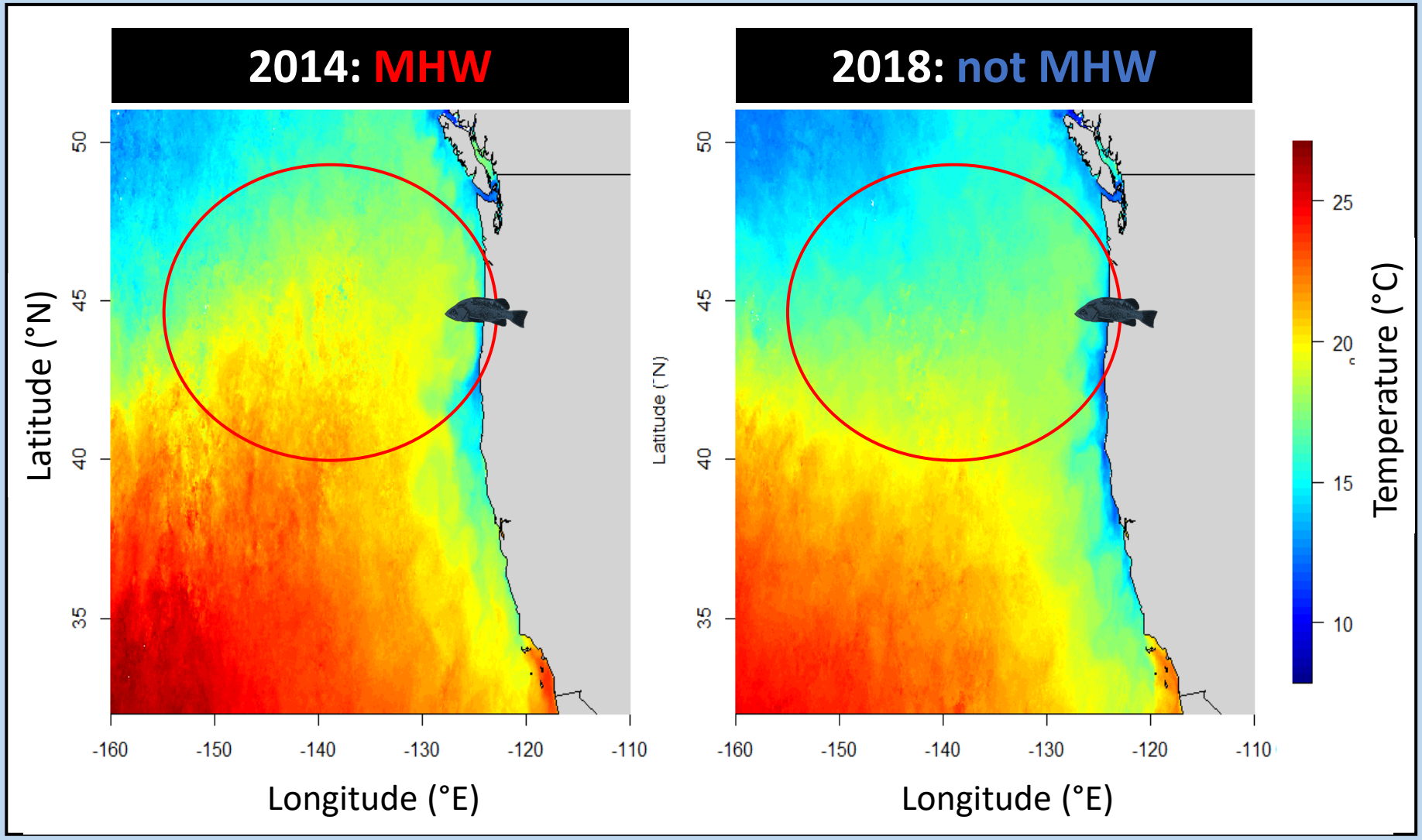
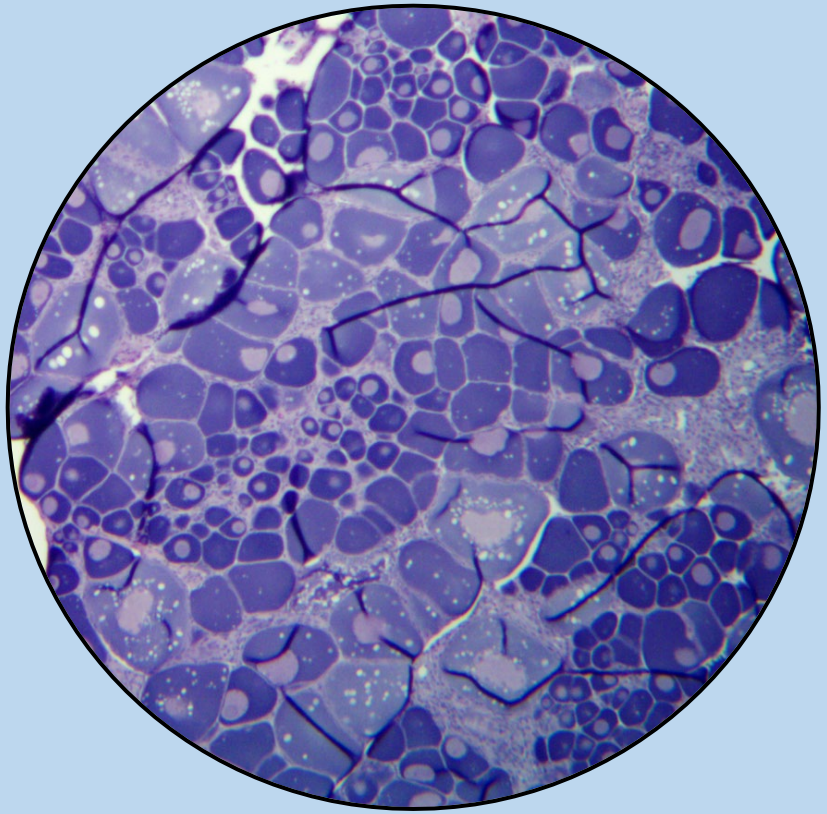


Research questions

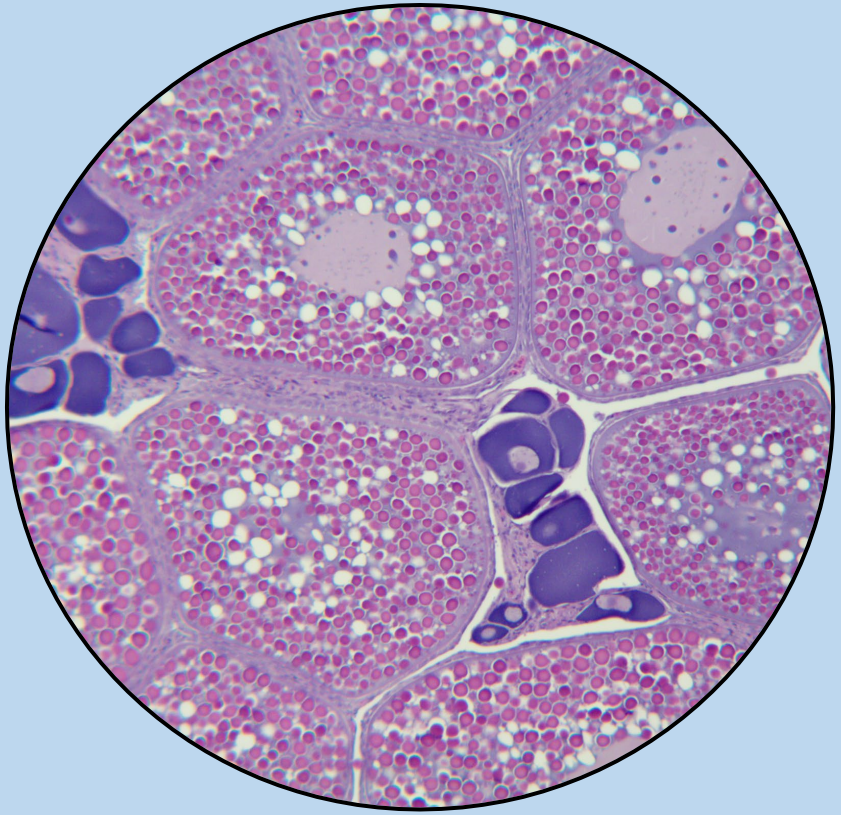
1. How do environmental conditions influence reproductive development?

2. How can we incorporate changes in reproductive potential in the stock assessment process?

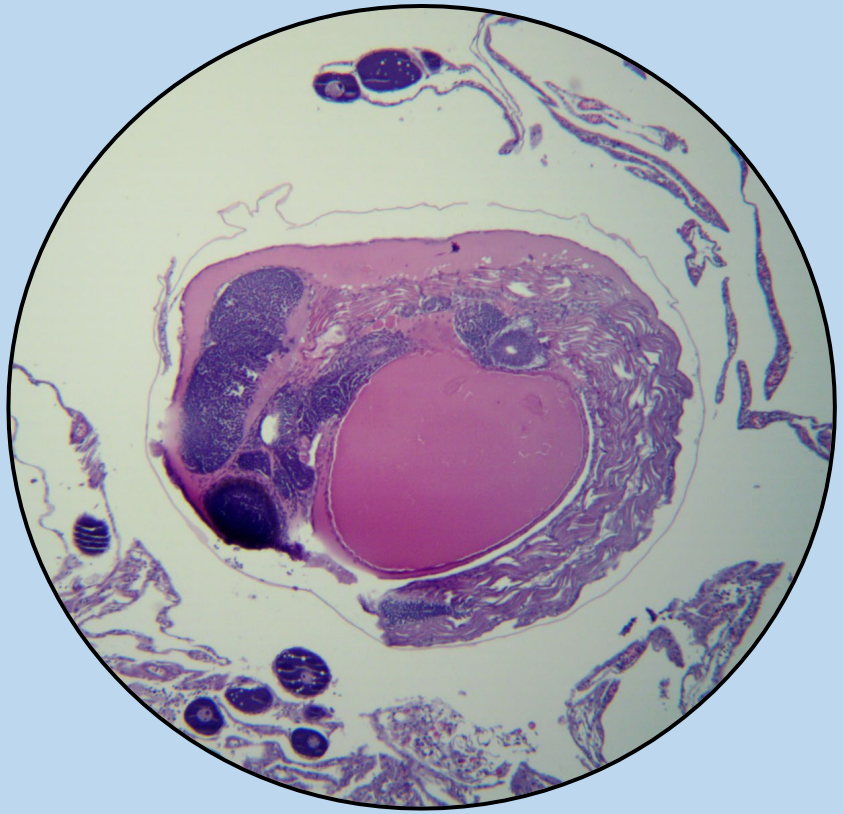
Reproductive strategy



high fecundity



maternal investment

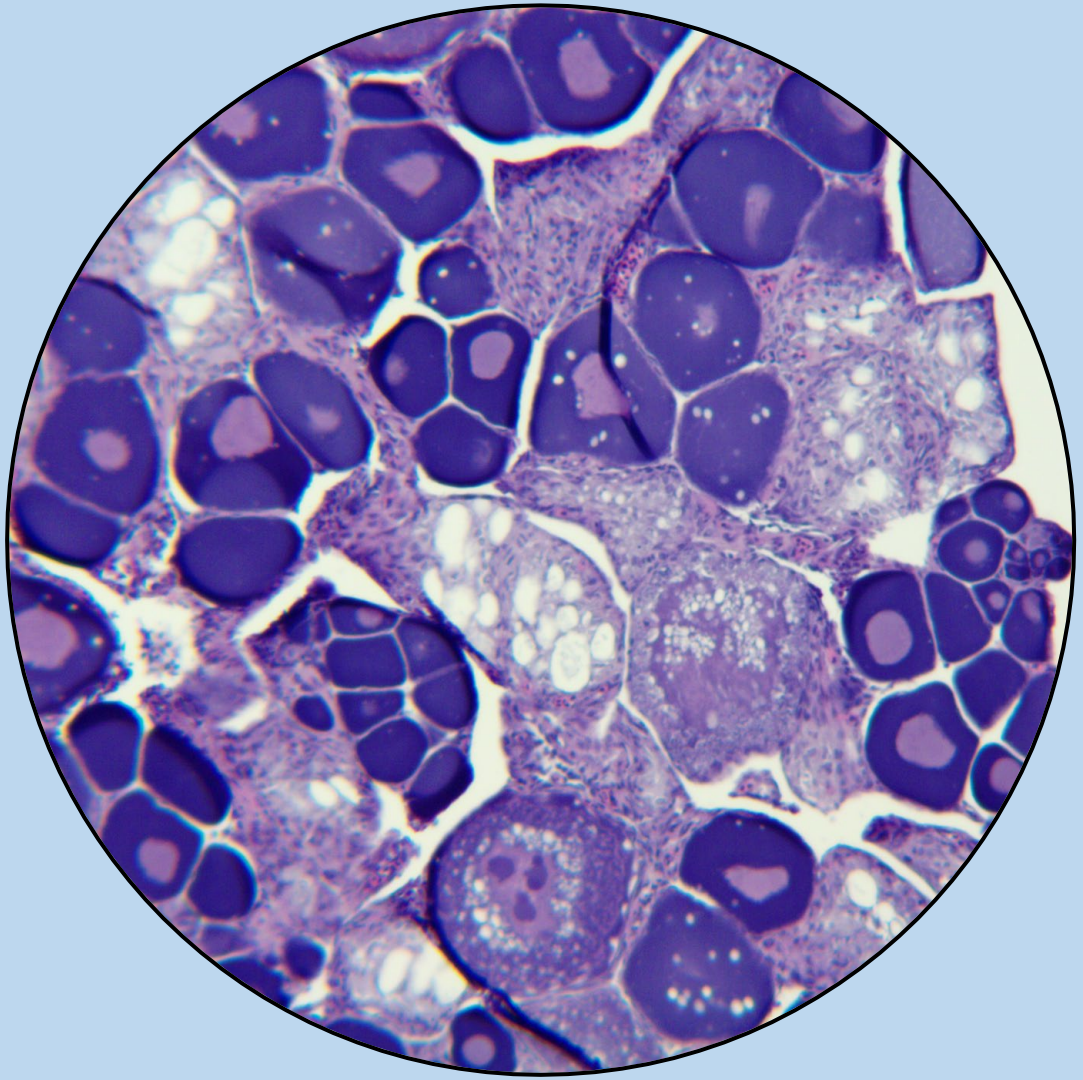


viviparous

Reproductive strategy

Atresia

oocyte (future egg) fails to develop



Reproductive strategy

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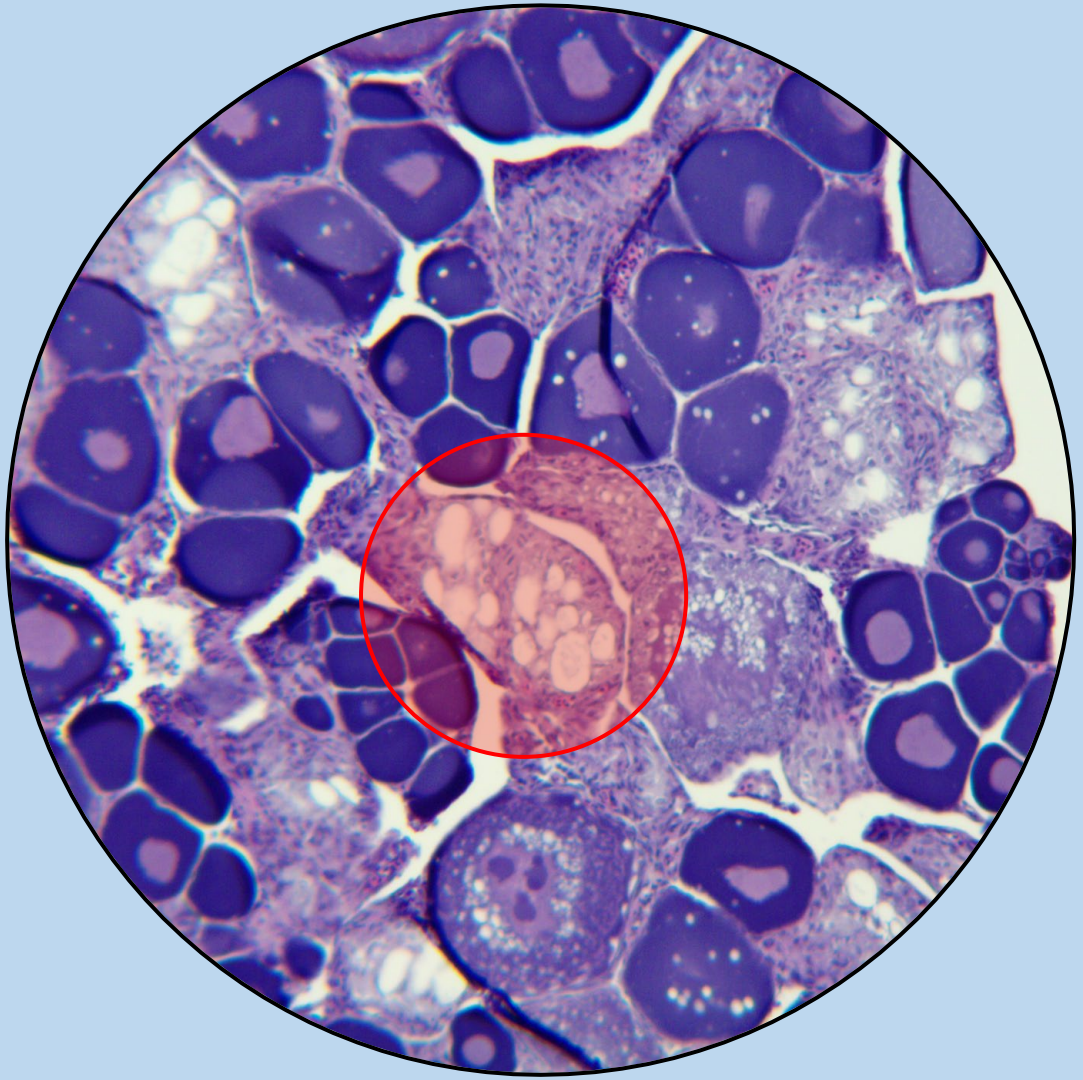


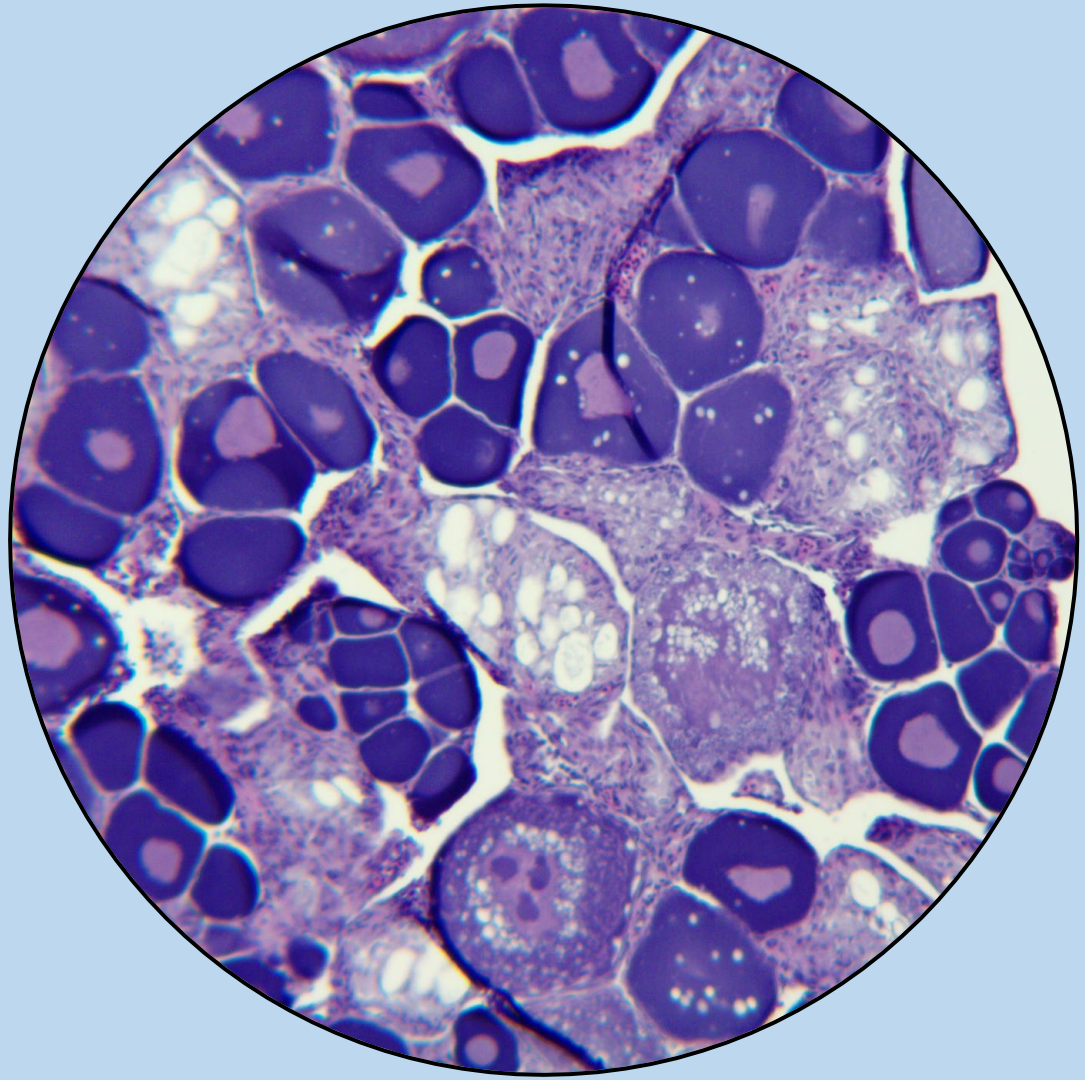
Reproductive strategy

Atresia

oocyte (future egg) fails to develop

Abortive maturation

ramp up development, but reabsorb developing oocytes



Reproductive strategy

Atresia

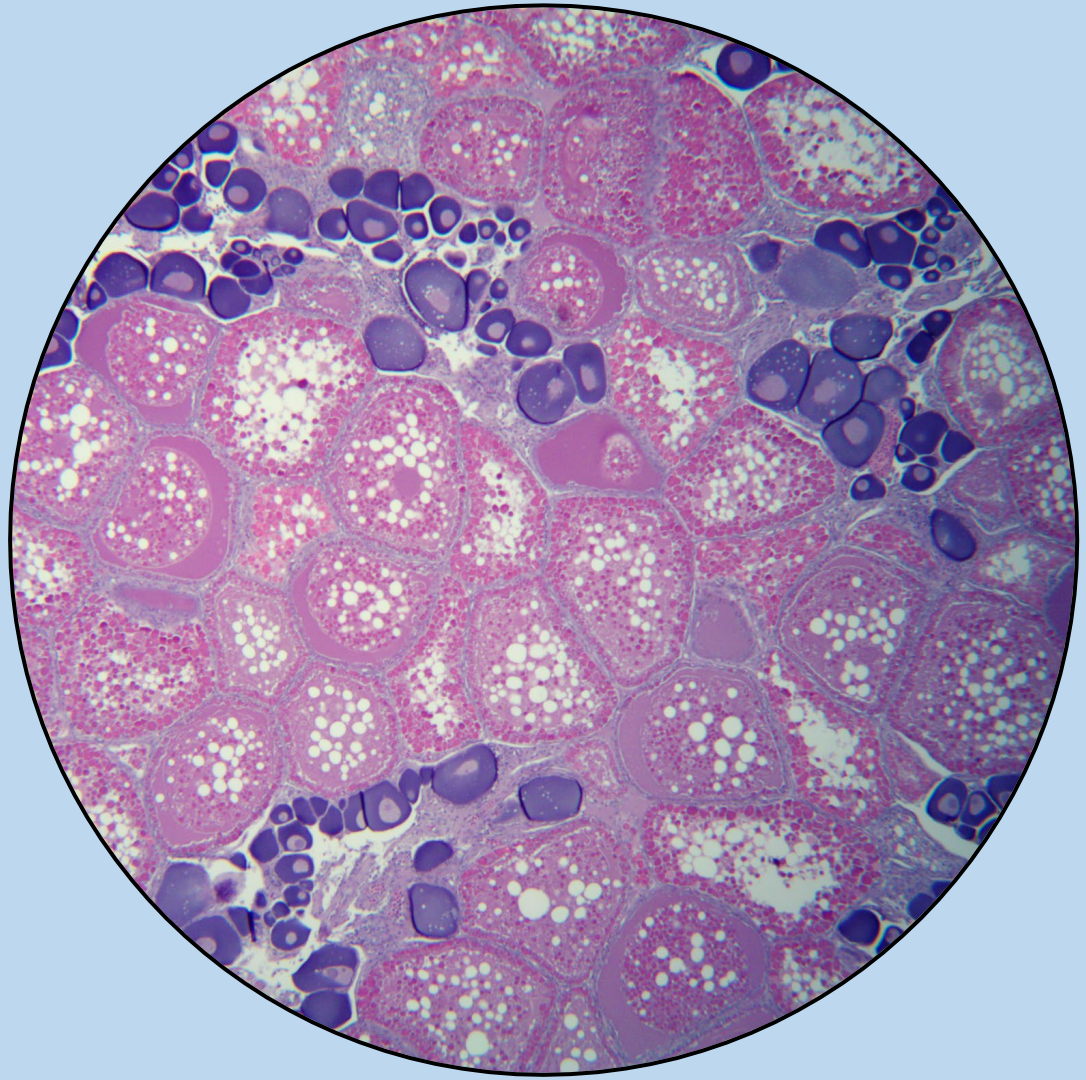
oocyte (future egg) fails to develop

Abortive maturation

ramp up development, but reabsorb developing oocytes

Skipped spawning

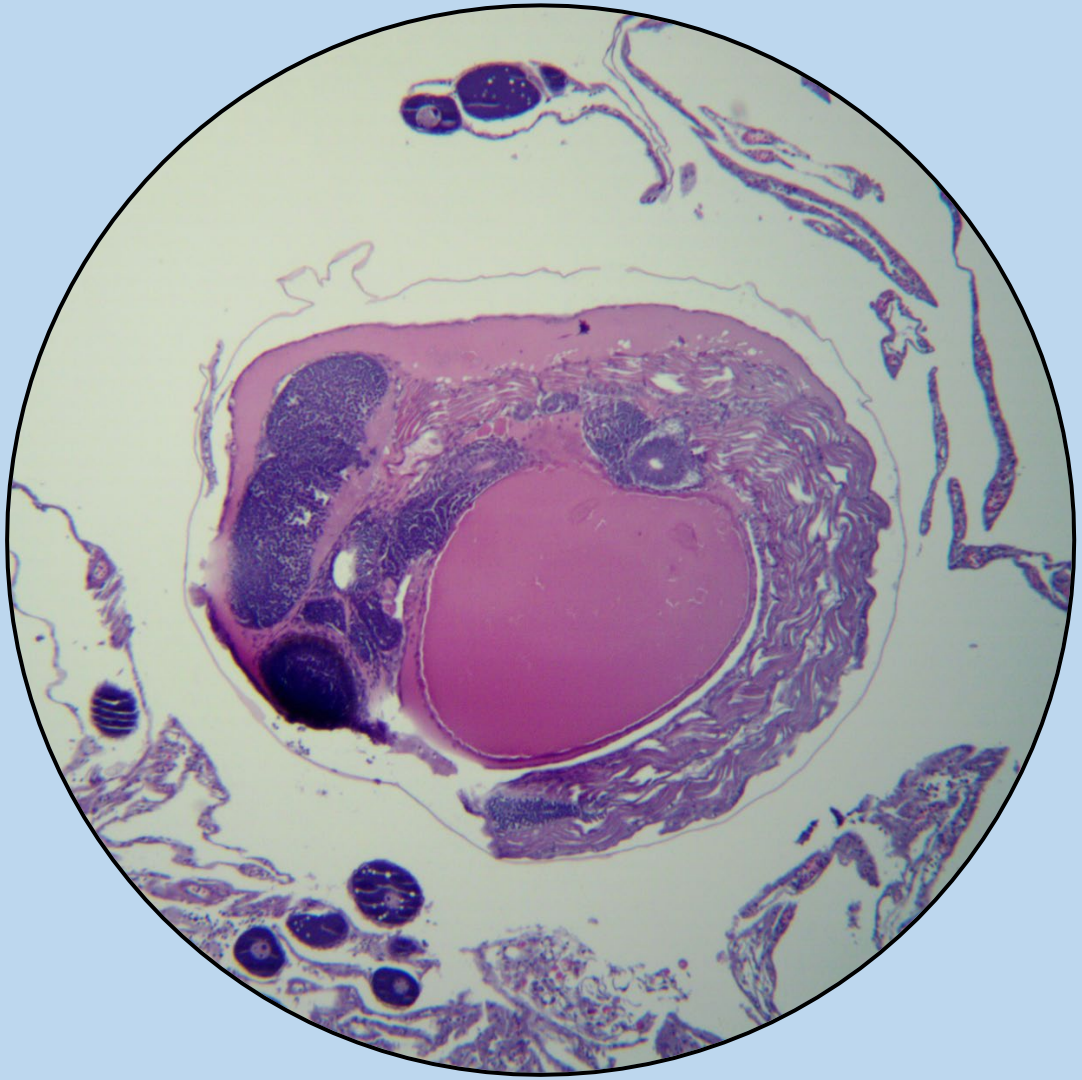
mature fish forgo spawning



Maturity schedule

L50

length at which 50% of females in a population reach maturity



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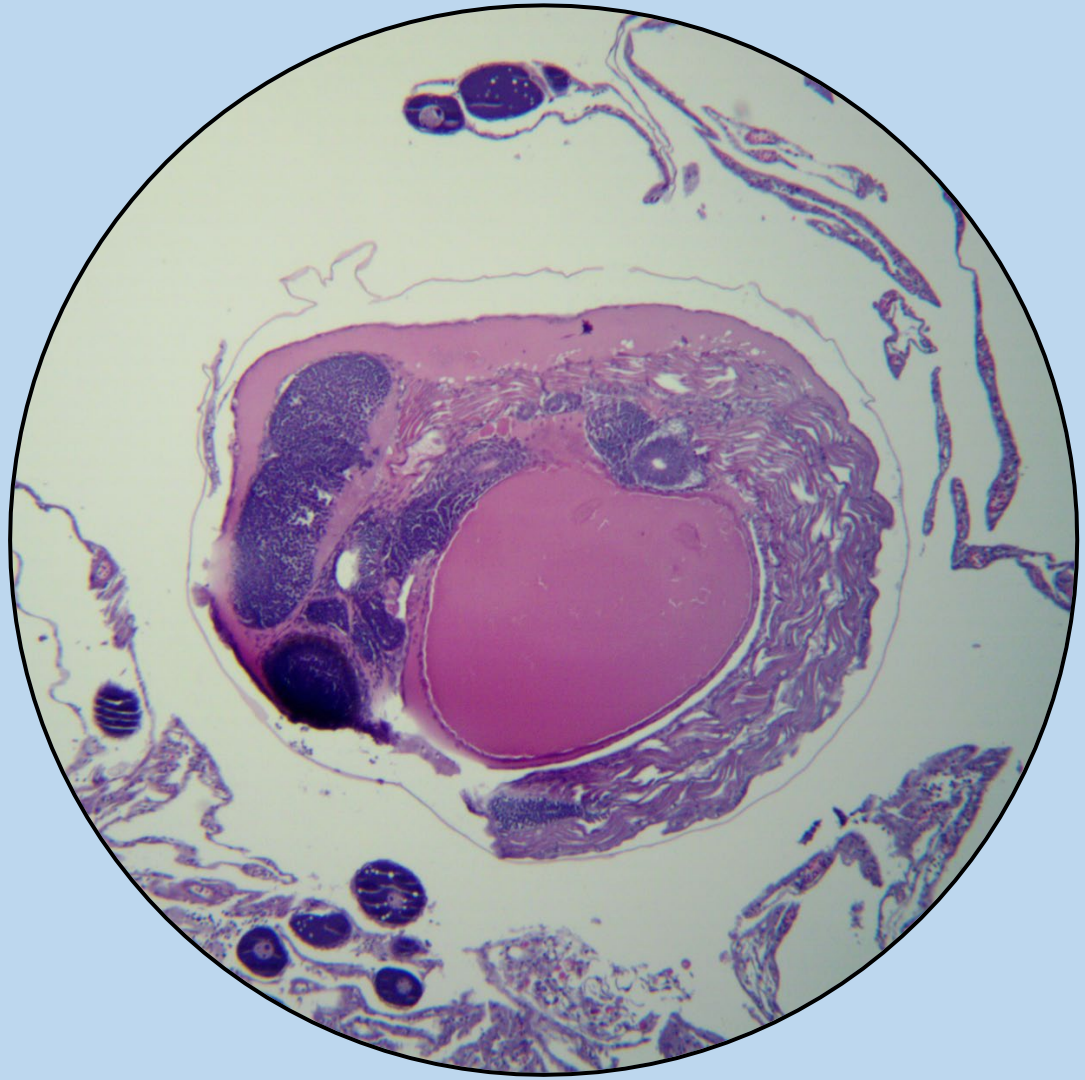
Biological maturity

energy shifts to reproductive development



Maturity schedule

L50

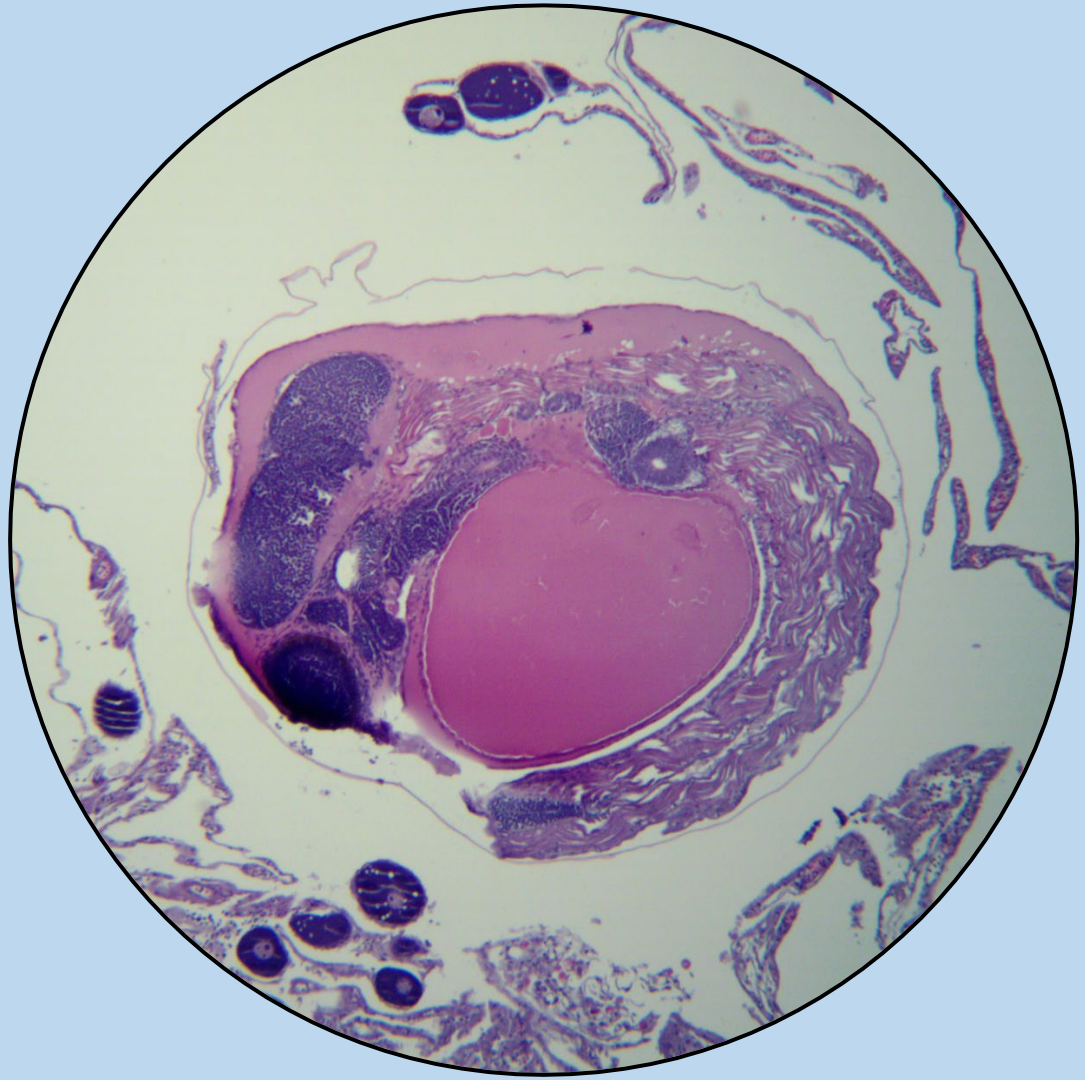
length at which 50% of females in a population reach maturity

Biological maturity

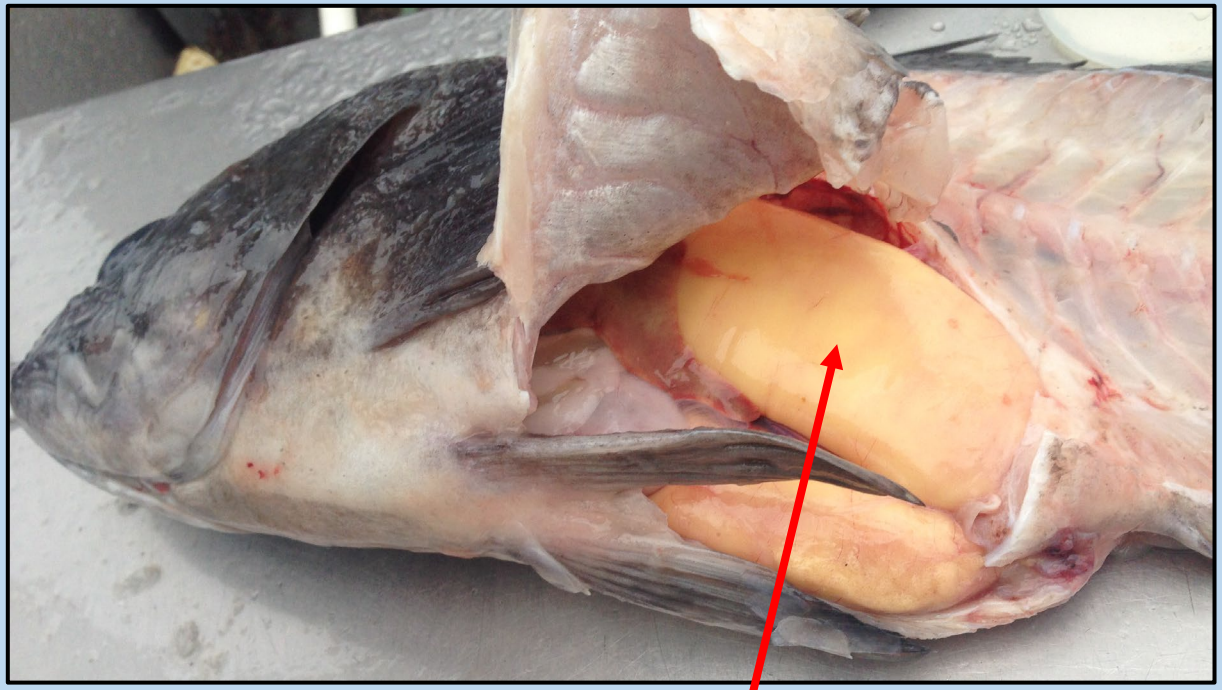
energy shifts to reproductive development

Functional maturity

takes into account abortive maturation and skipped spawning



Maturity sampling

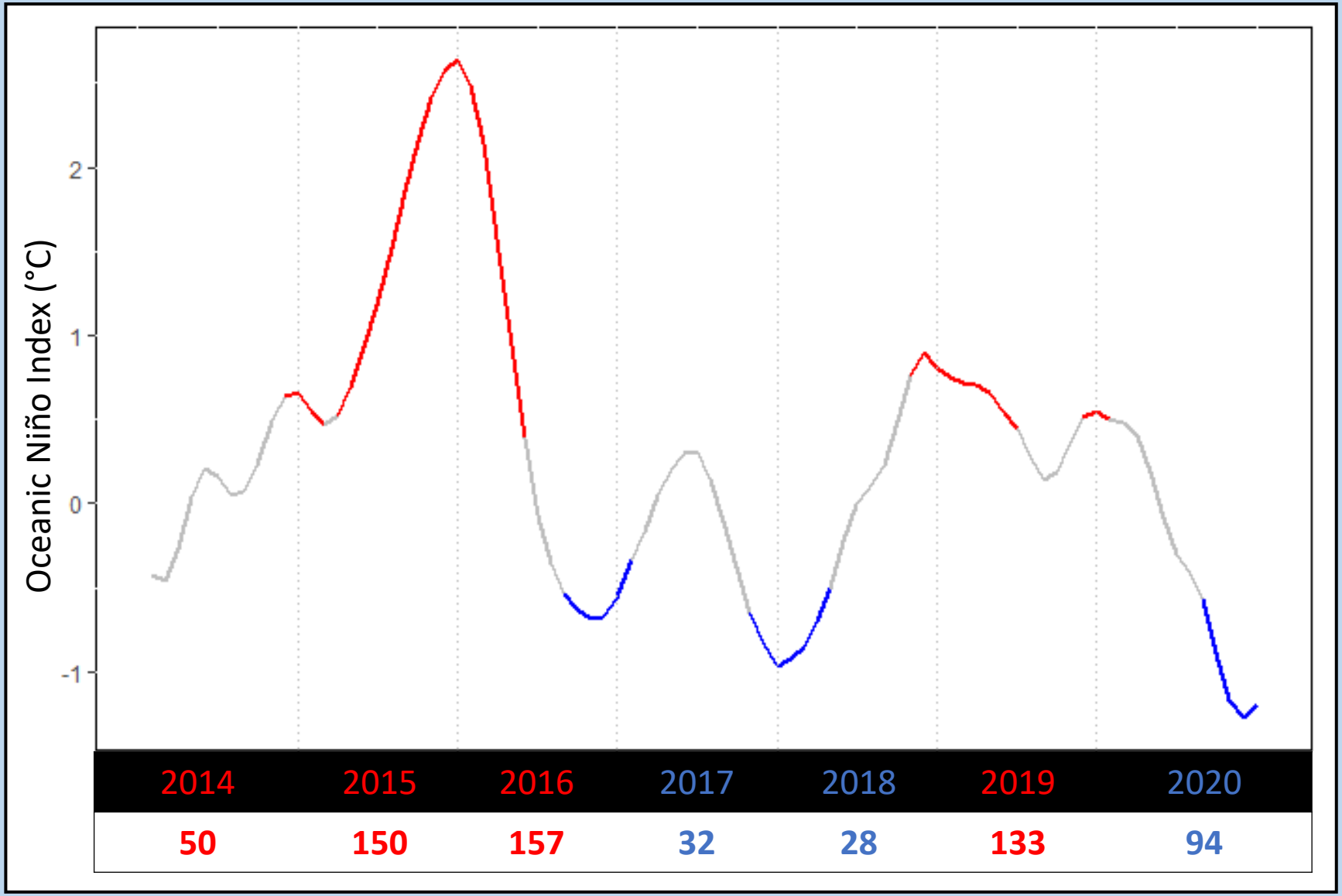


Ovary

644 samples

Maturity sampling

Maturity sampling



Maturity analysis

Goal: Estimate *L50* (biological) and *L50* (functional)

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Data: Immature (0), mature (1), and atresia

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Models: Standard logistic regression and flexible spline model

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Goal: Estimate *L50* (biological) and *L50* (functional)

Data: Immature (0), mature (1), and atresia

Models: Standard logistic regression and flexible spline model

Goal: Compare *L50* estimates in marine heat wave years and non-marine heat wave years

Results: Length at maturity

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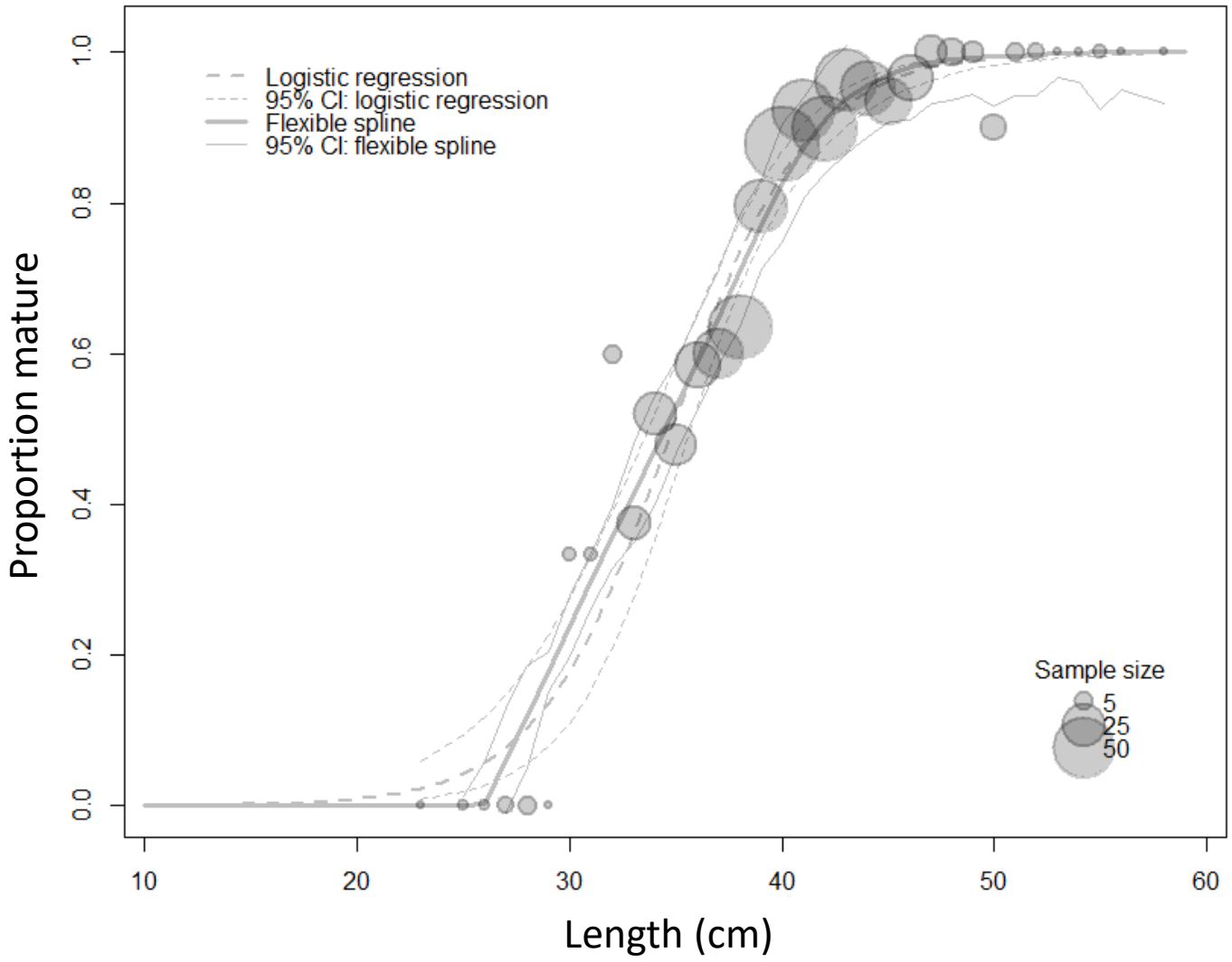
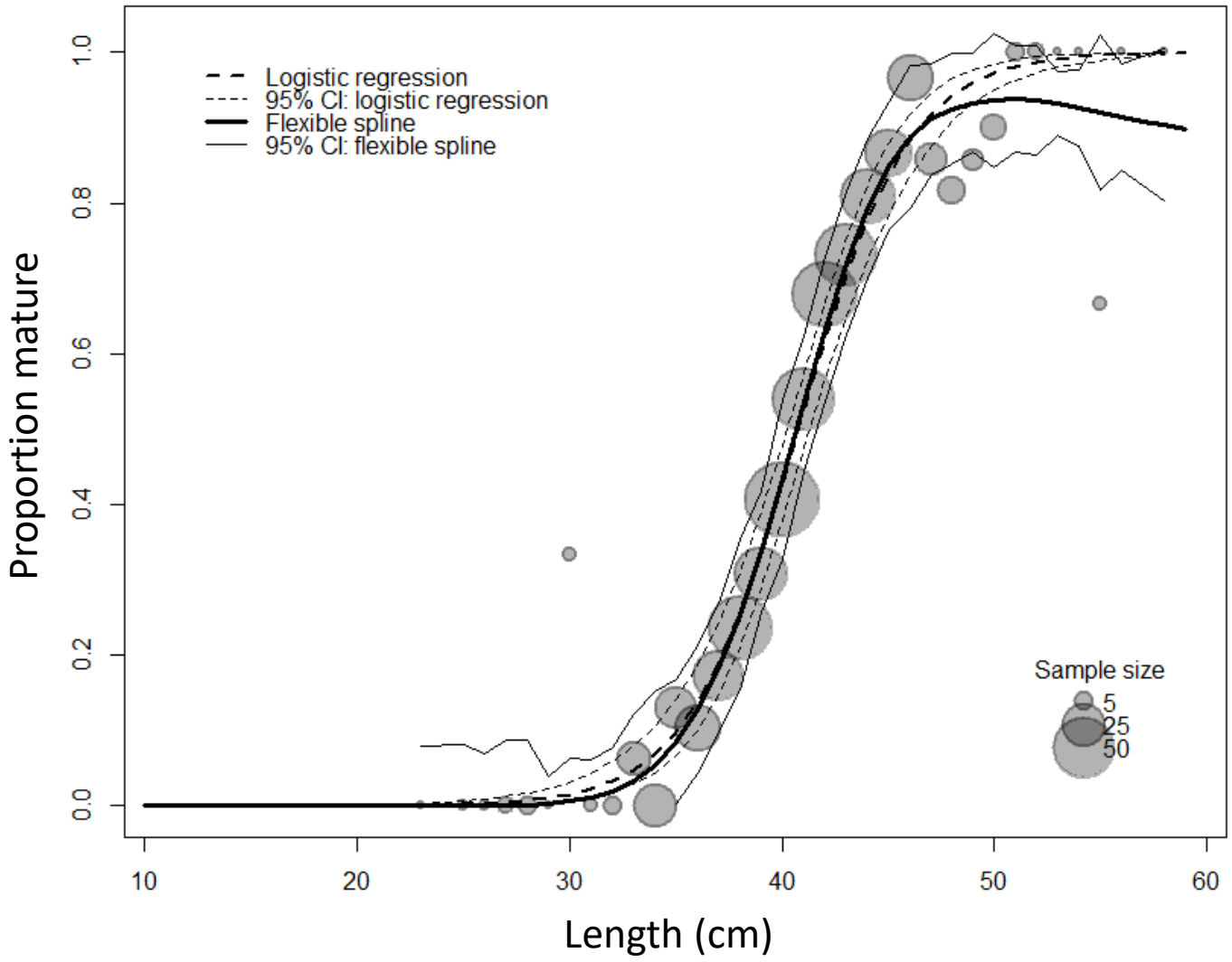
Biological maturity



L50 = 34.8 ± 0.5 cm

Results: Length at maturity

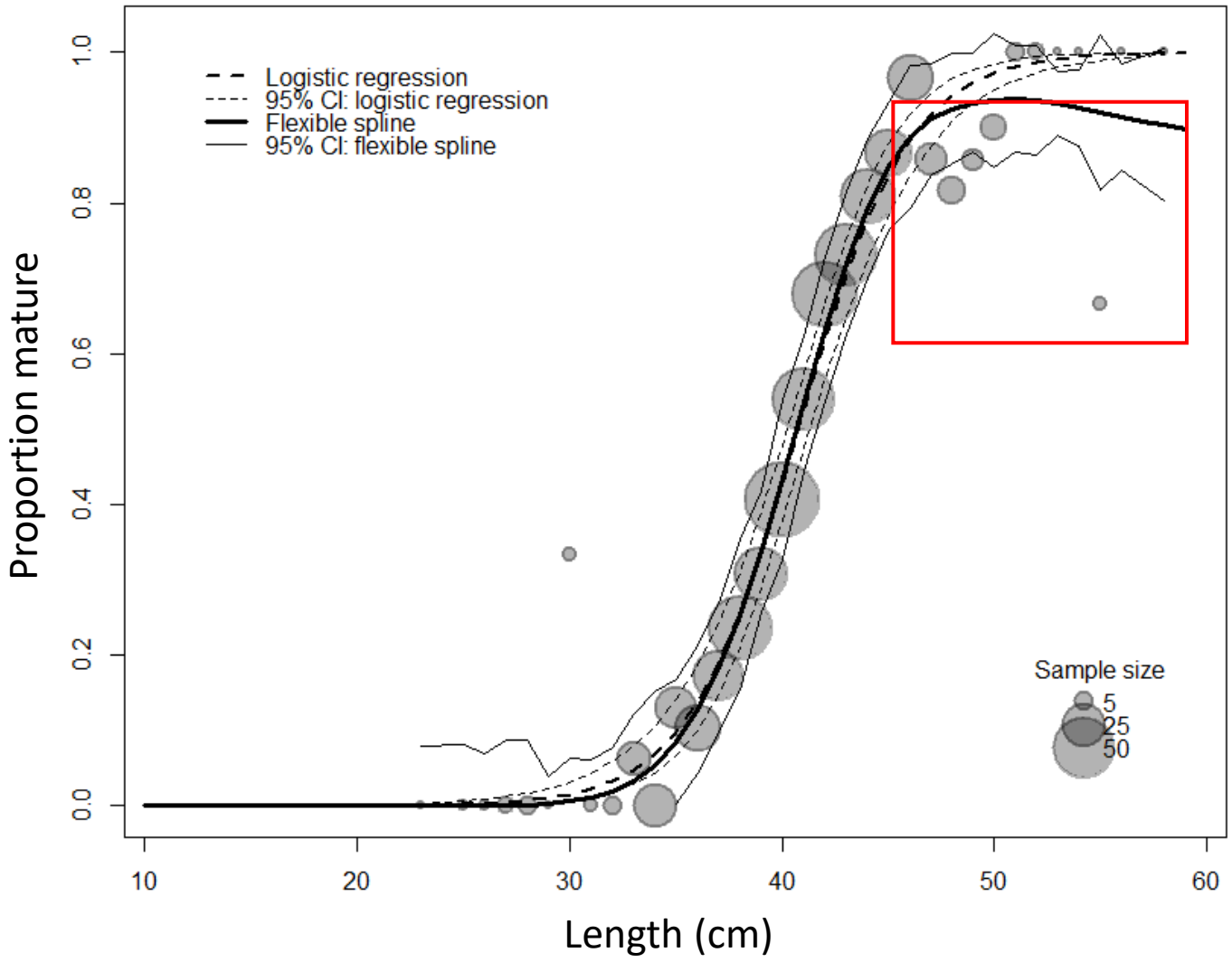
Functional maturity



L50 = 40.7 ± 0.5 cm

Results: Length at maturity

Functional maturity



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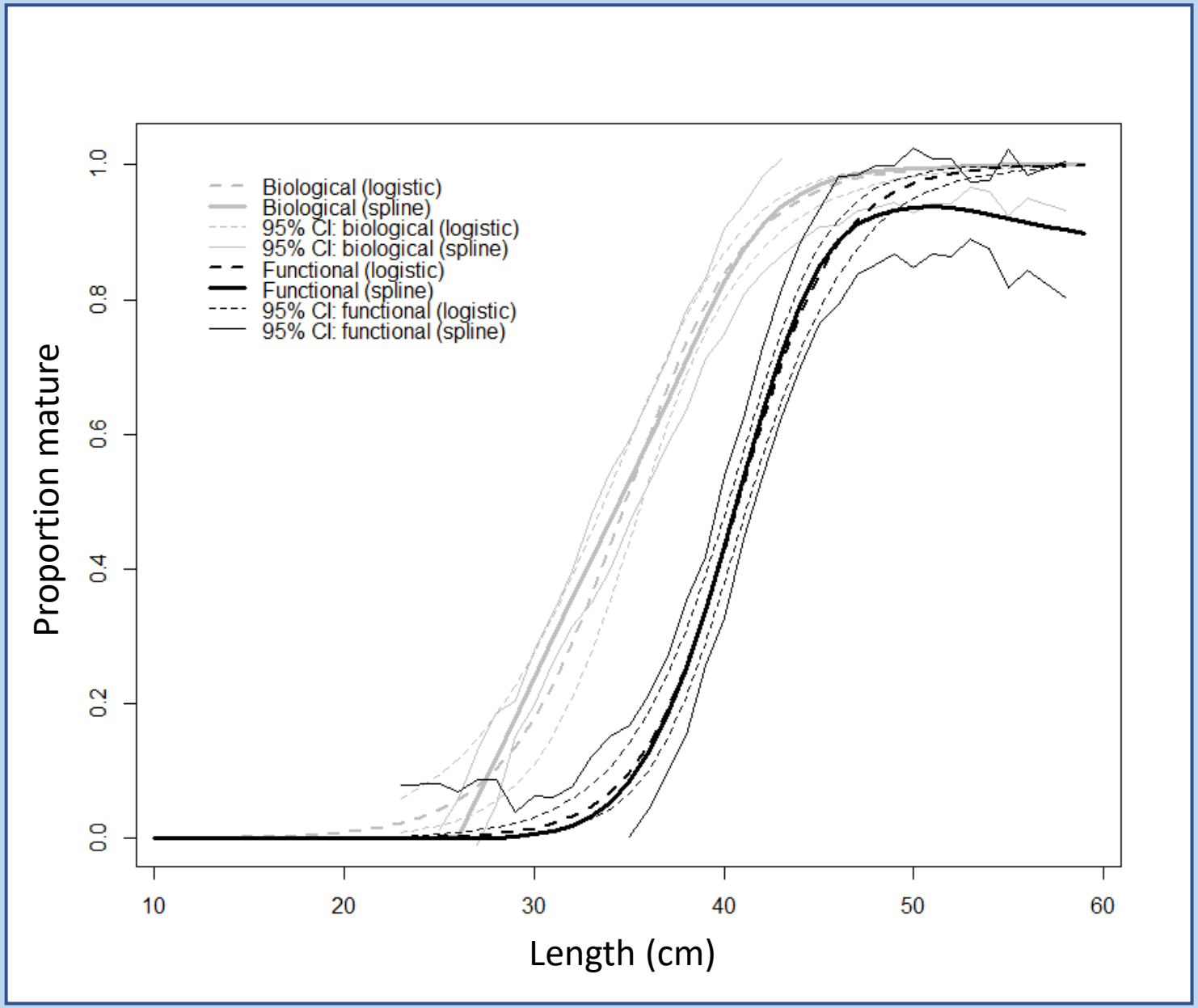

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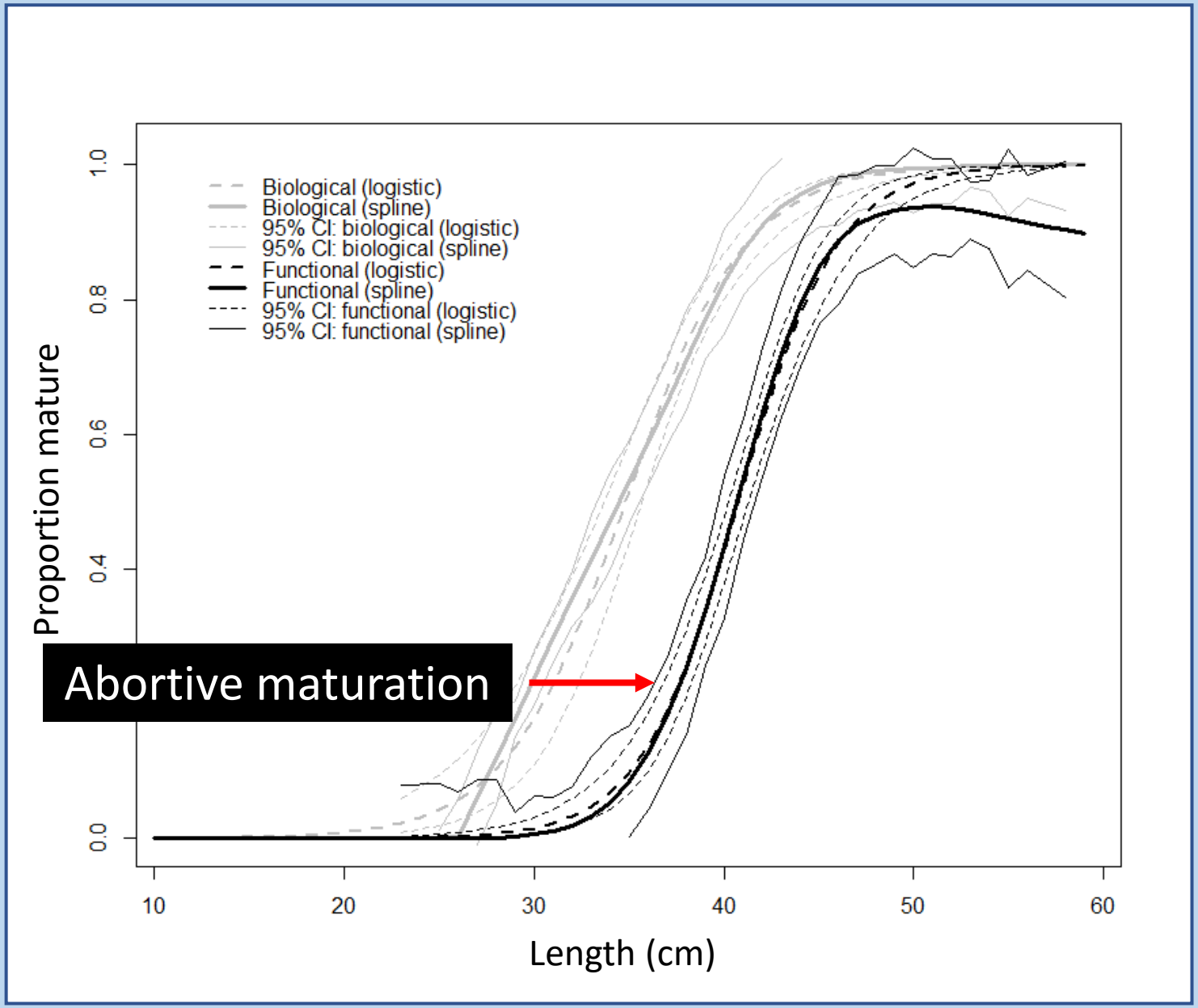

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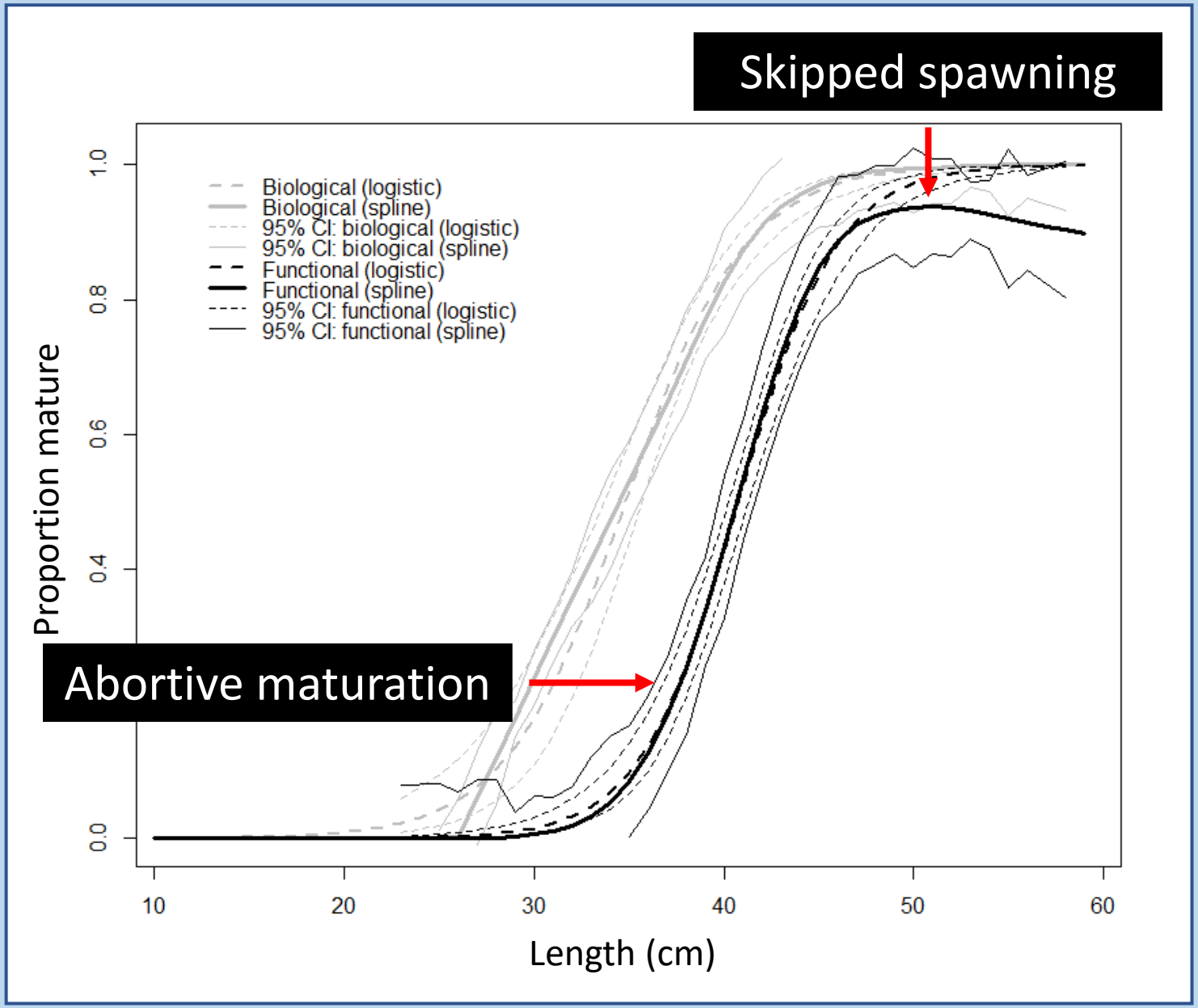

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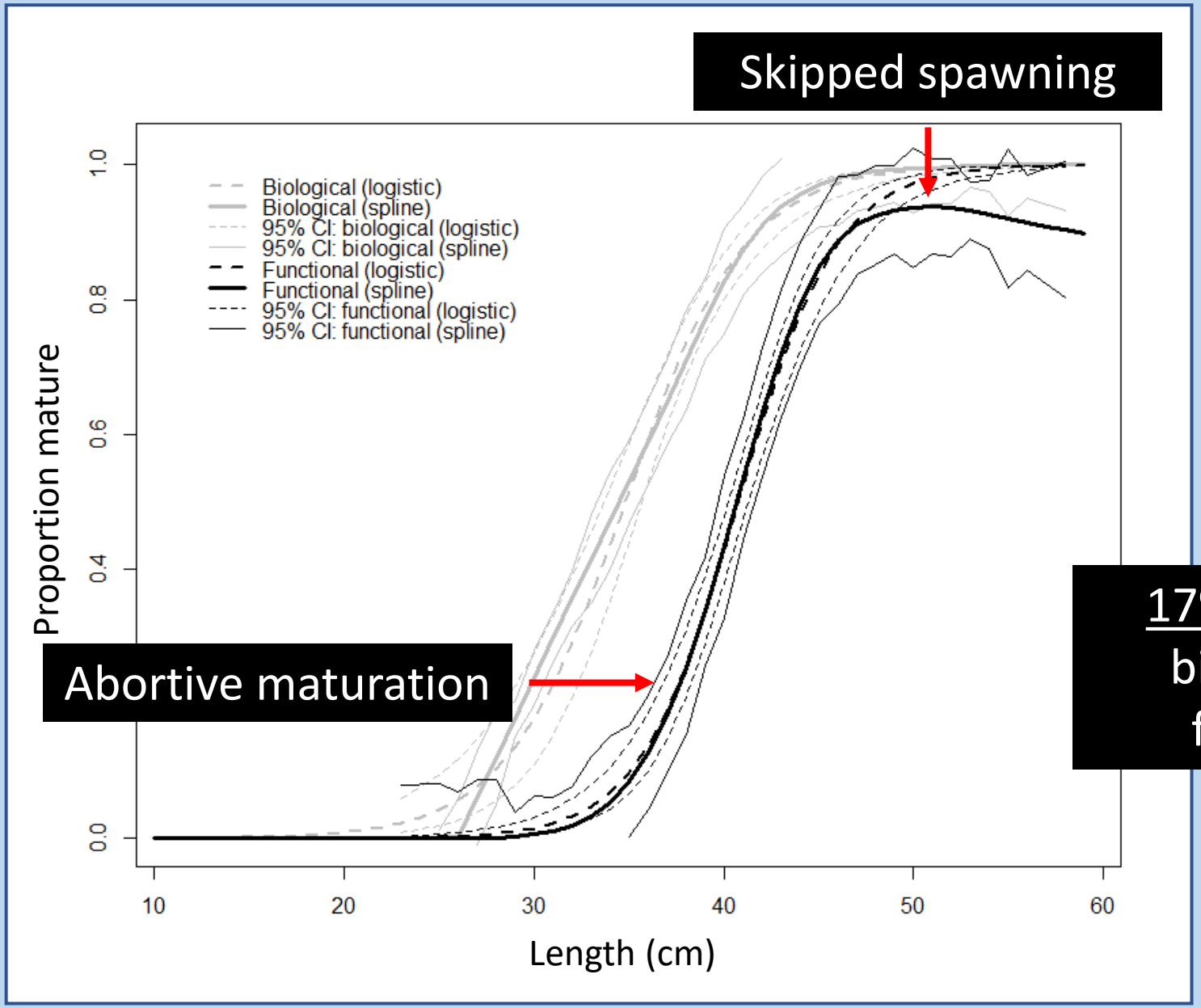

17% increase from biological *L50* to functional *L50*

Results: Marine heat wave impacts

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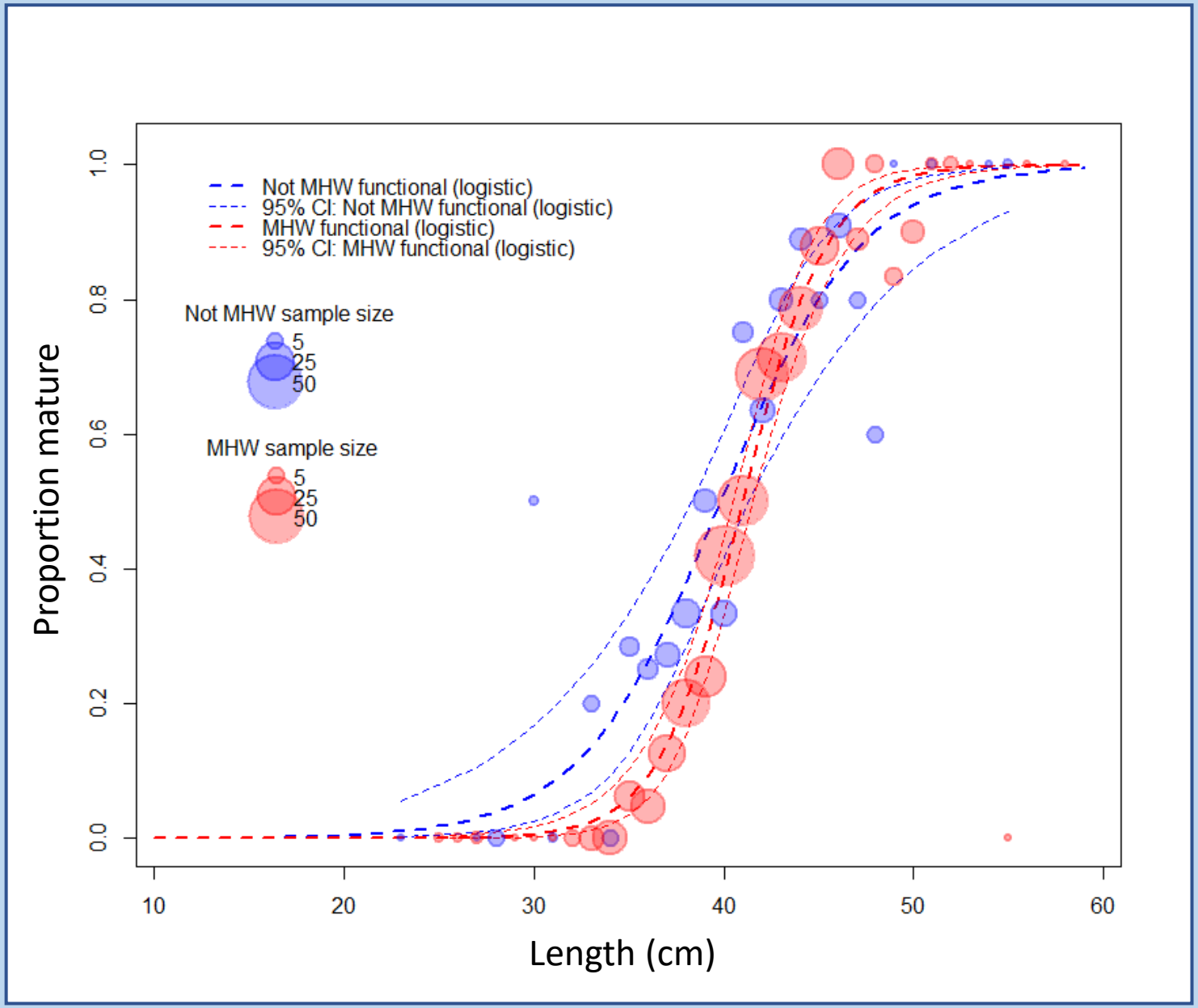
	not MHW	MHW
Abortive maturation	50%	
Skipped spawning	25%	
L50 (functional)	39.8 ± 2.0 cm	

Results: Marine heat wave impacts

	not MHW	MHW
Abortive maturation	50%	70%
Skipped spawning	25%	20%
L50 (functional)	39.8 ± 2.0 cm	41.0 ± 0.6 cm

Results: Marine heat wave impacts



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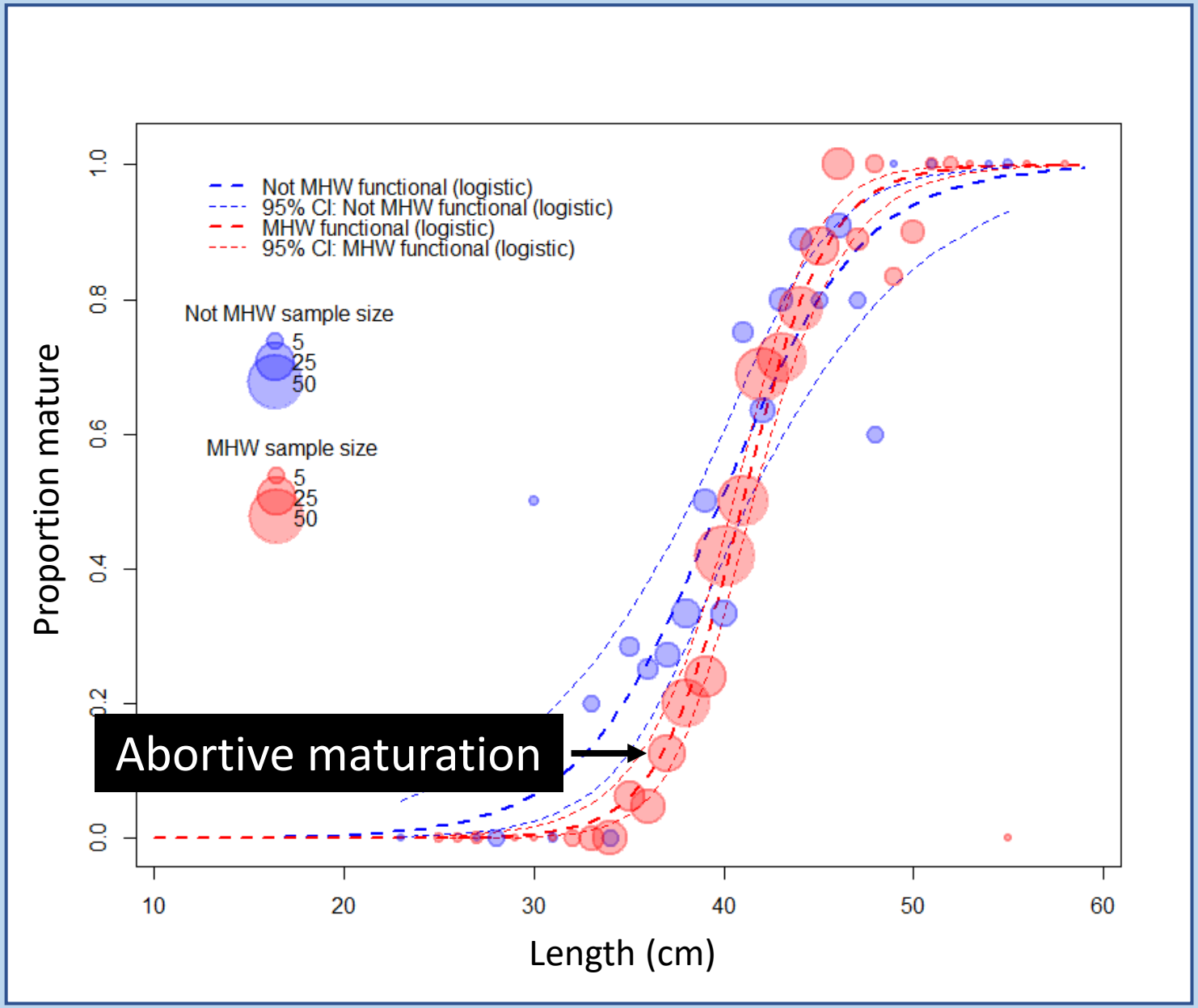

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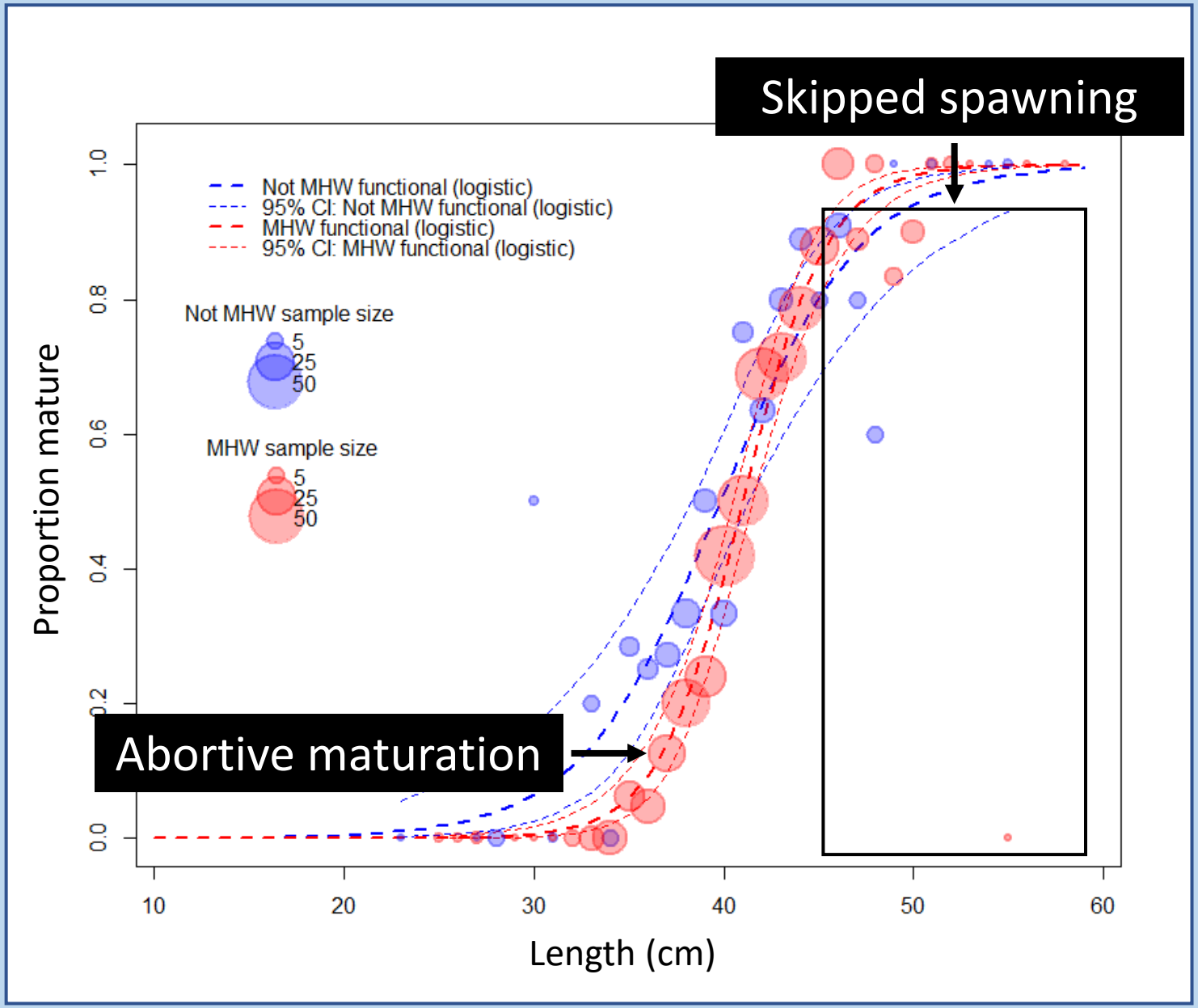

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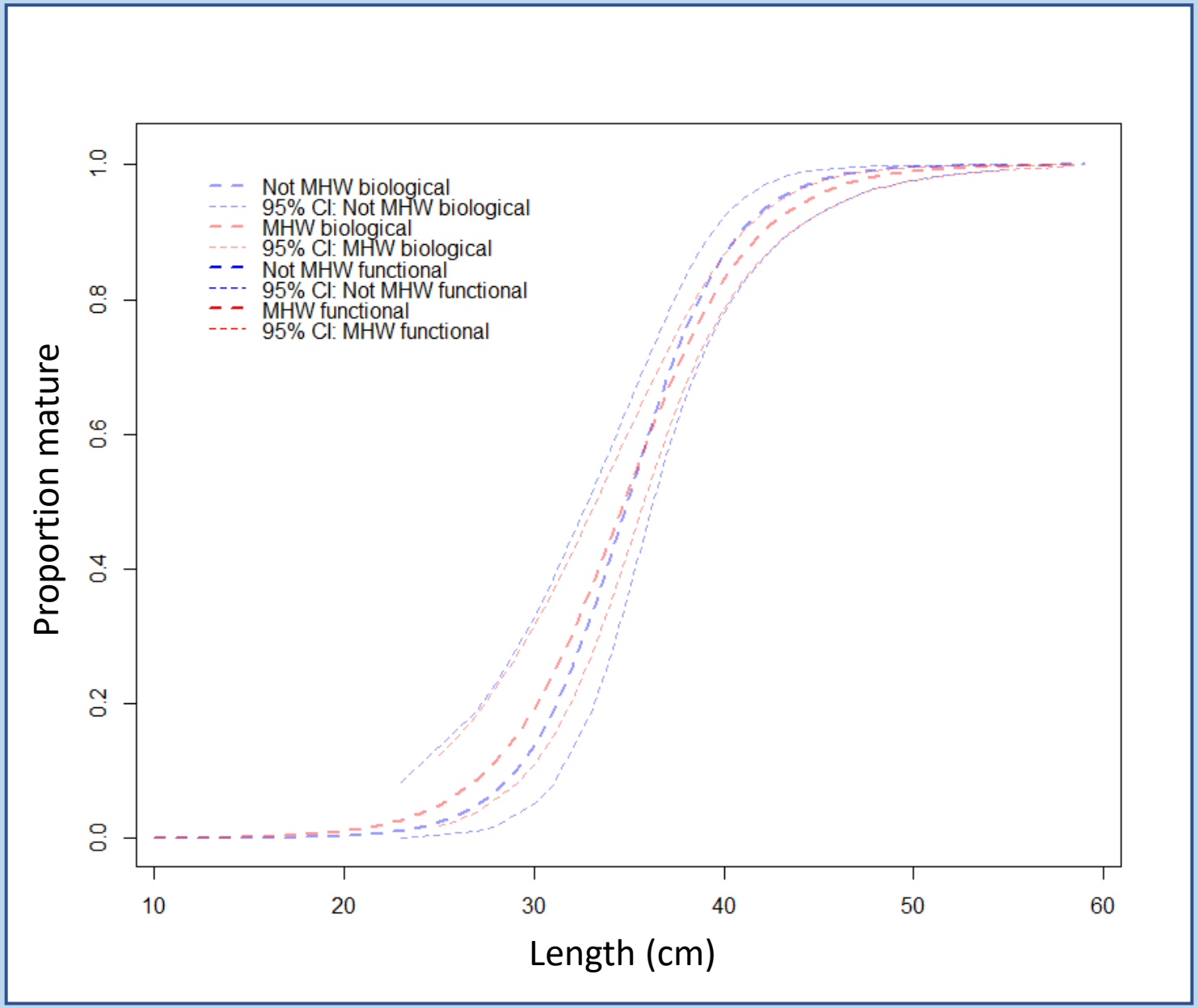

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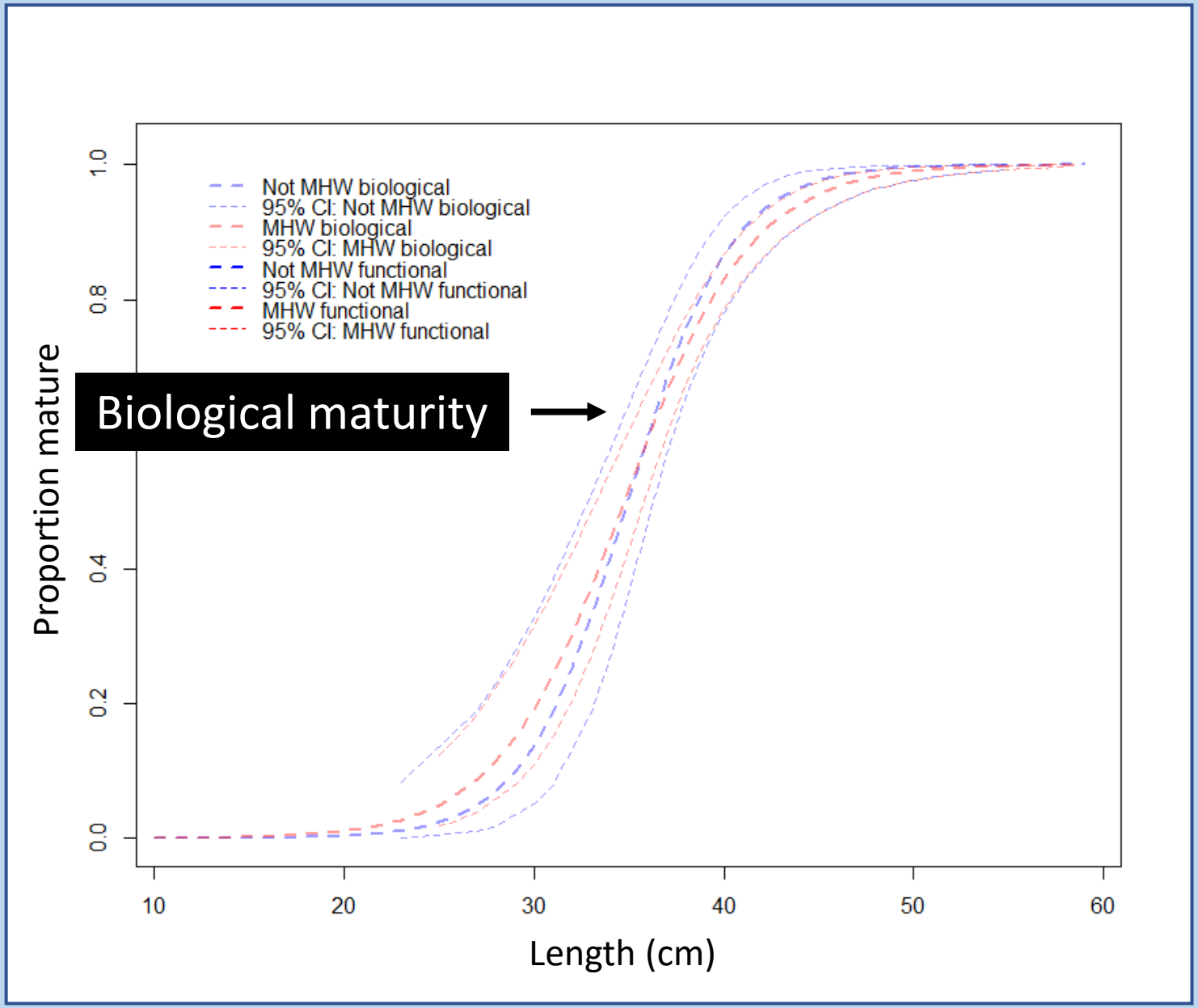

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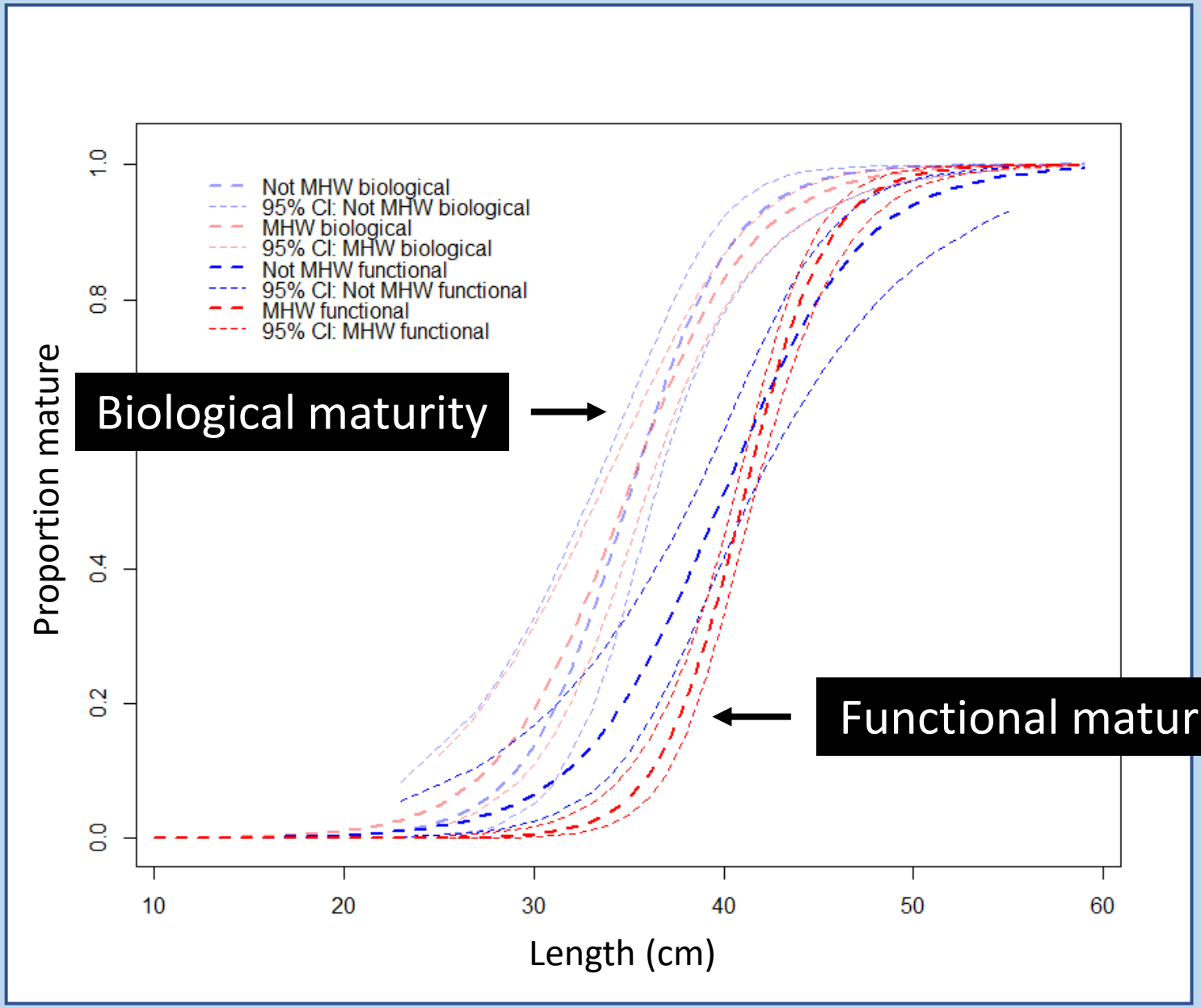

Results: Marine heat wave impacts

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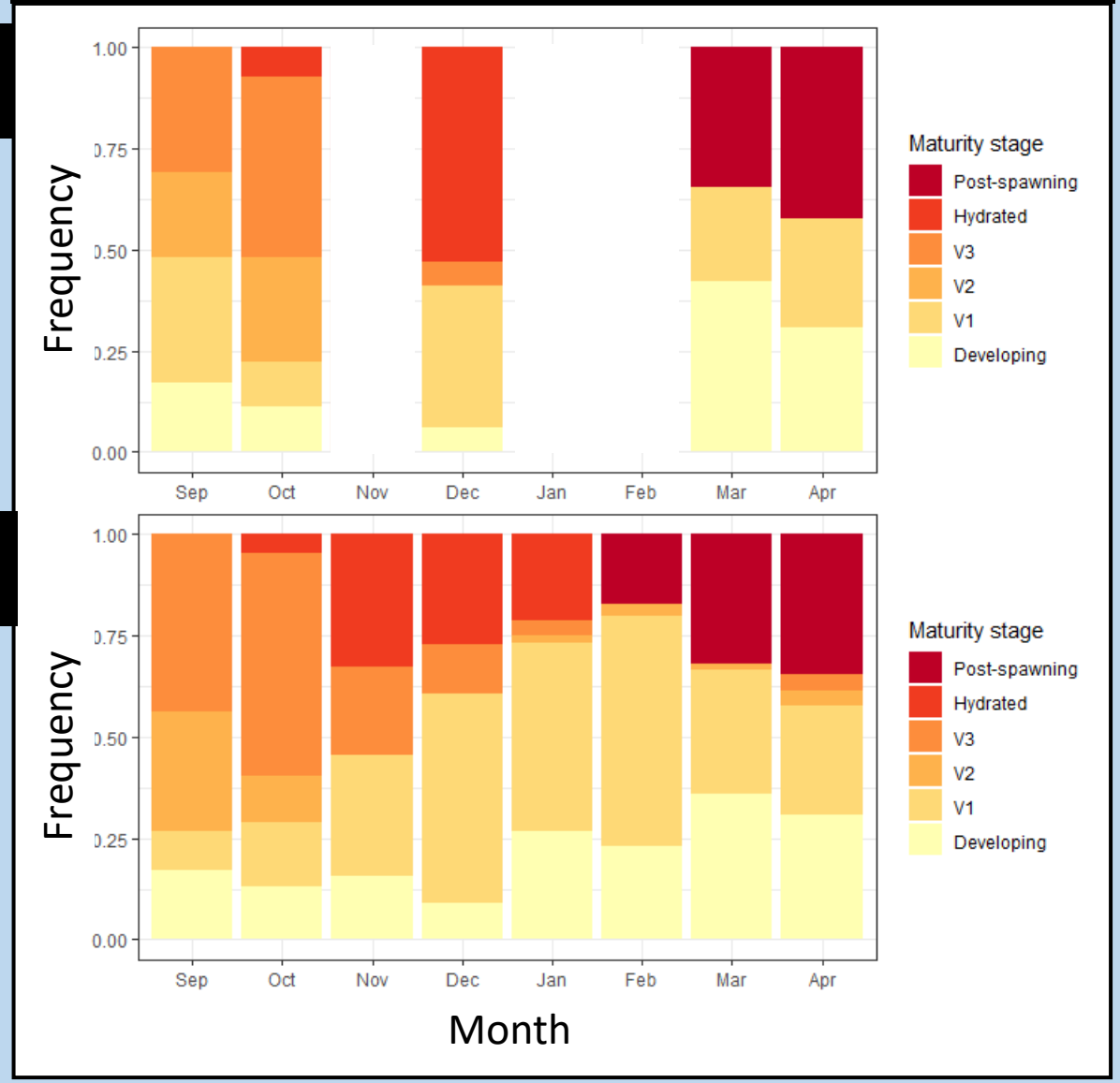
Reproductive development cycle

not MHW

MHW



Results: Marine heat wave impacts

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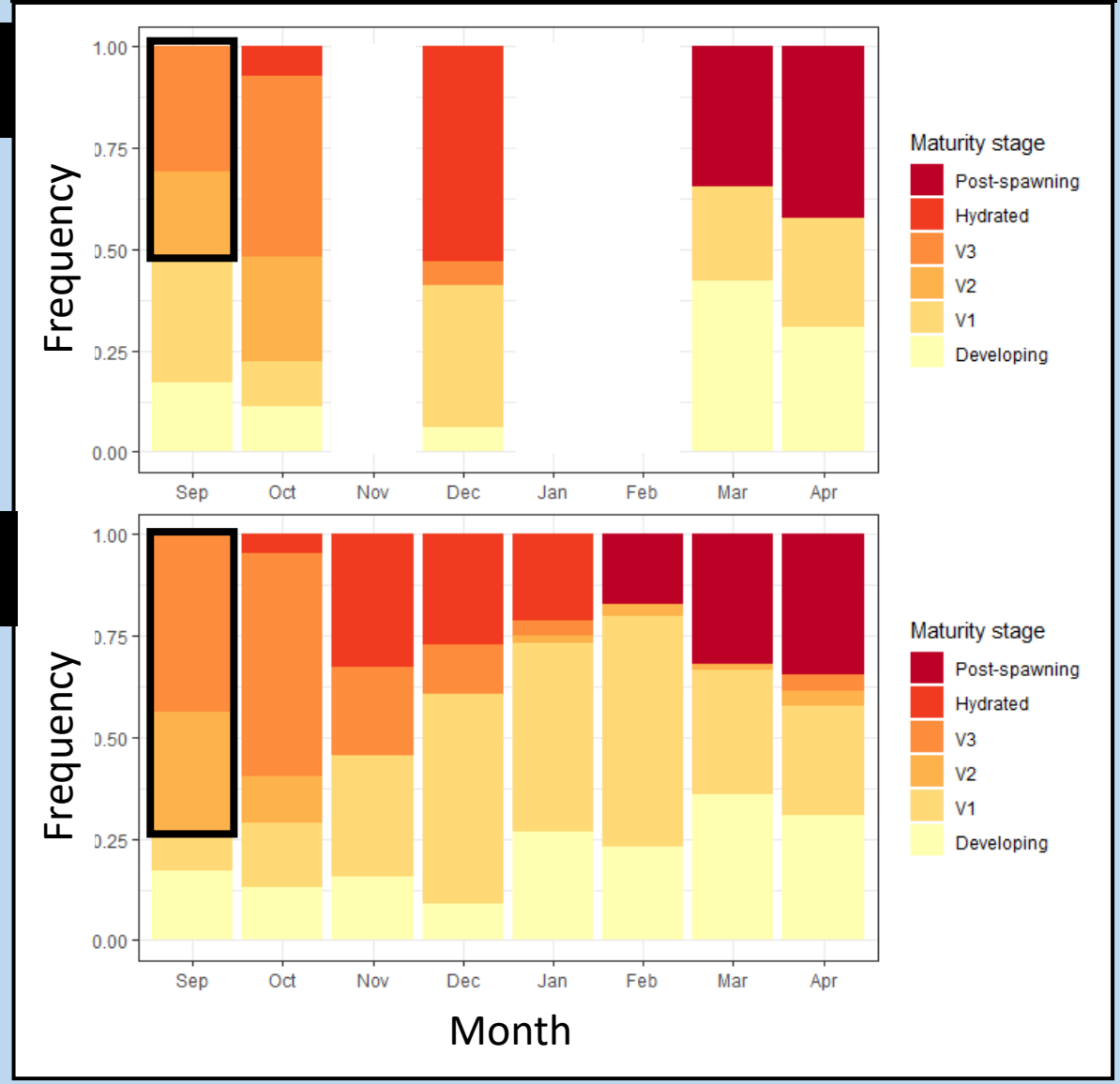
MHW



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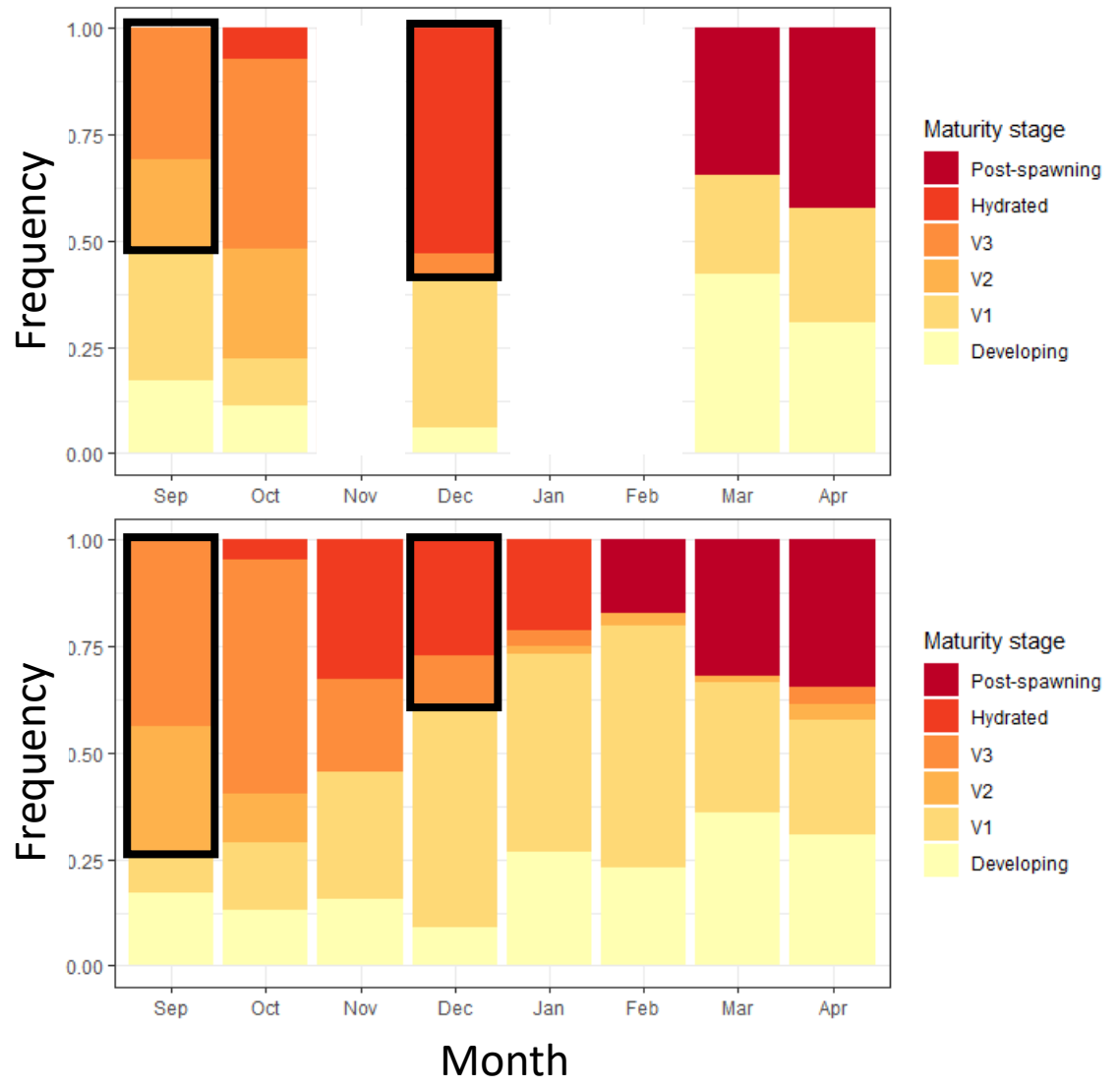
MHW

Reproductive development cycle



Implications for management

Account for fluidity in reproductive strategies

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17% increase from biological *L50* to functional *L50*

Implications for management

Species management under climate change

Implications for management

Account for fluidity in reproductive strategies

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Parasitic infection impacts

opening a can of worms…

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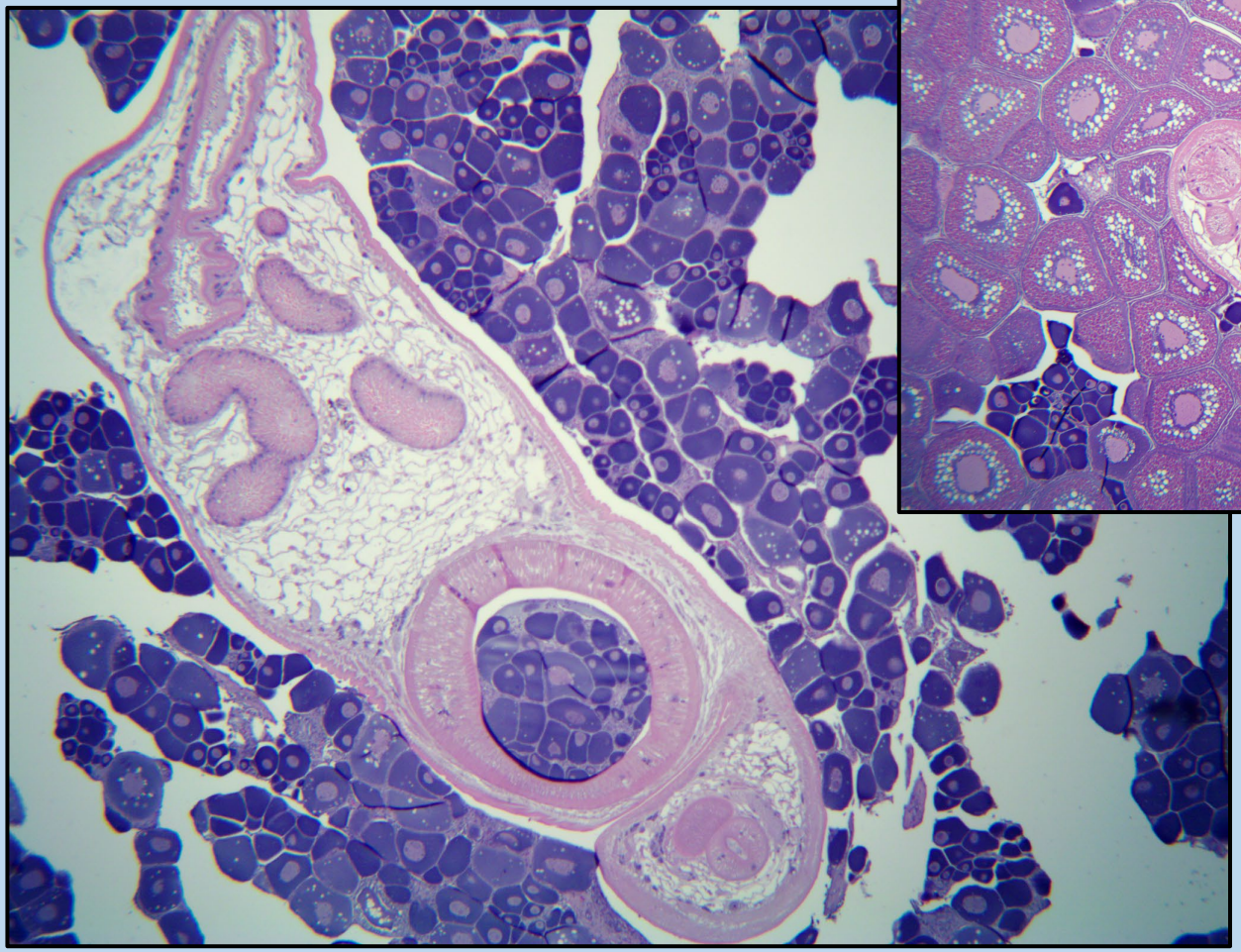

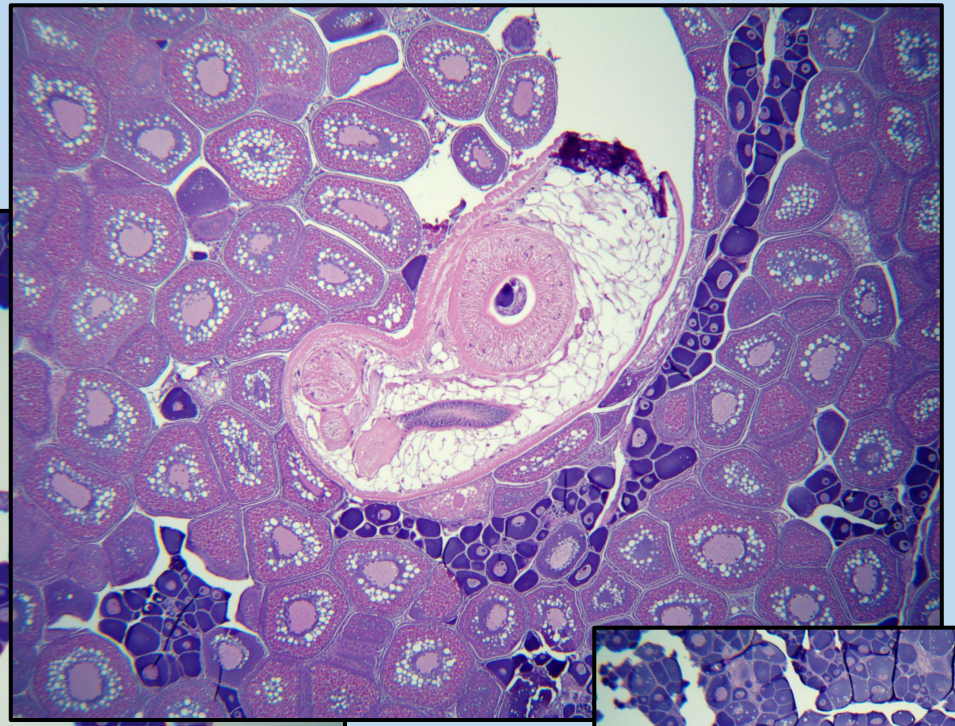

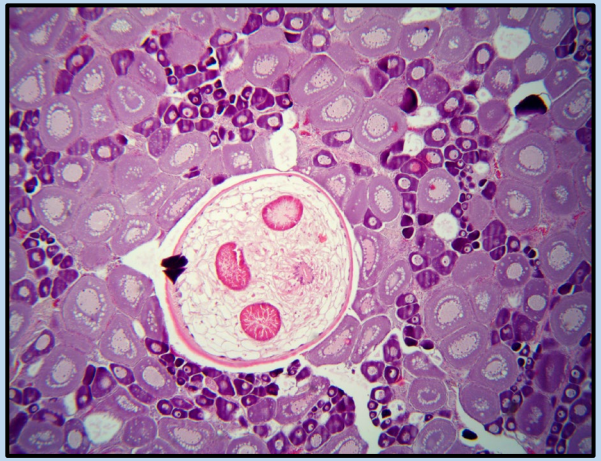

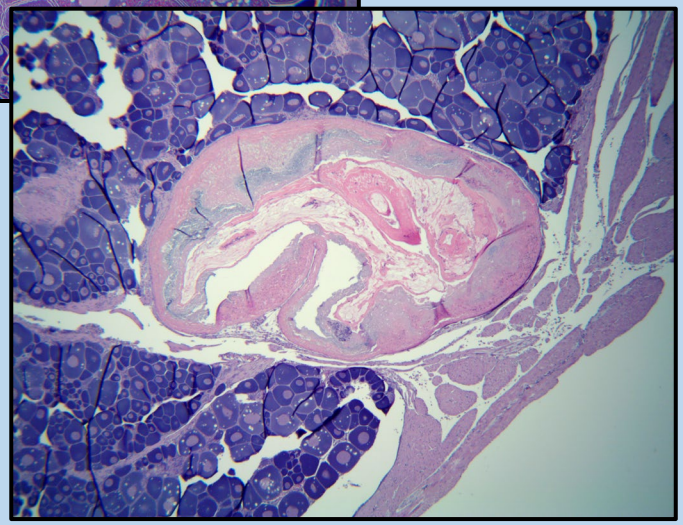

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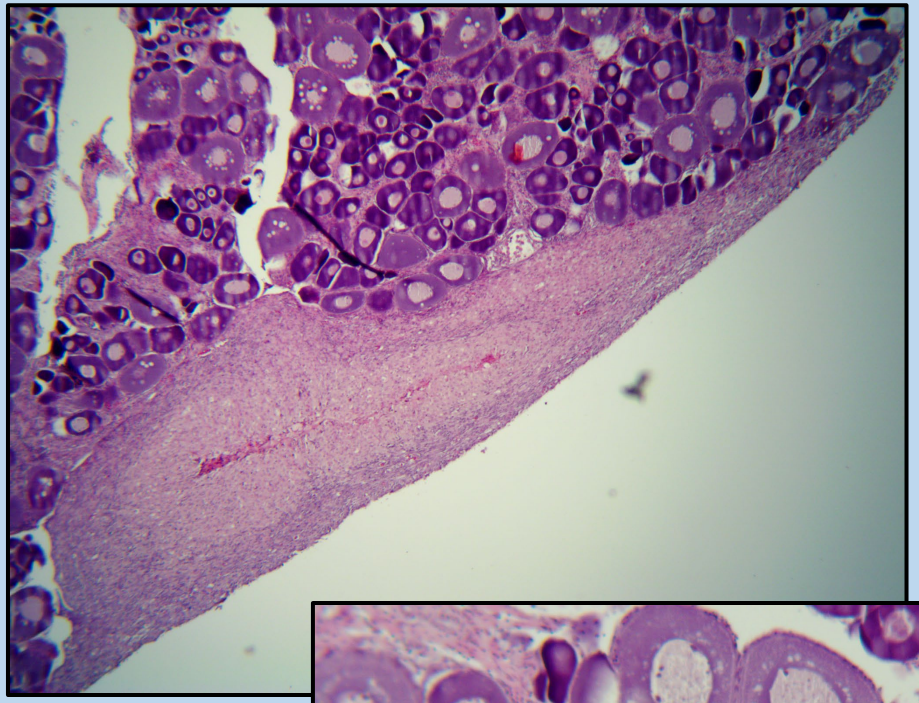
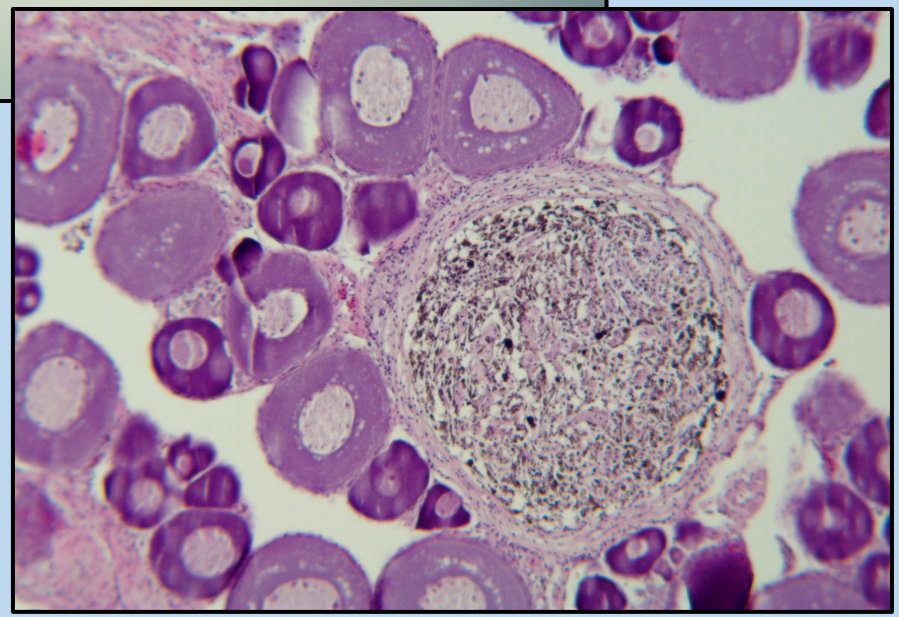
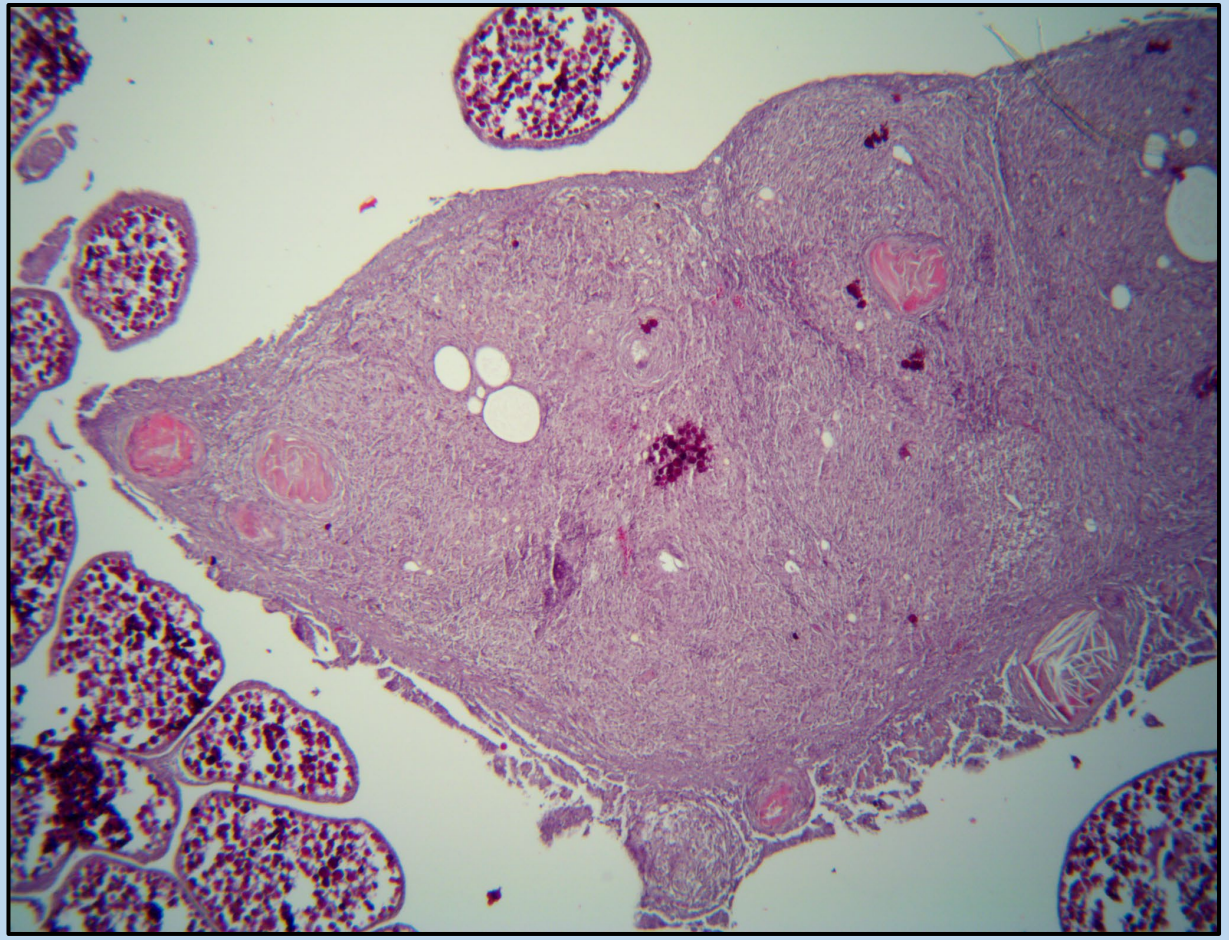






Never swim alone

Please contact me with additional questions!

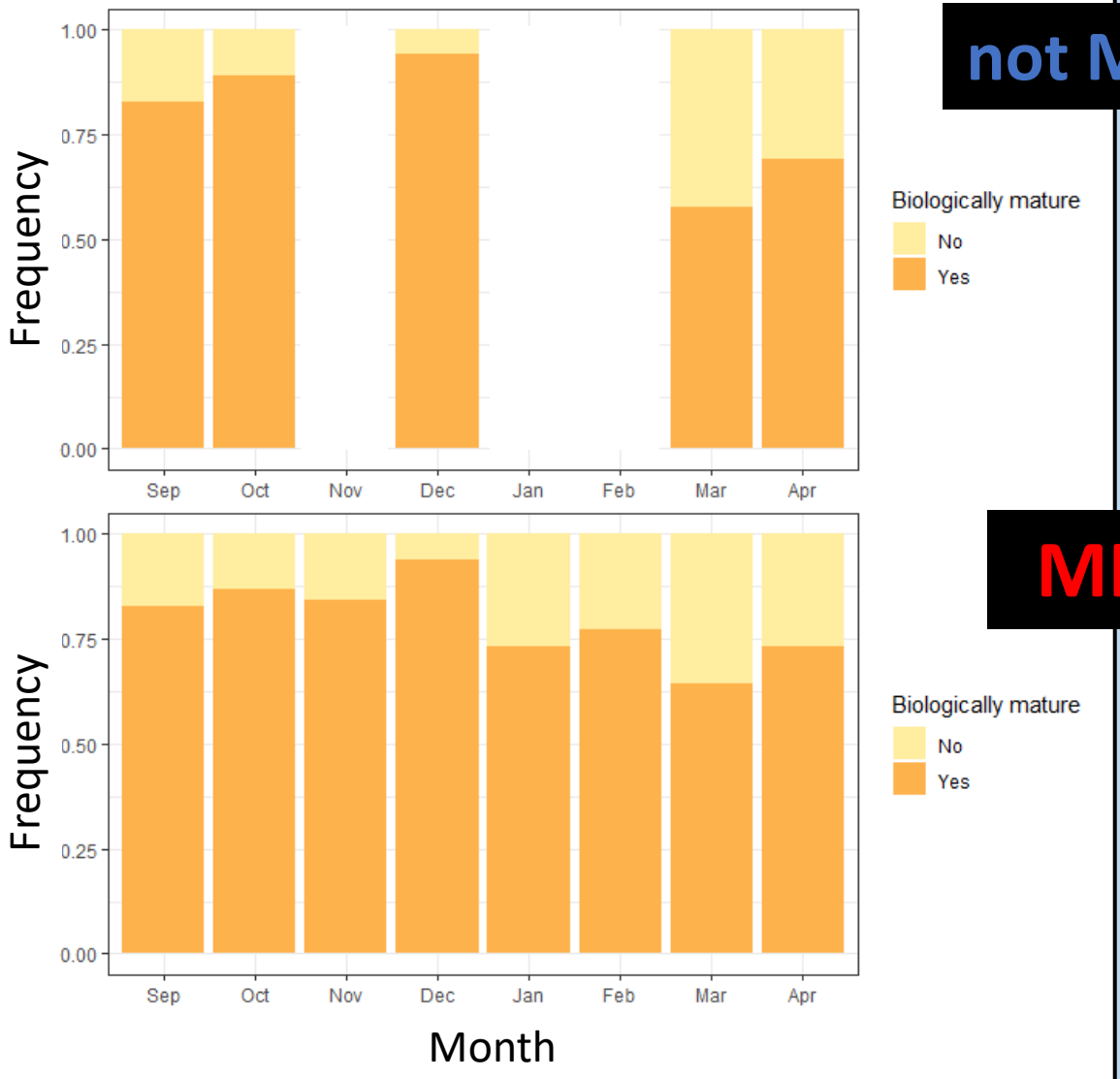
claire.rosemond@oregonstate.edu

@SeaRosemond

Claire Rosemond

Results: Marine heat wave impacts

Biological maturity



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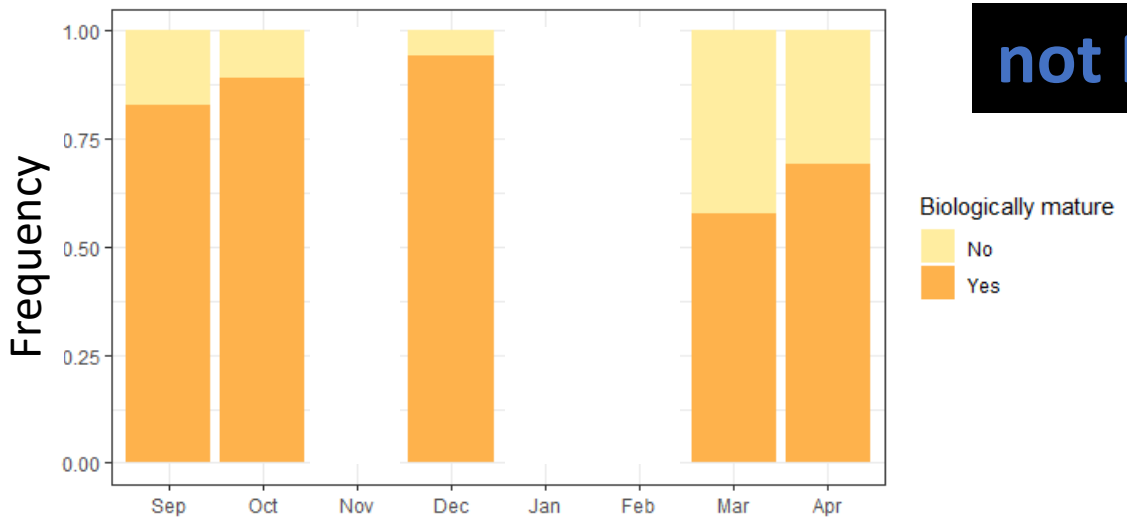
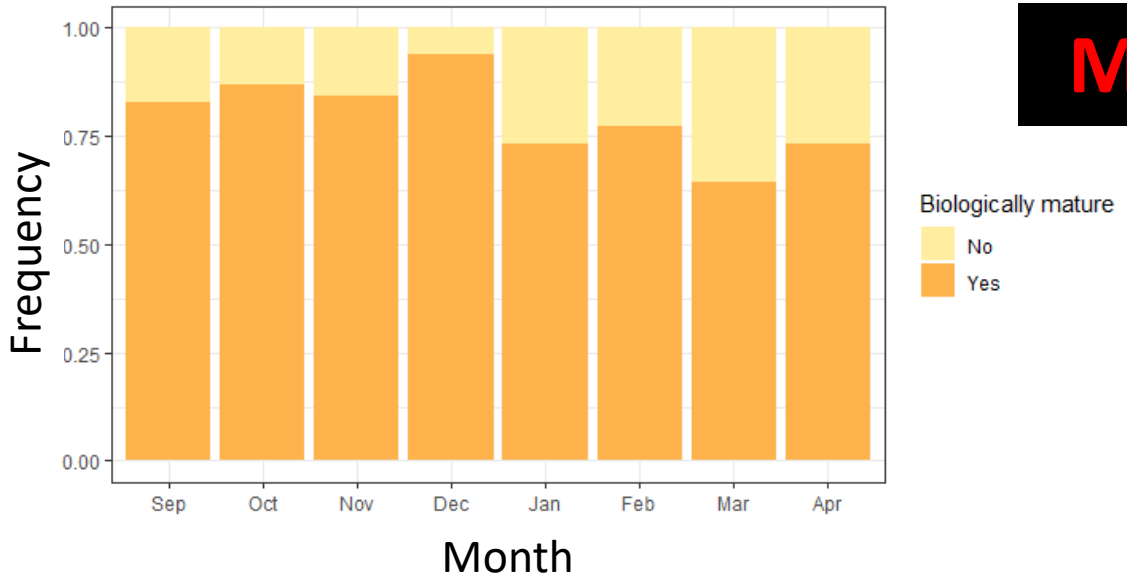
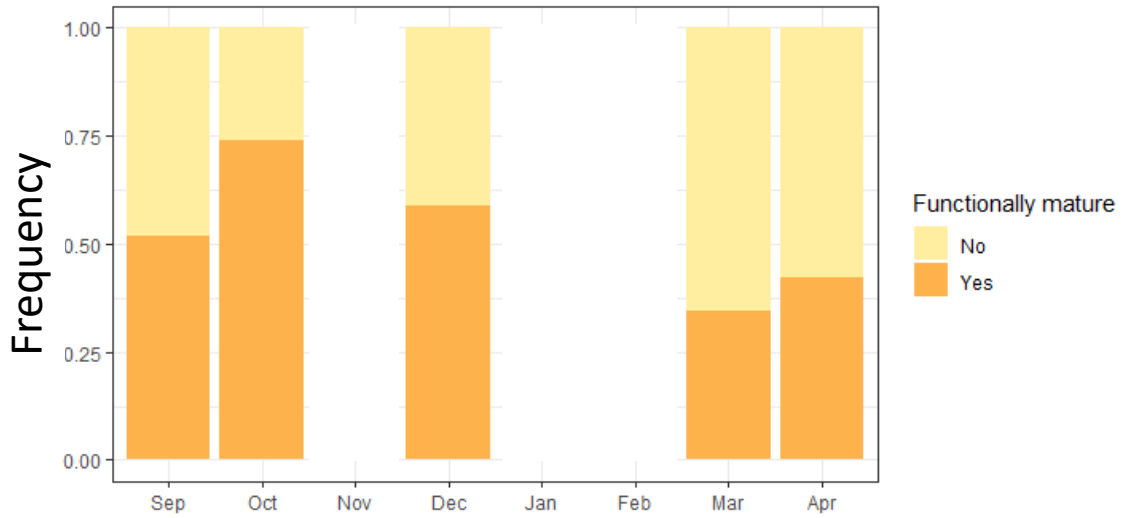
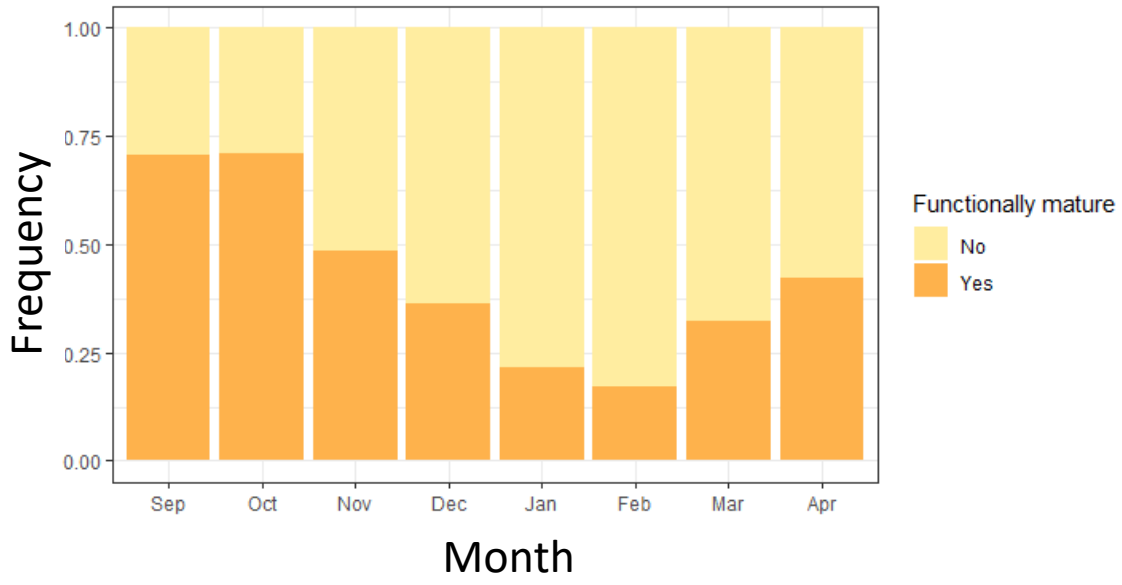




Functional maturity



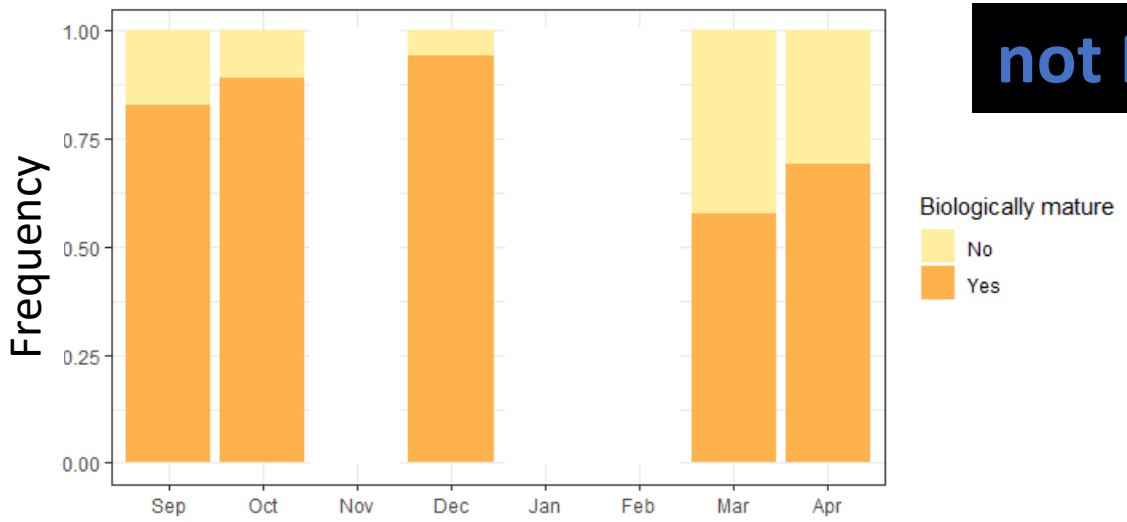


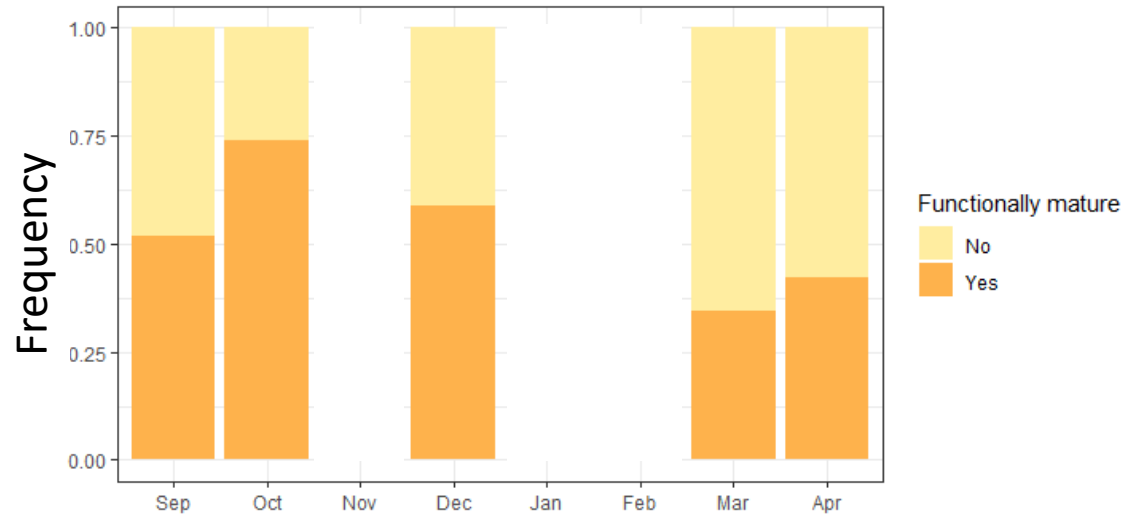
Results: Marine heat wave impacts

Biological maturity

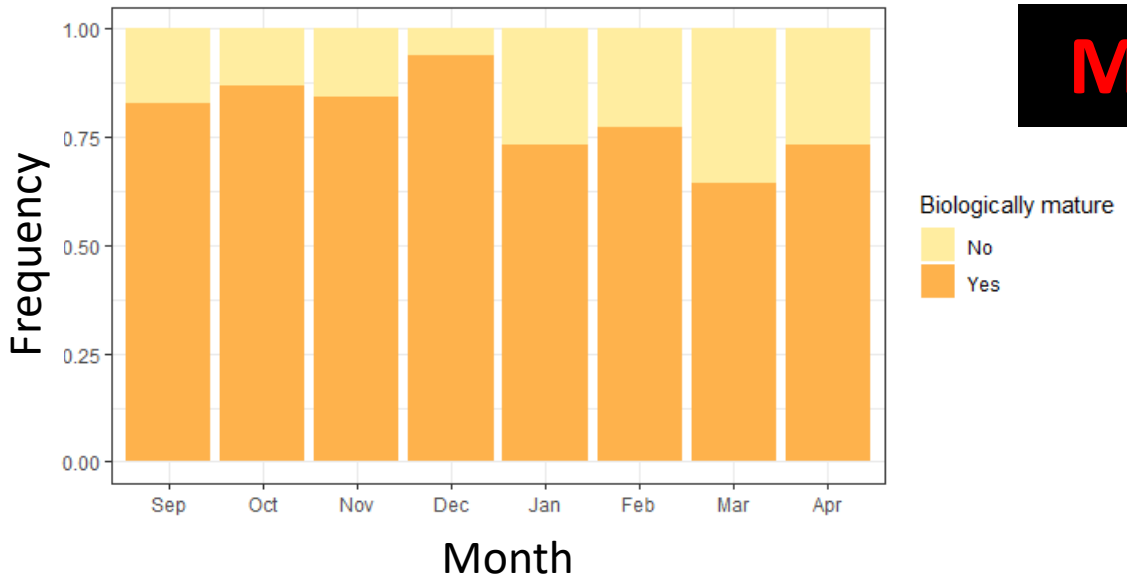
Functional maturity

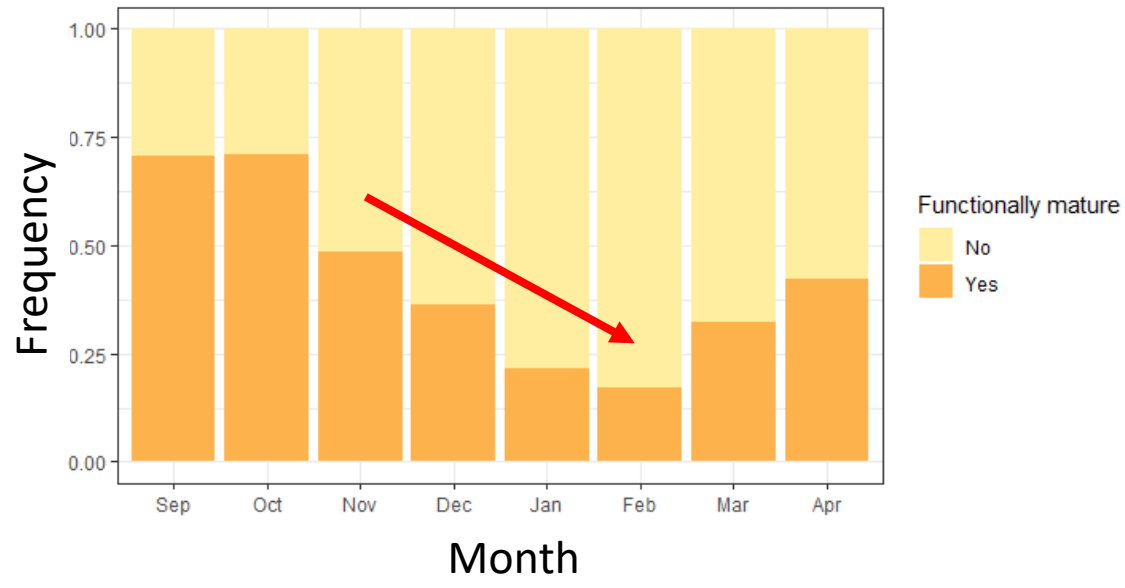
not MHW





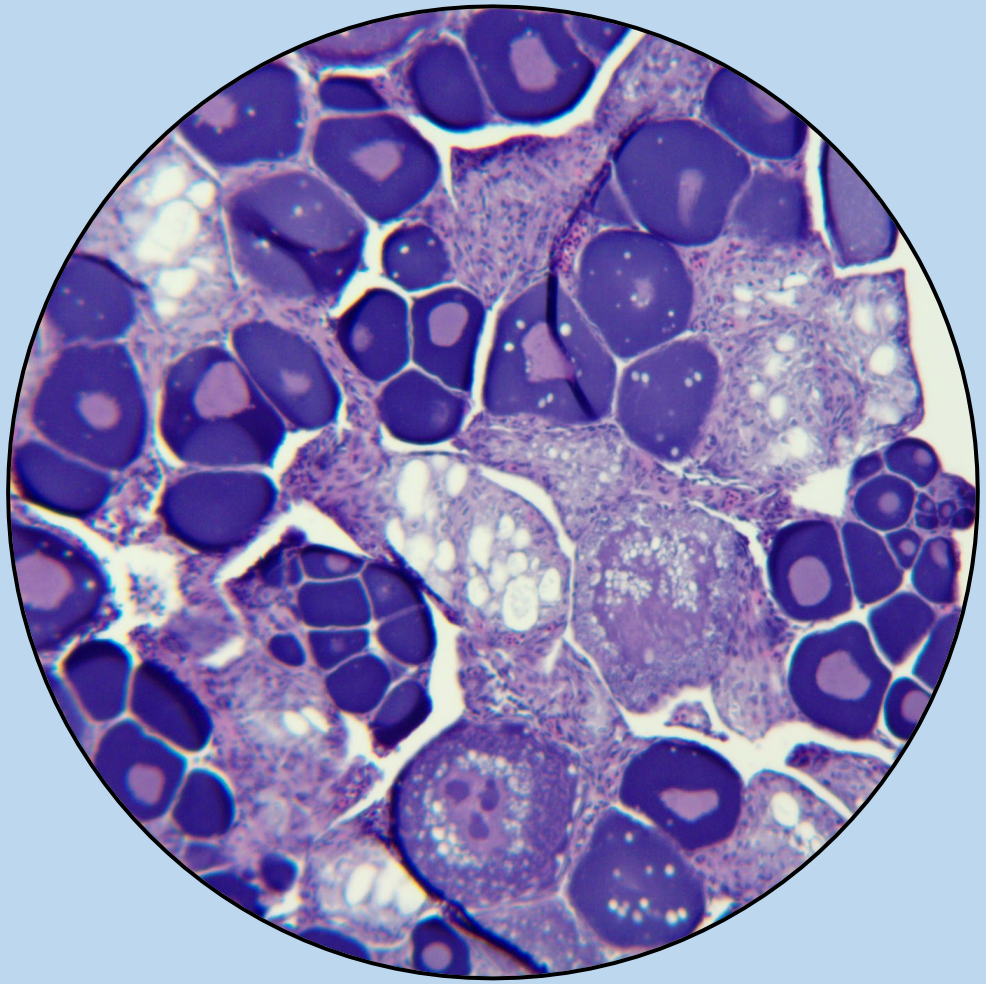
MHW





Reproductive strategy

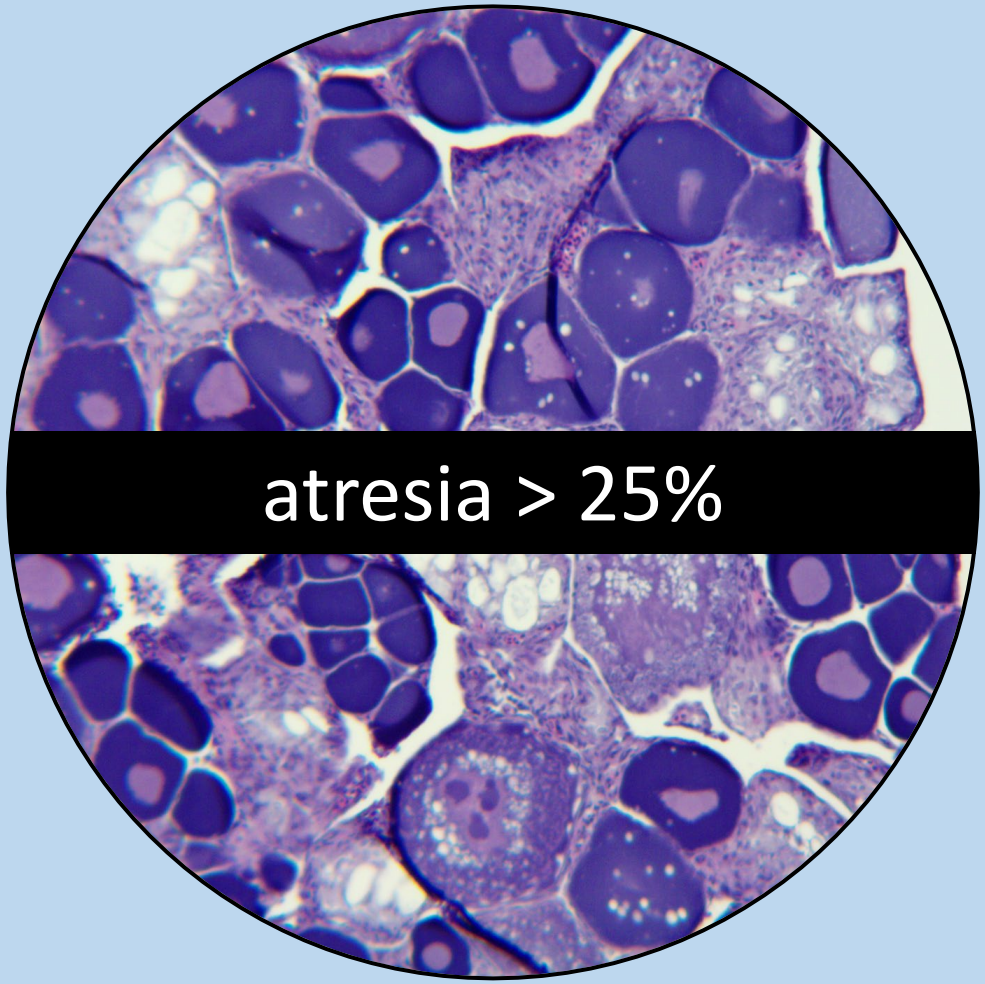
Abortive maturation



Skipped spawning

Reproductive strategy

Abortive maturation



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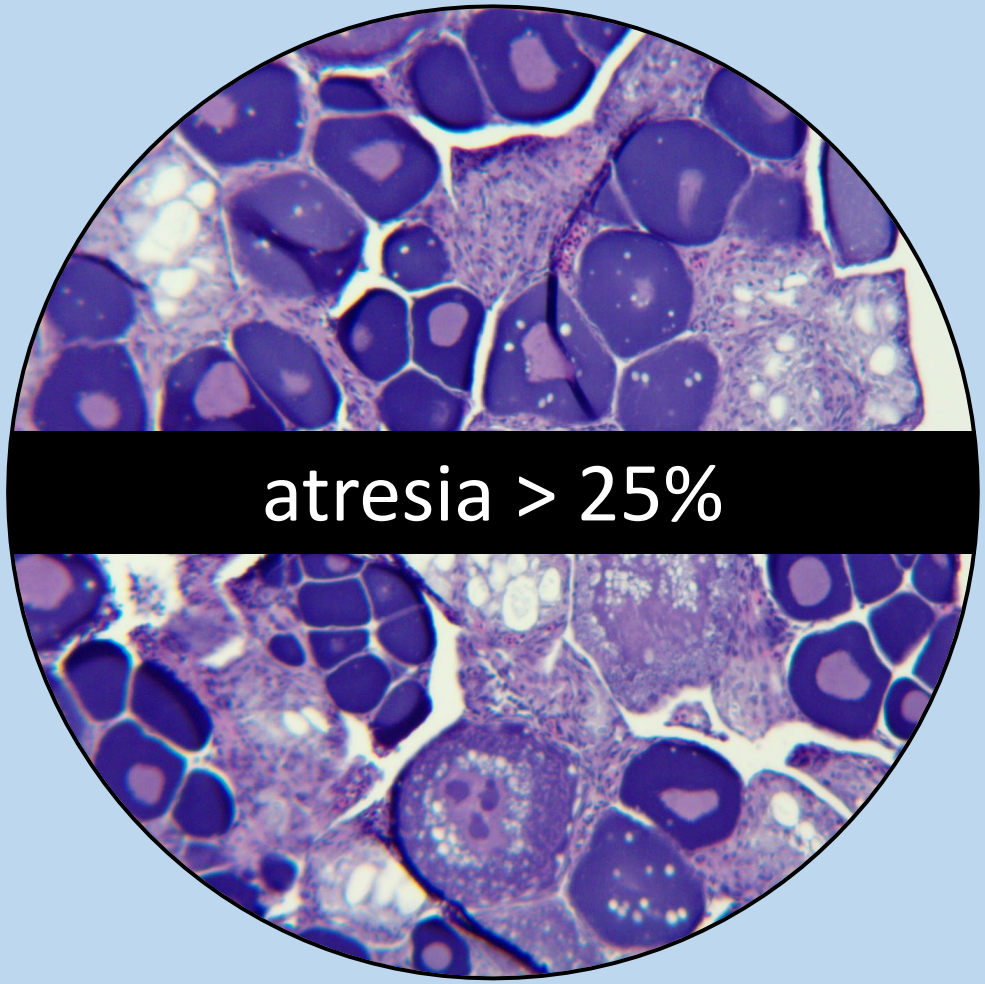
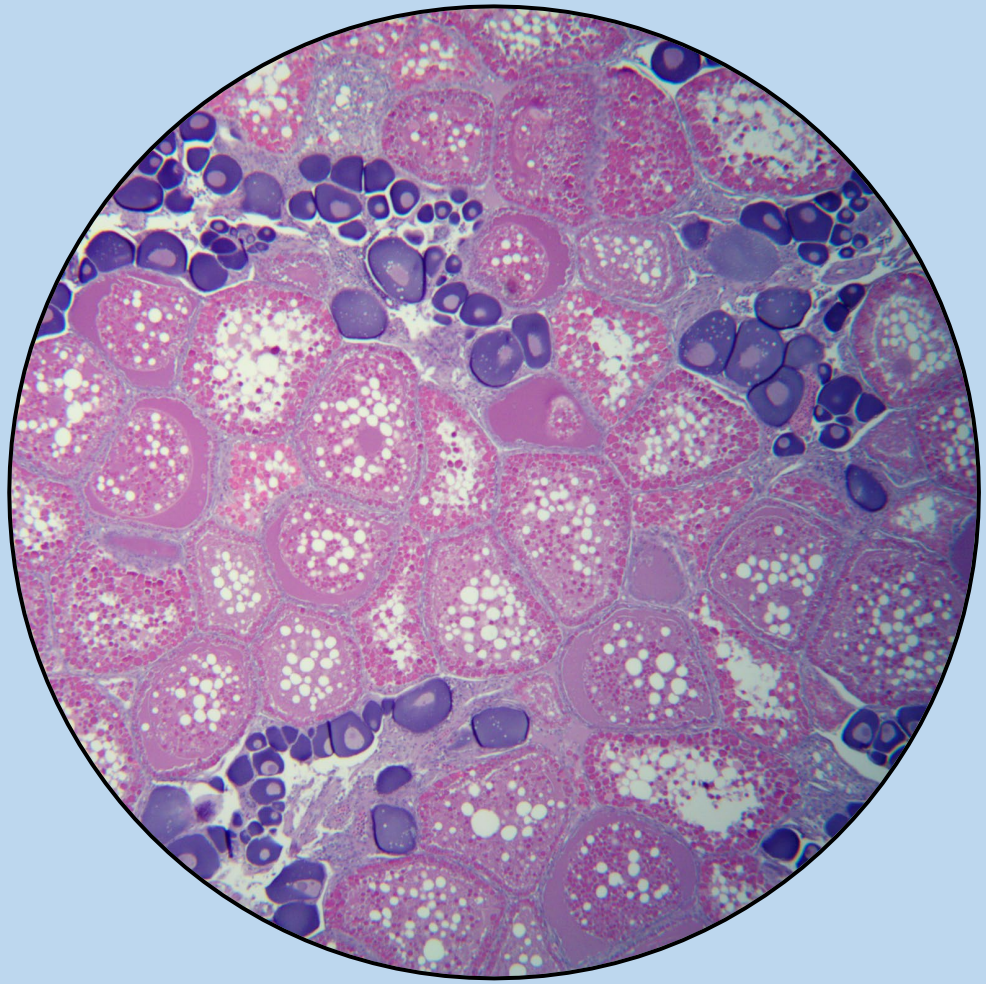
Reproductive strategy

Abortive maturation

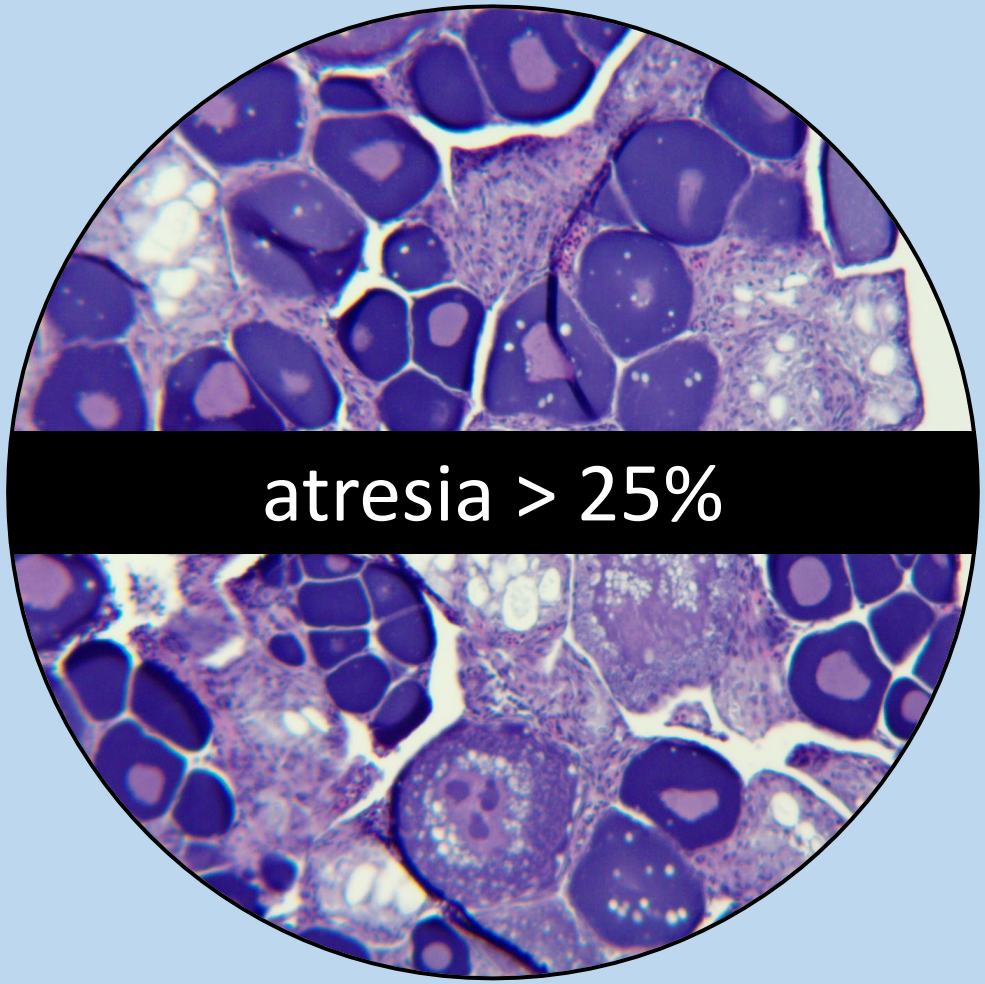


Skipped spawning

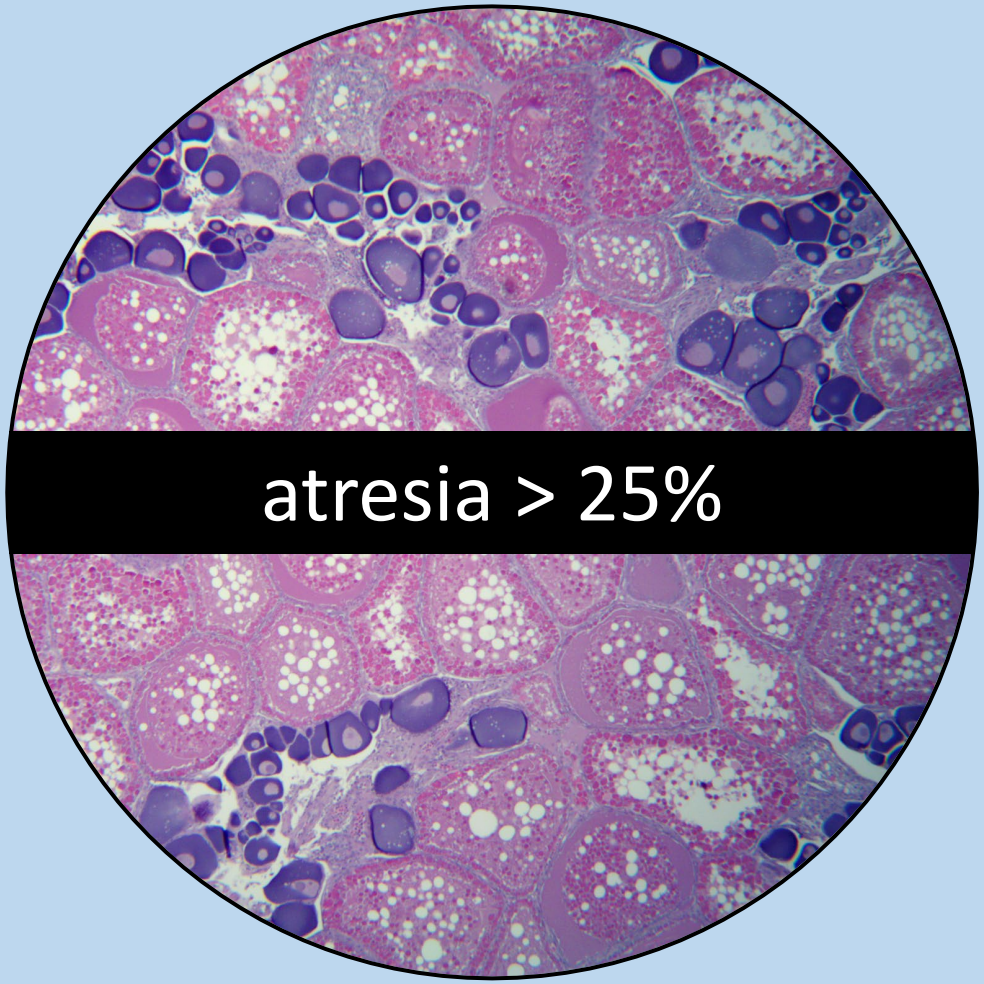


Reproductive strategy

Abortive maturation



Skipped spawning



Results: Age at maturity

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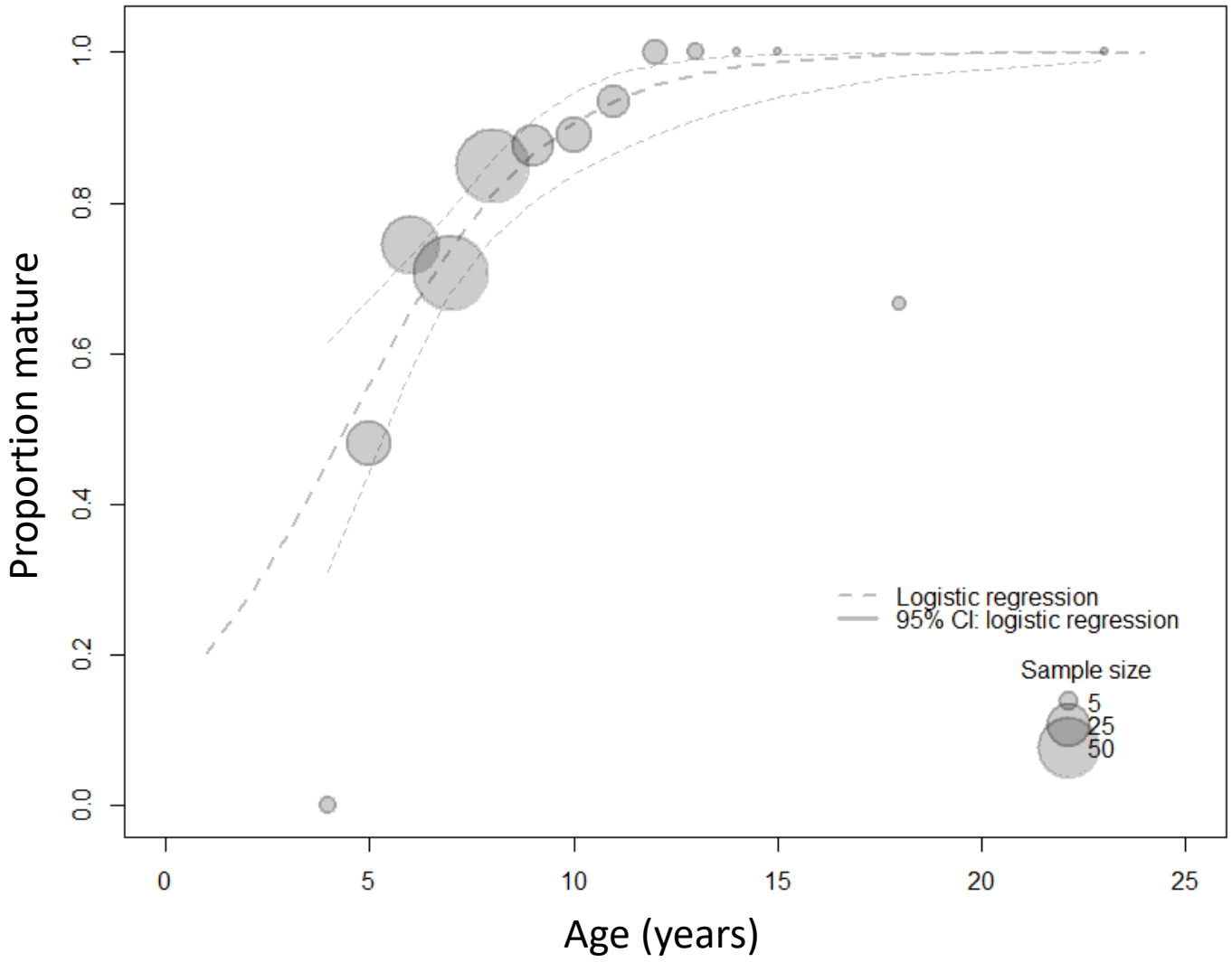
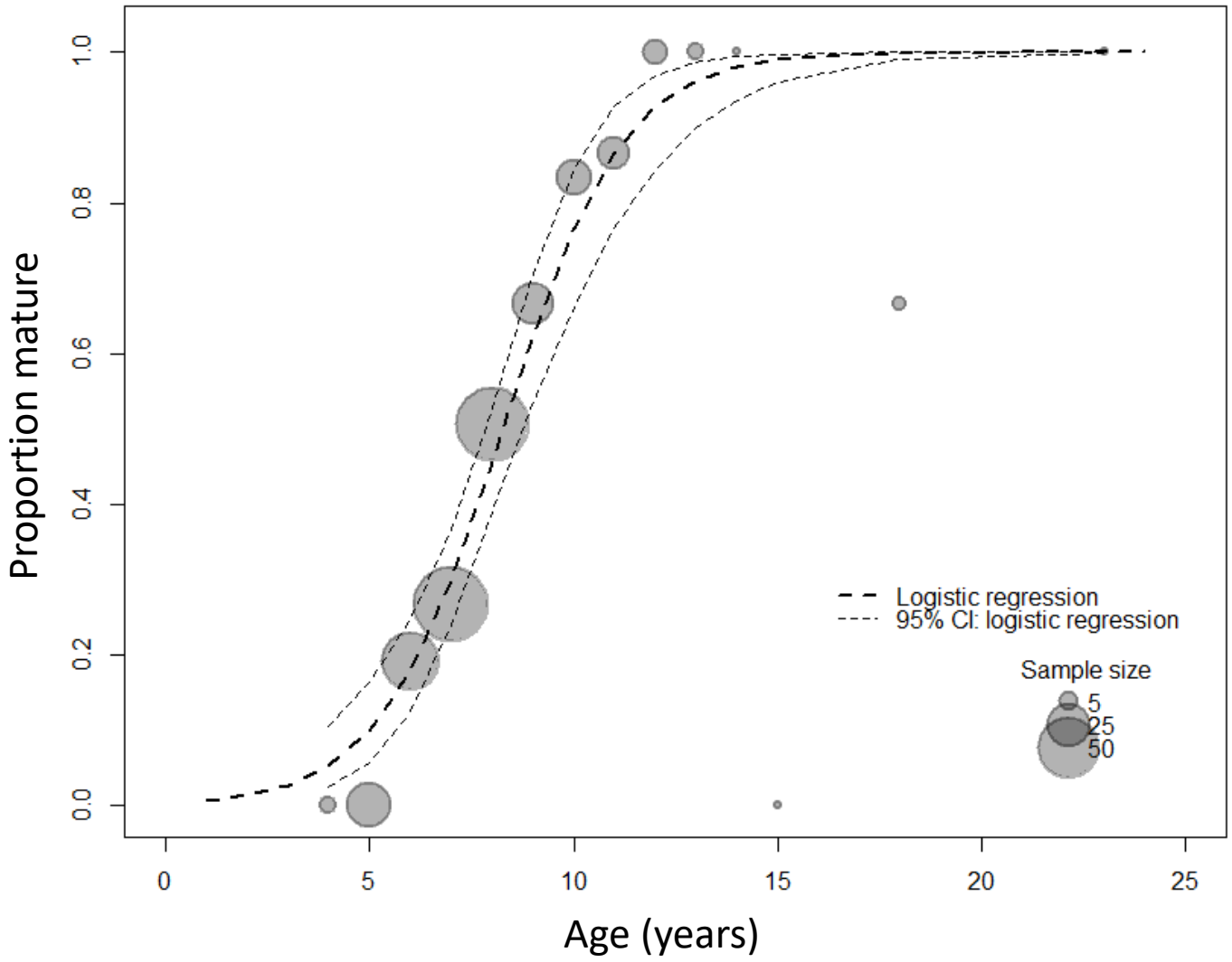
Biological maturity



A50 = 4.4 ± 0.2 yr

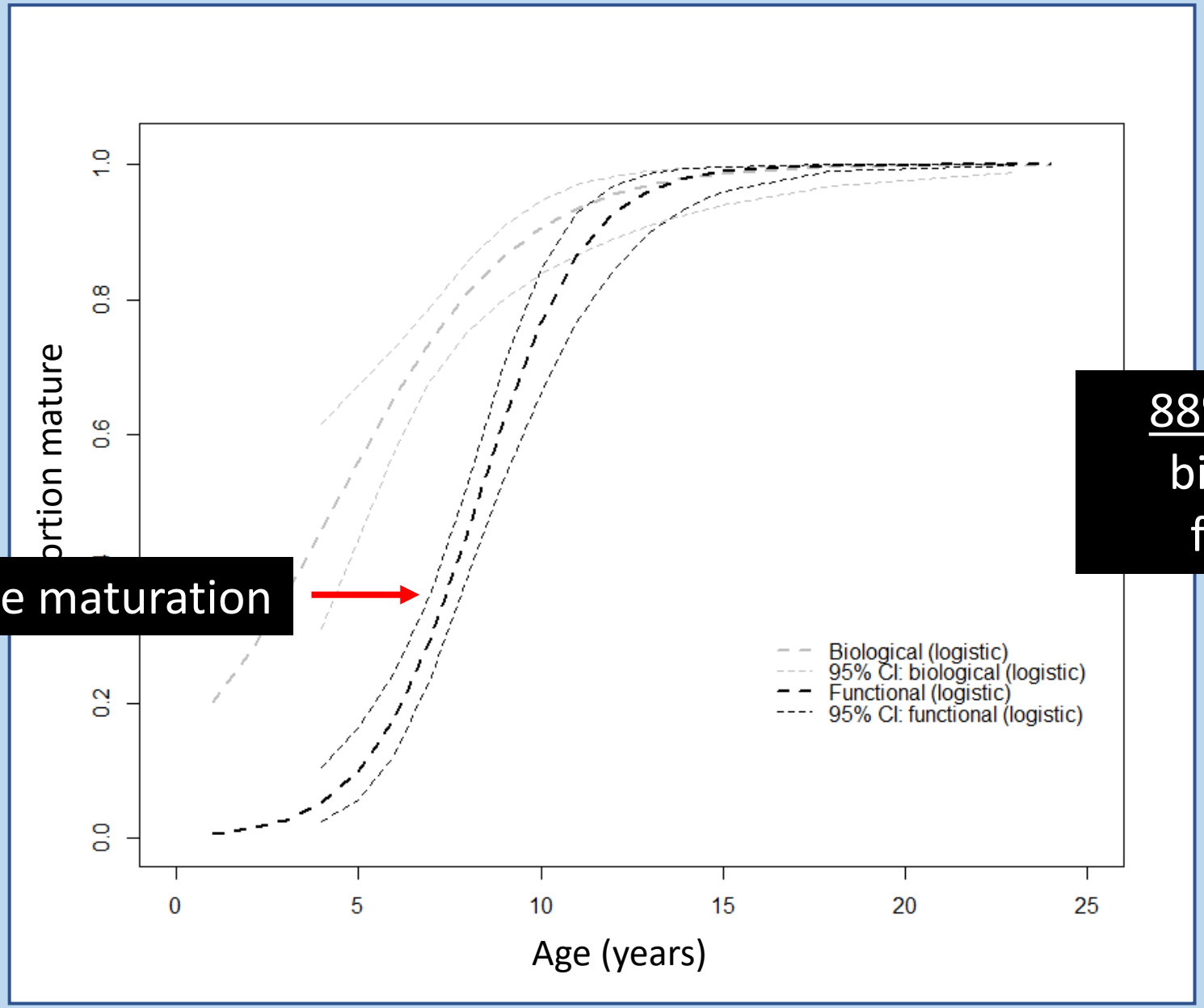
Results: Age at maturity

Functional maturity



A50 = 8.3 ± 0.2 yr

Results: Age at maturity



Abortive maturation

<u>88% increase</u> from biological *A50* to functional *A50*