WF4313/6613-Fisheries Management

Class 16– Recruitment

In the news

Trout Run: Trail race meets fishing tournament at the Driftless Area Flyathlon

October 9, 2017 by Tom Hazelton

Runners must carry a fishing rod and fish along the route. They're allowed to enter one fish, which they must measure with the ruler on their race bib, photograph, and then release. Each inch of trout reduces total run time, and native trout—in this case, brook trout—score double. This scoring scheme allows for lots of flexibility when it comes to race preparation.

Events Calendar

SAT 14 Mill City Farmers Market
October 14 @ 8:00 am – 1:00 pm
Mill City Farmers Market

MON 16 Dead – Brew at Wicked Wort Brewing Co.
October 16 @ 7:00 pm – 8:00 pm
Wicked Wort Brewing Co.

SAT 21 Mill City Farmers Market
October 21 @ 8:00 am – 1:00 pm
Mill City Farmers Market

View More...

In This Issue

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Announcements

Paddlefish Lab

- Group 1
- Meet at Front of Thompson @ 1pm
- Bug spray, water, sunscreen, raingear
- Potential to get wet

Class Topics
Recruit overfishing

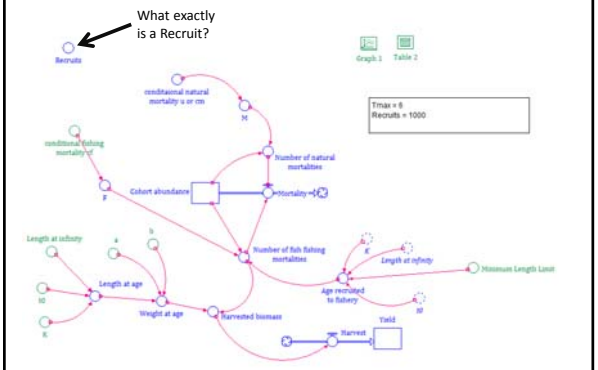
What is recruitment?

How do we assess and manage it?

RECRUITMENT MANAGEMENT

What is *recruitment*?

The addition of new fish into the catchable, harvestable, or adult populations.



Catchable, harvestable, or adult?

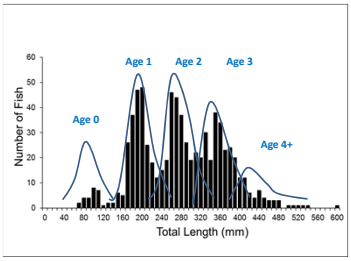
- Varies among fish
  - Species
  - Locations
  - Studies

The definition of a recruit is vague!

Defining a "recruit"

Typically defined by fish length or age

- Length: stock-size (200 mm) largemouth bass
- Age: age-1 white crappie



Recruit definitions

Froese (2004) – Coho salmon, OR

The data represent females migrating upstream to spawn (S), and the resulting female smolts migrating downstream approximately 1.5 years later (R).

Recruit definitions

- Beard et al. (2003) – Walleye, WI

where R is the number of age-0 recruits per kilometer, S is the number of adult walleyes per hectare,

Recruit definitions

- Belcher & Jennings (2004) – White shrimp, GA

The total pounds of white shrimp caught during May–June represented spawners, whereas the total pounds of white shrimp caught during August–January represented recruits.

Recruit definitions

- Allen & Miranda (2001) – Black crappie, MS

where R is recruits (number of age-1 fish), S is stock (number of fish older than age 1),

Recruit definitions

- Richards et al. (2004) – Lake Trout, MI

and Sitar 2000). To account for the time lag between spawning and recruitment at age 7, spawning stock CPE measured during 1970–1990 was matched with CPE of age-7 recruits during 1978–1998 to model recruitment of the 1971–1991 year-classes.

Factors influencing recruitment

<u>Density Independent</u>

- Changes in water level or flow
- Aquatic plant abundance or species composition
- Water temperature

<u>Density Dependent</u>

- Spawning stock abundance
- Year-class strength
- Can stabilize recruitment

IMPORTANT:

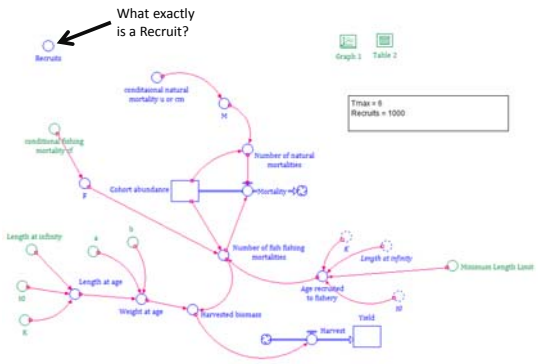
Recruitment is not determined solely by how many young-of-year (YOY = baby) fish are produced. You can have low recruitment in a year when YOY production is very high, or high recruitment when YOY production is relatively low.

Why do you think this is?

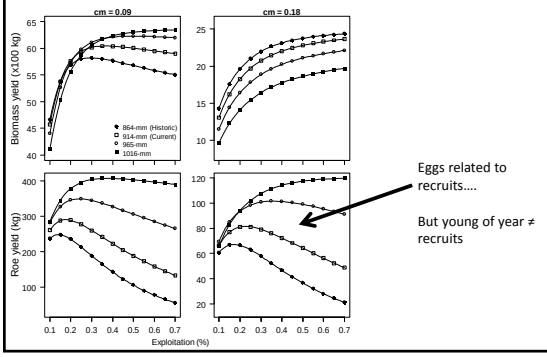
In a nutshell-preventing or minimizing recruitment overfishing!

You need old fish to make new fish and you need new fish to make old fish

MANAGING RECRUITMENT IN AGE STRUCTURED POPULATIONS



Predicted biomass and roe yields



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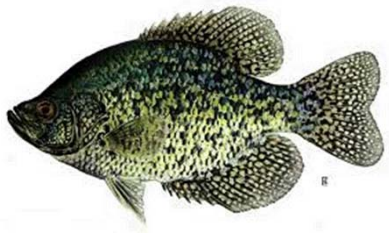
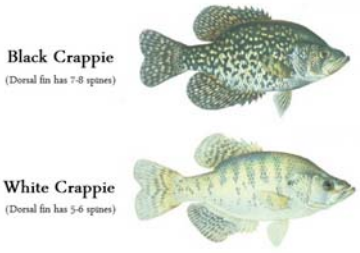


Crappie (White & Black)

- Typically co-managed as 1 species
- Most anglers cannot tell difference

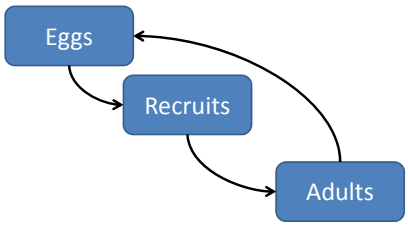


Recruits

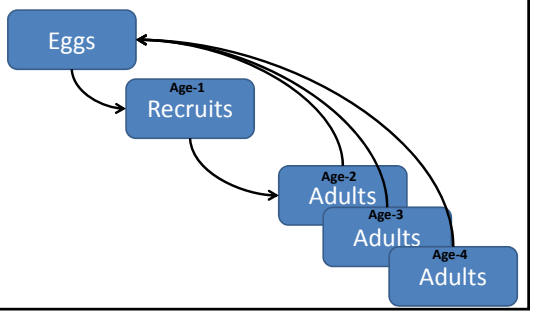
RECRUITMENT MANAGEMENT

WHAT IS IT?
HOW DO WE DO IT?

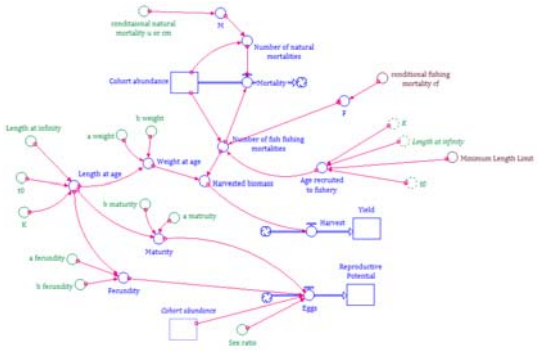
Conceptually



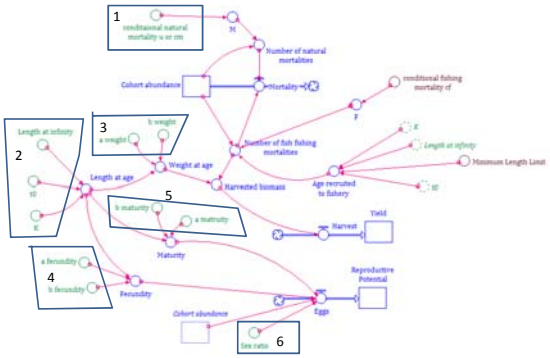
Adding age structure



Conceptually



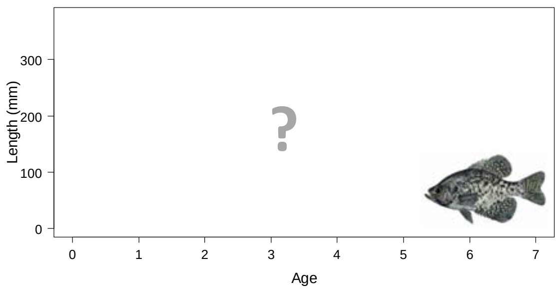
Bits of information needed



Bits of information needed

1. Natural Mortality
2. Length-Age
3. Weight-Length
4. Fecundity
5. Maturity
6. Sex ratio

Age-Length



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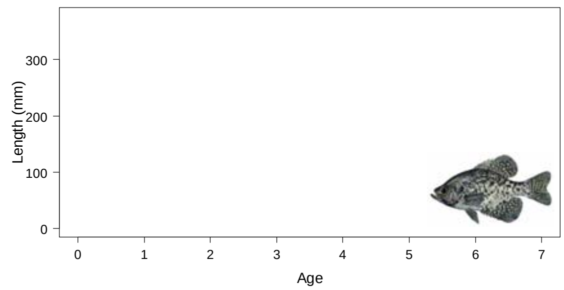

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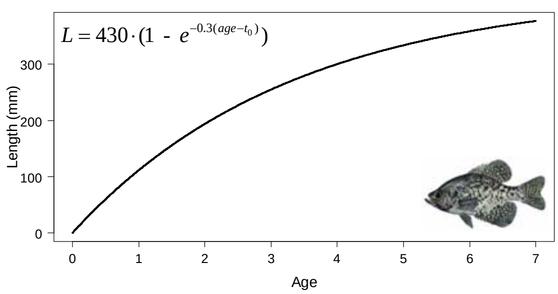

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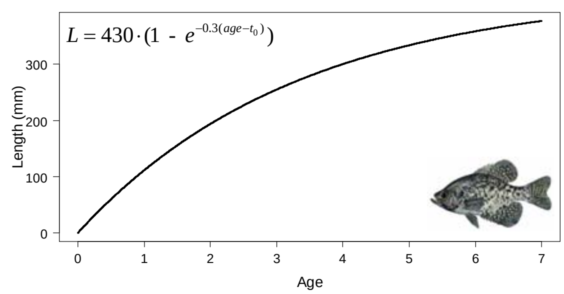

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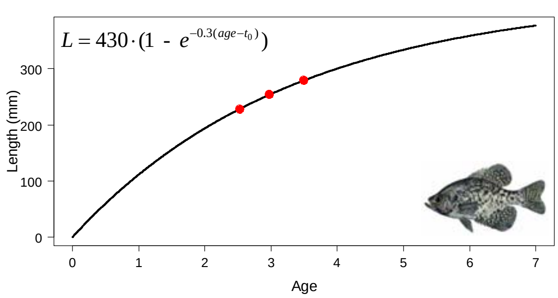
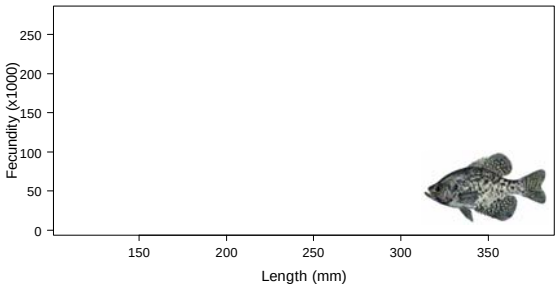


Fecundity

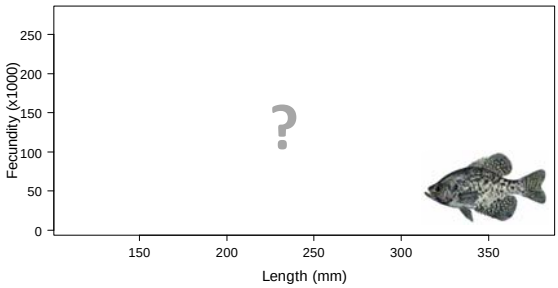
Number of eggs an animal produces during each reproductive cycle; the potential reproductive capacity of an organism or population. Usually increases with age and size

http://www.fishbase.org/Glossary/Glossary.php?q=fecundity&language=english&sc=is

Black Crappie Fecundity



Black Crappie Fecundity



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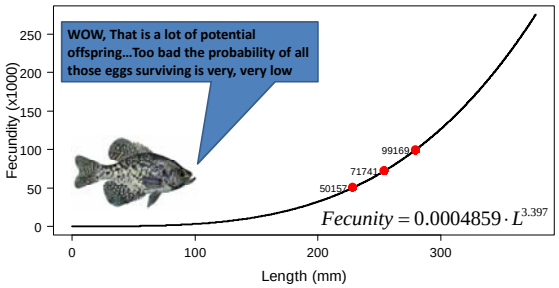
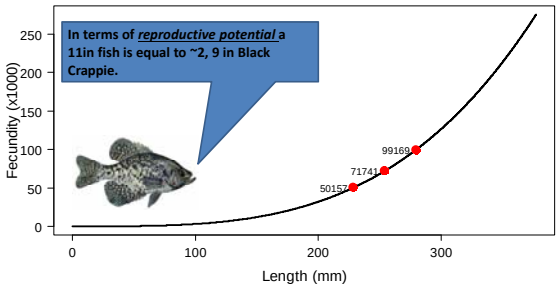
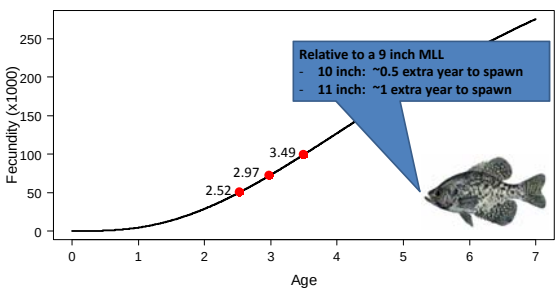


Black Crappie Fecundity



Fecundity & Age



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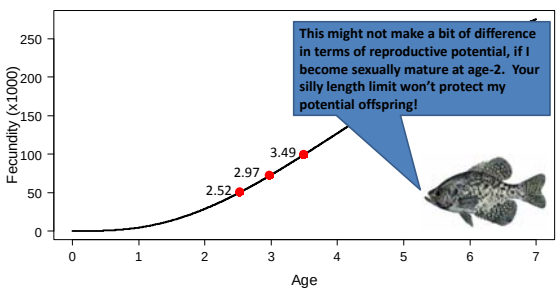


Maturity

A stage at which fish are able to develop ripe gonads and to participate in spawning.

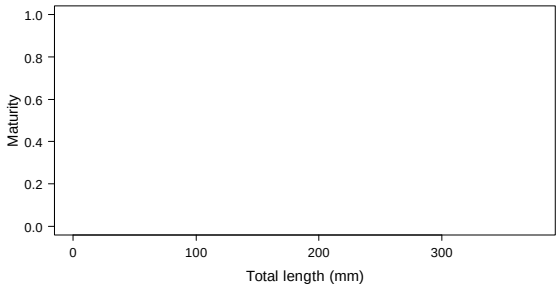
Length at first maturity

Mean length at which fish of a given population develop ripe gonads for the first time.

Determining sexual maturity & ratio

- Link maturity (yes or no) to length
- Sex ratio

Maturity function



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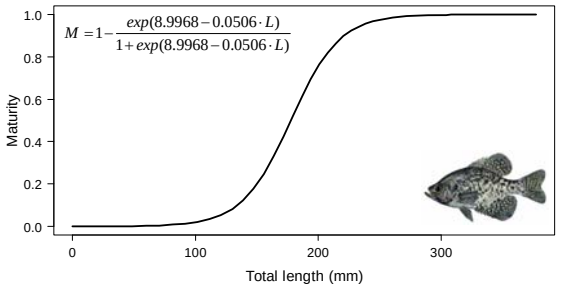

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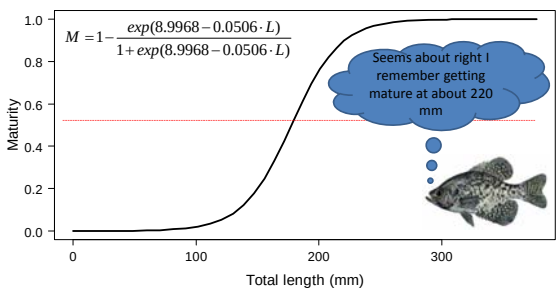

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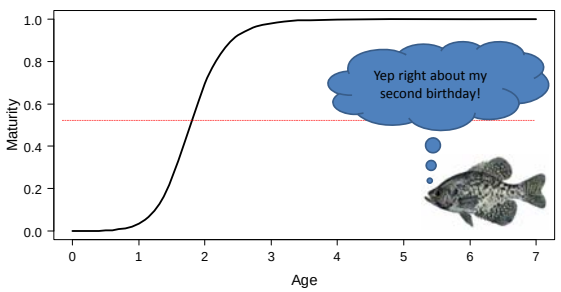
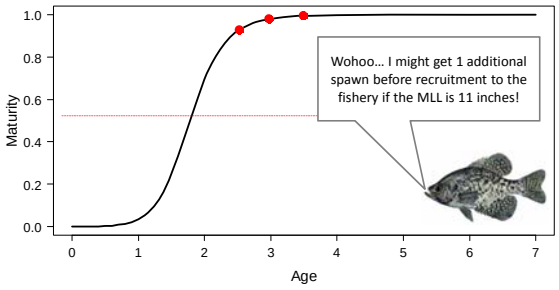
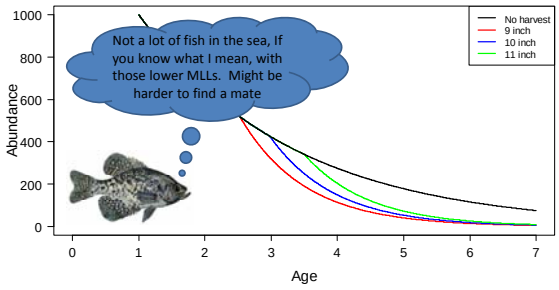


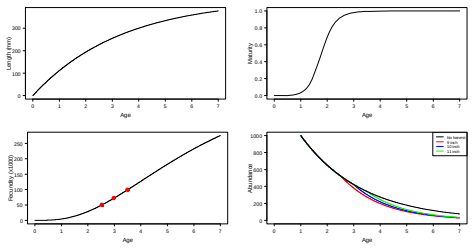
Maturity function & MLL



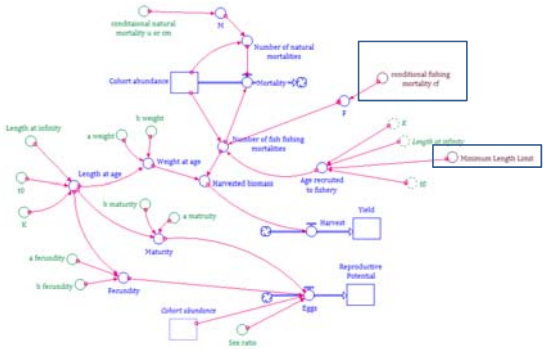
Abundance



Complex interactions? You bet!



Management parameters



Management parameters

Fecundity is a function of spawning stock abundance or biomass

Minimize recruitment overfishing

- Maintain enough spawning abundance or biomass in system
- Reproductive potential

Fishing mortality & Length limit

We do we want to manage recruitment?

- Angler satisfaction
  - Recruitment drives year to year variability in abundance and biomass
  - Recruitment drives fish abundance and biomass

Evaluation of recruitment overfishing

- Limited in practice
- Set regulations that are **robust** to recruitment overfishing
  - Ratio of spawning biomass to unfished biomass (SSR)
  - Ratio of spawning potential to unfished potential (SPR)

Spawning potential ratio

- **Spawning potential:** The number of eggs that could be produced by an average recruit over its lifetime
- **Ratio:** the fished stock is divided by the number of eggs that could be produced by an average recruit over its lifetime when the stock is unfished.
- Compares the spawning ability of a stock in the fished condition to the stock's spawning ability in the unfished condition.

Example

- 10 fish survive the first couple of years of life and are now large enough to be caught (recruited) in the fishery.
- Four are caught before they spawn (no eggs produced)
- Three others are caught after they spawn once (some eggs produced),
- The last three live to spawn three times (many eggs produced) before dying of old age.
- During their lifetime, the 10 fish produced 1 million eggs and the average recruit produced 100,000 eggs (1 million divided by 10).
- Unfished population, 10 fish survive as before. Three die of natural causes after spawning (some eggs produced) and the other seven spawn three times (very many eggs produced) before dying of old age.
- During their lifetime, these 10 fish produced 5 million eggs and the average recruit produced 500,000 eggs (5 million divided by 10).
- The spawning potential ratio is: 100,000 eggs produced by the average fished recruit divided by the 500,000 eggs produced by the average unfished recruit and is equal to 0.20 or 20 percent.

Spawning stock biomass (SSB) & Spawning stock biomass per recruit (SSBR)

- Biomass (weight):
  - entire adult stock,
  - mature females in the stock,
  - eggs they produce. These measures are called

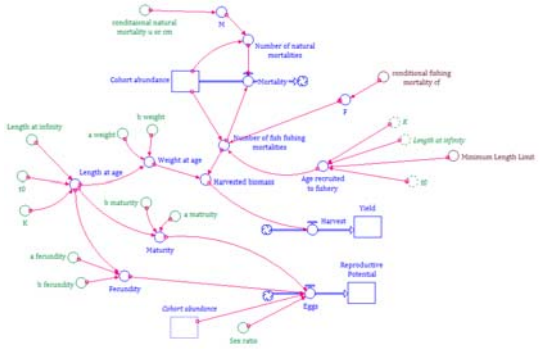
Spawning stock biomass (SSB) or spawning stock biomass per recruit (SSBR)

What is the SPR for Crappie?

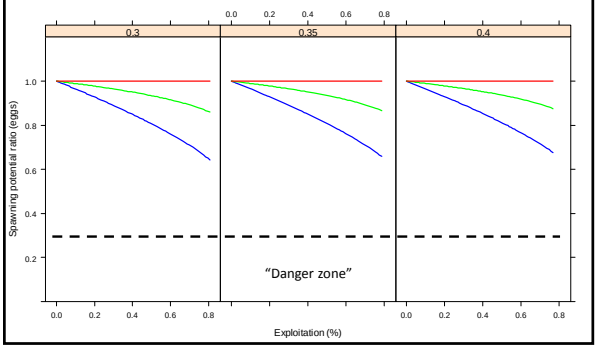
Stock specific SPR?

- Studies show that some stocks (depending on the species of fish) can maintain themselves if the spawning stock biomass per recruit can be kept at 20 to 35% (or more) of what it was in the unfished stock.
- Lower values of SPR may lead to severe stock declines.

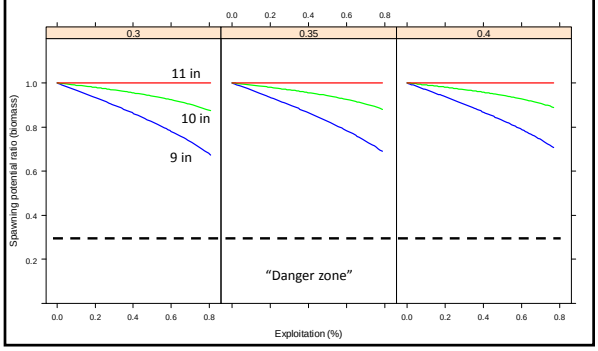
Conceptually



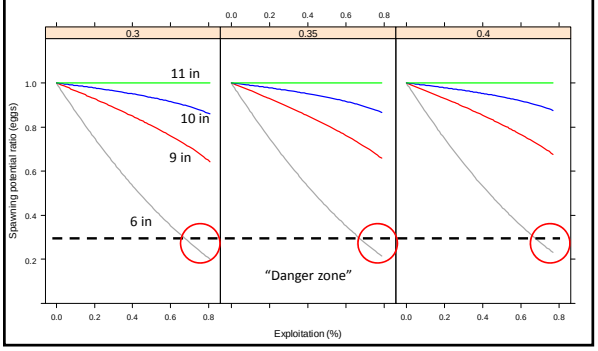
SPR-Eggs



SPR-Mature female biomass



Adding a 6 inch MLL



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