

Science, Service, Stewardship



Does Size Matter?

Effect of catching various sizes of fish on stock sustainability

Chris Lunsford, AFSC, Juneau AK

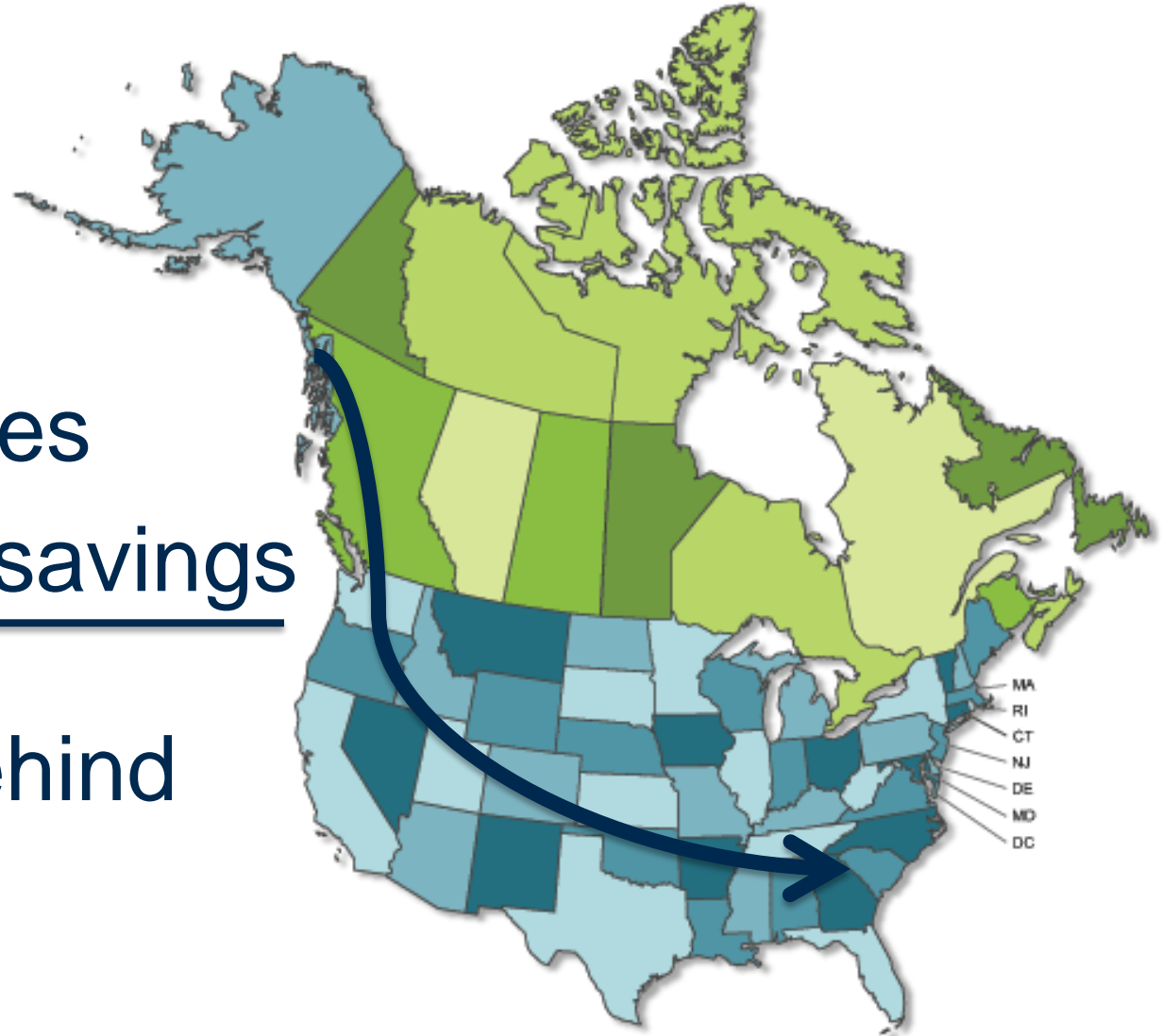
March 15, 2011

**NOAA
FISHERIES
SERVICE**



4 time zones
1 daylight savings

5 hours behind





How do you present size related mortality in the context of a barotrauma workshop?

Size dependent mortality factors

- Does one fish have a better chance of surviving than another

Stock sustainability factors

- Does one fish contribute more to the population than another

Release the right fish to promote population health



Why is a fish is released?

Regulatory Factors

- Size Limits
- Restrictive bag limits
- Area/time closures

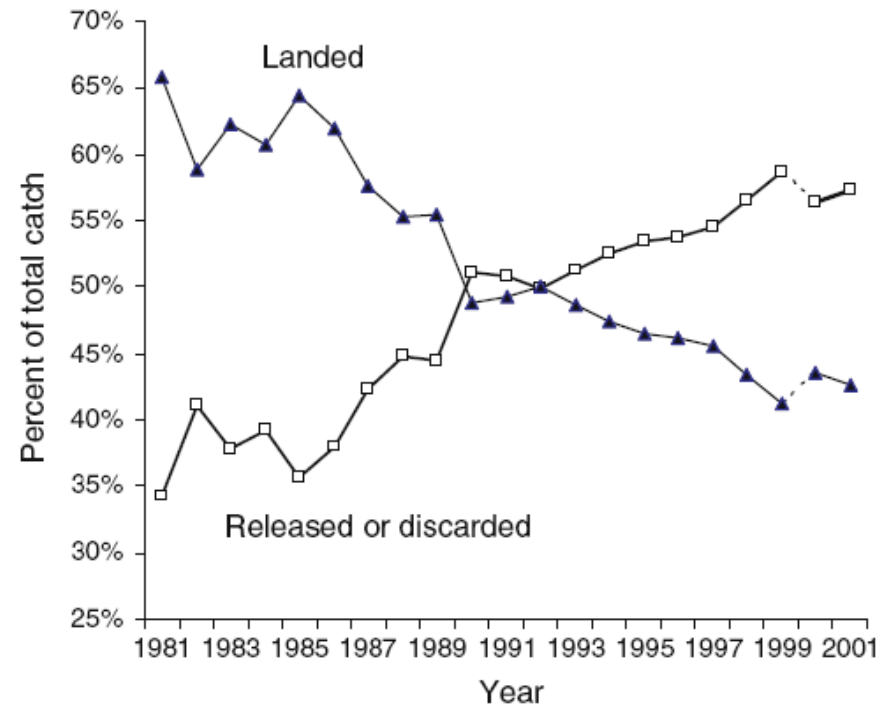
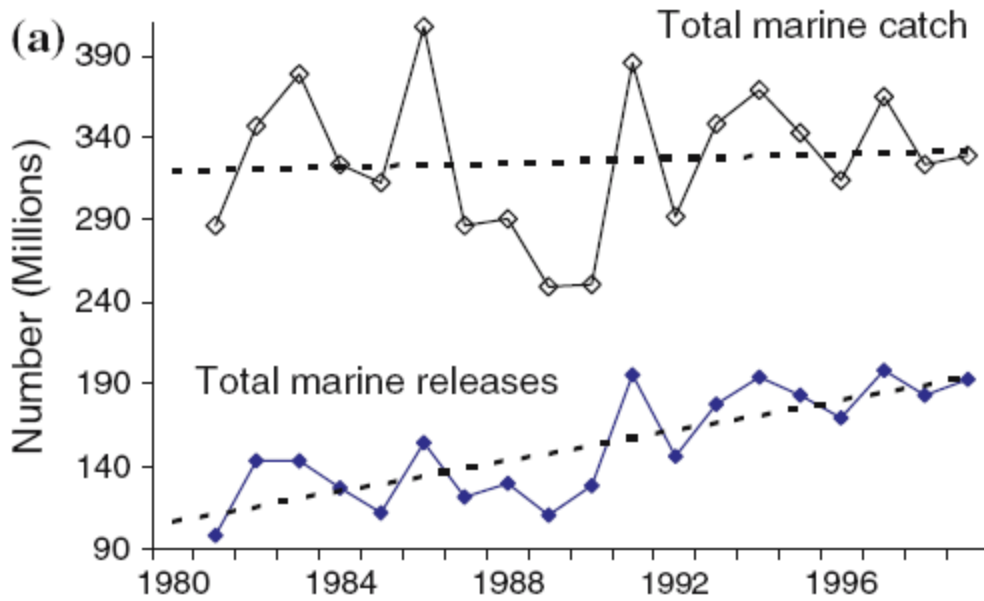
Voluntary Factors

- Catch and release
- Helping the population
- don't eat fish

Fish are released to promote population health



Releasing fish has become common in the US

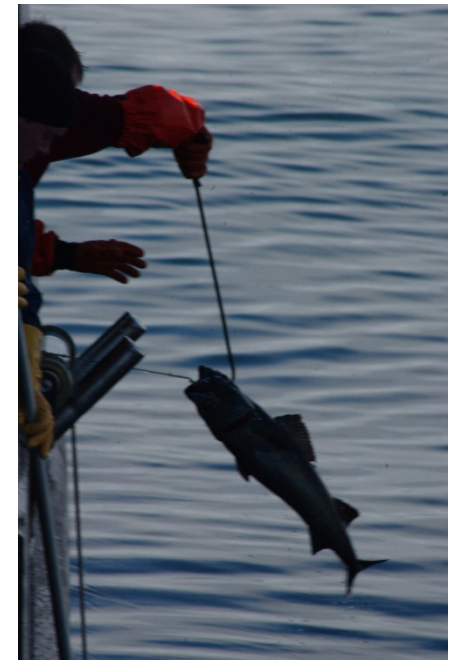




Catch and release and mortality

Every capture event has some probability of mortality associated with it

- Short term
 - Physical injury due to capture
- Mid term
 - Physiological stress due to capture
- Long term
 - Population effects due to removal





Factors that affect release mortality

- **Hook Location**
- **Gear effects**
- **recompression/venting**
- **Environmental conditions**
- **Stress**
- **Size of fish**





Fish size and release mortality

- **Are there differential mortality rates associated with fish size?**
- **Should handling/release techniques vary with fish size?**
- **What are the unseen effects - physiological and repeated capture effects?**
- **How do size selective removals impact a population's ability to sustain itself?**



Are there differential mortality rates by size?

• Review of 274 studies and 14 mortality factors

Hook location*

Fish size

Bait/artificial*

Hook size

Treble/single hook

Circle/J- hook**

Barbed/barbless hook***

Modified hook

Hook removal/cut line*

Venting**

Active/passive fishing

Play/handling time**

Capture depth*

Water temperature*

*highly significant $p < 0.01$

**significant $p < 0.05$

***marginally significant $p < 0.1$



Should handling and release techniques vary by fish size?

Should larger/smaller fish be Handled differently?

- physical injury probability higher for larger fish
- physiological stress probability higher for larger fish
- smaller fish less able to recover from serious injury





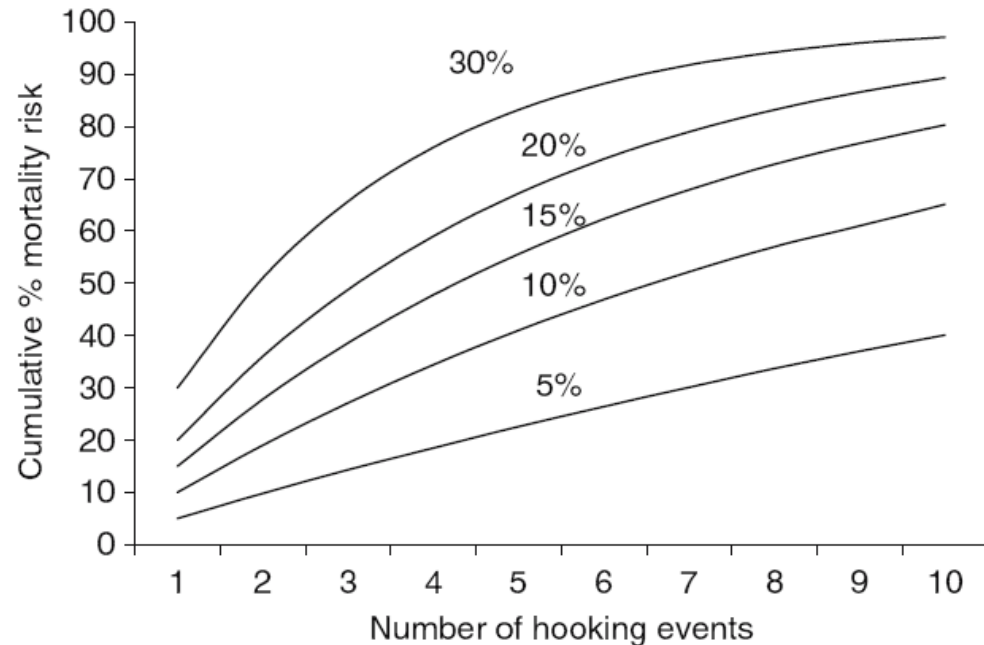
The unforeseen mortality factors

Physiological effects

- delayed mortality difficult to measure – large fish especially susceptible

Cumulative effects

- repeated captures increases risk of mortality – larger fish are more likely to have been caught multiple times





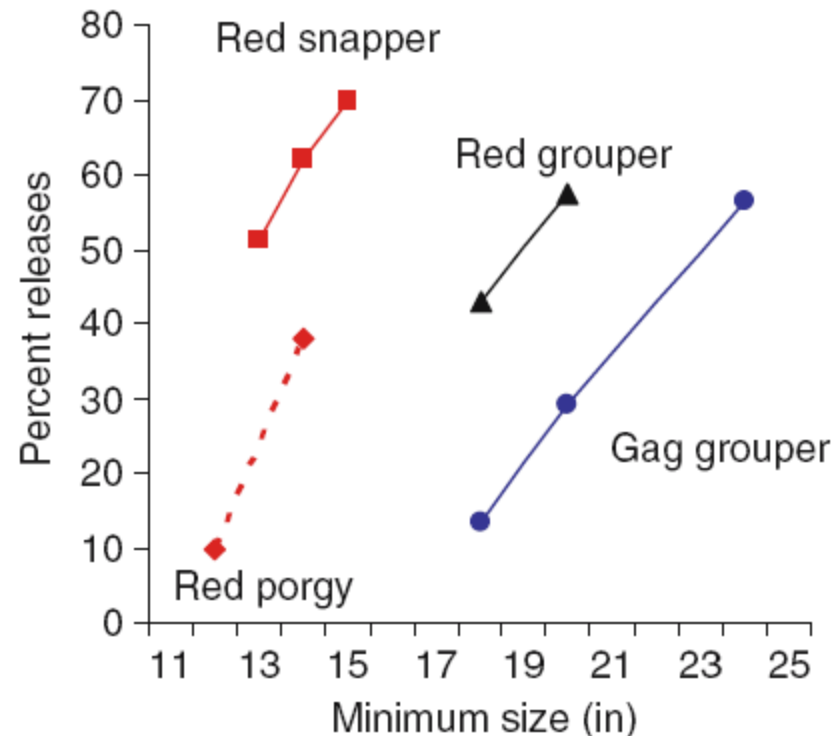
Indirect impacts on release mortality

Minimum size limit regulation

- when min size limit increased the probability of a fish being released increases

Cumulative effects

- increased probability of release also increases the probability of being recaptured





Release mortality summary

Review of 274 catch and release studies

- mean mortality was 18%
- multiple factors contribute to mortality risk
- risk of mortality extends beyond the capture event
- fish size alone is often not a significant factor but has indirect impacts on mortality





Workshop challenge – size and mortality

Points to ponder

- even when released there is a risk of mortality
- size only one of many factors that contribute to mortality risk
- need to consider all mortality factors when making decisions
- regulatory and voluntary release measures have multiple consequences





Fish size and stock sustainability

- **Not talking about if Fish X will survive at release**
- **How many Fish X's and Fish Y's should there be to ensure a healthy population**
 - size/age structure of population

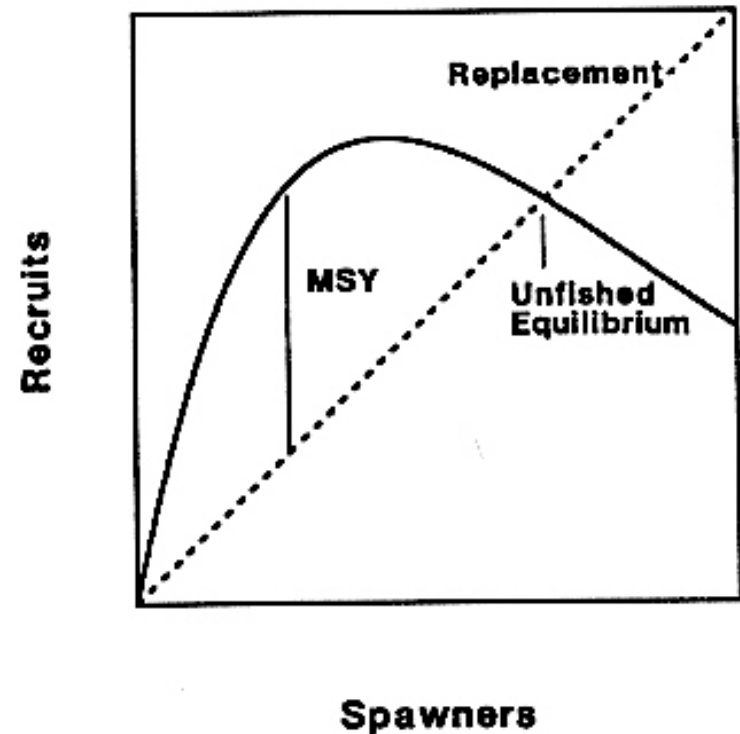




Fisheries management objectives

Maximum sustainable yield

- adopt harvest strategies which are used to maximize yield
- stock productivity is based on growth and recruitment
- have to estimate some measure of reproductive capacity or spawning potential





Measuring spawning potential of a population

Spawning Stock Biomass

- proxy for measurement of mature females in a population
- proportional to effective spawning potential of population
- assumes reproductive output per unit weight is same for all mature females.





Does spawning stock biomass accurately measure spawning potential?

Reproductive characteristics vary by fish size and age

- fecundity
- fish experience
- maternal age effects





Size matters - fecundity

Larger fish are more fecund

- proportional to body size
- can dedicate more energy to reproductive growth
- Atlantic cod fecundity can vary from 150,000 eggs to 25 million eggs





Size matters - experience

Larger/older fish are more experienced

- larger fish have larger eggs and offspring
- more batch spawnings
- experienced Atlantic cod contributed 10-12 times more offspring to age 1 than inexperienced fish





Size matters – maternal age

Larger/older fish gamble better (Pacific rockfish)

- more larvae
- commit more reproductive energy to larvae
- able to gamble on release timing

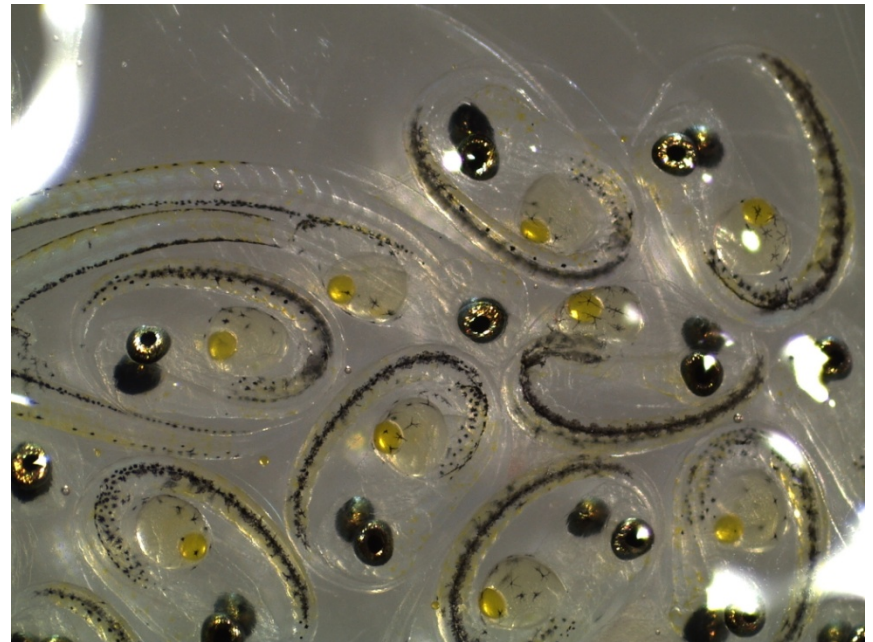




Size matters – maternal age

Larvae of larger/older females have better odds

- larger size at parturition
- more energy reserves for critical period
- parturition/release timing earlier





Understanding the effects of fishing

What fishing does to a population

- reduces population size
- selectively removes larger and older fish
- results in fewer old/large fish – age/size truncation





Spawning potential and size based mortality

Fishing effects may reduce spawning potential

- reduces population resiliency to change and perturbation
- evokes evolutionary responses which reduces spawning potential
- reduces the reproductive capacity of a population





Spawning potential in a recreational context

Size-based mortality effects and recreational fishing

- size selective fishing is common
- size specific mortality must be accounted for and evaluated even if released
- angler mindset can be influenced





Workshop challenge – release mortality and stock sustainability

Points to ponder

- recommendations designed to reduce mortality while accounting for numerous factors that interact - including size
- recommendations should strive to promote stable age/size population structure and population sustainability
- recommendations need to keep exploitation rates in perspective even though we're promoting releasing fish

