WF4133-Fisheries Science

Class14: Harvest, Gear, Effort, and Yield Continued

Housekeeping

Housekeeping

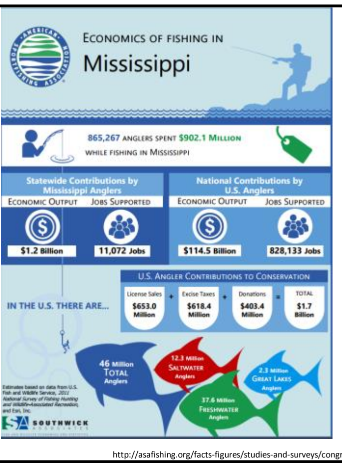
- Lab this afternoon
  - Extract otoliths
  - Estimate age
  - Limited materials

1-3

- Group 1: Team Gar
  - Bryant, Timothy Boyd
  - Whigham, Ricki Simone
  - Coleman, John-Austin F.
  - Fogarty, Paige Lauren
- Group 2: Team Paddlefish
  - Kroot, Thomas Johaness
  - Vernon, Elizabeth Brooke
  - Childs, Alison Brooke
  - Critcher, Jessie Ryan
- Group 3: Team Sturgeon
  - Goode, Carlee Skye
  - Brasington, Ryan Judson
  - Mitchell, Zachary Ray
  - Williams, Laurel Claire

3-5

- Group 4: Team Bass
  - Thompson, Brady Chance
  - Bullock, Sierra Lee
  - Shannon, Ashley Nicole
  - May, Amy Renee
- Group 5: Team Bluegill
  - Byrd, Steven Christopher
  - Woodyard, Ethan T.
  - Hamid, Keaton Taylor
  - Powell, Bonner Lee



http://asafishing.org/facts-figures/studies-and-surveys/congressional-district-fishing-impacts/

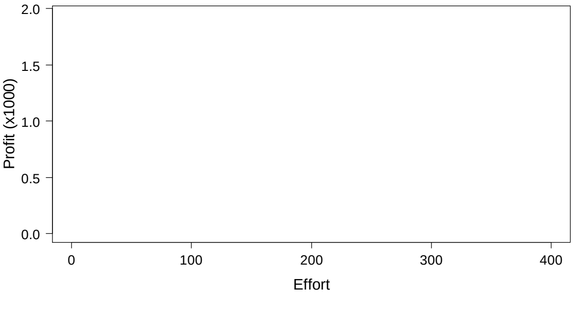
Biomass & harvest dynamics

$$\frac{dBiomass}{dt} = r \cdot \frac{K - Biomass_t}{K} - effort \cdot catchability \cdot Biomass_t$$

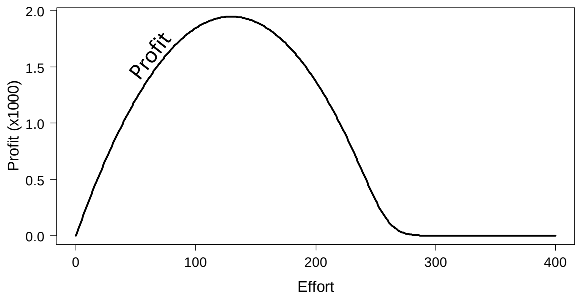
$$\frac{dYield_{biomass}}{dt} = effort \cdot catchability \cdot Biomass_t$$

$$\frac{dYield_{economic}}{dt} = effort \cdot catchability \cdot Biomass_t \cdot Landing\ price$$

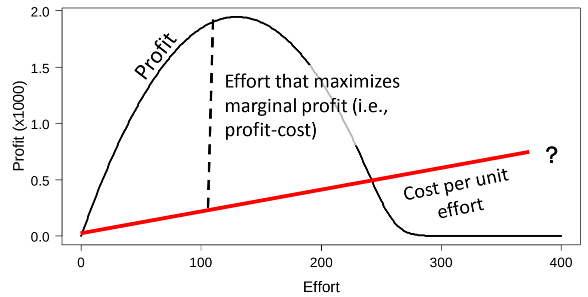
Linking catch, profit, & cost



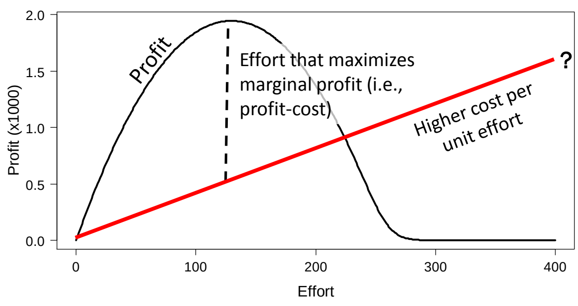
Profit versus effort



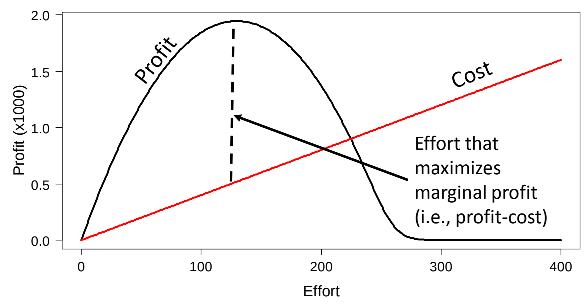
Maximizing profits



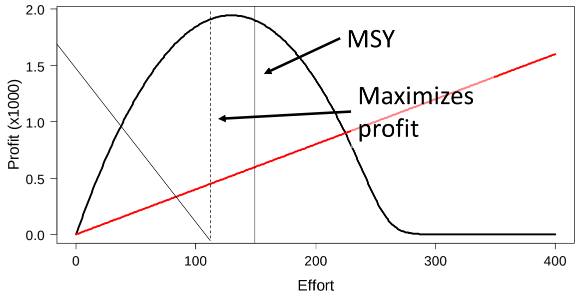
Maximizing profits



Profit & cost versus effort

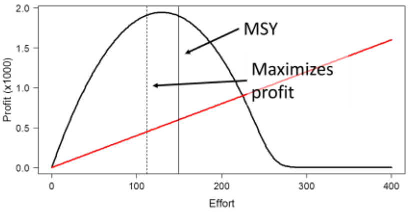


Putting it all together



Optimal sustained yield (OSY)

Maximize difference between maximum economic yield and cost



Optimal sustained yield (OSY)

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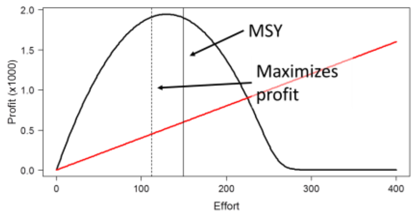


Example-MEY

- Graham Schaefer

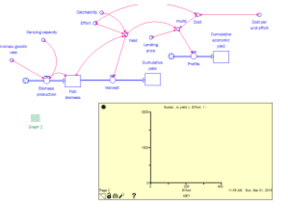
  r=0.3

  K=10,000

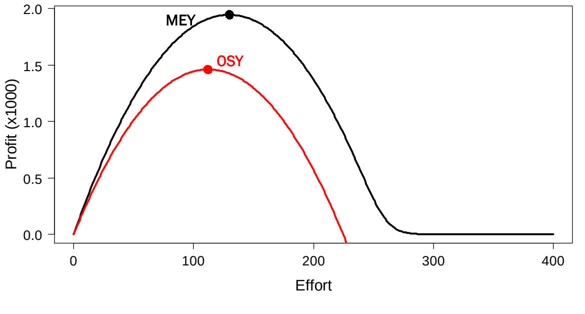
  Catchability = 0.001

  B_0=9,000

  Landing price= 3 USD



MEY & OSY



Some assumptions

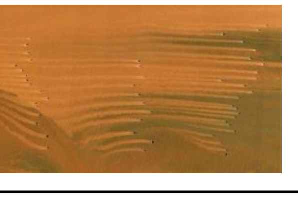
- Market price is constant
- Realistic?
- Market price declines with surplus
- Accounting for price drops?
- Lets leave that to the economists
- Take home-accounting for economics is important and a tool to minimize overfishing… at least in the long term

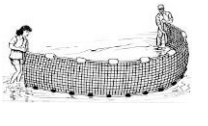
EFFORT & GEARS

Effort and gear

Two types of fishing gears

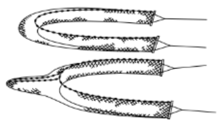
1. Active: fish are actively captured by gear
2. Passive: gear to which fish must swim and become stuck





Active gears

1. Seines
2. Trawls
3. Purse seines
4. Hand lining
5. Cast net

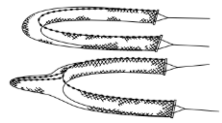


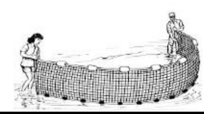
Effort associated with area, volume, time, distance, sets

Seines

Effort: could be related to volume or area fished, lots of assumptions

- Biomass per hectare
- Biomass per haul
- Biomass per volume

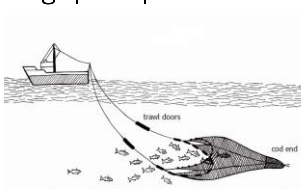




Trawls

Effort: could be related to volume or area fished

- Biomass per day, landings per trip
- Biomass per km
- Biomass per hect-ares, biomass per volume
- Lots of assumptions

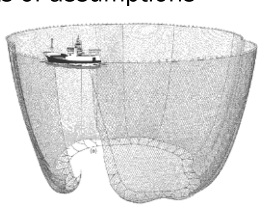


Trawl

Purse seines

Effort: could be related to volume or area fished

- Biomass per day, biomass per hectares, biomass per volume, lots of assumptions
- Landings per trip



Handlining

Effort: not related to volume or area fished, related to hooks, time, trip length

- Biomass per hook per hour
- Biomass per trip per trip length

Cast nets

Effort: not related to volume or area fished

- Fish per cast
- Biomass per cast

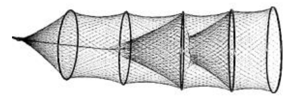

Journal Summary: Cast Nets are Useful Sampling Tools, and You Should Try One

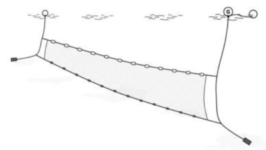
BY JEFF SCHAEFFER

Cast nets are commonly used by both sport and commercial anglers in estuarine habitats along the southern U.S. coast, but they are rarely used by fisheries scientists, especially when compared to other gears. This is due to the fact that they require practice and skill to deploy, but also because sampling with them is considered non-repeatable. A new study reported in the current issue of the American Fisheries Society's journal of *Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science* (Stein et al. 2014) dispels cast net myths and examines them critically as a sampling tool.

Passive

1. Hoop & fyke nets
2. Gill nets
3. Traps
4. Long & trot lines



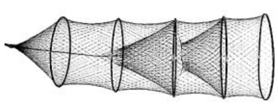


Effort associated with
~~area~~, ~~volume~~, time, ~~distance~~, sets

Hoop & Fyke nets

Effort: not related to volume or area fished

- Fish or biomass per net, assuming fixed time
- Fish per hour: soak time not fixed
- Fish per net night



Traps

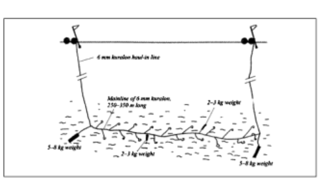
Effort: related to time or trap

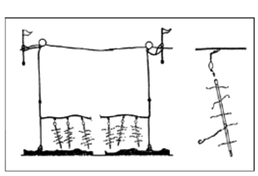
- Fish or biomass per net, assuming fixed time
- Fish per hour: soak time not fixed
- Fish per net night

Long & Trot Lines

Effort: related to soak time, length, # of hooks

- Fish or biomass per hook, fixed soak time
- Fish or biomass per meter, fixed soak time and hook density

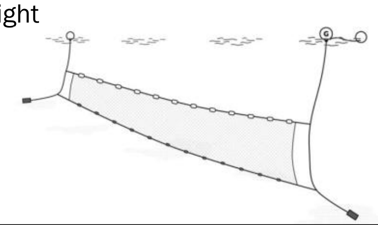




Gill nets

Effort: not related to volume or area fished

- Fish or biomass per net, assuming fixed time
- Fish per hour: soak time not fixed
- Fish per net night



AN EXAMPLE USING PADDLEFISH

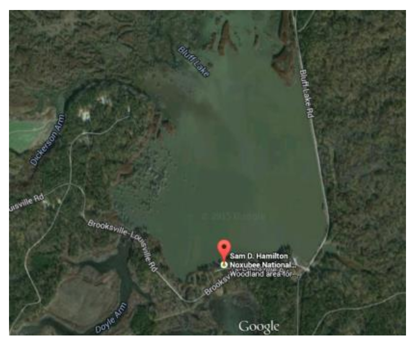
Paddlefish

- Vulnerable status-International Union for Conservation of Nature (IUCN)
- Declines?
  - Habitat alteration
  - Harvest
  - Water quality

Life history

- Long lived
- Sexually mature late in life
- Spawn in spring
  - Water temperature: 55 to 60 °F (13 to 16 °C)
  - Photoperiod increasing day length
  - Spring rise in river flow

Just down the road



Just down the road

Just down the road

5” Gill net

5” Gill net

Catchability & effort

- Set gill net for 30 minutes x 4
- 100 Paddlefish in pool
- Catch: 3,4,4,2

Example: Catch = 3

$$Catch = catchability \cdot effort \cdot Abundance$$
$$3 = catchability \cdot 30 \cdot 100$$
$$3 = catchability \cdot 3000$$
$$\frac{3}{3000} = catchability$$
$$0.001 = catchability$$

Example: Catch = 4

$$Catch = catchability \cdot effort \cdot Abundance$$
$$4 = catchability \cdot 30 \cdot 100$$
$$4 = catchability \cdot 3000$$
$$\frac{4}{3000} = catchability$$
$$0.0013 = catchability$$

Example: Catch = 2

$$Catch = catchability \cdot effort \cdot Abundance$$
$$2 = catchability \cdot 300 \cdot 100$$
$$2 = catchability \cdot 3000$$
$$\frac{2}{3000} = catchability$$
$$0.00067 = catchability$$

Catch

Catchability ~ 0.009925
Effort = 30 minutes
Population = 200

$$Catch = catchability \cdot effort \cdot Abundance$$
$$Catch = 0.0009925 \cdot 30 \cdot 200$$
$$Catch = 5.955$$

Catch

Catchability ~ 0.009925
Effort = 100 minutes
Population = 200

$$Catch = catchability \cdot effort \cdot Abundance$$
$$Catch = 0.0009925 \cdot 100 \cdot 200$$
$$Catch = 19.85$$

Catchability & effort

- Passive or active gears
- Links Catch to:
  - Effort
  - Catchability
  - Population

Why is it a good idea to link catch to effort?