

Fisheries Management Techniques FT 211

Joel Markis

Asst Professor

Fisheries Technology

University of Alaska Southeast



Fisheries Technology

Chapter 7

Active Capture Techniques



Outline

This Module will Contain 6 Main areas

- Active Fish Capture
- Towed Nets
- Dredges
- Surrounding Nets
- Other active Gear
- Gear Selection

Student Learning Outcomes

Students will be able to:

- Describe active fish capture techniques and be able to identify the three main categories
- Describe the use of towed nets and provide examples
- Describe the use of dredges and provide examples
- Describe the use of surrounding nets and provide examples
- Describe other active capture techniques and provide examples
- Summarize gear selection and what goes into selecting the right equipment for the conditions

Talk about active capture...



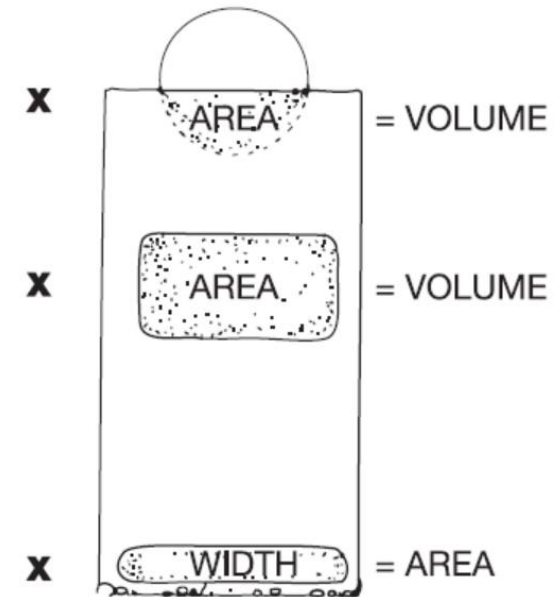
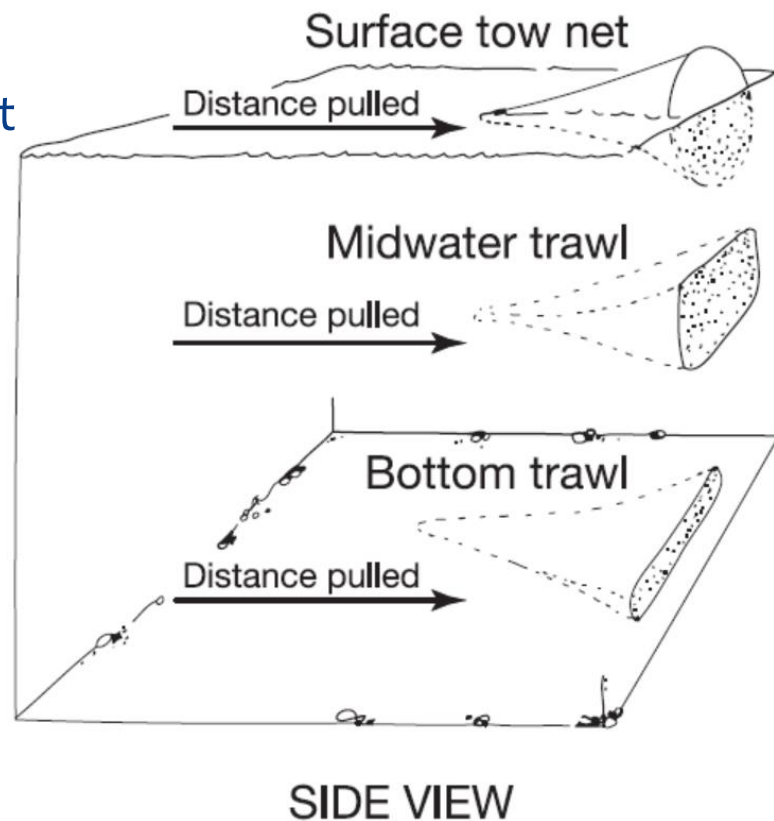
Active Capture

- Involves using moving nets or gears to collect fish, shellfish, or macro-invertebrates
- Difference between passive is that with passive you rely on fish to move into a stationary net or trap (or hook)
- Not always clear
 - Electrofishing, intoxicants, angling, Screw Traps



Active Capture

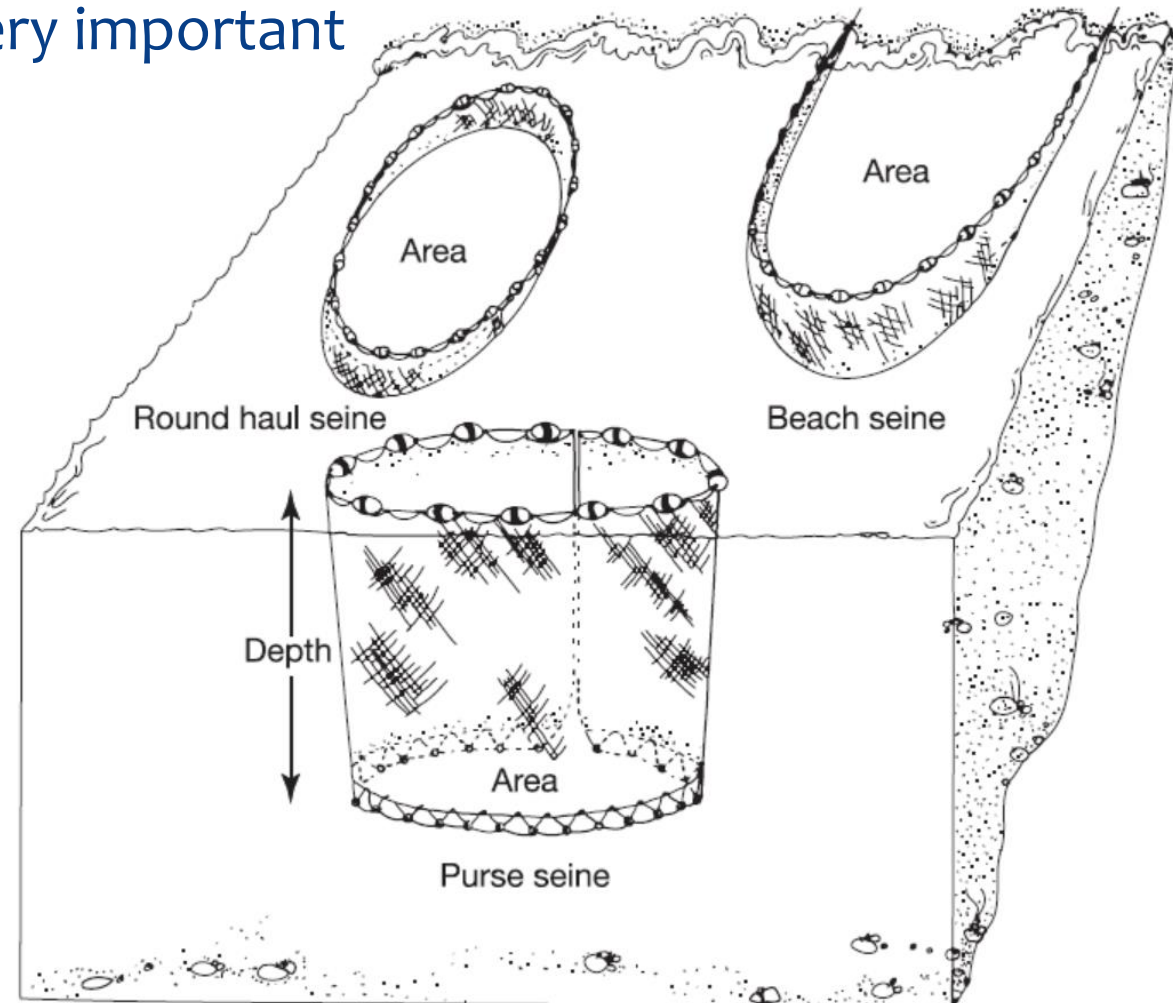
- Main gear types **enclose** or **sweep**
 - Specific area
 - Operate over a specified time
 - accurately defined unit of effort



FRONT VIEW

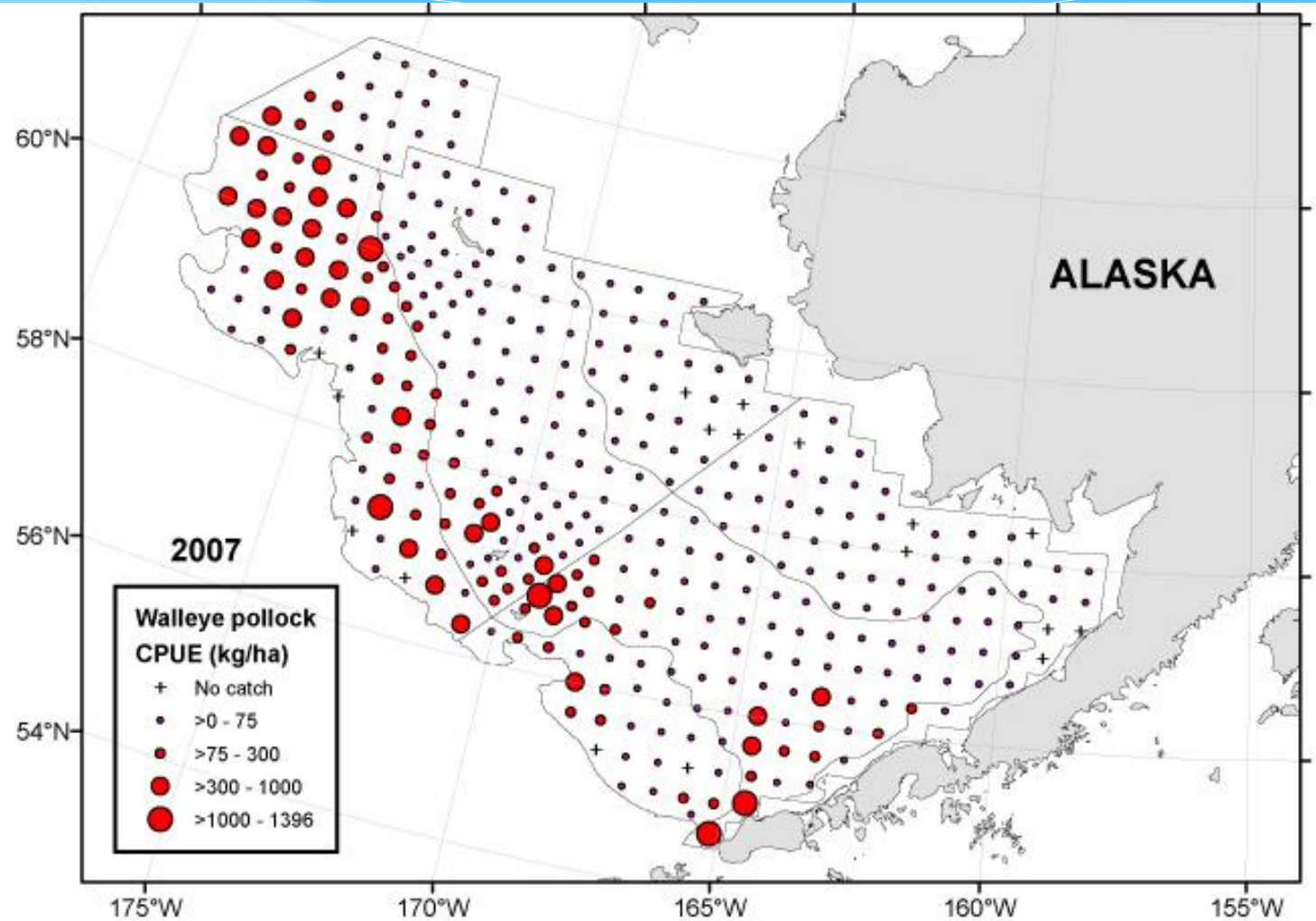
Active Capture

- Accurately define sampling effort is very important
 - when we need an index of abundance
 - Typically what we do in science



Standardization of effort

- Pull trawl fixed time at fixed speed
- Sweeping specific area
- Allows for extrapolation



Active vs Passive

Passive

- Gear does not enclose or cover a specific area
- May not accurately reflect abundance due to the behavior of the fish
- Can be set quickly from boat and requires very little labor
 - not as quick in collection of data

Active

- Gear is mobile in space and time
- Samples can be collected more rapidly but at a higher cost
- Usually need larger vessel to handle active gear
- Two or more people to safety and correctly operate the gear

Active Capture

- Shorter sampling periods allow for greater sample size
 - lots of tows vs 1 trap deployment
 - increases statistical precision of indices of abundance
 - cover more area and ensure more complete sampling
- More precise picture of fish spatial distribution and habitat use
- Time of capture can be determined more precisely
 - Time of capture important
 - Diet studies
 - Feeding rate
 - Behavior
 - Movement
- Active gears can catch less fish per unit time
 - Disadvantage if need big number of fish for your sample

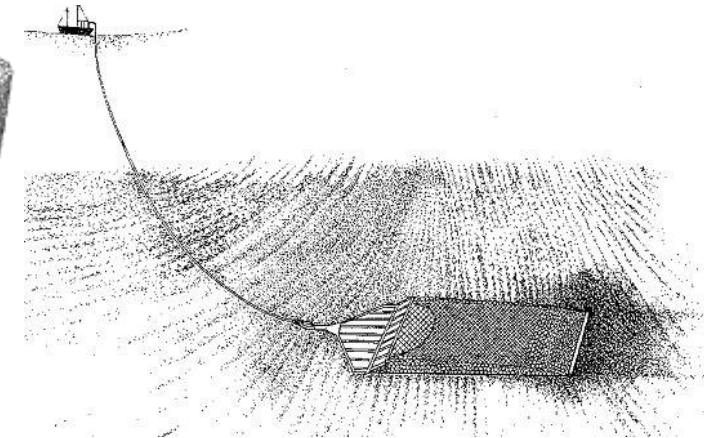
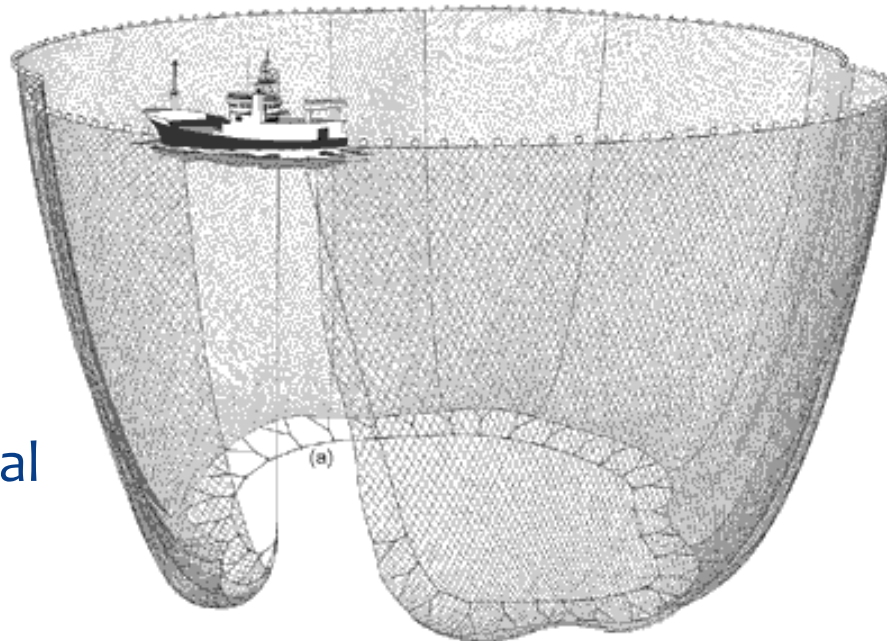
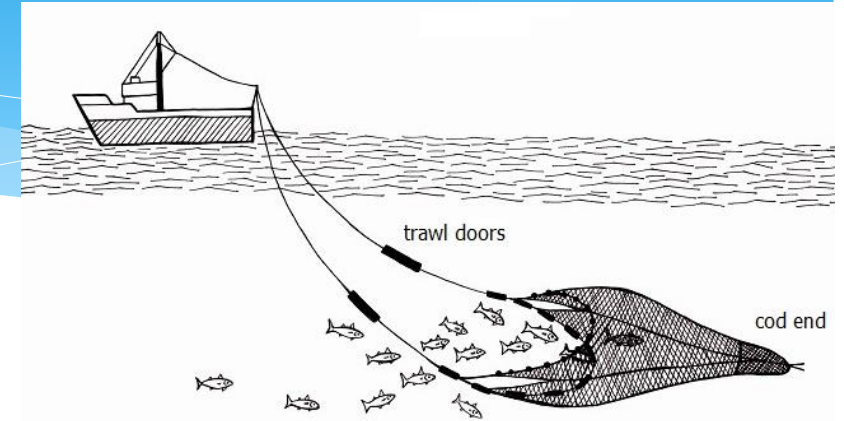
Requirements

- Larger boats
- More manpower
- Less sampling time than passive gear



3 Main Gear Types

- Towed Nets (Trawls)
- Dragged Nets (Dredges)
- Surrounding Nets (Seines)
- Others
 - Screw Traps
 - Spearfishing
 - Cast nets
 - Electrofishing
- Science
 - Scaled down commercial version



Net Material and Construction

- Natural Materials
 - cotton, hemp, linen (old school)
 - Thick, heavy
 - Rotting is a problem
- Synthetic materials
 - polyethylene, polypropylene
 - Stronger, thinner
 - Less prone to decay

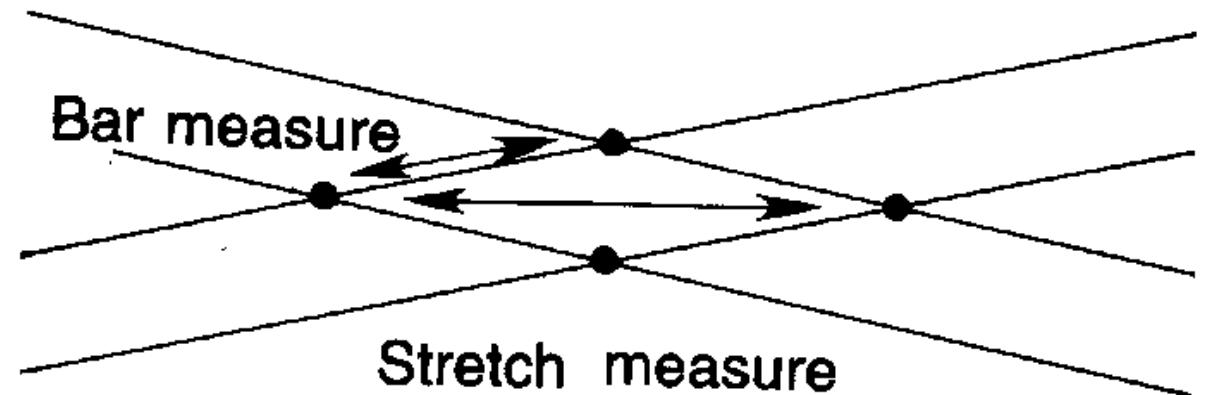


Mesh Size

- Bar length - distance knot to knot along diagonal

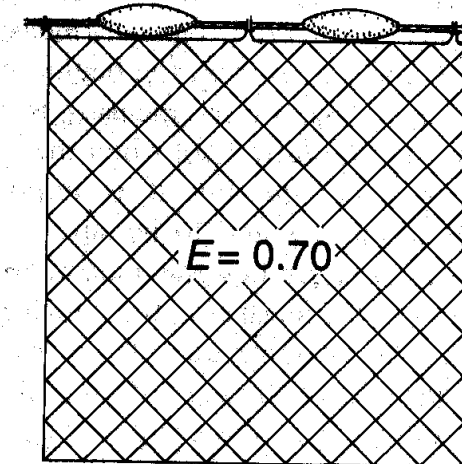
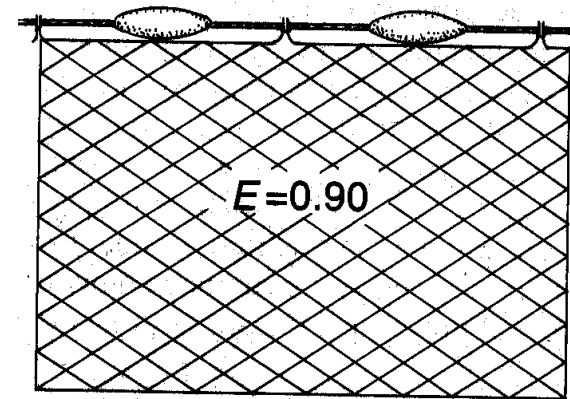


- Stretch measure - knot to knot distance when mesh is stretched

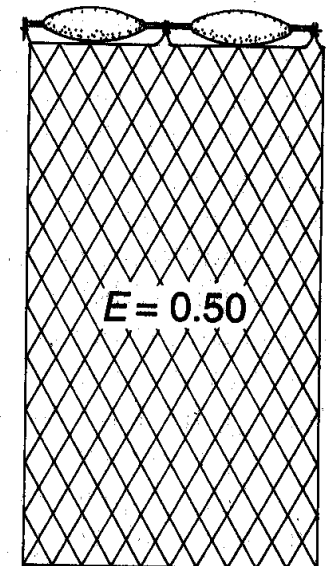


Hanging ratio (E)

- $E = \text{rope length} / \text{stretched length of netting}$
- Or use hanging % = $100 * (1 - E)$
- Range for trawls ($E = 0.6 - 0.8$)



Hanging ratio = E

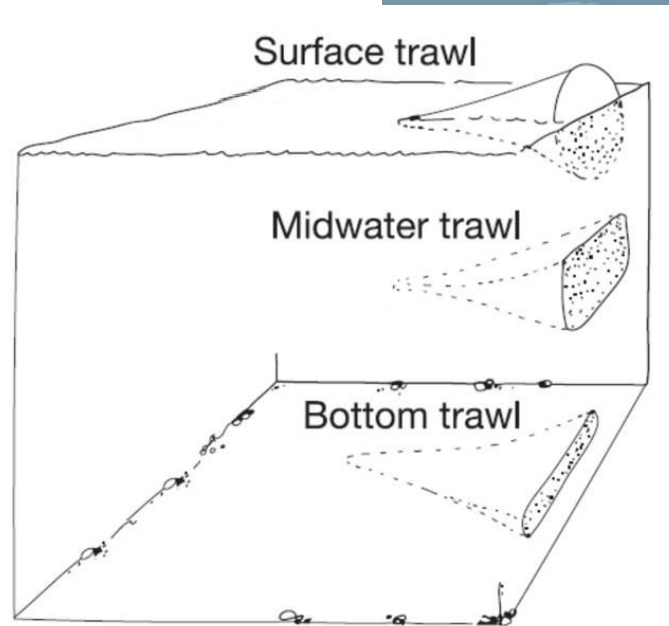
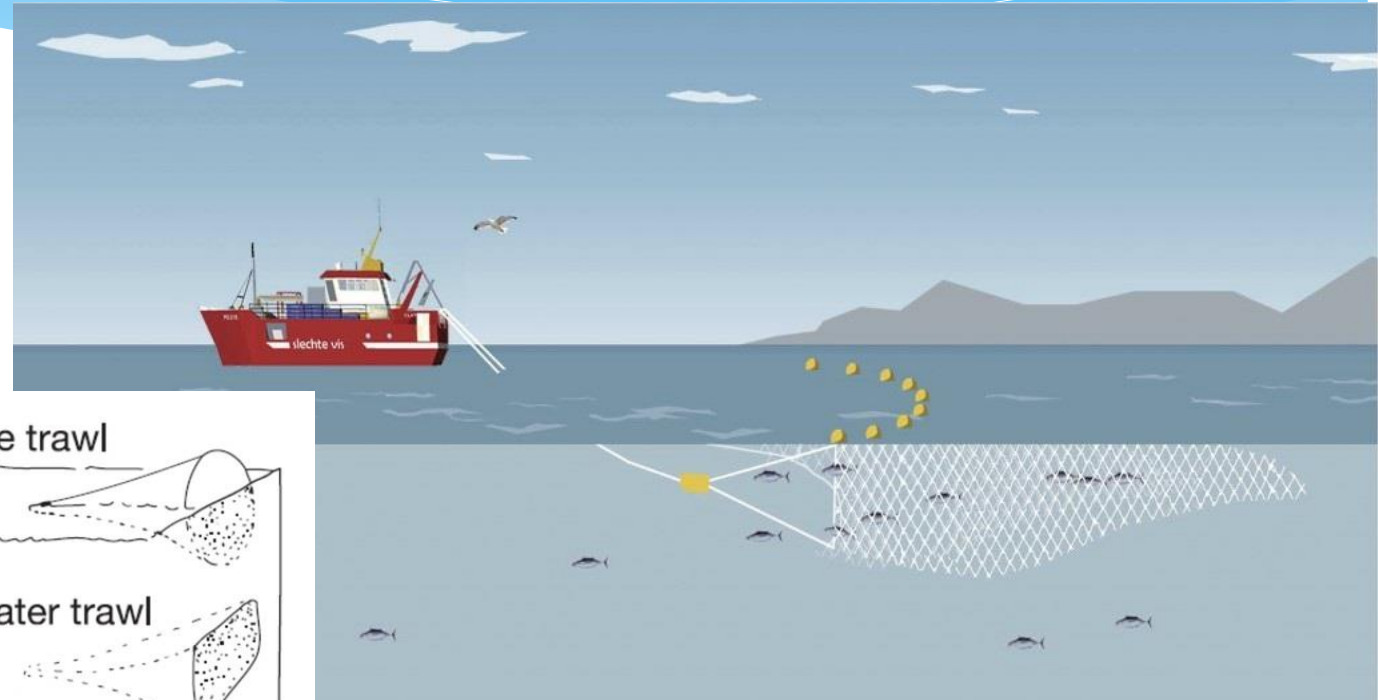


Self Check

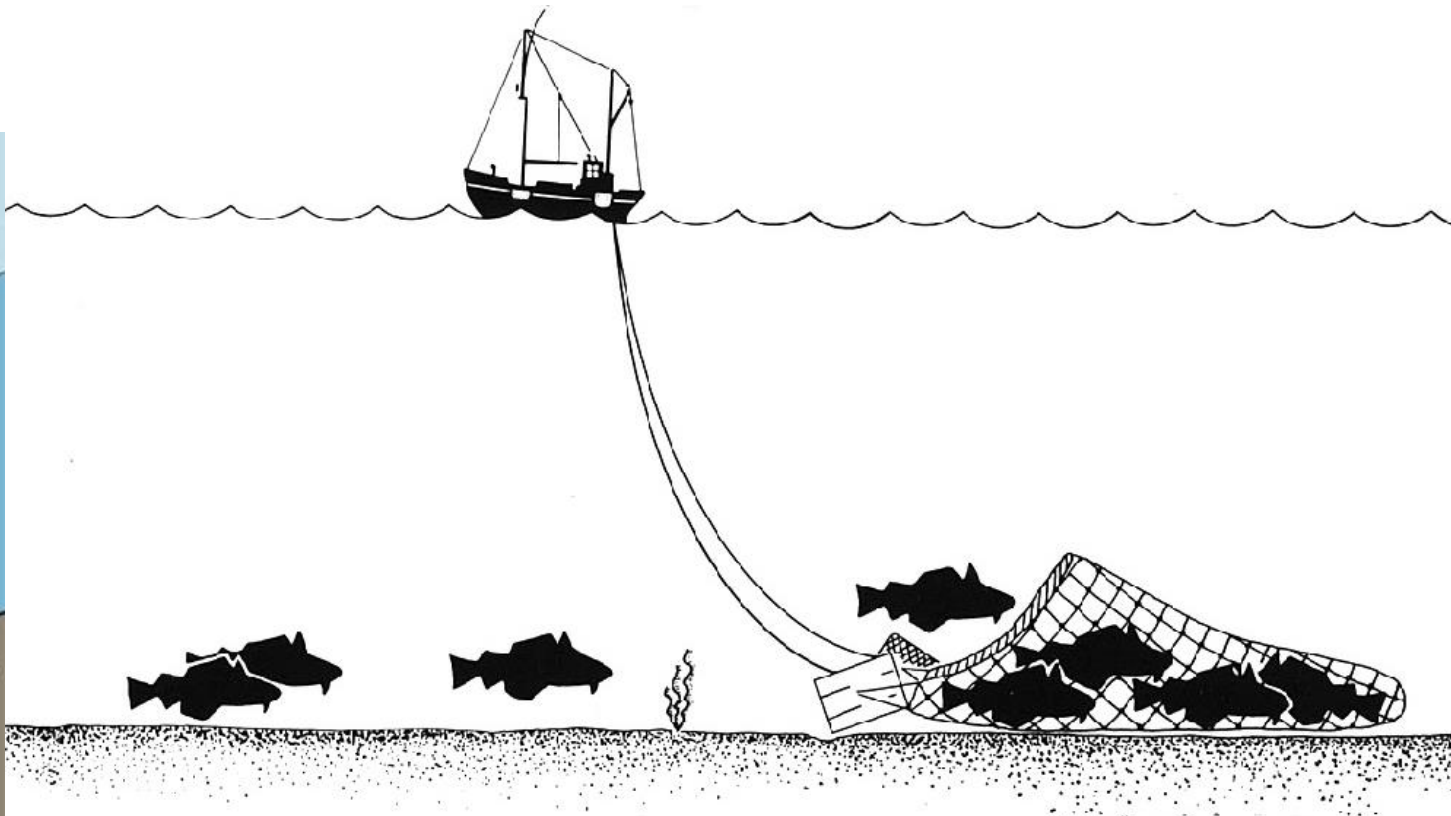
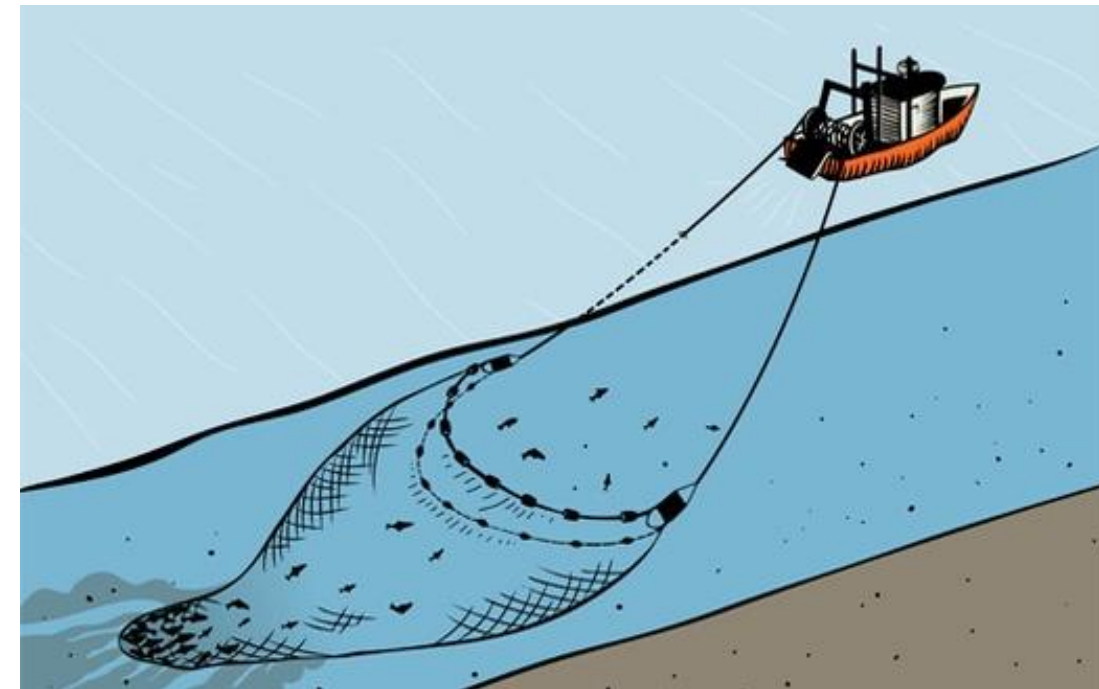
- Active capture techniques are more standardized and systematic than passive
 - **True**
 - False
- Which of the following is not an active capture technique
 - Dredge
 - **Pot**
 - Trawl
 - Sein

Towed Nets (Trawls)

- Funnel-shaped with cod-end (narrow backend)
- 2 Primary types
 - Beam Trawl
 - Otter Trawls
- 3 Positions
 - Surface
 - Midwater
 - bottom



Trawls (Draggers)



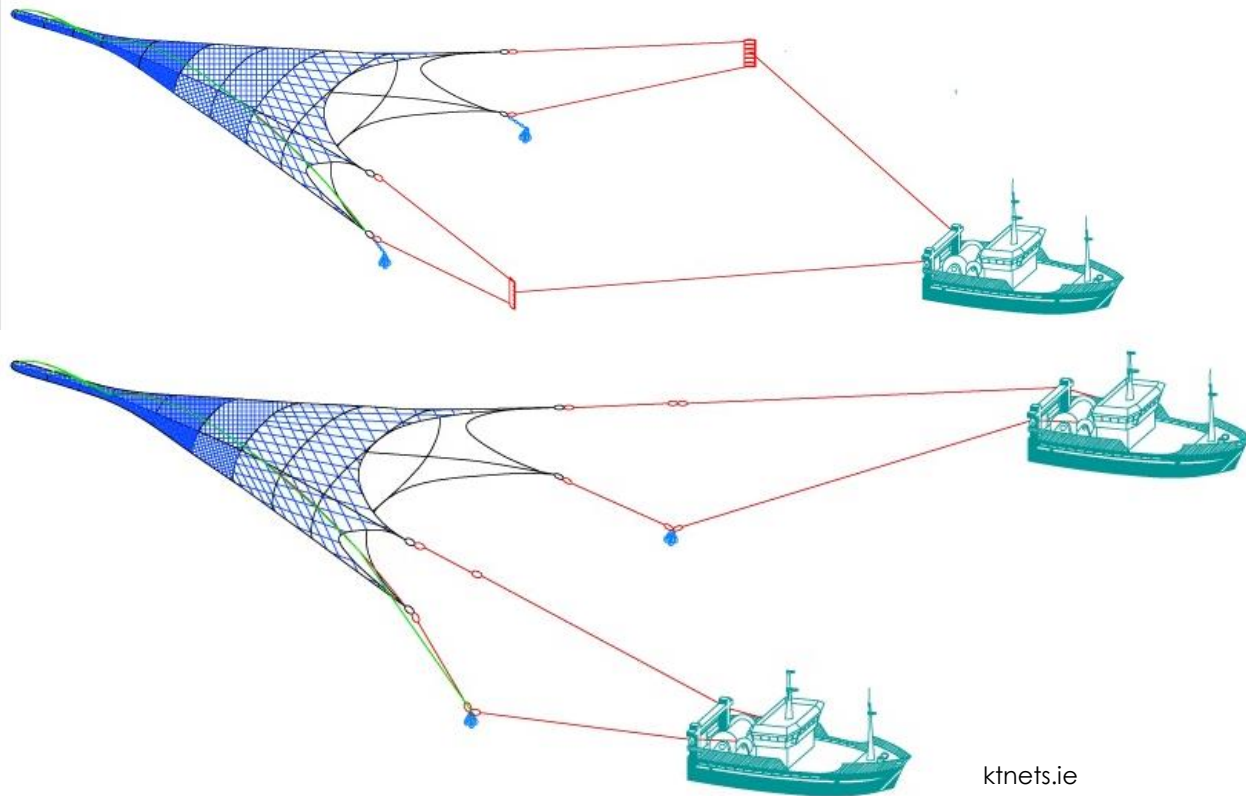
Trawler

- Large boats
- Stern Reel aft (Stern)
 - Sometimes 2
 - Ramp or chute in stern
- 2 Booms midship (Side)
 - Haul alongside
 - Shrimp
- 2 Boat Operations (paired)
 - 1 net

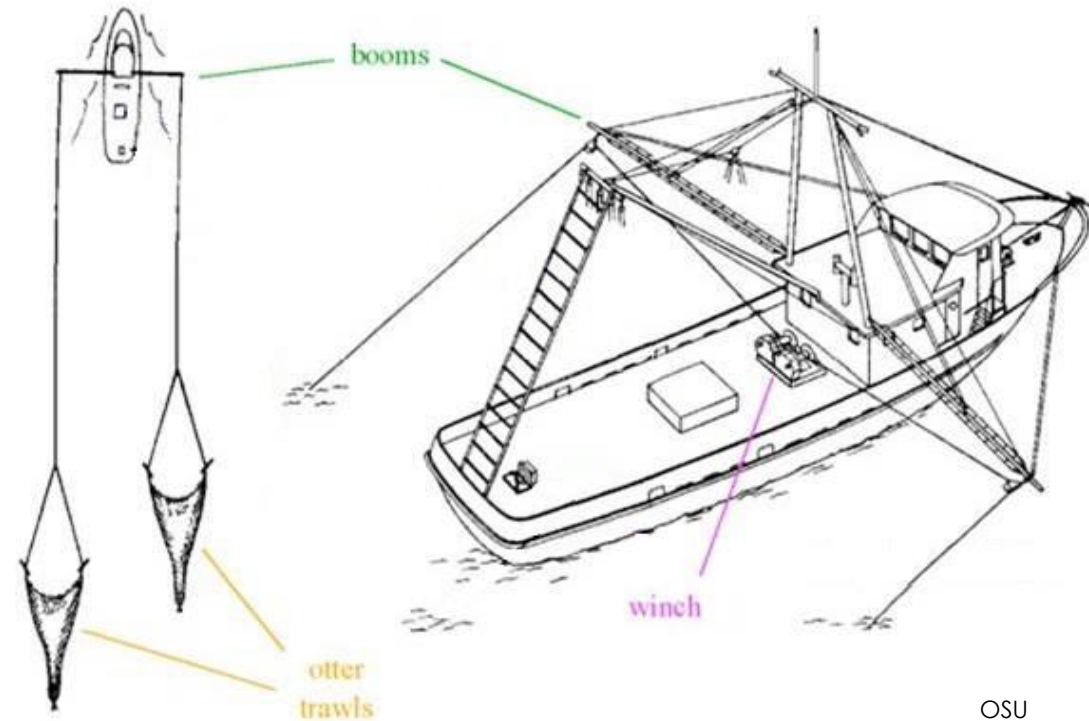


Trawlers

- Stern, Side, Paired



ktnets.ie



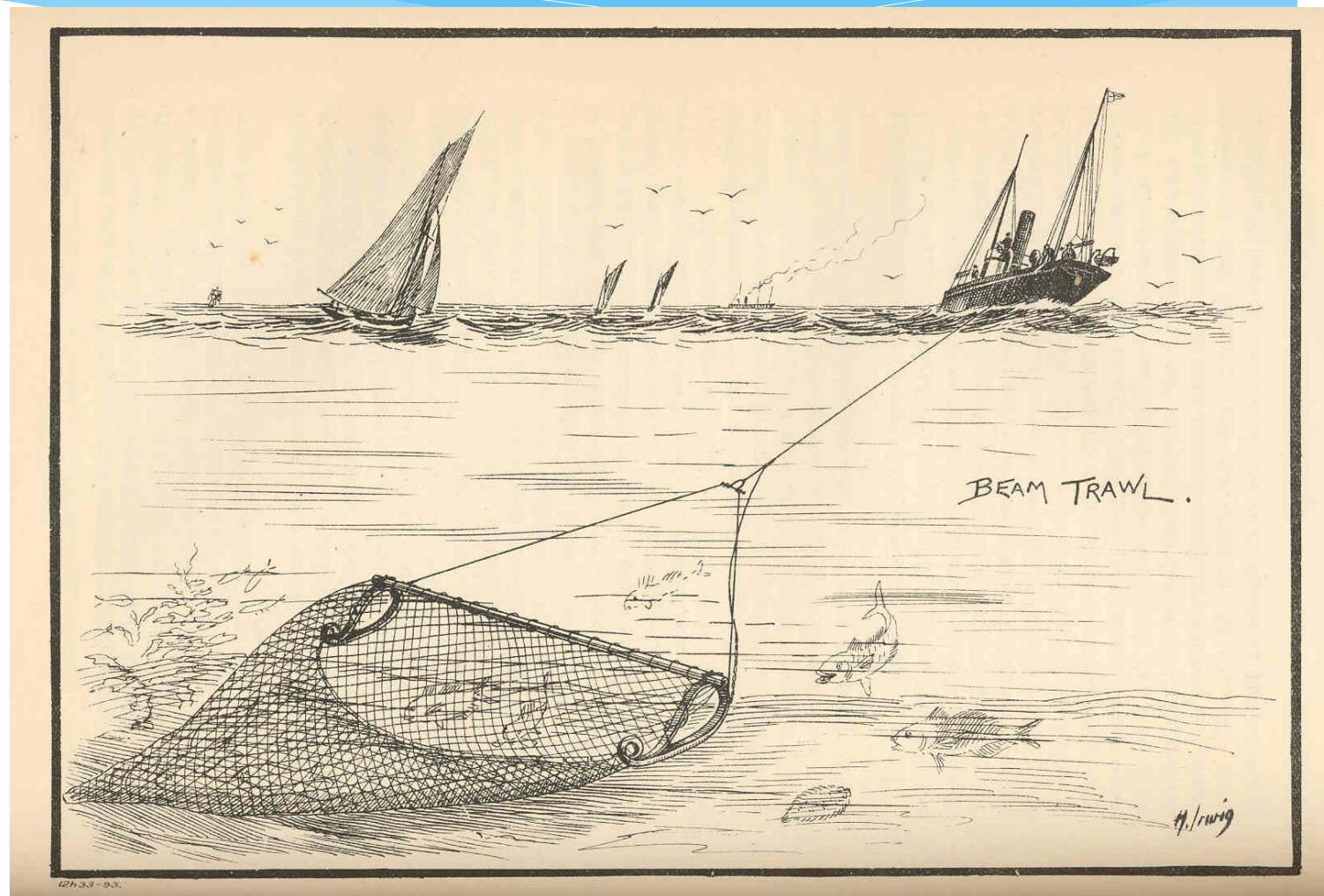
OSU

Commercial Trawling



Beam Trawls

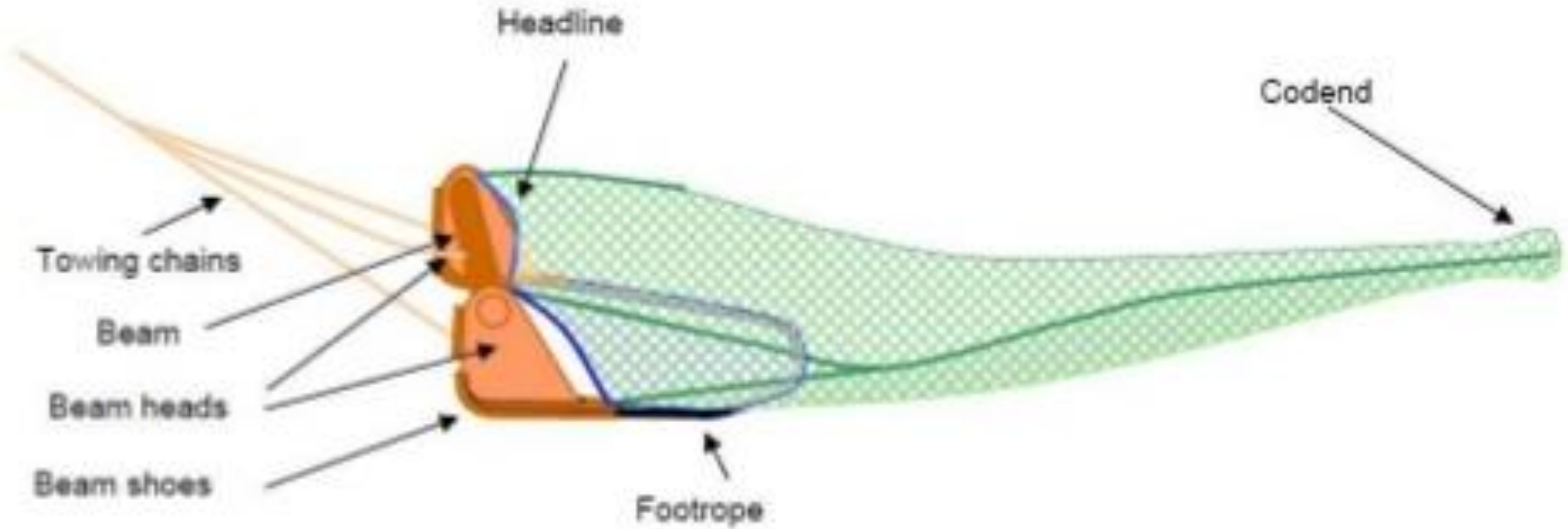
- Fixed width (beam)
- Sweep fixed area consistently
- Somewhat cumbersome if beam is large



Beam Trawls



Beam Trawl





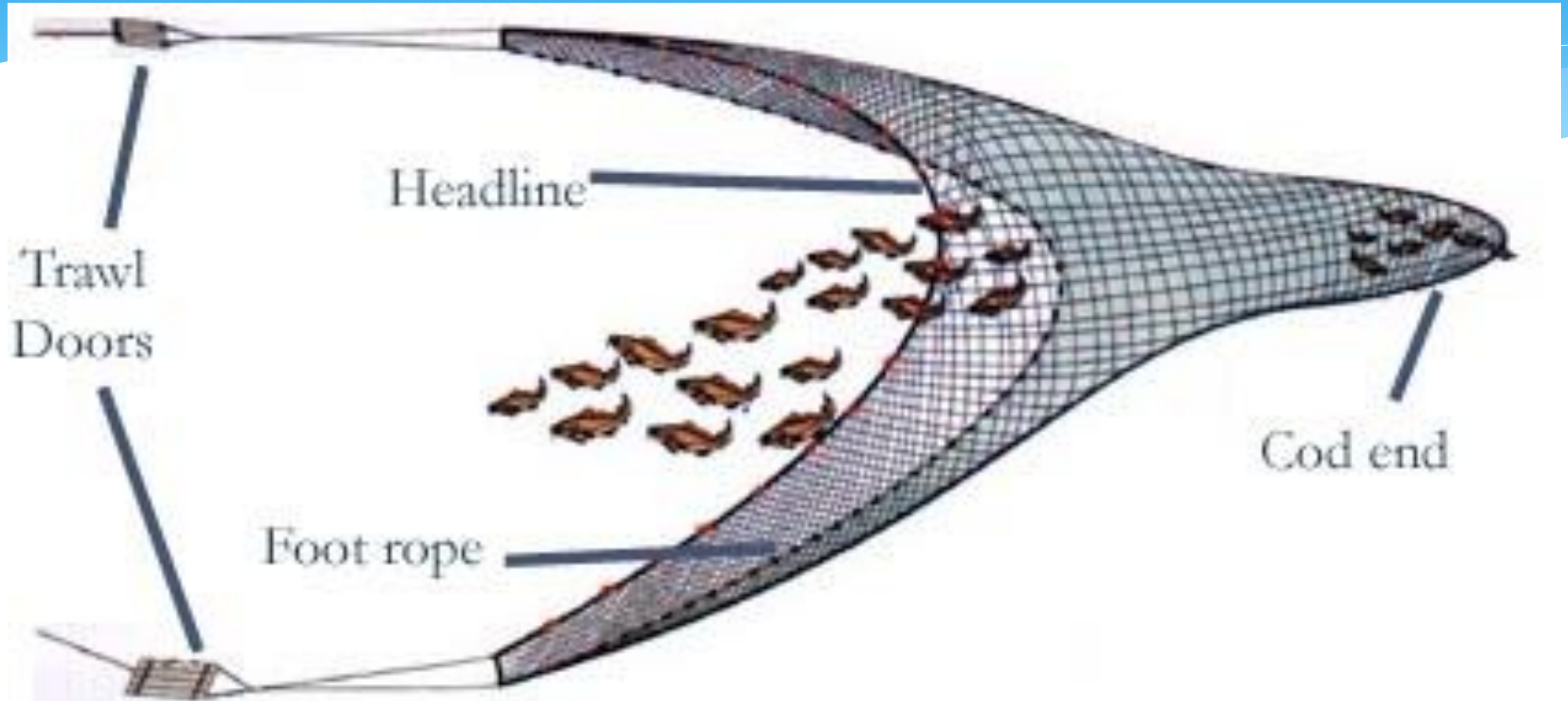


Otter Trawls

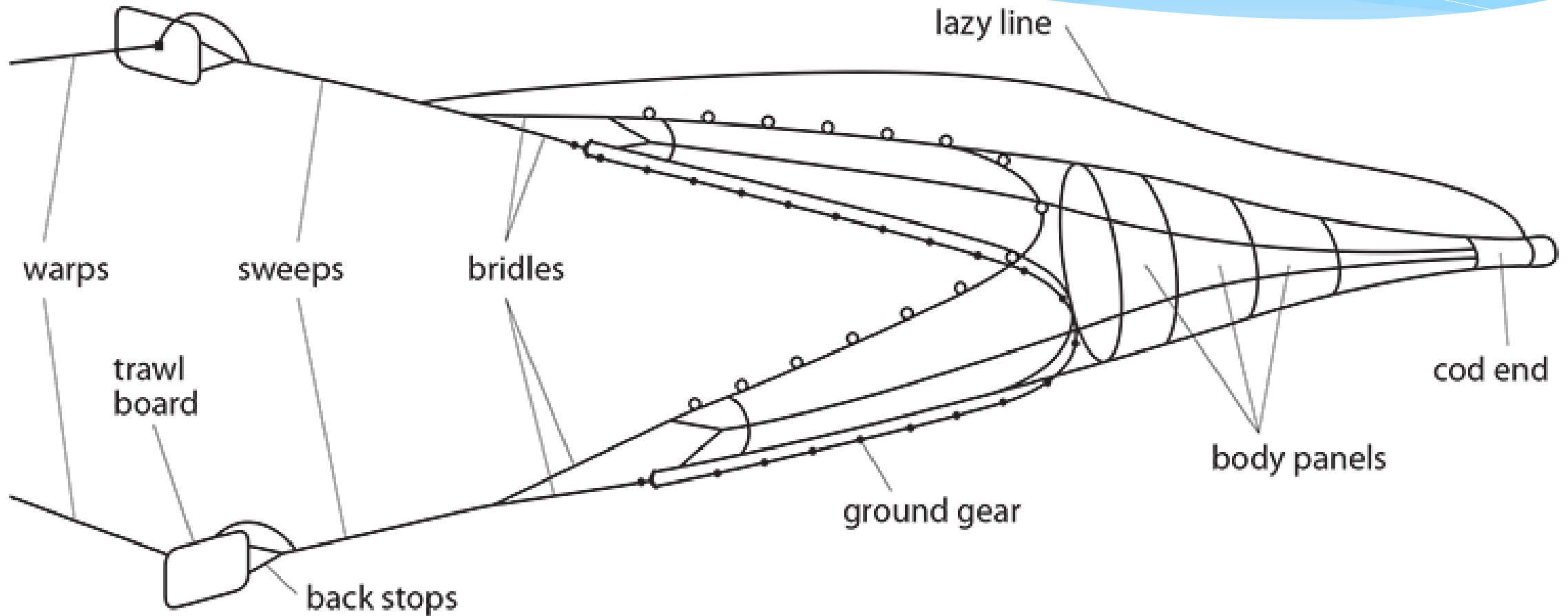
- Otter boards or trawl doors hold net open
 - Oval or square doors
 - Reinforced skids
- Mouth width depends on speed (inconsistent)
- Fished
 - Surface
 - Midwater
 - Bottom



Parts of an Otter Trawl



Parts of a Trawl



ADF&G Research Trawling

- Assess crab abundance
- Otter Trawl
 - Bottom Trawl
- 30 min tows at gridded stations



Trawling

- Spool net out
- Attach doors
- Deploy net
- Control size with speed
- Retrieval is opposite



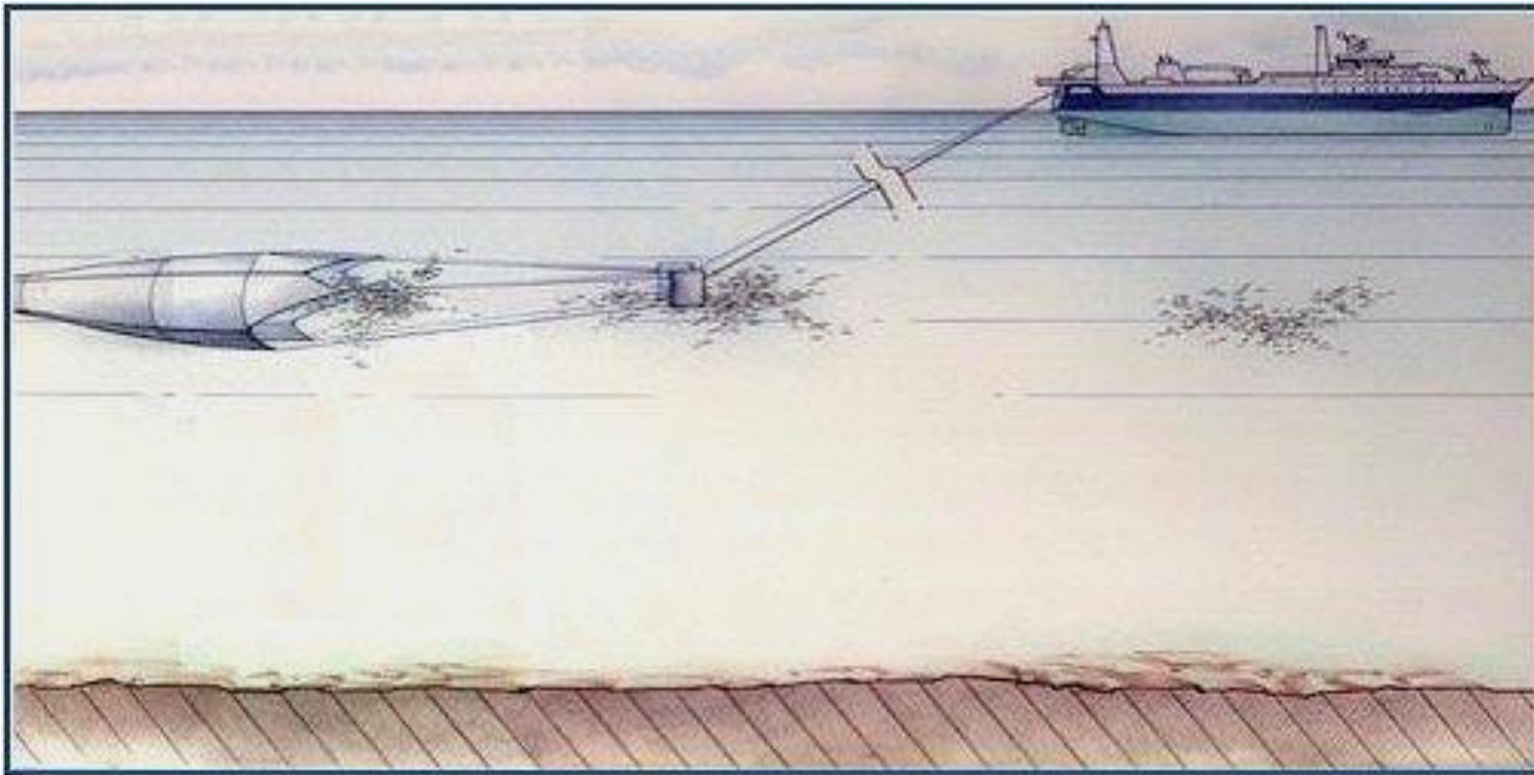
Otter Trawls

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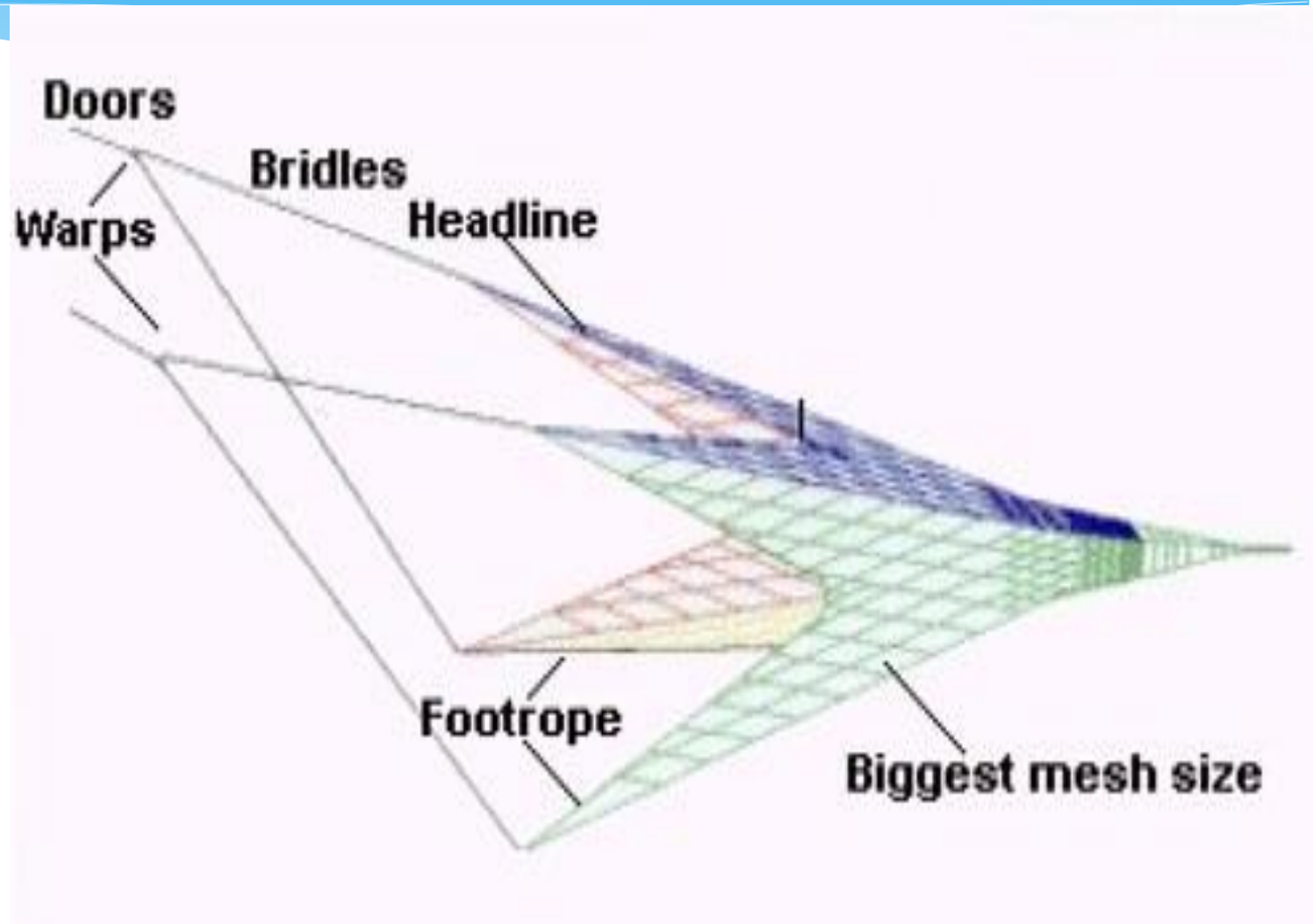
Midwater Trawls

- Depth determined by boat speed and warp out
- Determined by angle or by pressure sensor on net



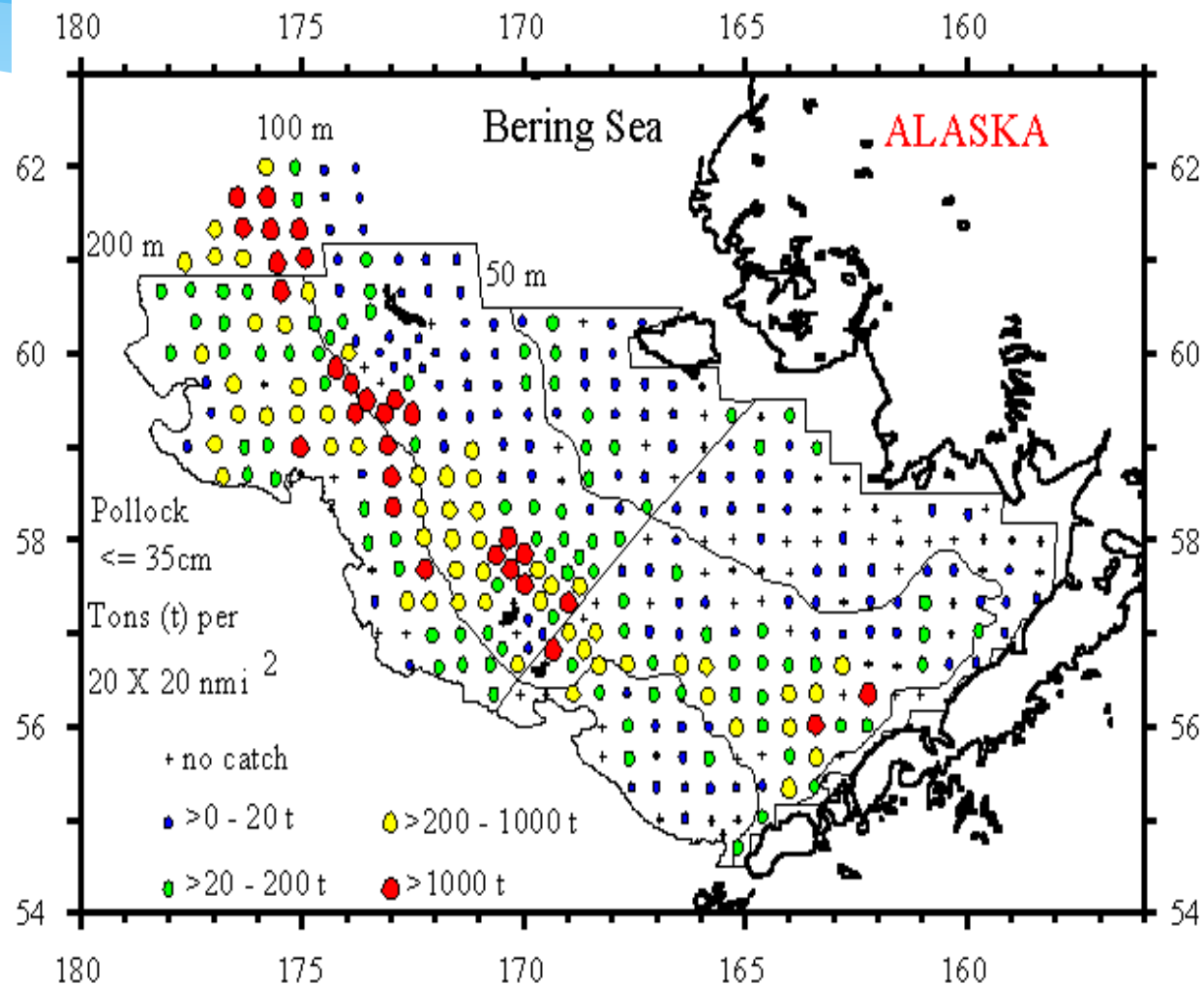
Midwater Trawls (cont.)

- Four Seams
- Coarse mesh at mouth
- Finer mesh toward cod-end
- Hydrodynamics
 - Key to good tow

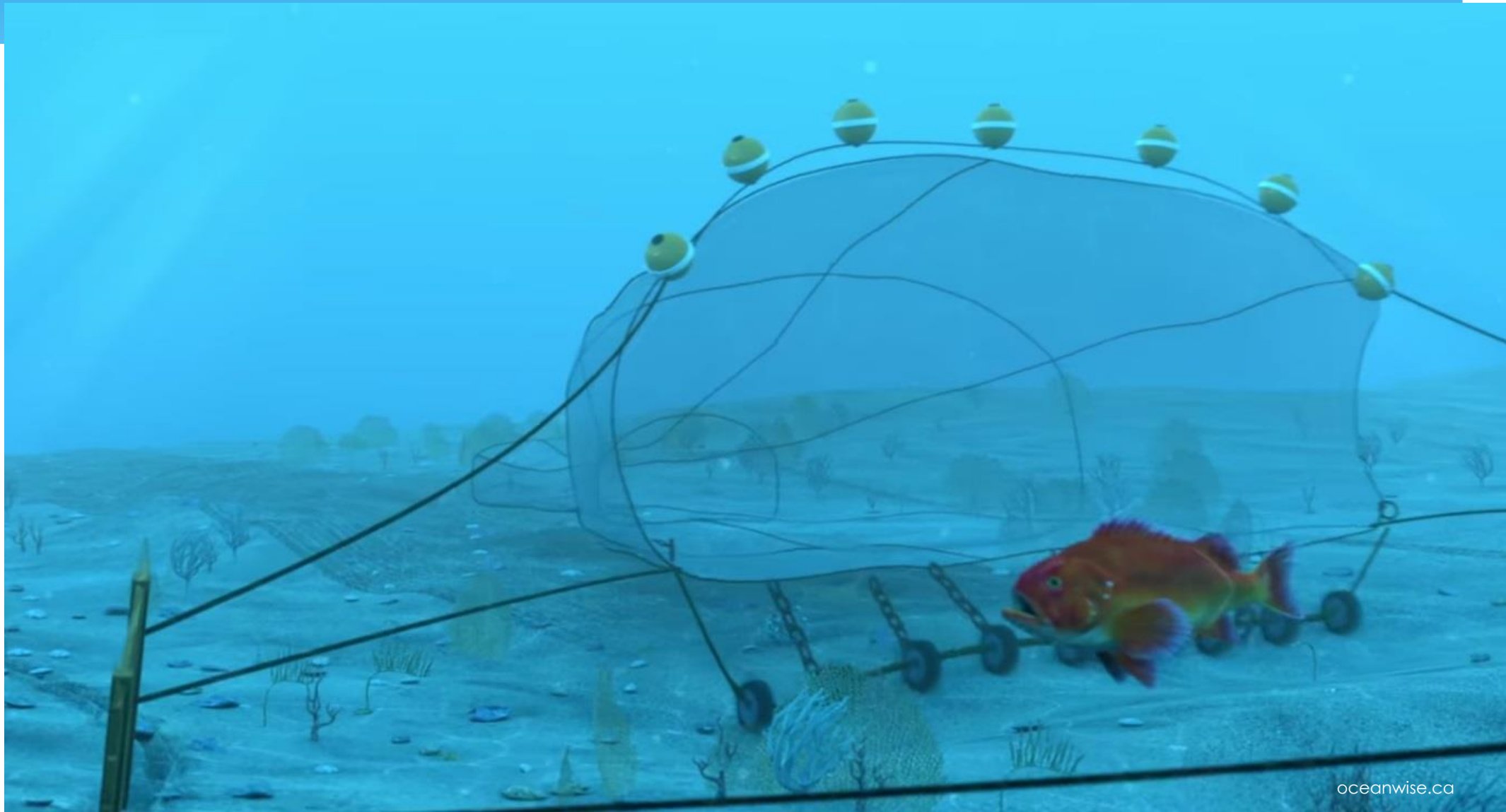


Use of Midwater Trawls

- Sample pelagic fish
- Ground truthing for acoustic surveys
- Sampling larvae and juveniles
 - Small (1 mm mesh)



Bottom Trawling



Bottom Trawl Modifications

- Contact the bottom to capture Demersal spp
- Modified Otter Trawl
- Rollers on the sweep chain
- Tickler chains on the sweep chain
- Plastic strips on the bag to prevent snagging (Chafe Gear)
- Size & material of doors



Bottom Trawl Modifications

Doors

Sweeps

Chafe Gear

Alloy steel construction
for light weight and stiffness

Adjustable bail
for depth regulation and angle of attack

Reinforcements
at all high-stress areas

Removable shoe
for replacement or weight reduction

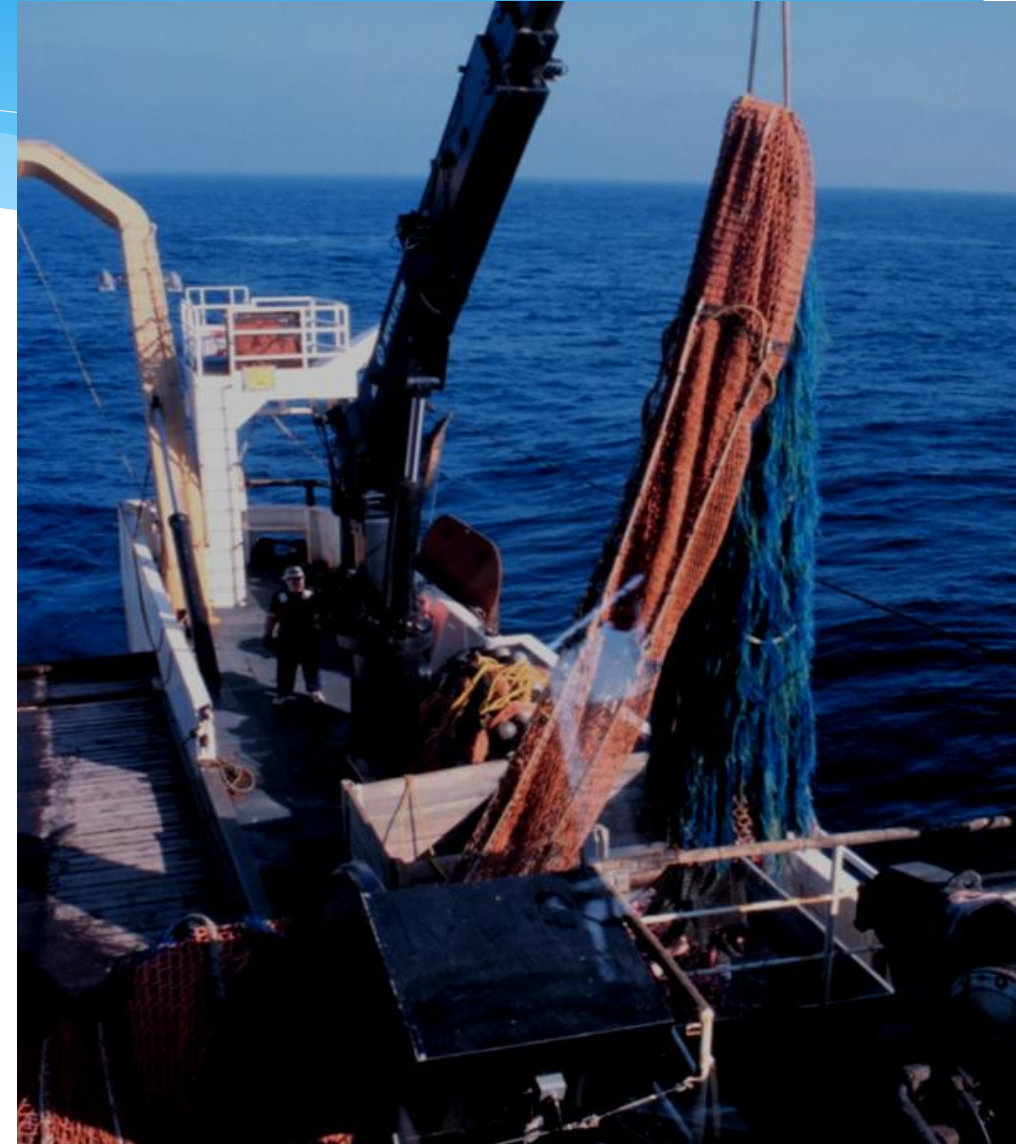


Multiple backstrap settings
to vary pitch and angle of attack

Cambered main wear plates

Faired leading edge
improves hydrodynamics and adds stiffness

Abrasion-resistant plate
at key wear points



Evaluating Gear Performance

- Did net catch fish?
- Net hang-up on bottom?
- Crossed or twisted trawl doors?
- Cod end come undone?



Trawling Pros & Cons

Pros

- Fish in good condition (unless deep trawls... pressure changes)
- For release of live specimens, short trawls (5-15 min)
- Quantitative index of pop abundance

Cons

- Can't sample when bottom is irregular (stobs, rocks)
- Need powerful boat (40 hp or greater **Much Greater**)
- By-catch of other species?

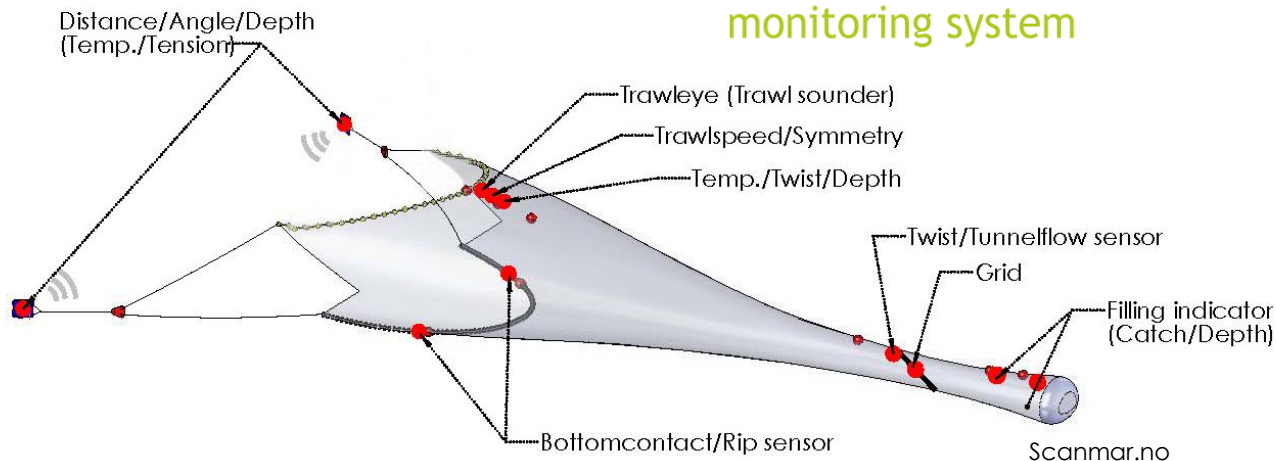
Trawling

- <https://www.youtube.com/watch?v=BnmGbDN278Y>

Technology to Evaluate Gear

- Depth/Pressure sensors (how deep)
- Laser distance measures (how big is net)
- Video camera mounted on gear (what did we miss)
- Pressure sensors (how much fish)

trawlvue
monitoring system



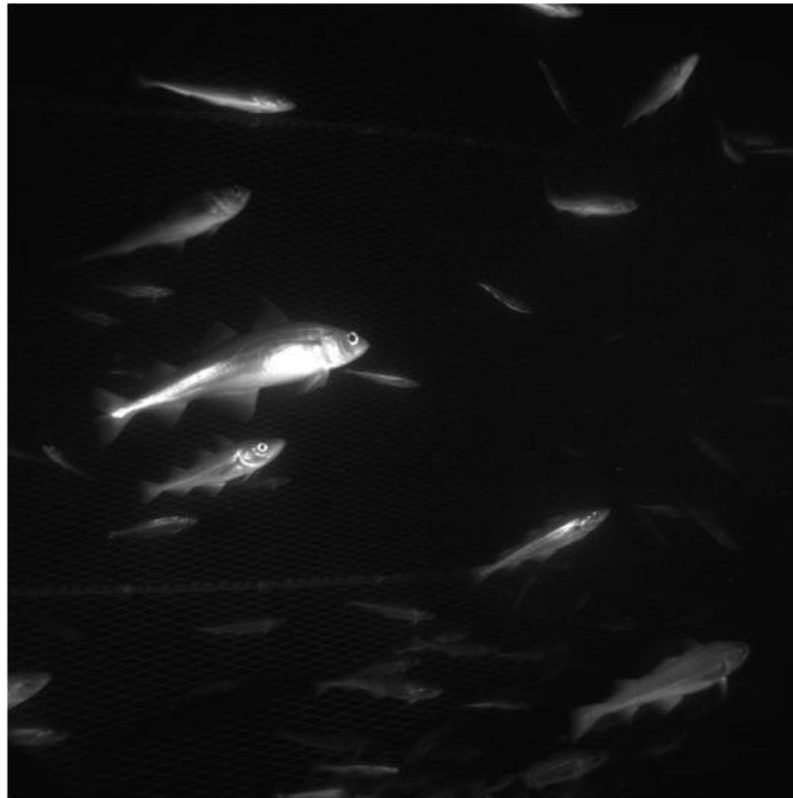
Cam Trawl Midwater

Cameras in Nets



Cam Trawl

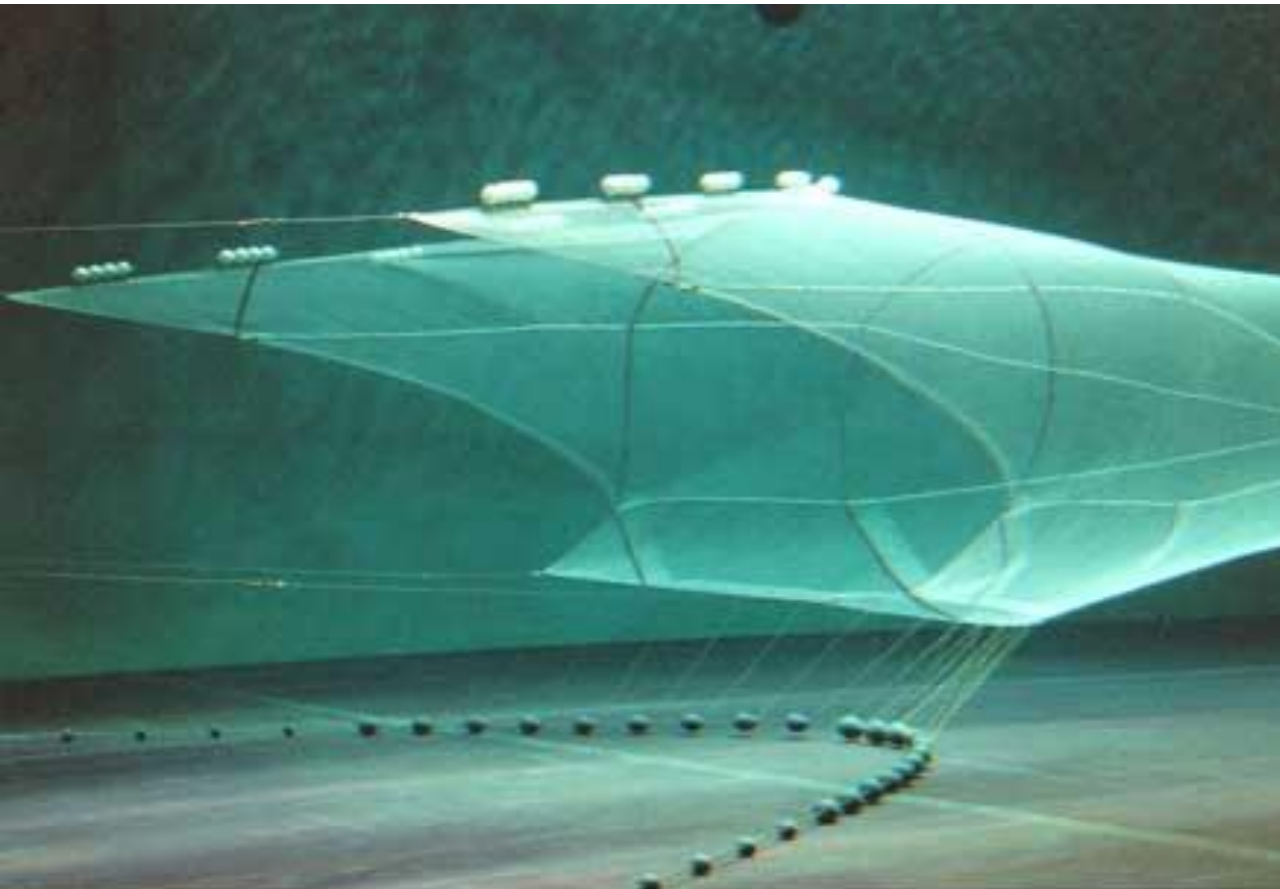
Stereo Cameras in the trawl



Video Recognition

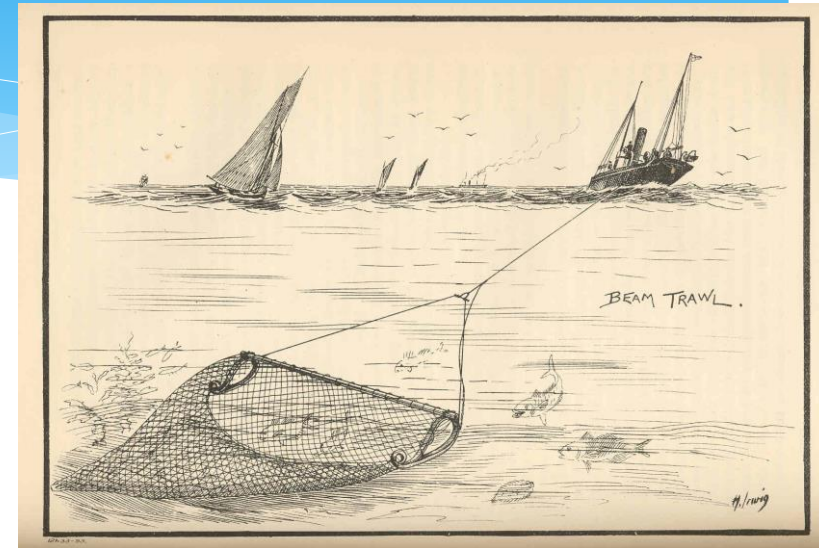
- Facial recognition (Homeland Security)
 - Used to recognize and measure fish
- Digital video cameras record fish brought onboard / discarded as bycatch
- Computers identify species
 - Estimate weight (using length)
- Allow computers to tally the catch for each species

Trawls



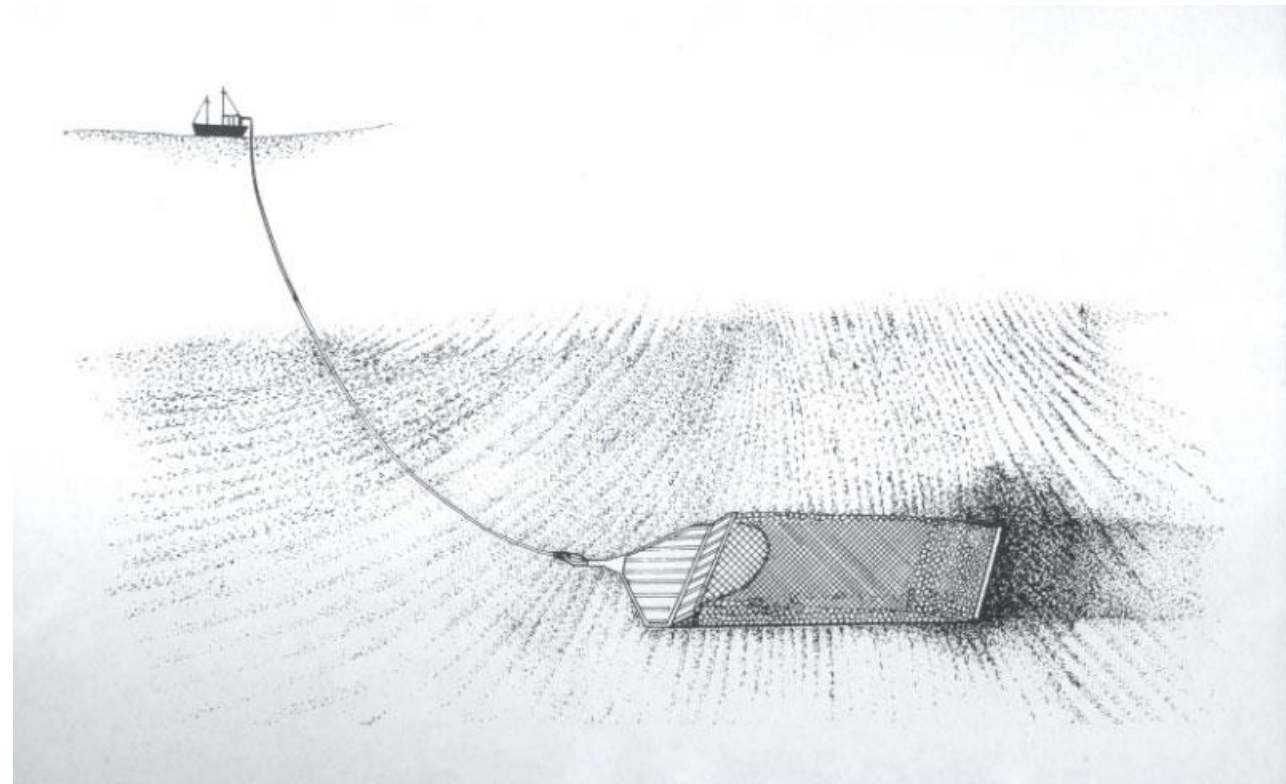
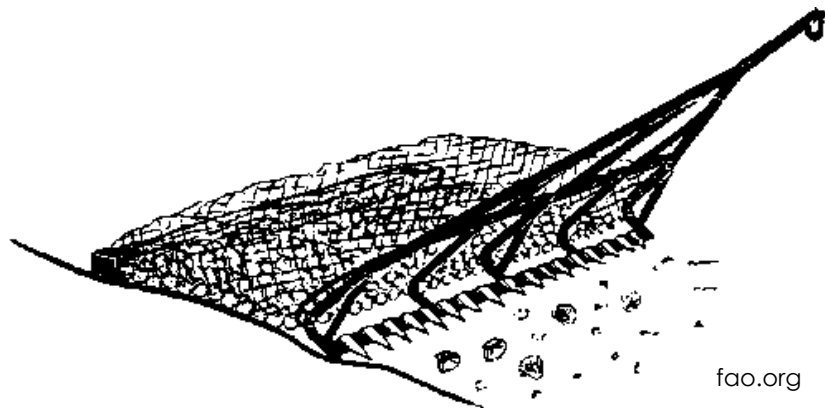
Self Check

- The above picture represents what kind of trawl?
 - Otter
 - **Beam**
 - Dredge
 - None of the above
- Bottom trawls have special modifications because they come into contact with the bottom of the ocean
 - True
 - False



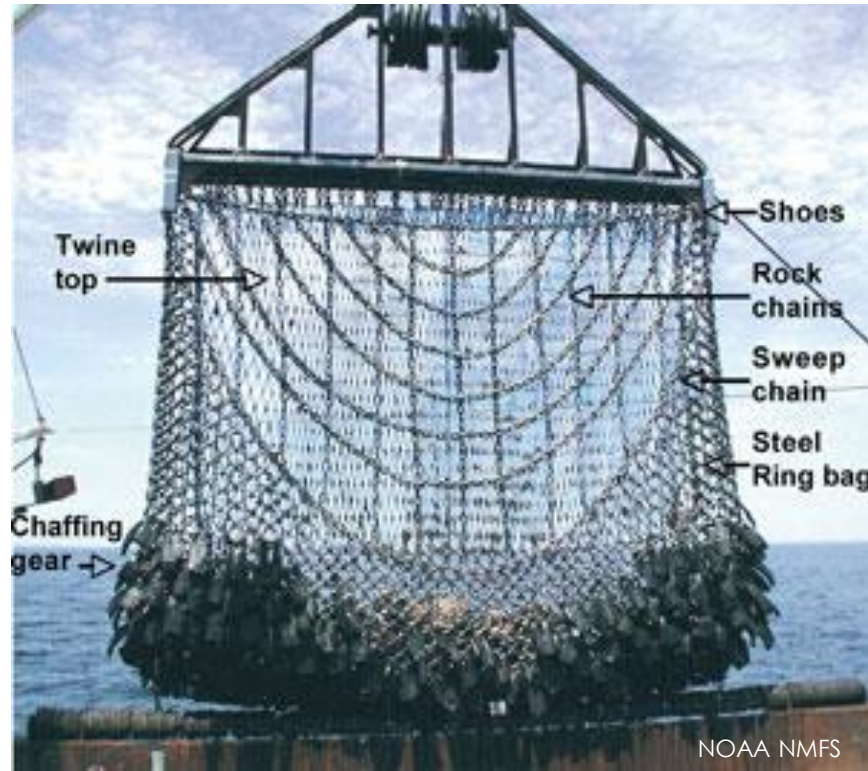
Dredges

- A **rigid frame** with a chain net dragged across the bottom of the ocean
- Uses teeth or water jets to dig into substrate
- Collects
 - **Scallops**
 - **Oysters**
 - Clams
 - Sea Cucumbers



Dredges

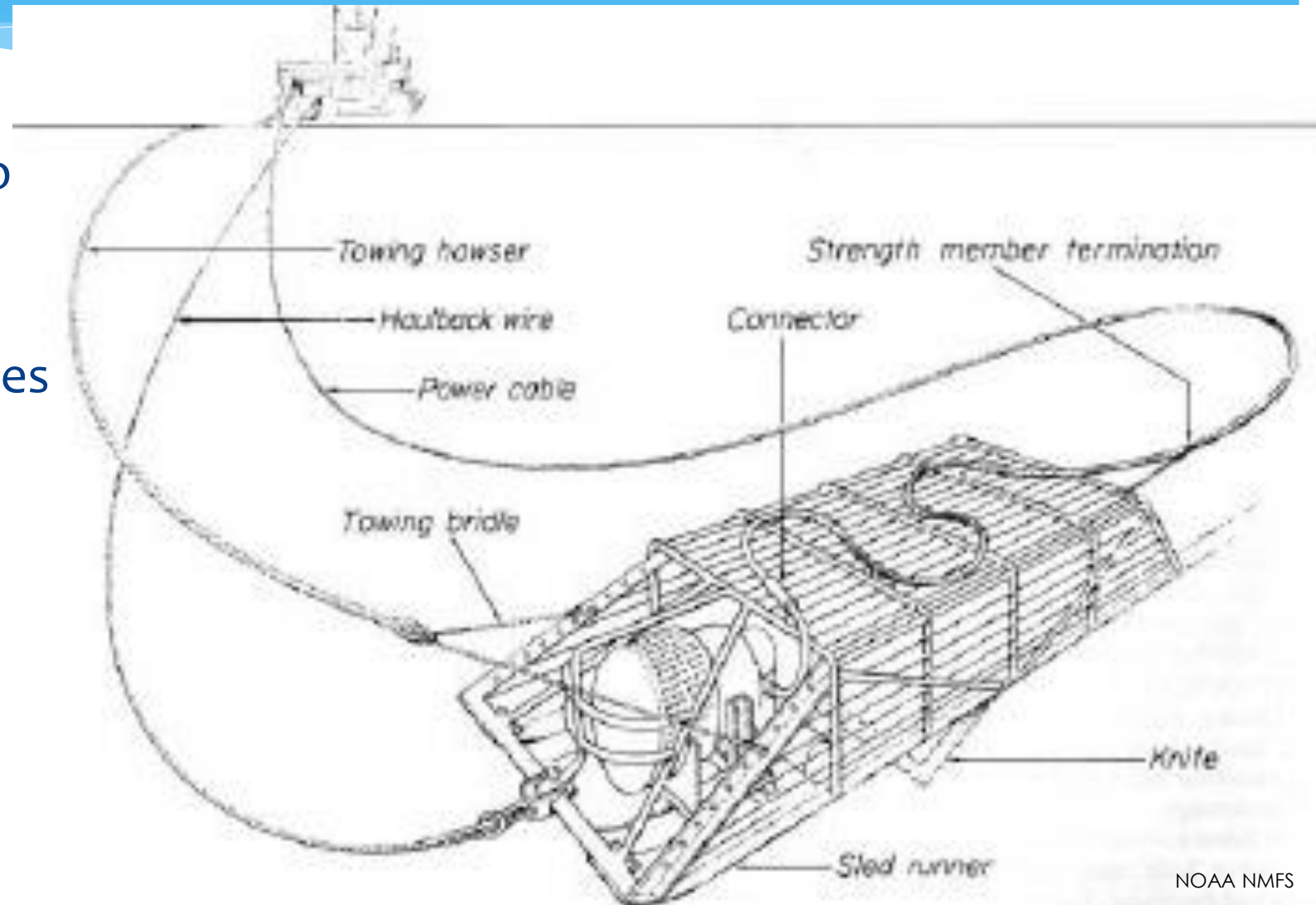
- Frame
- Rollers
- Sweep Chains
- Chain Bag
- Chafe gear



Dredges

Hydraulic dredge

- Uses water pressure to loosen substrate
- Used for clams & embedded invertebrates



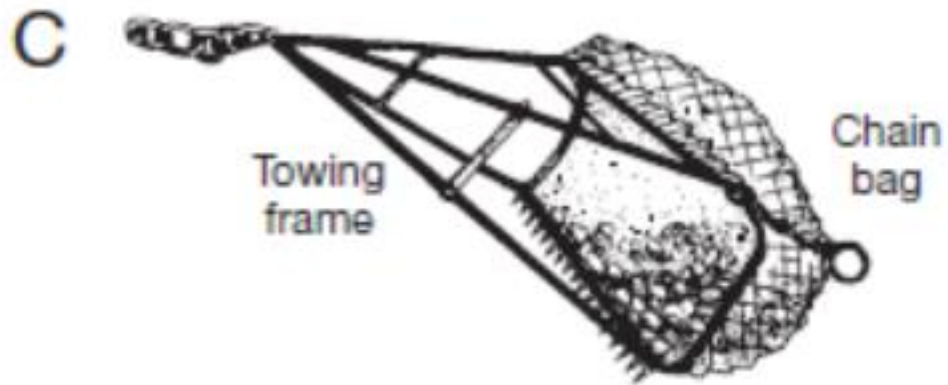
Dredges

Bottom Trawl vs Dredge

- very similar

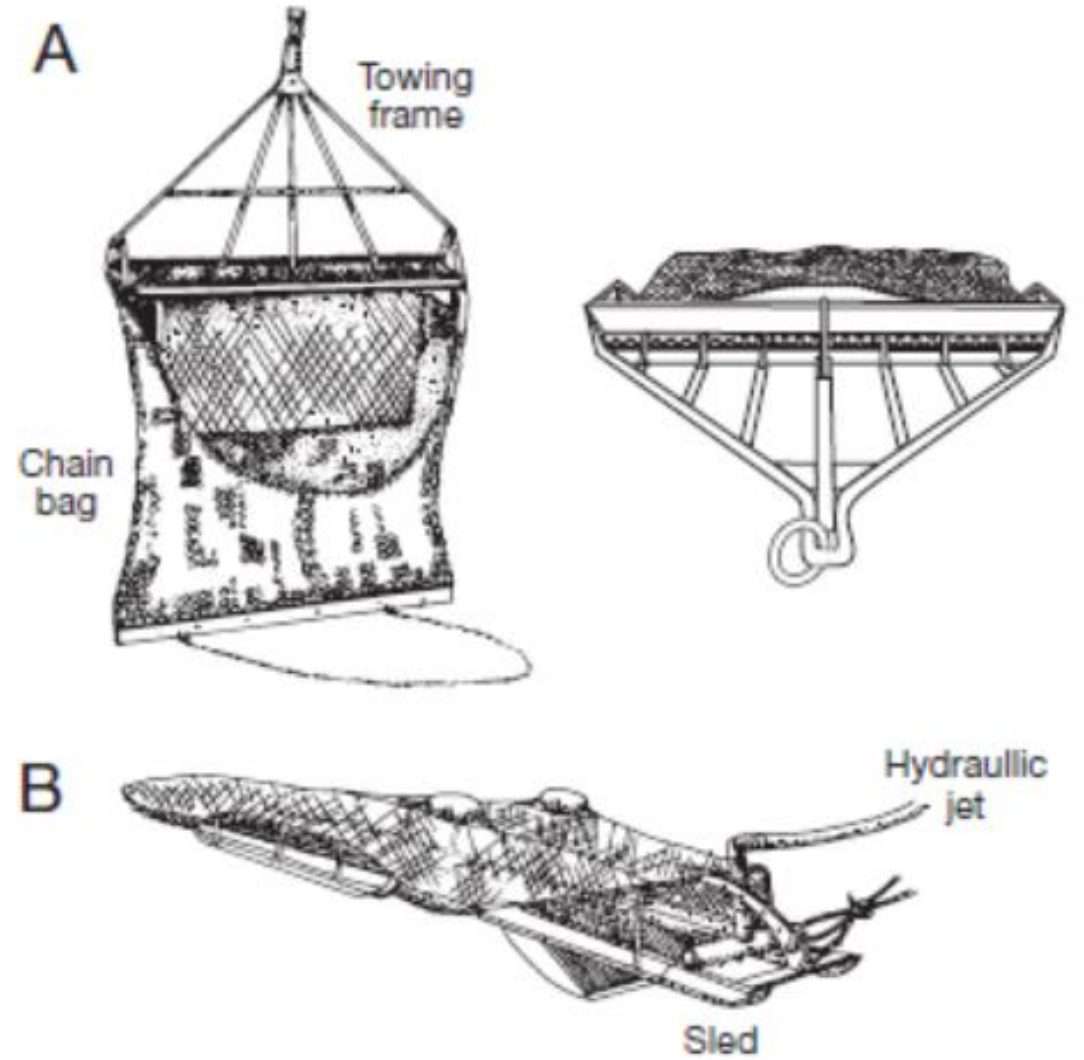
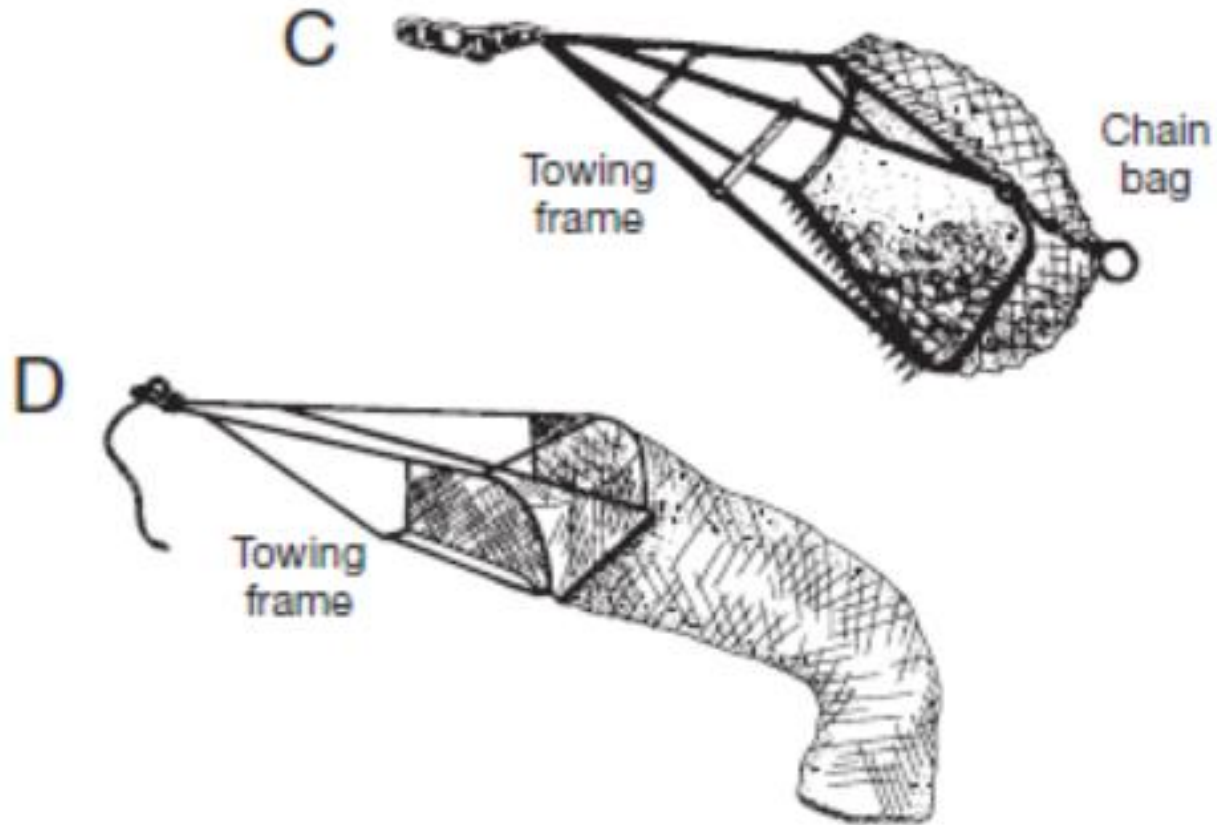
Dredges - Heavy-framed samplers designed to collect primarily embedded macroinvertebrates such as scallops and clams

No Doors



Dredge vs. Trawl

- Dredges are more destructive



Dredges

Pros

- One of the only effective ways to collect scallops, clams, oysters
- Fixed width for calculating area sampled
- Less prone to malfunction or tangle than trawls

Cons

- **Destroys benthic environment & Habitat**
- Cannot dredge in rocky areas

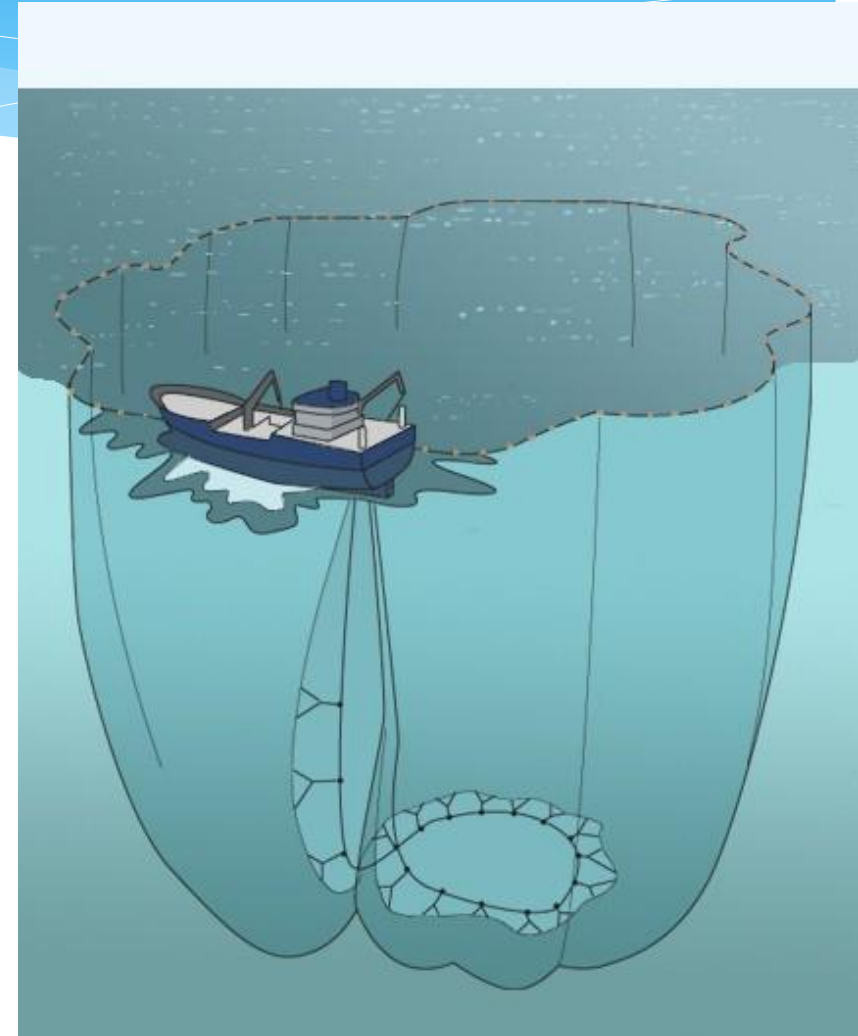
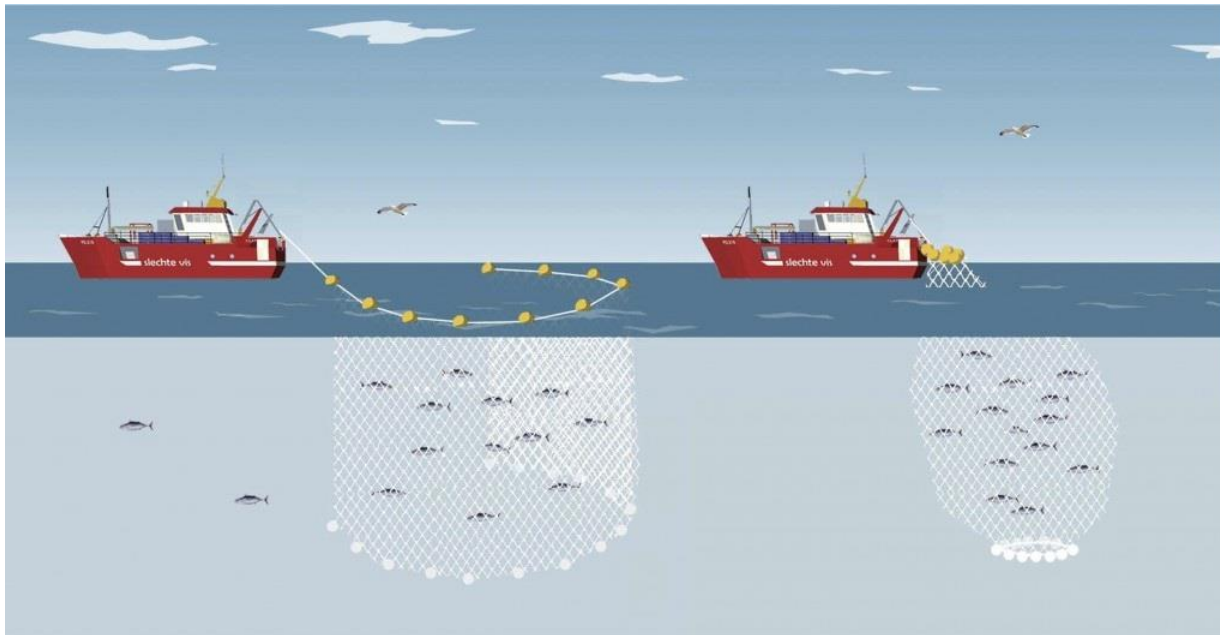
Self Check

- What is the primary difference between a dredge and a bottom trawl
 - The critters they collect
 - Dredges have a rigid metal tow frame
 - Dredges are more destructive
 - All of the above
- Click on the chafe gear on the dredge in the above image



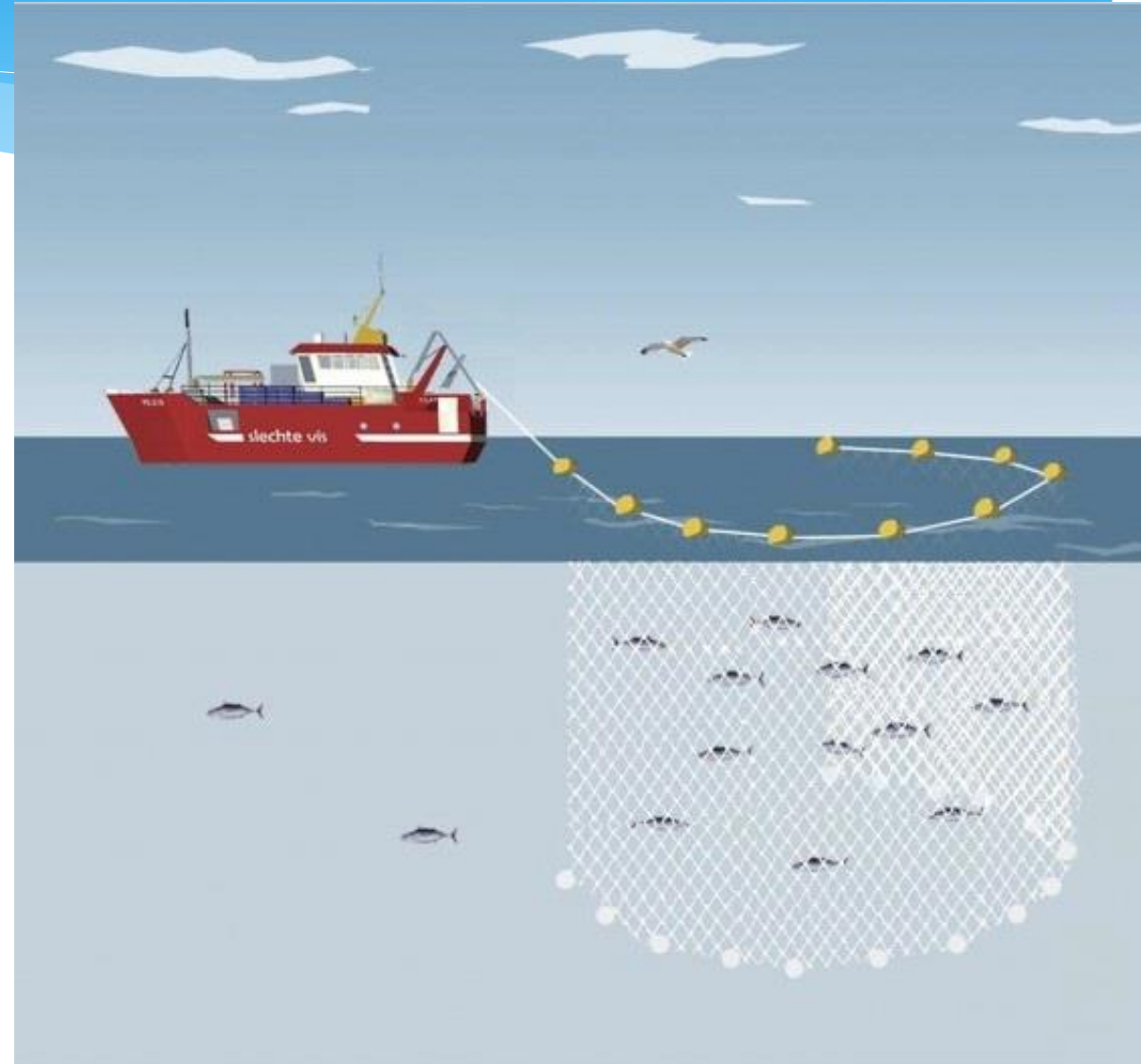
Surrounding or Encircling Gear

- Beach seines, Purse seines, Lampara nets
- Trap fish inside fence of mesh
- Area sampled is fairly standard



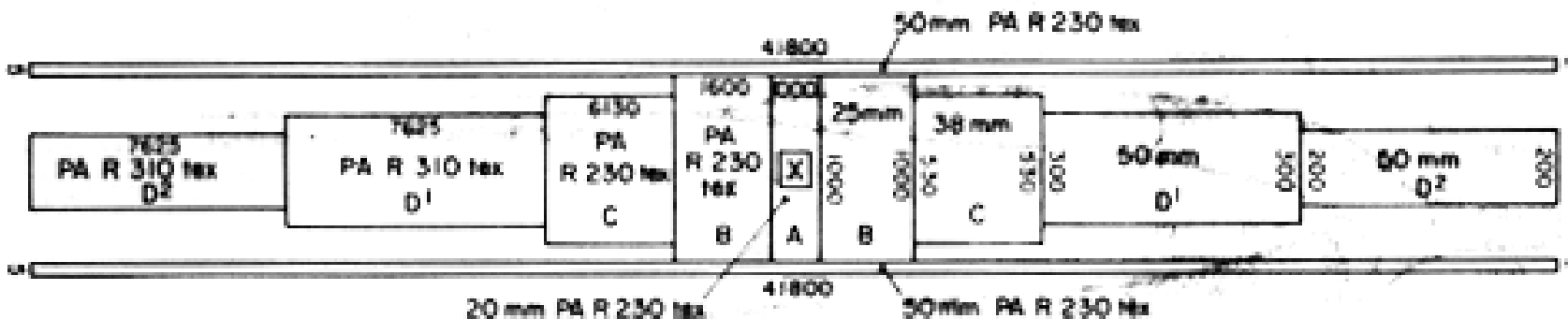
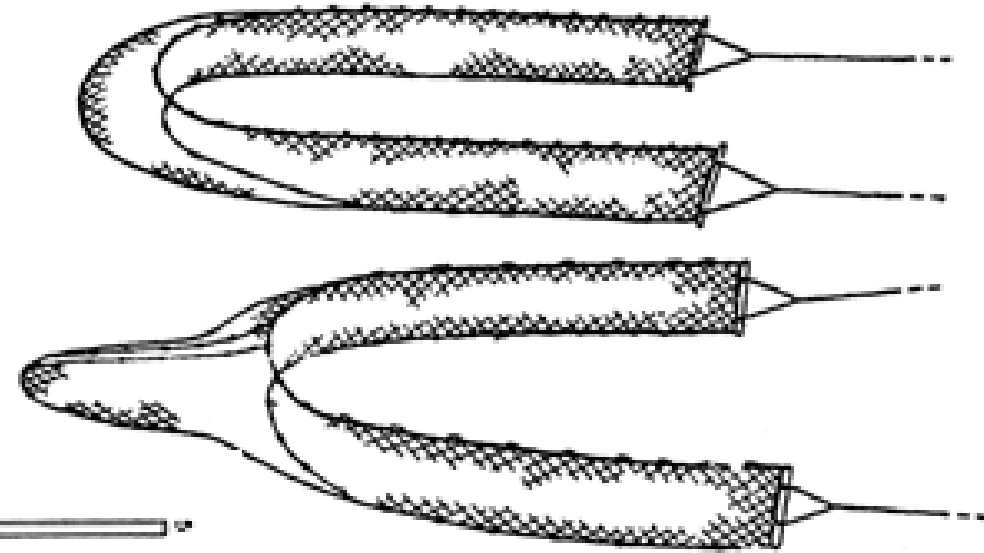
Seine components (cont)

- Cork / Float line
 - Cork, Styrofoam, or plastic
 - Hold net up
- Lead line
 - lead weights or lead core
 - polypropylene line (both)
- Mesh
 - Sizes vary depending on target species and habitat



Seine components

- Mesh - forms the wall of the seine
- Bunt - section of mesh wall where fish are concentrated
- Bag - small pocket sewn into the bunt for further fish concentration
- Dimensions vary widely



Fishing a beach seine

- Capture efficiencies varies
 - Diel
 - Seasonal
 - Species

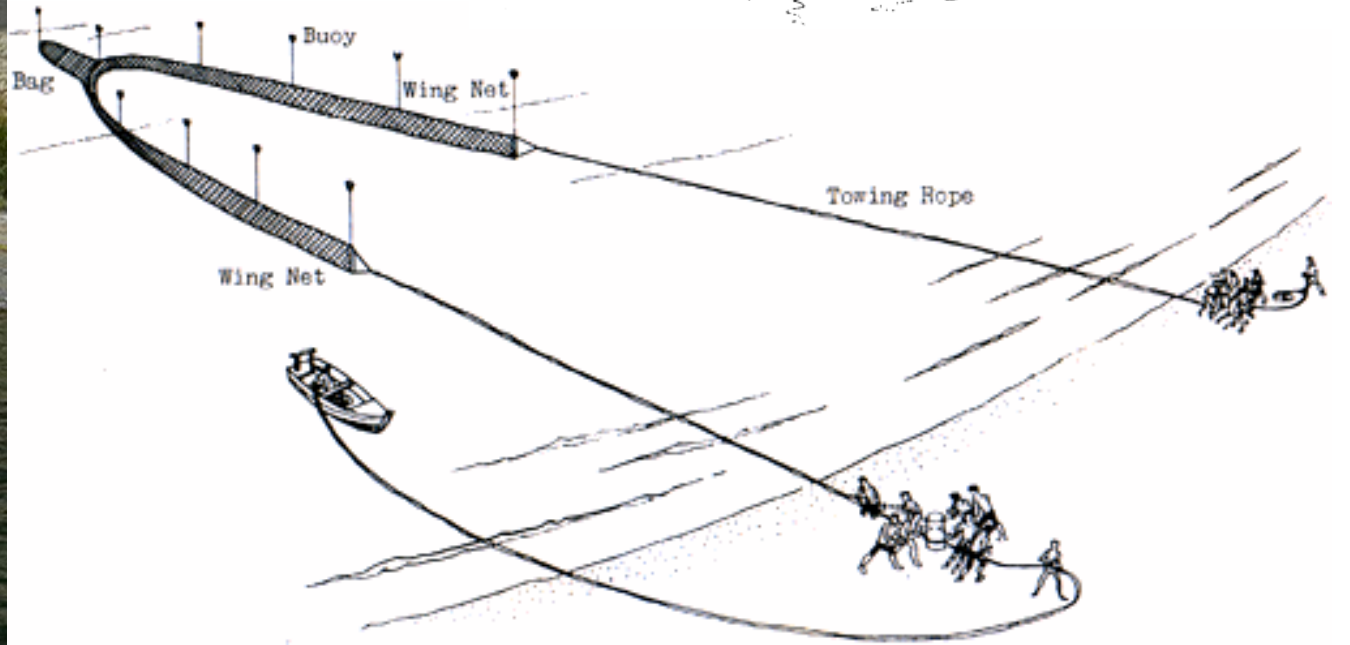
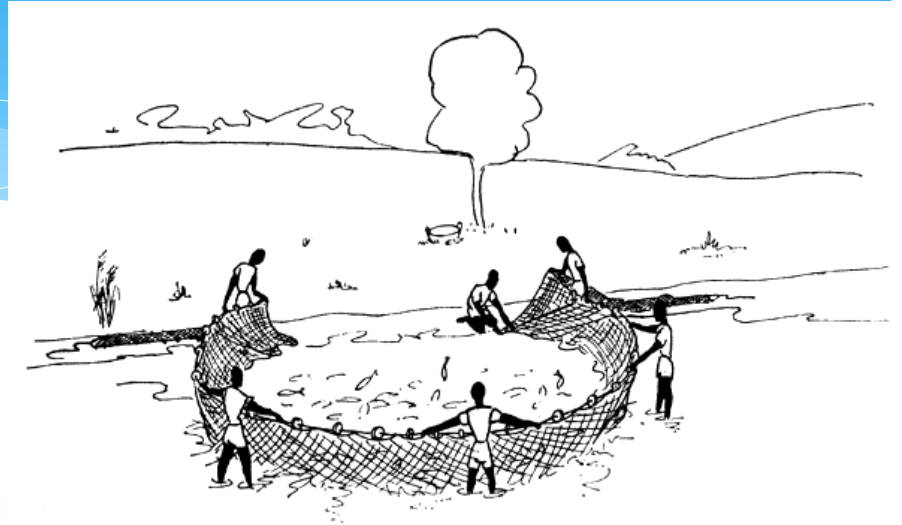


Fishing a beach seine (cont.)

- Fished near shore
- No obstructions to lift lead line / Snag
- Set in semi-circle retrieve both ends
- Set perpendicular to shore



Beach Seining



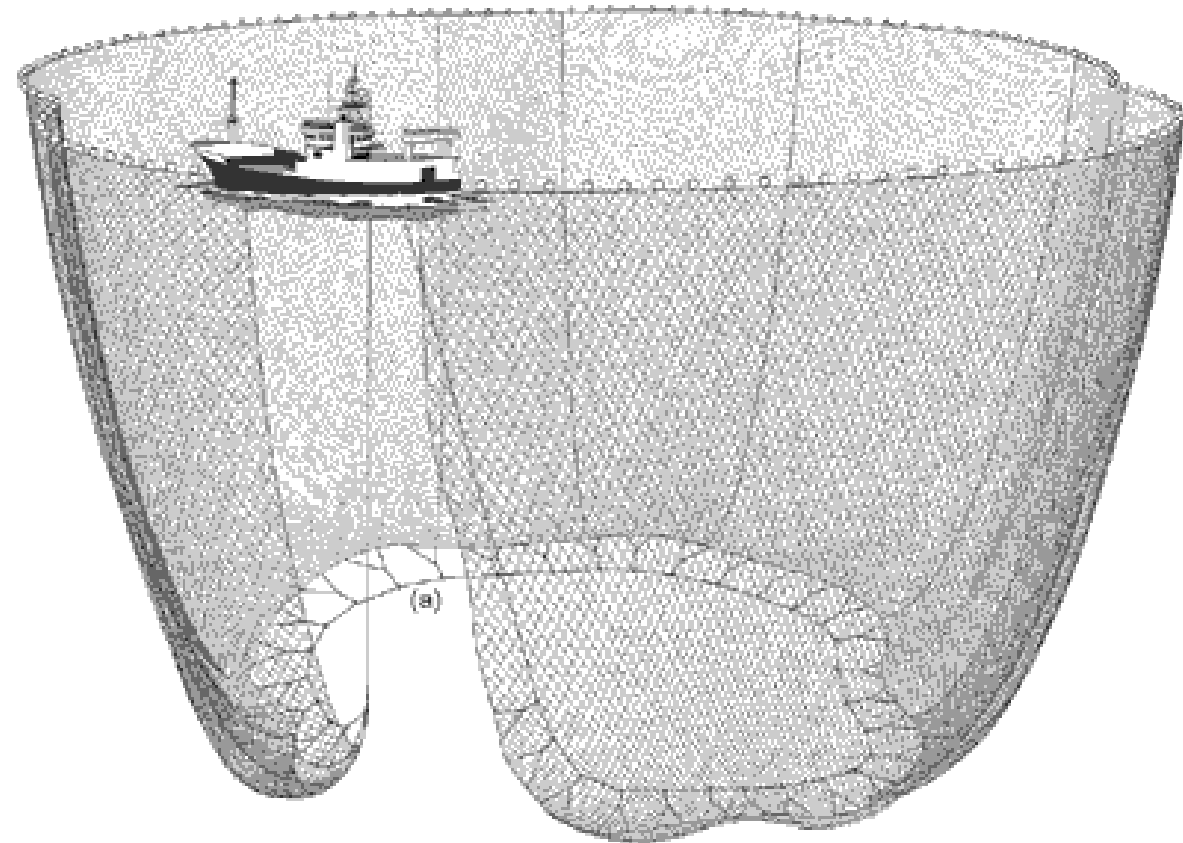
Stick Seine / Minnow seine

- Smaller seine with sticks or dowels connected to



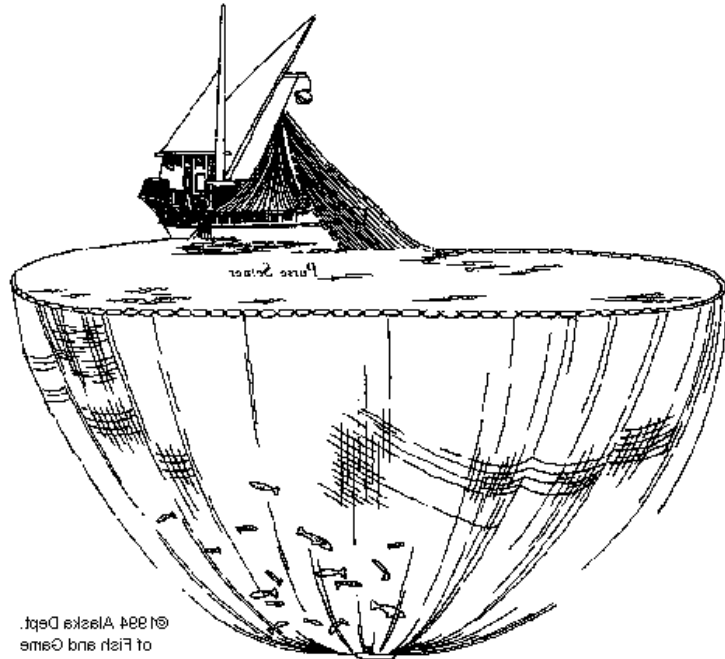
Purse seines

- For pelagic (open water) species
- Closes up like a purse



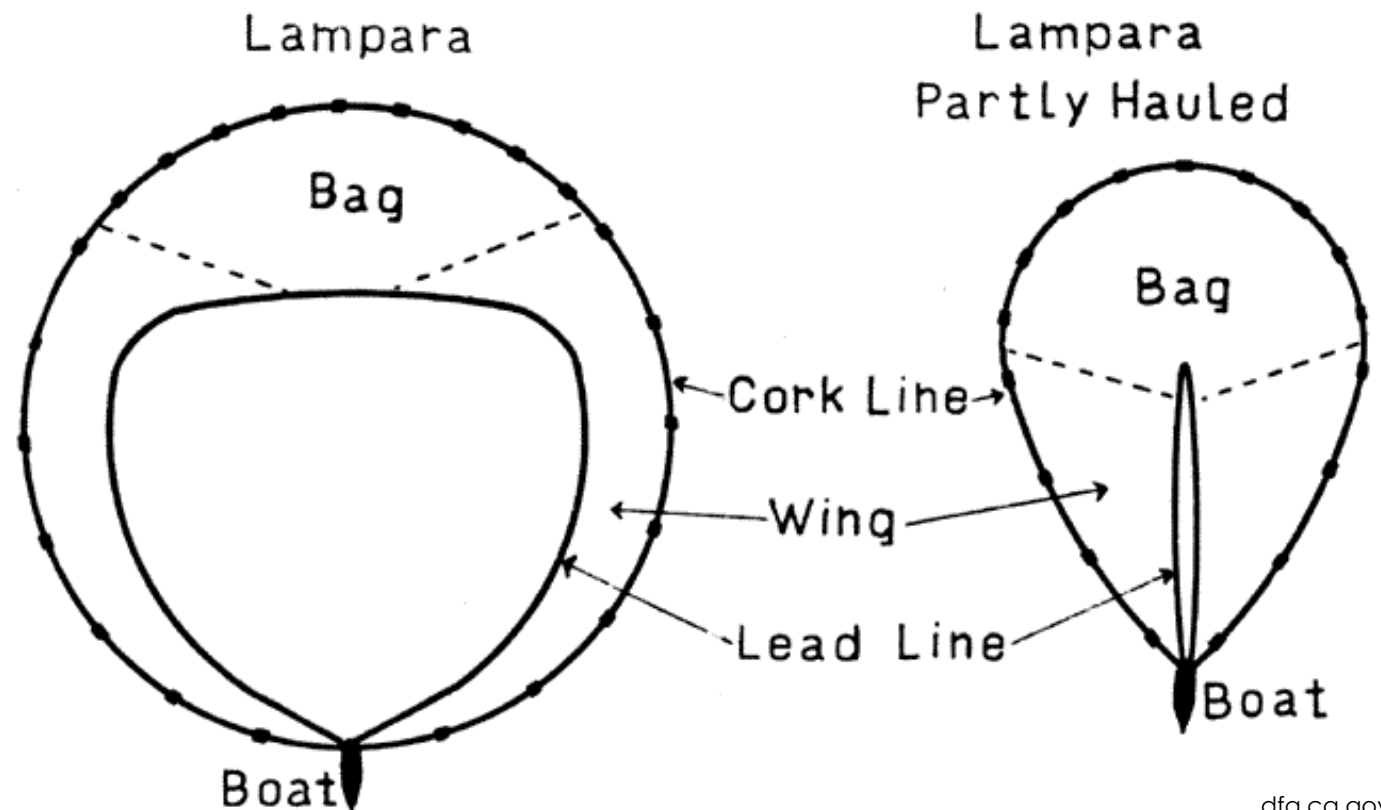
Fishing a purse seine

- Wall of mesh encircles fish
- Pull purse line from one or both ends
- Bottom of net cinches shut the drawstring on a purse



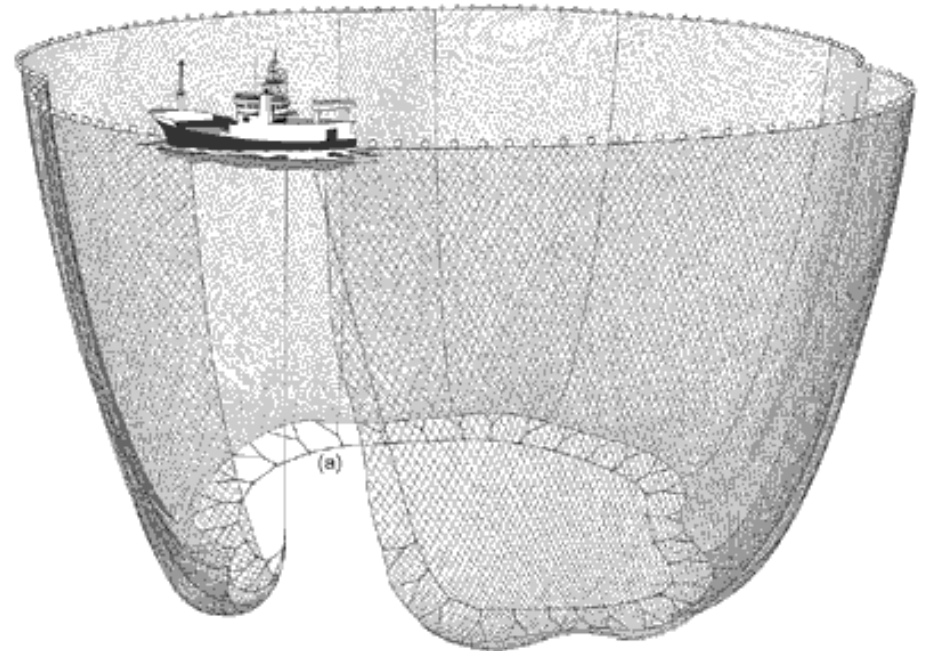
Lampara Net

- Typically used to fish smaller bait fish
 - Long Cork Line
 - Short Lead line



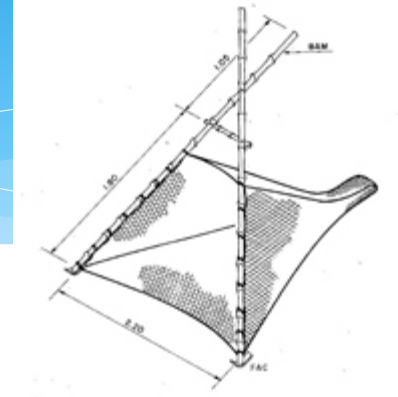
Self Check

- Lampara nets are typically fished for larger species like Tuna and Sailfish
 - True
 - False
- Click on the cork line in the above picture



Other Active Sampling Gears (cont.)

- Push nets
 - Rectangular rigid frame with mesh behind
 - Pushed in front of small boats - sample fish fry



Other Active Sampling Gears (cont.)

- Neuston nets
 - Neuston is the collective term for the organisms that float on the top of water
 - Sample the surface fauna of the ocean
 - Juvenile



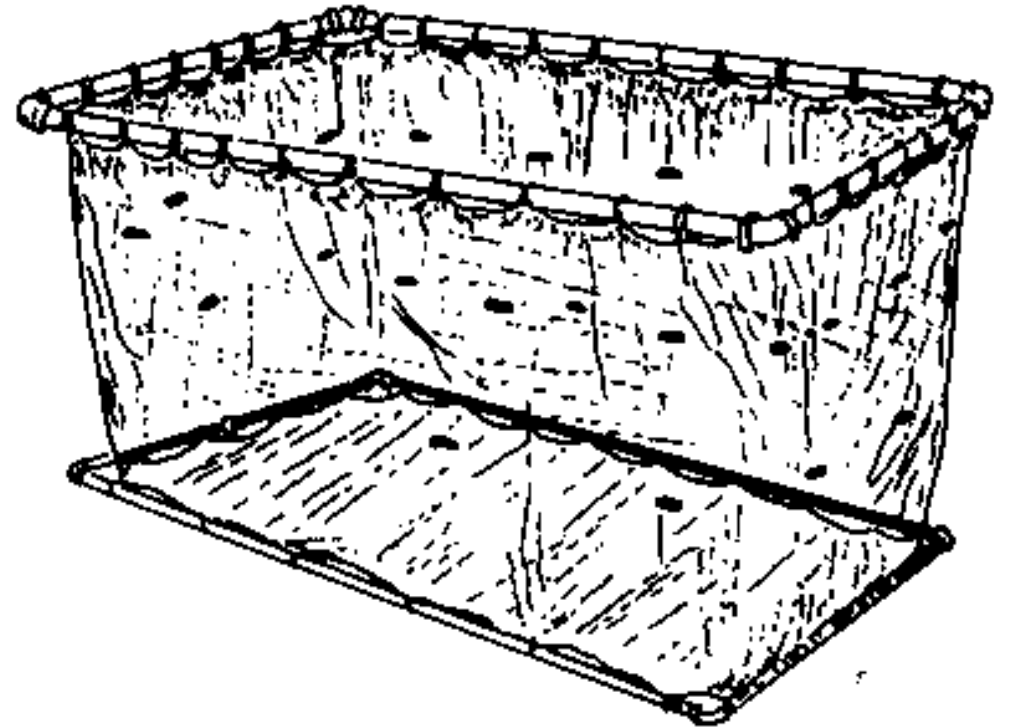
Other Active Sampling Gears (cont.)

- Lift nets (crab rings)
 - three line bridle on a bowl of mesh
 - bait the mesh or attract fish over net with light
 - lift the bowl and trap the fish (or crabs)



Other Active Sampling Gears (cont.)

- Pop nets
- Rectangular frame of mesh
- Set on bottom
- Released to pop up and form a box



Other Active Sampling Gears (cont.)

- Dip nets
 - Circular net on a pole
 - Lift fish from water - during electrofishing
 - Remove fish from containers



Other Active Sampling Gears (cont.)

- Fish Wheel
 - Ferris wheel for fish
 - Native Americans harvest anadromous fish this way



Other Active Sampling Gears (cont.)

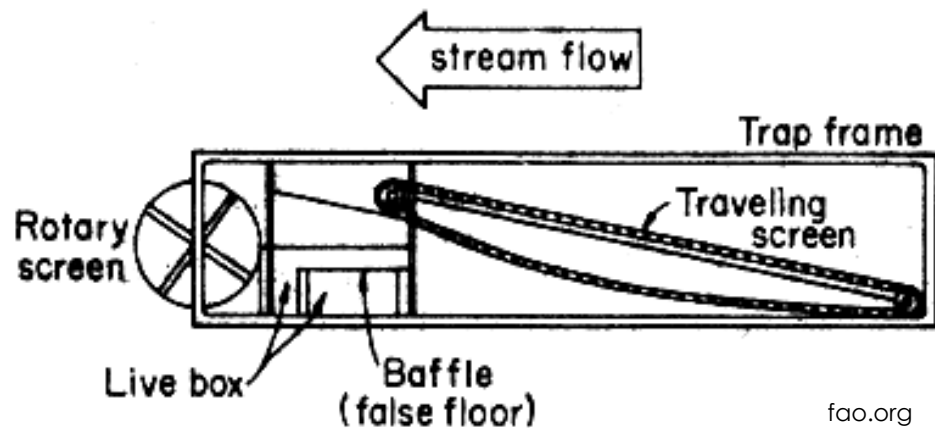
- Rotary Screw Trap
 - Capture out-migrating fish
 - Typically Salmon Smolt in PNW
- Trap spins with current of river
 - Like fish wheel



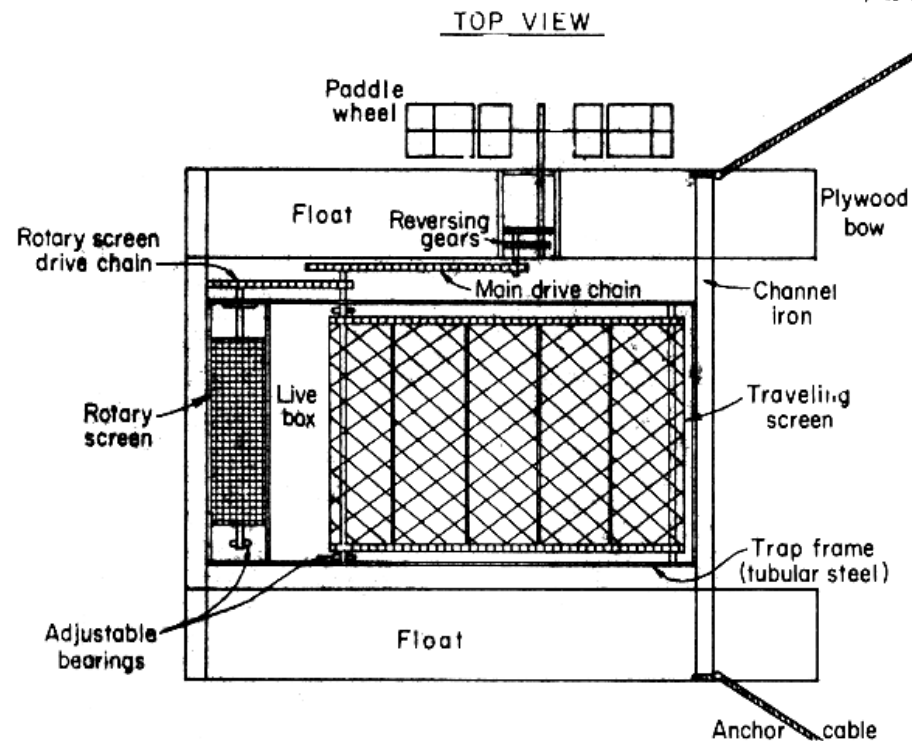
Other Active Sampling Gears (cont.)

Incline Plane Trap

- Out-migrating juveniles
- Uses water motion to operate conveyor belt that places fish in holding tank



fao.org



Other Active Sampling Gears (cont.)

- Cast nets (requires skill)
 - Circle of mesh
 - Weighted edges
 - Draw-string for cinching net closed
 - Usually near-shore for bait fish



Other Active Sampling Gears (cont.)

- Angling
 - Rod and reel sampling
 - To collect brood stock
 - To collect fish in good shape for radio telemetry studies
 - When other gears won't work



Other Active Sampling Gear

- Spears
 - Trident
 - Spear with barb
 - Usually clear water - tropical reef fish
 - Hawaiian sling or speargun



Spear Fishing



Self Check

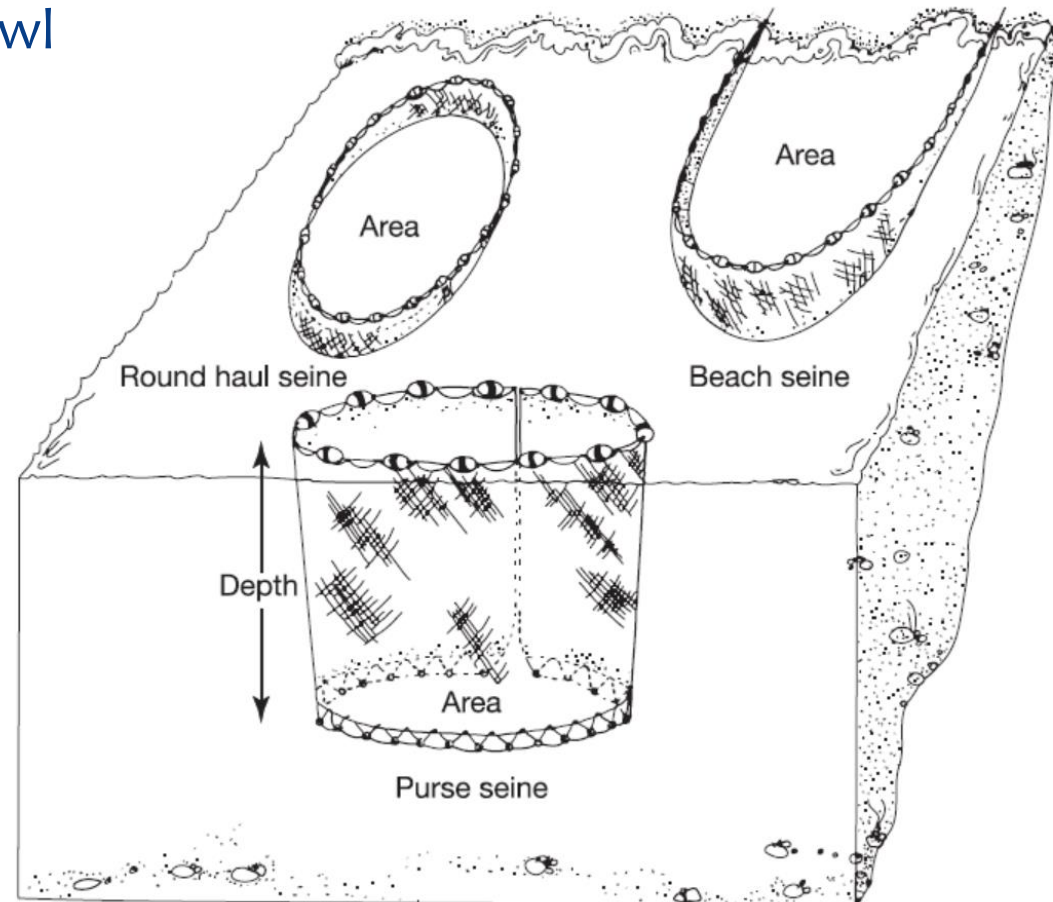
- Identify the active capture technique pictured above
 - Pop net
 - Lift net
 - Umbrella net
 - Neuston net

- A rotary screw trap is primarily used for capturing outmigrating juvenile fish
 - True
 - False



Gear Selection

- Why do you need the fish?
 - Relative abundance or density estimate - trawl
 - Live specimens for study - short trawl
 - Tissue requirements or diet studies - seine, spear, hook and line



Examples (cont.)

Rainbow trout - Lake Washington

- 600-m long, 37-m deep, 25mm beach seine
- collect fish for food habit study



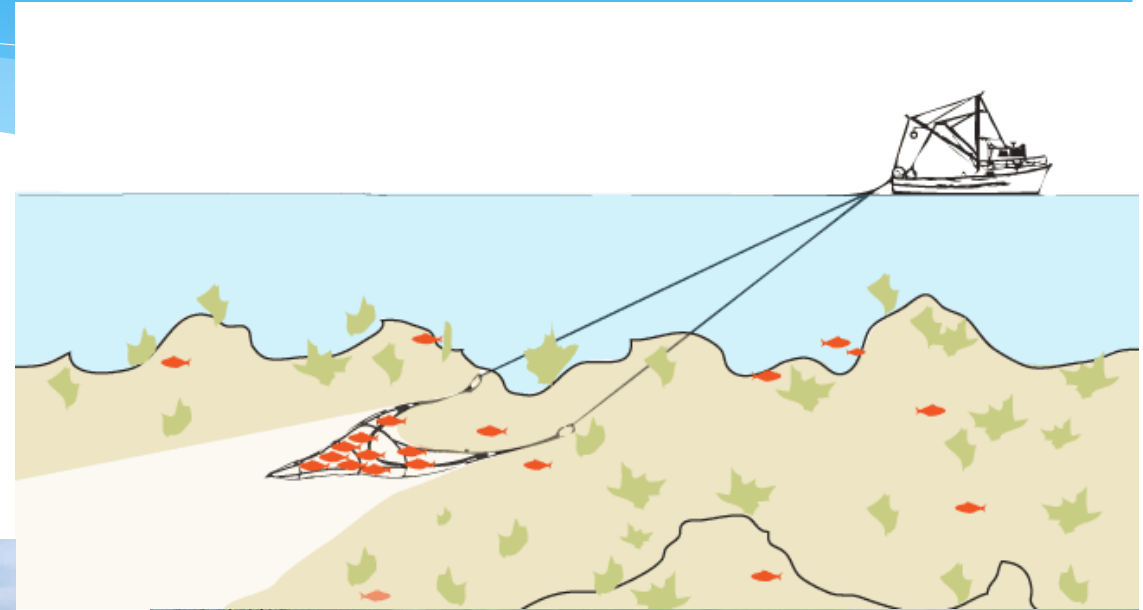
Gear Selection

- What is purpose of collection and goals of study?
- What habitat are you sampling?
- Behavior and size of target organism (s)
- Time, budget, personnel and vessels available

- Three broad purposes of fish collection:
 - Density or relative abundance
 - Collecting live specimens or whole specimen samples
 - Collecting accessory information:
 - scale samples, tissue samples, stomach contents

What is the Environment like?

- Shallow - beach seine
- Open water - purse seine
- Smooth bottom - otter trawl
- Rough bottom - scallop dredge, Tickle gear

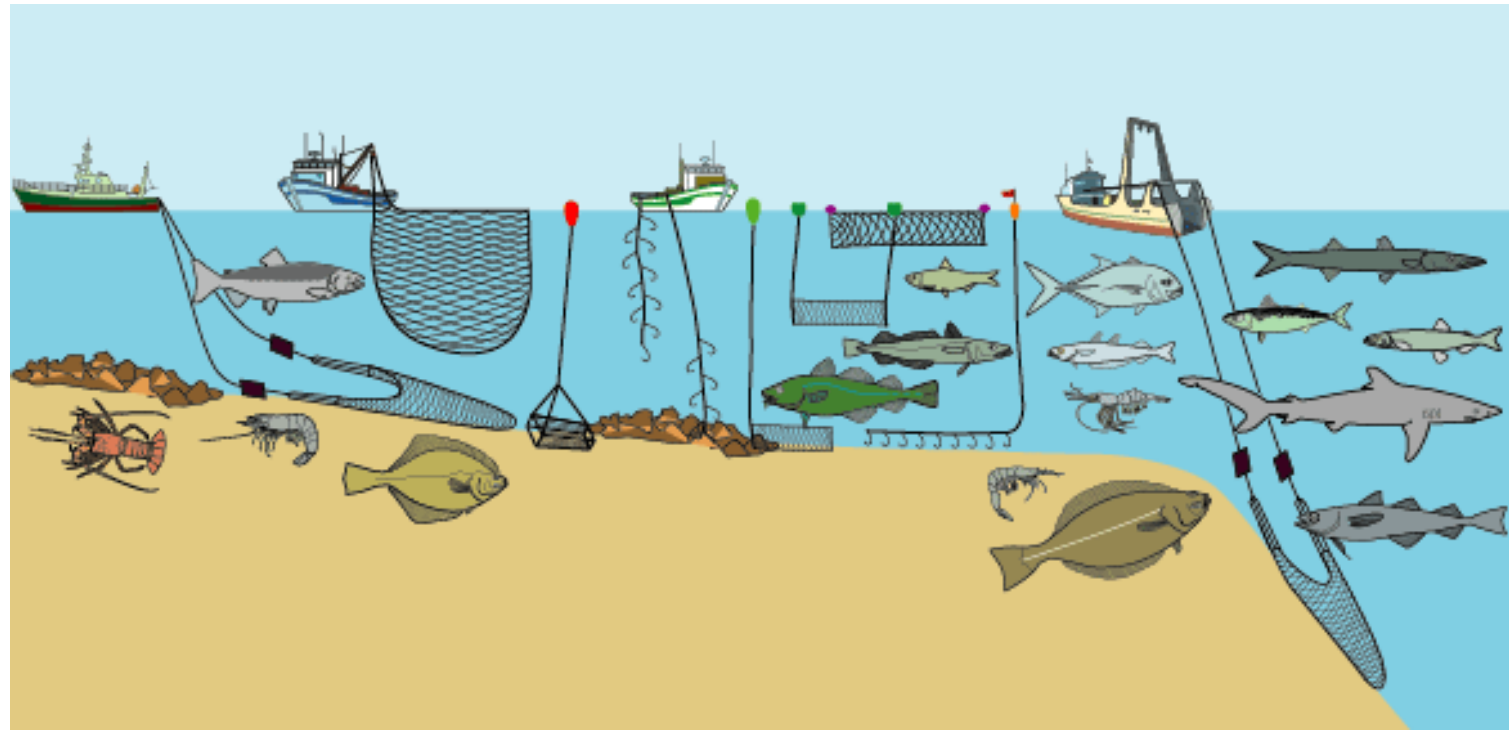


Environment

- Active gear prone to snagging on obstructions
- Water depth can limit gear choices:
 - Beach and haul seines – shallow water
 - Otter trawls – deep water
 - Angling – difficult bottom areas
- Active fish capture methods are harder in rivers and stream
 - Obstructions common
 - Current
 - Make electrofishing common in these habitats

What is life history of fish?

- Demersal - Otter trawl
- Pelagic - Purse seine / midwater trawl
- Associate with structure - Hook and line
- Littoral zone - Beach seine



Life History

Animal behavior and gear selection:

- Where does fish live?
 - Demersal / benthic, pelagic?
- Do bottom fishes live near structures or not
 - Coral reef fishes and largemouth bass
- Does species live close to shore?
- Diel behavior, seasonal behaviors, and ontogenetic
- Response by fishes to gear being used
 - Very important when establishing abundance index or density
- Influence of fish size to gear selection:
 - Smaller fish to escape large mesh

Gear selectivity

- Large, fast swimmers (tuna) outswim active gears
- Small fish pass through coarse mesh of trawls
- Ontogenetic changes in habitat affect selectivity
 - Juveniles inshore (beach seine)
 - Adults offshore (otter trawl)



Sampling Problems

Habitats with obstructions

- Obstruction interferes with sampling efficiency
- Sampling gear unable to sample habitat where fish live or hide

Open Ocean Habitats

Deepwater habitats in small lakes

- Shape of lake limits gear choices – lake may be too small for boat needed to handle deep water trawl or access may be hard.
- In these instances gill nets are sometimes appropriate

Large rivers

- High currents and debris make most sampling hard

Ice cover

- Spearing and angling used
 - Gill nets sometimes

Lift nets

- Nets put in water – difficult to do though

Self Check

- It is important to take into consideration the environment, habitat and life history of the fish you are interested in when selecting capture equipment
 - True
 - False
- A bottom trawl would be an appropriate selection for a demersal species that lives in a high structure area
 - True
 - False

Recap

- Active capture
- Towed Nets
- Dredges
- Surrounding Nets
- Other active Gear
- Gear Selection