



Chapter 7



Active Fish Capture Methods



7.1 Introduction

- Moving gear/nets through water
- Collecting
 - Fish
 - Crustaceans & Other Inverts.

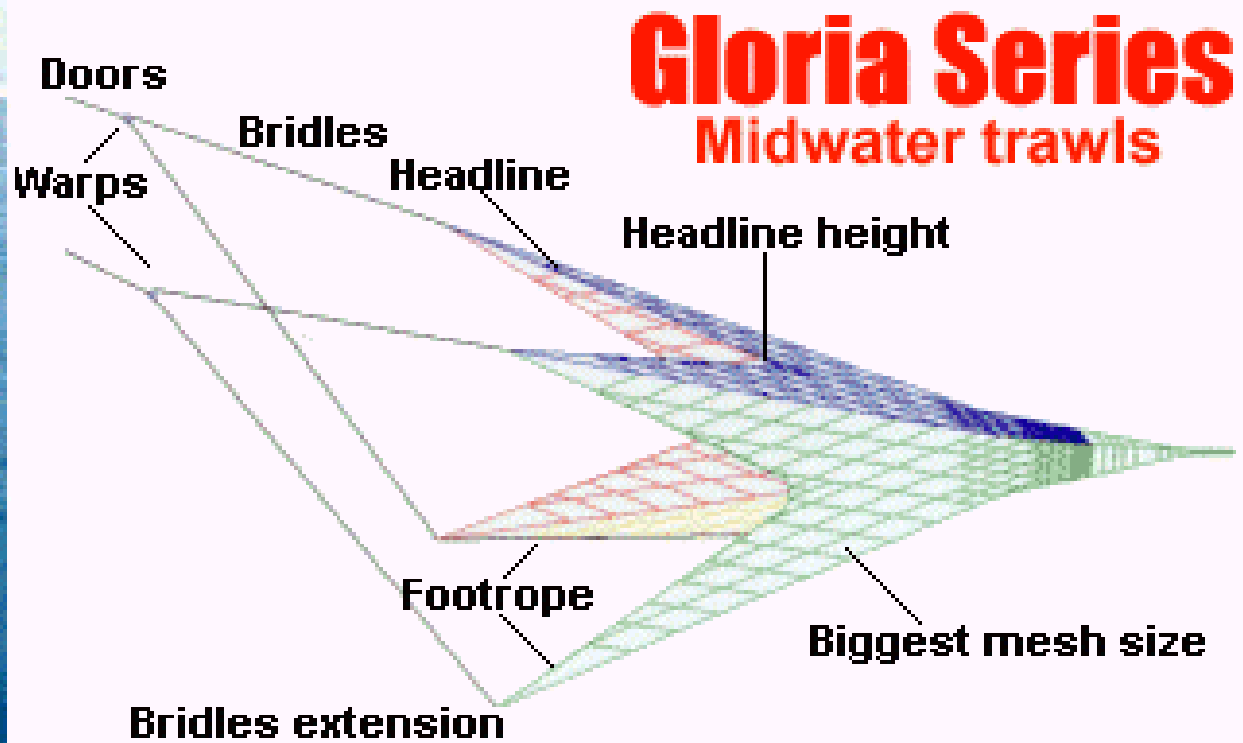
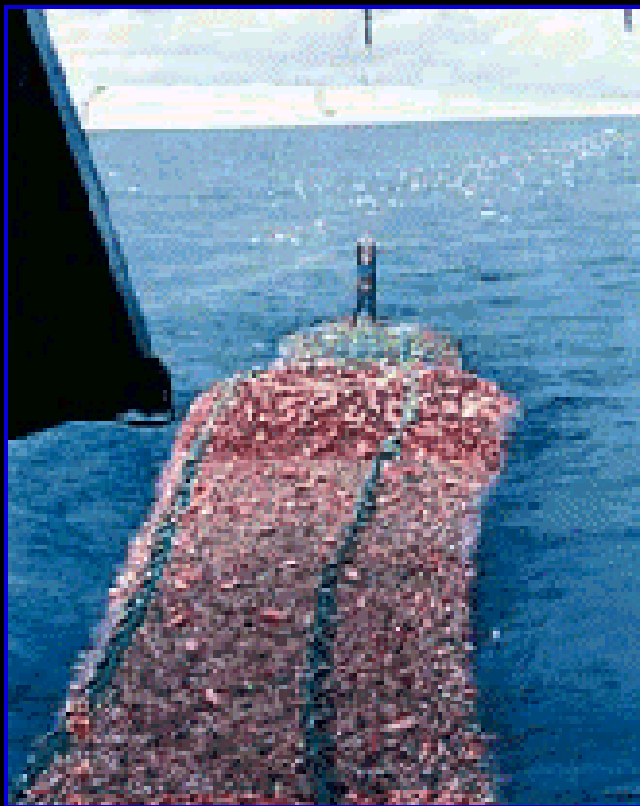


3 Main Gear Types

- Towed Nets
- Dredges
- Surrounding Nets
- Plus Others (Hook and line, cast nets)



Standardization of effort



- Pull trawl fixed time
- Sweeping specific area

Requirements



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

7.2 Net Material and Construction

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



Mesh size (cont.)

- small fish pass through mesh, measure consistently

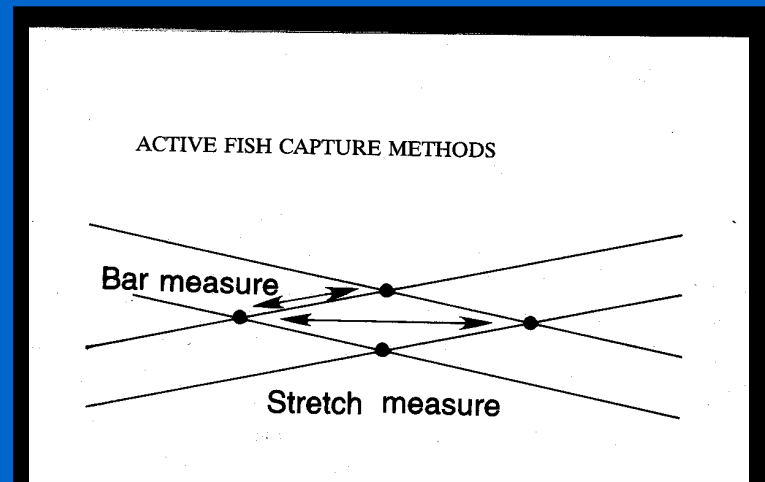


Mesh size

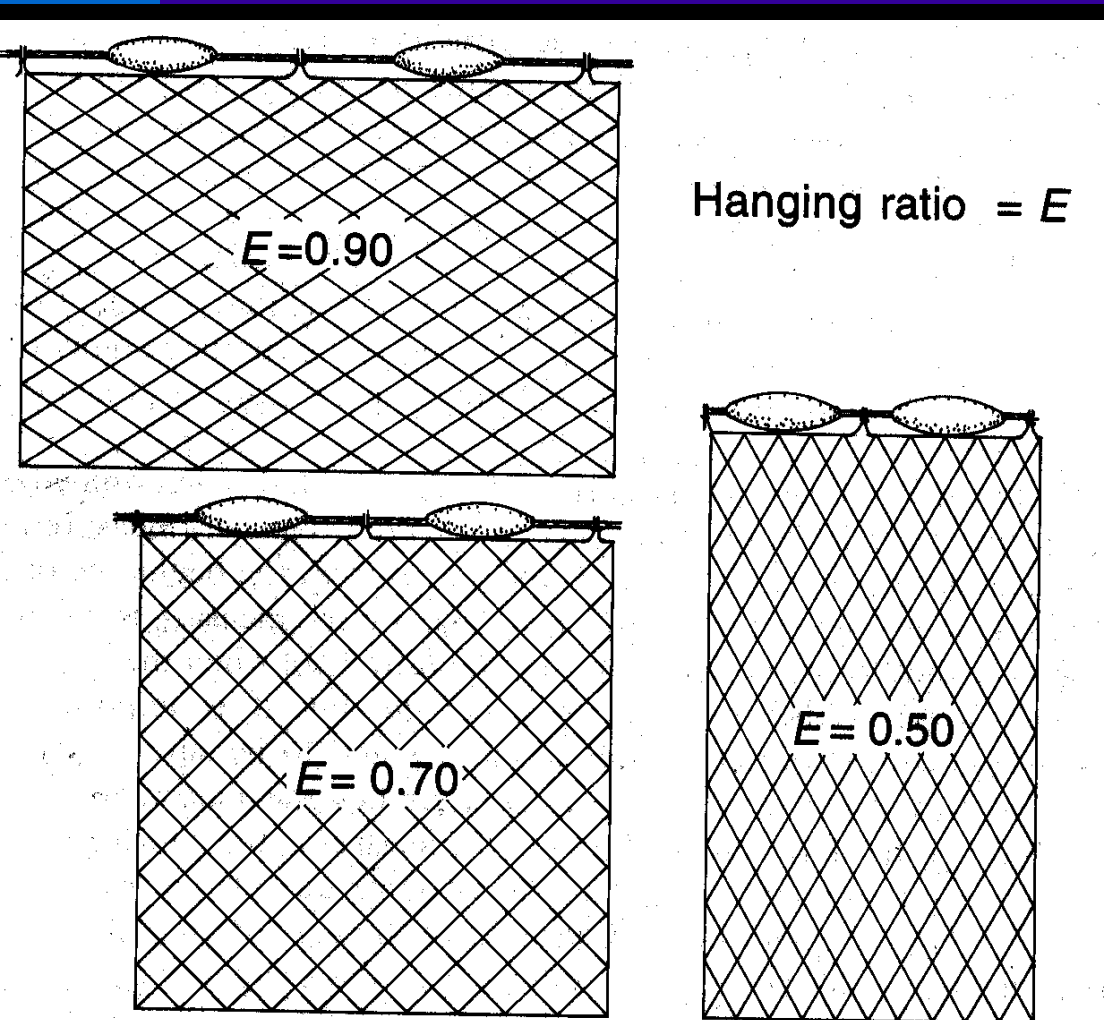
- Bar length - distance knot to knot along diagonal



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



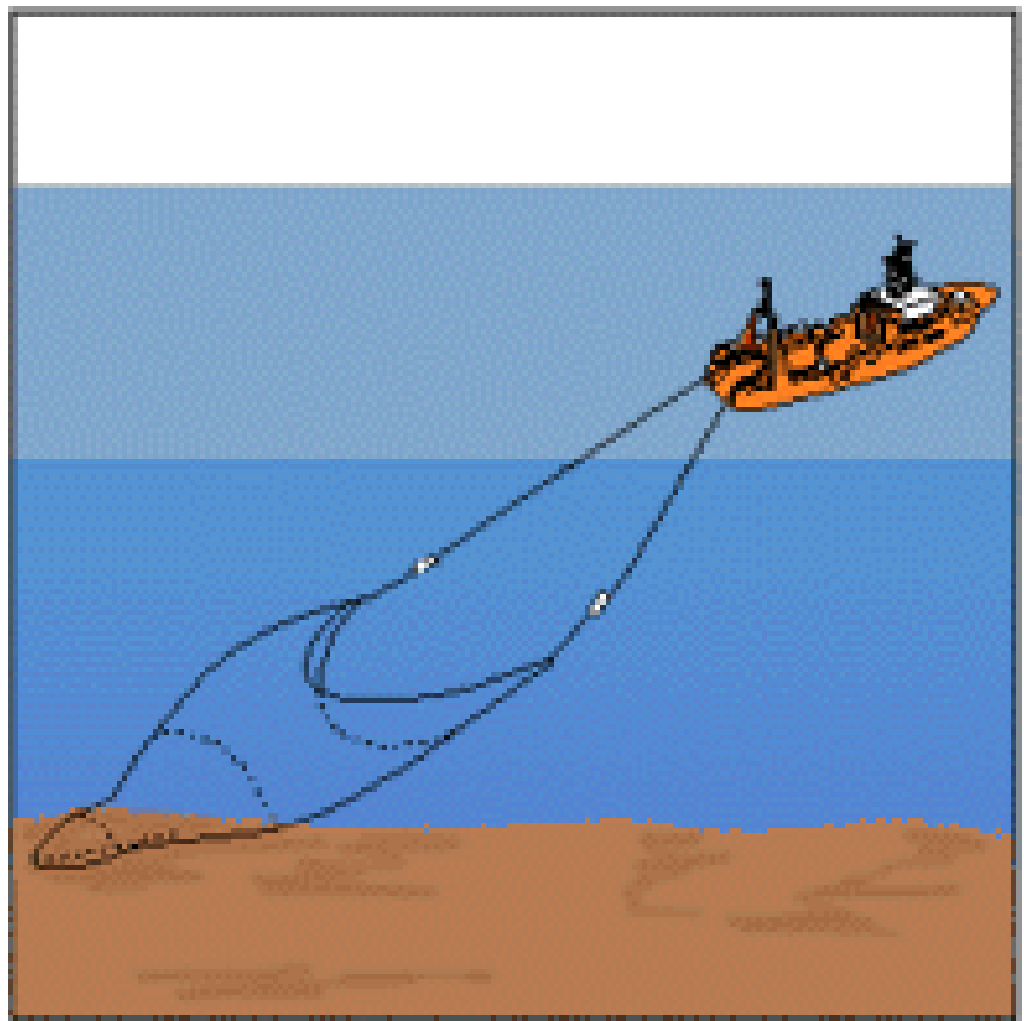
Hanging ratio (E)



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

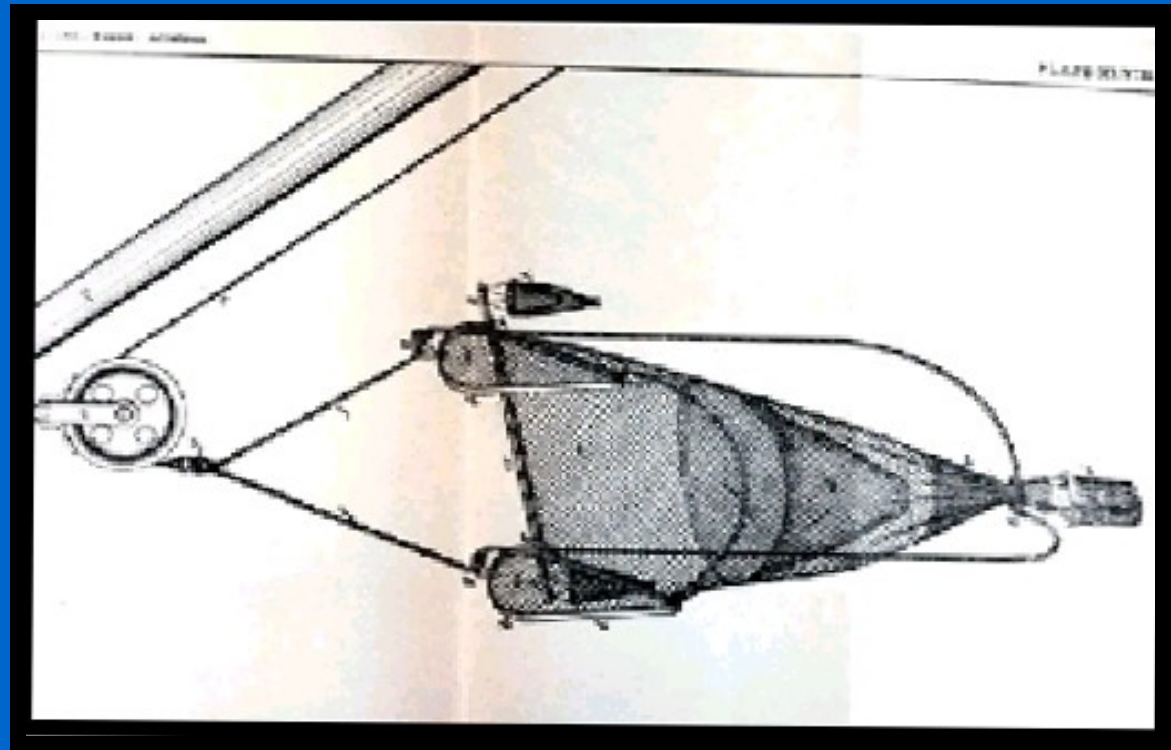
7.3 Draggged or Towed Gears: Trawls

- Funnel-shaped with cod-end (narrow backend)
- Midwater or bottom
- Beam or otter trawls



Beam Trawls

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



Otter Trawls



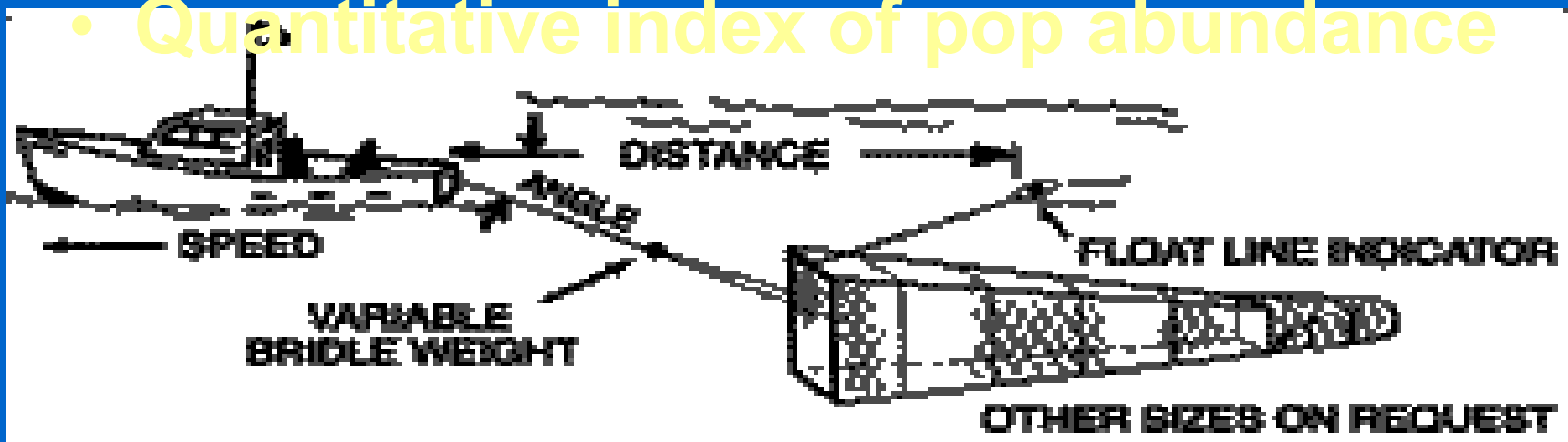
- Otter boards or trawl doors use force of water
- Oval or square, reinforced skids
- Boards hold open net
- Mouth width depends on force (inconsistent)

Trawling advantages



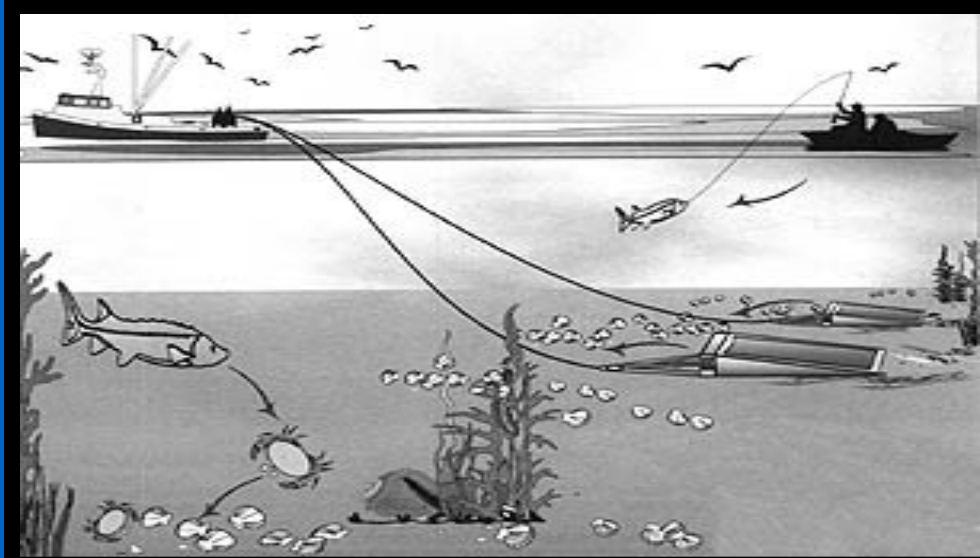
- Fish in good condition (unless deep trawls... pressure changes)
- For release of live specimens, short trawls (5-15 min)

- Quantitative index of pop abundance



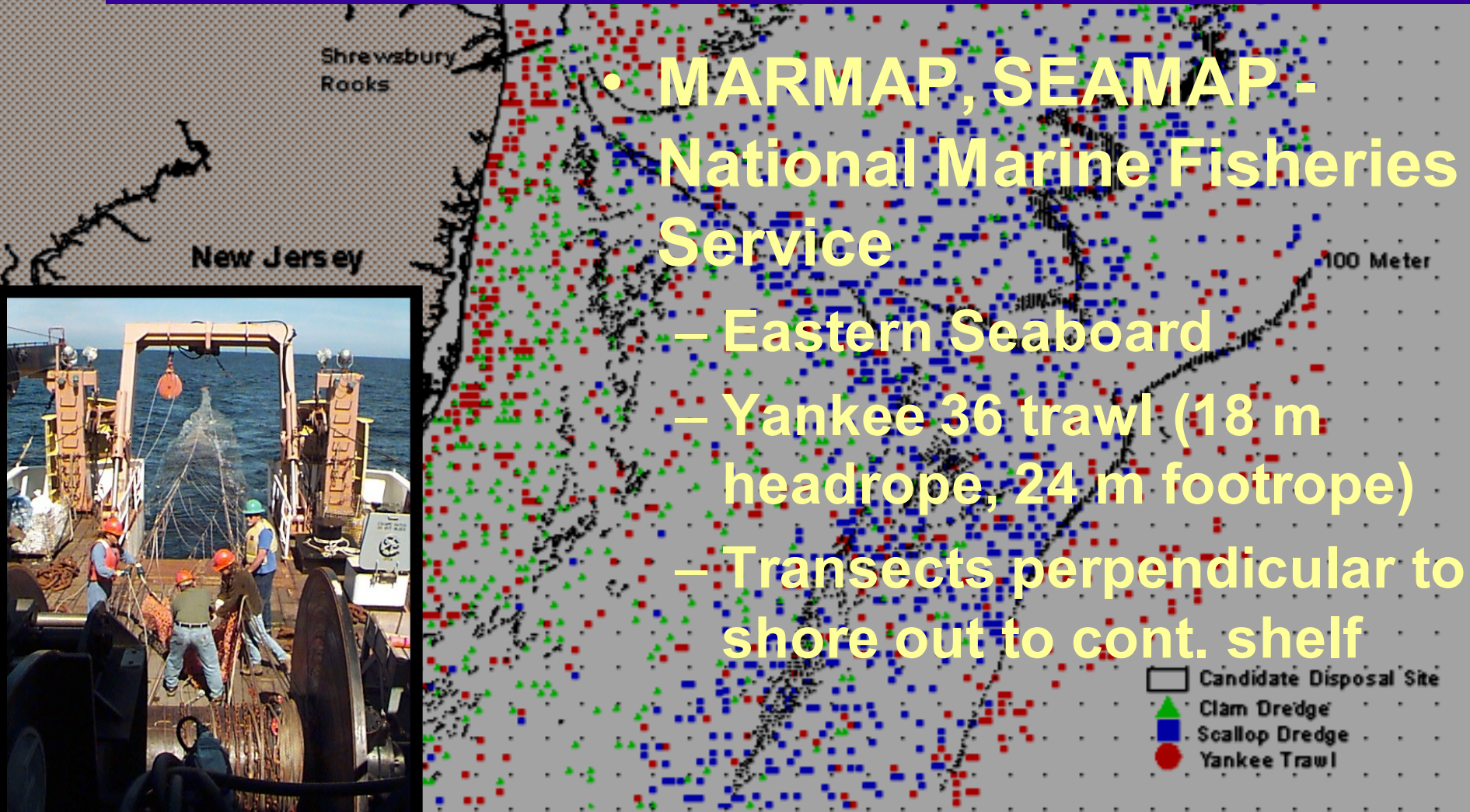
Trawl disadvantages

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



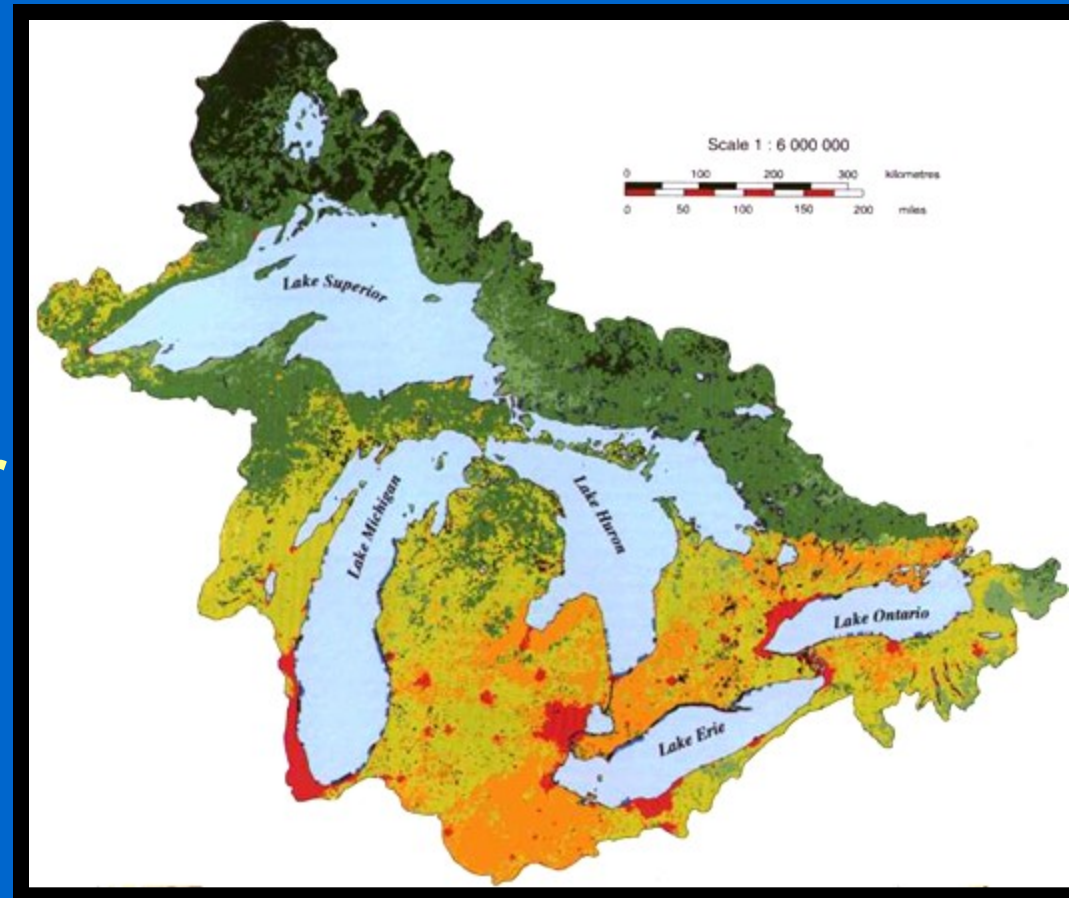
Examples of Sampling Programs

- MARMAP, SEAMAP - National Marine Fisheries Service
 - Eastern Seaboard
 - Yankee 36 trawl (18 m headrope, 24 m footrope)
 - Transects perpendicular to shore out to cont. shelf



Examples of Sampling Programs

- **Great Lakes Fisheries Survey - Great Lakes Laboratory**
 - Bottom & midwater trawls & acoustic surveys
 - 5 - 150 m depth
 - seasonal variation



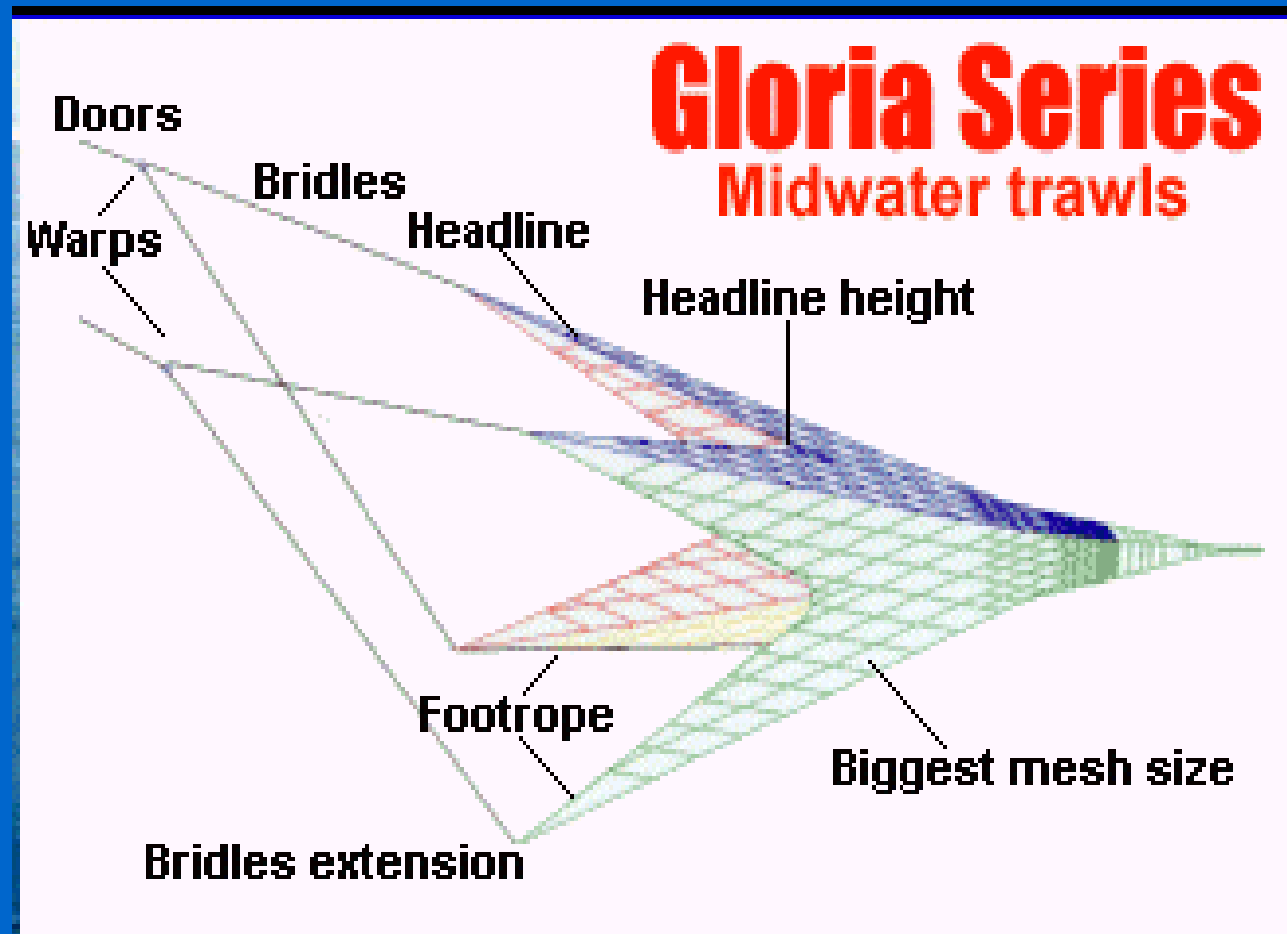
Bottom Trawl Modifications

- Rollers on the sweep chain
- Tickler chains on the sweep chain
- Plastic strips on the bag to prevent snagging
- Size & material of doors



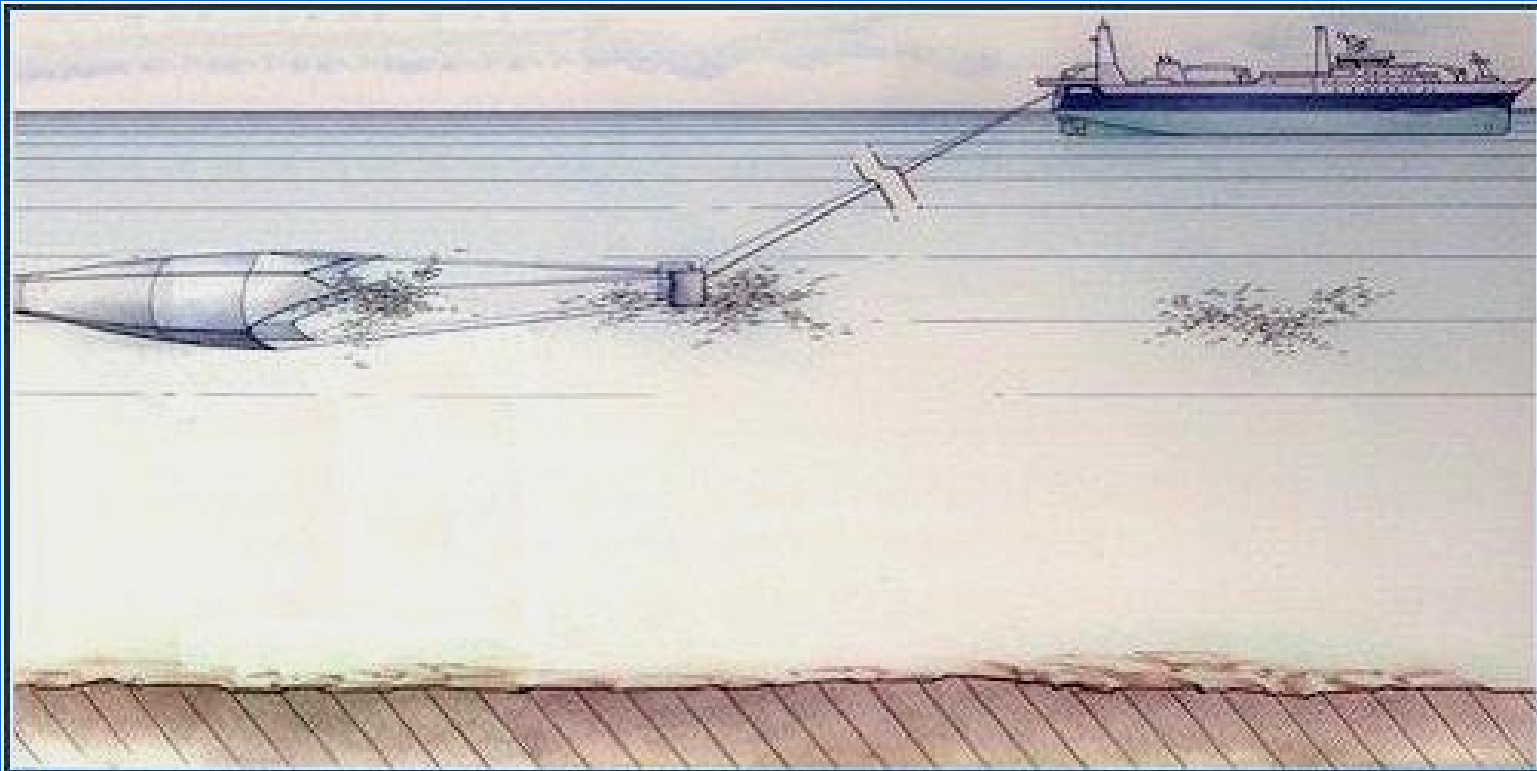
Midwater Trawls (cont.)

- Four seams
- Mesh at mouth coarse, mesh finer toward cod-end



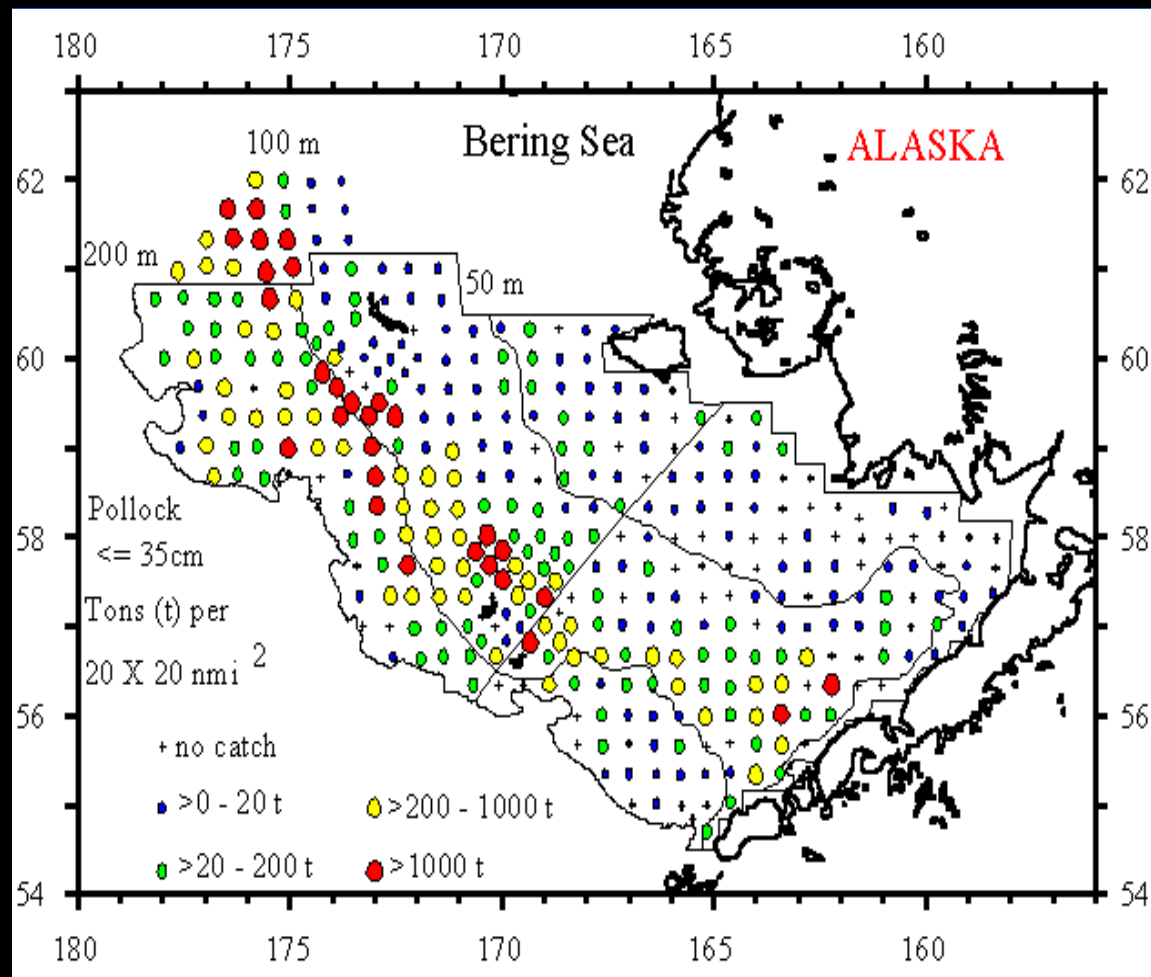
Midwater Trawls

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



Use of Midwater Trawls

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



Examples

- Remote Midwater Trawl
- Isaacs-Kid Midwater Trawl
- MOCHNESS
- BIONESS



Evaluating Gear Performance



- Did net catch fish?
- Net hang-up on bottom?

- Cod end tied?



- Crossed or twisted trawl doors?

Technology to Evaluate Gear

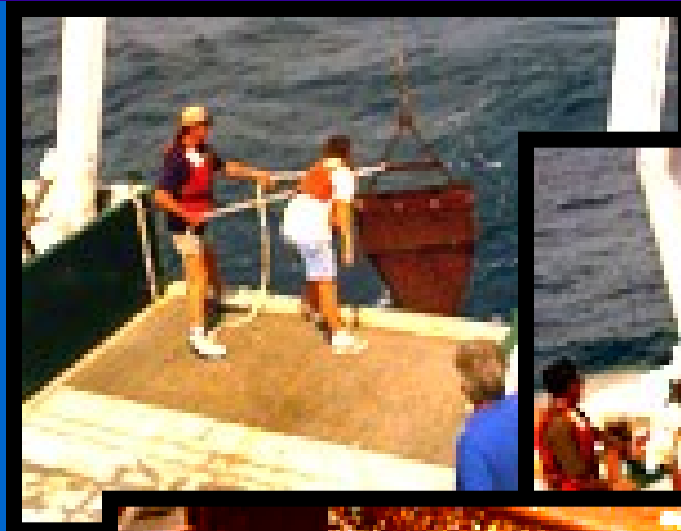


- Depth/Pressure sensors
- Laser distance measures
- Video camera mounted on gear

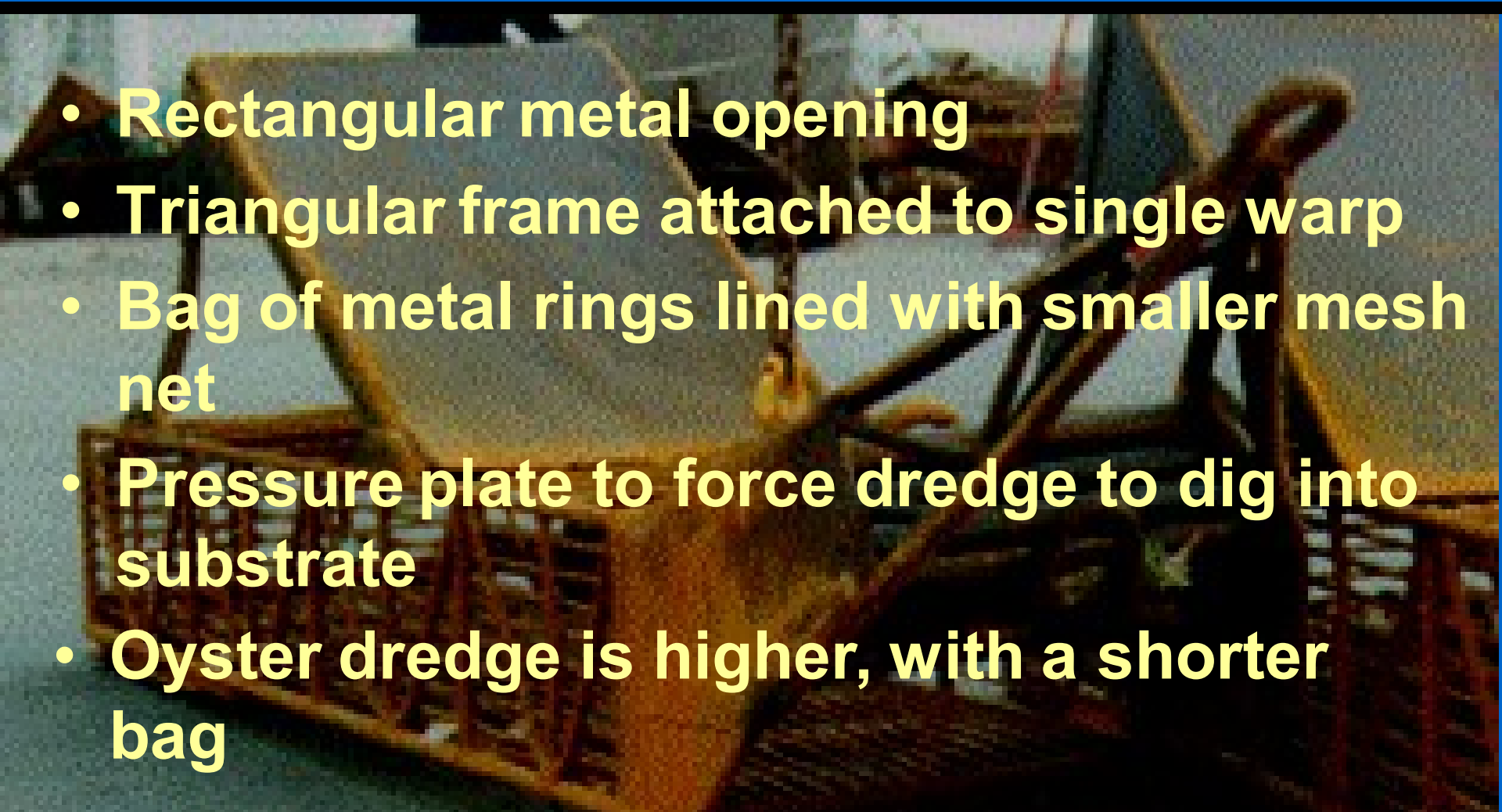


7.4 Dragged or Towed Gears - Dredges

- Heavy metal frames
- Chain link bags
- Cutting bars or teeth dig into substrate

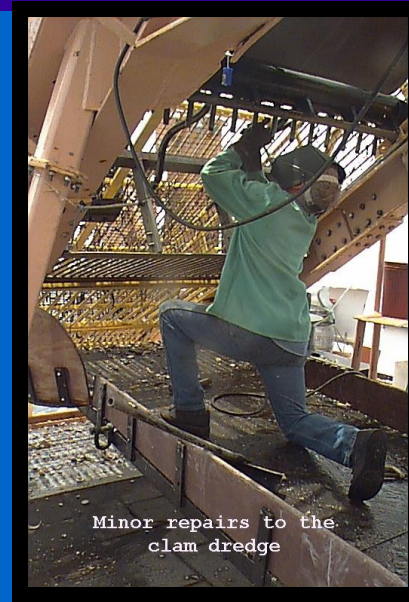


Scallop dredge

- Rectangular metal opening
 - Triangular frame attached to single warp
 - Bag of metal rings lined with smaller mesh net
 - Pressure plate to force dredge to dig into substrate
 - Oyster dredge is higher, with a shorter bag
- 
- A photograph of a scallop dredge, a rectangular metal frame with a triangular support structure, used for harvesting scallops from the seabed. The dredge is shown in a close-up view, highlighting its metal construction and the triangular frame. The background is slightly blurred, showing what appears to be a boat or a fishing vessel.

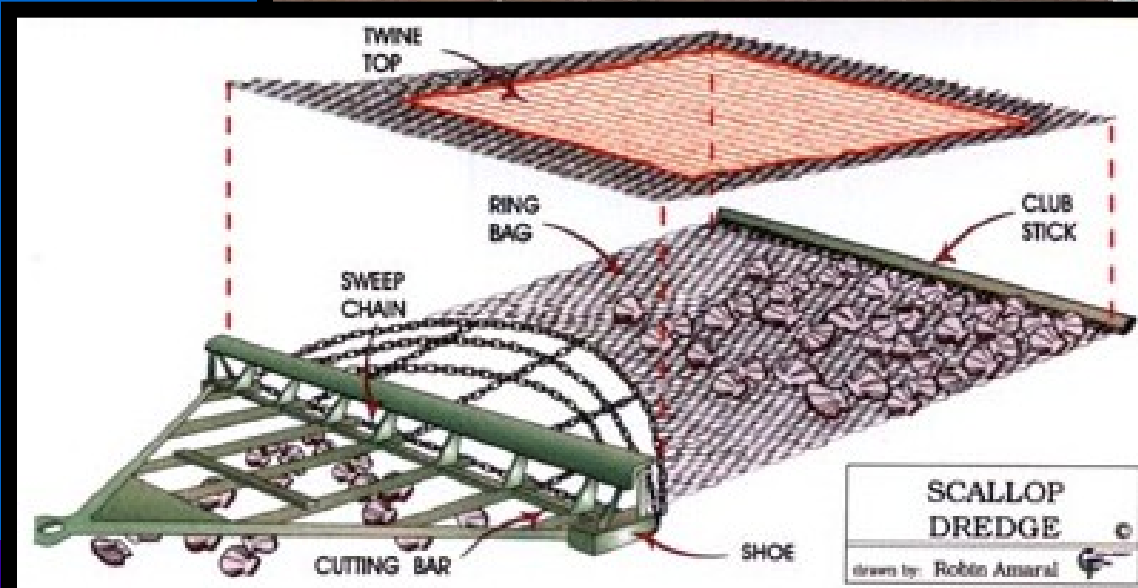
Monitoring performance

- Temperature/depth sensors
- Check the bottom of the dredge, abrasion will shine up the metal
- Debris (rocks, wood) in the dredge usually means catch will be low



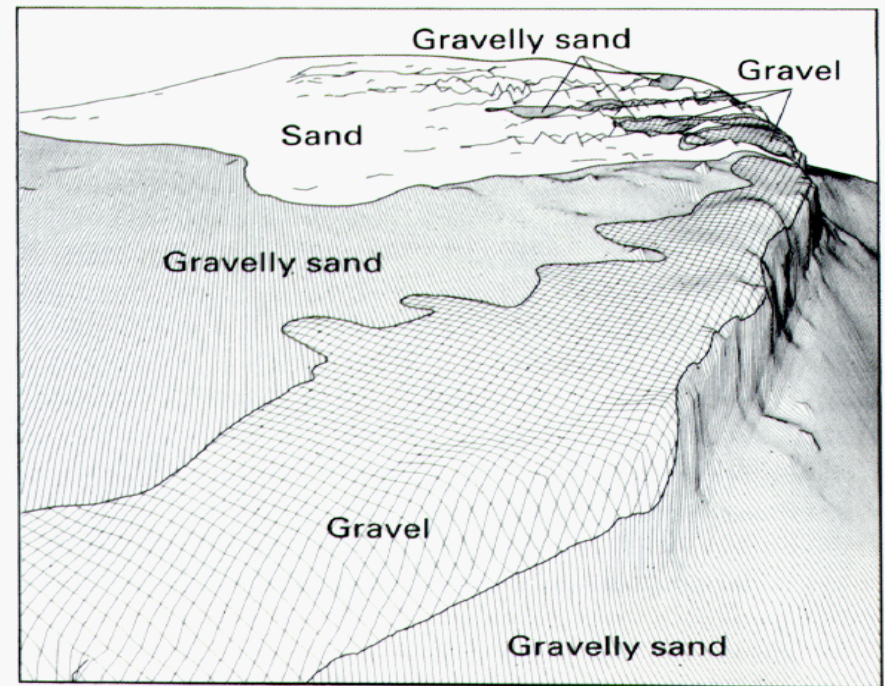
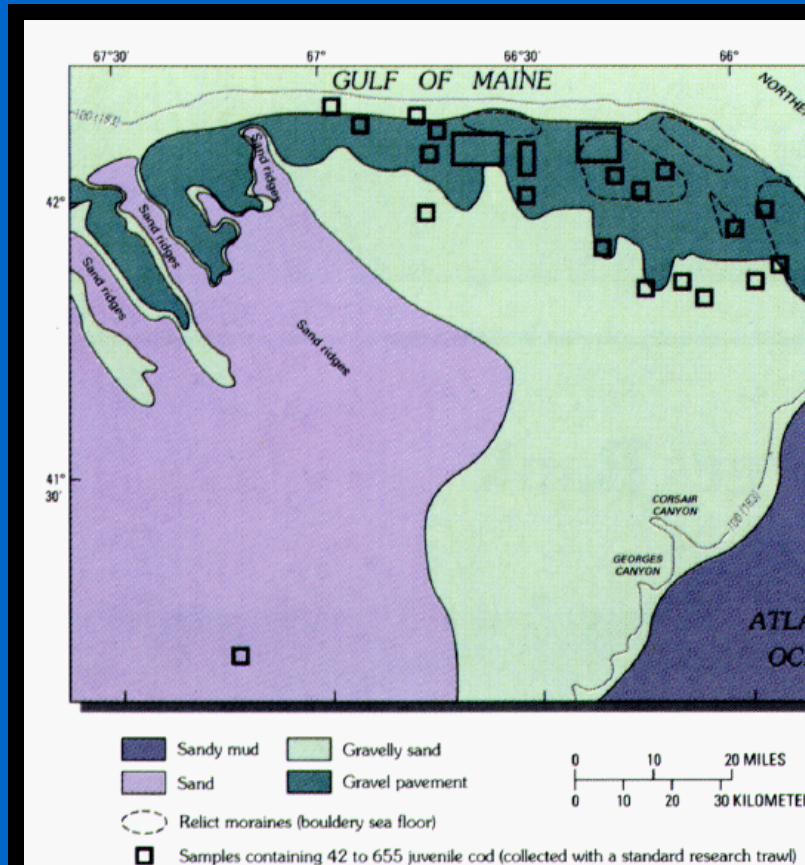
Examples of dredge surveys (cont.)

- 1. NMFS sea scallop survey
 - Along East Coast
 - 2.44-m wide
 - 5.1 cm diameter rings
 - 3.8 cm polypropylene mesh liner



Examples of dredge surveys

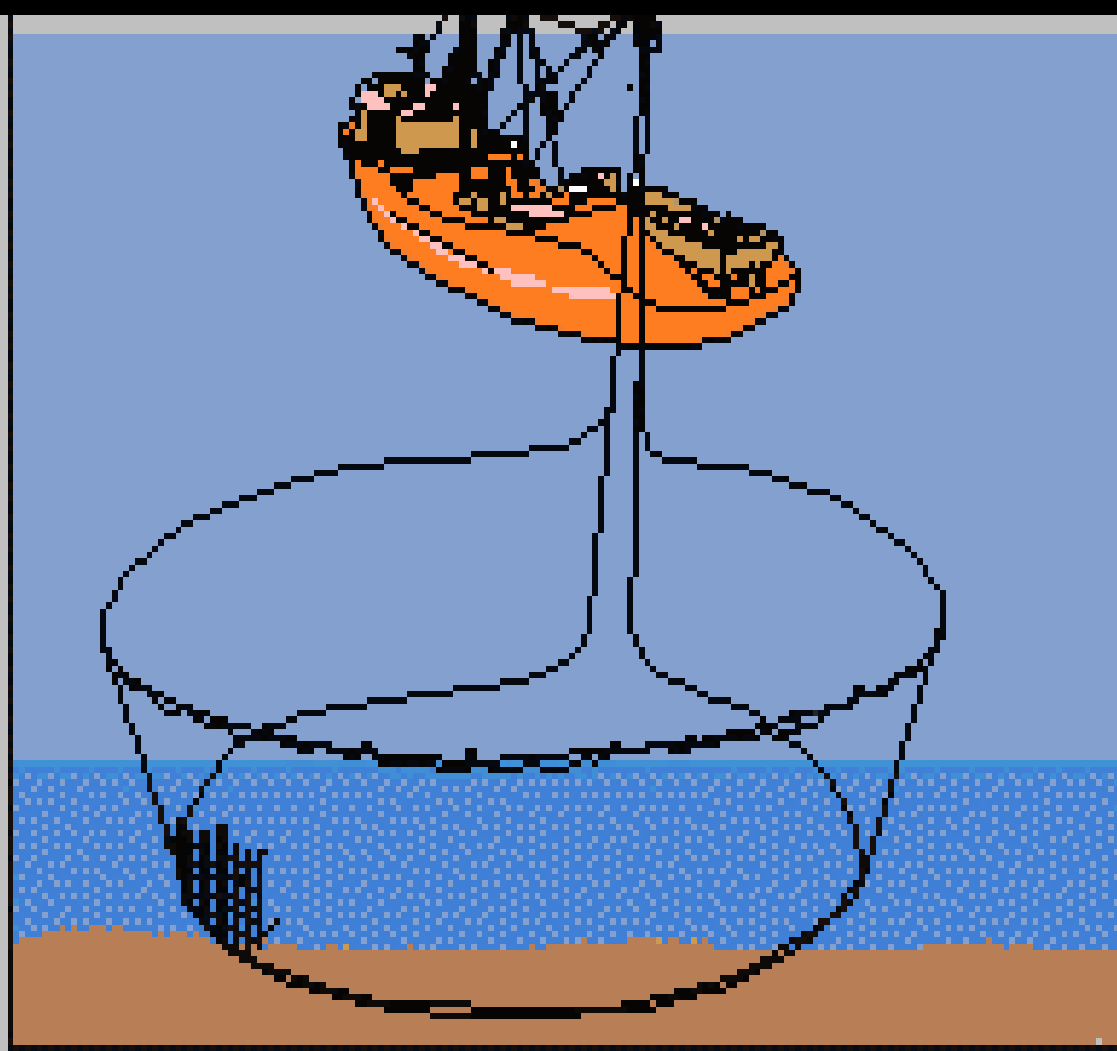
• 2. DFO survey of Georges Bank



Perspective view map looking southwest from Northeast Channel showing seafloor texture; eyepoint is 880 feet (268 m) above sea level and distance to horizon is 127 miles (205 km); vertical exaggeration is 100. Map shows the transition from gravelly, relatively smooth topography in the east (foreground) to sandy, very rough topography (sand ridges) in the west. Gravel pavement (including area where boulders are common) forms on the northern bank as sand ridges are eroded away and results in a gradual coarsening of the bank surface westward.

7.5 Surrounding or Encircling Gear

- beach seines, purse seines, lampara net
- trap fish inside fence of mesh
- area sampled is fairly standard



Seine components (cont)

- Float line - cork, styrofoam, or plastic floats hold mesh upright
- Lead line - lead weights attached or lead in core of polypropylene line



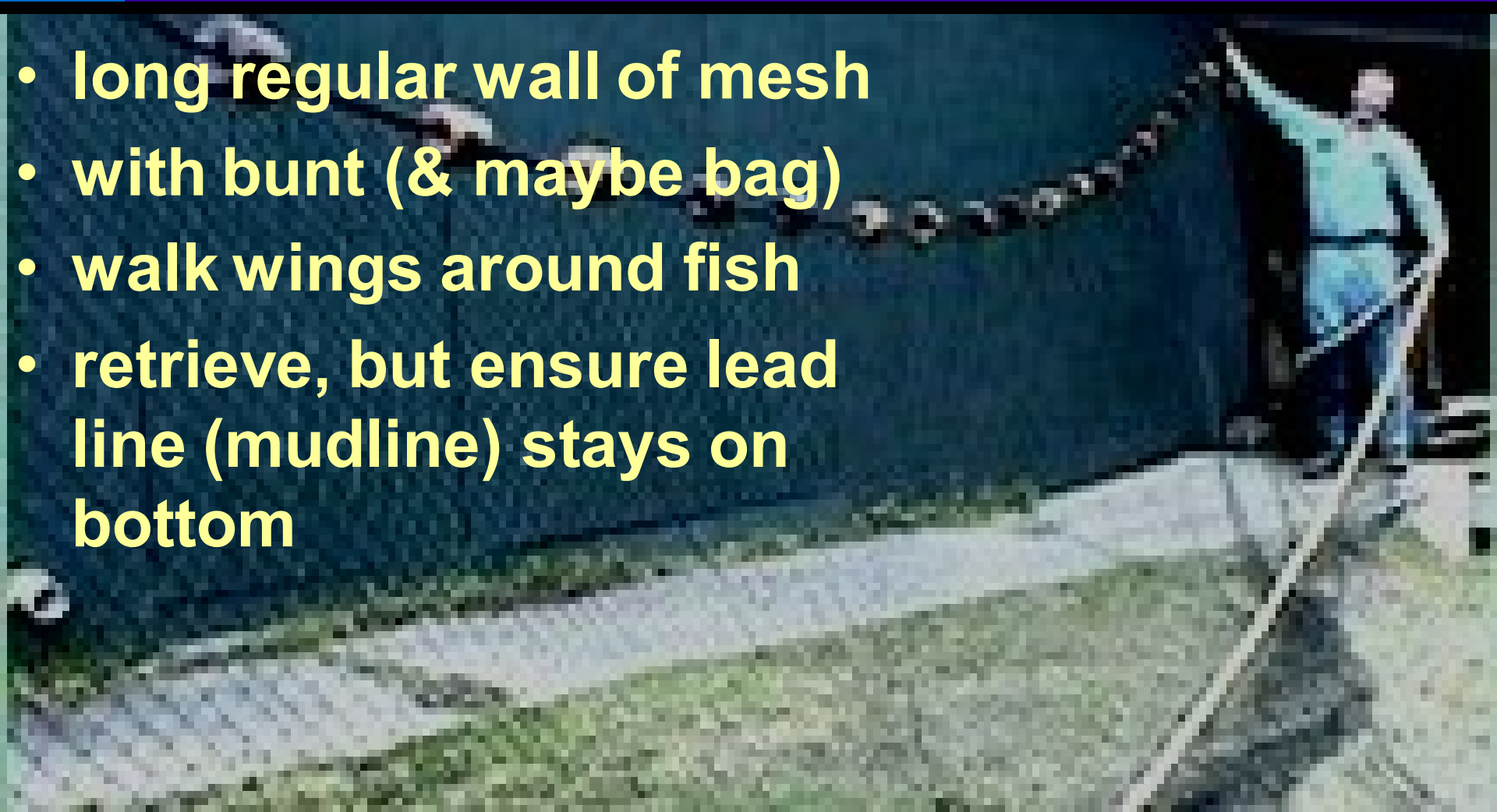
Seine components

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



Beach or haul seine

- long regular wall of mesh
- with bunt (& maybe bag)
- walk wings around fish
- retrieve, but ensure lead line (mudline) stays on bottom



Fishing a beach seine (cont.)



- fished near shore by wading; no obstructions to lift lead line
- set in semi-circle; retrieve both ends or
- set perpendicular to shore, walk along; then offshore fisher curls to shore

Fishing a beach seine

- 1-3 wings or leaders (guide fish)
- enclosure with throat
- float
- anchor



- pay attention to capture efficiencies - vary diel, seasonal, by species

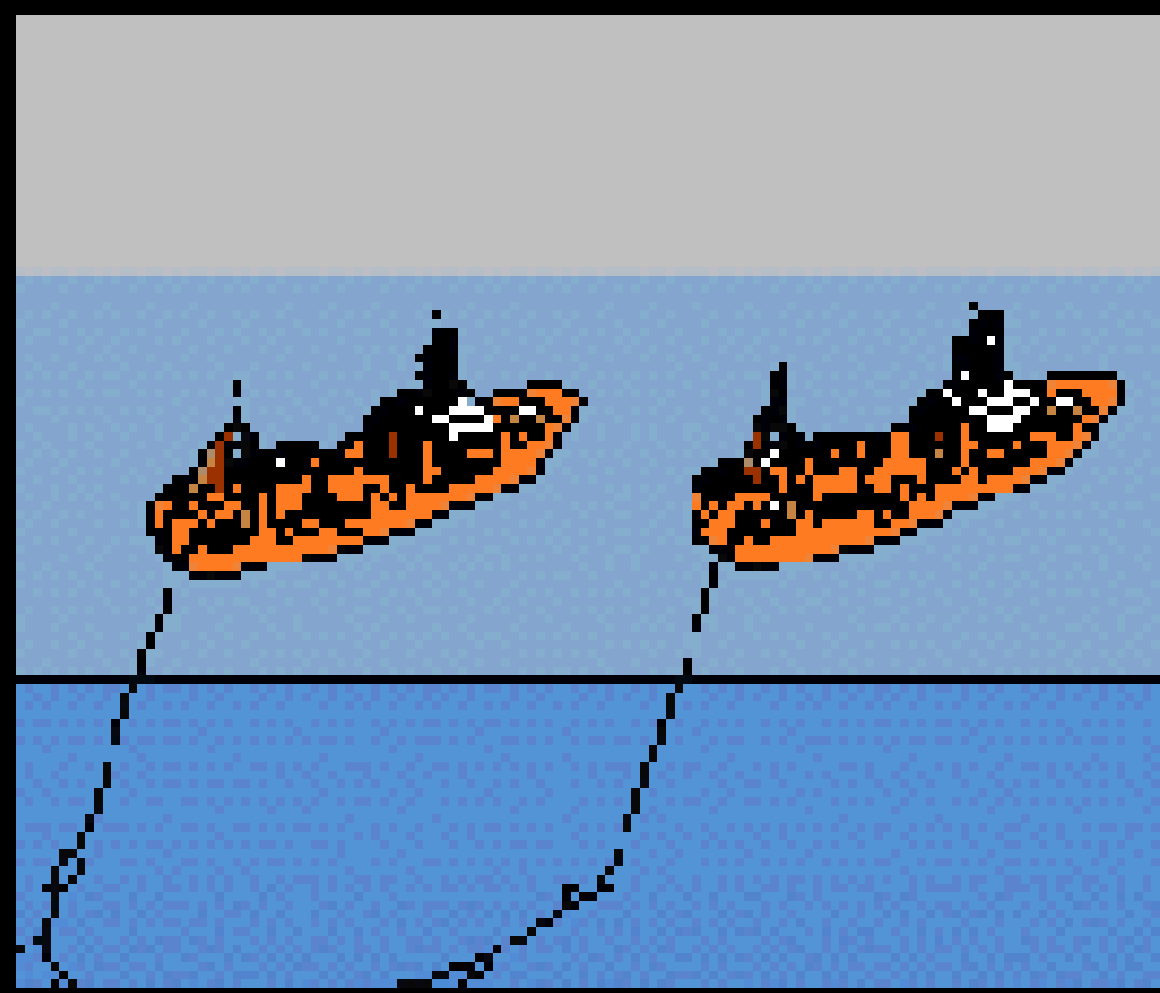
Purse seines

- For pelagic (open water) species



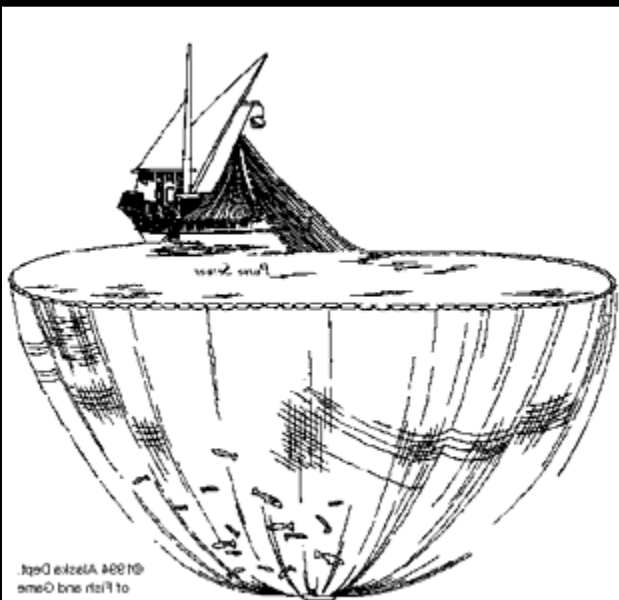
Purse seines

- Or demersal if leadline goes to the bottom
- Can fish with one or two boats



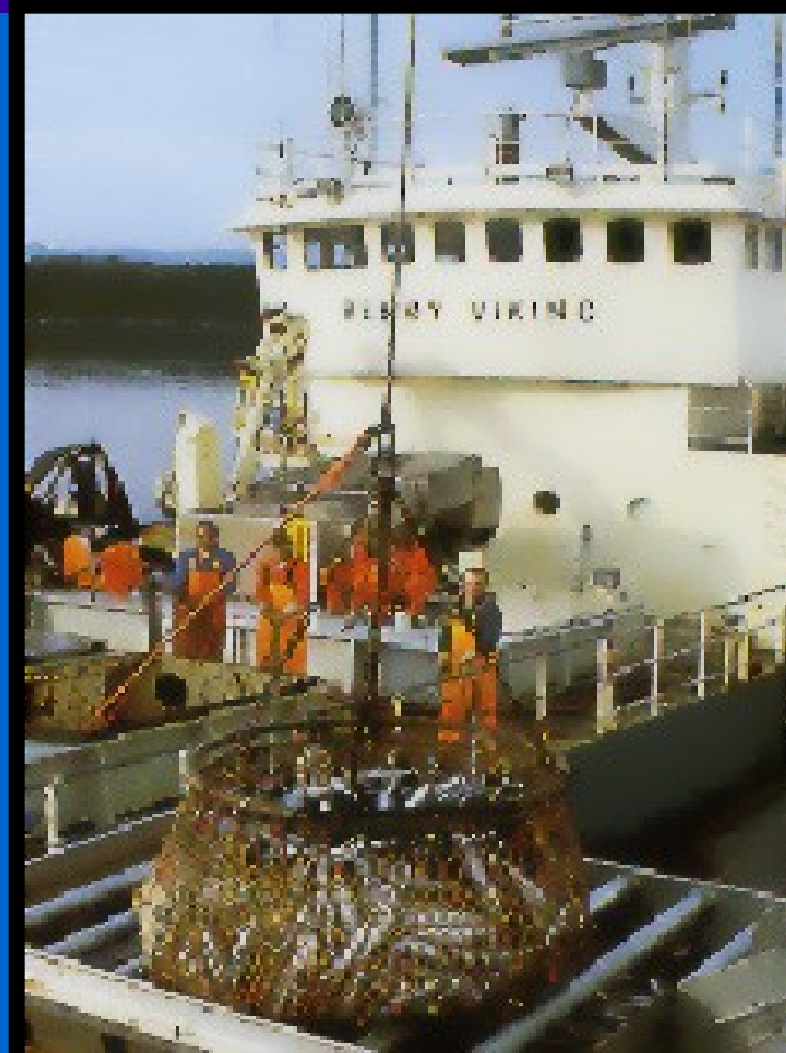
Fishing a purse seine (cont.)

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



Fishing a purse seine

- Fish are in a bowl of mesh
- Bowl is made smaller until fish in bunt of seine



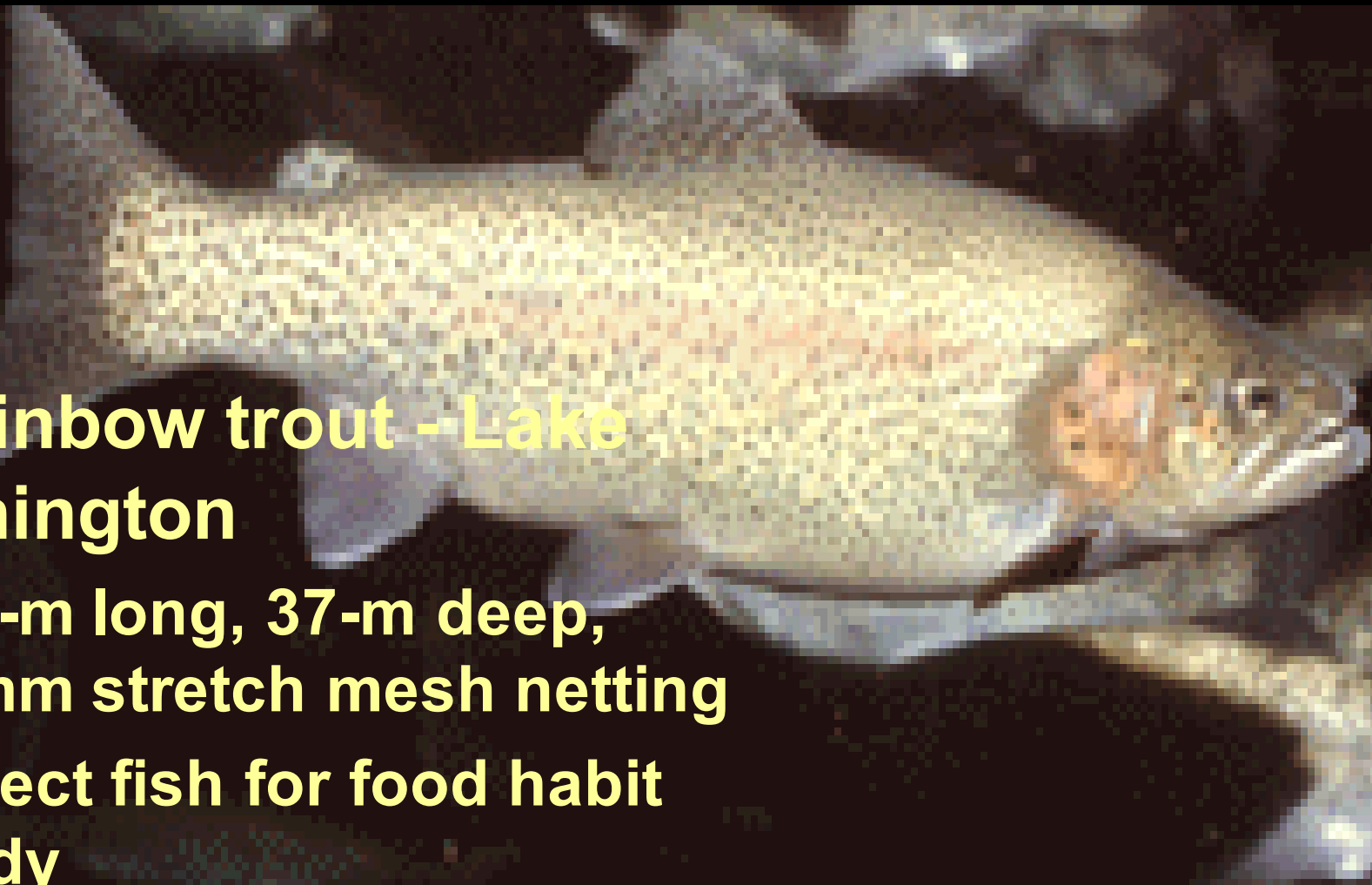
Examples

- **1. Juvenile coho salmon - Oregon and Washington**
 - 495-m long seine set in transects up & down coast
 - catch showed juveniles migrate north in ocean



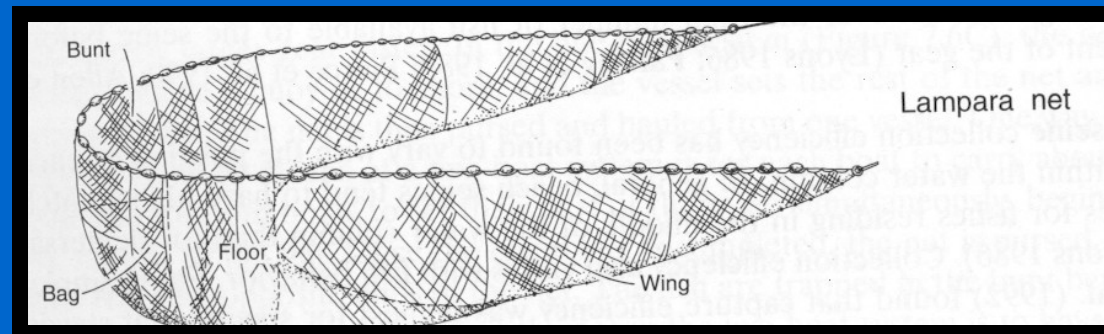
Examples (cont.)

- **2. Rainbow trout - Lake Washington**
 - 600-m long, 37-m deep, 25mm stretch mesh netting
 - collect fish for food habit study



Lampara net

- For catching fish near surface
- Used over rough bottom where beach or purse seine won't work
- Leadline shorter than float line
- After circling fish, ends of leadline pulled
- Leadlines come together making a bowl full of fish

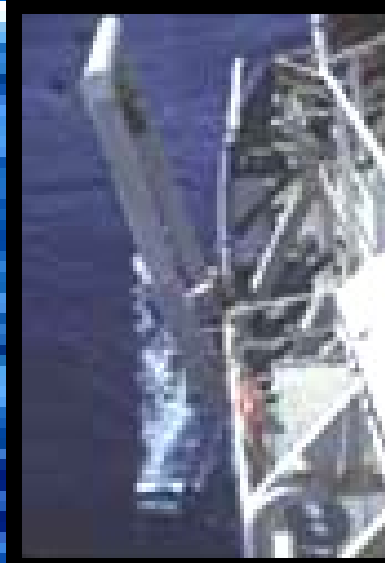
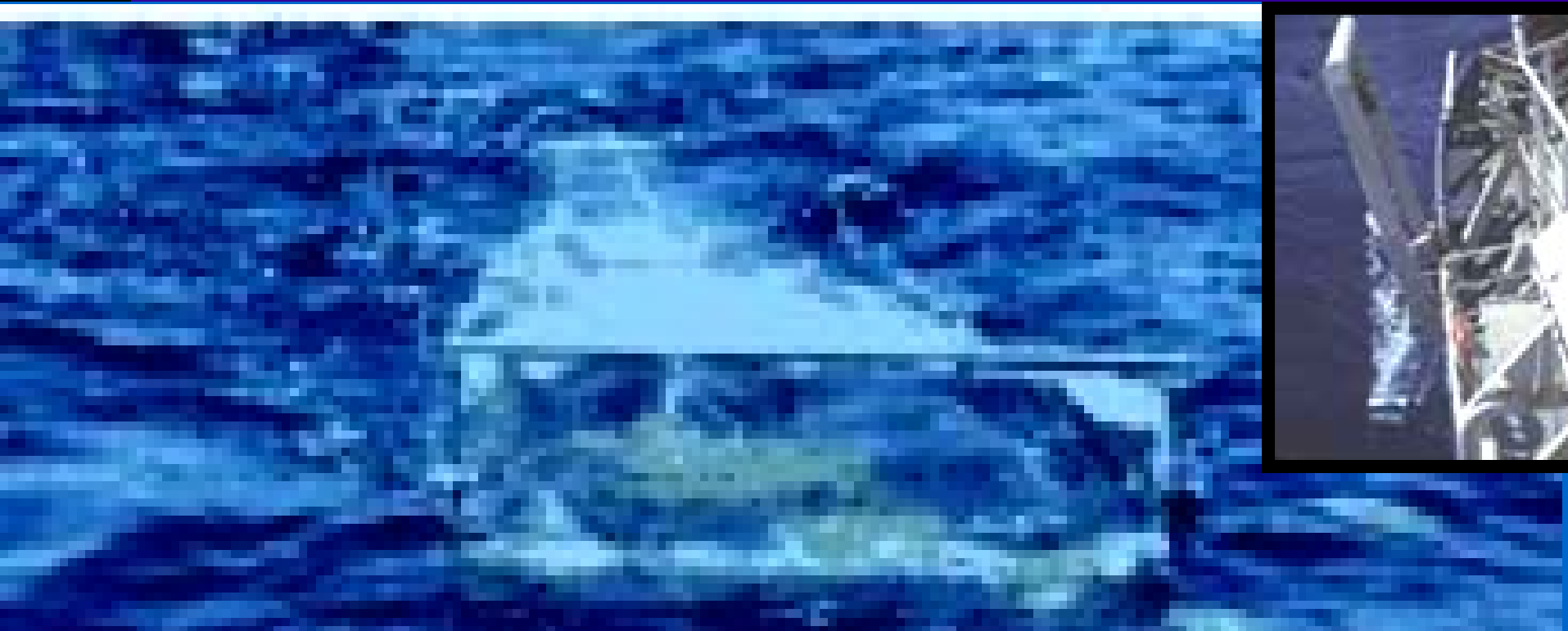


7.6 Other Active Sampling Gears (cont.)

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



7.6 Other Active Sampling Gears (cont.)

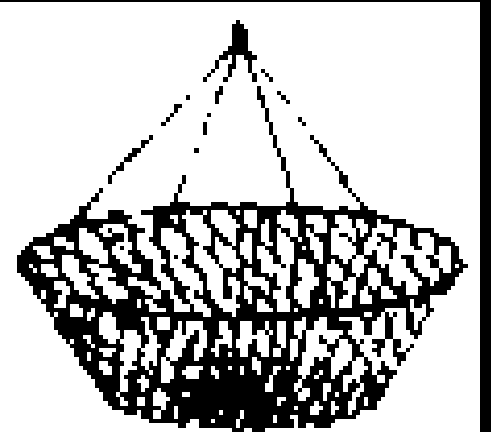


- **Neuston nets**
 - push net towed to the side or behind a boat

7.6 Other Active Sampling Gears (cont.)

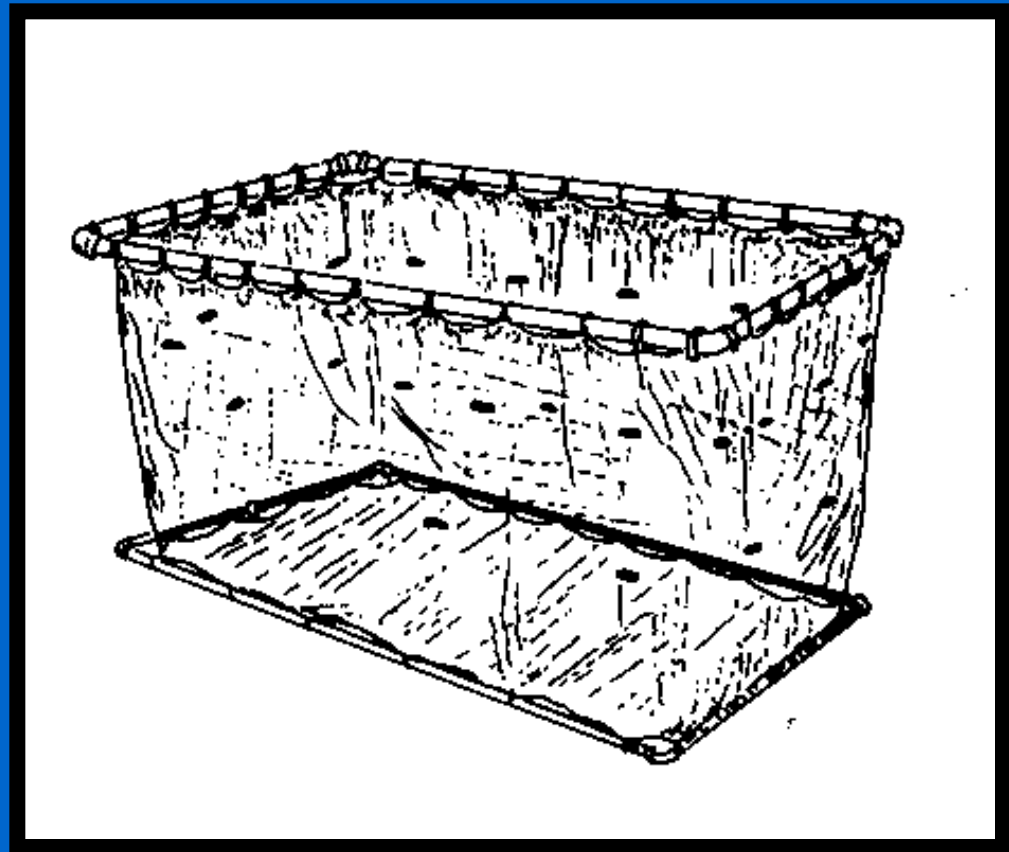
- Lift nets

- 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).



7.6 Other Active Sampling Gears (cont.)

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



7.6 Other Active Sampling Gears (cont.)



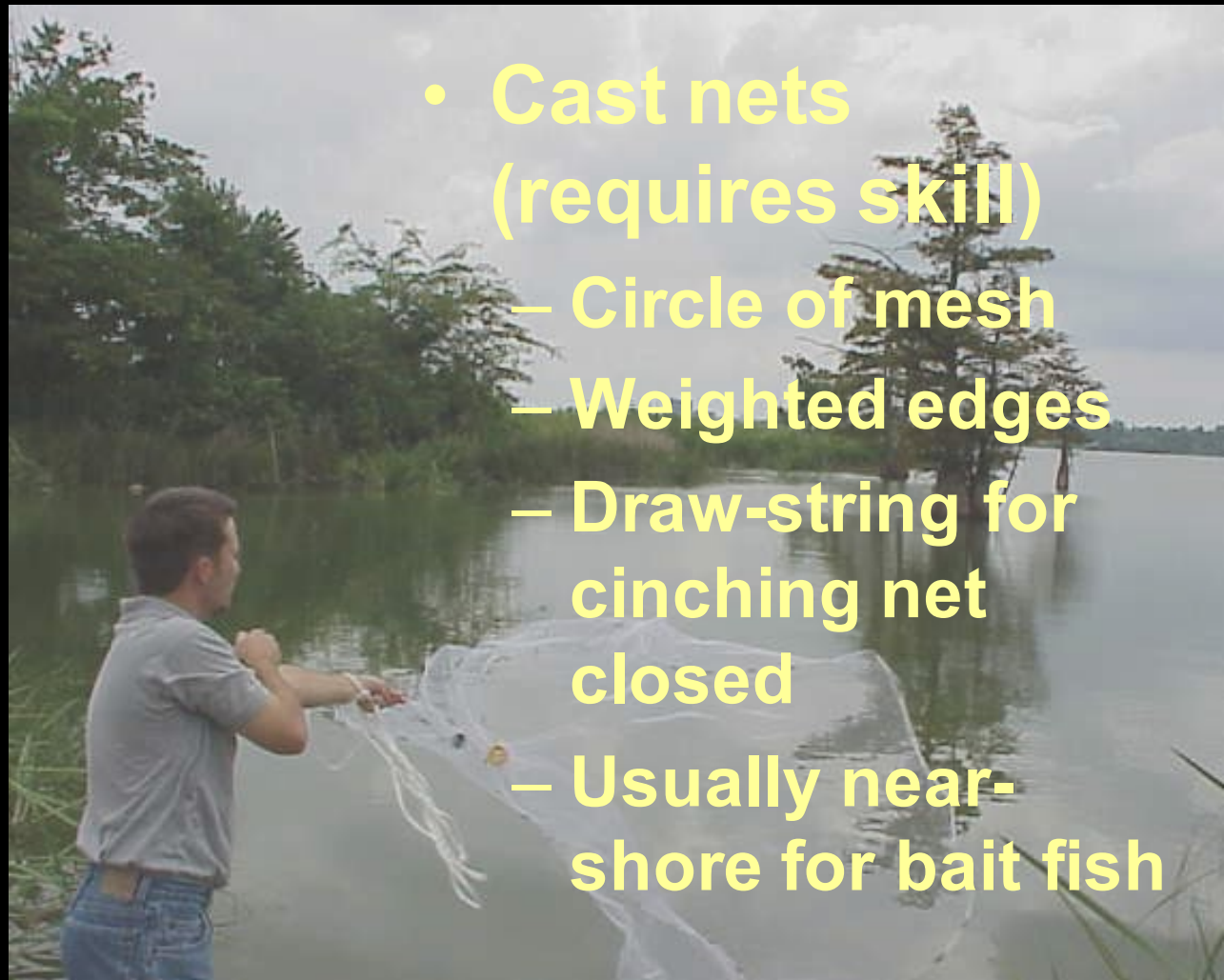
- Dip nets
 - Circular net on a pole
 - Lift fish from water - during electrofishing
 - Remove fish from containers

Other Active Sampling Gears (cont.)

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

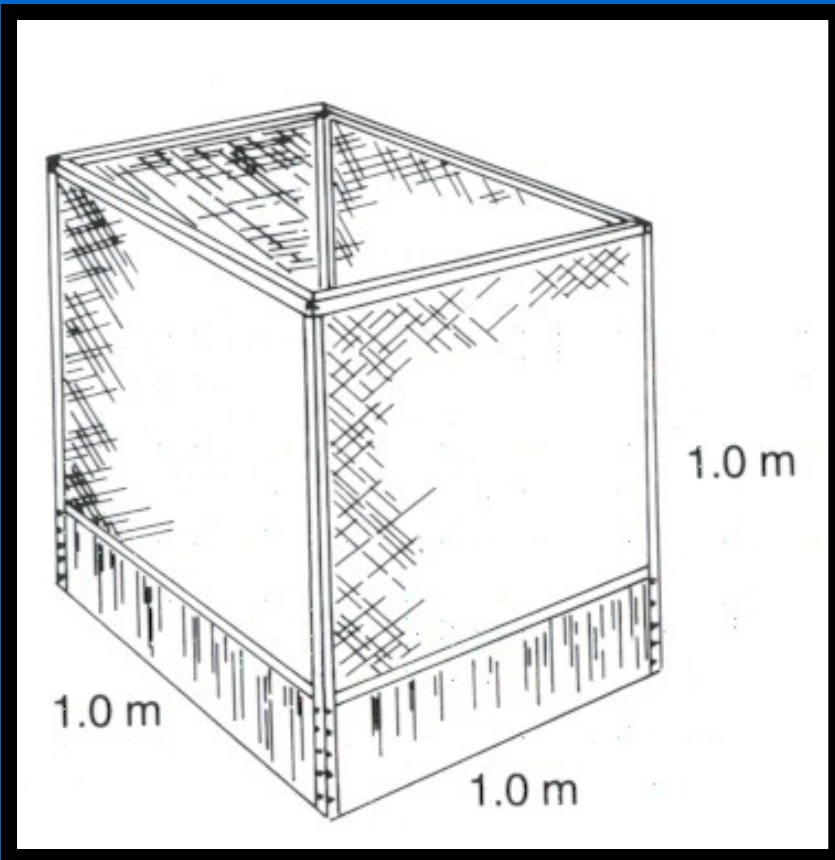


Other Active Sampling Gears (cont.)



- 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.)



- Drop nets
 - Rigid cylinder or box of mesh (usually $<1\text{m}^2$)
 - Thrown or dropped in sample area
 - Fish removed from fixed area...
quantitative sample

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



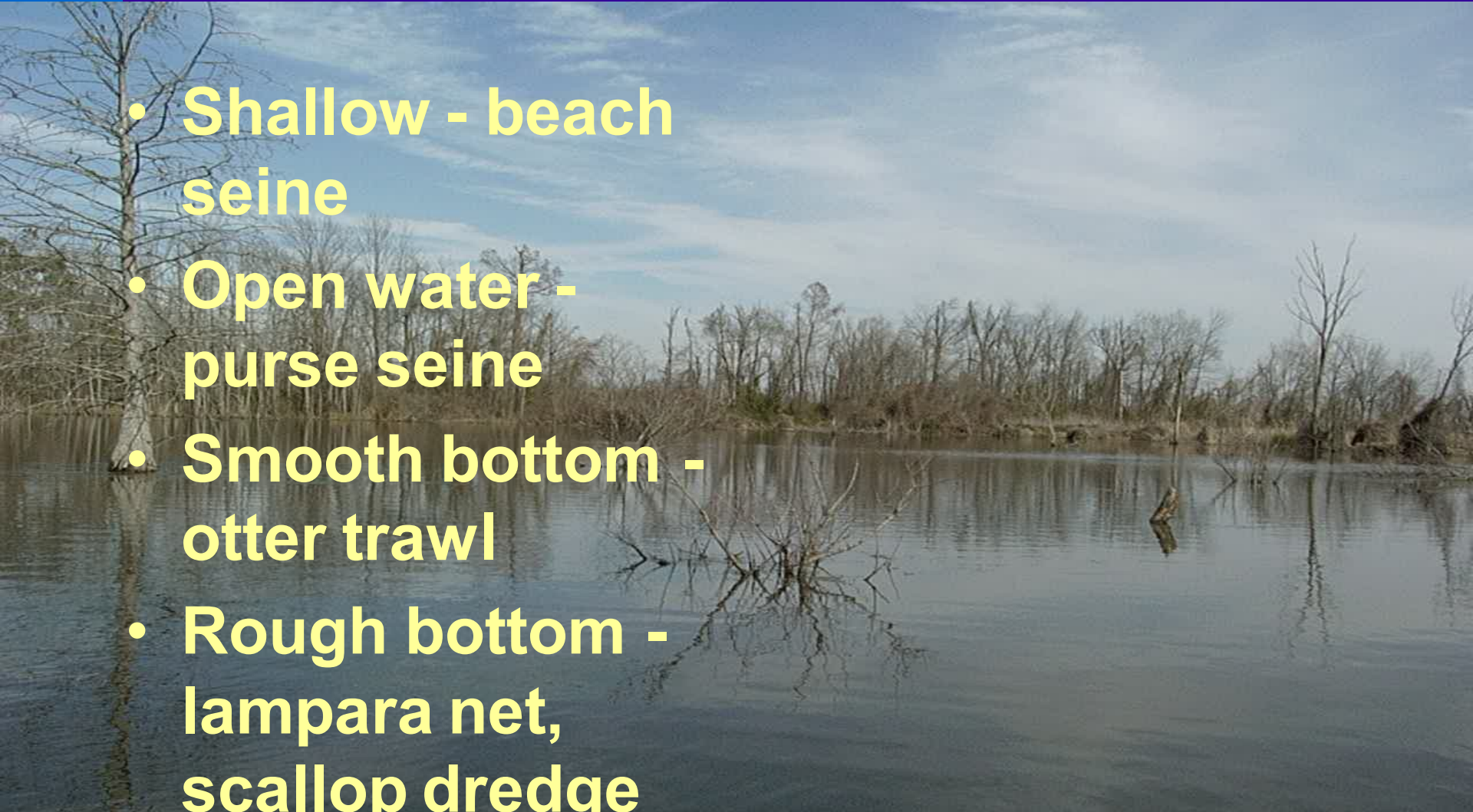
7.7 Gear selection

- 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



What is the environment like?

- Shallow - beach seine
- Open water - purse seine
- Smooth bottom - otter trawl
- Rough bottom - lampara net, scallop dredge



What is life history of fish?

- Demersal - otter trawl
- Pelagic - purse seine
- Associate with structure - hook and line
- Littoral zone - beach seine



Seining with feet on lead line

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)

7.8 Sampling Problems (cont.)

- **Structure**
 - Impedes progress of gear - woody debris in rivers
 - Gear won't go into habitat - elkhorn or staghorn corals



7.8 Sampling Problems

- **Lake size**
 - Small deep lake needs big boat to set trawl deep
 - But small lake won't fit

