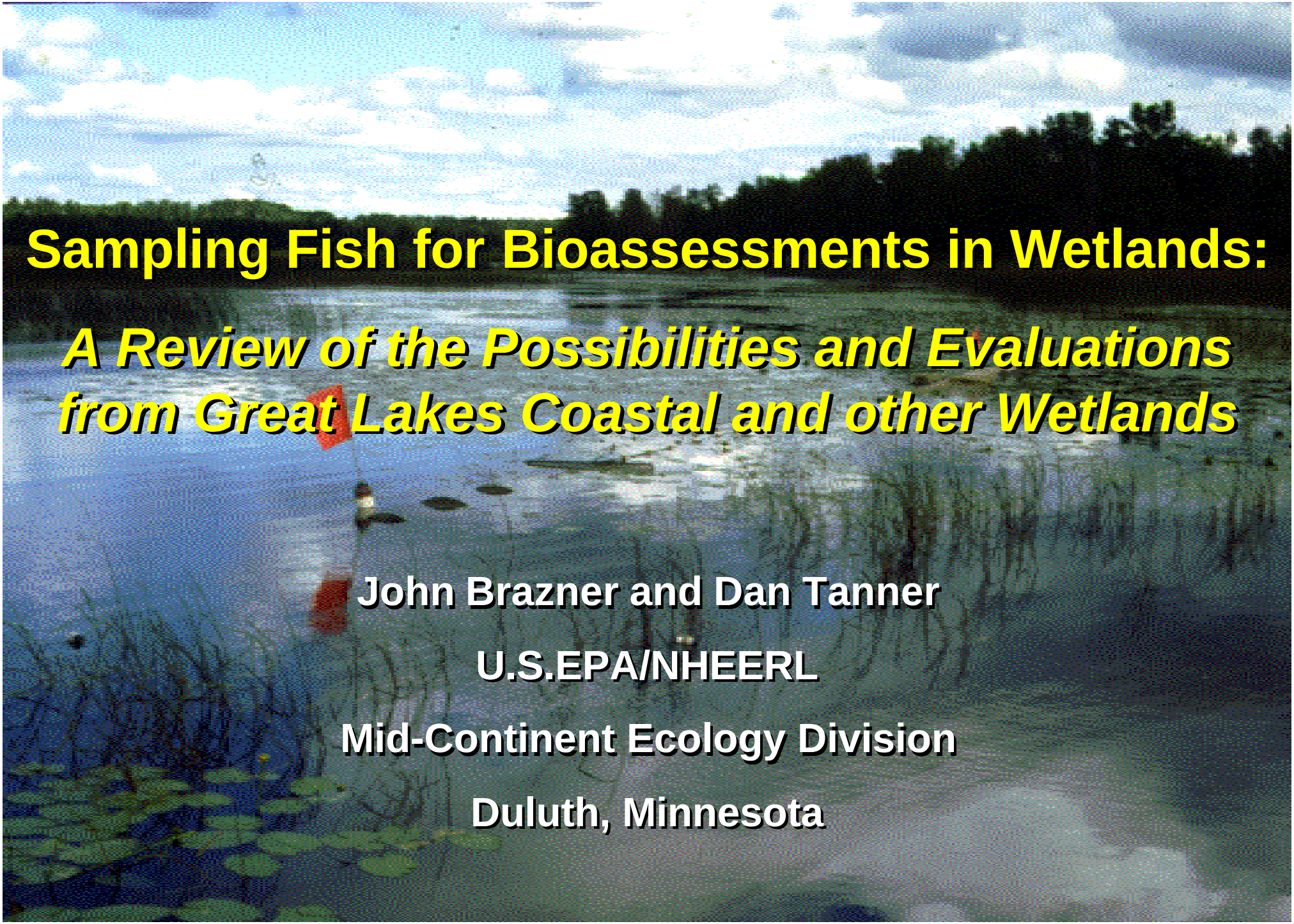


# Sampling Fish for Bioassessments in Wetlands:

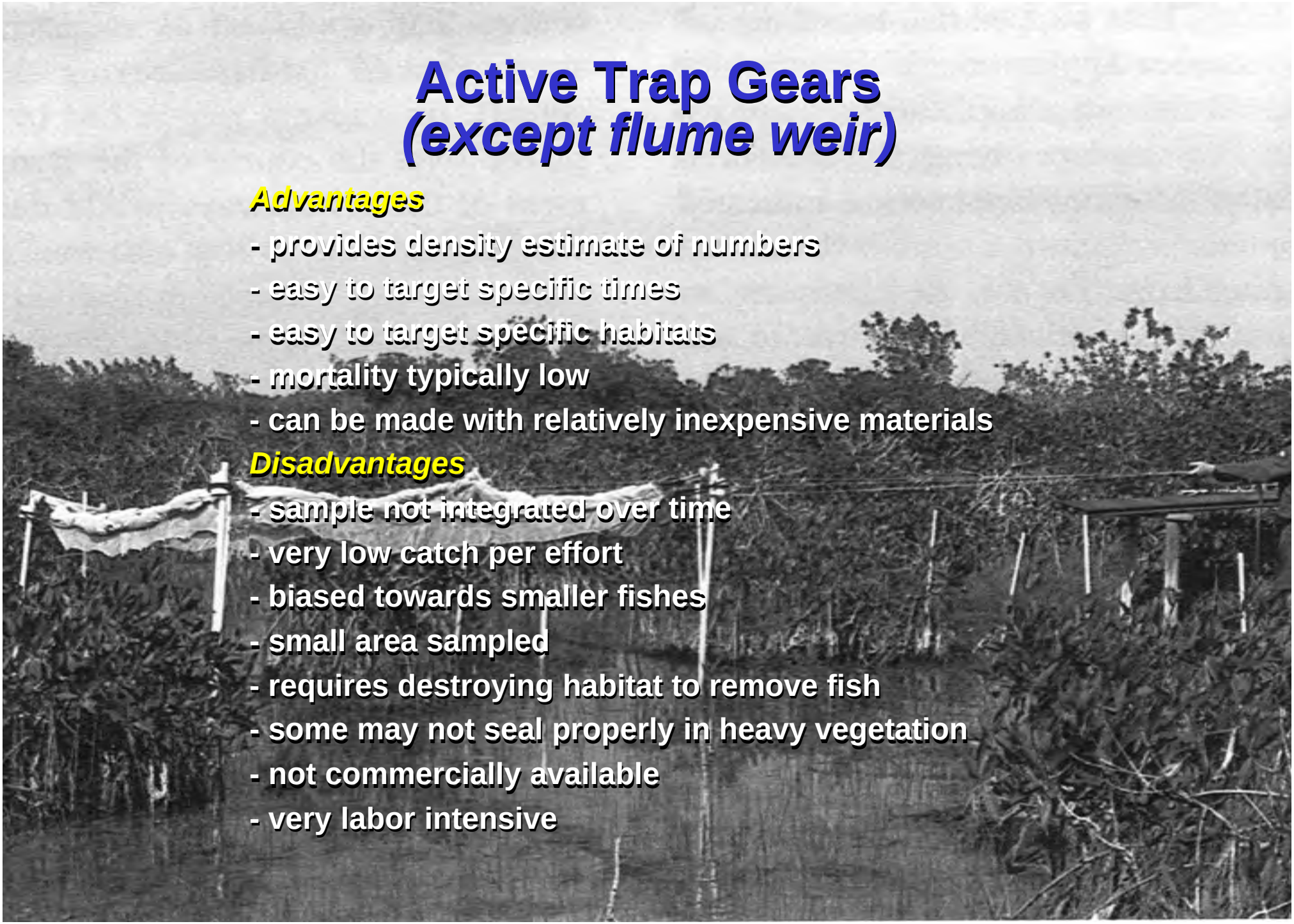
## *A Review of the Possibilities and Evaluations from Great Lakes Coastal and other Wetlands*

**John Brazner and Dan Tanner**

**U.S.EPA/NHEERL**

**Mid-Continent Ecology Division**

**Duluth, Minnesota**



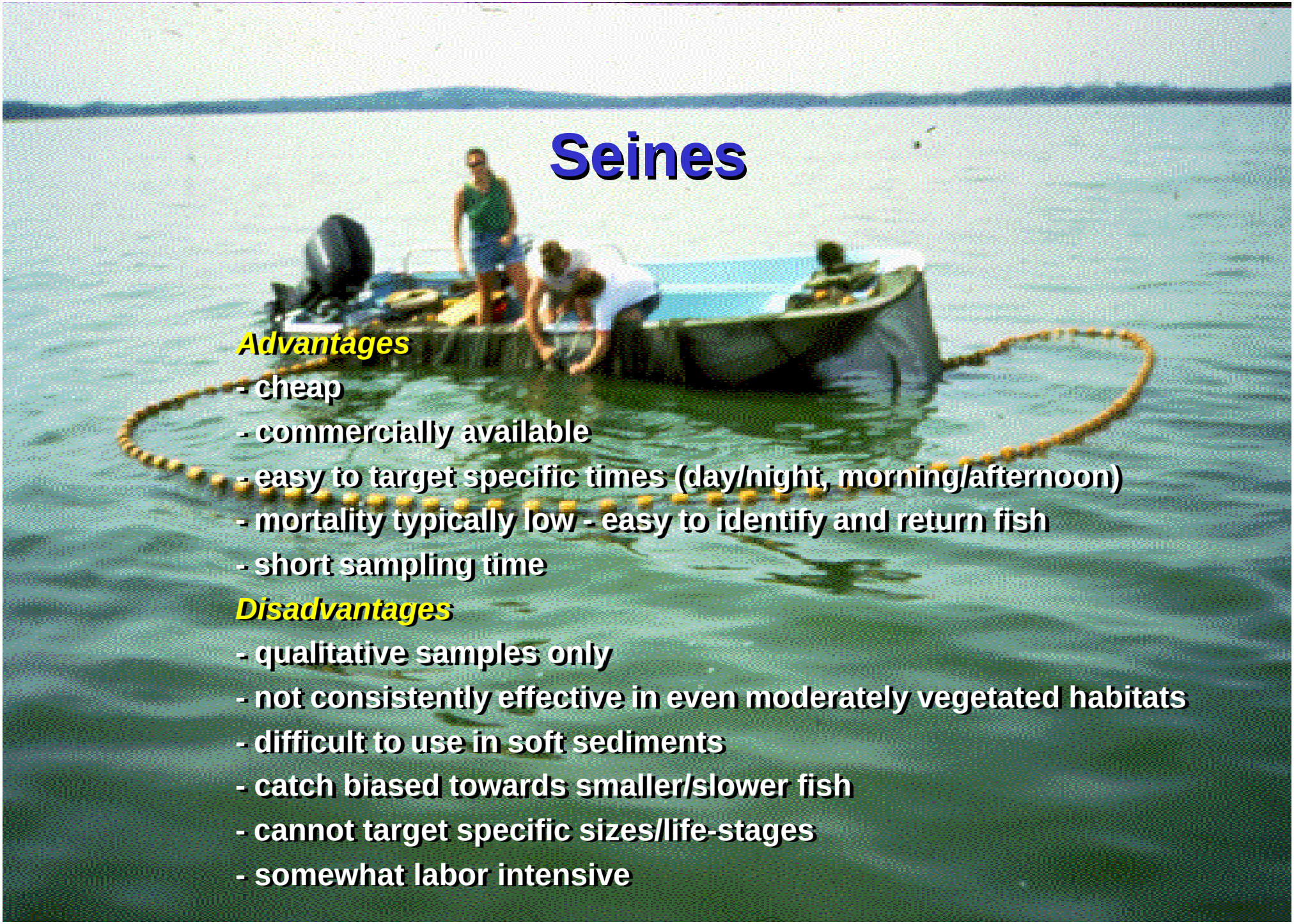
# Active Trap Gears
## *(except flume weir)*

***Advantages***

- provides density estimate of numbers
- easy to target specific times
- easy to target specific habitats
- mortality typically low
- can be made with relatively inexpensive materials

***Disadvantages***

- sample not integrated over time
- very low catch per effort
- biased towards smaller fishes
- small area sampled
- requires destroying habitat to remove fish
- some may not seal properly in heavy vegetation
- not commercially available
- very labor intensive



# Seines

***Advantages***

- cheap
- commercially available
- easy to target specific times (day/night, morning/afternoon)
- mortality typically low - easy to identify and return fish
- short sampling time

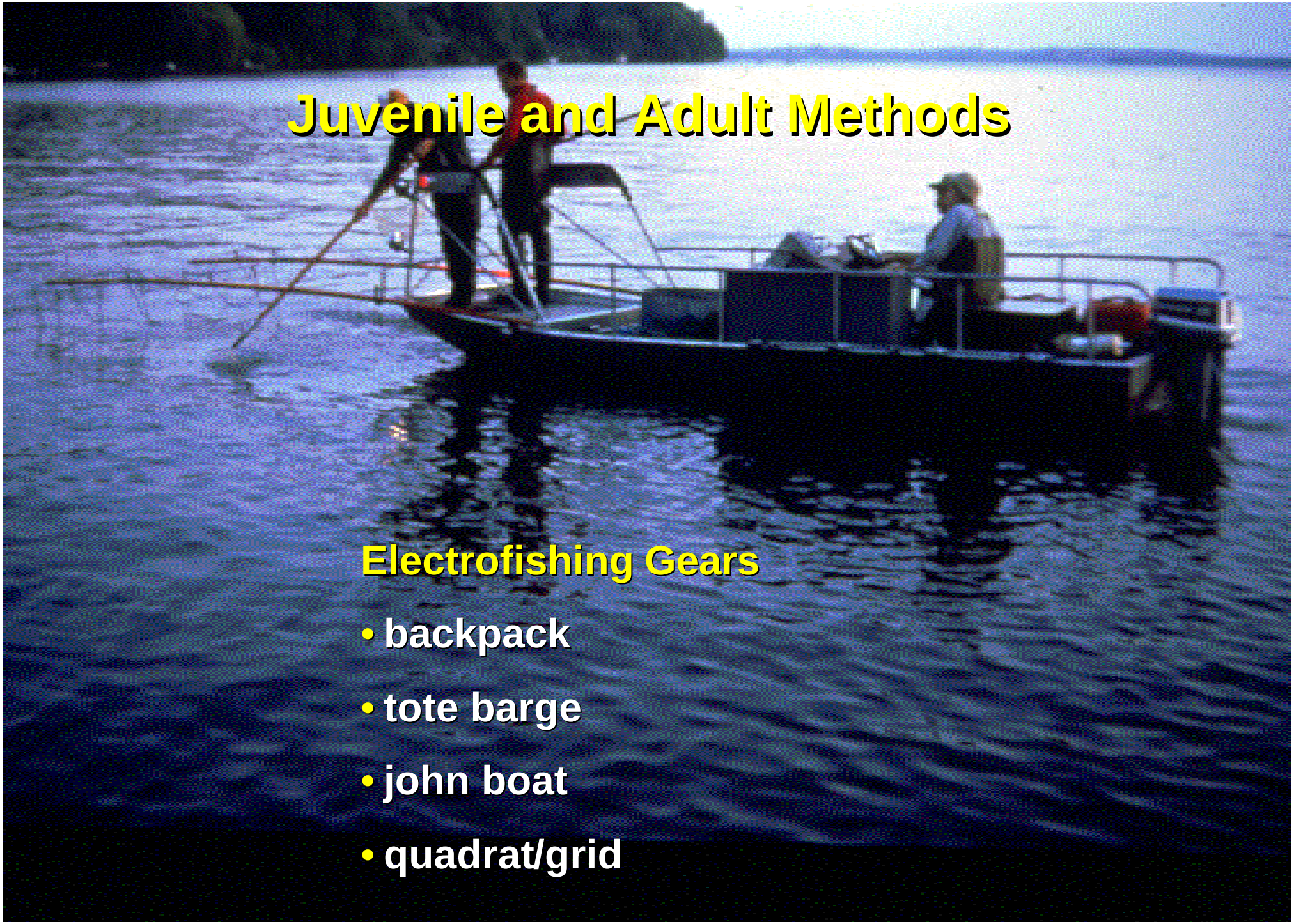
***Disadvantages***

- qualitative samples only
- not consistently effective in even moderately vegetated habitats
- difficult to use in soft sediments
- catch biased towards smaller/slower fish
- cannot target specific sizes/life-stages
- somewhat labor intensive

# Juvenile and Adult Methods

Seines

- beach seines
- purse seines



# Juvenile and Adult Methods

## Electrofishing Gears

- backpack
- tote barge
- john boat
- quadrat/grid

# Passive Trap Gears

***Advantages***

- integrated sample over time fished
- easy to target specific times (day/night, morning/afternoon)
- easy to target specific habitats (dense/moderate/sparse vegetation)
- mortality typically low - easy to identify and return fish
- wide range of sizes captured (20 mm and larger depending on mesh)
- can target specific sizes/life stages
- possible to assess direction of movement/migration patterns
- effective in all seasons (even under ice)
- relatively inexpensive ($300-400/fyke- or trap-net)

***Disadvantages***

- catch biased towards most active fish
- does not provide density estimate of numbers
- somewhat labor intensive
- some fish less “trapable” than others (e.g adult carp and bass)

# Juvenile and Adult Methods

## Passive Trap Gears

- fyke nets
- trap nets
- hoop nets
- pound nets
- flume/block nets
- minnow traps

# Larval Fish Methods

- drop box
- light trap
- tow sled
- hydraulic pumps
- fine-mesh seine

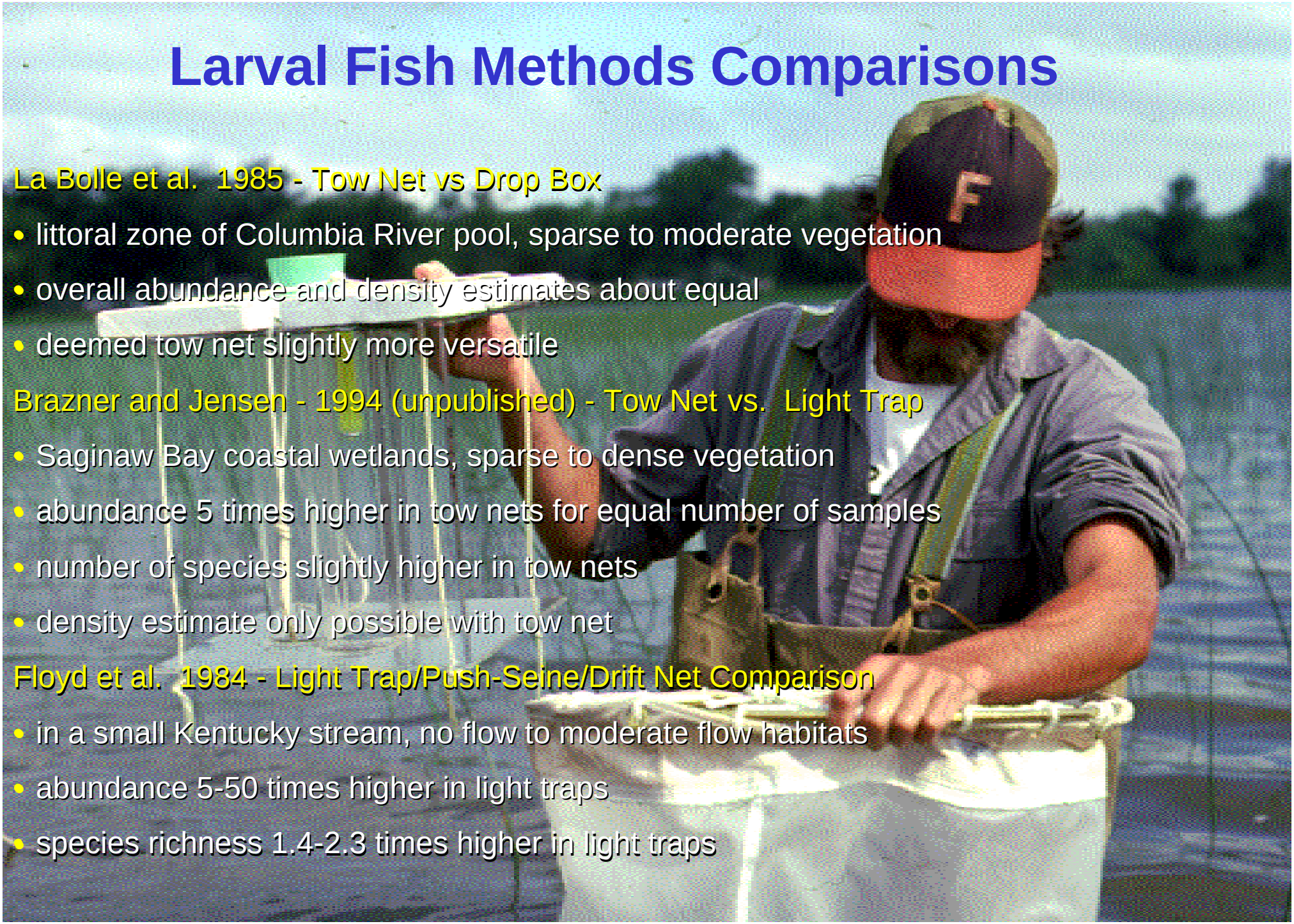
# Summary of Adult/Juvenile Gear Characteristics

| **Gear Characteristics** | Passive Traps | Active Traps | Electro-fishing | Seines |
|---|---|---|---|---|
| Density estimate | | ● | ● | |
| Time integrated | ● | | | |
| Time targeted | ● | ● | ● | ● |
| Habitat targeted | ● | ● | ● | |
| Inexpensive | ● | ● | | ● |
| Commercial source | ● | | ● | ● |
| Quick | | | ● | ● |
| Mortality low | ● | ● | ? | ● |
| Habitat destructive | | ● | | ● |
| Size bias | | ● | ● | ● |
| Habitat bias | | | ● | ● |
| Labor intensive | ● | ● | | ● |

# Summary of Larval Gear Characteristics

| Gear Characteristics | Fine-mesh seine | Tow-sled | Light trap | Drop box | Hydraulic Pump |
|---|---|---|---|---|---|
| Density estimate | | ● | | ● | ● |
| Time integrated | ● | | ● | | |
| Time targeted | ● | ● | | ● | ● |
| Habitat targeted | ● | ● | ● | ● | ● |
| Inexpensive | ● | ● | | ? | ● |
| Commercial source | ● | ● | ● | ● | ● |
| Quick | ● | ● | | | ● |
| Mortality low | ● | ● | | ● | ● |
| Habitat destructive | ? | | | ● | ● |
| Size bias | | | ● | ● | ● |
| Habitat bias | ● | | | | ● |
| Labor intensive | ● | ● | | ● | ● |

# Larval Fish Methods Comparisons



La Bolle et al.  1985 - Tow Net vs Drop Box

- littoral zone of Columbia River pool, sparse to moderate vegetation
- overall abundance and density estimates about equal
- deemed tow net slightly more versatile

Brazner and Jensen - 1994 (unpublished) - Tow Net vs.  Light Trap

- Saginaw Bay coastal wetlands, sparse to dense vegetation
- abundance 5 times higher in tow nets for equal number of samples
- number of species slightly higher in tow nets
- density estimate only possible with tow net

Floyd et al.  1984 - Light Trap/Push-Seine/Drift Net Comparison

- in a small Kentucky stream, no flow to moderate flow habitats
- abundance 5-50 times higher in light traps
- species richness 1.4-2.3 times higher in light traps

# Drop Net/Pop Net/Electrofishing Frame Comparison

## Dewey 1992 - < 1 m vegetated backwater lake habitat

- *all sampled 5.6 $m^2$, Upper Mississippi R.*
- *preset all methods 30 minutes prior to act of fishing*

| | Drop Net | Pop Net | Electrofishing Frame |
|---|---|---|---|
| Number of species | Most | Intermediate | Least |
| Number of fish | Most | Most | Least |

drop & pop nets deemed about equal for sampling small fish in shallow, vegetated habitats

pop net not well described

# Drop Trap/Throw Trap Comparison

## Kushlan 1981 - < *0.5 m moderately vegetated Everglades marsh*

| | Drop Trap 1 $m^2$ | Throw Trap 1 $m^2$ | Throw Trap 2.25 $m^2$ |
|---|---|---|---|
| Number of species | Least | Most | Least |
| Number of fish | Least | Most | Most |
| Accuracy and Precision | Worst | Intermediate | Best |
| Sampling Time | Least | Intermediate | Most |

1 $m^2$ throw trap most effective and efficient

- much easier to use than 2.25 $m^2$ trap

# Pop Net/Seine/Electrofishing Boat Comparison

## *Serafy et al. 1988-< 01.5 m sparsely vegetated tidal freshwater Susquehanna R. habitat*

- effort about equal across methods
- preset nets 4-6 h pre pop, 15 min to set

| | Pop Net<br>18.6 $m^2$ | Seine<br>465 $m^2$ | Electrofishing Boat<br>4000 $m^2$ |
|---|---|---|---|
| Species per $m^2$ | Highest | Intermediate | Lowest |
| Fish Density | Highest | Intermediate | Lowest |

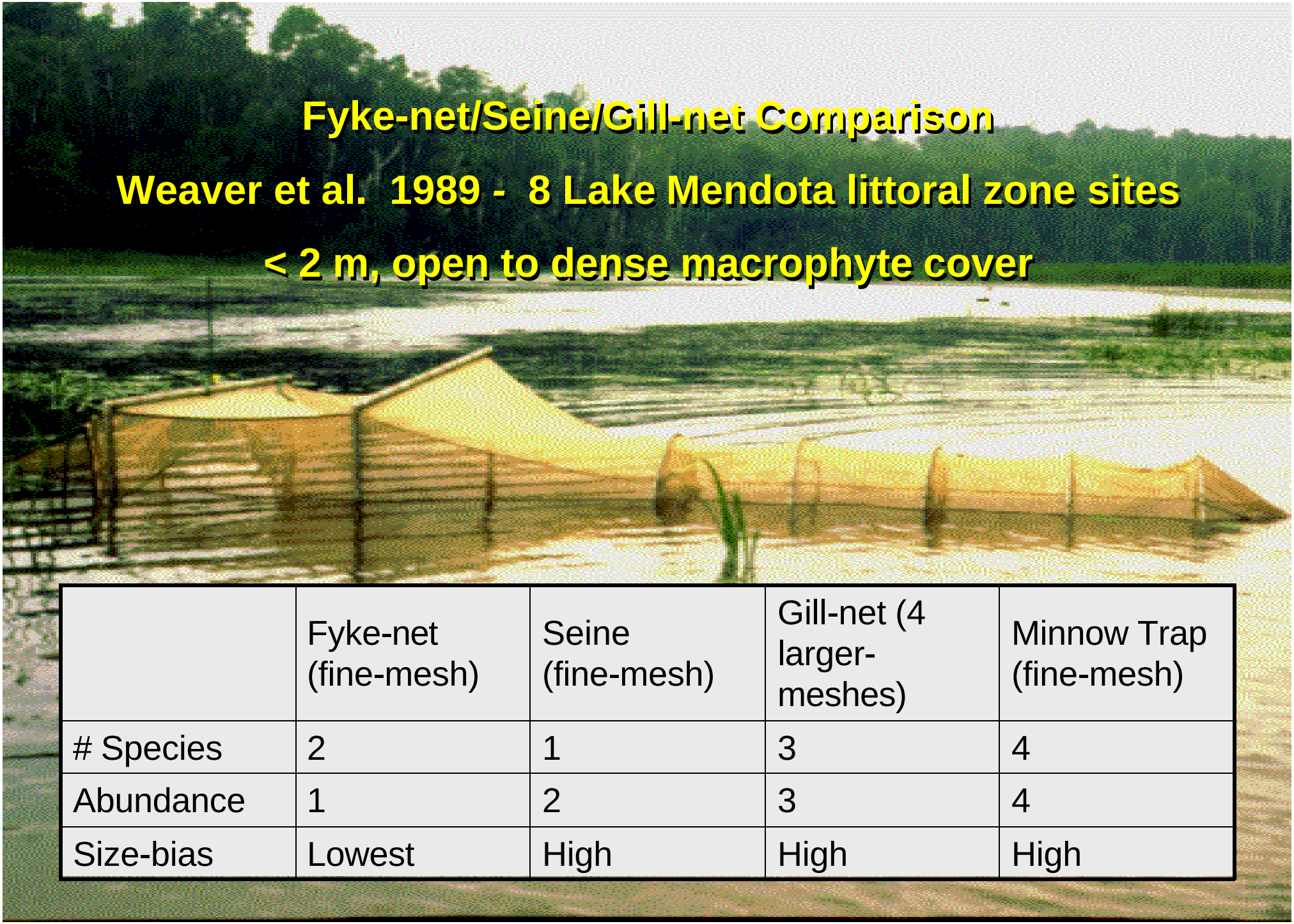
- pop nets give most accrate density estimates
  - Species richness only high on aveal basis - need lots of pops to match absolute richness of electrofishing because of huge diffs in area sampled

# Shallow-Lake Fishing Gear Comparison

## Hayes 1989 - New Zealand, < 1.5 m, some vegetated littoral

| | Minnow Trap (Fine-mesh) | Fyke-net (large-mesh) | Trap-net (fine-mesh) | Gill-net (3 larger-meshes) | Beach Seine (fine-mesh) | Purse Seine (fine-mesh) |
|---|---|---|---|---|---|---|
| # Species | 5 (least) | 4 | 1 (most) | 3 | 1 | 2 |
| # Fish | 6 (least) | 3 | 1 (most) | 4 | 2 | 5 |
| Size Bias | High | High | Low | High | High | High |

*** note differences in mesh-size in among gears



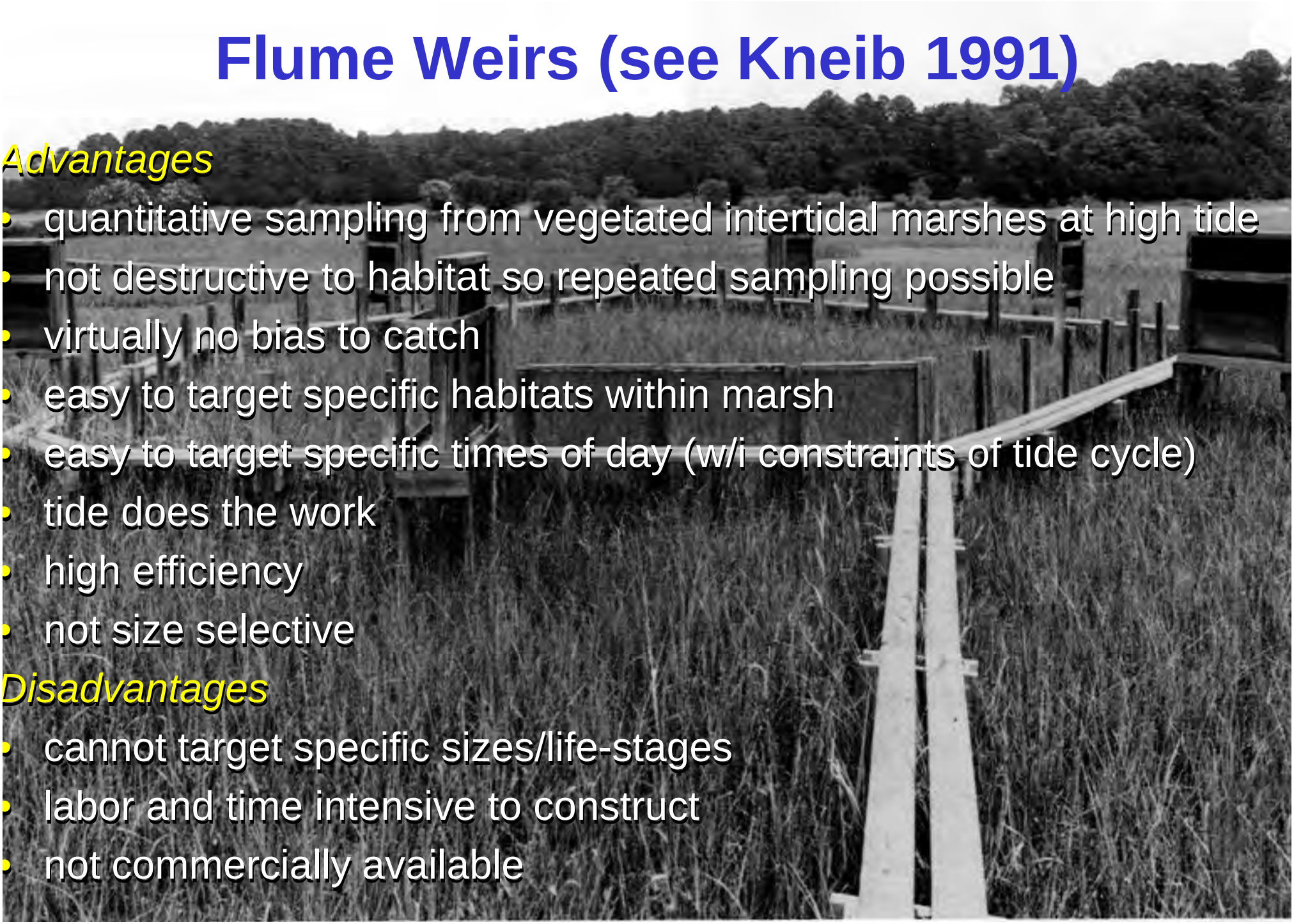
## Fyke-net/Seine/Gill-net Comparison

## Weaver et al. 1989 - 8 Lake Mendota littoral zone sites

## < 2 m, open to dense macrophyte cover

| | Fyke-net (fine-mesh) | Seine (fine-mesh) | Gill-net (4 larger-meshes) | Minnow Trap (fine-mesh) |
|---|---|---|---|---|
| # Species | 2 | 1 | 3 | 4 |
| Abundance | 1 | 2 | 3 | 4 |
| Size-bias | Lowest | High | High | High |

# Flume Weirs (see Kneib 1991)



*Advantages*

- quantitative sampling from vegetated intertidal marshes at high tide
- not destructive to habitat so repeated sampling possible
- virtually no bias to catch
- easy to target specific habitats within marsh
- easy to target specific times of day (w/i constraints of tide cycle)
- tide does the work
- high efficiency
- not size selective

*Disadvantages*

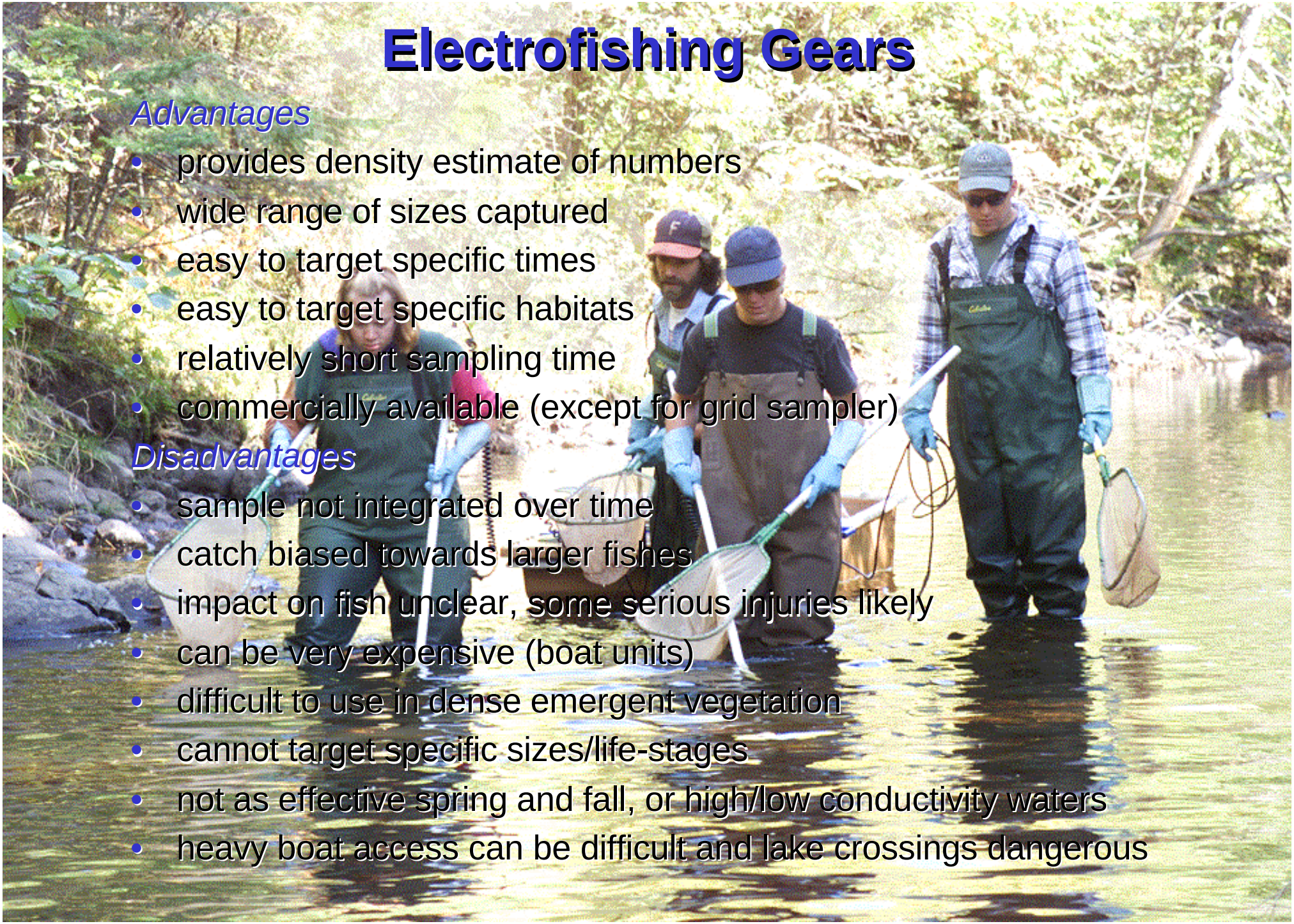
- cannot target specific sizes/life-stages
- labor and time intensive to construct
- not commercially available

# Juvenile and Adult Methods

Active Trap Gears

- pop nets
- drop nets
- throw nets
- lift net
- flume weir

# Electrofishing Gears



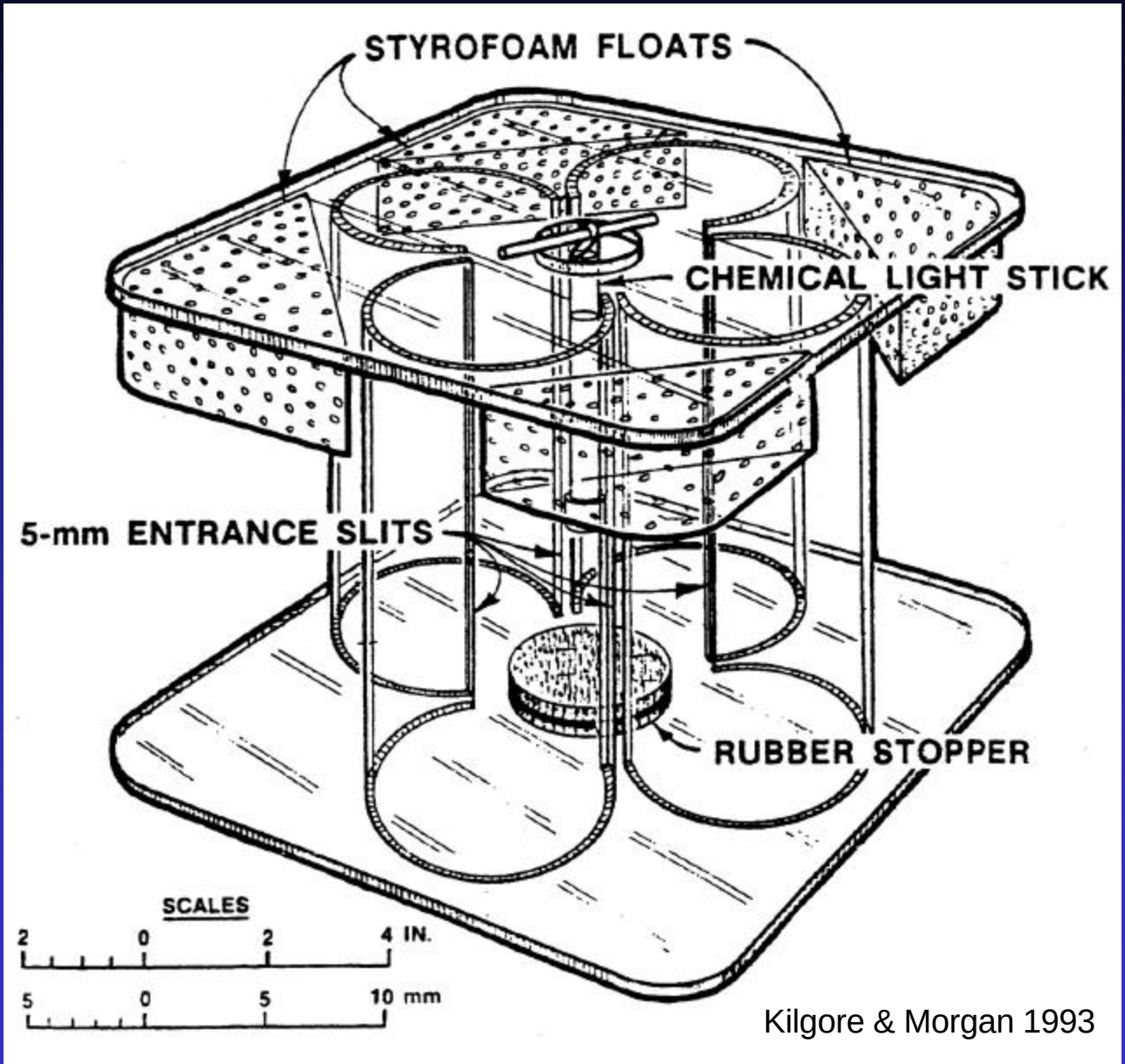
*Advantages*

- provides density estimate of numbers
- wide range of sizes captured
- easy to target specific times
- easy to target specific habitats
- relatively short sampling time
- commercially available (except for grid sampler)

*Disadvantages*

- sample not integrated over time
- catch biased towards larger fishes
- impact on fish unclear, some serious injuries likely
- can be very expensive (boat units)
- difficult to use in dense emergent vegetation
- cannot target specific sizes/life-stages
- not as effective spring and fall, or high/low conductivity waters
- heavy boat access can be difficult and lake crossings dangerous

# Larval Light Trap




Kilgore & Morgan 1993