Harvest and Transport of Fingerlings From Ponds

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Harvest and Transport – Rules of Thumb

- Reduce the number of stressors
- Reduce the severity of stressors
- Minimize the duration of stressors

REDUCE STRESS AS MUCH AS POSSIBLE!

At the Hatchery	During Transportation	At the Stocking Location
Seined in pond Concentrated into seine Netted Go across sort table Concentrated into crane bucket Put into hauling tank	Crowding Agitation from vehicle movement Ammonia Δ [DO] Δ Water Chemistry Δ Water pH Δ [Carbon dioxide] Δ Water temperature	Unloaded from hauling truck Δ Water Chemistry Δ Water temperature

Harvest

- Have a pre-determined plan in place
- Make sure fish are in suitable condition
- Ideally harvest during cooler temperatures or early morning
- Partially drain pond to concentrate fish then seine
    - Be sure there is proper aeration

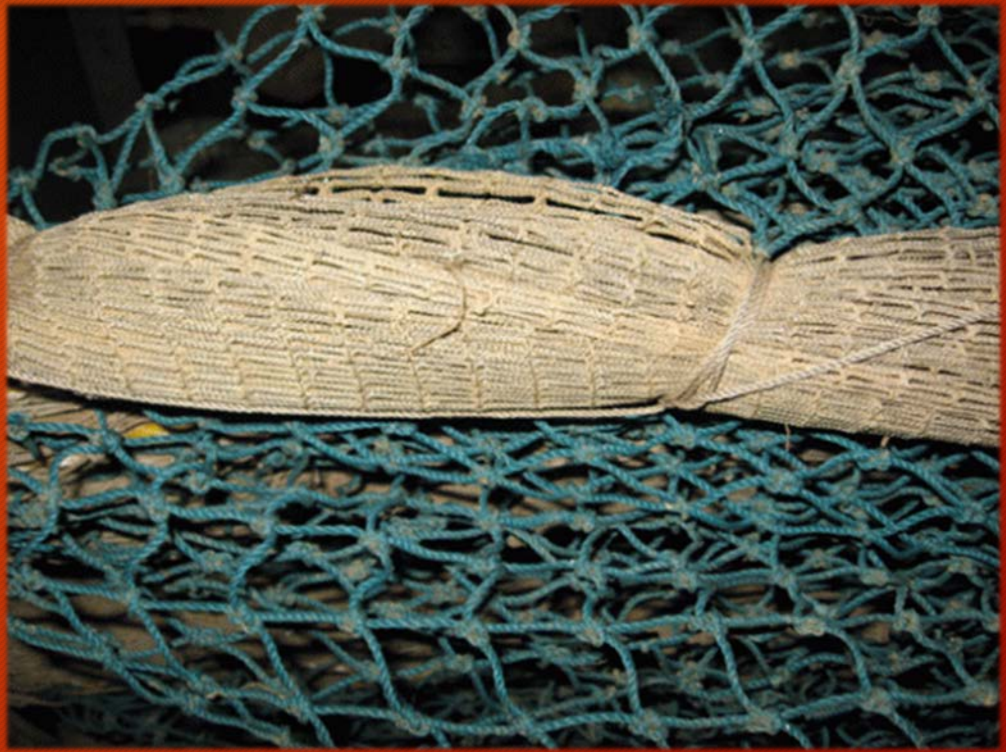
Harvest

- Depending on pond size, can be done once or multiple times
- Pond can contain harvest basin where remaining fish can be concentrated and netted
- Get fish to the transport tank as quick as possible

Harvest from Ponds

Harvest - Seine Specifications

- Seine length 1.5X > pond width
- Seine depth 1.5-2X > pond depth
- Mesh size no smaller than that needed to catch minimum size fish
- Use a mud line with soft substrates to avoid lead submersion



http://www.ag.auburn.edu/fish/mediagallery/2013/08/09/rolled-net-seine-mud-line/

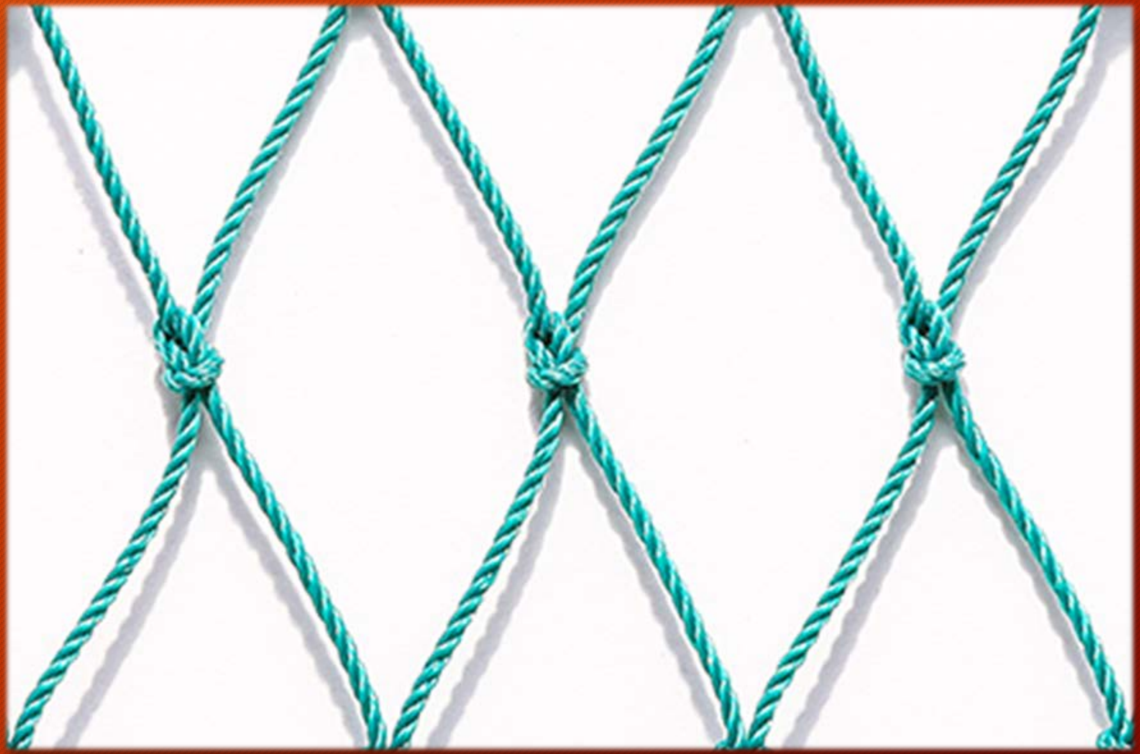
Harvest - Net Construction

- Knotted vs knotless nets
- Tarred vs untarred nets

Harvest - Net Construction

<u>Knotted Netting</u>

- Can be repaired if damaged
- Cheaper than knotless
- Abrasion can promote scale loss



http://english.nittoseimo.co.jp/21/41/

Harvest - Net Construction

Knotless Netting

- Stronger than knotted
- Lighter than knotted
- Smoother and therefore less damaging to fish
- Difficult to repair

http://english.nittoseimo.co.jp/21/41/

Harvest - Net Construction

Tarred Netting

- Resists decay from sunlight and wear
- Abrasion can be harmful to small scaled fish
- Often used in the catfish industry

Untarred Netting

- Less stressful and damaging to small scaled fish
- Can have a short lifetime

Harvest – Practices for Small Scaled Fishes

- Have a plan in place
- Knotless and untarred netting
- Appropriately sized netting
- Appropriate water/air temperatures

Transport

http://www.alumline.com/products/aluminum-tanks/aluminum-fish-tanks

Transport – Causes of Mortality

- Poor water quality

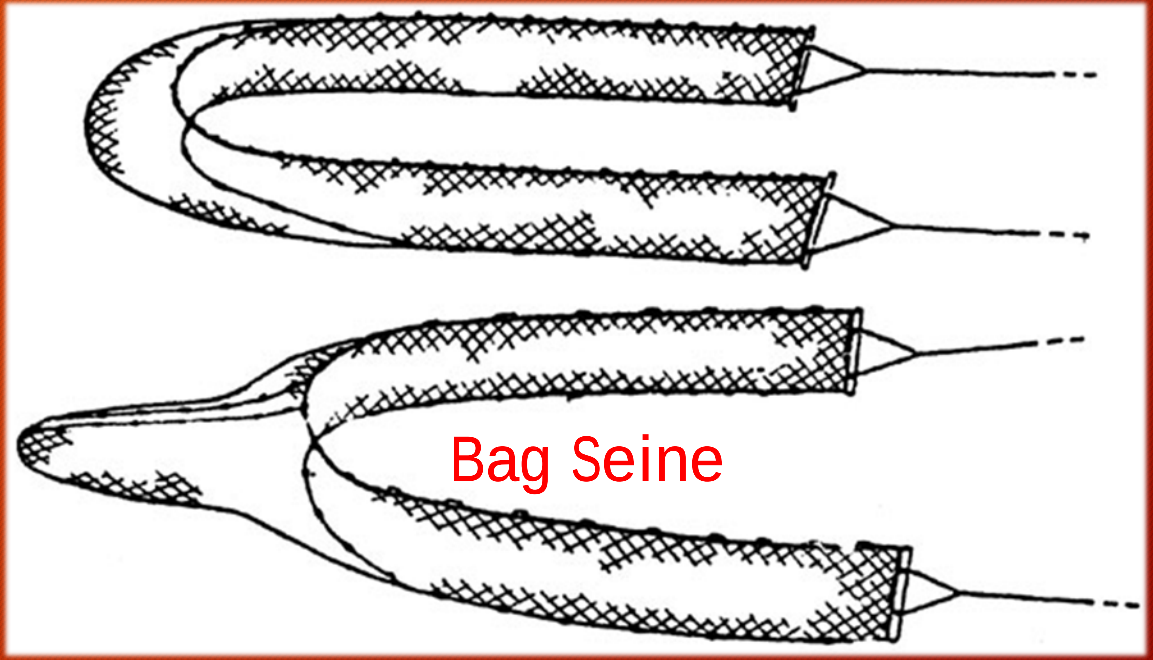
- Stress responses or physiological changes
  - Increase in metabolic rate
    - Accumulates toxic metabolites (lactic acid) and depletes energy reserves
    - Fish loses the ability to osmoregulate
  - Stressed-induced immunosuppression
    - Allows pathogens that would normally be resisted to initiate

Transport – Water Quality

- Temperature
- Dissolved Oxygen
- pH
- Ammonia
- Carbon dioxide

Transport – How to Reduce Stress

- Remove fish from feed at least 24 hrs prior to harvest
  - Allows for freshwater (reduces waste)
  - Eliminates digestion processes (saves energy)
- Have a transport plan in place – use a bag seine to temporarily hold fish
- Know the maximum density of your transport tanks



http://www.fao.org/fishery/geartype/202/en

Transport – How to Reduce Stress

- In general, densities are lower for smaller fish, in warmer water, and for longer transit time

Table 2. Loading densities for largemouth bass.

Fish Size (inches)	Loading Rate (pounds/gallon)
5	1.5
4	1.0
3	0.66
2	0.50
1	0.33

Transportation of Warmwater Fish, Gary L. Jensen. SRAC pub # 393

Size of Fish Pounds per 1,000 Fish	Transport Time in Hours		
	8	12	16
0.1	0.20	0.20	0.20
1.0	1.25	1.00	0.70
2.0	1.75	1.65	1.25
4.0	2.20	1.75	1.50
8.0	2.95	2.20	1.80
20.0	3.45	2.50	2.05
250.0	5.00	4.10	2.95
500.0	5.90	4.80	3.45
1,000.0	6.30	5.55	4.80

Transportation of Warmwater Fish, Gary L. Jensen. SRAC pub # 393

Transport – How to Move and Load Fish

- Do not overload nets
  - Can cause injury
- Compatible water temps
- Loading buckets
  - Wet transfer
- Monitor water quality
- Loading is often very stressful

Transport – Sorting Fish

- Graders
  - Need to separate sizes
  - How many fish per pound
- Styles
  - Panel
  - Floating
- Varying bar spacing

Table 2. Bar grader size for channel catfish.

Bar width in inches	Size retained in inches	Pounds/1,000 fish
27/64	3	8-10
32/64	4	18-20
40/64	5	32-35
48/64	6	60
62/64	7	93
64/64	8	112-140
96/64	11	750-1000

Table 3. Bar grader size for striped bass.

Bar width in inches	Size retained in inches	Pounds/1,000 fish
12/64	1	-
19/64	2¾	-
21/64-27/64	3	10
29/64	3½	15
31/64	3 9/10	20
32/64	4	23

Table 5. Bar grader size for golden shiner.

Bar width in inches	Size retained in inches	Pounds/1,000 fish
12/64-14/64	1¾	3
14/64-16/64	2½	5
16/64-18/64	3	8
18/64-21/64	3½	13.5
21/64-23/64	4	20-25
23/64-25/64	4½	30
25/64-27/64	5	40
Larger than 29/64	5½	60

Source: Modified from Ludwig and Stone, 1997.

Table 6. Bar grader size for fathead minnows.

Bar width in inches	Size retained in inches	Pounds/1,000 fish
13/64-15/64	1¾	3
15/64-17/64	2¼	4
Larger than 17/64	2¾	6

Source: Adapted from S. A. Flickinger, 1991.

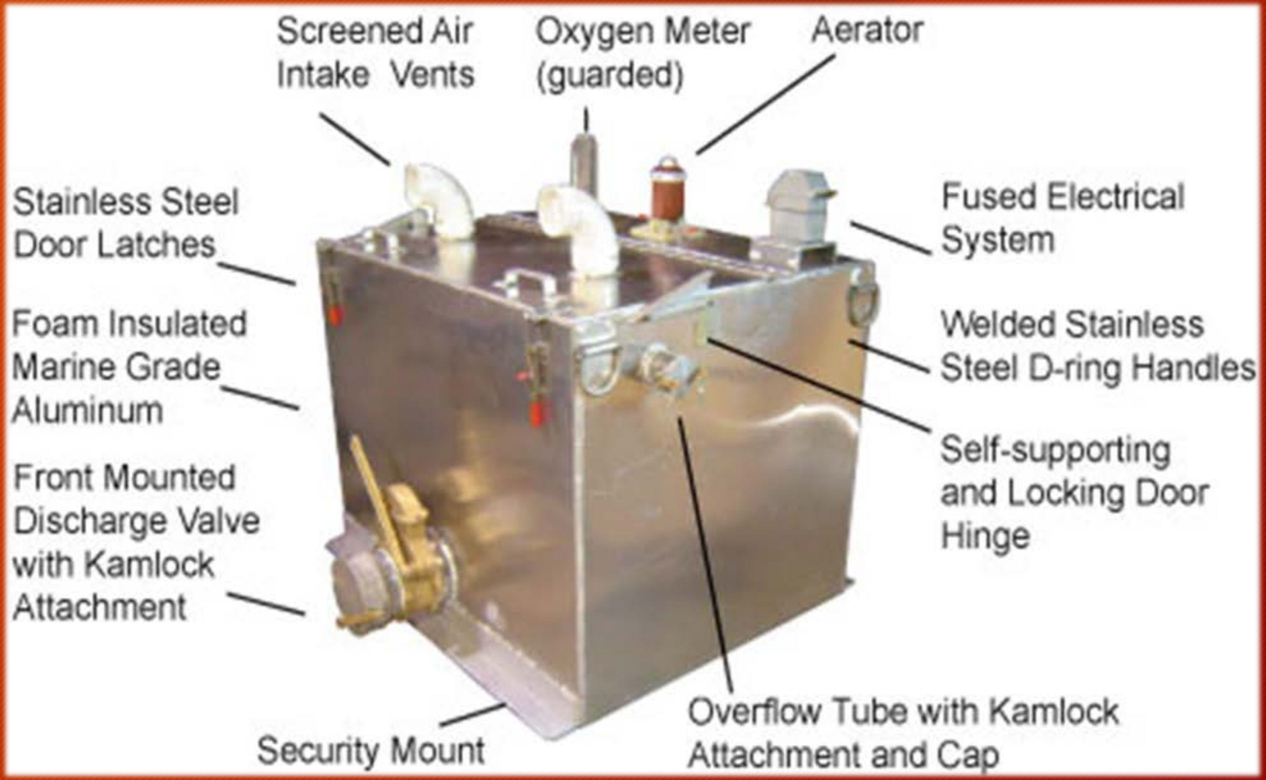
Sorting and Grading Warmwater Fish, Anita M. Kelly and David Heikes

Transport – Tanks

- Can be on truck or a trailer
- Construction
  - Wood, aluminum, fiberglass
- Most insulated to resist rapid temperature changes
- Sloped bottom to drain fish easily
- Water is heavy (8.3 lb/gal)- Match tank weight to truck or trailer
  - ¾-ton truck can pull a trailer with two 350-gal tanks or accommodate a 300-gal tank

Transport – Tanks

- Various sizes
  - 50-2,500 gallons
- Rounded corners
- Vents allow CO_2 to escape
- Baffles reduce water movement
- Drains



http://mfse.net/

Transport – Tank Aeration

- Ideal to have two systems
- Primary – bottled oxygen most common
  - For efficient use – fine pore diffusers
  - Heavy daily use or long distances – liquid oxygen more cost effective than gas
- Mechanical
  - Not as efficient as bottled oxygen
  - Causes foaming (interferes with CO_2 diffusion)
  - Best if used as the emergency backup

http://www.ag.auburn.edu/fish/mediagallery/2013/08/13/fish-transport-5/

Transport – Tank Aeration

- Agitators
  - Surface or deep water

- Deep water less damaging to small scaled fish

Surface

Deep Water

http://www.fountainpumpandsupply.com/fish_transport_aerators.html

Transport – Anesthetics

- Dissolve in the transport water
- Reduces the metabolic rate
- Reduces oxygen use
- Large doses can be lethal

Transport – Anesthetics

- Tricaine, MS-222, Finquel™

- Lowers water pH
  - Buffer with sodium bicarbonate

- 25-50 mg/L

- 21 day withdrawal time

http://www.ag.auburn.edu/fish/image_gallery/details.php?image_id=1880

Transport – Anesthetics

- Quinaldine
  - Dissolve in acetone prior to mixing with water
  - Low cost
  - Lowers pH
  - 15-60 mg/L
  - Not approved for food fish

http://fishremedies.com/quinaldine-sulfate.aspx

Transport – Anesthetics

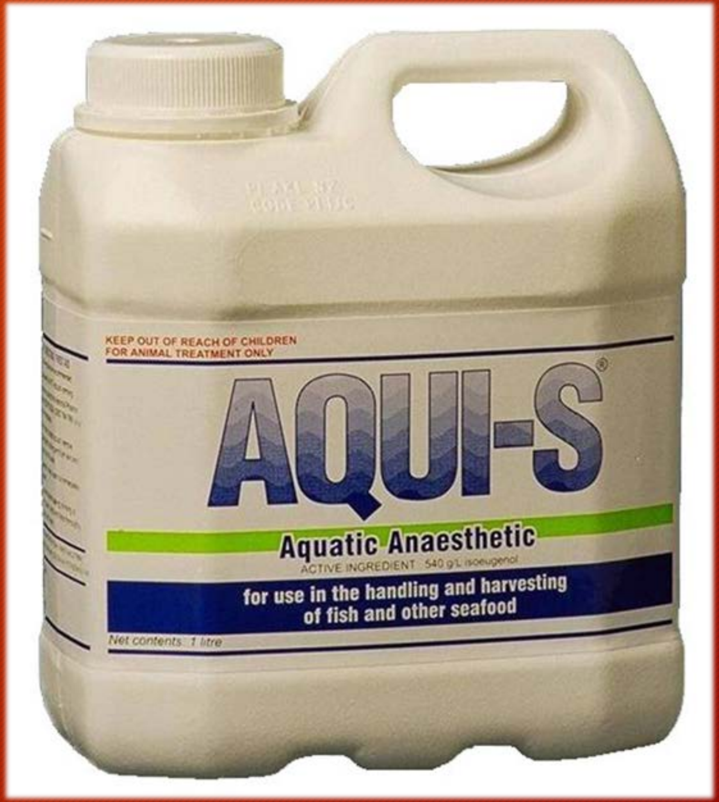
- CO_2
  - Need to adjust water pH to maintain specific levels
  - Long induction time
  - Low regulatory priority
  - Approved for food fish

https://www.midwestsupplies.com/new-20lb-co2-tank-empty

Transport – Anesthetics

- Clove oil
  - Eugenol
  - High margin of safety but long recovery time
  - 20 mg/L
  - NOT approved in the U.S.

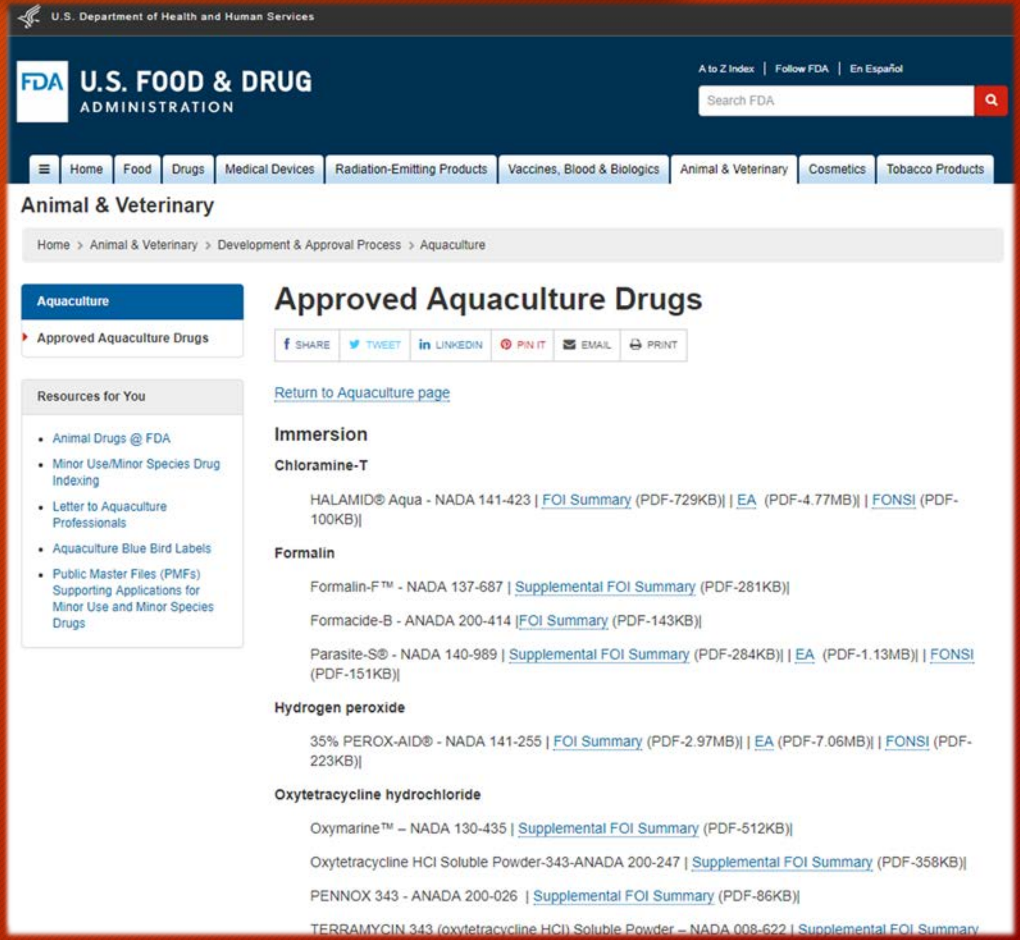
- Aqui-S
  - 10-20 mg/L
  - Active ingredient isoeugenol
  - Potential zero withdrawal time
  - Did not pass CVM review
    - Cancer in mice



https://www.primo.net.au/shop/AQUI-S/aqui-s-aquatic-anesthetic

Transport – Anesthetics

- Check regulations frequently
- https://fishculture.fisheries.org/
- FDA website
  - Approved aquaculture drugs



Transport – Additives

- Salts
    - Helps decrease stress by reducing plasma-ion disturbances
    - NaCl most common
        - 5-10 g/L or 0.04-0.08 lbs/gal
        - 4-8 lbs of salt per 100 gallons
    - Low regulatory priority

http://www.independent.co.uk/life-style/health-and-families/health-news/well-seasoned-how-salt-can-actually-be-good-for-you-771775.html

Transport – Additives

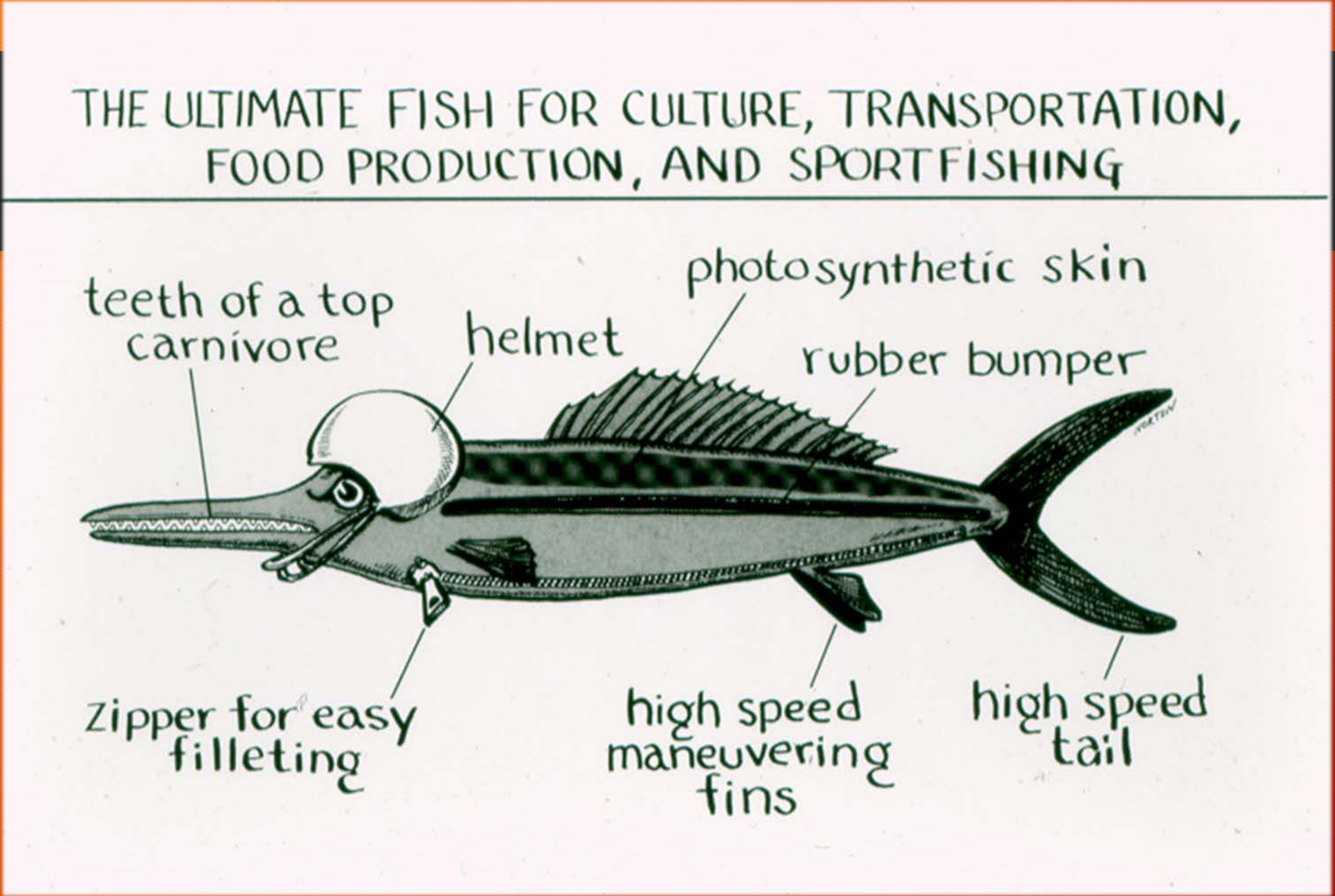
- Ice
  - Important to control water temperature
  - ½-lb/gallon will drop water temperature ~10 ⁰F
  - Avoid ice made form chlorinated tap water if possible

https://in8life.com/when-all-you-want-is-ice/

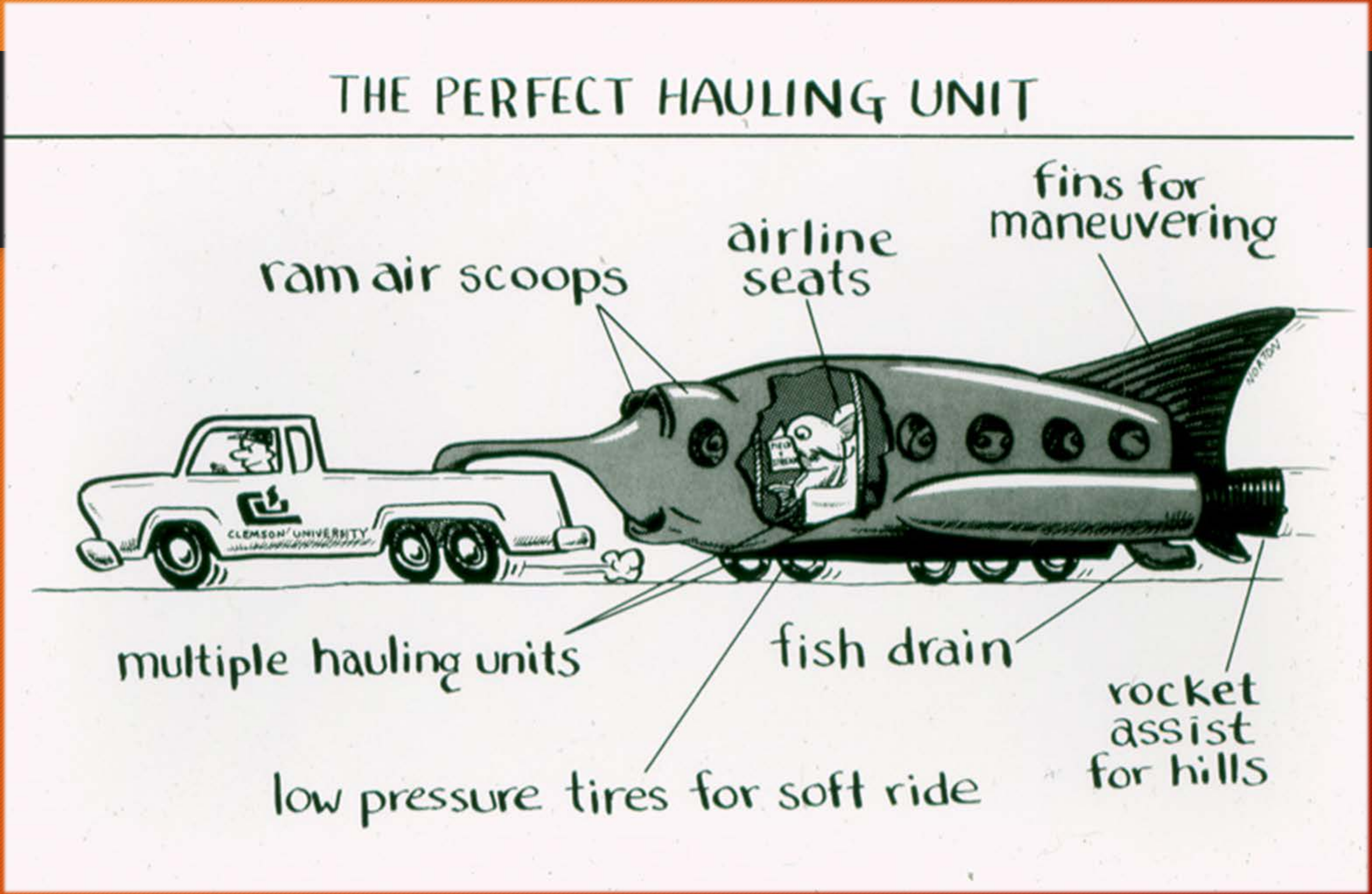
Transport – Shipping in Sealed Containers

- Successful with larvae and small fish
- Styrofoam shipping box with a heavy duty square plastic bag
- Pure oxygen introduced into the bag then sealed
- Anesthetics and salts can be added to the water
- Want to deliver within two days

https://zfin.org/zf_info/zfbook/chapt1/1.7.html



Wedemeyer, Fish Hatchery Management



Wedemeyer, Fish Hatchery Management

Questions???

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