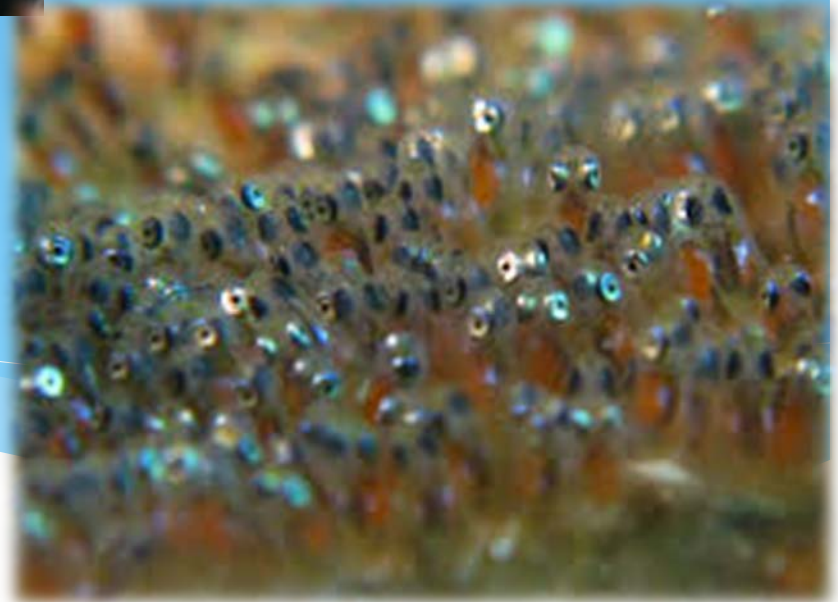




Incubators!



# What I was doing last week.....



# Questions from incubation video

- \* Does the R48 work better than the trays?
- \* What do hatchery's prefer.
- \* I found it really cool that the R48 had a burp tube, was curious how you would get the air bubble out of just a large container.
- \* While I was at SJH we used a lever type object to hit the bottom of the contain and raise the bubbles.
- \* Is it harder to pick the dead eggs out of the R48 compared to a heat tray?
- \* Thats so smooth how the fry will burrow saving you time from picking.
- \* I had no idea that the fry had to be reared in salt water! I thought it was fresh water.
- \* What about freezing temps? Does that impact one type of incubator over another?
- \* Would fry be impacted by freezing temps?

# Incubator Design and Function

- \* Many styles/sizes – pros and cons to each
- \* Materials: fiberglass, aluminum but also concrete, wood, natural elements
- \* Water flow to incubators varies
- \* Some designs are more suited to a particular specie than others.



# Incubator Design and Function

- \* Single pass/upwelling is typical water flow
- \* Do you remember what “upwelling” means?
- \* They are designed to provide uniform water flow to all eggs and alevins incubated .
- \* All are designed to minimize entrainment of air.



# Incubators

- **Vertical**

- Heath/FAL Trays
- NOPAD/Zenger Trays

- **Trough**

- Deep
- Shallow

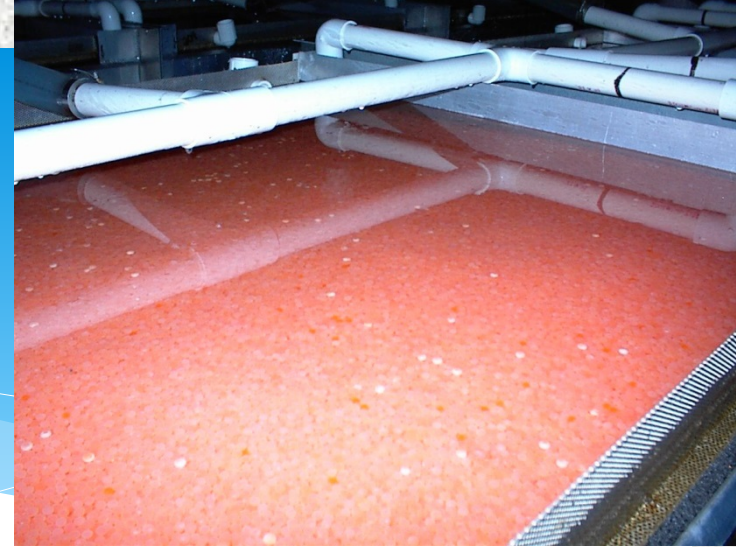
- **Pond**

- **Box**

- Kitoi
- Free style
- Deep and Shallow Matrix

- **Cylindrical**

- R 48 & R30
- Jars, Jugs, Pails and Buckets



# Vertical – Heath Trays



- \* This incubator is common in many facilities especially where eggs are collected in small lots or incubated as single families (one male/one female pairings)
- \* Incubators are stacked in a cabinet 8 trays per stack, single or double stack (16 trays) - varies with program goals
- \* Water flow is upwelling single pass 3-5gpm per 8 tray stack.

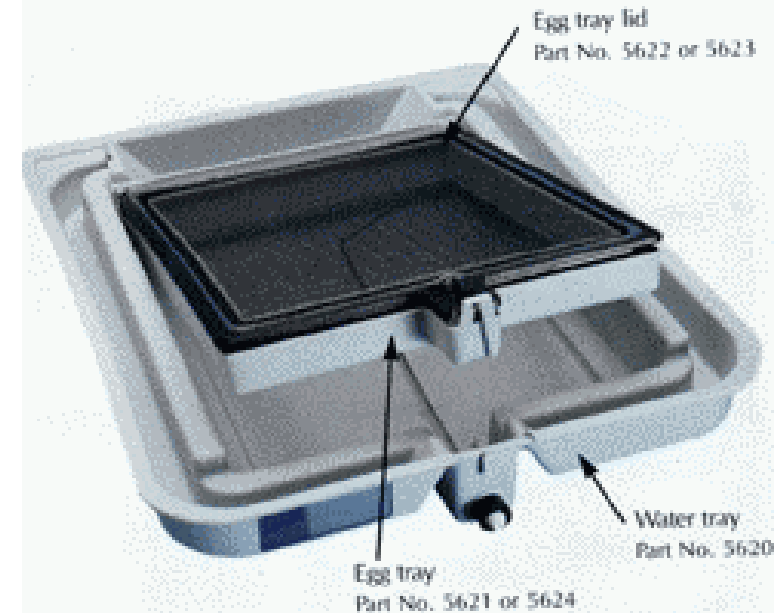
## \* **Advantages**

- \* Some aeration occurs between trays
- \* Small discrete lots of eggs are easily separated
- \* Allows inspection of each tray for fungus/mortality removal
- \* Low maintenance
- \* Fry quality is good with substrate
- \* Disease outbreaks can be contained to a stack. Losses will be minimized to 8 trays.
- \* If modified each tray can be adapted for isolation

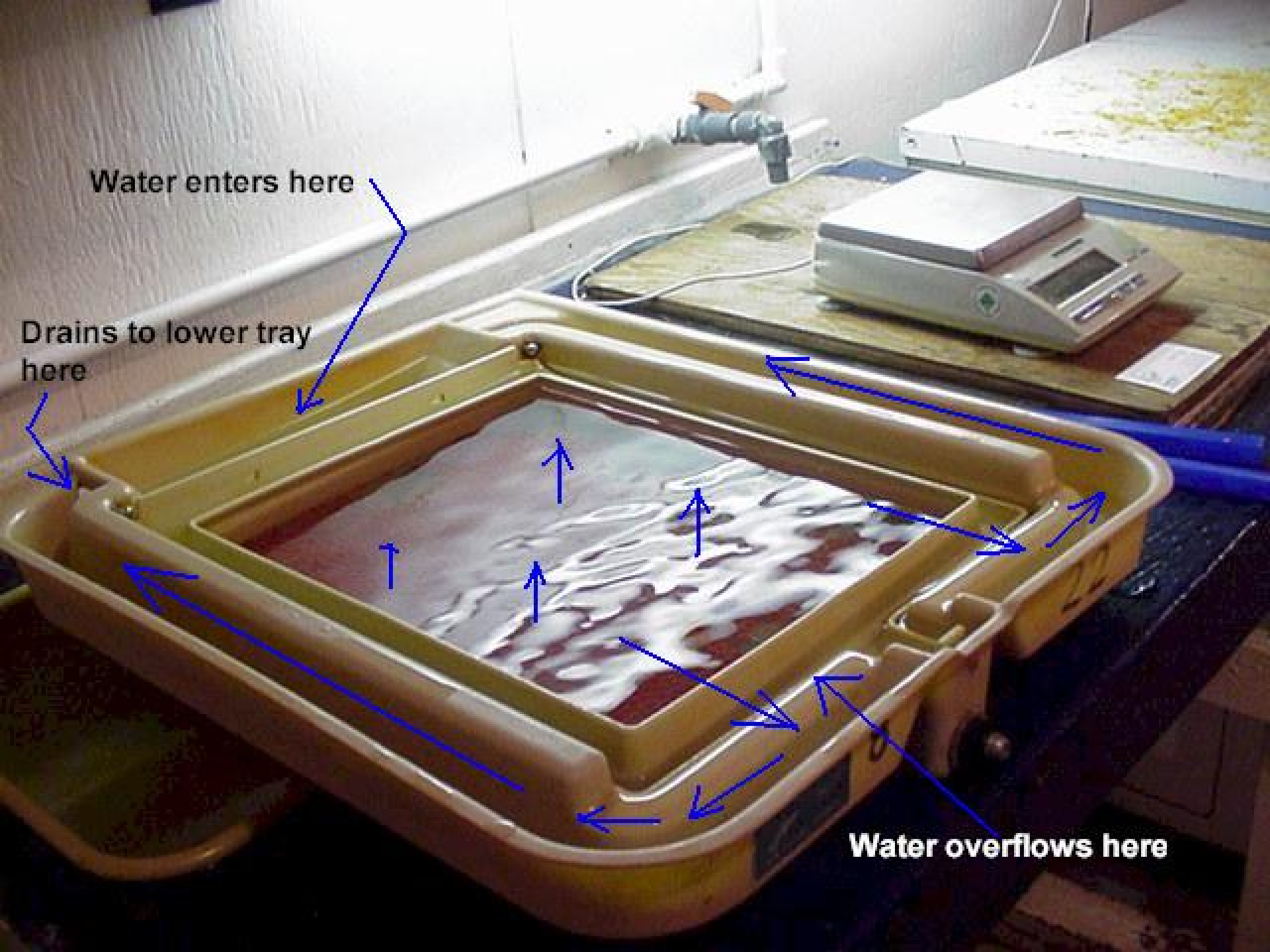
# Vertical – Heath Trays

## \* Disadvantages

- \* Requires a lot of floor space per stack for the number of eggs incubated
- \* Very expensive \$1800/16 trays
- \* Labor intensive, handling small lots are time consuming as well as time required to clean each season



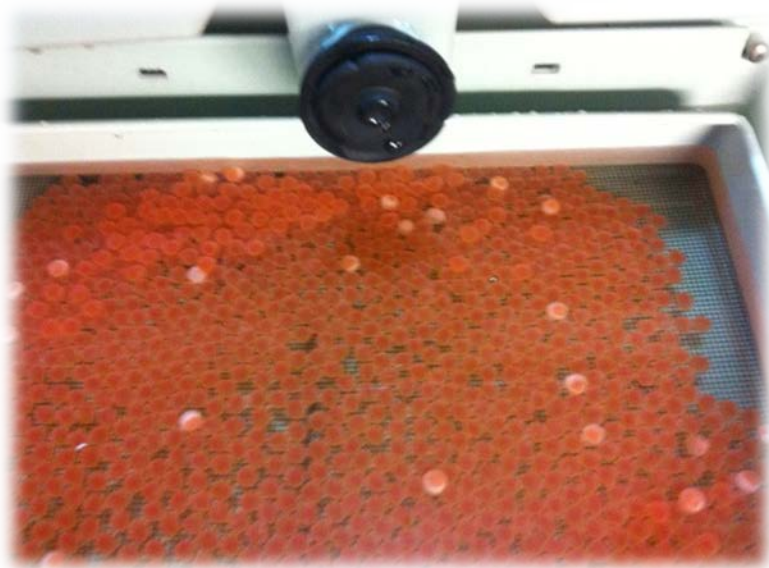




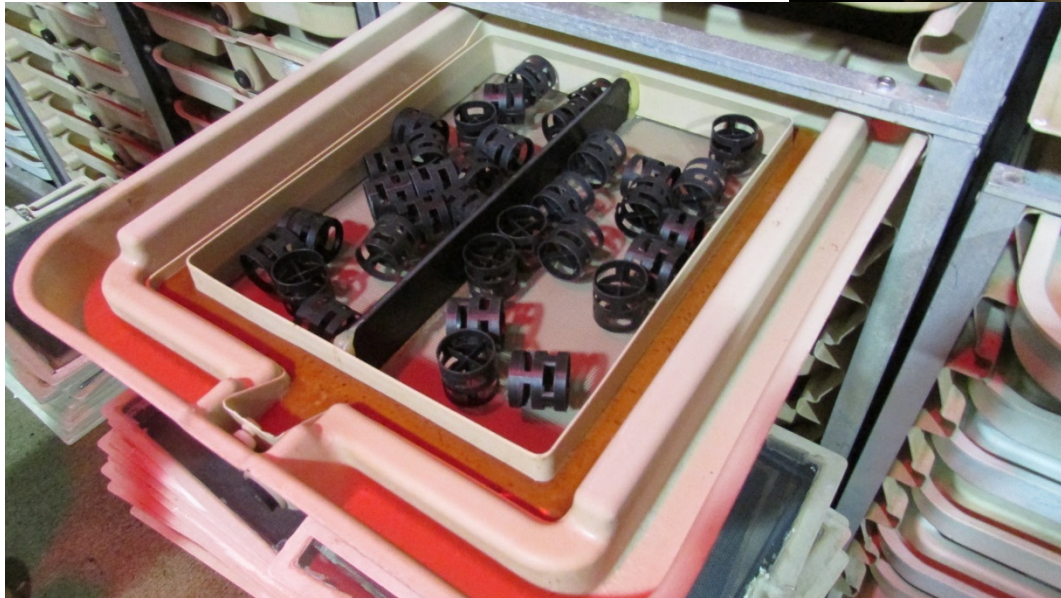
Water enters here

Drains to lower tray here

Water overflows here

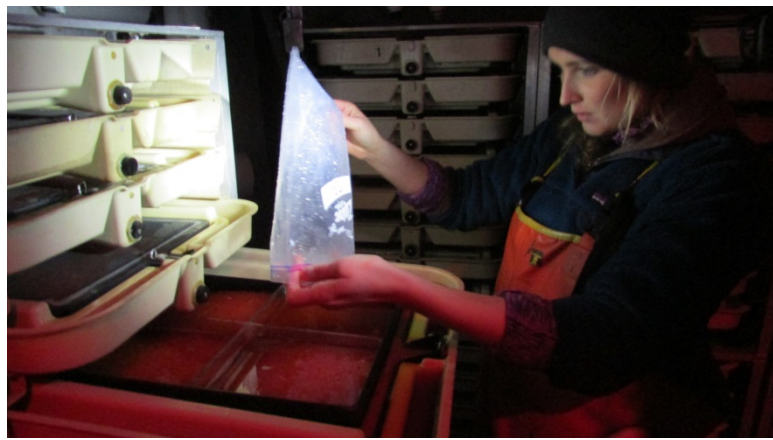














# NOPAD/Zenger



- \* Constructed of aluminum approx. 12" – 14" deep 4'x4'
- \* Stackable, water upwells through perforated pressure plate.
- \* Eggs may be seeded onto hatch screens.
- \* Or picked and seeded directly to Incubator
- \* Outlet is screened to prevent hatched fry from enter tray below
- \* Advantages
  - \* Best incubator available for large scale production
  - \* Forgiving with dirty water supplies, incubator is easily flushed for silt removal
  - \* Designed for volitional release
  - \* Easily cleaned and disinfected
  - \* Water efficient, uses half the water required by other types



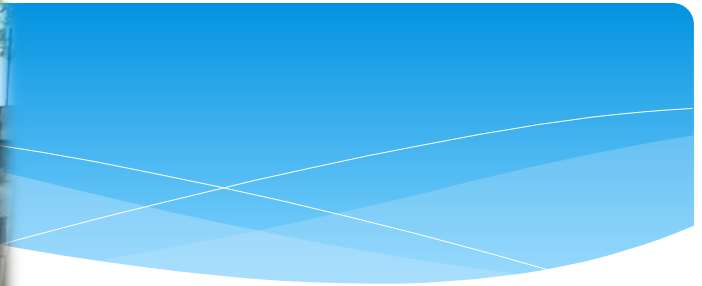












Cleaning – just as important as anything else!





# NOPAD/Zenger



## Disadvantages

- \* Difficult to load when stacked
- \* Air entrapped under pressure plate needs to be purged prior to loading and regularly after eyed stage
- \* Expensive and complicated plumbing manifold and supply to lower trays
- \* Overhead lifting capability is essential for efficient ponding of fry
- \* Requires a lot of floor space
- \* Outlet screens may require cleaning during hatch

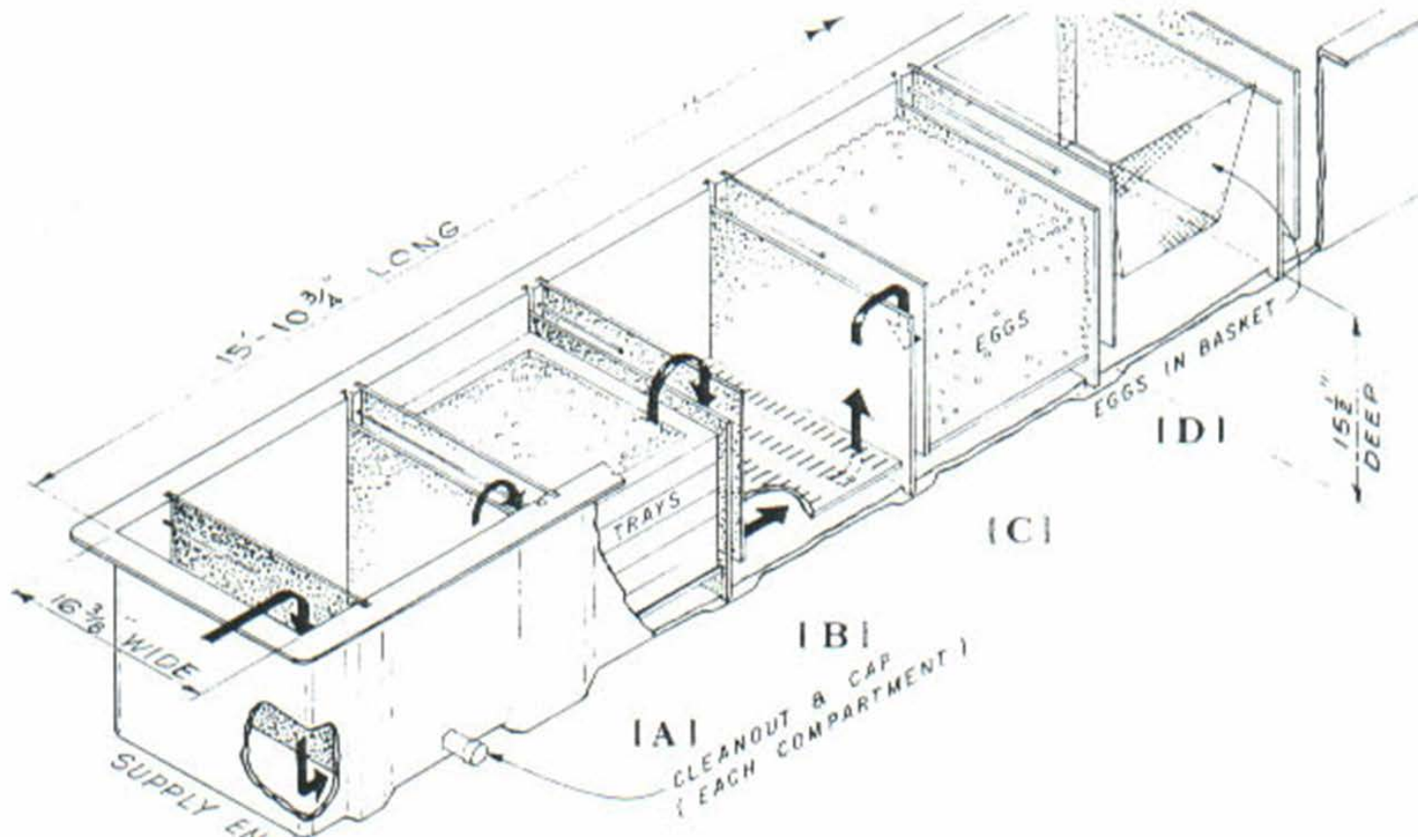
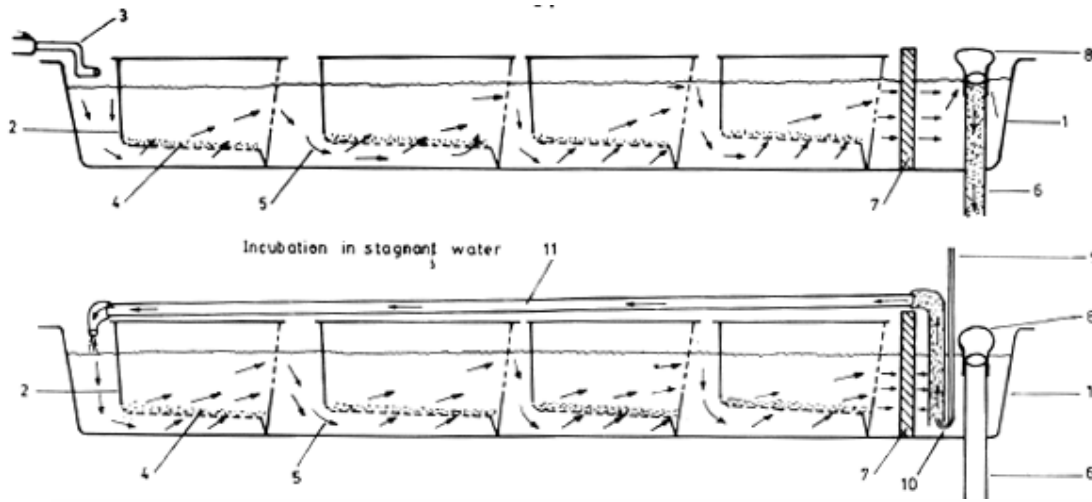
A word of warning if you stay in this  
business too long.....



# Trough Incubators

- Trough is divided into sections with removable baffles
  - Sections can be used for incubation as well as rearing
  - Upwelling flow created by baffles is repeated through each section until the water exits the tail end of the trough.
  - Old School, but still in use today at some sites
- **Advantages**
    - Allows easy inspection of contents, eggs/alevins
    - Simple design inexpensive to construct
    - Portable and can be adapted for many applications; streamside or placed into raceway for direct emergence of fry to rearing pond
  - **Disadvantages**
    - Requires a lot of space for number of eggs incubated or fry reared
    - Not practical for large scale production

# Flow pattern for trough incubators









# Pond style or Japanese “keeper” channels

- \* Screened trays are placed into a pond or raceway. Eggs are single layer per tray to avoid suffocation. Trays can be stacked.
- \* Flow is horizontal based on the rearing container design.
- \* Clean water is essential for this type of incubation. Silt can build up quickly and with horizontal flow could easily suffocate the eggs.
- \* Hatched fry drop through screen into pond for early rearing
- \* This method of incubation is not common in Alaska.

## \* **Advantages**

- \* Incubation and rearing uses same footprint
- \* Inexpensive and labor efficient
- \* Simple!

## \* **Disadvantages**

- \* Eggs can suffocate easily
- \* Not a good application for cold weather, freezing can be a problem unless water supply is a spring source
- \* Low density, requires lots of space



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### Oceans, Habitat and Enhancement



#### [General Information](#)

#### [Background](#)

#### [Staff](#)

#### [Fish Production](#)

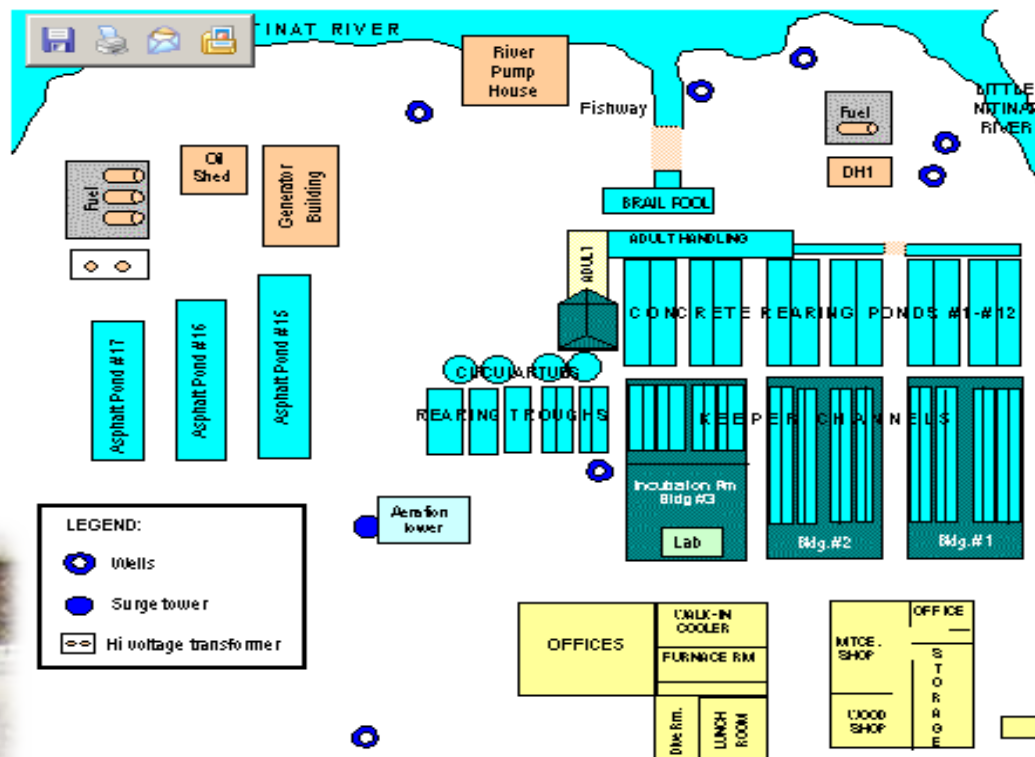
#### [Location Map](#)

#### [Hatchery Map](#)

#### [Local Area Info](#)

#### [Hatchery Main Page](#)

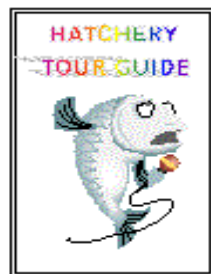
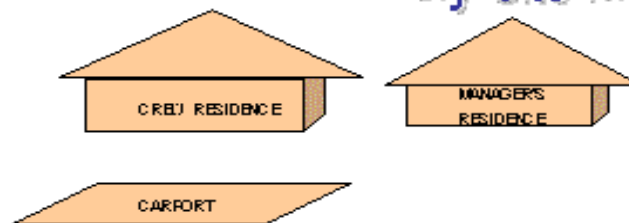
## Nitinat River Hatchery - Hatchery Map



**LEGEND:**

- Wells
- Surge tower
- Hi voltage transformer

## Nitinat River Hatchery Site Map





# Robertson Creek Hatchery

Port Alberni, B.C.



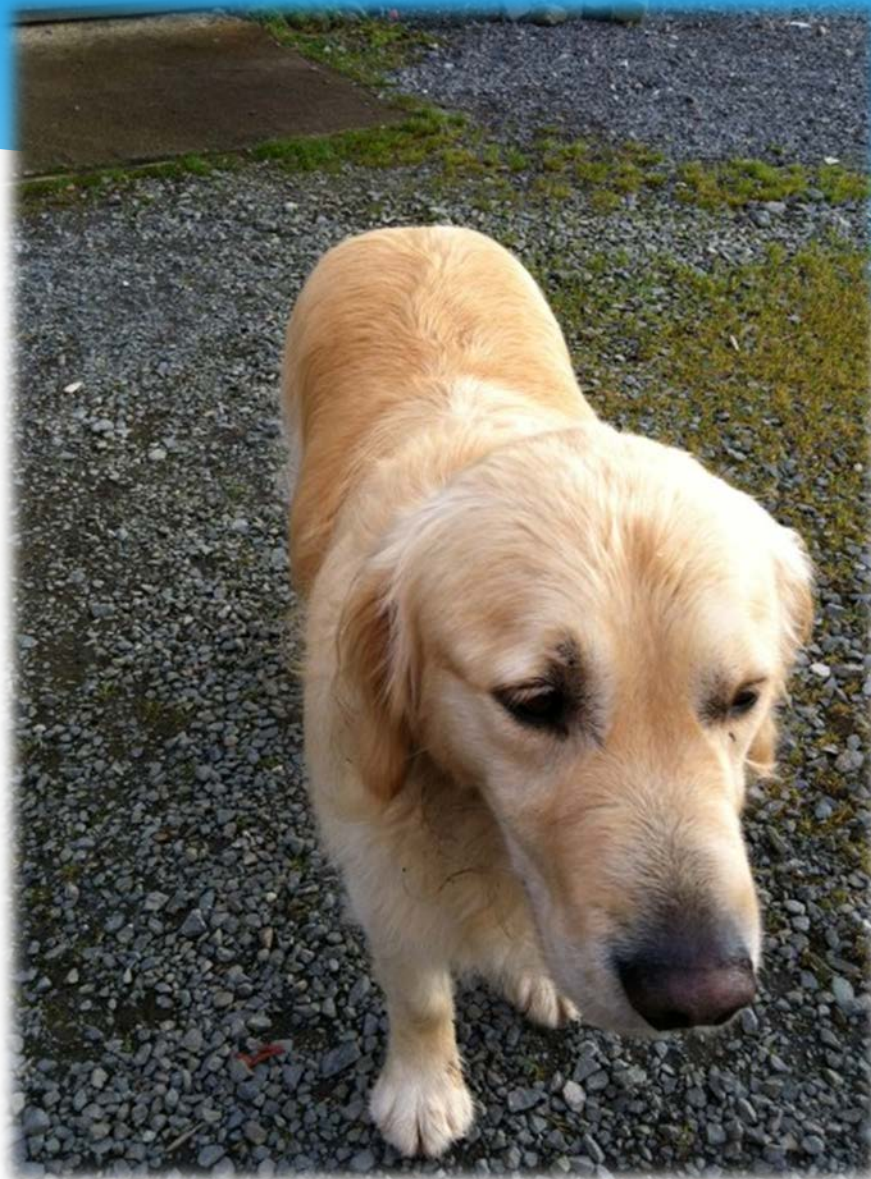


# Spawning Channels

- Constructed adjacent to natural spawning streams to provide optimal substrate and flow conditions for incubation and early rearing
- Spawning Channels are like stretches of engineered rivers, with ideal, flood-protected spawning conditions, built beside salmon-bearing rivers. They are an excellent technique for areas which have ample rearing area but limited natural spawning grounds



Barnie – hatchery dog.....





# Box - Type Incubators

- \* Most common type in Alaska is the Kitoi Box. Most box incubators are approx. 2'x2'x3' long constructed of aluminum.
- \* Flow enters the rear of the incubator upwells through a distribution plate, single pass to the outlet.

## \* Advantages

- \* Easily constructed from aluminum
- \* Labor efficient
- \* Simple plumbing and can be stacked
- \* Makes a good choice for a production facility if cost is a concern.
- \* Portable and can be used for a variety of applications



# Kitoi Box

- Disadvantages
  - Difficult to stack and supply water independently
  - Difficult to remove fry if not using a volitional release system
  - Despite good design characteristics they are prone to egg mortality in the corners of the box
  - Flow through larger box type incubators is troublesome as the size increases
  - Not practical for small egg lots
  - Not as water efficient as NOPAD style incubator.



# Kitoi Box w/iodophor added











# Free Style Box





Information Sources:

U. S. Fish and Wildlife Service  
Idaho Fish and Game

4. Free-Style Incubation Box The free-style incubator is a single plastic unit identical in principle to a module of a deep trough described earlier in this chapter. They are successfully used in Japan, and were recently introduced in the Pacific Northwest. Commonly manufactured from polyethylene or polypropylene plastic, the incubators measure about 2-x 2.5-x 2-feet deep (Fig. 18). They are used in tandem (Fig. 19) for egg incubation and singly for alevins. When used together, the water flows from one to the other.

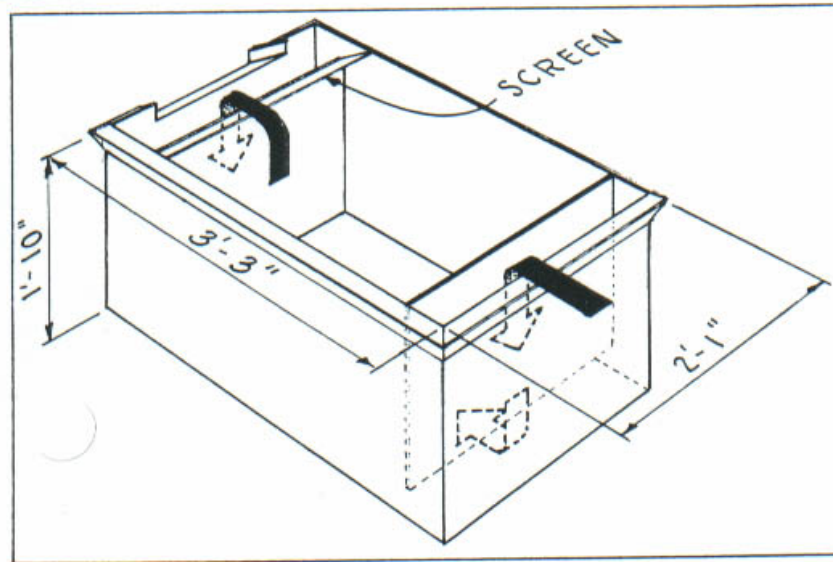


Figure 18. Free-style incubator.

Twenty gallons per minute is used for both egg and alevin incubation (Table 3). The recommended densities for salmon incubation are 500,000 eggs and 150,000 alevins per individual unit. As with deep troughs, eggs can be incubated on trays or poured directly into the unit. When using trays, the alevins drop through to a substrate below. The latter method allows alevins to volitionally move to rearing areas.



# Deep Matrix Box

Gravel has been commonly used as the substrate in this type of incubator

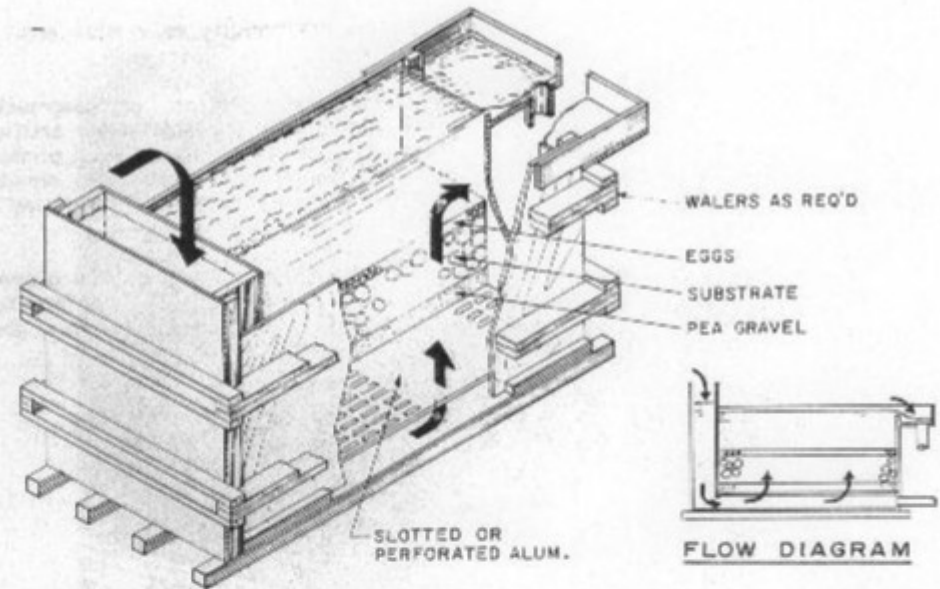


Figure 13. Typical large deep-matrix box.

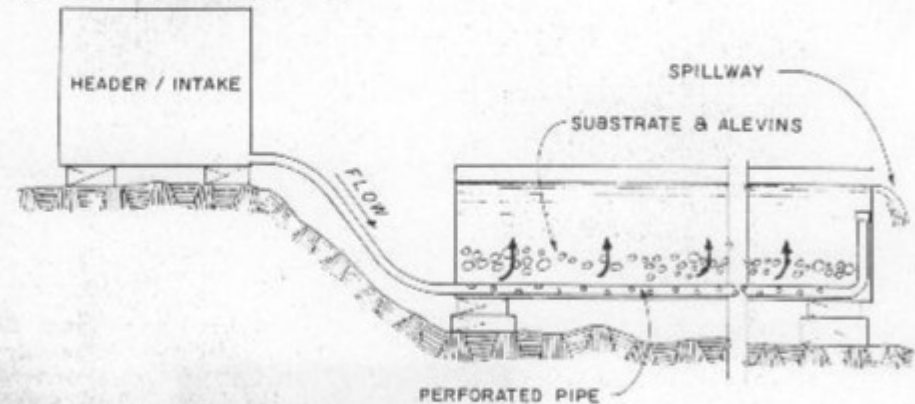
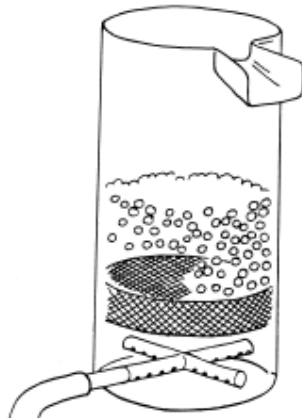


Figure 14. Typical small deep-matrix box.

Dimensions for perforations or spacings in a false bottom should be no greater than  $\frac{3}{32}$ -inch to prevent the passage of alevins. Smaller spacings should be used for sockeye or steelhead.

# Cylindrical Incubators

- Many sizes and shapes
- Typically single pass/upwelling
- Variety of materials
- Most common types are jar, jug and barrel style

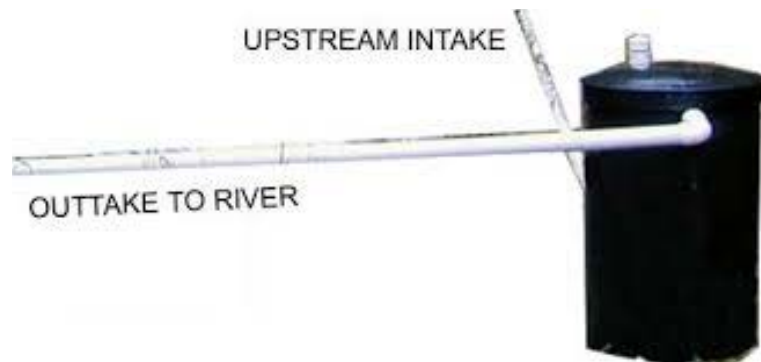


C. Upwelling incubator



# Jars, Jugs & Buckets

- \* These small incubators were developed to incubate small egg lots and single families
- \* Function is basically the same as larger style incubators with upwelling flow



- \* Advantages

- \* Inexpensive and easy to build
- \* Good for small lots

- \* Disadvantages

- \* Useful only for small lots
- \* Labor intensive





# R29 & R48 Barrel Incubators

- Fiberglass -
- Upwelling, single pass
- Pressure plate helps distribute water evenly



- Advantages
  - Labor efficient
  - Easy to load, clean and unload
  - Incubate large numbers of eggs to eye and hatch
  - Easily plumbed
- Disadvantages
  - Poor flow characteristics
  - Water inefficient
  - Inefficient space use
  - Expensive

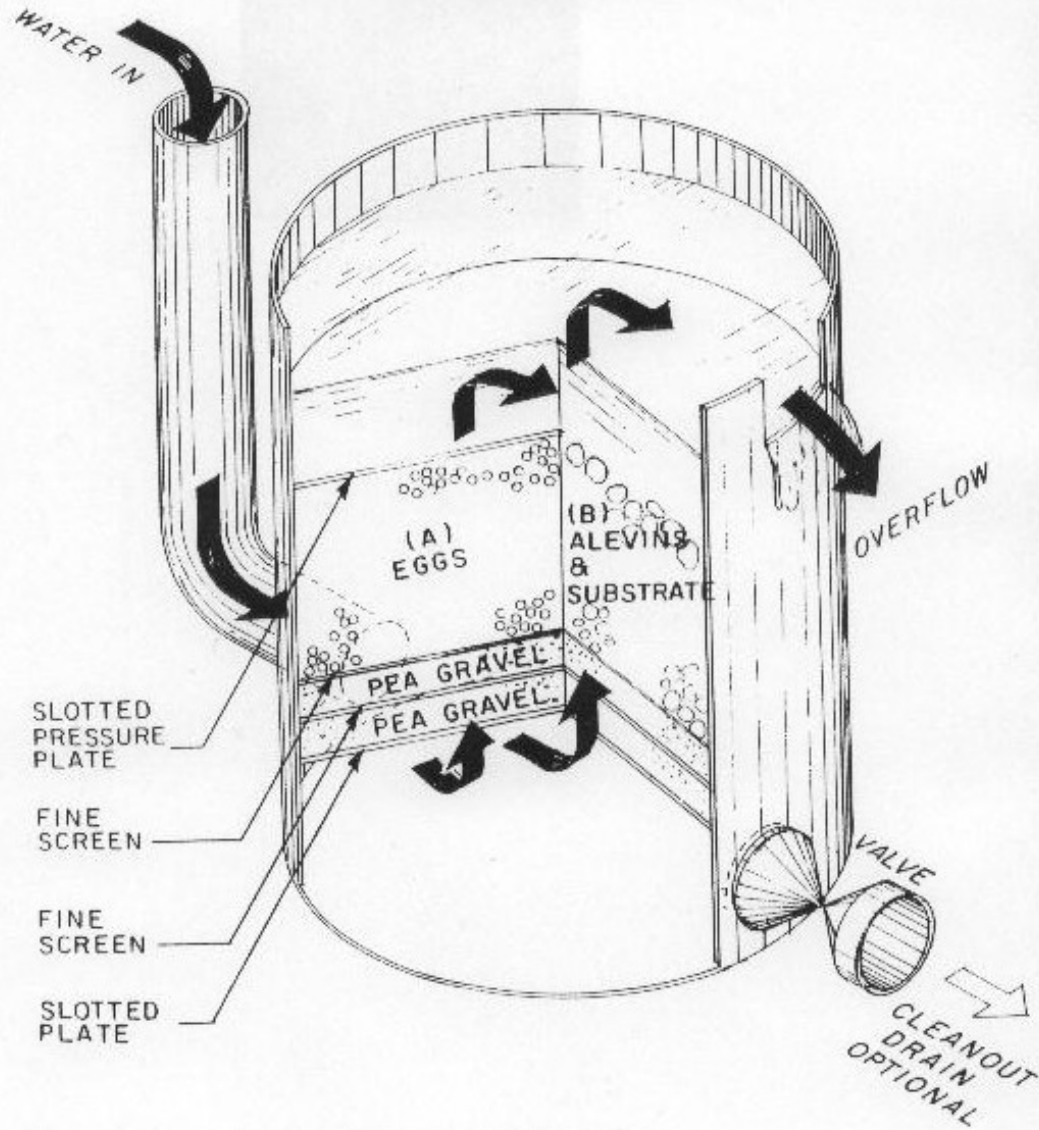
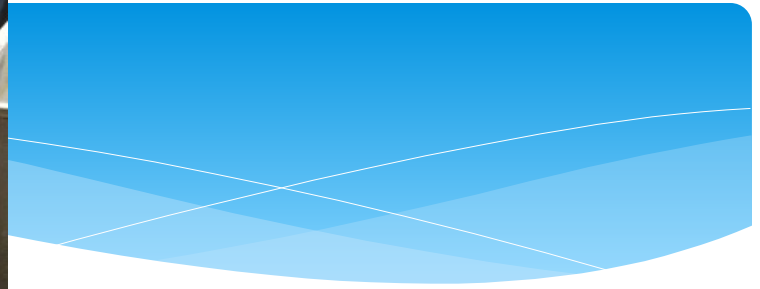


Figure 20. Illustration of a typical cylindrical incubator.





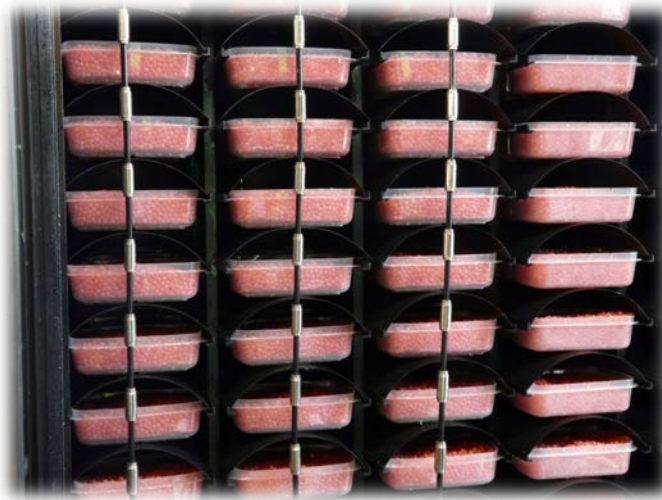


Pressure plate



# Other types of incubation

- \* Moist air
- \* Intermittent immersion



# Mist incubation

- Eggs don't have to be “bathed” in water
- Keep cool
- Keep moist
- Only good up to hatch





# Incubation Channel

- \* Like a spawning channel but eggs are eyed up in an incubator
- \* Increases survival from green to eye
- \* This method is essentially the same as eyed egg plants in a salmon stream.
- \* Both the spawning and incubation channels are alternatives to hatchery production.



# Substrate

- \* Studies have shown that fry incubated in substrate compared to no substrate result in larger healthier fry.
- \* Why?

## Types of substrate:

- \* Gravel
- \* Vexar
- \* PVC Saddles
- \* Bio-Rings



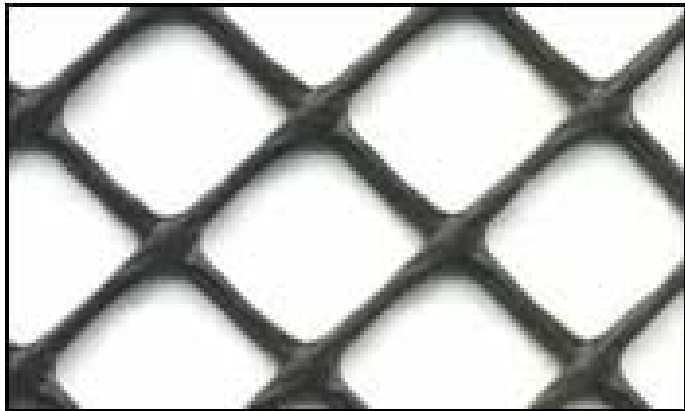
# Gravel

- \* Generally used in deep matrix box type incubators or in stream side incubators due to availability
- \* Size should be about  $\frac{3}{4}$  -  $2\frac{1}{2}$ " diameter without fines
- \* Advantages
  - \* Easy to clean
  - \* Inexpensive and readily available
  - \* Natural!
- \* Disadvantages
  - \* Heavy, labor intensive
  - \* Only suitable for volitional release
  - \* Not suitable for vertical stack type incubators (Heath trays)



# Vexar/plastics

- \* Folded in to a sandwich for use in smaller tray type incubators
- \*  $\frac{3}{4}$ " plastic square mesh heavy duty material



- \* Advantages
  - \* Easy to use one piece is assembled per tray
  - \* Easy to clean and disinfect
  - \* Very durable
- \* Disadvantages
  - \* None when used for vertical stack incubators



# PVC Saddles

- \* Saddles are about 1" x 1.5". Purchase slightly negatively buoyant
- \* Better choice than gravel



## \* Advantages

- \* Big improvement over gravel
- \* Light weight and easily handled if packaged in plastic netting
- \* Produces good quality fry

## \* Disadvantages

- \* Very expensive
- \* Very difficult to clean
- \* Non volitional ponding is difficult

# PVC Bio-Rings

- 1.5” plastic rings, available in various sizes but 1.5” is best
- Purchased slightly negatively buoyant



- Advantages
  - Easy to handle
  - Not necessary to package in plastic netting
  - Easily cleaned with hose
  - Produce excellent quality fry
  - Can be siphoned or dip netted for non-volitional release
  - Will not lock together in incubator
  - Very durable
- Disadvantages
  - Not an ideal substrate in vertical stack incubator
  - Very expensive \$15/cu'



# Assignment 6 - due 10/25/16

- \* What type(s) of incubators are at your project facility?
- \* How many incubators of each type?
- \* How are they configured? (e.g. 5 high, 10 high, single pass)
- \* What is the typical water flow through the incubators?
- \* How many eggs do they load for eyeing? For hatching? (be sure to identify what species – this will vary by species; can be approximate)
- \* Do they use substrate and, if so, what type?