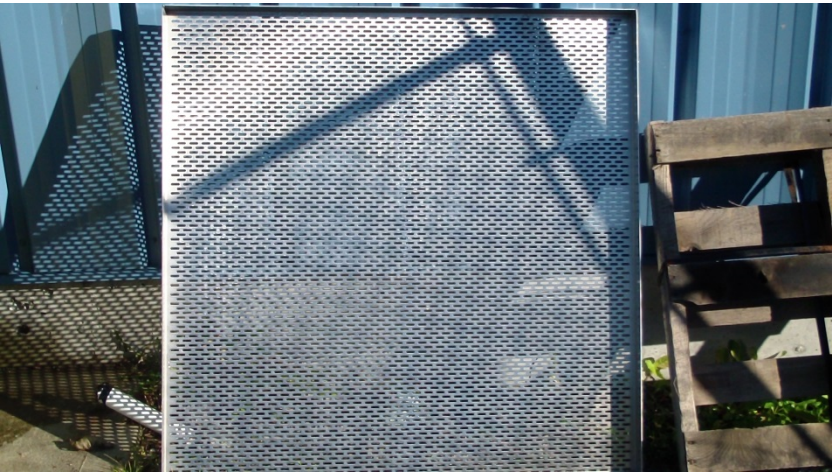
EARLY EGG INCUBATION

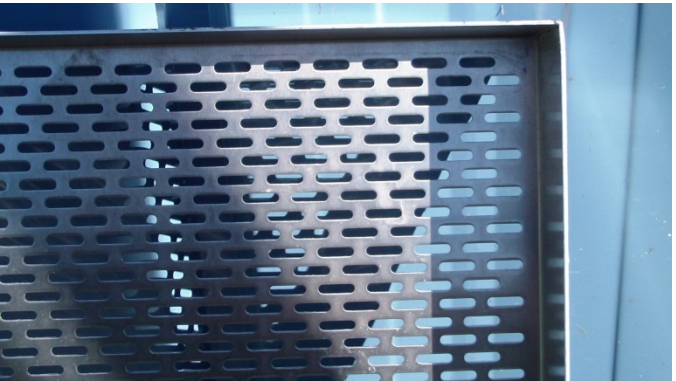
- More types of incubators in action
  - Seeding eggs
  - Tempering eggs
  - Saprolegnia
- Temperature units

WHAT'S THE DIFFERENCE BETWEEN A ZAK KNIFE AND A FISHERMAN?

- You don't feel too bad getting rid of one when it has passed its time of usefulness.
- Only one screw can go loose on a Zak
- A dunk in iodine will disinfect one.
- One gets picked up in a marine store, the other gets picked up in a bar.
- One starts off sharp.
- When a zak gets a little care it will work like its brand new for along time.
- A zak never complains!
- One is bright!
- A zak knife is always sharp – a fisherman is definitely not! (Maureen)

SALMON CULTURE LAB 2015!





SOLOMON GULCH - VALDEZ

PILLAR CREEK - KODIAK

EGG INCUBATION

- What is a “green” egg?
- What is an “eyed egg”?
- Why is it so important to thoroughly rinse eggs prior to putting them in an incubator?

EGG INCUBATION

- Remember – Always handle green eggs gently. After rinsing the water hardening process has begun so be gentle when loading the incubator.
- Any (significant) temperature difference between the eggs at the time of loading and the ambient water temperature of the incubator should be moderated at this time.
- Allow the eggs to become acclimated (tempered) to the new temperature whether it is lower or higher.
- Tempering within plus or minus 3 degrees C is ideal but often not practical.

TEMPERING - IF NECESSARY

- Example
  - Raceway = 15C
  - Hatchery = 9C
- Temper to 12C by:
  - Adjusting rinse temp
  - Creating a “bath”
- Separate gametes may need to be tempered quite a bit. Why?

SEEDING GREEN EGGS

- Seeding = Loading incubator with fertilized eggs and no substrate, always handle gently (do you remember what substrate is?)
- Load eggs evenly – water hardening
- NOPAD trays are a little challenging to load with green eggs
- Purge the air before loading any incubator!
- Some facilities do not load the top Heath tray

TYPICAL LOADING RATES

Eggs	Heath Tray	NOPAD	R48	Kitoi Box
Chinook	6,000	280,000 green 150,000 eyed	N/A	250,000 150,000
Coho	10,000	300,000 green 175,000 eyed	N/A	300,000 175,000
Sockeye	14,000	200,000 green 200,000 eyed	N/A	200,000 200,000
Chum	N/A	300,000 green 180,000 eyed	3,000,000	250,000 175,000
Pink	N/A	350,000 green 225,000 eyed	4,000,000	350,000 225,000

DISINFECTION

- Eggs can be disinfected and water hardened in incubators simultaneously
- Fill incubator with 1:100 iodophor / static bath for at least 10 minutes but better to let water harden
- Pinks and chums may not need to be disinfected this way
- Remember – Always disinfect eggs when received from another facility.
- Temper when necessary

Egg Tenderness

Time 0

↓ Very tender

1 – 2 hrs

↓ Can be handled

48 hrs

↓ Very tender

Visible eye

↓ Durable

Oxygen Demand

Time 0

↓ Increasing

Ponding

CARE OF EGGS DURING INCUBATION

- During Incubation
  - Always protect eggs from u.v. light
  - After eyeing purge air from incubators on a regular basis
  - Immediately after reaching the eyed stage stir lots to prevent *channeling* of flow, silt can build up during incubation and result in poor upwelling flow through eggs
  - With a dirty water supply it may be necessary to clean the incubator often. Heath trays can be hosed off or agitated to remove silt.
  - Clean from the top down one tray layer at a time. Keeping the eggs clean will result in better survival prior to hatch.
  - Use a *splash guard* when cleaning NOPAD trays, this allows silt to fall on floor and not into tray below

CLEANING, PURGING AIR, LEVELING THE SIDE SCREENS ARE IMPORTANT MAINTENANCE ITEMS

Use of a splash guard with NOPADs

SAPROLEGNIA – IGNORE IT AT YOUR OWN PERIL !

- Natural borne organism
- Grows on dead organic matter
- Many ways to minimize the impact – name some!
- If left unchecked it will consume ALL of the eggs

METHODS FOR CONTROL OF THE FUNGUS *SAPROLEGNIA*

- Concentration and frequency will depend upon your water quality especially temp and organic load
- Salt Water
- Hydrogen Peroxide
- Formalin
- Malachite Green was used in the past – now illegal
- Start fungus control treatments shortly after taking eggs
- It's easier to keep it under control than trying to play catch up

HYDROGEN PEROXIDE (H_2O_2)

- FDA classifies use of Hydrogen Peroxide a low regulatory priority when used at concentrations less than 500 ppm
- Has been found to be effective at controlling fungus when used in a range of 250 – 1000 ppm for a 15min drip every other day
- Not as effective as Formalin.
- Effectiveness varies with water quality and temp
- Dangerous to handle – 37% vs. 2% over the counter
- Environmentally friendly – turns into water
- More expensive than formalin
- Does not smell but direct contact with skin will cause burns

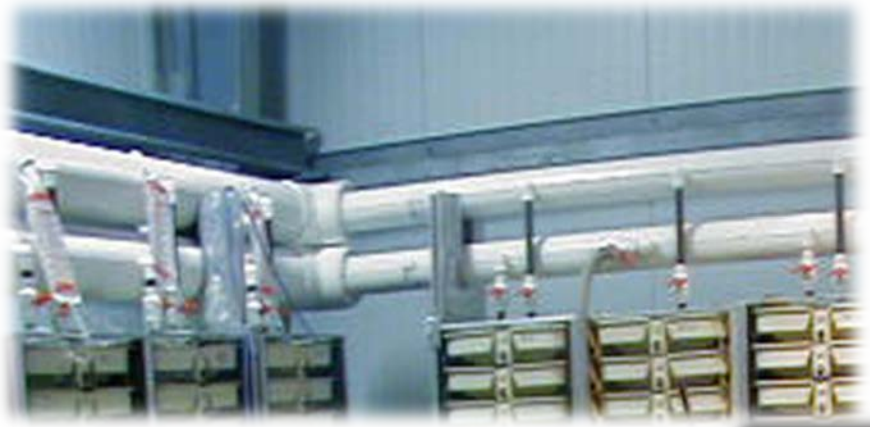
FORMALIN

- Generally used 3 x week at a concentration of 1:600 for 15 min – will vary with water and egg quality
- This is nasty stuff but is very effective.
- Depending on water quality and egg survival it may not be necessary to treat 3 x week or it may be necessary to treat every other day.(or every day!)
- Always wear protection to include full face respirator w/ formalin filter and gloves – don't compromise your health!
- Avoid use in an enclosed area – use good ventilation
- Formalin dosage used for eggs is lethal to alevin/fry.

SALT OR SEAWATER

- Least effective method but is user friendly
- Delivery method may be expensive if pumped
- Need to address disease concerns if using natural seawater
- Dosage – Salt (NaCL)
  - 1:111 or about 9 parts per thousand
  - Treat daily for 60 min or as needed
- Dosage – Seawater
  - 20 – 30ppt not to exceed 8hrs in 24 hour period
  - Temper water to avoid temperature shock

DELIVERY METHODS



- Drip
- Metered Pump
- IV bags
- Gravity feed with constant head tank

Always consider
your personal safety!

Formalin delivery system at Neets Bay

- Barrels of formalin on floor
- Pumped up to white tanks
- Gravity feed from white tanks to incubators
- Pvc lines to individual incubators

CALCULATIONS AND DOSAGES

- “ppm” = parts per million. The ratio is 1 : 1,000,000
- “ppt” = parts per thousand. The ratio is 1: 1,000
- Other ratios are typically stated as “1 : xxx”
- The first part is the chemical part, the second part is the volume being treated (typically water)
- **Calculate total amount of water to be treated as step 1**
- **Always convert to metric**

DOSAGE CALCULATIONS

- A variety of ways to come up with same number
- Double check figures – a mistake can be costly in more ways than one
- Be sure you are treating the right incubators!
- Dosage language varies: ppm or 1: ???, metric, standard measure, etc.

MATH TIME.....

How to calculate the amount of hydrogen peroxide (H_2O_2) to administer 1:1000 with flow of 15GPM over 15 minutes

1. Figure out how much water to treat
    1. Start by converting gallons per minute to ml per minute: 1gal = 3785ml. So in one minute there is 15 gallons. How many ml in one minute? 15 x 3785 = 57,000ml (rounded up)
    2. How much water in 15 minutes then? 57,000ml/ 1minutes x 15 minutes = 855,000ml total in 15 minutes.
    3. 1:1000 hydrogen peroxide. For every 1,000 parts of water add 1 part HP. How many "thousands" do we have? 855,000/1,000 = 855
    4. How much peroxide will we need (in ml)?
2. Can you calculate for 1:600 with the same flow and time?
3. There are usually a variety of ways to come up with the right dosage. Always good to double check with someone else if possible

HOW TO CALCULATE THE AMOUNT OF FORMALIN TO ADMINISTER 1:600 WITH FLOW OF 15GPM OVER 15 MINUTES

1. Convert gpm to ml: 15 gallons = 57,000ml / minute
2. Total water delivered in 15 minutes: 57,000ml /min x 15 minutes = 855,000ml of water to treat.
3. 1 part formalin to every 600 parts water: 855,000ml total amount of water / 600 = 1425ml of formalin to add over 15 minutes time. Also can be shown as 1.425L

TEMPERATURE UNITS - TU'S

- In AK we use centigrade – the lower 48 uses Fahrenheit
- Temperature units are used by fish culturists to estimate the development over time of eggs and alevin
- Temperature should be recorded AM & PM, then averaged
- 1 TU is equivalent to 1degree C for 24 hours
  - Example – A lot of eggs collected on day 1 @ 10C will have accumulated 10TU's after 24 hrs. After 12 days at the same temperature it will have 120TU's

DEGREE DAYS

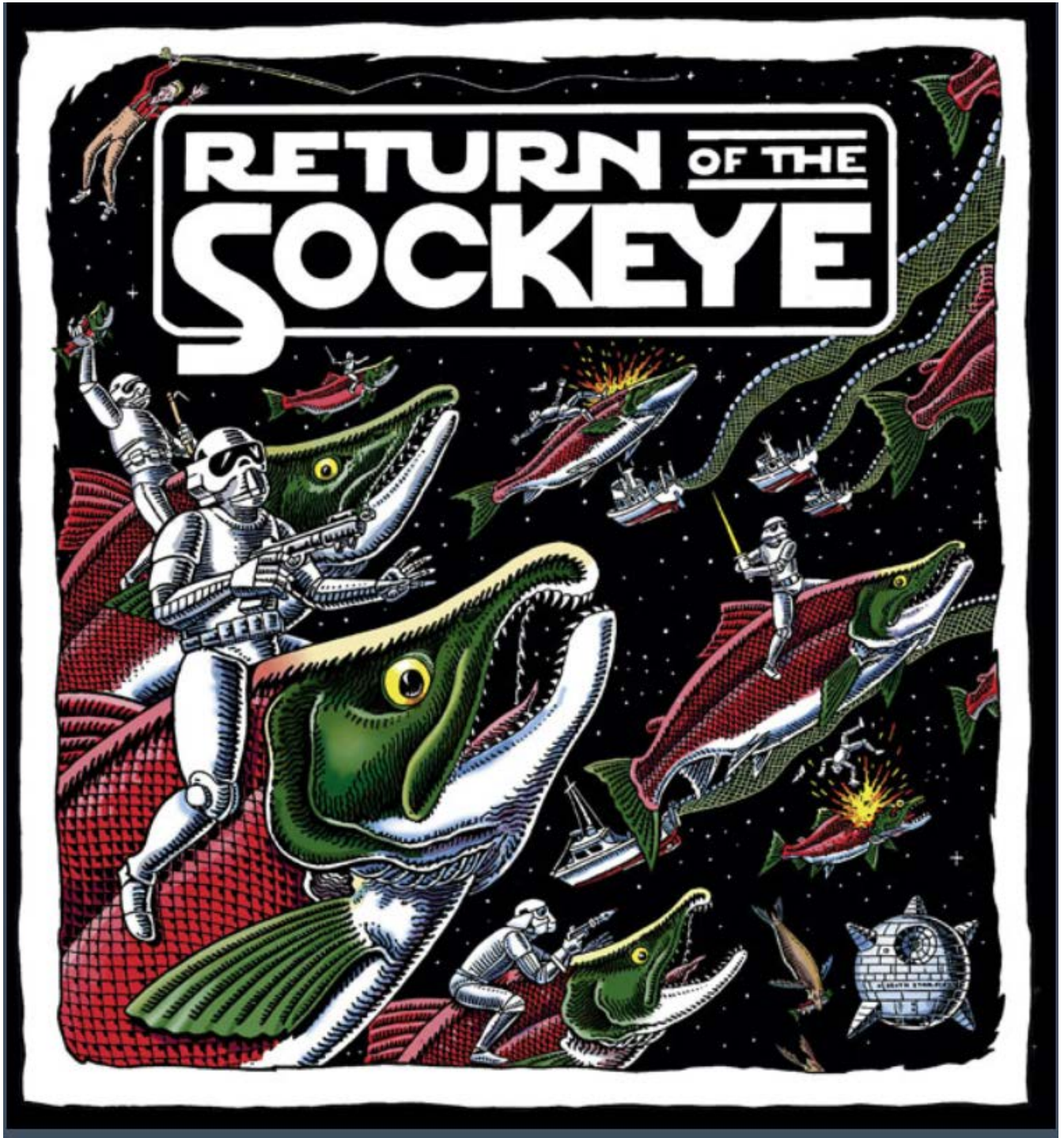
- A combination of time and temperature
- Salmon are very adapatable when it comes to temperature and development
- Why is it important to know where your fish are in the development stage?

TU RECORD

Date	AM	PM	Avg			
9/1/02	8	8.5	8.25	**Lot 1**		
9/2/02	8	8.5	8.25	8.25		
9/3/02	8	8.5	8.25	16.5		
9/4/02	8	8.5	8.25	24.75	**Lot 2**	
9/5/02	8	8.5	8.25	33	8.25	
9/6/02	8	8.5	8.25	41.25	16.5	
9/7/02	8	8.5	8.25	49.5	24.75	
9/8/02	8	8.5	8.25	57.75	33	
9/9/02	8	8.5	8.25	66	41.25	**Lot 3**
9/10/02	8	8.5	8.25	74.25	49.5	8.25
9/11/02	7.8	8	7.9	82.15	57.4	16.15
9/12/02	7.8	8	7.9	90.05	65.3	24.05
9/13/02	7.8	8	7.9	97.95	73.2	31.95
9/14/02	7.8	8	7.9	105.85	81.1	39.85
9/15/02	7.5	7.7	7.6	113.45	88.7	47.45
9/16/02	7.5	7.7	7.6	121.05	96.3	55.05
9/17/02	7.5	7.7	7.6	128.65	103.9	62.65

STAGES OF DEVELOPMENT BY TU

- Visible eye = 220 Tu's
- Silver ring around eye = 350 Tu's
- Hatch commences = 450 – 500 Tu's
- Emergence = 800 – 1000 Tu's
- Ponding = 800 – 1100 Tu's
- Temperature Units for each stage of development will vary between specie and average temperature, 2C vs 12C
- Eggs can be moved for shocking or transport as soon as the eye is visible, however a safer range is about 300TUs.
- Do not handle too close to hatch as handling can result in premature hatch.


RETURN OF THE
SOCKEYE

CAUSES OF MORTALITY DURING GREEN & EYED EGG INCUBATION

Green Egg Mortality During Incubation

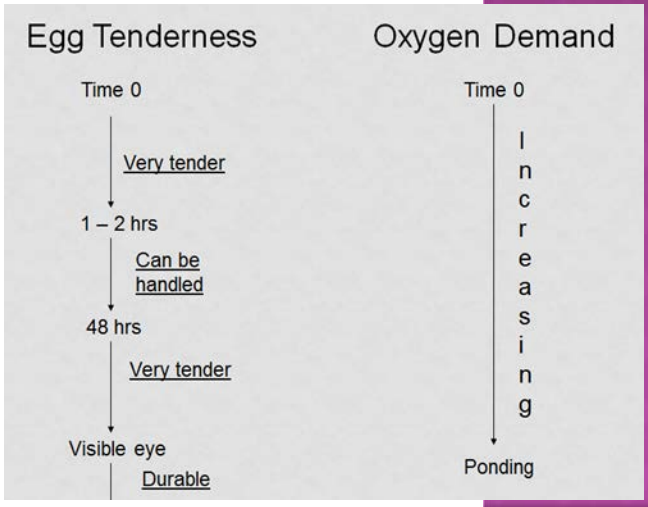
- Lack of O_2
  - What might cause this?
- Light
  - How would you prevent light from hitting the eggs?
- Improper calculated chemical treatments
  - Math!
- Poorly administered anti-fungal treatments
  - Don't let it get started
  - Observation and being proactive
- Quality In = Quality Out

GREEN EGG MORTALITY DURING INCUBATION

- Dirty water
  - What problems might this cause?
- Physical shock
  - From what?
- Lack of care
  - What maintenance activities are necessary?
- No matter what you do there will be a certain % loss due to natural causes

GREEN EGG INCUBATION - SOME CARDINAL RULES…….

- It's "hands off" once you load green until when?
- Treatments to control fungus
- Insure adequate flow with good water quality
- Keep the lights off and do not disturb
- Quality in – quality out!

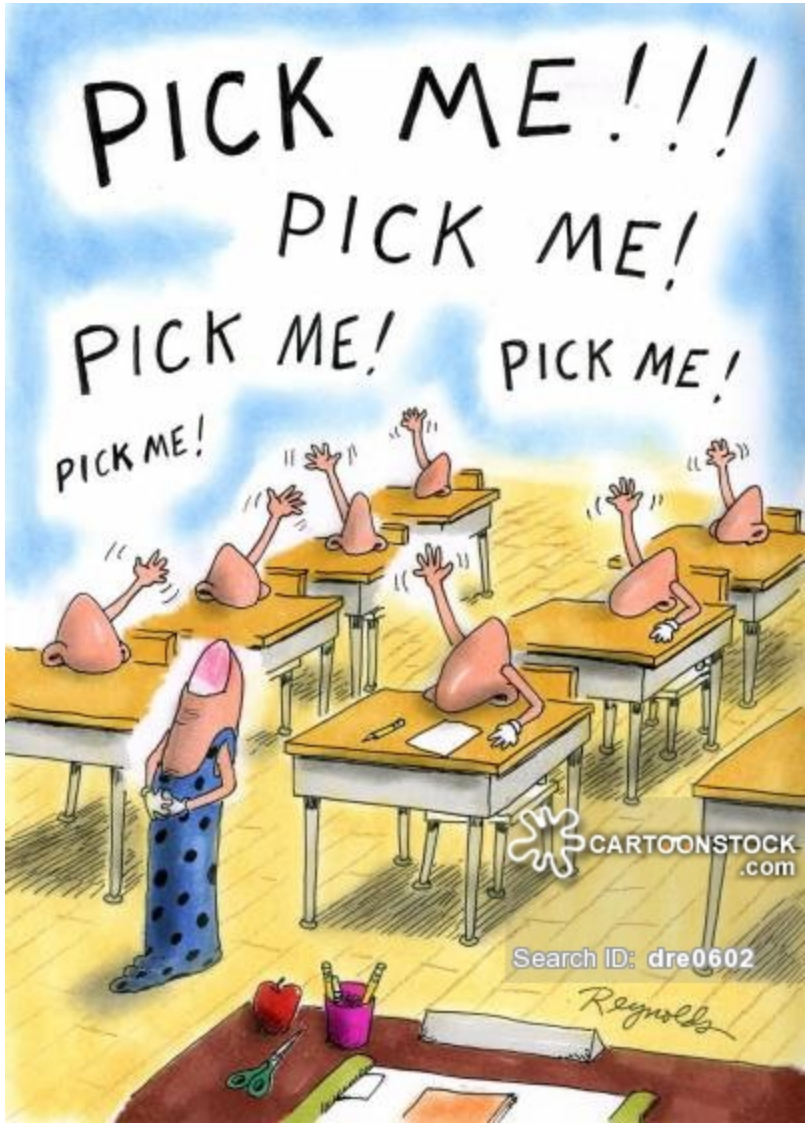


EYED EGGS CAN BE HANDLED

EYED EGG INCUBATION

- Good time to move them around and bust up any “clumps”
- Air purging is needed
- If you need to transport eggs, now is the best time to do so
- Take the time and be observant!

PICKING!


PICK ME!!!
PICK ME!
PICK ME!
PICK ME!
PICK ME!
CARTOONSTOCK .com
Search ID: dre0602
Reynolds

TO PICK OR NOT TO PICK?

Pick what? Why?

HATCH SCREENS FOR NOPADS

No picking necessary unless survival is terrible

Hatch nearly complete – dead eggs left behind

Hatch complete, screen removed

EGG SHOCKING - NECESSARY IF YOU WILL BE PICKING

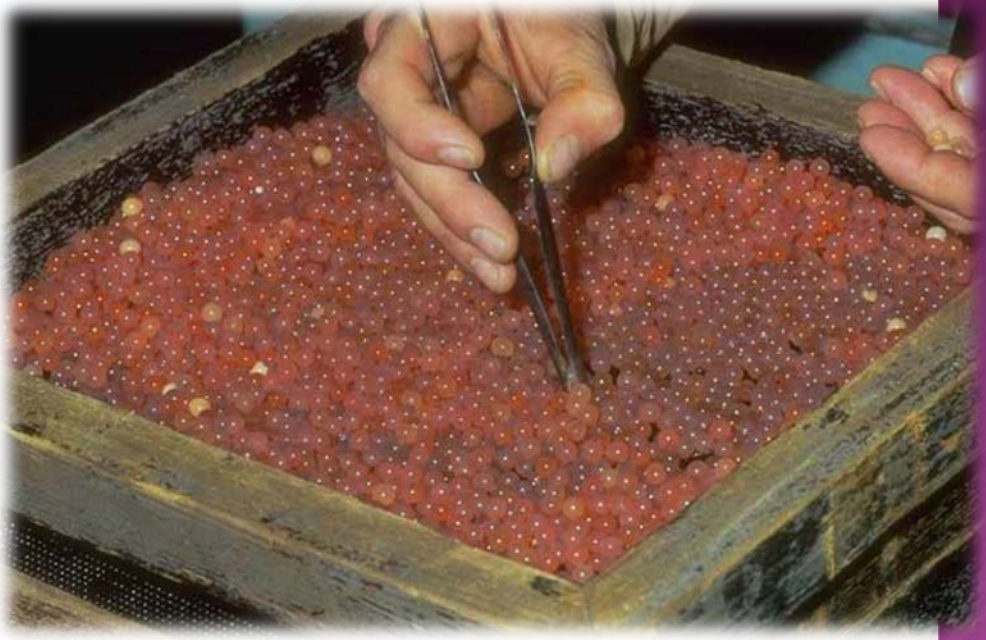
- After the eggs have a visible eye it is necessary to physically shock them.
- Breaks the yolk
- The yolk precipitates and the egg turns white.
- Wait about 24hrs
- Many methods – can you think of any?
- http://www.prsalmon.org/?p=405

Mechanical shocking by siphoning

FIGURE 12. Shocking eggs by the siphon method. *Photograph by J. H. Wales, June, 1958.*

EGG PICKING

Small lots of eggs can be hand picked or if you have time machine picked eggs can be cleaned up by hand



EGG PICKING METHODS IN THE OLDEN DAYS

6. PICKING EGGS

6.1. Pipette Method

Unless a fungicide is used to prevent dead eggs from fungusing and the fungus spreading to the fertile ones, it is necessary to remove the dead eggs. This is called egg picking.

Various methods have been developed to separate the white or dead eggs from the fertile ones. At one time, nearly all egg picking was done with a large pair of metal tweezers, a tedious process. A great improvement in technique was made when the pipette became universally adopted for picking eggs. It consists of a length of glass tube about eight inches long inserted into the bulb of an infant syringe. The inside diameter of the glass tube should be just large enough to pass the eggs. An experienced operator can pick eggs with a pipette quite rapidly. The operation, however, is quite tiring and can cause serious eye strain. In California, the pipette is used mostly for picking out small numbers of eggs preparatory to shipping. In making up pipettes for egg-picking work, the following materials are recommended:

Bulb, Goodrich, infant syringe, red, 2 ounces, No. 223, or 3 ounces, No. 224.

Tube, Pyrex, clear glass, 6-inch length, thickness of glass 1 mm. or more depending on inside diameter. The inside diameters of tubes commonly used are as follows:

5 mm.—0.197 inches for eastern brook trout
6 mm.—0.236 inches for small brown trout
7 mm.—0.276 inches for brown and small rainbow trout
8 mm.—0.315 inches for rainbow trout
9 mm.—0.354 inches for steelhead
10 mm.—0.394 inches for silver salmon
11 mm.—0.443 inches for king salmon

6.2. Siphon Egg-Picking Method

Various types of continuous-flow, siphon-type egg pickers have been developed, and great claims have been made for them. The continuous-flow, siphon egg picker consists of the pipette with bulb, and a length of flexible hose reaching from the bulb at working height to a pail on the floor. The siphon is started and the egg picker moves the glass tube in the basket of eggs in much the same way as when using the pipette alone. The flow of water through the siphon hose is controlled by applying pressure to the syringe bulb, located between the end of the glass

6.3. Salt Flotation Method

The flotation method is one of the older methods still used to some extent. A salt box in which a standard egg basket will fit is used. The salt box is filled with water to nearly overflowing and common stock or table salt is added and stirred into the water until a solution of the proper strength is reached. The amount of salt to be added can best be determined by dipping up a sample of the solution in a glass container, preferably a quart fruit jar, and then dropping a few eggs into the jar, using both live and dead eggs. If the solution is right, the dead or bad eggs will float and the live or good eggs will slowly settle to the bottom. If both good and bad eggs float, the solution is too strong and should be diluted by adding water. If both good and bad eggs settle to the bottom, the solution is too weak and more salt should be stirred in. The margin at which the salt solution will separate the good eggs from the bad is quite narrow, so great care must be taken in the preparation of the solution. When a solution of the proper strength has been attained, the basket containing the eggs is set into the salt box, and after a moment or two the good eggs begin to settle to the bottom. The bad eggs floating on top are then skimmed off with a small scaph net. Care must be taken in skimming off the dead eggs and any turbulence created by the scaph net must be kept down, since any movement of the water will cause the good eggs to rise to the surface and mix with the bad. The eggs in a basket should not be over one inch deep for salting, regardless of the size of the eggs. Separation becomes more difficult with more than that amount.

For satisfactory salting, trout eggs should be well eyed. The further the embryo has developed, the more rapidly will the eggs settle in the salt solution. Eggs should be shocked at least 36 hours before salting, for good results. As the solution becomes diluted, more salt should be added. A salinometer may be used to determine the strength of the solution.

Once the strength of the solution has been determined, it is easy to maintain it by periodic testing. The optimum strength may vary with different lots, depending on the stage of development and the elapsed time between shocking and salting.

6.4. Flush Treatment to Eliminate Egg Picking

Egg picking, once a tedious and time-consuming process and still practiced at most hatcheries, has been found entirely unnecessary at others so long as fungus can be controlled. To eliminate egg picking, trout and salmon eggs are flushed once each day with a malachite green solution from the day they are taken until hatching commences. The solution is made by dissolving 1½ ounces, dry weight, of malachite green in one gallon of water. The flow in the hatchery trough is regulated to about six gallons per minute and then three liquid ounces of

STATE OF CALIFORNIA DEPARTMENT OF FISH AND GAME
FISH BULLETIN No. 107
Trout and Salmon Culture (Hatchery Methods)

By
EARL LEITRITZ

PREFACE TO 1969 REPRINT

Ten years ago Earl Leitritz called attention to the rapid improvement in fish culture equipment and methods and predicted continuing progress. He was right. California has moved on to ponds with concrete sides and bottoms designed to operate with mechanical crowders and graders, fish loading with pumps, and better feeding methods. Hatchery troughs are no longer provided in new installations and as the older ponds are replaced, they will disappear in the older hatcheries.

ROBERT MACKLIN
February 1969

Bounce Picker

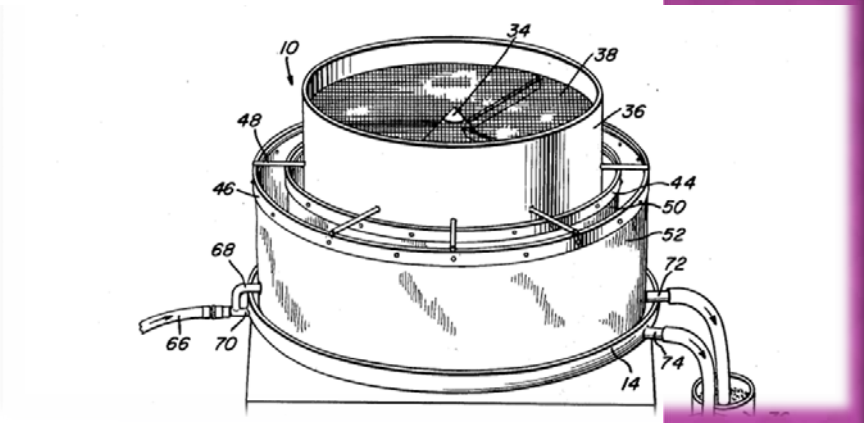
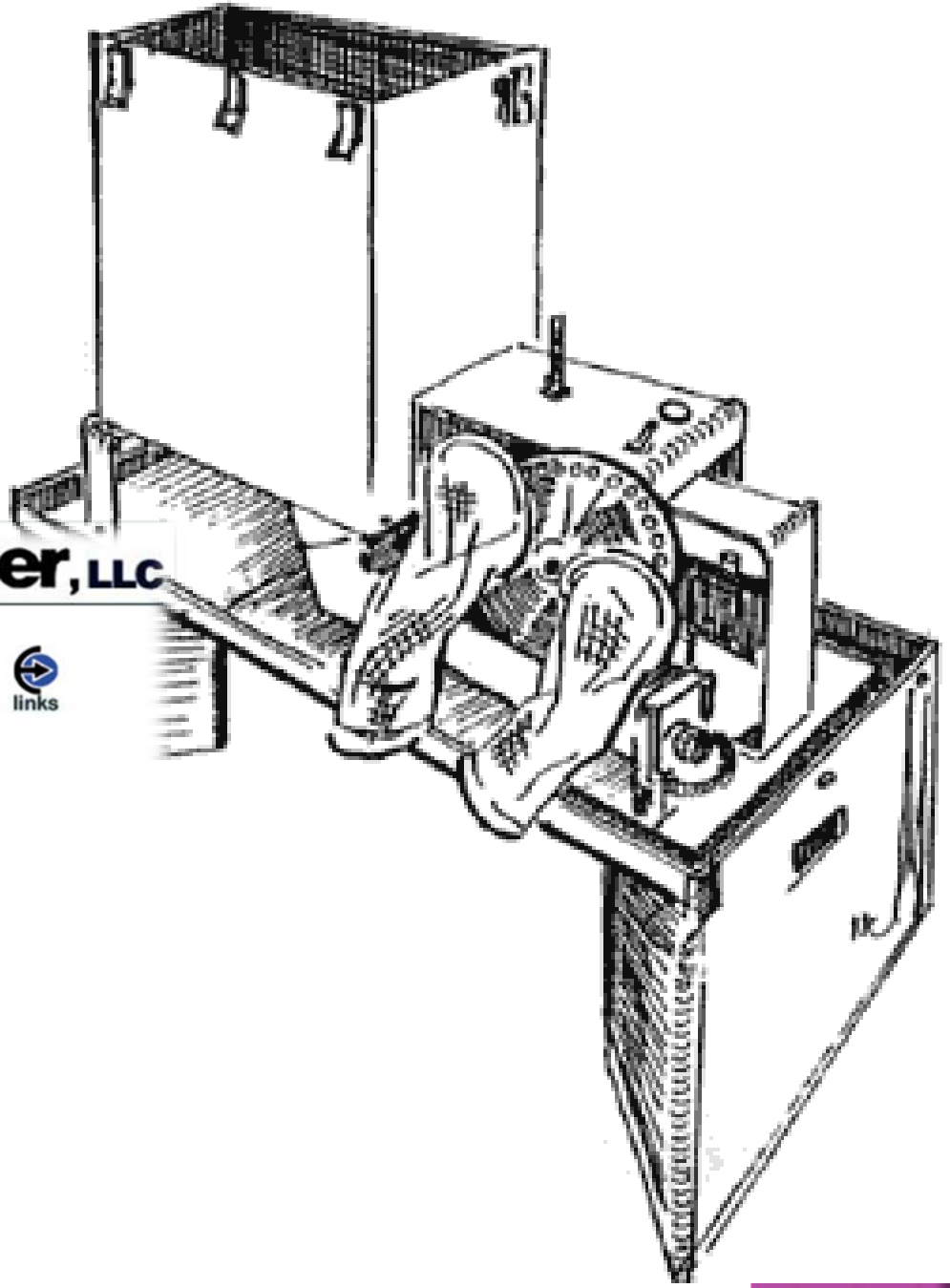


Photo sensor pickers



electronic sorters & counters

jensorter, LLC

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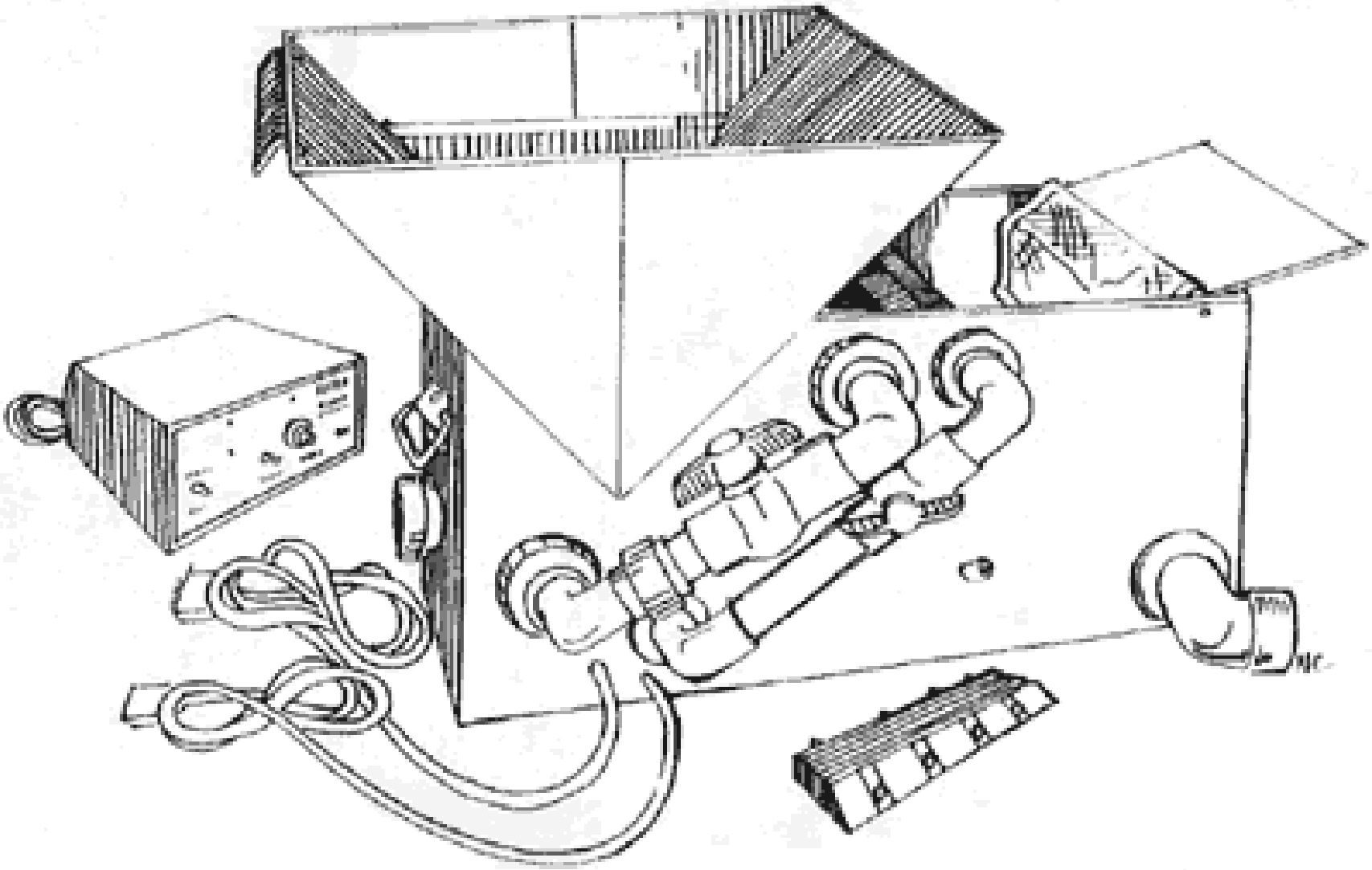
- Model JB (Fish Egg Sorter)
- Model JH (Fish Egg Sorter)
- Model JX (Fish Egg Sorter)
- Model JM4 (Fish Egg Sorter w/ Counters)
- Model JM8 (Fish Egg Sorter w/ Counters)
- Model JT (Fish Egg Sorting Table)
- Model BCM (Fish Egg Counter)
- Model FCM (Coolwater Fry Counter)

Jensorter, LLC
20756 High Desert Court,
Suite 6
Bend, OR 97701

Voice: 541-389-3591
Fax: 541-389-0050
info@jensorter.com

Jensorter with electronic egg counter



Select the proper size wheel for varying egg sizes – can be a little tricky

Jensorter Model JH – old, beat up, but reliable. Kinda like a university professor……..

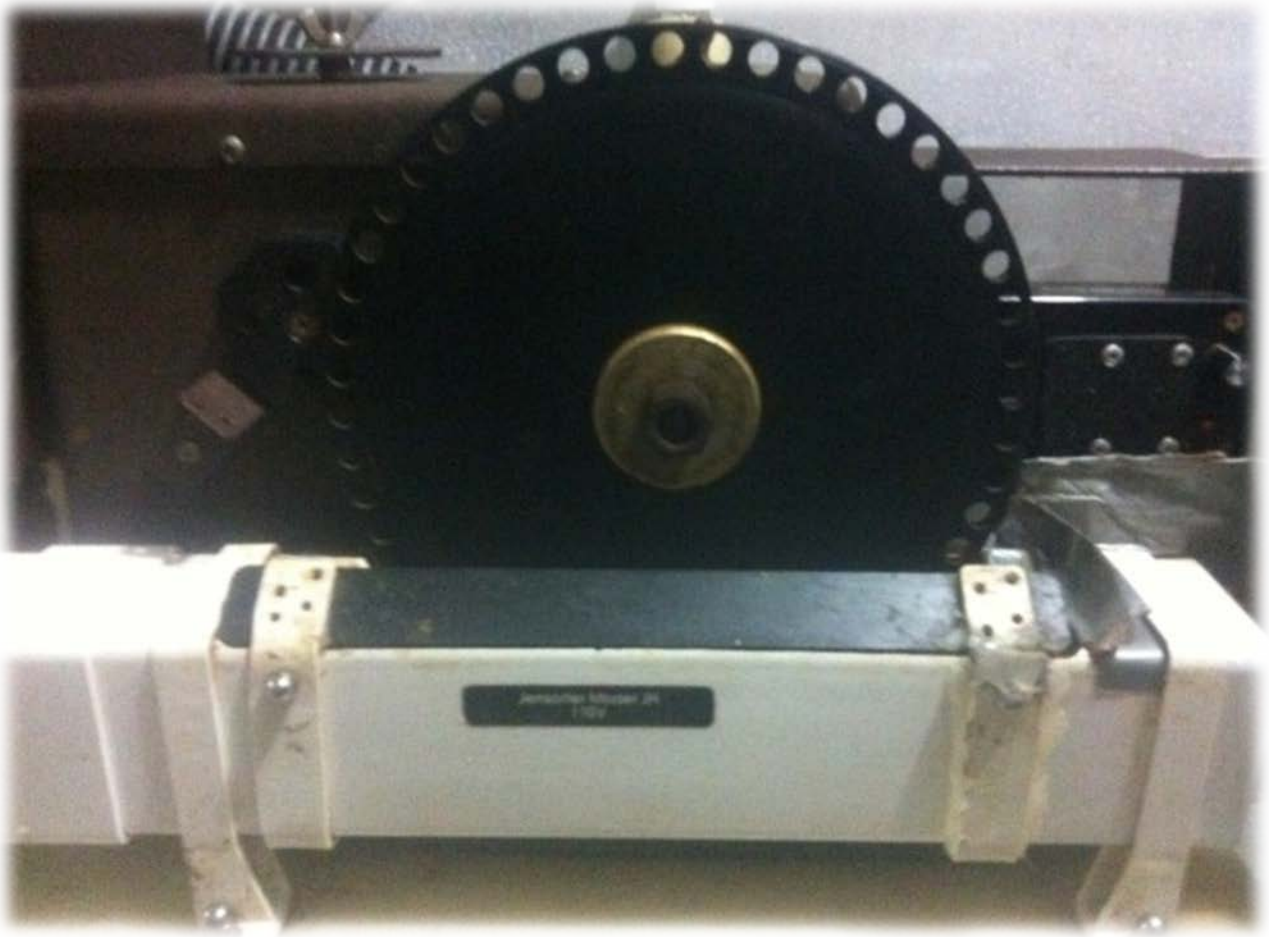
The photoelectric eye – key to good operation

Sensor control – touchy!

Looking behind the wheel – an air jet pushes live eggs off of the wheel

Water channel in front of machine moves eggs to the wheel where they are picked up.

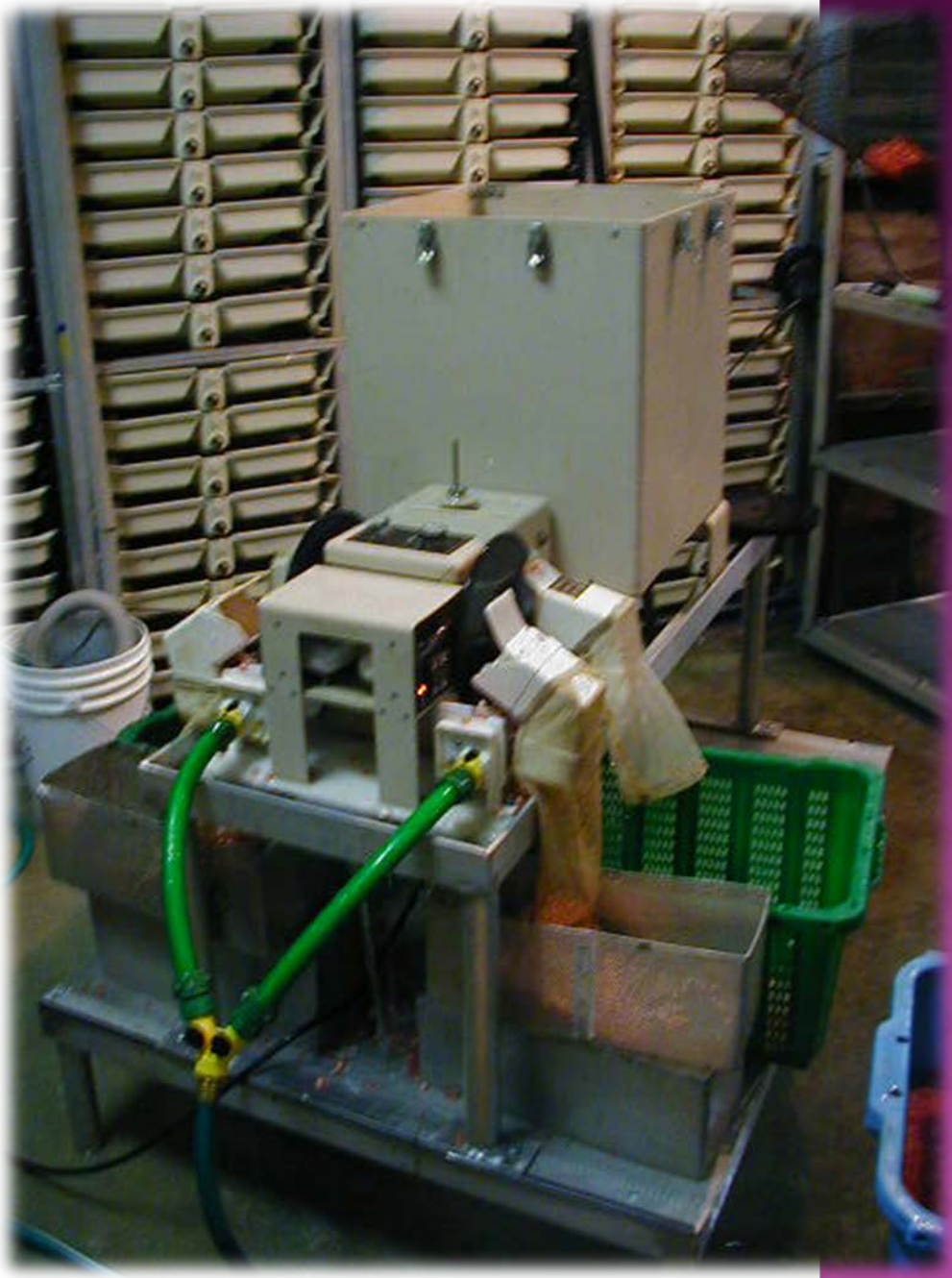
Water flow control is through a garden hose fitting.



Fully assembled unit. Routine cleaning is essential. Don’t turn your back to it while running!

http://www.prsalmon.org/?p=405

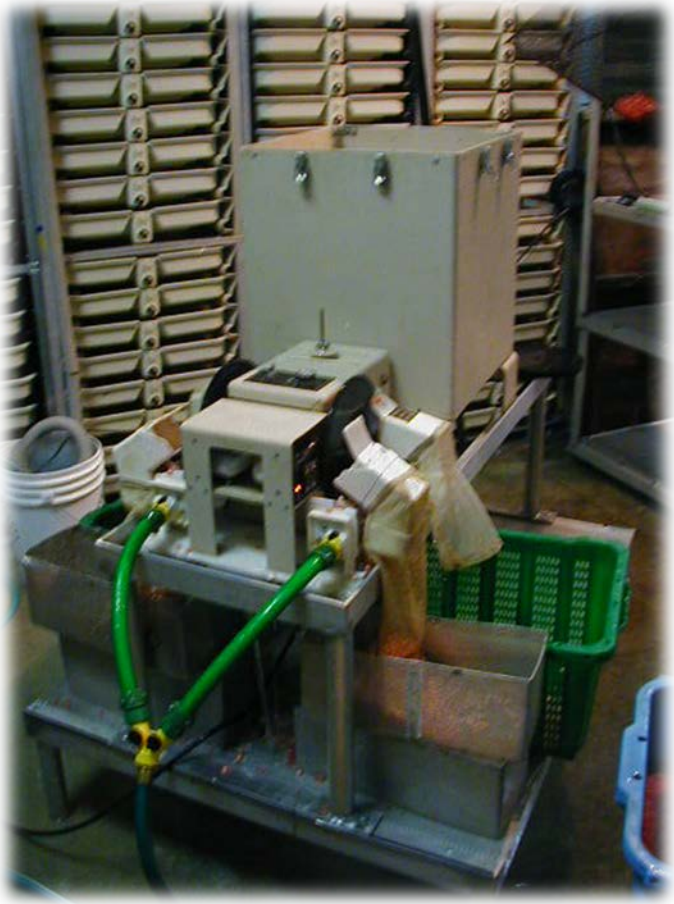
Double wheeled Jensorter – twice the capacity, twice the parts, twice the “challenge”



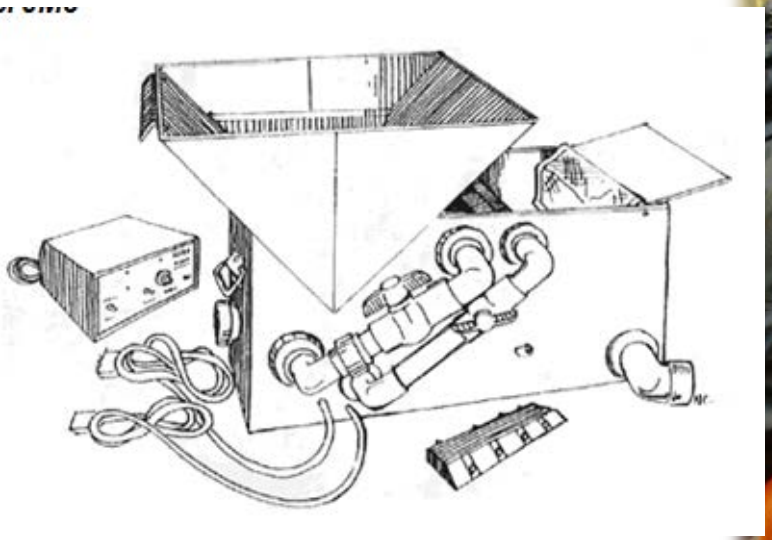
Note the hopper differences

JENSORTER SET UP FOR PICKING CHINOOK EGGS

JENSORTER SETUP



Jensorter JX8 – high capacity (800k/hr) and commonly used in AK



A common complaint with JX8 is “clumping” at the sorting heads

MATH TIME…… AGAIN……

ENUMERATING & ESTIMATING GREEN EGG TO EYED EGG SURVIVAL

There are three methods commonly used to enumerate eggs

- Weight Samples
- Volumetric
- Electronic

WEIGHT SAMPLES

- Always use at least three samples – find the avg
- Two ways to do this: count an exact number of eggs and then weigh OR weigh first and then count
  - Sample 1 100 gms = 222 eggs
  - Sample 2 100 gms = 232 eggs
  - Sample 3 100 gms = 250 eggs
- Don't weigh the water!
- Can you calculate grams per egg from the above data?
- How about eggs/gram?

100 egg paddle helps

WEIGHT SAMPLING SETUPS

Use of electronic balance to get grams/egg

Once gram/egg is found, use larger scale to get bulk amounts

Calculate bulk eggs to put into incubator

- Average weight = .32g / egg
- You need to weigh out 150,000 eggs
- How many kilograms?

VOLUMETRIC - A DIFFERENT METHOD

- Always use at least three samples then average
- Fill a graduated cylinder to 100 - 200ml count the eggs and apply the average to bulk volume measurements
- Example
  - Sample 1 100 ml = 350 eggs
  - Sample 2 100 ml = 330 eggs
  - Sample 3 100 ml = 300 eggs
    - Avg # eggs = 3.26/ml

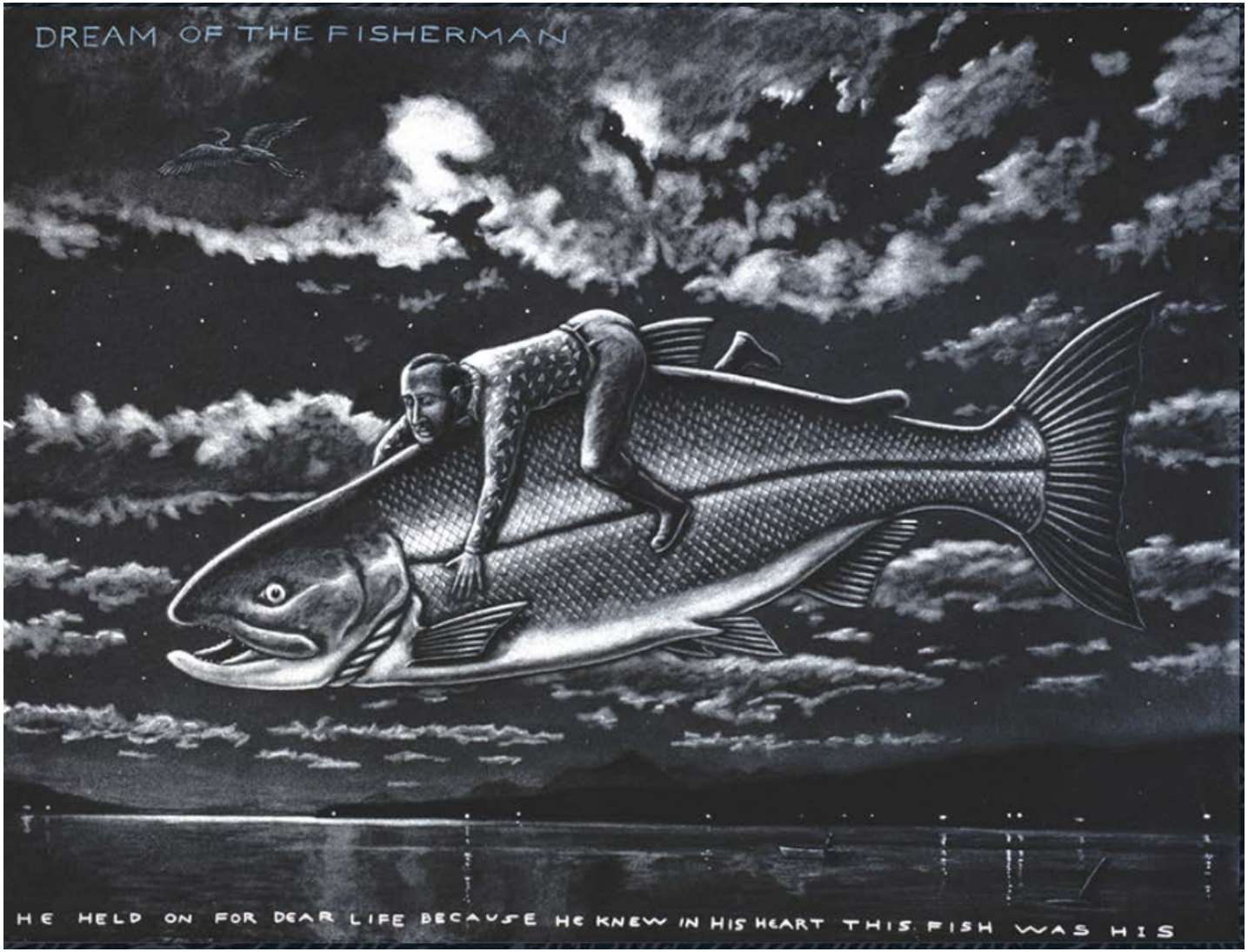
  Bulk sample of 10liters eggs = 32,600 eggs
- Can you calculate how many ml of eggs you'd need to get 100k eggs?

GREEN TO EYE PROCESS

LOADING EYED EGGS

- Usually loaded at 50% of green egg loading rate (remember the charts we saw?)
- Always use substrate, produces a larger healthier fry (your instructor can testify to this!)
- In deep matrix or box incubators load in alternating layers of eggs and substrate
- In NOPADS use hatch screens. Screens allow hatched fry to fall through to substrate leaving behind dead eggs and shells

NEXT WEEK = EXAM 2!



ASSIGNMENT 7 - DUE 11/1/16

- Work through the 8 problems I have listed in the Assignments folder.
- First slide will have the question and second slide the answer
- Do these until you get them all correct – will have similar questions on the exam
- On the honor system
- In the “Assignment 7” section of the gradebook just let me know that you got through them all and I will post the credit.