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Collecting Eggs and Larval rearing

SRI LANKA EXPORT DEVELOPMENT BOARD

National Aquaculture Development Authority of Sri Lanka
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NAQDA

Introduction

- Once spawning is achieved, the resulting eggs and larvae must be incubated
- In general, collecting eggs and larvae will be more efficient and yield better results than more natural methods
- This session examines the key areas for successful larval rearing
  - Egg and Larval Incubation
  - Water Quality for Hatchery
  - Hatchery Feeding
  - Trouble Shooting

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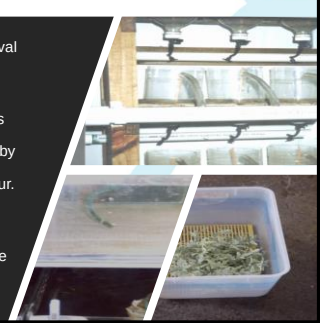
EGG AND LARVAL INCUBATION

Egg Incubation

- Hatching rates and survival can be increased using artificial incubation.
- Also, removal of the eggs from the parents may increase egg production by shortening the time for another spawning to occur.
- This means greater productivity and higher production yields possible



Egg Incubators

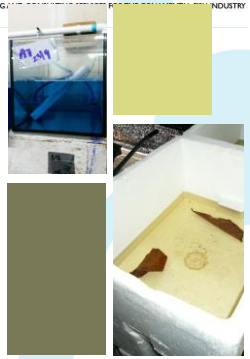
- A wide variety of systems can be used for incubating fish eggs and larvae.
- The use of these incubators is based on egg characteristics such as density, stickiness, and sensitivity of eggs to mechanical shock.
- Bright lights should be avoided – most eggs/larvae are sensitive to light

Poor Hatch Rate

- Many causes for poor hatch rates
- Water quality
  - Some species need very specific conditions
  - General hardness (calcium and magnesium) important for many Sth American species – levels too high will kill eggs
  - Make sure this is right, if not correct it
- Broodstock nutrition
  - Must have a varied diet
  - Include foods high in fatty acids and carotenes
- Fungus/bacterial infection
  - Ensure water is clean – use water from breeding tank
  - Add fungal treatment to prevent issues

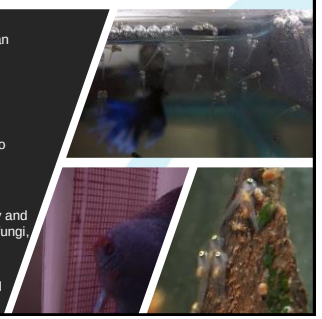
Chemicals to prevent egg spoilage

- Chemicals can be added to water to prevent egg fungal or stop the spread of fungus
  - Methylene Blue 2 to 3 ppm
  - Acriflavine 5 to 10ppm
  - Hydrogen peroxide, formalin can also be used
- Always be careful with dose rates – can vary between species, some eggs more sensitive to chemicals than others
- Indian almond leaf can also work very well



Larval Development and Rearing

- Larval rearing (just hatched) is an important phase of hatchery production.
- Newly hatched larvae are very delicate and require good water quality and husbandry in order to grow and survive.
- Many species are particularly susceptible to poor water quality and infection from various bacteria, fungi, and protozoans.
- High mortalities during the larval stage are not uncommon.

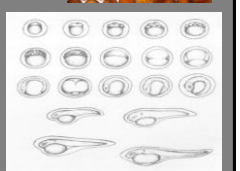


Larval Development

- The egg generally hatches into a free-swimming or floating **planktonic larvae,** although some species there is a large egg sac that prevents movement (eg salmonids) and the larvae have a benthic habitat.
- During this time, the larvae feed endogenously (absorbing their egg yolk reserves).

Larval Development

- The **larva** generally goes through a series of morphological changes, however, these are not as major as those in crustaceans and molluscs.
- The larvae then reaches a stage where it commences swimming activity known as swim-up.
- Swim-up is another critical stage, involves inflation of swim bladder as well

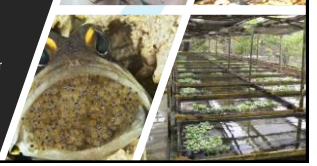


Swim Up

- Only then can the larvae start to feed
- Swim up is when the larvae begin swimming behaviour and typically swim to the surface of the water to take in air to inflate their swim bladder.
- At this stage they also begin to feed exogenously or commence feeding on zooplankton etc.
- After a few weeks the larva finally assume the shape and habit of the adult.
- It can be called a juvenile fingerling, or fry.

Fry and Larval Rearing

- Some species may display parental behaviour.
- These species will look after their offspring in various ways according to their different reproductive guilds
- Survival is generally higher in species with parental care but fish do not breed while caring for a brood
  - Remove brood to increase spawning frequency



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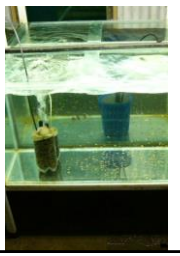
Fry and Larval Rearing

- Many larval rearing systems are very sophisticated, and utilise RAS technology to optimise the environment.
- These systems allow excellent control of water quality, exclude bacteria and other diseases
- Very expensive to set up and operate



Fry and Larval Rearing

However, technology need not be complicated for larval rearing.

Simple tanks / containers most often used

Causes for Mortality

- There are many possible causes of mortality during this phase
- Poor genetics
  - In breeding can lead to expression of 'recessive genes'
  - Lead to deformities and other physiological problems
- Poor or incorrect water quality
  - pH, mineral content
  - Fouled water – high bacterial levels
    - Overfeeding
    - More water changes
    - Filtration needed/ Sponge filters best
- Nutrition
  - Need to ensure good conditioning food for breeders
  - Are you feeding enough food? (full bellies)

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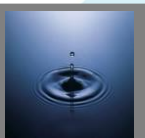
WATER QUALITY FOR HATCHERIES

Water Quality for Hatcheries

- It is essential to know the water quality standards for embryos and larvae of the particular fish species.
- General aquaculture water quality standards can be used as a reference.
- However, some species may have more specific requirements for water quality, i.e. salinity, pH, water hardness and dissolved minerals.



Temperature for Hatcheries

- Most species have a narrow temperature range for spawning, embryo development, survival, and growth of fish larvae.
- Incubation temperature also has a direct effect on the timing of embryonic development and largely determines hatch rate, hatching is delayed at low temperatures, and accelerated at high temperatures.
- The optimal temperature for development varies between species, and may vary between developmental stages.
- Ideally, temperatures should not vary more than ± 1°C (2°F) from optimal.
- Poor embryo survival, low hatch success, reduced growth rates, larval deformities, and increase in fry/larvae diseases often result from temperature fluctuations or temperatures outside the optimum range for the species

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Light & Photoperiod

- Light levels (photoperiod and intensity) during incubation can affect both development and larval survival.
- Fish embryos generally should be kept in either dim light or darkness.
- Light can also be used to synchronise hatching, altering light regime can be used to initiate hatching, swim-up and feeding for many species.

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Suspended Solids

- The presence of suspended solids, whether organic or inorganic can have a significant impact on eggs and larvae.
- Any suspended solids in incoming water will naturally tend to settle out on the egg or larval tanks.
- This will smother or cover them, reducing gaseous exchange and removal of wastes.
- It can also cause eggs to clump or stick together and increase fungal contamination, or even physical damage to the eggs and larvae.
- Water should be clear as possible and free of suspended solids

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Water Hardness and Dissolved Minerals

- Due to the size and permeability of sperm, eggs and larvae are susceptible to the chemical composition of the water.
- The level of dissolved gases and minerals in the water can effect aspects such as:
  - sperm activation and motility,
  - fertilisation,
  - water hardening of eggs.
- Fairly specific conditions are therefore needed for successful fertilisation and water hardening of eggs for some species.
- These conditions may include the levels of dissolved gases levels, pH, salinity, minerals, metals, and particulate matter from rocks, soil, plants and animals.

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HATCHERY FEEDING

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Hatchery feeds

- Suitable food for larvae and juveniles must be produced in sufficient quantity at the time it is needed for feeding
  - If not larvae and juveniles will not grow, starve and die
  - Even temporary lack of feed can cause big issues, particularly at critical parts of development ('the point of no return')
- While most species of ornamental fish will readily accept artificial feeds at market size, the feeding requirements for earlier life stages, particularly larvae and fry may vary considerably
- First feed generally occurs after swim-up when larvae begin to feed exogenously.
- It is important that the first feed be suitable for the species, and in most cases involves some type of livefood species.

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Hatchery Feeding for Ornamentals

- Types of feeds that can be used include:
  - Live feeds consisting of micro-organisms of different species and/or life stages
  - Inert or artificial feeds consisting of natural; feeds such as fish meat, soybean meal, grains etc. or formulated hatchery or micro diets
- This variation is, to a large degree, dependent on the species of fish, their size during the early life stages.

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Hatchery Feeding for Ornamentals

- Due to small mouth size of ornamentals, most depend on live feed for growth and survival – without a suitable live feed source production for most species will be poor
- However, some species are able to feed on artificial diets from first feed such as livebearers which are comparatively large

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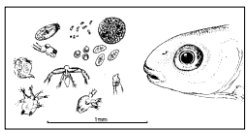
Size of feeds

- Size of food particles is critical and will vary with species and is related to the body length and mouth size (gape) of the larvae
  - If too big then fish are not able to grasp and eat the particles.
  - If too small then particles may be lost and feeding becomes inefficient.
- Feed particles should be around the size of the eye of the fish.



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Selection of live food organisms

- Live food organisms selected for hatchery feeds must
  - Be of appropriate size, motile, palatable and digestible to the larvae
  - Hardy, easy to culture and mass produce
- Nutritional quality must be high
- To improve nutritional quality of live feeds, their diet and culture conditions can be manipulated
- Zooplankton species such as Artemia and Rotifers are easily 'enriched' by feeding booster diets

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Green-water Culture

- Green-water culture is probably the most basic form of microalgae culture.
- It is easily done, any natural water source will have the tendency to go green if left for a period of time.
- Natural fertilisers such as manure or chemical fertilisers can hasten the process.

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Green-water Culture

- A green water culture can be started simply by taking some pond water, or water that has been aged
- The water should be kept in a wide shallow container in the open sun
- The water can be fertilised by:
  - adding some water from an aquarium
  - Adding aquatic plant fertiliser to the water
  - Adding a fertiliser such as Aquasol
  - Add a small amount of manure – approx 1 golfball sized lump per 1 Litres (2 gallon)

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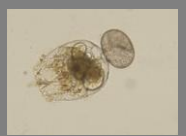
Growing Paramecium & Infusoria

- Paramecia are unicellular microorganisms called
- Ideal larval fish food and are widely used by hobbyists when breeding fish
- The term infusoria is a collective name for many microorganisms and can include paramecium, microscopic algae, bacteria, protozoan, desmids, rotifers and a host of other small organisms.

Growing Paramecium & Infusoria

- A quick and simple formulation for culturing paramecia follows:
- 1. Fill a 2 litre wide-mouthed jar with aged water (any trace of chlorine will kill the paramecium).
  2. Add approximately 30 seeds of boiled wheat, 5-gm of brewer's yeast, and paramecia culture.
  3. Cover and store in the light at approximately 28°C (The culture grows more slowly at lower temperatures).
- The culture should be ready for use in 4 days and remain useable for three weeks or more.
- Instead of boiled wheat you can use Liquid Fry or milk at about 20 drops per litre. Grains of rice can be used instead of the wheat



Daphnia & Moina

- Daphnia are small aquatic crustaceans commonly called water fleas – they are highly nutritious and are an ideal conditioning food
- Daphnia are herbivores or detritivores and feed on algae, bacteria, or decaying organic material in the water column.
- They occur widely in ponds where they can be harvested from for feeding to all types of fish

Daphnia & Moina

- Be careful harvesting zooplankton from wild as they can be diseased and some species prey on small fish.

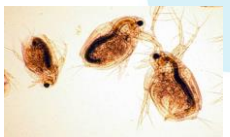


Photo of *Daphnia* and *Artemia* by Shane Willis

Daphnia & Moina

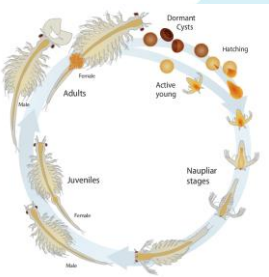
- Daphnia can be grown using greenwater (simply by adding new green water culture to the Daphnia culture 2 to 3 times per week)
- Add approx 1 teaspoon of dissolved yeast to a 100L culture twice a week or when the water clears
- Use a similar culture method to the one used for paramecium

Moina

- Moina is the preferred feed in S.E Asia for feeding fry
- Lesser reliance on Artemia
- Often grown on waste water from piggery with high organic and bacterial loads
- High levels of manure are useful in this
- Can be enriched like Artemia to improve the nutritional quality

Artemia

- Probably the most widely used feed
- Cysts or eggs come in a can
- Hatch after 24 hrs
- Easy and reliable source
- Very high in fatty acids = excellent nutrition for most species
- Without this would be hard to grow many species
- Normally feed 1st Instar stage but can on grow for larger species



Conditions for Hatching Artemia

- Temperature: 25-28ºC (77-85ºF) (must be constant for consistency of hatch time)
- Salinity: 5-35ppt
- pH: Optimum pH 8.0, acceptable range 7.0-8.5
- Dissolved Oxygen: > 4mg/L
- Light: strong, provided continuously at water surface
- Cyst Density: 2g cysts/L
- Hatching Container: conical tanks with aeration supplied at bottom to keep all cysts in circulation and to avoid local drops in dissolved oxygen and increases in carbon dioxide.
- Cysts will start hatching within 12-24 hours (depends on quality of cysts).

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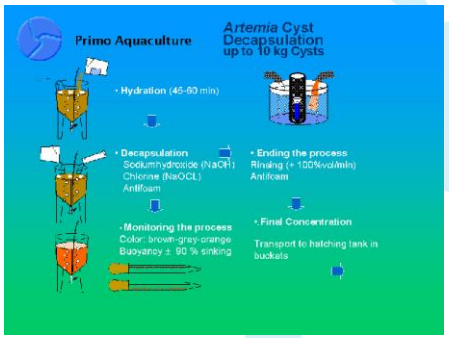

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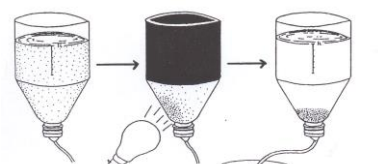
Simple Method for Harvesting Artemia



Pour nauplii into 1 litre of 5ppt saltwater. No aeration.

Blacken upper part of container. Add strong light. Nauplii will swim to the bottom.

Harvest nauplii from bottom. Can repeat again with second harvest after 5-10 minutes

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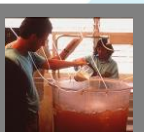
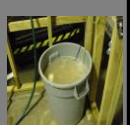
Enriching or Boosting Diets

- The quality of live feeds like Artemia and rotifers may be enhanced by enrichment.
- 2 day old Artemia can be placed into aerated tank
- Add boosting product (many on the market)
- The booster contains high levels of vitamins and fatty acids
- Can give significant increase to growth and survival
- Used widely for shrimp and marine fish hatcheries
- Can be applied to Moina and Daphnia as well



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Artemia Replacement and Micro Diets

- With the rising cost and supply issues with Artemia, artificial diets are used more in many sectors of the aquaculture industry
- These are very finely made micro-pellets
- They are quite expensive, but can be a complete replacement for Artemia
- Becoming popular in many western countries
- Can be used to replace some Artemia and may increase growth and survival


Feeding on the Farm

- Fry need to be fed regularly through the day
  - Lots of feeds – maybe 3 to 4
- Smaller species are generally more difficult to feed, with some of the smallest species requiring several types of live feed during their growth cycle.
- This requirement adds considerably to the skill requirement, labour input, and the cost of production.



Weaning

- Weaning is the process of changing the diet of fish from one type to another. This may be changing to different zooplankton species or from zooplankton to artificial diets.
- Some species are more difficult to wean onto artificial feeds than others, and high mortalities may occur during this stage.
- During weaning it is important that the culture conditions remain optimal (ie. Water quality, fish health etc.) to reduce stress.
- Feeding regimes are summarised in the following table.

Hatchery Feeding for Ornamentals

Species Group	First Feed requirements	Artificial diets suitable	Feed Contents
Barbs	Some require infursoria, Artemia, similar sized live foods, weaning 2nd – 3rd week	Yes	Protein: 32% minimum Fat: NDA
Catfish	Artemia, similar sized live foods, weaning 2nd – 3rd week	Yes	Protein: 32 – 35% Fat: NDA
Cichlids	Artemia, similar sized live foods, weaning 2nd – 3rd week	Yes	Protein: 40 – 50% Fat: 8 – 10%
Goldfish	Artemia, similar sized live foods, weaning 2nd – 3rd week	Yes	Protein: 30 – 38% Fat: low
Bubble nest breeders	Infursoria and similar sized feeds, Artemia from 2nd week, weaning 3rd – 4th week	Yes	Protein: 40% Fat: < 10%
Koi carp	Artemia, similar sized live foods, weaning 2nd – 3rd week	Yes	Protein: 31 – 38% Fat: 3 – 8%
Livebearers	Artemia or artificial feed	Yes	Protein: 40 – 45% Fat: 8%
Tetras	Infursoria and similar sized feeds, Artemia from 2nd week, weaning 3rd-4th week	Yes	Protein: 40% Fat: NDA
Rainbows	Infursoria and similar sized feeds, Artemia from 2nd week, weaning 3rd-4th week	Yes	Protein: Moderate Fat: Low

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TROUBLE SHOOTING IN THE HATCHERY

Trouble shooting in the hatchery

- The following slides detail some potential problem areas for when producing intensively or to watch for in new species
- Some of these problems may be an issue when you begin working with new species
- When working with new species, success may be poor with the original broodstock you work with
- Breeding success often improves with successive generations of fish that you breed at your farm
- Key areas to look at when there are breeding problems are
  - Water quality (pH and water hardness)
  - Broodstock conditioning and in particular feeding

Fish Not Breeding

- Stock are not sexually mature
  - Make sure fish are old enough to breed – this will vary with species
- Breeders are not conditioned properly
  - Different species may need to different times to condition properly for spawning. Check for signs of maturation such as colour, ripeness, breeding tubes
- Fish are not a pair, incorrect ratio of males to females
  - Check to ensure you have correctly paired the fish up with the correct ratio of male and female fish
- Breeding tank not sufficient, may be too small or incorrect spawning substrate
  - Check the spawning requirements for the species and ensure the correct spawning substrate and tank are being used

Fish Not Breeding

- Temperatures and water quality incorrect
  - Check temperature and water quality is correct for the species.
- Environmental stimuli not present or incorrect
  - Check the requirements of the species, absence or presence of light, water change, rapid change in water level or temperatures etc

Eggs Do Not Hatch

- Water quality incorrect
  - Check to ensure water quality matches species requirements – particular attention to general hardness, salt levels (TDS or conductivity) and pH
- Male infertile or not present
  - Check to ensure you have a male present. Try using a different male fish
- Fish were not sufficiently mature
  - Check readiness of fish to spawn – are the fish in spawning colour etc. Try resting for a while and pair them up again
- Lots of fungus on eggs
  - Infertile eggs will become infected by fungus which can spread to and kill good eggs. Try using a fungus preventative such as Acriflavine of Methylene Blue

Fry do not survive

- Broodstock nutrition
  - Ensuring broodstock are fed good quality fish food is important for production of quality fry. Ensure the food is suitable for the species, particularly protein and fat levels.
  - Also ensure vitamin B complex and C are present. Provision of live feed organisms will help improve the diet.
- Water quality not suitable for the species
  - Check water quality to ensure it is suitable, particularly temperature, ammonia and nitrite, pH. If using tap water use a water conditioner that can remove chlorine, chloramines and heavy metals to ensure nothing toxic is coming through the water.

High Number of Deformities

- Nutrition – particularly vitamin deficiency and incorrect fatty acid profile
  - Check how old the food is and how it is stored.
  - Old or incorrectly stored food can lose quality particularly for Vitamin C and B complex. Replace food or fortify with Vitamin C and B complex.
  - Try substituting some livefoods for broodstock conditioning.
  - Check fat content of food – is it correct % of diet for the species, if not replace with suitable diet
- Water quality
  - Check ammonia and nitrites, even low levels can cause development problems for some species of fish. Also nitrates

High Number of Deformities

- Temperature
  - Temperature affects egg and larval development, extreme temperatures outside a species normal range can cause developmental deformities.
  - Check spawning temps for the species and ensure egg hatching and larval rearing are within this range
- In-breeding
  - Close line-breeding (parents to siblings, siblings to siblings) can increase the likelihood of recessive genes that cause deformities being expressed.

Thankyou….

The end….

Any questions?????