Seahorse Manual

2010

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Seahorses are a very challenging species in husbandry and captive breeding terms and over the years there have been many attempts to keep them using a variety of methods. It is Sealife and The Seahorse Trust's long term intention to be completely self-sufficient in seahorses and this manual has been put together to be used, to make this long term aim a reality. The manual covers all subjects necessary to keep seahorses from basic husbandry to indepth captive breeding. It is to be used throughout the Sealife group and is to act as a guide to aquarist's intent on good husbandry of seahorses.
This manual covers all aspects from basic set, up, water parameters, transportation, husbandry, to food types and preparation for all stages of seahorse life, from fry to adult. By including contact points it will allow for feedback, so that experience gained can be included in further editions, thus improving seahorse husbandry.

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Intro

General description of the Syngnathidae family

Seahorses are bony fishes (Teleosts) and belong to the family *Syngnathidae*, which includes pipefish, pipehorses and Seadragons. The primary taxonomic groupings within this family reflect the location and development of the male's brood pouch, head/body axis, development of the caudal fin and the prehensile ability of the tail.

Seahorses and Pygmy Pipehorses are the subfamily *Hippocampinae*; they have a fully enclosed brood pouch with a small opening for the incubation and nurturing of the eggs and fry and an absent or vestigial caudal fin on a prehensile tail.

Pipefish form the subfamily *Syngnathidae*, the head is in line with the body, a small caudal fin is usually present and the brood pouch is formed by a simple or overlapping skin membrane or groove on the ventral side of the male's body trunk or tail. The tail is not usually fully prehensile although in some species such as the Worm Pipefish (*Nerophis lumbriciformis*) the tip can be fully prehensile aiding in gripping amongst algae or substrate. There is a group of Pipefish which form the subfamily *Doryhampinae* which are characterised by mostly exposed broods and a large flag like caudal fin which aids swimming.

The subfamily *Solegnathinae* contains the Seadragons and Pipehorses in which the head is held at a slight angle to the body and the tail is often semi or fully prehensile and the caudal fin can be completely absent. The brood pouch is absent which leads the eggs to be incubated under the tail or trunk region.

Although Seahorses are one of the most recognizable fish species due to their unusual morphology, classification is still in array. To date there are approximately 46 plus recognized species of Seahorse, although as new techniques in DNA analysis and exploration into areas previously unchecked develops, new species are being recognized or discovered.

Seahorses are recognized by their atypical upright shape and swimming posture, horse shaped head and prehensile tail. The head has covered sealed gills with a siphon like hole at the top of each gill cover; the gills have squat grape-like structures allowing them to cope with a variety of water types; from fresh (for very short periods of time) to full saline.

The body has a covering of skin over its skeletal structure, which is made up of a large number of interlocking plates; these plates allow for a variety of movements and give the Seahorse its solid appearance when it has been dried out; much to its downfall in terms of the traditional medicine trade. At the junctions of the interlocking plates the joints often rise to spines or tubercles, giving the individual Seahorses species atypical characteristics which should not be totally relied on for identifying species. As well as the spines and tubercles the skin often forms fleshy tendril like growths or filaments; taken to the extreme in Seadragons that have elaborate fleshy 'paddles' all over their bodies.

The prehensile tail is taken to extremes in some of the species and can hold on in the most extreme environmental conditions allowing the species to be protected from the fiercest of storms; the Seadragons do not have prehensile tails as such and are known to spend their time swimming. The Weedy and Leafy Seadragons have differing styles of swimming motion with the Weedy seemingly gliding through the water like an airplane and the Leafy adopting a 'Rocking horse' movement; both styles reflect the habitat they are known to occupy and allow them to blend easily into the environment.

Distribution of Seahorses is often associated with tropical coastal waters but recent research has shown that they are equally at home in cooler temperate waters. *Hippocampus guttulatus* is found as far North as The Shetland Islands and Norway and *Hippocampus abdominalis* is found to the most southern tip of New Zealand. With a wide latitudinal distribution from 50 degrees north to 50 degrees south and a temperature range from 4º to 30ºC (39-86ºF), makes Seahorses and pipefish one of the most diverse group of fish. It does not come as a surprise that the greatest diversity is within the Indo-Pacific Oceans along the tropical and sub-tropical band and most species are restricted to seawater although there are a number of species such as *Hippocampus abdominalis*, *Hippocampus capensis*, *Hippocampus guttulatus*, *Hippocampus hippocampus* and the *Hippocampus kuda* complex of Seahorses that are often found in fresh to brackish water conditions (for short periods of time). There is even a legend of a fully freshwater species living 150 miles up the Yangtze River, although a specimen is yet to be found in recent years and those that have been found historically are of a dubious source.

Seahorses are found normally in shallow coastline habitats between corals, algae or mangrove roots, as well as open sandy and muddy or in rocky crevices. However they are often encountered many kilometers out to sea on the seabed at depths of over 86 meters (260 feet) or amongst algal or flotsam rafts such as in the Sargasso Sea.

Seahorses are ambush predators preferring to remain still and wait for prey to come to them but when they do swim they can gain remarkable speeds for a relatively slow swimmer over a short distance. The body and fin development favors maneuverability in complex habitats and at speed in open water for short distances, all the more remarkable because they are propelled along solely by the small dorsal fin on their back which flutters like a Hummingbird wing at 35 to 70 beats per second, while the smaller pectoral fins behind the gills provide steering control. As far as is known the anal fin where present has no function and is left over as a vestige from times gone by when the Seahorses ancestors were horizontal swimmers.

The body has spines and cirri (although some species and older animals often lack them), along with pigmented cells in their skin that enable them to alter their colour and/or external peripheral shape giving them an excellent ability for camouflage; this combined with the upright stance makes them almost impossible to spot when sat still in their natural habitat. The capacity to change colour is used as a form of communication usually between males and females during courtship displays to signify breeding condition.

Seahorses use camouflage to conceal themselves when waiting for or approaching prey; they are typically carnivorous, feeding upon a wide range of crustaceans such as copepods, amphipods, isopods and caridean, euphausid and mysid shrimps. They are opportune feeders and will feed at all times but are predominantly diurnal or crepuscular with the exceptions of species such as Hippocampus comes (the Tiger Tail Seahorse) which is thought to be nocturnal, although captive observations seem to counter this.

The eye of the Seahorse can see in full color but is adapted to see at very low light levels and this is one reason why many of the Seahorse species cannot cope with bright lights or flash photography in captivity; the exception to this are those species that are found on brightly lit coral reefs.

During feeding when the prey is sighted the Seahorse leans forward gives an almighty suck and the food item disappears into the snout, as they do not have teeth the food is disintegrated as it is sucked in through a combination of force and by drawing the food item through the small mouth opening which is located at the front end of the snout. The actual process of sucking is aided by a small 'bag-like' arrangement under the tube snout which flicks down aided by a trigger that moves at lightening speed; as this bag opens creating a small vacuum the siphon like tubes in the sealed gills expel the water contents of the gills creating a greater suck than could normally be expected for such a small area. To stop the food disappearing into the gills there are internal gill rakers which stop large particles going into the delicate gill structures; only allowing small particulates to be expelled through the gill siphon, often giving the appearance of smoke; was this the basis of the fire breathing dragon legend?

The Seahorses digestive tract is very simple consisting of a tube from mouth to anus and lacking a full stomach; this simple system allows for the processing of food items but its simplicity means that often food is passed out of the anus only partially or not digested at all, which leads to one of the many problems in keeping and breeding Seahorses.

Seahorses vary greatly in size from the diminutive Pygmy Seahorses at just 3 cm (1¼ inches) from the top of the head down to the end of the tail to the Greater Seahorses represented by the *Hippocampus ingens* and *Hippocampus abdominalis* which can reach a massive 30 plus centimeters (12 inches) in length; males and females are often similar in size. The most obvious difference in the sexes is the notable brood pouch in the male but having a brood pouch does not necessarily mean the male is sexually mature. The sexual maturity of females is not obvious externally, although a thickening of the front of the abdominal cavity (from top to bottom) can indicate the presence of eggs. This area is also ideal in identifying a male's partner when eggs have been transferred from female to male, the front cavity sinks in as the eggs are exchanged and will 'refill' several hours later when the next brood of eggs are available.

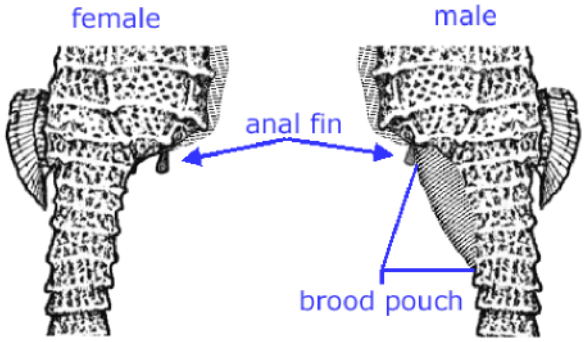


Fig. 1

The breeding season varies with location and may be influenced by environmental factors such as photoperiod and temperature, the duration of the season is thought to be longer in tropical than temperate waters; work by The Seahorse Trust has shown that temperate species such as *Hippocampus guttulatus* and *Hippocampus hippocampus* are known to breed all year around although the largest and more frequent broods certainly do occur during the warmer months of the year. It is certainly true that almost all tropical species breed frequently all year around and in greater numbers taking advantage of the larger amounts of plank tonic food available with which to feed their offspring.

The Seahorses famous LIFE long monogamy is not necessarily true at all times and can be as short as weeks or even seasons; although work in the field is ongoing and this will be proved or disapproved as time goes on.

In Seahorses the males brood pouch is the most developed of the Syngnathidae, forming a vascularised enclosed pouch with a muscular opening, the eggs are fertilised just prior to their deposition into the males' pouch. After the deposition of the eggs in the brood pouch, it is sealed and the eggs are then isolated from the external environment. Within the brood pouch, the extensive capillary network allows for oxygenation and removal of waste products by diffusion. The male provides nourishment to the young although they also have the equivalent of a yolk sac; however he also contributes calcium and alters chemical composition of the pouch fluids according to the embryo's needs. It is perhaps this paternal care of the developing young that has endeared the Seahorse to many people.

A typical male is able to breed continuously throughout a breeding season with the gestation period lasting approximately 9–45 days depending on species. The number of fry being developed in the pouch is directly dependent on the size of the parent species; Seahorse fry across all species tend to be similar in size (between 8 and 15mm (¼ to ½ inch) and so a small species such as *Hippocampus denise* can only fit up to 20 fry inside their pouch; they are actually one of the few Seahorse species that have an internal brood pouch, whereas a large species such as *Hippocampus ingens* can fit up to 500 (or more) fry in the brood pouch but there are unusual species such as *Hippocampus abdominalis* that can produce up to 1500 fry in each brood due to the inclusion in the pouch of sub divisional membranes that increase the surface area within the pouch which allows them to greatly increase the amount of fry embedded in the membranes.

Seahorse fry are fully developed and quite precocious when born and are more than able to feed and survive amongst the plankton during their first weeks of LIFE where they eat large quantities of plankton, after which they start to settle on the seabed and set up territories. Even being fully formed and very capable of surviving there is a high degree of predation on the fry and so out of every one to two thousand fry only one or two will survive to maturity.

In temperate areas Seahorses hold territories in shallower areas seasonally and will move into deeper water once the sea state changes and the winter storms start to pound the shallow coastal areas. The only exception to this is in areas that are sheltered from strong winter storms where Seahorses tend to be found throughout the year.

Conservation

In the wild Seahorses are threatened by a whole series of factors, such as traditional Chinese medicine, personal aquarium keeping, tourism and habitat destruction. For example, around 20 to 60 million Seahorses are captured every year for traditional Chinese medicine but there is no basis in science to suggest Seahorses and related species having any health giving properties and the use of Seahorses is based on the male's ability to get pregnant.

Seahorses are also taken dead for the curio trade as mementos of seaside visits and the dried Seahorses are often described by misinformed shop owners as being bycatch or washed up specimens; this is not the case and approximately 1 million animals, usually ones too small for the traditional medicine trade are taken for this appalling trade as well as shells, starfish, corals and urchins amongst many other creatures, all of which needs discouraging through education.

The keeping of Seahorses by private keepers can have beneficial effects in Seahorse conservation by the input of dedicated keepers but at the moment the taking of Seahorses from the wild is outstripping the number of animals produced by dedicated breeders; there are up to 1 million animals per annum taken from the wild to supply the private and public keeping of Seahorses throughout the world

One of the ways to conserve and preserve Seahorses is through captive breeding (aquaculture projects) and raising public awareness, here at SEA LIFE we have now implemented our own captive breeding programmes that will hopefully eliminate the need to display wild caught specimens. A decision has also been made by the SEA LIFE ethics committee to be completely self-sufficient in Seahorses and other vulnerable species within the next few years.

Manual

This manual has been put together to assist in the captive breeding work that the SEA LIFE Centres are undertaking to conserve Seahorses and related species by being completely self sufficient in Seahorses and not taking them from the wild except to bring in fresh blood lines and to bring in new species in need of captive breeding projects.

It is a guideline to SEA LIFE Centres and others to enable them to be able to breed their Seahorses for display and for the breeding programs but it will need to be updated periodically and you can help in this by sending feedback to Robin James, Emily Madge, David Garcia or Neil Garrick-Maidment (see below); by giving your successful or unsuccessful results back, the manual will be updated periodically giving access to the latest information.

Use the manual by referring to each section as you are setting up your breeding programs and follow the guidelines as best as you can, do not worry about bringing in new ideas; remember if they do or do not work let Robin and Emily know.

Husbandry

Husbandry

The definition of husbandry is the prudent management or conservation of resources. In Seahorse husbandry we find a mix of many different things including four important parts, Water Condition, Life Support Systems, Feeding and Diseases. To conserve our resources and make for good and prudent husbandry we have to look for all these parameters; if one is not good enough, then you put at risk the welfare of the whole resource.

Tank set up

Seahorses tend to be a sedentary species often holding small territories in the wild and are considered to only need a small area to live in but they do in fact require quite a large area to move in throughout a 24 hour period, so a tank which has a large base area is important to allow for natural behaviour but for breeding Seahorses height is also vital to allow adult Seahorses to be able to complete their courtship display in the water column; so a tank that is as high as it is wide is vital with a 60cm x 60cm x 60cm (2' x 2' x 2') size being the minimum size for a pair of Seahorses. Having said that Seahorses tend to be more social in captivity than is assumed in the wild and it is common to increase density of numbers more than would be tolerable in the wild, when setting up your tank, start with fewer numbers of animals and slowly increase, this will show up stress and the quality of the animals but do not be tempted to overstock tanks as this will cause stress leading to a number of disease and social problems which in extreme cases can lead to death. Where possible have equal numbers of males to females or more males than females but not the other way around.

Tank size and make up is often dictated by what is available but always bear in mind the Seahorses' needs when you are deciding where and how to house them.

Once you have the tank situated making sure it is not next to a busy door or somewhere where there is a rapid change of light, the next decision is filtration and tank layout; these two are linked because if you use an under gravel filter this will then dictate what you use on the base of the tank. See the chapter below on filtration when deciding which filtration to use.

In the wild Seahorses live on a variety of differing types of substrate so when deciding what you will use in the tank do some research on the species you are about to house and try and replicate this (bearing in mind filtration needs), not only does this allow the species to behave in a more natural way but with the correct tank labeling it will educate the public on the species you are keeping.

In the wild Seahorses have a patchy distribution; density can be high in some locations and very sparse in others. For our Seahorses it is not a problem to live in tanks with a high density as long as the numbers are built up slowly but a high density of individuals in our tanks could be detrimental to the water quality. It is recommended for you to have no more than 3 adult individuals together per 100 litres (22 galls.)

It is vital that each Seahorse tank is individually heated and filtrated; they are a species that are highly susceptible to disease and so a barrier needs to be formed between each tank to stop any potential spread throughout your collection; each tank will need its own set of cleaning equipment.

Décor

Marine algae are very useful when keeping Seahorses, not only do some of them such as the tropical Caulerpa filter the water but they also allow for much more natural behaviour of the Seahorses themselves and aesthetically they are more pleasing than plastic plants. If artificial plants are the only option then you should provide a number of upright areas for the Seahorses to cling to; a natural position for Seahorses is to sit with the tail horizontally gripping a plant or other object.

The decoration and substrate is different for display tanks and for only breeding tanks. In display tanks, you can use imitation sea grass, cords and ropes (anything without metal, where they can grab) and for substrate you can use coral chips, coral sand or gravel; in breeding tanks you can use just air hoses where they can grab; it is advised to not use substrate, it's easy to clean and siphon the tank.
When designing your Seahorse tanks make sure you have more than enough uprights for the Seahorses to cling to, stress is caused when several animals are forced to share the same upright.

Lighting

Lighting is crucial when keeping Seahorses, their eyes are designed to see well in full colour in very dimly lit areas

To illuminate our tanks we can use High Quality Indexes, Light Emitting Diodes or Fluorescent aquarium tubes (type Sun-light). Seahorses don't need special light equipment but be careful and don't use stark light for the tanks. Something really important about the light is the photoperiod; by playing with it and the temperature we can induce the courtship behaviour, there is more information in the breeding section.

Spotlights can be used effectively for Seahorse tanks creating a moody reflective style of lighting which gives the Seahorses the option to go into lit areas or darker areas; if this is coupled with lots of upright holdfasts it can give an interesting tank.

As you do your research into the species, you should keep adeptly the photoperiod in relation to itself in the wild and set your light timers to reflect this.

Filtration

Like every other sea water tank the water needs to be filtered and this can take many forms from sponge filters, canister filters to under gravel filters but whatever is used you must take into account the needs of the animals. There is much discussion about the pros and cons of various filtration systems but what is vital is that it is kept simple; this way if it goes wrong and it invariably will, then it is easy to fix.

Biological filtration such as air driven or power head under gravel filters are ideal for Seahorses but a word of caution if you are using air to drive the filter make sure it produces large bubbles not fine bubbles as supersatuation of the water can lead to gas bubble problems under the Seahorse skin.

A successful useful type of filtration for tropical Seahorses is to use a refugium separate from the main tank that has a bed of Caulerpa algae growing in it; leave the light on in the refugium 24 hours a day or reverse the lighting sequence from the main tank. You can also use this tank to breed copepods, Mysis and other food types in.

Water flow is vital to Seahorses in the wild they live in areas of the seabed that are often buffeted by strong currents and this is one of the reasons why they have a prehensile tail; species such as the Pygmy Seahorse live on sea fans which are positioned on the edge of open reefs and have a strong flow of water going over them which brings their food plankton to them. Do not be worried about using strong flows of water and where you can create a multi directional flow in the tank but remember to set up the tank with areas where if the Seahorse wants to he/she can get out of the current and water flow.

There are a number of types of filtration listed, use one that you are happy with but just a short note, using certain types can cause problems if they are used incorrectly, these are noted below.

Please note that some filtration systems work so well that living organisms such as Caulerpa Algae do not thrive in them, these include Skimmers and Ultra Violet- sterilization.

Biological-filters can take many forms from internal under gravel filters to external canister filters. Make sure that the flow is able to turn the water over twice a hour but do not turn it off for long periods as the bacteria can decay and cause serious water problems. Just a note on using air driven under gravel filters make sure you use a large air bore rather than one that produces fine bubbles as these tend to cause gas bubble problems in the Seahorses.

Skimmers have to be installed in the reservoir, so we are sure that the air bubbles cannot go into the main tank for the same reason that large air bubbles should be used in undergravel filters.

Ultra Violet Sterilization is really usefully to reduce the number of some bacterial groups and other micro organisms (some virus and fungi). You have to be sure that it is correctly installed (direction and flow) and be careful with electricity, if in doubt don't use it.

Ozone is a strong form of filtration and not recommended for Seahorses.

Temperature control

You will be keeping temperate or tropical Seahorses so according to which species you keep you will need either a heater or a chiller. There are a number of ways of using both these methods so use one you are happy with and can control correctly.

With the chiller make sure that the return water from the chiller is dissipated evenly through the tank (use a spinner or similar) and that it does not concentrate in one area creating a 'cold' spot in the tank and make sure it does not return directly onto an area the Seahorses congregate in.

When heating (or chilling) your tanks make sure it is precisely thermostatically controlled to stop any major variables in the temperature that might cause stress in the animals. If you use a glass clad heater than make sure it is protected to stoop the Seahorses clinging to it and burning themselves.

Temperature

At the SEA LIFE Centres we have two types of Seahorse, "Temperate" North Atlantic and South Pacific Seahorse (*Hippocampus hippocampus*, *Hippocampus abdominalis*, *Hippocampus. guttulatus* etc…) and "Tropical" Caribbean Sea and Tropical Indo-pacific ocean Seahorse (*Hippocampus reidi*, *Hippocampus erectus*, *Hippocampus kuda* etc…). In each sea there are different temperatures between winter and summer days (and night and day); like a lot of other marine animals Seahorse behaviour is controlled by these changes. For the Temperate species you can change the temperature between 16°-18°C (43-64 F), and for Tropical between 19°-26°C (66-78 F) throughout the year to replicate the wild temperatures, this coupled with light duration will recreate wild behaviour and increase the success in getting your Seahorses to breed.

Water quality

Water quality is the most important factor in an aquarium, if the water is not good enough, the fish are prone to stress and then they are not strong enough to resist the parasites and diseases that are ALWAYS in the tanks.

To ensure the welfare of your animals, you need to ensure the best water quality. To be sure your tanks are in the Good Water Quality range, you will need to monitor temperature and salinity daily, and the water chemistry weekly.

Keep your water parameters in levels from Good Water Quality (0, 0 mg/l Ammonia, <0,1 mg/l Nitrite and <50 mg/l Nitrate) so you reduce the stress factor in your tanks. Temperature, Salinity and pH are obviously important factors too. You have to be sure that you give your animals the appropriate parameters.

Salinity: Seahorse are present in almost all the seas of the world, some species can go into estuaries with a lower salinity (10-15‰), but the most of them live in "normal" seawater (between 30-36‰).

PH: The pH in all oceans is between 7,5pH and 8,4pH. In your Seahorse tanks, you have to keep the pH similar to the pH in the Seahorses natural sea environment, do your research for optimum conditions.

The best method to have a Good Water Quality is "don't wait for the parameters to be poor do water changes regularly". It is recommended that you do a water change weekly in your tanks, make sure that you change at least 10 to 20% of the water but importantly make sure the water you put back into the tank matches the water parameters and temperature of the tank you take out.

Feeding

Seahorses are carnivorous predators, feeding upon a wide range of crustaceans such as copepods, amphipods, isopods, and caridean, euphausid and mysid shrimps. It is best to feed adult individuals with live food (Artemia, Mysis, ghost shrimps and amphipods) and/or frozen food like Artemia, Mysis and krill. The feed frequency is 2-3 times a day for adult individuals, some centres have one day a week as a no feed day to replicate conditions in the wild if you do this make sure your Seahorses are in optimum condition and can cope with this.

For fry feeding please look at the breeding section.

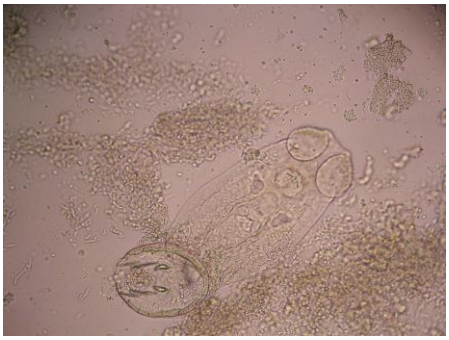
There is a section below for the cultivation of various types of food types.

Diseases

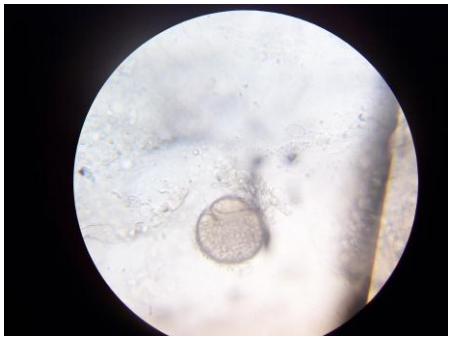
In this section you will find the common Seahorse diseases but the first step against a disease is observe and know the normal behaviour of your animals, so you can see if something is not normal (maybe courtship behaviour or a colour change) or wrong, such as the animal has air bubbles under the skin. Some signs of disease are:

- A general lack of interest in food is a sure sign that something is bothering your Seahorse.
- Itching behaviours such as individual's using their tails to scratch at their head and body suggests that the problem is due to parasites, but can equally be that the stocking levels are too high, particularly with juveniles.
- Floating at the surface indicates that your Seahorse is suffering from some sort of gas-bubble disease.
- Bulging of the eyes is called Exophthalmia, though not a disease as such it can be caused by a bacterial infection, trauma or gas bubbles.
- White patches on the skin and discoloration of tail tips and snouts are also a sign of a bacterial infection, commonly *Vibrio* sp.. This is often secondary to injury and is usually associated with protozoan parasites

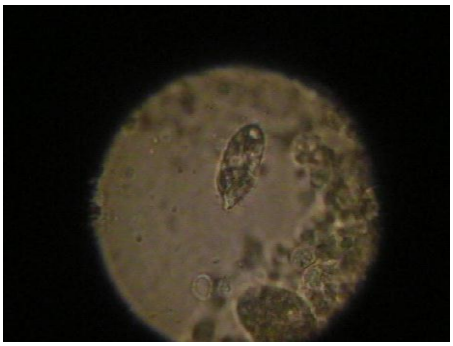
If your Seahorse exhibits one of these signs, please make a skin scrape/skin press, take pictures and write an AHEF (Animal Health Enquiry From) and send it to DDD (Displays Development Deptpartment). Here you have some sample pictures of parasites under the microscope and external symptoms:



Gill fluke



Cryptocarion irritans



Uronema – like parasite

External signs of Uronema

External gas bubble

Internal gas bubble

Once the problem has been identified there is a wide range of treatments available. The following table illustrates some of these. The treatments given are in order of severity. For example doing a freshwater dip on a suspected protozoal infection is less harmful to the Seahorse than Formalin. If the freshwater dip fails then move onto Formalin. Please before you do a treatment contact DDD with a completed AHEF.

Disease	Treatments	Dosage
Protozoans (e.g. *Cryptocaryon, Uronema* and *Brooklynella*)	Freshwater Dips	Warm the fresh water to the same temp as the tank and buffer the pH to the same level as the tank. Place the individual in the water for 2-3 mins. Repeat the process every other day for three days.
	Formalin (37-40%)	Add 0.1ml/l to the tank for 6 hours, turning off any trickles. Repeat after a week. Give a 50% water change between treatments as Formalin oxidises in water.
Gill Flukes	PraziquantelDroncit, Solupraz, Bancid, Cestocur)	As a bath – protocols will be issued out from DDD to Sites when we recommend use via the AHEF system
Bacterial Infections	Oxytetracycline (Aquatet)	Add 100mg/l to the tank for a period of 7 days. Make sure a 50% water change is given daily. Dim

	Oral Enrofloxacin (Baytril) (in food) or injectable Baytril (as a bath)	lights and add an air stone Treatments are carried out as per DDD recommendations. If Oxytetracycline fails, trying another antibiotic such as Baytril may prove effective. This will be issued as part of AHEF's process through veterinarian advice.

Gas-bubble Disease is caused by either bacterial infection (in which case waste gases produced by the infecting bacteria become trapped under the skin) decaying embryos in the males pouch or by gas super-saturation in the water in which the Seahorses reside. This can either be internal or external and the Seahorse will exhibit these symptoms.

- Severe bloating of the entire body
- External gas bubbles (pouch, tail and snout)
- Exophthalmia
- Buoyancy and movement complications

Bubbles/air in the pouch or under the skin can be released by following these simple steps; however the use of MS222 on Seahorses should not be attempted without consulting DDD and then only in the most extreme cases:

1. Remove the Seahorse from the tank and place into a 2 litre (this is not equivalent to 2 litres) bucket also dip out another bucket of tank water.
2. Put on some examination gloves.
3. Hold the Seahorse vertically between thumb and forefinger with the pouch facing outwards.
4. Using a glass pipette, place the tip of it into the pouch and move around gently whilst trying to massage the bubble out.
5. This must be done underwater.
6. Add a few drops of injectable Baytril into the pouch via the pipette (and a syringe) to prevent infection before returning the Seahorse to its tank.
7. Please be sure that treatments are carried out under consultation with DDD/IZVG through AHEF protocol.

It is important to remember that your Seahorse can transmit ZOONOTIC diseases (those that can transfer from animal to human) such as *Mycobacterium* sp. Ensure you use gloves when handling the Seahorse (and dispose of them when you have finished), be careful when you are siphoning and be extreme carefully if you have a cut on your skin.

Seahorse cultivation

In this manual you'll find information on how to breed the four most commonly kept species at SEA LIFE, *Hippocampus abdominalis*, *Hippocampus erectus*, *Hippocampus reidi* and *Hippocampus kuda*, future updated versions of the manual will include other species. You can help with this by sending your experiences into Robin James, David Garcia, Emily Madge and Neil Garrick-Maidment (contact details below).

When breeding Seahorses some husbandry procedures and technical details are the same for all species; this common care is described in the first part of this section. The following chapters concentrate on detailed breeding information for each species, this is a guideline only.

To breed Seahorses successfully you have to remember that the first step is in the good husbandry of the parents; good water quality, a low density in your tank is desirable (3 Seahorses per 100 l [20 galls] sex ratio of 2:1), appropriate tanks and a good quality food.

Courtship and Gestation

If your Seahorses are healthy and the conditions in the tank are good then they will start to take part in courtship behaviour which should lead to pregnant Seahorses and then fry. If the Seahorses don't begin the courtship, you will have to look at the setup of the tank and adjust the parameters: change the photoperiod and the temperature of your tank for your animals to see if this stimulates them, try changing the layout of the tank, make sure there is sufficient space to allow the courtship dance (a tall tank is vital) and most importantly ask advice from others that have been successful with that species. Just occasionally some individuals are not compatible so introduce new animals to see if this stimulates them into breeding (remember to quarantine them first). It is vital to observe your animals, particularly the behaviour exhibited during courtship including the various phases of colour-changing, posturing, head-pointing or flicking and swimming together.

When successful courtship happens there will be a transfer of the eggs and sperm between male and female. They swim together vertically and mirror each others behaviour and at the last moment as they rise in the water column (it's very important that your tanks are deep enough, more than 60 cm [2feet]) they turn towards each other and the female will put her ovipositor into the males pouch and deposit a large number of eggs into him; at the same time the male releases sperm as the eggs are deposited. A common problem in the successful completion of egg exchange is the depth of the tank; if it is not deep enough they cannot turn in time for the exchange to happen.

Fertilisation of the eggs appears to occur just prior to their deposition into the male's pouch. Once the female's fertilized eggs are deposited in the brood pouch, it is sealed and the eggs are then isolated from the external environment. Here, the developing young are kept by the male until they are ready for birth and are released from the brood pouch. This paternal care of the developing young has endeared the Seahorse to many people.

Within the brood pouch, the extensive capillary network allows for oxygenation and removal of waste products by diffusion.

The duration of pregnancy in Seahorses varies between approximately 9–45 days, depending on species and water temperature with time for gestation decreasing with increasing temperature. After this time, the male will produce approximately 300 juveniles per brood, from 8 to 16 mm (¼- ½ inch) length.

Food and feeding procedure

After the Seahorse babies (fry) are born they are developed and precocious enough right from birth to hunt for their own food. In your fry tanks give them zooplankton in the form of Artemia naupilli, rotifers or copepods, please look for the best food type for your fry in the food chapter below. The feeding frequency for the fry has to be between 5-7 times a day at a feeding rate of 100 to 200 Artemia naupilli per Seahorse fry per day (approximate 0.05 gram of cysts per Seahorse per day). You'll find in the following chapters the SEA LIFE procedures for decapsulation and enrichment of Artemia and the Phytoplankton and Rotifer protocols.

Recent work by The Seahorse Trust has shown that Seahorse fry are easily confused by over feeding the tank; in the wild plankton is a scarcer commodity than in captivity and it is seldom found in such concentrations as we can provide, so try to replicate this in your fry tanks. Only feed enough food to be consumed within the two hours before the next feed and siphon the old food out before you feed the next amount. This will allow the newly moulted, nutritionally low and therefore harder to digest naupilli to be removed, allowing your Seahorse fry to be eating softer and more nutritious naupilli. By doing this they will derive much more nutrition from a smaller amount of food as it is fully digested as it passes through the gut. Keep in mind that newly hatched Artemia naupilli only has up to 2 hours worth of nutrition in it before it is not worth eating or needs enriching and that they only form mouth parts at about 10 hours so there is a 6 hour period where they cannot ingest food and it has to absorbed through the skin which is nutritionally a lower source of food for them.

There have been some attempts to feed Seahorse fry with only frozen or artificial food but the survival rate using this method in Seahorses at a month old is almost zero, so it is vital to feed live food at the beginning and try to get them onto dead food as quickly as possible. Most Seahorse fry can take dead food (preferably dead Cyclops) at 20 to 30 days old (sometimes earlier) and dead Mysis (finely chopped at first and whole after a short period) a few weeks later but do not be tempted to just switch food from live foods to dead too quickly or without an overlap period otherwise the disruption will lead to malnutrition and death. Just a tip put some dead Mysis juice into your fry tank from day one to aid in the production of gut bacteria (flora) in the Seahorse fry; they will come to associate the 'scent' of the juice with feed times and will be stimulated to look for food when you put it in the tank. This aids in getting the fry to switch to dead food in a shorter period of time

There have also been some successful attempts using a mix of live food and artificial/frozen food with the first 10 days feeding only live food and after that a mix of both (50%) leading to full dead food within a month. It is vital to monitor your Seahorses very closely to see that they are feeding correctly and more importantly passing waste material and when you are persuading them to feed on dead food to make sure they feed correctly and are actually ingesting the food. It is common for Seahorse fry to strike at food, looking as though they have eaten only for it to be left discarded on the tank bottom.

It is recommended you siphon the tank bottom (approximately 10%) approximately two hours after they have been fed and refill the tank with fresh salt water (this water has to have the SAME parameters than the water on the fry tank).

A common problem, which usually happens during the first weeks, is that many Seahorses stay at the water surface and a few days later they die. There are two reason that explain this problem, firstly hyperinflation of the swim bladder (this may hinder normal swimming, or in extreme cases result in floating fish and increased mortality) this has been attributed to gas supersaturation caused by such factors as inadequate water depth or excessive air ingestion and ingested air bubbles. Normally this happens because of initial swim bladder infections and the babies go to the surface to hunt the naupilli (the Artemia has a positive phototropism and they are attracted by light because light represents the presence of food in the form of phytoplankton) and there they feed on the naupilli together with air bubbles.

It is recommended that you cover the top of the fry tanks with a dark plastic and illuminate the tank solely by the side (or just ambient room lighting); this will keep the naupilli in the middle of the tanks and you reduce the possibility of ingested air bubbles and create surface water movement as well. When you use this method the Seahorses have a higher than normal possibility of survival.

TIP: Feed the Seahorse fry with Artemia franciscana naupilli (length 0,46 mm at 12hrs) the first week; this naupilli is smaller than A. salina (length 1,27 mm at 12 hrs). This tip is really useful in feeding Seahorse fry with a size less than 8 mm (¼inch) such as *H. kuda* and *H. reidi.*

Fry tanks and Stocking density

In this subject there is not a fixed rule you can use PVC or glass tanks between 5 to 200 l (1-40 galls) you have to find the best choice for you at your SEA LIFE centre but you have to have bear some things in mind:

- The tanks have to be cleaned and siphoned each day, don't use substrate or excessive decoration in tank the Seahorse fry don't need it, just a plastic plant or something where the fry can attach their tails; keeping the tank empty of decorations makes your work easer.
- Don't use fine air bubbles to move the water; leave just the airline in the tank without a stone (or use a large bore air stone) and keep the airflow to approximate one bubble per second.

- Cover the top of the fry tank and illuminate it on just the side and use a long photoperiod between 15 Light: 9 Dark to 16 Light: 8 Dark; (a night light in the fry room is also helpful allowing the fry to feed during the night, bearing in mind they have excellent vision in low light levels) this long day length gives the Seahorses more time to hunt and they have a constant energy/food input.
- There is a fine balance to follow with Seahorse fry; it is vital that they do not expend more energy in getting and digesting the food than they do in catching and eating it.
- Keep the temperature at a constant level and DON'T use a chiller direct into the fry tank. To allow for a heat exchange you can use two tanks one inside the other (see figure 2). The inside tank contains the Seahorses with an airline and the outside tank contains the heater or chiller; by doing this you can keep the temperature at a constant level. The tanks can be linked as illustrated in fig. 2.

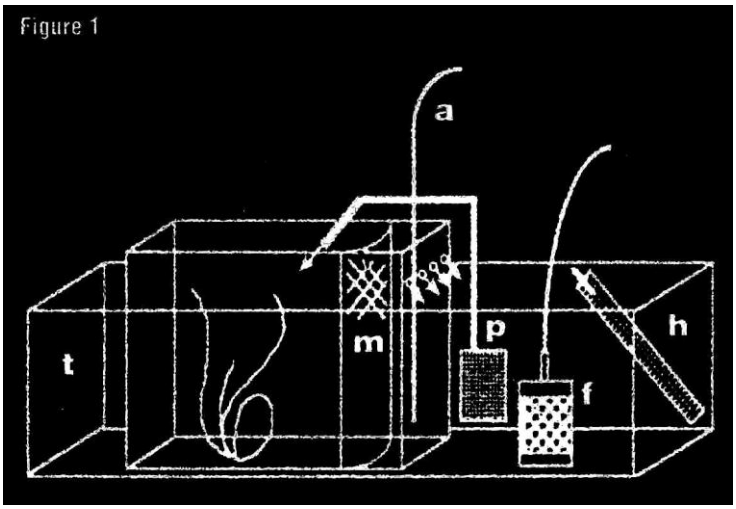


Figure 2: Diagram of fry tank set up.

It is important not to try and rear more fry than you can produce food for, so pick out 20 to 50 of the strongest looking fry (swimming strongly, solid looking bodies) and put them into your fry system and concentrate your resources on them.

Fry husbandry

The first husbandry procedure with Seahorse fry is in catching them out of the breeding tank and transferring them to the fry tank (one technique would be to transfer the father to the fry tank before he gives birth). Please don't use a net to catch them, use a siphon pipe and siphon them into a bucket to transfer them and then use the siphon pipe to put them into the fry tank from the bucket. You have to be careful using this procedure but it is the least harmful method of transfer and it stops the fry from ingesting large amounts of air. The water parameters in the fry and brood tank have to be exactly the same as the brood tank to avoid stress which might lead to death. Don't use fine air bubbles in the fry tank (the animals can ingest them), just a "big" air bubble from an airline each second is enough to move the water or use a large bore air stone. Seahorse fry cope very well with strong water movement and work by The Seahorses Trust has suggested that vigorous water movement in the tank actually aids digestion by moving the body and allows the fry to build stronger body muscles making them stronger adults.

When transferring fry take your time and make sure they acclimatise slowly. After transferring the fry, cover the tank, illuminate it from the side (or ambient room light is better) and feed the babies with naupilli and/or rotifers.

The fry tank should be equipped with a preconditioned sponge filter (this will contain natural bacteria ideal for breaking down nitrates and nitrites) and an air line with just a few plants to hang onto; if you use a small square of mesh attached to a sucker stuck to the side of the tank, this works very well and leaves the bottom of the tank clear for cleaning and for the fry to see the food, especially when they get onto dead food.

When you clean the tank do this just prior to feeding the fry, siphon the bottom of the tank and try and remove any surplus food left over from the previous feed, just as a tip if you want to attract uneaten live Artemia, put a bright light to the side of the tank which they will be attracted to and you can then siphon them as they bunch into a group.

The movement of your hand in water has to be really slow so there is little risk in injuring the animals.

A potential hazard in the tanks are small hydroids or young Aiptasia anemones both of which can either sting or kill the fry but they also eat large quantities of fry food making difficult to judge how much to feed the fry.

If you have more than one fry tank, please use different hose, buckets, etc for each tank, a sterile procedure is essential in your husbandry procedures to stop cross contamination.

Species section

Hippocampus abdominalis (Big-Belly Seahorse)

Description

The *Hippocampus abdominalis* is one of the largest Seahorse species with an adult height of up to 35 cm (14 inches), although 25 to 30 cm (10-12 inches) is more common. The colour is pale near white to mottled yellow to variable brown with dark spots and splotches on the head and trunk; the tail alternating dark and lighter bands and the dorsal fin is mottled. Males have more dark blotches (spots) than females and commonly have a yellow slash near the top of the pouch. The most distinguishing feature is the male's extended white pouch which can accommodate up to 1500 or more fry at any one time due to the inclusion of water.

Distribution

This species comes from Southern Australia and New Zealand in coastal water not deeper than 50 metres (150 feet approx). Its habitat is among algae, Sea grasses and rocky reefs in shallow water sandy bottom, macro algae stands; attached to sponges and in estuaries. They cope very well with strong water flows and in a tank situation it is vital to create areas where they can get out of the flow. In the wild they feed on small crustacean such crabs, amphipods and isopods; in captivity we feed them with live food like Mysis and enriched adult Artemia, as well as frozen food.

Water parameters

Temperature	10 – 20° C (for breeding 14-19°C 57-66 F))
Salinity	32-35% (this species has been found in estuaries with a salinity about 10‰!)
PH	7.8-8.2
Ammonia	0.0 mg/l
Nitrite	<0.1 mg/l
Nitrate	<50 mg/l
Photo period	Variable but should compare with northern Europe throughout the year.

Breeding information

Gestation approx 30 days

Hippocampus abdominalis is sexually mature when they reach a height of approximately 9 cm (3½ inches)(top of the crown to the end of the tail) they breed in spring through to the late summer (October to January, in the southern hemisphere) where they form groups in the wild and are known to be sexually polygamous in captivity.

The diameter of the egg averages 1.8mm and usually the brood size is about 300 to 500 individuals with a length at birth of about 16 mm (½inch) although due to the unique set up of the pouch which includes extra membranes to increase the surface area this allows them to have larger numbers of fry which can be up to 1500 or more at a go. The gestation is usually 30 days but this can vary either way for a few days depending on the temperature of the liquid and the number of fry held in the pouch.

To stimulate the courtship behaviour increase the temperature to 19°C (66°F)and lengthen the photoperiod to 15 L : 9 D slowly over a three week period prior to wanting them to mate. This should stimulate courtship behaviour which is seen as various phases of colour changing, mirror posturing, head pointing or flicking, and swimming together.

Like all Seahorses it is possible to see the moment the male has taken on board the eggs by the increase in the size of his pouch and to identify which female deposited the eggs because she will sink in along the front edge of her frontal chest region until new eggs fill the area. Phantom pregnancies do occur in all Seahorses and although the pouch is full of water nothing will come of it, this is quite common with young Seahorses.

Feeding the fry

The *H. abdominalis* fry are big enough to feed on newly hatched Artemia naupilli. and there are usually no problems with this, feed five to seven times per day and remember to siphon the tank before each feed. Make sure you add the juice of dead Mysis into the water from day one and add dead Cyclops from day 10; the circulation created by the air stone should allow the Cyclops to be held in suspension (a kriesel system is ideal for rearing Seahorse fry in) encouraging the Seahorse fry to think it is moving and making them strike at it as though it is live food. The Artemia can be enriched with Selco or algae (see below) to increase growth rates and give the fry extra nutrition and after day 7 start to increase the size of the Artemia they are feeding on, this will allow the Seahorse fry to take in more nutrition for less energy expended (very crucial in the rearing of Seahorses). See the chart below as a guide for the various stages of Artemia feeding. After 4 to 6 weeks the fry will be taking dead Mysis shrimp and can be weaned fully off the Artemia

Remember, to illuminate the fry tanks from the side and cover the top of the tanks. Use the table as a reference only; it's not a fixed rule. Monitor the fry and give them an appropriate food type. Introduce the chopped frozen food slowly and never be tempted to just stop one type of food and switch them to another, their digestive systems cannot cope with this and it will more than likely lead to death.

Fry	Food type
0-7 days old	Newly hatched Artemia A. franciscana naupilli, 5-7 times per day.
1 week old	Start to increase the size of the Artemia to 2 to 3 days
2 weeks old	Start to increase the size of the Artemia to 3 to 5 days Add dead Cyclops to the water at each feed or live Cyclops if you can get it.
3 weeks old	Start to increase the size of the Artemia to 5 to 7 days Add dead Cyclops to the water at each feed or live Cyclops if you can get it.
8-10 weeks old	Use just enriched 7 day old Artemia and increase the dead food which should be Cyclops and Mysis. Once you are sure they are feeding on dead food then decrease and eventually stop feeding live Artemia.

Hippocampus erectus (Lined Seahorse)

Description

The base colour of lined Seahorses varies from ash grey, orange, brown, yellow, red or black; brown some individuals tend to be paler on the ventral side. There is often a characteristic pattern of white lines following the contour of the neck, tiny white dots on the tail and this Seahorse may have darker or paler 'saddles' across dorsal surface often in line with the more enlarged body rings. It is a stocky solid Seahorse that usually grows up to 16cm (6½inch) from the top of the head to the end of the tail, although there are exceptions to this with one individual at Weymouth that reached almost 26cm (10¼inch).

After four months when they are approximately 7.5 cm, they are ready to breed. Wild individuals normally begin the courtship on April; however, animals living at or near the equator are breeding all of the year. If you keep your animals for a photoperiod of 14:10 and a temperature of 25-26°C (77-79°F), they are able to breed all around the year.

Distribution

The lined Seahorse is a fairly common resident of tropical and temperate waters ranging from Florida to Nova Scotia, the Gulf of Mexico, the Caribbean and the South American coast. They dwell in coastal waters where they can anchor themselves to seaweed, reefs or man-made structures using their prehensile tails. They have been found offshore to depths of 70 m (210Feet) associated with soft corals and benthic algae. They tolerate a wide range of salinities (10 to 36 ‰) and temperatures 8 to 28°C (47-84°F). Normally we keep at tropical conditions, 23-26°C (70-76°F), 32-35 ‰ and 7.8-8.2 pH.

Water parameters

Temperature	23-26° C (70-76°F)
Salinity	32-35%
PH	7.8-8.2
Ammonia	0.0 mg/l
Nitrite	<0.1 mg/l
Nitrate	<50 mg/l
Photo period	12L:12.D

Breeding information

Gestation approx 20-21 days

In the lined Seahorse the gestation period is approximately 20 to 21 days and they are easy to breed. After giving birth to between 50 and 400 fry the adults in common with other Seahorses have nothing more to do with them.

The fry are fully formed and approximately 8 to 13 mm (¼-½ inch)(from top of the coronet to the end of the tail and like most tropical Seahorse have a very upright swimming motion; it is actually possible to identify the species of Seahorse from their fry by observing the swimming motion, some species hold the tail out behind, others hold it horizontally to the right to the left and some species curl it up in line with the body.

It is very important that the naupilli is decapsulated first as the cyst can cause intestinal blockages in newborn *H. erectus* that result in death. Also by decapsulating it means that the fry can derive more nutrition from the food as the naupilli has not had to expend so much energy getting out of its egg case.

Fry	Food type
0-7 days old	Newly hatched Artemia A. franciscana naupilli, 5-7 times per day.
1 week old	Start to increase the size of the Artemia to 2 to 3 days
2 weeks old	Start to increase the size of the Artemia to 3 to 5 days Add dead Cyclops to the water at each feed or live Cyclops if you can get it.
3 weeks old	Start to increase the size of the Artemia to 5 to 7 days Add dead Cyclops to the water at each feed or live Cyclops if you can get it.
8-10 weeks old	Use just enriched 7 day old Artemia and increase the dead food which should be Cyclops and Mysis. Once you are sure they are feeding on dead food then decrease and eventually stop feeding live Artemia.

Hippocampus reidi (Slender Seahorse)

Description

Other names for *Hippocampus reidi* are the Brazilian Seahorse or Long Snout Seahorse which is a direct reference to its long narrow snout which is longer than in most Seahorse species. The Slender Seahorse has a wide range of colours from black, brown, and reddish-maroon to yellow and gold. Most of the body is mottled dark brown to black and covered with small dark and white spots. The tail is often heavily dotted in white. It may have bands across dorso-lateral surfaces, and males commonly have a prominent chest keel with a black line on the margin and their bodies are more mottled dark brown than females. The cheek and eye tubercles are broad, and the snout is long and narrow. They normally grow between 9 to 17.5 cm (3½-6¾inches) and like all Seahorses can grow for the full length of its LIFE time and in undisturbed areas Seahorse do and can attain quite large sizes.

Distribution

They are distributed from North Carolina, United States to Rio de Janeiro, Brazil and the Gulf of Mexico; here we can find them at depths between 2 and 60 m (6-180 feet) and found in small groups near to algae, sponges and sea grass, they have been found attached to floating marine algae such as Sargasso and other flotsam.

This Seahorse lives amongst various habitat types from macro algae through to open sandy areas, they cope very well with strong water flows across areas like sea grass meadows, although in a tank situation it is vital to create areas where they can get out of the flow.

Water parameters

Temperature	22-28°C (70-84° F)	(optimum 25-26°C 77-79° F)
Salinity	25-36%	(optimum 32-35 ‰)
PH	7.8-8.2	
Ammonia	0.0 mg/l	
Nitrite	<0.1 mg/l	
Nitrate	<50 mg/l	
Photo period	12L:12D	

Breeding information

Gestation approx 14-17 days

Captive Slender Seahorses have been known to reproduce throughout all the months of the year but little is known of breeding behaviour in their natural state. Observations of wild animals indicate that they form exclusive pair-bonds and this seems to be backed up in captivity.

The distribution area of *H. reidi* and *H. erectus* is nearly the same and so the husbandry and fry rearing parameters are almost the same. We can induce a courtship behaviour by using the same photoperiod and temperature; at the beginning use a photoperiod of 12 L:12 D and 23°C (70°F) and over a period of three weeks increase it to 15 L:9 D and 25-26 °C (77-79° F).

The brood size varies from 200 to 600 individuals with a size at birth of 7-9 mm (approx ¼ inch). The small size of the babies is a big problem for the first few days; to feed them use rotifers enriched with phytoplankton (like Isochrysis or Tetraselmis) mixed with newly hatched Artemia franciscana naupilli (less than 24 hours), after a few days you can use newly solely hatched Artemia. After 4 days or so, reduce to zero the rotifers (remember never switch from one food to another on any Seahorse species without a swap over period.) and then just use newly hatched Artemia. Keep this going for 7 days and then start to increase the size of the Artemia by giving them 2 day old enriched Artemia for a few days and then 3 day old enriched etc. (see guide below)

After 3 weeks put in dead Cyclops but remember to remove uneaten food before feeding the next batch, by the 8 to 10 weeks your Seahorse fry should be weaned from live food to solely dead food but make sure they are feeding on dead food before you stop using live. If you want breed *H. reidi* and other Seahorse species you have to make sure that you have stable and productive rotifers and phytoplankton culture at your site; if you don't, the fry will probably die.

Fry	Food type
0-4 days old	Newly hatched Artemia (A. franciscana naupilli, 5-7 times per day and rotifer enriched with phytoplankton
4-7 days old	Newly hatched Artemia A. franciscana naupilli, 5-7 times per day
1 week old	Start to increase the size of the Artemia to 2 to 3 days
2 weeks old	Start to increase the size of the Artemia to 3 to 5 days Add dead Cyclops to the water at each feed or live Cyclops if you can get it.
3 weeks old	Start to increase the size of the Artemia to 5 to 7 days Add dead Cyclops to the water at each feed or live Cyclops if you can get it.
8-10 weeks old	Use just enriched 7 day old Artemia and increase the dead food which should be Cyclops and Mysis. Once you are sure they are feeding on dead food then decrease and eventually stop feeding live Artemia.

H. kuda (Yellow Seahorse)

Description

The name Kuda Seahorse is attributed to a group of 10 Seahorse species which has meant that there is much confusion over this group of animals. *Hippocampus kuda* can vary greatly in size and color and come with a wide variety of common names, work is being undertaken at present by Project Seahorse to clear this up but it may be some time before we have the definitive Kuda Seahorse. There are many common names given to Kuda Seahorses the most common of which is the Yellow Seahorse which can often be a misnomer as they are not always yellow and the size varies greatly depending on the source of wild animals. Size-wise Kuda Seahorses can be as small as 10 to 11 cms (4-4¼ inch) and as large as 20cm (8 inch) from the top of the coronet to the end of the tail.

As a group of species they come from costal waters not deeper than 50 metres (150 feet) but are normally found between 1-10 m (3-30 feet) deep. Their habitat is coastal bays and lagoons, in sea grass and on floating weeds; sandy sediments in rocky littoral zone; macro algae and sea grass beds; mangrove branches, muddy bottoms, estuaries, harbours and the lower reaches of rivers (they can inhabit brackish waters).

Distribution

The *H. kuda* is one of the most widely distributed Seahorses in the Indo-Pacific Ocean from the Red Sea to Japan, India to Australia.

Water parameters

Temperature	23-26°C (71-82°F)	(optimum 22-28°C 70-84° F)
Salinity	32-36%	
PH	7.8-8.2	
Ammonia	0.0 mg/l	
Nitrite	<0.1 mg/l	
Nitrate	<50 mg/l	
Photo period	12 L:12 D	(16L:8D for breeding)

Work by The Seahorse Trust has shown that we tend to keep Seahorses too warm in captivity and so it is worth experimenting with temperature; a slightly cooler tank keeps diseases under control.

Breeding information

Gestation Approx 25-28 days

They breed all year around like most tropical species and can produce between 200 and a 1000 fry at any one time and in some rare cases the male will produce considerably more, when born the fry range in size from 6 to 10mm from the top of the head to the end of the tail.

If your Seahorses are not breeding then check the conditions and match what occurs in the wild to stimulate them. Increase you tank conditions to match the wild conditions over a period of four or five weeks increasing the photoperiod to 16 L:8 D and the temperature to 26 °C (82°F).

The fry prefer to stay on the surface of the water for the first two-three weeks after this they descend to the bottom, make sure that you provide for this in holdfasts, so for the first few weeks attach suckers to the sides of the tank with small squares of mesh for them to hold onto and then provide artificial plants on the tank bottom allowing them to hold on as they settle down to the bottom.

The *H. kuda* fry present the same problem as *H. reidi*, they are too small. To feed them we need a stabile and productive rotifer and phytoplankton (like Isochrysis or Tetraselmis) culture.

Remember to monitor your animals closely at feed time and make sure that they are eating food. After 10 weeks they are able to feed Artemia adult and small Mysis.

Fry	Food type
0-4 days old	Newly hatched Artemia (A. franciscana naupilli, 5-7 times per day and rotifer enriched with phytoplankton
4-7 days old	Newly hatched Artemia A. franciscana naupilli, 5-7 times per day
1 week old	Start to increase the size of the Artemia to 2 to 3 days
2 weeks old	Start to increase the size of the Artemia to 3 to 5 days Add dead Cyclops to the water at each feed or live Cyclops if you can get it.

3 weeks old	Start to increase the size of the Artemia to 5 to 7 days Add dead Cyclops to the water at each feed or live Cyclops if you can get it.
8-10 weeks old	Use just enriched 7 day old Artemia and increase the dead food which should be Cyclops and Mysis. Once you are sure they are feeding on dead food then decrease and eventually stop feeding live Artemia.

KEY ADVICE

- Ensure the Good Water Quality is the best possible doing regular water changes (up to 20-30%) and siphon twice a week or more for your adult tanks and several times daily for the fry tanks.

- Ensure the Good Water Quality in the fry tanks by siphoning every two hours before feeding, removing the uneaten food and waste products with the siphon and then top up ensuring the water has the right water parameters.

- Be sure that your tanks are suitably set up for your particular Seahorse species.

- Be careful with the other species that you keep together with Seahorse as tank companions. Don't keep species that could predate on the fry or species that could be dangerous for Seahorse (for example: sea dahlia).

- Observe your animals to recognise normal behaviour, this is the first step to preventing diseases and to know if the courtship behaviour has begin and is right for the species you keep.

- Cover the top of the fry tank and illuminate them from the side.

- Monitor the fry closely during the feed time and make sure that they have the appropriate food types, quantity and that they feed regularly.

- If you want breed *Hippocampus kuda* or *Hippocampus reidi,* be sure that you have a stable and productive rotifer/phytoplankton culture to ensure continuity of food.

- If you have any questions or feed back then please contact:-

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Remember this manual is **only as good as the feedback** given by everyone within SEA LIFE working on Seahorses; it will be updated periodically, so if you have some feedback then please let us know.

Food cultivation and feeding regimes

Rearing Seahorse Fry on Artemia using a 5 pot rearing system

It has long been thought that rearing Seahorse fry on Artemia is impossible because they do not hold enough nutritional value. This is partially true but if dealt with in the correct way then Artemia can be used very successfully.

Artemia is highly nutritious when it is first hatched out but the nutritional value drops very quickly to virtually nothing within 3 hours; added to this the carapace (shell) hardens during this 3 hour period and makes it very difficult to digest by all but the most harden fish fry.

The traditional way of cultivating Artemia is to put the eggs into a pot of seawater, aerated at 28ºC (80ºF) and wait for them to hatch 24 hours later. This one pot of Artemia is usually used for a 24 hour period and is quite often stored in a refrigerator until it is used; this is where the nutritional problems occur unless the Artemia is enriched. Once enriched (often for another 24 hours as the mouth parts do not form until 10 hours old) it often proves to be a poor source of food as it is by this point either too large or the carapace (shell) of the Artemia is too hard. By being too large or having too hard a carapace it means that fish fry like Seahorses cannot digest it as they have an extremely poor digestive system; which is not long enough to allow it to digest the hard carapace and derive enough nutrition from the naupilli.

By changing the protocol of hatching the Artemia it is possible to use it as a highly successful form of food especially for Seahorses; the only draw back with this system is that it is labour intensive.

The set up

We use a 5 pot system for the hatchery, each one labelled 1 to 5; all five pots sit in a glass fish tank with 4 inches of water in it. This water is heated by heater/thermostat to 28ºC (80ºF) and each of the pots is heated in turn by this hot water. Each pot also has an airline with an air stone into it.

The protocol

Start with pot 1 and fill it with saltwater and add your Artemia eggs (you can use unshelled eggs to increase the nutritional value higher.). 2 hours later repeat the process with pot 2 and then each 2 hours after repeat with the rest of the pots; it is possible to use more pots if your needs require it.

If you have set up pot 1 at 8am then 24 hours later at 8am the Artemia should have just hatched out, this is then the time to feed pot one to your fry; it is crucial that the time between hatching out and feeding is kept to a minimum.

Harvest the Artemia by letting the pot stand and the Artemia will sink to the bottom and the egg shells will rise to the surface. Use a siphon through a very fine mesh trap to siphon them out of the pot, once you have enough Artemia then give them a quick wash under a freshwater tap and then feed the Artemia to your Seahorse fry.

It is crucial that you only feed a small amount of Artemia to the Seahorse fry; enough to be eaten by the time the next pot is fed to the fry (2 hours later).

Once you have fed this pot of Artemia to the fry do not be tempted to keep what's left over, use it for some other fish species but don't be tempted to feed it later on to the Seahorse fry.

Once you have harvested pot 1 immediately set it up again ready for the next 24 hour period.

Every time you go to feed the next pot of Artemia be sure to siphon the tank of any debris from the bottom of the tank and crucially remove any left over Artemia from the tank. This can be done by putting a light to the side of the tank to attract the Artemia to it then siphon them from the tank. This is important as you do not want the Seahorse fry to be eating older hardened and nutritionally low value Artemia.

After feeding the Artemia, remember to top up the water you have removed from the fry tank, this way you will be changing water throughout the day lessening the build up of harmful nitrites and ammonia in the water which is better for the Seahorse fry.

As a side note we usually use water from the adult's tank to replace and indeed start up the fry tank; this is already filtered and as we use natural seawater it is a better source of water for the fry; they appear to do better in natural seawater than artificial.

These steps should be repeated every 2 hours with pots 2 then 3 then 4 then 5 and any others you add to the system.

This process should be repeated on time every 2 hours as the age of the Artemia naupilli is important for its nutritional value and carapace hardness.

Decapsulation of Artemia Cysts

Advantages:

The main advantages of decapsulation are as follows:

- No hard unhatched cysts floating about the tanks fouling the water. The hard cysts if eaten are difficult to digest and cause problems.
- There is also some proof that it increases the hatch rate because the young do not have to use as much energy when hatching.
- The Artemia contain a higher level of nutrition for a longer period due to the lack of need to 'fight' there way out of the egg cases.
- The Decapsulation process also sterilises the surface of the Artemia egg.

The process involves dissolving the hard outer shell using a strong sodium hypochlorite solution; the embryonic cuticle is resistant to the solution.

Equipment and Chemicals
1 bucket 10 – 15 litres (2-3 galls approx)
Measuring jug
Stirring rod
Ice packs or some kind of cooling material
Scales
Artemia net (50 micron mesh)
Sodium hypochlorite solution 12% spectrosol
Sodium hydroxide pellets
Safety Goggles
Lab coat or protective apron
Vinyl or Latex gloves
Vapour mask

HEALTH & SAFETY- WORK IN A WELL VENTILATED AREA, WEAR PERSONAL PROTECTIVE EQUIPMENT (PPE). You must carry out risk assessments for your working environment.

The decapsulation procedure should be carried out as follows:

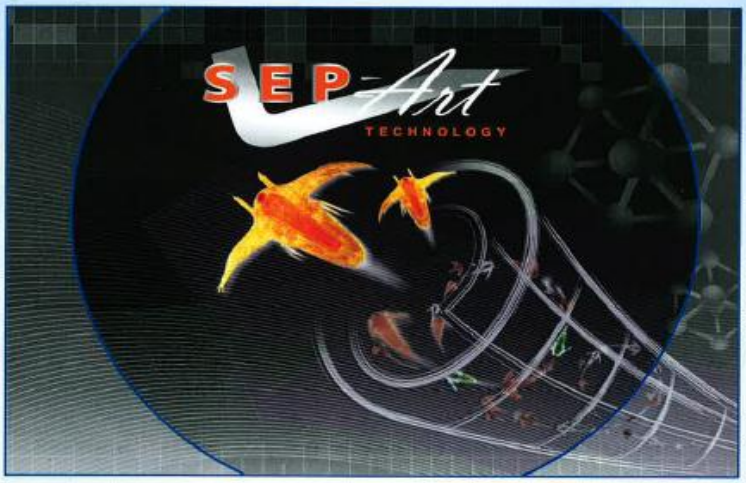
1. Hydrate 200g (½lb approx)) of capsulated Artemia cysts, in approximately 20 litres of warm freshwater 25-30 degrees C (77-86ºF) for 1 to 1.5 hours, no more.
2. Once the cysts have finished hydrating they should be drained in an Artemia net while the chemicals are prepared.

3. The decapsulation procedure should be carried out in a well-ventilated area and with extreme care, latex/vinyl gloves should be worn throughout.
4. Mix 27 grams of SODIUM HYDROXIDE with a small amount of fresh water, add 3 litres of warm sea water, then add 1 litre SODIUM HYPOCHLORITE and mix well. Opened and unopened sodium hypochlorite should be kept well sealed and refrigerated.
5. Stand the bucket of solution in a sink of cold water, put an ice pack into the sink, this acts as a cold water bath and prevents the decapsulation solution from over heating.
6. The hydrated cysts can then be added to the solution, this should be continually stirred throughout the reaction, which should take about 10 to 15 minutes (maximum). The reaction starts with minute bubbles forming on the surface of the solution; there is also a change in colour from brown to grey as the cysts begin to whiten. You will also detect a change in smell from chlorine to marzipan. Check the progress of the reaction throughout, put some cysts into a clear vial or net and check colour, white cysts are halfway through the reaction and the decapsulation should be allowed to continue for another 5 minutes, additional sodium hypochlorite may be required to accelerate the reaction. The reaction is complete when a noticeable colour change to orange has occurred. This will take no more than 15 minutes and should occur in 10 minutes.
7. Once the reaction is complete the cysts should be poured through an Artemia net and rinsed thoroughly with fresh water, allow cysts to drain thoroughly several times during rinsing and finish when the bleach smell has gone.
8. Leave the cysts in the net to drain and sit net on some tissue to absorb excess water.
9. The cysts can then be stored 'dry' in an airtight container.
10. The cysts are viable up to 2 weeks after decapsulation if stored correctly.

Alternatively:

This system is available and saves a lot of time and unwanted cysts.

SEP-*Art* SEPARATOR
THE REVOLUTIONARY TOOL
FOR THE PRODUCTION OF *ARTEMIA* NAUPLII



International patent pending: EP08151381.4 & corresponding patent applications

The SEP-*Art* technology transforms regular cysts into an *Artemia* product with a set of desirable characteristics. Through this technology INVE now introduces a product that guarantees on top of the other characteristics of the existing products, a perfect separation after hatching, independently of its origin or hatching quality.

INVE has developed the SEP-*Art* SEPARATOR, which facilitates the harvesting of *Artemia* nauplii originating from SEP-*Art* cysts. It is highly efficient and can handle large volumes allowing a fast and complete separation of full and empty cysts/cyst shells from the hatching medium. The SEP-*Art* SEPARATOR can easily separate *Artemia* nauplii from the cysts regardless of the hatching quality.

Application of the SEP-*Art* technology in the hatchery ensures:

- **Complete separation of *Artemia* nauplii.**
- **No decrease of viability and vitality during harvest.**
- **Maximized hatching and biomass output.**
- **Minimum labor input during harvesting.**

The SEP-*Art* SEPARATOR is:

- **Suitable for harvesting all types of SEP-*Art* cysts.**
- **Easy to install and use.**
- **Made of special saltwater resistant materials.**

FUNCTIONAL PARTS OF THE SEP-*Art* SEPARATOR

The SEP-*Art* SEPARATOR consists of three different parts, which need to be installed :

- small inlet pipe.
- 1m-pipe equipped with magnets.
- rust-resistant stand and screws.

INSTALLATION OF THE SEP-*Art* SEPARATOR

Fix the small pipe firmly in the coupling sleeve present on the 1m-pipe. In order to secure the SEP-*Art* SEPARATOR, a rust-resistant stand should be installed onto the 1m-pipe. Marks are available on the 1m-pipe of the SEP-*Art* SEPARATOR to give it immediately the perfect inclination for harvesting *Artemia* nauplii

POSITIONING OF THE FUNCTIONAL PARTS

CAPACITY

The SEP-*Art* SEPARATOR can handle a wide range of volumes and concentrations. The flowrate applied to separate the nauplii from the cysts is preferably set on 8 litres/minute
The maximum volume of hatching medium that can be handled by one SEPARATOR without interim cleaning depends on the quality and separation behavior of the cysts (total number of cysts present among the nauplii after removal of the aeration in the hatching tank). Maximum amount of cysts trapped in the SEP-*Art* SEPARATOR is the equivalent of 600-800 g dry cysts.

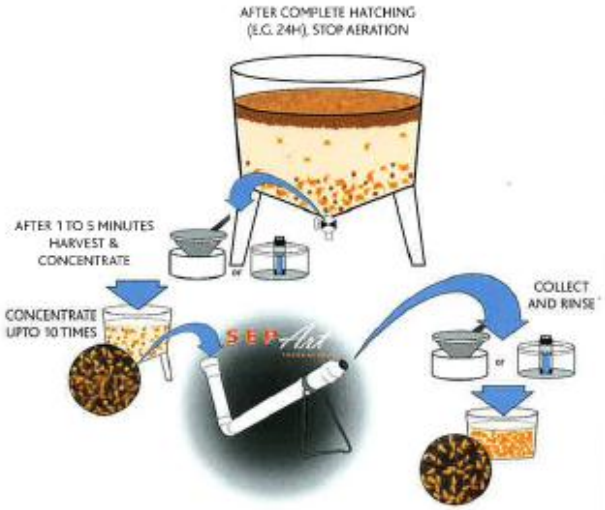
Handling 

USE & MAINTENANCE

Harvest

With hatching conditions close to optimal, the hatching will be completed within 24h.

- Stop aeration.
- Preferably cover top of the tank.
- After 1-5 minutes harvest the entire tank (except for the empty cyst shells floating at the surface) using a sieve or concentrator rinser.
- Transfer the concentrated nauplii and unhatched cysts to a new tank and top off with clean water to about 1/10 of the initial volume in the hatching tank.
- Harvest the nauplii by applying the SEP-*Art* SEPARATOR. Cysts and shells will be retained in the SEP-*Art* SEPARATOR, nauplii will pass the system and can be collected at the outlet of the SEP-*Art* SEPARATOR.
- Rinse the collected nauplii thoroughly with sea water.



Cleaning SEP-*Art* SEPARATOR

- The SEP-*Art* SEPARATOR can be cleaned by turning over the device. This way the water and cysts that remain in the tube of the flow through device are removed.
- Applying a strong water flow makes sure that all remaining cysts are removed from the magnets present inside of the SEP-*Art* device.
- Subsequently a disinfection procedure can be applied.

Important Note:
After use wash the SEP-*Art* SEPARATOR using fresh water/sea water with a disinfectant to clean the device. **Do not use acid to clean.**

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For more information, please contact your local
INVE Service Center or visit us at www.inve.com

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Rotifer Manual

What are Rotifers?

Rotifers make up a phylum (Rotatoria) of microscopic or near-microscopic organisms. Most rotifers are around 0.1-0.5 mm in length and about 90% of the species live in freshwater environments and a few in saltwater. Some rotifers are free swimming in the water column, others move by inch worming along the substrate, and some are sessile.

For us, the important rotifer group are the family Brachionidae this family belongs to the marine plankton group and it is one of the most important families of plankton's predators as a food source. Brachionus plicatlis is one of the species with special interest in aquaculture; this live food source has contributed to the successful hatchery production of more than 60 marine fish species and 18 species of crustaceans. The size of B. plicatlis is 60μm for males and about 240 μm for females.

The rotifer's body is differentiated into three distinct parts (see Fig 1):

THE HEAD - Here is the rotatory organ or corona. This corona is composed of several ciliated tufts around the mouth and is where its name of Rotatoria (bearing wheels) originates. This retractable corona is used for locomotion and the whirling water movement which facilitates the uptake of small food particles (algae and detritus).

TRUNK - Here we find the digestive tract, the excretory system and the genital organs. A characteristic organ for the rotifers is the mastax (*i.e.* a calcified apparatus in the mouth region), that is very effective in grinding ingested particles.

FOOT - is a ring-type retractable structure without segmentation ending in one or four toes.

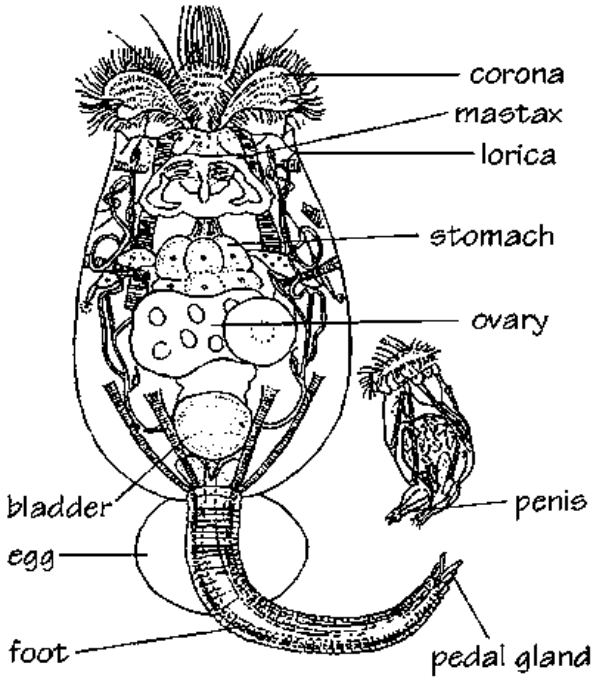


Fig. 1

Brachionus can perform two forms of reproduction; Asexual and Sexual (see Fig. 2).

Asexual: The females make parthenogenesis; it is thought that the female (diploid, 2n chromosomes) produce eggs with her fully genetic information (2n) and from these eggs enclosing a female (2n) that is an identical genetic copy from the mother.
Sexual: In specific environmental conditions the females start a sexual reproduction, a female (2n) produce eggs with the half of the mother's genetic information (haploid, n chromosomes). If this egg isn't fertilized, a male hatches (n). If the eggs (n) in the female (2n) are for a male (n) fertilized, then the female put the resting egg (2n) and with good environmental condition hatch a female (2n), and this female could be make parthenogenesis or sexual reproduction.

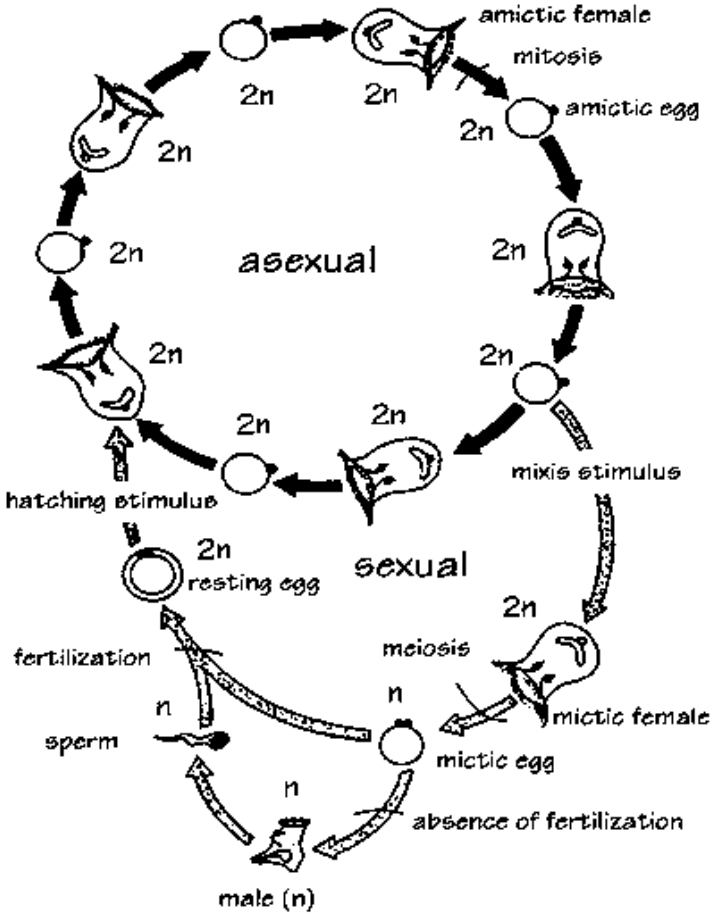


Fig. 2 Model of reproduction sexual-asexual from B.plicatilis (Hoff and Snell, 1987)

The rotifers LIFE span has been estimated to be between 3.4 to 4.4 days at 25°C (77°F). The larvae become adult after 0.5 to 1.5 days. Every four hours, the female lays an egg. and before a female dies she can lay up to ten eggs. This reproduction rate and small size make from B.plicatilis a really good candidate for live food production when cultivating Seahorses or other fish species.

Why do we need to produce Rotifer culture?

If you want to breed Seahorses or another fish species like Anemone fish, you need a diet for the babies. Some species *like H. abdominalis* can eat large naupilli (400µm at 24h.) such as Artemia but others need smaller examples like Rotifers (100 to 300 µm). We therefore need to produce a culture of rotifers to feed the larvae.

What are the needs of Rotifer?

To make a rotifer culture you need small tanks between 2.5 and 20 l (½-5 galls approx) with aeration and lighting. You can use commercial plankton reactors from several suppliers or glass tanks or carafes. The average temperature for the Brachionus's family is between 15° and 28°C (59-84°F), but there are optimal reproduction rates at 25°C temperature and the salinity has to be between 32 and 35 ‰.

Rotifers feed on small particles like algae or detritus and the Brachionus's family can feed on particles with a maximum size of 18µm. In our cultures, we use phytoplankton to feed them and from the Phytoplankton manual below you will see the algae are between 5µm (chlorella sp.) and 18 µm (diatoms group). A good method in culturing the rotifers is to always have them swimming in green water; you will have to add cultured water from your phytoplankton culture each time that you harvest it. To harvest the rotifers, it is recommended that you siphon the culture into a net with a mesh size of 50-70 µm to fish them out. Do this carefully so you don't injure the rotifers; they need to be alive to be used as food.

Where can I find rotifers?

You can buy them from Poseidon aquaculture in Germany but there are several suppliers on the internet but you should be sure that they are trustworthy – some suppliers can be unreliable. If you have problems finding a supplier for rotifers, please contact Display Development Department (DDD)

ADVICE

- Keep your tanks at between 15° C and 28° C (59-84°F) (Optimal 25°: 77°F) , with a Salinity 32-36‰
- Keep the water of your culture tanks "green" by adding water from the phytoplankton culture, the rotifers are then sure to have enough food
- Harvest the rotifers carefully, they need to be alive
- Make 2 or 4 parallel cultures

Enrichment

The majority of food types most commonly used in rearing Seahorses are naturally low in nutrients for various reasons, nutrient levels are further reduced when feeding from frozen during the defrosting process; where the juices from the defrosted food containing the nutrients are usually washed away. However, further enriching these food types with added vitamins and minerals can increase these nutrient levels giving the Seahorse and their fry greater nutrition by using the food as a 'vessel' for the nutrients

The two types of enrichment used at Bio are:

- Selco (what does it contain?)
- Zoe Marine (what does it contain?)

Selco

Selco is used to enrich live Artemia as follows:

1. Collect a sample of live Artemia, which is past their first moult (24 hours old) that will be sufficient for the morning and afternoon feeds.
2. Put the Artemia into a 4-6 litre (1-1¼ galls) bucket of fresh seawater and add 2-3ml of Super Selco.
3. Attach an airline to the bucket and leave to enrich for 24 hours.
4. After 24 hours strain the Artemia through a net to get rid of excess Selco and place into another bucket of fresh seawater.
5. Collect another sample of Artemia and repeat for the following day.

Top Tip

Artemia Naupilli can also be enriched with Selco before it is fed to baby Seahorses. This only needs to be enriched for around 30-minute's, as the Naupilli will readily absorb the nutrients through its soft body. Remember to thoroughly rinse the Naupilli before feeding as the Selco has a heavy precipitate that will cloud the tank!

Zoe Marine

Zoe Marine is a heavy Spirulina formula that is used to enrich frozen Mysis and Artemia. Zoe marine contains high dosages of natural marine algae combined with additional vitamin C to supplement the Seahorse's diet.

Alternatively, you can use Spirulina powder to hatch Artemia. Feed enough to colour the water, feed again when water goes clear.

Just add a few drops of Zoe Marine to frozen food in a little bit of seawater. You can also add some Zoe Marine to your live Artemia tank to give them extra nutrients:

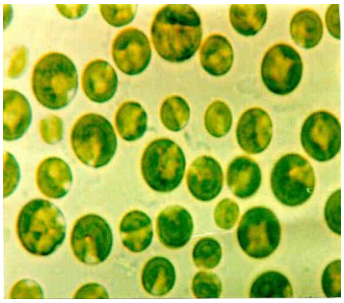
1. Add a few drops of Zoe Marine to your Artemia tank until you can see a slight tinge of green.
2. Leave overnight for the Artemia to feed.
3. In the morning do a 70% water change and add another few drops of Zoe Marine.
4. After a while you should begin to see that the Artemia is starting to turn dark green around the stomach and is now full of nutrients.

Phytoplankton

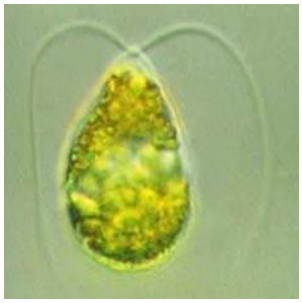
What is phytoplankton?

Phytoplankton is a group of organisms that live in water and belong to plankton (organisms that live in freshwater or saltwater and cannot swim freely and can move only with water currents) and can perform photosynthesis. This group is made up with free-floating algae, protists, and cyanobacteria.

The phytoplankton has great importance in aquaculture/aquarium because it is the first link in the food chain for aquatic animals. A group of various green algae specie are used in aquaculture or an aquarium e.g.: Dunaliella (17,8 µm), Chlorella (5 µm), Tetraselmis(18,4 µm), Monochrysis (10 µm), Isochrysis (10,2 µm) and from Diatom groups like: Phaeodactylum (10,4 µm) and Skeletonema (19 µm).

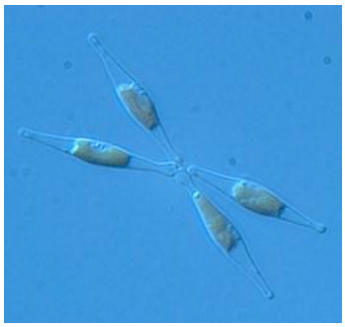


Chlorella sp.



Dunaliella sp.

Tetraselmis sp.



Phaeodactylum sp.

Skeletonema sp.

These micro algae are unicellular and they reproduce through cell division. Cell division is affected by light intensity, the photoperiod and temperature. In the next table (Table 1), you can find the optimal conditions for each algae:

Micro Algae	Photoperiod	Temperature
Phaeodactylum (diatomea)	10 h	25°C (77°F)
Skeletonema (diatomea)	13.1 h	18°C (66°F)
Dunaliella (cloroficea)	24 h	16°C (64°F)
Chlorella (cloroficea)	7.7 h	25°C (77°F)
Tetraselmis (cloroficea)	18 h	18°C (66°F)
Monochrysis (crisoficea)	15.3 h	20–25°C (68-77°F)
Isochrysis (crisoficea)	20.2 h	20°C (68°F)

What is the reason to do a phytoplankton culture?

If you want to breed Seahorses or another fish species like Anemone fish, you need food for the babies. Some species like *Hippocampus abdominalis* can feed naupilli (ca. 420µm at 24h.), but others need smaller examples like Rotifers (100 to 300 µm). We need therefore to produce a culture of phytoplankton to feed the rotifers.

What does phytoplankton need?

To cultivate phytoplankton, you need a tank with good illumination and movement on all water columns. There are several systems to cultivate phytoplankton: Intensive or extensive cultures.

Intensive cultures

Extensive cultures

To feed our rotifers or Artemia, we need no more than 500 ml - 1000 ml. algae every day. Also we can cultivate in tanks between 2.5 l. and 10 l. Glass tanks, Erlenmeyer, balloons or carafes could be our ideal culture medium.
The algae need *NUTRIENTS* (Nitrates and Phosphates), *CO_2, LIGHT* and *WATER CIRCULATION* to live.

NUTRIENTS: We source the nutrients for the phytoplankton direct from the 'waste products' from fish that will eventually be fed with the rotifers or Artemia. By resourcing these nutrients direct from this tank reduces the risk of infection from external parasites.

CO_2: In an intensive culture where big volumes of water (more than 1000 l. approx 200 galls)) with high concentrations of algae additional CO_2 needs to be added. In our smaller cultures we don't need to add CO_2.

LIGHT

We have two possibilities, natural light or artificial light.

Natural light: It's obviously the sun and the cheapest system. You can make your culture outdoors or indoors close to a window. A disadvantage here is you have to check and control the system's temperature (See above in Table 1 the optimal temperature) and maybe the cultures don't run all around the year (winter-autumn) at your site.

Artificial light: You can use LEDs, HQI or fluorescent tubes. HQI and LEDs are expensive and you can have problems to control the temperature in the system. I recommend the use of fluorescent tubes, behind or by the side of the tank. The light intensity has to be between 2000 and 4000 lux (Sunlight tubes).

Water movement: The water movement is really important; if it isn't strong enough the algae doesn't have enough light to make the photosynthesis or could form a sediment on the bottom and die. In our tanks the best and easiest system is simply aeration on the tank bottom. DON'T USE fine bubbles (movement isn't enough); big bubbles make a really good movement in the water column. If you use glass tanks you have to be careful in the corners - algae sedimentation can happens here.

Tip: Use 2 or 4 tanks in parallel culture, so you are sure to have algae every time.

Where can I find phytoplankton?

There are many suppliers available like Poseidon or Fimö in Germany. You can also try to use water from your displays tanks and normally a few weeks later you have lovely "green water". I have used water from a small Coral tank and here is the result after 3 weeks:

ADVICE

- Use small tanks with good aerations and lighting
- Make 2 or 4 parallels cultures
- Keep your tanks between 15° C and 28° C 59-84°F), with a Salinity 32-36 ‰
- Use water for your tanks to start the culture
- If you produce more algae than you need for your rotifers/Artemia, make water changes to keep the culture's density under control.

Further reading

Alisa Wagner Abbott **The Complete guide to Dwarf Seahorses** published by TFH.
April Kirkendoll **How to raise and train your Peppermint Shrimp** published by Lysmata publishing
Helen Scales **Poseidons's Steed** published by Gotham Books
Hoff and Snell **Plankton Culture Manual** published by Florida Aqua Farms. ISBN; 09662960-0-1
Neil Garrick-Maidment **Seahorses; Conservation and Care** published by TFH
Project Seahorse **Seahorses; An ID guide to Seahorses** published by Project Seahorse.
Rudie H.Kuiter **Seahorses. Pipefishes and their relatives** published by TMC
Seahorse group **Husbandry manual** available from Robin James or Emily Madge.

Information source

www.theSeahorsetrust.org
www.britishSeahorsesurvey.org
www.Seahorses.tv

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