Showfish

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Tropical Imports fish store gives 20% discount to COAST members.

New freshwater fish and plants arrive daily; new saltwater livestock, reptiles, and amphibians arrive weekly.

How cool is that—a fine bargain on an ever-changing variety of what you want anyway, and you get to buy it at a local fish store, too! For views of the inside of their store: http://www.tropical-imports.net/

CAUTION: ALL WATER FROM DWP NOW USES CHLORAMINE INSTEAD OF CHLORINE (EFFECTIVE END OF APRIL 2014)

Water characteristics of Buena Park, CA

Adapted from their annual water quality report of 2013. Some data has been reordered or omitted in order to harmonize the form/categories used from city to city in Showfish articles.

BUENA PARK, CA 2013 REPORT	MCL	PHG (MCLG)	Ground-water Average Amount	MWD Average Amount	Range of Detections	Most Recent Sampling Date
CHEMICALS						
Radiologicals						
Alpha Radiation (pCi/L)	15	(0)	ND	3	ND – 3	2012
Uranium (pCi/L)	20	0.43	4.3	2	ND – 7.6	2012
Organic Chemicals						
1,1-Dichloroethylene (ppb)	6	10	<0.5	ND	ND-1	2012
Microbiological						
Total Coliform Bacteria (a)	5%	0	Highest monthly positive:		1.8%	2012
Inorganic Chemicals						
Aluminum (ppm)	1	0.6	ND	0.15	ND – 0.34	2012
Arsenic (ppb)	10	0.004	2.7	ND	ND-5.4	2012
Fluoride (ppm) total	2	1	0.52	NR	0.43 - 0.86	2012
Nitrate as NO3 (ppm)	45	45	3.8	ND	ND – 13	2012
Nitrate +Ntrite as N (ppm)	10	10	0.86	ND	ND – 2.9	2012
Secondary Standards						
Aluminum (ppb)	200	600	ND	150	ND – 340	2012
Chloride (ppm)	500	n/a	33	90	17 – 93	2012
Manganese (ppb)	50	n/a	<20	ND	ND – 42	2012
Specific Conductance (mi-cromho/cm)	1,600	n/a	590	780	340 – 930	2012
Sulfate (ppm)	500	n/a	72	160	51 – 160	2012
Total Dissolved Solids (ppm)	1,000	n/a	370	500	320 – 500	2012
Turbidity (NTU)	5	n/a	0.31	ND	ND – 1	2012
Unregulated Contaminants Requir-ing Monitoring						
Boron (ppb)	NL = 1,000	n/a	<100	130	ND – 160	2012
Chromium -6 (ppb)	NRG	0.02	<1	ND	ND-2.1	2012
Calcium (ppm)	NRG	n/a	55	51	14-86	2012
Magnesium (ppm)	NRG	n/a	13	21	4.2-21	2012
pH (pH units)	NRG	n/a	8	8.1	7.6 – 8.4	2012
Potassium (ppm)	NRG	n/a	2.5	4	2.1-4	2012
Sodium (ppm)	NRG	n/a	54	80	37-120	2012

BUENA PARK, CA 2013 REPORT	MCL	PHG (MCLG)	Ground-water Average Amount	MWD Average Amount	Range of Detections	Most Recent Sampling Date
Total Alkalinity (ppm as CaCO3)	NRG	n/a	180	98	53-180	2012
Total Hardness (grains/gal)	NRG	n/a	11	12	3-16	2012
Total Hardness (ppm as CaCO3)	NRG	n/a	190	210	53 – 280	2012
Total Organic Carbon (ppm)	TT	n/a	<0.3	2.4	ND-2.7	2012
Vanadium (ppb)	NL = 50	n/a	<3	ND	ND-4.4	2012
TURBIDITY	**Treatment Technique**	**Turbidity Measure-ments**				**Sample Date**
Highest single turbidity measured	0.3 NTU	0.04				2012
Percentage samples < 0.3 NTU	95%	100%				2012
DISINFECTION BYPRODUCTS	**MCL (MRDL/ MRDLG)**	**Average Amount**			**Range of Detections**	
Total Trihalomethanes (ppb)	80	17			ND – 70	2012
Haloacetic Acids (ppb)	60	7.1			ND – 28	2012
Chlorine Residual (ppm)	(4 / 4)	1.1			ND – 3	2012
Aesthetic Quality						
Color (color units)	15	0.23			1 – 30	2012
Odor (threshold odor number)	3	1			1	2012
Turbidity (ntu)	5	0.16			ND – 2.8	2012
LEAD AND COPPER ACTION LEVELS AT RESDENTIAL TAPS	**Action Level (AL)**	**Health Goal**	**90th Per-centile Value**			
Lead (ppb)	15	0.2	ND			2012
Copper (ppm)	1.3	0.3	0.22			2012

pb = parts-per-billion; **ppm** = parts-per-million; **pCi/L** = picoCuries per liter; **NTU** = nephelometric turbidity units; **µmho/cm** = micromhos per centimeter; **ND** = not detected; **NR** = not required to be tested; **NRG** = not regulated; **NL** = Notification Level; < = average is less than the detection limit for reporting purposes; **MCL** = Maximum Contaminant Level; (**MCLG**) = federal MCL Goal; **PHG** = California Public Health Goal; **n/a** = not applicable; **TT** = treatment technique

East Coast Monster Fish Konvention is coming to New Jersey!

http://eastcoastmonsterfish.com/ August 1-3, Parsippany NJ

FEATURED SPEAKERS:
Jeff Cardwell on Monster Fish of the Amazon, **Solomon David** on Primitive Teleosts, **Michael Hill** on Aquarium Photography, **Dave Schumacher** on Lake Malawi Mbuna, **Anthony Tu** on Shopping for fish in South Vietnam, **Mike Whitaker** on Collecting L. Tanganyika Cichlids and Malaw Sand-Dweller Cichlids, **Ken Davis** on Cichlids of Honduras and Monster Fish of Uruguay

The Red Cherry Shrimp (RCS), *Neocaridina denticulata spp davidi,* var. 'red' (Bouvier 1904)

The Neocaridina genus of freshwater, land-locked shrimp is one of four dwarf shrimp genera in the Atyidae family of freshwater shrimp. The other three genera are Atya, Atyopsis, and Caridina. Neocaridina shrimp are native to Russia, Korea, Japan, China, Taiwan, and Vietnam.(1) The Neocaridina genus comprises 26 species and subspecies, although there is controversy over the decisions to place certain of the species in this genus.

The Atyidae family of freshwater shrimp have been with us since the mid-Cretaceous period (if not earlier). Molecular phylogeny undertaken (by 2007) indicates the 42 genera in the Atyidae family will be undergoing substan-tial shuffling at all taxonomic levels in the future, especially the Caridina genus.(2)

That has certainly proved to be true for the Red Cherry Shrimp (RCS), which has been Caridina denticulata sinensis Kemp 1918, then Neocaridina denticulata sinensis, then Neocaridina heterpoda, and is now Neocaridina denticulata spp davidi (Bouvier 1904).

Photo by Przemysław Malkowski from Wikipedia site

Figure 1. Female Red Cherry Shrimp (carrying yellow eggs, that is, berried)

Overview—a perfect beginner's shrimp

The red cherry shrimp (RCS) is an excellent shrimp for people who have never kept shrimp before. They accept a variety of food, can be kept in various kinds of water, breed easily, and are resilient and sociable.

All that being said, however, it must also be said that if you cannot keep your aquarium water stable and free of ammonia and nitrite, you will not be able to keep any dwarf freshwater shrimp healthy and alive for long. They can tolerate a wide range of hardness, pH, and temperature, but they cannot tolerate fluctuation in these parameters. Acclimatization and changes in their water must be done slowly, every time.

AQUARIUM SIZE: 10 gallon minimum unless you are REALLY good at keeping water stable and clean—2 gallon is fine for half a dozen shrimp if you can manage the water.

DÉCOR: Planted, with dark places for them to hide, especially for the female when carrying eggs. RCS like to perch on leaves, so plants with broad leaves in the lower half of the water column would be a good choice. Java moss is particularly good as cover for baby shrimp. Darker gravel will bring out deeper reds in them.

BACTERIAL COLONY: Fully mature—RCS will not survive the cycling process.

CURRENT: As slow as possible that will still maintain clean water. Provide obstacles to create "current shadows" if necessary. Filter outlet should be angled toward a wall.

FILTRATION: Low flow bubble up or [air driven] foam filter, producing 2 to 5 turns of tank water per hour. Power/canister filters tend to suck the shrimp inside or against an intake covering, killing them unless intake on such filters provide protection against that. Many people use them effectively and safely, however, so it can be done.

Stainless steel filter guard to protect fry and shrimp from filter uptake:
http://www.ebay.com/itm/Aquarium-14mm-Stainless-Steel-Filter-Guard-Mesh-Baby-Fry-Shrimp-Fish-/181278490849?pt=Fish_Filters&hash=item2a350a40e1

WATER CHANGES: Change out 25% to 30% water weekly. Add new conditioned water slowly.

TEMPERATURE: 65 °F to 85 °F, best at 75 °F (various articles report low temp at 39, 53, 60, 65, and 70 °F with high temp range at 80, 82, 84, and 85 °F)

pH RANGE: 6.2 to 8.0, best at 7.2 (Remember that free (unionized) ammonia becomes more toxic as pH rises higher than 7)

HARDNESS RANGE: 3 to 15 dKH, best at 8 dKH (54 ppm to 268 ppm, best at 143 ppm CaCO3)
(1 dKH = 17.857142857143 ppm and 0.35714285714286 meq / L)

TOTAL DISSOLVED SOLIDS: 100 TO 200 ppm

SIZE: 1-1/4 inches males, 1-1/2 inches female

LIFE SPAN: 1 to 2 years, sexual maturity at 4 to 6 months of age

SEXUAL DIMORPHISM: The female is the larger of the genders, and the more intensely colored. Females often have a yellow or pale green "saddle" on their back (this is her ovaries colored by maturing eggs). Females have a rounder-bottomed, longer tail section to enable them to carry their eggs safely. Viewed from above, females are broader in the tail section than males.

GESTATION: 21 to 30 days average (one site said up to 45 days), typically 20 to 30 green or yellow eggs, aka "berries". A female carrying eggs is "berried".

LARVAL STAGES: The young, known as shrimplets, are fully formed, 2 mm long shrimp at hatching; they do not undergo further larval development.

DIET: Omnivorous, but they particularly like and need algae

Anatomy

External elements

The shrimp has 19 separate sections of the body. Two main segments make up the body of a freshwater or marine shrimp.

The first part is the upper portion of the shrimp, referred to as the cephalothorax. The cephalothorax includes the head and the thorax or pereon region of the shrimp. It is covered by a protective plating system called the carapace. The cephalothorax consists of the rostrum (nose), stalked eyes, carapace, the 1st and 2nd antennas, antenulles, pereopods (walking legs – 5 sets), the maxillipeds, and the mandibles (jaws).

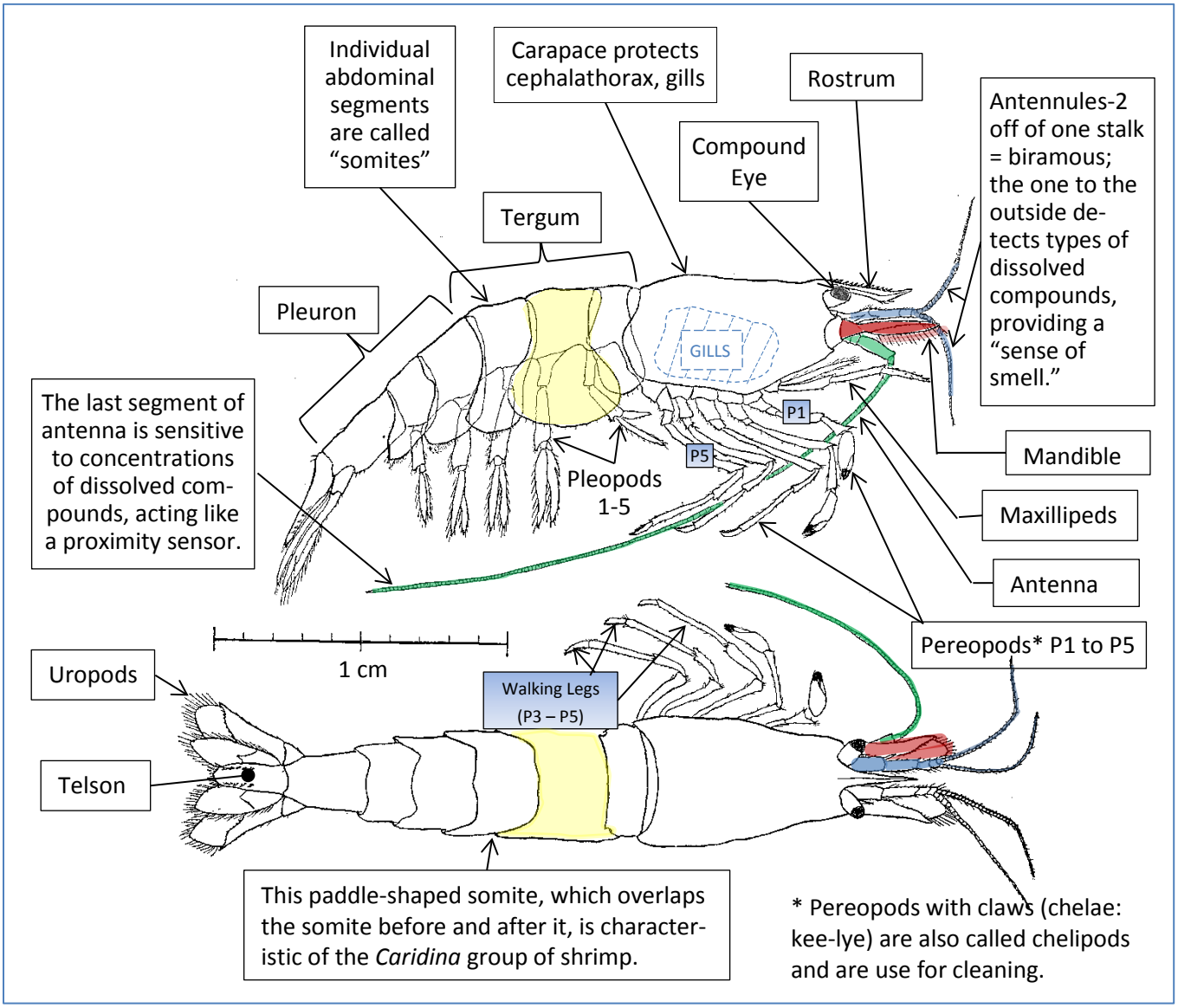


Figure 2. External anatomy of Neocaridina shrimp

Black and white illustration is from "On the Development and Growth of Neocaridina denticulata DE HAAN" by Mizue, Kazuhiro; Iwamoto, Yasuo, downloaded from Nagasaki University's Academic Output SITE

The antenna and antenulles are used as feelers and also provide sensory input for spatial orientation.

The three maxillipeds are used to rip food apart before it is moved into the two mandibles, where it is crushed and devoured. After the maxillipeds are the pereopods, or the "walking legs". Some authors identify only the last 3 pereopods as "walking legs". The RCS, as a member of the Decapods, always has 5 sets of pereopods and 5 sets of pleopods, no matter what common name the legs are given.

The lower portion of the body is often called the abdomen or pleon segment. This includes both upper and lower abdominal sections. The upper abdominal section is referred to as the tergum and comprises segments 1 through 3, with the first segment being closest to the carapace. The bottom section is referred to as the pleuron and comprises segments 4 through 6, with the last segment being next to the tail (uropods). The pleopods, often called swimmerets, are tucked under the abdomen of the shrimp. The terminal millimeter of the male's first two sets pleopods have a different shape than those of the female. The tail section of the shrimp is broken into three parts: a central, pointed segment called the telson, and two pairs of segments called uropods. The pleopods are used for swimming while their tails are used like aircraft wings to control their direction.

Internal Anatomy

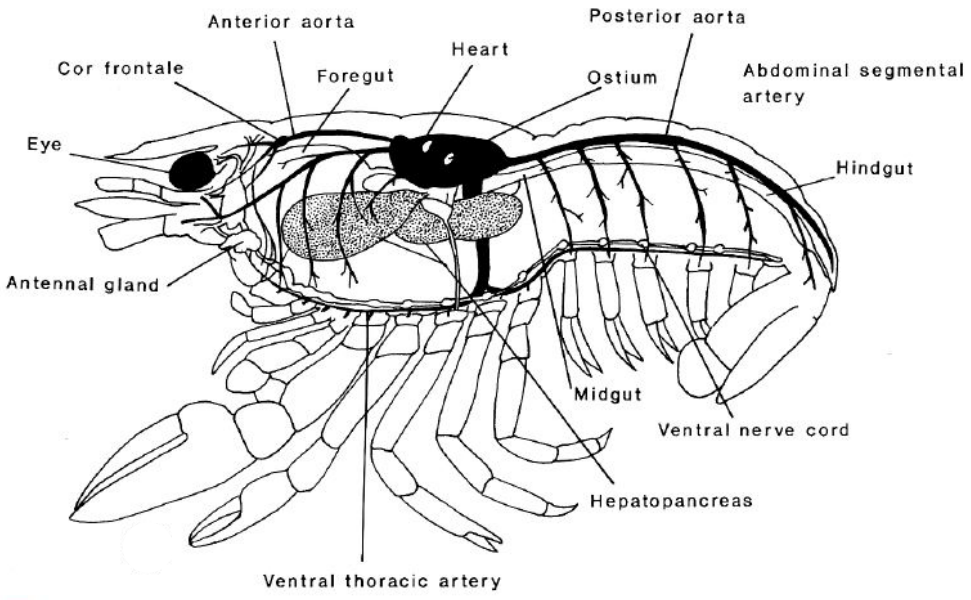


Figure 3. Internal anatomy (macruran decapod is shown, but it's similar to that of a dwarf shrimp)

See Figure 17 for a diagrams of shrimp reproductive anatomy.

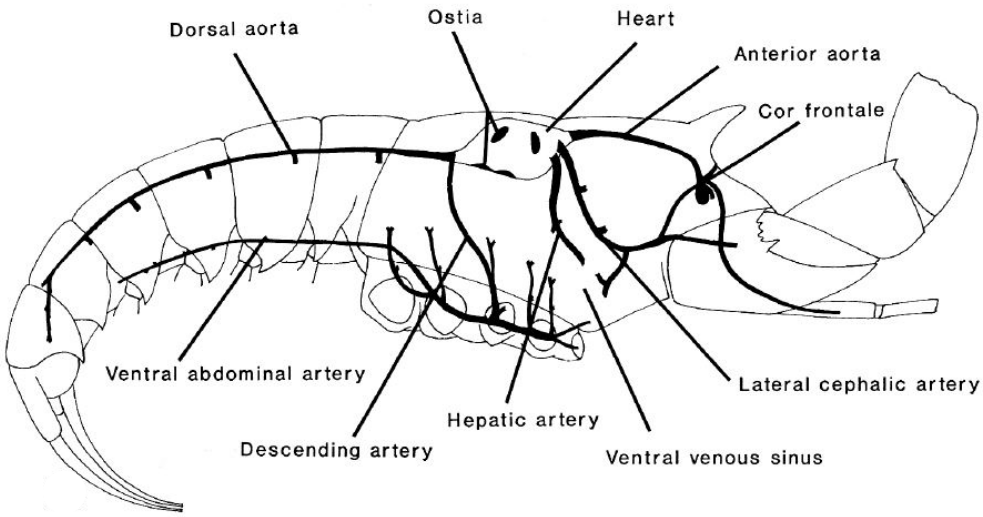


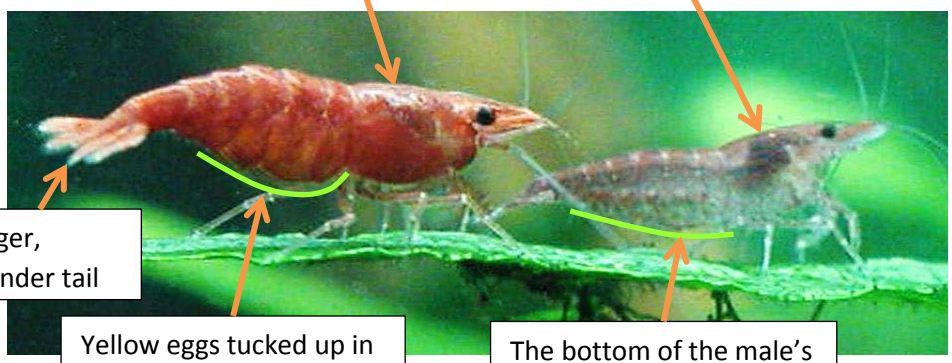
Figure 4. Circulatory system (macruran decapod is shown, but it's similar to that of a dwarf shrimp)

Ovaries with yellow eggs form a saddle pattern; some shrimp produce green eggs like the wild shrimp have.

Rounded curve along tail, providing space to hold her eggs

No copyright for photo was found; posted by Sarapintas at http://www.aquariofilia.net/forum/index.php?showtopic=181642

Figure 5. Female RCS showing the saddle created by the colored eggs in her ovaries.
Eggs are sometimes green in this aquarist-developed color variety—an inheritance from the wild shrimp, whose eggs are always green. The color of eggs does not influence thecolor of the shrimplets.



http://www.aquaticacafe.com/red_cherry_shrimp.html; no photo credit or copyright was found.

Figure 6. A pair of RCS exemplifying gender differences in shape, size, markings, and color

Natural habitat of the wild Neocaridina denticulata spp davidi

The RCS is an aquarium strain produced by line breeding for color (both Taiwan and Germany are listed as origin), but nonetheless its species evolved for life in a specific type of habitat. This Neoraridina species come from slow moving streams and from low-altitude mountain pools. They used to be common in rice paddies, but fertilizers and pesticides have made that a thing of the past.

Figure 7. Habitats typical of many subspecies of Neocaridina denticulata shrimp

Left: one habitat of N. saccam: a pond beside a road on a low-elevation mountain, Longci, Tainan Co., Taiwan

Right: one habitat of N. ketagalan: a small stream with slow velocity under dense vegetation. Both saccam and ketaglan were considered N. denticulata sinesis until a few years ago and their habitats are the same.

Photos are from the article Two New Species of the Land-Locked Freshwater Shrimps Genus, Neocaridina Kubo, 1938 (Decapoda: Caridea: Atyidae), from Taiwan, with Notes on Speciation on the Island by Hsi-Te Shih, and Yixiong Cai

Mosses, and ferns are common in these waters, but vegetation may or may not be dense, depending on canopy growth. Two hobbyists posted warnings about cryptocorines and anubias plants, which can poisin dwarf shrimp in a closed water system. If a stem of the plant is damaged, it releases oxalic acid, which is toxic to shrimp. Leaf litter is a common component of the stream/pond bed. Waters are clear and slow or provide areas where water is slowed to a safe speed for this dwarf shrimp. Hairy roots dangling far down in the water, such as those of water hyacinth, are baby shrimp approved. Temperature, hardness, and pH vary from place to place but most commonly are middle-of-the-road.

Aquarium set up and equipment

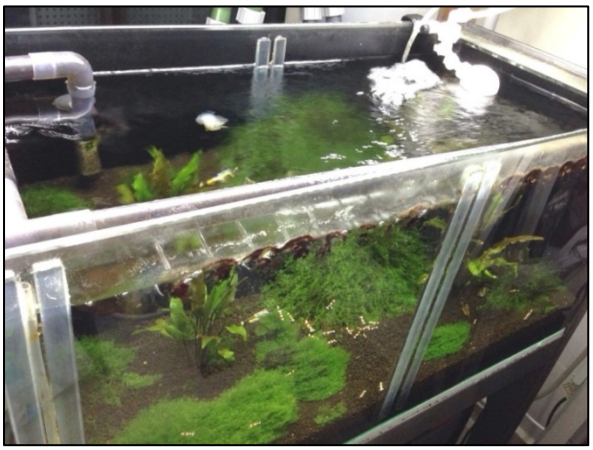
Due to the difficulty of keeping water parameters stable in small quantities of water, the smallest tank size recommended is 10 gallons. If it weren't for the need for stable water, you could keep RCS in a gallon tank. Manag-ing pH is even more difficult in tanks that are being dosed with CO2 for plants, which in turns affects the ionization rate of ammonia. Red cherry shrimp are most comfortable (and likely to appear) in a group—the larger the tank, the more shrimp are needed to create a comfortable shrimp community. A ten gallon tank can accommodate three dozen RCS without strain if they are added a few at a time.

Any medium- to small-grained substrates suitable for plants will be acceptable to the RCS; avoid pebble-sized gravel. Driftwood and rocks will provide shelter and a calm area to rest from current, i.e., a current shadow. Almond, guava, mulberry or oak leaves and scattered sticks would also provide places to hide and graze.

There should be leaf plants and mosses in the tank; plants should be moderate in quantity and be selected for some that will grow fast to consume free ammonia as fast as possible, as well as medium to slow growing plants (so fertilizer needs are minimal and nitrate can be consumed at a steady pace). As Mustafa Ucozler of petshrimp.com says: "Just keep in mind that you have a shrimp tank and not a planted tank and keep your priorities straight. It will be much harder for you to keep shrimp alive and breeding in the long run if you run a heavily fertilized, high-tech tank. A heavy fertilizer regime is just not compatible with the water parameter needs of shrimp over a long period of time."

AMAZON RIVER TRIVIA:

During the flood season, the Amazon can move as much as 300,000 cubic meters of water per minute out of the Amazon into ocean during floods. Even on a daily basis, water from the Amazon flows too fast to create much of a delta, but fresh water is detectable as many as 400 km out in the ocean. It is over 4,000 miles long—only the Ganges River is longer. At 7 million square kilometers, it's drainage basin is twice as large as the next largest basin in the world, which drains into the Congo River.



This 4 foot long tank demonstrates moderate plant density in a shrimp tank. The tank has an automatic fill valve to maintain water level, fed by conditioned water in a tank at the top of shelves. This shrimp fan also uses Eheim canister filters (which have valves to govern flow). Note the filter outlet is through a "rain bar" that is positioned to return water high up along the entire front wall.

The owner explains how the top–off system and the rain bar are made on his website, Shrimps Redefined.

Photo from http://shrimpsredefined.wordpress.com/ (no copyright found)

Figure 8. Plant variety and density in a shrimp tank

According to" shrimpsider" on http://aquarium-shops.com/article/setting-up-a-shrimp-tank/: "Java fern looks very nice, but anubia can harm shrimp when you cut the leaves. Anubia will release oxalic acid with crystal nettles, which are toxic to shrimp in higher concentration. Be alert that new plants from shops come with high pesticides toxic to shrimp!" The initial response of the shrimp to such toxins is agitated swimming, followed by many deaths in 1 to 5 days.

Preparing the substrate

Pour in clean gravel, plug in plants, add water—or to optimize your chances for a quicker, healthy success, sprinkle a layer of mineral powder then a layer nitrifying bacteria powder on the bottom of the tank. Follow with a 2 to 3 cm thick layer of your chosen gravel/sand substate. Repeat the three layers once again and add plants.

Sera's Guide to Freshwater Shrimp and Crayfish states it is important to have river sand or at least sand in fine grained gravel in a shrimp tank. The shrimp require single grains of sand or bits of fine gravel to orient themselves. They have a sense organ, called a statocyst, which "consists of a sac enclosing sensory hairs and particles of sand, lime, etc., that functions in maintaining equilibrium, serving to indicate position in space." (definition courtesy of http://dictionary.reference.com/browse/statocyst)

In addition to this 6 layer method of setting up your substrate to provide nitrifying bacteria, you can start the bacterial colony by adding a commercial bacteria culture such as Dr. Tim's Aquatics One and Only to the water. Best of all, you can start a new colony of bacteria by using substrate from another mature tank. Substrate selection needs to take into consideration what the optimum pH level is for the shrimp you will be housing. For example, Aquasoil tends to produce an acidic environment. Inert substrates may be your best choice if your tap water needs no change to the pH.

Dr. Tim Hovanec was one of the two microbiologist who isolated the species of bacteria that handle waste in aquariums. He found the way to package them so you can cycle your tank with the exact species needed. There is also a salt-water version that looks just like this one except for the word SALTWATER on the blue band at the top.

Cycling the tank

Dwarf freshwater shrimp are extremely sensitive to free

ammonia and nitrite and can tolerate only the very lowest levels of nitrate (≤ 5 ppm or mg/L).

Whereas fish will tell you that their water quality is degrading by their behaviour—hard breathing, itching or showing stress coloring—*Neocaridina denticulata spp davidi* shrimp will tell you by dying.

BorneoWild Balance (Substrate System 1) $20/100 g or Minerax $22/100 g and Bacter Crystal (Substrate System 3) $17/80 g. One jar will cover a 3 ft long tank bottom http://www.alphaprobreeders.com

Several good substrates are available for use with plants, in addition to quartz sand or gravel and lava gravel. Substrates for plants vary from about $20 to $70 for 15 to 18 lbs. *Note: ADA soil leaches ammonia for the first month or so, requiring large weekly water changes during the cycling phase.*

Figure 9. Examples of materials used in building a substrate for shrimp and plants

Expect to spend 4 to 6 weeks cycling the tank before the bacterial colony has grown enough to process waste completely so that ammonia and nitrite will not spike upon the addition of shrimp and their food. If you have the patience, cycle the tank for a few months months so that not only will your tank have a fine nitrifying bacterial colony, it will also have a good colony of tiny tasty things for shrimp to eat and plants that have recovered from being transplanted and are growing again.

Because *davidi* shrimp **must** have water with 0 ppm ammonia and 0 ppm nitrite, it's important to verify the levels in the new tank by test. There is more information on test kits later in this newsletter (p. 28). If you have a generous budget (like, say, $1000) and like to fuss, you can measure ammonia, nitrite, and nitrate using a colorimeter with its own reagents. Ordinary liquid test kits, however, are fairly accurate, fairly easy to read, and cost-wise are a pretty good bargain. Remember to check the shelf life remaining ('use by' date) before you buy any test kit. The accuracy of the tests degrades as the reagents age.

Stocking the aquarium

Shrimp are best kept is a species tank. To other fish, they are food, whether they can be eaten in one gulp or have to be taken bit by bit. In their homewaters, dwarf shrimp are often collected and sold to fishermen as bait. Some fish do get recommended as community tank mates, but always with reservation. Three philosophies of compatible fish seem to prevail: 1) choose fish with mouths too small to consider shrimp as prey or with highly specialized mouths that will inhibit the ability to catch shrimp; 2) choose small, non-aggressive, non-territorial fish; and 3) choose fish that are vegetarians. Not mentioned is another strategy that might work—choose fish who inhabit only the top half of the water column.

Geological Shrimp Sidebar

The *Atyidae* family of freshwater shrimp arose in the mid-Cretaceous Period. The Cretaceous comprised the last 79 million years of Mesozoic Era, which was preceded by the Jurassic Era and followed by the current Cenozoic Era. Germans call the Cretaceous "Kreide" (K) for "chalk", the era was originally noted for extensive beds of calcium carbonate from marine invertebrate shells found in the Paris Basin and western Europe (think White Cliffs of Dover). Creta is Latin for chalk, which is why we call it the Cretaceous instead of something like die Kreidelich.

This era saw the rise of birds, diminishing biodiversity, and the slow, ongoing extinction of giant sauropods. Theropods were still the top predators. Then most large vertebrates and many tropical invertebrates became extinct with the Cretaceous-Paleogene (K-Pg) event (that meteor thing in the Yucatan). Petroleum reserves were laid down in the Persian Gulf and the Gulf of Mexico to Venezuela. Gold, silver, copper, lead, zinc, molybdenum, tungsten, tin, iron, and manganese were concentrated into mineable ore deposits. (Map from USGS)

It is difficult to not overfeed shrimp when you are first learning how to take care of them, so some small bottom feeders are an assett. Even small bottom feeders relish baby shrimp, though, so cover such as Java moss that is dense (in proportion to fish size) is vital for baby shrimp.

Characteristics of fish that might not be much of a threat to dwarf shrimp in a community tank:

- Mouth size: very small, such as neon tetras
- Mouth shape and orientation: such as otocinclus, small coryadoras, or young small ancistrus
- Vegetarians: such as platys
- Non-aggressive: Least Livebearer (Heterandra formosa), African flame barb (Barbus jae), small tetras
- Body size: standard length (excludes tail in the measurement) of fish people have noted as "safe" for shrimp tanks are consistently an inch or less, but *Trichogaster lalius* aka dwarf gouramis that reach two inches in length are often mentioned as suitable.

Red cherry shrimp are social animals and should be kept with at least half a dozen of their own kind. They are not particularly aggressive, either amongst themselves or with other shrimp, and they are more confident in groups. Or to put it another way, if you want to see your shrimp, have lots. Stocking density should be a maximum of 6 per gallon.

Reproducing RCS *(an excellent name for a band!)*

Some of the things that make RCS such a good shrimp for beginning shrimpers are that they are comfortable reproducing in captivity; when hatched, the shrimplets are hatched fully formed and functional; and adults don't eat their young.

Cautionary information for those with multiple species of shrimp in a tank: RCS will crossbreed with *Neocaridina palmata* 'Blue Pearl' and *Neocaridina cf. zhangjiajiensis* var 'white' 'Snowball', and with other color varieties of *N. d. spp davidi* (such as 'sakura' or 'yellow'). They will probably crossbreed with *N. palmata* 'Marmoreal', and *Paracaridina* spec 'Blue Bee', 'Princess Bee', 'Golden Vietnam', and 'Larry' shrimp (I kid you not, "Larry" shrimp—formally identified as *Caridina (Paracaridina) meridionalis* spec. Larry).

Brood stock

Shrimp for breeding can be of any age, but if you start with young ones you get to enjoy them longer. After all, they only live one to two years; if you get one a year old, you won't get much of a chance to observe and enjoy them. Mature shrimp carried in a fish store may also be limited to females with their highly sellable red coloration and exclude the plainer-colored males altogether. RCS reach sexual maturity between 4 and 6 months of age. (Nur and Cristianis (3) found that the shrimp they were studying reached maturity at 75 days, at which time eggs were showing in the ovaries of the females.)

The best bet for starting a breeding colony is to get 6 to 10 shrimp when they are not yet mature, so they can set-tle into their new home and become comfortable with the food and shelter provided. With that quantity of shrimp, you are practically guaranteed to have both genders. Observe the shrimp carefully for sound structure. With animals that are intensively line bred, such as shrimp of these color varieties, it doesn't take a lot of un-man-aged breeding in a small colony to end up with deformities.

Common deformities

J. Green of http://atyidae.wordpress.com, whose site is full of excellent, scientifically based information, highlights deformities being seen more and more often.

- A "balloon head", which is a helmut-shaped carapace
- "Roll-up" antennae, which describes the curling of the first antennae (antennules). Shrimp with this deformity are sometimes called "treasure hunters". [Ed.: a particularly idiotic appellation in light of the fact that one function of the first antennae is to provide spatial orientation information to the shrimp.]
- An "open skirt", which is the result of the exoskeleton not extending the full distance down the sides
- A "hunchback", where the middle of the back is curved, creating a shrimp with an M shaped body. This is a bit more iffy to be sure about when looked at across all species of dwarf shrimp, as there are several whose natural shape has a fairly sharp peak in the back. RCS shrimp, however, do not; they possess the more common flexible spine with a smooth, shallow arc.

The simplest way to mitigate the risk of deformities is to outcross regularly with shrimp from other regions, breeders, and farms. Some people recommend an occassional outcross with the wild form.

Photographs in Figure 10 and Figure 11 are from http://atyidae.wordpress.com that credits photos by way of hyperlinks. These hyperlinks are now dead, so copyright ownership (if any) and permissions could not be ascertained or obtained.

Conditioning the brood stock

One of the nice things about RCS is that, if they are properly fed and their water is clean, you just about can't stop them breeding. Properly fed, according to results from a study by Nur and Christianus (3), meant commercial shrimp feed with 40% protein, fed in the morning and early evening. Clean water meant 50% water change weekly with checks for dissolved oxygen, ammonia, nitrite, and pH measured twice a week. Nur *et al* held the shrimp in small conditioning tanks for about a month to bring them into prime health.

In a mature tank, zooplankton, algae, and the biofilm on surfaces provide some of the live food dworf shrimp need, especially the newly hatched young shrimp. The juveniles and adults will also need staple foods and benefit greatly from leafy plant matter, such as spinach leaves, and other foods often given to algae eaters such as squash and cucumber.

Since shrimp are slow-eating nibblers, stability of food, especially dry food, in water is critical. Pelletized food retains its shape and structure in water longer than crumbles, and therefore fewer nutrients are leached away by the water. Pellets sink faster and facilitate more efficient consumption. Nutritional profiles being equal and suitable, the pellets are the better choice.

Farmers for shrimp for human consumption also use trays made of weighted PVC pipe and fine netting to hold food for shrimp to minimize food loss and waste, which has resulted in better growth for less feed to a degree that extra cost of labor setting and collecting the trays is neutralized. Some hobbyist tanks show 2 ounce plastic condiment cups sunk part way into the sand being used as a feeding tray.
(from http://www.shrimpnews.com/FreeReportsFolder/GeneralInformationFolder/About.html#Factors)

This table from the article "Pellets Or Crumbles Make A Difference In Shrimp Feeding" by Joachim W. Hertrampf in Kuala Lumpur gives some numbers to the superiority claimed for pellets compared to crumbles.
(from http://www.allaboutfeed.net/PageFiles/10974/001_boerderij-download-AAF11023D01.pdf)

Balloon Head carapace deformity—inflexible shape that limits eye stalk movement, leg range of motion, and alters water flow across the gills. It can't be easy to molt. The lower of the antennulae are short, curling down and in toward the body, limiting its ability to feel surrounding ground.

Normal, hydrodynamic carapace shape and flexible antennules

Figure 10. Example of a Balloon Head deformity and Roll-Up antennule compared to normal structure

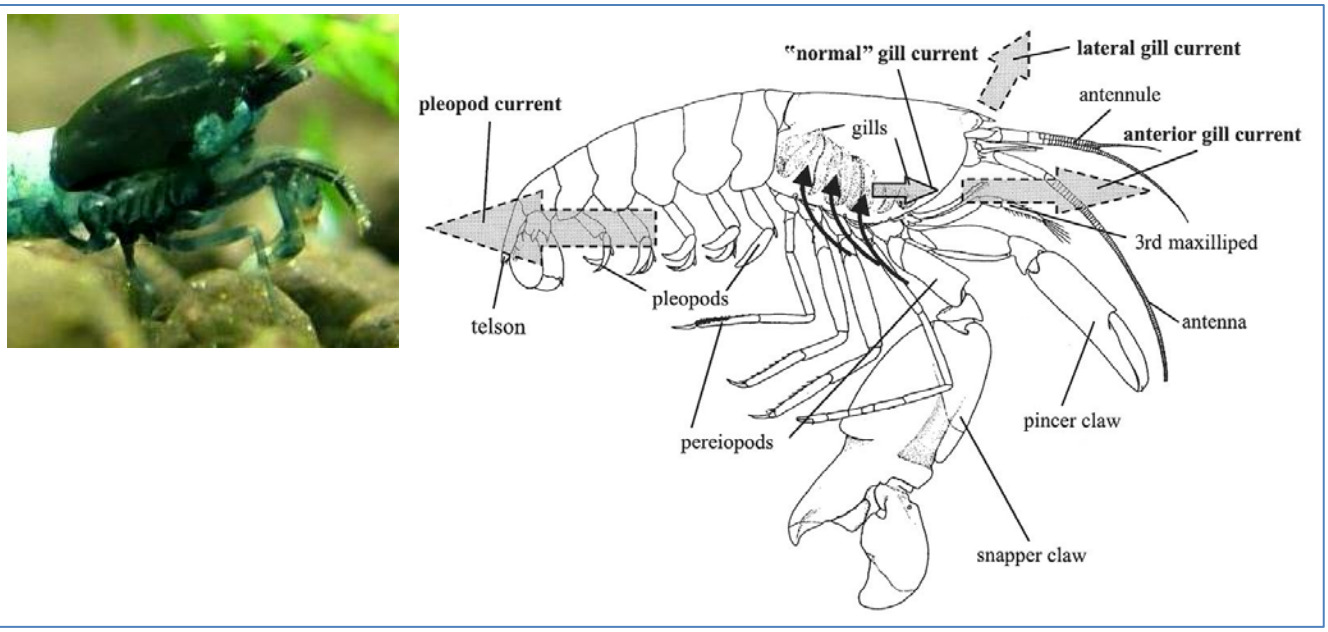


Figure 11. Normal current flow across gills and body

The illustration on current flow, which features a snapping shrimp, is from biobull.org

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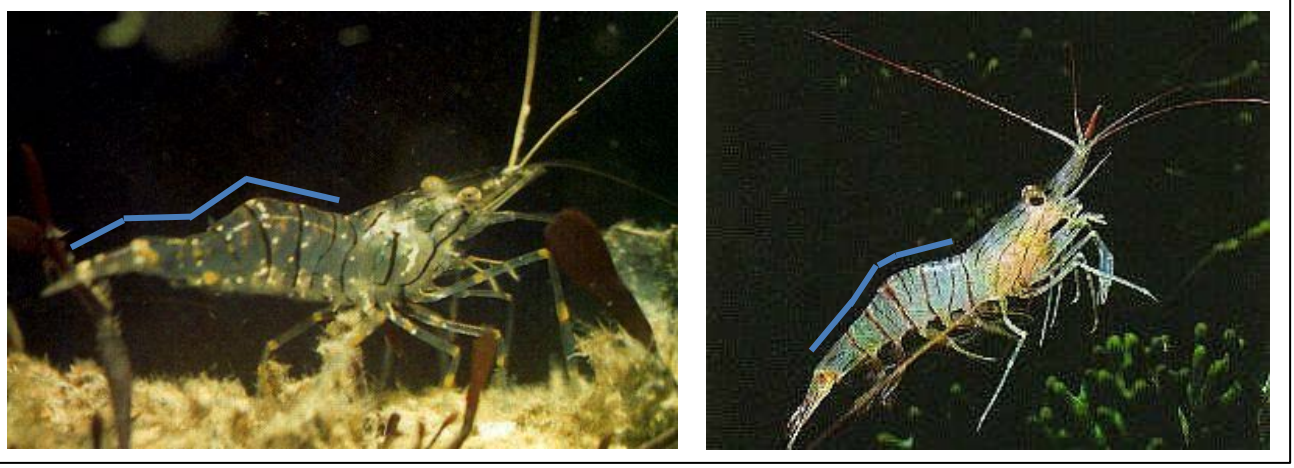

Figure 12. Example of a hunchback deformity (left) in a *Palaemon serratus* shrimp (shrimp on right is normal)

← The short and flared open skirt on this red shrimp has exposed his gills. Whether his telson and uropods are missing because of predation or mutation, or just not visible in the photo, was not noted.

The exceptionally short skirt on this red → ruby's carapace has exposed his gills and left his ventral thoracic artery, lateral cephalic artery, and front of his ventral venous sinus with only a thin layer of flesh to protect him from bumps, scrapes and attacks. Open skirts can occur on the abdomen, too—especially damaging to a female's ability to care for her eggs.

Figure 13. Examples of the "short skirt" deformity of the carapace

Since shrimp are slow-eating nibblers, stability of food, especially dry food, in water is critical. Pelletized food retains its shape and structure in water longer than crumbles, and therefore fewer nutrients are leached away by the water. Pellets sink faster and facilitate more efficient consumption. Nutritional profiles being equal and suitable, the pellets are the better choice.

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(from http://www.shrimpnews.com/FreeReportsFolder/GeneralInformationFolder/About.html)

A study reported in the article "Pellets Or Crumbles Make A Difference In Shrimp Feeding" by Joachim W. Hertrampf of Kuala Lumpur quantified the superiority claimed for pellets compared to crumbles. Juvenile shrimp fed on pellets gained weight 33.8% to 42.5% faster than those shrimp fed on crumbles, and they did so on 11.9% to 0.02% less food. Hertrampf attributed the better and more uniform growth of pellet-fed shrimp to the insignificant nutrient losses by leaching, as opposed to high nutrient losses in crumbled feed.
(from http:/www.allaboutfeed.net/PageFiles/10974/001_boerderij-download-AAF11023D01.pdf)

Among hobbyists' most highly recommended brands of food are BorneoWild, Mosura, and Shirakura; other esoteric food include Ebikuma Dango (cited as particularly good for conditioning breeding stock) and Ebita Breed's Hinomaru Bentu, which contains Shrimp Guard, an immune system booster. The more readily available Hikari

and Sera shrimp foods as well as OSI and Hikari algae wafers were often recommended as well. Breeders consistently state that a balanced diet of vegetables (algae, blanched baby spinach leaves, cucumbers, etc.) and meat is required (including live food such as daphnia and baby brine shrimp), with vegetable matter forming the larger portion. The females, some hobbyists commented, seem to benefit from a meatier diet when their eggs are developing in their ovaries.

Algae wafers were often recommended in forums, usually with follow-on comments such as "my shrimp loved them" and "my shrimp ignored them." Another important component of dwarf shrimp diet is their shed exoskeletons (exuvia), which shrimp will consume to recover the minerals needed to grow/maintain a new skeleton.

Figure 14. A variety of vegetable and meaty foods are needed for health shrimp

Foods developed in Japan, where shrimp breeding has been a significant hobbyist and commercial farm part of the fish food market for many years, is deemed by shrimp and hobbyist alike to be the best. The three most readily available brands—Mosura, Shirakura, and BorneoWild—have special-purpose foods for growth, conditioning, color enhancement and sometimes species.

Photo credits for Figure 9: ● Sera http://www.sera.com.sg/fw_food_crabshrimp.php ● Shirakura http://www.eliteinverts.com/shirakura-ebi-dama-30-grams/ ● Daphnia http://daphniaforsale.com/index.php/daphnia-magna/ ● ri http://www.drsfostersmith.com/product/prod_display.cfm?c=3578+7927+7932+4313&pcatid=4313 ● Mosura http://www.eliteinverts.com/shrimp-crab-crayfish-snail-food-supplements/ ● Baby Spinach http://www.photos-public-domain.com ● Brine shrimp by Aimi Zabidi of Sarawak at http://mehbetta.blogspot.com/2012/03/feeding-fry-baby-brine-shrimp-bbs.html Cucumber http://www.bigoven.com/article/recipe/cucumber ● Mosura Brood care http://www.theshrimptank.com/food/mosura-brood-care/ ● Ebikuma Dango http://www.aquabid.com/cgi-bin/auction/closed.cgi?view_archive_item&foodo1223593800 ● Algae fers http://www.drsfostersmith.com/product/prod_display.cfm?pcatid=4260 Borneo Wild http://www.theshrimptank.com/food/ ● Ebita Breed http://www.ebay.com/sch/leonwood017/m.html?item=121274725170&rt=nc&_trksid=p2047675.l2562 ● ber http://www.bigoven.com/article/recipe/cucumber ● Brine shrimp Aimi Zabidi in Sarawak at http://mehbetta.blogspot.com/2012/03/feeding-fry-baby-brine-shrimp-bbs.html ● Hikari Shrimp Cuisine and OSI Spirulina fers: http://www.drsfostersmith.com/product/prod_display.cfm?c=3578+7927+7932+4313&pcatid=4313

The mating of the cherry shrimp

The mating cycle in wild shrimp falls in late spring (April/May) and, in a good year, again in early fall (August/September). In the aquarium, with a constant source of good food and a safe, clean home, the female can begin developing new eggs while she is carrying fertilized ones in her brood pouch.

When a female with eggs maturing in her ovaries molts, she releases pheromones so the male will learn of her status and location. With penaeid shrimp, a female's skeleton will sometimes be lightly peppered with tiny white spots a day or two before molting; RCS may do the same. There is virtually no description of early signs of molting it at all or molting—other than one or two statements that molting takes about ten seconds. After shedding her exoskeleton, the female will find soft mud to hide in if possible while her new skeleton hardens.

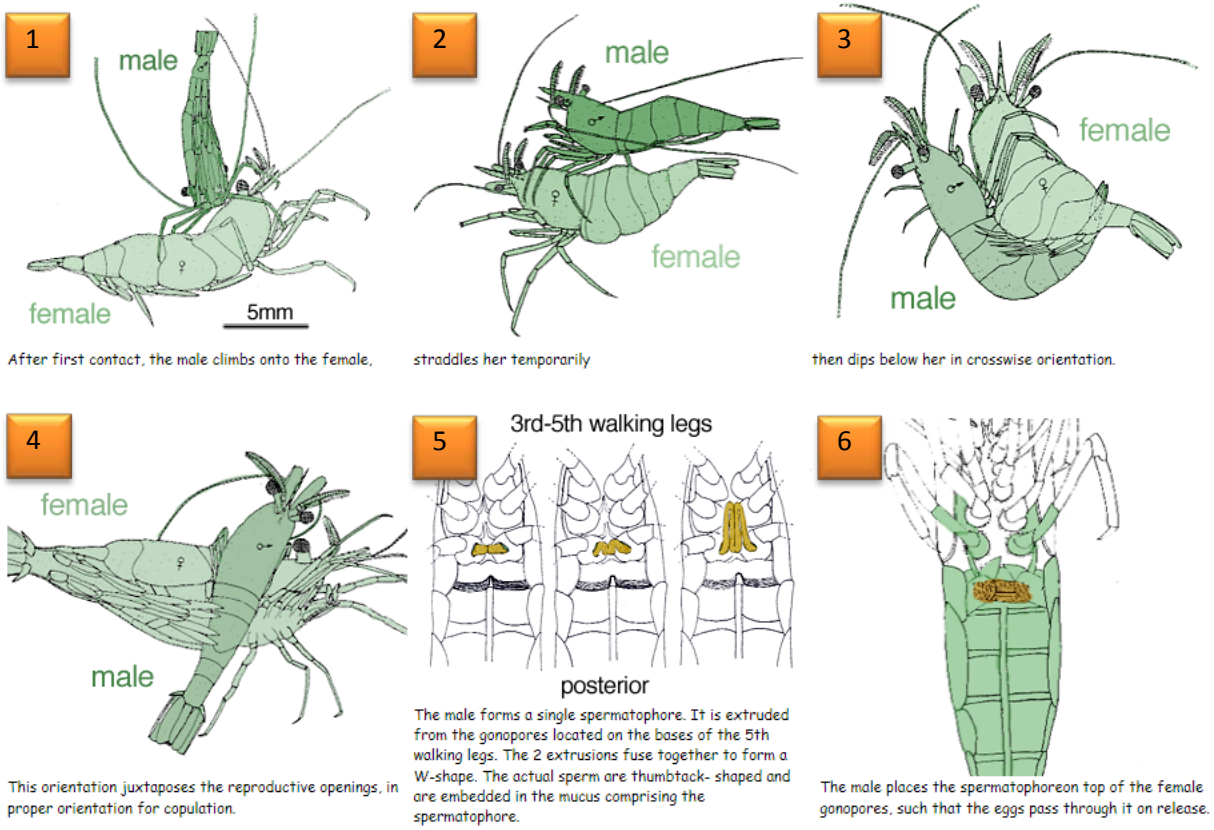


Figure 15. Mating dance of a Caridean shrimp

Figure 13 is from http://www.asnailsodyssey.com/LEARNABOUT/SHRIMP/shriRepr.php, where it illustrates the mating sequence of marine carideans.

When the male shrimp "scents" the female's pheromones, he will become unusually active and will swim farther up in the water column than is his custom. Several males may gather in hope of being successful. (Optimism is an important part of any courtship. ☺) The unsuccessful suitors will usually try to find another female elsewhere—females in a community can be influenced by the pheromones the first female, and may be able to bring eggs maturity quickly themselves.

Once the two shrimp have found each other, the male climbs on top of the female (number (1) in Figure 13), straddles her (2), then swings beneath her. Illustrations (3) and (4) show and state that the male has a crosswise orientation to the female in these two steps—the RCS male and female assume a position more face-to-face and parallel on the long axis. At this time the male moves his spermataphore (5), a little packet of sperm cells embedded in a sticky mucus membrane, from between his pleopods to the opening of the gonopores between the female's pleopods (6), using his setae-rich appendix masculina. Elapsed time? Ten seconds. They prefer romantic twilit evenings for this process.

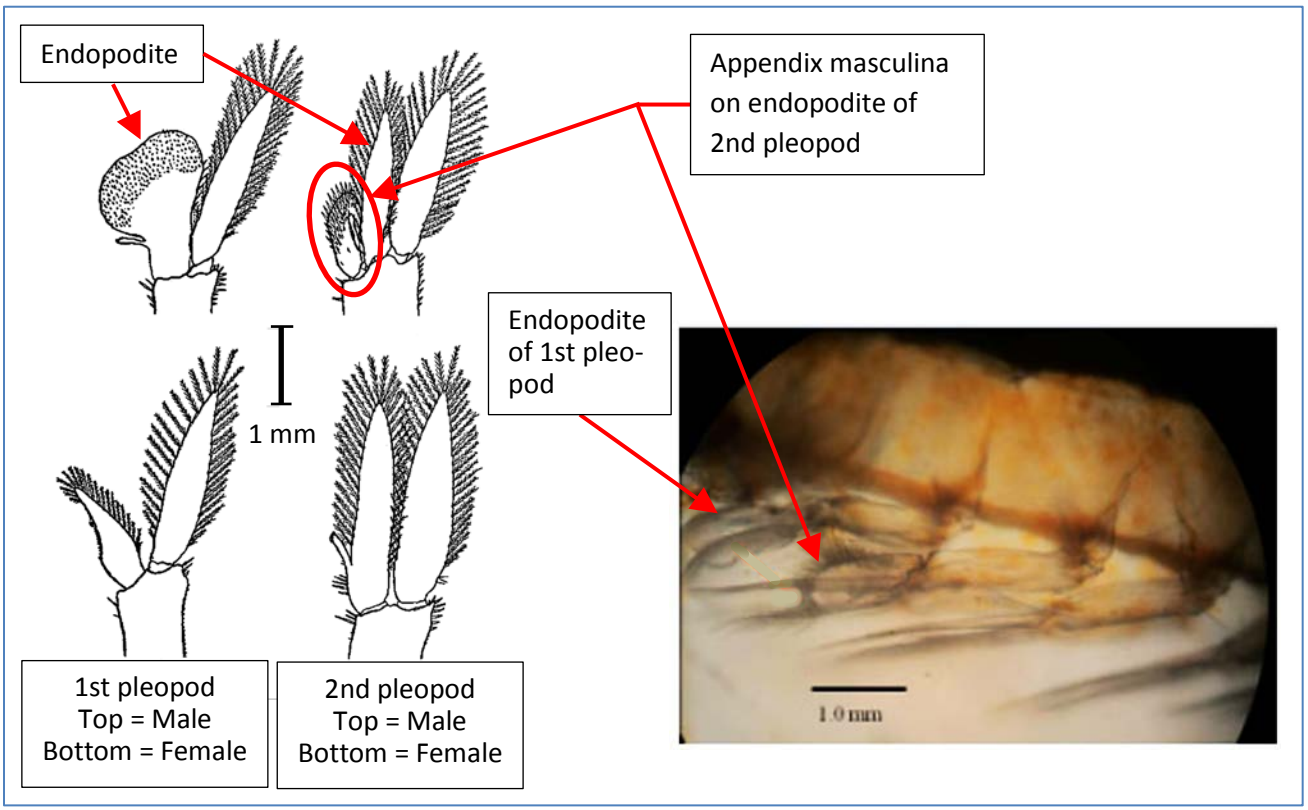


Figure 16. Foot size does matter

Males have differently shaped and larger sized "feet" on the first and second pleopods than the females have. The appendix masculina is used in the transfer of the spermataphore to the female's gonophore opening.

Black and white illustration is from "On the Development and Growth of Neocaridina denticulata DE HAAN" by Mizue, Kazuhiro; Iwamoto, Yasuo, downloaded from Nagasaki University's Academic Output SITE
Photo from F.A.H. Nur and A. Christianus, 2013. Breeding and Life Cycle of Neocaridina denticulata sinensis (Kemp, 1918). Asian Journal of Animal and Veterinary Advances, 8: 108-115 URL: http://scialert.net/abstract/?doi=ajava.2013.108.115

When the female releases her eggs from her gonopores, the eggs have to pass through the spermataphore with its thumbtack-shaped sperm cells on their way to the female's brood pouch. The eggs are fertilized during the passage. The eggs have a tether by which they attach to the female, and the egg cluster is covered by a filamentous, transparent membrane. At this stage, the female is "pregnant"; technically, she is ovigerous, but in the vernacular she is "berried". The number of eggs she produces is directly proportional to her mass, with the typical range being 20 to 30 eggs. (In 1961, when Mizue and Iwamoto were studying the wild form, the females

produced over 100 eggs in a spawn.) The "brood pouch" is the space created by the side walls of the abdominal skeleton, the cupping of the pleopods, and the membrane. The female uses her pleopods to keep fresh water flowing over her eggs until they hatch. How long the eggs take to mature is influenced by temperature; on average eggs hatch after 15 days at 27 °C, up to 3 to 4 weeks in cooler water. First time mothers occassionally drop all their eggs after carrying them for just a couple of days. When first produced, the eggs are somewhat translucent and become opaque as they mature. Eggs of different colors are not uncommon; some hobbyists say this is just the wild side coming through, others say it is an indication of more than one color line existing in the "pedigree". Totally white* eggs are dead and often fuzzy with an attack of fungus. *Snowball and white pearl shrimp have naturally totally white eggs, but they're not fuzzy.

With her eggs held tucked up by her swimmerets (pleopods), the female's movement is hampered. More so than usual, she needs a place to hide. Such a place can be created with driftwood, rocks, and/or plants if desired. Alternatively or additionally, several differents styles of manufactured shelters can be placed around the bottom of the tank, nestled into plants or tucked half under driftwood.

http://www.ebay.com/itm/Aquarium-Shelter-Shrimp-Breeding-Shelter-Cave-Crystal-Red-Shrimps-CRS-/181190662900?pt=Decorations&var=&hash=item2a2fce1af4

http://www.ebay.co.uk/itm/2pcs-Fish-Tank-Aquarium-Shrimp-5cm-Square-House-Cave-Breeding-Rearing-Shelter-/190998216273

"completely hand made using only 100% fish and reptile materials" (Gee, I hope not…)

http://www.ebay.co.uk/itm/slate-cave-tube-for-fish-reptile-ideal-breeding-plecs-fry-shrimp-etc-BEST-SELLER-/191086777776

http://www.ebay.co.uk/itm/6-piece-Shrimp-Pyramid-in-Terra-Shrimp-Cave-Crawfsh-Clay-Tube-Cave-/151242244675

Figure 17. Different types of manufactured housing

The stacked cylinder style also come in scorched or dried bamboo; no benefits were given for the scorching. People generally tuck these caves between rocks or pieces of driftwood or cover them with moss. I didn't see reports about whether or not the shrimp cared about the appearance of the caves as distinct from how hidden the caves were.

When you can see well-defined eyes in the eggs, the time to hatching is 1-2 days according to some, or 5-7 days according to those who describe themselves as very observant. The photo (on the right in Figure 16) of the eggs showing the shrimplets' eyes is from www.planetinverts.com, an exceptional resource for hobbyists. They have excellent photos of RCS molting and breeding, and of a hatchling emerging from egg.

The female helps the eggs hatch, loosening the cluster to give them room. Hatching her entire clutch of eggs can take the female hours and occurs most often at night. When the shrimplets hatch, they do not get completely free of the egg shell at first. The egg sticks to the top of the baby's carapace, allowing it to hang and mature another 20 to 30 minutes. The shrimplets first molt occurs at that time—it takes about a minute—and they detach from the egg shell completely at last and can swim away. Molt 2 is two to three days later, molt 3 in another two or three days, and molt 4 is from one to three days later. Molt 5 comes three to four days later, by which time the shrimplets uropods and telson are fully formed and its yolk sac, formerly a little yellow dot showing through its carapace, is virtually consumed. At this stage, the shrimplet's growth accelerates, and within a month it will be about 7/16" long (11 mm), and gender differences will be discernable. By the second month, the shrimp will be 5/8" long (16 mm) and will soon be capable of reproduction.

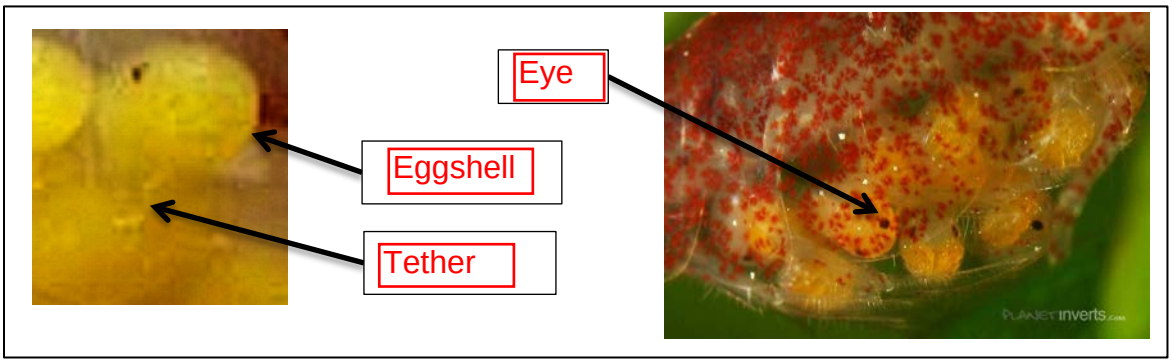


Figure 18. Eyes amidst the swimmerets

Those eyes will give you enough time to be sure there is plenty of mature java moss clumps nearby to provide shelter and algae to feed the shrimplets.

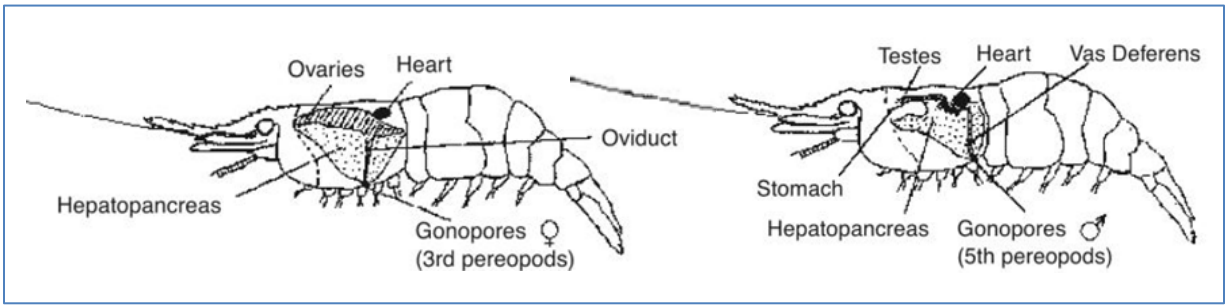


Figure 19. Example—internal reproductive organs of the prawn, *Macrobrachium rosenbergii*

From Michael B. New's book Freshwater Prawns: Biology and Farming (Source: modified after PA Sandifer & TIJ Smith (1985) Freshwater prawns, in Crustacean and Mullusk Aquaculture in the US)

Raising the baby shrimp

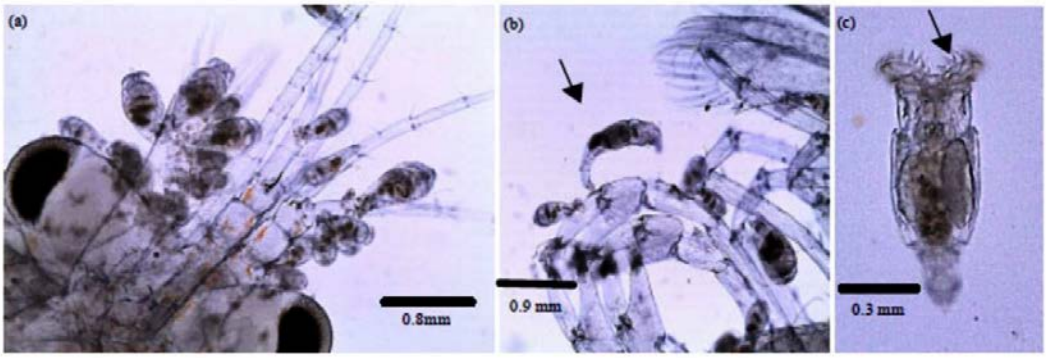
The shrimplets of this species pass through the equivalent of larval stages while in their eggs. When they hatch, they look and will soon eat like their parents. Their uropods and telson aren't fully formed and they absorb a bit of an egg sac for a few days (their bodies will have a yellowish spot and their feces will be white-ish until they start eating). The shrimplets graze on the biofilm, plankton, and algae at first. They nibble on the detritus from their parents' food as they grow, and finally move onto to the same diet the adults eat. Parents do not seem to be particularly interested in the shrimplets, either for protection or for dinner. As long as the shrimplets have moss to graze on and hide in, they will pretty much raise themselves.

Grooming

The one problem that seems to hit the young and adults is parasitism by clitellate annelids. In the picture below from the Nur and Christianus article, several *Holtodrilus* sp have overwhelmed a shrimplet. The annelids will infect both adults and newly hatched shrimp, covering the entire body. The annelids are most dense at the appendages. Mortality rate of infected animals is high.

Killing the *Holtodrilus* is relatively easy, however. The shrimp should be cultured in a slightly saline water – 5 to 10 ppt—as they can endure the salt but the annelids cannot. Nur and Christianos did not say if the saltwater condition was a treatment lasting a few days and periodically repeated or if the saltwater was to be a constant in their tank at all times.

For many of the larger pests which can attach themselves to shrimp, shedding the exoskeleton gets rid of the attaching animals. It does not, sadly, prevent reinfestation, but it's an interesting evolutionary tactic.



6(a-c): *Holtodrilus* sp. were distributed all over the body surface of *N. d. sinensis* cultured in freshwater, (a) *Holtodrilus* sp. attached to the nauplliar appendages of larvae, (b) *Holtodrilus* sp. elongated (arrow) ready to move and (c) Tooth (arrow) on the jaws of *Holtodrilus* sp.

Figure 20. Annelids such as *Holtodrilus* sp can overwhelm and cause the death of shrimp.

Photo from F.A.H. Nur and A. Christianus, 2013. Breeding and Life Cycle of Neocaridina denticulata sinensis (Kemp, 1918). Asian Journal of Animal and Veterinary Advances, 8: 108-115 URL: http://scialert.net/abstract/?doi=ajava.2013.108.115

Dwarf shrimp groom themselves whenever they're not eating, sleeping, hibernating, defending, or reproducing. It is of critical importance to them, and they have legs dedicated to cleaning different areas. They motions are as regimented as a cat's, and are patterned much like the cleaning strokes of birds and cats.

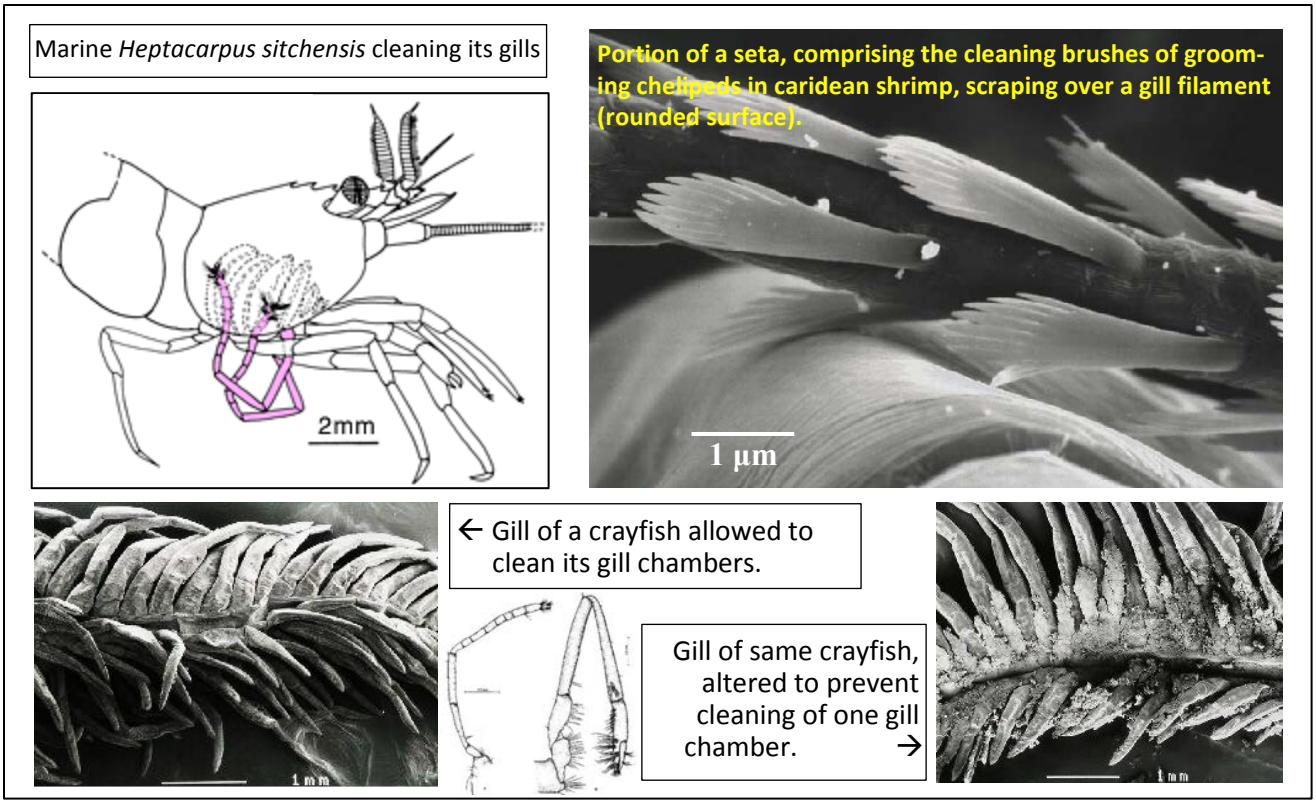


Figure 21. Shrimp use the brush-like setae and claws of their chelipeds to keep themselves clean

Shrimp have an excellent body and structure for accumulating particles of sediment and organic debris, as well as bacteria, fungi, protozoans, and algae. Such debris interferes with their breathing, their senses of smell and touch, swimming, and keeping eggs clean. The efficiency—and criticality—of their cleaning efforts are shown in the comparison photos in Figure 21 where the shrimp's ability to clean one side of its gills was removed.

Most of the information on grooming and the photos in Figure 21 are from:
http://www.asnailsodyssey.com/LEARNABOUT/SHRIMP/shriTrue.php
Bauer 1975 Zool J Linn Soc 56: 45. Bauer, R.T. 1978. Antifouling adaptations of marine shrimps (Decapoda: Caridea): functional morphology and adaptive value of general body grooming and antennal cleaning behaviours. Marine Biology 49: 69-82. Bauer, R.T. 1977. Antifouling adaptations of marine shrimp (Decapoda: Caridea): functional morphology and adaptive significance of antennular preening by the third maxillipeds. Marine Biology 40: 260-276 Cowles 1994 J Crust Biol 14: 247
http://www.ucs.louisiana.edu/~rtb6933/shrimp/clean.html Antifouling Mechanisms: Grooming Morphology and Behavior
Bauer, R.T. 2013. Adaptive modification of appendages for grooming (cleaning; antifouling) and reproduction in the Crustacea, pp. 337-375. in: M. Thiel and L. Watling (eds.), Functional Morphology of Crustacea, Vol. 1.. Bauer, R.T. 1998. Gill-cleaning mechanisms of the crayfish Procambarus clarkii (Astacidea: Cambaridae): experimental testing of setobranch function. Invertebrate Biology 177: 129-143 Bauer, R.T. 1989a. Continuous reproduction and episodic recruitment in nine caridean shrimp species inhabiting a tropical seagrass meadow. Journal of Experimental Marine Biology and Ecology, 127: 175-187 Bauer, R.T. 1981. Grooming behavior and morphology of the Decapod Crustacea. Journal of Crustacean Biology 1: 153-173

Shrimp-ery Summary

1. Have a fully cycled, mature, 10 gallon* tank ready for shrimp before you get them. They cannot endure ammonia or nitrite and have almost no tolerance to nitrate. Shrimp-proof the filter inlet if appropriate. *Larger is better, smaller only if you have a track record of being able to maintain the ammonia level at zero, as required.

2. Optimum water parameters:
    a. pH: 7.2
    b. Temperature: 75 °F
    c. Hardness: 8 dKH (143 ppm $CaCO_3$)
    d. Total dissolved solids: 100-200 ppm
3. If opting for a community tank, select tankmates based on whether or not they can eat shrimp (fish) or hybridize with the shrimp species/variant you buy.
4. Use moderation in quantity and types of plants. Shrimp don't do well with heavy fertilization and prefer softer lighting.
5. Stock 2 to 3 shrimp maximum per gallon (for beginners). The limit in shrimp tanks is not the bioload produced by the shrimp, but the bioload of food left uneaten.
6. Cull your stock mercilessly for deformities. Outcross your line every couple of generations.

NEOCARIDINA SPECIES WORDSEARCH PUZZLE

I M E T I L O Z Q S M A K M B M Q R J S L X B S L K K P I D D O B K K V E
M R D F P T U U J F L M S X O V T D G C G B M P M S V Y N R B F G A Q F X
K J I Q G E F E N Y P G I C S X L N R R X R D U M J V N X G Y I O L B I B
F E A O D U L N T M H H S Y E F U G K L O N G I P O D A X P K B Y E A E O
C P U I M G C C B A B C N X N D O B K J S R Y T R N F A R A I J R P Y D Q
B I R N B O A X R F S F E O S X D K K Z T M E U J W T F S W P D U J M O C
C U O Q B D T L H I R N N Z I B I G K C X M R M L Z B A V O X E F Y J Y O
Y O A L I A Y E S L S Q E Y S A A N U A D O P I L I C A R G N Y B T L I C
G E N V T X E N N W T D F T P D N T Y F Z J P R L M Z M H S Q I C D X E C
D W E N Q E E I G S E R N K P H I G E Y M A W F Y F B S I L W X P B C H U
C R Z T G I L F L Z I W I G S L C F H J G O E P J H G S T W Y V R S S Y L
B A C Q U Y B O R E R S L H W M A O K S H G Y D B I A L V K D K G D V S R
Q T E H I S Q M V E M F D H E O D B M E Y A R L U W M J H Y V Z T P S I S
T K N O K W R D Y A K V J F K T B G H N C L Z E B T U V X F X H N Q Y S H
F A M U D A C U R V I F R O N S E U V A X M A T Y T D U T T A Z X X L N D
I G P I V O D L H M I J J F O Q V R S H H W E E X J X P A V N F X N G E I
P S H T D Y M O Z D F F K N L K I I O I N Y N H X A V D K U A Y S D L N R
S T V J G N J M P Z B M E H L U A O I P S D D V V B P G N L M C Z Y T A Y
K I X C G O P Y J O P L Q Q W Q Q J W L O N R V X J H A J Y A Q D K B H F
J P S W G B I N A Q D A C N L G C W S A I D E N V R K L Q T B E O O O S N
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S G X G P R T A A N P R G B E H O U Y F R A I N R U J A B Y U N M P S U V
N E J P C I B T G A T A M L A P S Q Y Q Y L D L A Q C O K H T W H K O G N
V O U E D K E L I I I Q E T Z F D Y K I V V I Z D X J K Y I O S W M M L Q
L T T I L K Y U O W H S T F J X L N P Z W L A J I E R J C G S E R F O O Y
D E V S A C C A M Y A S D L L B U M U S W G N N N R P U O X P V X Q H E Z
C A J J S J J A X K S V I I E P Z Q B V W N A H U E L D Q J B Y C J U N I
D E G U U J K N L Z Y A U T N A V R V A N Z L E O A K Z H B P P H T S V Y
V M L U O Y A N G E N S I S Q G Y H Z C X B I E T A S O N I P S U E L O J
L I F Y T Q S E Y T O C Y Q P N M X G I V P S A C H X V K T O S E Z G W L

LIST OF NEOCARIDINA SPECIES (and spp species)

anhuiensis	denticulata	homospina	luodianica	saccam
bamana	euspinosa	iriomotensis	luoyangensis	spinosa
bosensis	fukiensis	ishigakiensis	linfenensis	xiapuensis
brevidactyla	gracilipoda	ketagalan	longipoda	zhangjiajiensis
curvifrons	heteropoda	keunbaei	meridianalis	zhoushanensis
davidi	hofendopoda	koreana	palmata	(Solution at end)

Red Shrimp and Pasta Recipe

Ingredients

1/4	cup	Olive Oil
1	lb.	Red Shrimp (not Red Cherry Shrimp--red shrimp *Pleoticus robustus* from Connecticut)
1/2	lb.	Snipped Green Beans
1	pint	Cherry Tomatoes
1/4	lb.	Shiitake Mushrooms
1/4	cup	Roasted Garlic
4	each	Fresh Basil Leaves Chopped
1/4	cup	White Wine
1	Splash	Lemon Juice

Salt & Pepper to Taste
Bow-tie Pasta

Directions:

Sauté green beans and shiitake mushrooms in olive oil; add roasted garlic, cherry tomato halves, fresh basil.

Add red shrimp. (Do not overcook red shrimp.**) They are very tender so they cook quickly.

Add a splash of white wine and lemon juice, salt and pepper to taste and toss with bow-tie pasta.

**Note: Chef Chaz says he can't emphasize enough that it would be a tragic mistake to overcook these shrimp. You pretty much just threaten them with heat. The shrimp are in season for the summer, beginning in June. Captain Daniel Packer Inne of Mystic, Connetcticut doesn't list this dish on their menu, but local gourmets who are in on the secret request it.

Recipe: Paull, Chaz, "Red Shrimp Recipe" (2007).*Wrack Lines.* Paper 31. http://digitalcommons.uconn.edu/wracklines/31
Photo: http://www.ilovealabamafood.com/famous-dishes/royal-red-shrimp review of King Neptune's, Gulf Shores, AL

Is It a Prawn or a Shrimp?

Whether an animal is prawn or shrimp, when sticking to zoology, is fairly a straightforward matter. A person does not have to resort to a microscope and counting meristic differences to explain it.

- Prawns are larger than shrimp.
- Prawns have claws on three pairs of legs; shrimp have claws on two pairs of legs.

- Prawns have proportionately longer legs than shrimp have.
- Prawns prefer to walk about, shrimp prefer to swim about.
- Prawns have branched gills, shrimp have plate like, lamellar gills.
- Each segment of a prawn's abdomen overlaps the one that follows it; segment 2 on a shrimp overlaps both section 1 and section 3.
- Prawns are Penaeids, shrimp are Carideans

Both shrimp and prawns come in freshwater and saltwater varieties. Both have reproductive tactics that vary between species, both have species that live in temperate zones and running water or tropical waters in still pools. Both prawns and shrimp have some species that need a high vegetable content in their diet, and others that need a significant percentage of their diet in animal life.

Outside the zoological realm, the lines between prawns and shrimp get a little fuzzier. It is becoming common for marketing to assign the term "prawn" based on size, i.e., how many animals there are per pound. For example, 15 per pound may be labelled "prawns" while 18 per pound of the same species may be labelled "shrimp".

In addition to advertising/food pressures, the name game is also influenced by culture. In some regions, if people eat it, that 10-legged thing is a prawn—shrimp are what's used for bait. In the United Kingdom, it's the habit to call any shrimp or prawn that inhabits the ocean "shrimp" while those that are fresh water inhabitants are "prawns".

Etymology: Prawn -- first recorded useage between 1400-1450, comes from late Middle English praine or prane. Shrimp—first recorded useage in the 1300's; comes from Middle English *shrimpe*, which is probably from Middle Low German *schrempen* to shrink. (etymology from http://www.asnailsodyssey.com/index.php by Tom Carefoot)

The ACA convention is in Louisville, Kentucky this year—home of the "Run for the Roses" Kentucky Derby, the cheeseburger, and mint juleps.

2014 ACA Louisville Convention

Thursday, **July 10th** through Sunday, **July 13th** 2014

http://2014.aca-convention.com/

Ammonia-Nitrite-Nitrate Test Kit Tidbits

The choice of ammonia test kit brand needs to be coordinated with the water conditioner you use, whether the kit uses liquid, powder, tablets, or strips. There are two chemicals used to measure ammonia—Nessler's reagent and salicylate-hypochlorite measure total ammonia—as well as Seachem's proprietary hydrophobic sensor technology, which measures free and total ammonia. If you use Amquel, you will get a false reading of ammonia with a kit that uses Nessler's reagent. If you use sodium thiosulfate for dechlorinating water, you will get a false ammonia reading from salicylate. If you use Seachem Prime, you will have to use their hydrophobic technology (as you will get a false ammonia reading with Nessler's or salicylate because the sodium thiosulfate in Prime reacts with the chloride ion in the reagents) or wait 24 hours to run your test.

API Ammonia measure 0 , 0.25, 0.5, 1, 2, 4, 8 ppm. The yellow to green to blue green color shift shown in the figure below is characteristic of salicylate. LaMotte's average range ammonia test uses salicylate, but its low range (0.02, 0.04, 0.08, 0.14, 0.2, 0.4, 0.6, 1.0 ppm) ammonia test uses Nessler's reagent . Salifert ammonia test uses Nessler's reagent, and can measure as little as 0.5 ppm total ammonia. Hanna ammonia test uses Nessler's, and relies on matching the intensity of the yellow/amber color rather than a color shift to take a reading.

Figure 22. Three different technologies for measuring total ammonia

Seachem's Multi Test uses hydrophobic sensor technology—the kit also measures free ammonia. API test kit uses salicylate, and Seneye seems to use light and optical filters to measure ammonia, pH, and temperature.

Seneye, a new company, has a device with an in-tank monitor that measures your water parameters, sends the information to your PC or the cloud, and provides you with alerts, status, and graphing over a 30 day period of ammonia (and pH, temp, and water level, but not nitrite or nitrate).

Figure 23. Examples of two different technologies used to measure nitrite and nitrate
Seachem's Multi Test uses hydrophobic sensors, while API's tests use reagents.

API Nitrite measures 0 ppm, 0.25, 0.5, 1, 2, and 5 ppm. API Nitrate measures 0, 5, 10, 20, 40, 80, 160 ppm; for the *davidi* shrimp, a kit that measure nitrate from 0, 0.5, 1, 2, 4, 8, and 16 ppm would be more useful (I saw no kit labeled for that range).

Colorimeters—expensive and fiddly to use, they do their job with a precision that ordinary tests can't match. The accuracy and precision of the nitrate, nitrite, and ammonia tests can be improved by using a colorimeter in place of the color comparator. The colorimeter is a simplified spectrophotometer, which measures the amount of color in the sample at a specific wavelength of light. By choosing the appropriate nutrient test preprogrammed in the colorimeter, the correct wavelength is utilized.

Colorimeter info from http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/cwt/guidance/3312.pdf

Toxic ammonia calculator

The fraction of unionized ammonia (NH_3) is not directly measured, but instead is calculated using measures of total ammonia, pH, temperature, and ionic strength (measured either in terms of total dissolved solids or conductivity). The American Fisheries Society has developed an ammonia calculator (Table 9 on the referenced web page) for this purpose. Once the required data are entered, the tool will calculate the amount of unionized ammonia in both mg/L and µg/L. (this paragraph quoted from http://www.epa.gov/caddis/ssr_amm_wtm.html) (Consult your water company's annual report for TDS or conductivity of your water.)

Information on test kits, reagents, and their interactions with water conditioners was gleaned from these sites, among others:
http://answers.seneye.com/index.php?title=en/water_chemistry/what_is_ammonia_NH3_%26_NH4_?/Ammonia_Test_Kit
http://answers.seneye.com/index.php?title=en/water_chemistry/what_is_ammonia_NH3_%26_NH4_%3F/Ammonia_Test_Kit/NH4_and_NH3_calculations_%26_tables
http://www.kordon.com/kordon/products/water-conditioner/amquel-plus#contraindications-toxicityU38T!
http://www.seachem.com/Library/SeaGrams/Testkit_Guidelines.pdf

The aquarium as an element of Extreme Interior Design

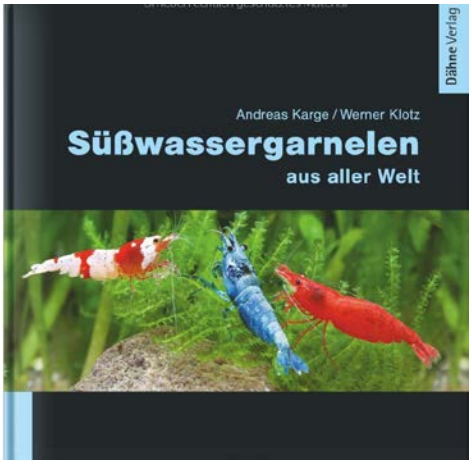
(As long as we're discussing ammonia here…)

The Mumin Papa Café in Akashi, Hyogo Prefecture, Japan has many fish tanks around the tables, a decorating tactic becoming common in fancy restaurants there. But Mumin Papa one also has a toilet that has three of its walls bordering an aquarium (only $263K in then-year dollars). It's been known since at least February 2007, and its fame is still going strong. According to several sites, this is the women's bathroom; the men's is ordinary.

Rumor has it that the turtle likes to stare.

Image from http://www.independent.co.uk/multimedia/archive/00061/loo4_akashi_61595a.jpg via themost10.com site

Furthur reading possibilities on freshwater shrimp



Available only in German as this time.

The unique standard of Freshwater prawns in third, fully edited Edition. The popularity of freshwater shrimp are growing, but aquarists, dealers and breeders are often lacking the necessary basic knowledge. The renowned expert remedy this deficiency. The basics of morphology, Anatomy, diseases and parasites are explained clearly and easy to understand. The subsequent detailed descriptions list all known species and introduce them with the exact professional designation in Word and image. Simple determination keys and key differentiators enable the aquarist thus closely associate the animals. The new version is corrected, supplemented and extended to newly discovered animals.

Freshwater Shrimp of the World, by Anderas Karge and Werner Klotz

These two much-touted resources are scarce but still obtainable. Volume 1 English edition is available from Amazon. com. Volume 2 is available from Used Book Sellers on Amazon. de and from http://www.garnelenhaus.de/Books-and-Magazines/Dennerle-Breeders-n-Keepers-Vol-2::1749.html (shipping is more than the cost of the book/magazine though).

Breeders 'n' Keepers, Volume 1 and 2 - Shrimp Keepers Magazine (Aquarium Freshwater Shrimp)
by Chris Lukhaup (Vol 1 English and German; Vol 2 German only) Paperback

CONSERVATION NEWS—WILD AXOLOTLS SIGHTED

Edited from an Associated Press article. MEXICO CITY — Mexico's salamander-like axolotl apparently hasn't disappeared from its only known natural habitat in Mexico City's few remaining lakes. Researchers biologist Armando Tovar Garza of Mexico's National Autonomous University and team members say they have sighted, but not caught, two of the slippery little creatures during a second effort to find them.

Growing up to a foot long (30 centimeters), axolotls use four stubby legs to drag themselves along the bottom or thick tails to swim in Xochimilco's murky channels while feeding on aquatic insects, small fish and crustaceans. A week's long effort last year by researchers in skiffs trying to net axolotls in the shallow, muddy waters of Xochimilco lake found none, raising fears that they might only now survive in captivity. The creature is important in scientific research because of its ability to regenerate severed limbs.

The axolotl's only natural habitat is the Xochimilco network of lakes and canals — the "floating gardens" of earth piled on reed mats that the Aztecs built to grow crops. The lakes and canals are now suffering from pollution, urban sprawl and invasive species. The garden-islands have increasingly been converted to illicit shantytowns, with untreated sewage often running off into the water.

In this Feb. 21, 2014 photo, a young axolotl swims inside a plastic container at an experimental station.

Some axolotls still survive in aquariums, water tanks and research labs, but experts said those conditions aren't the best; Tovar Garza said some small mutations, possibly the result of interbreeding, have already been seen. Releasing captive-bred axolotls into the wild could spread a fungus infection that is fatal to them and could reduce their genetic diversity

Alarmed by the creature's falling numbers in recent years, researchers built axolotl "shelters" in Xochimilco to help them breed in the cleanest part of their remaining habitat. Sacks of rocks and reedy plants act as filters around a selected area, and cleaner water is pumped in, to create better conditions. The shelters also include permeable cages and other devices intended to help protect axolotls from non-native carp and tilapia that were introduced to the lake system years ago and compete with axolotls for food. The Mexican Academy of Sciences said that a 1998 survey found an average of 6,000 axolotls per square kilometer, a figure that dropped to 1,000 in a 2003 study and 100 in a 2008 survey.

FOUND—LONG LOST DESERT CICHLID ENCLAVE ON TATAOUINE

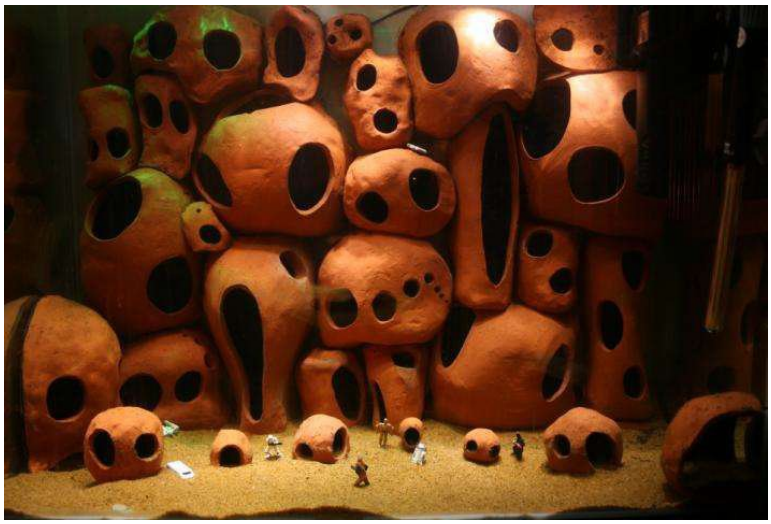
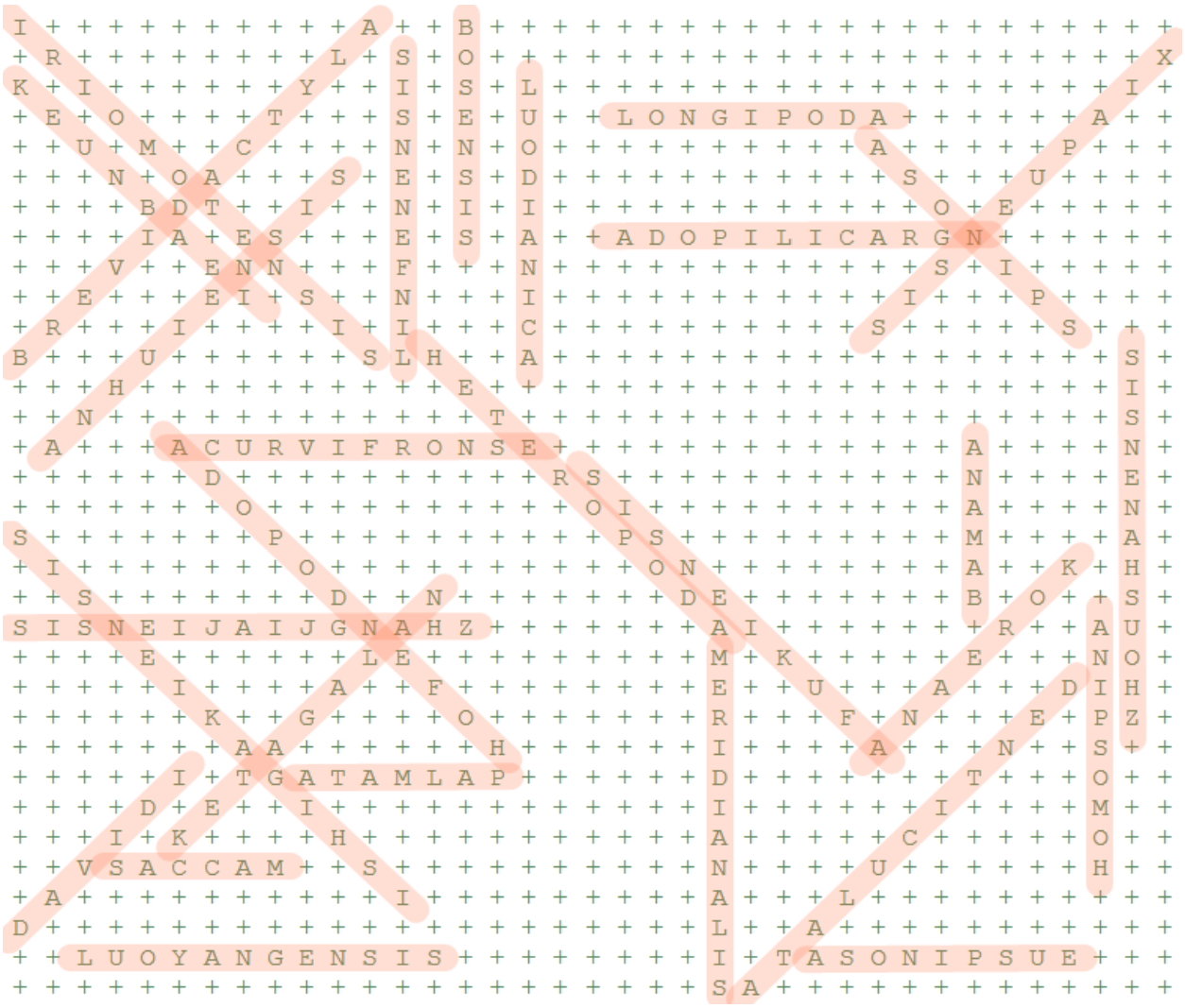


Photo Caption: This 30" x 24" x 15" custom made tank has been filled using hand crafted pieces of pottery that are hollow and provide ample hiding places for the occupants. The lighting is produced by seventeen super bright white LEDs mounted in a custom lid. The Tataouine-esque feel to the tank has led to the introduction of several star wars characters--the fish seem to love Chewbacca! http://www.ratemyfishtank.com/photo-main.php/8719

WORDSEARCH PUZZLE SOLUTION



(Over, Down, Diagonal)	**ANHUIENSIS** (2,15,NE)	**BAMANA** (31,20,N)	**BOSENSIS** (15,1,S)	**BREVIDACTYLA** (1,12,NE)
CURVIFRONS (7,15,E)	**DAVIDI** (1,31,NE)	**DENTICULATA** (34,23,SW)	**EUSPINOSA** (34,32,W)	**FUKIENSIS** (27,24,NW)
GRACILIPODA (30,8,W)	**HETEROPODA** (14,12,SE)	**HOFENDOPODA** (16,25,NW)	**HOMOSPINA** (35,29,N)	**IRIOMOTENSIS** (1,1,SE)
ISHIGAKIENSIS (13,30,NW)	**KETAGALAN** (6,28,NE)	**KEUNBAEI** (1,3,SE)	**KOREANA** (34,19,SW)	**LINFENENSIS** (13,12,N)
LONGIPODA (20,4,E)	**LUODIANICA** (17,3,S)	**LUOYANGENSIS** (3,32,E)	**MERIDIANALIS** (23,22,S)	**PALMATA** (16,26,W)
SACCAM (4,29,E)	**SPINOSA** (34,11,NW)	**XIAPUENSIS** (37,2,SW)	**ZHANGJIAJIENSIS** (15,21,W)	**ZHOUSHANENSIS** (36,24,N)