IN THIS MONTH'S MASWA NEWS

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often quite diffuse and gametic cells can be spread throughout the body wall or even in tiny packets scattered throughout the animal – this makes it pretty easy to miss some functioning testes or ovarian tissue even during careful dissection. “Anomalous” hermaphrodites are often found in species in which sexes are “confirmed” to be separate, and simultaneous or sequential hermaphroditism appears to be the norm in a few well-studied species. So, even though researchers believe that anemones generally have a single sex, and the sex of the animal does not change through time, that may be as much our ignorance as the biology of the animals. In any case, juvenile anemones are exceeding rare in nature, and it is safe to say that successful sexual reproduction in the wild is uncommon: either 1) very few eggs are fertilised (although a single female can release hundreds of thousands of eggs in a single spawning event), 2) very few larvae survive, or 3) very few larvae find a suitable place to settle and metamorphose into a juvenile anemone. The answer to this question remains a subject of debate among researchers.

More information about the difficulty associated with keeping host anemones is becoming available in aquarium magazines all the time, and the writings of authors like Ron Shimek and Nick Dakin is slowly making the point clear that anemones are **not** beginner animals for any aquarium. However, I still I felt obliged to write this summary, because even these authors fail to mention the extremely **low rate of success** among even experienced reef enthusiasts in keeping these animals in aquaria. Most of the people I know who report long-term (again this means roughly 5 years or so, and that is far from “long-term” with an animal that ought to live for centuries!) success with anemones maintain them in a tank specifically designed to meet the needs of the animal, and in which the introduction of corals and other invertebrates is of secondary or little concern. If you intend to set up an aquarium with the specific goal of keeping anemones (with or without clownfishes), and gear the tank to that goal, I think that is great. I still encourage you to research the needs and natural habitats of the animals extensively, and to search out those rare pet shops that will be honest and informative (by which I mean somewhat discouraging) on the success rate of the average aquarist in keeping these animals. If you walk into a petshop and say “I want to add a Sebae anemone to my tank for my clownfish,” and they show you to a tank of partially inflated white anemones and reply anything like “No problem, they are hardy and easy to keep,” I would recommend that you find a shop that provides you with much better guidance. In a recent Marine Answers column in Practical Fishkeeping, someone asked Nick Dakin about the chances of success with a completely bleached, white anemone to which Nick replied, “Buying anemones that have lost all, or most, of their zooxanthellae is always going to be a risky business. Some survive, many others do not. I would continue to search for a good specimen that exhibits all the marks of a healthy anemone - a good basic brown colouration (although it may be red, green, etc), a strong foot, and a fully expanded body.”

I think that is sound advice, but even when starting with an animal in excellent initial health, success rates with anemones in aquaria is still disturbingly low. Considering the confusing nature of the relationship between clownfishes and their anemone hosts, the apparent specificity and diversity of natural anemone diets, their lighting requirements, and the fact that a pitiful 5% of experienced reef keepers have managed to keep one of these anemones alive for more than approximately 1/100 of their expected natural lifespan, I hope that rather than reading this article and considering what to look for when choosing your next anemone that you will seriously consider whether your aquarium and ability are right for these animals. If you decide that you are up to the challenge, I hope that you consider what is the best way to go about choosing your ‘last anemone’ rather than replacing yet another victim in your quest. I say last anemone, because if properly cared for and allowed to live out its natural life span, these animals should become a family heirloom that should out-live not only you but likely your children and possibly your grandchildren. Until we reach the point where these amazing animals are routinely surviving for more than a couple of years in captivity, perhaps we, as responsible aquarists, should resist the temptation to buy them – no matter how beautiful and fascinating they are.

NEXT MEETINGS

September's meeting will be held at Phil Melvin’s house at 7.30pm on the 29th September 1999. Phil’s address is 193 Summerlakes Pde Ballajura. Phil has a great reef aquarium. Its is 6ft long, 2 ½ foot wide and 2 foot tall. The tank is built from 10mm polished arrissed glass and glued with black silicone. The aquarium is setup as a Berlin system and has a 8cm deep live sand bed, live rock and a large downdraft protein skimmer. Phil is known to many of his “reef” friends as “gadget man”. The reason for this is his love of building gadgets for his tank! His gadgets of best acclaim are his 200 Liitre auto Kalkwasser top up unit in the ceiling above his tank and his electronic temperature controller for his cooling fans.

October’s meeting will be held at Nathan Cope’s house, which is located at 21A Norton Road South Perth. The meeting will begin at 7.30pm sharp. Nathan hosted a meeting at his place a few months ago, shortly after he got his tank setup and running. His tank is now slowly filling up with fish and corals and it should be interesting to see how it has progressed since we last saw it. Nathan has a very large aquarium that is viewable from both sides. Its setup as a Berlin system with live rock, live sand, Metal Halide lighting and a Red Sea Berlin venturi protein skimmer. You will be amazed by the amount of food that Nathan puts into his tank. He will explain to us how important it is to feed a tank sufficient amounts of food in order to support all the critters that live in the live sand. Be there or be square!

PREVIOUS MEETINGS by Nathan Cope and Andy Dolphin

July's MASWA meeting was held at Grant's place in Forestfield. This was Grant's third meeting and his tank has certainly progressed from the two or three pieces of live rock he had at last year's meeting. I think Grant is happy with the decision to take the "slowly-does-it" approach. The meeting was well attended and it was good to see some new faces and a couple of faces we hadn't seen for a while. Discussion was lively as usual particularly with regard to the age-old topic of nitrate and trickle filters. Dennis mentioned an article he'd seen explaining why live rock was "better" at nitrate reduction than a trickle system because of the direct association between nitrite and nitrate. I'll try to expand on this in a short article in this newsletter or in the next one.

August's MASWA meeting was at Andrew Jones' house. There was a fairly large turnout of members and a few new faces as well.

Andrew has a tall profile 4' Berlin-style reef tank. It would have to be the shallowest tank I have seen lit by a 400W metal halide and it is obvious that the corals appreciate the light intensity. As an example, Andrew has an Acropora head in his aquarium where the polyp tentacles are so expanded that the coral looks fluffy! Andrew also haa an orange crinoid (feather star) that has been in his aquarium for about a month. These animals usually die of starvation very quickly in aquaria as they will only eat certain species of plankton and cannot adapt to any other sort of food. The crinoid in Andrew's aquarium looks healthy at the moment and Andrew says that at night, his aquarium is swarming with plankton, so hopefully this animal will continue to do well. I'm sure Andrew will keep us updated on its health. There is also a Marine Betta or Comet in Andrew's aquarium. These are pretty but usually very shy fish and Andrew's was no exception. It finally showed its face toward the end of the meeting. Overall, Andrew's aquarium was very healthy and a good example of what to strive for in a reef aquarium. I would have to say it is one of the healthiest I've seen and certainly the best I've seen of that size aquarium.

specialist P. biaculeatus. The fact that both innate and behavioural protection is possible, and that the level of protection differs at different stages of the life of the fishes only adds to the existing confusion about exactly how and why the association between clownfishes and anemones has developed (although a recent molecular study of the clownfishes suggests that the ancestral anemonefish was likely a host specialist like Premnas biaculeatus, and that the extreme host generalist A. clarkii descended from that specialist ancestor – see Elliott et al. 1999). At present all that can be said from the data is that there is no clear generalisations that can be made about the mechanism of protection from anemones. The protection of anemone fishes varies by the species of host as well as the developmental stage of the fish, and in tanks the "rules" of host preferences and associations often seem to break down. It is not uncommon for a pair of clowns to spend all their time in a long-tentacled plate coral (Heliofungia spp.), or some such "inappropriate host" despite an available anemone of the "correct" species nearby. That brings me to my last point. The majority of clownfish sold in the pet trade today (in the US) are captively raised and even wild caught ones do not **need** an anemone. In the wild, the association is vital to the survival of both the fish and anemones: juvenile survivorship of clownfishes is significantly higher when associated with an anemone (in order to survive heavy predation on newly settled fish), and the anemones are often unable to survive the attacks of butterflyfishes without their clownfish hosts to protect them. However, at the size that clownfish and anemones are sold for the pet trade, and **especially** in the absence of the typical suite of natural predators, clownfishes and anemones have absolutely **no** requirement for one another in an aquarium (Fautin & Allen 1992, Wilkerson 1996, Shimek 1997).

In general, there are more cases of success reported among aquarists who keep the Bubble-tip or Rose anemone (Entacmaea quadricolor) than all the other species combined, and to date, this is the only anemone that is reported to reproduce with any frequency in aquaria. After E. quadricolor, the sebae anemone (Heteractis malu or H. gelam) and the green carpet anemone (Stichodactyla mertensii) appear to have higher success rates than the others, but there are obviously exceptions to that generalisation, and Ron Shimek has a saddle carpet (S. haddoni) that has repeatedly spawned eggs in his aquarium (Shimek 1997).

Even more exciting than the common asexual reproduction (splitting) among E. quadricolor over the past 5 years (some aquarists have so many of these anemones in their tanks that they are forced to thin them regularly), is the slow trickle of reports from aquarists who have had their anemones spawn (like Ron) in their aquariums. Asexual reproduction is common among many corals and is reported for other host anemone species in the wild, but with the exception of E. quadricolor, reproduction of host anemones is exceedingly rare thus far in aquaria.

Unfortunately. the mode of sexual reproduction in most tropical anemones is unknown, but there are detailed descriptions of many temperate species. Among the species described, there is almost an even split between species that spawn pelagic larvae and those that brood internally. There are sufficient reports of free spawning among the host anemones (at least Stichodactyla & Entacmaea) to rule out internal brooding as the typical mode of sexual reproduction, but we simply do not know much about the reproductive biology of these animals. If the host anemones are free-spawners, which spawn pelagic (free swimming) or demersal (bottom-hugging) larvae, there is again an almost even split among those larvae that do and do not feed in the plankton. Depending on the mode of reproduction and whether or not the larvae feed, it may be simple or difficult to raise the young—even if someone were successful in obtaining a spawning pair without any means to sex the animals in advance. In fact, it is virtually impossible for the average person to sex anemones.

Anemones generally have separate sexes, but it is difficult to be sure because the gonads are

animals (such as not feeding them or keeping soft-sediment species in a bare-bottom Berlin-style reef tank).

Fourth, the relationship between clownfish and their anemone hosts are not as simple as many people have been lead to believe, either. Recent research has found that the ability of clownfishes to contact anemones results from an odd mixture of innate defences (which vary by species), behavioural adaptation and developmental stage (e.g, Elliott et al. 1994, 1995; Elliott & Mariscal 1996, 1997) . Joel Elliott and his colleagues examined the vulnerability of various developmental stages (eggs, 0-5 day old larvae, and 7-14 day old juveniles) of 10 species of anemone fishes (Amphiprion & Premnas) to being stung by 9 species of host anemones (in the genera listed above for Wilkerson's anemone survey). Among other things, these researchers found that anemones failed to sting the eggs of any species of anemone fishes tested, but the larvae of all species were captured, killed and eaten by the anemones, regardless of species. If the researchers raised the larvae in a tank, and then allowed recently metamorphosed juvenile anemonefishes to contact a variety of anemones for the first time, they found that some species of clownfishes were protected from some species of anemone (but which larvae were stung by which anemones varied by species).

Only A. percula (true percula clown) was immune to the stings of all potential host anemones as a juvenile, with most other species being stung by at least one species of anemone (most frequently Stichodactyla gigantea). Unlike Amphiprion, which was generally protected from several, if not most species of host anemone, Premnas biaculeatus (the Maroon or Spine-cheeked clown) was protected from only it's natural host species, Entacmaea quadricolor (the Bubble-tip or Rose anemone). As it turns out, all the species tested were capable of contacting the tentacles of E. quadricolor without being stung as soon as they metamorphosed into juveniles. Relatively few species were able to contact Stichodactyla gigantea (the giant carpet anemone) without being stung. Even in cases in which the juvenile clownfishes were stung when contacting anemones, most reacted by swimming violently and many were successful in breaking contact with the tentacle in all cases other than for the carpet anemones (Stichodactyla spp.) which generally captured and consumed any juvenile clownfishes which contacted their tentacles. However, developmental changes as the clownfishes mature allow the adults of many of these same species to enter the carpet anemones without harm.

Those fishes that managed to escape initial contact could typically acclimatise to the anemone if given time, and eventually become protected. Hence there is some behavioural or developmental component to the association, but the results discussed above are for naive fishes and must therefore be an "innate" protection from the nematocysts of the host anemone species.

In their book, Fautin & Allen (1992) say "We believe that for fish that live with many types of hosts (such as Amphiprion clarkii, which is the least host-specific), behaviour is likely to be more important to adaptation, whereas for host-specific fish (such a Premnas biaculeatus), biochemistry is probably the more significant factor." What they mean is that generalist clownfish either 1) accumulate anemone mucus through repeated contact and complexing compounds in the water in close proximity to the anemone (e.g., Elliott & Mariscal 1997), or 2) adapt their mucus to match the biochemical composition of the host anemone (e.g., Elliott et al. 1994 -- although the actual mechanism of behavioural adaptation is still unknown). Extreme host-specialists, on the other hand, ought to be protected by an innate genetic or biochemical mechanism of some sort.

The research of Elliott and his colleagues shows that the generalist clownfish A. clarkii have an innate protection that appears similar (and surprisingly effective) to that of the extreme host

CHOOSING YOUR LAST ANEMONE.

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Ladies and Gentleman, girls and boys. Please get your eyes ready and brains in gear to read this ***special SCOOP article*** *by the well renowned reef authority, Rob Toonen. We are the first to see this article!*

Although I applaud the efforts of people to provide more information about anemones, I think that most articles in aquarium magazines about these awesome animals fall far short of their goals. I think there is a critical piece of information absent from most anemone articles that all beginners (and even advanced hobbyists) should be told: namely that the vast majority of anemones **do not survive in captivity**. Despite the fact that I, and many of my friends and colleagues were lured into starting marine aquaria by the fascinating relationship between the clownfish and their host anemones, I generally try to discourage most hobbyists from ever purchasing one for their reef aquarium, no matter how successful or devoted they are. Part of the problem is that many of the anemones which host clown fishes are not really "reef" animals in the typical sense of the phrase, and part is that husbandry of anemones is poorly understood. I feel that many aquarists are mislead into thinking that anemones are appropriate for even a beginners reef tank. Regardless of the frequency with which I have overheard an employee in a petshop claim that "anemones are hardy animals that are easy to keep," this couldn't be further from the truth (as recent articles in FAMA, Practical Fishkeeping, Aquarium Fish and Tropical Fish Hobbyist have tried to point out), and I will try to explain some of the reasons why I think anemones should be avoided by all but the most serious aquarists in this article.

First, the anemones that host clownfishes typically harbour photosynthetic algal symbionts (zooxanthellae, zoochlorellae, etc.), and algal production in intense light appears to be the major source of energy for these anemones (Fautin & Allen 1992). The shape and behaviour of tropical host anemones both serve to increase the amount of area available for "harvesting" sunlight, and with few exceptions, intense lighting (typical of coral reef tanks) is required for anemones to gain sufficient energy for survival. Some species are found exclusively in very shallow water and only in areas that are directly exposed to sunlight (e.g., Stichodactyla gigantea), while others can sometimes be found in shaded areas, or even deep water environments (e.g., Entacmaea quadricolor). Depending on the habitat from which the animals were collected, very different levels of lighting may be required to maintain them successfully. Even in tanks with intense metal halide lighting in which stony corals are thriving, anemones are often reported to bleach and wither—whether this is a result of too much light for a low-light adapted animal or a sign of other stressors is unknown. Furthermore, despite the fact that anemones look to be helpless blobs just waiting for something to blunder into their waiting tentacles, all anemones require some animal prey for long-term survival. In fact, most species appear to be prey specialists, and require both specific mechanical and chemical cues for the discharge of their cnidae (specialised stinging cells that anemones use to capture their prey).

The cues required and the venom that is associated with these stinging cells both differ by species, and—just to make things more complicated—also differ depending on the condition and hunger of the animal tested (e.g., Elliott & Cook 1989). To date, there has been no cnidarian (the group which includes hard and soft corals, anemones, gorgonians, mushrooms, jellyfish, hydroids and the like) discovered which is capable of obtaining 100% of their nutritional requirements from light alone (Toonen 1997). All cnidarians require food of some sort (whether that involves uptake of dissolved organics or active prey capture) to survive, and if the animal has specific feeding or prey requirements, it makes the job of maintaining them in an aquarium that much more difficult. Anemones seem to fall into this latter category, and there are foods that are readily accepted by one species that are basically ignored and dropped by others. Known prey preferences of various captive species of host anemone include (Wilkerson 1996; Shimek 1997):

Common Name	**Species Name**	**Foods Commonly Accepted in Captivity**
Bubble-tip Anemone	*Entacmaea quadricolor*	brine shrimp, clam, fish, krill, scallops, shrimp, squid
Ritteri Anemone	*Hecteractis magnifica*	fish, squid, shrimp
Sebae Anemone	*Hecteractic crispa*	brine shrimp, clam, fish, krill, scallops, shrimp
Sebae Anemone	*Hecteractis malu*	brine shrimp, clam, fish, shrimp
Long-Tentacled Anemone	*Macrodactyla doreensis*	fish, shrimp
Sticky Carpet Anemone	*Cryptodendrum adheasivum*	brine shrimp, fish, shrimp
Saddle Carpet Anemone	*Stichodactyla haddoni*	fish, shrimp, slam, snails, squid
Green Carpet Anemone	*Stichodactyla mertensii*	fish, shrimp
Giant Carpet Anemone	*Stichodactyla gigantea*	fish, shrimp, squid

However, just to make the problem of providing proper food for the animals more difficult, different aquarists frequently report that their anemones will only accept specific prey items that differ from other reports for the same species. This could mean that the animals have been misidentified (which is a common occurrence) and are not actually the same anemone species, or (more likely) that prey preference and feeding requirements differ depending on the animal in question and the conditions under which it is kept (as has been demonstrated experimentally in other cnidarians such as jellyfish—Toonen & Chia 1993;Toonen 1996).

Secondly, and perhaps most discouraging is that these animals are essentially immortal in nature. They certainly appear capable of living several hundred years (yes, you read that right— hundreds!), and do not seem to age in the way with which we are accustomed, but rather live on until disease, a predator or some natural disaster kills them . For example, Fautin and Allen (1992) estimate the lifespan of a small anemone in New Zealand (based on actuarial tables) to exceed 300 years, and there is rumoured to be an anemone in the care of Oxford University that has been kept in captivity for nearly 200 years. Despite their natural longevity, the life span of the vast majority of captive anemones is less than two years. A recent survey of reefkeepers conducted by Joyce Wilkerson (1996) found that among a

couple of hundred respondents only 5% of hobbyists with **2-5 years** of reef keeping experience had managed to keep their anemone alive for 2 years or more (this survey was specific to the clownfish/anemone host species Entacmaea, Heteractis, Stichodactyla, Macrodactyla & Cryptodendrum). That's not very encouraging is it? To make it worse, among hobbyists with less than 2 years of experience, nearly half of the anemones purchased were dead within 3 months—overall only 1 in 13 anemones survived for 3 years or more and only 1 in 32 anemones survived for 5 or more years in captivity (which by most accounts is considered success). Even if we consider 5 years to be a ripe old age for these animals in an aquarium (this is roughly the equivalent of considering rearing a human to 1 year of age as being a "success"), only 3% of anemones purchased ever make it to this age (and if you have ever worked in a pet shop or know someone who has, you should realise that only a small percentage of "difficult animals" even survive long enough to make it home into an aquarium).

This survey included many highly experienced and professional reef keepers. If I remember correctly, Alf Nilsen topped this list of experienced aquarists with 32 years of reef tank experience, and the other respondents included many of the people who write the aquarium texts that we all refer to when faced with some difficulty in our own aquarium.

Let me reiterate this:
despite the general expertise of the people who participated in the survey, only 5% of people can keep an anemone alive for more that 2 years! That is pretty abysmal for an animal with a natural life span of hundreds of years; **especially** given that, according to Daphne Fautin (co-author of the popular book Anemone Fishes and their Host Sea Anemones), removal of these anemones and their clownfishes is causing serious changes in the natural communities that she studies (and I heard rumours that she has recently become an active advocate of trying to outlaw the collection and importation of wild-caught anemones). In their book, Fautin and Allen (1992) mention that some populations they once studied in the Philippines have become extinct as a result of collection (either of the anemones or their protective clownfishes) and the habitat destruction associated with dynamite/cyanide fishing.

Third, many of the host anemone species (in particular several of the Heteractis, Macrodactyla and Stichodactyla species) are not generally found on the reef itself, and are therefore poorly suited to being kept in a reef aquarium. Even with those species that do commonly occur on hard substrata, and typically live in close association with stony corals (in particular, H. magnifica, and Stichodactyla mertensii), tank conditions that support excellent coral growth often do not support long-term survival of the anemones. Given that many reef-living anemones do not seem to flourish in reef tanks, it is not at all surprising that species living predominantly in the soft, sandy sediments adjacent to reefs (e.g., Heteractis aurora, H. malu, H. crispa, Stichodactyla haddoni, S. gigantea, and Macrodactyla doreensis) do not seem to flourish in reef tanks. Aside from habitat differences, various conditions of flow, lighting and food required by anemones apparently differ from those required by corals, because anemones are often reported to bleach and wither in tanks within which corals are thriving and even reproducing.

There have been a number of theories as to why the survival of anemones in captive aquaria is so low, including lighting, feeding, flow, typical nutrient loads and the list goes on, but the truth of the matter is that no one really knows. If anything constructive came out of the anemone survey Wilkerson conducted, it is that every aquarist who had accomplished the feat of keeping an anemone for 3 years or more had a different explanation for their success. Lighting type and intensity, food type and feeding frequency, tank size, conditions and everything else questioned seemed to differ among the successful respondents, and there were no clear patterns that Joyce could pull from the responses she got to her survey. There do not seem to be any easy answers to specifically identify what people are "doing right" although there were many things that unsuccessful people are likely doing "wrong" with these

MEETINGS – SOCIAL CALENDAR

Upcoming Meetings

September 29th Phil Melvin's house: **193 Summerlakes Pde, Ballajura**
October 27th Nathan Cope's house: **21A Norton St, South Perth**
November 24th ???
December 29th ???

If there is anything you would like to know more about or anything you would like to add to the newsletter, perhaps you have a different view to those hearin, call or send comments to the current editor, David Bloch. Remember, this is your newsletter.

Attention**: **If you are able to hold a meeting at your place, please let us know.

MASWA Membership

Currently MASWA requests an annual $20 donation from members, $10 for Junior members. This covers the cost of newsletters, drinks, nibbles and other costs associated with the society. Members will receive information sheets and discounts on some products.

Friends in Common

Jan Anderson, David Bloch, Dennis Bozil, Darren Collins, Nathan Cope, Andy Dolphin, Tony Fiorentino, Jim & Gloria Fletcher, Paul Groves, Peter Harris, Mike Hudson, Frank Krause, Craig Lawrence, Grant Magill, Phil and Caron Melvin, Peter and Marina Olive, Steve Tofts, Greg Weryk, Rick White.

If you've paid your money and your name is not on this list, tell Andy! Members on the web should check they are on the web site members list. Thanks to all of you for your encouragement and support, we look forward to seeing you at the next meeting!

DISCLAIMER

The Marine Aquarists Society of WA is a name that we, as a group of friends with like interests have applied to ourselves for the purpose of information exchange. No one person, nor the group as a whole, can be held responsible for liablilites, injuries or other that may result either directly or indirectly as a result of our gatherings or the information exchange therein. The same applies to the information contained in this newsletter.