December 1968

tropical fish hobbyist

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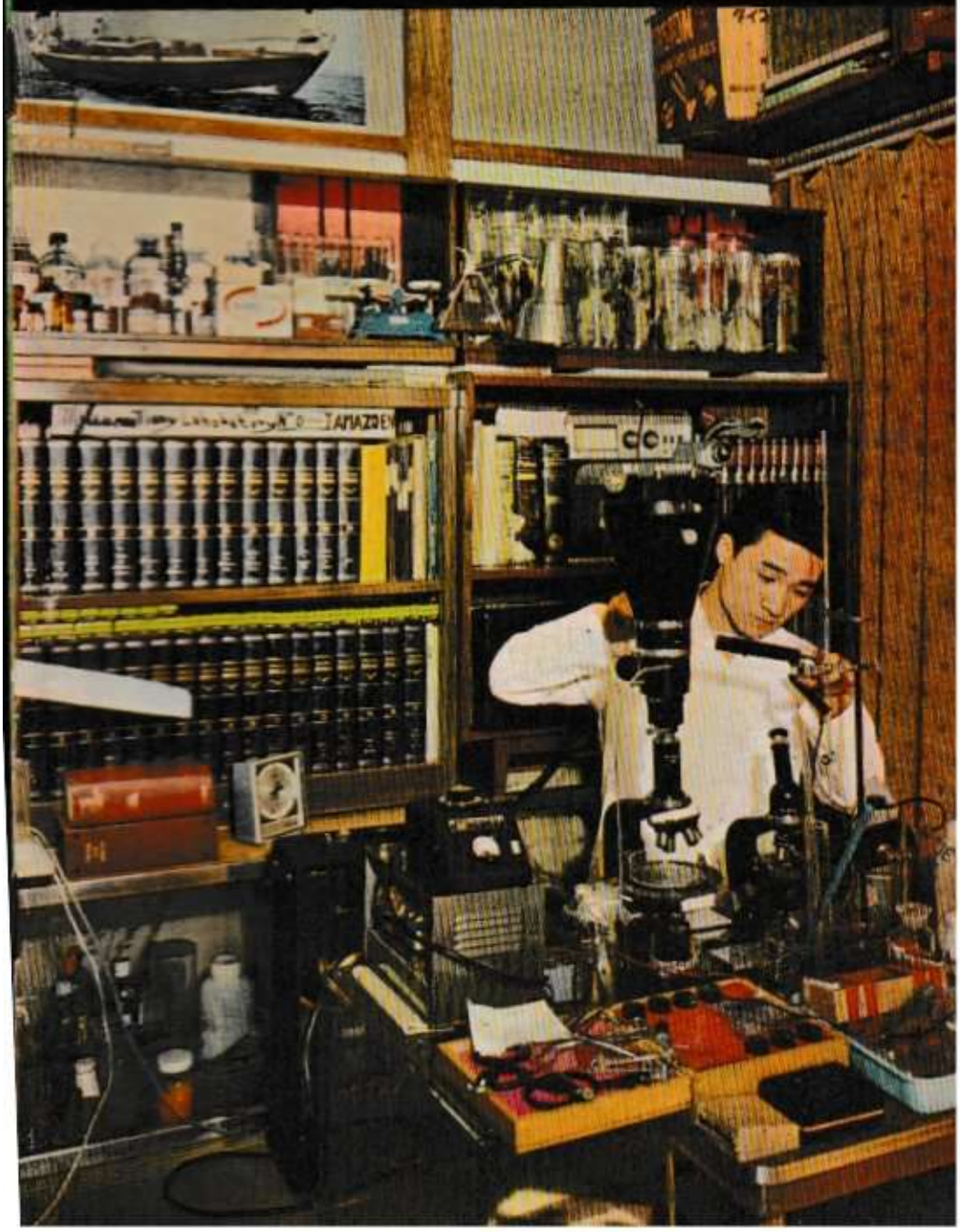

tropical fish hobbyist

Vol. XVII, December, 1968 (1969) No. 4

contents

cover

Our cover this month shows noted Japanese aquarist Hiroshi Azuma at work in part of the laboratory he uses to help further aquarium research connected with his studies of breeding the hard-to-spawn species with which he's had remarkable success. In the last four years, Azuma has spawned and sold over 10,000 **Metynnis schreitmuelleri**, and now he's working at crossing **Metynnis schreitmuelleri** and **Mylossoma argenteum**. Hiroshi Azuma tells about his successful **Metynnis** spawning methods in the article beginning on page 82. Photo by Hiroshi Azuma.

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editorial

Don't you love this time of the year and that warm, cozy feeling we get when we're indoors trying to protect ourselves from the harsh elements? Somehow at this time of the year things don't seem as bad; somehow everything seems richer and even more precious. And doesn't the sight of your beautiful aquarium even seem a little more special? Huddled indoors, away from any of nature's creations and beauty that we may have daily contact with, our 20 gallon tank at this time of the year keeps the rhythms of nature with us and brings some of the magic of the universe into our humble abodes.

Without trying to sound corny, this season seems to make people become more appreciative for many things that they might have taken for granted during the rest of the year, and seems to encourage outward expression for that which in daily hurriedness the proper gratitude was not expressed. So we here at TFH would like to take time out to say thanks to and for some big and small blessings: we are grateful to this big wonderful country for letting us try to live the kind of lives we think we want to live; we are very happy that more and more individuals are joining our favorite kind of organizations...aquarium societies; and we are especially grateful to our many readers who have taken time out to write us of their feelings and ideas concerning the hobby and this magazine. Merry Christmas to everyone out there in tropical fish land from everyone here at TFH!

Joseph M. Bellanca

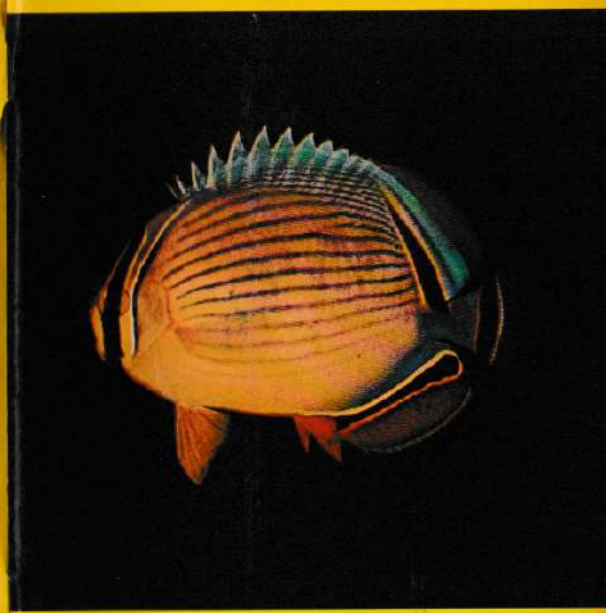
FILTRATION of Marine Aquaria

BY WILLIAM BRANDENBURG, CHRISTCHURCH, NEW ZEALAND

Resulting from a series of experiments that were reported in the April, 1966, issue of ICHTHYOLOGICA/THE AQUARIUM JOURNAL, the possibility has emerged that the growing of marine algae under strong light may help to solve some of the problems induced by the accumulation of food remnants and metabolic wastes when keeping marine fishes in closed-circuit aquaria.

To explore this possibility further, and to try to explain some of the observed effects, further experiments were recently undertaken. In this present article, the author will report on these experiments and will endeavour to make some suggestions for further extension of this work and its possible applications to home aquarium practice. A short recapitulation of the earlier findings is required for better understanding of the present article by readers who do not have a copy of the previous article available.

After a series of experiments with the keeping of tropical marine fishes in small closed circuit aquaria, indications were that the conventional methods of filtration as advocated by various authors of popular books on the subject were not entirely satisfactory. In addition an experiment was



This editorial feature goes **one step further into the complexities** and controversy of how to **effectively** filtrate marine aquariums. Many salt-water aquarists are not satisfied with the results they have been getting with the information and instructions given to them in certain literature so they have decided to experiment on their own. These **experiments** based on individual research have taken many directions over the past ten years. **Chaetodon trifasciatus** the fish in this photo is one of the salt-water species which would become more popular if salt-water maintenance were to be refined to the point of **scientific standards.** In this way, any aquarist could set up his tank with a certain degree of predictability. Dr. John Randall caught this **Chaetodon** in the waters off Tahiti and photographed it utilizing his special photographic techniques.

made using ultraviolet radiation to sterilise the effluent of ordinary sand filters and this again did not appear to hold the solution to the problem. Available information and observations suggested that two effects may be held responsible for this: The accumulation of metabolic wastes in various stages of degradation towards their end products, which would be nitrates and possibly phosphates in the water and the development of pathogenic bacteria, possibly in the filter medium. A further experiment showed that spontaneous, strong development of algae could be induced by exposing a relatively thin waterlayer over the filters to strong incandescent light. There was evidence of abundant production of oxygen as a result of photosynthesis by the algae. It was found that under this treatment the general health, appetite, and longevity of the fishes kept improved greatly. In the experiments up to this point separate filter tanks were used, with a relatively coarse filter medium consisting of alluvial sand with particles of 1 m.m., more or less, in a layer of about 4 inches thick. This left a waterlayer about 4 inches deep over the filter bed, which was illuminated 24 hours a day with 100–150 watts of incandescent light per square foot of surface.

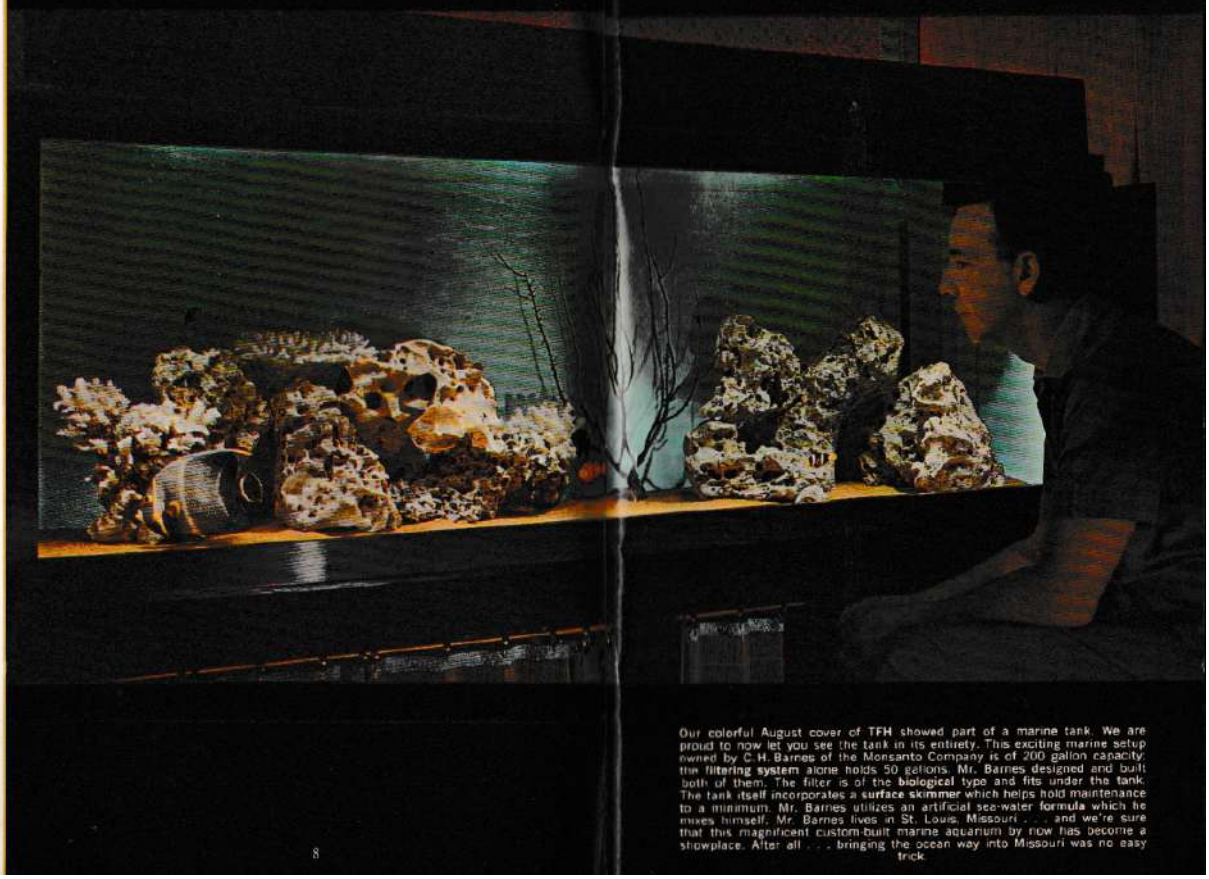
This point having been reached, several problems needed to be sorted out. Possibly most important was an attempt to discover upon which factor the beneficial effect of the algal growth exactly depended. There are two possibilities to be considered:

(a) The removal of nitrogenous and possibly phosphatic compounds from the water, which accumulate as a result of the metabolism of the fishes.

(b) The disinfectant effect of the oxygen generated by the algae as a by-product of photosynthesis. This could have a direct effect on the bacteria in the water, but could also be expected to turn the filter medium into a very highly oxygenated environment, so altering the bacterial population towards a predominance of aerobic types and making the environment less suitable for pathogenic bacteria.

To gain circumstantial evidence on this matter a 24 gallon tank containing 14 coral reef fishes of various species was deliberately treated with chemicals to simulate conditions of an accumulation of fully digested and mineralised metabolic residues. Sodium nitrate was added to the tank to give a nitrate level in the water of 100 times the highest recorded level in natural seawater according to Nichol and others, raising it to 700 parts per million, and monocalciumphosphate was added to a similar level. The author was not at the time aware that this constitutes an unnatural phosphate to nitrogen ratio, and the phosphate concentration should not have exceeded 100 parts per million. This would not be very likely to have affected the result of the experiment greatly, as the tank was being filtered over a medium containing plenty of crushed shell, and the excess phosphate would have gone out of solution quite quickly. The salts were added slowly over a period of about 24 hours.

The two largest genera of the **Pomacentridae** family, (Damselfishes) are **Abudefduf** and **Pomacentrus.** In this photo **Pomacentrus vaiuli** is shown to its advantage with its electric blue markings and eye-catching dorsal color pattern. This species is not one of the more demanding marine fishes, although its **aggressiveness** requires that the aquarist be cautious in choosing its tankmates. This specimen measured **SL** 40mm, **TL** 2.1 inches. Photographed by Dr. John Randall.



Our colorful August cover of **TFH** showed part of a marine tank. We are proud to now let you see the tank in its entirety. This exciting marine setup owned by C. H. Barnes of the Monsanto Company is of 200 gallon capacity; the **filtering system** alone holds 50 gallons. Mr. Barnes designed and built both of them. The filter is of the **biological** type and fits under the tank. The tank itself incorporates a **surface skimmer** which helps hold maintenance to a minimum. Mr. Barnes utilizes an artificial sea-water formula which he mixes himself. Mr. Barnes lives in St. Louis, Missouri . . . and we're sure that this magnificent custom-built marine aquarium by now has become a showplace. After all . . . bringing the ocean way into Missouri was no easy trick.

The most immediately noticeable effect on the fishes was a strong reduction in appetite. The day after treatment, fishes that had been feeding vigorously and fighting over food would only play with the food offered and hardly eat any at all. A chaetodontid (name unknown, possibly Pseudocentropyge sp.) that is extremely difficult to acclimatize had been eating newly hatched brine shrimp with relish. In a day or two it commenced to show definite annoyance with brine shrimp being in the water around it. After about a week, some of the "easier" species of fishes such as damsels (*Abudefduf, Dascyllus*) and clowns (*Amphiprion*) very gradually started to feed again, but not with anything like the same vigor as before. It proved impossible to bring the chaetodontid back to normal feeding in spite of a water change, and it died about a month later.

It is necessary to mention that the tank treated in this way was one of a pair that both were being filtered with filters under strong light and that there were established algal beds over the filters. There were no other appreciable effects. There was no obvious increase in disease incidence. All the fish remained clean and intact, with no evidence of skin damage, which is usually an early indicator of impending trouble with marine fishes. Although the experiment was not very accurate, it served to alter my original conviction that the oxygen being produced by the growing algae was the main beneficial factor. I am now more inclined to the view that accumulation of metabolic wastes is a greater hazard, as it probably tends to influence their condition adversely, and lowers their resistance. There is some doubt whether nitrates as such are a danger in this respect. I have been advised that there are many marine bacteria that will reduce *nitrates* to *nitrites* even under highly aerobic conditions. This is much more likely to be the cause of difficulties.

The experiment was at the same time meant to indicate if algal growth could be artificially stimulated by "fertilizing." In seawater all elements recognized as necessary for plantgrowth are present in abundance, and only nitrogen and phosphorous could theoretically sink to levels low enough to be growth limiting. Conversely, their increase to high levels might stimulate growth. However, there was no evidence of increased algal development in the treated tank. This tends to confirm many observations made before and after this experiment, that light is under normal circumstances the only limiting factor, and that only under extremely high levels of illumination other factors may come into play.

Early experiments had suggested that only incandescent light was satisfactory to induce adequate algal growth under artificial light conditions. This was reinforced by others reporting poor results with fluorescent light. The use of incandescent light brings about some problems in its heavy use of electric power, and the fact that tanks tend to overheat in summer under strong lights. Renewed observations have suggested that early lack of success with fluorescent lights simply was caused by the fact that not

The family **Carangidae** is made up of fishes who comprise the jet set of the oceans; they are **fast** moving fishes . . . and they have to be, because fishermen are constantly after them. Many of the species of this large family are **schooling** fish whose synchronized ballet has delighted many scuba divers. In a marine aquarium, the younger specimens of these **Carangids** such as the ones of the **Caranx** genus depicted in this photo exhibit brilliant colors and some of this schooling **behavior.** A large tank would enhance and effectuate the schooling spectacle. Photo by Dr. Herbert R. Axelrod.

enough light was used. Recent experiments have confirmed this. Excellent algal growth has now been obtained with ordinary "natural white" fluorescent tubes using a loading of 30 watts per square foot of watersurface and waterdepth of up to 12 inches.

A mishap that occurred seems to indicate that even this level of illumination is not far off the minimum level required. One 20 watt tube in a unit of 6 became defective and was not immediately replaced. Recovery of the algal growth after the usual weekly cleanout was very much slower than usual. The reaction of the fishes was almost immediate. Skin disorders showed up within a very few days, and an outbreak of so-called "popeye disease" killed three specimens before the trouble could be corrected. Further spread of the disease was stopped without the use of drugs: A drastic increase in light appeared to halt the trouble. In this particular experiment light is on over the algal beds only during about 16 hours a day. The author thinks that he has now sufficient evidence accumulated to suggest that *all systems under this method will have to be designed to avoid interruptions in algal development.* This will usually mean that two algal beds will have to be available per tank to allow periodic cleaning up. Under satisfactory light conditions an algal culture must show evidence of renewed photosynthetic activity in the form of oxygen bubbles within 12 hours after illumination is restarted, even after a drastic cleanout.

Experiments with two types of fluorescent tubes that have a high output in the parts of the spectrum that are most important for plant growth have been made, but no improvement on the use of ordinary "natural white tubes has been obtained."

Until recently all experiments by the author had used separate filter tanks through which the water from the display tanks was circulated by means of airlifts. Such a lay-out is complicated, easily upset, and difficult to camouflage satisfactorily when associated with an ornamental aquarium. A further experiment was designed to attempt to simplify the system. Basically this consisted of an attempt to grow the algae in the display tank itself, using the gravel on the bottom of the tank as a filterlayer as in normal practice with undergravel filters.

In this experiment, undergravel filters were installed in an ordinary tank constructed of asbestos cement, with their risers along the back of the tank. A sheet of asbestos cement was especially prepared as a background for this tank. Its lower edge was broken off roughly and irregularly with a pair of pliers and its surface was made very rough by roughcasting a mixture of cement and polyurethane plastic onto it. This was to provide a growing surface for the algae. This sheet was placed at the back of the tank, hung up by its upper edge and angled forward so that its rough lower edge was about 5 inches forward in the tank and ended about 4 inches above the

If you're tinkering with the idea of a salt-water aquarium why not devote it to members of the family **Canthigasteridae.** Next to people, puffers are the strangest things on this planet. Their outlandish form could put surrealistic paintings out of style. In fact, this **Canthigaster solandri** with its dream-like appearance looks like it leaped out of a Salvador Dali painting. This family of puffers differs morphologically from other puffers in several ways including very small **external gill openings.** These fishes usually don't reach a size of more than 5 inches while members of the **Tetraodontidae** puffer family can grow to be giants by comparison . . . a maximum of 36 inches. Their **geographical range** includes both the **Pacific** and Atlantic waters. Photo by Dr. John Randall.

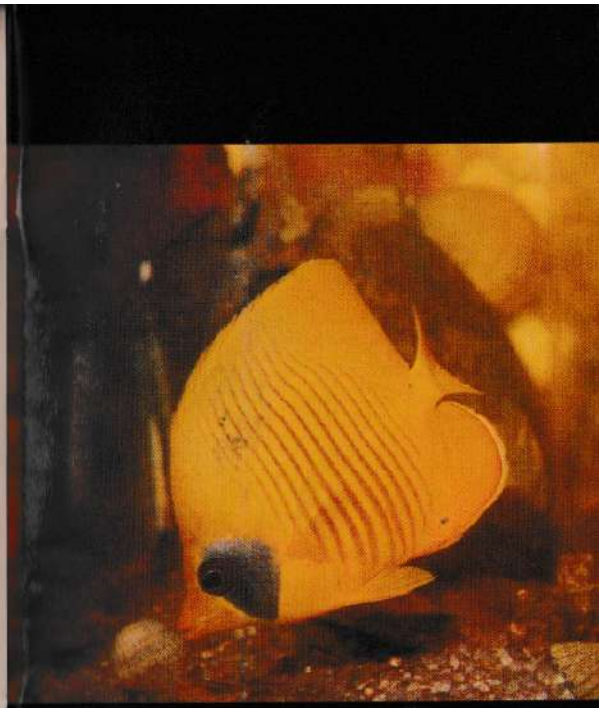
surface of the gravel in the tank. The fishes could pass under this and get behind the background sheet in complete shadow to escape the strong light. All filter risers, heaters and thermostats were now hidden behind the background sheet. A few pieces of coral decorated the remaining bottom area of the tank. Strong fluorescent lights were installed over the tank and due to its forward sloping position the background received extra strong illumination.

Massive algal growth established itself in this tank in a very short time. Not only the background became covered, but also the bottom and the coral decorations. In full swing this tank requires cleaning out weekly. Sides and back are brushed lightly to dislodge loose algae, coral decorations have to be cleaned with a jet of water and a good 1 lb. jar full of wet algal mass is removed from this 24 gallon tank by straining with a net.

Due to the presence of large bubbles of oxygen that get caught in and under the algal mat, large sections of this usually come loose and float to the surface within a week. From the decorative point of view, the system in its present form is unsuitable. At present however this tank is being used for a longevity trial. No cleaning is done; only the excess algal growth is loosened and removed regularly, and the top layer of gravel is stirred and smoothed out again—no siphoning. This tank has stood for 11 months at the time of writing without any water change with the fishes still in excellent condition and eating very well. Species kept are various damsels and clowns.

Although this experiment has been a failure in its original form, it has served to show up the possibilities of various techniques. The author would like to end this article with a description of a filter design which he thinks is worth experimenting with. It incorporates the various features worked out during his recent experiments. He hopes to build a number of filters along these lines in the very near future for further experimentation. This design is most likely to have faults also. It is certain that differences of opinion exist already amongst persons having experimented with systems incorporating algal growth about the actual sequence of operations. Due to difficulties with motile algae that swim freely from filters to tanks the author at present favors a system where the filter medium is placed in the flow from the algal beds to the display tanks. An opinion has reached him from Holland however, where on the basis of authoritative studies a reverse arrangement—the algae between the filters and the display tanks—is favored. In the meantime, it is in the interest of marine fishkeeping, that as many persons as possible begin experimenting with a method as promising as this one appears to be. And it is in that spirit that this description is offered.

It appears to be difficult to get away from a separate filter tank, so this must be the basis of the design, a sketch of which is included in this article.

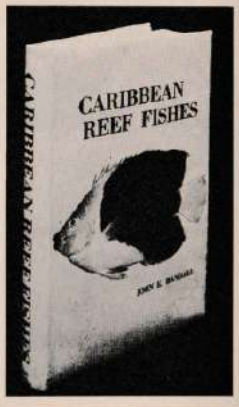


Chaetodon semilarvatus would be a good candidate for future experiments in marine filtration. As it is already, many aquarists and scientists are intrigued with the salt-water family **Chaetodontidae**, fishes who inhabit mostly shallow marine water **environments**. The glorious colors of these marine creatures places them in the forefront of nature's most beautiful creations: their presence transforms daily existence in the **tropical reefs** into one of pageantry and splendor. These fishes up until now have been grouped by scientists into a classification based upon the possession of a strong spine on the lower margin of the **preoperculum**. The butterfly fishes of this family do not have this strong spine, but the angelfishes of this family do possess this structure. Warren Burgess of the University of Hawaii is the world's leading authority on Chaetodonts. His forthcoming volume on the **classification** of these marine creatures should prove to be a milestone in ichthyology and should be of great interest to every salt-water aquarist. Photo by Marcuse.

picture making, tired their eyes and minds in the exacting rigors of achieving taxonomical fish descriptions, and we the aquarists in the comfort of our living rooms are the ones who reap the rewards . . . many hours of enjoyable and informative reading.

The format of this diagnostic guided tour of over 300 species is a technical triumph. The fishes are arranged in an approximate phylogenetic sequence with a general introductory discussion of each fish family included. The integration of photographs and text within the 318 pages of this volume is especially well organized: you don't have to thumb through half of the book to find the photograph of a species being discussed—the identifying photo always appears next to the species description text. So you don't have to, after having read an interesting description, turn to figure #10,234 (wherever that may be) to find a photo of the fish you now have become interested in . . . it's always right next to the text. Some books make it awfully difficult for the reader, but this one is a well planned voyage—in fact if you have a little of Sinbad the Sailor in you with a yen for ocean exploration, this book might be just the journey you've been seeking to make. And this exciting journey is made easier by the inclusion of an ichthyological glossary of terms . . . so don't be afraid, you'll understand all the words and you will thereby become more familiar with these necessary scientific terms.

In these rapidly moving and changing times that we are living in, Caribbean Reef Fishes is an important document. This document makes permanent the panorama of marine life in a segment



of the world which in the coming years might find itself disrupted and changed in the midst of exploration by the industrial corporations of the world. This volume is a valuable addition to the library of any concerned aquarist, ichthyologist or ocean explorer.

JMB

Frederick J. Kerr

One of the rewards of writing this column is that the author hears from a number of young aquarists interested in breeding bettas. It is rewarding not only because it clearly proves that our hobby will be around for a long time, but also because it makes me realize that a large proportion of my readers are relatively new to the hobby. Because they are new, they ask for information which seems readily available from other sources. Each mail brings requests on how to breed bettas. It is impossible to do justice to breeding bettas in a column length article and, additionally, it would be necessary to repeat the column every few months. My recommendation to those interested in learning how to breed bettas is to spend a few cents and purchase TFH's publication *Beautiful Bettas*. This is possibly the most complete work on bettas available at the price.

Q. I have 2 very picky female bettas. The only thing they will really eat is live brine shrimp. They will only eat a little of other things. Can you help me?

Lee Roth
Bloomfield, Michigan

A. *There are a number of ways to get around this situation, but none of them comes with a guarantee. One way is to simply stop feeding these females live brine shrimp. When they get hungry enough they will probably learn to accept other foods. Another possibility is to place other fishes in the tank which accept other kinds of food with gusto. The competition will sometimes motivate slow eaters.*

Betta Societies

Q. I am interested in contacting betta societies especially those in the New York area. I am also interested in obtaining the addresses of breeders who sell bettas.

Gilbert Schnaper
New York, New York

A. *I do not have addresses for local betta societies. If the officers of any local societies devoted exclusively to bettas will send me information about their group, I will pass it on to our readers. The International Betta Congress should be able to supply your needs. The dues are five dollars a year sent to* 1845 *North Pulaski, Milwaukee, Wisconsin* 53202.

Neglect

Q. I have a male betta that keeps getting fungus. I am able to successfully treat him, but keeping my male well is a problem. I am sure this is due to a lack of a regular feeding schedule. Also I do not clean my bettas often enough. My questions are:

1. Are three feedings daily enough?
2. How often should my bettas' tank be cleaned?
3. Are ollies and shrimp-imps good foods?

4. What other live foods should I feed him besides daphnia and mosquitoes?

Linda Thomas
Richfield, Minnesota

A. It seems as though you have answered your own questions. I doubt, however, that a regular feeding schedule, whatever that means, has anything to do with the disease. The dirty tank could.

1. Three feedings are plenty, but don't stuff him every time.

2. Any time the water is not clear and whenever there is dirt on the bottom.

3. Yes.

4. Live foods are not necessary. Frozen foods and dried foods are sufficient if given in variety.

Breeding Questions

Q. 1. In raising bettas is it necessary to condition the pair with live foods?

2. Can you raise platy fry with betta fry if they are about the same size?

3. Should the male be able to see the female?

Ellen Stephens
Dallas, Texas

A. *1. No. Frozen foods are just as good.*

2. You probably can, but no doubt both the platies and the bettas would grow better in separate aquariums. Even if they are the same size to start with, one species will outgrow the other in a short time.

3. It is not necessary for the male to see the female, but if he can, he is often stimulated to greater activity.

Attention Societies

The betta slide program mentioned in the July 1968 issue of *Tropical Fish Hobbyist* is distributed by us. I hope that you will see fit to mention this fact because otherwise you are in slight error. The International Betta Congress originally prepared the program for us. Clubs may rent it for ten dollars. We pay postage both ways.

Fred Howard
Aqua Engineers
Box 1
Ortonville, Michigan
48462

A HAPPY EVENT

Tropical fish hobbyists enjoy sharing their interests in aquatic life with other people; they would very much like to pass on their fascination for the creatures of the underwater world to the uninitiated—those persons who think that fish are just fish. Well, the aquarium societies of this country have been busy at this type of missionary work utilizing exhibitions and shows to get their message across to the general public. One very successful and recent exhibition of fishes for the purposes of creating interest in the intelligent but unexposed public was put together by the Exotic Aquarium Society of New Jersey; it was a very exciting event held in the spacious and modern auditorium of the huge Garden State Plaza in Paramus, New Jersey. Tens of thousands of curious people passed through to view the marvelous aquarium displays which numbered into the hundreds. Many species of fresh and salt-water fishes were displayed in a manner that expressed good taste yet coupled with theatrical flair and imagination. The end result was visitors who were awed and amazed that things called fishes could be so beautiful. We salute the aquarium societies of the world for their zealous work in striving to further their own knowledge of aquatic creatures and in helping to inform the general public.

Valerie Edwards responds to **Heniochus acuminatus.**

David Gewirtz gazes at a large Tilapia specimen.

Photos by Jack Anderson courtesy of THE HERALD NEWS.

Jonathan Sumner watches an impressive tigerfish.

Cabomba aquatica Aublet.

The Plant Genus *Cabomba*

BY GERHARD BRUENNER

Our old and well-known *Cabomba* is certainly one of the few aquatic plants which has never lost its popularity in spite of the many new plants that have been introduced throughout the years. On the other hand, one could say that this genus of plants has never really enjoyed the general appreciation it justly deserves when one considers that it is one of the more ornamental groups of plants. The most probable explanation for this is the reputation these plants have of needing large amounts of light, and of being plants that are rather difficult to cultivate.

The truth of the matter is that growing *Cabomba* in tanks that are located at well-illuminated places with direct sunlight *is* nearly effortless, but keeping it in home tanks under artificial light may sometimes turn out to be problematic unless the fancier will content himself with specimens that are only a pale shadow of that *Cabomba* which is extremely ornamental when grown under daylight. And even with this problem the recent utilization of fluorescent lighting has called forth a radical change. What many people who are aware that *Cabomba* needs a relatively large amount of luminous intensity in order to attain a really thriving and therefore ornamental growth, besides keeping the plants in continuous good condition, are not aware that it is not only a question of the intensity of the artificial lighting, but also a question of its quality and composition: the photobiologically active components of the radiation that influence the vital processes of the plant decisively, and most especially the regulation of the stretching and the leaf-growing mechanisms. For this reason the introduction of fluorescent lamps that are especially tuned to plant growth has to be considered another essential improvement in the cultivation of just those aquarium plants that are especially hungry for light. This is something that I believe I may state safely, at least for *Cabomba*.

The different species of *Cabomba* often enough do not do too well with regard to growth and leaf development when illuminated by the common fluorescent lamps (respectively when they are too far from the source of light). *Cabomba* reared under Gro-Lux Standard lamps (16 inches distance from bottom to lamp), to the contrary, show sturdy shapes, fully developed ornamental compound leaves, and increased speed of growth.

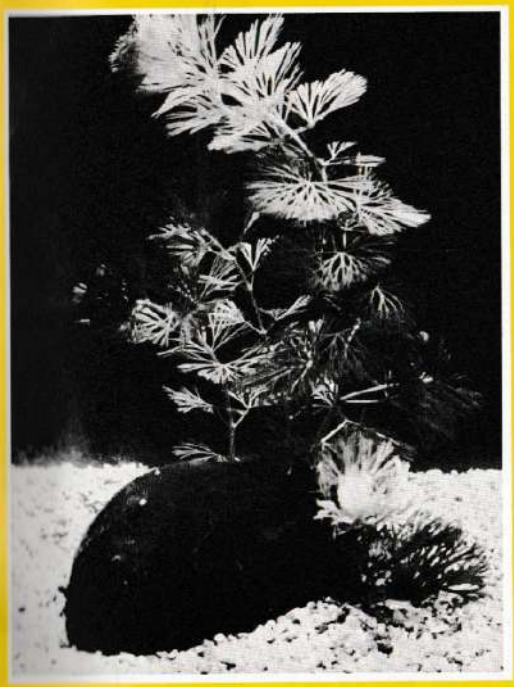
My present experience indicates that the cultivated species of *Cabomba* show no specific differentiations with regard to their need for light. This question though can hardly be answered absolutely. If previously it was often considered difficult to class the cultivated species of *Cabomba* correctly, now, with the large numbers of recent importations, there is less certainty with reference to classifying the species of pre-cultivated plants one finds in the shops of the trade. All submerged forms of the genus are extremely variable, meaning that their formative character depends strongly on the factors presented by their surroundings. The same species may yield strongly

differing individuals if cultivated under different conditions. Even features that are considered nearly unchangeable, like floating leaves and flowers, may eventually change in shape and size. Further to this, one should consider the only partly-known geographic strains which apparently are imported as new species with fancy names and which on their part have already developed forms adapted to the aquarium.

Of the species that were already imported at the turn of the century, *Cabomba aquatica* and *Cabomba caroliniana* continue being cultivated. Formerly the variety *paucipartita* of the second of these species was seen relatively often. This variety was described by Ramshorst and Florschuetz as having rather small leaves and relatively wide leaf segments. Today, this form has been widely displaced by a form that is very fine-leaved and quite more ornamental, and which reminds one of the nominate form of *Cabomba caroliniana*. It is questionable whether the now often offered "red *Cabomba*" should be classed as *Cabomba caroliniana var. pulcherrima*. Fassett considers it an independent species. De Wit offers the hypothesis that it pertains to *Cabomba piauhyensis* "which in this case ranges from northern Brazil to South Carolina".

Be as it may, all species that are being offered today (the present lists of the trade enumerate over seven species), stand out through their ease of growth and beauty. It should be our aim to create even in our tanks those vital conditions which guarantee thriving growth and with it stately plants with greater longevity.

In its Central and South American home regions, *Cabomba* is generally found in unbelievably dense masses, mostly on the shallow shores of ponds, lakes, and lagoons, growing at intensely lighted locations. Water tests in Surinam showed pH values between 5.3 and 6.7, and temperatures between 70° and 88° Farenheit, as well as water with small percentages of salt. Kroemmelbein on the other hand found *Cabomba* in Cuba in water assaying at 7° DH and a temperature of 80°F. With regard to water temperature the nominate form of *Cabomba caroliniana*, found mainly in the south-eastern states of the United States, holds a special position. It suffers a more pronounced yearly rhythm and is therefore fit for moderately heated tanks, for instance, for keeping the Diamond Perch as proposed by Lehmann.



Plant-loving aquerists claim that aquatic-plants in a tank provide **oxygen**, consume **carbon dioxide** and other fish wastes, besides stimulating **biologic** circulation. If this is true then the **Cabomba caroliniana** in this photo besides being very decorative is also most functional. Most species of **Cabomba** do not do well in waters which are **eutrophic** (hard, alkaline). The aquarist who wants to be successful with **Cabomba** should provide an environment of **dystrophic** water (soft, acid).

For the constantly high temperatures of the tropical tank, the Central and South American plants prove to be more enduring. *Cabomba* is especially sensitive to minerals, which means that it needs soft water with little salt. The water's hardness should by no means surpass 8° DH. My best results were always achieved with pure rain water. Something that often shows to be favorable is an admixture of peat moss and clay to the bottom soil. This should be done very sparingly, though, as there is the danger of the proliferation of algae. In my opinion the danger of contamination of *Cabomba* with algae is mainly a problem of water, which means water too rich in nutrient compounds containing too few stands of plants which do not grow sufficiently. It is wrong to limit the supply of light out of fear of algae, as one is often advised. Hothouse tanks, which generally are exposed to full sunlight, and in which *Cabomba* thrives free of algae, prove sufficiently well that intensive lighting does not cause the overgrowth of algae. It is advisable, though, to plant *Cabomba* only in those tanks which already have a well-growing, vigorous plant population, and in which a certain balance has been reached. Incipient lack of nutrients may be counteracted by the cautious addition of commercial fertilizer solutions.

As was stated before, vigorous and impressive shoots of *Cabomba* in the home aquarium can only be obtained under intensive incidence of artificial light. For this, it is of importance that the distance between plant and source of light is not too great, a danger that always exists in the case of tanks with a high water level (over 24 inches). In such cases, near the bottom the intensity of the radiation should hardly be sufficient. Therefore we see very sparing developments at first. The more the shoot grows taller and approaches the surface, though, the more vigorous and prettier becomes its growth. Conditions in relatively shallow tanks are much more favorable, since in these sufficient luminous intensity prevails even near the bottom so as to warrant normal growth from the start. It is self-evident that light-hungry plants like *Cabomba* must have unencumbered locations. Just a few beautiful shoots of *Cabomba* in an open foreground are certainly preferable to a heavy thicket in the background that is wilting due to excessive shadowing.

Using intense lighting with Gro-Lux Standard I was able to notice something further. Up to then all my red-leaved forms of *Cabomba* turned "green", that is, even with intensive artificial lighting the beautiful red hue of stems and leaves was generally lost just after a few weeks. With Gro-Lux Standard it is now my experience that the red coloration remains constant. It is true that the intense red of the tips of the shoots cultivated

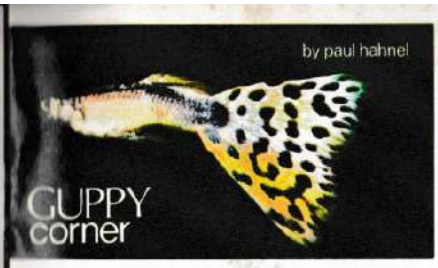
Cabomba with elegant upper water form. ▶

under natural sunlight has given way to a somewhat more subdued brownish red. But this coloration apparently is firm, at least at a short distance from the source of light (8 inches). Increasing "greenification" is still to be observed when quick-growing floating plants start to shadow the *Cabomba*. But as soon as these floating plants are removed and the *Cabomba* gets its full share of light again, the red coloration returns. If you realize that most developments of color represent a protective reaction on the part of such plants, you will be able to interpret this observation as meaning that Gro-Lux Standard presents certain energetic (short-waved) light components which lead the plant to shield its sensitive cell plasma against the destructive action of these wave lengths (similar to what happens under the open sky). It remains an open question, however, whether this variety of *Cabomba* will retain its ability to react even after years of being kept in the aquarium. It would be interesting to know how far this observation is confirmed by other red-leaved varieties of aquatic plants which prove to be so transitory in our indoor tanks. There is one thing we have to take into account, though: any kind of reddish coloration looks more intense under Gro-Lux Standard, an advantage which may still enhance the coloring of the plants on one hand, but which on the other may give origin to misunderstandings about color. If you value *Cabomba* with pretty red shoots, do not try to save on electric current. (Use a minimum of two lamps of the same length as the tank.) In such cases it will often be necessary to shield plants which demand less light (*Cryptocoryne*, for instance) by means of layers of floating plants.

As a rule, fully developed floating leaves of *Cabomba* do not grow in home tanks. You may occasionally see the small, generally white, triple flowers on long stems that float on the surface. At temperatures around 78°F and under favorable conditions of light and water, *Cabomba* grows quite quickly. Excessively long shoots should be cut off near the bottom and shortened to the desired lengths from below. Then remove 2–4 leaf insertions and set the shortened stem into the bottom soil again. This makes the adventitious roots develop quicker and more vigorously. That *Cabomba* needs running water and strong aeration in order to grow well is something I cannot confirm. To the contrary, to me it seems more important to plant the stems in spots where they are moved the least possible, and are allowed to develop without disturbances.

Today the fancier need not accept the formerly frequently stunted forms of *Cabomba*. Modern fluorescent lamps if well used guarantee that we can induce *Cabomba* to show a wonderful richness, even under the conditions of an indoor tank. I am sure thusly that these beautiful aquatic plants will acquire many new friends.

Cabomba caroliniana takes many surprising growth directions in its course of maturing. Its upper floating form which makes contact with the air provides excellent hiding facilities for young fishes. This photo is proof positive that this species of **Cabomba** can flourish with other genera of aquatic vegetation with the proper care. The **Cryptocoryne** species in this tank also benefit from the new form of artificial illumination. ▶



Small Males

Q. Last April I got hold of some guppies. I didn't have two of the same strain. So I just left them together and let them breed. The young have grown up now. They're very active. I feed them flake food, freeze-dried brine shrimp, and sometimes mosquito larvae. I leave my light on 12-13 hours and have good plants. My females are growing well and are now quite large in size. My males are in a 10 gallon tank and my females in a five.

1. I have not overcrowded my males . . . I only have five. But my males are very small. Do you know why? I spend a great deal of time trying to keep the tank clean.

2. Could a sharp change in the pH make the males stop growing?

3. Could it be in the genes?

4. Could you tell me why the males don't eat very much?

5. Does fungus have any after effect?

Michael Hamley
Key West, Florida

A. 1. *I have for the past 15 years fed my fish flake food and I have also been feeding my guppies freeze-dried brine shrimp and tubifex (Miracle brand). I consider all these foods to be wholesome. Up until now, guppies have not been able in general to be so lucky as to receive mosquito larvae; there is now a freeze-dried mosquito larvae on the market. I leave the light on in my tanks for 7 to 9 hours. Males kept by themselves without females generally are poor eaters. I would suggest that you put some females in with the males.*

You should also put in your tank a feeding ring that is held by a rubber suction cup; in this manner the fish will always know where to go for their food. This gives the fish more confidence and keeps your tank cleaner.

2. *No fish will tolerate a sudden change in pH which in many cases is fatal.*

3. *The females you have are large and growing good, so the question of the genes may be ruled out.*

4. *As number one.*

5. *A properly treated fungus infection caught in time will not always have a bad effect on your fish.*

Mutation

Q. 1. Through the breeding of my half blacks, I have acquired an apparent mutation. These fish are half blonde or golden where the normal guppy is grey. I would like to know if anyone else is interested or has had this type of guppy, if so send me a letter and we will compare notes.

2. Maybe you can send me more information with which I can judge my guppies?

Marty Donegan
Downers Grove, Illinois

A. 1. *I have not as yet ever seen any half black and gold combinations exhibited in any guppy show.*

2. *Since this type of guppy has never been exhibited, there have been no show standards established for this kind of guppy, but form and shape have always been important in judging entries at any guppy show.*

salts OF THE seven seas

BY ALFRED A. SHULTZ

Q. I want to set up a salt-water tank. I have a friend who lives near the seashore; he is willing to bring me some ocean water. Do you think that I should let my friend do so?

Or should I purchase artificial sea salts for my new tank? Can I mix a little of the real thing with the artificial formula?

Henry Tokar,
Boston,
Mass.

A. *Your best bet is an artificial sea-water formula. There are several excellent manufactured brands on the market today. With real ocean water, the only way an aquarist can be sure that he is collecting sea-water that isn't polluted is by going out a couple of miles out to sea. Anyway, it is easier maintaining an artificial formula in terms of replacing the salt water that evaporates in the tank . . .*

Q. I am wondering if I can put regular gravel in my salt-water tank. If not what would you recommend? Everybody seems to tell me something different. I am confused.

Edward McIntyre,
Cleveland, Ohio

A. *Beach sand should be used. Don't use regular gravel. Some sand is calcareous; the calcium in it helps the tank water to lose acidity due to any build-up of waste materials in the tank. A layer of one inch thickness is sufficient. With only this one inch layer of sand in your tank, there is less danger of food polluting where you can't get at it to clean it. And if you just mix some more of the prepared salts. But with real ocean water, you have to go out and collect fresh sea water every time you have to replace the evaporated tank water or store the sea water in your home. Storing ocean water in the home can really be a problem.*

you have any marine scavangers such as the hermit crab in your tank, he will have an easier time of getting to any of the small left-overs in the one inch layer of sand.

Q. I would like to set up a 20 gallon marine tank in my bedroom but the only space I have left in this room is right near the radiator. I know that this space would be alright for my regular tropical fishes because they like warmth, but I am not quite sure how this condition would be for marine fishes. I thought I would ask you before doing anything definite.

Sonja Wilenski,
Des Moines, Iowa

A. *Most marines cannot tolerate a large range of temperatures. They especially cannot stand high temperatures. Anything over 80° F. will cause them trouble.*

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MAIL CALL

If you have an aquarium question that you would like answered, send it to MAIL CALL. Each month the most interesting questions received and their answers will be published in this column. Letters containing questions cannot be acknowledged or answered personally. Address all questions to: MAIL CALL, T.F.H. Publications, Inc., 245 Cornelison Avenue, Jersey City, N. J. 07302.

Halfbeaks

Q. I have just purchased a pair of half-beaks. They are quite interesting, but as yet I have found little information concerning them. Could you please answer some questions I have about them.

1. I understand that half-beaks are livebearers. How often do they breed?

2. Do half-beaks have any special requirements such as water temperature, pH, and hardness?

Any additional information or advice concerning these odd creatures would prove very helpful. Thank you.

Frank Pastore
Long Island, New York

A. 1. Dermogenys pusillus, *the Halfbeak, is a most interesting livebearer. Within our domestic aquaria, even the most experienced aquarists have not been successful with breeding them with any consistency. The female will give birth to a small brood and if you're lucky she'll give birth a couple of times. But the pattern has been with other aquarists that after having given birth once or twice, the subsequent attempts will only produce fry who are born dead or prematurely.*

2. Apparently the aquarium world doesn't have all the answers on the best maintenance possible for these curious creatures, but we do know an addition of sea salt to their aquarium water helps them to be more comfortable. Their temperature shouldn't ever drop below 75° F. They are especially fond of and definitely need live foods. They might accept Miracle's freeze-dried mosquito larvae.

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Two Questions

It would be greatly appreciated if you could give me answers to these two questions:

Q. 1. I purchased an algae eater (*Gyrinocheilus aymonieri*) last spring. I was having the problem of a thin film of algae growing over all objects in the tank. It wasn't really heavy, but it was unsightly and I remedied this situation with the purchase of the algae eater. It is about 3 inches long and I was told that it was not an aggressive fish. However, since the purchase of this fish I have noticed it following certain other fish in the tank. I had several swordtails, gouramis, danios and several Corydoras aeneus. The algae eater followed the fishes in the order that I have mentioned. A few days after I first noticed the fish being followed by the algae eater, they turned up dead. The bodies were slightly mutilated

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inches of water over the marbles at the bottom. An aquarium book told me to put three inches of water over the marbles. I left the male and female in the bowl for twenty-four hours and no eggs. I only have one big question for you. What am I doing wrong? Your magazine is the best.

Dan Schultz
Sturtevant, Wis.

A. 1. Although the zebra danio is one of the easiest egg layers to breed that does not mean it will spawn in a bowl. You need the surface area that a tank will give you. Use at least a 5 gallon aquarium. Also, you must first condition your fish breeders with good-feedings. When the female is ready she'll be properly filled with roe so that she will be fat on the under part of her body. Putting their tank in sunlight will also put them more in the mood for spawning. Your water should be clean and the temperature around about 75° F. You should have regular aeration in the tank.

Conservation

Q. Did you know that Lake Erie, as far as its biological environment goes, has already got one foot in the grave? That's right . . . one more foot, and its life on earth is over! And I'm not sure that it was meant for it to end. Did you know that for a good day's fishing off the coast of Florida, you have to travel at least 5 miles off the coast to get away from the pollution. The United States only claims 3 miles of it. The rest we give to the world. So, do we have the right to pollute water which isn't even ours? I don't think so. One way to cut down on pollution would be to enforce the laws we have for throwing litter in lakes. Also we should require factories and chemical companies to dispose of their wastes by some different means other than dumping it into our rivers which sooner or later dumps it into our oceans. I am very sure that you realize everything I have told you is true. What I want to ask you is, if you would please use your influence in your magazine to tell hobbyists, who I'm sure also realize what has happened, to appeal to our government for improvement in this intolerable situation by writing letters to their congressmen, or Secretary of the Interior Udall, water polluting companies. Let somebody know what the majority of Americans want done. There is a great need for articles on matters of conservation in T.F.H., which is truly a great magazine. Thank you for taking time to read this letter.

Jay Taylor
Orlando, Florida

A. Your concern, Jay, is commendable. Many Americans are expressing increasing interest in the burgeoning problem of the pollution of our precious waterways. We need more letters like yours before TFH could make any official stand. We will be running articles on conservation and the problems of ocean exploration. In the meantime your suggestion for people to write to their elected officials in Washington is an excellent idea. And if our readers want TFH to work further officially on this matter they should write us personally. We need your help and show of documented interest.

Fish Behavior

Q. I love your magazine very much. I am sure I made a sound investment ordering your magazine. At the end of every month I look forward to the latest issue. I enjoy Mail Call very much and would like to see it lengthened. I would be very grateful if you could tell me the addresses of a few fish clubs in Chicago. I also have a few questions to ask:

1. Could you tell me of a plant that is fast growing and is well suited for hiding fry?

2. Could you please tell me if it is normal for a male Dwarf Gourami to send streams of water out of the tank? The gourami is in a 30 gallon tank. When I go near the tank the gourami comes to the top of the water; he sends up a water stream from 1 inch to six inches

high. He is not the only fish in the tank. He has a mate but he does not show interest in her. He does this only to me and only when I am near the tank. Could it be a way to show me he knows I love and care for him. He has not done this for two weeks and came down with dropsy the other day and died. (I

sm the one that feeds the fish). Thank you for your help.

Eleanor Perry
Chicago, Illinois

A. 1. *We receive a monthly magazine from a society in Chicago . . . Mid West Aquarists, 5562 W. Fullerton Ave., Chicago, Illinois 60639. Why don't you write to them about membership. If you are going to breed egg-layers, I would suggest you put some floating plants in your tank.* Riccia fluitans L. (Crystalwort) *will be fine for such purposes. This plant is perfect for nest building and it holds the egg-layers spawn. This kind of a plant also provides a hiding place for baby live-bearers. Water Sprite* Ceratopteris thalictroides (L.) Brogn *is a very rapid growing aquarium fern.*

Colisa lalia (male).

2. *Male Dwarf Gouramis have been known to behave in that manner. And some fishes are able to recognize their owner, especially at feeding time.*

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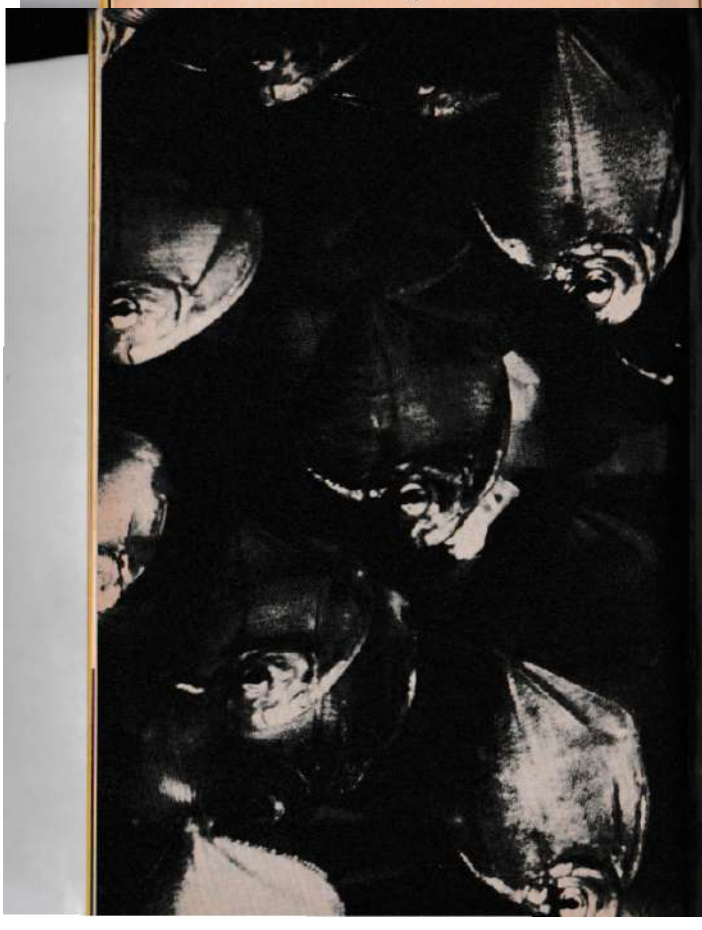


japanese aquarist spawns metynnis

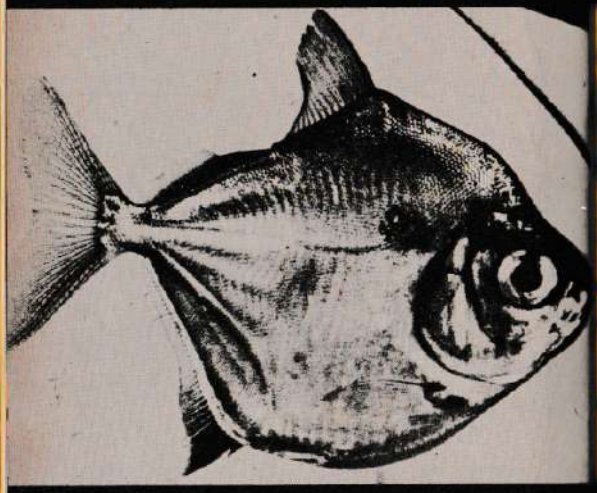
BY HIROSHI AZUMA

I have been breeding *Metynnis schreitmuelleri* for four years and I have raised and sold more than 10,000 of them to petshops in Tokyo and other cities in Japan. It is hard for me to understand why so many people have problems with this fish as it is very simple for me to breed them. As a matter of fact, I not only spawn them naturally, but I have been successful in breeding them using artificial methods . . . and I have even crossed them with *Mylossoma argenteum* and gotten fertile eggs!

In spawning *Metynnis schreitmuelleri* I select a pair which is about the same size. The female I use most is about 15 cm. long (6 inches) and the male I use is about 12 cm. long (5½ inches). I set up an aquarium measuring 90 × 45 × 45 cm. (36 × 18 × 18 inches) and fill it with water at a very high temperature, about 29-30°C. (about 86°F.). The pH of the water is from 6.4 to 6.6 and is well aerated. I put sand on the bottom of the tank with

An underrated aquarium fish, the "Silver Dollar", **Metynnis schreitmuelleri**, when kept in large aquaria, comes into its own, doing its own thing, i.e., **shoaling**. A school of these mirror-like fishes glisten in even the most subdued light, which is probably the best type of **lighting** to provide since these fishes do not display a positive reaction to light. This is not really a case of a **negative tropism**, but they do seem more comfortable with softer illumination. Even the eggs of **M. schreitmuelleri** exhibit a negative **sensitivity** to light. Research and experimentation with this species' response to light might open doors to our knowledge of the function of light **biologically** for aquatic vertebrates. Photo by Gunter Senfft.

Sexing **M. schreitmuelleri** is a test for even the experienced aquarist for this species does not possess obvious **sexual dimorphism.** The anal fin provides some clues . . . the female's is straighter along the outside edge.



a few water plants. I only use an airstone in the breeding tank; no filters as they might suck in the babies. An undergravel filter would be satisfactory but I don't have one.

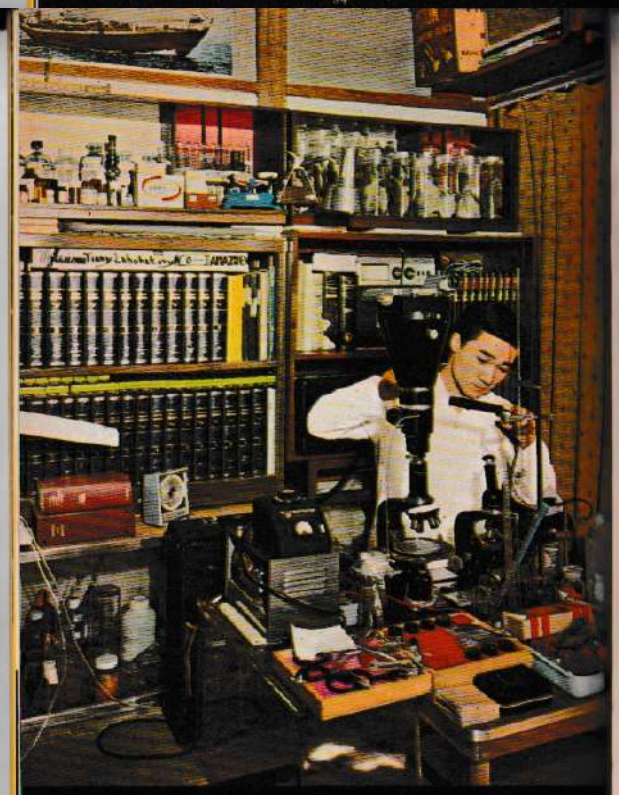
First, I put in the male and give him 24 hours to get accustomed to the aquarium. The following day I add the female to the tank. In a few hours the female seems at home and begins to swim restlessly back and forth close to the glass front of the tank. The male stays very close to her and begins to take on his breeding colors.

Sexually active males turn a handsome brick red. The color is iridescent and color photography hardly does it justice. As soon as the male gets ready to spawn, two large, round, deep black blotches appear on the back part of the gill cover. These blotches are used by me for species indentification because *schreitmuelleri* is very close to *maculatus.*

Metynnis schreitmuelleri does not possess a marked **sexual dichromatism,** except at spawning time the male becomes flushed with a strong red-coloring. Photo by Kremser.

After the first day together, the male becomes more and more aggressive and really goes after the female with determination. When he reaches the heights of frustration, he will begin to attack (gently) the ventral area of the female with his mouth. Initially the female seems very sensitive in this area and does her best to escape this attention, but she soon settles down to match the male's enthusiasm and the pair exercise some beautiful swimming maneuvers together. Suddenly they stop and the only active movement seems to be increased breathing and a rapid motion of the male's anal fin. The pair come close together for a short "embrace" when they push against each other. When they pull apart 10 to 20 eggs fall away from the female.

Spawning always seems to take place in the morning, which is true of most characins. They prefer spawning on the water plants, but often their eggs fall to the gravel. The eggs are fairly large, measuring 2.0–2.2 mm. (about $\frac{1}{12}$



Hiroshi Azuma is an aquarist who brings scientific procedure to the hobby. With modern scientific equipment he better observes and records his experimentation and discoveries. His recent progress in tropical fish endeavors has brought him a great deal of attention in Japan. Tropical Fish Hobbyist magazine finds satisfaction in introducing this young Japanese pioneer to the aquarium world at large.

inch) in diameter.

Spawning continues all day and 800 to 3,000 eggs are usually produced. The parents don't seem to bother the eggs, but they should be removed immediately after spawning.

The eggs seem to be sensitive to light, so I cover the aquarium as soon as I have removed the breeders. I try to keep as much light from reaching the eggs as possible.

At 30°C. (86°F.) the eggs hatch in two days. Four to five days after spawning, the fry are free swimming. I feed them on *Cyclops* and newly hatched brine shrimp and their growth is phenomenal. In six months they are almost as large as their parents.

So you can see that breeding *Metynnis schreitmuelleri* is not difficult at all. Why don't you try it?

In the next issue of TFH I'll write about crossing *Metynnis* with *Mylossoma.*

"He doesn't seem to appreciate how hard and long I work to make this food myself."

The gouramis, at least the South-East Asian species, are generally known as well-behaved fishes if we do not consider the fact that during the spawning period they somewhat angrily chase away any fish that approaches their bubble nest. Two species of the genus *Colisa*, however, should be considered an exception in this regard. *Colisa labiosa* and *Colisa fasciata* just like to seek quarrels with other fishes, in addition to which the male *C. labiosa* courts the females of all other species of the genus.

Colisa fasciata, on the other hand, seems to be a misogynist (woman-hater), for you will rarely see a male and a female of this species living harmoniously together. Whenever a female shows herself near a male, she is immediately chased away, often paying for her temerity with torn fins.

One male, which due to a lack of space I placed in a tank full of cichlids, took no nonsense from the *Pseudotropheus auratus* or the *Haplochromis burtoni*. To the contrary, this doughty warrior bickered continuously with the other inhabitants of the tank, and even went as far as going into mouth-pulling with the *Haplochromis burtoni*. The only thing that is remarkable in this is that all the cichlids were quite larger than the *Colisa fasciata*. Therefore it is not advisable to place pairs of this species in small tanks, except for spawning purposes.

Colisa_fasciata

C. fasciata are native to Bengal, Burma, Thailand, and Assam. In the aquarium males reach sizes up to 4" and females up to 3". Like all known species of the genus *Colisa*, the Striped Gourami also shows beautiful colors. The entire body of the male has a reddish brown foundation color and is covered with blue-green cross stripes from the pectoral fins to the caudal peduncle. The dorsal fin is of a bluish hue, excepting a red wedge at its end. It ends in a pointed tip and is bordered with a white seam. The females show similar colors, but with less vivid hues. Their dorsal and anal fins are rounded.

As is stated often, for keeping the Striped Gourami, one should choose a rather large, well-planted tank. It is my experience that a temperature of 70°F. shows best results as a living temperature. As with most all labyrinth fishes, you may set these fish up for breeding at any time, provided you feed them well on daphnia, white worms, and mosquito larvae. For this, use a 5 to 7½ gallon tank. This, too, must be densely planted, or at least offer sufficient shelter for the female to hide in. Water is no problem for this species either. Tap water with a neutral pH value and medium hardness will do perfectly well. I also use tap water with a hardness of 18 DH. At a temperature of 78° to 80°F. my fish always spawn on the following day, after they have been placed in the breeding tank. I usually transfer the pair to the tank in the afternoon, only to have the male already next morning busily building his bubble nest. This nest has a large surface and consists of a maximum of two layers of large foam bubbles. Parts of plants is something my fish never use. During this period the female should not dare show herself—even a glimpse of her while catching air is sufficient to drive the male to attack her. You can count on spawning about noon.

It is quite interesting now to watch the behavior of the female. There are no mating plays before spawning. If she desires to spawn, the female approaches the male slowly, he immediately chases her away, and then rather roughly. Generally, the female tries once more to reach the male while moving slowly, but she is immediately chased away once again. Now the female changes her tactics. Lightning-fast she shoots out of her hiding place towards the male and starts immediately to push his body and caudal peduncle with his mouth. It is only now that the male remains calm. Moving his whole body leisurely while slowly progressing towards the surface, he accepts the courting of the female. Meanwhile, the female remains in a position perpendicular to that of the male and slides up his sides with her head turned upwards and the belly glued to his body. Now the male bends slowly and embraces his mate. She is now turned upside-down, so that her

Camera close-up *Colisa fasciata*

belly is pointing towards the surface of the water. They embrace, sink to the bottom where they separate again, for this was only a mock mating. The female now disappears immediately into her shelter. After some time she dashes out again towards the male, and the same play pattern is repeated, with the sole difference that there now is a mating. At this time you will be able to watch this: while the pair are lying on the bottom, a shivering passes through the body of the male. Then a short, spurting motion takes place and you see the spawn surging forth. Now the male loosens the embrace, while the female remains belly-up for a few seconds—like dead. Then, with the speed of lightning she escapes to her shelter. Usually the male still chases her a little bit so as to let her know that it is now the time for her to scram. Leisurely, the male now gathers up the eggs which are still floating around. These eggs are amber colored. Sometimes you will see some whitish ones too, which probably were not fertilized and which the male will not collect.

This game is repeated every two or three hours until the female is empty of roe. You will immediately notice that the spawning has reached its finish, for now only one or two eggs are released. But the female returns to the male even after no more eggs are left in order to mate with him once or two times more, but, of course, without producing any further eggs. At this point it is advisable to remove the female from the spawning tank, for now the male starts to chase her again.

The male gathers the eggs, which are scattered all over the surface, and carries them together in a heap. After a few hours, you will notice a yellowish spot in the large bubble nest where its surface is slightly raised. This protuberance, where the whole spawn is gathered together, measures about ¾" in diameter. The young, sometimes numbering over 1000, hatch after about 24 hours and are free-swimming after another two days. Now you had better remove the male from the nursery tank, as he is apt to consider his offspring delectable meals. The first food for the young are rotatoria. You can feed them on this for ten days, when you should go over to cyclops nauplii. Otherwise you can also skim off the eggs after they have been spawned and transfer them to a separate nursery tank. This is something I always prefer to do. As with all Gouramis, it is extremely important to keep the baby fish well fed, as well as to change their water frequently. Beautiful and sturdy fish will thank you for your efforts.

HANS JOACHIM RICHTER

A large northern seahorse, *Hippocampus hudsonius* DeKay, 128 mm. from tip of snout to tip of tail, was kept under observation at the Narragansett Marine Laboratory between October 1, 1951, and February 15, 1952. The experimental tank was monitored by hydrophone and magnetic tape recorder.

RECORDED SOUNDS.—Fourteen sounds recorded for analysis during this period were loud clicks, similar to the snapping of finger against thumb. Their frequency distribution extends between octaves 0 to 50 cycles per second (cps) and 2400 to 4800 cps, with maximum energy in the 300 to 600 cps and 400 to 800 cps bands.

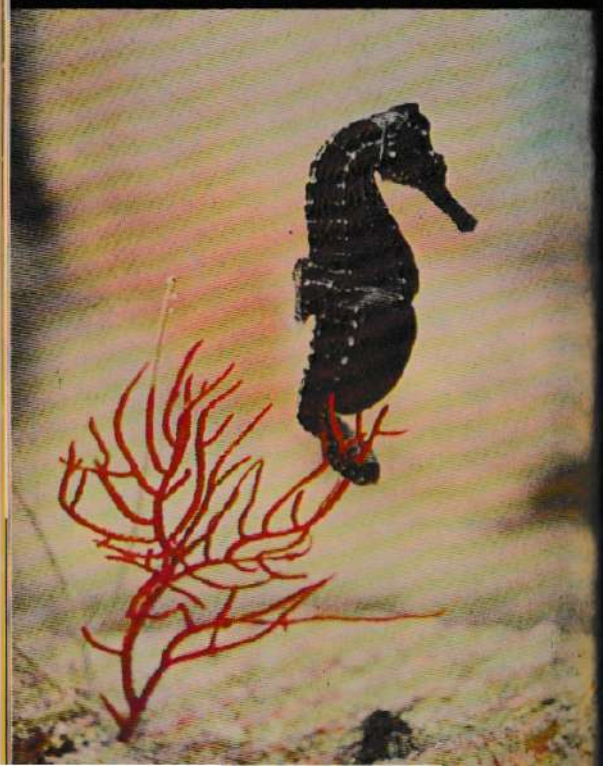
The Production of Underwater Sound by the Northern Seahorse, *Hippocampus hudsonius*

BY MARIE POLAND FISH

STIMULATION TO SOUND PRODUCTION.—Spontaneous soundmaking was limited to the first two days and seemed to be associated with strangeness of environment. Although held elsewhere in captivity for two weeks previously, the specimen immediately reacted to the new location with a vigorous snapping, repeated at intervals of approximately one-half to three-fourths of an hour during the first day. After the first burst of five, the snaps were made singly, doubly, or in a series of four spaced about one second apart. Preceding each sound or burst of sounds, the seahorse cruised the length of the tank one or more times in its characteristic upright position, propelled by the rapidly vibrating ear-like pectorals and the rudder-like dorsal fin, its prehensile tail curling tightly up from a horizontal position and down again persistently. Then the tail attached to a branched twig, and, after a short period in which the fins were collapsed and only slight movement in the gill region was evident, the sound was made, accompanied by the head motions described in the next section. Following its soundmaking, the fish remained stationary for some minutes except for a slow and constant movement of the head from side to side.

Living plankton was available in the tank during the period of

Like the Trojan Horse of old, **Hippocampus hudsonius** waits omnisciently for the important moment. Only, in **H. hudsonius** there are no hidden warriors waiting to attack, but seahorse eggs which are waiting to burst forth into new life after sitting out their incubation period in their father's pouch. Photo by Marine Studios, Marineland, Fla.



captivity, and the seahorse appeared to search for additional food among the detritus on the bottom, but no sounds were associated with feeding. Attempts at irritation with a glass rod were greeted by the mere drawing downward of the head and a tight coiling of the tail; no outward fear was induced. Tapping on the glass wall, or even sudden motions close by without touching the tank, were sufficient to cause a quick jerking of body and subsequent recoiling. But there was no animal sound.

Raising the temperature of the water over a period of two hours from 65° to 75°F. resulted in slowing the specimen's activity to a standstill. Sudden removal from the 75° water to another aquarium at 65° induced immediate swimming and sound production.

It is inferred that, for this one fish at least, sound may be used in new surroundings for orientation, perhaps to find the whereabouts of others of its species. This specimen was a female, and was said to have spawned eggs in captivity during the previous week, but the author cannot verify that report.

Previous reports of soundmaking among seahorses are limited to a European species, *Hippocampus brevirostris* Cuvier, in which both sexes allegedly make a monotonous noise analogous to that of a tamtam, especially during the breeding season (Dufossé, 1874). The fact that copulation occurs among members of this family, at which time the eggs are deposited by the female in the brood pouch of the male, lends plausibility to the theory that a mating call may be used to bring individuals together.

An amusing story concerns an artist who was sketching two seahorses in separate jars. "Suddenly a sharp little snapping voice called at short and regular intervals from one container, followed by a response from the other. Gill (1905) concludes that they were 'thus conversing or signalling to each other.'

"Uchida in a 1939 radio broadcast in Japan described a similar episode where two seahorses in separate jars conversed for some time 'as if they were exchanging telegraphic code'." (Fish, 1948.)

MECHANISMS INVOLVED IN SOUNDMAKING.—All of the recorded sounds were made in the same way. The specimen was observed to lift its head several times from the usual position at right angles to the body in a motion resembling "stretching of the neck." Then finally the head flexed as high as possible, so that its top was almost in a straight line with the edge of the back. The coincident snapping

sound appeared to be stridulatory in origin, and its high frequency corroborated this theory.

Examination of the dead specimen showed a loose articulation between the posterior margin of the skull and the anterior margin of the coronet, which is a star-shaped, ossified crest mounted in a socket-like base. (Whether this structure represents a true skull bone, or whether it is a modification of a spiny dorsal fin support, has not been definitely determined.) When the seahorse's head was extended moderately, the articulating bony edges could be seen to rub together, but when elevated more sharply, the coronet overlapped the other bone. Dissection showed adequate muscular equipment to permit such movement in the living fish. It is suggested, therefore, that the "finger-snapping sound" results when the skull edge slips forcibly under the coronet, or, more likely perhaps, when it snaps out. Vibrations thus set up may be transferred to and amplified by the air bladder. Burkenroad (1931) observed a click, described as quite similar to that of an elaterid beetle, when the pipefish *Syngnathus louisianae* Günther repeatedly snapped its head sharply upward.

In the example cited by Gill (1905), sound was attributed to the muscular closing and sudden expansion of the lower jaw of the seahorse. Possibly this is another noisemaking mechanism, but the author tends to believe that the sound produced, which is described as a snapping resembling in tone and strength (without benefit of hydrophone and amplifier) that of the scarlet prawn, *Alpheus ruber* Milne-Edwards, could not be made by the short, toothless jaws at the end of the seahorse's narrow, tube-like snout. We noted rapid movement of the mouthparts along with almost imperceptible quivering of the whole body during the head stretching, but greater vibratory movement of the same type at other times produced no sound.

ACKNOWLEDGEMENTS.—Acknowledgement is made of the valuable assistance of William H. Mowbray in the sound analyses, and of Prof. Robert A. DeWolf in dissection of the specimen.

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It would seem that evolution was having fun when it developed the **Seahorse** for these curious creatures do not have a stomach, teeth, or ribs. And if that isn't enough to set him apart from the rest of the crowd, he also swims in a unusual style . . . almost straight up and down. But don't tell **Hippocampus hudsonius** he's weird . . . he wouldn't believe you anyway. Photo by Marine Studios, Marineland, Fla.

Contest Winners

We're getting swamped with good photos from you people. We love it. Only in the confusion of the hundreds of entries we pulled a boo boo. In our October issue we wrongly credited the winning photographs: William R. Kratt actually is the photographer of the black angelfish and John Jawor was really the winning photographer of Category II (Landscape); they were both great photos. You gentlemen have our apologies, but you are both winners anyway.

If you find a camera under your Christmas tree this year, why not make your first pictures, fish pictures! That way you can enter our popular TFH monthly contest.

Category II (Landscape). H. Schechter, Bronx, New York.

Category I (Close-up). Jens Meulengracht-Madsen, Copenhagen, Denmark.