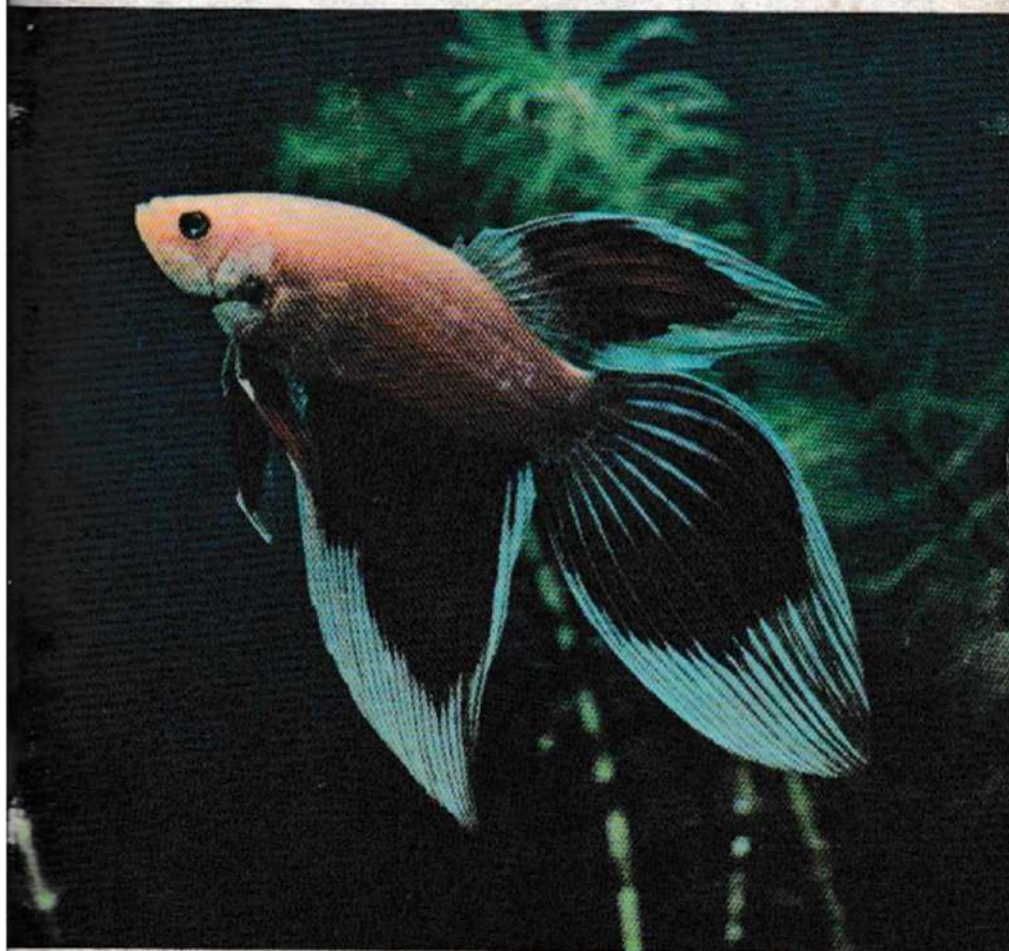


DECEMBER, 1967
VOL. I NO. 2

THE AQUARIUM

35¢



- THE EXOTIC NATIVE
- EVERYMAN'S EGGLAYERS
- KNIFEFISH REGENERATION
- THE LITTLE KNOWN HIGOI



DECEMBER, 1967
VOL. I NO. 2

THE AQUARIUM

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On The Cover

Aquarium photographer Andrey Roth captures the beauty of a fine Libby Cambodia Betta generously supplied to this magazine by Mr. and Mrs. Warren Young of Little Falls, New Jersey. Mr. Young is one of the nation's most prominent breeders of *Betta splendens*.

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the Exotic native

by JOHN R. QUINN

Expeditions great and small have been sent to search far corners of our wide world for the beautiful, the spectacular, and the unknown of the animal kingdom. What many people don't realize is that many creatures of exotic beauty and strangeness can be found in the most surprising places, even very close to home. The Eastern seaboard of the U.S., deemed just about the most heavily populated region in the world, has its fair share of little known, living treasures and New Jersey, claiming more people per square miles than any other state, is at the top of the range of one of these creatures.

This animal, which happens to be a fish, is found as far north as Southern New Jersey and as far south as to Florida, and inhabits the dark, wine-colored waters of lowland cedar bogs. Threading its way between the submerged sphagnum moss fronds with a grace and bearing only an angelfish could possess, is our subject, the gorgeous, and very native, black-banded sunfish. Known also as the "chaetodon," which means (literally) "angelfish"; this diminutive, peaceful creature is poles apart from its cousin, the voracious large-mouth bass. Both belong to the Centrarchidae, the sunfishes and their relations, but they vary in both size and temperament all the way from the tiny pygmy sunfish of Florida to our large basses of angling fame. In fact, the peace-loving black-banded sunfish is so well suited to aquarium life that it is reared commercially

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KNIFEFISH REGENERATION

by BRAZ WALKER

Certainly one of the most fascinating groups of freshwater fishes to both scientists and those aquarists equipped to handle them are the gymnotid "eels" (or "knife" fishes) of Central and South America. Not only has investigative interest been generated in recent years in regard to their electro-navigation systems, which in many ways seems more sophisticated than our own, but the efficiency of their propulsive system is enviable in its capability to furnish almost equal backward or forward motive power.

Physical proficiency is one thing but the almost uncanny ability of these creatures to survive massive physical injuries, such as mutilation or amputation of as much as one-third of the rear portion of the body, and to completely regenerate the lost member is a gift seldom paralleled in the higher and more complicated life forms of this level. From the branching point of their characid ancestry to their contemporary position, their evolution seems to have been based on the unusual and although many of the "tough" species of fishes can survive almost unbelievable injuries, the ability to completely regenerate the entire caudal fin (when present), lost nerve and muscle tissue, skin, scales and fin rays (in some cases) to a "like-new" condition, is



photographs by the author

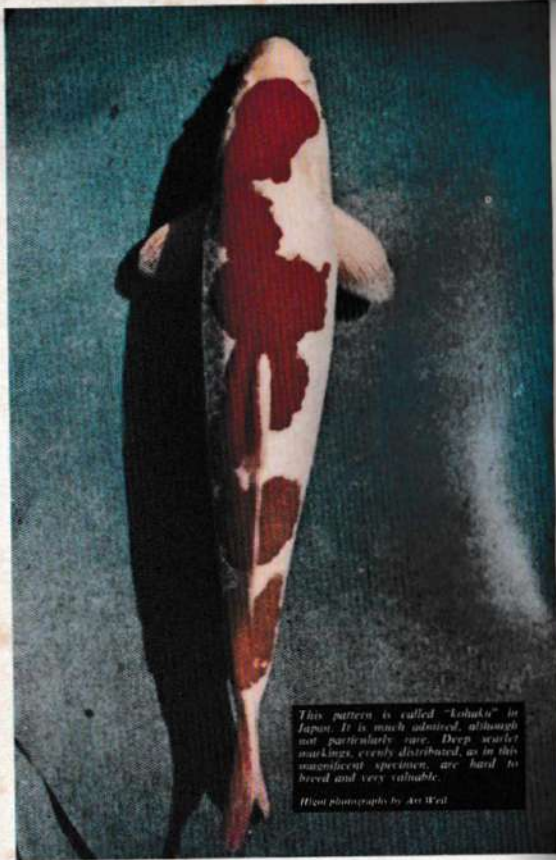
Gymnotus carapo, the banded knife eel.

perhaps their most remarkable ability.

It is significant that the more predatory the species, the less frequently specimens are found in the midst of regeneration. *Electrophorus electricus*, the electric eel, is understandably attacked with less frequency than its lower voltage cousins and consequently, is less frequently collected with regeneration in progress. It does not, however, lack the ability if the need arises. This takes care of one entire family of the Suborder Gymnotoidei, since this is the sole occupant of the family Electrophoridae.

Gymnotus carapo, the nearest relative of the electric eel and a typical rapidly-moving, well-camouflaged predator, is also less apt to be found regenerating. In my own experience, however, the rapidity with which injuries in this species heal and regeneration of sizeable chunks of flesh bitten from the rear by other *G. carapo* occurs (this often happens in

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This pattern is called "kohaku" in Japan. It is much admired, although not particularly rare. Deep scarlet markings, evenly distributed, as in this magnificent specimen, are hard to breed and very valuable.

Best photographs by Art Ward

THE LITTLE KNOWN HIGOI

by DONALD L. DADEY

What is possibly the most magnificent of all domesticated fish species raised by hobbyists the world over, is next to unknown in America. Japanese colored-carp, or "higo" as they are called in Japan, are practically impossible to buy in the United States. And if you want to stump your local pet dealer or even the reference librarian, ask them for some information on higo!

Perhaps the principal reason why higo haven't caught on here is their rather close resemblance to goldfish. Viewed superficially, there seems to be no difference between them, and little reason to prefer the higo. Higo are, in fact, virtually identical in shape to the so-called "common" goldfish, and they resemble our familiar wild carp in conformation even more closely. Higo exhibit none of the strange or exaggerated body, fin, or eye development that most types of goldfish display.

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The following is a guest editorial, written by Braz Walker of Waco, Texas. From time to time we shall publish such editorials, either on an invitation basis or upon acceptance of unsolicited material meeting our requirements. If interested, try your hand!

GOD (OR CIRCUMSTANCE, IF YOU PREFER) has entrusted us with a unique custodianship. We are the curators of life on this planet and the distributors of its wealth. We are responsible not only for any conservation which might occur but also any abuse. Getting to the point, as the only creature which keeps pets, we assume further responsibility.

The unparalleled growth of the aquarium hobby in recent years has resulted in an influx of vast numbers of what would have been considered "dream fishes" by our predecessors, while a combination of transportation improvements and competitive marketing has brought the prices of many fine and exotic fishes almost ridiculously low. If you will forgive my rewiring an old maxim, many hobbyists in our country are losing sight of the individual "trees" in staring at the forest of varieties of fishes and new equipment.

To quote a British friend of mine, "Our fishes are more dear to us (British) than to American hobbyists." He qualified this by explaining that comparative wages and living costs made purchases necessarily more careful, but that also the individual creature, goldfish or discus, was prized as much for the fact that it was a living organism for which the aquarist had assumed responsibility as for monetary consideration.

Do you give the best care of which you are capable to every fish you purchase, regardless of price? Do I? A guppy or a neon tetra may be easily replaced in your aquarium, but once lost through neglect or abuse, the life of the INDIVIDUAL is gone.

BRAZ WALKER

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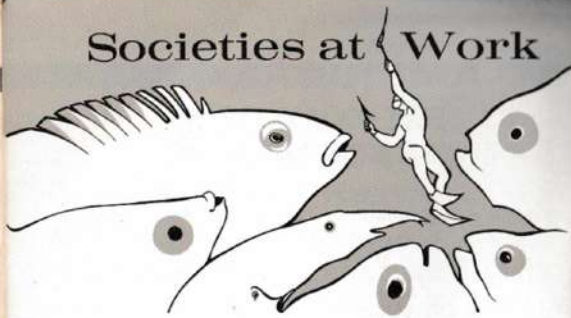
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Societies at Work



By HELEN SIMKATIS

THE SAN FRANCISCO AQUARIUM SOCIETY'S newsletter which is called *ANCHOR* was the first subject of this writer's review after a long vacation from the bulletins and it proved to be a pleasure to read and an excellent aid to get back into the swing again. The bulletin is well-produced, easy to read, and intermingles club news with a variety of articles that should please both members and non-members. Marine biology buffs will enjoy Mary Beth Libbey's *Tidal Zones* in which she sums up her conclusions made during a study of the band of shoreline margined by the low-low tide and the high-high tide of the northern California Pacific coast. She lists and describes the plants and animals she discovered in this area and accompanies her text with two interesting line drawings. Michael Osborn tells us *Your Fishes Can Do Tricks* and describes the antics of a three-spotted gourami with whom he has worked. Albert J. Klee offers a review *On Diseases of Fishes* and discusses the effects of various parasites. Mr. Klee tells us how the parasites operate but medications are not gone into. *Man in the Depths* is a special report on Sealab III Habitat. Sealab III, a part of the Navy's Man-in-the-Sea program, will be placed at a depth of 430 feet off San Clemente Island, California, early in 1968. This operation will entail the services of two porpoises, two sea lions and a harbor seal who are to be trained to work with aquanauts for search and rescue as well as for the delivery of small items. They will be trained to assist in underwater photography, wear harnesses, and their adaptability and capabilities will be appraised. Betty Jayne Ormsby fills us in on the *Amazon Sword Plant* which she considers the "King of the Aquatic plants." She agrees with most authorities that this species requires plenty of light

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but does not go along in the belief that it demands acid water. She has found them doing very well in a pH of approximately 7.6. She goes into propagation and points out that healthy plants that do not produce runners are probably males. All in all, this August issue of *ANCHOR* is a well-balanced hobbyist's fare and we look forward to receiving subsequent issues. Subscription cost is \$2.50. Write to *ANCHOR*, SAN FRANCISCO AQUARIUM SOCIETY, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118.

The summer issue of the *COLORADO AQUARIST* (published by the COLORADO AQUARIUM SOCIETY, INC.) contains a reference piece by Ella Pittman entitled *Planning an Attractive Aquarium*, in which the author painstakingly examines why some aquariums are objects of beauty and others do not quite make the grade. She divides her subject in three categories, i.e., Natural Aquariums, the Art Aquarium, and Novelty Aquariums. The Natural Aquarium, Author Pittman tells us, should "capture a little piece of nature at its best." The background should not steal the show and perfect symmetry should be avoided. Her line drawings offer suggestions on how rocks and plants might be placed. The Art Aquarium, we are told, presents a "special effect." This is a stage setting for perhaps one species of fish and the arrangement may be most formal. Color, composition, and props are the aids here to manage a dramatic setting and simplicity is usually the passport to success. The Novelty Aquarium may employ a picture frame tank, a water bottle on its side, or some other type of bizarre container, but again good composition comes into play, and simplicity should be the keynote. She also adds some suggestions for the divided betta tank and goldfish aquariums. This article is certainly notebook material. Wilma Chadez in *My Baby Whale* offers information on the mormyrids; some first-hand, and some gleaned from another source. The same author also discusses the butterfly fish (*Pantodon buchholzi*), and tells us this is a friendly species that will accept food from one's fingers. Its interesting form and habits make it a rewarding aquarium subject. The *COLORADO AQUARIST* continues to be a first-rate society bulletin and can be had by non-members of the COLORADO AQUARIUM SOCIETY for \$2 per year. Write to the COLORADO AQUARIUM SOCIETY, P.O. Box 19278, Denver, Colorado 80219 for information regarding the society and its publications.

AQUA JEWELS (August issue) came through with a striking cover drawing of a black angel fish by Kappy Sprenger. Tina Mann's *Drippings from the Net* covered her visit to the American Pet Products Manufacturers Trade Show and a colorful account it is. We not only enjoy the "fun city" vicariously, but we get to enjoy her visit with Ginny Reed (past editor of *WET PET GAZETTE*), Mr. Walter Simon of Halvin

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Products, Al Klee, and many others. Kappy Sprenger discusses *Spawning Bettus*, Part II in this issue, a piece that has also appeared in *FISHNET* and *AQUARIST*. The article will be most helpful to those hobbyists who have had difficulty in raising newly hatched fry. Her method is clearly delineated and removal of male, feeding, and keeping the aquarium clean are all carefully treated. Her test for velvet will be appreciated by those who have been plagued by this disease and her method of dispatching it is not too difficult. Don Tallmadge in his *From a Dealer's Point of View* goes into acclimating newly collected marine specimens and how to deal with parasites. *AQUA JEWELS* is a beautifully produced bulletin, and the charming drawings that accompany the articles it contains do much to enhance its pages. Write to the AQUARIUM SOCIETY OF BROWARD COUNTY, P.O. Box 4332, Sunrise Station, Fort Lauderdale, Florida 33304 for information regarding the publishing society and its bulletin.

There is a *Piscatorial View of the Mekong* in the August issue of *THE TROPICAL BREEZE* by Herb Meyer which is both colorful and entertaining. Author Meyer takes us on a trip up the Mekong River to Cat Lo and although he wasn't able to explore the maze of river channels for specimens, he was able to examine the catch of some fishermen along a pier, and offers some excellent descriptions of what they were catching. One species he considered for an aquarium subject was a puffer with striking coloration. He glimpsed a fish which he guessed to be the archer and he gives a humorous account of watching a number of mudskippers along a sloping shore, sunning themselves and acting like puppies playing dead. Needless to say, author Meyer is finding ways of building himself an aquarium. Ole Doc Jordan is still *Scanning the Periodicals* and lacing them with his special brand of humor and philosophy. *THE TROPICAL BREEZE* is published by the SAN DIEGO TROPICAL FISH SOCIETY and information regarding the society and its bulletin can be had by writing the society at P.O. Box 4156, North Park Station, San Diego, California 92104.



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THIS IS MY PROBLEM

by HELEN SIMKATIS

From: James R. Carlson—Richfield, Minnesota

I am interested in raising bleeding heart platies, but I cannot find a supplier in my area. Could you tell me where I can send for them? Also, the water in my aquarium is soft but very alkaline. The pH, taken with bromthymol blue pH test paper, and a laboratory pH meter, ranges from 7.4 to 8.0. Many of my plants must be potted with acid soil in order to survive. *Vallisneria* will not grow well at all. The temperature is 74°F. and the 10-gallon tank receives 50 watts of light for 14 hours a day. Must I adjust the pH chemically in order to grow plants successfully. Is such a pH harmful to my fish (guppies and swordtails)? I dislike to add chemicals to the water because of the danger of shocking the fish. However, I am not satisfied with the way my plants are growing.

Answer: It is difficult to find a breeder of fish on the commercial level who will ship a small order of fish to an individual. The best way to acquire any special strain of fish is from your regular dealer by having him order them with a regular shipment. It may be he will not be successful in locating what you want right away but give him a chance to work on it and eventually he will

find what you are looking for. Another method of locating hard-to-find fish is to contact an aquarium society. Very often, even if the fish you want is not being raised by one of the members, someone in the club will know where such a fish is available. Your water problem is somewhat unusual but the general rule will apply. Water is difficult to keep at a certain pH when your basic source differs from the desired reading as much as yours does. Our suggestion would be to work with the plants that like what you have to offer. Cryptocorynes, for instance, do very well in your prevailing water conditions. A peat moss filter might give you the acidity you require and using this method would obviate the use of chemicals which you are trying to avoid, but again this would be a constant struggle to maintain the mean you have selected. Adaptation to the water the aquarist has available to work with is perhaps best in the long stretch. The fish, incidentally, which you have should like the alkaline water and perhaps a mineral product sold and designed for aquarium use would supply minerals your water lacks. These are large tablet-like discs and can be found in most aquarium shops.



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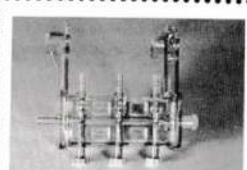
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From: Geoff Kemble, West Point, New York

I purchased your pamphlet on turtles and it answered all of my questions except one. Does tap water, which contains chlorine and other treatment chemicals, have any harmful effects on turtles?

Answer: Chlorine is an irritant to eye and gill tissues and in that 24 hours of aging water will allow the gas to escape, this procedure should be practiced whenever aquatic animals are to be maintained. From our correspondence and experience, we have concluded that other chemicals used in public water systems are used in such minute quantities that most aquatic animals including turtles, are not adversely affected by them.

From: Jeffrey Stone, Skokie, Illinois

In the fall I will undertake a study concerning the pacemaker mechanism of the lobster (*Homarus americanus*). In conjunction with this study I would like to know the type of food to feed the lobster. Also, I have been informed that the temperature of the water that the lobsters must be kept in is 50°F. I would appreciate suggestions on how to attain a constant temperature.

Answer: *Homarus americanus* is a scavenger of the ocean floor. It will dig for clams and occasionally catch a fish. Your cue, therefore, is to supply your specimen with raw fish, canned clams (might make a good staple), and any other high protein food you may have on hand. Your problem will not be in securing the proper food; rather, your problem will be keeping the aquarium water clean and suitable for your specimen. This means that perhaps hand-feeding will be in order. At any rate, you will have to be meticulous in keeping the aquarium free from decaying food. Although there are

aquariums available on the market that will maintain a temperature of 50°F, and are especially constructed for salt-water animals, you may not wish to make the investment necessary for such equipment and will have to depend on your ability to devise a method for keeping the water in your aquarium suitable for your specimen. This can be done by keeping the aquarium in an unheated room, or basement. If the latter is selected as a location, be sure your aquarium receives some daylight or sufficient artificial light. This would seem to be the most practical way to meet your problem. I might add that a great deal of work has been done on *Homarus americanus* because of its importance commercially. Literature on the subject should be plentiful in the journals published by any of the marine research establishments in the New England and Nova Scotia areas.

From: Shirley Talmudge, Franklin, New Jersey

Nothing is said in *Exotic Aquarium Fishes* about feeding fish live ants. I have been doing this all summer and find my fish relish them. I now hesitate to use them for fear of harming my fish. Do they have any bad effects? A few days ago my small son threw a piece of canned sandwich meat into a tank containing a Jack Dempsey. Much to my surprise the fish gobbled it up in a second. Later I discovered my other assorted tropicals fought for this food. Will this have any bad effect on my fish?

Answer: I do not believe the ants will hurt your fish although I have read that fish very often will not eat them because they do not taste good to them. Your experience, however, contradicts this assumption and in that your fish have been eating ants all summer and have not

continued on page 43

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CRUSTACEANS

WALDO L. SCHMITT, Ann Arbor, University of Michigan Press, 1965. 204 pages, 75 figures. \$4.50.

Dr. Schmitt succeeds masterfully in presenting the world of crustaceans to the reader in clear and fascinating text. Starting with a charming historical view which courses through such things as the use of these animals in designs on ancient Greek coins, their presence in picture on Assyrian wall reliefs, and Aristotle's description of certain forms, the author in turn considers their body organization and functions, classification, habits and homes, communication, light and color, their use as food and medicine, and, of course, their "hins" (we learn, for example, that Napoleon's troops in Egypt contracted a parasitic worm which they got from drinking water carrying its intermediate host, *Cyclops*).

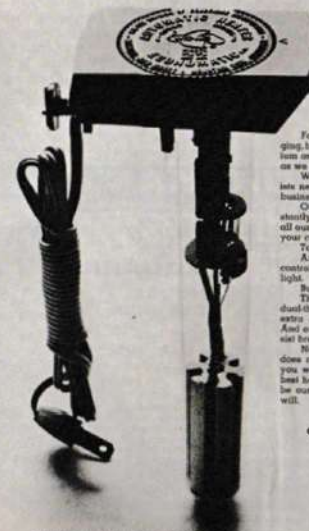
According to Dr. Schmitt, the Great Salt Lake brine shrimp is of a different species than *Artemia salina*, viz., *Artemia gracilis*. He offers some interesting data, also, on the dollar volume of the brine shrimp industry in this country. Of course, *Daphnia* are not overlooked

nor are the other crustaceans known well to aquarists (*Cypris*, gill worms, fish lice, "crawdads", etc.). All in all, *Crustaceans* is a delightful book and should be in the hands of all aquarist-naturalists. As a door prize or club award, it is a very fine choice.

Some time ago I received a letter from Sara Rafus of Rafus Aquarium, Morgentown, West Virginia, in which she asked who first bred the albino *Corydoras* and placed them upon the market. She is convinced that there is more than one type available and asked for comment. According to Sara: "My original breeders were definitely *ancus* but some I bought show a distinct difference in shape, almost like a *Brochis* rather than a *Corydoras*."

As it is generally thought that the albino *Corydoras* originated in Germany, I wrote to Dieter Vogt, the Editor of the world-famous DATZ (the German aquarium magazine) and author of a book on catfishes. Herr Vogt, however, replied that he didn't know either! One school of thought in Germany is that they originated in the United States, another opts for East Germany (DDR), Berlin in particular. Since they did not originate here, it would appear

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METAFRAME

that East Germany is the "best guess" yet! In any event, the lucky breeder who discovered the first albino *Corydoras* is still unknown.

More interesting, however, is the remark by Herr Vogt that only albino *paleatus* are available in Germany, and not *aeneus*. The question remains, are there any albino *Corydoras aeneus*? This is a difficult question to answer. All of the fish and pictures I have seen indicate *paleatus* only, even those specimens purported to be *aeneus*. *Corydoras paleatus* are not always slim and hobbyists may be making a mistake in identification by referring to the chunkier specimens as *aeneus*. There is a possibility, however, that some hybridization has taken place between the two species. One report states that male albino "aeneus" are sterile and that common practice is to breed an albino female "aeneus" with a normally-colored male *aeneus*, then inbreeding to obtain the

desired albinos. The best information to date, however, is that the albino *Corydoras* seen today is *paleatus*, with a chance that some specimens are *paleatus* x *aeneus* crosses. Readers are invited to voice their opinions on the matter, also, as the mystery remains.

Although we did not elect to broadcast it in an editorial (a formalized conveyance, best left for more important topics), readers will note a number of changes in the appearance of this issue of *THE AQUARIUM*. Magazines are never really born overnight, an evolutionary process being required before anyone can say, "This is it!" One department that we would like to launch as soon as possible, however, is *Adversaria*, a column of controversy. Here is your chance to sound off on hobby matters. It differs from *This Is My Problem* in that you tell us, not vice versa!

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ABOUT OUR AUTHORS



DONALD L. DADEY

Donald L. Dadey is a lifelong (forty years) resident of Cincinnati, and has taught high school in the area for twelve years. According to Don, "People I meet often mistake me for a biology or a science teacher because of my enthusiasm for pets and gardening. Actually, I came to these interests through literature—in which I am certified and try to teach along with various social studies—by encountering the writings of such men as Darwin, Thoreau, Audubon, Burroughs, Krutch, Durrell and Cincinnati's own Maslowski."

Don's "current menagerie", as he calls it, includes twenty-one geese, a canary, a basenji dog with four pups, another dog of indeterminate ancestry, a parakeet (which doesn't talk), a mynah bird (which does), twelve ducks, three hives of bees, and a number of fish (number uncertain, though probably in the thousands) which he keeps in several large ponds on his farm in Jackson County, Ohio.

He specializes in raising shubunkin goldfish and Japanese colored

carp (higoji), having imported some of the latter from Japan just last year. Of these he says, "I saw a few gorgeous color photographs of them by Dr. Innes and decided I had to have some. A very thorough canvassing of libraries and pet dealers all over the country yielded little information, and only two firms that occasionally sell them. So, I wrote to Japan and contacted a very friendly, cooperative chap, Mr. Toyoda, manager of the Koriyama Fish Farm who supplied me with much authoritative information and my original breeding stock."

Don says that his pet hobbies are all the more enjoyable because his wife, Barbara, shares all the pleasures and chores connected with them.



JOHN R. QUINN

John R. Quinn is a staff artist-naturalist with the ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA. At the Museum, he designed and set up the live fish exhibit, "Some Fishes Of The Pine Barrens", which has proved very popular. His special

(continued on page 6)

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BIG BROTHER IS WATCHING!

IT MIGHT BE SAID THAT THE YEAR 1957 marked the birth of significant restrictive legislation in this country with regard to aquarium fishes. During that year the State of Kentucky banned the sale of piranhas and the Mexican banded tetra (*Astyanax fasciatus*) as a consequence of fear that these fishes might get loose in their waters and become a hazard in one way or another. On May 1, 1957, it became illegal to import piranhas into Florida because of disquietude that they might become established there also. This led to passage in the United States Congress of a bill prohibiting the importation of piranhas and certain parasitic South American catfishes, except under licence by the Secretary of The Treasury.

The effect of this legislation was nil, however, as today, piranhas freely enter the United States, ironically mostly through Florida, and Kentucky residents as well as residents of other States can easily obtain any quantity of these fishes that they desire. Although we cannot agree with Charles Dickens that, "The Law is an ass," we have come to observe that, like Prohibition, bad laws are simply ignored.

In any event, legislative activity during the past few years has not diminished. The State of Oregon, for example, considered several restrictive bills. The first would have granted authority to the Oregon Game Commission to destroy any "dangerous animal", without liability to themselves (the Game Commission was to have decided what a "dangerous animal" was), and to require a \$1.00 licence for each fish in the Characin family. The second would have prohibited the sale of any animal under six weeks of age unless accompanied by its mother. We could, of course, take time out to satirize these bills (e.g., pick out the "mother" daphnia!) but some things are satire in and of themselves. The only outcome (fortunately) of this asinine legislation was that piranhas were outlawed in Oregon, an act tantamount to outlawing banana trees in the Antarctic.

In South Carolina, a bill was offered to outlaw not only piranhas but any other aquatic organism not native to the State. In 1965, the State of Illinois attempted to require that a veterinarian's certificate of health accompany the sale of each animal. California entered this sophomoric race with legislation that enabled it to ban piranhas, characins (tetras) and cyprinid fishes (goldfish, barbs, rasboras, etc.). And now, the State of Texas has followed suit with restrictive legislation on piranhas, electric eels, arowanas and a number of other fishes.

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letter from an individual in the California Department of Fish and Game who, as it turned out, was engaged in preparing a paper on piranhas, apparently from the comfort of his armchair. Among other things, he admitted to lack of knowledge of the minimum water temperature in which piranhas are found; indeed, he volunteered the information that practically no information was available to him on the subject of the natural habitat of these fishes. Yet, without any real knowledge whatsoever of these extremely important considerations, the California Fish and Game Department (who just a few years ago, paid a prominent ichthyologist \$50 to tell them what a piranha looked like!) declared the piranha to be a menace to the City of San Francisco. When asked why his State had placed the arowana on the restricted list, a Texas official replied: "They are reported to grow to a large size." This sort of pseudoscience prostitutes the use of term "biology".

State officials often emphasize that if an aquarist obtains a permit, he may keep the restricted fish in his aquarium. Sound easy? Have you dealt with any governmental licencing agency recently? Have you stood in line, waiting for a surly clerk to take your money? (You didn't think that licenes, were free, did you?) Were they open for business at convenient hours and at convenient places? It just isn't that easy and we all know it.

While State agencies are wasting taxpayer's dollars (and time) with trivia, they are shirking the really important problems which are their prime responsibility. Recently, President Johnson's Water Pollution Control Advisory Board, in an unprecedented action, sharply criticized the Texas water program. In its report to Secretary of the Interior Udall, the Board expressed concern over the use and abuse of groundwater resources in Texas. It recommended that, in the interest of fish, wildlife, recreation and commercial fishing, Texas' many reservoirs should include storage to maintain proper salt and fresh water balances in the Gulf Coast estuaries. Yet, we find the Texas Parks and Wildlife Department more occupied with aquarists and their arowanas.

If there were point to restrictive fish legislation, then the matter would be different, but we have yet to receive any explanation as to how licencing solves any problems. To be effective, an aquarist would have to be held accountable for the disposition of a licenced fish in his possession; but certainly, one dried-up fish looks like the next. And what to do about the offspring of those that are bred? If a resulting brood numbers 800 fry, are we to obtain 800 licences? Any reasonable man will conclude that licencing only provides jobs for petty clerks, and much misery for honest aquarists. Dishonest citizens are not bothered by licences.

We have no objection to laws prohibiting the release of fishes into public waters, but it seems to us that what an aquarist keeps in his own tanks at home is his own business, not the business of busybodies.

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Some aquarists have attempted to defend themselves against restrictive legislation by arguing that non-native aquarium fishes could not survive in American waters. Except for such extreme cases as the piranha in Oregon, this is a feeble defense indeed. Readers may not be aware of the fact that Oscars (*Astronotus ocellatus*), *Tilapia heudeloti*, the pike livebearer (*Belonesox*) and the snakehead (*Ophicephalus*) are established and reproducing in Florida waters. *Plecostomus* are so plentiful in certain natural Texas waters that the local dealers can't sell them in their stores. *Tilapia mossambica*, having escaped accidentally from the San Antonio Zoo, is now established in the San Antonio River.

When one considers how these fishes became established, it is clear that some hobbyists must share a good deal of the onus of this restrictive legislation. For the acts of unthinking persons who wantonly release exotic fishes into native waters, the majority must suffer. This, however, is the history of mankind, not just of the aquarium hobby; the innocent do suffer. On the other hand, we cannot condemn the introduction of non-native species per se. The pheasant, for example, is an introduced species and fishermen in Florida are having a wonderful time catching Oscars (which they call, "ringtail bass"!).

There are undercurrents involved in the basic pattern of restrictive legislation, however, that concern us both as aquarists and citizens: (a) the deceit, pettiness and arrogance of the bureaucratic mind, (b) the unmerited aura of "expertise" exuded by State fish and game officials, (c) the penalization of the innocent and, (d) the utter futility of all of this legislation.

I am reminded of a line in Gerald Green's, "The Last Angry Man", spoken by one of the principles fed up with the triteness and smallness of the bureaucratic mind: "The bastards won't let you live!" And so it is with anti-fish legislation. Typically the legislation is ramrodded through. The sponsor of the Texas bill, for example, maintained that an emergency existed and requested that the Texas Constitutional Rule requiring three separate readings of the bill be suspended. It seems that the first step of those who would "protect" us, is to suspend our Constitutional guarantees.

In California, when fish store owner Frank Adams refused to surrender his piranhas and was arrested, the California Department of Fish and Game demanded of the judge that Adams post a ridiculously-high \$1,000,000 bond while pending trial!

Some people are overly impressed by the aura of "expertise" that surrounds those with the title of "aquatic biologist", or other such terms as used by professionals in the State fish and game departments. All too often, the aura is there but the "expertise" is not. We once received a

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33



This halfbeak fry was born too early. Note the large yolk sac.

photograph by the author.

Although from the point of view of color as well as form this fish may not appear spectacular, the hobbyist can have a very interesting time with this viviparous addition to his aquarium. In their natural habitat *Dermogenys* usually prefers open water but in the aquarium, they will be found most often under the shelter of a leaf or a cluster of a plant such as *Riccia*. From such vantage points they study their surroundings and search for food that might be headed their way. In this they are assisted by a pair of very small projections, located on the sides of the jaw hinges. Most likely, these contain very sensitive nerve endings which accurately register even the rippling caused by an insect on the water's surface. In this way they find their prey.

Apart from observation of living fish in the aquarium, it is possible to see many more things with the aid of a good magnifying glass or microscope. If we study a dead specimen through the scope, we discover that the jaws are provided with a long row of sinister-looking, very sharp teeth. These teeth indicate that the halfbeak is a true carnivore, hardly pleased with vegetable food except in the very young stages. There is no hope for any animal that gets between its teeth after the powerful upper jaw is closed.

continued on page 62

Shown here nearly twice natural size, a fully mature female halfbeak.

the HALFBEAK

by WILLIAM A. TOMEY

IT HAS BEEN QUITE A FEW YEARS now since I first made the acquaintance of the halfbeak, *Dermogenys pusillus* (pronounced DER'-MO-GEN-US PEW'-SILL-US) and I have never regretted that day. For the aquarist, it is a simple matter to keep these interesting and wonderful creatures provided one is willing to take a few precautions to insure the comfort of his fish.

The halfbeak is a pronounced surface-fish, found naturally at the surface in the open waters of the creeks and rivers of tropical southeast Asia. They are elongated, slender fish having their fins well-placed towards the rear. Their lower jaw is strongly extended, bright-red in the males and somewhat black in the females (exceptions to this observation exist, however). Depending upon their origin, their fins may be anything from transparent to bright-red. The males are somewhat smaller than the females and their finrays are thickened a bit and curved backwards. The halfbeak is a very hardy fish, even to the extent of withstanding temperatures of up to 100° F. An optimum range, however, is from 68° F to 82° F.

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DADEY

from page 9

Two things make higo so decorative and highly prized by their fanciers: their fantastic range of colors and their majestic size. Self colors include bright scarlet, pure white, yellow, orange, black, peacock-blue, or chocolate-brown. Many more shades and combinations of these colors are officially named and are recognized types. An "Oghon" (gold) higo of good quality, for instance, has an iridescent glow just like burnished gold itself. The colors deepen and intensify as the fish grow older. A mature higo may reach three feet in length and weigh twenty to thirty pounds. The higo's life span is about twenty years but they have been known to live over thirty years. One can readily see how the owners of these regally-large, gorgeous fish can take such pride and pleasure in them.

The famed "Emperor's carp" of Japan, which have delighted many tourists, are higo. These fish have been selectively bred and have been the subjects of poetry and paintings in Japan since at least the Sixteenth Century. Higo were then, by royal decree, the exclusive property of the nobility, as has been the case in other times and places with falcons, Arabian horses, or various breeds of dogs.

Since World War II, a fresh wave of enthusiasm for keeping higo has swept Japan. People of all ages, social strata, and occupations participate in this hobby because of the relatively small amount of cash and space needed for it as compared to other types of animal fancy. Higo shows and auctions attract much public attention. Higo pools, incorporating the widely admired principles of Japanese landscaping, are the loveliest feature of many homes, temples, parks, and restaurants.

Then too, it is always possible that one might "hit the jackpot" and breed an exceptionally fine fish which had considerable value. In November 1965, at the annual international carp show in Honolulu, the winner, a ten-inch "kohaku" (red and white) female higo, was valued at \$2,000! Deep-dyed higo fanciers have traditions and rigorous competitive standards of the sort we associate with such big-time operations as the *Westminster Kennel Club Dog Show* here in the U.S.A. The owners of the best higo breeders won't sell them for any price.

Because of the competition and potential profit involved, only superior individuals of the same colors are used for a mating. The feeding habits, breeding season, environmental preference, and temperature tolerance of higo are all much the same as those of goldfish and wild carp. But goldfish and higo cannot hybridize. Therefore, any gold fish breeder or fancier probably could raise and enjoy higo and goldfish equally well.

Breeding higo are generally mixed in the ratio of three males to one female. These are three and four years old respectively, and are over one foot long. Spawning takes place once in the springtime when the water temperature is 66 to 70 degrees F. One female produces about 100,000 eggs and of these, about one-third hatch. Even though unable to hybridize

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Blue-black and scarlet.

with goldfish, higo are similar in that a fairly large percentage of the hatch revert to inferior color types which should be culled. Raising the fry involves the same steps as in raising goldfish fry.

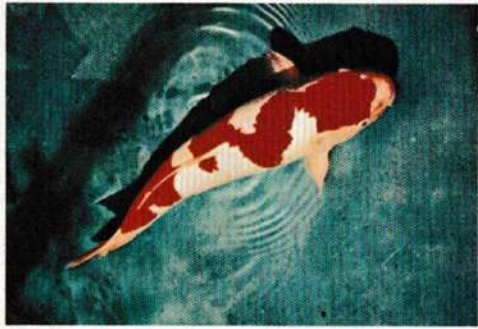
Higo eat the same natural algae and vegetable matter as carp and goldfish, but they especially relish red worms, bread crumbs, and rolled oats. Japanese breeders give them dried silkworm larvae, called "sanagi," as a special growth-promoting, conditioning food. Higo can be trained to come, when "called" for food, just as goldfish can. They maintain their best condition and reach maximum size in mud-bottom ponds of over one-eighth acre in area and containing fertilized water. They will, however, grow and thrive in large aquaria or garden pools if well-fed and if the water is kept aerated and filtered.

To avoid further confusion about this fish, one should note that higo are sometimes called "koi." But "koi" translates merely as "carp," including all types, whereas "higo" means specifically ornamental (or "beautiful") carp.

Higo may be bought from Japanese suppliers as they can be shipped successfully by air. Prices at present range from \$0.45 each for fingerlings, to \$10.00 to \$25.00 for breeders of reasonable quality. The connoisseur will have to spend a great deal more to gratify his taste. The leading supplier, who will gladly answer inquiries is *Koriyama Goldfish and Supplies, Inc.*, of Tokyo.

EDITOR'S NOTE: Apparently it is not too difficult to obtain fingerling higo as I obtained a dozen, at very reasonable prices, at the *Aquarium Stock Co.*, of New York City. (If other retail dealers stock higo or, for that matter, any other hard-to-find fishes, we would like to know about it . . . many of our readers write to us for sources of supply and we are happy to oblige both hobbyist and dealer if at all possible.) They, in the usual plastic bag, accompanied me back to Ohio and are now happily swimming in a 65-gallon tank. At first, they picked at the scales of some other fishes in the tank, goldfish and the native minnow, *Notropis lutrensis*, but have ceased this behavior now. They have, however, nibbled at the ends of all of the *Vallisneria* in the aquarium, leaving these plants with chopped, ragged ends. They have not bothered the swordplants or the cryptocorynes to date. AJK

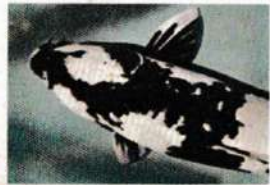
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(Below) Another red-and-white kohaku of the type that sold for \$2,000 at the annual international carp show in Hawaii last year.

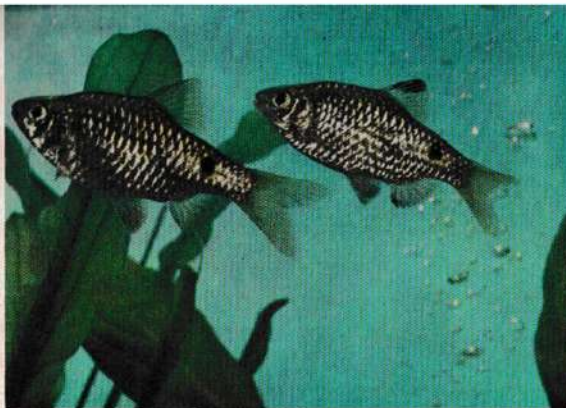


(Above) Pure black-and-white coloration is rare and costly. They are called "hito-uwari" in Japan and are almost impossible to buy. (Right) This is a hybrid which developed unusually beautiful markings.



Red, black, and white patterns are called "sankei" in Japan. This fish is designated "yellow". Sell colors such as this are more easily bred and less expensive than variegated types.

A well-aerated hiogo pond laid out in a traditional Japanese design.



The rosy barb (*Barbus conchonius*), an easily bred egglayer.



Even novice breeders successfully spawn the zebra (*Brachydanio rerio*).

EVERYMAN'S EGGLAYERS

By JERRY CURRIER & MARTY SMITH

WANT TO TRY YOUR HAND at something more challenging than live-bearers? Why not attempt some of the egg-layers? The myth that egg-layers are terribly difficult or next to impossible to breed and raise, has caused a lot of people to shy away from them. Let's take a quick look at some of the egg-layers that are easy. Maybe we can dispel some of the "mystery" about them!

Many hobbyists have "cut their teeth" on a pretty little fish which originally came from China. If it weren't for the fact that this fish is easy to spawn, the chances are that we would not see them today due to the world's political situation. We are, of course, talking about the white cloud mountain fish (*Tanichthys albonubes*). All this fish needs is a well-balanced diet and a member of the opposite sex. Before you know it you will have more white clouds than you'll have room for. By simply tossing a few pairs into a 15-gallon tank, supplying them with some bushy plants and good food, you can sit back and let Nature take its course. The white cloud is not only an easy spawner but it is also a very hardy fish. They like cooler water than most of the "tropicals" and can be kept in unheated aquariums with little difficulty.

continued on page 75



Somewhat larger in size the pearl danio (*B. albolineatus*) is no more difficult to breed than the zebra.

QUINN

from page 5

in Europe and shipped back to its native land to be sold to discerning aquarists who desire a beautiful, non-snail killer among our native sunfishes.

The little chaetodon sports its colors in a rather unique habitat, showing a definite preference for waters of acid content. Pine Barren and coast white-cedar bogs conform to these preferences and consequently, it is only in these situations that the fish is locally abundant, found in company with other such rarities as the Pine Barren's tree frog and the scarlet snake.

These attractive and fascinating creatures, plus the countless other members of the indigenous flora and fauna, combine to make the Pine Barrens one of the most intriguing wild life communities on earth. Hidden in the shadowed cedars, the pitch pine and amber waters, are enough wonders and mysteries to keep an active naturalist busy for a life time. Here are pitcher plants, and venus fly traps, lichens and mushrooms, hog-nosed snakes and fence lizards, tree frogs and turtles, pine warblers and red-tailed hawks, one could go on forever. And here, among these in the protecting, concealing waters swims the chaetodon, black-banded on tarnished-silver. One would think that the fish's silvery, contrasting dress would render it vulnerable to predators but apparently, when concealed in the waving fronds of sphagnum moss, its colors create a reflecting, pattern-disrupting effect which hides it effectively from its enemies.

In general appearance, the black banded sunfish is very reminiscent of the tropical angelfish, or "scalare," so well known to home aquarists. As though to add the Creators' finishing touches to the jeweled black and silver body color, the fish's eyes hold a ring of the brightest carmine; a soft salmon pink suffuses the ventral fins. All combine to produce a creature of charming grace and beauty. It seems so improbable when, examining the catch in a seine, our eyes fall upon the bright, barred-silver form of the chaetodon laying among its darker and more drab comrades of other species. In fact it is my distinct impression, acquired often by many captures of the species, that the chaetodon accepts its fate with much more dignity than the others. I've rarely observed it struggling and flapping; rather, the creature lays quiet and seems to regard one (if that's possible!) with a calm resignation. But even then, to see this creature lying in a net like a tarnished silver dollar, is to behold one of nature's small glories.

The black-banded sunfish, although a relatively delicate species, occasionally displays tenacity of life. While succumbing to low temperatures in home aquaria, they appear in the wild as early as mid-March. In fact, as I pen this paragraph, I sit astride a small spillway on an amber-colored Barrens lake on a warming March day. Searching sprouting sphagnum of the lake shore, I chance to see a slight movement in the



A beautiful illustration of the black-banded sunfish, *Enneacanthus chaetodon*. The scientific name of this fish used to be "*Mesopentus chaetodon*" but this is now obsolete. The name is pronounced EN-NA-EE-KAN'-THUS-KEE-TOE-DON.

still very cold water, and, looking closer, discern a chaetodon of moderate size numbingly moving through the heavy growth. The fish is netted and will reside in my aquarium, but the fact remains that an adventuresome individual ventured forth when the milky white spring ice yet covered the lakes and a few early whirligig beetles traced slow, jerky patterns in the warmer shallows. It was a Spring Peeper day in the Pines, and although I collected other small fishes, none were actively swimming about.

This sunfish displays almost recessive temperament mainly in its contacts with other species. Larger individuals can develop into aggressive bullies, largely against their own kind; at least this appears to be the case in an aquarium where I have observed them at length. But any aggressive behavior is not carried into the spawning pattern for rather than scraping out a hollow in the bottom sand and defending it as most sunfishes do, the chaetodon prefers to hide its eggs and young in the dense sphagnum thickets that are its home. I would surmise that only in the confines of an aquarium, will the largest, dominant fish show aggressive traits.

It is in the properly balanced home tank that this sunfish may be enjoyed to fullest advantage. In New Jersey, at the northern limit of its

continued on page 64

A HISTORY OF THE AQUARIUM HOBBY IN AMERICA

By ALBERT J. KLEE



An extremely ornate paludarium of the 1850's. A paludarium is a marsh-aquarium, combining the qualities of both the terrarium and the aquarium and was, many years ago, extremely popular.

PART 1: THE STIRRINGS OF THE HOBBY

The following project, an account of the history of the aquarium hobby in America, was first started by the author almost 20 years ago and since the beginning of 1966, approximately one-third of it has already appeared in print elsewhere. Because of the great interest evinced by aquarists throughout the country in this project and because *The Aquarium* itself is embarking upon a new phase in its own history, we are redoubling what has already appeared, rewriting and adding much additional information so that readers everywhere may all share in our common heritage. *AJK*

During the course of the years in which I have been interested in the aquarium hobby the past has always asserted itself, dimly at times, tantalizingly so at other times. Consequently a desire built up to learn how our hobby here in America started and who started it. Did it just occur? Did it grow "like Topsy"? What were things really like in the days past? In the process of research to this end, several things became clear. It is unfortunate but true that the little history that has been published in the aquarium literature falls far short of answering any of these questions. More regrettable is that what has been made available is highly misleading and that consequently, aquarists have been saddled with conclusions that do not bear close examination under the light of the facts. Perhaps it is high time then that we broke with tradition and vanquished several long-time aquarium myths, to set their bones at rest with those of since forgotten, but nevertheless significant fishes that graced the tanks of aquarists over a century ago.

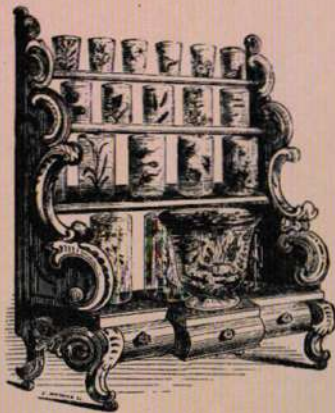
It is necessary to leave the American scene for a brief moment to examine the roots of the aquarium hobby where it first started, viz., England. There, during the period 1841-1852, the first significant activity pertaining to the aquarium hobby as we know it today, took place. The following account, by Shirley Hibberd, to be found in his *The Book Of The Aquarium* (1856), very nicely describes the development of the aquarium in England and, as it is a collector's item in addition, readers will find it helpful in understanding the very basic roots of the aquarium hobby no matter what the country. Hibberd himself (he was a man, not a woman . . . in those days, Shirley was a man's name!) was primarily a horticulturist (actually a Fellow of the Royal Society of Horticulturists) but became interested as a consequence of the fact that aquatic plants played an important role in the birth of the new hobby.

Lavoisier was the first who, upon philosophical grounds, established the fact of this balance of influences. De Saussure, in 1780, proved that plants had a tendency to improve the atmosphere, by robbing it of the gases most baneful to animal life; and Priestly, by means of well-devised experi-

ments, ascertained that when atmospheric air had become vitiated by combustion and animal respiration, plants had the power of restoring it to a normal condition, so as to be again capable of supporting flame, and the breathing of animals. Inglehouse and Ellis contributed to this inquiry, and modern chemistry establishes the fact, that though vegetables absorb oxygen, they do, by the decomposition of carbonic acid into its elements—oxygen and carbon—yield a large quantity of the first element to the atmosphere, while retaining the second for the construction of their tissues.

In the philosophical examination of this subject, the report of Professor Daubeny to the British Association, in 1833, is perhaps the most conclusive and elaborate of any of the contributions of modern chemists. He regarded light as operating upon the green parts of plants in such a way as to enable them to assimilate carbon and evolve oxygen; and concluded that as a very small portion of a tree or shrub generates a considerable quantity of oxygen, there were no reasons to doubt that the influence of the vegetable might serve as a complete compensation for that of the animal kingdom.

The formation of a marine Aquarium was first accomplished by Dr.



A "cabinet aquarium" of the 1850's. The glass jars were regularly used for housing a few specimens and permitted a variety of animals to be exhibited.

Johnstone, one of our most successful students of marine life. In his "History of British Sponges," published in 1842, he describes the formation of a little marine Aquarium in a glass jar, containing only six ounces of sea-water, stocked with living corallines, minute coniferæ, ulva, several little mussels, annelides, rissosæ, and a star-fish. The jar was placed upon a table, seldom disturbed, and after eight weeks, the water still unchanged, had lost little of its capability for the support of animal life; some of the animals were still active, and the coralline was still growing.

Dr. Lancaster, in his interesting and attractive work on the "Aquarium," expresses an opinion that the original idea was taken from the success attending the cultivation of plants in glass cases, on the plan recommended by Mr. Ward. With this opinion I quite concur, and it is agreeable to have to associate Mr. Ward's name with the subject before us, for he was one of the early pioneers, and at a meeting of the British Association at Oxford, 1849, communicated an account of his success in growing marine algae in artificial sea-water. In 1841 Mr. Ward established the first Aquarium for fishes and plants in his fern-house in Wellesloe Square, his object being *not* to determine the counterbalancing influence of plants and animals in water—that having been ascertained long before by Priestly—but to determine whether the limited quantity of air in the fern-house would be sufficient for the well-being of the fishes. Dr. Lancaster had sticklebacks in jars containing *Vallisneria* and *Callitriche* in 1849, and from that date there commenced a little stir upon the subject among the scientific public, about which date I made my own first experiments with a collection of marine objects, gathered on the shore at Sunderland, where Peter Allan's Cave and Rock gave a local and romantic interest to those splendid cliffs of magnesian limestone.

Further experiments were made by Mr. Robert Warrington, who reported upon them to the Chemical Society, in March, 1850. Two small gold fish were placed in a glass receiver of about twelve gallons capacity, covered with muslin to exclude the dust. The vessel was half filled with spring-water, with a bottom of sand and mud, and some loose fragments of limestone and sandstone, so arranged as to form shelter and shade. A small specimen of *Vallisneria spiralis* was, at the same time, planted in the mud and kept in place by a stone. Everything went on well for a time, till it was found that the natural decay of the older leaves of the plant began to produce turbidity in the water, and a coniferoid growth accumulated on the sides of the vessel, and on the surface of the water; to meet this emergency, Mr. Warrington introduced a few pond snails, which greedily fed on the decaying vegetable matter and slimy mucus growth, so as quickly to restore the whole to a healthy state.

Here was a complete circle of compensating processes. The plants grew and increased by offsets, and at the same time exhaled sufficient oxygen to preserve the health and beauty of the fishes. The snails ate up the mucus, and bred rapidly; their eggs and young supplied the fishes with food. Thus the three tenants of the globe maintained each other as in any well-ordered human community; and the water preserved its purity unchanged, and the compensating powers of animals and vegetables were established.

The first marine vivarium established in London, was constructed by Mrs. Thynne, who made the experiment of bringing some living madrepores from Torquay to London, for the purpose of study and the entertainment of friends; this was in the autumn of 1846. A stone jar was filled with sea-

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water; the madrepores were fixed on a large sponge by means of a needle and thread. They arrived in London safely, and were placed in two glass bowls, and the water changed every other day. But the six gallons of water brought by Mrs. Thynne was now exhausted, and must be used again. She then devised means to freshen it for second use. "I thought of having it *airated by pouring it backwards and forwards before an open window*, for half or three-quarters of an hour between each time of using it. This was doubtless a fatiguing operation; but I had a little handmaid, who, besides being rather anxious to oblige me, thought it rather an amusement."

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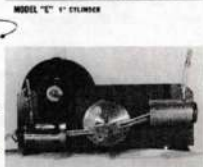
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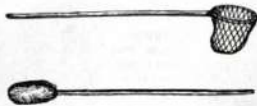
I did not know whether it were alive or dead; but in the following June a bright spot appeared on one side, and it threw forth a spore which attached itself to the rock, and in about six weeks a full-grown young sponge stood beside its parent. I placed this sponge in a darkened room, and found the spicula grew most on whichever side was turned to the light. From this time I regularly placed sea-weed in my glass bowls; but as I was afraid that I might not keep the exact balance required, I still had the water refreshed by aeration. I do not know from which, or whether it was from both causes, that my little flock continued to thrive so much, but I seldom had a death."

Mr. Warrington and Mr. Gosse commenced experiments with sea-water, almost simultaneously in the spring of 1852, and with such success as to establish the possibility of adjusting the balance of animal and vegetable life, so that the most delicate productions of the deep sea may be reared in small tanks, with scarcely any detriment to their health and vigour. Mr. Bowerbank, following in the steps of Mr. Ward, in the culture of fresh-water plants and fishes, gave to Mr. Mitchell, Secretary of the Zoological Society, the hint which resulted in the establishment of the interesting vivaria at the Regent's Park Gardens, unquestionably the most curious and novel scene which those charming gardens contain. The botanist and zoologist have here presented to them, sufficiently close for microscopic examination, those productions of nature which hitherto have been most hidden, and hence least studied of all the tribes that come within their circles of research.

New species have been distinguished, the forms of those already known are now displayed in all the freshness of life and health, the habits of the creatures in all their moods manifested even more plainly than we could expect to see them, were it possible to watch them in their native deeps; besides this we can watch the growth and reproduction of animals and plants which heretofore we have been wont to make acquaintance with as isolated, mutilated, shrivelled, and dead specimens, happy if we could detect a few of their structural peculiarities after death had contracted, distorted, or destroyed the most delicate and most interesting. But in the Aquarium

—The minutest fish
Will pass the very hardest gazer's wish,
And show his little eyes' anatomy. Keats.

The Aquarium-house at the Regent's Park Zoological Gardens was first opened to public inspection in 1853, and at once attracted popular attention for the novelty and rare beauty of the exhibition. From that day we may fairly date the establishment of the Aquarium as a popular adorn-



The upper figure shows a typical net used in the 1850's. The lower figure shows a cleaning stick, consisting of a hazel stick to which was attached a sponge.

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in which was offered to the public the first treatise on the management of the River Tank, just as Mr. Gosse's "Aquarium" was the first treatise on the Marine Tank.

To Warrington, then, belongs the honor of first giving practical form to the aquarium. Philip Henry Gosse (an English zoologist), however, must be credited with the popularization of this discovery. His writings on the subject (started in 1852) were read with avidity; aquaria became parlor or library ornaments and the directors of the zoological gardens in both London and Dublin seized early upon the new discovery as a means of entertainment and instruction for their visitors.

The English humor magazine, Punch, leveled its most keen wit and severest satire against the labors of collectors and the mishaps which befell housekeepers by the breakage of tanks, the deluging of parlor floors and the drenching of carpets!

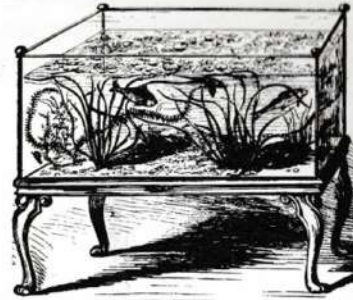
It was not long before the new fad spread to America. In 1854, James Ambrose Cutting, an inventor and photographic pioneer (in that same year, Cutting and his partner, Isaac Rehn, patented a "positive negative" called an "Ambrotype". It replaced the Daguerrotype in popularity for about two years, after which paper prints finally won out.) established two small but perfect aquaria in his home. William E. Damon, however, gives the following account in his *Ocean Wonders* (1879):

In this country I believe the writer was one of the very first to be inoculated with the aquarial passion—a passion that has grown with time, and has a deeper hold today than even in the first period of magnificent visions.

So far as I have been able to ascertain, the pioneer inductor of the private aquarium in this country was Miss Elizabeth Emerson Damon, of Windsor, Vermont; and her first essays were made with the simple apparatus of a two-quart glass jar, with a few fish, some tadpoles and snails, and some *Potamogeton* (common pond-weed); but so perfectly balanced was this young aquarium with animal and vegetable life, that I fell in love with it at first sight; and never since, among all the aquarial curiosities which I have possessed, and the thousands I have seen, has there been a collection nearer perfection than that contained in the poor old two-quart jar—an opinion confirmed by nearly a quarter of a century's experience that Nature's laws are unchangeable, and that it is not the quantity but the quality which makes perfect.

Thus we might say that, at the very least, James A. Cutting of Boston, and Elizabeth E. Damon of Windsor, Vermont, were two of our earliest aquarists. The first to introduce the wonders of the aquarium world to the American public, however, was none other than P. T. Barnum. In 1856, Barnum induced the directors of the Zoological Gardens of London to "lend" him two of their curators. He purchased a number of tanks and together with some sea anemones and other marine animals which he shipped to New York, established at the American (Barnum's) Museum, the first public aquarium in this country.

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A typical rectangular tank of the 1850's. It was about 340 gallons capacity and cost, in terms of today's currency, roughly \$110.

ment, either of a public exhibition or a private household. The knowledge of the principles involved in its construction and maintenance spread rapidly among students and *dilettanti*; exhibitions of a similar kind, though of less perfect character, were subsequently opened at various public institutions, and amongst others at the Crystal Palace; at the Surrey Gardens; the Royal Polytechnic Institutions; by the Zoological Society of Ireland, in Dublin; and by other public institutions at Edinburgh, Galway, and Scarborough; while on the continent, where studies of this kind are far less popular than here, several scientific societies kept pace with the times, and added Aquaria to the number of popular recreations and means of scientific study.

The Aquarium involves so many matters of minute detail, that its present perfection is to be attributed, not to its popularity, but to the persevering ardour of the many scientific men who have given their close attention to it, and who, through patient investigation and repeated trials and disappointments, have achieved success, and through the medium of their several published experiences have secured for this choicest of indoor recreations, the appreciation of men of taste and scientific study everywhere. To the writings of Mr. Gosse, a naturalist who has traversed the globe, and who never wrote a line but what betrayed a Christian spirit united to a profound philosophical sagacity, we owe much of our extended knowledge of marine life, and of the rationale of Aquarium management; and to the student of the Aquarium I most heartily commend that gentleman's elegant and able works on the subject, and here cheerfully acknowledge that I am deeply indebted to them for information which I could scarcely have acquired by other means. Mr. Warrington, an old disciple of this school, Mr. Bowerbank, Mr. Sowerby, Dr. Badham, and recently Dr. Lancaster, have severally thrown light upon the subject, and to these works of high character, I humbly add my own work on "Rustic Adornments for Homes of Taste,"

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Barnum's exhibition had significant influence for two people who later were to become famous as the two leading aquarists of the day. One, to shortly emerge as the leading professional aquarist was Henry D. Butler; the other was William Emerson Damon (a New Yorker, the brother of Elizabeth Damon), our first amateur aquarist authority. It was after viewing Barnum's "Aqual Hall" that Damon was seized with a fervor for the hobby, as we noted from his own account:

From fish to fish I traveled, and from those fishes I never stirred for the whole day; and, when finally dragged away from the place by my companion, my first thought was, "I must have an aquarium!" At first I wanted one as big as the Central Park, where could be kept every kind of fish I had ever heard of; then, successively, I felt obliged to reduce the size to that of Union Square and of the Everett House; and thought I was very moderate when I had compressed my imagination to the limits of two city lots, and mentally flooded them for the purpose of fish-culture! But, finally, on reflection, it became apparent to my sobered thought that in so large an aquarium as I had been imagining I should not be able to see my fish, any more than if I should drop them into the ocean. So away went my dreams, and, in sad sobriety, I at last concluded to content myself with a tank of the largest size!

In 1859, Henry Butler and James Cutting opened a public aquarium at 21 Bromfield Street, corner of Province Street, in Boston, called *The Aqual and Zoological Gardens*. Here they displayed for the public

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some 41 tanks of local and exotic fishes plus a variety of other animals. In early 1861, Butler secured the first whale ever shown alive to the public, and brought it to Boston (a white beluga whale). It was kept alive for about one year and although Barnum also exhibited a whale, contrary to what has been written, the Boston whale was the first.

By 1861, Cutting and Butler also were exhibiting a bottlenose dolphin, a gray shark and a harbor seal. Very late in that same year, Barnum, to supplement his aquarium, bought out Boston's Aquarial Gardens and moved the collection to New York. Cutting remained in Boston while Butler became a co-owner of the American (Barnum's) Museum.

For a while, there was some question as to the term to be employed to describe these "river gardens". The word "aquarium" was championed by Gosse, "aqua-vivarium" by Lankester. Hibberd stated the case as follows:

Whether we should call the contrivance in which living aquatic objects are presented by the term Vivary, Aquavivarium, Water Show, Aquarium, or ought else, has been settled by a power that is not always obedient to the perceptions of the learned. Public opinion is in favor of Aquarium, and I take it that the term has become popular because it is the most easy of utterance of any that have been devised. Dr. Lancaster's favourite designation is too long for general and familiar use, though it is, perhaps, philosophi-

cally the most correct. The term Vivarium, which takes the next place as suited for popular use, applies to any collection of animals—to a park of deer, a rabbit warren, a menagerie, or a wild beast show. Hence such a term could never convey the very special idea which we have before us in this instance. It is the water that gives the collection its special character; and water always reminds us of old Aquarius, who treats us to an annual drenching from his celestial watering-pot. Aquarius triumphed, and the pretty prison in which his cool companions of the sign Pisces were doomed to be confined acquired his name; and, since it is better to follow than to oppose usage, we leave the philological part of the question to the learned, and adopt *Aquarium* as the name of our collection.

In 1857, an article appeared in *Frank Leslie's Illustrated Newspaper* "a new pleasure—the Aquarium or Aquavivarium", thus effectively hedging. Henry D. Butler wrote one of the first two books ever written on the subject in America, "The Family Aquarium, or Aqua Vivarium" (1858), thus hedging in his title at least. The other book, authored by Arthur M. Edwards and entitled, "Life beneath the waters, or the Aquarium in America" (also 1858), did not hedge. But Butler referred to the collection at his museum as "The Grand Aquaria at the American (Barnum's) Museum", and mostly used the term "aquarium" in his book; thus, with Edwards, sharing credit for the popularization of this term in the United States.

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We should briefly remark on these two historic books. Butler's, with his experience at the American (Barnum's) Museum, was far more authoritative. Edwards offered for his qualifications as a competent authority, the fact that he had kept an aquarium for 2 years! His recommended cure for body fungus or "slime" was to place the fish in a bucket of water and to throw sand over it. According to Edwards, the fish would then rub itself and eradicate the slime! Butler's book was heavy with the literary style of the day. Speaking of plants he states: "A plant is philosophically called an organized body without voluntary motion". This would, of course, apply also to a stone! Nevertheless, Butler's advice was generally sound. He warned against feeding bread or biscuit due to their fouling the water and instead recommended chopped earthworms, pieces of dried beef, brewer's ale-grains, the spawn of molluscs and well-cleaned millet seeds.

In 1861, Barnum organized expeditions to Honduras and the Gulf of Mexico for tropical fishes for the American Museum. Barnum engaged, for this purpose, William Damon, Damon, and Albert S. Bickmore, a student of Professor Agassiz at Harvard, sailed from Bermuda in a fishing smack with well over 600 live tropical marine fishes. This was a remarkable feat for its time. Barnum's exhibit kindled an interest in aquaria in the United States on the parts of individuals, especially those residing in the northeastern portion of the country. Indeed, by 1864, Mr. B. Greenwood, of Broadway, New York City, did a thriving business in his pet store in exclusively freshwater stock. A chemist by the name of Davis, also of New York City, manufactured an aquarium cement sold by Greenwood. Both tanks and stock were shipped via rail express to the mid-west.

Probably the most accomplished and enthusiastic aquarist in the United States in the early 1860's, however, was William Damon. Damon was the first American ever to maintain a saltwater aquarium in his home. His sister owned the first freshwater aquarium in the United States and, as we have already mentioned, he was one of the first two men successfully to transport ocean fishes from the tropics to the temperate zone. In 1879, Damon wrote a book, "Ocean Wonders", containing a chapter on marine and freshwater aquaria. He was not the first American to write about the aquarium but he had more years of experience in fish-keeping, than did any other American aquarist of his time. In a 6-gallon marine tank, Damon kept anemones (some of which he himself had brought from Bermuda in 1861), serpulid worms, tubularia, barnacles, hydractinia, shrimp, a sand crab, nereid worms, buccinid whelks and 12 varieties of marine algae. The water in this tank maintained its integrity and was not changed for 23 months! Many present day marine aquarists would be happy to equal Damon's achievement. Further, Damon was

very successful in keeping seahorses alive in the aquarium.

William Emerson Damon was a confidant of Robert West, the editorialist of the *Commercial Advertiser* who, at the time, exerted perhaps more influence than any other individual in advancing the hobby in the public appreciation. We shall meet Robert West shortly. Damon knew the leading amateurs and professionals of the day, including even Louis Agassiz, and he was a polished author on aquarium matters.

We have seen, therefore, how the aquarium hobby was brought to the attention of America solely by English aquarists and authors and how a handful of Americans took it to fruition. Their names certainly must forever be etched upon the figurative tablet commemorating the pioneer aquarists in this country... Butler, Cutting, Barnum, Greenwood, Elizabeth Damon and Davis. But above all, William Emerson Damon by any set of standards, occupies an honored niche as the first of the master aquarists who were to follow him.

To be continued.

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TOMEY

from page 35

The halfbeak, which may reach a length of 2½ to 3 inches, has a period of gestation varying from 5 to 8 weeks. There are many aquarists who think that it is simple to breed these livebearers and soon populate their tanks with halfbeaks. It is true but there are many things that must be done, e.g., hatching brine shrimp nauplii, netting of infusoria, changing the water and keeping an eye on the temperature.

If the female halfbeak is carrying young and the moment of birth is not far off, one can fill a separate tank with fresh tap water where the mother-to-be can be housed alone. It often happens, however, that the fry are born prematurely. Such fry will have very large yolk sacs and this will pose certain difficulties. Indeed, they are quite helpless and unable to fill their swimbladders with air. To prevent this, I recommend that water from the tank in which the female fish is kept be used to fill the delivery tank. Maintain the same temperature and provide dense vegetation to protect the fry from the cannibalism of the mother fish. Then transfer the female and feed her well.

In this way you may obtain up to 30 young fish which will be fully developed and quite prepared for the struggle for life that awaits them. Immediately after birth the fry seek a quiet place among the floating plants and, in a day, are freewimming and searching for food. If pond infusoria and newly-hatched brine shrimp are supplied, the fry will grow rapidly.



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QUINN

from page 45

range, I have found them locally abundant in such waters as Lenape Lake at Mays' Landing and at Lake Oswego in Penn State Forest. It must be remembered that State permission is necessary in order to collect them and most other small non-game species; this is to insure that large numbers are not taken for bait, or kept in the hands of inexperienced persons.

The ideal method for acclimating them to captivity is to transport, and to keep them in their native water. They most definitely succumb to overcrowding both in the collecting pail and in the aquarium. It is advisable to collect a few of the best specimens taken each trip. I've found it very wise to pull a few cedar roots from the lake bottom and include them in the tank to maintain acidity although, as an experiment, I have kept individuals for over a year in a normal fresh water aquarium. In fact, the one fish which lived the longest was kept in the company of platies and tetras.

Getting these shy creatures over the shock of capture can be a problem, second only to that of inducing them to accept food. Plenty of natural cover and live food is almost essential at first, the preference being tubifex worms or fresh water shrimp. When thoroughly acclimated, though, most chaetodonts will accept bits of raw beef for variety. A steady diet of tubifex, moreover, tends to have "fattening" effects on most sunfishes, the individuals taking on a fat, healthy-looking appearance, only to succumb soon afterwards. Hence, variation in diet would seem to be a major key to a well balanced collection of chaetodonts.

To conclude with a word on the conservation of the chaetodon, and other lesser-known species of fishes, let it suffice to say that although the waters of the coastal cedar swamps are still host to a wonderful array of native fishes, civilization is inexorably closing in, seeking out the last undeveloped niches. Roads are thrust in, jet airports are planned and pushed, and, as accompanying background noise, the din of outboard motors grows louder with each passing summer. A tour of the many dams and spillways throughout the region will often reveal rafts of soap-suds at their bases. The value of waterfront real estate continues to rise, bringing in land speculators and developers of the lowest caliber.

All of these things cannot help but threaten the very existence of the black-banded sunfish and all its fellow dwellers of the amber lakes. The answer is clear cut; keep development and exploitation out of as much of the Pine Barren regions as is possible, for unless we can stem the human tide, the hordes of people looking for fun, profits, and a place to dispose of their garbage, the chaetodon and all others dependent upon clean water for life will surely vanish in our lifetime. The loss of one of the smaller of God's creatures will be as deep and complete as the extinction of one of the greatest.

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fields of endeavor include ornithology, nature art and writing, and the keeping of native fishes in aquaria.

Some of John's contributions to the nature art and literary fields have been published in *The Naturalist*, *Duck's Unlimited Quarterly*, *The Living Wilderness*, and similar magazines. He is married and has two daughters (ages 4 and 3). At home he keeps two aquaria (one containing a collection of catfishes, the other with native sunfishes) plus two burrowing owls and a Siamese cat. As a boy, his sources of inspiration in the fields of ichthyology were Dr. William T. Innes, Henry Fowler and Christopher Coates.

John is currently illustrating a new book, *The Birds of South America*, and his future fish projects include an attempt to breed and rear the blacknosed dace, his personal favorite among our native fishes.

from page 22

suffered, this would seem to answer your question. The canned meat should not hurt your fish either but most canned meats have a high fat content and this might in time prove harmful. Also, such food may cause a film on the surface of your aquarium water and cloudiness in the water. To answer both your questions I should like to add that fish require a varied diet. Both the ants and the canned meat might be used safely as long as neither becomes the main fare. Follow the information given in *Exotic Aquarium Fishes* and use these foods you have found acceptable by your fish as supplemental diet aids.

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WALKER

from page 7

transit when several are shipped together), brings up the question as to whether injury is less frequent, fatality is more likely to result from injury, or regeneration is more rapid and complete. Any one of these factors or a combination of all could result in finding proportionately fewer *Gymnotus carapo* in a state of regeneration.

The Apterontidae knife-fishes (sometimes incorrectly Sternarchidae) of which the black ghost, *Apteronotus albifrons*, is best known, can be described as gymnotids which have retained at least a semblance of the caudal fin. Unlike others whose stern end tapers to a neat and often dagger-like point, the point is blunted by an amusingly small, rounded tail at the end of a short caudal peduncle which ordinarily extends beyond the last ray of the anal fin. Injuries within this family seem to occur almost invariably to the caudal portion, often completely removing the entire tail, peduncle, part of the anal, skin, scales and part of the lateral line. Regeneration of all these will occur, but not with the apparent accuracy of other families.

One knife-fish, *Apteronotus hasemani*, was found regenerating not one, but two caudal fins and frequently, specimens were collected which had regenerated the caudal and lost portion of the anal such that these fins joined at the rear of the fish. Others had regenerated the caudal and anal fins and separated them by a much smaller caudal peduncle than the original. This family is apparently more susceptible to injuries than the others.

One of the knife-fishes most frequently found regenerating, aside from the electric eel, is the largest member of the suborder. Oddly, *Rhamphichthys rostratus* in spite of his sometimes six-foot size is also perhaps the most defenseless of the knife-fishes. This tube-mouthed, mud-sucking member of the family Rhamphichthidae resembles a *Hypopomus* with a pipefish head, and was the first gymnotid to be found in a state of regeneration which resembled the reproduced tail of a lizard.

Certainly regeneration is not uncommon in the animal kingdom. The invertebrates are especially adept at the process and in many ways, the proficiency of particular life forms seems to decrease as they progress up the evolutionary scale toward specialization.

In lower forms such as the Protozoa, the processes of regeneration and asexual reproduction are closely related. In both cases the animal may become divided into two sections. Regeneration, however, does not necessarily result in a whole new animal; parts such as a mouth may be replaced individually. Remarkably, a damaged front end always knows to replace the missing foot portion, while the posterior will invariably attempt to replace the oral parts which may be missing!

Sponges, in many cases, not only have efficient regenerative powers, but there is also the ability (after being strained through fine silk cloth) to reassemble or reaggregate the separated cells on the other side, again

becoming a complete sponge. In *Hydra*, a sub-surface contraction closes the wound and is very shortly covered with epidermis (similar to skin). Locally available cells increase and migrate toward the wound, transforming along the way into the types of cells specifically needed. In many cases, only a small fragment is necessary in order to produce a complete, new animal. Any region of the stem of *Hydra* is capable of forming any part of the hydranth (the business end), but again, through some uncanny "knowledge," it never mistakenly reproduces any part not needed.

Regeneration is not always foolproof by any means, and in certain creatures, such as some of the flatworms, if the amputated part is too great, strange things may happen, e.g., an injured rear end growing a head instead of the missing posterior. Also, when an injury to the front end calls for a head replacement, the greater the amputation, the smaller the regenerated head. Mollusks, too, have regenerative ability. Octopi and squid can replace lost arms and tentacles. Snails can reproduce parts such as eyes or tentacles.

The vertebrate animals do not reproduce asexually and since this is so closely tied in with the regenerative powers in many invertebrates, it is understandable that regeneration would be less common. The most notable exception in the group who apparently lack any great ability to manufacture new parts, are the salamanders. Some can regenerate an entire eye and optic nerve. Fingers, feet, and complete legs or tails can

be replaced by many. Because of their kinship and similarity in many respects, it might be expected that frogs, too, possess the ability. Oddly, at the same point where their similarity in appearance ends, their regenerative power seems to end for when tadpoles reach the stage of metamorphosis and begin to take on the "new look" of the adult frog, the ability to regenerate the tail and hind legs is lost.

As the reptiles evolved from the amphibians they retained in some cases, a portion of the regenerative powers of their forbears. Limbs can be replaced as well as tails, but reptiles lack the efficiency of the amphibians and in comparison, there is a notable lack of quality in the regenerated reptilian appendage.

The ability of newts to regenerate various parts and pieces has been demonstrated in the laboratory again and again. A lens can be removed from the eye and from a small growth which appears in another part of the eye, a new lens will grow. The very specialized cell layer known as the retina is where visual images are received and may be the originating point of the new lens; or, it may be the cornea, the transparent covering of the pupil's outer surface. This involves the process called "dedifferentiation"; cells which are differentiated or highly specialized and vastly different from those needed for replacement, lose their original specialized qualities or peculiarities and take on new "identities," assuming the roles of other differentiated cells quite unlike their former makeup. In some



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of the lower animals such as flatworms, there seems to be a "reserve" of embryonic cells which have never fully developed. When a wound occurs, the cells accumulate at this point and begin to differentiate or assume the characteristics of the needed cells without having to first go through the process of dedifferentiation or "un-specialization."

On the other hand, in those vertebrates who regenerate efficiently, there is proof that the cells needed are already present in the wound area, occupying roles perhaps as skin cells or muscle cells which will assume complete personality changes when needed. Exposure to radiation kills regenerative ability in newts, but a limb grafted onto an irradiated stump and subsequently re-amputated slightly past the old amputation point onto the new limb, will be regenerated from those non-irradiated cells remaining on the end of the stump. The ability of cells to change their nature is remarkable, but not unlimited. Experiments have failed in trying to make limb cells regenerate tails. It is still difficult to con a sow's ear into becoming a silk purse!

Perhaps one of the most remarkable features in the entire process of regeneration in animals is the ability of the process to be self-limiting. It is not hard to imagine what might happen if an unlimited "chain reaction" of cell dedifferentiation, redifferentiation, division and multiplication would take place. A two-ounce newt might end up with a five pound arm which he would find a bit unwieldy! It has been suggested

that the limiting forces used so effectively in regeneration might potentially control the rampant growth of a tumor.

Higher animals, even ourselves, are capable of regenerating an almost unbelievable amount of vital material. An example is the ability of some mammals to regenerate a complete liver when as much as three-fourths of the organ has been removed. Each day, millions upon millions of blood cells, and others, which have life spans of only a few hours, are replaced within our own bodies. Somehow, these internal repairs and even the rapid and complete healing of countless little scratches and cuts, lack the spectacular nature of such external replacements as a tentacle, a toe or an eye.

Perhaps the most remarkable of all among the vertebrate regenerators, however, are the gymnotid eels which can not only survive massive injuries, but also eventually replace the lost parts. There are problems involved in the study of regeneration in these knifefishes which have somewhat retarded efforts to determine exactly how the function is performed. These are generally shy, retiring creatures which are active for the most part at night. Little is known of their breeding habits and the difficulty of capture and transportation has so far limited studies in this area mostly to the field. With the knowledge of how other creatures regenerate, at least a rough comparison can be made.

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organs are located at the front end, so far so in fact that the anus is often found where the throat would be expected! Within the body cavity, the swim bladder invariably occupies the greatest length toward the posterior portion where attacks seem to be most frequent. Even this is nestled comfortably against the underside of the forward portion of the backbone. Attacks involving this portion of the vertebral column would undoubtedly prove fatal anyway.

One of the accompanying illustrations shows injuries which were present on *living* specimens when they were captured; these injuries were ordinarily in a state of healing or repair. Several areas were either noticeably uninjured or seldom injured. The dorsal quarter (upper anterior or forward half), was never found injured and the ventral quarter (lower anterior half) was infrequently so. This would probably indicate (a) that these injuries are ordinarily rare, or (b) ordinarily fatal.

In experiments with *Sternopygus macrurus* in which various injuries were inflicted upon the fish by surgically removing sections of flesh and other tissue and then subsequently returning the fish to an observable natural environment, it became clear that caudal injuries involving removal of as much as one-third of the length not only resulted in relatively little bleeding, although the caudal artery was severed, but also did not seem to greatly inconvenience the fish. Those in which the greater injuries of this type were observed did, however, seem less active at first.



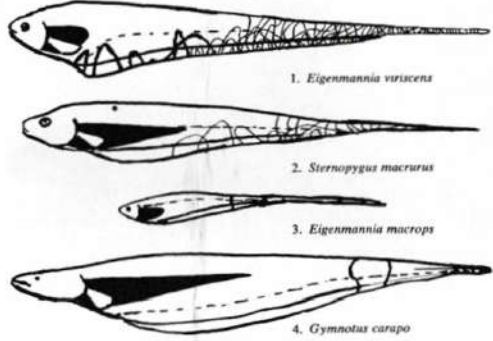
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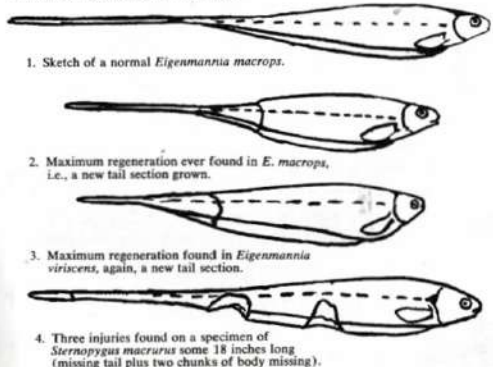
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Examples of regeneration in knife-fishes.



Diagonal injuries which missed the vital organs but approached the anterior end of the fish closely enough to remove most of the anal fin were eventually, but not immediately, fatal. Ventral injuries which penetrated the body cavity were fatal, some rather quickly. Dorsal injuries produced more bleeding in proportion to the size of the injury, but were not fatal except in cases where the vertebral column, artery and spinal cord were all severed. Wounds found on collected specimens seemed reasonably proportionate to the results of the experiments except for the fact that no dorsal injuries were found. This area is probably least subject to attack.

Many animals can survive serious injuries. Fishes, generally, are capable of replacing scales, skin and fin rays if the injury is not too serious. In most cases, enough must remain of a given part to act as "seed" from which replacement material can grow. The knife-fishes, however, like some of the more simple creatures whose lack of complexity seems to allow them to concentrate on more basic survival techniques, seem to be able to restore from "memory" certain parts which have been completely removed.

Survival devices are many and diverse but few groups have more going for them than the gymnotid knife-fishes with their almost flawless navigation system, their instantly reversible propulsive system, and the ability to grow a new tire if a blowout should occur!

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Hypopomus species, a banded *Hypopomus*.



Adontosternarchus sachsi, the toothless knife-fish.



Steatogenes elegans, the elegant knife-fish.



Hypopomus artedi, a common knife-fish.

are large and after they are free-swimming they are easily fed in the manner of the danios. Growth is very rapid and overcrowding must be avoided if you wish to prevent stunting them.

After you have gained some experience with the fishes mentioned above, you may wish to approach the more difficult varieties. The principles are the same but more care may be required concerning water conditions and rearing the fry. Breeding the egg-layers is *not* hard if you follow a few simple procedures:

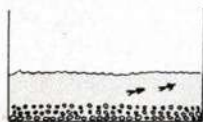
1. The parents **MUST** be properly conditioned, i.e., the females should be bulging with roe and the males should be lively and show their best colors.
2. Proper care must be taken to protect the eggs from the parents after the spawning act is completed.
3. Sufficient food in proper sizes **MUST** be available to the fry when they become free swimming.
4. Growing room is an absolute necessity, i.e., the fry must not be crowded.

Two basic methods for spawning the egg-scattering type of egg-layer.



A

A: This method utilizes either plants or an artificial spawning grass. The material is simply weighted down to cover the bottom of the tank.



B

B: This method utilizes several layers of marbles. The idea in both cases is to provide hiding places for the eggs so that the parent fish do not eat them. A low water level is kept in both methods, i.e., about 3 inches above the material or marbles. The artificial spawning grass is preferred.

The white cloud is an "egg-scattering" fish. In other words, the eggs are dropped by the female and fertilized by the male as they drift down. The parents are not given to spawn-robbing so you can leave the parents in the spawning aquarium without fear. The fry are easy to raise although they are not rapid growers and you should have plenty of good-sized white clouds in four months or so. You won't have to worry about infusoria for the newly-hatched fry if the breeding aquarium is allowed to age a few weeks prior to introducing the parents. The infusoria count can be increased if the empty aquarium is fed very lightly once or twice a week with a commercial dry food. If you want to start right away or don't have the patience to wait for proper aging, you can use one of the commercially available liquid fry foods or the so called "infusoria tablets" after the fry hatch. Within a week or less you should start feeding finely-crushed dry foods and brine shrimp nauplii if you expect the best growth from the fry.

Another fish that has started many experts on the road to egg-layer success is the zebra danio (*Brachydanio rerio*). The zebra requires a bit more preparation than does the white cloud. The reason is simply that the zebra is an avid egg eater. The simplest method to prevent spawn-robbing is to cover the bottom of the spawning aquarium with a layer or two of medium-sized marbles or large pebbles. You then fill the aquarium to a depth of three inches above the *surface* of the marbles or pebbles. If you place one well-conditioned female and two healthy males in this aquarium in the evening, the fish will usually spawn the next morning.

By using these same methods you can get the pearl danio (*Brachydanio albolineatus*), the spotted danio (*Brachydanio nigrofasciatus*) and the leopard danio (*Brachydanio frankei*) to spawn. With all of the danios the rearing of the fry is easy and the growth is very rapid, maturity being attained within two months provided a good diet of live and dry food is supplied.

After you have had some success with the fishes mentioned above you might like to try some of the barbs. Good choices for the beginner are the tiger barb (*Barbus tetrazona*) and the rosy barb (*Barbus conchonus*). Once more the big "secret" seems to be in the conditioning of the fish prior to spawning. Proper conditioning is achieved through liberal quantities of dry and live foods.

The barbs are egg-scattering fishes that drop semi-adhesive eggs in bunches of bushy plants. The artificial spawning grasses available today are ideal for this purpose. A bit more care must be taken with the barbs to protect the eggs from the depredations of the parents as they are notorious spawn-robbers. They must be removed as soon as spawning is completed if you wish to save an appreciable number of eggs. The fry



Barbus tetrazona, the Sumatra barb, offers a challenge to beginners.

The White Cloud Mountain fish (*Tanichthys albonubes*) breeds more like the zebra.



Let's take these items one at a time and see what it takes to put them to use. "The parents must be properly conditioned." Several things contribute to correct "conditioning", but the two basic needs are adequate diet and proper water chemistry. Very few fishes will gain the prime of health on a diet of dry food or one kind of live or frozen food. Variety and a well balanced diet are the major keys to good health for your fishes. This means that the fishes should be offered a good dry food, live or frozen foods and possibly a vegetable food such as algae, spinach, lettuce or the like.

No fish is happy if the water he lives in is too hot, too cold, or chemically wrong for his needs. Most standard reference books list the needs of the fish they treat and you should make some effort to supply the water required. You may find that an inexpensive water test kit will be an invaluable aid to keeping the water within comfortable limits for your fish.

"Take care to prevent the parents from eating the eggs". In the case of the danios, the use of a double layer of marbles or large pebbles on the bottom of the spawning tank is usually sufficient, as mentioned previously. Fishes like the barbs must be removed from the spawning tank IMMEDIATELY after spawning is completed.

"Sufficient food in proper sizes MUST be available to the fry". Most egg-layer fry are very small, as compared to livebearers, and must have microscopic foods for the first few days of life. This is usually supplied in the form of infusoria. The fishes we have mentioned can do without infusoria provided that they have a very finely ground dry food and brine shrimp nauplii as soon as they become free swimming. Contrary to popular opinion, we have found that while they may seem smaller than baby brine shrimp they have large mouths! If you decide you need infusoria use one of the commercial preparations available at your dealers.

"Growing room is an absolute necessity." Here is one place that short-cuts and skimping cannot be allowed to creep in. Baby fish grow very rapidly and need all the room they can get. The fry are easily stunted if you do not allow enough growing space. Although you can spawn all of the fish we have mentioned in a five gallon tank you should not expect to raise the fry to maturity in it. The average spawn of the zebra danio is 500 to 800 eggs. To gain the maximum growth from this many fry, you'll need at least one fifteen-gallon raising tank and two would be better!

Are the egg-layers difficult? Not unless you make them so. Of course they require a bit more work but the rewards are greater. Remember, you only get out of your hobby what you put into it. How about it, egg-layers anyone? 🐟



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