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Aquatic Life

Aquatic Life

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An international monthly magazine devoted to the study, care and breeding of fishes and other animals and plants in the home aquarium and terrarium.

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JOSEPH E. BAUSMAN .....PUBLISHER
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Popular and scientific artic'es and notes on subjects pertaining to the aquarium and terrarium, and to the habits of fishes in general, are always wanted for "Aquatic Life." Readers are invited to join in making it a medium of mutual help by contributing to it the results of their studies. The pages are always open to anyone having information of interest to the aquarist and student of aquatic biology. Manuscripts, books for review and general correspondence should be addressed to the editor.

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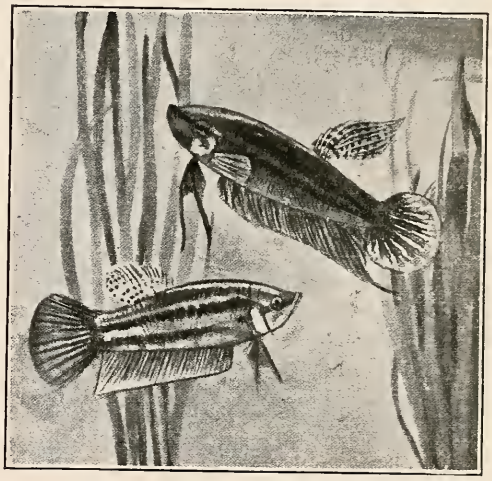
Betta rubra

C. J. HEEDE

There seems to be considerable doubt as to the status of the red fighting fish, *Betta rubra*, as a valid species. Aquarists who have compared it with authentic specimens of *Betta splendens* consider it little more than a color variety. Even *Betta splendens* was at one time confused with *B. pugnax* and again with *B. trifasciata*.

Few fishes present greater contrast between normal coloration and that assumed during breeding periods. Throughout the cooler parts of the year both sexes are dingy brown. But when the temperature is raised artificially, or summer approaches, sexual activity is aroused and the male dons gorgeous colors to dazzle his prospective mate. His body then becomes a rich reddish-brown, passing to a velvety black with a greenish-blue cast, the dark lengthwise stripes becoming more pronounced. The dorsal fin is blue, with dark spots, while the rays of the caudal and anal fins are blood-red, with the membrane greenish-blue. The female remains a rather plain brown, with perhaps a touch of red.

The red fighting fish is not difficult to breed if maintained under the proper conditions, and lends itself well to observation. If an adequate minimum degree of warmth has been provided, breeding will commence when the temperature rises to 80 or above. Then the male engages in the construction of the floating nest of bubbles, rising to the surface for air and discharging it in the selected location in bubbles formed with the mucus secreted in its mouth. If tiny floating or filamentous plants, such as Riccia and Duckweed, are present, they may be used to give strength to the structure. The eggs are extruded just under the nest, the female being assisted by the male, who winds his body about her, head nearly touching tail, with a gentle pressure. The eggs are fertilized as discharged, and fall to the bottom, but are



Betta rubra

immediately recovered by the male and carried in his mouth, to be placed in the nest.

The eggs develop rapidly and, at a high temperature, the fry may appear in 20 hours. The nest is carefully guarded and kept in repair by the male alone, the additional bubbles added from time to time actually forcing the youngsters up into the foam and above the water surface, which insures them the maximum of air with the required moisture. Within a few days the yolk-sac is absorbed, and the fry are free-swimming, and will endeavor to leave the nest. At this time, in aqua-

rium breeding, the male should be removed, leaving the young to forage alone.

The young of labyrinth fishes are very minute at the outset, needing a plentiful supply of Infusoria. Unless the breeding tank is of good size, its normal infusorian fauna will speedily be exhausted, so provision must be made to furnish this food by adding water from another tank set aside without fishes to permit this minute life to develop. In addition to Infusoria, artificial food as fine as flour, the inside of mealworms and the yolk of hard-boiled eggs, squezed sparingly into the water, may be tried. When the larval stage has been passed they may be given rotifers and the tiniest Daphne, to be followed later by large Daphne, enchytraeid worms and scraped raw beef.

Lucania ommata

Lucania ommata, which was described and illustrated by Mr. W. W. Welsh in Aquatic Life for March, 1919, had up to that time been reported only from Florida. Two months later its range was considerably extended when it was discovered in Southern Georgia by Dr. Hugh M. Smith, United States Commissioner of Fisheries, who writes the editor as follows:

"When I was in southern Georgia, in May, 1919, I visited a large artificial lake near Milltown that had been formed by the damming of a swamp about 75 years ago. This swamp was one of the head waters of the Suwanee River. The lake, which is seven miles long, is generally known as Banks' Mill Pond. It contains a rank growth of all kinds of vegetation and teems with animal life. I found *Lucania ommata* to be quite common, and dipped a number of specimens while passing among the lilies in a canoe, the fish being under the leaves of the lilies. The extension of the range of *Lucania* was brought to the attention of the Biological Society of Washington at a meeting held last spring."

Because of the deadlock between the employing printers, supported by the publishers, and the printers in New York, more than 200 periodicals, including magazines and trade journals, have suspended publication until the labor troubles can be straightened out. For the same reason the publication of many books has been delayed. Among the periodicals that have ceased publication temporarily are Collier's, the Cosmopolitan, Harper's Bazaar, Home and Garden, McCall's, the Metropolitan, the Pictorial Review, Vanity Fair, Today's Housewife, the Woman's World, the Christian Herald, Good Housekeeping, Hearst's Magazine, the Independent, McClure's Magazine, the Outlook, the Theatre, the People's Home Journal, Vogue, the Delineator, Everybody's Magazine, the Home Sector, the Designer, and the many publications issued by the Frank A. Munsey Company. Trade papers to the number of 119 have also suspended publication. The leading New York book publishers have decided to stand with the periodical publishers in the fight. One result of the trouble is that some of the periodical publishers will remove from New York to other cities. The November issue of McClure's is being printed in Cincinnati, and the announcement has been made that the Cosmopolitan, Good Housekeeping and Hearst's Magazine will hereafter be published in Chicago.—*The Writer.*

The way to kill competition is to create something too good for competition to imitate.

With everybody striking for more pay, the wages of sin still plug along under the same old schedule.

Observations on the Chelonians of North America. VI.

DR. R. W. SHUFELDT, C. M. Z. S.

Young of the Wood Tortoise **Chelopus insculptus**

Some time during the early part of October, 1919, the well-known Washington aquariculturist, Mr. Edward S. Schmid, received a consignment of a large number of very young pond turtles of several species, all of which had been taken by collectors in the District of Columbia. Among these interesting specimens occurred one, the like of which he had never seen before of all the thousands of young turtles he has possessed in his time; neither was it known to me, for I had never seen one like it, either in life or literature. With his usual generosity, Mr. Schmid duly presented me with this curious little chelonian, and it is now in my possession, alive, and in excellent condition. A few hours after receiving it, I handed it to Dr. Leonard Stejneger, Chief Curator of the U. S. National Museum, for identification. He found that it had never been figured in any work known to him, and, turning to the great chelonian collection of that institution, it was found to be, upon comparison, the very young of the Wood Tortoise (*Chelopus insculptus*), which Doctor Stejneger surmised before any comparisons were made. It was found that the National Museum possessed but three young specimens of this species, and the smallest one of them was fully three times the size of my specimen, and quite differently marked. Later on I made photographs of it, natural size, while it was under water in a shallow, white-lined pan, and these give it from above and below. It is shown here in Figure 1, while the figures of the young of our common Snapping Turtle (*C. serpentina*) are presented in Figure 2 for comparison. These latter I also photographed from life from specimens kindly placed at my disposal by Mr. Schmid; the upper and lower views are of different individuals.

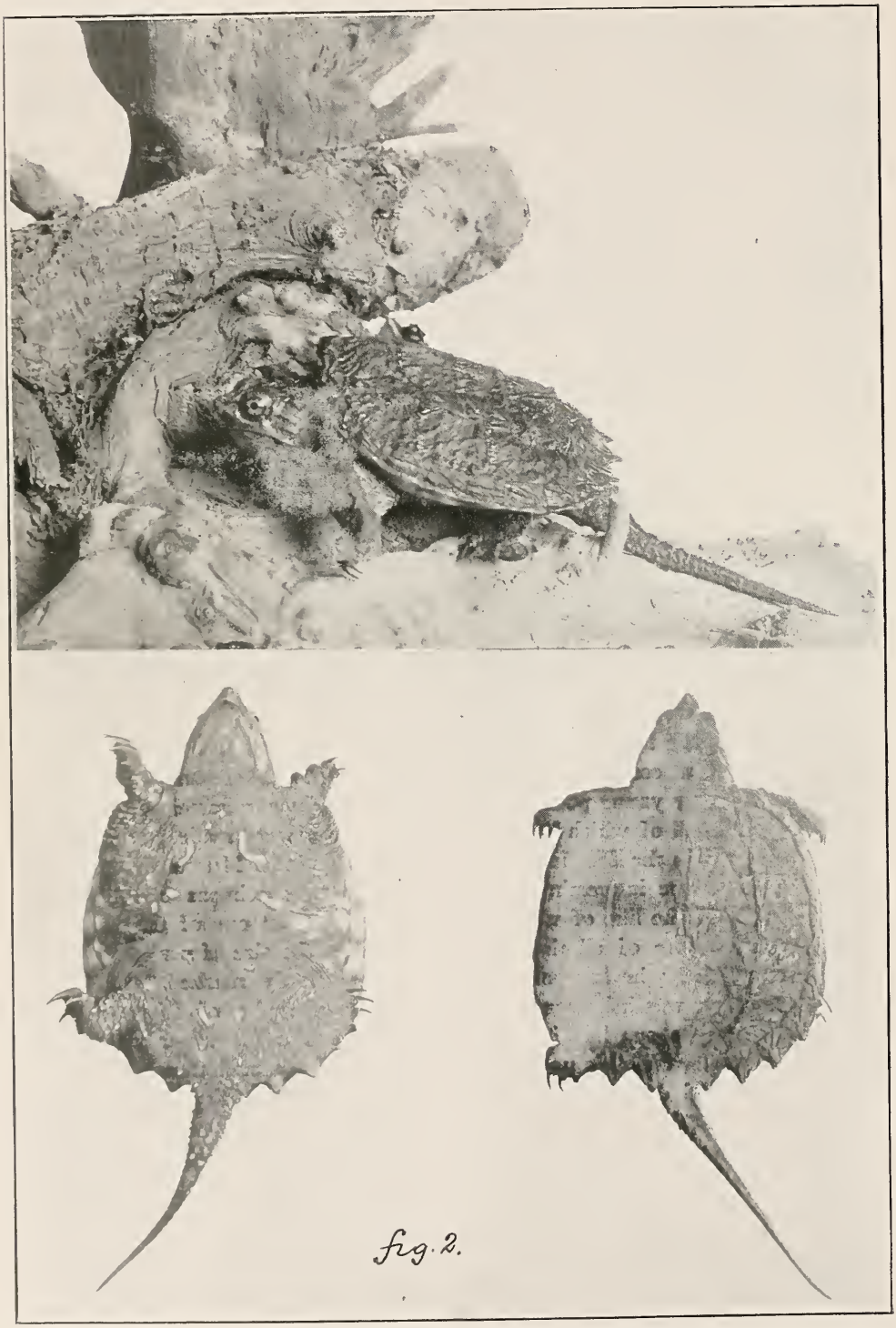


fig. 2.

Coming back to our young Wood Turtle, which is strictly aquatic in its habits in contradistinction to the adults of this species, it is to be noted, in the specimen here being considered, that the upper surface of the carapace, the head, limbs and tail, are all of a somewhat palish earth brown, and present no markings of any kind. The scalation of the legs and tail is extremely fine and delicate, the head being smooth, somewhat darker in color, and the irides of the eyes a rich brown color.

Beneath, the plastron presents a ground color of a pinkish shade, sometimes referred to as flesh color; a large area, centrally carried almost to the periphery, is of a blackish brown; while a restricted, medio-longitudinal part, centrally situated, is of a whitish shade. This plastron is of a sub-elliptical outline, a conspicuous notch being formed by the two distal or *anal* ı *cutes,* while the gular ones, anteriorly, form neither a process nor a notch.

In form the carapace above is of a subcircular outline; and, while scarcely domed at all, it forms, medio-longitudinally, a low, broad and rounded elevation, hardly entitled to the name of crest. The margin scutes are nearly square in outline, and very conspicuous. Omitting the *nuchal* and *pygal* ones, they number ten upon either side, the nuchal scute being very small.

The head may be withdrawn well within the shell, and the strikingly long tail, when curved around to one side, its tip comes slightly beyond the base of the fore limb opposite. The animal seems to have no choice as to which side it brings its tail against the shell; while in swimming, this appendage projects backwards in the median line, with a length of a little over three centimeters, the length of the carapace being about three and a half centimeters.

This little turtle walks very well indeed on land, and is an excellent swimmer. Except in the matter of general outline, it bears no resemblance at all to the young of any of our ordinary pond turtles; while upon the other hand, it reminds one very much of the young of our common snapping turtles, here shown upon three views in Figure 2. The marked length of the tail in the two is largely responsible for this, and the general circularity of form. In the young snapper, however, the posterior margin of the shell presents a series of strongly pronounced notches, a feature entirely absent in the carapace of the young wood tortoise.

South Australian Society

The South Australian Aquarium Society met on Tuesday, September 11th, in Mr. Hosking's rooms, Norwood. The president, Mr. Edgar R. Waite, was in the chair.

Mr. Herbert M. Hale delivered an address, illustrated by lantern slides, on the photography of aquatic life. The first series of slides dealt with the various methods of obtaining such photographs. Illustrations of the apparatus used by Messrs. Williamson, well-known in connection with undersea cinematography, were given. The aquarist may install an arrangement similar in principle. A concrete pond with a window let in the side has an underground observation chamber. The fishes are photographed through the window, and as the observation chamber is kept quite dark, the operator is invisible to the fishes, the window acting as a mirror to them. Inhabitants of the pond are lighted from above as in nature, and, being under natural conditions, are likely to retain characteristic attitudes.

In an aquarium, or when removed from the water, many fishes appear silvery, and one wonders how they escape detection by enemies. This appearance

is due solely to reflected light, and if such a fish is placed upon some black bars, these are reflected on the sides of the fish, a condition admirably illustrated. In a pond or river the surroundings are similarly reflected and the fish is afforded a measure of protection. The back, which is exposed to light from above, is almost invariably dark-colored.

Excellent pictures of fishes may be obtained by using a narrow glass aquarium.

"Maw, oh, maw! Can we come in?"
(Donahey in Cleveland Plain Dealer).

The subject cannot then vary its position in regard to the camera, and consequently remains in focus. Other methods of photographing marine life in rock pools were demonstrated, and the use of various tanks, cells and lenses for smaller aquatic animals was explained. The lecturer then exhibited a series of his own photographs, including photomicrographs of some of the minute inhabitants of our ponds and streams.

Fundulus nottii

The star-headed minnow, *Fundulus nottii,* is particularly attractive little killifish that for some reason or other has not attained the popularity it deserves. Did it come from India, or some other far-off land, it would no doubt be highly valued and bred with the same zeal as the species of *Haplochilus,* which it resembles in habits and spawning. But though "a beautiful and strikingly colored little fish" (Jordan and Evermann), we pass it by because it is a native species.

Nott's *Fundulus* does not appear to have been bred in the aquarium, but its spawning habits are indicated by the fact that several times aquarists have secured it from eggs attached to water hyacinths and other aquatic plants shipped from the South. In one instance it appeared from hyacinths that had been merely raked from the water, dumped into a barrel and shipped. It is quite hardy in the aquarium, and, unlike the exotic fishes, finds ordinary house temperature to its liking during the winter.

The body is silvery, with six black stripes running from head to tail, and ten to thirteen fainter vertical bars. These vary in intensity. A broad black bar covers the eye and extends down over the cheek; lower jaw and upper part of gill-cover red; breast and lower part of gill-cover reddish yellow. (Named for Dr. Nott, its discoverer.)

Thomas Edison says its easier to improve machinery than to improve men.

Nature seldom makes a fool; she simply furnishes the raw material, and lets the fellow finish the job to suit himself.—*Josh Billings.*

Beef Heart and Beef Liver for Young Fishes

Observation Breeding and Rearing Tanks Used by Albert Gale, Esq.

In connection with the short article on the result of feeding beef liver and heart to young trout, published in the United States Fisheries Bulletin for March, 1919, the following details of the method of preparation and feeding is given for those who may be interested in using it for other fish. The Bureau has not used this food for goldfish, but has no doubt that it would make excellent food for them, although it is believed that less expensive foods for such fish can be found in various commercial preparations and in cream of wheat and rolled oats, mush, etc.

If the fish to which it is desired to feed the heart and liver are very young it is necessary to remove all gristle or connective tissue and pass the meat through a food chopper seven or eight times, using the plate with the finest perforations. It is then mixed with a sufficient amount of water to reduce it to such consistency as will permit its being spread evenly on the surface of the water. The use of an egg-beater has been found advantageous in removing from the feed at this stage any remaining portions of the connective tissue, the stringy portions becoming attached to the movable parts of the egg-beater as they are revolved in the mixture. In the first feeding stages a feather

is used for spreading the food, but as the fish develop and take food more readily, it can be spread with a spoon. As the fish increase in size the meat may be reduced to suitable size for feeding by passing it through the meat chopper only once or twice, or by using a plate with coarser perforations.

Beef heart is more difficult to prepare than liver, for the reason that it has a somewhat greater amount of connective tissue or gristle, and where only young fish are on hand, this is a waste; if older fish are being held, the portions unsuitable for feeding the young fish can be used advantageously for fingerlings or adults.

The meat used by the Bureau of Fisheries in its experiments at Wytheville is what is known to the trade as "frozen." Under this designation meat is shipped from the packing house frozen, and so received; this to distinguish it from the so-called "fresh" meat, or meat that has been frozen, but from which the frost is extracted before shipping. It is fed raw.

The gland sold under the trade name of "spleen," which is cheaper than either beef heart or beef liver, has also been found more or less satisfactory food for young fish. It is prepared in the same manner as the other meats, but unless fingerlings or adult fishes are being fed, there will be a considerable amount of waste, as the percentage of gristle mentioned previously in this paper is greater than in either heart or liver. This food is used by the Bureau principally at its Pacific Coast stations for various species of salmon which are propagated in that section.

This method of feeding fish in aquaria necessitates frequent change of water, as the particles of meat are too fine to be removed from the aquarium except by drawing off the water.

In feeding beef liver prepared as described, its introduction into the water produces a milky discoloration, sometimes known to fish-culturists as "smoke." This is more or less objectionable, especially in aquariums, where there is no circulation. This objectionable feature may be overcome by "washing" the liver before feeding. This is done by adding a considerable amount of water to the *prepared* food and then pouring the milky water from the surface of the mixture, or it may be removed by the use of a short piece of rubber tubing used in the manner of a syphon.

Experiments conducted with this washed liver would indicate that some of its nutritive value is lost by the washing process. Prepared by the *Bureau of Fisheries,* in response to a request for information from a reader of Aquatic Life. Published by permission.

Heterandria formosa

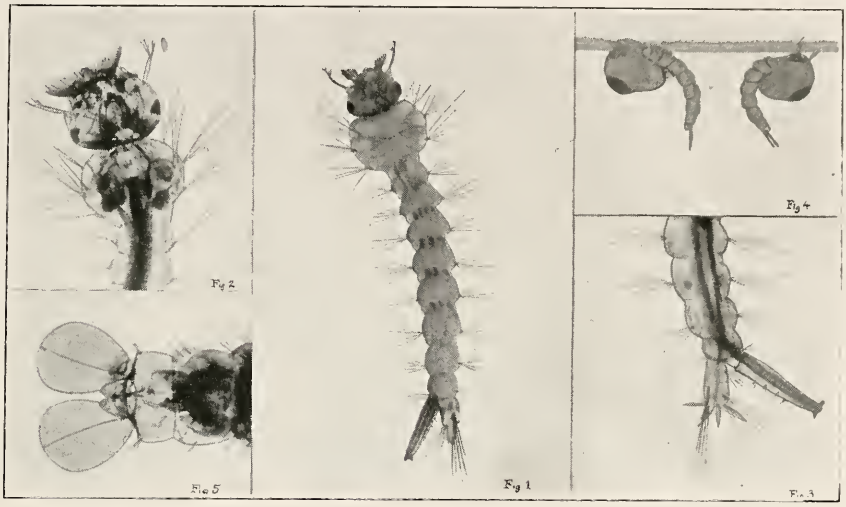
With *Lucania ommata* and the pigmy sunfishes, *Heterandria formosa* ranks among the least of fishes in point of size, but this is an advantage in the eyes of the aquarist, for the little fellow adapts itself readily to the smallest of tanks, even breeding in a quart jar.

The specific name *formosa* means comely, and Professor Agassiz did not unwisely choose the name. It is somewhat straw-brown in color, with a dark lengthwise stripe, some vertical dark streaks and a black spot on anal and dorsal fins.

It breeds readily in small aquaria, bearing a few young in a litter, however, which would be expected from its small size. No particular provision need be made for breeding other than to place the female alone in a small tank with several bunches of *Myriophyllum* and *Anacharis,* removing her when the young have been expelled.

Notes on Mosquito Larvae

HERBERT M. HALE
South Australian Museum



1. The Larval Mosquito. 2. Head of Larva, Showing Tracheae, etc. 3. Breathing Tube and Tracheal Gills of Larva. 4. Pupae Floating Below Surface Film. 5. Termination of Abdomen of Pupa, Showing the Paddles. Photomicrographs by the Author.

Mosquitoes occur nearly all over the world, though they may not everywhere be recognized as such. Aquarists are familiar with the tiny aquatic larva of the insect, perhaps better known as the "mosquito wriggler." This name is accounted for by the peculiar method of swimming. The larva appears to "wriggle" through the water, progression being accomplished by quick sideways movements of the body. As a fish food it is almost unrivaled, being appreciated by nearly all fishes; youngsters thrive and grow rapidly when liberally fed with small larvae. The number eaten is enormous. An instance is recorded of a female *Gambusia affinis* which, although regularly fed on other foods, consumed about 140 large wrigglers within an hour and a half. In the Hawaiian Islands, where mosquitoes are prevalent, this fish has been successfully acclimated, and materially reduced the pest. The insects, if unchecked, increase very rapidly and require only a month in which to complete their metamorphoses, being then ready to bring forth a new generation. The aquarist may insure a supply by installing a tub in a quiet corner of the garden; water containing straw or any decaying matter will furnish suitable breeding conditions. Before long numer-

ous tiny, boat-like masses appear on the surface of the water, each mass consisting of 200 to 400 eggs. These soon hatch, and as the larvae breathe at the surface, they may be collected with a small net, one "scoop" of which often yields the equivalent of an egg-cup full of wrigglers. Some species deposit their eggs singly; others lay in damp places, where water will later collect and the eggs remain dry for some time.

The larvae of different sorts of mosquitoes sometimes exhibit considerable variation. The accompanying illustrations, from photographs by the author, show a quite common type. Apart from its capacity as a fish food, this wriggler is well worth careful examination. It is protected with numerous tufts of hair, and some of the hairs are branched or feathered. Unlike the condition in the adult, the two brown eyes are of simple construction. There are two crescent-shaped brushes of hair round the mouth in place of the biting mandibles of other insects. If the larva is viewed alive through a magnifying glass, these brushes will be seen in rapid motion. Their function is to create a current whereby small animalcules or particles of vegetable matter are carried to the mouth organs. Predaceous and cannibal larvae have stronger hairs in the feeding brushes, these then being used to seize the prey.

Respiration is effected through a breathing tube at the posterior end of the body. This is the longer of the caudal tubes in the illustrations, but it varies in length in the different species. One authority observed that examples with a short tube are mostly found in temporary pools, whilst those with a long one occur in permanent waters. The orifice is only opened when the insect comes to the surface to breathe. It is closed at will with five or six little leaves, an ingenious mechanism by means of which water is prevented from finding its way into the air passages. When closed the tube is sharp and pointed, and is thus easily pushed through the surface film, which would otherwise offer considerable resistance to so tiny a creature. Once the film is pierced, the flaps open out in the form of a cup, which floats and enables the larva to remain suspended head downward.

In a certain group some members of which convey malaria, the larva has respiratory openings, but no external breathing tube, and clings to the surface film by means of broad hairs.

Air is conveyed to the various parts through numerous *tracheae*, or air pipes, which ramify through the body in all directions; some of these *tracheae* may be seen in the photo-micrograph of the head. The shorter and thicker tube is the last abdominal segment, and the exterior termination of the digestive canal. The vent is protected by long hairs, and has a pair of thin, finlike tracheal gills on each side.

The larval form is maintained for a fortnight or thereabouts, the time sometimes being longer, owing to cold weather or paucity of food. During this period the skin is shed three times; at the fourth moult the pupal stage is assumed. The insect does not now at all resemble its previous state; it is still active and swimming is accomplished by strong jerks of the abdomen, at the termination of which two paddles are attached. Digestive apparatus is absent and the organs of respiration are greatly changed. The caudal tube is lost in casting the skin, and the pupa breathes through two little funnels situated on the back, near the head. When not in motion it floats at the surface and the openings of these funnels are held just above the water. The insect, which, as development proceeds, can

be distinguished just under the transparent skin, does not remain long in this condition. In a few days the perfect mosquito emerges, ready in turn to propagate its species.

Linseed Meal Cause of Disease Among Trout

Some time ago a peculiar disease appeared at a commercial trout hatchery in Rhode Island among yearling and two-year-old trout. The fish turned black, many because blind, and large numbers died. Just previous to death an affected fish would dart rapidly about, sometimes jumping entirely out of the water. After swimming nervously in this way for a few seconds, the fish would usually turn partly on its side, remain quiescent for an instant, and then resume its former unnaturally sluggish swimming. In most cases the fish would repeat this performance several times before finally succumbing.

Dr. L. H. Almy, then fish pathologist in this Bureau, was detailed to an investigation of the trouble. It was learned that the disease had manifested itself a few weeks after the superintendent had begun feeding with a mixture of linseed meal, wheat middlings, and meat scraps, the linseed meal having been substituted for cottonseed meal previously used. When the meat scrap, with flour and salt, was used without the linseed meal, the disease was definitely checked in both adult fish and fry. Experiments planned by the fish pathologist were then undertaken at the same hatchery to ascertain which, if either, of the two meals had brought on the disease. The results served to establish the following points:

(1) Of the two vegetable meals, linseed and cottonseed, the linseed meal alone is responsible for causing the pigment change, blindness, and death. (2) The causative agent is contained in the non-oil constituents of the linseed meal. (3) Linsed oil in the food of trout has a slightly injurious effect upon the fish. (4) Fish affected with linseed-meal poisoning can be brought back to a healthy condition, except for the pigment change and blindness, by a diet of some fresh-meat product. (5) Yearling trout on a diet of hog lungs gained in weight three times as fast during three months as those receiving the wheat-meat-meal mixtures; however, a three times greater gross weight of food was consumed in the former case than in the latter.

Further experiments were then undertaken at the White Sulphur Springs (W. Va.) hatchery of the Bureau, with the co-operation of Superintendent R. K. Robinson, to determine more definitely the nature of the toxic non-oil constituent of the linseed meal. These experiments afforded clear evidence that the outward manifestations of the disease brought about in trout by the ingestion of linseed meal—viz., pigment change, excitability, and weakened eyesight or blindness—are due primarily to the prussic-acid constituent of linseed meal. The experiments indicated also that a food mixture consisting of wheat middlings and meatmeal, although not injurious and apparently an acceptable food for the fish, does not compare with fresh hog lungs as a food for yearling trout.—*Fisheries Service Bulletin.*

At the recent Philadelphia exhibition of aquarium fishes an urchin was listening in amazement to the remarks of a bystander who seemed to know "all about 'em," and was accordingly credited in the mind of the youngster with a great and varied collection. The boy wanted some fishes for an unused aquarium at home, but even a ten-cent goldfish was beyond his little purse, so finally he engaged the gentleman in conversation and asked if

he didn't have "a few old fishes he didn't want any more."

"I have no fishes," the man replied, "but I'll be glad to tell you how to keep and breed them, my boy." A grin of contempt and disappointment flitted over the face of the boy. "Well, if yer ain't got no fishes," he said, "yer information can't be much good."

The Redfield Theory

Casper L. Redfield, of Chicago, has repeatedly called the attention of scientists to a theory advanced by him which purports to account for the improvement noted in various animals and man by the effect of age on protoplasm. In the trotting horse, for instance, he finds that young animals are not the record-makers, but that powers of such animals increase up to a considerable age. He finds, also, that the progeny of such sires appear to be influenced by age in the same way, the older the animal at the time of breeding, the likelier the colt will be to show improved speed. Redfield asserts that such relationships exist elsewhere, and even concludes that the difference between genius and mediocrity in man is a matter of age only. He finds that no really great men of the caliber of Darwin, Edison or Galileo have been sons of young parents. According to his theory, the male parents for at least three generations must have been more than 32 years old when their children were born. In three generations a man has seven male ancestors, and if the total of their ages when their children were born does not total at least 234 years, the third generation will not be eminent. Since all great men are obviously related to many mediocre persons, some explanation for their superiority must exist, and this theory seems to be a step in solving the riddle. Whether it is the right explanation or not depends upon further investigation, but we may here call attention to something similar that exists in the protoplasm of plants. Growers of melons and certain other vegetables are aware that old seeds produce more fruitful plants than do young ones. A certain age or maturity of the protoplasm seems to be necessary. It is well known, too, that seedling peonies do not show their capabilities the first time they blossom. The flowers may be nearly single the first season and steadily increase in size and number of petals for several successive years. The double pink daisy (*Pyrethrum hybridum*), often requires four or five years to show the double feature. At the first blooming the flower heads may exhibit the "single" condition, and the novice finding no double flowers among them, may hastily conclude that his is inferior stock, but in a few years doubling may begin. All this shows that some change in the protoplasm must take place with age. As a matter of fact, growing old may be assumed to be due to changes in the protoplasm of the individual. Seekers for an elixir of life might find these facts worth investigation.—*The American Botanist.*

(Aquarists have an exceptional opportunity to test this theory in its application to fishes.—*Ed.*)

Passaic Society

The Passaic County Aquarium Society was organized by Charles Pietzsch, Paul Findeisen, Julius Hutermeier, Fred Baumgarten, J. S. Roass, K. Blankennagel and Max Ronath, on October 7th, 1919. Regular meeting will be held on the first and third Tuesdays of each month, at Max Donath's hotel, Clifton, N. J. Aquarists who may desire to become members can secure information from the secretary, addressing him at 168 Hamilton avenue, Passaic, N. J.—Kuno Blankenagel, *Secretary.*

Statement of the Ownership, Management, Circulation, Etc., Required by the Act of Congress of August 24, 1912, of Aquatic Life, published monthly at Philadelphia, Pennsylvania, for October 1, 1919.

State of Pennsylvania, } ss:
County of Philadelphia. }

Before me, a notary public in and for the State and County aforesaid, personally appeared W. A. Poyser, who, having been duly sworn according to law, deposes and says that he is the editor of AQUATIC LIFE, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, to wit:

That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher—Joseph E. Bausman, 542 East Girard Avenue, Philadelphia, Pa.

Editor—W. A. Poyser, 207 South Thirty-seventh street, Philadelphia, Pa.

Managing Editor—None.

Business Managers—None.

That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent. or more of the total amount of stock.)

—*Owners*—Joseph E. Bausman, 542 East Girard Avenue, Philadelphia, Pa.; W. A. Poyser, 207 South Thirty-seventh street, Philadelphia, Pa.

That the known bondholders, mortgagees and other security holders owning or holding 1 per cent. or more of the total amount of bonds, mortgages, or other securities are: *None.*

W. A. POYSER, *Editor.*

Sworn to and subscribed before me this 1st day of October, 1919.

(Seal) JOSEPHINE V. YEAGER.

My commission expires April first, 1923.

Little Arthur—"I say, father, is it true that nature never wastes anything?"

Father—"Yes, Arthur; quite true."

"Then what's the use of the Mexican swordtail having a sword when it can't use it?"

The primary class had been studying physiology, and in response to a question concerning the human skeleton a pupil replied: "The skeleton is if you sat down without it you couldn't get up."

Aquatic Life

1918—1919

SEPTEMBER, 1918. The Blood-fin (*Heede*); Breeding Haplochilus cameronensis (*Nelles*); The Spotted Gourami (*Kearns*); Japanese Snail (*Boyd*); Aquarium Water and Its Restoration (*Dormeier*); Aquarium Heater (*Hale*); Fish Foods (*Heede*); Happy Families, Breeding Habits of Mud-minnow, notes and news.

OCTOBER. Aquarium Heating (*Breder*); Hemiramphus fluviatilis (*Brind*); Mollienisia latipinna (*Heede*); Blue-tailed Skink (*Deckert*); Factors Controlling the Development of Tropical Aquarium Fishes (*Webber*); Snails in Aquaria (*Gale*); Habits of Black Bass, The Pipe-fish, notes, etc.

NOVEMBER. American Live-bearing Toothcarps (*Bade*); Aquarium Notes (*Leitholf*); Notes on Krefftius adspersus (*Freund*); The Anatomy of the Fish (*Clark*); Breeding Habits of Burmese Eel (*Finckh*); A Bloated Axolotl (*Waite*); The Name "Water Flea," notes and news.

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JANUARY, 1919. Limia caudofasciata (*Leitholf*); Classification of Fishes (*Stead*); Color Changes of the Chub-sucker (*Hubbs*); *Neetroplus carpintis* (*Brind*); A Simple Heated Aquarium (*Finckh*); Notes on the Breeding Habits of the Pigmy Sunfish (*Poyser*); Goldfish Farm of Kichigoro Akiyama, notes and news.

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MAY. Nanostomus eques (*Brind*); The Water Horse-tail (*Wobler*); Observations on the Chelonians of North America, Part II.

(*Shufeldt*); I Became a Fancier (*Proctor*); A Peculiar Planorbis (*Breder*); Association and Color Discrimination in Mudminnows and Sticklebacks (*White*); The Hay Infusion Microcosm (*Woodruff*); The Bladderworts, notes and news.

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JULY. A Big-headed Gurnard (*Fowler*); The Nesting Habits of Certain Sunfishes as Observed in a Park Lagoon in Chicago (*Hubbs*); Badis badis (*Brind*); The Paradise Fish (*Balleisen*); The Garden a Terrarium (*Breder*); Philadelphia Aquarium, A Fish Elevator, Akiyama Goldfish Farm, notes and news.

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Announcement

Since the initial appearance of *Aquatic Life*, in 1915, the publishing world has been passing through an era of difficulties which have caused may delays, effecting even the largest periodicals. It is a custom under such condition to drop numbers, publishing the following number with the designation of the month during which or before which it is mailed to readers. To the present time *Aquatic Life* has not availed itself of this privilege, hoping that it would be possible to issue numbers sufficiently close together to eventually make up the lost time. This would now seem to be impossible. It has, therefore, been decided to eliminate the numbers for October, November and December, 1919, thus concluding Volume IV with the September, 1919, number. All subscriptions affected will be extended. Those expiring with the December number, or beyond, will be extended three months; with November, two months; with October, one month. Each subscriber will accordingly receive the actual number of copies for which payment has been made.

February, 1920 15c Copy

Aquatic Life

Aquatic Life

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An international monthly magazine devoted to the study, care and breeding of fishes and other animals and plants in the home aquarium and terrarium.

W. A. POYSER.....EDITOR
JOSEPH E. BAUSMAN .....PUBLISHER
542 East Girard Avenue ..... Philadelphia

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Popular and scientific articles and notes on subjects pertaining to the aquarium and terrarium, and to the habits of fishes in general, are always wanted for "Aquatic Life." Readers are invited to join in making it a medium of mutual help by contributing to it the results of their studies. The pages are always open to anyone having information of interest to the aquarist and student of aquatic biology. Manuscripts, books for review and general correspondence should be addressed to the editor.

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Goldfish Foods and Feeding as Practiced in Japan

EIICHIRO NaKASHIMA

The purpose of this paper is to present an outline of the substances used as foods for goldfish by the breeders of Japan. Foods naturally fall into two classes, animal and vegetable. Though the goldfish is often classed as omnivorous it is a fact that to produce the most vigorous specimens it is necessary that animal substances dominate in the food supplied. First in importance are the entomostracans—Daphnia, Cyclops, Cypris and allied forms. Following close in point of value come larval mosquitoes, tubifex worms, the dried and ground chrysalis of the silkwork, ground shrimp, dried bonito, boiled eggs of domestic fowl, dregs of meat and similar substances. The foods of vegetable origin are usually used as ingredients in prepared mixtures, viz., worm-eaten wheat flour, wheat bran, buckwheat flour, worm-eaten rice flour, rice brain, corn meal, etc.

The advance of the science of sanitation, in Japan as elsewhere, has made for the stamping out of the stagnant and often filthy ponds in which the much-to-be-desired entomostracans—Daphnia, Cyclops, etc.—reach their greatest development in numbers. The Japanese were thus early led to put aside ponds and study conditions favoring their development under control. A small, muddy pond about fifty feet square is now much favored. The pond may have a bottom of sand or mud, but a mixture of the two is preferable. The water should first be drawn off, and the bottom then thoroughly worked with a large wooden rake, after which manure should be spread evenly over the soil; about a medium-sized bucketful to each five square feet of surface. The manure may be human feces, from domestic animals, artificial or rice bran, etc. Any may be used alone or several sorts mixed. To promote decomposition water is withheld for several days to expose the bed to the sun's rays. Then it is permitted to fill to a depth of six inches and a quantity of adult Daphnia introduced. At intervals more water is added until a depth of two to three feet is reached. After a lapse of ten to fifteen days plenty of Daphnia will be found.

The quantity produced by such a pond will depend upon the climate, nature of the water, soil temperature, initial treatment of the pond, etc. Water plants should have been removed in preparing the bottom, as it is considered that they absorb certain materials needed by the Dahpnia, their presence, therefore, being detrimental. When animal manures are used the Daphnia appear most quickly and in great abundance, but do not long persist. On the other hand, with manure of vegetable origin, they seem to develop more slowly but the supply is of longer duration. It is better in consequence to use a mixture of the two classes of manure.

Larval mosquitoes are found in almost all bodies of freshwater and at times may be collected in quantity, affording valuable food for adult fishes. In a past number of *Aquatic Life*, H. E. Finckh, Esq., of Australia, describes an admirable scheme for maintaining a supply at

home, whereby the eggs are collected and hatched in jars, being thus small enough for very young fishes. This plan, while entirely suitable where the output is small, would not be practicable for an establishment rearing many thousands of goldfish.

Tubifex worms, which will be found described in most zoological textbooks, occur in sand and mud, especially in dirty drains and ditches. They are considered indispensable in rearing lionheads. When they are collected, much mud will be taken. This may be placed in a pan of water and stirred several times, when they will assemble in masses and may be removed. Otherwise, put the catch into a sieve with a wire-cloth bottom, or in a bamboo basket, finely woven, through the meshes of which they will eventfully find their way into the water below. For young fishes it may be necessary to cut them into small pieces. At other times care should be taken not to use too many, as they may be injured in handling and quickly die and pollute the water.

The silkworm is very abundant in Japan and the chrysalids are very cheap. These are dried and ground and mixed with vegetable ingredients, such as wheat flour, bran and corn meal. It is considered very nourishing, and is used by most Japanese breeders. If fed alone, it is apt to kill the fish, as it is rich in fats and decomposes readily.

Dried, ground shrimp is a very nourishing food and may be used alone, but it is rather expensive and for that reason is usually added to mixtures of the vegetable substances.

The bonito is a fish of the mackerel family and is widely distributed over the world. In method of using and in effect it does not differ much from shrimp, but is at times used for fishes while being transported great distances.

"Yolk water" is made by filtering, through cheese-cloth, the yolks of hard-boiled chicken's eggs. This is for larval fish not yet large enough to take Daphnia, and may be used as a substitute in the absence of the latter. Sometimes the yolk, broken in small pieces, rather than mashed and filtered, is fed to adult fish in advance of the spawning season.

Dregs of meat or lean meat scraps are used as an ingredient in mixtures.

Worm-eaten wheat flour, flour that has been infested with weevils, is considered valuable, and has the added advantage of being cheap, an important feature considering the quantities used by the large fish farms. In connection with the other vegetable materials it forms the basis of many food mixtures.

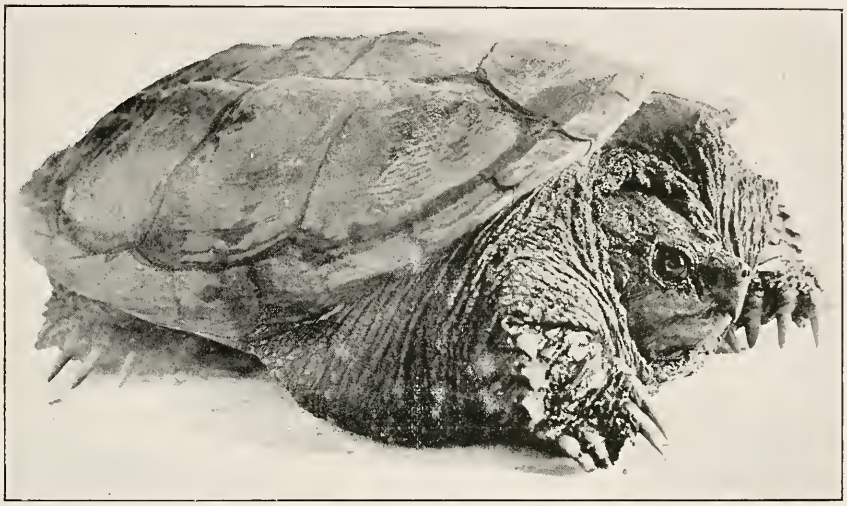
An artificial food for young fish may be composed of "just a trifle" of ground shrimp or chrysalis, 10 parts corn meal, 25 parts rice bran and 65 parts wheat dust. These should be thoroughly mixed while dry and then stirred into a pot of boiling water, blending well and making a mixture harder than mash. For older fish the ingredients may be a trifle of shrimp, 20 parts corn meal and 80 parts wheat. Before and during breeding activities there is need for a more non-nitrogenous food, so the mixture should be changed to 20 parts shrimp and 80 parts corn meal.

Due to the increasing difficulties of securing sufficient quantities of live foods, the Breeders' Association of Tokyo has been experimenting with a view of making prepared food simulate more closely in calories and bulk the live foods. The materials available are grains and flesh. The grains should be powdered and the flesh boiled, all bones

(Concluded on page 20.)

Observations on the Chelonians of North America. VII.

DR. R. W. SHUFELDT, C. M. Z. S.



Common Snapping Turtle **Chelydra serpentina**

In Part VI of the present series there was presented three different views of the young of our common Snapping Turtle (*Chelydra serpentina*), and in the present contribution it is my intention to offer some notes on the adult of this interesting and widely known species. One of the handsomest examples of this species of the family *Chelydridae* I captured near Edgemoor, in Maryland, early in the summer of 1919, later presenting it to the National Zoological Park, at Washington, D. C., where it was duly placed in the alligator tank, and where it was devoured next day by one of those voracious reptiles. It was an unusually fine individual, its dark parts being of a deep, leaden black, and the usual markings of yellowish white, the contrast making a very attractive combination, especially when the animal was just being lifted out of the water. This specimen had a length of some thirty centimeters, and was taken in a little stream that passed through a marshy place where cattails and other aquatic plants flourished.

I made but one photograph of this capture; this is here reproduced, and it gives a very excellent idea of the appearance of one of this species. In *American Forestry* and elsewhere I have published some of my photographs of other snapping turtles, and they show direct views of upper and lower parts of the shell as presented by examples of this species.

There is another species of snapping turtle which is confined to Mexico and Guatemala, while our United States species is found as far south as Ecuador in South America. These, however, are the merest pygmies when we come to compare them with our giant, the Alligator Snapping Turtle (*Macrochelys lacertina*), which may come to weigh as much as 160 pounds, and which inhabits the main rivers that empty into the Gulf of Mexico from western Texas to similar streams emptying into the Gulf of Mexico in western Florida. It is nowhere especially abundant, and I do not recall having seen a single specimen of it during the year and a half I spent in the city of New Orleans. From personal observation, then, I can add nothing to the history of this great reptile beyond what has already been published.

I have, however, from time to time, owned specimens of our common snapping turtle during the past fifty-five years or more, and kept them in captivity for study. These I have usually captured myself, having come across them in their haunts in the slow-running, muddy streams of southwestern Connecticut, and in the marshy tracts of the southern States.

Specimens of this reptile may come to weigh from 31 to 33 pounds, and have a length of nearly 30 inches. A bite from a big one is no trifling matter, for cases are on record where a finger or a toe has been bitten off by a large specimen, while the Alligator Snapper has been known to bite off a hand or a foot. Marvelous, indeed, is the power of the sharp, cutting jaws of either of these species; and one in good health has the habit, when irritated, of striking at its enemy much as an angry snake does. They capture the fish they feed upon in the same manner, and a snapping turtle will conceal itself in the soft mud at the bottom of the pond or stream where it lives, thus taking hapless minnows and other species that chance to swim over it within striking distance. As given, this chelonian stroke is of lightning rapidity, so like a flash indeed that the eye appreciates it with great difficulty. Snappers invariably feed under water, and many a young duck has been dragged beneath that element, to be devoured by one of these voracious reptiles. As a matter of fact, a snapper will starve to death should opportunity to feed under water be denied it. This may be easily demonstrated through experiment, but it is a cruel thing to do. Through gentleness and kindness, some good-tempered specimens of our snapping turtle have come to be very harmless pets, and will feed out of the hand of the one accustomed to giving them food beneath the surface of the water in the tank where they are kept.

Years ago I often kept tiny little snappers in one of my aquaria, and well do I remember a specimen I had that was not more than an inch in length, from the back of which grew a long tassel of elegant, green moss, fully twice the length of the turtle. This moss streamed out from behind it in a very attractive fashion, as it swam the length of the aquarium, wherein it lived at peace with other young turtles of various species.

Eggs of this turtle are spherical in form, with tough, roughish, white shells, the female laying some dozen of them to the clutch. She often lays these at some distance from the pond or stream in which she lives, and she will plod over the ground until she comes to a place of her liking, when she will proceed to worry a sizable excavation, into which she settles down, depositing egg after egg until the clutch is complete. Then

out she crawls again and begins to push the earth over her treasures through any movement of which she is capable, sometimes crowding it in front of her until it tumbles into the cavity, or working it in through a sidelong motion. After the eggs are all safely covered, she will pass again and again over the place until she appears to feel quite satisfied that she has made it appear as natural as possible. Beyond this fact, however, we stand much in need of a whole lot more information on this subject, especially as to the time of incubation, how the tiny young find their way to water, and many other points.

February Pointers

Nature knows no fiscal year, but the aquarist must know the "fishal year." During this month of short and dull days we are aware that the oxygen released by the plants is almost nil. It is beneficial, therefore, to occasionally add fresh water to the self-sustaining aquarium. In thus proceeding, syphon the water from the bottom, taking with it the accumulation of sediment, and replace with water of the same temperature drawn several hours before.

If fishes incline to mate, either separate the sexes or lower the temperature. Vitality to produce strong, healthy offspring is lacking at this season and breeding should ordinarily be discouraged until later when it is possible to provide abundant live foods.

Food-rings eliminate guess work and over-feeding. The rings may be of glass, cork or paraffin. One of the latter material may be made by pouring it while hot into a tin-box cover. When cool remove the centre of the disc with a pointed knife. Surplus food produces noxious gases and otherwise fouls the water. Guard against it. If you can secure daphne, or have propagating boxes of enchytraeids and angle worms, they may be fed to great advantage. Scraped raw beef is a good substitute.

Roots of plants should not be disturbed this month. Growth is slow and the plants do not readily overcome lost energy incidental to bruised roots and leaves which will speedily decay.

Specimens brought from outdoors must be gradually acclimated to the greater warmth of the house and *quarantined*. At no other time of the year are parasites introduced on the new arrivals so apt to make their presence known.

The greatest danger of the winter months is in the often rapid changes of temperature, affecting small aquaria more so than larger ones. The vitality of the fishes is comparatively low, making them very susceptible to disease and parasites. While the "white pest," *Ichthyopthirius multifilius,* may infest fishes at any time, we know it best from its ravages during the cold months. Many schemes to combat this pest have been devised, but the best general plan is to gradually raise the temperature of the aquarium and feed live food as much as possible. If convenient, mechanical aeration may be used. Two or three times daily syphon a little water from the bottom of the tank, replacing with fresh, warm water. Make a solution of sheep manure and warm water and add a little twice daily to the aquarium, continuing until the water in the aquarium takes on a darker color.—*Chicago Aquarium Society.*

A lot of problems solve themselves if let alone.

A man never finds the ideal woman until he locates one who believes everything he tells her.

The MOSQUITO

HERBERT M. HALE, South Australian Museum

In the last number of *Aquatic Life* the larva and pupa of the mosquito were described; the present article deals with the adult insect.

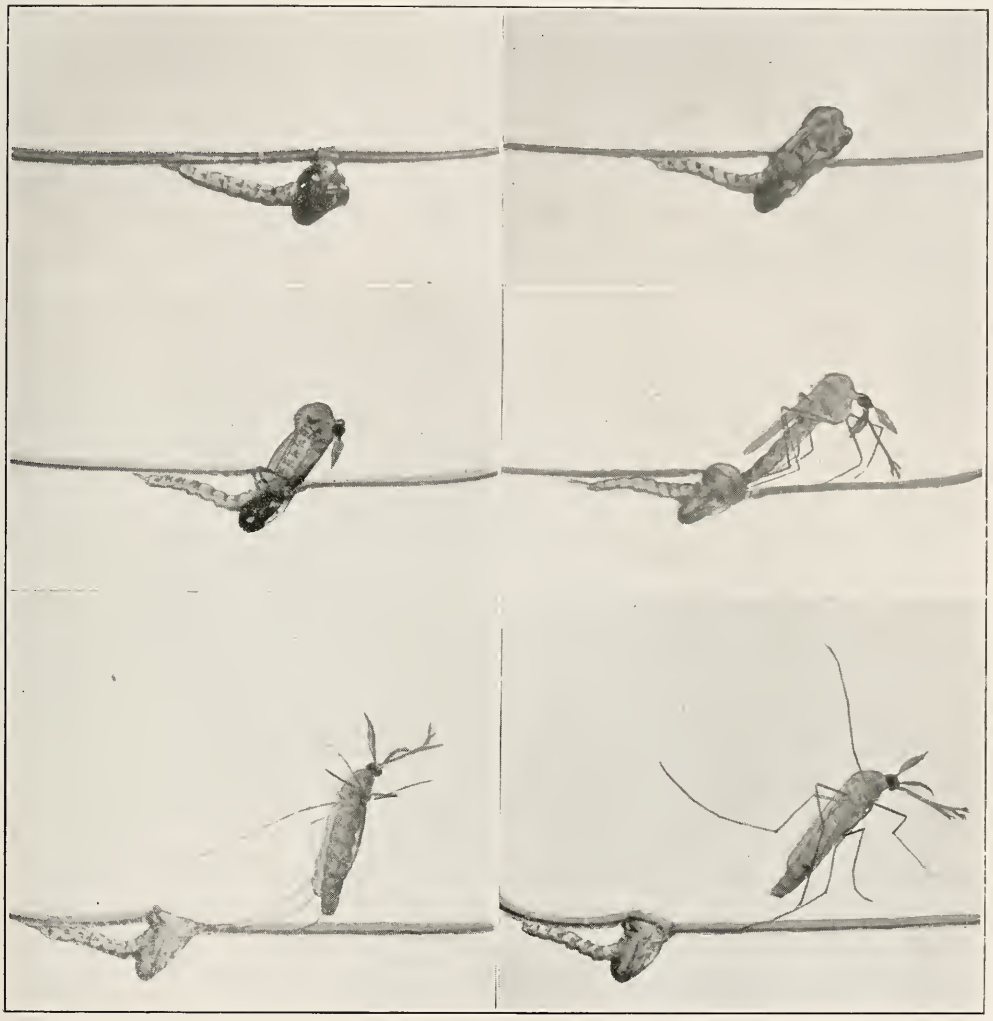
The active little pupa contains the developing imago or perfect insect, the head and thorax being enclosed in the larger part, whilst the curved tail is the abdomen. In a short time the mosquito is ready to leave the chrysalis case, and commence the final period of its life history; the photographs show the manner in which this change is effected. The mosquito illustrated is *Culex fatigans,* a widely distributed species, pictures of the immature stages of which appeared in the previous paper.

When fully developed the pupa is very dark in color; if disturbed it is reluctant to dive. By now placing it in a small aquarium the completion of the metamorphosis may be admirably observed.

Just prior to emergence the pupa unbends its abdomen and floats at the surface in a horizontal position. The enclosed mosquito pushes upwards against the skin, which slowly bulges until the portion between the breathing-tubes protrudes above the surface. This is then burst open and the thorax immediately appears through the slit—emerging first because the head is bent downwards beneath it in the chrysalis. The insect rises up out of the case with a very steady and regular motion, and excepting for an occasional wriggle of the abdomen, without visible effort. In the third picture the antennae are released, and it is apparent from the feathery appearance of these organs that the emerging mosquito is a male. The body is now almost upright and is supported by the floating pupal skin; the legs are held stiffly along the sides and are still partially enclosed. The slightest breeze will cause the mosquito to career over the surface as if in a miniature boat, and a sudden gust may upset it. Even when capsized the withdrawal is frequently completed, but the insect is entangled in the surface film from which it cannot extricate itself. Individuals which have thus perished will often be seen on the surface of a pond. If fishes or predaceous aquatic insects are present there is the additional danger of an attack from below.

The wings are extracted before the legs are entirely withdrawn from their sheaths. The front pair is freed first and greater stability is attained by resting them on the surface-film, the latter being indented but not pierced by the infinitesimal pressure of these delicate members. The middle pair soon follows and finally the ends of the long hind legs are drawn out.

Our mosquito is now free and after resting until the wings are dry, would in the usual course of events, flutter away in search of a mate. Being imprisoned in a glass cell, however, it settles on the side of this and we may examine it at leisure. The head is much smaller proportionately than in the larva, in which the eyes were represented by mere blotches of pigment, whereas each now consists of a great number of lenses. Tiny, variously colored scales



The Birth of a Mosquito

Photographs by the author : Enlarged three and one-half diameters

clothe the insect, giving it a beautiful iridescent appearance. The female which has smaller and less ornate antennae than the male, sucks blood, and is provided with a sheathed set of lancets for puncturing the skin. The male, not being so equipped, is comparatively inoffensive, feeding on plant and other juices as does the common house fly; in a few species both sexes are said to bite, but usually the female only is the offender. The peculiar buzzing note of the female attracts the male, he being enabled to recognize her call by means of the vibrations of the hairs on his plumose antennae, these acting as recorders of sound. After impregnation the eggs are deposited on the water, often in several batches. To accomplish this the female stands on the surface film, steadying herself by grasping with the fore legs some floating particle such as duckweed. As the eggs are laid they are fastened together with a waterproof

secretion and arranged in a boat-shaped mass with the aid of the hind legs; her duty being now fulfilled she soon dies.

Each egg has a trap-door arrangement at the bottom, through which the little wriggler drops out into the water; thus again commences the life cycle of the insect.

Goldfish Foods

(Concluded from page 14.)

and fats being carefully removed. The resultant food should not only be properly compounded but it should contain some sort of a binder, chicken egg or agar agar, to prevent it dissolving or breaking up and polluting the water.

To secure a food as a substitute for larval mosquitoes, this insect was analysed by a chemist. With this information it was possible to make a mixture the elements of which approximate those of the mosquito, viz., two pints of wheat flour boiled like mash, one chicken egg, one and one-half scruples of sugar and one-fifth of a pint of lean, boiled pork. These ingredients are thoroughly mixed and then dried, keeping perfectly for a long time.

Food mixtures, regardless of how prepared, will if used without discrimination, pollute the water. For this reason Japanese breeders invariably use feeding pans. These are unglazed porcelain dishes, very shallow, and about eighteen inches in diameter. The dishes are suspended by three strong strings from poles thrust into the banks of the pond, and extend about two feet from the shore. Into these the foods are placed with dippers. For larval fish the pans are suspended about two inches below the surface of the water, while for well-grown young and adults the depth may be five inches.

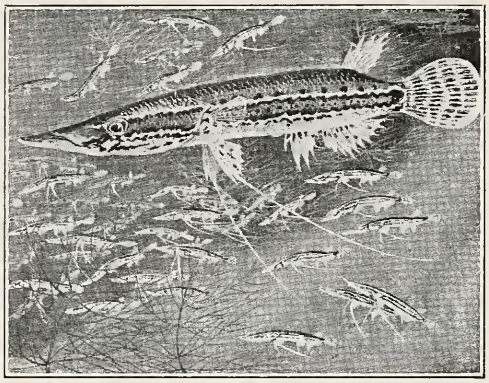
A business succeeds only as it serves.

Luciocephalus pulcher

C. J. HEEDE

Along the eastern coast of Sumatra, six to ten miles inland, in swamp waters and ditches, is found that peculiar labyrinth fish, *Luciocephalus pulcher*. Literally translated the name means pretty pike-head, and in appearance it does resemble that voracious game fish.

The general color is attractive reddish-brown, with a dark lateral band bordered



Luciocephalus pulcher

with black and white; abdomen light gray, with a tint of rose. As with other labyrinth fishes the coloration is apt to vary considerably. Full grown individuals may reach a length of four inches.

Authentic information on its breeding habits seems to be lacking, though an opinion has been held that it is live-bearing, which is unlikely. It is known to aquarists only from a number of specimens taken to Europe in 1905, which did not long survive.

About six hundred species of fishes are found in the rivers of the United States.

The Greeks played an instrument called a lyre. The instrument is still used, but now it's a mouth-organ.—*Harvard Lampoon.*

Maintaining an Aquarium

MAX TRELL

Too many people are inclined to believe that the maintenance of an aquarium is a divine gift bestowed upon a lucky minority much in the same fashion as the gift of music, poetry and the other arts. Fortunately they are wrong. Few things are so easy, give so little trouble; in fact, so nearly take care of themselves, as the aquarium. All that is required is a short, enjoyable apprenticeship and a great deal of interest. I am ready to guarantee that, given a person with a willingness to learn and an interest in the subject (provided he is neither immature in intellect or years), I will put him in a position to keep alive as many finny pets as he has room for, and in a shorter time than he perhaps thinks possible.

Aquarium, from my pen, immediately excludes bowls, flat dishes, jars, hanging contrivances and a vast army of glass receptacles that are veritable torture chambers for the inhabitants. The normal affair is a rectangular box from a foot to sixty inches long, with a depth of not more than twenty inches in the largest size, the bottom preferably of slate, though glass may be used in small sizes. Aquaria are occasionally manufactured with metal bottoms. Unless these have been so treated as to be rust-proof, it is walking into unnecessary danger to buy them.

A two-inch layer of small, white pebbles or sand should, after thorough washing, be spread over the bottom and a quantity of water-plants (which any dealer can supply) placed in position. The quantity of plants needed will depend both on the size of the aquarium and the species of the plants. The plants have a two-fold use. The first is to supply oxygen to the air-breathing animals in the water, and the second is to beautify the tank. Without plants the aquarium would be devoid of interest no matter how many fishes it contained.

Fishes at the surface is an ominous sign. It signifies that either the water is dank and foul or that the amount of oxygen in the water is insufficient to support the animal life contained therein. The fishes may do one of two things. They may remain at the bottom and drown or swim at the top and live a few days longer. Unless other conditions are factors they will be found at the top taking advantage of the oxygen absorbed by the water from the air. The remedy in the case of foul water is a speedy change, and in the second, the installation of more oxygen-giving plants or the removal of some of the fishes to another tank. Excessively hot weather, or a protracted period of dull days, reduces the activity of the plants and brings the fishes to the surface. But even this is an indication of too many fishes, and refutes that ill-chosen term "balanced aquarium." No aquarium is balanced. Either the plants are giving off more oxygen than is actually being consumed, the excess being given off into the atmosphere, or there is an insufficient supply and the fishes are at the surface in agony. The proper term is "self-sustaining aquarium," the plants being suf-

ficient in number to liberate at all times and under all conditions *more* oxygen than is needed.

Novices aiming at odd effects place fairy castles and tunnels in the tank. Nothing is more ridiculous, save perhaps celluloid ducks, geese and alligators! Space, even in the largest of tanks, is never excessive and should not be deliberately wasted. To do so merely for the transient pleasure of seeing a fish squeeze through a window and emerge from the roof is as lamentable as it is laughable.

An important consideration is the location of the tank. No one would think of keeping a rubber-plant or a geranium in a dark corner. A place in the sunlight is necessary; do not confuse sunlight with sunshine. Water plants will invariably cease to function and decay unless they are given sufficient light to perform the process of photosynthesis, in which the needed oxygen is liberated for the fishes. But while it is absolutely necessary that they have light, on the other hand too much light will have another consequence. Doubtless everyone has seen the green slime peculiar to swamps and pools, commonly mis-termed malaria water. A similar condition will soon prevail in the aquarium if it is allowed to stand in the direct rays of the sun. This is caused by an excessive growth of algae, a group of one-celled plants. So well do they thrive with warmth and sunshine that in a few weeks they may dominate the tank, covering and choking the higher plants, in some instances even rendering movement on the part of the fishes difficult. A large sheet of tissue paper applied to the side of the aquarium nearest the window serves to prevent such an excessive growth. Snails and tadpoles, both of which feed on algae, may well be introduced.

It is nothing short of idiocy to place too many fishes in an aquarium. A single hot day will work havoc in an overstocked tank. Three or four fish will live indefinitely in an aquarium of adequate size if they are fed once a day and kept out of reach of inquisitive boys with long fingers and kind-hearted neighbors who like to see the fish eat.

Many kinds of fish-foods are on the market. Dried shrimp, ground to the proper size, is a good winter food. In the spring and summer small earthworms, white worms, mosquito larvae and daphne are not to be excelled. The fish should be fed sparingly, especially when using dried foods. As soon as a bit of food travels through the water and lodges on the bottom unnoticed it is time to stop. More if added will only remain on the bottom to decompose. It may be mentioned that the least desirable food is the white rice-wafer so commonly sold. The fishes should preferably be fed in the morning.

If the tank holds more than ten gallons the water need never be changed. The water will evaporate, however, so fresh water of the same temperature should be added from time to time to keep the level constant. With small tanks half the water should be removed by syphoning at intervals of two months and refilled with fresh water.

The selection of fishes rests with the owner. My advice is to start with hardy, inexpensive fishes, such as those brought from our southern States, or captured in nearby ponds. Later, with increased knowledge, the more expensive exotics may be acquired. Fishes are apt to perish at the beginning for no apparent reason, and it is less discouraging to lose a native fish easily replaced than it is a costly tropical one. But in a short while,

if the budding aquarist does not become discouraged, dead fishes will be the exception. Interest will then become more eclectic and tropical as well as cold-water species will be studied and enjoyed. No matter how burning the desire and how catholic the taste, let the motto be: "Quality always before quantity."

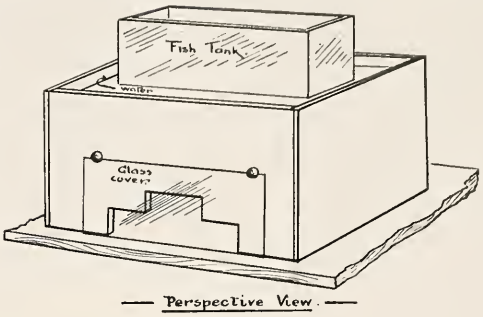
An Easily Constructed Heated Aquarium

H. E. FINCKH

It was mid-winter and my ten permanent heated tanks were fully populated. The unexpected arrival of some forty fine exotic fishes made necessary the immediate construction of some sort of heated accommodations. My eye rested on an empty, rectangular kerosense can, and within two hours the problem was solved.

The kerosene can I cut in two, lengthwise, thus making two deep trays of equal size. The edges of the trays were bent outward at right angles, forming a flange on all sides an inch wide. From one-inch lumber a frame was constructed of such length and width that the flange rested on the top, to which it was tacked to prevent slipping. Through one side of the frame an opening was cut to permit the placing of a lamp below the pan, ventilation being provided by several holes drilled through the opposite side. The lamp opening was closed by a piece of glass held in place by two studs in such a way that it may be pushed aside when necessary.

The bottom of the tin tray was covered with a thick piece of felt, an established all-glass tank placed thereon, and the tin tray then filled with water . The insertion of the lamp below placed the heater in operation. The apparatus will be understood by reference to the appended sketches.



On the morning following the making of the heater the glass in my den stood at 50 degrees, whereas the water in the all-glass aquarium was just 70. This box, and another constructed since, have now been in operation for more than two months, giving such satisfaction that I venture the description to aid others who may sometime be landed in a similar predicament.

Roosevelt Wild Life Forest Experiment Station

The selection of one of America's best known authorities on fish life as Ichthyologist at the Roosevelt Wild Life Forest Experiment Station was announced by the New York State College of Forestry at Syracuse, when it became known that Prof. T. L. Hankinson had accepted the position. This is the first appointment made to the technical staff of the station since Dr. Charles C. Adams was made director.

The selection is of particular import-

ance, because it marks the continuation by the Roosevelt station of years of work in progress under the supervision of the college. Professor Hankinson has for five summers been engaged in the study of the fish of Oneida Lake and in the Palisades Interstate Park region, in co-operation with Dr. Adams.

The selection of Professor Hankinson for the Roosevelt Wild Life Forest Experiment Station is the beginning of a definite program of important work. So far the work has been devoted to fish, owing to limited funds, but now will be extended to big game, game birds, fur-bearing animals, game vermin and similar forest problems.

"It is significant to know that the Roosevelt Wild Life Forest Experiment Station at the New York State College of Forestry at Syracuse is the direct outgrowth of plans, presented to Mr. Roosevelt in December, 1916, for the study of the natural history of forest wild life. He greeted the suggestions with instant enthusiastic approval, and urged that they should be taken up 'in a big way.'"

This was the preliminary explanation made by Dr. Charles C. Adams, Director of the Station, when before the New York Fish, Game and Forest League convention he told for the first time the latest plans for development of the station and of the work already well under way.

"The station is new in name," Dr. Adams said, "but its work is already well under way. For the last five years the New York State College of Forestry has been making a study of the fish life of the State, giving special attention to the Oneida Lake and to the Palisades Interstate Park. This survey work is in the main to be continued by the Roosevelt Station and Professor T. L. Hankinson, who has been associated with me in the fish survey for the College of Forestry, now comes as the first full-time member of the technical staff of the Roosevelt Station. It is now actually under way.

"Such a station is unique, as no other similar station or institution is known to exist. It opens up a vast field for the 'field naturalist.' As a memorial to Theodore Roosevelt the plan has already received hearty support from many leading naturalists and sportsmen.

"The field is so large that I can only give typical phases of the work as laid out. There has, for instance, never been made an exhaustive scientific study of a trout stream in America. This will, it is hoped, be made one of the specialties of the Roosevelt Station. The relation of fur-bearing animals to game vermin is another subject demanding detailed study.

"Upon a foundation of fact and inference such as can only be built up by investigations on the ecology, life histories, physiology, disease and heredity of wild life we may hope to build up such principles of management or policies for wild life as will fit them into the texture of modern social and economic life. It is only when this is done in a scientific manner that forest wild life will be intelligently and sympathetically appreciated and can be used by man to the best advantage. This is in fact the largest wild life problem."

The man in jail doesn't have to dodge automobiles.

"Oh, Oswald is my darling boy," sang the maiden before the row; then she saw him with another and she isn't singing now. Which reminds us that we have never seen a jealous goldfish. Have you?

Aquatic Life

1918—1919—1920

OCTOBER. Aquarium Heating (*Breder*); Hemiramphus fluviatilis (*Brind*); Mollienisia latipinna (*Heede*); Blue-tailed Skink (*Deckert*); Factors Controlling the Development of Tropical Aquarium Fishes (*Webber*); Snails in Aquaria (*Gale*); Habits of Black Bass, The Pipe-fish, notes, etc.

NOVEMBER. American Live-bearing Toothcarps (*Bade*); Aquarium Notes (*Leitholf*); Notes on Krefftius adspersus (*Freund*); The Anatomy of the Fish (*Clark*); Breeding Habits of Burmese Eel (*Finckh*); A Bloated Axolotl (*Waite*); The Name "Water Flea," notes and news.

DECEMBER. Cynolebias bellottii (*Brind*); Tillaea recurva and Other Notes (*Finckh*); Another Tank Heater (*Kuhn*); Aquarist vs. Aquarian (*Mellen*); Emotions of Fishes (*Gale*); A Cigar Box Aquarium (*Modesto*); Florida Notes (*Carlton*); Photosynthesis, Miscellaneous notes, news, etc.

JANUARY, 1919. Limia caudofasciata (*Leitholf*); Classification of Fishes (*Stead*); Color Changes of the Chub-sucker (*Hubbs*); *Neetroplus carpintis* (*Brind*); A Simple Heated Aquarium (*Finckh*); Notes on the Breeding Habits of the Pigmy Sunfish (*Poyser*); Goldfish Farm of Kichigoro Akiyama, notes and news.

FEBRUARY. Polycentropsis abbreviata (*Brind*); Chologaster cornutus, the Fish of the Dismal Swamp (*Welsh*); A Wood Aquarium (*Pilkington*); Danio malabaricus (*Leitholf*); Notes on Native Fishes (*Pray*); Managing the Aquarium (*Innes*); Reactions of Fishes to Habit-forming Drugs, The Boston Show, A True Fish Story, notes and news.

MARCH. Breeding the Goldfish (*Hanna*); Observations on the Chelonians of North America, Part I (*Shufeldt*); Lucania ommata (*Welsh*); Apistogramma agassizi (*Heede*); The Water-fleas (*Tompkins*); Viviparous Fishes-in-general (*Stead*); Breeding the Striped Gourami (*Simpson*); Notes and news.

APRIL. The Surinam Toad (*Deckert*); Cichlasoma nigrofasciatum (*Brind*); Keeping Living Food Alive (*Innes*); Beware the Dragonfly (*Gordon*); An Electrolytic Aerator (*Putnam*); Water Lilies, Some Cultural and Historical Notes (*Pring*); Beef vs. Liver, notes and news.

MAY. Nanostomus eques (*Brind*); The Water Horse-tail (*Wobler*); Observations on the Chelonians of North America, Part II. (*Shufeldt*); I Became a Fancier (*Proctor*); A Peculiar Planorbis (*Breder*); Association and Color Discrimination in Mudminnows and Sticklebacks (*White*); The Hay Infusion Microcosm (*Woodruff*); The Bladderworts, notes and news.

JUNE. Observations on the Chelonians of North America, Part III (*Shufeldt*); Gambusia episcopi (*Brind*); The Wheel Animalcules (*Bade*); Sonnet to a Goldfish (*Burditt*); A Study of the Diamond Bass (*Trell*); The Brook Stickleback (*Barker*); Goldfish in China, Red-colored Water, Crappie Spawn in Washington Aquarium, and Society News.

JULY. A Big-headed Gurnard (*Fowler*); The Nesting Habits of Certain Sunfishes as Observed in a Park Lagoon in Chicago (*Hubbs*); Badis badis (*Brind*); The Paradise Fish (*Balleisen*); The Garden a Terrarium (*Breder*); Philadelphia Aquarium, A Fish Elevator, Akiyama Goldfish Farm, notes and news.

AUGUST. Observations on the Chelonians of North America, Part IV (*Shufeldt*); The Steinhart Aquarium, with portrait of Ignatz Steinhart; Lebias sophiæ (*Brind*); The Senses of Fishes (*Herrick*); Marine Aquaria, An Epidemic Among Fishes, Manufacture of Pearl Buttons, etc.

SEPTEMBER. Platypoecilus maculatus (*Brind*); Observations on the Chelonians of North America, Part V (*Shufeldt*); Notes on the Life-history of Planorbis corneus and Other Freshwater Mollusks (*Webster*); Philadelphia Exhibition, Naples Aquarium, Aquaria in the Conservatory of the Missouri Botanical Garden, Xiphophorus montezumae, Freshwater Shrimp, notes and news.

JANUARY, 1920. Betta rubra (*Heede*); Observations on the Chelonians of North America, Part VI (*Shufeldt*); Beef Heart and Beef Liver for Young Fishes; Notes on Mosquito Larvae (*Hale*); Lucania ommata (extension of range); Habits of Fundulus nottii and Heterandria formosa; Linseed meal cause of disease among trout; South Australian Aquarium Society, Passaic Aquarium Society, the Redfield Theory, etc.

March, 1920 15c Copy

Aquatic Life

Aquatic Life

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An international monthly magazine devoted to the study, care and breeding of fishes and other animals and plants in the home aquarium and terrarium.

W. A. POYSER.....EDITOR
JOSEPH E. BAUSMAN .....PUBLISHER
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Popular and scientific artic'es and notes on subjects pertaining to the aquarium and terrarium, and to the habits of fishes in general, are always wanted for "Aquatic Life." Readers are invited to join in making it a medium of mutual help by contributing to it the results of their studies. The pages are always open to anyone having information of interest to the aquarist and student of aquatic biology. Manuscripts, books for review and general correspondence should be addressed to the editor.

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The Australian Congolly

HERBERT M. HALE, South Australian Museum

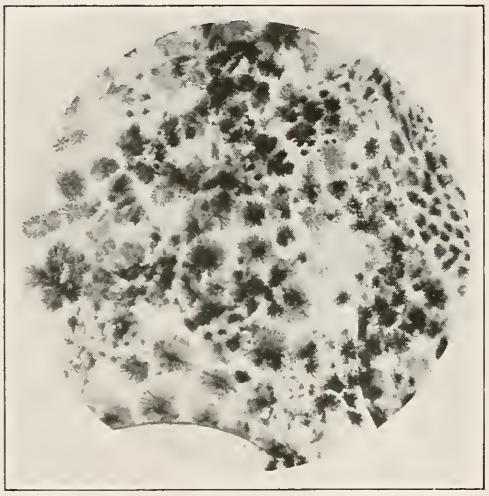
The Congolly **Pseudaphritis urvillii**

Photograph by the author

The "Congolly," known to fishermen as the "Sandy Whiting," is popular with Australian aquarists. Living in most of our estuarine rivers, it thrives equally well in fresh, brackish or sea water. Full-grown specimens measure nearly twelve inches in length, but smaller examples are more suitable for aquaria. A wild fish makes itself at home at once and in a few days becomes quite tame. Although a "bottom" fish it is in no way inconspicuous and a movement at the front of the glass will always bring it to the fore. As regards food it is equally accommodating, but appears to prefer earth worms to anything else.

Towards the close of last summer a friend and I obtained some fishes from the coast, at a spot where fresh water from a river mixes with the sea water from Pt. Adelaide. Here we found that the normally brackish creek was but a series of large disconnected pools, in which the water, owing to months of evaporation, had become much salter than the sea. The increase of salinity having been very gradual, Gobies, Atherines and Congollies had accustomed themselves to the new conditions and were present in great numbers. We collected dozens of the last-named fish, and on reaching home placed several direct from the salt into fresh water. At first the movements of the gill-covers were abnormally rapid, but otherwise the fishes showed no discomfort at the abrupt change. In a few minutes they were busily feeding on mosquito larvae and now, six months later, are still quite healthy. After this long sojourn in fresh water, I recently put one of them into a marine aquarium; the result of the sudden transference was as before, the fish immediately accepting food.

These Congollies were taken from a pool with a white sand bottom and when first obtained were practically colorless. After installing them in a well-planted aquarium with a dark gravel bottom a totally different appearance was assumed. The characteristic chequered pattern soon became apparent, rendering the fishes less easy of detection in their new surroundings. To obtain a photograph



Portion of skin of Congolly Showing color-cells

Photomicrograph by the author

the example whose picture is here reproduced was placed in a small aquarium standing near a window. In this bright situation the fish at once commenced to pale, the color markings eventually almost disappearing.

Many fishes alter the intensity of their coloring in protective resemblance of their surroundings, or when influenced by various emotions; even the individual markings sometimes change to a considerable extent. Incorporated in the skin are numerous pigment cells which are capable of great contraction; when so reduced the colors become pale or indistinct. Differently colored cells are present, and when those containing one particular pigment are expanded and the others contracted to tiny dots, the predominating color of the fish is that of the relaxed cells. In the same way different markings appear and disappear on the skin. Aquarists are familiar with the color changes of the Paradise Fish during the breeding season.

The Congolly *(Pseudaphritis urvillii)* was originally described and figured by Cuvier and Valenciennes in their "Histoire Naturelle des Poissons" in 1831; since then no illustration of the fish has been published.

The Cleveland Society

The Cleveland Aquarium Society was founded at a meeting held on January 12 at the Cleveland Chamber of Industry. Rev. Frederick R. Webber presided.

A committee was appointed to draft a constitution and arrange other details for discussion and adoption at the next meeting.

The chairman read a very interesting paper on the care of aquaria and fishes. This was followed by a general discussion, and everyone became well acquainted. It is hoped that the activities of the Society will result in the establishment of a public aquarium.—*Ralph H. Whipple.*

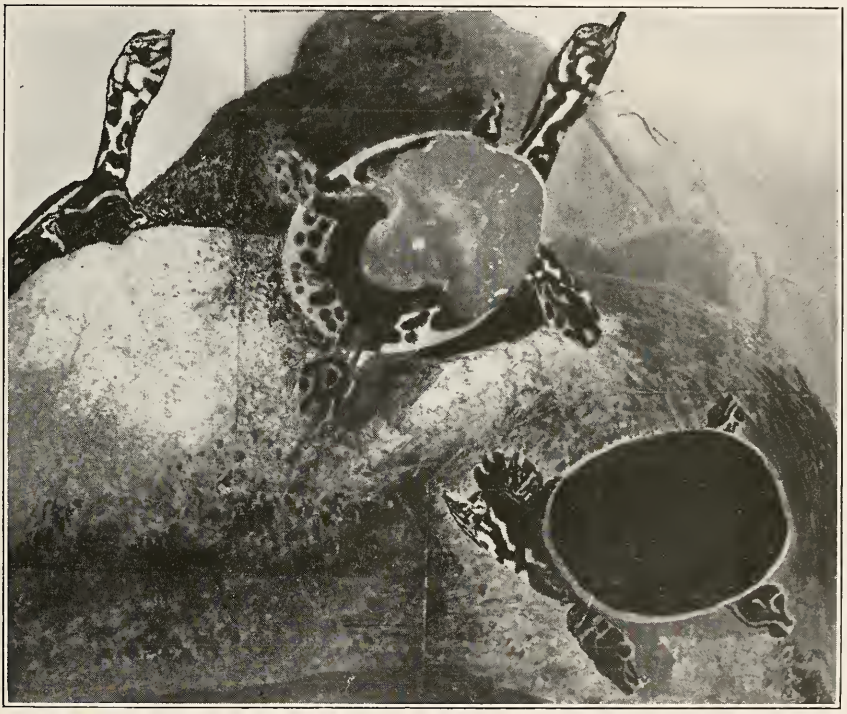
"Delia," said Mrs. Barrows sternly, "I met that policeman today who sat in the kitchen with you so long last night, I took advantage of the opportunity to speak to him."

"Oh, go on now," replied Delia, with a smile. "Ye needn't think that'll make me wan bit jealous, mum, oi have got him safe enough."—*New York Globe.*

Somehow the majority of our habits seem to be bad.

Observations on the Chelonians of North America. VIII.

DR. R. W. SHUFELDT, C. M. Z. S.



Young of the Southern Soft-shelled Turtle

Soft-shelled turtles of the family *Amydidae* constitute a very conspicuous and rather numerous group of fresh water chelonians, of which we have but four or five species, out of nearly thirty, in this country. Southern Asia, Africa and the East Indies are the regions where the majority are found, and they belong in several genera. On the other hand, the North American species all fall in the same genus—the genus *Amyda*—of which we have four quite distinct species. These are the Southern Soft-shelled Turtle *(A. ferox)*, the Spiny Soft-shelled Turtle *(A. spinifer)*, the Brown Soft-shelled Turtle *(A. mutica)*, and Emory's Soft-shelled Turtle *(A. emoryi)*. The first-named is found from Georgia to Florida and westward as far as Louisiana; the Spiny occurs in the central part of the United States; the Brown has the same range as the Spiny; and, finally,

Emory's Soft-shell occurs in the tributaries of the Rio Grande in Texas and elsewhere.

Any one of these species is entirely different, both in appearance and in structure, from any of our other fresh-water species; upon the other hand, they exhibit some very striking differences among themselves, with respect to their external characters.

Recently I have been engaged upon the anatomy of *A. ferox*, fine specimens

As a group, all of these soft-shelled turtles are entirely different in structure and appearance from all other species inhabiting our inland waters. In any one of them, the entire shell is pliable and leathery, especially in front and posteriorly. When we take a medium-sized *Amyda ferox* out of the water, we may note that its shell is so flexible in front that it droops over the orifice into which the head has been withdrawn. Moreover, the entire animal is much com-

Head of the Southern Soft-shelled Turtle; dorsal view

of which have been sent me from the South by Mr. Fred. W. Walker, of Orlando, Florida. Mr. Walker is a very energetic collector, and a good naturalist; he has promised other southern species of turtles in the near future, and I trust to figure and describe them in this series of articles as they come to hand.

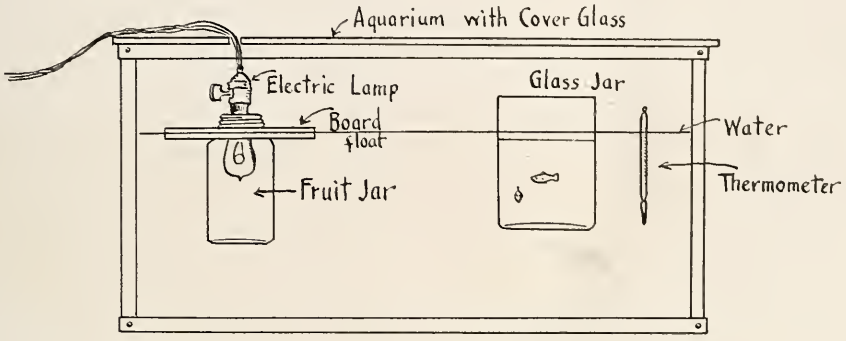
It also gives me pleasure to once more thank Mr. Edward S. Schmid, of Washington, D. C., for several beautiful specimens of the young of *Amyda ferox*, as well as for the young of other turtles, which will be figured later on in AQUATIC LIFE.

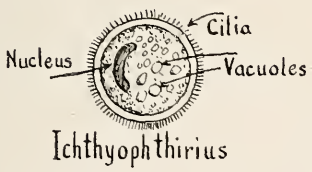
pressed in the vertical direction. Its snout is run out proboscis-fashion, and it possesses a very long and flexible neck. Being a species of ferocious temper, with wonderful control over the projecting capacity of this lengthy neck, it can thrust it out with almost incredible celerity and seize one by the finger or hand, inflicting a wound often of very decided severity. The edges of its jaws are of razor-like sharpness, and as weapons they are concealed beneath the thin, overlaying skin. After a thrust and a strike, it can, with marked rapidity, draw its

(Continued on page 35)

Ichthyophthirius multifilius

REV. FREDERICK R. WEBBER, Cleveland Aquarium Society





Every aquarist knows *Ichthyopthirius multifilius*, the parasitic infusorian which destroys many tropical aquarium fishes, as well as rainbow trout, brook trout, and even carp, shad, pike and whitefish. It exists both in the aquarium and in the native haunts of fishes. The infested fish hangs listlessly in the water, with drooping fins. Now and then it "shakes" violently from side to side. This wriggling movement is almost constant during the later stages. After a few days the fish appears to be covered with small white spots, like fine salt sprinkled over its body. If examined closely, small pits are discovered where the grains have been. The fins are also affected. The cause is a small ciliated protozoan, from one-half to less than one millimeter in size. When examined under a microscope, we find that the parasite is round, of protoplasmic structure, and completely covered with cilia. The contained protoplasm is filled with round, somewhat opaque granules, making the crescent-shaped nucleus difficult to distinguish. In some pustules two animals are found.

The young parasite is a free-swimming creature, which moves rapidly through the water, often in an irregular course, turning rapidly on its own axis. If no host is found the animal may perish, although some have been known to live in water for a long time. When a fish-

host is found, the young parasite attaches himself thereto, boring into the epidermis. An otherwise diseased fish is particularly in danger, as it is usually covered with a layer of slime which is favorable to the purposes of the pest. It bores into the membrane and, rotating within the cyst, proceeds to feed upon the vital fluids of the unfortunate host.

A knowledge of the life-history of the parasite is necessary that it may intelligently be combatted. As we have said before, the pest begins its life as a free-swimming, microscopic creature. Having fastened to the host, it feeds for a period varying from a few days to a week or two, depending on the temperature of the water. The warmer the water the more rapid is the development. Then the parasite leaves the host, dropping to the bottom of the aquarium in a jelly-like cyst.

At this stage of its progress, authorities differ. Some writers, such as Hofer, in his *"Fischkrankeiten,"* state with assurance that the only method of propagation is by division. The parasite, they say, divides into two, these two into four, the four into eight, and the eight into sixteen, up to certain limits, which some observers have placed as high as several hundred. Others who have made a minute study, such as Harvey A. Van Cott, declare with equal conviction that it multiplies in two ways: by division as we have already described, and also by the formation of spores, even while still on the body of the host. Hofer denies this. He says: "The previously disseminated view that the multiplication of the Ichthyopthirius parasite takes place within the pustule and that the escaping young immediately seek a host in their vicinity has been shown to be false by recent investigation, a circumstance that is important in the treatment of the disease."

Whether the pest multiplies only when quiescent on the bottom of the tank, or whether it also forms spores while on the body of the fish, remains a disputed feature. We believe that we are safe in saying that it multiplies in both ways; on the bottom of the tank by division, and also by the formation of spores. Further, it seems that some investigators have found these to take place both on the fish and also in the water. When spores are formed, the crescent-shaped nucleus seems to widen out within the cell, and then break up into many minute granules. Then the cell wall breaks, and these "granules" swim out, each one a voracious pest.

If the German theory is true, that the adult parasite drops from the fish to the bottom of the tank, lies there in a quiescent state for some hours, and then multiplies, the remedy would be simple. It would be necessary only to change the water three times a day, say at 6 A. M., 2 P. M. and 10 P. M. In so doing the pests that fall to the bottom will be washed away gradually, until within a week or two none are left. We have known this treatment to be attempted in several instances with good results. One man reported two years ago that he had saved a tank of *Haplochilus chaperi* in this manner. In the same way another saved a number of *Xiphophorus helleri* and *Lebistes reticulatus*. But we know of other repeated attempts where this treatment either failed, or in case the parasites seemed to be washed away, the fishes later refused to eat and apparently died of starvation.

One aquarist states that the surest way is to place the fish in swiftly flowing water, of the proper temperature, of course. He argues that whatever may be the correct method of propagation, the

(Concluded on page 32)

Rivulus strigatus

WALTER LANNOY BRIND, F. Z. S.

Rivulus strigatus was introduced to me by Mr. John Lowel, of The Aquarium Society, in 1913. He had one or two pairs at that time, having received them from Germany through an engineer on one of the German steamships then plying between Cuxhaven or Bremen and New York City. The male fish showed such brilliant colors and well-defined markings that they made a lasting impression on my mind. I was naturally anxious to secure a pair for study, but my persuasive powers were not equal to the task, and so I left my friend's house without them. Since then I have owned a number of pairs, and the intimate association did not serve to dull the glamour of that first meeting.

The male of the species has a conspicuous black collar around the outline of the gill-covers and extending forward through the eyes to the snout. The back is warm chestnut-brown, merging into the turquoise blue of the sides, on which scarlet dots are arranged symmetrically in "herring-bone" fashion as shown by the illustrations; abdomen and throat, creamy yellow. The fins, save the pectorals which are transparent, are mottled with brown and purple.

The female, as is often the case among fishes, is much more somber. The back is chestnut, passing to cream on the throat and abdomen, with dark purplish-brown dots arranged in the herring-bone design on the sides.

As far as my knowledge goes, Mr. Lowel did not succeed in breeding the species. Later, however, specimens were imported direct from Brazil by gentlemen connected with the New York Zoological Society, and they were successful in having them spawn in an aquarium holding about five gallons. The eggs were deposited singly on the filaments of *Myriophyllum* after the manner of other species of the genus. Development is comparatively slow, ten or more days passing before the fry emerge.

Rivulus strigatus

With Infusoria abundant in the tank, the young will thrive and grow apace. In an emergency one may use finely powdered nutritious dry food. When the fry are large enough they may be given small Daphne and Cyclops, after which the growth will be more rapid and they will soon be able to master young and tender enchrytraeid worms.

While *Rivulus strigatus* is a native of Brazil, it does not seem to demand a particularly high temperature, 73 degrees, Fahrenheit, being sufficient except while breeding, when it should be a few degrees higher. The largest specimens I have seen measured two inches.

When half a dozen women get together they all talk at once. If they didn't they would never get through.

Ichthyopthirius

(Concluded from page 30)

parasites will all be washed away within two weeks.

Contact poisons or chemicals are useless to destroy the parasite. A chemical strong enough to eat through the cyst would likewise destroy the fish. The parasites within the water, or on the bottom, may be destroyed in several way. A 1 per cent. solution of lime is said to be effective. A 10 per cent. to 20 per cent. solution of common salt is also recommended. One writer prefers a weak solution of the salts of copper. But of course these methods are only employed to eliminate the parasite from the water and the bottom of the aquarium. The fishes should be removed before introducing the substance employed.

In order to rid the fish of the parasite, Mr. Van Cott advises the use of a large aquarium, filled with clean water. This tank is provided with a heater, made by fitting an electric light bulb inside a fruit jar, and anchoring it in the water. Several clean glass jars are also necessary. One of these jars is filled two-thirds full of clean, old water of the same temperature as that from which the sick fish is taken. A teaspoonful of sea salt is added. This jar, with the fish in it, is floated in the big aquarium, and the temperature slowly raised to 100 F. and maintained there. To retain the heat the tank is well covered at night with a thick blanket. In the morning, fill a second jar with water of the same temperature, change the fish to it and place in the large aquarium as before. Discard the water in the first jar, and sterilize thoroughly with hot water. Do this at least twice daily for several days.

A method employed with success by several members of the Chicago Aquarium Society is both simple and seemingly effective. As soon as the first symptoms of infection appear, a sack made of cheesecloth is filled with sheep manure and suspended in the tank, the temperature of the water being slowly raised and thereafter maintained at an even degree. The only objection to this method is the unsightly color of the water and an incidental rapid growth of filamentous algae, but its frequent effectiveness and its stimulation of plant-life within the aquarium makes it well worthy of a trial. It is the least bothersome of all the methods.

When the pest occurs, the treatment should be prompt, painstaking and carried out faithfully until the parasite is eliminated. If the tank is not a valued one, it is best to remove all plants, boil the sand thoroughly and carefully clean the tank, using new plants when resetting. If the tank is a prized one, change the water a number of times by syphoning, taking care to remove all water and sediment, and the top layer of sand. It should be allowed to stand a month before stocking with fishes.

A wise aquarist will spare no pains to maintain his tanks at a temperature sufficient to keep the fishes in comfort and health. Fluctuating temperature, and especially chill, will reduce the vitality of a fish and frequently lead to this disease. A single infested fish will communicate the parasite to others, and within a few days a large tank of fine fishes may be reduced to a sorry state.

While some men practice what they preach, the majority would be ashamed to preach half they practice.

According to Professor Agassiz the jaws of the young snapping turtle snap while the animal is still within the egg.

An Odd Trunkfish

CARL L. HUBBS

Field Museum of Natural History and Chicago Aquarium Society

Lactophrys tricornis **Horned Trunkfish**

Photograph from life by P. H. Pope

Among the myriads of peculiar tropical marine fishes, few are as little like our conventional conception of a fish as are the species of the Ostraciontidae, the trunkfishes. In these odd creatures the body is almost entirely closed in a hard bony carapace, made up of hexagonal plates (which are modified scales). Only the mouth and eyes, and the fins and their bases are free, and of the fins the pelvic or ventral pair is wholly lacking. Many of the species are brightly colored, and conspicuously spotted.

Four species of trunkfishes, referred to the genus *Lactophrys*, inhabit tropical American waters between the United States and Brazil. Perhaps the best known species is *Lactophrys tricornis* (the horned trunkfish, cowfish or cuckold). Most of the names applied to this fish refer to the horns which are developed on the carapace, the two most prominent extending forward from above

(Concluded on page 36)

THE AVIARY AND AQUARIUM

Photograph by Parker A. Stacy

North Carolina Notes

S. D. CARLTON

I fully agree with the article on *Fundulus nottii* (January number). They are very pretty, hardy, eat dry foods readily, and should have a place in every collection.

The Black-banded Sunfish is the daintiest aquarium fish of America. The opinion has been held in the past that they would starve rather than eat dry foods, and that therefore to keep them in aquaria it was necessary to provide such living foods as Daphne and mosquito larvae. This is in direct opposition to my experience, as they take dry foods with avidity.

Next in point of beauty comes *Enneacanthus gloriosus*. This is a very active species, and while not so hardy as the others it will thrive on ordinary food.

The hardiest of all is *Centrarchus macropterus*. These are yellowish-green, looking like burnished brass as they glide through the water. There is a characteristic black spot, surrounded by an orange ring, on the soft dorsal. It takes dry food readily and soon becomes tame enough to snap at a finger.

The Pirate Perch, *Aphredoderus sayanus,* seem to be night prowlers and are always in hiding. I have never seen them eat, but have missed several small minnows! However, I like them. The general color is rich warm brown, with purple reflections.

When I move to a new locality, my first stunt is to make a tank, and then "go fishing." Hence the present twenty-gallon aquarium, with its native plants and the fishes mentioned; all collected near Camp Bragg.

The Aviary and Aquarium

The photograph on the opposite page shows a happy combination of aquarium and aviary designed and constructed by Mr. Parker A. Stacy. The woodwork is mahogany, measuring seven feet from peak to floor. The aquarium has a cast iron base, with steel corners and top frame, and holds twenty-five gallons. All metal work, the bars of the aviary and the frame of the aquarium, is finished in gilt; an excellent contrast with the dark mahogany.

The Chelonians

(Continued from page 28)

head back into the shell so as to be almost entirely out of sight.

Its feet bespeak its thoroughly aquatic habits, for they are like four rounded paddles, and capable of rendering a maximum service in swimming. Indeed, our soft-shelled turtles are the most aquatic of all the members of the chelonian group of fresh-water species in the United States. They rarely leave the water; and if they are forced to crawl over any rough or rocky place, they are sure to scratch or even lacerate the soft, smooth and tender skin-covering to the outer surface of the plastron.

The young are very beautiful little creatures, and have a great habit of extending their necks when investigating anything. Sometimes one of them will shoot like lightning to the bottom of the aquarium, shuffle under the sand or vegetation, and in a few moments you will see it protrude its long little black and whitish neck to the limit, which gives the animal a most ludicrous appearance.

The Southern soft-shelled turtle may come to weigh as much as 30 pounds, and possess a carapace of nearly 20 inches in length, with a corresponding width of nearly 16 inches.

All of the species are eaten in the parts where they occur, and one may often see them in the markets for sale. The young of all of them are prettily marked and colored.

An adult Southern Soft-shelled turtle has the carapace of a dull brown without any markings. Its head is of the same color, with brown, indistinct bands running forwards to join anterior to the eye. Its plastron is of a delicate creamy white and thoroughly immaculate, while it sometimes exhibits scratches or other adventitious lines and blotches.

Ditmars, who has had the opportunity to examine a great many of this species of *Amyda*, says that "specimens not fully grown have an olive or pale brown carapace, marked with dull, black spots, or dots, disposed in rings. On each side of the head and neck is a yellowish band; this extends forward through the eye and unites with its fellow on the top of the head, a short distance in front of the eyes. The character evinced by these bands is important in distinguishing the species from the Spiny Soft-shelled Turtle, on the top of the head of which the bands unite way forwards—at the base of the proboscis."

In many localities these turtles are known as "flap-jacks" on account of their flattened form and the pliable margins to their carapaces.

An Odd Trunkfish

(Concluded from page 33)

the eye. These horns are normally straight or very nearly so, but in the specimen figured, one of the horns was sharply bent inward. The photograph was taken from life by P. H. Pope, and the unusual specimen was collected at the Bermuda Biological Station in July, 1916, by Dr. W. J. Crozier, then Director of the station.

Society News

The first annual meeting of the London Aquarium Society was held on January 2. W. T. Webster was elected president; J. R. Shattock and W. R. Temple, vice-presidents. Seventeen new members were admitted.

The president read the annual address and dealt with the conception of the Society and its objectives. He appealed to the Society to establish a reputation and to live up to it, and to dispel any idea that the body should be considered as a few people enraptured with a "goldfish in a globe."

Mr. B. T. Child sent for exhibition a fine specimen of a Dutch tench. The meeting expressed its opinion that the importation of such fishes for breeding purposes would lead to an improvement of our stock, and this particular specimen was promptly secured by one of our members for that purpose. Mounted diatoms, and living Daphnia and rotifers were exhibited under microscopes by the president and Mr. Sheldrick.—*Hon. Sec.*

The annual meeting of the Brooklyn Aquarium Society was held on January 20, in the Auditorium of the Pacific Branch of the Brooklyn Public Library. The following were elected to office for the ensuing year: *President*, Dr. Frederick Schneider; *vice-president*, John C. Donovan; *secretary*, J. H. Shenk; *treasurer*, A. L. Wright; *member of Board of Directors*, Dr. J. H. Finney; *auditing committee*, C. J. Heede, H. A. Van Cott and R. D. Bright.—J. H. Shenk, *Secretary.*

At the annual meeting of the Essex County Aquarium Society, the following officers were elected: *President*, Rev. B. J. Coltorti; *vice-president*, E. C. George; *treasurer*, Dr. William Bachmann; *secretary*, Dr. J. S. Voegtlen.

The society holds its meetings on the first and third Fridays at the Newark Turn Verein, 186 William street, Newark, N. J. Members of other societies and those who are interested in aquarium nature-study are invited to attend.—J. S. Voegtlen, *Secretary.*

Aquatic Life

1919 — 1920

MAY. Nanostomus eques (*Brind*); The Water Horse-tail (*Wobler*); Observations on the Chelonians of North America, Part II. (*Shufeldt*); I Became a Fancier (*Proctor*); A Peculiar Planorbis (*Breder*); Association and Color Discrimination in Mudminnows and Sticklebacks (*White*); The Hay Infusion Microcosm (*Woodruff*); The Bladderworts, notes and news.

JUNE. Observations on the Chelonians of North America, Part III (*Shufeldt*); Gambusia episcopi (*Brind*); The Wheel Animalcules (*Bade*); Sonnet to a Goldfish (*Burditt*); A Study of the Diamond Bass (*Trell*); The Brook Stickleback (*Barker*); Goldfish in China, Red-colored Water, Crappie Spawn in Washington Aquarium, and Society News.

JULY. A Big-headed Gurnard (*Fowler*); The Nesting Habits of Certain Sunfishes as Observed in a Park Lagoon in Chicago (*Hubbs*); Badis badis (*Brind*); The Paradise Fish (*Balleisen*); The Garden a Terrarium (*Breder*); Philadelphia Aquarium, A Fish Elevator, Akiyama Goldfish Farm, notes and news.

AUGUST. Observations on the Chelonians of North America, Part IV (*Shufeldt*); The Steinhart Aquarium, with portrait of Ignatz Steinhart; Lebias sophiæ (*Brind*); The Senses of Fishes (*Herrick*); Marine Aquaria, An Epidemic Among Fishes, Manufacture of Pearl Buttons, etc.

SEPTEMBER. Platypoecilus maculatus (*Brind*); Observations on the Chelonians of North America, Part V (*Shufeldt*); Notes on the Life-history of Planorbis corneus and Other Freshwater Mollusks (*Webster*); Philadelphia Exhibition, Naples Aquarium, Aquaria in the Conservatory of the Missouri Botanical Garden, Xiphophorus montezumae, Freshwater Shrimp, notes and news.

JANUARY, 1920. Betta rubra (*Heede*); Observations on the Chelonians of North America, Part VI (*Shufeldt*); Beef Heart and Beef Liver for Young Fishes; Notes on Mosquito Larvae (*Hale*); Lucania ommata (extension of range); Habits of Fundulus nottii and Heterandria formosa; Linseed meal cause of disease among trout; South Australian Aquarium Society, Passaic Aquarium Society, the Redfield Theory, etc.

FEBRUARY. Goldfish Foods and Feeding as Practiced in Japan (*Nakashima*); Observations on the Chelonians of North America, Part VII (*Shufeldt*); The Mosquito (*Hale*); Luciocephalus pulcher (*Heede*); Maintaining an Aquarium (*Trell*); An Easily Constructed Heated Aquarium (*Finckh*); Roosevelt Wild Life Forest Experiment Station, February Pointers, etc.

April 1920 15c Copy

Aquatic Life

Aquatic Life

Vol. V April, 1920 No. 4

An international monthly magazine devoted to the study, care and breeding of fishes and other animals and plants in the home aquarium and terrarium.

W. A. POYSER ..... EDITOR
JOSEPH E. BAUSMAN ..... PUBLISHER
542 East Girard Avenue ..... Philadelphia

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Popular and scientific articles and notes on subjects pertaining to the aquarium and terrarium, and to the habits of fishes in general, are always wanted for "Aquatic Life." Readers are invited to join in making it a medium of mutual help by contributing to it the results of their studies. The pages are always open to any one having information of interest to the aquarist and student of aquatic biology. Manuscripts, books for review and general correspondence should be addressed to the editor.

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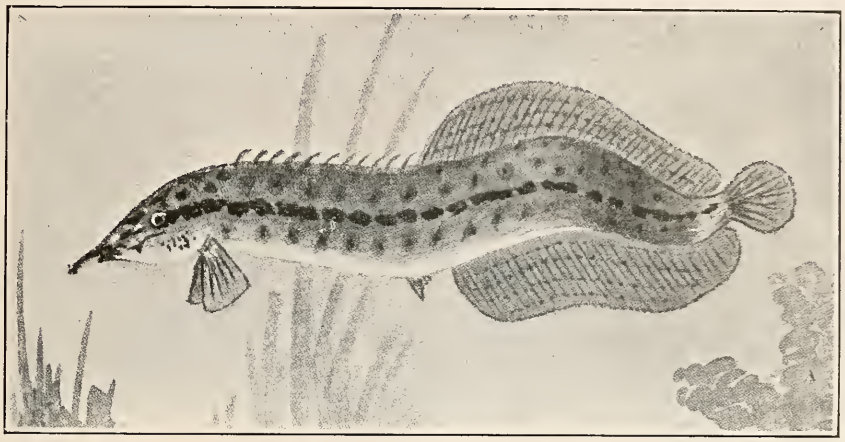
Mastacembelus pancalus

PEYTON MacMORRIS, M. D.



Mastacembelus pancalus **India**

The species of the family to which our subject belongs inhabit Southern Asia, extending from Syria to the Malay Archipelago. All the species of *Mastacembelus* are characterized by the long, fleshy appendage to the snout, and in some the dorsal and anal fins are confluent with the caudal instead of distinct as in the species illustrated.

Pancalus, specimens of which were secured by European aquarists about fifteen years ago, inhabits the deltas of the rivers of India, and may be inferred as common, inasmuch as it has attracted sufficient attention to be known to the natives by sundry names—Pangkal, Gochi, Gangr-gonti and others equally jargon-like to the Anglo-Saxon. Though small, about seven inches in length, it is held in esteem as a food fish, not only by the natives, but by others to whom fishes of snake-like form are not repulsive.

The general color of this species is greenish-olive above, becoming yellowish beneath, with many yellowish-white spots distributed over the sides. The lateral line is pronounced, but technical descriptions of the species do not indicate a lateral color stripe as prominent as illustrated. Secondary sexual characters do not seem to be developed.

References may be found in aquarium literature to *Mastacembelus argus* Guenther, of Siam. In the aquarium the eggs are said to adhere to the glass sides, plants or stones, hatching in a few days, the young gathering in a school about

the parents after the manner of the cichlids. The latter habit is scarcely what one would expect in a fish of this sort.

The favored foods seem to be Daphne, white worms, tubifex worms and similar small forms of life. An average water temperature of 75 degrees, Fahrenheit, should be maintained.

The London Society

A meeting of the London Aquarium Society was held on Friday evening, February 6, the president in the chair. Nineteen new members, ordinary, associate, honorary, and ex-officio, were elected. One of our members, Mr. D. F. Leney, of Oxford University, exhibited *a pair of Amblystoma tigrinum* which had completed their metamorphosis by special feeding from the axolotl state and become land animals; also an axolotl in process of turning by the evaporation method; and salamander and newt larvae in process of metamorphosis by iodine treatment. Probably such a varied display has never before been witnessed, and Mr. Leney's exhibits attracted considerable attention and discussion.

Mr. Cura showed nine varieties of tropical fishes, including two species of gurami, and the Siamese fighting-fish. Mr. B. T. Child exhibited the lamprey. Mr. P. W. Horn exhibited winter buds of various aquatic plants, and the contents of the stomach of a heron showing remains of rats, water-beetles, and their larvae. The president had on view under a microscope a specimen of Trombidium (the harvest-mite) so troublesome to anglers.

The meeting considered the generous proposal of the British Sea Anglers Society offering them their room as a meeting place. This was much appreciated, and it was unanimously agreed that it be accepted.—*Hon. Sec.*

A New Treatment To Eliminate Ichthyophthirius

C. L. HAUTHAWAY

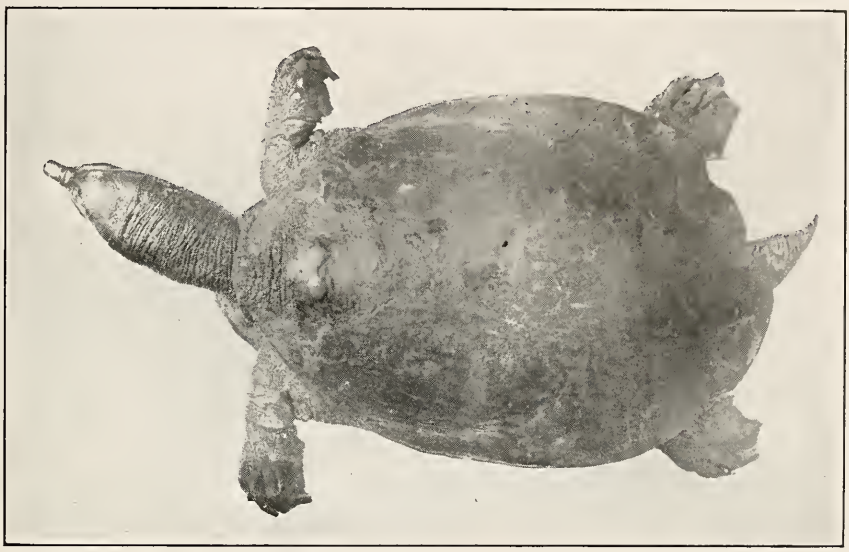
In the collection of the writer is a fifty-gallon *tropical* community tank containing twenty-one species of fishes. In this was unwittingly placed eight or ten pairs of new fishes immediately they arrived, which almost at once gave evidence of being infested with *Ichthyophthirius*, whereupon they were removed.

The fishes were then placed in two-quart jars, partially filled with pure water, which were floated in the large aquarium. A similar number of jars were filled likewise with pure water and also floated. To those containing the fishes a generous portion of Daphne was added, and more from time to time as it was consumed. Night and morning, until cured, the fishes were transferred to the reserve jars of pure water, and Daphne supplied as before, the used jars being sterilized and then replaced in readiness.

The purpose of the Daphne is twofold. My theory is that the parasite is devoured by the Daphne when it leaves the host, and others eliminated when the fishes are transferred. On the other hand there is no better nor more invigorating food for fishes than Daphne, and being consumed during the treatment, enable the patients to maintain strength to resist the enervating influence of the parasite. I may wrongfully state the "why" of the method, but fishes so treated, both my own and those belonging to friends, have invariably been cured. The large tank mentioned is heated by electricity and maintained at a uniform warm temperature by means of a thermostat. Under these conditions Daphne will not live long, dying and polluting the water to the detriment of the patients if transfers are not made as often or more often than stated.

Observations on the Chelonians of North America. IX.

DR. R. W. SHUFELDT, C. M. Z. S.



Southern Soft-shelled Turtle **Dorsal View**

It is not a difficult matter to distinguish a Spiny Soft-shelled turtle from the Florida species, for the former has an olive instead of a brown head, on each side of which we may note, including the neck, a yellow, black-edged line running through the eye, and joining the one from the opposite side at the root of the nose. Then, on the anterior edge of the carapace in this species we find a conspicuous row of little cone-shaped tubercles, which are entirely lacking in the other species.

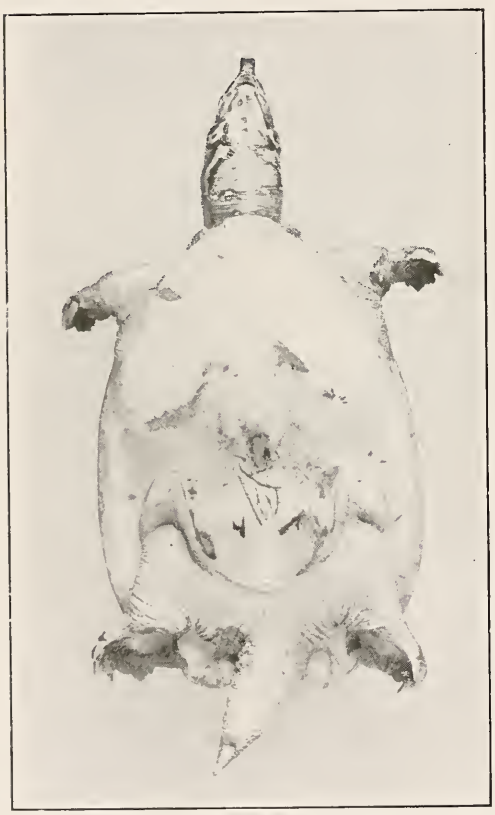
This Spiny Soft-shell rarely exceed 15 inches in length of carapace; and, like its congeners, it causes no end of annoyance to anglers in streams and ponds where it may occur in numbers, and for the reason that it will take the worm or minnow on the hook as quickly as any fish that ever lived—and if hooked, it will put up the stiffest kind of a fight to get away.

Our Spiny Soft-shell is an abundant species in all the area inhabited by it; it even extends its excursions into the big canals in New York State, and by so doing finds its way into the Hudson River, where a few specimens are taken every season.

Of all the North American species of these turtles, the "brown" is the small-

est; it has no spines on the carapace as in the last species, while its head is proportionately narrower. Dull blotches may be detected on its olive or brown carapace; but they are in some instances very obscure and not readily seen. A big specimen of this species may possess a carapace measuring some 7 inches in length, but it would be the exception.

Emory's Soft-shell turtle also lacks the



Southern Soft-shelled Turtle
Ventral View

spines on the front edge of the carapace, and its proboscis is proportionately shorter. Its olive-tinted carapace is thickly dotted over with black dottings. Average specimens run about a foot in length.

In pools, or muddy, sluggish streams in those parts of the country where any of these soft-shelled turtles are abundant, one may occasionally see them out of the water, though this is by no means their custom. They present a curious sight, and one not easily forgotten. A slimy, old, water-soaked log, out in the full glare of the sun and flush with the surface of the water of the pool, will sometimes, in the warm season, tempt several of them, of various sizes, to climb out for a good sun-bath. As a rule, when comfortably settled on the log, they will pull in their legs and stretch out their necks, until they resemble so many brown water snakes rearing aloft. This feat led Ditmars to say that they, when so basking, impart "the idea of as many snakes emerging from under flat stones." Should anything alarm them, the entire bunch is into the water in a twinkling, when they dart to places of hiding, at the bottom or along the banks, with the swiftness of the best fish that ever lived.

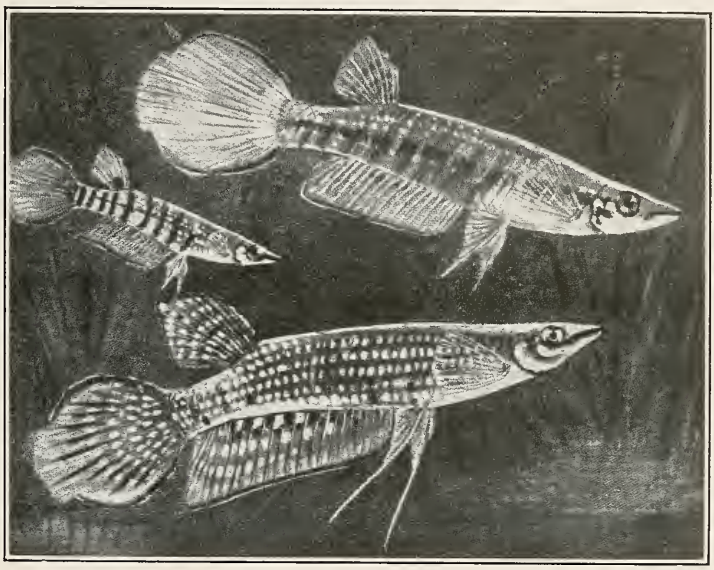
In some parts of the South, these reptiles are known as the "soft-shelled snappers or snapping turtles," and for the best of reasons. As already stated, its bite is a most dangerous one, and cases are known where a large Florida soft-shell has bitten off a man's finger. So quick is its attacking stroke that one is thrown quite off one's guard, and the first thing realized is that the vicious reptile has the part seized in its powerful keen-edged jaws.

The small specimens of these interesting turtles make very interesting aquarium pets; but they must be constantly supplied with food, such as angling worms, tiny fish, and so on, regularly, or they will soon die. In nature the adults feed upon many things, chiefly on the various species of fresh-water mollusca. In addition they capture and eat no end of small fish, aquatic batrachians, as frogs and newts, and, finally, the

(*Concluded on Page 48*)

Notes on Haplochilus lineatus

CHARLES J. SAWYER



Haplochilus lineatus **India**

There are aquarists who "go into raptures" when *Haplochilus cameronensis* is mentioned, proclaiming it as the most beautiful member of the genus. But then to decide, the state of mind of the individual must be considered. I prefer *H. lineatus.* Its beauty is of a different sort, sparkling and sharp, like a finely cut gem. Besides it has "pep." I think none the less of it because a big fellow once gobbled a batch of young guppies, whereby I gained a bit of experience.

When *lineatus* was first secured by aquarists it was identified as *Haplochilus rubrostigma,* and this apparently erroneous name has stuck like a postage stamp ever since. The differences between the two are not great, the formulae of fins and scales being much alike. If *lineatus* and *rubrostigma* are distinct from one another, the question concerns identification; if the two names refer to the same fish we must accept *lineatus* as correct, it being the older. Both species, conceding them as distinct, are found in the same general localities in India.

The coloration varies with age, sex and temperature. Each scale has a golden green spot in the centre, making this the dominant color, contrasting well with the red "trimmings." The female is usually lighter, with the green spots not so pronounced, and further distinguished by a lengthwise black stripe, somewhat broken, and eight to ten vertical bands passing down the sides to the abdomen; these bands are present in the young of both sexes, the males losing them with approaching maturity.

For the propagation of this *Haplochilus,* preference should be given to a broad and shallow, rather than a small, deep aquarium. Rooted vegetation is not a matter of much moment, but plenty of loose *Myriophyllum, Anacharis,* etc., should be thrown in and allowed to float near the surface. On these plants the eggs will be deposited. At least once every day, and more often if possible, the plants should be examined for eggs If found, either the mass of plants, or the adult fish, should be removed to another aquarium.

The eggs will hatch in about two weeks at ordinary summer temperature, but more quickly if very warm. From this time on, success will depend upon foods and temperature. Keep the babies warm and see that they have plenty of minute forms of life. Eventually they will be large enough to master small Daphne and growth will be quickened. Continue using Daphne as long as it is obtainable, later passing to white worms, and chopped earthworms, with prepared foods as an emergency ration. White worms are greatly relished, the fish often leaping from the water to pick them from one's fingers.

While *lineatus* will thrive in a comparatively small tank, it should be given as large a one as possible, especially if it is desired to raise fine specimens. In nature it reaches a length of four inches, but if aquarium-bred is seldom more than three inches. Heat is a factor in growth, so not less than 70 degrees should be provided during the cold months, while for propagation it should be ten degrees higher.

The Aquatic Association of Maryland has become affiliated with the Maryland Academy of Sciences, which has been well known in scientific circles for a great many years. While linking its destinies with those of the academy and thus adding an aquatic section to that body, the association preserves its identity and will operate under its own constitution and by-laws.

At the recent annual meeting the following officers were elected for the ensuing year: *President,* J. Shelton Hill; *vice-president,* P. C. Chambliss; *secretary,* William Jay Smith; *treasurer,* Louis Hens.

At the annual meeting of the St. Louis Aquarium Society, held on March 3d, officers were elected as follows: *President,* Paul Hohenstein; *vice-president,* Frank Gutweiler; *treasurer,* Frank Moran; *secretary,* John Wetzel.

Carleton E. Davis, Chief of the Bureau of Water, of Philadelphia, gave a lecture on "Water Conditions" at a recent meeting of the Philadelphia Goldfish Fanciers' Society. Other societies should find it to their advantage to arrange for similar talks by local sanitary engineers.

Crisp lettuce, chopped very fine, has been found to be relished by both goldfish and wild native and exotic fishes. Even those of decided carnivorous characteristics will take it with avidity.

The Artificial Production of Albinism

EDGAR R. WAITE, F. L. S.

Director of the South Australian Museum

Amblystoma tigrinum **Larval form or Axolotl**

It is within common experience that Axolotls kept in captivity are apt to produce colorless offspring; the fact has been mentioned in *Aquatic Life* (Vol. 1, p. 130), as has also the record of an albino frog (Vol. 11, p. 132).

The South Australian summer of 1919-20 was characterized by a rapid succession of extremes of temperature, and to this circumstance is attributed our comparative failure in breeding axolotls during this season. Several pairs produced eggs, but in nearly all cases they failed to develop. One female laid about thirty eggs of which only two hatched, all the others dying in various stages within the eggs.

The two survivors are both colorless, the only indication of color being minute dots distributed over the body; the pupils of the eyes appear to be pink, but are each surrounded with a dark ring, for which appearance the hard fibrous sclerotic coat may be responsible. The beating of the heart and the course of the blood and food systems can be easily traced, while the difference in the color of the blood in the efferent and afferent vessels of the gills conveying respectively venous and arterial fluid furnishes an interesting object lesson.

It is not, however, to describe the appearance of a colorless axolotl that I now write, but rather to vaguely indicate a possible reason for the peculiar condition in these batrachians. The term "albinism" should denote an entire absence of color, either locally or generally. The little dots above referred to would suggest, not an absence of pigment, but

rather an absence of the power to expand the chromatophores or color cells.

On mentioning the condition and later showing specimens to my friend, Professor T. Brailsford Robertson, he kindly referred me to a series of papers recently published by Dr. P. E. Smith, of the University of California. This author had experimented with frog tadpoles and discovered that if the *Hypophysis cerebri* or pituitary bodies were removed, the tadpoles assumed an albino condition; growth was retarded and the larvae were unable to undergo the usual metamorphosis, that is, they were incapable of becoming frogs. It may be said that the experiments were not conducted with the aim of producing albinism; this was an unexpected result, but was a condition regarded as of inestimable value, as it became an invariable index to the success of the operation of removing the pituitary body.

The albino tadpoles were next fed with gland substances (pituitary, adrenal, etc.), and growth was resumed and even exceeded that attained under normal conditions. Another surprising result was the development of pigmented skin, due to the expansion of the chromatophores which, though evidently present, were incapable of action in the absence of the necessary glandular material.

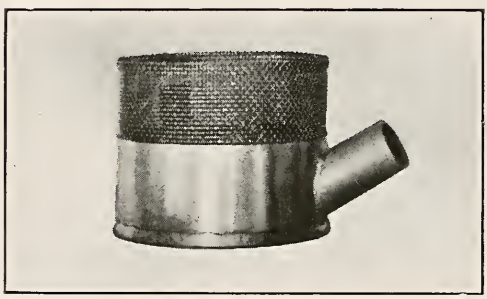
It is well known that the absence or derangement of certain bodies, such as the thyroid and pituitary glands, produces strange conditions in the human subject, and the interesting experiments conducted by Dr. Smith fairly conclusively prove that albinism in frogs and axolotls is due to some abnormal condition of those apparently insignificant organs, of which medical science has much to learn.

Many animals from man to fishes, down to starfishes at least, are known to produce albinos or color variations, and an interesting and valuable field of research is thus revealed to students of nature.

A Metal Net for Larval Fishes

HARRY W. BALLEISEN

There are often times when it is advisable to move recently hatched fishes from one tank to another. When we use a spoon, ladle or cup the fry manage to escape when the implement is raised to the surface, being washed out by the disturbance. At this age the fish are very



tender and are apt to be injured if handled in a cloth net. Hence the metal net as illustrated.

Take a baking powder can and with tinners' shears cut it down to the depth shown. Select a piece of brass wire-cloth twice the depth of the can in width, and long enough to reach around and slightly over-lap within the can. Before bending the wire-cloth to insert in the can, turn over one long edge, the upper one when completed, then bend the strip (the turned edge outside), and insert in the can and solder; the screen should extend to the bottom. On the outside of the can solder a short piece of brass tubing, and in it insert a snug-fitting wooden handle.

The purpose of the wire-cloth is to prevent the fry floating out while the implement is being drawn out of the water, while the can retains ample water to insure them against injury.

The "BALANCED" AQUARIUM
A Question and an Experiment

J. H. POWERS

A Well Arranged Aquarium in the Collection of H. E. Finckh

To the aquarist the theory of the balanced aquarium is well nigh sacred. To question it is like questioning the trinity among theologians. Yet much in the writer's experience has shown that it is not a dogma which can be trusted or applied with confidence.

Besides, as no doubt the readers of *Aquatic Life* know, it has even its theoretical limitations. The animal absorbs oxygen and gives off carbonic acid; the plant absorbs carbonic acid and gives off oxygen. So runs the formula. But not always by any means. For the animal the formula holds good. But for the plant only in the sunlight. Only by means of the energy of the sun, acting in conjunction with the green coloring matter of the plant and its living protoplasm, can photosynthesis take place, that process which builds up the plant's food substances, employing carbon dioxide and incidentally giving off oxygen.

But place the growing plant in the dark, and its nature is at once reversed. It becomes an animal so far as its gaseous exchanges are concerned. It needs and uses oxygen and it excretes carbonic acid.

This now being the case, the practical question arises for the aquarist: what is the actual condition of the balanced aquarium during the night? The animal population is of course deoxygenating the water while supplying it with the excretory compound of carbon. The vegetable population of the aquarium is doing exactly the same thing. But in

what degree? Does the balance established during the day essentially last over through the night? Do the plants give off so much oxygen in the light and themselves utilize so little during the night that their influence is after all essentially the one ascribed to them in the accepted theory of the balanced aquarium?

This question is at once of practical and theoretical interest. The writer has asked a number of botanists for information. What is the condition of the water, say of an aquarium in which there is no animal life, but in which the maximum bulk of a given plant is growing, for instance, after so many hours of sunlight, followed by so many hours of darkness? Is the period of oxygenization actually followed by one of deoxygenation, or, as indicated above, is the deoxygenating influence slight as compared with the other? So far, the botanists to which the writer has appealed have been unable to give answers to these questions, or to point to any literature touching upon them. The writer would be greatly pleased if some reader of *Aquatic Life* might do better.

Now for the experiment. Several years ago the writer was engaged in a series of experiments in regard to the metamorphosis of the Tiger Salamander. This animal, of course, lives in the water in its early or tadpole stage. During this period it has a fine system of external gills. It has lungs also, however, even before it hatches from the egg, and at some period in its life its gills are usually absorbed and the animal becomes chiefly an air breather and chiefly a land animal.

The points at issue, which lead to the experiment, were the following. Could the larval salamander really develop for a long period by the use of its gills alone, and at what time would it begin to rise to the surface and breathe by means of its lungs?

Two young salamanders were chosen for the experiment. They were about three centimeters long and had hatched from eggs in a large battery jar used as an aquarium. It was situated in an east window and contained a fairly copious growth of several algae. There were small worms and crustaceans also present which served as food for the two larva. These little animals throve exceedingly, growing as fast as did others in an adjacent pond. They were the picture of contentment, striding about the bottom of the jar with slow searching movements, now and then jabbing and munch, munch, munching if the jab proved successful in approved young salamandrine fashion. Their gills were finely developed. Blood could plainly be seen circulating in them.

These animals were watched for hours during several days to ascertain whether they rose to the surface for air. But no suggestion of a rising movement was observed. They were plainly living under ideal conditions of a balanced aquarium. The oxygen that they were absorbing through skin and gills was sufficient for their respiratory needs.

The next question, however, was, what of the conduct of these animals during the night? Observed by lamp light during the evening they were as quiet as usual. It really seemed to the writer that they were living an exclusively under water life. To prove this, however, a screen of mosquito netting was stretched across the jar about two centimeters below the surface and held there by means of a light elastic spring. The placing of it was done without exciting the animals. They seemed as content afterwards as before. Yet, to the writ-

er's great surprise, the following morning, there were two holes bored through the netting and both animals were in the shallow water above it.

Replaced by the removal of the net, they soon became quiet and resumed their ordinary contented daylight life. Toward evening, two films of netting were stretched across the jar. But the next morning both animals had again penetrated the impediment and reached the surface. At the third trial, three layers of mosquito netting spanned the opening of the jar. It seemed utterly impossible that a creature so delicate as were these tiny larvae could ever press aside the strands of this triple net and reach the surface. And was it really necessary that they do so? Would they not finally make a virtue of necessity and remain content with the conditions of respiration which their balanced aquarium furnished them beneath the surface? But no. The third morning, one animal had penetrated the triple net; while its companion had failed to do so, and was dead at the bottom of the jar. The conditions in the jar looked quite normal meanwhile. The vegetable growth was healthy as ever.

In this instance it is plain that the respiratory conditions furnished by a balanced aquarium during the day and during the night were markedly dissimilar. The writer has never made further experiments on the subject. He is indeed not an aquarist in the ordinary sense of the term, having little to do with fish, or with the larger aquatic animals. But in year-long work with minute forms of animal life, his attention has repeatedly been called to the fact that the balanced aquarium is in no wise so valuable a means of promoting life as is ordinarily supposed. Many minor forms of life live longer, grow and multiply faster, withstand changes of temperature better, when reared in aquaria without plants rather than with. Definite parallel experiments have shown this to be the case again and again.

Undoubtedly this is not true of fish and typical aquarium animals. It would be absurd for the writer to deem that all the practical aquarists in the world were wrong in their view of the matter. But can we not have more and better knowledge than that which is embodied in the mere dogma as it is usually advanced?

It seems to the writer that it would be very interesting if some readers of *Aquatic Life,* who have splendid aquaria at their disposal, would make careful observations of the conduct of animals, fish and otherwise, after periods of light and darkness; after a long stretch of sunlight, for instance, blanket an aquarium for twelve hours and note by some careful means the conduct of its inmates. The writer at least would feel his knowledge of animal life greatly extended by the results of such careful investigation.

Venus's Fly Trap

Venus's Fly Trap is a bit of "bog life" for the conservatory that never fails to arouse interest; even those who squint at your fishes and ask "what good are they" will be impressed.

The plant can be briefly described as a rosette of leaves, the latter on broadly winged stems. From the centre of the rosette, at the proper season, usually April and May in its native haunts, springs the tall flower stalk, with its terminal cluster of eight to ten white blossoms. But the flower is the least interesting feature. The leaves catch insects! Sharp, rigid projections, like diminutive spikes, stand out from the leaf-margins, and on the surface are

glands that both secrete and absorb. Let an unfortunate insect alight upon a leaf and the lobes close, the projections interlocking like the teeth of a steel trap, the centre of the movement being the mid-rib and is more rapid than might be expected. The glands secrete a fluid which acts like the gastric juice of animals and reduces the victim to the proper state to permit the absorption of its nitrogenous matter.

The Fly Trap may be potted in soil, but it is more interesting to grow in damp moss like an epiphytic orchid, which will demonstrate that the roots probably serve solely for the absorption of water.

The Chelonians

(*Concluded from Page 40*)

young of ducks, coots, divers, and other water fowl.

The females of any of the species come ashore in the summer time to lay eggs. These may number several dozen to the single clutch, are perfectly round, and as white as snow. She always selects a place where no shade can ever be. Once satisfied with the selected site, she works her way down into the sand until all is covered save the tip of her proboscis. Often it requires a week or ten days, sometimes longer, before her entire complement is deposited. Each egg possesses a very thin, brittle shell, averages something over an inch in diameter, and looks like a big, white marble.

By closely imitating their habitats in nature, these turtles may easily be kept in zoological gardens or on private premises; and there is no trouble in feeding them beyond securing what they so readily devour. Even good-sized fish, recently dead, will be enjoyed by them—that is, by the larger specimens; while angling worms constitute, in my experience, the best food for the very young specimens.

In perfectly clear water it is a most interesting experience to study their various motions and graceful swimming. The extreme suppleness of their limbs admit of their darting either forwards or backwards with extraordinary rapidity. When frightened, one will scurry to the bottom and hide much quicker than it takes to tell it. Here it will conceal itself among the vegetation, or even work its way down into the sand or mud. When it believes that the danger is over, we next see its long, snake-like neck protruding to admit of its seeing about in all directions. Cautiously it will come out into the open; and should it desire to breathe the air, it will, with a single sweep of its powerful anterior limbs, shoot to the surface like a rocket.

Soft-shelled turtles have thriven in captivity, if regularly fed in comfortable places, for many years at a time, especially if the trial be made with specimens of the proper ages, particularly the young and subadult specimens. Old ones do not do so well for some reason, having probably been too long in their native waters.

The South Side Aquarium Club, of Chicago, will have a public exhibition of aquarium fishes April 11th to 18th, inclusive, in the Washington Park Conservatory, Fifty-seventh and Cottage Grove avenue. Thirty-five to forty tanks, with as many species of fishes, will be shown.

A bird in the hand is vulgar. Use a knife and fork.

Ignorance may be bliss, but one's knowledge of one's ignorance is what blisters.

Aquatic Life

1919 — 1920

MAY. Nanostomus eques (*Brind*); The Water Horse-tail (*Wobler*); Observations on the Chelonians of North America, Part II. (*Shufeldt*); I Became a Fancier (*Proctor*); A Peculiar Planorbis (*Breder*); Association and Color Discrimination in Mudminnows and Sticklebacks (*White*); The Hay Infusion Microcosm (*Woodruff*); The Bladderworts. notes and news.

JUNE. Observations on the Chelonians of North America, Part III (*Shufeldt*); Gambusia episcopi (*Brind*); The Wheel Animalcules (*Bade*); Sonnet to a Goldfish (*Burditt*); A Study of the Diamond Bass (*Trell*); The Brook Stickleback (*Barker*); Goldfish in China, Red-colored Water, Crappie Spawn in Washington Aquarium, and Society News.

JULY. A Big-headed Gurnard (*Fowler*); The Nesting Habits of Certain Sunfishes as Observed in a Park Lagoon in Chicago (*Hubbs*); Badis badis (*Brind*); The Paradise Fish (*Balleisen*); The Garden a Terrarium (*Breder*); Philadelphia Aquarium, A Fish Elevator, Akiyama Goldfish Farm, notes and news.

AUGUST. Observations on the Chelonians of North America, Part IV (*Shufeldt*); The Steinhart Aquarium. with portrait of Ignatz Steinhart; Lebias sophiæ (*Brind*); The Senses of Fishes (*Herrick*); Marine Aquaria, An Epidemic Among Fishes, Manufacture of Pearl Buttons, etc.

SEPTEMBER. Platypoecilus maculatus (*Brind*); Observations on the Chelonians of North America, Part V (*Shufeldt*); Notes on the Life-history of Planorbis corneus and Other Freshwater Mollusks (*Webster*); Philadelphia Exhibition, Naples Aquarium, Aquaria in the Conservatory of the Missouri Botanical Garden, Xiphophorus montezumae, Freshwater Shrimp, notes and news.

JANUARY, 1920. Betta rubra (*Heede*); Observations on the Chelonians of North America, Part VI (*Shufeldt*); Beef Heart and Beef Liver for Young Fishes; Notes on Mosquito Larvae (*Hale*); Lucania ommata (extension of range); Habits of Fundulus nottii and Heterandria formosa; Linseed meal cause of disease among trout; South Australian Aquarium Society, Passaic Aquarium Society, the Redfield Theory, etc.

FEBRUARY. Goldfish Foods and Feeding as Practiced in Japan (*Nakashima*); Observations on the Chelonians of North America, Part VII (*Shufeldt*); The Mosquito (*Hale*); Luciocephalus pulcher (*Heede*); Maintaining an Aquarium (*Trell*); An Easily Constructed Heated Aquarium (*Finckh*); Roosevelt Wild Life Forest Experiment Station, February Pointers, etc.

MARCH. The Australian Congolly (*Hale*); Observations on the Chelonians of North America, Part VIII (*Shufeldt*); Ichthyopthirius multifilius (*Webber*); Rivulus strigatus (*Brind*): An Odd Trunkfish (*Hubbs*); North Carolina Notes (*Carlton*); Society news.

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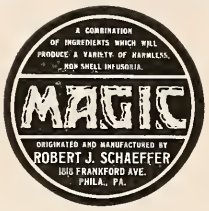

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May, 1920 15t Copy

Aquatic Life

Aquatic Life

Vol. V May, 1920 No. 5

An international monthly magazine devoted to the study, care and breeding of fishes and other animals and plants in the home aquarium and terrarium.

W. A. POYSER ..... EDITOR
JOSEPH E. BAUSMAN ..... PUBLISHER
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Aquarium Microscopy

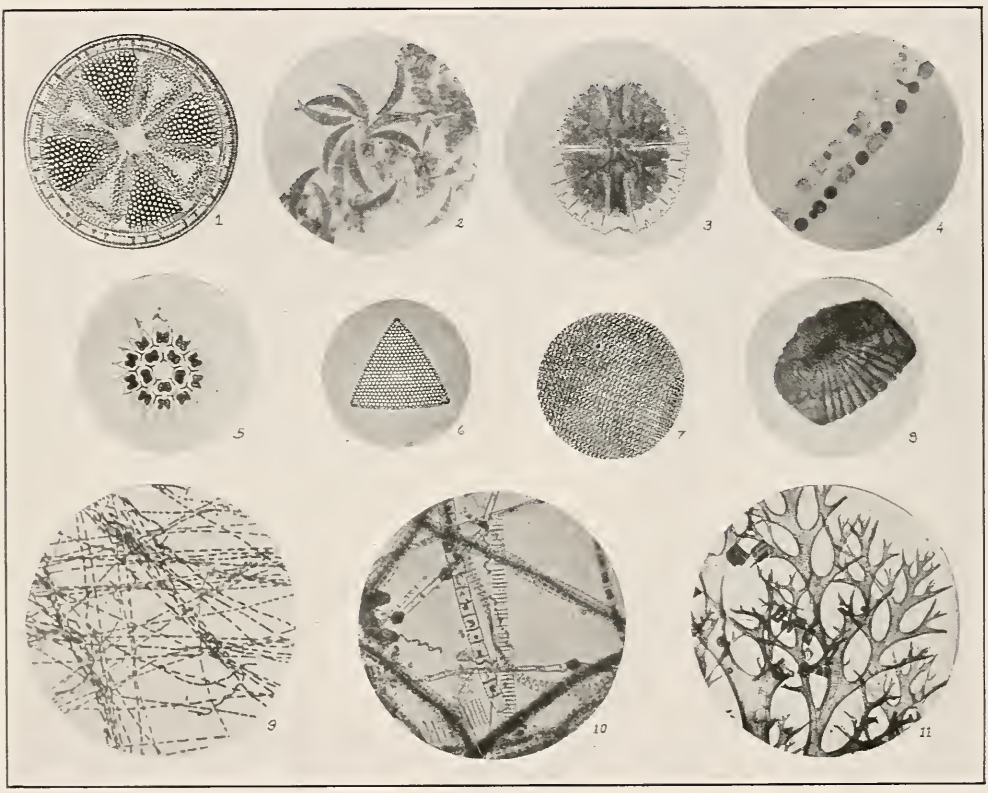
PROFESSOR R. FRANCE

PARADISE FISH, MACROPODUS VIRIDI-AURATUS, THREE DAYS OLD
Photomicrographs by Carl L. Hartshorn

The aquarist has more than one reason to wish to be the owner of a microscope. The miniature life-community, confined within the limits of his glass tank, again and again presents to him—not infrequently contrary to his desired aim—revelations of the microscopic world, be it in the form of a green covering on the sides of his aquarium threatening its transparency, a mass of fine green algae weaving a network among his *Vallisneria, Sagittaria* and other plants, or in the dark green or brownish colored covering of the sand of his old tanks, which may suggest to him a cleaning and a rearrangement. But apart from this disturbing interference, the influence of the invisible "microcosmos" is apparent in many other ways. In feeding his fishes with *Daphnia* and *Cyclops,* in hunting for Hydra, or in caring for his aquatic plants, a microscope is a valuable aid and teacher, increasing the enjoyment in his pastime a hundredfold.

Every aquarium is an inexhaustible source of microscopic life and always harbors a rich microscopic fauna and flora. One never fails to find the diatoms, which have been called the "jewels of the plant world," as well as some of the graceful desmids, unicellular bright-green algae, of which *Closterium, Cosmarium* and *Micrasterias* are frequent kinds; also the tiny and beautiful *Scenedesmus* and *Pediastrum,* the latter a relative of the peculiar water-net, *Hydrodictyon,* will seldom be missing,

nor some representatives of the *Oscillatoriaceae,* whose peculiar wavy motion has not yet been satisfactorily explained. The latter, generally massed into skin-like layers, may be seen even with a magnification as low as 80 to 100 diameters, and with the diatoms and desmids gether anywhere in nature. One will never look in vain, for instance, for *Paramecium* and *Chilodon,* and it is an interesting fact that the largest of all infusorians, *Spirostomum ambiguum,* which is even visible to the naked eye as a "white worm" of a length of about one



1. Actinoptychus heliopelta, a marine diatom. 2. Closterium, a desmid, from the side of an aquarium (Carl L. Hartshorn). 3. Micrasterias, a desmid. 4. Spirogyra, a filamentous algae, in conjugation (Charles M. Breder, Jr.). 5. Pediastrum pertusum. 6. Triceratium favus, a marine diatom. 7. A portion of the radula or tongue of a snail. 8. A scale of the mouth-breeder, Haplochromis strigigena (Charles M. Breder, Jr.). 9. Bacteria, Bacillus subtilis, from an aquarium. 10. Filamentous desmids and diatoms. 11. Diatoms, Isthmia sp., on Microcladia Coulteri, a seaweed. Photomicrographs by Charles P. Titus except as otherwise noted.

they form, as "crawling plants," some of the most interesting forms of microscopic life.

One will never fail to find in an aquarium many of the lively infusorians; many an old aquarium will furnish a larger variety than may be found to- millimeter, is most easily obtainable from almost any permanent aquarium. Then there are almost always present during the summer months, appearing like a white fungous growth on plants, the charming *Vorticella,* showing under the microscope one of the wonders of life—

the reaction of the living cell in response to stimuli, in the contraction of the spiral "muscle" in the thread-like stalk or pedicle by which the animal is fastened to plants, etc. *Amoeba* are frequent inhabitants of the surface of the mud covering the bottom, and through a study of them the fundamental facts of life will be better understood. These minute forms are not difficult to remove from an aquarium for examination with a long pipette, without otherwise disturbing the whole. It is not so easy, however, to catch the larger rotifers or wheel animalcules, or the small crustaceans, which requires the aid of a small net of silk gauze.

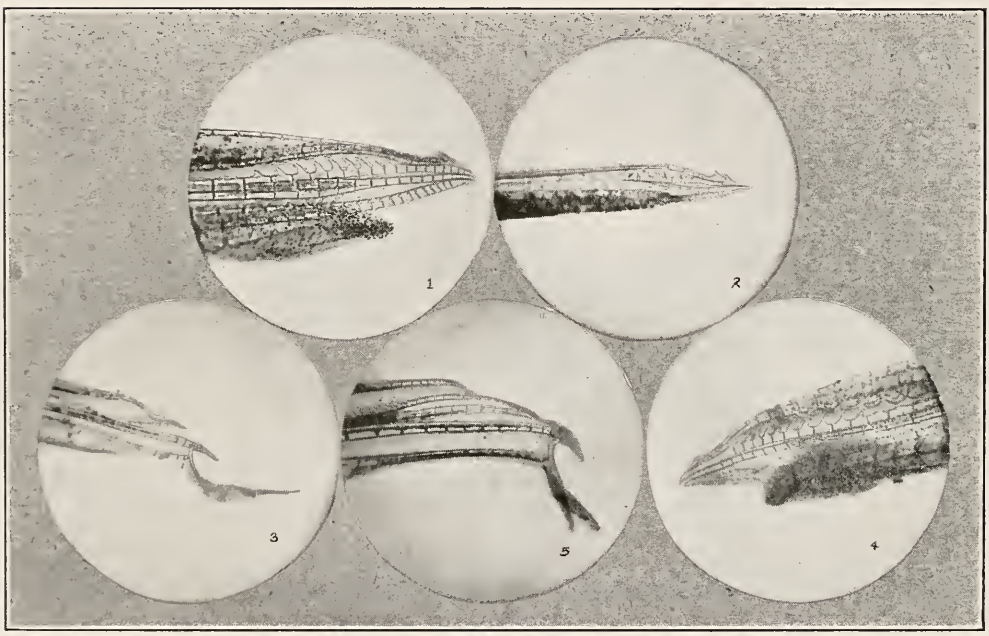
It will certainly excite interest to watch under the microscope living rotifers (say *Branchionus*) or cladocerans (*Daphnia,* etc.). They afford views of the living workings of the inner organs, as the stomach, brain, heart, and even of a living embryo in the process of segmentation, and so on. Not less entertaining and educational is the observation of a Hydra catching infusoria and other foods, or of mosquito larvae, which are also wonderfully transparent.

The observation of the higher plant life also offers a source of no less enjoyment, as aquatic plants afford particularly fine opportunities in many ways to examine, without further preparation, the inner structure of the plant and plant cell, besides for instance the methods of plants for protection against attacks by snails, and many other interesting adaptions of submerged plants. Let us take as an example the formation of air-cells, enabling plants to float, for the study of which the different kinds of *Lemna* and the leaf-stalks of *Myriophyllum* are very fine objects. The structure of the leaf may also be seen without preparation in *Fontinalis* and *Anacharis,* while one of the most interesting phenomena, the flow or circulation of protoplasm within the cell, can easily be observed in *Chara, Nitella, Vallisneria,* etc. All root ends of plants are provided with a sort of protective cap (calyptra), which is nowhere more plainly to be seen than on the rootlets of Lemna. And by the way, those not informed often erroneously regard the roots of *Lemna* as stalks of the floating leaf, which is really not a leaf. As a matter of fact *Lemna* have no leaves, but the apparent floating leaf is a stalk contracted into leaf-shape, from which, as in other plants, the roots descend.

These few examples prove to what degree the use of a microscope may enrich the knowledge of an aquarist, and the better enable him to rationally care for his pets, the fishes and plants. But this is not the main profit derived. It is the deepening of his knowledge of the complicated interdependence of life and its hidden laws, as between animal and plant aquatic life. Only he who is also acquainted with the microscopic aquatic life will be able to fully understand the law of "biocenosis," the relation of organisms to other organisms with which they live. It must have been actually seen how each is interwoven with the other, how the bacteria in the sediment and sand, the rhizopods and the algae contribute to the aeration and are, therefore, necessary for the well-being of the whole aquarium. From the manner which the aquarium is inhabited by these beings invisible to the naked eye, the aquarist is enabled to arrive at conclusions as to the dangers threatening or as to the safety and stability of his little world or community. The occurrence of sulphur-bacteria, principally *Beggiatoa,* indicates imperfect aeration as these forms can only exist in the presence of sulphuret-

ted hydrogen. On the other hand, an abundance of green algae, like *Scenedesmus, Closterium* and so on, is a guarantee for good health of the fishes, securing aeration of the aquarium throughout.

The aquarist, who is at the same time a microscopist, may have the opportunity of seeing unrolled before his view a regular world-history in miniature, whole nations of infinitesimal animalcules coming and going, one preying on the other, one holding the other in check or balance, and each having its own particular task. The infusoria prey on the bacteria, they themselves being devoured by other "carnivorous" infusoria; the rotifers hunt both kinds of infusoria; the crustaceans live on algae as well as rotifers; the snails check the excessive growth on the glass; the whole community of minute beings plays its part in relation to the health of the fishes; the larger plants, discharging oxygen in the process of photosynthesis, create the conditions necessary for the existence of the microscopically small inhabitants of the aquarium, which again will dispose in smaller or greater degree of the refuse matter of the larger inhabitants. Most assuredly a fascinating cycle of life. And this constant automatic purification process not only reveals to the careful observer natural law after law in the small cosmos of his aquarium, but also will permit him to draw more general conclusions as to the greater laws of the universe, and even as to how human life and his own existence are dependent on natural laws, teaching him that these



Distal Ends of Modified Anal Fins of Male Viviparous Poeciliids

The structure of the so-called intromittant organ in these fishes is a stable diagnostic character and has played an important part in recent studies of the group. 1. Mollienisia sphenops. 2. Gambusia holbrooki. 3. Cnesterodon decemmaculatus. 4. Mollienisia formosa. 5. Phalloceros caudomaculatus. Photomicrographs by Dr. E. Bade.

may not be broken with impunity.

Thus aquariculture from a mere pastime may be elevated to an educational medium of the first magnitude. For this reason no public school should be without an aquarium. It will prove an invaluable aid to instruction in natural history, and obviously the more so in connection with the use of the microscope.

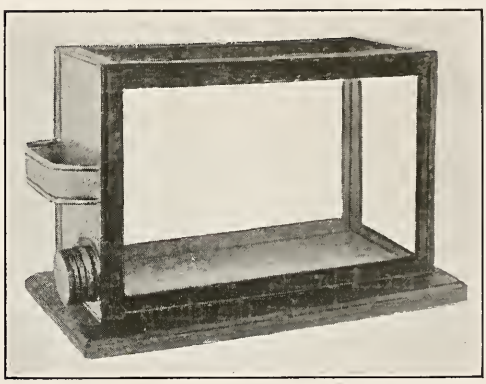
Now, in conclusion, we will not omit to point out the advantages every professional microscopist would derive from keeping a self-sustaining aquarium. Every scientist and microscopist should become a practical aquarist and keep his own "home pond." It will enable him to keep and cultivate for an indefinite time at least some of the material collected, having it at hand not only in season, but also out of season; and explorations in his home tank may be made to yield more surprises than many an excursion for collecting purposes in the open, often thus saving much valuable time. The habits and life-history of many subjects, such as *Daphnia, Cyclops, Cypris, Plumatella* and all kinds of algae could not be studied better and more conveniently than in a real self-sustaining aquarium. A microscopist, after owning an aquarium, will have no more cause for the old complaint: "Of all the interesting things described in books I can find little or nothing myself." He will enjoy the same pleasures as the aquarist who adopted the use of the microscope in connection with aquariculture; he will always be able to make observations at first hand, thus enlarging his practical knowledge, and soon both will become convinced that microscopy and aquarian nature-study go hand in hand and are but two ways leading to the same goal.

A noise like ready money will wake a man when an alarm clock fails.

A "Tin Can" Aquarium

HARRY W. BALLEISEN

Modesto, in a past number of *Aquatic Life,* tells us how we may make a very attractive aquarium from a cigar box. Now some aquarists criticize wood as material for a tank, and for them we present an improvisation that has surely greater strength and durability, even though it may not lend itself to a finish equal to wood. We refer to a tank made from a square or rectangular can such as



that in which varnish is sold. In the tank illustrated in course of construction, the top of the can, showing the handle and spout, has not been removed in that the idea may be better grasped.

The first step is to punch four holes, about an eighth of an inch in diameter, in the corners of the five sides of the can, from which panels are to be removed. With a scratch-awl and rule draw lines connecting the holes, thus indicating the panels. The position of the holes will, of course, dictate the width of the frame.

Take a sharp can-opener, and it is essential that it be sharp to make a smooth edge, and cut out carefully the largest panel—that which will be the front or top of the aquarium, then the two narrower ones, the top and bottom of the can, which will form the ends of the tank, being left to the last. In so proceeding

the smaller sides act as supports, while the larger are being cut; for much the same reason all the holes should be punched before proceeding to remove the panels. The handle of the can and the spout should be removed with a soldering iron. Should the spout encroach on the part reserved as the frame, a piece of tin may be soldered on the inside.

We have now a frame for an aquarium, but the edges of the angles are sharp. If one has the facilities, and provision has been made in laying out the width of the angles, the edges may be turned over and crimped on the inside. The same effect can be secured by cutting strips of tin a quarter inch wide and of the proper lengths. Each strip is then bent lengthwise along a line drawn down the middle, which can be done in a vise if the worker does not have access to a sheet metal brake. The bent strips are then crimped over the sharp edges and finally soldered. It will be noted that we have not removed that side of the can which will become the bottom of the aquarium.

For a base select a piece of good wood one inch thick, and one and one-half inches wider and longer than the bottom of the frame, which will allow an extension of three-quarters of an inch on all sides. Fasten the frame to the wood base with four nails, one in each corner; more may be used if the frame has warped or it otherwise seems desirable.

In setting the glass, insert the bottom first, placing the piece on a bed of cement laid around the edge in sufficient quantity to insure adequate support on all sides; then insert the long sides and the ends last. When the cement has set the tank may be painted as desired and placed in service when dry.

Aquaria of this sort are entirely suitable for the breeding of many small tropical fishes and for photographing, though for the latter use the glass on the side exposed to the camera should be white and of the best quality.

May Pointers

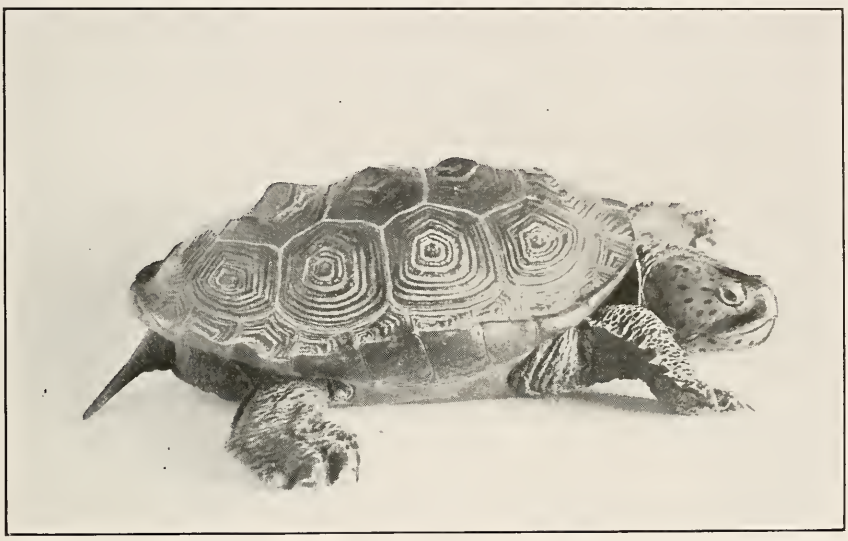
Spring is well advanced and plants, both in the home aquarium and outdoors, are growing rapidly. In the ponds round about we find many pretty plants that are seasonably desirable, but before adding them to our collection they should be carefully washed and also sterilized in a solution of permanganate of potash. To force growth, plants may be set in shallow pots in rich loamy soil topped with gravel or sand, and then submerged in the aquarium.

If a few days after an aquarium has been set a scum appears on the surface of the water (bacteria), it may be taken as evidence of the decay of vegetable matter, perhaps the plants or portions of them that have been injured in handling. The roots may be found blackened and giving off an offensive odor. If these plants are allowed to float loose at the surface, in a sunny situation, new roots will be produced, when the plants may then be safely placed in position at the bottom.

Daphnia and kindred crustaceans are now quite plentiful. The catch should be poured into an aquarium reserved for the purpose, that enemies of fishes may be removed and none but the desired "fleas" transferred to the aquaria containing fishes and fry. If an aerating device is in use, it may well be extended to the Daphnia tank. Sediment syphoned from permanent tanks will contain much that is desirable as food for the crustaceans.—*Chicago Aquarium Society.*

Observations on the Chelonians of North America. X.

DR. R. W. SHUFELDT, C. M. Z. S.



Diamond-back Terrapin **Malacoclemmys palustris**

Various classifiers of our terrapins have associated in the genus *Malacoclemmys* a number of species to be found in this country, which structurally, in several instances, have very little to do with each other. In the present series of articles, Lesueur's Terrapin (*M. lesueurii*) has already been figured and briefly described. In habits, distribution, and in its anatomy, this species is entirely different from the subject of the present account, which is the widely known Diamond-back Terrapin (*M. palustris*). This is likewise more or less true of the other representatives of the genus, as the Geographic Terrapin (*M. geographica*); the Kohn's Terrapin (*M. kohnii*); Baur's Terrapin (*M. pulchra*), and the Ocellated Terrapin (*M. oculifera*).

It is not my intention to present any of these differences in this article, apart from the fact that the Diamond-back is the species which, in its morphology, distribution and habits, departs more widely from what various herpetologists have given as the generic distinctions with respect to other groups of terrapins.

It would seem that the Diamond-back has been so named for the reason that it has nothing on its back that in any way resembles a diamond. The usual thir-

teen dorsal scutes of the carapace are rough, each composed of several-sided shields formed like low pyramids, rising step-fashion, the steps defined by grooves (see figure). These scutes are hexagonal for the medium row, and irregularly pentagonal for the surrounding ones. The center of each shield in the median row develops a blunt-pointed tubercle, the whole line of them forming the so-called "keel," which, on side view, has the appearance of a serrated ridge. These serrations vary greatly in different individuals, being very low in some and conspicuous in others. Age may have something to do with this, they becoming more or less rubbed down in very old specimens.

In the matter of coloration, this terrapin, as in the case of other terrapins, varies considerably. Very young specimens are extremely beautiful, being of a pale whitish gray, with dark concentric markings. An old female at hand as I write, has the carapace above of a dark olive brown, while the plastron is of a yellowish olive, with the central portion and heavy radiations from it, of an earth brown. The limbs are black, the hinder pair being webbed and very large. The head is of a beautiful olive gray, dotted over with black spots. There is a broad, black maxillary stripe below either eye, and a similar median one on the top of the head. A peculiar character is seen in the curling-up of the free margin of the carapace, especially posteriorly (see figure).

Female Diamond-backs are considerably larger than the males, and have proportionately much larger heads and longer tails. A big one may have a total length of 20 centimeters, and weigh a couple of pounds.

This species ranges from Texas to the coasts of New England, as far north as Massachusetts, being a salt-water species, inhabiting the marshes along the coast, sometimes migrating up the larger rivers. They have been taken up the Hudson as far as Newburgh; but this does not happen very often.

One of the fullest accounts of this species, giving descriptions, distribution, habits, economic value, and many other particulars, is the work of Dr. R. E. Coker, entitled "The Cultivation of the Diamond-back Terrapin." (Bull. No. 14, the North Carolina Geol. Surv., 1906; illustrated.)

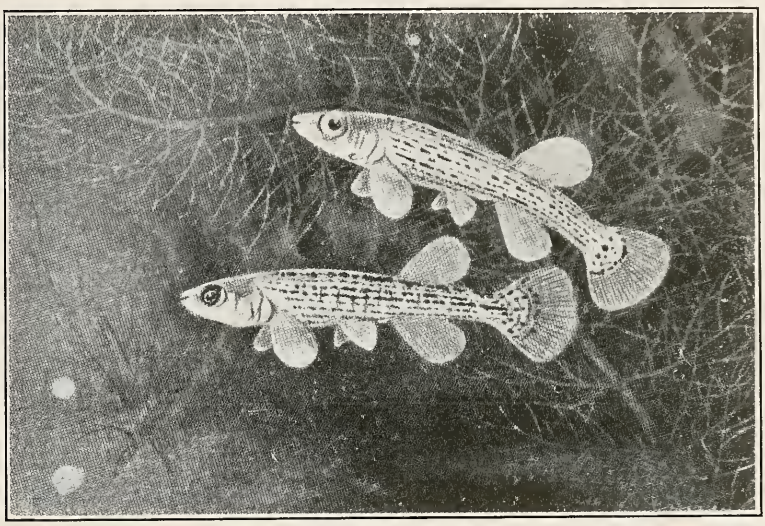
This terrapin in nature subsists principally upon the leaves of certain aquatic plants, small crustaceans, snails. Occasionally it may capture small fishes, while in a captive state we may add to its diet chopped meat, oysters and clams. The cut of the Diamond-back here shown is a reproduction of one of the writer's own photographs of a specimen obtained in Center Market in Washington, D. C. The stand where it was borrowed had some one hundred of these reptiles in a big barrel, and they were selling at from $3 to $5 apiece, the market men purchasing them for $2 per head. They were in excellent condition, and apparently none the worse for being kept as described.

Like other terrapins, this species feeds under water, and lays white eggs. Doctor Coker well describes their nests and breeding habits. The young of the Diamond-back terrapin would probably thrive in aquaria, if kept under proper conditions of temperature, food, and salinity of the water, for they will very soon die in fresh water. Common table salt will answer to produce the correct saline condition.

Rainbow chasers get at least a run for their money. Gladness is appreciated only by those who know what sadness is.

The Stud Fishes

CHARLES J. SAWYER



Fundulus catenatus **Stud Fish**

More than once I have heard aquarists growling about changes in the scientific names of fishes, and it has been amusing to listen to the arguments. Maledictions have been heaped on the heads of ichthyologists who have dared relegate well established names to the background. The object of a change is to place a fish with other species believed to be its nearest of kin, or to bring into usage a name found to antedate the one by which it may be commonly known, the latter becoming a synonym. There are other reasons why a name must go, such as preoccupation in the new genus, and mere appropriateness never saves it, but all such changes follow definite rules agreed to by zoologists and no one is a law unto himself as some seem to think. But among systematists it must be admitted that we have radicals and conservatives. The two groups are not in accord as to what constitutes a species, nor do they agree as to the limits of a genus, that is, how far a form may depart in characteristics from the type and still be retained. The radical will split the genus and set up the divergent species in a new one. It is in such interpretations that the zoologist is guided by the results of his researches, or influenced by personal opinion, rather than by a

law, but even then he must retain the oldest specific name. Not all splits and transfers, however, can be termed radical and assigned as the work of those who cannot let well enough alone.

Going back over a period of a century we may find many divergent species placed at one time or another in a single genus that are obviously not sufficiently related to be so intimately associated. The genus *Poecilia* may be cited as an example. It was described in 1801 by Bloch and Schneider for the species *vivipara,* which we thus know as the "type" of the genus. Others described fishes and placed them here. Then at various times more careful study, made possible perhaps by additional specimens, depleted the genus and today it is comparatively small. *Poecilia olivacea* we now know as *"Fundulus notatus*; *Poecilia sphenops* is *Mollienisia sphenops; Poecilia catenata* is *Fundulus catenatus,* and so on. The rambling of a species from one position to another is just as exasperating to the systematist as to the aquarist, perhaps more so, but so long as species are described and assigned to genera wherein their status is questionable, whatever the opinion of their sponsors, just so long will there be others to switch them elsewhere. It will ever be thus. I believe it was Professor Cope who rightly transferred Storer's *catenata* from *Poecilia* to *Fundulus,* but it wouldn't surprise me if someone restored Jordan's *Xenisma* for it and *stellifer.*

Leaving nomenclature and its tangles, why haven't aquarists acquired the stud fishes? Both should be highly desirable. Eight or nine years ago the enterprising Germans had *Fundulus catenatus,* but apparently did nothing with it. It's a handsome fellow. The male is greenish or bluish, with an orange spot on each scale forming somewhat chain-like lines; hence the name, catenatus, meaning chained. The female is not quite as attractive, the spots being brown instead of orange. It is found in the Tennessee and Cumberland rivers, and in streams in the Ozarks.

Even more desirable is the smaller *F. stellifer.* This is a brilliant species. The body is blue above and silvery below, the male having orange spots irregularly distributed over the body. On the female the spots are olive-brown and smaller. This species comes from Georgia.

Do you remember the slogan of a few years ago: "See America First?" Why not, then, "Study American Fishes First?"

The Microscopical Society

During the past winter a group of microscopists have met at intervals for the discussion of matters of interest, especially with regard to technique. Talks have been given on the principles of microscopy (Frank J. Keeley); methods of illumination, demonstrated with twenty-five microscopes and objects mounted in various media (Mr. Keeley); photomicrography (Dr. Thomas S. Stewart); mounting methods, with demonstration of slide microtome (Dr. Stewart); cell making and mounting objects dry (W. A. Poyser).

The group has now formally organized as The Philadelphia Microscopical Society. Meetings will be held, except during July and August, on the fourth Thursday of the month, at 8 P. M., in laboratory of the Wagner Institute of Science, Seventeenth and Montgomery avenue. The meetings are open to the public. Microscopists desiring to become members may obtain further information by addressing the secretary, W. A. Poyser, 207 South Thirty-seventh street. The necessary qualification is an interest in microscopy; the dues are purely nominal.

The Guide-Book To The New York Aquarium

DR. R. W. SHUFELDT

Epinephelus striatus **Nassau Grouper**

It will be good news to many who are familiar with the present status and the remarkable growth of *The New York Aquarium*, that it has at last been enabled to issue the desideratum of all such institutions, an illustrated "Guide Book." This has come about as one of the many achievements of Dr. Charles H. Townsend, the present director of this most interesting centre of instruction for all who love to observe and study aquatic life as it is here exhibited in the Old Castle Garden at the foot of Broadway in the world's most populous city.

Those who now visit the aquarium can do so with the assurance that their studies of the many forms on exhibition in the great tanks and pools there can be more advantageously undertaken through the aid of the above referred to Guide Book—not only this, for the little volume may be taken home for future reference to revive the memory as to what the visitor observed there. This treatise—for it falls short of nothing else, is a small octavo hand book bound in boards, and having nearly 200 pages of text matter, and many illustrations of fish and other denizens of the ocean and our inland waters. There are also excellent figures of inside and outside views of the building itself.

It is truly wonderful what a host of living forms of a great variety of species have been brought together in this building under the skillful management and foresight of Dr. Townsend, not to mention the admirable methods that have been inaugurated to properly exhibit them.

In a brief notice like the present one it will be quite out of the question to set forth even a small part of the mass of information that this modest appearing

Guide Book contains,—for its index alone occupies upwards of six pages of fine print. As a preface we have an account of the "Equipment and Methods" of the aquarium, followed by an elaborate series of descriptions devoted primarily to "The Collection," and followed by brief histories of the fishes and other forms to be seen in the tanks, pools and small aquaria there found to contain them.

The reproductions or cuts are all from photographs from life, the latter having been made by some of our most distinguished photographers of living forms in nature and in captivity.

How well some of the fish have been taken may be judged from the cut of the Nassau Grouper, illustrating this brief notice, it having been furnished the writer by Dr. Townsend to illustrate what is here set forth, which will have fully attained its object should it bring such information as the writer trust it will, to many a student of our aquatic forms, a large proportion of which can be studied in no other way.

Notes and News

At the 610th regular meeting of the Biological Society of Washington, held in the assembly hall of the Cosmos Club, on Saturday evening, April 3d, Dr. R. W. Shufeldt presented a paper entitled, "Observations on the Cervical Region of the Spine in Chelonians," which was illustrated by lantern slides.

The Hudson County Aquarium Society, founded less than two years ago, has a membership of one hundred. Meetings are held on the fourth Thursday in the Jersey City Public Library, Jersey City, N. J. The officers: *President,* Harvey A. Van Cott; *vice-president,* James H. McConnell; *treasurer,* Frank W. Hedden; *recording secretary,* William A. Whitten; *financial secretary,* Mrs. F. W. Hedden; *corresponding secretary,* Mrs. M. Kiekert, 107 Linden avenue, Jersey City, N. J.

The largest aquarium south of Philadelphia has been established at Miami, Florida. Fifty large exhibition tanks have been installed, one being the largest in America and the second largest in the world. There are said to be about five hundred species of fishes about Miami, and investigations will be started to ascertain the food values of each, not to mention life-history and habitat studies. Apparently the work will in the main be confined to saltwater species.

It is always encouraging when a business house finds it necessary to move to larger quarters. Success in business usually follows a strict application of the golden rule. So it is not surprising to now find The Aquarium Stock Company in a finer store at 174 Chambers street, better able than ever to supply the needs of the aquarist. We note that they can now supply imported dried daphne for which many have inquired during the past few years.

Dr. Albert Hazen Wright, of Cornell University, informs the editor that he collected many specimens of *Lucania ommata* in Okefinokee Swamp Georgia, in 1912.

"The verra best music I effer heard whateffer was doun at Jamie McLaughlan's," said the piper. "There wass fifteen of us pipers in the wee back parlour, all playin' different chunes. I thocht I was floatin' in heevin."—*Tit Bits.*

A man is worth what his ideas are worth.

Statement of the Ownership, Management, Circulation, Etc., Required by the Act of Congress of August 24, 1912, of Aquatic Life, published monthly at Philadelphia, Pennsylvania, for April 1, 1920.

State of Pennsylvania, County of Philadelphia. } ss:

Before me, a notary public in and for the State and County aforesaid, personally appeared W. A. Poyser, who, having been duly sworn according to law, deposes and says that he is the editor of AQUATIC LIFE, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, to wit:

That the names and addresses of the publisher, editor, managing editor and business managers are:

Publisher—Joseph E. Bausman, 542 East Girard Avenue, Philadelphia, Pa.

Editor—W. A. Poyser, 207 South Thirty-seventh Street, Philadelphia, Pa.

Managing Editor—None.

Business Managers—None.

That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent. or more of the total amount of stock.)

Owners—Joseph E. Bausman, 542 East Girard Avenue, Philadelphia, Pa.; W. A. Poyser, 207 South Thirty-seventh Street, Philadelphia, Pa.

That the known bondholders, mortgagees and other security holders, owning or holding 1 per cent. or more of the total amount of bonds, mortgages, or other securities are: *None.*

W. A. POYSER, *Editor.*

Sworn to and subscribed before me this 30th day of March, 1920.

(Seal) A. D. DEWEES.

My commission expires February 19, 1921.

Aquatic Life, 1920

JANUARY, 1920. Betta rubra (*Heede*); Observations on the Chelonians of North America, Part VI (*Shufeldt*); Beef Heart and Beef Liver for Young Fishes; Notes on Mosquito Larvae (*Hale*); Lucania ommata (extension of range); Habits of Fundulus nottii and Heterandria formosa; Linseed meal cause of disease among trout; South Australian Aquarium Society, Passaic Aquarium Society, the Redfield Theory, etc.

FEBRUARY. Goldfish Foods and Feeding as Practiced in Japan (*Nakashima*); Observations on the Chelonians of North America, Part VII (*Shufeldt*); The Mosquito (*Hale*); Luciocephalus pulcher (*Heede*); Maintaining an Aquarium (*Trell*); An Easily Constructed Heated Aquarium (*Finckh*); Roosevelt Wild Life Forest Experiment Station, February Pointers, etc.

MARCH. The Australian Congolly (*Hale*); Observations on the Chelonians of North America, Part VIII (*Shufeldt*); Ichthyopthirius multifilius (*Webber*); Rivulus strigatus (*Brind*); An Odd Trunkfish (*Hubbs*); North Carolina Notes (*Carlton*); Society news.

APRIL. Mastacembelus pancalus (*MacMorris*); A New Treatment to Eliminate Ichthyophthirius (*Hauthaway*); Observations on the Chelonians of North America, Part IX (*Shufeldt*); Notes on Haplochilus lineatus (*Sawyer*); The Artificial Production of Albinism (*Waite*); A Metal Net for Larval Fishes (*Balleisen*); The "Balanced" Aquarium—A Question and an Experiment (*Powers*); Venus's Fly Trap, Notes and News.

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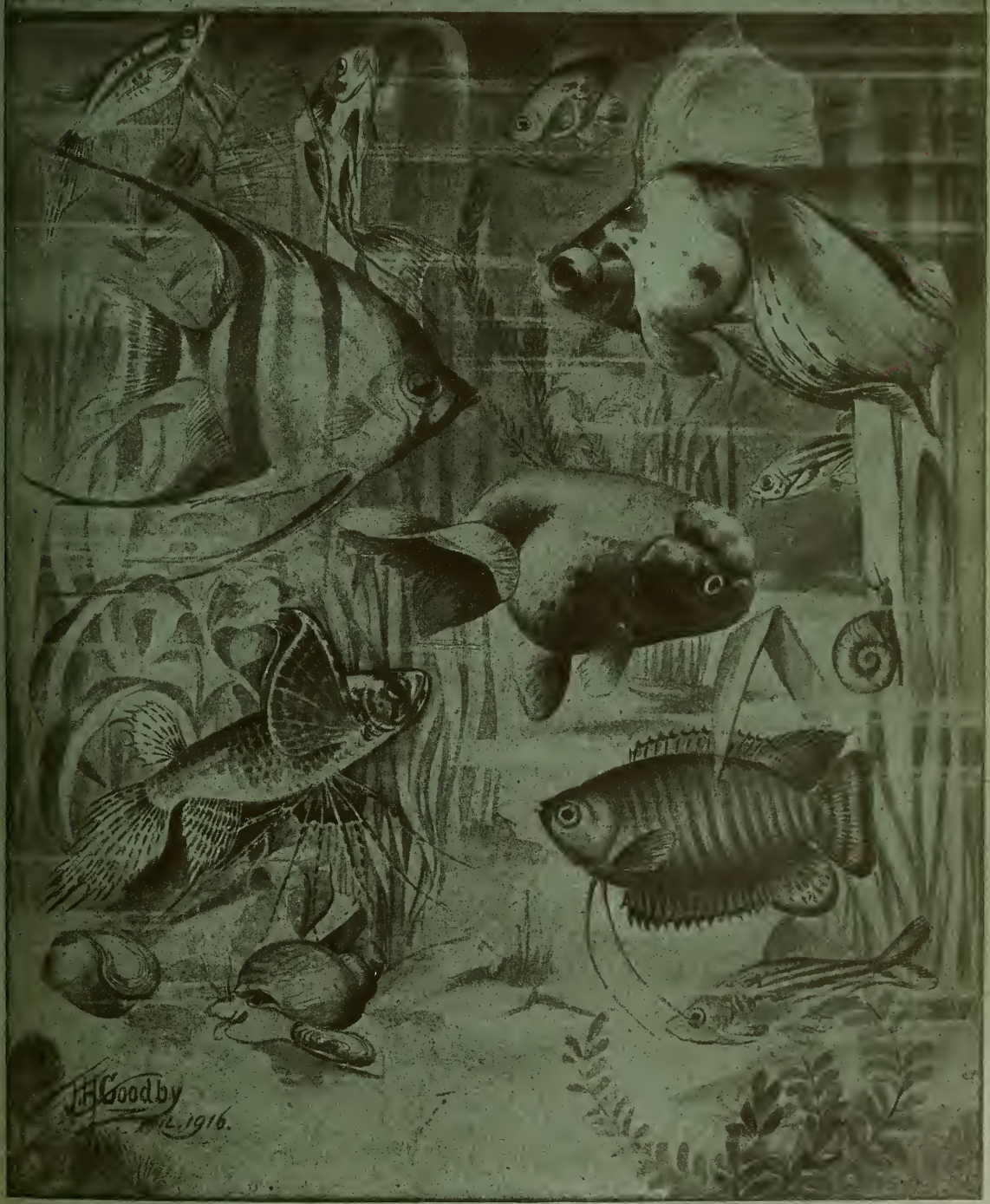

Aquatic Life

Vol. V June, 1920 No. 6

An international monthly magazine devoted to the study, care and breeding of fishes and other animals and plants in the home aquarium and terrarium.

W. A. POYSER ..... EDITOR
JOSEPH E. BAUSMAN ..... PUBLISHER
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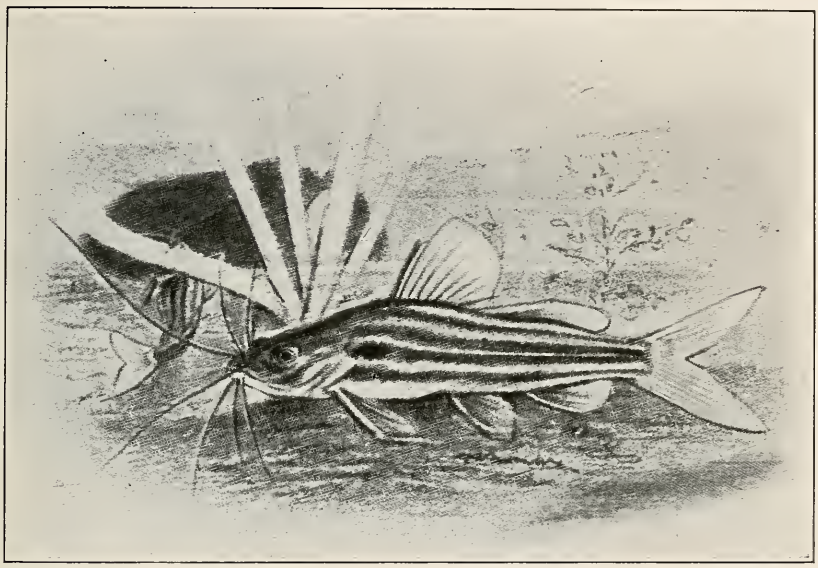
Macrones vittatus

PEYTON MacMORRIS, M. D.



Macrones vittatus **The Fiddler**

The striped catfish of India, *Macrones vittatus*, was brought to the United States about fifteen years ago, but did not seem to long persist in collections, perhaps because in those days particular attention was not directed toward maintaining adequate warmth for specimens from tropical countries.

In the aquarium it is a graceful fish, more lively and rapid than those other catfishes, native and foreign, with which most of us are familiar, and decidedly more pugnacious. Surgeon Day, who studied it in confinement more than forty years ago, says: "This fish is termed 'the fiddler' in Mysore. I touched one which was on the wet ground, at which it appeared to become very irate, erecting its dorsal fin and making a noise resembling the buzzing of a bee, evidently a sign of anger. Having put some small carp into an aquarium containing one of these fishes it rushed at a small example, seized it by the middle of its back and shook it like a dog killing a rat, at this time its barbels were stiffened out laterally like a cat's whiskers." This is in direct opposition to Eggling's

remark that "This handsome fish is hardy and lives well in the aquarium, where it can be kept together with other fishes." So in view of conflicting opinions it will be well, when next it comes to us from India, to first experiment by associating it with specimens we can best afford to lose!

The fiddler is quite an attractively marked catfish, differing much in this respect from our native species which can boast of little ornamentation. Dark bands run lengthwise along each side of the body, with intensity varying with the individual. These alternate with golden stripes, the central one showing a pearly lustre. On the shoulder, just back of the opercle, is a velvety black spot, often quite pronounced. The fins are dusky or grayish, with the tips somewhat dark. If the barbels have a sensory function, this fish is well provided, having eight, the longest pair reaching the anal fin.

Though Day's experience would seem to indicate this fish as carnivorous, others have found it to eat dry prepared foods and such substances as are commonly given aquarium fishes of like size. It reaches a length of eight inches.

Appropriate Names

Dr. Lucas says, "Time was, long ago, to be sure, when the names of people were descriptive; but Black, White, Strong, Smith and Carpenter have ceased to mean anything," etc.

I was therefore much interested, in going through our aquarium library recently, to find at least a dozen instances where there seemed to be a correlation between the name of a writer and the subject of his interest.

The names of some of the students of aquatic life seem singularly appropriate. Dr. Theodore Gill was one of the most noted ichthyologists. Others who have added to the knowledge of fishes are M. C. Marsh, William P. Seal, and Alvin Seale, while W. H. Fry discourses on "Practical Fish Breeding." Mr. R. H. Pond has written about aquatic plants. Dr. H. G. Barnacle describes shells, and Captain Barnacle writes on whales. Walter K. Fisher is interested in starfishes and sea birds. P. A. Fish studied the walrus, and H. A. Smeltz made observations on the oysters. Mr. Pope and Mr. Lord each contributed to the biology of Devil's Lake (North Dakota.)—Ida M. Mellen, *The New York Aquarium.*

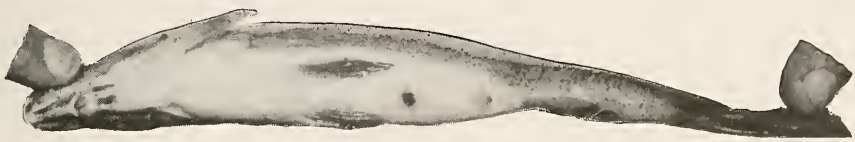
South Australian Society

On Saturday, February 28th, the members of the South Australian Aquarium Society visited the neighborhood of Aldgate, under the leadership of Dr. Robert Pulleine. The afternoon was devoted to collecting specimens for the exhibit of the society at the All-Australian Peace Exhibition. Dr. Pulleine conducted the party to a large pool, which was found to contain a great variety of aquatic life. Many of the so-called native trout (*Galaxias olibus*) were obtained, as well as a considerable number of aquatic insects. Among the last-named two kinds of "fish killers," Nepa and Ranatra, were of particular interest. These insects grasp their prey with the strong forelegs, plunging the formidable beak into the victim to suck the juices from its body.

The president, Mr. Edgar R. Waite, F. L. S., recently recorded a curious fact concerning the Mexican Axolotl. These batrachians sometimes develop a disease causing them to become bloated, infected individuals floating at the surface of the water until death. Some of the frog tadpoles in the pool were found to be suffering from a similar condition in a marked degree.—H. M. Hale, *Honorary Secretary.*

An Interesting Abnormality

LESLIE TASCHE
Zoological Laboratory, University of Wisconsin



Yellow Perch, Perca flavesens, Showing Two Ani
Photograph by A. S. Pearse

The abnormal has always been interesting. Normal structure, although interesting from a purely scientific standpoint, fails to attract the attention of the average man. It is too commonplace. The abnormal on the contrary is made conspicuous by its noticeable dissimilarity to the normal. People since the beginning of time have preserved and exhibited every variety of unnatural forms, "Freaks of Nature," as they are called, and have wondered at their origin and development. During the early periods of civilization there was a great deal of superstition connected with many of these malformations. Many forms were feared and great reverence was extended to them, because they were thought to be the work of spirits, others were used as charms for luck and for medicinal purposes, but most of them were kept merely because they were different. As civilization advanced, most of these superstitious views were discredited and men began to examine them scientifically as to origin and development; but to this day people of many classes still believe in the supernatural powers of some of the types and everybody is more or less interested in any striking malformation that is put on exhibition. Scientific investigations have shown that these forms are the result of unnatural embryological development or the product of pathological changes in the growth of parts of the body in respect to size, shape, position, or number.

An example of one of these "Freaks of Nature" is found in a yellow perch, *Perca flavesens* (Mitchill): the presence of two ani situated exactly on the median line. The fish was caught on November 23, 1917, in Lake Mendota near Madison, Wisconsin. It was normal in size, measuring 16.1 centimeters in length, and apparently in good condition. The presence of two ani came to the notice of Professor A. S. Pearse while he was preparing to dissect the fish in order to determine what it had eaten, and he took the accompanying photograph.

The presence of two ani in the Class Pisces is not a very rare thing by any means, but such openings are usually paired; one to the right and one to the left of the median line, usually at right

angles to it and usually at a relatively short distance apart. The present specimen on the contrary does not possess this arrangement. Both ani are on the median line and are 48 millimeters apart. The posterior anus is located at the place where the normal anus should perforate the body wall, but it is peculiar in that it is the non-functional one of the two. The anterior anus, although 48 millimeters out of its normal position, is the functional one. The posterior anus has a strip of intestine leading inward which ends blindly about 4 centimeters within the body cavity. It is smaller in diameter than the functional intestine and practically without a lumen. The functional intestine, leading to the anterior anus, is somewhat shorter than that in a normal perch.

No attempt will be made to explain how this peculiar structure developed, as a competent pathologist and an embryologist declined to commit themselves.

The Diatomaceae of Philadelphia and Vicinity, by Charles S. Boyer, is a description of the diatoms of the region within a radius of one hundred miles, including the forms found in the blue clay of the ancient Delaware River bed, which underlies a portion of the city. The work is profusely illustrated with forty plates, containing more than seven hundred drawings by the author. All the species recorded from the region, including freshwater, brackish and marine forms, are shown.

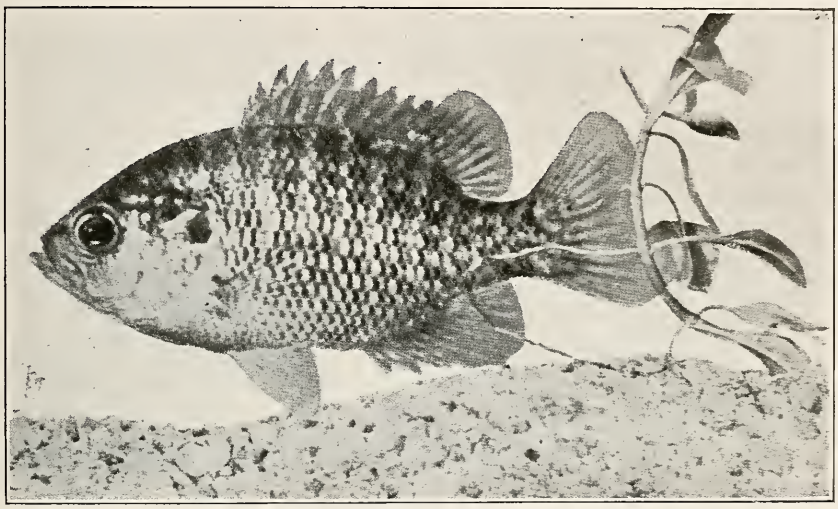
Mr. Boyer's work removes the multitude of difficulties that have heretofore beset the microscopist who would study the forms of the Middle Atlantic States. The literature of the subject is scattered through the journals of science over many years; major works are rare and expensive and none so satisfactorily illustrated. The characters distinguishing species of diatoms are often so subtle that no amount of word painting can convey the proper conception, and it is only when a description is supplemented by an adequate drawing that a form can be identified with certainty. And if this opinion is correct, Mr. Boyer has left little to be desired.

The microscopist who passes the diatoms neglects the plants that play a not often sufficiently emphasized part in the economy of nature. Before the warmth of spring has awakened the higher plants, the diatoms are abroad, multiplying, liberating oxygen in the process of photosynthesis, and preparing the waters for the coming wave of animal life. How great a factor they have been in past ages is evidenced by vast fossil deposits in all parts of the world. Nor is their role in the aquarium to be overlooked. The brown film on the glass is macroscopic proof of the presence of untold numbers. In the absence of the higher plants the burden of breaking up carbonic acid is thrust upon them. The "practical man" may be interested in the theory, scarcely tenable, however, that this minute plant is responsible for certain oil fields. Each individual at a stage in its life contains a minute globule of oil, and deaths in great numbers as indicated by the extent of the deposits, permitted it to accumulate. The theory does not seem to hold for several reasons. When the bed was being formed, water covered the area. The valves of the diatom, when death overtakes it, separate. It seems reasonable that the globule of oil would rise to the surface and be dispersed, and as such beds are formed very slowly, the quantity would not be marked.

It is easier to see through some fat people than through some thin ones.

The Blue-spotted Sunfish

CHARLES J. SAWYER



Blue-spotted Sunfish **Apomotis cyanellus**

The most beautiful aquarium I ever saw was in Chicago, ten years ago, and contained naught but a collection of sunfishes. The tank was so situated that the light came over the shoulder of the observer, giving an impression of the iridescent colors of the fishes to be obtained in no other way. It is in this particular that most aquaria fail, being usually situated close to a window, the near side of the fishes being shown almost solely by reflected light. Only by direct light is the full play of colors evident.

Prominent in the collection was the little Blue-spot, a sunfish that is quite common in the Middle West. Forbes and Richardson (*Fishes of Illinois*), remark that "this beautiful little sunfish is much the commonest of its family in our smaller streams, and is, indeed, often almost the sole sunfish product of the net in prairie creeks." It lends itself well to life in the home aquarium and lives long. It is not a particularly pugnacious species, but nevertheless it will "run the show" if large enough to awe the more docile kinds, so in a sunfish tank it is well to associate specimens similar in size. But if the Blue-spot does bully the others it will not do them unto death as is so characteristic of the cichlids.

Throughout the summer the owner of the collection mentioned fed his pets on flies, which he caught by placing wire-net traps in likely situations. These were taken with avidity. The lack of fear shown as they snapped them from the fingers made one think that at least the first step had been taken in making them tame. Sometimes the earthworm was on the bill-of-fare, and during the winter dry foods and scraped raw beef kept them in the pink of condition. The owner considered this tank the most interesting of a number in his conservatory, and from my experiences with the sunfishes I can understand his preference.

The general body-color of the Blue-spot is olivaceous, darkest above and becoming yellowish or coppery below. Each scale has a blue spot and a golden edge, giving an impression of stripes; cheeks with blue markings, the opercular small and dark with yellowish edging. The fins are dusky, with green and blue marking; dorsal usually with a dark spot; anal edged with yellow or orange. Considerable variation may be found in the intensity of the colors, and at times the vertical fins of highly colored individuals may have a strong suggestion of yellow.

On and after July 1, the American Railway Express Co. will keep a duplicate copy of every receipt it issues when receiving business from shippers. The duplicates will be retained by the express company for the purposes of record and reference, and will be held at the shipping office.

Shippers who have been accustomed to prepare their own receipts or who have their own forms, have been requested to make provision for supplying duplicates of such receipts to the express driver or receiving clerk who signs them.

As a matter of convenience to shippers, the regular receipt forms of the express carrier will be revised to permit their use in duplicate form.

In cases where prepaid receipts are now being issued in duplicate, the extra copy being used as a record of charges paid, a third copy will be required under the new system, and in such instances prepaid receipts will be issued in triplicate.

One of the objects of the new system is to bring about better protection for and methods of recording the *movement of express packages in transit,* a matter of great interest to aquarists.

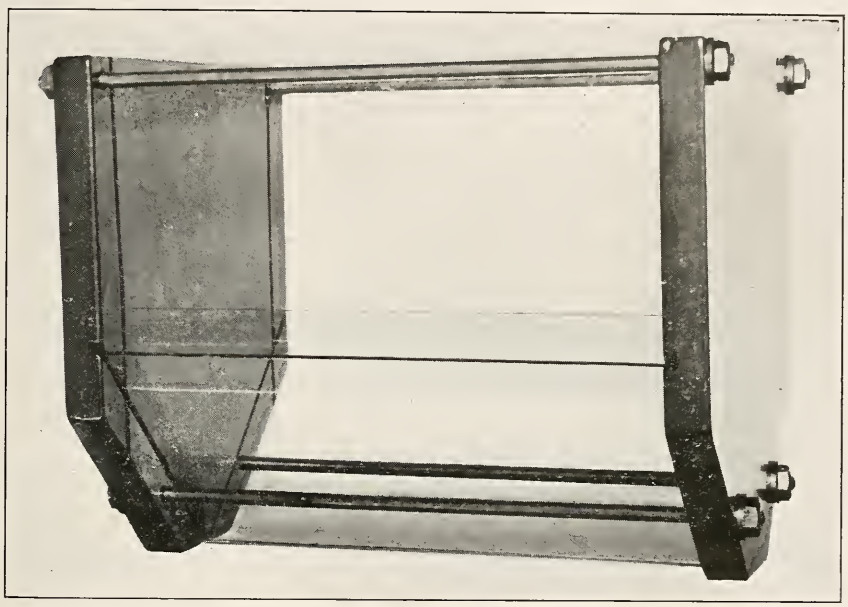
At the regular meeting of The Naturalists' Society of New South Wales, Sydney, held on April 6th, in the assembly room of the Department of Education, Mr. H. E. Finckh delivered a lecture on "The Aquarium, Its History and Management," which was illustrated by lantern slides. On April 10th the members spent "An Afternoon Among the Fishes," with Mr. Finckh, who has been exceptionally successful in breeding native and exotic fishes under natural conditions in his many picturesque ponds. An illustrated article describing "The Ponds of Hermes," as the estate of Mr. Finckh is called, is in hand for publication in an early number of *Aquatic Life.*

The regular meeting of The Philadelphia Microscopical Society was held on May 27th. The constitution was adopted and the following officers elected: *President,* Hugh F. Munro; *vice-presidents,* L. M. Dorsey and Louis H. Koch; *secretary and treasurer,* W. A. Poyser; *Trustees,* Dr. Thomas S. Stewart and E. L. Gayhart.

Mr. Koch talked on the application of the microscope in mineralogy, exhibiting specimens from his collection and explaining the methods of preparation and study.

Breeding Viviparous Poeciliids

HARRY W. BALLEISEN



The prevalent method in breeding livebearing fishes is to place the female in a small, thickly planted aquarium. At birth the young drop to the bottom and later rise to the surface seeking concealment among the plants about the surface. The disposition of the parent fish seems to differ with the species. Some give little attention to the fry if well fed, permitting them to grow up in the same tank without danger, while others have been noted to devour the new-born fry as fast as expelled. Probably in all cases a number are lost, depending upon whether the female has been well fed during confinement. Losses are apt to be greater in a small aquarium than in a large one.

During the past ten or fifteen years several styles of "breeding compartments" have been proposed and have possessed merit. The best seems to be the all-glass slot-in-the-bottom cage, which is designed to hang in the water from the side of the tank. Its disadvantage lay in its small size, but as it is not now obtainable we need not go further. On the same principle is the compartment about to be described, which has the great advantage of being

"home made" from materials easily secured. It is apparent that its size can be varied to meet individual preference.

For the one illustrated we need two pieces of poplar, or other good wood, ½ thick by 5½ wide, and 6⅛ inches long; four pieces of ordinary window glass, 4 by 7 inches; four brass rods, diameter 3-16 inches, length 8¼ inches, threaded three-fourths of an inch on each end, and furnished with washers and nuts.

The first step is to lay out the wood ends. With a saw cut off the two lower corners of the block. To determine the position of the cut, measure two inches from the corner both ways, and draw a line connecting the two points. Next, with a rule, define the positions to be occupied by the grooves for the glass. These as illustrated are half an inch from the edges. Proceeding carefully, cut the grooves with your saw to a depth of about an eighth inch; then finish with a chisel or knife. Note that it is essential that both ends be alike. Clamp or hold the two ends one upon the other, and bore the holes for the bolts. Use a drill a trifle larger than the rod. The upper pair of holes are one-fourth inch in from the top and side, the lower ones one inch from the bottom. Give the ends a coat of wood filler and follow with three coats of best waterproof varnish. Allow twenty-four hours for each coat to harden.

The next and final step is to assemble the contraption. Try the pieces of glass, one after the other, in the grooves. They should fit nicely. Under no circumstances should they be forced; enlarge the groove if necessary. Put washers and nuts on one end of the rods and insert through the block; lay it on a table, rods projecting upward. Assistance will now be needed to hold the glasses in place while other wood end is being inserted. Draw up the nuts using the fingers only and the compartment is ready for trial. If the nuts are drawn up too tight, as with a wrench, the glass is very apt to crack.

When in use the compartment should project about half an inch above the surface of the water in the aquarium, and several means may be used to this end. Two hooks may be used, somewhat S-shaped, and the cage suspended from the edge of the tank, the hooks running under the upper brass rod. Or it may be hung from two rods placed across the top of the tank and running through two screw-eyes inserted in the wooden ends. If it seems preferable to float the compartment, buoyancy can be added by fastening strips of wood across each end, or by tying corks to the lower rods, the length of the strings or wire attached to the corks, as well as their size, determining the height in the water.

The use of the cage or compartment necessitates an aquarium from which all fishes have been removed, otherwise its very object would be defeated. If one has a large tank available, and a number of females approaching delivery, all could be placed in separate compartments in the same aquarium. A few days' difference in the dates of the arrivals from the several females would not be a matter of moment, and the fry could be reared together. Various species could be associated. For average small species the two pieces of glass forming the V-shaped bottom of the compartment should be adjusted to leave a slot about an eighth-inch wide. If it seems desirable the width of the slot can be increased by changing the position of the glass.

It's the hard jobs that make us.

Bufo halophilus

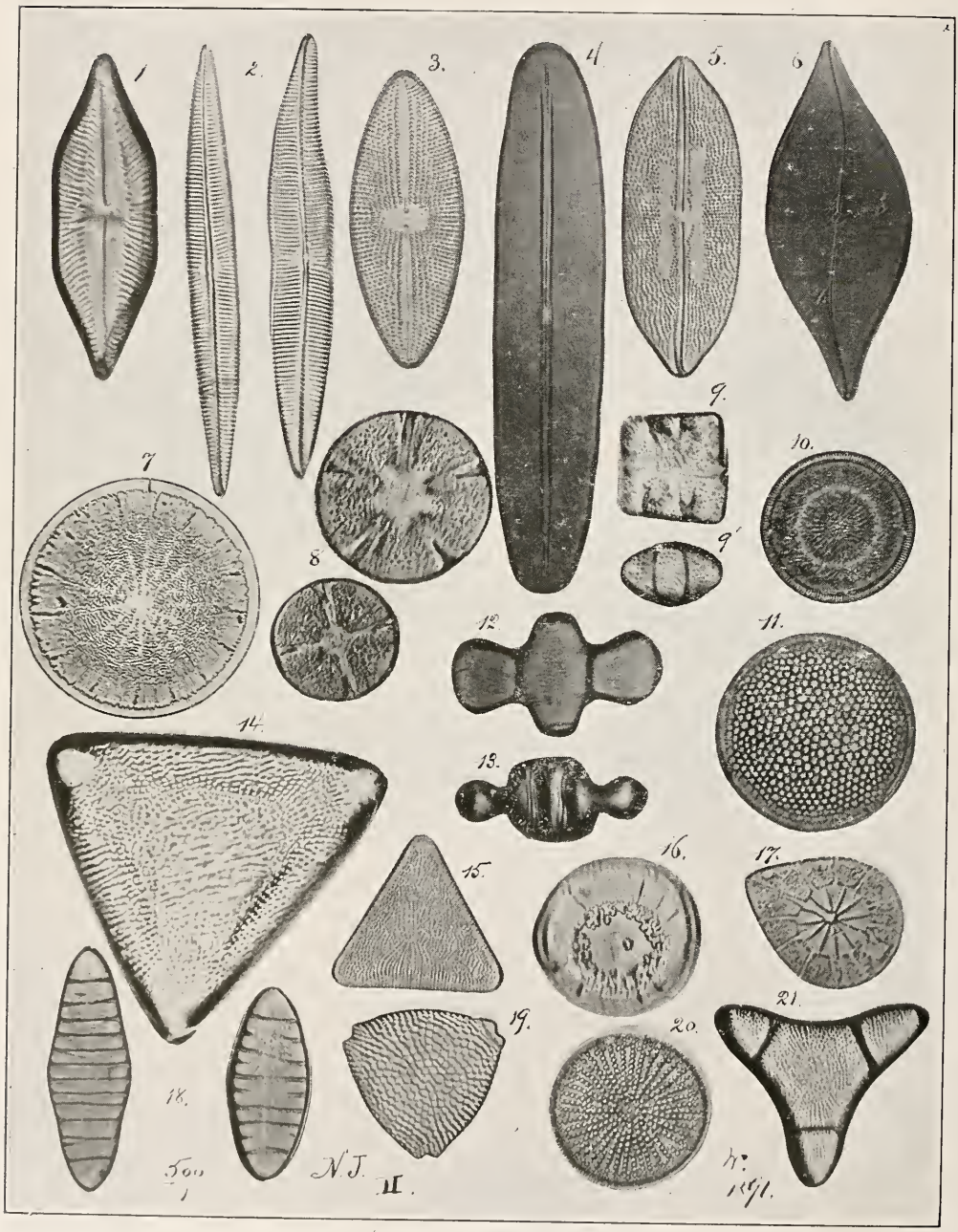
PAUL D. R. RUTHLING

California Toad **Bufo halophilus**

After the winter rains and cold and frosty nights, the spring sunshine breaks forth in Southern California, and warms the days and tempers the nights with a mildness that is agreeable both to man and other animals. Thus it is that as the day draws to a close after a refreshing collecting trip on foot in the mountains, one is attracted by the hoarse, rasping squawk of *Bufo halophilus,* as this toad-philosopher sits at the shore of a little pond emitting his plaintive melody and allowing his thoughts to turn, as thoughts in springtime often will, to love.

Although one approaches quietly the source of noises heard in the distance, the little intermittent pond of water, left over from the rainy season, takes on an air of quietude when one reaches its shores. By sitting down and watching noiselessly one soon sees ripples here and there. In the centers of many of them, chubby old toads may be distinguished quietly floating after having pushed themselves upwards from their hiding places on the bottom. Soon they kick their way to some floating log or clump of weeds to which they cling as they give voice to throaty notes of love. Intermingled with the lower hoarseness of the toads' voices may be distinguished the shriller rolling peep of tree-toads

Concluded on page 72.



Fossil Diatoms of New Jersey

Photomicrographs by Dr. D. B. Ward

The Diatomaceae

H. C. WHEELER

To how many readers does the word "Diatoms" convey any meaning? I think it is safe to assert that for every person who is familiar with these aquatic plants, there are thousands, perhaps more, who have never heard of them, yet everyone who drinks water (a beverage destined to become more commonly used) has very likely swallowed many.

The diatoms make up an order of Algae called Diatomaceae and inhabit both marine and fresh waters. They are remarkable for the formation of a siliceous skeleton, which is often beautifully sculptured. So small are the individuals that they appear to the naked eye as so much dust. The tiny *Achnanthes exigua,* frequent in aquaria, measures but about 12 microns long, while a large species, such as *Pinnularia nobilis,* may reach 350 microns. A micron, the unit of measurement, is a thousandth of a millimetre.

On the death of the organism, the siliceous frame is not readily decomposed, but sinks to the bottom of the body of water in which it lived. In the course of eons of time sufficient are gathered together to form what is known to the geologists as deposits of "diatomaceous earth." When one contemplates the minuteness of the individual diatom, it seems difficult to realize that some of the deposits in various parts of the United States are hundreds of feet thick. The area occupied by the City of Richmond, Virginia, consists almost entirely of such a deposit ranging up to seventy-five feet or more thick. Vast deposits occur in California, in Canada, England, Germany, Hungary, Russia and in fact in every country in the world.

What is their function? When living they assist in purifying the water by liberating oxygen, further, they form an important item in the food of fishes, oysters and other forms of aquatic life. After death their flinty coating is used for such diverse purposes as the manufacture of tooth powder, metal polish, boiler coverings and dynamite.

To the student of natural history they furnish a very inviting field and the beauty of their design makes the subject doubly interesting. It was largely due to the efforts of the microscopists of the last century to see their fine structure that the optical perfection of the microscope was attained, so it may be safely said that the humble, microscopic diatom has contributed its share to the progress of the world. They are exceedingly common and a student need never be without an ample supply of subjects on which to work. I have found upwards of thirty species in our drinking water supply by merely attaching a cheap filter to the faucet in the kitchen.

Owing to their very small size, and their transparency, the production of photographs suitable for purposes of illustration is not always easy. It may be possible, however, to make illustrations of a few of these interesting forms at a future date, and also give concise directions for collecting and preparing them for study.

Explanation of Plate

1. *Navicula yarrensis De Wittiana* (Kain & Schultze) Cleve (*Navicula De Wittiana,* Kain & Schultze).
2. *Navicula longa* Greg.
3. *Navicula Schultzei* Kain.
4. *Frustulia Lewisiana* (Grev.) De Toni.
5. *Navicula irrorata* Grev.
6. *Pleurosigma Normanii fossilis* Grun. (*Pleurosigma virginiacum,* H. L. Smith).
7. *Actinocyclus Ralfsii* (W. Smith), Ralfs var.?
8. *Actinodiscus atlanticus* Kain & Schultze.
9. *Anaulus mediterraneus* Grun.
10. *Actinocyclus* sp.?
11. *Eupodiscus inconspicuus* Rattray.
12. Sp.?
13. Sp.?
14. *Triceratium arcticum* Brightw.
15. *Triceratium condecorum* Brightw.
16. *Hyalodiscus stelliger* Bailey?
17. *Asteromphalus flabellatus* (Breb.) Grev. var.?
18. *Tetracyclus ellipticus* (Ehrenb.) Grun. (*Biddulphia Woolmanii,* Kain & Schultze).
19. *Triceratium indentatum* Kain & Schultze.
20. *Actinocyclus* sp.?
21. *Triceratium Kainii* Schultze.

(The plate, page 70, is from a photograph, by Dr. D. B. Ward, presented to the editor by Professor D. E. Owen, of the University of Pennsylvania. It is one of a series and lacks a list of the species shown. This has been supplied as accurately as possible by a well-known diatomist. The magnification indicated on the original, five hundred diameters, has been reduced approximately one-sixth in the photo-engraving.)

Bufo halophilus

Concluded from page 69.

(*Hyla regilla*) as nature's vocalists join in discordant chorus.

Southern California's common toad, *Bufo halophilus,* ventures forth to breed, sometimes early in March and sometimes later, usually in April. This toad is found throughout the valleys and foot hills of the coastal regions and, where the conditions are favorable, in isolated desert places. It is not common in the mountains near Los Angeles.

The eggs are laid in great strings, many yards in length, in pools of canyon washes, in irrigating ditches or in large puddles left by the rains. In most cases, the breeding places are dry in the summertime. The young hatch in a short time, as is the case with our eastern toad, and the tadpoles necessarily develop rapidly before their aquatic environment is changed to one of dry land.

During the winter the adults are common under boards, logs, under stones and in other such places, where they hibernate. These hibernating places are not usually very far from the springtime breeding pools or streams. In the hot summer days the toads retire to these hiding places, where it is damp and protected from the heat of the sun, or find their way into the deep, damp burrow of some mammal. In the evening, as the fierce southwest sun hides itself behind the mountains, our little toad friends venture forth in search of evening meals, which consist of insects of various kinds, worms, isopods and many other animals that crawl or fly.

Bufo halophilus is an excellent pet for the terrarium and will feed readily, even from one's fingers. Kept in a terrarium he should be provided with some bark under which he can find a damp place to hide. Earth and grass add to his comforts, and water should always be accessible. One has little difficulty in feeding him if one can only get enough, because our little toad is a firm believer in the philosophy that to be happy one must eat, whether in captivity or at large in the rolling hills of young toad-hood days.

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aquatic life

Aquatic Life

Vol. V July, 1920 No. 7

An international monthly magazine devoted to the study, care and breeding of fishes and other animals and plants in the home aquarium and terrarium.

W. A. POYSER ..... EDITOR
JOSEPH E. BAUSMAN ..... PUBLISHER
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Popular and scientific articles and notes on subjects pertaining to the aquarium and terrarium, and to the habits of fishes in general, are always wanted for "Aquatic Life." Readers are invited to join in making it a medium of mutual help by contributing to it the results of their studies. The pages are always open to any one having information of interest to the aquarist and student of aquatic biology. Manuscripts, books for review and general correspondence should be addressed to the editor.

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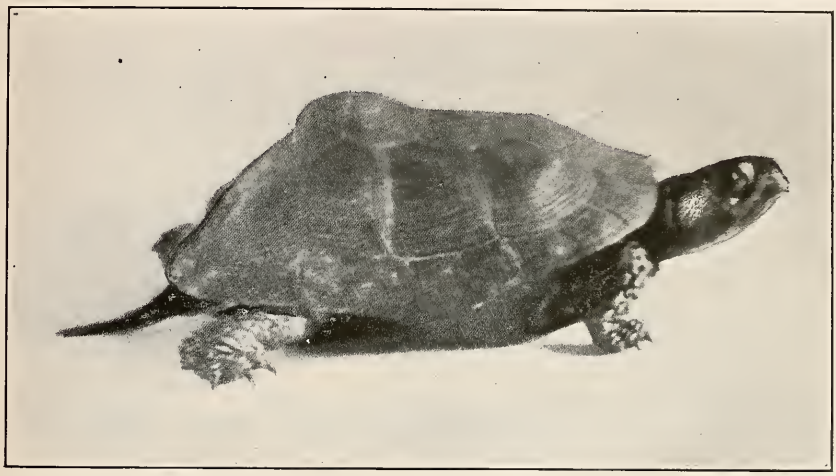
On a Deformed Specimen of Muhlenberg's Turtle

R. W. SHUFELDT, M. D.



Melanemys muhlenbergi **Muhlenberg's Turtle**

In *Nature-Study Review* for 1914, I published an article with four figures, entitled "Rare Deformity in a Painted Turtle (*Chrysemys picta*), with Notes on the Species" (pp. 218-222). One of the illustrations showed that this young turtle—for it was a small specimen—possessed a peculiar and conspicuous hump in the median line on top of the carapace. Upon dissection, the cavity within this remarkable elevation contained no anatomical structures—in fact, it was practically empty. Having seen thousands of young turtles in my lifetime, representing nearly all the known species of eastern North America, and never having noted any such peculiarity before, I naturally thought that a second example of it would never come to hand; in this, however, I was mistaken. During the spring of 1920, Dr. Raymond L. Ditmars, of the New York Zoological Gardens, kindly presented me with a rather young specimen of a female Muhlenberg's turtle, which possessed identically the same kind of a hump on its back as did the specimen of the Painted turtle referred to above, and which occupied the same part of the carapace in the median line. This is well shown in the accompanying photograph, made by me shortly after the specimen was received.

This turtle was kept in a small aquarium and fed with angling worms, which it greatly relished, but I soon discovered

that the specimen was rather sickly, and that it doubtless would not live long. When placed in deep water it was totally unable to swim to the bottom, in order to secure the pieces of worms fed to it. This inability was evidently caused by the hollow hump on its back acting as a float, and preventing the animal from diving. There was no trouble in this way for the anterior half of its body; but when the hump came to the level of the surface, all its efforts to get below it failed. Such a disability would surely act as a serious handicap in nature, and it certainly did not conduce to its comfort or happiness in captivity. Whether it had anything to do with its death, which occurred in due course, it would be hard to say. As I desired a complete osteological specimen of this species, I made no dissection or post-mortem to discover the conditions present. I feel quite sure, however, that it was but a second example of the state of things I had described in the young Painted Turtle, referred to above.

This Muhlenberg's turtle presented another curious thing, never before noticed by me in any turtle. Its plastron, on its outer surface, was of a pale, deep yellow, with an irregular central figure, and surrounded externally by a jet black pattern. Now after the demise of the specimen, it was left for ten days or more on a window-sill, which was painted white. As there was no occasion to disturb it, it remained in one place for several days. Upon picking it up, I found that the *black* figure on the surface of the plastron was printed in deep black on the white sill of the window, and no amount of ordinary scrubbing would remove it. Three more times the dead turtle was pushed to another place on the sill, and each time another print was left on the white paint, though each new one was several shades lighter than the preceding one. Nothing like this has ever been noticed by me previously; and I believe that it will require a very efficient scourer to eventually remove these remarkable stains.

Phalloptychus januarius

GEORGE S. MYERS

The spotted tooth-carp, *Phalloptychus januarius*, formerly called *Girardinus reticulatus* by aquarists, is a native of Brazil. It seems to be the least offensive of the live-bearing fishes, which with its distinctive coloring has made it a popular aquarium fish.

The ground color is yellowish, over which is distributed many black spots and blotches which may extend to the fins. In common with most of the fishes of the group to which it belongs the female is largest, reaching a length of one and three-quarter inches, half an inch longer than the male.

Consistent with its size, the number of young produced in a litter is not great, but a goodly proportion will survive as the female is not particularly cannibalistic and will often permit the young to grow up in the same tank unmolested. To conserve food for the youngsters, however, it is well to remove the parent.

The best dry food is shrimp ground to a suitable size, while Daphne ranks first among live foods. In my experience the fish does not seem to care for the white worm, *Enchytraeus albidus*.

"The men who make the best husbands," says a writer, "are those who possess the knotty type of foot with square toes." But a young friend of ours, addicted to stopping late, says they make the worst kind of prospective fathers-in-law.—*London Opinion.*

Notes on Fundulus luciae

D. R. CRAWFORD

United States Bureau of Fisheries

Fundulus luciae **Baird's Killifish**

This attractive little minnow was first described by Professor S. F. Baird under the name of *Hydrargyra luciae* from a few specimens which he colllected at Great Egg Harbor, New Jersey. His description may be found in the Smithsonian Report for 1854, but evidently his specimens have disappeared, and nothing further was known of this minnow until Dr. H. M. Smith, Commissioner of Fisheries, in the summer of 1890, collected two specimens on St. George Island which is near the mouth of the Potomac River. He has described it under the name of *Zygonectes luciae* in the Bulletin of the U. S. Fish Commission, Volume X, for 1890, and pictures it in a drawing on Plate XVIII, which accompanies his article. Since 1890, nothing further has been added to our knowledge, Jordan and Evermann merely changing the name to *Fundulus luciae*, and using Dr. Smith's description which is sufficient and need not be repeated here.

The writer had occasion to collect ten specimens of *Fundulus luciae* while visiting Lewisetta, Virginia, across the river from St. George Island, for the purpose of collecting other fishes, and, since very little seems to be known of the habits of this minnow, no excuse

seems necessary for the following notes.

Fundulus luciae was found rather abundantly in a number of small tidal ponds near Lewisetta in company with other species of *Fundulus, Gambusia, Cyprinodon* and *Lucania.* These ponds have a soft, muddy bottom from which aquatic weeds grow abundantly in clumps, leaving small areas free of growth. When such a place was approached cautiously, numerous minnows could be seen feeding, but upon the slightest movement, they would dart into the clumps of weeds and bury themselves in the mud. If the eye was quick enough to follow them, they could be taken very easily with a small dip-net.

It was observed that *Fundulus luciae* prefers to feed on the bottom, evidently catching the numerous animalcules which are found in such places. When these minnows remain undisturbed for a while, they rise to the surface and lie motionless for long periods of time with the posterior half of the body hanging somewhat limply downward. Except for their darting movements, they swim slowly and only for short distances between resting periods.

Seven specimens were brought back to Washington alive, and these were placed in a small aquarium with some of the original brackish water and native plants. In a short time, they became accustomed to their confinement and further observations were made. The habit of feeding on the bottom which was observed in the field was again noted. Floating food was not touched, but when particles sank to the bottom they were quickly seized. A number of small crustaceans were placed in the aquarium, but they were not eaten until after they had settled to the bottom.

On June 15, about a week after the fish had been placed in the aquarium, the water became very foul and a small parasite attacked the tail of one of the fish. The fish were removed to clean, fresh water and the aquarium thoroughly washed out, after which tap water was used to replace the original brackish water. Further growth of the parasite seems to have been checked. The minnows remained on the bottom and lay very still for several days. It was noted that this habit is usually displayed in bright sunlight, but when the light is diffused, the fish swim upward from the bottom.

The colors have faded somewhat in captivity, and they become even dimmer if the aquarium is shaded with a black cloth, but they are very bright at times when the sunlight strikes through the water. The yellow tints of the fins and lower parts of the body are brightest when the water is warm. The black spot on the dorsal fin, which does not show in the illustration, is sometimes scarcely visible in strong light.

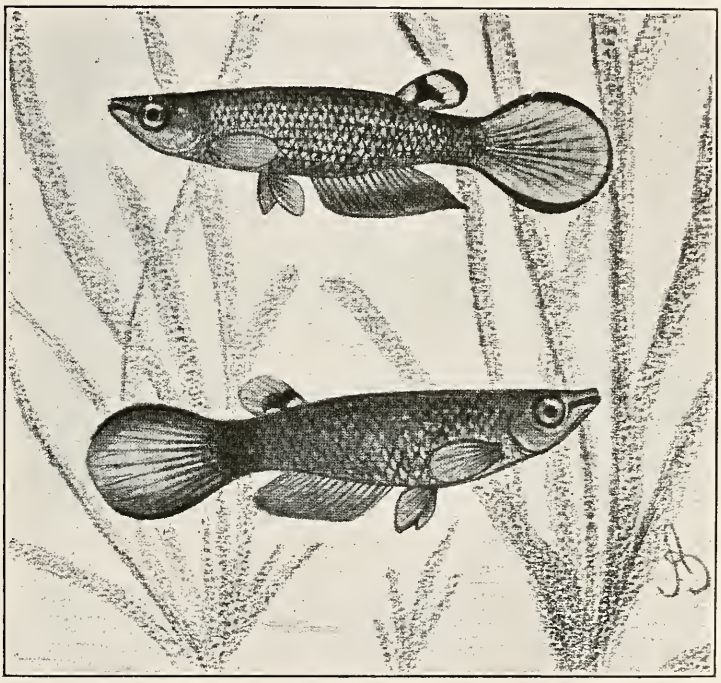
While at the surface, two or more of the minnows usually lie near each other, sometimes one above the other. They frequently come into contact while swimming about, but they are not quarrelsome and seldom molest each other.

Mr. C. M. Breder, of the U. S. Bureau of Fisheries, deserves much credit for taking the photograph which accompanies this article, for it was only after four hours of painstaking effort that a suitable one was obtained.

A joint meeting of the Executive and Annual Exhibition Committees of the Brooklyn Aquarium Society was held on Friday evening, June 4th. Subject to the approval of the Board of Directors of the Brooklyn Museum, September 23, 24, 25 and 26 were decided as tentative dates for the next annual exhibit. The secretary was instructed to communicate with nearby societies to ascertain if the designated days conflicted with any arrangements they may have made. The committee is composed of Dr. Frederick Schneider, chairman; C. E. Visel, C. J. Heede, George W. Post, John Debus, F. B. Johonnot, A. L. Wright, J. H. Shenk, secretary, 500 Eastern Parkway, Brooklyn.

Haplochilus panchax

WALTER LANNOY BRIND, F. Z. S.

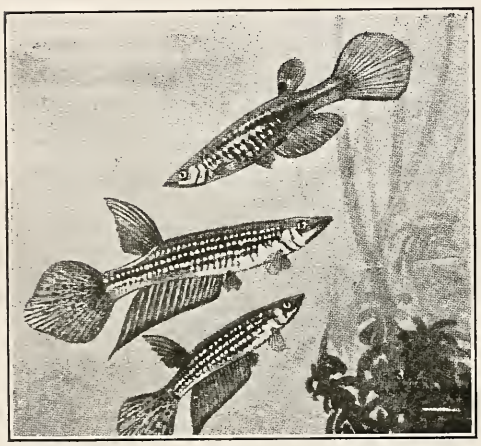


Haplochilus panchax **India**

Haplochilus panchax is one of the East Indian tooth-carps which has been somewhat neglected by American aquarists, so that even the typical form—the red phase—has become quite rare in our collections. Compared with its cousin, *Haplochilus lineatus,* it is not a voracious species, and I keep it in harmony in happy family aquaria with docile species of its own size or larger. It seeks to avoid rather than encourage clashes with its fellow denizens. Whether others secured this species prior to 1910, when I brought specimens from Germany, I do not know. A few years ago it was collected for me in Java by an officer on the Radja, one of the vessels of the Netherlands Steamship Company, and brought to New York with other interesting fishes. At the time of the end of the World War my collector was transferred to another ship and ceased to make

the port of New York, which brought to a close my importations from the Dutch East Indies.

A large specimen will be three inches in length, but when reared in the aquarium few individuals grow to more than two inches. The ground color of the body is olive on the back or dorsal region, bluish gray on the sides and whitish on the abdomen. Vertical, indistinct



Haplochilus panchax blockii

bars of golden scales are peculiar to the male, but are seldom visible. The tip of the dorsal fin and the margin of the tail are black outside and red within, the two colors forming a narrow border. A characteristic black blotch appears on the dorsal as shown in illustration. The sexual distinctions are the acute extremity of the anal fin and the color border of the caudal fin in the male. The female has a rounded anal and the tail fin is almost colorless, as are the other fins in both sexes. The general shape of the fish is that characteristic of the genus.

Several color phases have been noticed and called *blockii, mattei, lutescens* and so on. A yellow form and a blue-white form occur in Java, particularly in the vicinity of Soerabaia, in each of which yellow and white replace the red of the typical species. The forms interbreed indiscriminately and the females cannot be distinguished from one another. By crossing the red with the yellow some of the resulting males will show orange instead of yellow or red and are very beautiful.

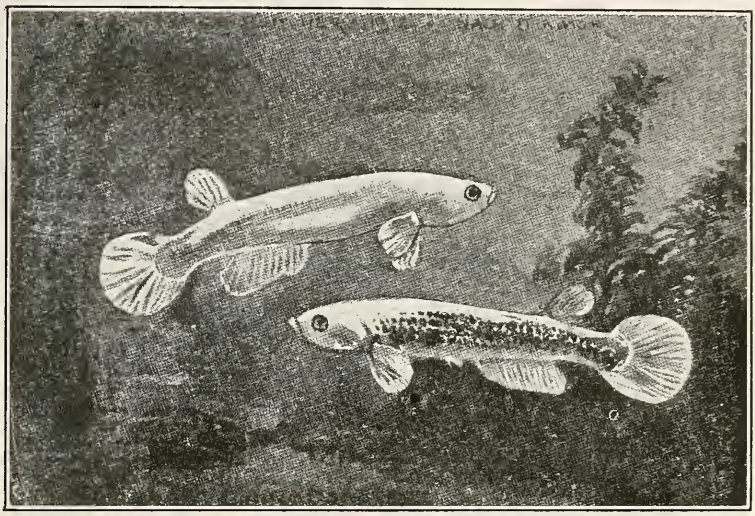
It is quite easy to breed *panchax*. One merely needs a small globe, some filamentous algae, *Nitella* or small bladderwort, soft (old) aquarium water and sunshine. Keep the fish apart until eggs can be seen within the female when her container is held up to the light. Then introduce the male and place the globe in the sunshine. They may begin spawning within a few minutes, swimming side by side and fluttering fins and tails against each other whenever they happen to meet the bushy plants. The eggs are large—almost the size of the head of an average pin, and are attached singly by a filament to the plants. The eggs should be removed with the plants to which they adhere, and placed in a separate container in the sunshine, a mason jar answering well. At a temperature of 75 degrees, Fahrenheit, the eggs will hatch in about ten days. The fry should first be fed with *Infusoria,* and later with screened *Daphnia* and *Cyclops,* though failing these they will eat finely powdered prepared food. Tanks containing this fish should be kept covered by a sheet of glass.

Many a man who imagines he is a born leader isn't even a successful follower.

Observer—"I noticed you got up and gave that lady your seat in the street car the other day." Observed—"Since childhood I have respected a woman with a strap in her hand."—*Pennsylvania Punch Bowl.*

The Red Rivulus

GEORGE S. MYERS



The Xanthic Form of Rivulus urophthalmus

The golden *Rivulus,* perhaps more commonly called the red *Rivulus,* is a native of Brazil, from whence it was taken to Germany in 1911. There seems to be some doubt as to the species of which it is a color variety. References may be found to it as *Rivulus poeyi flava,* and it has been called *R. harti.* Stansch disposes of it as a yellow-red form of *R. urophthalmus,* which is probably correct. The fish called *R. poeyi* by aquarists when first imported, was later found to be *R. urophthalmus,* which arouses a doubt as to whether true *poeyi* has yet been secured.

Leaving aside the question of identification, the fish seems to be an albinotic (a xanthic) form. It does not seem to have been determined whether it contains more than the normal amount of yellow pigment which in the presumed normal species is masked by the melanin or black coloring matter. The prevailing color of the form is light orange-yellow, with lengthwise rows of small vermillion spots, the latter being more noticeable in the male. The fins and eyes have a greenish tinge. It reaches a length of two and one-half to three inches.

It breeds in a manner similar to other egg-laying cyprinodonts, such as *Haplochilus, Fundulus* and so on. The eggs

are deposited on the leaves of floatplants like *Myriophyllum, Riccia* and the smallest bladderwort. The male and female should be separated for a time and then placed together for several days in a suitably planted tank. When eggs are observed the parents should be removed. About two weeks later they may spawn again. The fry should be provided with an abundance of microscopic life (*Infusoria* and rotifers) and gradually introduced to the tiniest Daphne as growth proceeds. During breeding it is well to maintain a temperature of 80 degrees, Fahrenheit, while throughout the winter 75 degrees will be sufficient, possibly lower, but it is scarcely advisable to flirt with a minimum about which may lurk danger.

The red Rivulus is far from being an active fish and will "sit" for hours in a clump of plants, rarely changing its position, but if tempted with a scrap of raw beef, or a worm, it will leap high out of the water to secure the coveted morsel, and for this reason the tank should be provided with a tight covering of glass lest it leap forth unobserved and "dry up." The story has been told that one was placed in an uncovered tank at the end of a long row. It soon disappeared. Days later the owner discovered it in the tank at the other end of the shelf, concluding that "by leaps and bounds and good luck" it had managed in the interval of its seeming disappearance to explore the intervening tanks! It would thus seem that its sense of direction is good, which is only one of the reasons for considering it an intelligent and interesting member of an aquarian collection.

If you only care enough for a result, you will almost certainly attain it.—*William James.*

The Ideal Fish Food

F. W. HEIDELBERGER

The aquarist who does not give his fishes the proper food loses much of the pleasure that would otherwise be his. There is no better food, in the experience of the writer, than the white earthworm, *Enchytraeus albidus.* To demonstrate this it is only necessary to equip two tanks of like size, with the same number and kinds of fishes and plants. To the fishes in one give white worms exclusively, and to the others prepared food, oatmeal, chopped fish, scraped beef, etc. At the end of a month compare results. Those fed on worms will have grown and be in superior condition. Reverse the method and the fishes heretofore given worm will barely touch dry food, while those in the control tank will ravenously devour them.

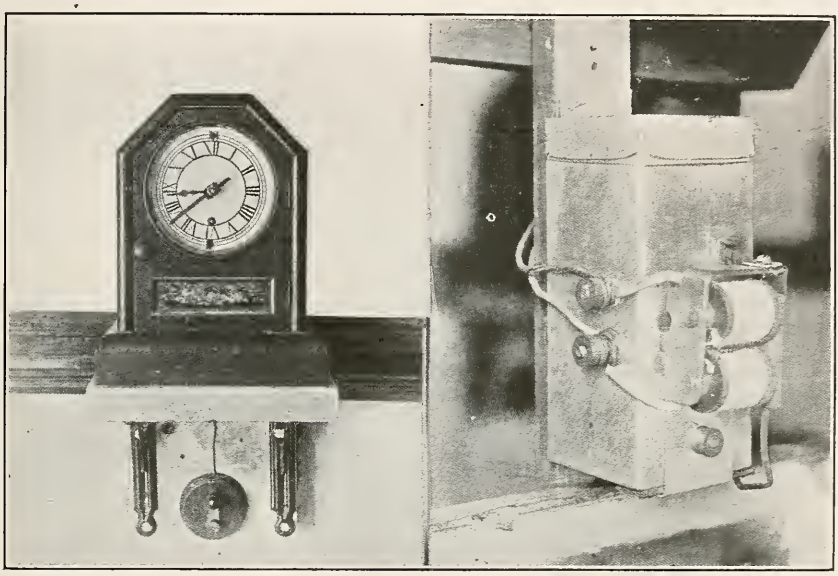
Feeding worms is easy if the aquarium is arranged with a space on the bottom free from sand. Just drop a bit of earth full of worms over the clear place. The fishes will take keen delight in pulling the worms from the earth. If after several feedings there remains some sediment, merely syphon it out.

During the three years the writer has used worms his goldfish have spawned a number of times in the aquarium, and he has some beautiful telescopes which were reared on them. If chopped fine the worms will be taken eagerly by fry.

Pennsylvania now has a law prohibiting the sale of any but fresh eggs. What's worrying everybody, including those called upon to enforce the measure, is how to tell fresh eggs. We all know that a fresh egg is one that doesn't retaliate in its own "odorous" way when you smash it. The question is how to tell one without giving it the Christopher Columbus.

An Automatic Feeding Device for Aquaria

CHARLES M. BREDER, Jr
United States Bureau of Fisheries



It is quite evident to most aquarists that the feeding of prepared foods once, or possibly twice, daily is not the best method attainable for promoting growth and general vigor in fishes. Live food in quantities, no doubt, is the most nearly ideal, but it is denied to all except those having considerable time to devote to their hobby.

It is often asserted that in a state of nature fishes in general tend to gorge themselves with whatever food is available and rest while the process of digestion is operative, repeating the cycle continually, thus dividing their daily food into fairly well defined "meals." This, no doubt, is true but under the artificial conditions imposed by the close confinement of home aquaria, the writer has found a quite continuous feeding or nibbling to take place throughout long periods of observation. If, for example, large quantities of *Daphnia* be introduced, the feeding will take on a sudden activity (usually with a visible distention of the abdomen), and will then proceed as formerly with the constant and incessent pickings as the digestion of the previously ingulfed matter proceeds. It would seem to follow that a gradual feeding would be more beneficial than the methods usually employed. Work-

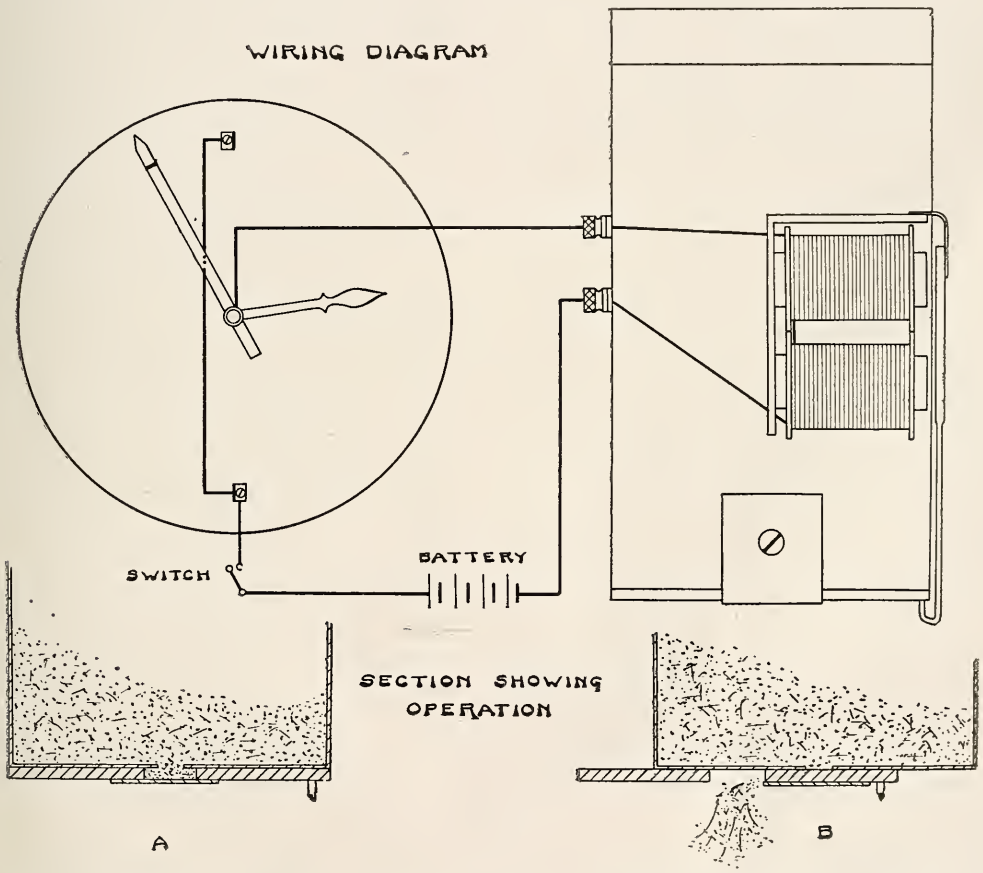
ing with this point of view in mind, a scheme for feeding continuously was developed, and as most species confined in aquaria have been observed to rest at night, feeding during the daylight hours need only be considered. It might be said to be the general practice in commercial hatcheries devoted to the rearing of the Salmonoids, etc., to detail attendants to the feeding of the fry by hand at definite intervals. This in moderately large establishments amounts to a continuous process, it being time to feed the first trough full of young by the time the last has been finished. Automatic devices have been experimented with to eliminate this expenditure of energy, usually depending on water power, but so far as the writer's information goes have been unsatisfactory. Of course a point enters here that does not concern the aquarist as the food usually used by these establishments is wet and mushy, not being dessicated as is the customary aquaria fish food.

The accompanying sketch and photographs explain in general the arrangement of the device. The clock which controls the mechanism is seen to be simply a switch of which the minute hand forms the lever with a small piece of phosopher-bronze wire at its tip, making contact with the stationary points at VI and XII. The closing of the circuit at these periods causes a certain quantity of food to be dropped into the aquarium below. This period can be lengthened or shortened at will by decreasing or increasing the number of contact points.

The food hopper is simply a small metal container to which the working elements of a common door bell have been attached. The gong and clapper have been removed, the rod for supporting the clapper being passed through the hole in a strip of rather heavy copper that forms the valve, so allowing only a certain predetermined amount of food to escape at the proper time. The two diagrams "A" and "B" show this action. While at rest "A" a hole in the bottom of the reservoir is directly above the large opening in the moving valve piece, which allows the opening to fill with food. When an electrical impulse is sent through the magnets causing them to attract the armature, it is evident that the strip will assume position "B" and block the hole in the reservoir and allow the food that was previously in the valve strip opening to fall below, as it passes beyond the strap-like piece that formerly held it in place. Of course a single stroke bell should be used, or the vibrator shunted around if the bell is of the vibrating type. The amount of food ejected at a time is determined by the size of the opening made in the moving strip and the thickness of the metal employed. A number of interchangeable strips might be employed for experimental work.

A battery of three dry cells will suffice to operate this device, although a much more positive action can be obtained by using 4 or 6 in series, or any other available source of suitable current may be used. A switch introduced in the circuit (below the clock), was used to stop the action in the evening and start it again in the morning. This was not such a hardship as one might imagine, as the writer naturally made it a practice to visit the aquaria before leaving home in the morning and again in the evening before retiring. Thus the act of throwing the switch in the proper direction at the appropriate time soon became as habitual as winding one's watch. However, a refinement could easily be introduced doing away with this switch, by engaging an idle gear (on the reverse side of the

dial) with another, half its diameter, mounted on the hour hand spindle. This idle gear should carry a disc one-half of which should be composed of brass, while the other should be of ebonite or other insulating substance. A brush bearing on the periphery of this disc connected to one side of the circuit and the other connected to the stationary contacts would cause every revolution of the hour hand (once in 12 hours), and consequently one-half a revolution of the disc to alternate twelve hours of closed circuit with twelve open, approximating the day light hours close enough for most purposes. In this manner if an eight day clock is used, the device need be thought of but once a week.



A complete and positive test of the worth of this method was unfortunately not possible owing to unexpected necessity for dismanteling the room used in the experiment. It was in progress on about 100 young *Barbus conchonius* and *vitatus* in a 4-foot tank. A control tank like the first in all respects and containing similar fish, but feed by hand, failed to show the same growth although the priod in which the device was in use lasted little over a month. It was found that the amount consumed was considerably greater in the machine-fed tank, which is the most significant fact to be noted. About four times as much was taken with by thus giving a little at a time all through the day, instead of a comparatively large quantity once a day. The writer believes that it would pay an

aquarist with facilities to experiment with such an apparatus with a view to positively establishing or destroying the worth of the scheme. Any granular food could be used with the same proportional chances of success, depending on the value of its ingredients, that it would allow by hand feeding.

"Electric" Fishes

Certain fishes exhibit peculiar electrical phenomena of muscles, nerves and heart, which have given them the name of electric fishes. These have the power of giving electrical shocks from specially constructed and living electrical batteries. Our knowledge of their properties has been increased by measurements made with a very sensitive galvanometer.

There are in all about fifty species of these fishes, but electrical properties of only five or six have been studied in detail. The best known are various species of torpedo, belonging to the skate family, found in the Mediterranean and Adriatic seas; the gymnotus, an eel found in the region of the Orinoco in South America; the malapterurus, the raash or thunderer fish, of the Arabs, a native of the Nile, the Niger, Senegal and other African rivers, and various species of skate found in the seas around Great Britain.

The electrical fishes do not belong to any one class or group—some are found in fresh water, while others inhabit the sea. They possess two distinct types of electrical organs. One closely relates in structure to muscle, as found in the torpedo, gymnotus and skate, while the other presents more of the characters of the structure of the secreting gland as illustrated by the electric organ of the thunderer fish. Both types are built upon a vast number of microscopical elements, each of which is supplied with a nerve fibre.

These nerve fibres come from large nerves that originate in the nerve centres brain or spinal cord, and in these centres are found special large nerve cells, with which the nerve fibres of the electric organs are connected and from which they spring. Yet the electricity is not generated in the electric centres and conveyed by the electric nerves to the electric organ itself. It is only produced, however, so as to give a shock when set in action by nervous impulses transmitted to it from the electric centres by the electric nerves.

There are few departments of physiological science in which can be found a more striking example of organic adaptiveness than in the construction of the electric fishes. In these animals there are specialized organs for the production of electricity on an economical basis far surpassing anything yet contrived by man. The organs are either modified muscles or modified glands, structures which in all animals manifest electrical properties.—*Exchange.*

Oceans are the earth's great storehouse of water. They cover some eight-elevenths of the surface of the earth to an average depth of about two miles. They receive the off-flow from all the continents and send it back by way of the atmosphere.

The fresh waters of the earth descend in the first instance out of the atmosphere. They rise in a vapor from the whole surface of the earth, but chiefly from the ocean. Evaporation frees them from the ocean's salts, these being non-volatile. They drift about with the currents of the atmosphere, gathering its gases to saturation, together with small quantities of drifting solids; they descend impartially upon water and land, chiefly as rain, snow and hail.—*Needham and Lloyd.*

JANUARY, 1920. Betta rubra (*Heede*); Observations on the Chelonians of North America, Part VI (*Shufeldt*); Beef Heart and Beef Liver for Young Fishes; Notes on Mosquito Larvae (*Hale*); Lucania ommata (extension of range); Habits of Fundulus nottii and Heterandria formosa; Linseed meal cause of disease among trout; South Australian Aquarium Society, Passaic Aquarium Society, the Redfield Theory, etc.

FEBRUARY. Goldfish Foods and Feeding as Practiced in Japan (*Nakashima*); Observations on the Chelonians of North America, Part VII (*Shufeldt*); The Mosquito (*Hale*); Luciocephalus pulcher (*Heede*); Maintaining an Aquarium (*Trell*); An Easily Constructed Heated Aquarium (*Finckh*); Roosevelt Wild Life Forest Experiment Station, February Pointers, etc.

MARCH. The Australian Congolly (*Hale*); Observations on the Chelonians of North America, Part VIII (*Shufeldt*); Ichthyopthirius multifilius (*Webber*); Rivulus strigatus (*Brind*); An Odd Trunkfish (*Hubbs*); North Carolina Notes (*Carlton*); Society news.

APRIL. Mastacembelus pancalus (*MacMorris*); A New Treatment to Eliminate Ichthyophthirius (*Hauthaway*); Observations on the Chelonians of North America, Part IX (*Shufeldt*); Notes on Haplochilus lineatus (*Sawyer*); The Artificial Production of Albinism (*Waite*); A Metal Net for Larval Fishes (*Balleisen*); The "Balanced Aquarium—A Question and an Experiment (*Powers*); Venus's Fly Trap, Notes and News.

MAY. Aquarium Microscopy (*France*); A "Tin Can" Aquarium (*Balleisen*); Observations on the Chelonians of North America, Part X (*Shufeldt*); The Stud Fishes (*Sawyer*); The Guide Book to The New York Aquarium (*Shufeldt*); May Pointers, The Microscopical Society, Notes and News.

JUNE. Macrones vittatus (*MacMorris*); An Interesting Abnormality (*Tasche*); Blue-spotted Sunfish (*Sawyer*); Breeding Viviparous Poeciliids (*Balleisen*); Bufo halophilus (*Ruthling*); The Diatomaceae (*Wheeler*); Appropriate Names (*Mellen*); Boyer's *"The Diatomaceae of Philadelphia"* and society news.

DEPARTMENT OF COMMERCE
Bureau of Fisheries
Washington

March 6, 1920.

Mr. F. K. Christine,
518 Belgrade Street,
Philadelphia, Pa.

Dear Sir:

I wish to advise that the Bureau purchased six boxes of your creative infusoria for the purpose of making some laboratory tests and tests at some of our stations for the purpose of determining its value in the creation of minute aquatic life. Very favorable reports have been received, and the experiments made at Washington have demonstrated that it is very excellent material for the production of infusoria. It is believed, however, that the amount you suggest to use to fifty gallons should be doubled. If the temperature of the water is in the neighborhood of 60 or 65 degrees F., much better results may be expected. If this is followed up by the production of daphne and other aquatic insects it is believed that the aquarist can have a very good range of aquatic life and at a very reasonable cost. It was found preferable to infusoria produced by hay in that it did not discolor the water, and the infusoria appeared in greater numbers than the culture produced by hay. It was thought that you might be interested in receiving this information.

Very truly yours,
G. C. LEACH.
In Charge Division Fish Culture

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August, 1920 15c Copy

Aquatic Life

Aquatic Life

Vol. V August, 1920 No. 8

An international monthly magazine devoted to the study, care and breeding of fishes and other animals and plants in the home aquarium and terrarium.

W. A. POYSER ..... EDITOR
JOSEPH E. BAUSMAN ..... PUBLISHER
632 East Girard Avenue ..... Philadelphia

Entered as second-class matter, September 2d, 1915, at the Post Office, Philadelphia, Pa., under Act of March 3d, 1879.

Popular and scientific articles and notes on subjects pertaining to the aquarium and terrarium, and to the habits of fishes in general, are always wanted for "Aquatic Life." Readers are invited to join in making it a medium of mutual help by contributing to it the results of their studies. The pages are always open to any one having information of interest to the aquarist and student of aquatic biology. Manuscripts, books for review and general correspondence should be addressed to the editor.

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Fitzroyia lineata

WALTER LANNOY BRIND, F. Z. S.

Fitzroyia lineata **Argentina**

There seems to be an interesting bit of history concerning the subject of the present paper. It was originally described by Jenyns, in 1842, as *Lebias lineata*. On the next page of his work he describes a species which he calls *Lebias multidentata*. Both descriptions. refer to the same fish, the multiple naming being probably due to failure to associate the sexes. Note that *lineata* is the oldest name, though only by the length of time it took the compositor to set about a page of type! Now the fish was not a *Lebias,* and, when Gunther was working on his catalogue of the fishes of the British Museum (published 1866), he found that it could not be properly assigned to any genus then known. He thereupon created the genus *Fitzroyia* for *L. multidentata* and *Jenynsia* for *L. lineata. Fitzroyia* precedes *Jenynsia* by a few pages and is older by a

scratch. In assembling, therefore, the proper name of the fish, the oldest genus is *Fitzroyia*, and the oldest specific name is that of the original author, so the proper name according to the law of priority is *Fitzroyia lineata*. This has been recognized by Berg (Annals of the National Museum, Argentina) and by our American ichthyologists Eigenmann and Henn. English systematists—Regan and Boulenger—seem to prefer *Jenynsia*.

So far as I know this species has never been brought to the United States. The Germans secured it in 1905 but allowed it to die out within a few years. A writer of an interesting article, in one of their magazines in 1910 expresses great regret at its disappearance. It has the distinction of being the "farthest south" viviparous fish, ranging from the La Plata to the Rio Grande do Sul, Argentina Republic. It is not, however, the only member of the geus occurring in southern South America.

It is said that the streams it inhabits are reasonably cool, which would make it a desirable fish for those not having facilities for providing the extreme and constant heat demanded by some exotic fishes. It seems to be quite a large species. German authors giving the length of a female as 12 centimeters (about four and three-fourth inches), but Henn notes that the largest female in the collection of the Indiana University Museum measures 69 millimeters (less than three inches). In the male, writers agree in giving its length as up to 45 millimeters (less than two inches). *Fitzroyia* is unique among viviparous fishes studied in aquaria in that the anal fin is modified into an actual tube for the transmission of sperm. The one other genus in which the anal is tubular, *Anableps*, has not been studied in aquaria, and its decribed habits indicate it as entirely unsuitable. Our subject has another peculiarity, the tip of the anal being bent either to the right or to the left, males thus being rights or lefts. This male dextrality and sinistrality seems to have no significance (in this genus) as the genital orifice of the female is symmetrical. In certain other fishes the females are also rights and lefts, the orifice being protected by a process making it necessary for a right female to mate with a left male and vice versa.

The coloration is quite suggestive of *Mollienisia latipinna*. The back is brownish olive, passing to silvery gray on the sides, with the lower parts white. The sides have a decided light blue lustre and four or five horizontal rows of black dashes The dorsal region of the male inclines to blue-green, while the female is rather brownish.

In common with more familiar fishes that bring forth living young, in the present species the period of gestation has been determined as lasting from four to six weeks, temperature being apparently the determining factor. The young are few in number, considering the size of the parent, a female bred in Germany giving from twelve to thirty young in a litter, which, however, were quite large at birth, some measuring nearly three-fourths of an inch in length. It is amusing to note that the confusion in the names has been carried down practically to the present day. An aquarium book mentions both but not as synonyms, one being given as viviparous or live-bearing while the other is disposed of as oviparous or egg-laying!

While the fish is unknown in our collections, it seems to the writer that it should not be hard to secure if the proper efforts were put forth when steamship service with South America becomes bet-

(*Concluded on page 90*)

The Leafy Sea-dragon

HERBERT M. HALE
South Australian Museum

Leafy Sea-dragon **Phyllopteryx eques**
Photograph by the author; two-fifths natural size

In *Aquatic Life,* Volume I, page 11, mention is made of an Australian seahorse as a remarkable instance of protective imitation. The photograph accompanying this note shows a particularly large and perfect example of the Leafy Sea-dragon, *Phyllopteryx eques,* a South Australian member of the group. The foliaceous apendages greatly resemble the weeds amongst which the fish lives. Gunther, in describing this species (*Proceedings of the Zoological Society,* 1865, page 327), remarks: "Its form is still more extraordinary than that of

the preceding species (*P. foliatus*), the spines, crest and cutaneous appendages being much more developed. . . . . There is no doubt that these fish attach themselves with the prehensile end of their tail to stems of seaweed or other objects; and when they are in the vicinity of seaweed of a similar colour, their resemblance to it must be so great that they would easily escape being observed by their enemies."

The Red-bellied Newt

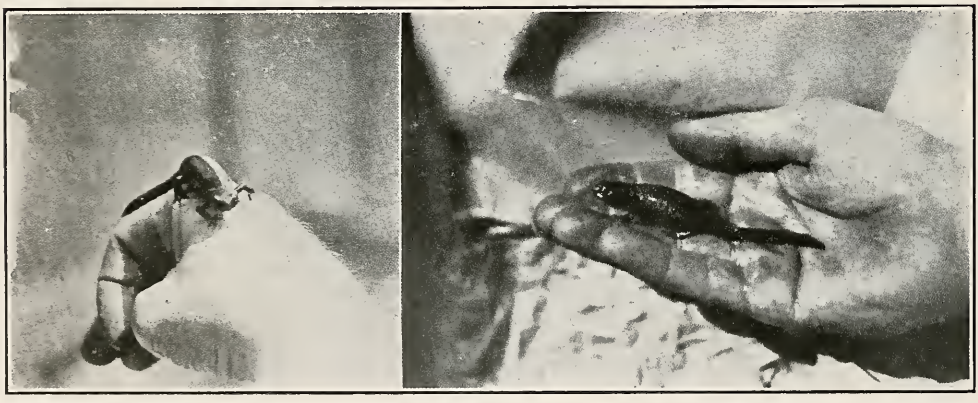
HARRY W. BALLEISEN

The red-bellied newt of Asia and Japan is a mighty interesting pet for the aquarist. It soon becomes friendly and learns to take food from the hand. Any sort of a small aquarium, with a few rocks, will be an adequate home. The rocks may be arranged that the uppermost projects above the water surface, and a newt will sometimes evidence his appreciation by perching on the summit, but usually they will be hiding in the crevices, coming out at intervals to search for food. The aquarium should be covered with a piece of glass, as otherwise some may manage to escape and—dry up!

When quite small I find that Daphne and small snails are desirable as food, but as the newt grows it prefers earthworms and mealworms. During the winter months when worms are unobtainable we may substitute shredded raw meat, but it is necessary to use a pair of forceps, wiggling the meat scraps to simulate a worm. The newts should not be tempted with too large worms or scraps. They gulp their food, and if too large a piece is taken they may later disgorge it.

In 1918, when the newts were added to my collection, they measured two inches long. During the summer of the first year the skin was cast off three times, but has not been observed to take place since. The specimens now measure four inches, having grown two inches in two years.

The eggs of this newt, according to the breeder from whom I secured them, are deposited on a leaf of *Sagittaria*, the tip of the leaf then being bent over to form a pocket protecting the egg until hatched.



Red-bellied Newt **Diemyctylus pyrrogaster**

Photographs by author

If you want knowledge, you must toil for it; if food, you must toil for it, and if pleasure, you must toil for it; toil is the law.—*Ruskin.*

Melanotaenia nigrans

H. E. FINCKH
Royal Zoological Society of New South Wales

Melanotaenia nigrans **Photograph by Author**

The atherine, *Melanotaenia nigrans,* is a beautiful aqurium fish inhabiting the western river system of New South Wales and the northern coastal rivers of Queensland. My examples measure four inches long and are rather shy. I have not succeeded in breeding it, either in pond or aquarium, and so far as I am aware its spawning habits are yet unknown.

The color of the body above is light brown and the lower part of a pinkish gray. Every scale gleams with iridescent color, showing alternately red, green, blue and yellow, giving an effect scarcely equalled by such showy fish as the Mexican swordtail, *Xiphophorus helleri.* The two dorsal fins, and the anal and caudal, emerge from the body bright yellow and pass into red with a narrow black band. The gill-covers scintillate with bright red, yellow and green, making a suitable setting for the large and prominent white eye, with iris circled by a yellow band. The atherine is a fish that once seen will be long remembered.

Fitzroyia lineata

(*Concluded from page* 86)

ter organized or, rather, back to normal I find no references that would indicate *Fitzroyia* to be other than frequent or common in suitable situations in its native country. American aquarists seem to be woefully lacking in the sort of enterprise that secured for the Germans so many fishes, from all parts of the world, before the war interrupted their endeavors. It is only necessary to become acquainted with the steward or other underofficer of the ship making the desired port and a direct return trip, and provide him with cans and a net. Give him brief instructions as to the care of the fishes and the chances are that *anything* he brings you will be worth while. It is well to tell him to go a bit inland and explore slow streams and ponds. In such situations he is most likely to find species well adapted to aquarian conditions. If collections are made at the seaboard he is apt to take the young of large species or those of brackish and salt water which are less desirable. But the extent of his tramps, and the possibility of further collections on subsequent trips, is apt to be governed by your liberality when the "consideration" for his trouble is arranged. Be generous. Among the fishes may be some that will be saleable at many times the amount of his honorarium.

Aquarists Collecting Daphnia in Philadelphia

Photograph by Harry W. Balleisen.

The other fellow's fad is always silly.

"Somebody should stand up for the street railways," exclaimed the man who believes in fair play. "Sir," exclaimed the protesting citizen, "as a passenger I have stood up for them twice a day for years."—*Washington Post.*

Fundulus diaphanus

GEORGE S. MYERS

The common killifish, *Fundulus diaphanus,* is one of our native cyprinodonts that deserves closer acquaintance. It is as attractive as the several relatives which are common to aquarian collections, and it has the added advantage of being exceptionally hardy under the conditions imposed by confinement in home aquaria. As an experiment, I once placed a female killy in a quart jar without plants, keeping her there, without change of water, for six months. She was fed once a week. At the end of the period she was just as robust and healthy as on the day I captured her in a nearby stream. Such treatment is not to be commended, nor is its mention intended to induce others to follow. To see the killy at its best one should provide a properly equipped tank of suitable size.

This killy is olive-green in color, with many vertical brown or black bars which at times may not be apparent. The sides are silvery and overlaid with iridescent purple, a feature which the female lacks. It reaches a length of five inches, but such large specimens are scarcely suitable for a tank of average size. Like its relations, native and exotic, it deposits its eggs on the leaves of floating plants. The preferred food is Daphnia, but it will take any sort of prepared food.

Fundulus diaphanus **Photograph by Dr. R. W. Shufeldt**

For capturing wild killifish a twelve-inch net, with a handle at least six feet long, is necessary. When the fish are seen, a quick overhead sweep of the net should be made; scooping *up* nearly always results in failure.

Wise is the woman who gives as much thought to feathering her own nest as to feathering her hat.

Aquarian Diatoms

CHARLES S. BOYER, A. M., F. R. M. S.

The moderate temperature of aquaria facilitates the growth of diatoms throughout the year. The thin yellow film, becoming darker when dry, clinging to the glass sides below the surface of the water and gradually creeping above the surface on the parts more exposed to the light, will be found, on examination by the microscope, to be composed entirely of the frustles of small diatoms. Although the deposit is frequently removed as an obstruction to the view, it must not be considered detrimental to the life of the aquatic fauna. On the contrary the mucus surrounding the diatoms is a source of food not only to the snails employed in cleaning the walls but also to the fish and the continued growth of the frustules is an indication of the purification of the water as they are constantly throwing off bubbles of oxygen.

It is well known that the size of aquatic animals is, to a certain degree, determined by the extent of the habitat and that some snails which live in small ponds do not essentially differ, except in size, from larger forms occurring in lakes. It will be found, therefore, that all diatoms in aquaria are of the most minute dimensions, except, possibly, a few larger forms which may occasionally appear in the water supply but which do not persist in growth. There are several diatoms which, in this neighborhood at least, are of constant occurrence, growing on the walls of aquaria at all seasons. The following list is the result of numerous collections made at different times in several aquaria.

Navicula minima. This form while not quite the smallest as its name would imply is only about two-thousandth of an inch in length. It is linear in outline and rounded at the ends, with fine lines radiating from a longitudinal line in the middle, and may be recognized by the bright, somewhat quadrangular space in the centre. The zone view is oblong. (Fig. 1.)

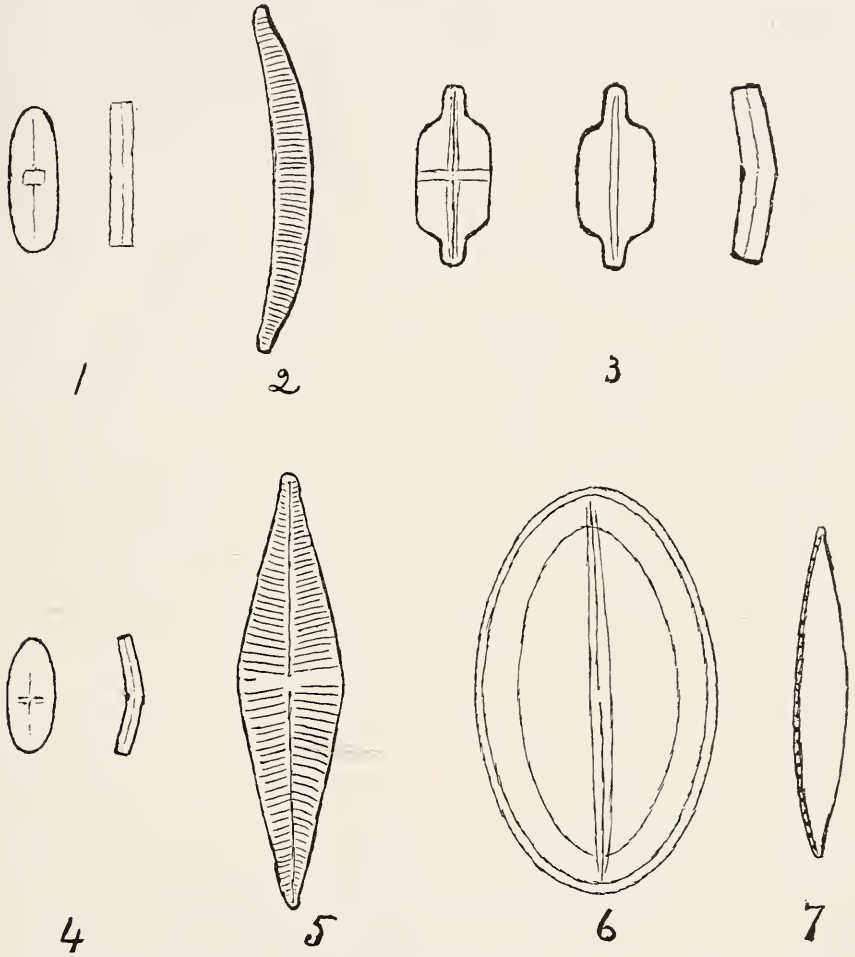
Eunotia pectinalis minor. The smaller Comb Eunotia, so-called because it looks like a comb with a curved back, being convex on one side and concave on the other, with quite visible transverse lines. Its length is at least twice that of the *Navicula* although the ordinary form of *Eunotia pectinalis* is often five or six times longer. When seen in another view it is, like most diatoms, quadrangular in outline. (Fig. 2.)

Achnanthes exigua. This little form always occurs, frequently in great abundance, in any gathering made from aquaria and has been kept living in a small two ounce bottle for several years. The two valves are unlike except in outline which is rhombic-elliptical or sometimes quadrate with beaked ends. One valve is crossed transversely by a blank line while the other valve has only the usual longitudinal line in the middle. The length is about the same as that of *Navicula minima.* A quadrate form, constricted in the middle, is frequently found with the others. (Fig. 3.)

Achnanthes linearis curta. This form is elliptical, with a distinct longitudinal line and a small blank space in the centre in one valve and merely an indistinct

longitudinal line in the other. In a view at right angles it is narrow, quadrangular, and slightly bent in the middle as is the case with *Achnanthes exigua.* It is sometimes more abundant than any other form. (Fig. 4.)

Cocconeis placentula. This form is broadly elliptical and flat, like a little cake, as its name implies, and the two valves are not alike, one having a distinct longitudinal line and a well marked central space, while the other is without the central space. Sometimes a rim surrounds one of the valves divided into minute cells. (Fig. 6.)



1. Navicula minima. 2. Eunotia pectinalis minor. 3. Achnanthes exigua. 4. Achnanthes linearis curta. 5. Gomphonema angustatum. 6. Cocconeis placentula. 7. Nitzschia amphibia. Drawings by author.

Gomphonema angustatum. The outline of this form is lanceolate but one end is broader and shorter than the other, with a blank space in the middle nearer the broad end. In the other view it is slightly cuneate. The length is three times that of the *Navicula.* (Fig. 5.)

Nitzschia amphibia. Nitzschiae differ from other diatoms in that one edge is much more definite in marking than the other and in this little form, one of the

smallest of the genus, a row of dots is noticed on one side but not on the other, except when the two valves are seen together. (Fig. 7.)

In all of the above forms there are more or less distinctly marked transverse lines, but they are scarcely noticed except under high magnification.

Certain other diatoms will probably be found in aquaria at different times but the above species appear to be constant. I have repeatedly transferred other species from streams or ponds to an aquarium but they all disappear except these minute forms.

It is to be understood, of course, that in the collection of material only that which occurs or has occurred as a living film on the walls of the aquarium should be gathered as the valves which lie on the surface of the sand will, in many cases, include dead forms from the water supply which will vary in different localities.

If this article should receive the attention of distant observers it might be possible to determine whether there is a diatomaceous flora, constant to aquarian habitat.

Result of Feeding Trout on Dried Flies

The use of imported dried flies in feeding young trout has been experimentally undertaken at several hatcheries of the U. S. Bureau of Fisheries. Reports of the comparative tests recently made at the Green Lake (Me.) station indicate no better results than earlier trials elsewhere gave.

Superintendent Race at Green Lake set aside four troughs, each 12 feet long, 1 foot wide, and 8 inches deep, and into each trough counted 930 brook-trout fry that had not previously taken food. This number was selected instead of 1000 because 930 fish were found to weigh 3 ounces. The fish in two troughs were fed exclusively on dried flies, and those in two troughs exclusively on beef liver. Feeding began on May 20 and the experiment was discontinued on June 18, when the fishes were planted. The results were as follows:

The lots of fish fed on dried flies gained sixty-six and two-thirds per cent. in weight in the month and sustained a mortality of forty-one and three-fourths per cent. The liver-fed fish gained 800 per cent. in weight and showed a death rate of eight and one-third per cent.

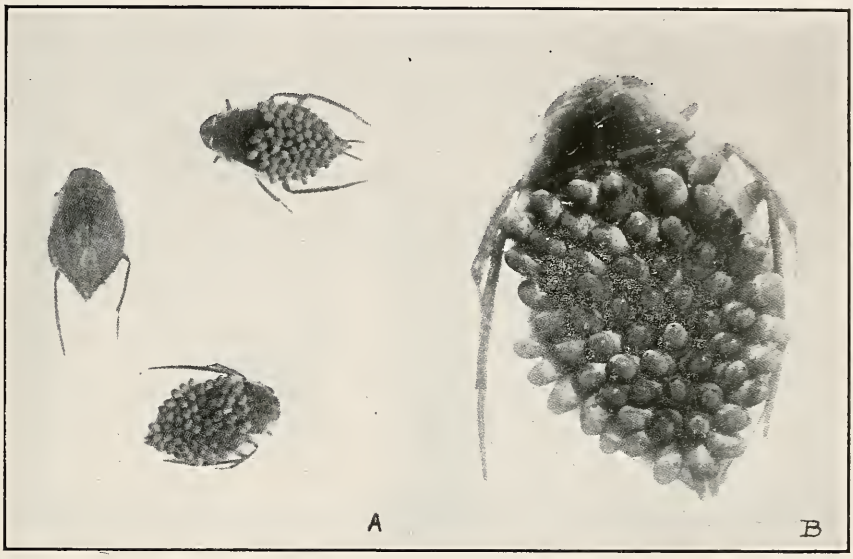
For the coming season the Chicago Aquarium Society has arranged a program that promises lively and interesting meetings. Dr. H. C. Champlin has succeeded Fred G. Orsinger as presiding officer. The meetings are held at the Keedy Studio, 367 North Dearborn street.—*W. P. O.*

The tadpoles of frogs and toads are rather remarkable for their ability to replace lost parts, and continue to grow after serious injuries. Eight and ten-legged frogs, two-tailed tadpoles, and other monstrosities have been produced by splitting embryonic structures. It is also possible to form composite tadpoles by grafting parts of different individuals together.—*General Zoology (Pearse).*

The people who are hard to get along with are those who object to our having our own way.

"Never hear much about malaria out this way any more?" "No," answered Uncle Bill Bottletop. "Malaria gets terrible unpopular when there is nothing to cure it with except quinine."—*Kansas City Star.*

The Economy of the Freshwater Aquarium



Diplonchus sp., an Australian Water-bug, Carrying Eggs.
Photographs by H. M. Hale. A, natural size; B, enlarged 3½ diameters.

At a meeting of the South Australian Aquarium Society held on May 4, Mr. A. G. Edquist delivered an interesting address on "The Economy of the Fresh water Aquarium."

The lecturer dealt largely with aquatic plants and the elimination of undesirable elements from the aquarium. Mention was made of many species or aquatic plants available and the method by which each is propagated was clearly described. To ensure the best growth it is necessary that the plants be exposed to good light, but strong diffused light is preferable to direct sunlight. The soil in which they are rooted must contain either humus or a colloid such as alumina. In fact, aquatic plants flourish in a soil containing the same mineral content as is suited to terrestrial vegetation. They must be fed and if the soil does not contain enough nourishment, this can be supplied by adding weak nutrient solutions—such as of superphosphate—to the water. Although the roots of aquatic plants are not adapted for the absorption of nutriment, the necessary nourishing constitutents dissolved in the water are assimilated

through the leaves. The plant may almost be said to sweat, throwing off an acid secretion which may turn the water sour. If for this or any other reason the water becomes acid, the growth will be sickly and the inhabitants of the aquarium will not thrive. To counteract acidity the soil must contain calcium carbonate, or a small quantity of lime water or ammonia can be added to the water.

Lack of food in the soil, the presence of bacteria, wrong lighting, and the use of bad water, all result in weak or sickly plants. Water from wells sometimes contains salts deleterious to aquatic vegetation, whilst rainwater lacks nourishing substances and needs to be fortified with nutrient solutions.

With a view to counteracting the too rapid growth of confervae and of preventing the development of diatoms and undesirable vegetation in aquaria, Mr. Edquist suggests and superintends a variety of experiments by his students at the High Schools throughout the State. An effective means of destroying the pests is to add small quantities of weak solutions of ammonia, copper sulphate or iron sulphate to the aquarium affected. Flowers of sulphur sprinkled on the surface of the water will materially assist in keeping the vessels free from confervae.

Mr. Edquist also insisted that, unless artificially stimulated aquatic plants undergo a resting or winter period in consonance with terrestrial vegetation, and reminded his hearers that some lowly animal forms provided against drought conditions by producing an abundance of eggs as the water receded or evaporated, which living through long periods of dry weather, ensured the continuance of the species and the appearance of new generations when the water once more soaked the thirsty earth.—*Herbert M. Hale, Hon. Secretary.*

(The photographs of the Australian water-bug, *Diplonchus,* sp., were made by Mr. Hale from local specimens and exhibited at the annual meeting of the society. Some American species have a similar habit. Professor Comstock states that "A striking feature in the life history of many of the giant water bugs is that the female fastens her eggs on the top of her own back with a thin layer of waterproof glue, which she secretes for this purpose." He illustrates a female of *Serphus* sp., with the eggs so attached. In commenting on the giant water-bugs, Needham and Lloyd say "The eggs of a smaller, related water-bug, *Zaitha* or *Belostoma,* are attached by the female to the broad back of the male, and are carried by him during their incubation. The nymphs of this family, on escaping from the egg suddenly unroll and expand their flat bodies, and attain at once proportions that would seem impossible on looking at the egg."—*Editor.*)

One of the members of the Ridgewood Aquarium Society, who has been keeping tropical fishes for several years, decided to add a few goldfish to his collection. He built a large aquarium, equipped it with running water, and secured six nice goldfish. When the landlord called for the rent on the first of the following month he noticed the new tank and, pointing to it, said to our friend the aquarist: "See here, Mr. Blank, I don't care how many of those small (tropical) fish you keep, but you must get rid of those large ones. They drink too much water." This is a fact and not a mere fish story. It happened last month.—*Brooklynite.*

It takes a hustler to distinguish the difference between an obstacle and a hindrance in his path.

MARCH. The Australian Congolly (*Hale*); Observations on the Chelonians of North America, Part VIII (*Shufeldt*); Ichthyopthirius multifilius (*Webber*); Rivulus strigatus (*Brind*); An Odd Trunkfish (*Hubbs*); North Carolina Notes (*Carlton*); Society news.

APRIL. Mastacembelus pancalus (*MacMorris*); A New Treatment to Eliminate Ichthyophthirius (*Hauthaway*); Observations on the Chelonians of North America, Part IX (*Shufeldt*); Notes on Haplochilus lineatus (*Sawyer*); The Artificial Production of Albinism (*Waite*); A Metal Net for Larval Fishes (*Balleisen*); The "Balanced Aquarium—A Question and an Experiment (*Powers*); Venus's Fly Trap, Notes and News.

MAY. Aquarium Microscopy (*France*); A "Tin Can" Aquarium (*Balleisen*); Observations on the Chelonians of North America, Part X (*Shufeldt*); The Stud Fishes (*Sawyer*); The Guide Book to The New York Aquarium (*Shufeldt*); May Pointers, The Microscopical Society, Notes and News.

JUNE. Macrones vittatus (*MacMorris*); An Interesting Abnormality (*Tasche*); Blue-spotted Sunfish (*Sawyer*); Breeding Viviparous Poeciliids (*Balleisen*); Bufo halophilus (*Ruthling*); The Diatomaceae (*Wheeler*); Appropriate Names (*Mellen*); Boyer's *"The Diatomaceae of Philadelphia"* and society news.

JULY. On a Deformed Specimen of Muhlenberg's Turtle (*Shufeldt*); Phalloptychus januarius (*Myers*); Notes on Fundulus luciae (*Crawford*); Haplochilus panchax (*Brind*); The Red Rivulus (*Myers*); The Ideal Fish Food (*Heidelberger*); An Automatic Feeding Device for Aquaria (*Breder*); Electric Fishes, notes and news.

September, 1920 15c Copy

Aquatic Life

Aquatic Life

Vol. V Sept. 1920 No. 9

An international monthly magazine devoted to the study, care and breeding of fishes and other animals and plants in the home aquarium and terrarium.

W. A. POYSER ..... EDITOR
JOSEPH E. BAUSMAN ..... PUBLISHER
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Popular and scientific articles and notes on subjects pertaining to the aquarium and terrarium, and to the habits of fishes in general, are always wanted for "Aquatic Life." Readers are invited to join in making it a medium of mutual help by contributing to it the results of their studies. The pages are always open to any one having information of interest to the aquarist and student of aquatic biology. Manuscripts, books for review and general correspondence should be addressed to the editor.

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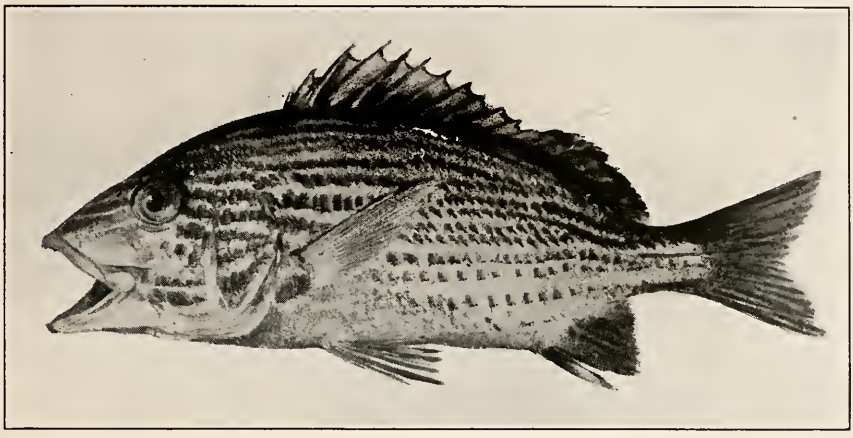
North American Fishes

I. The Yellow Grunt (Haemulon sciurus)

R. W. SHUFELDT, M. D., C. M. Z. S.



The Yellow Grunt **Haemulon sciurus**

Grunters are contained in the family *Haemulidae,* and some seven or eight species of them occur in our South Atlantic waters. The form here to be noted is also known by the names Ronco Amarillo and Boar Grunt. Its generic name is derived from two Greek words signifying "bloody gums," which refers to the bright red color of the mouth-parts, while its specific name, *sciurus,* has reference to the grunting noise the fish makes upon being captured, which sounds not a little like the grunting of a gray squirrel.

This species occurs in the South Atlantic, from the Florida Keys to Brazil. My cut of the fish is reproduced from a photograph direct from a specimen, and it shows the external parts so well that a detailed description of them is obviated.

This grunt, in life, has been described by Doctor Jordan as being "deep brassy yellow, scarcely paler below or darker above; head and body with about 12 conspicuous, slightly wavy, longitudinal stripes of sky-blue, deepest on the snout, each with a very narrow edge of dusky olive, these stripes on the head curving upward below the eye, the first stripe below the eye forking near the posterior margin of preopercle, and inclosing an oblong area of the ground color; iris gilt, a dark spot under the angle of preopercle; spinous dorsal edged and shaded with yellowish, its membrane mostly bluish; soft dorsal yellowish; caudal yellowish, broadly dusky at base, the degree of this duskiness being variable; mouth

deep orange within; pectorals pale yellowish; anals and ventrals deeper yellowish; the young have more yellow on the fins and less on the body, with traces of a dark caudal spot."

Yellow grunts, many of which I have caught in the harbor of Key West, Florida, as well as in the Bahamas, run about ten or eleven inches in length, and are readily taken with hook and line, baiting with conch. Specimens up to 18 or 20 inches have been caught, and the one here figured came from the New York Aquarium.

Tumor in a Brook Trout

HAROLD L. BABCOCK, M. D.

About one year ago an adult brook trout (Salvelinus fontinalis), weighing 2¾ pounds, which had been in the Marine Park Aquarium at Boston for three years, developed a tumor on the left side in the region of the lateral line two inches posterior to the opercle. It steadily increased in size and the fish was finally removed from the exhibition tank. While the growth seemed in no way to inconvenience the trout, its appearance as an exhibition specimen was ruined, and it was decided to operate in the hope of determining the nature of the disease. With the assistance of the Aquarium Director, Mr. W. H. Chute, the fish was taken from the tank and held fast to a board by burlap drawn tightly across its body and tacked down above and below. A window was then cut in the burlap over the tumor. The board was held so that the fish's head was under water. The growth was smooth, soft and fluctuating, about the size of an English walnut. Upon dissection it was found to be a hydrocyle directly under the skin, filled with a thin straw-colored fluid.

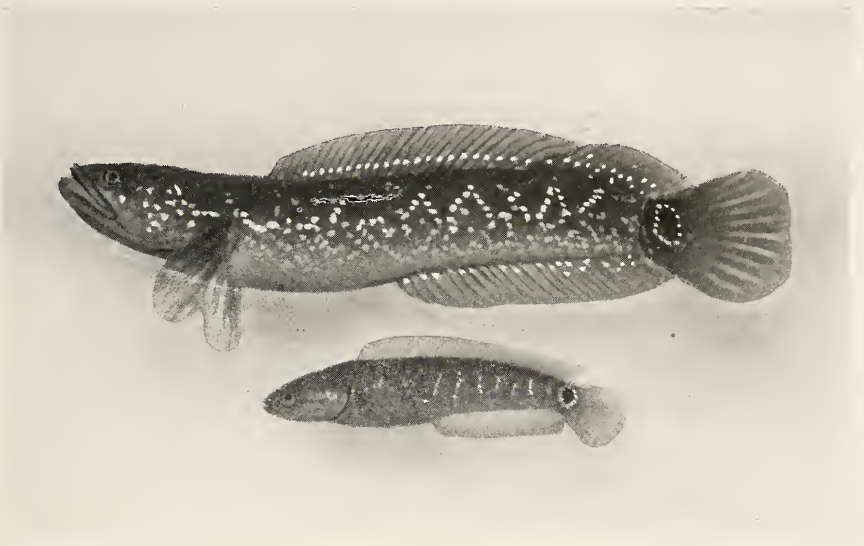
The fish was returned to the tank, but died at the end of twelve hours. It seemed unable to maintain its normal position. This may have been due to a disturbance in the organ of equilibrium which is associated with the sense organs of the lateral line, and which may have been injured in operating, or to an injury to the swimming bladder during the struggle in preparing the fish for operation. Microscopic examination of the tissue by the State Biologist, Dr. D. L. Belding, showed nothing of an infectious or malignant nature. It probably originated as the result of an injury.

British Aquarium Society

The monthly meeting of the British Aquarium Society took place on Friday, September 10, at 7.30 P. M., at 4, Fetter-lane, when the chair was taken by the president, Mr. W. T. Webster. There was a large attendance, which was very remarkable, considering so many of the members are on holiday bent. There were many specimens of aquatic life, both plant and animal. Mr. Webster showed two very fine specimens from his famous collections of axolotl which excited great admiration. Mr. Lawson, the secretary, had a fine plant of *Potomergeton natans*. Mr. Horn, the curator of Bethnel Green Museum, also brought plants which were undoubtedly grown under favorable circumstances, and many other members had exhibits—namely, the cyclops, etc. The great feature of the evening was a lecture by the chairman on the Mollusca, dealing principally with *Planorbis corneus*—its breeding and general habits, which was most interesting and instructive, and much appreciated. After the lecture there was a very animated discussion on a point that the chairman could not decide from observation, namely, has the *P. corneus* the power to make good any misfortune that may happen to the shell? The meeting closed with a hearty vote of thanks to the popular chairman.

Channa fasciata

WILLIAM T. INNES



Channa fasciata **Photo. by Author**

A single adult pair and a few young of *Channa fasciata* were recently imported from Southern Asia. During the early part of the late summer, my friend Locke, of San Francisco, made a pilgrimage to the Eastern States in search of rare tropicals, bringing to me the breeding pair. He thought them a new species of "snakehead" (*Ophiocephalus*) this opinion having been ventured by a prominent ichthyologist of California. The fish has, however, been since determined unquestionably as *Channa fasciata* by Mr. Henry W. Fowler, of the Academy of Natural Sciences of Philadelphia. The original description, by an early writer, is complete and convincing.

The snakeheads are provided with an accessory superbranchial cavity, and are able to breathe atmospheric air. All are inhabitants of fresh water. Of the two genera making up the family, the snakeheads proper are most numerous, about twenty-five species being known from Asia and three from Africa. Channa, which is distinguished by the absence of ventrals fins, boasts of but three species from Ceylon and China. The group seems to be more closely related to the climbing perches (Anabantidae) than to the more familiar labyrinth fishes of the family Osphromenidae, many of which

have been bred and studied by the aquarist.

My adult fish are about six inches in length. The back is a dark bottle green, ending in broad points on the sides, these being outlined clearly by conspicuous silver dots, which are also otherwise distributed over the head, abdomen and fins. The body is long and flexible but not eel-like.

I have not been able to observe the deposition of eggs, but three times have discovered them floating free at the surface of the water. It would seem that they are deposited during the night. The eggs are larger than those of the goldfish, but are more difficult to see on account of their transparency. Each batch was made noticeable by the milky, infertile ones, which averaged rather high—fifty per cent. Incubation takes about four days at temperatures from 80 to 85 degrees, Fahrenheit. The larvae appear as minute, helpless, black tadpoles for several days. For the first two weeks they were given Daphnia, and then placed on a diet of scrambled eggs, which has been the principal food of all my fishes and reptiles this year. The young grew rapidly and at the end of four months had attained a length of about three inches. If kept in small aquaria and not fed heavily I believe they can be matured at this size.

For food for the adults I was advised to use live fish, but this was quite an undertaking, so I decided to first try earthworms. These they took greedily. I soon discovered they would relish any animal food or prepared foods in which there was a flavoring of animal matter. Their mouths are capacious and they like large chunks.

While rearing the young many disappeared, and I was led to suspect cannibalism, but I later found their dried remains on the floor, which was tangible proof that they had been leaping out of the shallow tray. While I do not consider them at all quarrelsome or vicious, I do not doubt they would swallow a much smaller fish if afforded the opportunity. With one lot I raised young goldfish which were not molested. The adults pay no attention to eggs and fry.

(The photograph of *Channa fasciata,* showing an adult and a youngster, which appears on the preceding page, was taken by Mr. Innes for the forthcoming edition of his "Goldfish Varieties and Tropical Aquarium Fishes." This is the first photograph of the species, which has apparently not been figured since it was first described.—*Ed.*)

Christian J. Heede

Too late for mention in the August number came the sad news that our old friend and contributor, Christian Julius Heede, of Brooklyn, had passed away after a long and useful life. Mr. Heede was well known through his frequent contributions to aquarian literature, having had many papers published in *The Aquarium Magazine, The Aquarium Bulletin* and in *Aquatic Life*. His interest in biology began many years ago, perhaps almost half a century, while still in Denmark, the land of his birth, and his studies were pursued with added vigor when he became a resident of the United States. He combined the characteristics of the naturalist with those of the fancier, and his original research work coupled with an extensive first-hand knowledge of the literature of the subject in several languages, placed him in the front rank among aquarists. He will be remembered as a lovable and generous man, ever ready to share his great store of knowledge—and fishes and plants—with his friends.

Notes on Hybrid Sunfishes

CARL L. HUBBS

Museum of Zoology, University of Michigan

The hybridization of fishes in nature is a subject of interest to aquarists, as well as to systematic ichthyologists and geneticists. It has even been suggested that hybridization plays a part in that complex process known as "the origin of species," but there has been too much suggesting, and too little actual study, in such discussions. Definite knowledge is yet too meager, in the case of fishes at least, to permit of a discussion of the general aspects of natural hybridization. First, we should determine the frequency, indeed the very existence, of hybridization in nature between fish species.

David Starr Jordan has stated that although thousands of American salmon and trout had passed under his examination, he has never yet seen an individual which he had the slightest reason to regard as a "hybrid:" "It is certainly illogical to conclude that every specimen which does not correspond to our closet-formed definition of its species must therefore be a 'hybrid' with some other. There is no evidence worth mentioning, known to me, of extensive hybridization in a state of nature in any group of fishes. This matter is much in need of further study." Granting the wisdom and critical value of these remarks, it must be observed that they require some modification. In Europe, a number of hybrids between distinct species, and in some cases between distinct genera, of the carp family (Cyprinidae), have not only been recorded but also described and studied, and occasionally found not rare locally. Trout variously intermediate between supposed species, and similar to hybrids produced in the hatcheries, have been taken in the streams of both Europe and America. Poeciliod fishes have been obtained in Central America, which resemble hybrids readily produced in aquaria between the genera *Platypoecilus* and *Xiphophorus*. To mention but one other case, sunfishes intermediate between the warmouth bass (*Chaenobryttus gulosus*) and several species of *Lepomis*, occurring in the Potomac basin, have lately been interpreted as hybrids (by Radcliffe and by McAtee and Weed).

Among the hundreds of sunfishes (Centrarchidae) readily referrible to the ten very distinct and abundant species of the region, which the writer has collected in waters tributary to Lake Michigan and Lake Erie, there were obtained nine individuals which cannot be referred to any known species. Six of these were seized in the lagoon of Jackson Park, in the city of Chicago, in which body of water the following species of typical sunfishes (the genus *Lepomis*), in addition to the warmouth bass (*Chaenobryttus gulosus*), occur and breed (as the present writer has observed in the number of *Aquatic Life* for July, 1919); the blue-gill (*L. incisor*), the most abundant species; the pumpkin-seed (*L. gibbosus*), abundant, but less so than the blue-gill, and the blue-green sunfish (*L. cyanellus*), not rare, but probably never abundant.

Five of the six of these strange sunfishes possessed characteristics either of the warmouth or of the blue-gill, or intermediate between those of these two very distinct species. Detailed comparisons follow:

In all five specimens the jaws were shorter than in the warmouth, yet longer than in the blue-gill; the lower jaw projected, as in the warmouth, but the teeth on the tongue, as in the blue-gill, were lacking. The black opercular flap, or "ear," was not as stiff and bony as in the warmouth, yet possessed more or less definitely the bluish and reddish margin characteristic of that species. In all, the cheeks were marked with dark mottlings, absent in the blue-gill, but even more distinctly developed in the warmouth. The lower margin of the head was marked, either faintly, or definitely, with the broad blue band diagnostic of the bue-gill. The colors of the body varied greatly, both between individuals and in the same individual (observed in an aquarium); in all the rich colors of the warmouth were variously developed, but the dark vertical bars in most of the specimens were more like those of the blue-gill; the lower sides in proper lights, showed more or less distinctly the silvery-purple sheen of the blue-gill. The single large dark blotch always present on the soft dorsal fin of the blue-gill, was replaced by a variable number of spots, usually fewer, however, than in the warmouth. The iris of the eye in some was entirely brown, as in the blue-gill, but in others was marked with red as in the warmouth. These five sunfishes appeared to be hybrids between *Chaenobryttus gulosus* and *Lepomis incisor*.

The sixth unidentifiable sunfish seined in the Chicago park lagoon mentioned above, similarly combined characters of two of the other resident species, the blue-green sunfish (*Lepomis cyanellus*) and the pumpkin-seed (*Lepomis gibbosus*).

The mouth, as in the other hybrids described above, was intermediate in size between those of the supposed parent-species, and also intermediate in obliquity; the lower jaw projected as in the blue-green sunfish, but the maxillary lacked the supplementary bone developed in that species; the opercular spot was colored as in *cyanellus,* but the cheeks were mottled with olive-green and bright bue as in *gibbosus*; the gill-rakers and the pharyngeal bone and its teeth, were intermediate. The body was beautifully marked with vertical mottlings of olive-green and bright blue. The dorsal fin was intermediate in color, but the pelvic (ventral) fins were margined with white, and the anal fin was bordered with orange-vermillion, as in brightly colored examples of the blue-green sunfishes. Should this apparent hybrid have inherited the docile habits of the blue-green sunfish rather than the fighting spirit of the pumpkin-seed, it would have been attractive as an aquarium fish.

The three other supposedly hybrid sunfishes collected by the writer were seined singly last summer in the Huron River of Southern Michigan, in each case in company with both of the apparent parent-species—the blue-gill (*Lepomis incisor*) and the pumpkin-seed (*Lepomis gibbosus*). Each of the three differed more notably from each of the other two than would be expected if they represented a distinct species. In all characters each was either intermediate between, or like either one or the other of the parent-species. How varied and irregular this resemblance was, furthermore, may be seen from the following detailed comparison (in which the speci-

mens are for brevity termed *A, B* and *C*).

In all three specimens the pharyngeal bones (which form an accessory jaw in the throat behind the gills), were wider than in *incisor*, and many of the pharyngeal teeth were molars rather than canines, yet neither the bone nor the teeth it bears were nearly as havy as in *gibbosus*. The gill-rakers in all were likewise intermediate. The structure and coloration of the opercular flap in specimen *A* was intermediate, but more like that of *incisor;* in *B* also intermediate, yet not so unlike that of *gibbosus;* in *C*, indistinguishable from that of *gibbosus*. In none of the specimens was the blue margin of the gill-covers (a character of *incisor*) distinctly developed; the blue cheek markings of *gibbosus* were evident in *A*, barely apparent in *B*, fully developed in *C*, in all the bronzy blotches on the cheeks (another *gibbosus* character) were developed; in none, except faintly in *A*, were the streaks of color behind the mouth, and in line with it (a feature of *incisor*), developed. In the outlines and form of the head and body all were variously intermediate. Specimens *A* and *B* possessed, while *C* lacked, the blue metallic luster of *incisor;* all had the coffee-colored flecks on the body and the numerous dark spots on the vertical fins, both of which are features of *gibbosus*, never evident in incisor. It seems legitimate to regard these three individuals as hybrids between *Lepomis incisor* and *Lepomis gibbosus*.

Of the three presumed type of hybrid sunfishes here discussed, namely *Chaenobryttus gulosus x Lepomis incisor; Lepomis cyanellus x Lepomis gibbosus*, and *Lepomis incisor* and *Lepomis gibbosus*, it should be noted with emphasis, that for each of the three pairs of supposed parent-species the breeding seasons, the breeding habits and the breeding areas actually overlap. Furthermore, the writer has observed a male pumpkin-seed (*L. gibbosus*) and a female blue-gill (*L. incisor*) engaged in their characteristic gyrating spawning movements, over a nest at the very edge of the Jackson Park lagoon in Chicago. Significantly, also, the largest specimen (here called *C*) of the presumed hybrids between these two species secured in Michigan, was a male taken in the breeding season of both parent species; yet the tests were not enlarged, and the characters were those of the females or immature, rather than of the males of each species.

In conclusion we must not overlook (as others have done), the fact that specimens similar to the supposed hybrids described above have long been known, yet referred to as distinct species. It is certainly probable, however, in some cases indeed almost certain, that some or all of these specimens are also hybrids, and that consequently the so-called species based on them should no longer retain a place in the system. The nominal species referred to are *murinus, ischyrus, phenax;* possibly *macrochirus, albulus* and *gillii*, and almost certainly *Lepomis euryorus*. Two Michigan specimens typical of the last named "species," which has been recorded as such, on the basis of a few individuals in each case, from Michigan, Ohio, Indiana, Illinois and Minnesota, are found on careful examination to be intermediate between *Lepomis cyanellus* and *L. gibbosus* in all characters of form; structure and position of mouth; pharyngeal arch and teeth, and at least in some of the color characters; they can scarcely be other than hybrids.

If a man's in debt it proves that he once had credit.

Fig. 3.

Fig. 2.

Fig. 1.

Leney: Experiments on the Axolotl

Experiments on the Axolotl

D. F. LENEY, F. Z. S.

Laboratory of Comparative Anatomy, Oxford University

The axolotl seems to attract attention in *Aquatic Life* from time to time, so perhaps a few notes on it may not come amiss.

It has been known for some time that the axolotl or larval form of *Amblystoma tigrinum* will give up its aquatic life and take to a terrestrial one when forced to breathe atmospheric air. This external stimulus brings about complete absorption of the feathery gills, and also of the fin along the back and tail, while the head becomes rounded and the eyes more prominent. Figure 1 will give an idea of the halfway stage, with gills partly absorbed and the dorsal fin beginning to be absorbed. In nature this metamorphosis is brought about by the gradual drying up of the pools where the axolotl live, while in captivity the slow evaporation of the water in which the larvae are, will usually have the same effect (see Proc. Zool. Soc., 1913—2, p. 403).

Goodenach fed young frog tadpoles on the thyroid gland of the ox and found that they turned into frogs in an exceptionally short time. Feeding with potassium iodide mixed with flour did this as well. And keeping them in a weak solution of iodine crystals had the same effect. Does this answer with axolotl?

Last winter, at the Laboratory of Comparative Anatomy, of Oxford University, a pair of mature black axolotl were fed twice a week, for seven weeks, on pieces of ox thyroid. At the end of this time both had left the water and had attained the perfect stage known as *Amblystoma tigrinum*. Figure 2 is of the male shortly after coming onto dry land. The chief interest is that the axolotl were sexually mature, hence the thyroid must have supplied the necessary stimulant for the metamorphosis to take place.

Kendall has found that the thyroid gland stores and secretes iodine, in some form or other, into the blood, so that it may be presumed that iodine is one of the stimulating agents at work to bring about metamorphosis. Accordingly a young axolotl was put in a weak solution of iodine crystals. A visible reduction of the gills and tail fin took place, but unfortunately the patient died soon after Figure 3 was taken, where the very reduced gills can be seen.

Similarly the young of *Salamandra maculosa*, the spotted salamander, have been on thyroid gland and have metamorphosed in an abnormally short time, but the iodine treatment appears to have little or no effect on them, whereas when small larvae of *Triton vulgaris*, the smooth newt, are kept in weak solutions of iodine, they rapidly metamorphose.

Quite recently, in May, a white adult axolotl, in a large aquarium, was observed to become covered with pink spots on either side of its body; a disease of some kind. After this it was noticed to be generally near the top of the water. Three weeks later it was found to have lost most of the filaments on its gills and to be respiring with its lungs almost en-

tirely. When placed in water shallow enough to enable it to keep its head in the air, if desired, and to which a little sea salt had been added to cure the disease if possible, the gills continued to be absorbed and the creature became cured of the disease. At the time of writing, August, the axolotl is just about to leave the water as a perfect amblystome. This probably means that the disease in some way caused metamorphosis, and not the brackish water, which has no such effect on a normal individual.

These experiments show the importance of the thyroid gland and its secretions and the need of ascertaining the principles on which it acts. It would be very interesting and useful if anyone would experiment on permanently aquatic salamanders, such as *Amphiuma*, *Necturus*, *Proteus*, *Siren* and others, to see if one of these might not come onto land as a creature hitherto unknown to science. Scarceness of living material in England makes this almost impossible, but in the native countries of these creatures it should not be difficult. It may be possible; who knows until he tries?

Some Tip-top Broadtail Telescopes Bred in 1920

Photograph by Harry W. Balleisen

The judge was evidently getting a bit fed up with the jury, and at last he announced:

"I discharge this jury!"

A tall, lean member of the twelve then rose.

"Say, judge, you can't discharge me."

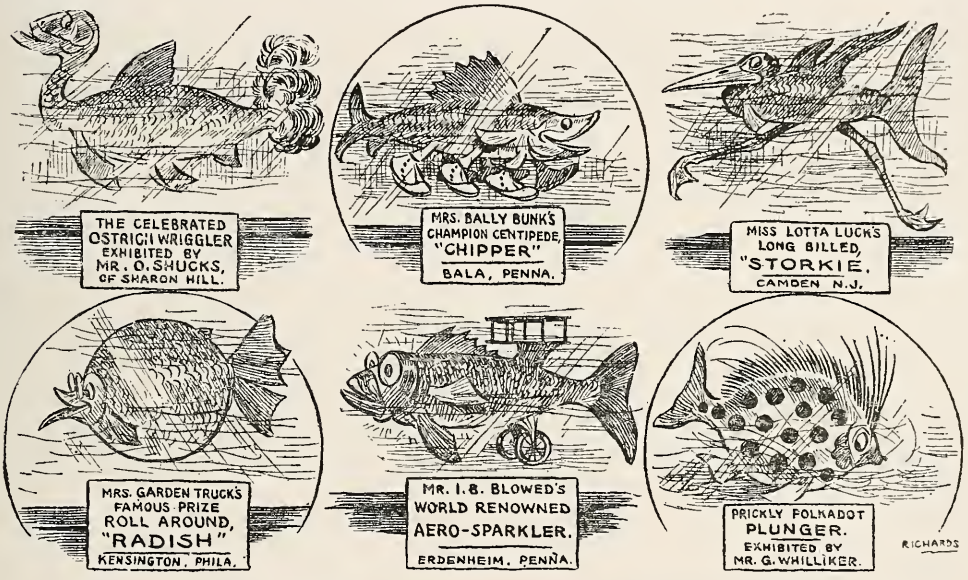
"Can't discharge you? Why not?" thundered the judge.

"Waal," replied the juryman, pointing to the counsel for the defense, "I was hired by that guy over there!"—*Jack Canuck.*

South Australian Society

At a meeting of the South Australian Aquarium Society held on Tuesday, August 3, 1920, Mr. W. J. Kimber delivered an address on "Fresh-water Mollusca."

The lecturer remarked that the fresh-water mollusca fauna of Australia is poor; in the United States of America 200 species of *Unio* have been named, whilst in all Australia there are but wide distribution of some species being thus accounted for. The development of the shell was dealt with and Mr. Kimber spoke of the usefulness of molluscs in aquaria. Our small fresh-water limpet has about 4400 teeth placed in 200 rows and with these teeth the excessive growth of algae is rasped off the glass. Although water snails are generally herbivorous they relish flesh and



A Newspaper Cartoonist's Impressions of the Philadelphia Exhibition

three. He mentioned the extraordinary number of eggs deposited at one time by some species of Mollusca. The fresh-water mussel lays about 200,000 eggs, but this is not large as compared with the millions laid by the oyster. Mollusca's eggs form the principal food of some fishes and of the great quantity deposited comparatively few survive. The larvae have interesting habits, some even attaching themselves to fishes, being thus transferred for long distances. Authentic records have been made of the transportation of small bivalves on the legs of birds and of water-beetles, the the larger species have been known to feed upon their brethren and even to devour small fishes. The bivalves feed by continuously filtering the water and retaining the nutrient matter.

Many parasites of higher forms of life utilize molluscs as intermediate hosts. Thus some parasites of sea-birds live in the branchial cavities of sea-snails in the first stages of development, and the live fluke, which has caused the death of over three million sheep in the Commonwealth, uses a water-snail as its first host. The dreaded disease *Bilhartzia* is similarly propagated.—*Herbert M. Hale*, Honorary Secretary.

The Axolotl Again

No apology is needed in referring again and again to this salamander. The results of investigations have a distinct and valuable relation to possibilities from fishes to the human subject.

I have lately been engaged in inquiring into the feeding of this creature in order to ascertain the effect of certain natural foods upon its growth. It occurred to me that I might do a little glandular feeding in my own way without recourse to either extracted glands or glandular preparations. My idea was to try and find the quickest growing larvae—that is, something which completes its metamorphosis in a very short time, and in consequence likely to possess glandular matter either in abundance or the best form.

I made use of the larvae of one of our midges—species not determined, and by feeding the young axolotl with the best developed larvae which they were able to negotiate, I have produced axolotl this year exceeding in size for age anything I have previously been able to turn out.

I am not an entomologist, consequently am not able to suggest any particular species. This is where the entomologist comes in with his valuable assistance—someone who has made a special study of the subject. The relation between the entomologist and medical science is much closer than is usually credited.

I remember when the medical faculty first suspected, or more than suspected, the mosquito to be responsible for the spread of yellow fever, they, the doctors, felt that it was improbable that all the numerous species of mosquitos were to be blamed; if so, the efforts to check the spread of the fever might be much easier; they wanted to know how many kinds of mosquitos were known and their habits. The entomologists supplied this information at once.—*W. T. Webster,* in The Fishing Gazette.

"That one looks old enough to be a grandfather," said a woman Saturday at the pet fish exhibition in Horticultural Hall, Fairmount Park, Philadelphia. "Is he?"

"That is a roe fish, madam," said a committeeman.

"I mean the biggest one, there, that one with the long whiskers," continued the woman.

"That is a roe fish, madam," repeated the committeeman.

"I am not asking you what sort of a fish it is, but whether it is not old enough to be a grandfather? It certainly is big enough."

"It is big enough, madam, but it is a roe fish," answered the committeeman.

"Well, can't a row fish be a grandfather, as well as any other kind?" queried the woman, a touch of irritation noticeable in her voice.

"No, madam, a roe fish cannot be a grandfather," once more said the committeeman.

"Well, I never had an aquarium," said the woman, "but I can't see why the 'kind' it is has anything to do with its becoming a grandfather," that in a tone between disgust and despair.

"But, madam, you will never be a grandfather, no matter how long you live," said the committeeman.

"No, sir, I shall not," retorted the woman indignantly, "but I am a lady."

"So also is the fish," asserted the committeeman politely, but firmly.

"Well, why on earth didn't you say so in the first place."—*Public Ledger.*

The greatest profit is where the profits are reinvested in a business—it becomes compound profit.

The pen may be mightier than the sword, but truth doesn't always lie at the bottom of the inkwell.

April. Mastacembelus pancalus (*MacMorris*); A New Treatment to Eliminate Ichthyophthirius (*Hauthaway*); Observations on the Chelonians of North America, Part IX (*Shufeldt*); Notes on Haplochilus lineatus (*Sawyer*); The Artificial Production of Albinism (*Waite*); A Metal Net for Larval Fishes (*Balleisen*); The "Balanced Aquarium—A Question and an Experiment (*Powers*); Venus's Fly Trap, Notes and News.

May. Aquarium Microscopy (*France*); A "Tin Can" Aquarium (*Balleisen*); Observations on the Chelonians of North America, Part X (*Shufeldt*); The Stud Fishes (*Sawyer*); The Guide Book to The New York Aquarium (*Shufeldt*); May Pointers, The Microscopical Society, Notes and News.

June. Macrones vittatus (*MacMorris*); An Interesting Abnormality (*Tasche*); Blue-spotted Sunfish (*Sawyer*); Breeding Viviparous Poeciliids (*Balleisen*); Bufo halophilus (*Ruthling*); The Diatomaceae (*Wheeler*); Appropriate Names (*Mellen*); Boyer's *"The Diatomaceae of Philadelphia"* and society news.

July. On a Deformed Specimen of Muhlenberg's Turtle (*Shufeldt*); Phalloptychus januarius (*Myers*); Notes on Fundulus luciae (*Crawford*); Haplochilus panchax (*Brind*); The Red Rivulus (*Myers*); The Ideal Fish Food (*Heidelberger*); An Automatic Feeding Device for Aquaria (*Breder*); Electric Fishes, notes and news.

August. Fitzroyia lineata (*Brind*); The Leafy Sea-dragon (*Hale*); The Red-bellied Newt (*Balleisen*); Melanotaenia nigrans (*Finckh*); Fundulus diaphanus (*Myers*); Aquarian Diatoms (*Boyer*); Aquarists Collecting Daphnia in Philadelphia, Result of Feeding Trout on Dried Flies, The Economy of the Fresh-water Aquarium, etc.

October, 1920 15c Copy

Aquatic Life

Aquatic Life

Vol. V Oct. 1920 No. 10

An international monthly magazine devoted to the study, care and breeding of fishes and other animals and plants in the home aquarium and terrarium.

W. A. POYSER ..... EDITOR
JOSEPH E. BAUSMAN ..... PUBLISHER
632 East Girard Avenue ..... Philadelphia

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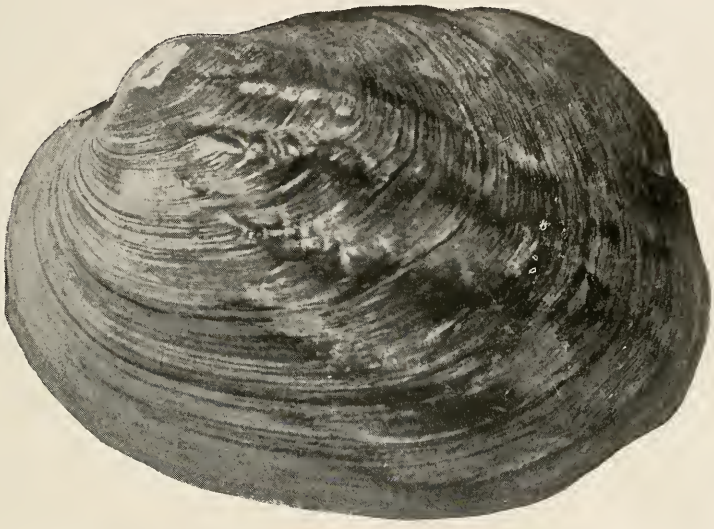
The Larger River Mussels in Aquaria

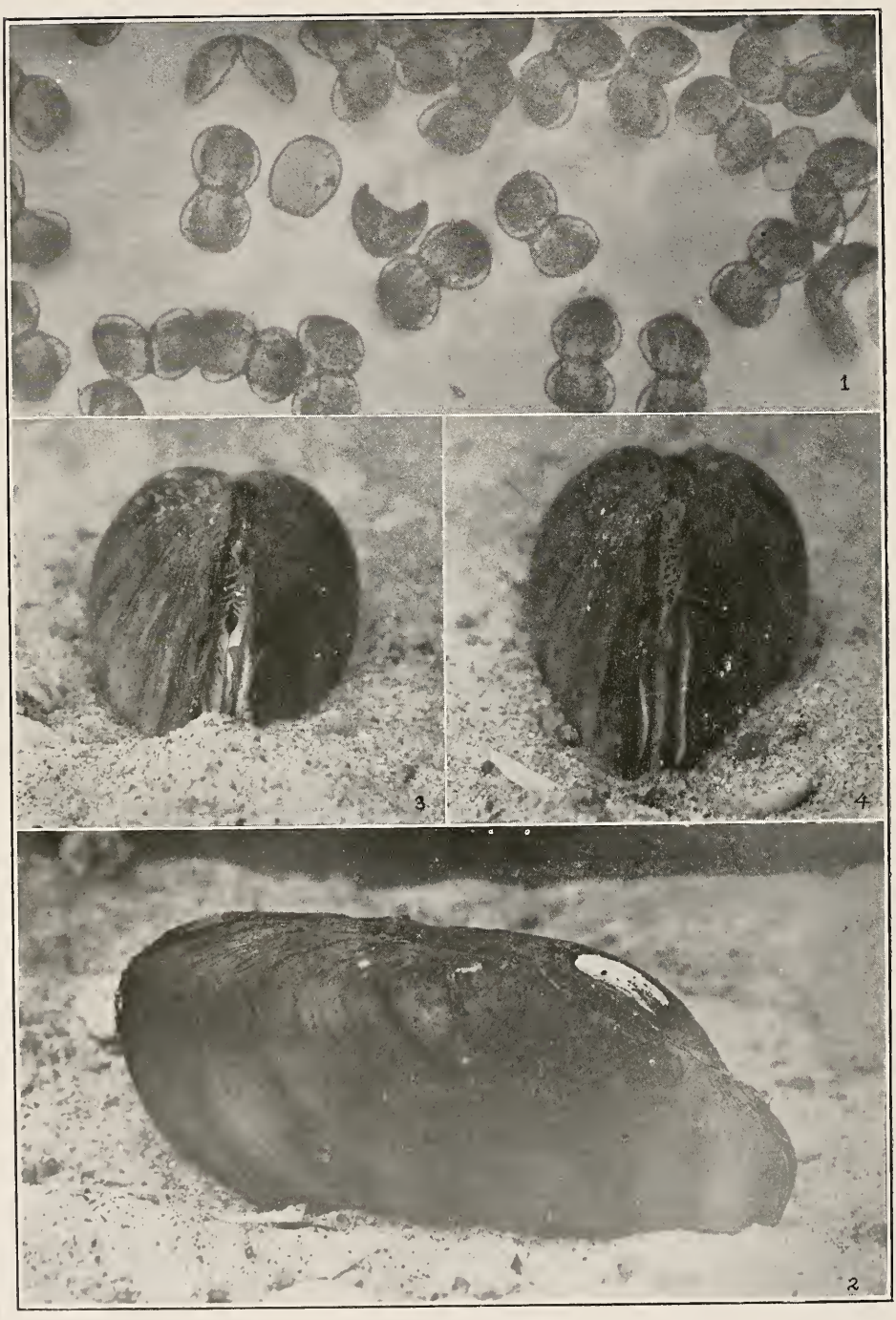
CHARLES M. BREDER, Jr
United States Bureau of Fisheries



Three-ridge Mussel, *Quadrula undulata* (Barnes) from South Dakota
Photograph by courtesy of Bureau of Fisheries

Through the kindness of Dr. R. E. Coker, of the U. S. Bureau of Fisheries, the writer has been able to secure a few of the larger Mississippi River mussels for observation in small aquaria. These were all of species of considerable economic importance, the shells being used in great numbers for the manufacture of the common pearl buttons, which form a real necessity in our daily life.

The only species which survived in the confinement of small aquaria for any length of time was the "Three Ridge" *Quadrula undulata,* although the shipping may have had more to do with the death of the others than the actual confinement in small bodies of still water. Three specimens of this species have been kept in various small aquaria for over nine months, at the end of which period one succumbed, for an unknown reason, and another met with an accident. The remaining individual, at this writing, is apparently in perfect health at the writer's home, living in a small tank, 18x12x 12 inches, after having spent various periods of time in small jars ranging from one 12 inches high by 8 inches in diameter up to size of the present container. A year has now elapsed since it left its



Breder: The Larger River Mussels in Aquaria

native waters. These three shells all measured about 11 cm. in greatest length. The writer strongly recommends these to aquarists as at no time have they been known to indulge in "plowing" up the bottom of the aquarium, being content to remain in practically any position. They have been only rarely noted to shift their position and then usually not more than half the length of the shell. At no time have they been in aquaria containing sand in sufficient quantity to completely cover their shells. No particular care has been bestowed upon them at all, simply being placed in the aquarium and forgotten. The amount of food that they have been able to draw from the suspended material in the crystal clear water of the aquarium has evidently been sufficient to maintain life. It is generally believed that their presence aids in keeping the water in such a condition, although they are apparently by no means essential.

Shortly after arriving at Washington, several individuals of other species emitted glochidia, the larval form in which these organisms start their life. These are little bivalved creatures that normally have the valves widely spread, but on slight stimulation of the ligament connecting the two, they are brought together with considerable vigor. In this manner they are able to attach themselves to fish, different species of mussels requiring different hosts for their purpose, which is one of parasitism. This attachment occurs usually on the gill filaments or on the fins. In a short time the injured tissue grows over and around the animal, completely encysting it. Enclosed in this cyst the young mussel further develops and finally breaks out of it to lead its sedentary existence on the river bottom, apparently leaving the fish none the worse for its experience. It is evident that as well as protecting and nourishing the mussel in its early and most precarious time of life the distribution of the species is much more effectively accomplished by this parasitic habit, as the host may carry it much farther than its sluggish adult movements could ever hope to.

Two periods are thus brought into the life of every mussel when its existence hangs by a very slender thread, dependent solely on external circumstances; first when it is emitted as glochidium, here depending on the passing of a luckless fish of proper species, in the absence of which it perishes in a short time; and second when it leaves the fish and faces the possibility of falling onto an unsuitable bottom, such as one covered with flocculent mud, which would smother it, or into water too deep to allow its existence. It is almost needless to add that for every one which survives, thousands fail at either of these vital times. To counteract this and insure the perpetuation of the species countless numbers of glochidia are discharged from the brood chamber of the parent mussel, where they have been incubated, to the time when they are ready to take their chances in the outside world. Aquarists need have no fear of infecting their various fishes as the possibility of any of the usual aquarium fish being suitable hosts for these species is very remote.

Explanation of Plate

1. Living glochidia of *Lampsilis ligamentina*, as seen through the microscope, one hour after expulsion. Magnification, 40 diameters.

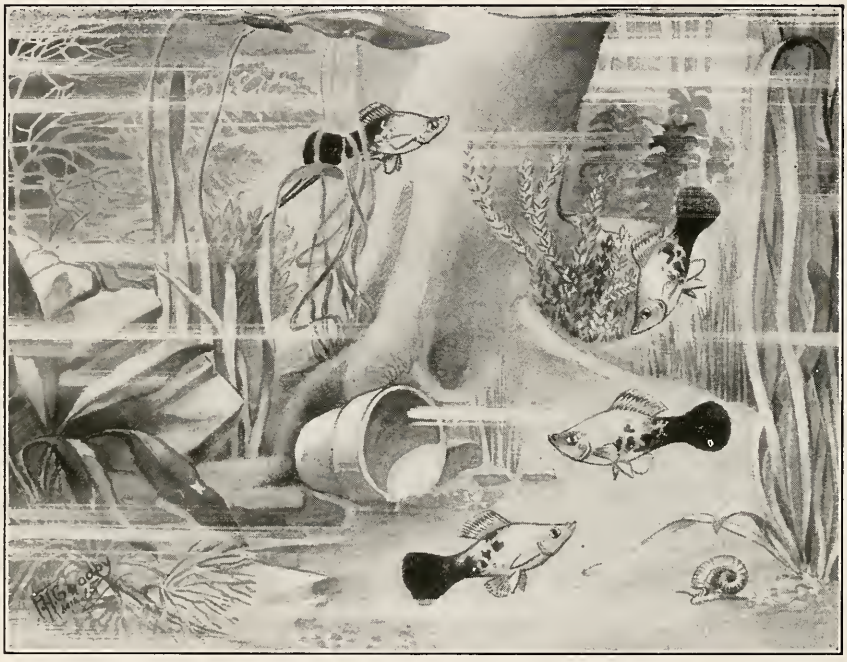
2. *Lampsilis ligamentina*. Length, 11.5 centimeters.

3. *Lampsilis anodontiodes*. Length, 10 centimeters. This species has the greatest commercial value. The shell externally is a rather pleasing shade of yellow.

4. *Lampsilis anodontiodes* with syphon extended. (Photographs by the author.)

Notes on the Hybrid Xiphophorus helleri x Platypoecilus maculatus

F. S. CURTIS, San Francisco Aquarium Society



The Poecilid Hybrid, Xiphophorus helleri x Platypoecilus maculatus

From time to time articles have appeared in aquarium periodicals giving rather brief and general descriptions of this most beautiful and interesting hybrid. The writers, however, seem to have confined their remarks to examples that were strongly marked as hybrids, saying little of those reverting to the original forms and not showing composite characteristics. It occurs to me, therefore, that my experience in breeding these hybrids, and that of Mr. F. S. Locke, may be of general interest.

Aquarists are well aware that both the paternal *Platypoecilus maculatus* and the maternal *Xiphophorus helleri* belong to the viviparous branch of the family Poeciliidae or killifishes. There are two very distinct forms of *X. helleri,* one which is of a general bluish cast with little or no orange or yellow in the lateral stripe and tail, and another which is much more brightly colored, having a deep orange-red lateral stripe with a clear

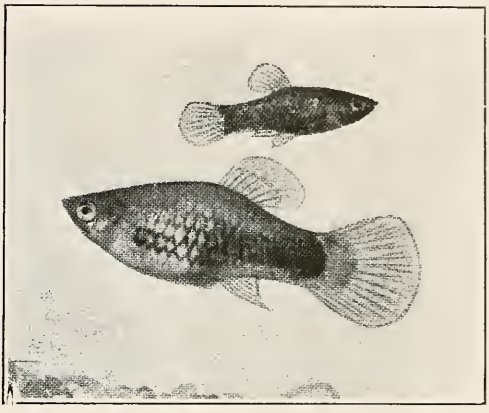
lemon-yellow stripe above and below it and with bright yellow or orange in the tail.

In 1915 I mated a particularly large and highly colored male of *X. helleri* to a correspondingly well developed female of the same species belonging to the phase called "rachovii." From their progeny I paired the best female, with strong rachovii characteristics, to an unrelated male of the bright red type. From this union I selected what promised to be a fine "rachovii" female and bred her to a deep red male of *Platypoecilus maculatus (rubra)*.

In November, 1918, I was rewarded with two litters of hybrids, 98 in all. Six of the fry were "throw-backs," and were to all appearances straight females of *P. maculatus,* of a pale sandy color; of the 92 composite individuals there were but twenty females, but all, both sexes, were darkly mottled over the entire body from birth. Let us digress for a moment for a comment on the preponderance of males. With *X. helleri,* its form "rachovii, and *Platypoecilus maculatus*, pure litters usually contain more females than males, generally in the ratio of 8 or 10 to 1; in the hybrids, you will note, this tendency is reversed, but not in quite the same ratio.

The hybrids, both male and female, rather favor the maternal parent in shape, and both sexes are practically of the same size and color, although the reddish hues in the male hybrid are straw color in the female. In this connection note the departure from the parental forms wherein the females are much larger than the males and are almost entirely lacking in any of the brilliant colors so characteristic of males. In many of the hybrids the scales are overcast with dark blue, like blued steel, similar to that seen in a well colored male of the "nigra" form of *P. maculatus.* A peculiarity of the color scheme is that black predominates and is confined almost entirely to the posterior portion of the body, forward of the dorsal being red speckled with black.

By a careful study of the colors in both parent species we see the reason for the excess of black, and why it is naturally confined to the tail rather than the head. In typical *X. helleri* there is a black bor-



Platypoecilus maculatus

Upper, male of red phase (rubra); lower, female of black phase (nigra)

der, both edges, to the sword-like extension of the tail-fin; in the form rachovii there is in addition to the black border a large crescent-shaped black spot at the base of the tail; in *P. maculatus*, red form or "rubra," appears this same black spot and males have small black dots more or less over the entire body. It is asserted, and we believe correctly, that the forms of *P. maculata* called rubra, nigra and pulchra are color variants developed by aquarists, and this species in nature, as well as *X. helleri*, is much given to color variation. Typical *P. maculatus* is olivaceous in color shading to pearly white on the belly. The dark crescent or half-moon shaped spot at the base of the tail is in evidence and in most specimens a dark spot appears on each side of the body. Occasionally, particu-

larly in males, we find a metallic blue spot on the sides.

I have gone minutely into the characteristics of the hybrids in order to bring out clearly the dominant colors and to show that it is not at all strange that black should prevail. In well colored specimens of the black (nigra) form of *P. maculatus* the body is all black except the back and belly, the sides overlaid with bright metallic blue. If so intense a black is found in this variant relative, it is small wonder that the hybrids, with black showing in both parental species, should be thus darkly marked.

Males of the cross have well developed but short spikes to the tails, showing the helleri blood. Many of the spikes are orange, while the entire tail may be similarly tinted. The other fins are generally clear. In size the hybrids are about midway between the parents. They are inclined to be shy, resembling *X. Helleri* in this respect. In this hybrid we have a form which in all respects is a composite, showing some of the characteristics of each parent, but differing from both in that both sexes are of the same size and general coloration, with the sex ratio reversed.

It is well to note that in the hybrids there is little or no change in color from birth to maturity as there is in both parents, for in pure bred types the young at birth are all olivaceous in color, putting on the more brilliant hues only when mature.

On account of lack of tank space I was unable to segregate any particular pairs of this first generation of hybrids to breed from, but was obliged to keep all the composite types in one large tank. I am unable, consequently, to say what effect line breeding would have had on the next generation. Early in September, 1919, I noticed the first young of the second hybrid generation. They were expelled a few at a time, usually not more than 8 or 10, which is rather at variance with the parental species which may produce large litters within a few hours—80 for helleri and 40 to 50 for maculatus being not uncommon.

Out of a total of 310 young of this second generation, 29.4 per cent., or, to be exact, 91 individuals, reverted back to the original types. Three were maculatus rubra (2 males, 1 female), and of the 88, 40 per cent. were helleri rachovii and 60 per cent. typical helleri. All appeared to be dwarfs, not reaching half the size of those of the composite group, but small as they were the females showed a tendency to be larger than the males, and as close as could be determined there were four times as many females as males; thus in these throw-backs we see the characteristics of the original species.

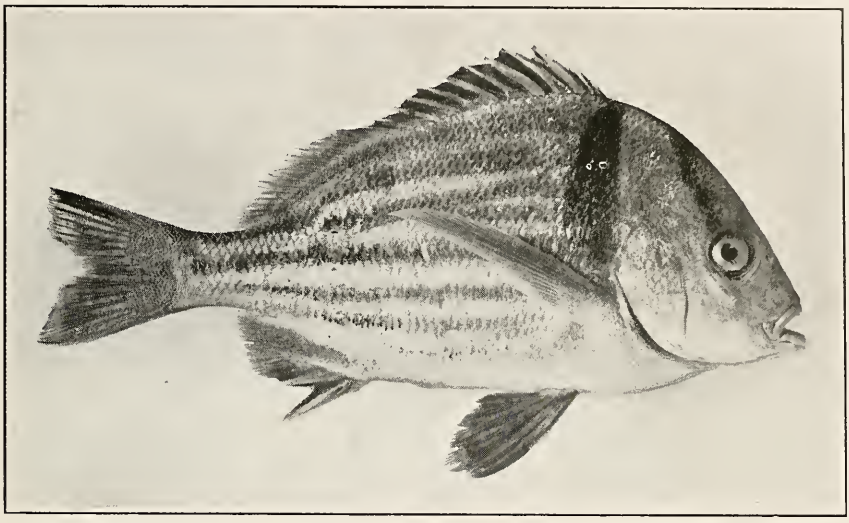
In the 219 composite fish we find for the most part the intense black predominating, but on the other hand the red, when it appears, is much more intense, not an orange or sandy red as in the first hybrid generation. There were also more speckled fish than in the first generation, which were blotched rather than speckled. Many are solid bright red forward from the dorsal fin with the remainder of the body intense black, including dorsal and tail, and reminding one very much of a black male of *Gambusia affinis;* some are light red with vertical markings of black, and the general color scheme is much more diverse than in the previous generation. Thus far the sexes are about equal in size and color, except, that the red is lighter in the females, often sandy. These fish are developing much more rapidly than the first generation under exactly the same conditions. It is not yet possible to determine the ratio of the sexes.

(Concluded on page 117)

North American Fishes

II. The Pork Fish (Anisotremus virginicus)

R. W. SHUFELDT, M. D., C. M. Z. S.



The Pork Fish — Anisotremus virginicus

In the first of these brief fish sketches of North American Fishes there was described and figured a specimen of the Yellow Grunt (*Haemulon sciurus*), while the present article will be devoted to a similar account of the Pork Fish (*Anisotremus virginicus*).

This Pork Fish belongs in the same family with the Yellow Grunt, that is, in the family *Haemulidae* or Grunters, which contains several other genera, some of which will be described and figured later on in the present series. There are about a dozen different species, perhaps more, in the genus *Anisotremus,* in so far as our fish fauna goes, while others occur in waters south of the American limits. The Pork Fish is not entitled to its specific name of *virginicus*, given it by Linnaeus, as it is not found as far north as Virginia, its range being from Florida to Brazil. It is one of the most abundant fishes in West Indian waters, and constantly displayed for sale in the fish markets of Habana, Cuba, where I have frequently seen it among many other interesting forms.

The specimen shown in my cut is from a photograph I made of one that lived in a tank at the New York Aquarium, and was kindly supplied by Dr. Chas. H. Townsend, the director of that famous

institution.

With respect to the external characters of the Pork Fish, they are all well shown in the cut, thus obviating the necessity of any detailed description of them. Special note, however, should be made of the two anterior dark bands, one—a vertical one—extending downwards from the first dorsal ray of the pectoral fin, and the other—an oblique one—passing downwards from the top of the head through the eye to a point back of the angle of the mouth. The bands are very black and distinct in the living fish. In front of the anterior bar, the color is of a deep orange yellow, while between the two bars it shades to a pearly gray, spotted over with yellow, these latter merging into a yellow area above. The entire fish is of a gray color having pearly lustre, the body exhibiting some eight longitudinal stripes, which are of a rich yellow color. Fins deep yellow; iris gray. Young specimens are very differently colored as compared with adult ones, the principal color being a bright yellow, while they show, as Dr. Jordan points out, "a large round jet-black spot at base of caudal," with various stripes anteriorly. (p. 1323.)

Some species of *Anisotremus* occur in the Pacific along our western coasts, others along both coasts of Central America; of Mexico, and in the Atlantic and Pacific Oceans off the more northerly coast of South America; so it will be seen that the species of this genus are of wide distribution.

(Concluded from page 115)

I hope to be able to give further reports in the future, as I have paired brother and sister in the "throw-backs:" Brother and sister by color and also unrelated individuals by color in the composite class. I was able to secure unrelated individuals from Mr. Locke whose hybrids are from typical helleri. His experience has been quite similar to mine as to color, size, "throw-backs" and preponderance of males over females.

Your readers who have tried aerating pails of fishes on long journeys will appreciate the following joke, which is too good to keep to ourselves:

A messenger from the aquarium was conveying a collection of freshwater fishes from the New Jersey State Hatchery to the New York Aquarium, and was, of course, kept busy aerating the water by lifting out a dipperful now and then and letting it fall slowly back into the cans.

An old lady, alighting at one of the stations, noticed him with apparent interest and sympathy as she passed. On reaching the door, she inquired solicitously of the guard, "Is that poor man insane?"—Ida M. Mellen, *Secretary, The New York Aquarium.*

Don't slam a door within your mind; open the door, so that ideas may go in and out.

A member of a national medical association tells the following story at the expense of a physician:

"Are you sure," an anxious patient once asked—"are you sure that I shall recover? I have heard that doctors have sometimes given wrong diagnoses and treated a patient for penumonia who afterwards died of typhoid fever."

"You have been woefully misinformed," replied the physician indignantly. "If I treat a man for pneumonia, he dies of pneumonia."—*Harpers.*

Do not blow your own trumpet; nor, which is the same thing, ask other people to blow it. No trumpeter ever rose to be a general.—*Edward Everett Hale.*

MAY. Aquarium Microscopy (*France*); A "Tin Can" Aquarium (*Balleisen*); Observations on the Chelonians of North America, Part X (*Shufeldt*); The Stud Fishes (*Sawyer*); The Guide Book to The New York Aquarium (*Shufeldt*); May Pointers, The Microscopical Society, Notes and News.

JUNE. Macrones vittatus (*MacMorris*); An Interesting Abnormality (*Tasche*); Blue-spotted Sunfish (*Sawyer*); Breeding Viviparous Poeciliids (*Balleisen*); Bufo halophilus (*Ruthling*); The Diatomaceae (*Wheeler*); Appropriate Names (*Mellen*); Boyer's *"The Diatomaceae of Philadelphia"* and society news.

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AUGUST. Fitzroyia lineata (*Brind*); The Leafy Sea-dragon (*Hale*); The Red-bellied Newt (*Balleisen*); Melanotaenia nigrans (*Finckh*); Fundulus diaphanus (*Myers*); Aquarian Diatoms (*Boyer*); Aquarists Collecting Daphnia in Philadelphia, Result of Feeding Trout on Dried Flies, The Economy of the Fresh-water Aquarium, etc.

SEPTEMBER. North American Fishes—I. Haemulon sciurus (*Schufeldt*); Tumor in a Brook Trout (*Babcock*); Channa fasciata (*Innes*); Notes on Hybrid Sunfishes (*Hubbs*); Experiments on the Axolotl (*Leney*); Christian J. Heede, The British Aquarium Society, The South Australian Aquarium Society, Photographs of Broadtail Telescopes, cartoon, etc.

Statement of the Ownership, Management, Circulation, Etc., Required by the Act of Congress of August 24, 1912, of Aquatic Life, published monthly at Philadelphia, Pennsylvania, for October 1, 1920.

State of Pennsylvania, County of Philadelphia. } ss:

Before me, a notary public in and for the State and County aforesaid, personally appeared W. A. Poyser, who, having been duly sworn according to law, deposes and says that he is the editor of AQUATIC LIFE, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, to wit:

That the names and addresses of the publisher, editor, managing editor and business managers are:

Publisher—Joseph E. Bausman, 632 East Girard Avenue, Philadelphia, Pa.

Editor—W. A. Poyser, 207 South Thirty-seventh Street, Philadelphia, Pa.

Managing Editor—None.

Business Managers—None.

That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent. or more of the total amount of stock.)

Owners—Joseph E. Bausman, 632 East Girard Avenue, Philadelphia, Pa., W. A. Poyser, 207 South Thirty-seventh Street, Philadelphia, Pa.

That the known bondholders, mortgagees and other security holders, owning or holding 1 per cent. or more of the total amount of bonds, mortgages, or other securities are: *None.*

W. A. POYSER, *Editor.*

Sworn to and subscribed before me this 21st day of September, 1920.

(Seal) A. D. DEWEES.

My commission expires February 19, 1 21.

November, 1920 15c Copy

Aquatic Life

Aquatic Life

Vol. V **November** **No. 11**

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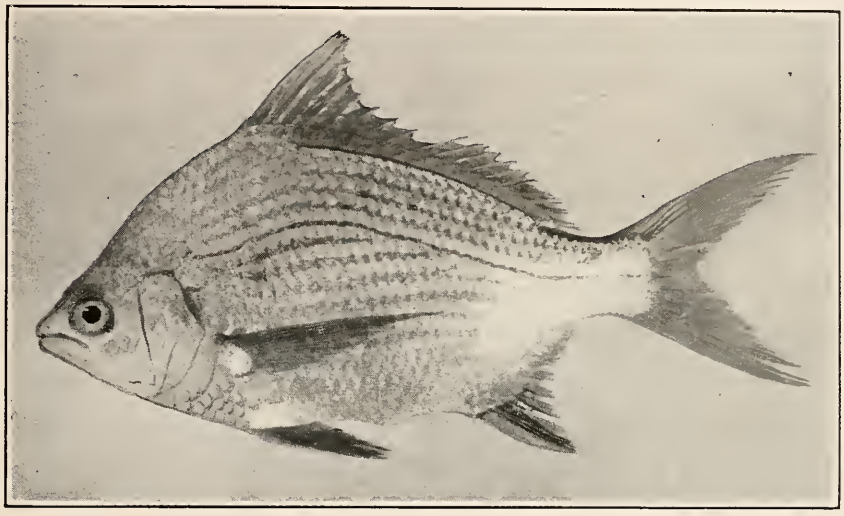
North American Fishes
III. The Striped Moharra (Gerres embryx)

R. W. SHUFELDT, M. D., C. M. Z. S.



Striped Moharra — Gerres embryx

Insofar as I am aware, the fish here to be described has not yet been figured, nor does it appear to have received a vernacular name. This being the case, I propose to call it the Striped Moharra (*Gerres embryx*), Jordan and Starks. Its characters are presented in some detail in the "Fishes of North and Middle America" by Jordan and Evermann in Part II, p. 1379, where it is described as a "new species." This fish sometimes occurs in the fish markets of Washington, where it is called the "Silver Perch," and it was from a specimen obtained there that I made the negative from which the cut here presented was made. Its specific name *embryx* is from two Greek words meaning in the ocean depths, and Jordan and Evermann say of it "length about a foot. Coast of South Carolina, in rather deep water, in company with *Calamus leucosteus, Centropristes philadelphicus, Larimus faciatus,* and *Stellifer lanceolatus.* Here described from a specimen (No. 449, L. S. Jr. Univ. Mus.) 12 inches long, taken at Charleston, by Mr. Charles C. Leslie." (p. 1379.) Of these authors the family *Gerridaes* (No. C L I I I) contained the Mojarras and Mojarritas, with fishes bearing several other names.

The *Gerridea* stand between the fami-

lies *Moendae* and *Kyphosidae* of the group *Percoidea* of the teleostean fishes, and the general form of many of them is well exemplified by the subject of the present sketch. My photograph of *Gerres embryx*, here reproduced, presents the form so accurately, with the character and shape of its fins and its scalation, that any description along these lines is rendered quite unnecessary.

In the upper jaw the teeth are minute, movable, and slender, there being none in the lower jaw; while, as Doctor Jordan points out, the pharyngeals have "short, blunt, pebble-like teeth on the middle, and small, sharp, conical teeth on the outer edge." There are from seven to fourteen short gill-rakers, and four or five rows of scales on the cheeks, with none on the lower jaw.

This is a silvery fish, palest ventrad, with a darker shade along the back. Ten or eleven dark, narrow stripes run down on either side; one of these covers the lateral line, those above it being parallel therewith; those below are nearly straight. There is a black spot on the tip of the snout above, while the superior fins are dusky in color; as a rule the ventral ones are lacking in all color. Jordan describes some seven other species of *Gerres*, and they occur on both coasts of the Americas.

In December, Chicago was honored with the meeting of the American Association for the Advancement of Science, and it was probably the greatest assembly in the history of the organization. Hundreds of investigators from all parts of the realm met to confer on recent research, talk over old times and lay plans for the future. The membership includes the great men of the day in science, and the men to whom the world turned for aid in the great war.

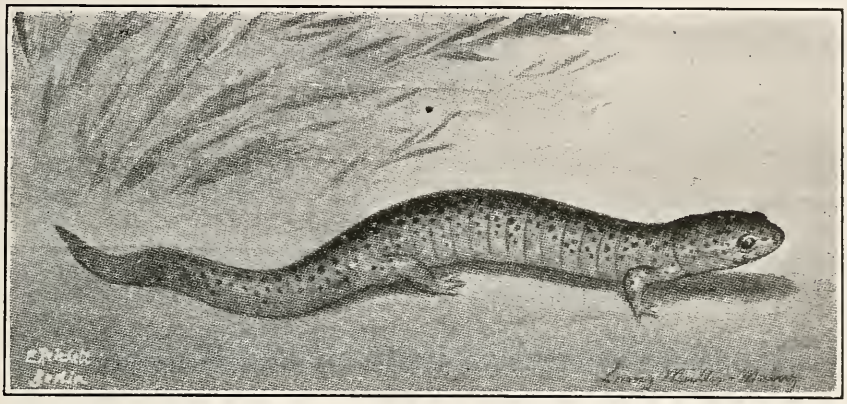
Believing that all good things should not be confined to a limited circle, the Chicago Aquarium Society invited some of these men to its rooms in the Keedy Studio, that they of the scientific world might rub elbows with business men with whom science is a hobby. And a mighty friendly rubbing it was, our guests representing the zoological departments of seven universities. With us were Dr. Henry B. Ward, Prof. Frank Smith and Dr. H. J. Van Cleave, of the University of Illinois; Drs. George R. La Rue, A. J. Ruthven, Peter Ukkelberg, Paul S. Welch and Carl Hubbs, of the University of Michigan; Dr. Raymond C. Osborn, University of Ohio, and Director of the Biological Station at Put-in-bay; Dr. Van Austin, of the University of Wisconsin; Dr. Guberlet, of the Oklahoma Agricultural Station; Dr. E. H. Brandquist, of Northwestern University, and Prof. M. H. Stoll, of Detroit Junior College.

We showed them our pets and swapped fish stories. Dr. Ward, who has done government fishing in Alaska; Dr. Osborne, famous for work with Great Lakes fishes, and Dr. Ruthven, who has seen fabulous snakes in South America, made points for their side. The aquarists were ably represented by Dr. George H. Cleveland, of the Chicago Fisherman's Club; the well-known Chicago Guy—Guernsey—and our president, Dr. H. G. Champlin. After a moist intermission, honorary memberships were presented to Dr. Ward, Dr. La Rue, Floyd S. Young, Guy Guernsey, Carl Hubbs, C. B. Whitford and I. J. Ackerman for deeds and activities in advancing aquarian science and the welfare of the society.

The gathering was then transported to the Orpheum Theatre, in the Loop, for a private exhibition by Mr. William P. Orsinger of five reels of aquatic life and deep sea animals. December 29 is marked a red letter day in the annals of the Chicago Aquarium Society.

The Red Salamander

E. R. DUNN



Red Salamander — Spelerpes ruber

The red salamander, *Spelerpes ruber* (Daudin), ranges throughout the eastern half of the United States. It is, however, local in its distribution, being very common in certain places, and decidedly rare in others seemingly as suitable in a single neighborhood. It is more aquatic than others of our eastern salamanders, preferring cold springs to any other habitat. Here they may sometimes be found in great numbers. I have taken at least 68 from a single swamp spring near Haverford College, Pennsylvania.

In the natural state its food is small earthworms and sowbugs. In one specimen I found a caterpillar of the army worm. In captivity it will eat finely chopped beef. Large larvae will eat very small ones.

The identification of the adult is an easy matter. It cannot be mistaken for any of the salamanders of the Northeast, except *Gyrinophilus porphyriticus,* which is larger, more uniform in color, and restricted to the Alleghenies. The adult ruber reaches 5½ inches. The ground color is a clear red. The upper surface is crowded with black spots which are sharply defined in the small specimens, but in old and large animals are outlined with dusky, which may obscure the ground color on the back. In the young the belly is unspotted, but very fine black spots appear with age. The tail is about two-fifths the total length.

The larvae are more difficult to identify. The ground color is white, and the pigment is uniformly distributed over the dorsal surface, except for a few small spots called pigmentless areas, which are

of service in identifying larvae. They reach a large size before transforming and probably spend two years in the larval The breeding period is probably in the early spring, and the transformation takes place in the late spring and early summer.

Around Philadelphia they are likely to be confused with the larvae of the Two-lined Salamander, *Spelerpes bilineatus.* These reach 70 mm. before transformation, and adults of 48 mm. have been found. Larvae ruber reach 110 mm. and adults of 80 mm. have been noted.

The smallest positively identified ruber I have are 50 mm. long. In comparison with bilineatus larvae of the same size they are much more uniformly dark. Larvae of bilineatus always have two rows of large light spots on the back. In ruber the spots are few and very small. In bilineatus at 50 mm. the pigment for the lateral dark lines has begun to collect on the sides of these light spots, thus showing an approach to the adult coloration.

At 79 mm. ruber is much more robust than bilineatus, and its coloration is the same as at 50 mm., while bilineatus shows a much closer approximation to the adult, in fact 70 mm. is an extreme length for larval bilineatus and few reach it. Ruber generally transforms at a length of 90 mm. External conditions, however, modify the size at transformation.

In regard to keeping ruber in the aquarium, I can only say that it is very hardy and will live indefinitely with little or no care. The larvae will live best in very shallow water. I have never tried keeping them in balanced aquaria. The adults should have easy egress from the water.

To convince you must believe.

A rolling stone gathers no moss, and, on the other hand, no rust either.

British Aquarium Society

A meeting of the above Society was held at 4, Fetter-lane, on Friday, January 21. The chair was occupied by the president, Mr. W. T. Webster, F. R. M. S. A letter from the editor of *Country Life,* in which he related his experience in regard to fish taking mosquito pupae as food, was read by the President.

The principal business of the meeting was a lecture, illustrated by lantern slides, on "British Fresh Water Leeches," by Mr. H. Whitehead, B. Sc., of the Essex County Museum. The natural feeling towards leeches is one of repulsion, due, probably, to its reputation for blood-sucking. It was comforting then to hear that the medicinal leech is the only British species which is able to pierce the skin of mammals. Of the fourteen species found in Great Britain, three only are marine, and eleven are found in fresh water. Of the British fresh water leeches, only two species attack fresh water fish—(*Piscicola geometra and Hemiclepsis marginata*)—a point of special interest to members of this society. Others prey upon worms, aquatic larvae, newts, frogs and sickly fish. The young leeches have many enemies, among which are moles, shrews, voles, hedgehogs, ducks, storks and herons. Certain fish, and aquatic larvae (*Hydrophilus*) do a great deal of damage. Their own kind attack them, and even the harmless snail-leeches suck them when tender.

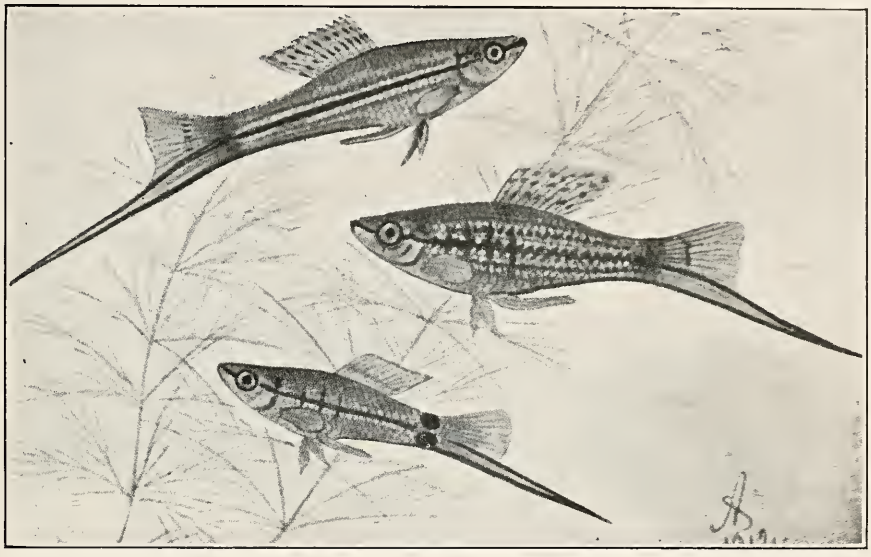
All leeches are hermaphrodite, but self-fertilization does not take place. The eggs are carried in the clitellum which, when deposited, forms a cocoon.

By the aid of an interesting lantern slide, the leech was compared and contrasted with the earthworm. Fresh water leeches are found in ponds and streams, under the leaves of planks, and under

Concluded on page 123

The Mexican Swordtail

GEORGE S. MYERS



Typical male of Xiphophorus helleri (upper) and two variants

The Mexican Swordtail, *Xiphophorus helleri*, was described and named by the naturalist Heckel in 1848. It occurs extensively from Southern Mexico and Central America to Venezuela in company with *Platypoecilia*, *Mollienisia*, *Poecilia* and other members of the group of live-bearing tooth-carps familiar to aquarists. It was first secured by German aquarists in 1909 and was brought to this country about a year later. It soon became popular and is now the most easily procured exotic aquarium fish. Beautiful coloration and interesting breeding habits made friends for it everywhere.

The body, in the male, is an intense silvery-blue which in some specimens shows a decided greenish tinge. Along the side, ending at the tail-fin, is a red or reddish line. The dorsal fin is large, reminding one of Mollienisia, and marked with dots of claret. The gill-covers are bright silver-blue. The sword, a prolongation of the lower rays of the tail, is in some individuals a metallic peacock green, and in others yellow or bright orange. In all cases it is outlined with black. Fish bred from stock brought from Venezuela have in addition to the usual red lateral stripe, a wide reddish-

gold band on each side of it, above and below being metallic blue. The sword is intense yellow-green. The general coloration of the female is similar but not so vivid, and she lacks the sword-like extension of the tail. Her dorsal fin is somewhat smaller.

Individuals vary considerably in size, due mainly to environment and foods. When a litter is given plenty of room, abundant and proper food and adequate warmth, large and sturdy specimens will result. On the other hand if crowded and poorly fed they will be scrawny and small. In nature it attains a large size for a cyprniodout, a male (including the sword) reaching 6½ inches, the female a trifle less. The average size for a mature aquarium grown fish is 3½ inches. This does not mean that large ones cannot be grown in home aquaria. The writer has in his collection a male, grown in a 24-inch tank, that measures 6¾ inches in all.

The number of young in a litter varies with the size of the female, large ones having families of a hundred or more. If well fed the fry will mature in four to five months. The best food is daphne, and this is practically essential to rearing large specimens in the aquarium. When mature the fish may be given dried foods, such as dahpne, shrimp and similar substances.

The swordtail does not thrive at temperatures under 65 or over 80 degrees, 70 to 75 being the happy medium at which it will afford no end of amusement and pleasure to its possessor.

Concluded from page 121

stones and logs. By the alternate application of their two sucker-like discs, they are able to travel from one solid body to another. One species (*Arhynchobdelloe*) are able to swim in an eel-like fashion. Of the British fresh-water leeches, one division possesses a tube-like, telescopic proboscis. This organ is absent in the other division, but some of its members possess instead a rasp-like tricuspid jaw. To the former division belong the Fish-leech (*Piscicola geometra*) and the Chequered-leech (*Protoclepsis tessellata*), to the latter, the Horse-leech (*Hoemopsis sanguisuga*), which does not attack horses, the medicinal leech (*Hirudo medicinalis*) and Dutrochet's Leech (*Trocheta subviridis*).

Leech farming does not seem to have been practiced in England, although during the first half of the nineteenth century, the medicinal leech was a favorite agent for blood-letting. The French, however, specialized in leech-culture, too often at the expense of poor decrepit horses.

Today—our lecturer informed us—leeches are still used in the East-end of London by the alien population in cases of neuralgia, gumboils, etc. The non-alien population sometimes use them for curing "black-eyes."

Leeches which attack fresh water fish are very active. The Fish-leech attaches itself to weeds and stones by the posterior suckers and waves its body about until prey comes within its reach. It can swim well, and it attacks most species of fresh water fish, and may remain on its host for some days. It is fairly common in trout fisheries.

Hemiclepsis marginata is a fairly active leech, but is unable to swim. It is parasitic upon fish. It is an agent in the transmission of certain trypanosomes which infest fish. On hatching, the young attach themselves to the mother and leave her about three weeks later. This leech can be distinguished from the Fish-leech by the seven logitudinal rows of yellow spots which run along the back. The ventral surface is without spots.

December, 1920 15¢ Copy

Aquatic Life

Terrarium Notes
On the Marbled Salamander

RUTH BERNICE BREDER

Marbled Salamander

Photographs by R. W. Shufeldt, M. D.

The interesting specimen of the marbled salamander, *Amblystoma opacum*, on which these notes were made was taken September 6th, 1920, midway between the Ohio and Chesapeake Canal and the Potomac River, about three miles above Cabin John, Maryland. It was from general appearances a very healthy and sturdy specimen and beautifully marked. It agrees with the specimen described by Dr. Shufeldt (AQUATIC LIFE, Vol. II, pp. 113-114).

Aquatic Life

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W. A. POYSER, F. R. M. S., ...EDITOR
JOSEPH E. BAUSMAN .....PUBLISHER
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whose excellent photograph is reproduced herewith.

The specimen was found in a dense woodland at the edge of a small rain pool about four feet in diameter, and was hiding under a bit of wood scarcely large enough to cover it. The sky was overcast and rain had been falling for about two hours, it being noon when the specimen was taken.

On September 11th it was placed in a cylindrical jar, 14 inches high, and 15 inches in diameter, a vivarium which also contained two young box tortoises (1¼ inches), a painted turtle (1½ inches), and a snake (17 inches). The jar was fitted with about two inches of leaf mold from the woods, a pan of water about 4 inches in diameter and plants such as spotted wintergreen and wandering jew. Some red plant lice, aphids, were offered at this time, but the writer did not observe that any were eaten.

The salamander would sit the day long peeping from under the pan of water, appearing to be watching the movements of an eel in the adjoining jar, the observation of which suggested that it might be hungry. From September 14th to November 18th little was seen of the salamander, it apparently being in a state of hibernation, but once when seen at night still appeared to be in perfect condition. On the latter date it was moved to a smaller jar (10 inches high by 8 inches in diameter), with a small Plethodon, a long-tailed species. This jar was thought to present more favorable conditions, containing dead leaves, pieces of bark and twigs, smooth stones and about half an inch of water. From this time on both specimens have been out and about continually, and since November 25th out every night, often with a bright moon full upon them. From November 29th to January 8th, 1921, the Amblystoma would sit sheltered under the piece of bark with at least half of its body exposed, and the writer took from this that the salamander finding itself undisturbed by the prowlings of other animals had no desire to hide. The former belief that they desired to hibernate would thus be unfounded.

On December 1st the salamander ate three meal worms in rapid succession. These were almost one-third its length, which at this time was 4½ inches. At this "stage of the game" an interesting thing happened. The long-tailed individual attempted to eat one of the meal worms, but the worm was too large for it, and the marbled salamander apparently becoming angry snapped at the Plethodon, catching hold of a leg. The "long-tail" retaliated, but then the writer interferred and the worm was quickly disposed of by the larger of the two. Neither specimen had been observed to

(Concluded on page 127)

North American Fishes

IV. The Mackerel (Scomber scombrus)

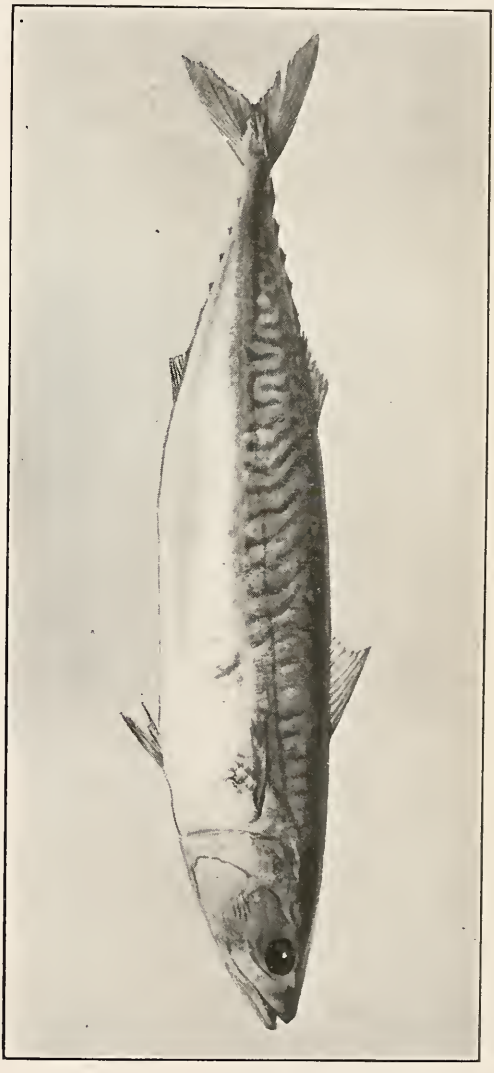
R. W. SHUFELDT, M. D., C. M. Z. S.

Most authoritative writers on our fishes associate the mackerels and their nearest allies in a group, *Scombroidei,* relegating the true mackerels to the family *Scombridae,* in which the typical mackerels constitute the genus *Scomber.* At the time Jordan and Evermann published their "Fishes of North America," there were but two species of mackerels representing the genus *Scomber;* these were the Common mackerel (*Scomber scombrus*)—the subject of the present article—and the Chub mackerel (*S. colias*). This latter is a fish of wide distribution, occurring in many places in the New as well as in the Old World. Although smaller than and inferior to our Common mackerel, it is, nevertheless, a fish of considerable economic importance, and it is known by many vernacular names.

Linnaeus gave the Common mackerel its name of *Scomber scombrus;* but it is quite possible that modern ichthyologists have changed it since—at least the one for the species. The cut illustrating the present article is a reproduction from a photograph of a market specimen by the writer, and reduced about two-thirds.

This Common mackerel lacks an air-bladder; possesses eleven or twelve dorsal spines, and is silvery below the median line of the body. On the other hand, the Chub mackerel has an air-bladder, and but nine or ten dorsal spines, with the sides below the median line, in the adult fish, more or less mottled.

There is no fish in the world that is better known; more extensively used as a food fish, or, of its class, more beautiful in form and coloration than the Common mackerel. It is not necessary to enter into the details of its external characters here, as they are very clearly



shown in the accompanying cut; and, as for its general anatomy, that is a large subject, one much in need of treatment and at the hands of the comparative anatomist. Even when Jordan and Evermann issued their great work on the "Fishes of North America," they were quite at a loss to present the exact relations of some of the fishes supposed to be related to the *Scombroidei*. The relationships were not known, and for the reason that the anatomy of the forms in question was not known.

All the mackerels are carnivorous by nature, and the few species in the genus are of wide distribution. They are sought for food by man in all parts of the world where they occur; and as they generally swim in immense schools, they are frequently taken in large numbers at a time. The word *Scomber* is from the Greek, and is a very old term for a mackerel. An adult specimen of the Common species averages about 18 or 19 inches in length. They are extremely abundant on both coasts of the Atlantic, ranging southward to Cape Hatteras on our side, and to Spain in Europe.

Marbled Salamander

(Concluded from page 125)

eat prior to this time. The following day the Amblystoma was offered worms again and refused. On December 3rd a housefly, half stunned, was placed in front of this salamander and was immediately accepted. On December 5th the salamander was out all day, but the next two days it remained under cover. Then it came back to its old place of feeding (a smooth stone) and was offered a meal worm 1¾ inches long but refused it, taking another 1¼ inches.

During the two weeks following it was unavoidably neglected, but at the end of the period it quickly disposed of another worm. On January 8th it ate a worm almost half as long as itself, having a difficult task to swallow it. From this date to the time of writing both individuals have been in a state of semi-torpidity, due to sudden changes in temperature. At no time during the day was temperature lower than 57 degrees, Fahrenheit, recorded in the vivarium, but during the night it no doubt fell considerably due to open windows. These salamanders have been in continuous good health ever since they were taken. Altogether they have made decidedly picturesque as well as interesting pets and are quite tame, coming up to the stone upon which they are usually fed and showing other evidences of intelligence.

News Notes

The Reading Aquarium Society gave its annual duck dinner in connection with the regular meeting and exhibition in December. Black telescopes were exhibited in competition for prizes, the first being awarded to Mr. Kershner, the second to Mr. Hepler, and the third to Mr. Hermansader.

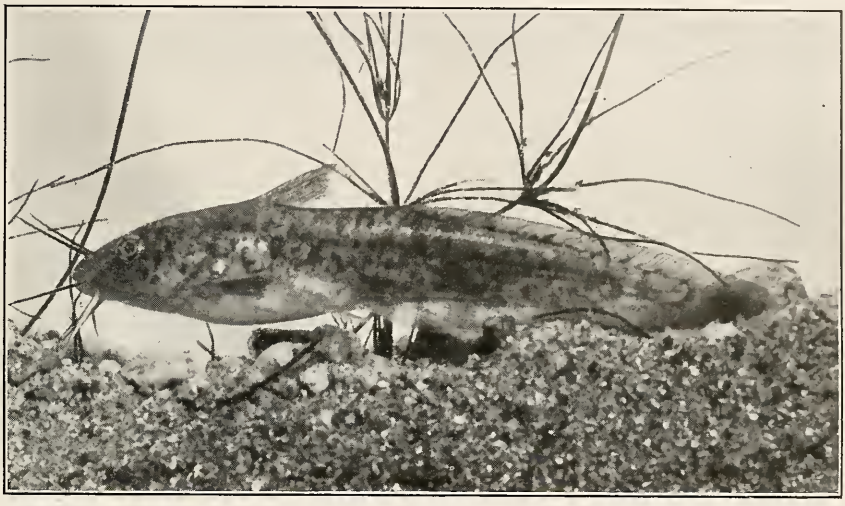
At the annual meeting of the Milwaukee Aquarium Society the following officers were elected for the ensuing year: *President*, Henry O. Bossert; *vice-president*, W. R. White; *treasurer*, Carl Bauer; *recording secretary*, W. O. Bechor; *corresponding secretary*, H. A. Fechtmeyer; *Custodian*, L. Koszolka; *librarian*, Jacob Merget.

During the latter part of May the Chicago Aquarium Society will have a public exhibition in the Art Institute. The exhibits will be arranged to emphasize the nature-study idea, and in other ways depart from the average "aquarium show."

Hugo C. Nelles has again been elected president of the Ridgewood Aquarium Society, a tribute to his efforts to advance aquarian interests.

An Australian Catfish

HERBERT M. HALE
South Australian Museum



Tandanus tandanus

Photo by Author

During a recent collecting outing of the South Australian Aquarium Society to the River Murray, many of the indigenous fishes were obtained, and although the majority of the species are much too large for aquaria when adult, the young of some of them proved of sufficient interest to warrant their maintenance in captivity. Tiny fresh-water catfishes were plentiful in the irrigation waters and numbers have been since introduced into members' aquaria with happy results. When placed in company with other species they appear to be quite inoffensive and being bottom feeders act as scavengers; during their frequent peregrinations meat or other food lying on the bottom is eagerly eaten by them and thus the floor of the aquarium is kept free from refuse passed over by more fastidious inmates. At intervals they also poke about between stones and pebbles in search of small aquatic creatures, often disturbing quite a cloud of sand in the water; in the writer's aquaria they ate the smaller water-snails with which the jars were stocked. Judging from the examination of the stomach contents of large examples the natural food consists largely of crustaceans, aquatic insects and molluscs.

The Murray catfish is not popular with anglers on account of the serrated spines with which the pectoral and first

dorsal fins are armed and even small examples, but an inch or two in length; can inflict uncomfortable wounds. One member of our society, the president, as it happened, placed his hand in a collecting tin containing several little catfishes and straightway received a practical demonstration of the efficacy of these weapons of defense. The spines form jagged punctures which ache painfully for some hours; although this species does not possess poison sacs at the bases of its spines as do some of the American catfishes, the mucous secreted from the skin possibly acts as an irritant. The spine in front of each pectoral fin fits into a curious basal socket, so modified that a twist of the erected member is analogous in result to a half turn of a screw in a thread; the fish is thus enabled to lock these spines at right angles to the body, in which position they remain even after death. To predaceous brethren this renders the catfish an uncomfortable meal for the rigid spikes pierce the stomach or throat of an agressor; the wounds thus inflicted have been known to cause the death of water birds such as Cormorants and Pelicans.

Catfishes derive their popular name from the presence of the barbels or "feelers" around the mouth, these having a fancied resemblance to the whiskers of a feline. In the species illustrated they are eight in number, four below the chin, one at each corner of the mouth and two on the upper surface of the snout. After watching a newly introduced fish wandering disconsolately over the bottom of an aquarium, it is obvious that these are tactile organs, and as such must be a great asset in the depths of the usually murky waters of the Murray. About 1200 species of the *Nematognathi* (thread-jaw) have been described, the majority of them being confined to fresh water. Much has been written of their breeding habits, for in this group one of the progenitors usually watches over the eggs and young. Our catfish builds a nest, which has been described by Mr. David G. Stead, Naturalist to the Board of Fisheries for New South Wales, as follows:

"This species possesses the interesting habit of forming a mound or nest in which to deposit its eggs. The nest is formed either of sandy grit or pebbles (if the latter are available); and is often at least three feet in diameter. During the process of incubation it is jealously guarded by one or other of the parents. In regard to the formation of the nest, one man who had been fishing for many years on some of the western rivers of New South Wales, informed me that he had seen the fishes carrying pebbles in their mouths to the desired spot. Others state that the mound is formed by a simple fanning motion of the tail; this fanning also tends to dislodge the more minute particles, and so leave the coarser particles behind for the formation of the nest." It has also been noted that both sexes seem to unite in the subsequent attendance on the nest in which the ova are deposited.

Tandanus tandanus is called "Pamori" by the aboriginals and was at one time largely utilized as food by them. Full grown examples measure about two feet in total length. The color of the young is olive with lighter mottlings, but adult fishes taken from the main stream are much darker, being a mottled reddish brown; in both cases the abdomen is opalescent. As is usual with most of our fresh-water fishes the intensity of the coloring is rapidly adjusted to harmonize with new surroundings.

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