Aquatic Life

Volume III, 1917 - 1918

W. A. POYSER
EDITOR

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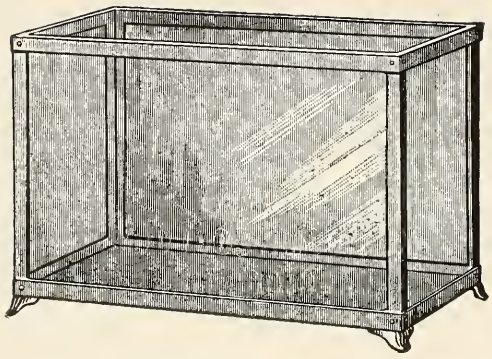
September, 1917 10 Cents

Aquatic Life

Black-banded Sunfish (Mesogonistius chaetodon)
Courtesy of the North Carolina Geological and Economic Survey



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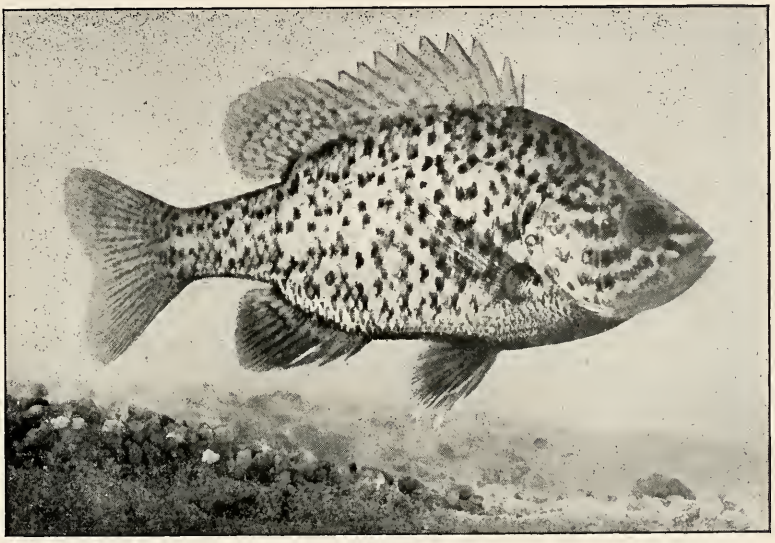
The American Sunfish Family, with an Annotated Checklist of the Species

JOHN LEE BENNINGTON



Eupomotis gibbosus Photograph by Dr. R. W. Shufeldt

Courtesy The Nature-Study Review

Probably no species of fishes are better known to all men, and boys, than the sunfishes. Others may be as familiar by name, the food and game fishes, but these would scarcely be as readily placed taxonomically, though with some sunfishes specific determination is difficult. The group, including *Elassoma* and *Micropterus*, ranges in size from little more than an inch in length to a weight of twenty-five pounds, though this latter is rare and far above the average. Equal diversity is presented in ecological relationships. Certain species evince a preference for running water; others like still water: some cloudy water, others clear; some a clean, hard bottom, others mud; species will be found in ponds and lakes, rivulets and creeks and large and small rivers. The group is distinctly American, and ranges from Southern Canada through the United States to Mexico, though but a single species occurs west of the Rocky Mountains. The natural range of a number of species has been extended through the efforts of the various fish commissions. The family is, however, more characteristic of the Eastern States, where species and numbers are relatively more abundant.

The sunfishes as a whole are remarkably brilliantly colored, and rival the ex-

otic cichlids more familiar to the aquarian. The sexes present little or no differences. In disposition the species vary from the timid and inoffensive Black-banded Sunfish to the voracious black basses; all are carnivorous. In the wild live food is taken exclusively by all—small fishes, even their own fry, molluscs, crayfishes, entomostracans, water bugs, aquatic larvae, etc. In the aquarium some species can be accustomed to dry prepared foods, while others demand living material and require that it "wiggle" to be worthy of notice. The provident aquarist can meet the call by maintaining a supply of enchytrae, earthworms and mealworms during the winter months. Chopped lean meat will often be found acceptable. It will be found quite amusing to feed flies. The fishes will almost leap for them and soon learn to anticipate the morsels. Ordinary household temperature suffices for the sunfishes at all times, and probably the warmth of summer will cause more discomfort than the cold of winter, particularly if the aquarium be small and therefore subject to a rapid rise during the day.

Every aquarist seems to have an individual conception of the most attractive aquarium insofar as the assortment of fishes is concerned. Mine is a collection of sunfishes. There seems to be but one requirement to ensure a happy, or rather non-quarrelsome family; all the specimens should be alike in size, the more voracious perhaps a little smaller. A big fellow becomes a bully, and will pester his smaller congeners. Individuality in temperament will also crop up, so a little watchfulness and the removal of offenders is advisable. The larger the aquarium the less trouble in this respect—and all others. To the person of limited means the sunfishes solve the problem of an attractive aquarium at the minimum cost.

Eupomotis gibbosus, the Common Sunfish, in an Aquarium

Photograph by Dr. R. W. Shufeldt Courtesy The Nature-Study Review

All the species seem to be nest builders. Most of our knowledge of them has resulted from field observations, as apparently but two, the Black-banded Sunfish and the Blue-gill, have been bred in aquaria. The preferred bottom seems to be of sand or gravel. The water-depth at the location selected varies with the species. Calico Bass construct nests at a depth of six feet, making observation difficult, while the familiar Pumpkin-seed chooses the shallows where all may see, the water at times barely covering the nest. Probably no fish is more ambitious than the Pumpkin-seed in the construction of its nursery. With energy worthy of a larger fish, an oval or round spot, perhaps three feet in diameter, is carefully cleared of all movable debris to a depth of three inches or until the right sort of bottom is reached. The greatest depth is at the center or crater, sloping upward to a bank of sand about the circumference. The eggs, one-twenty-fifth of an inch in diameter and so nearly resembling translucent grains of sand as to make detection difficult, are deposited in the crater midst the coarse sand and pebbles. During the spawning operation the male is ever alert to thwart trespassers. During incubation he assiduously guards the nest, and then the fry during the first few days. The female has been reported as assisting in rare cases. The male at this time, burdened with the responsibilities of a large family, is a fearless creature. Woe to a stranger venturing near. It will not hesitate to attack even the largest fishes, and, as the sunfishes nest in communities, an intruder will often be driven off by the combined efforts of the entire colony. After being deserted by the parent, the youngsters remain in companies, often for a considerable time.

The following list is believed to include all the species. It has not been thought necessary to give the synonomy, which may be found in nearly all systematic works. In all cases the maximum recorded size has been given, and, especially among the larger species, it will be found considerably greater than the average. A number of the species are classed as food and game fishes, and are therefore protected by law. Permission should be obtained from the local fish and game commission to collect small specimens for the aquarium in cases where capture would otherwise be illegal. Many can be purchased from private commercial fish hatcheries. Wild fishes in general are more successfully acclimated in the aquarium during the fall months.

CHECKLIST

ELASSOMA EVERGLADEI. *Southern Pigmy Sunfish.* Brown, with darker spots; dorsal and anal spotted with red; two red spots at base of caudal. 1.3 inches. Swamp streams. North Carolina to Florida. (*Elassoma*, diminution, a little thing; *evergladei*, of the everglades.)

ELASSOMA ZONATUM. *Pigmy Sunfish.* Olive Green, 10 to 12 vertical bands on sides; fins faintly barred. 1.5 inches. Sluggish waters. Southern Illinois to Alabama and Texas (*zonatum*, banded). ed.)

POMOXIS ANNULARIS. *White Crappie.* Silver olive marked with green; fins mottled with green. 12 inches. Lakes, ponds and small rivers. Eastern U. S., Great Lakes to Texas. (*Pomoxis*, sharp opercle; *annularis*, ringed.)

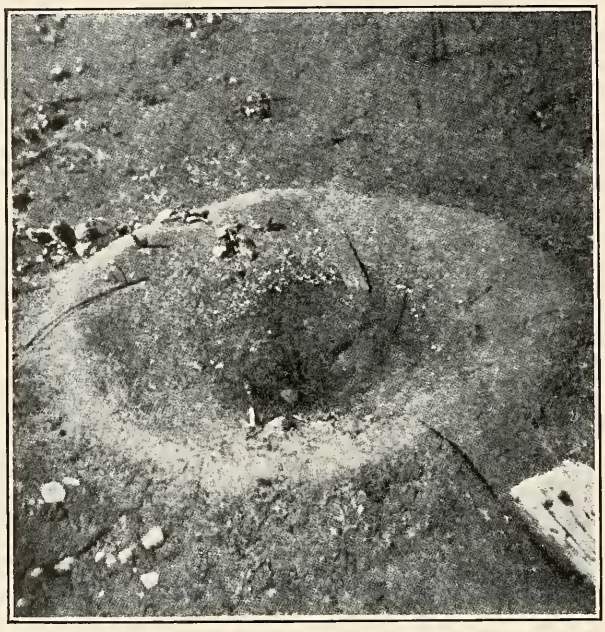
POMOXIS SPAROIDES. *Green, Calico or Strawberry Bass.* Silvery green, pink or purple diffusion; sides mottled with dark green; fins spotted in irregular rows. 12 inches. Clear lakes and rivers. Eastern and Southern U. S. to Texas (*sparoides*, like *Sparus*, the sea bream).

CENTRARCHUS MACROPTERUS. *Round*

Sunfish. Bright yellowish or pea green, with rows of dark brown spots; soft dorsal and anal faintly mottled or barred. 6 inches. Lowland waters and streams. Virginia to Florida and Louisiana; northward in Mississippi Valley to Illinois. A desirable species. (*Centrarchus,* spiny anal; *macropterus,* large-finned.)

ACANTHARCHUS POMOTIS. *Mud Sunfish.* Dark greenish, with five blackish lengthwise bands; cheeks banded. 6 inches. Sluggish muddy waters. New York to South Carolina. Voracious and nocturnal—likes to hide. (*Acantharchus,* spiny anal; *pomotis,* opercle-ear.)

AMBLOPLITES RUPESTRIS. *Rock Bass.* Pale green with dark mottlings; dark sopt on each scale; fins mottled. 14 inches. Ponds and streams. Spawns on gravelly bars. Canada and southward through the Mississippi Valley and eastward. Predaceous. (*Ambloplites,* blunt armature; *rupestris,* inhabiting rocks.)

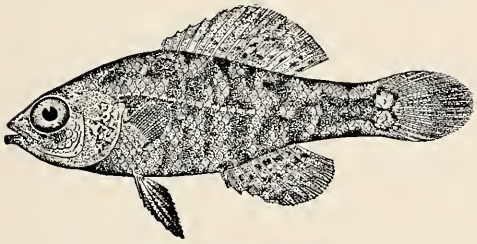


Large Nest Entirely Exposed Courtesy The Ohio Journal of Science

AMBLOPLITES RUPESTRIS CAVIFRONS. *Cope's Rock Bass.* Distinguished from the preceding by larger mouth and more projecting snout; front concave; cheeks naked. Virginia. (*Cavifrons,* concave forehead.)

ARCHOPLITES INTERRUPTUS. *Sacra-*

mento Perch. Blackish above, sides silvery, with about 7 blackish upright bars; fins plain. 24 inches. Sacramento and San Joaquin rivers, California. The only member of the group native to the region west of the Rocky Mountains. (*Archoplites,* anal or vent armature; *interruptus,* interrupted.)



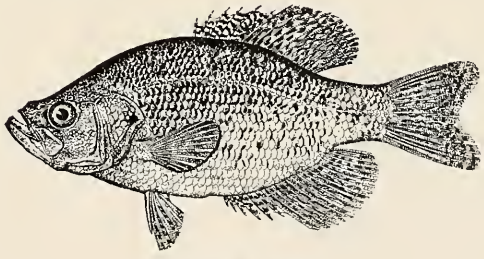
Elassoma evergladei

CHAENOBRYTTUS GULOSUS. *Warmouth; Black Sunfish.* Dark green above, clouded with red, blue or bronze; yellow below; vertical fins mottled. 10 inches. Creeks and rivers, mud-bottoms preferred. Great Lakes region eastward and southward to Louisiana and Texas. (*Chaenobryttus,* yawning growl; *gulosus,* large-throated.)

ENNEACANTHUS GLORIOSUS. *Blue-spotted Sunfish.* Males dark olive green, numerous blue spots on body having a tendency to form cross-stripes; opercular spot pearly blue with blue margin; females duller. 3 inches. Clear streams. New Jersey to Florida. A desirable aquarium fish; somewhat shy and not apt to quarrel. (*Enneachanthus,* nine-spined; *gloriosus,* glorious.)

ENNEACANTHUS OBESUS. *Little Sunfish.* Olive green with 5 to 8 dark bars; body, cheeks and fins with purple or golden spots. 3.75 inches. Sluggish waters. Massachusetts to Florida. Shy and not particularly pugnacious. (*Obesus,* fat or thick.)

MESOGONISTIUS CHAETODON. *Black-banded Sunfish.* Straw-colored, silvery or purplish reflection, with vertical black bars. 4 inches. Coastal swamp streams and ponds, occasionally in rivers. New Jersey to North Carolina. Shy, retiring and docile; will not molest goldfish. Forms nest in dense plant-growth; has been bred in aquarium. Demands live food, preferably crutaceans (*Daphnia, Cyclops,* etc.). Dr. Hugh M. Smith observes: "Judging by its behavior in captivity, this dainty little fish eats only living, moving food. Even when hungry it refused chopped meat. When supplied with white-fish fry and trout fry it ate them promptly, but without great avidity. One fish which struck at a trout fry failed to grasp it, and, although the fry dropped to the bottom dead, the sunfish did not notice it further. Another stopped following a trout fry to pursue a gammarid. Insect larvae and small crustacea were always eaten readily, and such animals are doubtless the usual natural food." *Mesogonistius,* middle-angled sail, in reference to the contour of the dorsal fin; *chaetodon,* bristle-teeth, inappropriate in direct application, and given because this sunfish resembles in coloration some species of the salt-water genus *Chaetodon.*)

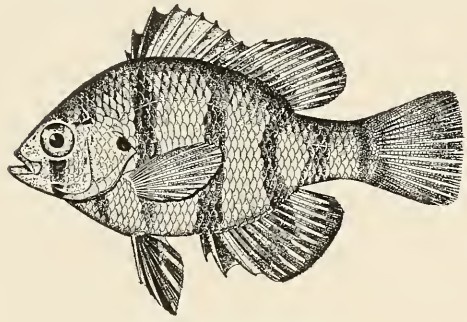


Pomoxis annularis

APOMOTIS CYANELLUS. *Blue-spotted or Green Sunfish.* Olivaceous, yellowish below; each scale with an emerald green spot; sides with 7 or 8 dusky upright bars; fins dusky. 7 inches. Quiet creeks and small rivers. Great Lakes region south to Mexico. An attractive species Will dominate the aquarium if permitted; select smaller specimens. (*Apomotis,*

without opercle-ear; *cyanellus,* blue or bluish.)

Apomotis ischyrus. Life colors unknown. Peculiar to Illinois, and but three specimens have been collected. 5 to 7 inches. Illinois aquarians should study the description of this species in Forbes and Richardson's *Fishes of Illi-*



Mesogonistius chaetodon

nois, and compare carefully with all unfamiliar specimens collected. If secured, Professor S. A. Forbes, State Laboratory, Urbana, Illinois, should be informed at once, if possible sending a specimen preserved in alcohol or formalin. (*ischyrus,* stout or robust.)

Apomotis phenax. *Deceptive Sunfish.* Olive green; body deeper and more compressed than A. cyanellus; scales larger. 6 inches. Beesley Point, N. J. Little known; locality in doubt. (*phenax,* deceptive.)

Apomotis punctatus. *Spotted Sunfish.* Olivaceous, with numerous tiny deep brown spots, smaller than pin-heads, sometimes covering entire body. 6 inches. Lowland streams. South Carolina to Florida. A handsome and distinctive species. (*punctatus,* spotted.)

Apomotis symmetricus. *Symmetrical Sunfish.* Green with darker bars; body and fins with numerous brown specks. 2.5 inches. Rivers, ponds and lakes. Illinois to Louisiana and Texas. (*symmetricus,* symmetrical.)

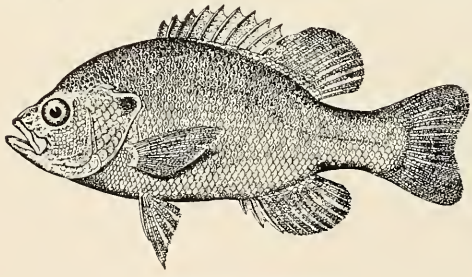
Lepomis auritus. *Long-eared Sunfish; Yellow-belly.* Light olive above; belly orange; scales of sides pale blue with reddish centers; fins yellow or orange; opercular flap long and narrow. 8 inches. Streams. Maine to Louisiana; abundant east of the Alleghenies. An attractive species with a fair disposition. (*Lepomis,* scaly opercle; *auritus,* eared.

Lepomis auritus solis. Distinguished from the preceding by larger scales on cheeks and breast, and a dusky spot on rear dorsal. (*solis,* of the sun.)

Lepomis haplognathus. Mexico. Olivaceous; yellow below; cheeks with blue bands. 4.5 inches. Little known. (*haplognathus,* simple jaw.)

Lepomis humilis. *Red-spotted sunfish.* Light olive with small dots of gold or emerald, and spots of orange; belly deep orange. 3.5 inches. Small rivers, lakes and ponds. Middle U. S. and the Dakotas to Texas. Probably the most brilliant of the sunfishes. (*humilis,* humble.)

Lepomis macrochirus. *Chain-sided Sunfish.* Steelish-blue, with many orange



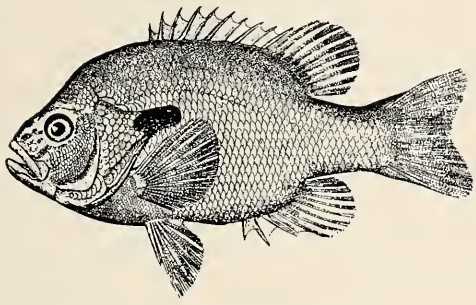
Apomotis cyanellus

spots so arranged that the ground color forms a series of vertical chain-like bars. 5 inches. Ohio Valley south and southwest to Kentucky and Missouri. Handsome and hardy in aquaria. Very voracious. (*macrochirus,* large hand.)

Lepomis megalotis. *Large-eared Sunfish.* Brilliant blue above; orange below; sides with orange spots and blue

streaks; cheeks orange with blue stripes. 6 inches. Creeks and small rivers. Michigan to Minnesota, South Carolina and south to Rio Grande. Very attractive. (*megalotis,* large-eared.)

LEPOMIS MINIATUS. Dark olive, with rows of bronze or purplish spots below lateral; below light or brassy; cheeks



Lepomis auritus

dark bluish-green. 4 inches. Lakes and ponds. Mississippi Valley; Southern Illinois to Florida, Louisiana and Texas. (*miniatus,* vermillion or scarlet.)

LEPOMIS PALLADUS. *Blue-gill Sunfish.* Light to dark green with purple lustre; sides with dark bars; belly coppery-red. 12 inches. Ponds, lakes and rivers. Great Lakes to Florida and the Rio Grande. An attractive fish for large tanks. (*palladus-pallidis,* pale.)

EUPOMOTIS EURYORUS. Rare and little known. Allied to E. gibbosus. 6 to 8 inches. Lakes and creeks, Northern Great Lakes region. (*Eupomotis,* true opercle-ear; *euryorus,* wide margin.)

EUPOMOTIS GIBBOSUS. *Common Sunfish; Sunny; Pumpkin-seed.* Olive above with bluish reflection; sides spotted with orange; cheeks orange with blue streaks; lower fins orange, dorsal and caudal with orange spots; opercular flap black, rear margin bright scarlet. 6 inches. Ponds and streams. Eastern U. S. An attractive fish and probably the most abundant species. Select small specimens; large ones are quarrelsome. (*gibbosus,* rounded outline like a full moon.)

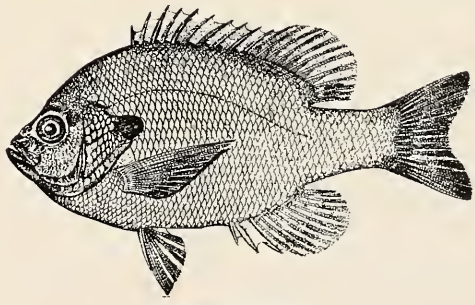
EUPOMOTIS HEROS. Pale olive, slightly mottled; black opercular flap with wide border, which is blood-red in males, pale in females. 8 inches. Streams. Southern Illinois and Indiana to Florida and the Rio Grande. (*heros,* hero, after a genus of *Cichlidae* which this species resembles.)

EUPOMOTIS HOLBROOKI. *Holbrook's Sunfish.* Dark green above; silver below; breast yellow; fin dark with yellow rays. 10 inches. Lowland streams. Virginia to Florida. (*holbrooki,* in honor of Dr. Holbrook.)

EUPOMOTIS PALLIDUS. Bears a resemblance to *L. palladus.* Rare; few specimens known. 7 inches. Georgia to Texas.

MICROPTERUS DOLOMIEU. *Small-mouth Black Bass.* Dull green with brassy lustre. 6 pounds. Cool, swift waters. Canada, Middle and Eastern U. S. (*Micropterus,* small-finned, an inappropriate name; *dolomieu,* in honor of Dolomieu, a French naturalist.)

MICROPTERUS SALMOIDES. *Large-*



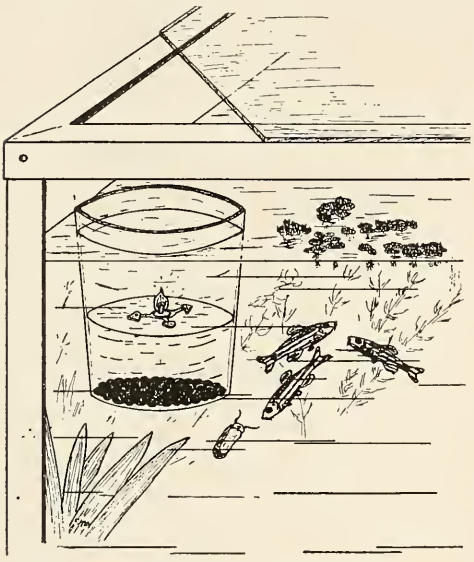
Lepomis palladus

mouth Black Bass. Back green; sides silvery; belly white; black lateral band. 25 pounds. Lakes and sluggish warm water; has been taken in brackish and salt water. U. S. east of the Rockies. (*salmoides,* like a salmon or trout; inappropriate, but given because this species is called "trout" by the fishermen in some localities, especially in the South.)

An Emergency Heater

CHARLES M. BREDER, JR.

When the aquarium heater fails, and the tropical fishes are in danger, float a shell-glass tumbler in the tank with a sweet oil night-light in it. Place a number of lead shot, or other weight, in the bottom of the glass; just enough to prevent it from capsizing. Pour in sweet oil until the glass settles to a point where



The Heater in Use Drawing by Author

the water is about one-half inch from the brim. After the correct quantity of oil has been ascertained a rubber band may be passed around the glass as a marker for future fillings. I found that the average glass floated in this way holds enough oil to last for twelve hours or more.

Fifty wicks for these night-lights, together with a float for them, can be bought at almost any drug store for ten cents. They are designed to furnish a dull light for the sick room. Additional floats may be made of a piece of tin and a few bits of cork, patterned after the one supplied with the wicks, if more than one heater is to be used. The cover-glass directly over the light should be removed, as the heat arising from the lamp would cause it to crack. A corner may be cut from the cover if the heater is intended to be semi-permanent. It is not safe to use this device with large or very active fishes as they might upset it, but it is just the thing to save *Danio rerio,* or other small species, when things go wrong with the regular heating apparatus. The fishes always congregate about one of these heaters, being attracted by both the heat and the light.

Milwaukee Society

The Milwaukee Aquarium Society held its regular meeting on Wednesday evening, August 1st, in the Public Museum. Mr. C. G. B. Schenk read an interesting paper on Goldfish, which was followed by a spirited discussion.

The Society contemplates holding a competition in the near future for household aquaria. A lively interest is indicated, so there should be a full representation of the membership in the contest.

The recent resignation of President Roth has necessitated several changes of officers, the following appointments resulting: *President,* George J. C. Steffen; *Recording Secretary,* W. R. White; *Treasurer,* George Hemsing.—Arthur Simon, *Corresponding Secretary.*

Truth is stranger than fiction! "A copy of your interesting publication with subscription rates will be appreciated. Your postage will not be wasted as I intended to subscribe for it. I have an aquarium, but never dreamed that there was a publication for the aquarist. I picked up a copy in the street, and although it was full of dirt, I was able to distinguish your address. It is strange how one gets things sometimes.—*Joseph Stern.*

Batrachoseps Major, A Remarkable Salamander*

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

Three specimens of the Garden Salamander (Batrachoseps major) Camp. The smallest one at one time lost his tail near the middle, and the part has been fully restored, a marked constriction being observed at the point of fracture. Photographed from life by the author; natural size.

During the middle of April, 1917, I examined three specimens of the new salamander, *Batrachoseps major,* collected by Mr. Charles Lewis Camp in California, and described by him in the University of California Publications (Zoölogy)**. These specimens were all alive and in fine condition, and shortly after they came into my temporary possession I made two five by eight negatives of them, all vertical view. One of these negatives has two specimens upon it, and the other three. The latter is rather the more interesting, and a photograph made from it is here reproduced, in that some idea of this new form may be obtained. It possesses an annulated tail, which is twice the length of its body, and fully as thick anteriorly. For a salamander, its limbs are rather long, and each foot normally possesses four toes. All the live specimens I had had probably been kept in confinement some two or three weeks, or maybe more. This may accouunt for my finding their under-parts a pale pinkish gray rather than "light yellow," as given by Mr. Camp. The upper parts are darker, being of a light shade of brown, showing fine, transverse, zig-zag lines from side to side. Under some conditions all of these salamanders turned much darker, and then paler again, the interval being considerable and the change very gradual. The jaws are broadly rounded and the eyes somewhat prominent.

*Read before the Aquarium Society of Washington, at its regular meeting, April 12, 1917.

**Vol. 12, No. 12, pp. 327-334, April 2, 1917.

Mr. Camp says, in his above-cited description, where he calls this new species the "Garden Salamander," that "the detection of a new species of *Batrachoseps* in southern California is not to be wondered at, considering the obscurity of the descriptions in the literature relating to this genus. This new salamander is fairly common in the western part of the San Gabriel Valley, especially in the district immediately surrounding Pasadena." This introduction is followed by a very careful description of the type specimen, together with many measurements and comparisons with other forms of *Batrachoseps* and its allies.

In searching for it in southern California, one should look beneath old boards in gardens and yards, in postholes, or under loose bricks and cement of old sidewalks.

The costal folds are generally eighteen in number; but we find specimens having but seventeen, or even as many as nineteen. They do not present many variable characters. As yet its habits have not been described, though it is quite probable they do not differ much as compared with other species more or less like it. In mid-summer they may work their way underground to a distance of several feet, and they are entirely terrestrial.

Propagating Enchytrae

CHARLES H. ROHRBACH

To keep a constant supply of live food during the winter months, and in fact throughout the year, secure a "set" of Enchytrae, or white worms, from a reliable dealer in aquarists' supplies. Prepare a large wooden box a foot and one-half to two feet square and six inches deep, and fill to a depth of about four inches with rich, black soil—woodland mould, such as may be found about the roots of trees in the woods. Moisten well with a mixture of half milk and half water; skimmed or sour milk will do. Do not soak the earth enough to make it soggy. Now spread the "setting" of the worms over the soil and they will soon disappear below.

Keep the box moist at all times; never let it dry, and occasionally add a little undiluted sour milk and mashed potatoes. Do not cover tightly or it will become mouldy and failure result. With such a box a little care will keep the worms constantly multiplying, ensuring an ample and continuous supply of food for the fishes.

Spawning Goldfish in Aquaria

S. S. HORDES

Before I became interested in goldfish I could not believe that it was possible to breed them in an aquarium. No matter where I bought goldfish I was told that an aquarium at least five feet long, with running water, was needed for propagation. As I could not place such a one in my apartment, I secured an aquarium measuring 22 by 12 inches, and stocked it with quite a lot of *Sagittaria,* some *Anacharis* and a few floating plants. To my surprise, on July 7th, I discovered eggs attached to the plants and sides of the tank. Observing the old fish eat several eggs, I quickly removed them.

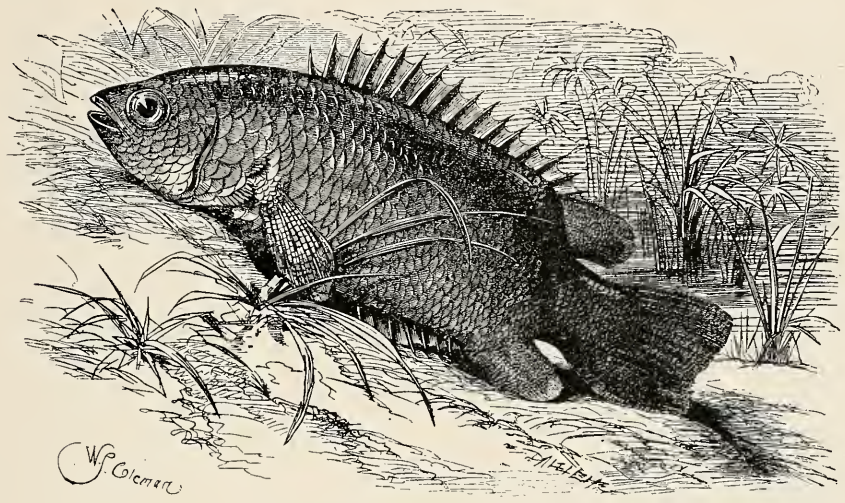
Friday, July 13th, was lucky Friday. I became the guardian of quite a family, numbering seventy-five babies or more—almost an institution. They knew when to come—on Friday—just when fish are wanted!

I wouldn't miss one issue of Aquatic Life for the price of twelve. I wish it was a semi-monthly instead of a monthly.—H. A. Knight, California.

Some people learn from their experiences; others never recover from them.

The CLIMBING PERCH

WALTER LANNOY BRIND, F. Z. S.



Climbing Perch (Anabas scandens)

Back in 1900, before there had been any extensive importations of exotic fishes, I made the acquaintance of *Anabas scandens,* the Climbing Perch. Our introduction took place in the store of Fred Kaempfer, Chicago's leading pet-stock dealer. The fish had been sent to Chicago by Otto Eggling, of New York City. Eggling had a Lascar sailor on a British tramp steamer plying between Calcutta and New York, who brought "muchli" (fishes) with him.

The Climbing Perch, and incidentally it is not a perch, was known and commented upon by travelers more than a hundred years before I possessed a pair. Lieutenant Daldorf, of the Danish navy, mentions, in his memoirs of 1797, that he captured it in the act of climbing a tree. He found it with the spiny margin of the gill-covers hooked into the interstices of the bark, and watched while it curled its tail around, thrust its pectoral fins forward and pushed ahead. The opercula are remarkably mobile and may be moved outward almost at right angles to the body, and the mere closing, if in contact with an object, is sufficient to pull an average fish forward half an inch. The movements described by Lieutenant Daldorf exactly correspond to those I have obesrved when placing this fish on the ground and out of water. In the instance described by the naval officer it seems to me quite possible that a fallen trunk of a tree, partly submerged, in a pond in process of drying up, as so often happens in India, had afforded the fish an easy

egress when it decided to search for another pool. Daldorf's observations were at one time doubted, but have since been practically verified by many writers.

In the Natural History of Ceylon, by Sir J. Emerson Tennent, appears the following account of a migration of this species, which is intensely interesting. It was contributed to the work by a government agent in Trincomalee:

"I was lately on duty inspecting the bund of a large tank at Nade-cadua, which being out of repair, the remaining water was confined in a small hollow in the otherwise dry bed. Whilst there, heavy rains came on, and as we stood on the high ground, we observed a pelican on the margin of the shallow pool gorging himself; our people went towards him, and raised a cry of Fish! fish! We hurried down, and found numbers of fish struggling upward through the grass, in the rills formed by the trickling of the rain. There was scarcely enough water to cover them, but nevertheless they made rapid progress up the bank, on which our followers collected about two baskets of them at a distance of about forty yards from the tank. They were forcing their way up the knoll, and had they not been interrupted first by the pelican and afterwards by ourselves, they would in a few minutes have gained the highest point, and descended on the other side in a pool which formed another portion of the tank.

"As the tanks dry up, the fish congregate in the little pools till at last you find them in thousands in the moistest parts of the beds, rolling in the blue mud, which is at that time about the consistence of thick gruel.

"As the moisture further evaporates, the surface fish are left uncovered, and they crawl away in search of fresh pools. In one place I saw hundreds diverging in every direction from the tank they had just abandoned, to a distance of fifty or sixty yards, and still traveling onwards. In going this distance, however, they must have used muscular exertion enough to have taken them half a mile on level ground, for at these places all the cattle and wild animals of the neighborhood had latterly come to drink, so that the surface was everywhere indented with footmarks in addition to the cracks in the surrounding baked mud, into which the fish tumbled in their progress. In these holes, which were deep and the sides perpendicular, they remained to die, and were carried off by kites and crows.

"My impression is, that this migration must take place at night or before sunrise, for it was only early in the morning that I have seen them progressing, and I found that those I brought away with me in the chatties appeared quiet by day, but a large proportion managed to get out of the chatties by night—some escaped altogether, others were trodden on and killed. (A chatty is a large earthen dish. —*Ed.*).

"One peculiarity is the large size of the vertebral column, quite disproportioned to the bulk of the fish. I particularly noticed that all in the act of migrating had their gills expanded."

I have never bred the Climbing Perch. Those who have succeeded say that the eggs float loose at the surface of the water, and not in a nest of air-bubbles, such as is constructed by the related species of Labyrinth fishes (*Macropodus, Polycanthus, Trichogaster*, etc.), for the Climbing Perch is a Labyrinth fish. The eggs hatch in two or three days. The fry, like those of other fishes, feed upon microscopic animal life, and later on tiny Daphne and the other minute denizens of the water. This fish can stand pretty cool water; artificial heat, except during the winter months and when breeding, is

(*Concluded on page 16.*)

Rivulus Flabellicauda

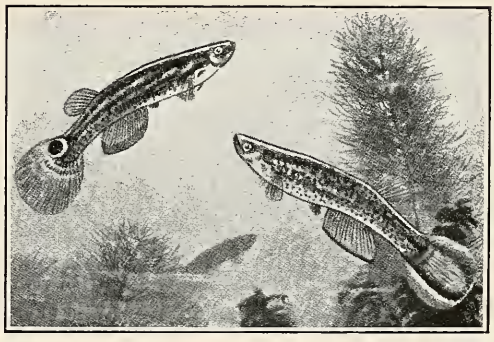
ERNEST LEITHOLF

For a long time we had in our collection a single specimen of *Rivulus flabellicauda;* a female. She lived in a large community aquarium in which sundry *Barbus, Danio* and other docile species mingled happily. The family soon learned to associate the sound of a knife striking a board with an impending threat —chopped earthworm—and in a moment would change from a calm, deliberative body to a turbulent mob, dashing and plunging about in their eagerness for the coveted morsel. The female *flabellicauda* was the only exception. She hovered unsociably in the background, making an occasional furtive venture into the food-eager crowd, but quickly darting back to cover. It was not until a male was placed in this tank that she lost her shyness.

It is surprising how quickly a fish will discover, among scores of other species, one of its own kind. Barely a few moments elapsed after the introduction of the male before both were swimming excitedly together near the surface. Reaching a floating plant, the male suddenly closed in sidewise upon the female, wave-like motion followed by a curling of the posterior ends of their bodies terminated in a violent effort, and the eggs were expelled and fertilized. After an interval of rest the operation was repeated.

That evening I secured a number of the eggs, which were attached to the plants, but they failed to hatch. This I think was due to the condition of the male, which had just finished a long journey. Later, however, we hatched and reared quite a number, for the species is very prolific. When discovered the eggs should be removed to a separate vessel. Hatching will take place in about two weeks, varying with the temperature, which should range from a minimum of 70 degrees to 90 degrees. At the present writing we still have offspring of that first pair.

This *Rivulus* comes from Central America and is a decidedly colorful fish. The back of the male is light brownish



Rivulus flabellicauda (Syn. R. tenuis)

gray merging into pale blue on the sides, marked with reddish spots; belly, citron yellow. The complimentary colors, blue and yellow, produce a fine effect, particularly when intensified during the breeding season. Throat, pale orange to a rich red; gills dark blue green, with reddish dots; dorsal, yellowish, edged with light green; ventrals and anal, yellowish green; pectorals, greenish; lower edge of caudal, pale orange, center light, light ochre to orange or red; top, greenish.

The female is much plainer. Body, light brownish gray; gills, dark blue green; pectorals, yellowish; dorsal and ventrals, colorless; base of anal, grayish white blending into a light grayish brown

and edged with a darker shade; caudal, mottled, with dark spot edged with yellowish white at upper base.

The following list includes the species that have been studied by the aquarian and several that have not yet been introduced: *R. cylindraceus* and *R. marmoratus,* Cuba; *R. elegans* and *R. flabellicauda,* Central America and Mexico; *R. isthmensis,* Costa Rica; *R. uropthalmus, R. Uropthalmus poeyi, R. Ocellatus* and *R. strigatus,* Brazil.

(Glossary:—*Rivulus,* inhabiting rivulets; *cylindraceus,* cylindrical; *marmoratus,* marbled; *elegans,* elegant; *flabellicauda,* fan-shaped tail; *isthmensis,* of the isthmus; *uropthalmus,* tail-eye; *poeyi,* in honor of Prof. Felipe Poey y Aloy; *ocellatus,* eye-like spots; *strigatus,* streaked.)

Snails are slow, even when it comes to dying, and one naturalist who had mounted a shell upon a card was surprised to find four years later that the warm water employed in soaking the shell off the mount had revived the inmate, which he had long supposed to be dried and dead.

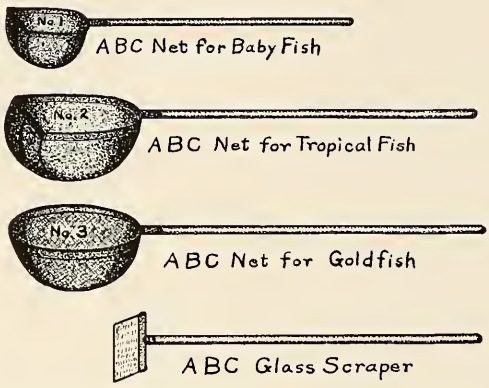
Several specimens in another collection were revived in a similar manner after they had lain in a drawer for some fifteen years. These had not been glued to a card, but had been left lying loose, and, though frequently handled, had shown no signs of life.

They were thrown into tepid water, with the idea of cleaning the shells, but to the surprise of the owner were found creeping about the basin when he returned to complete the task.—*Tit-Bits.*

An autumnal sigh! Hath no eyes for the harvest moon, nor glories that with it attune, no love for autumn cool; yea, to Willie 'tis all a sigh, for near the day is drawing nigh to hustle back to school.

Aquarium Nets

There are about 57 varieties of utensils used by the aquarian. Some few of us have all, others some, but every man *needs* nets. Of all devices it is the most essential—fishes can't be handled with a makeshift. More than this it is desirable to have several styles. The slow-moving goldfish many be caught easily in mid-water, and for it we have the round, shal-

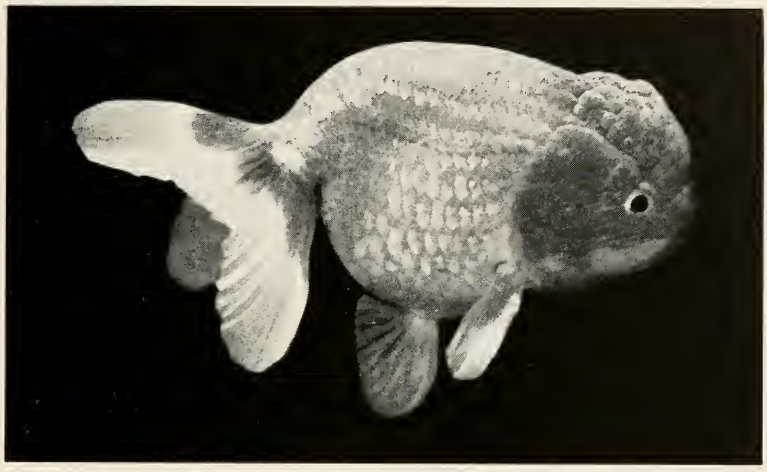


low style, as with it there will be little chance of marring the fins. The agile and alert tropical and native fishes require different tactics. Deliberate movement of the net is necessary, but the capture will not be effected until the net is brought over the fish and against the glass side, and this is best accomplished by the straight edged net. Sometimes it is well to use a net in the left hand to drive the fish from among the plants, capturing it in one held in the right hand. For the little fellows use a little net. The *A B C* nets are constructed along these lines, and are strong and carefully made.

Various means are employed to remove the omnipresent vegetable growth from the glass. The efficient way is to use a scraper, such as the *A B C.* Its sharp edge removes the most persistent growth and leaves the glass clean and bright. This device, like the nets, has a strong wood handle, and with reasonable care will serve the average aquarist for a long time.

Storing Mosquito Larvae

WILLIAM T. INNES



Lionhead Goldfish (Shishigashira Ranchu)

Considering the great value of the larvae of mosquitoes as fish food, I am frequently surprised to meet breeders who never collect it. Some do not seem to know it by sight, but more are deterred by the risk of having the larvae hatch in the home. This unpleasant feature can be overcome in a number of ways. I have recently devised a method which is so simple and effective that there is now no reason why larvae should not be freely used. After removing any considerable quantity of dirt, which may have been taken with them while collecting, they are placed in a large bottle. The ordinary five-gallon drinking-water bottle is ideal for the purpose. About four inches of water is sufficient. Place a small piece of mosquito netting over the neck, fastening it securely with a rubber band. This is, of course, to prevent the escape of the mature mosquitoes that may hatch before the larvae are used. When desired for food, remove the netting and insert a cork stopper, invert the bottle, withdraw the cork and pour out the needed quantity. *Replace the netting!* When stored in this manner the larvae are given sufficient fresh air, and it is impossible for any of the mosquitoes to escape. When the bottle is inverted, the larvae, in alarm, seek the bottom of the water, which in this case happens to be in the neck of the bottle from which they will be poured.

Naturally one should not place in the aquarium more than will be consumed at once by the fishes, for hatching takes place quickly, especially after the pupal stage has been reached. In this phase the

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

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Practical articles and notes on topics pertaining to the aquarium and terrarium are always wanted for Aquatic Life. Readers of the magazine are invited to join in making it a medium of mutual help, and to contribute to it any ideas that may occur to them. The pages are always open for anyone who has anything helpful and practical to say. Manuscripts, books for review and general correspondence should be addressed to the editor.

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body is no longer straight, but is ball-like, and the insect cannot descend below the surface for more than a few moments at a time. All mosquitoes pass through a pupal stage before hatching. Therefore if all the catch is still in the straight or most active form (larval), there is no immediate prospect of mosquito annoyance. The development can be retarded by keeping the bottle in a cool place and using clean water. Enough larvae may be placed in such a bottle to cover the surface nearly solid. There must be enough room for all to come to the surface at one time, as they breathe air during each stage of development. When the supply has been used there will usually be found a number of mosquitoes which have hatched in the bottle. These can readily be drowned by filling to the top with water, pouring it through the netting.

It is a well authenticated fact that fishes grow amazingly on mosquito larvae, and, as they are plentiful during August and September when Daphnia are scarce, the breeder is foolish to neglect them. Every larva eaten is one less mosquito in the community. If we get sufficiently busy around the standing pools we will not only have big, strong fishes, but we will become extremely popular citizens!

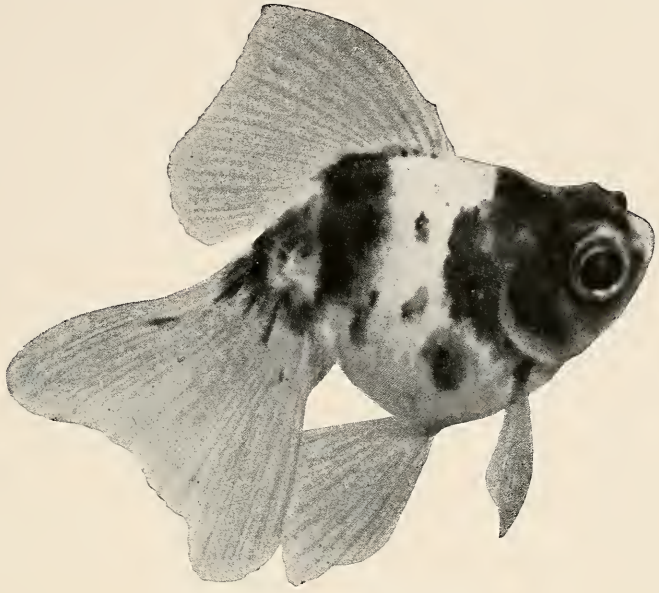
The Climbing Perch

(*Concluded from page 12.*)

not necessary. For propagation a large, shallow tank with a glass cover is needed. Earthworms, mealworms, flies and similar forms are the preferred foods of the adult. In color the species is light brassy olive, with orange eyes. Length up to seven inches.

Fame is a bubble, but it seldom comes from blowing your own horn.

Inadvertently two illustrations in the August number were transposed. For *Polycentrus schomburgki* read *Geophagus jurupari* and vice versa.



Broad-tail Calico Telescope Goldfish

Owned by George E. Wilt — Photograph by H. W. Schmid

Address to Goldfishes

HARTLEY COLERIDGE

(1796-1849)

Restless forms of living light
Quivering on your lucid wings,
Cheating still the curious sight
With a thousand shadowings;
Various as the tints of even,
Gorgeous as the hues of heaven,
Reflected on your native streams
In flitting, flashing, billowy gleams!
Harmless warriors, clad in mail
Of silver breastplate, golden scale;—
Mail of Nature's own bestowing,
With peaceful radiance mildly glowing—
Fleet are ye as fleetest galley
Or pirate rover sent from Sallee;
Keener than the Tartar's arrow,
Sport ye in your sea so narrow.

Was the sun himself your sire?
Were ye born of vital fire?
Or of the shade of golden flowers,
Such as we fetch from Eastern bowers,
To mock this murky clime of ours?
Upwards, downwards, now ye glance,
Weaving many a mazy dance;
Seeming still to grow in size
When ye would elude our eyes—
Pretty creatures! we might deem
Ye were happy as ye seem—
As gay, as gamesome, and as blithe,
As light, as loving, and as lithe,
As gladly earnest in your play,
As when ye gleamed in far Cathay;

And yet, since on this hapless earth
There's small sincerity in mirth,
And laughter oft is but an art
To drown the outcry of the heart;
It may be that your ceaseless gambols,
Your wheelings, dartings, divings, rambles,
Your restless roving round and round
The circuit of your crystal bound—
Is but the task of weary pain,
An endless labour, dull and vain;
And while your forms are gaily shining,
Your little lives are inly pining!
Nay—but still I fain would dream
That ye are happy as ye seem.

Fishes that live in the great depths of the ocean are usually blind, but are peculiarly adapted to their environment. The pressure where they live is sufficient to powder glass. To overcome this the skeleton is porous and the water appears to circulate through them as through a sponge. They are so fragile out of water that when taken from the nets they almost drop in pieces. This will seem remarkable because they are fierce carnivorous creatures. Some are phosphorescent, having one or even more colors.

Mr. C. A. Holtgreve, 7419 North Clark Street, Chicago, Illinois, desires to obtain by purchase the first volume of AQUATIC LIFE; the bound edition, an unbound set, or single copies.

Please discontinue my advertisement. I have disposed of all the fishes I had for sale. I have had very good results from the advertisement; in fact I received more orders than I was able to fill.—*Otto Gneiding.*

The perplexity of Deacon Phishphan! Has it ever happened to you?—F. R. Webber, *Chicago Aquarium Society.*

Philadelphia Exhibition

The Annual Free Exhibition of Aquaria and fishes under the auspices of the Goldfish Fanciers' Society and The Aquarium Society of Philadelphia will be held in Horticultural Hall, Fairmount Park, October 6th, 7th and 8th. This is the biggest event in the calendar of the aquarist and attracts thousands of visitors. The coming show will far surpass those of former years. The finest goldfish in the world, the beautiful exotic or tropical fishes, aquatic plants, new and unusual types of aquaria, and various instructive features designed to help those not familiar with things aquatic will be shown.

Entries may be made by anyone, whether a member of the Philadelphia societies or not, subject only to a possible limitation of space should the number of individual exhibits prove unexpectedly large. Information as to entries may be obtained from the secretary of the Exhibition Committee, Fred Richardson, 3841 North Marshall Street, Philadelphia.—*R. L. Harding.*

The first autumn meeting of The Philadelphia Goldfish Fanciers' Society will be held in Saull's Hall, 802 West Girard avenue, on Wednesday evening, September 19th. Annual public auction sale of fishes donated by members. Come prepared to give and buy!—Fred Richardson, *Secretary.*

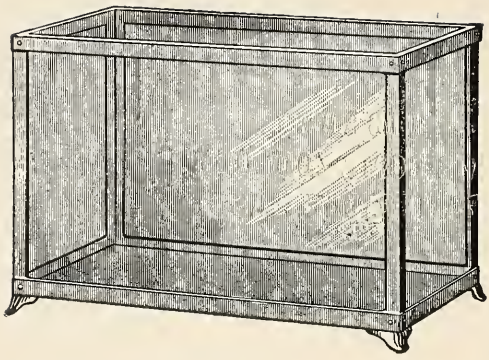
In the July issue appears an article on mosquitoes. The author erroneously blames the male for the blood-sucking. As a male, I protest. The male mosquito, if he eats at all, is a poor, harmless vegetarian. It is the ferocious Amazon of the species that causes all our trouble. As the mosquito is a good argument of mine against Woman Suffrage, I trust you will make the necessary correction.—*Dodoichthys.*

Don't judge a man by his coat or a ham by its canvas cover.

The chief value of nature study in character building is that, like life itself, it deals with realities. The experience of living is itself a form of nature study. One must in life make his own observations, frame his own inductions, and apply them in action as he goes along. The habit of finding out the best thing to do next, and then doing it, is the basis of character. A strong character is built up by doing, not by imitation, nor by feeling, nor by suggestion. Nature study, if it be genuine, is essentiallly doing.—*David Starr Jordan.*

October, 1917 10c a copy

Aquatic Life



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Corethra: A Winter Fish Food

GEORGE HEMSING

The Nets Showed a Yellowish Mass of Corethra

The value of live food for aquarium fishes cannot be overestimated, which fact is clearly shown by the numerous articles appearing in these columns concerning the propagation of Daphne for the purpose. More recently "Enchytrae," or white-worms, have entered the field, and I read with interest the article by Mr. C. J. Heede, AQUATIC LIFE, December, 1916, page 43. His statement regarding their use as a food for aquarium fishes, "especially during the winter months when Daphne is scarce and unobtainable," leads me to ask: Why not feed *Corethra?* So little has been said about this particular larva, well-known and used with success by most of the members of the Milwaukee Society, that I often wonder whether these "submarines" lurk only in waters adjacent to our fair city. This, of course, we know is not the case, for we read much about the gathering of Daphne, and while so engaged, others must surely be getting Corethra, as they occur in ponds of the same nature.

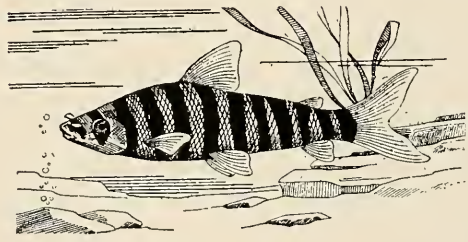
To the uninitiated a word about larval *Corethra* may not be amiss. It is a long, narrow creature of extraordinary transparency, resembling glass. In fact, thousands may be in the pond under examination, large numbers practically on the surface, and yet they can hardly be seen. They are known as "phantom larvae," a name little to be wondered at, for no sooner is one noticed than it as mysteriously vanishes, only to reappear the very next moment possibly half an inch from

its former position. For some moments the larvae rests contented and motionless near the surface, then suddenly it changes its direction and faces the other way. They are supplied with colored air-sacs, of which there are four arranged in two pairs, which act as floats and may also play some part in respiration. Corethra is predaceous, and its transparency assists it in capturing its prey. It is also possible that the colored air-sacs draw attention, and thus attracted by these bright spots, its victims are less able to discern the motionless form until it is too late, for the next moment the Daphne or Cyclops, as the case may be, is roughly seized and held in the mouth of the larva, from which escape is prevented by strong hairs, and then the juices of the victim are extracted.

Larva of the Midge, Corethra
(After Weismann - greatly enlarged)

Inasmuch as Daphne and other crustaceans form the food of Corethra, it follows that the latter are usually found where the former abound. In the hot summer months, when transformation into the mature gnat-like fly takes place, the larvae are scarce, but it is during this period that Daphne is found in abundance. The young Corethra hatched late in summer, however, remain in the larval state until the following spring, and it is therefore during the fall and winter months that the supply is most ample. Personally, I prefer Corethra as a fish food to Daphne, not only for the reason that one can lay in a supply (they can be kept for months in large pans of cold water, or even in tubs), but because I think they are more relished by the fishes, judging from the greediness with which they devour them, and, furthermore, there is no danger of dead "bugs" contaminating the water in the aquarium, as in the case of an over-supply of Daphne, because Corethra will live in the tank as long as the fishes will let them. While their size prevents their being fed alive to very small fishes, their use, however, is not limited to mature ones. Once a youngster is able to "smoke" a Corethra without strangling in the act, you can fairly see it grow. The remarkable growth attained by some of my exotic fishes I attribute solely to the diet of Corethra, *and Corethra can be collected in winter;* hence this story.

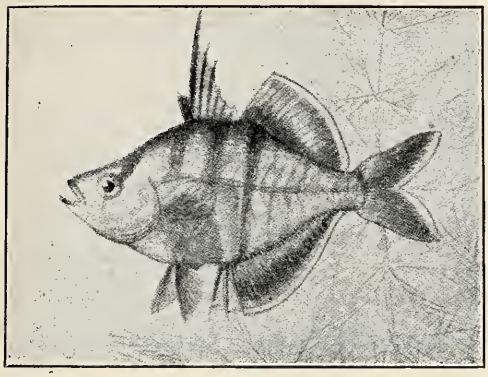
The morning of January 1st, last, although not very early I assure you, found me pajama-clad answering the ring of my 'phone, and, after a "Happy New Year" exchange, my friend Rev. Rubrecht on the other end of the wire asked: "Do I understand that the program for this morning is a bugging expedition?" And so it was arranged.



Leporinus fasciatus **Brazil**

Within an hour, with buckets, nets, ice-pick and all the necessary paraphernalia, we were speeding along on a West Allis car for Johnson's Woods, bug-hole bound. The sun shining bright, and the thermometer just at the freezing point, made a beautiful morning with just enough tinge in the air to put us on our mettle, happy as school boys during vacation time. On arriving at our destination, we immediately set to work cutting a hole. A week of zero weather had made the ice thick, but by taking turns

it was only a short time later that a cake about three by eight was cut and "shoved under." Now the question was, did we make a strike. Our cheesecloth nets were soon making their circuitous journey through the water, creating a current which was the means of drawing the bugs owing to their lack of power of re-



Ambassis lala **India**

sistance. After a few strokes the nets were withdrawn, and, anxiously peering into them, we joyously shouted "they're here." The operation was repeated again and again, the nets always showing a yellowish mass of nice clean Corethra. When we were about ready to leave, a happy couple who had followed us from our home, appeared at the top of the bank with a camera. For those fish fans who have never experienced the invigorating sport of "bugging in winter," a photograph is reproduced herewith to show how it is done.

The Origin of Salt Water

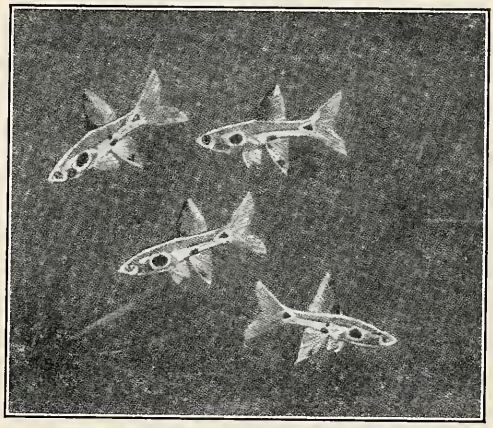
Some twenty years ago Prof. Edward Hull, in a lecture to the members of the Victoria Institute, London, explained that throughout all geological time the ocean had been receiving continual supplies from rivers bringing down not only sediments, but salts and carbonates, together with free silica, in solution.

The sediment was deposited over the ocean floor, and generally not far from the lands, while the dissolved ingredients were carried by the currents into all parts.

Meanwhile the ocean surface was constantly giving off, particularly over the equatorial regions, enormous quantities of vapor, which were carried into the higher regions of the atmosphere and were precipitated in the form of rain and snow over the lands. Part, of course, fell on the sea again, but the greater quantity fell on the land surfaces, and was returned to the ocean in streams charged with fresh salts and carbonates.

The consequence of that process must clearly be that the saline ingredients had been increasing in the oceanic waters from the earliest periods down to the present day.

The eggs of the native frogs are laid in large jelly-like masses; those of the toad in a long string.



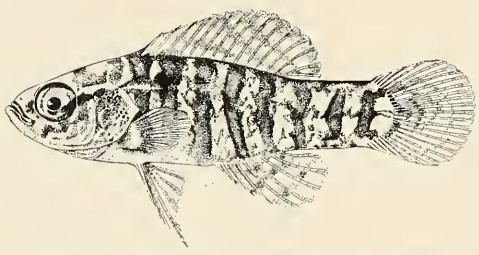
Rasbora maculata **East Asia**

When filling an aquarium place a glass tumbler on the bottom and pour the water into it. After the water reaches the level of the top of the tumbler, the current will be deflected upward, and there will be no disturbance of the sand.

THE PIGMY SUNFISHES

DR. ROBERT E. COKER, U. S. Bureau of Fisheries

Among the most interesting and the least known fishes of the United States are the pigmy sunfishes, *Elassoma zonatum,* Jordan and *Elassoma evergladei,* Jordan, the smallest of our spiny-rayed fishes. *Elassoma zonatum* was originally described by Jordan in the Bulletin of the National Museum, No. 10, 1877, from specimens collected by Professor H. G. Reynolds in the Little Red River, Arkansas. He referred to them as "curious little fish, representing a type entirely new to me, for which I would propose the above generic name" *(Elassoma,* meaning a diminutive being). Jordan could not then positively assign the species to a particular family, but, a couple of years later, with more material from Forbes' collections in Illinois, he created for the pigmy fish a new family called Elassomidae which he placed between the small pirate perches (Aphredoderidae) and the sunfishes (Centrarchidae). In 1884, another species was added to this unique family in *Elassoma evergladei* from Lake Jessup and Indian River, Florida. The *evergladei* seems to be a very variable form, but it differs from *zonatum* principally in having much larger scales.



Pigmy Sunfish Elassoma zonatum

Although many collections have been made subsequently, the genus and family remain to the present time with only the two representatives, the *zonatum* of the south generally and the *evergladei* of Florida and southern Georgia. American ichthyologists have followed Jordan in preserving a distinct family for the pygmies, although Boulenger in the Catalogue of Fishes in the British Museum (1895) regards them as only a dwarfed form of the Centrarchidae.

Jordan's original specimens were just one inch in length, but specimens later collected in Mississippi measured 1⅝ inches, according to Dr. O. P. Hay. Our specimens are rather uniform in size, varying from ⅝ to ¾ inches in length, except that a single example has a length of 1⅛ inches.

These were collected by Mr. Franklin Barnes, who was engaged for the Bureau in northern Louisiana in an ecological study of fishes with reference to mosquito extermination and who had been requested to keep a lookout for the pigmy sunfishes. It was some months before he found them and then only in one collecting station. Again, during the spring of the present year, they were looked for in the same and other places, but they did not at first appear. Later they were found, but only at the original station. In order that something might be learned of the feeding habits of this elusive species, specimens were sent to Washington. Although four days were consumed in the journey by express from Mound, Louisiana, to Washington, D. C., in hot weather, the lot of fishes, comprising 75 *Elassoma zonatum,* 2 *Gambusia affinis* and 8 *Fundulus chrysotus* in a ten-gallon milk can, came through with none dead. It may be men-

tioned that a year previously, Mr. William Welsh, of the Bureau, while on a canoe trip on the Pee Dee and its tributaries, carried specimens collected in South Carolina for a week in a five-gallon can, finding in this test that they survived better than *Gambusia affinis* and *Fundulus chrysotus*. Only *Chologaster cornutus* Agassiz, the "fish of the Dismal Swamp," seemed to be more hardy.

Habitat of the Pigmy Sunfish, Elassoma zonatum, at Mound, Louisiana

Practically nothing has been known of the habits of the pigmy sunfishes except that they live in sluggish waters, and are rarely taken. In aquaria they have proven rather shy, extremely so at first, and they display a remarkable faculty for hiding. After a dozen or more had been placed in a small aquarium with aquatic plants, it was almost impossible to believe that they were still there. A careful and close examination finally revealed a few, motionless against a pebble on the bottom, near a plant leaf at the surface, or by the stems of an aquatic plant. To line up against the stem of a plant, at whatever angle it may stand, and then remain motionless, seems to be a favorite pose. The translucency of the body, except where it is marked with dark bars and stippling on the surface, aids in concealment when the fish are among plants or debris. In the open water the distinct dark bars and spots, contrasted with dark spots between, render them quite conspicuous.

In spite of the predilection for stagnant water and the habit of remaining motionless a good deal of the time, the pigmies are not sluggish. This is revealed when entomostraca or mosquito larvae are placed in the aquarium. Immediately the fish appear here and there, alert, excited, and making quick pounces upon their prey. A pigmy sunfish will seize a wiggler more than half its own

length, even if he cannot completely swallow it at once; often the tail of the wiggler projects from the mouth of the fish for several seconds. Again, if the fish are disturbed by removing them with a dipnet to another jar which affords no means of concealment, their high nervous tension is evident, as they dart about with surprising rapidity, all the fins literally quivering.

Possibly the pigmy sunfish may prove to be effective agents in the destruction of mosquito larvae, but it remains to be learned if they are adapted to a sufficient variety of habitats. A character peculiarly favorable to efficiency against mosquitoes is their habit of lurking amidst the vegetation and debris, where the mosquito larvae are usually safest from top minnows and other species.

What we know of the pigmy sunfishes can be briefly stated. They are southern in distribution, extending from the Carolinas to Texas and north to southern Illinois at least, being addicted to sluggish waters, and not often found or recognized. Somewhat in the nature of tiny pikes they lurk quietly amidst vegetation or debris, but in the search of food, or when disturbed, they display a high degree of activity and vigor. They are distinctly predaceous, so far as entomostraca, mosquito larvae, and other animals of small size are concerned. I have not with certainty observed them take lifeless foods.

Those who may have the opportunity to collect the pigmy sunfishes and further to observe their habits would be interested in the following description of the one habitat in the vicinity of Mound, Louisiana, in which they found:

"'Cypress Bayou': Seepage and surface water; motion varying according to season, none when these collections were made; clear and blackish; depth 1 to 3 feet in dry seasons; bottom exceedingly soft; 30 to 40 feet wide. Aquatic vegetation exceedingly abundant; *Lemna jessiae diffusa* and Ceratophyllum forming a dense mat; also some *Echinochloa colona* and *Zizarniopsis miliceae* present. No scum. Some shade from few overhanging bushes and trees. Some large debris." (See photograph.)

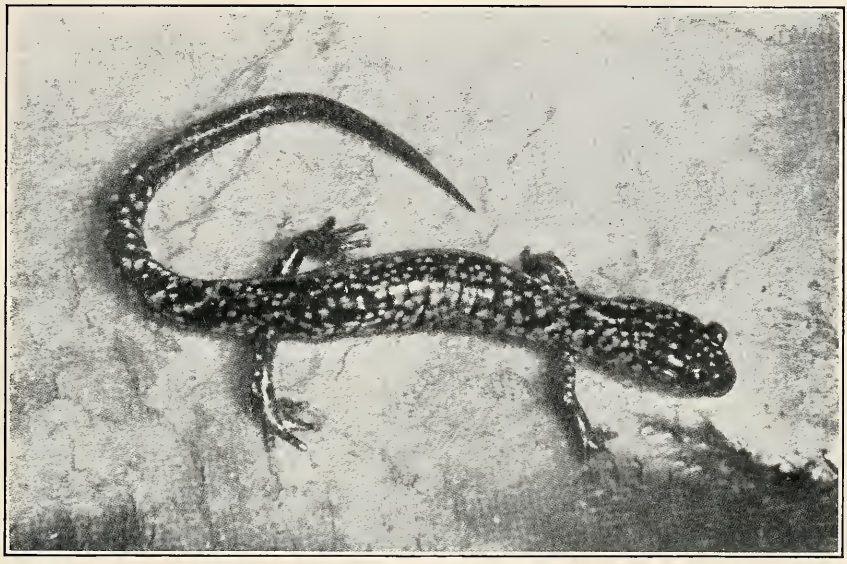
The striking characters of the fish are its usually conspicuous bands, a more intense spot on one band (or a short stripe) on the side and under the beginning of the dorsal, and the two circular or semilunar clear spots at the base of the tail. While the eyes are very large, they are not so conspicuous in the living fish as would be imagined from the drawing.

The body varies from clear translucent to a thin yellow green color, overlaid by black stippling and bands. Even in an indidivual fish the color is variable, as the black markings may fade slowly or suddenly. The fading of the black appears to be accompanied by the assumption of the yellowish color. The illustration herewith is the first published drawing of *Elassoma zonatum*.

Tadpoles when first placed in an aquarium are good scavengers, but just so soon as they learn to eat fish food their value ends, and they become little more than pests to stir up the sediment and roil the water. They may occasionally be introduced for a brief period and will work industriously, especially if they have been previously placed for about a week in a bucket of clear water without food.

The Slimy Salamander

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



The Slimy Salamander (Plethodon glutinosus); natural size. Reproduced from a photograph of the living specimen by the author

On the evening of May 10th, 1917, at a regular meeting of THE AQUARIUM SOCIETY OF WASHINGTON, Mr. Titus Ulke exhibited a very beautiful specimen of the Slimy Salamander *(P. glutinosus)*, which he had collected at Harper's Ferry, Va., a few days before. Mr. Ulke kindly loaned me this specimen for a day or so, and during that time I succeeded in obtaining some very excellent photographs of it; one of these is here shown to illustrate my notes. It will be observed that this specimen presents very unusual markings for the species, the white speckling on the upper parts being very numerous. However, the Slimy Salamander is known to show great variation in this particular, some individuals being like the one in the cut, others having very few fine speckles, while still others are *blotched* with the light color marking. Sometimes the speckling is moderately continued onto the ventral aspect of the animal, where the general color is of a deep lead color or stone gray; for the rest, it is a rich black, as shown in the cut. The tail is round; the eyes conspicuously prominent, the species being a slender one of moderate size.

This specimen measured about five inches in length, half of which being devoted to the tail. This Salamander has rather a wide range, being found from southern Canada to Florida and westward to include Texas. In some sections

it is said to be very abundant; but this surely does not apply to the District of Columbia, where I have collected salamanders for many years, and where I have never taken a single individual of this species.

When trying to escape from the hand, the Slimy Salamander often attempts to do so by quite an active little jump in a horizontal direction; but the attempt is feeble. As a matter of fact, it is a gentle little creature, and, in my eyes, a very pretty one. It has earned its scientific and common names from the slimy exudation from its skin—a clear, sticky mucous, a product of the dermal glands. The species is a typical land one, and to some extent of nocturnal habits. It will also come out from its hiding places under logs, flat stones, and leaf-masses in rainy weather. Doubtless it lives upon the same character of food as do other salamanders allied to it—small worms of various kinds, and certain insects, such as it can capture. In captivity, I doubt not but that it would take bits of raw meat; but I made no trials along such lines, as I had, at that time, quite a list of living things in my study to photograph.

Philadelphia Goldfish Fanciers

The September meeting of the Philadelphia Goldfish Fanciers' Society was held on the 19th, at 804 West Girard avenue.

The public sale of fishes, with George B. Smith as auctioneer, resulted in a gratifying addition to the funds of the organization.

New members: John Korn and Robert Spalding.

Next meeting, October 17th. Competition for telescopes, scaled and scaleless, more than one year old. A silver cup and three ribbons will be awarded in each class. Entries for the Household Aquarium Contest must be made at this meeting. An award will not be made unless at least six aquaria are entered.—Fred Richardson, *Secretary*.

The Essex Exhibition

The second annual exhibition of the Essex County Aquarium Society was held in the Newark Free Library, September 13th to 16th. The attendance was large, due, no doubt, to the co-operation of the local newspapers. Inasmuch as five silver cups and many ribbons were to be awarded, the rivalry among the individual aquarists ran high. The tropical fishes were judged by Mr. Edward Kiernan, and the goldfish breeds by Mr. Richard Dorn. Awards were made as follows:

Cup for best goldfish entered by a member to Rev. B. J. Coltorti; *cup for best pair of tropical fish*, Mr. C. M. Breder, Jr.; *cup for largest entry* by a member, Mr. Charles Thomas; *cup for largest entry* by a non-member, Mr. F. W. Hadden; *cup for society* having the largest aggregate entry by members, the Brooklyn Aquarium Society.

Scaleless Goldfish: 1st and 2nd. Rev. B. J. Coltorti (Broadtail Telescopes); 3rd, F. W. Hedden (Blue Japs).

Opaque-scaled Goldfish: 1st and 2nd. F. W. Hedden (Telescope Moors and Lionheads); 3rd, Dr. William Bachmann (Fringetail Japs).

Tropical Fishes: Paradise Fish; 1st, William Tricker; 2nd and 3rd, Frank Storsberg. Trichogaster fasciatus; 2nd, C. M. Breder, Jr. Polycanthus dayi; 1st, C. M. Breder, Jr. Platypoecilus maculatus rubra; 1st and 2nd, C. H. Peters; 3rd, Mrs. William Ball. Mollienisia latipinna; 2nd, C. M. Breder, Jr. Xiphophorus helleri, single and double stripe; 1st on each, William Tricker; 3rd on single stripe, A. G. Hines. Gam-

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Resuscitation of Exotic Fishes

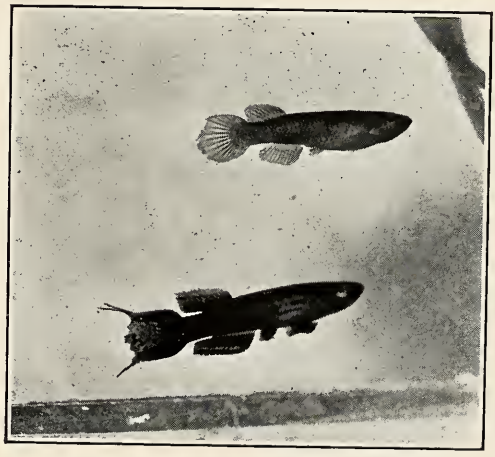
ERNEST LEITHOLF

The ability of exotic fishes to revive after exposure to low temperatures is sometimes surprising. I have saved fishes shipped during the spring and autumn that arrived apparently dead. Resuscitation is, of course, only possible when the exposure has not been too long and the drop in temperature gradual; not below 35 degrees, Fahrenheit, which I think marks the "dead line" for most of them, the sub-tropical species, being hardier are excepted.

The method I use is so simple that I urge all aquarists to try it before discarding any seemingly dead fishes received in shipments during cold weather. Place the fish in a receptacle in the water in which it was received. Then prepare some old settled warm water from an established tank by adding to it salt in the proportion of a teaspoonful to the quart. Apply "first aid" by adding this warm salt water to the receptacle containing the fish until a temperature of 75 degrees has been reached. Revival may not be immediate, but I have saved some valuable fishes in this manner.

In my home I have a "community tank" which is maintained at a temperature of 75 to 80 degrees, but one night it dropped to 50, due to faulty heating. While the majority of the fishes were not affected by the temporary fall several were in distress. A male of *Haplochilus cameronensis* was laying upon the bottom and apparently lifeless. I placed him in a jar containing water from the tank, added some salt and placed the jar on the end of the kitchen stove. The temperature gradually rose to 75 degrees. In about five minutes I noticed a slight tremor pass through its body and a perceptible rise and fall of the gill-covers; twenty-five minutes later the pectoral fins began to move. An hour and a half after placing the fish in the jar he righted himself and began to swim weakly about.

At another time I had a number of fishes in a tank in the garden. As the weather was getting steadily colder, and



Haplochilus cameronensis West Africa

Photograph by Lee S. Crandall

in fact did drop that night to 36 degrees, I removed all as I then thought, to warmer quarters. The following morning I discovered a *Danio rerio,* which I had neglected to remove, laying on the bottom motionless. On the impulse of the moment I placed it in a can of the icy water, added salt, and set the can near a heater indoors. When I returned home that night I was surprised to find my *Danio* very much alive.

While the suggested treatment is efficacious only at times and because it

is not possible for one to distinguish between suspended animation and absolute lifelessness, yet every fish saved encourages to further efforts, and the labor envolved is slight.

Breeding Danio Rerio

JACOB MERGET

The little *Danio rerio* from the East Indies, is, in the opinion of the writer, one of the most attractive of our aquarium fishes. Further, it is not a difficult

Upper, Female **Danio rerio** *Lower, Male*

species to propagate, and is therefore a desirable species for the beginner, most of whom look for one of the egg-laying class after having successfully bred some of the live-bearing kinds. There is something sprightly about this fish that compels attention, not to mention its incessant activity; it is never still a moment. The back is olive-green, which merges into indigo blue on the sides to the yellowish belly. Golden stripes run lengthwise along the sides from the gill-covers to the tail, the anal fin being likewise striped. The pectoral and dorsal fins are greenish yellow, the latter with a dark margin edged with yellowish white. The barbels or "whiskers" are so slender and transparent that they can seldom be discerned. The males are slender; the females deep through the abdomen, especially when gravid.

My breeding tank measures 20 by 12 inches, and contains a nice growth of *Vallisneria*. The sunny corner nearest the window, where the plants are thickest, is the spot the fish chose for spawning. Here "with malice aforethought" I have an egg-trap consisting of a number of pebbles, one to two inches in diameter, placed among the plants. Directly above floats a clump of Bladderwort *(Utricularia);* this also serves a purpose. When spawning is imminent the males swim along the bottom towards or in front of the female, color intensified and with whiskers distended; the female will be round and plump, so much so at times that swimming in the usual manner seems difficult. During the operation the male chases or drives the female, each dash usually ending in the clump of *Utricularia*. Here the eggs are expelled and fertilized, dropping into the trap below before the fishes are able to catch and devour them, which they will do if the water depth is too great. If more than six inches they will be able to capture them before they reach the bottom. With intervals of a few minutes the spawning proceeds until all the eggs have been expelled.

The pebbles are now lifted and the eggs removed with a dip-tube to a shallow dish, which is placed in a warm, sunny place for incubation. Hatching takes place forty hours to four days later, being dependent upon the temperature, which should be, if possible, about 75 degrees or more. The fry require an abundance of Infusoria, which should be fed several times daily until they are large enough to eat tiny Daphne and Cyclops.

A supply of Infusoria can be produced by placing a pinch of dried aquarium plants in a quart jar. A number of such jars should be prepared a week or two before the fry are expected. A pinch of the dried plant will be sufficient for each jar; too much will decompose with a bad odor. To feed the fry it is merely necessary to pour a cupful of the water from a jar into the rearing tank.

Notes on Fundulus Heteroclitus

CHARLES M. BREDER, JR.

Fundulus heteroclitus Male, with abnormal Eye Photograph by Author

The accompanying photograph shows, slightly more than natural size, a male of *Fundulus heteroclitus* with one abnormal eye. The protrusion is as prominent as in many of the so-called "telescope" goldfish. The specimen was taken from a small tidal stream emptying into the Hackensack River in the Jersey City Meadows. It was seemingly in perfect health and was placed in a twenty-gallon tank with a number of the same species. On the next morning to my great disappointment I found the monstrosity dead. There was no apparent reason, as the other lived on for about nine months, and would probably be still alive had not an accident terminated their career. The specimen is now preserved in alcohol, and the photograph was taken of it in this condition. The scars on the side are from the nibbling of the other fishes, which began to devour it before it was removed.

Later five smaller specimens of the same species were taken directly from the surf along the New Jersey coast and successfully acclimated to the freshwater aquarium. Last spring they favored me with some spawn, but as I seldom took any particular notice of them I was unaware of it until apprised by a friend. I had given him some *Salvinia* from the tank containing the *Fundulus,* and they had evidently spawned on its small, submerged, root-like leaves, for he showed me a young *heteroclitus* that developed in the tank in which he placed the plants. It would be interesting to know if any other aquarist has breed this species.

(Mr. Breder has performed a valuable service in recording his aberrant specimen by photography. A similar monstrosity has been reported in *Eupomotis gibbosus,* the Common Sunfish, both eyes protruding. Such examples tend to substantiate the theory that the Telescope Goldfish was developed by mating specimens of the goldfish exhibiting eye-protrusion, the extreme form of today being the result of selective breeding of subsequent generations, the variation thus becoming well fixed.

That Mr. Breder's fish deposited spawn on a floating plant is interesting and indicative of the adaptability of the

species to changed environment. Henry W. Fowler, in his work on the fishes of New Jersey (Ann. Rep. New Jersey State Museum 1905), describes its spawning habits as follows:

"This interesting little fish was found in abundance May 7th, 1905, swimming in the lower waters of the small creek at Cape May Point. This stream flows directly into the salt water of the bay side. At its mouth but few of the fish occur,

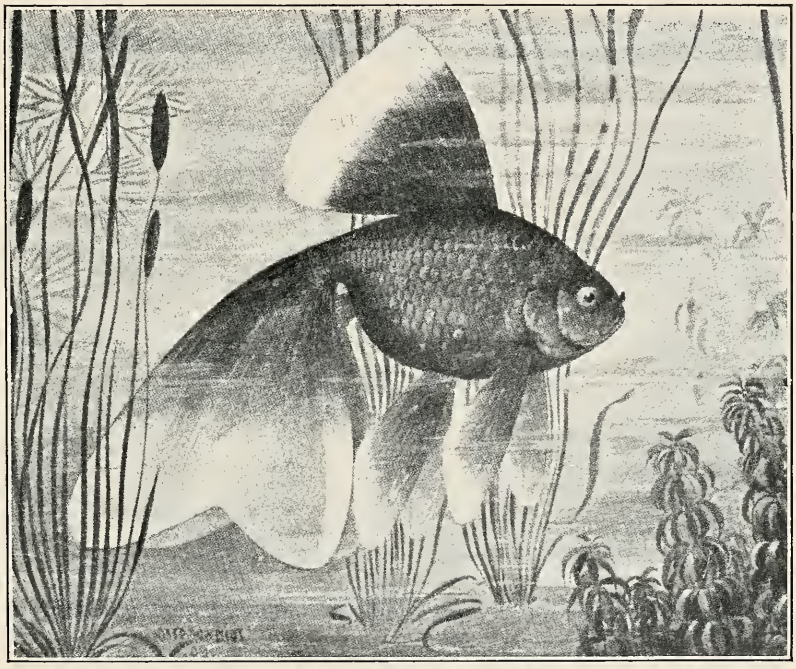
Fundulus heteroclitus

though thirty yards or so above they are abundant in numerous schools or shoals along the shallows of the banks, which are formed of sand. We did not notice them to any extent above these places or other than where the stream passes over the sandy beach. They were easily frightened into the deeper waters or channel by any sudden movement, though not at all disturbed by loud talking or other noise. Provided there is no movement on the banks one may watch them conduct their spawning for a long time. They do not remain in the channel long, but soon swim up in the shallows close to the shore, and often when the orgasm takes place they are more or less out of the water. The usual method is for a male to swim rather nervously alongside a female and crowd her close on the shore, at the same time bending his body in a somewhat undulated fashion with the brilliant dorsal fin thrown over her back, and then with a rapid flapping of his tail, which produces a rippling sound in the water, the milt is apparently expelled. This operation lasts but several seconds, and sometimes the participants find themselves washed ashore, when there is a very hurried attempt to get back into the water. All along these banks we could hear these little ripplings and see the fish wriggling back into the water. Sometimes copulation would take place entirely under the water on the little shoals. It did not appear that it was always necessary for these animals to have a projection or some support of a similar nature from the bottom to enable them to successfully accomplish their purpose. In fact, they would frequently fasten alongside one another on a perfectly smooth bottom, in which case the male would apparently crowd the female down. I was unable to determine the manner of coupling, if such takes place, of the organs of generation. Examples freshly caught would produce milt or ova, as the sex of the individual may be, if they were forced out by pressure on the abdomen with the thumb. The milt was purely white and milky. The ova was about the size of No. 4 shot, translucent, and of a very pale brownish. No male organ of generation was noted. The female has the oviduct extending along the front of the anal fin nearly to its lower margin, and the ova could be forced through it only in regular sequence. When in the water the two sexes are readily recognized, as they are very distinctly marked. The males are blackish, and are decidedly black in contrast alongside the pale brownish females. Rather small males, of about two inches in length, display the dark and brilliant colors of the older ones. The females were frequently seen swimming to and fro over the shallows, suddenly inclining their bodies somewhat on the side so that their shining whitish abdomens may be readily seen. I did not determine whether the eggs were

laid simply awaiting the initiative of the male. The intercourse between the sexes was in some cases I noted confined to a single pair, though mostly it seemed to be promiscuous. In fact, these animals seemed to have nearly unlimited powers of intercourse."

The form found along the Jersey coast an accent that makes it rhyme with soup. But down here in Chicago they call the fish the "guppy," pronouncing it in such a way that makes it jibe with puppy.

Orsinger and Keedy just returned the other day, from a trip to Philadelphia where the fish is called "goo-pay." And in Pittsburgh, Pennsylvania, and in



Opaque-scaled Japanese Broadtail Goldfish Courtesy of Harry P. Peters

is *Fundulus heteroclitus macrolepidotus*. *Fundulus*, of the bottom; *heteroclitus*, different angle or slope; *macrolepidotus*, large-scaled.—*Editor*.

Help Wanted!

Lebistes reticulatus or Girardinus guppyi or Acanthocephalus reticulatus! I got him in Milwaukee, where they call the fish the "goop"—they give the word Nashville, Tennessee, I'm told that all the fish-fas call the fish the "goo-pie-ee."

They can talk of simple spelling, and rules of punctuation, and can want a standard dialect for all this mighty nation, but I, a humble citizen, do hereby file my wish, for a little pocket manual to pronounce the names of fish.—*Webber of Chicago.*

Aquatic Life

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

W. A. POYSER.....Editor
JOSEPH E. BAUSMAN.....Publisher
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Practical articles and notes on topics pertaining to the aquarium and terrarium are always wanted for Aquatic Life. Readers of the magazine are invited to join in making it a medium of mutual help, and to contribute to it any ideas that may occur to them. The pages are always open for anyone who has anything helpful and practical to say. Manuscripts, books for review and general correspondence should be addressed to the editor.

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Vol. III October, 1917 No. 2

Herewith please find one dollar to renew my subscription to Aquatic Life. Have only one fault to find with the magazine, and that is you do not ask enough for it. A dollar and a half, or two dollars, would be little enough.—Charles E. Visel, *Brooklyn.*

The Book Department of Aquatic Life desires a copy of "Goldfish Breeds and Other Aquarium Fishes," by Herman T. Wolf. It must be in fair condition with no missing pages. Address the publisher, quoting price postpaid.

The Essex Exhibition

Concluded from Page 26

busia holbrooki; 1st, C. H. Peters. Girardinus reticulata; 1st, C. H. Peters. Danio rerio; cup and 1st, C. M. Breder, Jr. Hybrids; 1st, Otto Walter; 2nd, C. M. Breder, Jr. Mouth-breeders; 3rd, Otto Walter. Chanchito; 3rd, C. M. Breder, Jr. Lebistes reticulatus; 1st, C. H. Peters; 2nd, A. G. Hines. Aquatic Plants; 1st, William Tricker.—H. T. Hartshorn, *Exhibition Secretary.*

Sometime since the publisher offered a substantial cloth binder that will hold 24 numbers, the issues of two years. Since these were made the price of materials has advanced, making it now impossible to manufacture them at the original figure, and for this reason they will no longer be carried after the present stock is exhausted. While the supply lasts the binder will be sent postpaid for $1.35, or including a year's subscription for $2.00.

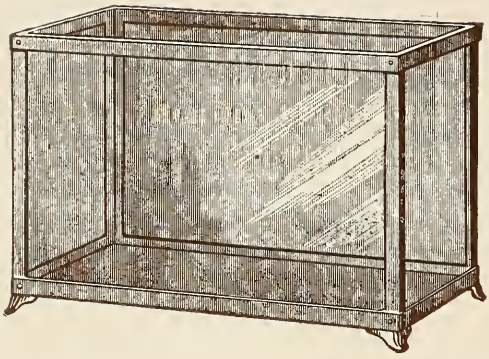
Irregularly shaped stones will often add to the beauty of an aquarium if tastefully arranged. Smooth pieces should be selected, and if moss or other plants are attached, so much the better.

Unfamiliar native plants should be used with caution in the aquarium. Some are good oxygenators, while others are almost useless and soon become slimy and disintegrate in the still water, which is often warmer than that from which they have been taken. This particularly applies to the native species of *Potomogeton.*

The water in an aquarium will evaporate, and more rapidly in a warm room. When fresh water is added to replace the loss, it should be of the same temperature.

November 1917 10c Copy

Aquatic Life



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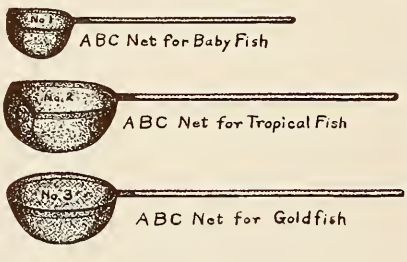

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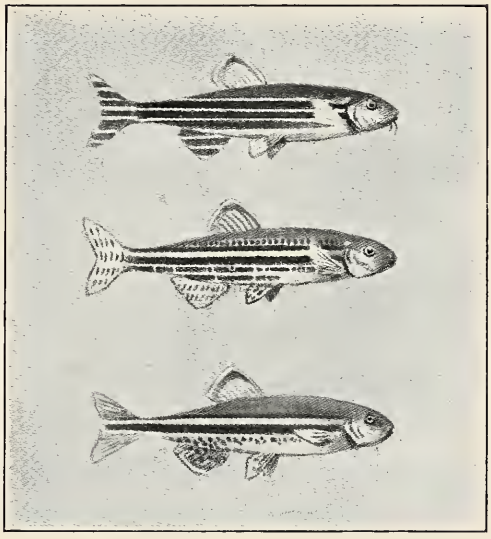
A HYBRID IN DANIO

ERNEST LEITHOLF

During the past few years, after having raised a sufficient number of young *Danio rerio* and *D. analipunctatus,* we have at times placed breeding pairs of both species together. While the species have been associated we have at times secured spawn, but until this year the resulting progeny have always proved of one or the other, and from this we concluded that there was no disposition to interbreed. Last spring three or four pairs of each species were placed together in an aquarium. From them we raised a large number of young, the eggs having been secured at intervals. Later in the season, while selecting specimens to be placed aside for breeding next year, we were astonished to discover four youngsters, about three-fourths grown, that displayed unmistakable evidences of hybridity!

To give a good conception of the relative color arrangements of the parents and their fortuitous offspring, I have prepared three sketches; *D. rerio* is shown at the top, the hybrid next, and *D. analipunctatus* below. The hybrids seem to have inherited characters equally from each parent. The body is similarly prim and elegant, but the colors are more iridescent, and the silvery bars of a warmer hue than in *D. rerio.* The back or dorsal region is a greenish olive. Through the centre of the side runs a wide, dark blue band, which is edged above with a prominent band of silver, this in turn is followed by a band of blue about half as wide as the central one. The two wide bands with the narrow one above is a pronounced characteristic of *D. analipunctatus.* A row of symmetrical dots crowns the upper bands. Below the bands are two rows of dark blue bars of varying lengths, interspersed with dots, the lowest extending forward to the ventrals. At this point the four individuals differ somewhat in detail. In one the dots predominate, but the linear effect is retained. The caudal, anal and ventral fins carry rows of long dashes.

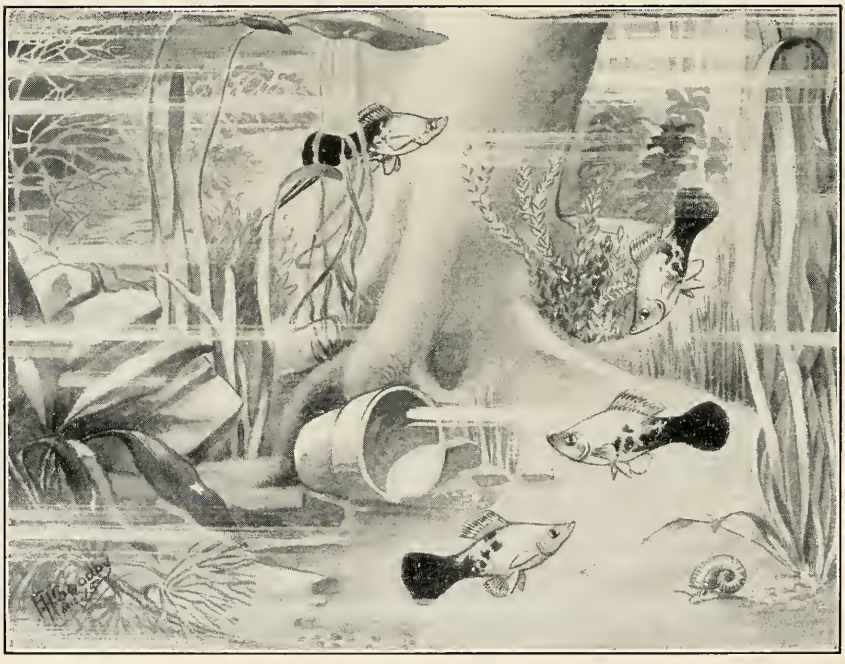


Upper, Danio rerio; lower, D. analipunctatus; centre, D. rerio x D. analipunctatus

Original Water Color by the Author From Life

Regarding the actual production of the hybrid, we are inclined to think that the parent species chanced to spawn simultaneously, and that the sperm of one fertilized the ova of the other. This seems the only tenable theory, inasmuch as the persistent association of the parent species during other years yielded none other than the progeny of properly disposed Danio. The possibility of this hybrid being fertile is now engrossing our thoughts. It is needless to add that the four individuals are enjoying unusual care.

The Japanese Shubunkin. A fertile hybrid from the Chinese Calico Telescope Goldfish and the Wakin, a form of the Common Goldfish



The Poecilid Hybrid, Xiphophorus helleri x Platypoecilus maculatus rubra.
From the original paintings by F. H. Goodby

The Fertility of the Poecilid Hybrid

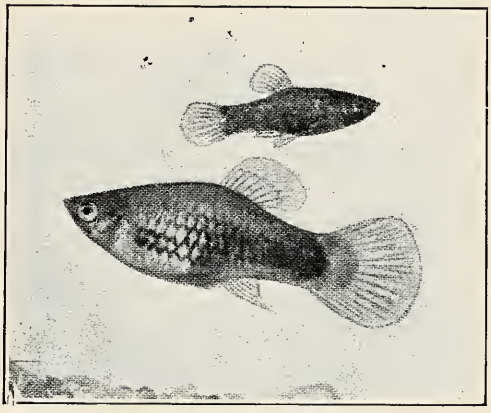
F. R. WEBBER

When three Wisconsin men announced that they had produced the now famous and much-sought-after hybrid, *Platypoecilus maculatus rubra X Xiphophorus helleri,* many experienced aquarians smiled, talked about Mendel's law, reversion to the parental forms, mule fish and the like. Many were the terms of good-natured derision used by those not fortunate enough to possess them. But now it has even been positively proven that the hybrid is fertile and breeds true to form! Thus far there is no sign of even a small fraction of the offspring reverting.

For the benefit of new readers of Aquatic Life, it may not be amiss to trace the history of this interesting fish. In 1914 the Rev. Paul Wagner Roth, of Milwaukee, read in a foreign periodical of an attempt to cross *Platypoecilus maculatus rubra* with *Xiphophorus helleri.* This he recounted to the members of the Milwaukee Aquarium Society. The announcement was hailed with considerable interest, and experiments were soon begun.

In June, 1914, Mr. J. K. Jensen, of Janesville, Wisconsin, accomplished the cross. He described it to the writer as follows: "Roth gave me a lot of young Helleri and Platys. I kept them in the tank here and fed them well on Daphne, Corethra larvæ, etc. I had almost given up expecting hybrids. One day I noticed a small fish in the tank. I said to myself, 'What can it be? I haven't any fish like that." Then I though of the hybrid. I had never seen one, but it proved to be 'him' sure enough." The triumph was announced to the Milwaukee Aquarium Society.

A few months later Mr. Francis H. Goodby, also of Milwaukee, announced the arrival of about seventy of the new fish. About a month later Mr. Jacob Merget succeeded in producing them. He reports that all of his first batch were deformed, the next weaklings, but the third physically perfect. Later, Rev.



Platypoecilus maculatus

Upper, male of red phase (ruba) Lower, female of black phase (nigra)

Roth was very successful, so much so that the form became popularly known as "Roth's hybrid."*

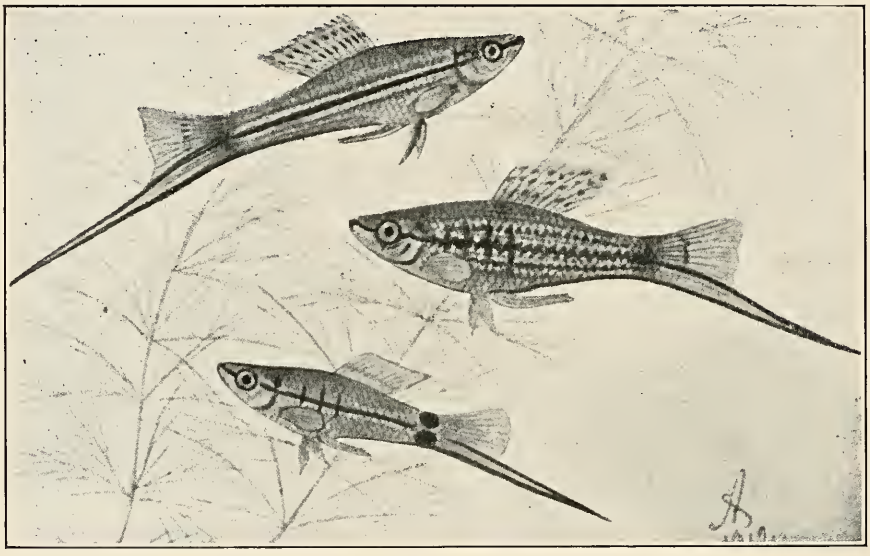
For a time it was thought by many that the hybrids would either be sterile, or else would breed back to either parent. About a year ago the writer received a letter from Mr. Merget, assuring him that he had not only produced the hybrids, but

*An Interesting Fish Hybrid. Rev. Paul Wagner Roth. Aquatic Life, Vol. 1, pp. 55-57, et. seq. Describes hybrid and how produced.

Hybridizing Fishes. Jacob Merget. Aquatic Life, Vol. 1, p. 131, et. seq. Describes method of accomplishing the cross.

My "Faulty Techniques." Jacob Merget. Aquatic Life, Vol. 2, p. 66, et. seq. Records fertility of the hybrid.

had offspring from them. Learning that Rev. Roth had also succeeded, we wrote him about it. He replied by sending two pairs of youngsters from the hybrids. Either the males could not stand a railroad trip, or else we were not versed in their requirements. At any rate, the young males seemed to lose interest in life, and gradually pined away and died, while the females grew large and strong.



Typical male of Xiphophorus helleri (upper) and two variants

Last spring the writer visited Rev. Roth and returned to Chicago with several pairs. One pair we gave to Mr. Fred Orsinger, and the others were retained. In a week or two Mr. Orsinger phoned, announcing the arrival of a whole batch of babies from the hybrids, and a month or so later another lot. Then Dr. A. H. Peck, another Chicago aquarist, was successful. The patience of the writer was finally rewarded by the discovery of some babies swimming merrily in the tank with their hybrid parents.

The writer can positively attest to the fact that the original cross is neither sterile, nor do any of the offspring revert. The experience of a number of us has proven it. The writer has had some sharp discussions with several wise ones, who insist that it is a physical impossibility to produce young from hybrid parents without at least part reverting to the form of the parents of the original cross—just as they once confidently insisted that this original cross was impossible. But the proof of the pudding lies in the eating thereof! A number of us have the proof in the form of the hybrid and progeny from it. So what can the cock-sure doubter say? Is it a nature fake? Be it as it may, the fish is among us to stay and is eagerly sought by the very ones who once said that "it ain't no fish." And although we are far from being revengeful, yet the knowledge of this fact brings sweet solace to the soul!

Comments

Inasmuch as the mule, our most familiar hybrid, is sterile, the opinion seems to prevail among the uninformed that all crosses are sterile. No law has yet been formulated to cover the question of fertility. While fertile hybrids are not common, the capacity for hybridization in the first generation is widespread. Fertile hybrids have been secured by crossing the Virginia deer and the Ceylon deer, the American bison and domestic cattle, the brook trout and the Charr, the common goldfish and the carp. The Shubunkin is a hybrid of the Chinese Calico Telescope Goldfish and the Wakin, the Japanese form of the common goldfish. And now we have the poecilid hybrid. Had the peas used by Mendel produced sterile hybrids, his work, at least with the particular species, would have ended. Indeed, it is in the behavior of the offspring of the first hybrid generation that Mendel's law becomes apparent. His results have been confirmed and extended by workers, both for plants and animals, but much is still uncertain concerning both the extent to which the principles may be found to occur and also the fundamental physical basis on which they depend.

The interesting feature of Mr. Webber's article has to do with the emphasis he places on the absence of a reversional tendency. It is not clear whether he implies that the hybrids were all of a type which resembled neither parent, or whether there was a reversional tendency, but not to such a degree that any of the offspring were counterparts of the parents of the first hybrid generation. An absolute reversion in such a cross would be astounding. The parent species differ in colors and form and in all other characters save those which place them in related genera in the family POECILIIDAE. Too many factors are involved in such a cross to permit an absolute reversion. Mendel, in his most easily explained experiments, selected species that differed essentially in but one character; size, for example. One parent was tall, the other a dwarf. Otherwise they were much alike, so but one character, size, was to be studied in the first and succeeding generations, and this without the confusion that would result were other factors also opposed. The same applies to an animal cross between a black and a white, the colors being the opposing characters. When animals of sundry divergent characters are crossed, many factors are involved, not only of the immediate subjects, but of their ancestors. Thus some hybrids exhibit characters that are obviously those of ancestors, which, perhaps, may be non-existent today, as in the case of Ewart's experiments with the zebras. In certain cases it may happen that when a black mouse is bred to an albino, each from a strain breeding true to its color, the result will be a reversion to the wild gray color. This is due to the bringing together of complimentary factors that, in the course of evolution, had become separated.

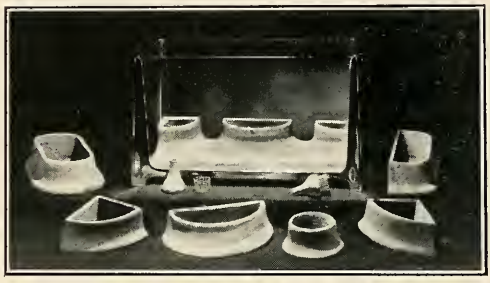
The writer has examined numerous specimens of the hybrid, *Xiphophorus helleri X Platypoecilus maculata rubra,* none of which, however, were bred by the gentlemen named by Mr. Webber. The dominants were unlike either parent other than in shape, which was intermediate, and in a tendency toward the development of the lower rays of the caudal fin into the "sword" that is characteristic of the male *Xiphophorus.* The recessive can be described as resembling a pale female *Xiphophorus,* which, also, in certain cases, is said to develop a "sword-tail." The proportion of dominants and recessives exhibiting the "sword-tail" character does not seem to have been accurately recorded, so it is yet to be

determined which type of tail is dominant. In any event it would seem that in this hybrid we have individuals that are dominants in this factor and recessives in the others, or vice versa. One writer records that in the first hybrid generation the individuals bearing general dominant characters prevail in the ratio 6:4. In a litter of the second hybrid generation examined by the writer the proportion was about 5:5. The father was an apparent dominant, and the mother a recessive, the result indicating that the dominant was impure, or, in other words, carried the recessive character. From the evidence thus far made available, the poecilid hybrid conforms to Mendel's law, but further studies should be made. And in this connection it may be noted that we are dealing with parent forms in themselves variable. We have three or four color forms of each that freely interbreed. *Platypoecilus maculatus rubra* varies to a great extent in the intensity of the orange or red ground color and in the presence or absence of the tiny dark spots. Further, it may or may not be possible to draw conclusions from a single litter. Contrary to the heretofore accepted theory, live-bearing fishes, or at least certain species bred by aquarians, will bring forth several litters resultant from a single intercourse with the male. The writer once possessed a female of *P. m. rubra* that produced five successive litters. The specimen occupied a small aquarium alone; hence clandestine intercourse was impossible. From this it follows that a gravid female of the first hybrid generation should be segregated immediately upon the fact becoming apparent, and kept so until all the litters had been developed and expelled, and conclusions drawn from the total rather than from a single litter.

The hybrid *Danio* does not admit of much discussion. Too few individuals in proportion to the normal total were secured. That it is an "intermediate" places it in contrast with the poecilid hybrid. If it proves fertile and reproduces intermediates, it will be the third case in which heredity does not seem to follow the Mendelian rule. The two recorded cases may be due to some physiological reason we do not yet understand. —*Editor.*

Plant Containers

Sturdy fishes! Luxuriant plants! And that is the sum total of a flourishing aquarium. Smith says this follows as



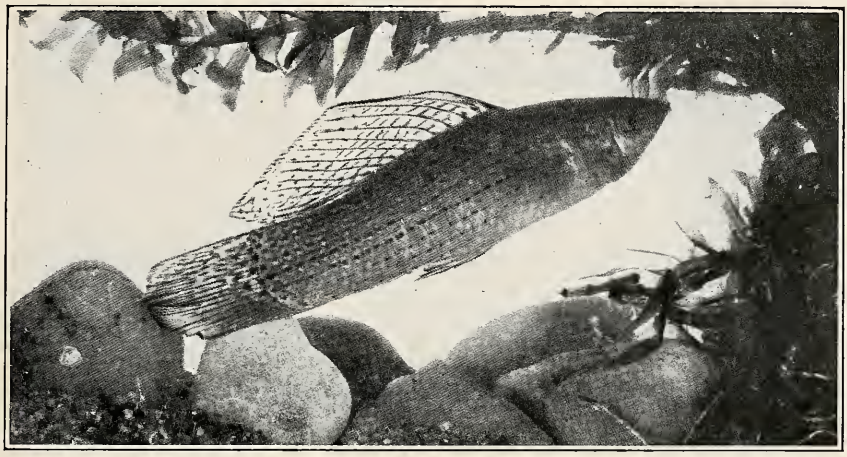
Smith's Plant Containers

the natural sequence to the use of his plant containers.

Resetting an aquarium is the least interesting and most laborious task that falls to our lot. The work is easy if the plants are in containers. Removal is unnecessary, and the little sand can be drawn out by syphoning. Instead of the quantity of sand ordinarily necessary to anchor the plants, we have a mere sprinkling to cover the bottom. One style covers the entire bottom, with openings in suitable places, so that no soil or sand is used other than that in which the plants are actually growing. This arrangement is especially valuable when one wants to go the limit in feeding young tropicals; surplus food is easily removed. Ask Mr. Smith to tell you about them.

Notes on Mollienisia Latipinna

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



Male specimen of Mollienisia latipinna; natural size
Reproduction of a photograph from life by the author

In Jordan and Evermann's "Fishes of North America" (Pt. I, pp. 698-701) we find four species of the genus *Mollienisia* described, but none of them are figured in the work; as a matter of fact, I do not recall a good figure of any of these forms. The genus was originally described by Le Sueur, and named for the French Minister of Finance, Mollien, who was associated with Le Sueur in his scientific work, and who, too, was a patron of Peron's. Two of the species are found in Mexico, another at Lake Peten (Günther), and the fourth, *M. latipinna*, occurs in enormous numbers in lowland swamps and streams from South Carolina, round the Gulf Coast to Northern Mexico. Recently Mr. Edward S. Schmid, of Washington, D. C., has imported a large number of them from New Orleans, and through his kindness I have been enabled to photograph several of these beautiful fishes alive. One of these photographs—that of a fine male—is here reproduced to illustrate my article. Jordan gives a good account of the characters of *Mollienisia latipinna,* describing the great beauty of the male, the female being considerably smaller, and very plainly colored. He says: "The male, a fish of remarkable beauty. It often enters the sea, the gorgeous dorsal fin of the male being conspicuous in the shallow water about the wharves at Pensacola." The markings of the male are well shown in my figure; the principal colors are bright lavender, brilliant orange, black and white.

Many years ago I saw thousands of specimens of this species in the very shallow pools connecting with the bayous south of New Orleans, La.; they were

mating, and, as the gorgeously colored males chased the females about in the clear water of the pools, a scene was presented that I have never forgotten. To the best of my recollection I would say that some of the old males exhibited markings of a bright azure blue in addition to the orange ones; but I may be mistaken about this. My Louisiana field notes are not at hand at this writing; but I remember that in them I had drawings of both the male and female of this elegant little butterfly of a fish. Indeed, *Mollienisia latipinna* might well be called the "Butterfly Fish," in the absence of any other vernacular name found in Jordan and Evermann for it.

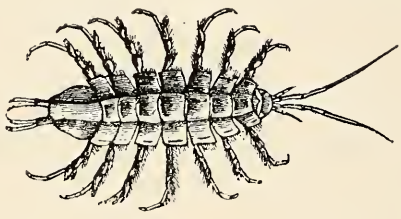
The Water-Asel

JOHN LEE BENNINGTON

The Water-asel or Slater, *Asellus,* is, barring the Pill-bug, *Armadillidium vulgare,* the most familiar of the order Isopoda, a division of animals of the class Crustacea. Of the seven American species, *Asellus communis* is the one most frequently met. It measures about three-fifths of an inch in length, with a breadth of one-fifth. Superficially it resembles *A. aquaticus,* which is illustrated. It is strictly aquatic and breathes by means of gills on the modified abdominal or hinder appendages.

This isopod will often be taken in ponds and streams, crawling about among the stones or on the plants, for it cannot swim. It is quite prolific, and reproduces rapidly in spite of pronounced cannibalistic habits. The eggs, which may number from fifty to sixty, are carried by the female in a brood-pouch during incubation, and the young therein for some time after hatching.

The aquarian is apt to look upon *Asellus* with suspicion, but there need be little hesitation in introducing it into an aquarium if the fish have passed the stage of fry. It has been accused of devouring spawn, which is quite possible, but inasmuch as it crawls—it cannot swim—any depredation among very young fish would be by accident rather than by design. However, to be on the safe side of the question, don't place it in a tank with fry. Normally it feeds upon soft plants, living and dead, and for this reason it makes a useful scavenger in the aquarium, aside from its interesting habits. Of course, if one desires to investigate its life history it should be placed alone in a small, properly equipped



Asellus aquaticus

observation tank. The Asel is regarded as a savory morsel by fishes large enough to devour it, hence if kept with other than the smaller species its life in the aquarium is apt to be brief.

A spectator at the Philadelphia exhibition, who remarked that he was not aware that such peculiar fishes existed, reminds one of the comment of the farmer on his first visit to a zoological garden. He plodded from house to house, his bewilderment increasing, until he stopped in amazement before the giraffe and ejaculated: "Oh, pshaw! There ain't no such animal."

Below is given a copy of an inscription that adorned a board fence in Kent:

"Notis—If any man's or woman's cows get into these here oats, his or her tail will be cut off as the case may be."—*The Country Gentleman.*

THE COMMON TREE TOAD

RICHARD DECKERT, New York Zoological Garden

There are few people who have spent some time in the country, in the eastern United States who have not at one time or another come across this wonderfully interesting little chap. Perhaps, while inhaling the fragrance of some flowering vine, you have seen a bluish green tree toad, sound asleep under cover of a clump of leaves. Another time you have been picking cherries, and climbing among the limbs, have put your hand on what looked like a brown or gray knob of some branch, to feel it wet and soft and to see it come to life. It is our Hyla, sleeping after a good meal of flies and beetles. In early October, while looking for the first ripe apple, we will sometimes come across him in the old orchard. He may be found on the white-painted gate post of a fence, himself almost white, and looking like a paint blister. His behavior is not like that of most frogs, particularly the Spring Peeper, *Hyla pickeringii*. He is fat, lazy and confident —not easily frightened, and when taken in hand will cling with his ten sticky toe-pads, so that it takes quite some force to disengage him. If the hand is turned upside down, he will slowly climb around until again uppermost, then begin to tuck in his "arms and legs," satisfied to remain on his living perch.

All his actions can be summed up in the word "cute." His color changes, while rather slow, can be wonderfully diverse. Pale yellowish white, whitish gray, without marks, or with the star on his shoulders faintly outlined with black, this star sometimes pale green or pink, he can assume almost any shade of gray, brown and green, from palest bluish green to grass green.

The above mentioned more or less star-shaped mark on his shoulder, two broad longitudinal bars on the sides, two, sometimes three cross bars on the arms and legs, and a V-shaped mark on the head between the eyes, are usually present when the tree toad assumes a medium or

The Tree Toad **Hyla versicolor**

Photograph from life by D. Franklin

dark color. These marks may be absent or but faintly indicated when our tree toad is dressed in his paler hues.

A white, chalky patch under the eye can always be distinguished, no matter what the color of the rest of the body. The under sides are grayish white without spots, the concealed surfaces of the hind legs are orange yellow, marbled with dark brown on the hinder sides of the thighs. The iris of the eye usually corresponds with the color of the body, except when the latter is green. It then assumes a silvery or pale brassy hue. The upper parts are covered with even-sized, large, more or less prominent granules or warts. When the tree toad has been ex-

posed to strong light for some time, he may become almost perfectly smooth. The skin is usually very loose, and forms many folds, making the tree toad appear as if "his clothes did not fit him." The abdomen is evenly granular, the throat much wrinkled, and in the male dark gray or black.

The Spring Peeper **Hyla pickeringii**

Photograph from life by D. Franklin

The male, when giving voice to its call, can distend this throat pouch until it is larger than his head. His voice is loud, high-pitched, and strongly trilled, and often resembles the bleat of a very young kid. Aside from the songs of birds, there is, to the writer's mind, hardly a more cheerful sound in nature, so full of happiness and utter contentment it seems. In May, when the woods are beautiful in their new spring hues, and the cherry trees are in bloom, the tree toad wanders to the nearest pond, the males arriving first. In the afternoon they start their calls, sometimes in the high grass and weeds, still some distance from the pond. The chorus at the pond becomes stronger when rain is threatening, and other tree toads still in the trees, will answer those at the pond. Breeding operations begin in late May or early June, and are usually over by July—dependent on the weather. The eggs are laid in small packets of from six to twenty each, surrounded by small quantities of foam. They float at the surface of the water, usually gathering around a protruding stick, leaf or grass-stem.

Hyla versicolor prefers ponds containing pond lilies, pickerel weed and floating plants. From 1000 to 2000 eggs are laid by one female. The eggs hatch in from two to five days, and the tadpoles transform into perfect baby tree toads after 55 to 65 days. The color of the tadpole is dark olive green, usually with a reddish golden tinge near the head. The belly is white with golden iridiscence. The base of the tail is colored like the body, the remainder to the tip being orange or vermilion red, with black spots. Like all tadpoles, they have many enemies, such as the back swimmers (*Notonecta*), the large diving beetle (*Dytiscus*) and the larger dragonfly larvæ. Leeches will also attach themselves to these helpless creatures, sucking their blood. Fishes eat them, as do many birds, particularly ducks.

The perfectly formed baby frogs are large, considering the size of the adult, which is two inches. They are from five-eighths to three-quarters inch long, from snout to vent, and at first pea green in color; they do not assume the gray tints until some time after leaving the pond. Their chief food is mosquitoes, small spiders, flies and plant lice.

Like most species of tree toads, our little friend has the sense of locality strongly developed. I have found individuals in the same spot day after day for many weeks. I have left the cover of the vivarium open time and again, and although the tree toads would wander at night over the plants surrounding their cage, in the morning I would, with rare exceptions, find them tucked in the various corners of their homes. Three or

four will often choose the same corner, but do not dispute with one another. The first comer chooses his resting place, and the others sit under, above, or on top of him, as the case may be. When hunting for insects our little friend concentrates all his attention on the prey, leaping at it and never worrying where he himself is going to land. His sticky toes are sure to find something to cling to, and, after quite some efforts, he will find a new rest-

The Larva of a Dragonfly

ing place, from which he begins his hunt for the next victim.

To the best of my knowledge, the tree toad hibernates in the pulp which fills the deep knotholes often found in fruit trees, willows and swamp oak.

A French woman, proud of her limited konwledge of English, and an American woman, proud of her limited knowledge of French, were introduced at a social affair. The French woman insisted in expressing herself in bad English and the American woman would talk nothing but bad French.

When the guests began to depart they were still at it. At last they arose to go. Here is their watery farewell:

"Reservoir," said the fair American.

"Tanks," responded her new friend.

Can't afford to miss a single number. I always "devour" every line of an issue before I read my evening paper.—John L. Davis, *Penna.*

An aquarist who has an exalted opinion of himself is a mighty poor judge of goldfish.—Mose.

The Philadelphia Show

WM. T. INNES

In the fore part of October for the past several years Philadelphia fish fanciers have prepared exhibitions in Horticultural Hall, Fairmount Park, that the public might become better acquainted with the remarkable achievements in developing and breeding fancy goldfishes and exotic wild species. That we have succeeded in arousing a decided interest is evidenced by the large crowds that are attracted, even when the exhibition is but slightly advertised, which was the case this year. Visitors come from many points, and leave with the conviction that the trip was well spent. Dr. Leonard, of Carbondale, telegraphed: "Meet me at the piscatorial centre of the universe Saturday at two." I did not need a code to translate the dispatch, but went straight to Horticultural Hall, and there met the next Mayor of Carbondale.

While there have been shows and shows in other years, it is practically a set custom to say that the last surpassed all others. That is exactly what I want to say this year, but let none take it for an empty statement. The exhibitors were there with the "real goods" in such profusion that no experienced observer could fail to be impressed with the progress made in the breeding of beautiful aquarium fishes. Mr. Rudolph Wolf, whose extensive importations some years ago were largely instrumental in founding Philadelphia as the goldfish centre, visited the exhibition twice, the second time being accompanied by his brother, Mr. Herman T. Wolf, formerly an active contributor to aquarium literature. These gentlemen were delighted with the improvements in the different breeds, which is gratifying in view of their wide and long experience.

The Calico Telescope reigns supreme, and it is with this breed that most of the progress has been made. The riot of colors among them is gorgeous and daz-

Aquatic Life

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

W. A. POYSER.....Editor
JOSEPH E. BAUSMAN.....Publisher
542 E. Girard Avenue, Philadelphia.

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

Practical articles and notes on topics pertaining to the aquarium and terrarium are always wanted for Aquatic Life. Readers of the magazine are invited to join in making it a medium of mutual help, and to contribute to it any ideas that may occur to them. The pages are always open for anyone who has anything helpful and practical to say. Manuscripts, books for review and general correspondence should be addressed to the editor.

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Vol. III **November, 1917** **No. 3**

zling. A judge would have his own troubles in picking the winner in such a superb collection of aristocrats of the aquarium.

The tropical fish section was not quite up to the standard, due largely to the dearth of importations, but was somewhat redeemed by a choice display of young *Pterophyllum scalare* and a new arrival called the Scarlet Chanchito.* A common Chanchito, *Cichlasoma* (*Heros*) *facetum,* of extraordinary size—nearly a foot long—did not seem to catch the eye of the general public, but tropical fish fanciers thought it a wonder.

Mr. J. Louis Troemner exhibited a beautifully colored chart, showing the different stages of progress in the development of the fancy goldfish breeds. The public found this both interesting and instructive, if one may judge from the attention it received.

The exhibition was given under the auspices of The Goldfish Fanciers' Society, The Goldfish Exhibitors and The Aquarium Society of Philadelphia. Those contributing to its success by showing their fishes were: Messrs. Smith, Ayling, Klippen, Eck, Barrett, Phillips (Brooklyn), Leffman, Graff, Peters, Weida, Demuth, Wilt, Bausman, Visel (Brooklyn), Allen, Hannig, G. Kempter, Hawkins, H. Kempter, Bell, Christy, Schaefer, Heilman, Troemner, Hinkle, Walton, Williams and Paullin.

*This was labeled *Cichlasoma erythrogaster,* a tentative name under which it was distributed by the importer who at the time thought it new to science. It was later identified as a variant of *Thorichthys helleri* (*syn. Cichlasoma helleri.*)—Editor.

The regular October meeting of The Goldfish Fanciers' Society of Philadelphia was held in Saull's Hall, 804 W. Girard avenue, on Wednesday evening, the 17th.

The competition was for Telescopes more than one year old. Messrs. Howard Galbraith, Charles Hinkle and Elmer C. Hazlett were appointed judges, making awards as follows:

Transparent-scaled Telescopes.—*Cup and blue ribbon,* Joseph E. Bausman; *red,* George E. Wilt; *yellow,* James H. McBride.

Opaque-scaled Telescopes. — *Cup,* John Eck; *blue ribbon,* M. Marblestone; *red,* Thomas Ayling; *yellow,* George E. Wilt.

New members: Dr. H. H. Cushing, Fred A. Smith and Frank McKeown.

The next meeting will be held on November 21st. Competition for Broadtail Japs, opaque-scaled and transparent-scaled(scaled and scaleless), over a year old. One cup and three ribbons to be awarded in each class. On "cup nights" an entrance fee of ten cents is charged for each fish.—Fred Richardson

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 1st, 1917.

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 37th 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 37th 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 19th day of September, 1917.

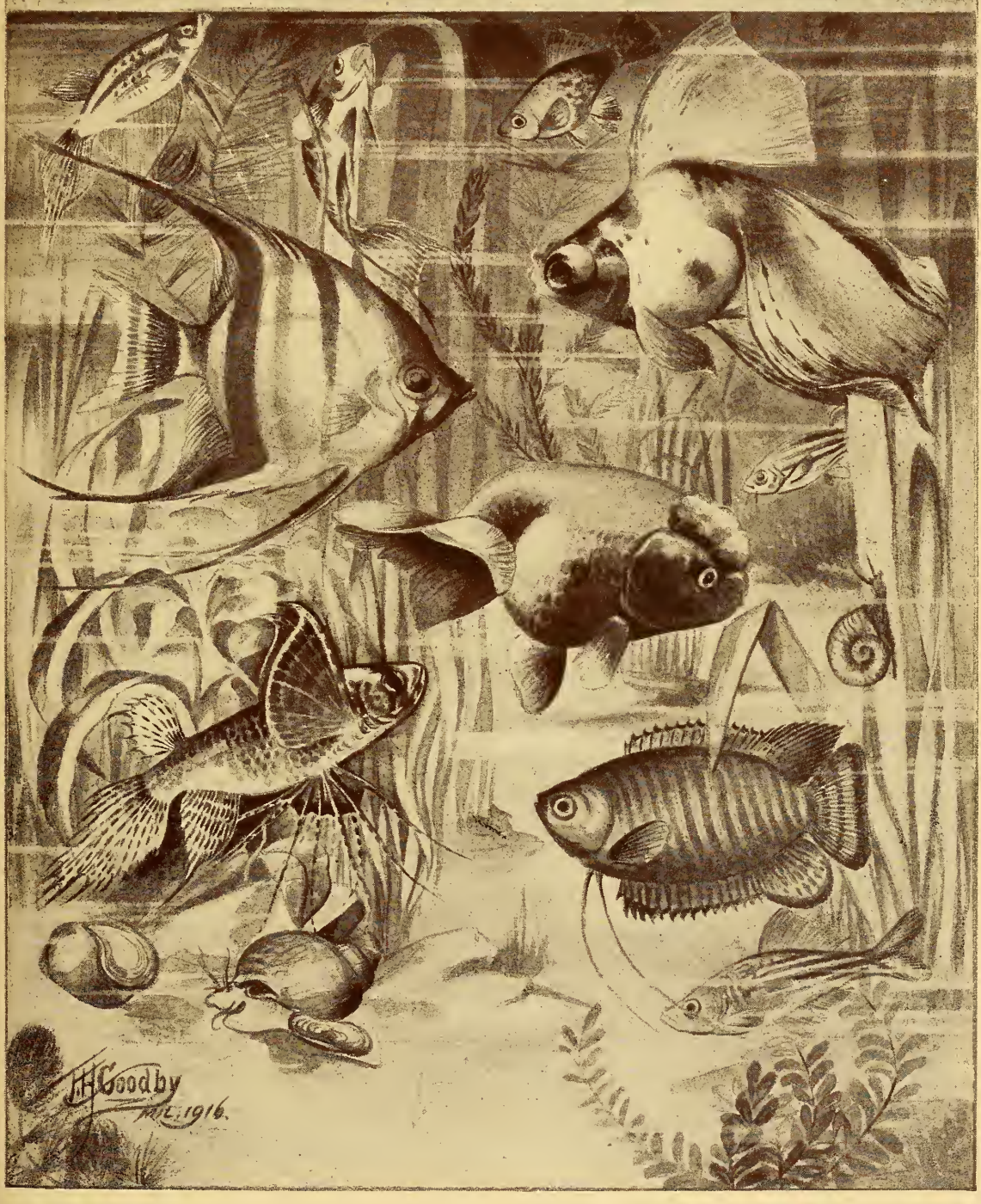
(Seal) A. D. DEWEES.

(My commission expires February 19, 1921.)

For although it be a more new and difficult way, to find out the nature of things, by the things themselves; then by reading of books, to take our knowledge upon trust from the opinions of philosophers; yet must it needs be confessed that the former is much more open and less fraudulent, especially in the secrets relating to natural philosophy.—*William Harvey,* ANATOMICAL EXERCITATIONS, 1653.

December 1917 10c Copy

Aquatic Life



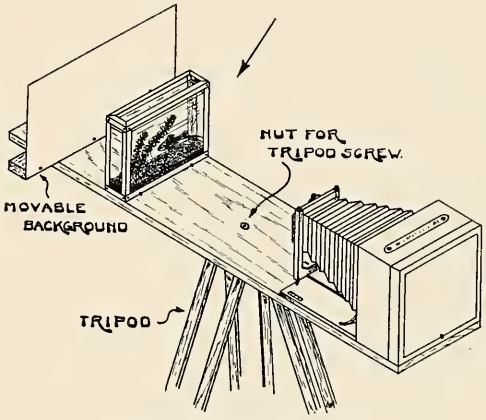
Aquarium Photography

CHARLES M. BREDER, JR.

It is often desirable to record aquaria and their contents by photography. Aside from scientific value, photographs of fishes and aquatic plants are of interest to aquarians and nature students, and the work affords a pleasant pastime, not to mention possible profit. An enlarged print of a rare or fine fish makes a handsome ornament for the conservatory long after the original has run its life, and is a permanent record of the prowess of the owner in fish culture. Lantern slides are not difficult to make, and a good series is a valuable addition to the paraphernalia of the nature club or individual lecturer. Those who desire slides or prints usually pay well for them. Fishes could easily be obtained from other fanciers in exchange for photographic services.

A plate camera with a focusing screen is indispensable for the work, the more expensive the better; but that does not mean that good work cannot be done with an instrument moderate in cost. The photographs used to illustrate this paper were taken with an Eastman Plate Camera, Series C, No. 4, with a Rapid Rectilinear lens, working up to U. S. 4. The shutter has speeds up to a hundredth of a second, but for these purposes I have used nothing over one-fiftieth. This camera uses plates 4 by 5 inches. The bellows can be extended so that objects may be photographed three-fourths size without any extra attachment. The outfit, without the tripod, was bought second-hand for eight dollars, and ones similar to it are usually to be had for about that amount.

For taking general views of tank interiors—plants and rock work—there is nothing much to be said. The side of the tank nearest the camera must be parallel with the photographic plate, and no light reflected from the side of the tank must shine directly into the lens.



The Author's Apparatus

This light can usually be seen on the ground glass while focusing. If these precautions are not observed, the reflected light will appear in the picture as white streaks. As long exposures are necessary, the tank being usually closely planted, the fishes should be removed; otherwise they will appear as blurs. The sediment that is stirred up in catching the fishes must be allowed to settle before making the exposure. Particles in suspension in the water appear in the photograph as specks. The correct exposure must be worked out for each aquarium, as conditions vary so much that no general rule can be given. It should be borne in mind that water and glass are somewhat more opaque to actinic light

than air, and in consequence the exposure should be longer.

For picturing aquatic plants an ordinary tank containing nothing other than the subject will often give excellent results. But to show the structure of the plant in general, it is good practice to lay it upon a white sheet on the floor and photograph from above. This will give

The Egyptian Mouthbreeder
Haplochromis strigigena

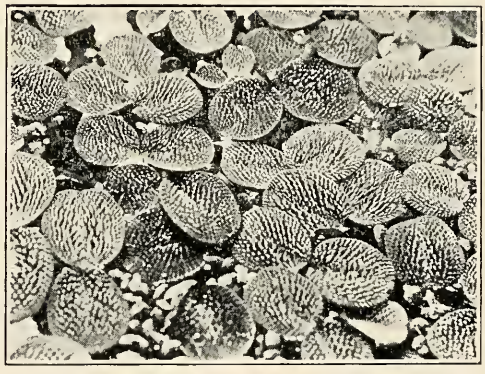
a sharp picture of the entire plant, which will serve as well as a drawing for purposes of identification. Views showing the exposed portions of floating plants are taken like an ordinary photograph, the camera being pointed slightly downward.

The most difficult subjects are living fishes, particularly the smaller species. After considerable experimenting I found that a special apparatus was necessary. Briefly, it consists of a very narrow tank, which keeps the fish in focus automatically, an adjustable background, the camera, and a suitable support for all. The camera is equipped with a copying lens costing thirty cents, which enables one to take pictures life size and over. The exposed glass side of the aquarium is the same size as the photographic plate, so that when the camera is focused to take in this area it is working at full size. The background is a piece of heavy cardboard tacked to a strip of wood. It can be moved to any desired position. The apparatus is supported on a long board, which rests on an ordinary tripod. The device is portable, allowing one to follow the sun or carry it to another conservatory.

Inasmuch as all cameras are not alike, the apparatus must be made to conform to the particular instrument used. Below is a detailed description of the apparatus made for the camera described:

The *base* is a board three-fourths of an inch thick, two feet long and six inches wide. A hexagonal nut is firmly mortised in the centre. The screw in the head of the tripod fits into this nut and holds the board rigid. Near one end, the exact position depending upon the tripod socket in the camera, is bored a simple hole, through which is thrust a thumbscrew to engage the socket in the camera. The board is varnished to improve its appearance.

The *aquarium* measures two by five by



Salvinia species

six inches over all. The frame is made of gauge 20 galvanized iron strips, one inch wide, and bent at right angles lengthwise. Soft tinned rivets were used to put the strips together, but it could just as well be soldered. With the outside measurements given, the exposed glass on the sides is four by five inches. The leg of the angle that overhangs the top is cut down to about a quarter inch, so that it just protects the raw edge of the

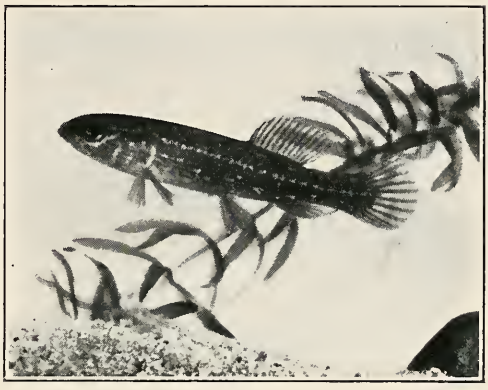
glass. This makes the transfer of fish easier and minimizes the danger of injury. Very clear single-thick window glass, free from all flaws, should be used for the sides if good results are to be expected. Thin polished plate is best. The ends and bottom need not be so perfect. Any good aquarium cement may be used to secure the glasses.

The *background* is merely a piece of clean white cardboard, six by eight inches, supported by a block of wood, eight by two by one inch, to which it is tacked. It can be placed in any desired position behind the tank. For light-colored fishes dark cardboard may be used. A scene daubed roughly and placed out of focus will give the effect of depth and enhance the beauty of the resulting negative. Colored and mottled boards may also be used.

After the device has been set, the camera must be adjusted to give the maximum degree of definition. This can be done by focusing with the aid of a hand magnifying glass on a pebble or other object in the centre of the tank. When the proper position is found two tacks should be placed in front of the tank as markers for future use. The arrow in my sketch indicates the best direction from which to have the light. This can always be had from 10 A. M. to 2 P. M., the apparatus being moved to secure it. The best photographs will be taken during the summer, as the sun is stronger and rides higher in the sky.

Some photographers prefer to have the background close to the tank, so that the shadow of the fish is seen. I do not care for this, as it tends to spoil the effect. I prefer to have it far enough away that the shadow is diffused or so out of focus that it does not appear in the photograph. After all has been arranged and the specimen is in the tank, patience alone can aid one. To force a nervous fish into position is almost impossible; waiting in quiet and snapping the shutter at the proper moment I find to be the swiftest method.

Large goldfish and other species can be photographed in a similar way in a larger tank. One four by eight by ten inches could be focused down to half-size. This is more simple, as the chance for blurring by the motion of the fish is greatly reduced, and the depth of focus increased considerably. A great many photographs have been taken this way because of its ease. Another form of tank has a movable partition to bring the subject into focus. For very small fishes this can be applied to the four by five tank.



The American Mud Minnow
Umbra pygmaea

In aquatic photography it is better to use speed plates, even if they do cost more than the ordinary kind, as the superior result is worth the difference. I use "Seed Graflex" plates.

It is "safety first" to avoid the use of kitchen utensils in the management of aquaria, as they may contain traces of soap, soda and other substances that would prove injurious if introduced into the tank. Every aquarist should have an enameled pail and several pans for "aquarium use only."

The Bitterling

About friend Bitterling. The sex of this fish, as you know, is readily determined during the breeding season, when the female protrudes her oviduct and the male changes to gorgeous colors. I have come to the conclusion that the sexes can be distinguished at all times. You will notice that some individuals have a certain amount of red in the eye, whilst in others it is entirely absent. I believe, as a result of my personal observations, that it is the males which possess the "red eye." I shall be glad to know if this is so, or if you will personally attempt to confirm my opinion.—*John R. Shattock*, in a letter to the editor.

The activities of the submarines (despite Mr. Shattock's efforts as a member of the British Royal Flying Corps) made it advisable to postpone a shipment of this interesting species. The bitterling is not a new fish to American aquarians, though it is now extinct in our collections. Other than in sex discrimination, the species presents another suggestion for observation. The eggs are deposited by the female in the syphon of a mussel. Here incubation takes place and the fry leave the foster mother ten to fifteen days after the insertion of the eggs. It will be interesting to determine if the fish will accept an American mollusc, and if the mussel will concur in the interrelationship. If the bitterling has been bred here, using an American species, the fact has apparently not been published.—*Editor.*

Rhodeus amarus (Bitterling) Photograph by Dr. E. Bade

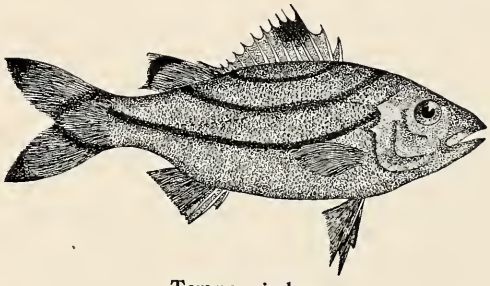
When arranging the plants in an aquarium, leave the centre clear. The light will be better diffused and the fishes more readily observed.

TERAPON JARBUA

WALTER LANNOY BRIND, F. Z. S.

Here at last is a "tropical fish" that is different from those with which we are familiar. Aquarists will be apt to remark its resemblance to one of our American game fishes, the black bass, and there is a relationship. The genus *Terapon* is a division of the family of HÆMULIDÆ, one of the groups making up the vast assemblage of bass-like fishes of the tropical seas. *Terapon jarbua* was first described by the Swedish naturalist, Petrus Forskal, in 1775, as *Sciaena jarbua*. Forskal's specimens were collected in the Red Sea. Later, in 1817, Cuvier, the French zoologist, described his genus *Terapon*, to which he transferred our subject, so today we know the fish as *Terapon jarbua* (Forskal) Cuvier. The native Javanese call it the "Ikan Rong Gerong." This I obtained from a native through my Dutch collector, Captain Van Dyck, who acted as interpreter. If the fish is viewed from above, the black stripes appearing on the sides form concentric rings, arranged one within the other in a "round and round" pattern. Does not Rong Gerong sound like "round and round?" The thought may be fanciful, but it would seem to indicate a possibility of the natives adopting a name sounding like a description that might have been given the fish by a traveler or sailor speaking English! The native names of some other fish do not, however, lend themselves so well to this theory. Ikan means water, and is always placed first.

In color the Rong Gerong is silvery, with a beautiful metallic lustre, darker on the back, and shading to pearly white on the belly. The stripes and markings are black, though at times they appear faint, and again become a dark brown. The scales are very small, and number eighty-five along the lateral line. Six specimens reached me direct from Java last October, but the smallest ones, barely



Terapon jarbua

three-fourths of an inch long, did not long survive. At this writing the remaining four are in fine condition. The largest measures 2¼ inches long, ¾ inch deep and ½ inch thick at the shoulders, so it is a sturdy fish. They live quite peaceably together, and I have yet to notice any antagonism. In its native countries the species frequents the sea, but is also found in brackish water like that in the Hudson River at Spuyten Duyvil, and in perfectly fresh water. The tank in which I showed several specimens at the recent exhibition of The Aquarium Society, held in the American Museum of Natural History, New York City, contained one-fifth brackish water from the Hudson and four-fifths fresh water.

The Rong Gerong does not seem to be a difficult fish to please. Mine find a twenty-gallon aquarium ample. This is

lightly planted with *Vallisneria* and *Sagittaria*. Some fragments of coral have been strewn over the sandy bottom, and a fine tuffstone grotto placed in the centre. Scrupulous cleanliness is essential with this, as with all aquaria. I carefully remove all excess food, sediment and feces with a syphon. An average temperature of 75 degrees, Fahrenheit, which is that at which we maintain most of our exotic fishes, seems to suit it very well. All the way from Java, a journey of nearly three months, they were fed on scraped beefsteak. They will eat medium-grain fish food, but prefer Enchytræ to anything else, except perhaps Daphne. Evidently the matter of proper foods is not a difficult one with this fish.

In regard to breeding habits, it is probable that a nest will be hollowed in the sand to form a nursery for the eggs and young. I intend to make provision for this when my fish incline to propagation, though I do not know whether or not I now have both sexes. In any event, my collector tells me that he can secure specimens six inches long, and that the species is abundant in the vicinity of his port in Java. The vessel will arrive in New York next May, and should bring me a goodly collection of this and other fishes.

A Fisherman's Last Thought

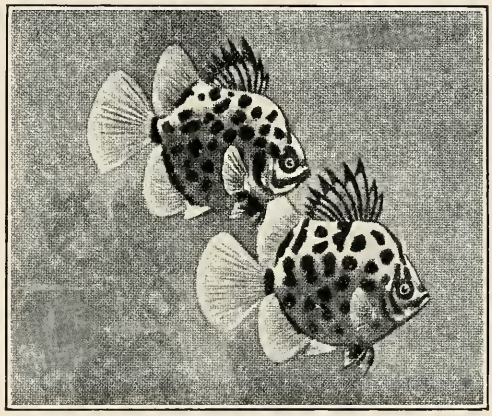
From Maine comes a story of an old fisherman who was lying on his deathbed. After a few preliminary words, the worthy minister, who had been sent for, said that if the old gentleman had anything on his mind, it was hoped he would confide it to the pastoral ear, so that he might die in peace.

"Well, sir," said the old sportsman, "if I had may life to live over again, I'd fish more with bait and less with flies."—*Harper's Magazine.*

The New York Show

W. M. PACKER

The Eighth Annual Exhibition of The Aquarium Society was held at the American Museum of Natural History, New York City, on October 12, 13 and 14. It was the most successful one in the history of the society. The attendance was unusually large, and all found it most interesting. Many species of tropical fishes, goldfish, aquatic and semi-aquatic plants were shown in two hundred aquaria.



Scatophagus argus

Mr. William L. Paullin, of Philadelphia, entered ten young *Pterophyllum scalare*. Though less than a quarter of a dollar in size, they were perfectly developed, with bodies and fins like mature specimens. Mr. Paullin was awarded a special prize.

Mr. Walter L. Brind, in one of his tropical tanks, exhibited *Scatophagus argus* and *Terapon jarbua,* the latter species never having been previously shown in this country. The entry won a special prize.

The five silver cups offered by the Society were awarded as follows:

Mr. A. A. Phillips, Brooklyn, cup for best display of goldfish, cup for best developed young goldfish hatched this year.

(Concluded on page 56.)

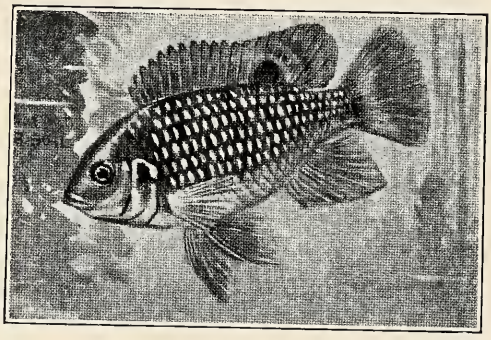
TILAPIA NATALENSIS

C. J. HEEDE

The South African mouthbreeder, *Tilapia natalensis,* is a native of the Southern extremity of the Dark Continent, near the thirtieth parallel. In consequence the species, which is strong and robust, will accommodate itself to a lower temperature than will be liked by the more familiar Egyptian Mouthbreeder, *Paratilapia multicolor—Haplochromis strigigena,* if you prefer the newer classification.

The general coloration of the male is dark blue, with some bright red on the lower part of the head, and on the dorsal and caudal fins. The female is grayish and lacks distinctive markings and colors. In the male the dorsal fin is pointed at the rear, that of the female being rounded and shorter. The dorsal bears the characteristic "Tilapia dark spot," which may be noted in the accompanying illustration.

To observe the breeding habits and for the rearing of the young, this species should be provided with a roomy aquarium, containing about three inches of *clean* sand; it is important that no soil be used. The temperature should average 75 to 80 degrees Fahrenheit. Like the Egyptian Mouthbreeder, the male will make a nest, a mere hollow in the sand. Here, after proper coaxing, the female will deposit the eggs, and after fertilization, will take them into the brood-pouch in her mouth. At this point in the proceedings the male should be removed, or as soon after as possible, lest his now unwelcome attentions disturb the mother. The eggs will hatch in about fifteen days. One or two days after the youngsters leave the mother, and are swimming about, she should be removed. During incubation and while she is carrying the young in her mouth, the female takes no food, consequently she completes her duties physically enervated and needs coddling. It is well, therefore, to segregate her and feed well until she has recovered her usual strength and vigor, and not until then should she be restored to her mate. In



The South African Mouthbreeder

the meantime the young should be fed on very fine live or prepared foods, preferably the former. Later, with the older ones, they may be given scraped lean raw beef, clean chopped earthworms, enchytraeid worms and similar materials. They will also partake of algae and fine-leaved plants.

A number of other species in the genus *Tilapia* are known to aquarists, though apparently but few have been bred. References will be found in aquarium literature to *T. nilotica,* West Asia, North and West Africa; *T. tholloni,* Congo, West Africa; *T. hendeloti,* Niger West Africa; *T. sp. incert.,* East Africa; *T. guineensis,* West Africa; *T. microcephala,* West Africa; *T. lepidura,* Congo, West Africa.

Barbus Conchonius

ERNEST LEITHOLF

The genus *Barbus* contains a great number of species, more than two hundred, and ranges through Europe, Asia and Africa. The members vary in size from the giant *Barbus mosal* of the mountains of India, which is said to reach a length of six feet and to have scales as large as the palm of the hand, to the comparatively tiny species of the aquarist. Eleven species seem to have received attention in the aquarium, viz.,

Barbus conchonius

B. chola, B. conchonius, B. gelius, B. lateristriga, B. maculatus, B. phutunio, B. semifasciolatus, B. ticto, B. trispilus, B. vittatus and B. camptocanthus.

The common barbel, *Barbus conchonius,* is a native of India, where it reaches a length of about six inches. Examples bred in the aquarium rarely exceed three to three and a half inches, the greatest size being attained in large tanks. The species is quite tenacious of life in confinement, is not hard to breed, and may be carried through the winter months with little difficulty. It will stand such a low temperature as 55 degrees, but it will be well to keep it warmer.

Both sexes are alike in colors. The back is a rich olive green; sides silvery; a black spot with a golden edge at the base of the caudal. The fins of the female are colorless, while those of the male are suffused with orange red, the dorsal having a black dash at the tip. During the breeding periods the male presents a wonderful change. The colors become intense, and the body takes on a rosy or brilliant red hue, through which the bright scales gleam like silver. A picture is presented that is bound to thrill and fascinate the observer.

To breed the barbel a large densely planted tank should be provided. Few eggs will escape the maws of the adults if abundant plants are not provided to conceal them from their sharp eyes. While active at all times they become more so when spawning is soon to occur. This takes the form of a merry chase, the one after the other, along the sides of the tank with an occasional dash into the interior. Suddenly the female will head for the roots of a water hyacinth and, while passing through them, suddenly turn and release a number of eggs, which are promptly fertilized by the male who is eagerly following for the purpose. The orgasm is repeated frequently during the day. Spawning may be resumed after an interval of a few days if the fish are in good condition and well fed in the meantime.

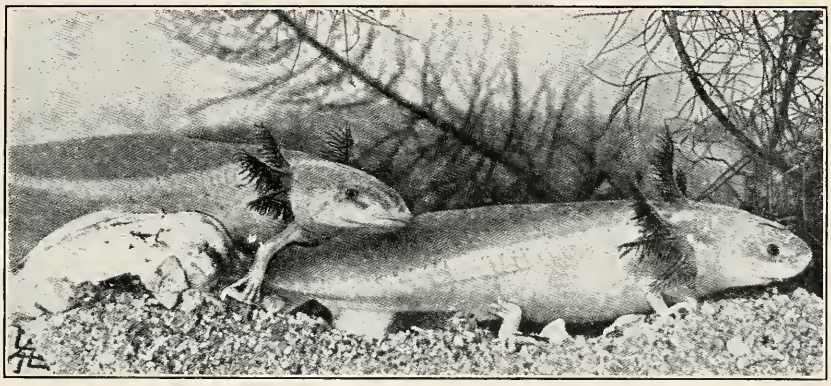
The eggs, small and clear, will hatch in about 36 hours in a temperature of 70 to 75 degrees. The fry are tiny and transparent, and for that reason are rather difficult to discern. With the usual abundant supply of infusoria, and later Daphne and other foods, they will develop to maturity in four to six months.

I find this barbel a very interesting member of my fish family. It is quite curious and will carefully inspect any

(Concluded on page 56.)

AMBLYSTOMA TIGRINUM

FRANK A. HASSENPLUG, M. D.



Amblystoma tigrinum Axolotl or Larval Form

Much has been written concerning this bartrachian, but many of the writers appear to have had little experience with it, both as a captive and in the wild state. As it is found in nearly every portion of the United States, although not very common east of the Mississippi, we think the views of one who has had considerable experience with it during the past twenty-five years may be of interest. The animal has a great many names, the most common being water dog, mud puppy, devil fish and hijalote (Mexican). All are familiar in perhaps eight of the Western States. The aquarist knows the larval form as the Axolotl.

The poor creature is feared almost universally and destroyed whenever encountered, not only by thoughtless boys, but by fairly intelligent adults, nearly all of whom say that its bite is not only dangerous but usually fatal. In reality they never attempt to bite either from fear or viciousness, but under one condition they may be induced to take hold of a finger. While feeding they are extremely stupid, though not at all sluggish, and while snapping to the right or left in search of food in their immediate vicinity they are as likely to grab the leg or tail of a companion, holding tenaciously for a few seconds, as they are to take the food. While in this state of excitement or hunger they will grasp one's little finger and may be withdrawn from the water, remaining suspended in the air for half a minute. The muscles of the jaws are so weak and the teeth so small that they never puncture the skin or produce even slight pain.

If the temperature of the water changes gradually it makes no great difference to them what it may be. They may be taken in a shallow surface pond during July in water too warm for human comfort, or in one of the icy lakes on Pike's Peak, thirteen thousand feet above sea level, in October. Here the water is always cold, and the surface covered with ice seven months in a

year. Of course they really go to the sunny side of a lake in early morning if one portion is in the sun and the other shaded.

In Colorado, Wyoming and New Mexico the spawning season depends more upon the altitude than upon the month. Western Kansas and Eastern Colorado have a summer climate similar to that of Pennsylvania, and the spawn may be found as early as the middle of April. In the mining district of Cripple Creek, which is two miles above sea level, with cool or cold nights all summer, the eggs are not laid until late July or early August. The spawn appears in bunches as large as that of the frogs, the individual eggs being larger, but the mass is more drawn out and may extend nearly three feet from end to end. Eggs hatched in one of our aquaria in April developed to adult specimens before Christmas, while those emerging in August may remain in the larval state all winter, whether in a warm room or in their natural haunts.

One writer declares that the change from the larval to adult form will not take place if the animals are kept in water with no opportunity to walk upon land, but there is little or no truth in this statement. Normally they change to the adult form during the first or second season; some never change and others are slow in making the metamorphosis. One in the larval or tadpole form lived in one of my receptacles for four years, and there was no way of telling its age when it came into my possession. During the change from gill to lung breathers the gills shrink, the body which has been olive or blackish in color, commences to get spotted and blotched from the belly toward the back. The tail, which has been quite flat now becomes rounded. The animals become restless, and instead of remaining in the water seek land, especially after a rain and when darkness affords a certain amount of security from enemies.

Mortality during the metamorphosis is rather large. It is safe to say that in captivity fully one-fourth die while undergoing the change. If nothing happens to interfere with their normal length of life it will, more than likely, reach ten years. One that has been in my possession for ten years and one month is as lively as any. Three others are past four years, and a number are just a year old at this writing.

The author has never seen a hijalote more than a foot in length, but some fairly reliable observers in Colorado have reported specimens measuring fifteen inches. Those in my possession average ten and one-half inches, and in every instance they had attained their maximum length and weight within a year, whether hatched in the spring or toward the approach of cold weather. This applies not only to those indigenous to Colorado, but also those from South Dakota, Nebraska, Kansas, Northern Texas and New and Old Mexico.

When inhabiting lakes and ponds the food is principally insect life that falls on the surface of the water, but they also devour worms, diseased minnows that are not able to elude them, dead minnows, and at times we have known them to practice cannibalism in the absence of more suitable foods. In captivity it grows rapidly if fed every other day. Raw meat, liver and kidney, cut in thin strips, seems to satisfy every want. If fed all they can eat three or four times a week, an individual hatched early in the season will reach a length of ten inches before Christmas.

Some years in Colorado the water dog is not at all plentiful, while at other times it may be so numerous in certain sections as to be regarded as a pest. Ten

years ago they were so plentiful in one of the prairie towns that, at night just after a rain, women refused to walk to the railroad station, where they were to be found by the thousand under the big arc lights. They were attracted by the lights, or, what is more probable, the insects that fell to the ground from about them. Just across from the station was a marshy piece of ground, and this was probably their breeding haunt, as they disappeared never to return as soon as the place was drained.

Personally we have never used the water dog as a table delicacy, but others report the flavor excellent. This species and one closely related were esteemed for their flavor in several towns of Old Mexico, not only by the peons, but by the cultured of direct Castillian descent. The name of water dog very likely came from the sound they emit as they expell the vitiated air at the surface, and take a fresh supply, but it takes one with good powers of imagination to construe the sound into the bark of a dog.

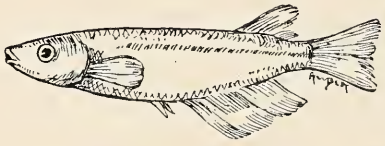
Haplochilus Latipes

C. ARTHUR ORR

The Japanese Medaka, *Haplochilus latipes,* is probably the most inoffensive species in the genus, at least insofar as they are known to the aquarian. It is timid, but not shy, and lacks the voraciousness of some of its relatives. Two distinct color forms, yellow and grayish-blue, are usually to be had. They readily interbreed, which probably explains the so-called "checkered" varieties.

No egg-laying fish is more easily bred, nor in smaller confines. The eggs are extruded from the oviduct and carried for some hours suspended from the anal region of the female in a cluster resembling a bunch of tiny golden grapes. Later they are attached singly to the plants by a tiny filament. I have not witnessed this transfer, nor have I been able to ascertain when fertilization is effected. The eggs are comparatively large, soon become "eyed," and will hatch in twelve to fourteen days.

Breeding can be carried on in a battery of quart preserving jars, merely placing in each a few stems of *Myriophyllum or Anacharis.* Several jars will be needed for each pair of fish. When eggs are observed on the female, the transferance



The Medaka Courtesy Pacific Goldfish Co

to the plants may be expected momentarily and, when accomplished, the fish should be placed in another jar. Drop a pinch of Taubles' Infusoria Compound in the jar with the eggs, and when the young appear the infusorians will be present to furnish the food needed to carry them through the critical period. The tiniest Daphne should follow when the babies appear to be large enough to consume them, and if this be unobtainable, use powdered dry shrimp and prepared foods. Imported wild specimens will reach a length of an inch and a half, but those bred in aquaria are usually much smaller.

(*Haplochilus,* single or simple lip; *latipes,* broad or wide foot, having reference to the anal fin).

In most aquaria a frequent removal of all sediment is wise. The sand will remain "sweet" for a longer period.

When transferring fishes from one aquarium to another be sure the temperature of both is alike.

Aquatic Life

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

W. A. POYSER.....Editor
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Practical articles and notes on topics pertaining to the aquarium and terrarium are always wanted for Aquatic Life. Readers of the magazine are invited to join in making it a medium of mutual help, and to contribute to it any ideas that may occur to them. The pages are always open for anyone who has anything helpful and practical to say. Manuscripts, books for review and general correspondence should be addressed to the editor.

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Vol. III December, 1917 No. 4

(Concluded from page 52.)

new object placed in the tank. It is perfectly docile and may be kept with any of the smaller species of exotic fishes usually found in collections.

The generic name *Barbus* is derived from the presence of barbels about the mouth, which are believed to be concerned with the sense of touch, hence the common name barbel; *conchonius* is from "kunchon," a native Bengalese name. The species was formerly called *B. pyrrhopterus,* meaning fiery-finned barbel.

(Concluded from page 50.)

Mr. Isaac Buchanan, Elizabeth, N. J., cup for the best display of exotic or tropical fishes.

Mr. Charles Tricker, Arlington, N. J., cup for his splendid display of aquatic and semi-aquatic plants.

Mr. C. F. Shippell, New York City, cup for three beautiful balanced aquaria, which were of exceptional workmanship and new in design and shape.

The special prizes this year were diplomas instead of the usual ribbons. The following aquarists secured one or more: Messrs. Carl Lazer, Clarence Ruch, August Obermiller, Hugo C. Nelles and Otto Gneiding.

With reference to my article on the poecilid hybrid, it is true that not all are alike in color and size. None, however, are reversions to the parental forms.—*F. R. Webber.*

The Ridgewood Aquarium Society, of Brooklyn, New York, was organized some months ago, with the following officers: *President,* Rev. E. P. Hall; *vice-president,* Frank J. Beilston; *secretary,* R. M. Ulike; *treasurer,* William Kreck; *sergeant-at-arms,* Adolph Fisher.

Monthly meetings are held in the German M. E. Chapel, Woodward avenue and Grove street, Brooklyn.

At the recent Kentucky State Fair, held at Louisville, the U. S. Bureau of Fisheries had on exhibit 10 large aquaria, which were stocked with specimens of large-mouth black bass, small-mouth black bass, rock bass, crappie, sunfish, pike perch, yellow perch, white bass, yellow bass, pike, brook trout, rainbow trout, goldfish, channel catfish, and rock sturgeon.

The regular meeting of the Philadelphia Goldfish Fanciers' Society was held at 804 Girard avenue, on November 21st.

Scaled and transparent-scaled Japs were in competition and received awards as follows:

SCALED: *Cup,* Joseph E. Bausman; *blue ribbon,* Mrs. E. Ahlers; *red,* Michael J. Moylan; *yellow,* Charles C. Hampel.

TRANSPARENT-SCALED: *Cup,* J. Martin Wacker; *blue,* George E. Wilt; *red,* Dr. F. C. Leffman; *yellow,* Joseph E. Bausman.

Judges—James A. McDevitt, Thomas Ayling and Joseph E. Van Stavern.

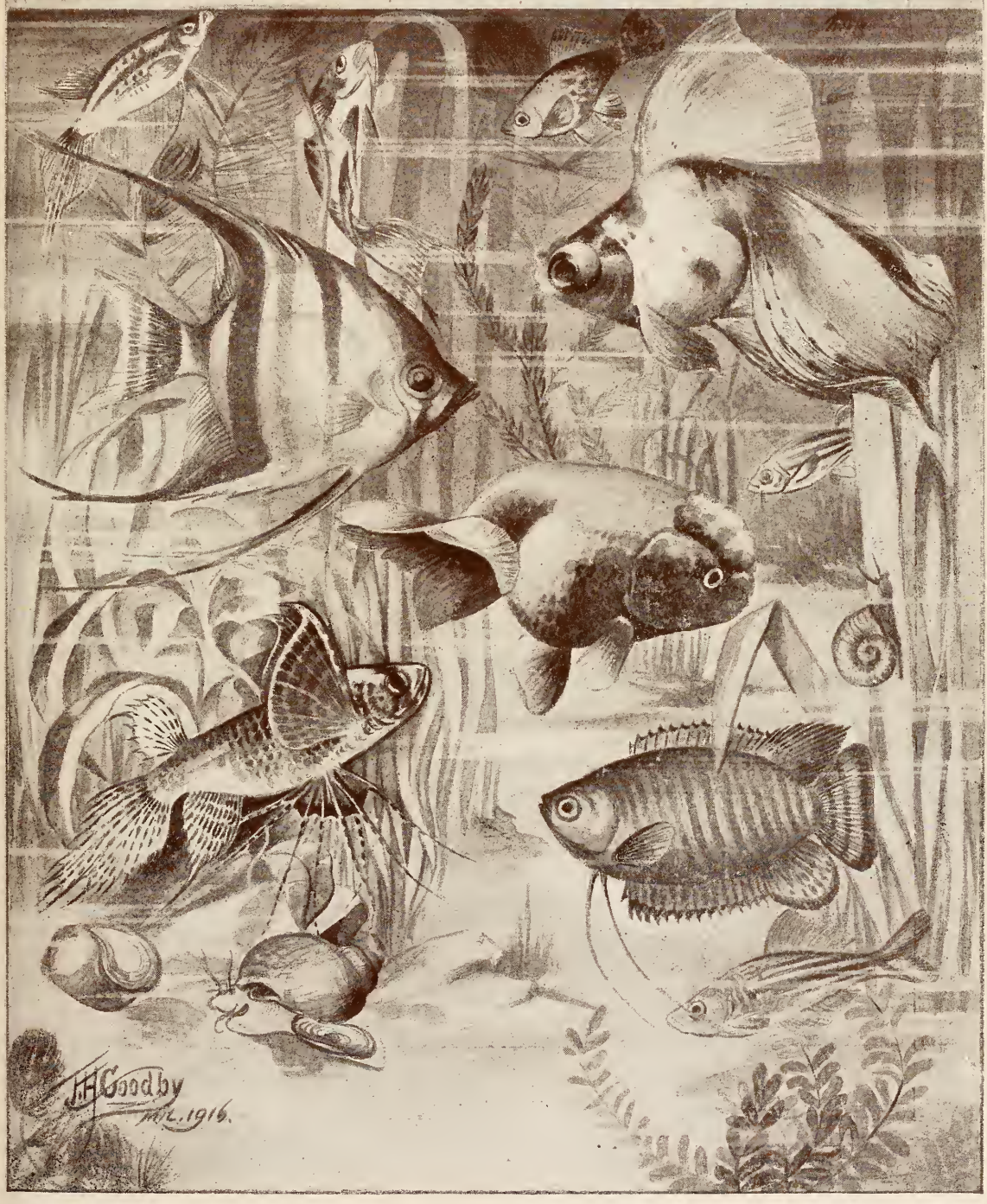
The next meeting will be held on December 19th. Exhibition of Lionheads, Orandas, Celestials, Nymphs and Single-tail Telescopes. A cup and three ribbons will be awarded to Lionheads and Orandas, three ribbons to Celestials and six ribbons to Nymphs and Single-tail Telescopes. This combines the classes formerly shown at the December and January meetings. The January meeting will be a "special," announcement of which will be made later.—FRED RICHARDSON, *Secretary.*

Another society in Philadelphia—total four! The West Philadelphia Goldfish Fanciers' Association was launched at a preliminary meeting on November 6th. Permanent officers will be elected and other organization details perfected in the near future. Mr. George E. Wilt, 1519 North Sixty-second street, Philadelphia, will be glad to furnish details. The membership will not be restricted to residents of West Philadelphia.

He who knows what secrets and virtues are in the ground, the water, the plants, the heavens, and how to come at these enchantments, is the rich and royal man.—*Emerson.*

January, 1918 10c Copy

Aquatic Life



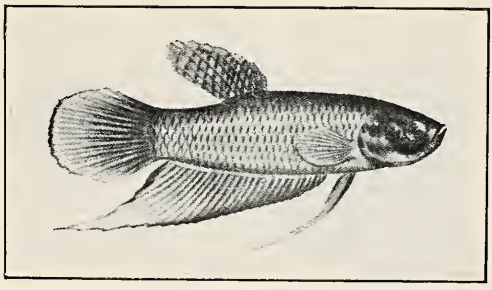
Notes on the Nesting Habits of Two Labyrinth Fishes

EDGAR R. WAITE, F. L. S.
Director, South Australian Museum

I recently studied the life-histories of two species of allied fishes, and in the case of one was rewarded by making discoveries hitherto unknown to me.

The Fighting Fish, to which I allude, is a native of Southeastern Asia, and the examples were procured for me at Penang, in the Strait Settlements. The breeding habit of this fish, though remarkable, is not the only interesting feature. It has long been known that the Siamese breed fighting fishes especially for combat, and are as infatuated with their sport as the Malays are with their cock-fights; they stake considerable sums of money on the issue, and sometimes their own persons and families. The license to exhibit fish-fights is farmed, and brings considerable revenue to the King of Siam. When the fish is in a state of quiet, its dull colors present nothing remarkable; but if two be brought together, or if one sees its own image in a looking-glass, the little creature becomes suddenly excited; the raised fins and the whole body shine with metallic colors of dazzling beauty, while the projected gill-membrane, waving like black frill round the throat, adds something of grotesqueness to the general appearance. In this state it makes repeated darts at its real or reflected antagonist, but both, when taken out of each other's sight, instantly become quiet.

The little fishes, which when fully adult, measure only one and three-quarters of an inch in length, reached me on April 5th, and I immediately placed a pair in an old-established aquarium. The following day the male blew a number of bubbles on the top of the water. Rising to the surface, a mouthful of air was taken and retained for two or three seconds, during which time it received a coating of mucous. The bubble thus formed was blown at the surface, and the operation repeated until a circular mass was produced, three inches in



The Fighting Fish, Betta splendens
From Drawing by A. R. McCulloch

diameter. Another layer of bubbles was next blown, which had the effect of raising the first out of the water. Seven or eight layers were formed in all, but as the later bubbles were blown only under the central portion, a dome-shaped structure resulted. So viscid is the secretion enclosing the bubble that, though exposed to the air for ten or twelve days, it still fulfilled its function.

On the third day the nest was completed and breeding commenced. Then one witnessed a remarkable display of color and action, comparable to the "showing" of the peacocks, turkeys, and other gallinaceous birds. The fins of the male fish are extended to the utmost, the black gill membranes and the blood-red gills exhibited beneath. The

body and fins become resplendent with iridescent colors and quiver with intense excitement. After the eggs are extruded the male takes up a position below his mate and secures them, to the number

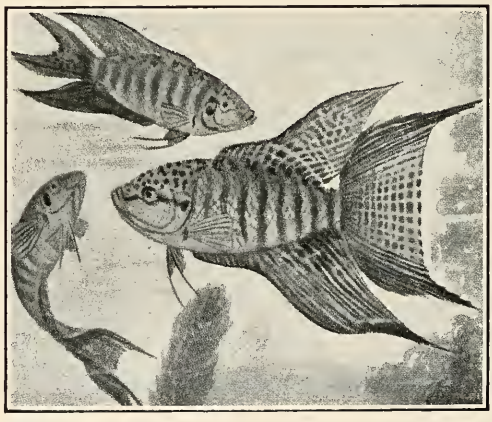
Nest of Betta splendens

Photograph by the Author

of six or so, in his mouth. He there gives them a coating of mucous and places them beneath the bubbles to which they adhere. The scene is re-enacted until from one hundred and fifty to two hundred eggs are produced. The female is not allowed in the vicinity of the floating nest when laying is completed, and the male is untiring in the care of the eggs, constantly moving their position and recoating them with mucous.

On the third day the eggs hatched; the young fishes remained beneath the bubbles for some time, but occasionally showed a tendency to sink. They were immediately taken in charge by the watchful father and replaced. In a day or two the numbers disposed to leave the shelter of the nest increased to such an extent that the male could not possibly secure them all, though he frequently had seven or eight in his mouth at once. He would search for them most diligently at the bottom of the aquarium, and securing some carry them back to the cradle. Many were, however, eaten by the female, and all the remainder died when winter set in.

I was much more successful with the Paradise fish. I bought these in the city, and understood they were obtained in China. The life-history of this fish was previously known, but comparison brought out some additional facts. The eggs of this fish do not sink, and I was led to ascertain, if possible, what real object the male has in so zealously guarding the eggs. To this end, as soon as a complement was produced, I removed them, along with the nest of bubbles, to another aquarium. They hatched in the usual course, and in the absence of enemies were soon able to look after themselves. With the view of ascertaining the function of the bubbles, I removed, from another nest, some of the newly deposited eggs, and carefully rejected all bubbles. As before, these



Macropodus viridi-auratus **(Paradise Fish)**

eggs developed equally with those left under paternal care. It would seem, therefore, that the purpose of the nest and care of the parent is simply protective. The mass of spume hides the eggs or young from aerial or terrestrial enemies, while the attendance and vigilance

of the male secures them from attack of aquatic foes.

The nest of the Fighting fish has a more important function, for without it and the care of the male the eggs would sink and perish.

Into an aquarium containing a pair of Paradise fish and their family, a few days old, I introduced a spray of Bladderwort. Next day nearly all the little

A Bladderwort (Utricularia) in Flower
An American Species
Photographed by Chas. M. Breder, Jr.

fishes had disappeared, and the missing ones were discovered in the bladders of the plant. Some were seized by the head and some by the tail, and a little patient watching was rewarded by seeing a young fish caught. One of the fry was caught by the extreme tip of the tail; it had been swimming close to one of the bladders and possibly touched the mouth when it was instantly trapped.

At intervals its struggles were frantic; at the end of seven minutes the tail was entirely engulphed and continued to wriggle within the bladder, while the head and body were shaken without. The little fish lived for an hour and a half, but it was not until the following morning that the whole was taken into the bladder.

Fighting Fish in Battle

When two of these fish are placed in the same vessel they proceed to take each other's measure, shoulder up to each other in school-boy fashion, and back, and push around the "ring," the small fins vibrating rapidly all the time, colors glowing, and each little being quivering with excitement and wrath. This goes on for some minutes, until, as the spectators are growing impatient, one fish suddenly flips his head around, makes a dart, and a considerable dent in the tail of his adversary shows at once that he has got home. Henceforth there is no hesitation until one or the other cries "peccavi." In regular fish fights on which money depends, the battle is continued until one fish turns tail and is chased around the bottom by the other. But this is usually an affair of an hour, and frequently of three or four. The determination and pluck of the fighters are wonderful. The ordinary wild fishes do not evince nearly so much as those that have been bred and reared for the purpose. The tail is the part which shows most damage, for it is very easily torn; but a good grip on a side fin is much more effective. When one pins the other by the nose a very exciting struggle takes place, the two lying fastened together like professional wrestlers, and then shaking each other backward and forward with might and main.

They often seem extremely exhausted, but still fight on bravely, and sometimes it is a matter of difficulty to part them. They display considerable agility in evading their opponent's mouth, and also in suddenly twisting around and taking a piece out of his tail. In twenty minutes or so these appendages, which looked so brave and bright as they went into the fray, are torn to ribbons. The fishs'

general appearance after the fight suggests that of a sailing ship emerging from a hot action, with her canvas hanging in streamers, her topmasts shot away, and her crew gasping for breath, but still ready to fight again. The combatants sometimes succumb to a long contest, but generally they only make superficial damage, and are immediately ready to feed. After a match they are always rested for a week or longer, according to the extent of their injuries, and most of the rents and cuts are repaired by nature. Enthusiastic owners often wage six or seven pounds or more on their favorites, and many people earn a little money in this way by breeding fighting fish and then backing them against others.—*London Field.*

A New Parasite of the Buffalo Fish

Dr. T. B. Magath, investigator at the Fisheries Biological Station at Fairport, Iowa, has discovered a new and evidently important form of trematode worm, which infests buffalo fishes in ponds. The life history of the parasite has been definitely worked out, and is briefly as follows:

The adult trematode, living in the alimentary tract of the buffalo fish, expels its eggs, which pass out into the water with the feces of the fish. From these eggs, which are "laid" during the late summer, there hatches in the fall a ciliated embryo (mericidium), which swims in the water until it finds a snail of the species *Planorbis trivolvis.* Into this snail it works its way and eventually encysts in its host's liver. In the usual manner it grows and multiples there during winter and spring, and in summer emerges from the snail as a tailed and styleted cercaria. This larva can live for several hours in the water, but must find a May fly larva for its second intermediate host, into which it bores and encysts just beneath the cuticle. If the buffalofish eats the infected larva it obtains the young parasite, which very rapidly develops and assumes in late summer the adult form ready to expel its eggs. The association of the buffalofish, the snail, and May fly larva seems to be essential for the perpetuation of the parasite. The probable importance of the form is suggested by the fact that a serious mortality occurred among the fishes that were so infested.

Dr. Magath also investigated the life history of the trematode parasite of the bluegill sunfish, which is found in the larval stage in that fish and in the adult stage in the kingfisher.—*Fisheries' Service Bulletin.*

George W. Price, of Philadelphia, who seems to own all the specimens of *Scatophagus argus* living in this country today, has made an interesting observation. When four or five were placed in a tank well populated with Hydra, they were observed to devour a few, and soon after all had disappeared. The supposition is that the "Scats" ate them, so here at last is a fish with a kindly disposition that finds the pest to its liking.

Whether sand or gravel is best in an aquarium is a mooted question. Fanciers are about equally divided, and both factions have success.

Possibly one reason some men fail to make money in the aquarium business is that they rely upon the fishes to do all the work.

Science can cut through anything except mental concrete.

HIPPOCAMPUS HUDSONIUS

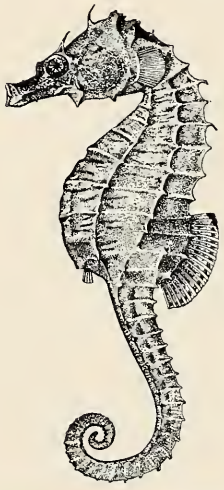
ERWIN O. FREUND

A rather unique performance, particularly for one to witness a thousand miles from the shore of the ocean, took place in my marine aquarium on October 5th. Myself and another member of the Chicago Aquarium Society were fortunate in being present when about one hundred baby sea horses, *Hippocampus hudsonius,* left the parental pouch.

The male, when he arrived, displayed an enormously distended abdomen, which protruded in every direction except toward the back. He was so misshapen that the vent and anal fin were fully an inch above the position noted in normal specimens. On the evening of October 5th the lower portion of the protuberance, previously black, developed a dark yellowish color. Contortions and twistings began, which gradually changed to regular backward and forward labor convulsions. These efforts from time to time (between periods of rest), resulted in the expulsion of the babies. From one to four were expelled in a delivery, the opening being round and a quarter of an inch in diameter, giving a fairly clear view of the cavity. The youngsters were curled when expelled, but immediately straightened out and sank to the bottom, where they lay on their sides, wriggling at times rather violently. The babies were equipped with a yolk-sac and were pinkish in color, otherwise they resembled the parents.

In order to determine the proper environment for rearing, some were placed in a shallow glass vessel with one inch of still water; others in deep still water. Another lot was placed in shallow water, provided with an aerator, and the aquarium placed on an electric heating pad to ensure an even temperature. The remaining babies were left with the parents.

On the second day the parents ate those left with them, all being devoured in two hours. Those in the other vessels absorbed the yolk-sac in forty-eight hours. The fry in the shallow aerated



Hippocampus hudsonius

water died on the second day. Those in deep water on the third day. Those in the shallow still water on the fourth day.

The male parent died on the fourth evening. Soon after the convulsions ceased the abdomen became covered by a gelatinous-like membrane, which turned a yellowish-white and developed bubbles. He entwined his tail about his favorite branch on the coral reef and remained there motionless until he died. A post mortem examination revealed several young and evidence of infection.

Though I have been advised by Mr.

Richard Donker, an experienced aquarist, that no sea horses born in captivity have been reared, I refuse to accept the fact as an ultimatum against trying. Some day I may be successful. The scene will be re-enacted in due time in my aquarium. On October second a great number of eggs were observed floating about. These were transparent and colorless, with the exception of a yellowish red spot at the top. Within two days they had disappeared, and have evidently been deposited in the brood-pouch of one of the males, for he is now developing a similar protuberance.

(The sea-horses are singular creatures which depart greatly from the popular idea of the conventional fish; their head and neck bear a striking resemblance to a horse's; the fish move through the water in an erect position; and when resting they usually curl their prehensile tail about a bit of seaweed or blade of grass. Additional interest attaches to these fishes, because the male fish receives the eggs in a pouch and carries them until they are hatched, and the young occupy the pouch until they are of considerable size, going out in search of food and returning for shelter. * * Many species, none of large size, exist in warmer waters of all parts of the world. * * Dr. R. E. Coker reports that a large male taken August 18,1902, had a pouch full of young and delivered them in the laboratory aquarium August 20th. The opening in the pouch is at its anterior end, and is slit-like when closed, but round when the young are about to be extruded. When liberating the young, the fish swam upright, and made a peculiar effort resembling peristalsis. The young emerged several at a time and were forced some distance from the parent. They swam in a cluster near the surface and on the side of the aquarium nearest the light.—*Fishes of North Carolina.*

In symbolic and heraldic art the "sea-horse" appears as a fabulous marine animal with fore parts like those of a horse joined to the tail of a fish. Neptune is depicted as using them to draw his chariot. In Biblical literature and early books generally, the term often refers uncertainly to the walrus or the hippopotamus. *Hippocampus,* the ancient Greek name for the sea-horse; *hudsonius,* Hudsonian, relating to the Hudson River.—Editor.

Water has many properties that fit it for being the abode of organic life. Second only in importance to its power of carrying dissolved food materials is its transparency. It admits the light of the sun, and the primary source of energy for all organic life is the radiant energy of the sun. Green plants use this energy directly; animals get it indirectly with their food. Green plants constitute the producing class of organisms in water as on land. Just in proportion as the sun's rays are excluded, the process of plant assimilation (Photosynthesis) is impeded. When we wish to prevent the growth of algae or other green plants in a reservoir or in a spring we cover it to exclude the light. Thus we shut off the power.—*Life of Inland Waters.*

Keep in touch with the world, with all right activities, with fresh air and sunshine, with good natured and contented human beings, and you will be a long time getting old.

You may be interested in knowing that we recently received a request for a sample copy of *Lorquinia* from a man in Belfast, Ireland, who said he had seen our advertisement in *Aquatic Life.*—*Lorquin Natural History Club.*

THE WATER FISH

WALTER LANNOY BRIND, F. Z. S.

This novel little fish was first imported by the writer during the spring of last year, six specimens reaching New York alive after the long trip from Java aboard a Dutch steamer. Known to science as *Haplochilus celebensis,* the native Javanese call it the water fish, because it is so transparent. In general appearance it suggests the familiar Medaka, *H. latipes,* but it is more slender and differs in color. The body can be described as the color of greenish glass and so transparent, or rather translucent, that the bones of the vertebral column are clearly visible; eyes, silvery blue; tail and anal fins with orange edges. The dorsal and anal fins of the male are more pronounced and have fringed edges, whereas in the female they are shorter and even. Length, 1¼ inches.

Temperature, within certain limits, seems immaterial to this fish. My examples were caught in a jungle pool, in water knee deep, that recorded 104 degrees, Fahrenheit. Yet I have kept and bred them for nearly a year at a temperature of about 72 degrees, and this in a small all-glass tank holding less than two and a half gallons of water.

While the four survivors, a male and three females, have consistently spawned, I have not many youngsters to show. This probably because they have been kept with specimens of *H. panchax and H. chaperi,* which have no doubt eaten many. The fish proceeds to reproduce its kind after the manner of the Medaka. The eggs leave the genital tract and are carried in clusters of three to six attached exteriorly to the vent in the female. As the female swims among the plants, which should be of the tiny-leaved sorts, such as *Myriophyllum, Utricularia minor* or *Cabomba,* the eggs are rubbed off and become attached to the plants singly by a hair-like filament. The eggs hatch in about ten days.

As far as food is concerned, the waterfish is easily satisfied. One day, if fortune smiles, they get Daphne; the next

Haplochilus celebensis

may bring enchytrae or white worms, or mashed potatoes with scrambled eggs and Graham crackers. All are taken with the same apparent gusto. In disposition they are exceedingly docile, and I have yet to note the slightest sign of quarrelsomeness.

The illustration is an enlargement of a clipping from a film of a motion picture produced by the writer and entitled "The Freshwater Aquarium." In the group appears a pair of *Haplochilus chaperi,* that the transparency of *H. celebensis* may be made more apparent by the contrast.

Circumventing Nature in Breeding Three Fishes

ERNEST LEITHOLF

Necessity is the mother of invention and, when it becomes necessary to meet unusual deviations from the normal in breeding fishes, is also the mother of discovery! Hence this article, which concerns unusual and original means used to propagate three popular species of exotic fishes by members of the Pittsburgh Aquarium Society.

Mr. H. L. Dolde was repeatedly disappointed in his efforts to breed the Chanchito, *Cichlasoma facetum*. The fish spawned a number of times, but invariably devoured the eggs. Finally he decided to strive for success in a new way. When the next lot of eggs was discovered the stone to which they were attached was removed and placed in another aquarium containing old clear water and thriving plants. Here the temperature varied between 70 and 75 degrees. It soon became apparent that the eggs had not suffered and were developing normally. After five or six days the heads of the fry began to break through the egg shells. With posterior ends still attached to the stone, the mass of fry began the swaying movement or agitation characteristic of this period in their development. The continuous movement gradually severed the attachment and soon all had tumbled helplessly on to the bottom of the tank. Then followed several days of floundering about the bottom with frantic efforts to swim, after which the "pseudo-orphans" gained control of the situation and eagerly chased any particle that looked like food. From this time on their development was normal and nothing untoward resulted in the absence of parental care. We secured several from this brood, and they are now an inch and a half long. Later the parents reformed and spawned repeatedly, displaying all the tender solicitude of the species for its eggs and young.

The experiment of Mr. Adolph Stucky concerns surgery. He possessed a fine female specimen of *Platypoecilus maculatus rubra,* which became ill and failed to respond to treatment. Finally, when the fish was so weak that respiration was scarcely perceptible, he decided to attempt to save the unborn young by performing a "Caesarian operation," using a keen razor for the purpose. The majority of the fry were dead, but eight were delivered alive, and seven were living and well when the writer saw them a month later. Mr. Stucky values these fish more than any others in his collection, and they are probably the first members of the finny tribe that have started their career after the manner of the immortal Caesar!

While it is the custom to segregate the mouth-breeder, *Haplochromis strigigena,* my brother Oscar and I have not found it necessary. The species will breed in association with other fishes. When segregation is practiced, the male is removed from the female, after she has taken the eggs into her mouth. We reverse this process. When we observe a female carrying eggs in a family tank we remove her to solitary confinement, there to incubate the eggs and care for the young undisturbed. The success of this method depends upon the rapidity of the transfer. If the female is harassed and frightened while attempting to capture her, or if she is retained in the net more than an instant, she will unfailingly disgorge the eggs, which spells failure. All must be accomplished quickly with the new aquarium close at hand.

If we knew better we would all do better.

CARE OF AQUARIA

GEORGE A. SCHENK

The old saying, "An ounce of prevention is better than a pound of cure," when referring to the home aquarium, might well be changed to "prevention is the only cure worth consideration," for when the fundamental principles are understood and followed, disease will be practically unknown.

To make the aquarium a success, it must be treated as a kingdom in itself, and made independent of outside aid except for food and light. This means that it must contain both animal and vegetable life. The fishes, which usually form the animal life of the aquarium, require oxygen, and this must be present in abundance to maintain them in health and comfort. Their gills correspond to our lungs, and are made up of delicate tissue ramified by minute blood capillaries. Through the thin walls of the capillaries the oxygen meets the blood, purifies it and is then returned to the water in the form of carbon dioxide, a compound that is deadly poison to animal life. Here the plants take hold. The carbon is needed in tissue-building, so the compound is absorbed, the carbon retained and the oxygen returned to the water. This completes the cycle in which the oxygen can be said to be the carrier of carbon from the animal to the plant.

When the fishes are ailing look to the plants. They form the keystone of the aquarium. Have them in abundance and, if the fishes have sufficient room to swim about, you cannot have too many. Those plants which best adapt themselves to life in the aquarium and are rapid in growth are the best "oxygenators." *Sagittaria, Anacharis* and *Vallisneria* are the mainstays. Plants must have direct light to flourish, but under natural conditions aquatic species receive it from above, and that is reduced in coming through the water. In the aquarium they

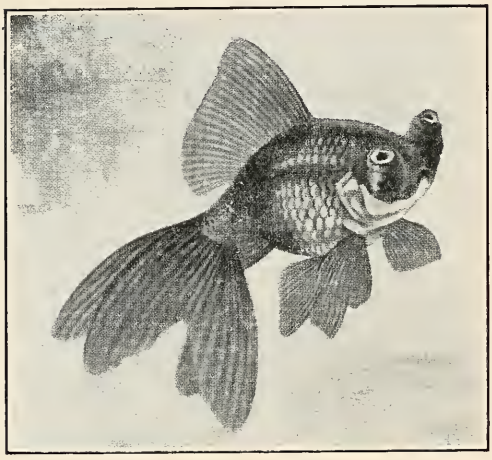
Sagittaria

Photo by Charles M. Breder, Jr.

are exposed to the light from all sides, and if it is too intense, or directly from the sun, their leaves become covered with algae, nutrition and respiration is retarded, and they gradually die. A similar decline will follow when the light is not sufficient to stimulate active growth.

It follows that in choosing a location for an aquarium that the plants must be considered first. At or near a north or northeast window through which the light can fall direct from the sky to the

tank is the ideal place. An eastern exposure is nearly as good, while the south and west are least desirable unless the direct sunlight can be subdued in some manner. A tree with heavy foliage will accomplish this during the spring and summer months, but at other times means must be taken to cut down the



Celestial Telescope Goldfish

An unusual example. Normal individuals lack a dorsal fin

light. A frame of light wood, covered with green cloth or crepe paper, will help if set in the lower sash of the window or hung on the side of the tank nearest the window, the back glass of the aquarium may be painted with white lead mixed with turpentine, or the glass of the window may be replaced with ground or frosted panes, or painted with the lead and turpentine mixture. Except in very large tanks, direct sunlight not only stimulates algae, but overheats the water, causing a rise during the day and a corresponding drop during the ensuing night, which in itself is detrimental.

The best bottom is one composed of pebbles and gravel, with plenty of sand to fill the spaces between. Sand alone packs hard and does not give the roots of the plants a fair chance to spread. If pebbles and gravel are used without the sand, trouble may come, for particles of food, humus and excreta sift down among them and decay. A mixture of the three is ideal.

Arrange the bottom so that a gentle slope is formed from the back and sides to the middle-front. The sediment and unconsumed food will collect at the lowest point and can easily be removed with a dip-tube or syphoned out with a rubber hose. Do this frequently—don't wait until it works its way into the sand to decay and pollute the water.

Cleanliness is the prime consideration. Don't depend upon snails, tadpoles or other so-called scavengers. Their work has been greatly over-rated. Snails are interesting creatures, and should be in the tank in abundance, for they do help, but don't depend upon them to do your work. Tadpoles are a first-class nuisance and merely serve to keep the bottom in agitation.

Algae may be removed from the glass in a number of ways. There are several styles of scrapers on the market for this purpose. One can easily be made by fastening a safety razor blade to a handle of wood or wire. Considering the small cost, and the long life of the article, it will be economy to buy one! A clean bristle hand brush that has not been used with soap or grease, such as may be purchased for a dime, will readily remove the growth. Some aquarists consider all bristle brushes taboo, having found that in some the bristles in the process of manufacture have been treated with certain chemicals, which when introduced in the aquarium have caused deaths among the fishes. In the absence of all other means a clean piece of muslin or linen, such as an old handkerchief, rolled in a ball and held in the hand will take off all but the hardest growth.

Mention may be made of several

other accessories. A pair of long wooden forceps is useful for removing dead leaves and snails, neither of which should be allowed to rot in the tank, or for rearranging the plants and stones. Cork or glass food rings confine the foods and prevent the particles from spreading indiscriminately over the surface of the water. For snipping off leaves a pair of scissors, with round ends, can be fitted with extension handles of wood. Any article may be regarded as useful that enables one to work in the tank without putting the hands in the water, for this should be done as little as possible, lest injurious substances be introduced. When it is necessary the hand should be clean and free from tobacco.

Anacharis

Photo by Henry A. Dreer

The health and growth of a fish depends largely upon its diet. This must be a well-balanced ration, consisting of all the elements needed for proper nourishment, and be fed in quantities such as our common sense will tell us is right. So much has been written of the ills of over-feeding that I often wonder that the novice has the courage to feed his fish at all. Give them as much as they care to eat and will consume within a period of ten to fifteen minutes, once a day and preferably during the early morning hours. For the basic diet any of the several foods advertised in *Aquatic Life* are good. By way of variety, feed raw oysters, shrimp and fish finely chopped. To goldfish don't feed raw scraped beef, liver or other parts of warm-blooded animals, except as a rare treat. Daphnia and Enchytrae are without equal, and should be used as much as possible. Well cooked, strained oatmeal is good, either alone or cooked with one-fourth part of finely ground dried shrimp.

Another phase that must be given consideration is the fact that the fishes and plants appropriate salts and other mineral matter from the water, so provision must be made for its replacement. To this end draw off a half or a third of the water each week and replace with new water of the same temperature. It will be better not to do this at one time, but rather take a little every other day or so. Once a week add a quarter of a teaspoonful of ground sea salt and a teaspoonful of epsom salt to each ten gallons of water in the tank.

When conditions in the aquarium are favorable, sickness and death will be rare, but of course cannot be entirely eliminated. A diagnosis of the common ills of goldfish with their treatments will be considered in an article to appear in the next issue.

Aquatic Life is indeed very interesting. I anxiously await its arrival each month.—Chas. F. Higgins, *New Hampshire.*

Aquatic Life

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

W. A. POYSER.....Editor
JOSEPH E. BAUSMAN.....Publisher
542 E. Girard Avenue, Philadelphia.

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Practical articles and notes on topics pertaining to the aquarium and terrarium are always wanted for Aquatic Life. Readers of the magazine are invited to join in making it a medium of mutual help, and to contribute to it any ideas that may occur to them. The pages are always open for anyone who has anything helpful and practical to say. Manuscripts, books for review and general correspondence should be addressed to the editor.

Aquatic Life has the largest circulation of any magazine in the world devoted to this branch of nature-study. It presents to advertisers a market that can be reached through no other medium. Rates made known on application.

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Vol. III **January 1918** **No. 5**

In a city as large as Chicago the news of the organization of another aquarium society will not be surprising. *The Chicago Society Aquatic Life* was organized on November 1st, at 1714 Girard street. Officers for the ensuing year have been elected as follows: *President,* Dr. Frank Zuehlke, 2752 Belmont avenue; *Secretary,* Gustav Germann, 1714 Girard street; *Treasurer,* Frank W. Krempel, 2643 North Whipple street.

Regular meetings will be held at the home of Mr. Aug. Lauterbach, 935 North Hoyne avenue, on the second and fourth Saturday of every month at 8.45 P. M.

One of the first actions of the new organization was to adopt *Aquatic Life* as official organ. This synchronizes with the objects of the society. It is our purpose to study aquatic life in all its forms, to make known the results of our investigations and to promulgate knowledge of the breeding of fishes and the care of aquaria and related subjects.

Steady progress is being made in a campaign for members. The writer will be glad to communicate with aquarists desiring to become affiliated with the organization.—Gustav Germann, *Secretary.*

The regular meeting of the Philadelphia Goldfish Fanciers' Society was held in Saull's Hall, 802 Girard avenue, on December 19th. Competitive exhibition of Lionheads, Orandas, Celestial Telescopes, Nymphs and Singletail Telescopes. Judges, Charles Hinkle and J. Louis Troemner.

Awards: *Lionheads*—Cup, Michael J. Moylan; blue and yellow ribbons, John Krause; red, William J. Christy. *Orandas*—Cup, A. A. Phillips, Jr.; blue, J. Martin Wacker; red, A. A. Phillips, Jr.; yellow, Charles J. Hannig. *Scaled Singletail Telescopes*—Blue, Gustav Armbruster; red, John Krause; yellow, J. Martin Wacker. *Scaleless Singletail Telescopes*—Blue, Warren C. Allen; red, Dr. Louis W. Rehbein; yellow, Dr. F. C. Leffman. *Scaled Nymph*—Blue, J. Martin Wacker.

Household Aquarium Competition:—Cup, Michael J. Moylan; blue, Dr. Louis W. Rehbein; red, William J. Christy; yellow, Harry P. Peters. Judges, George B. Smith, George E. Wilt and Dr. F. C. Leffman.

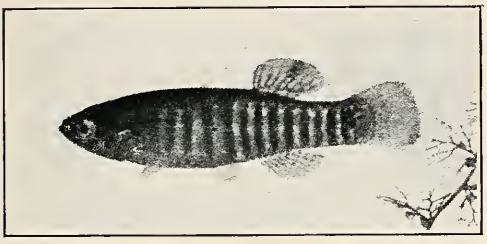
Mr. Joseph A. Biskup was elected to membership.

Exhibition for next meeting, January 16th—"Blue Ribbon Winners."

Fred Richardson, *Secretary.*

The Aquatic Association of Maryland held its first "fish show" Wednesday evening, December 12th, in Room 651, Lexington Building Annex, Baltimore. It was purely a "homey" affair, intended to give the various members an opportunity to see just what "the other fellow" is doing in the way of fish culture and maintenance.

Other than fishes, the principal feature was that the affair was designated as ladies' night. The majority of male members escorted one, either his wife,



Fundulus heteroclitus

sweetheart, sister, or mayhaps somebody's else! Who can tell! Anyway, they were there, in full force, and were entertained and entertained others in turn.

The aquaria were arranged in a double row down the long hall, and it was a beautiful picture they made with their graceful aquatic plants and vari-hued finny inhabitants. That every member of the Association must show something was a rule of the exhibition, and the variety entered caused one to marvel. Even the lowly "bull minnow," famous as a bait for pike fishing in these parts, was present disguised under its formidable scientific name (*Fundulus heteroclitus*) —only one old fisherman recognized it!

One big outstanding fact was made evident through the exhibition. That is that the members—at least some of them—have fishes of which they can justly be proud. Better still, some that they have reared from "babyhood" up. Notable among them were the Japs displayed by Ernest Gill; the Moors and Calico Telescopes shown by Louis Hens; a splendid bronze-colored Telescope exhibited by J. A. Marrian, Jr.; the Shubunkins of Mrs. Kenneth K. Kirwan; Comets entered by J. Shelton Smith and E. E. Eitel; tropical fishes by Mr. and Mrs. H. A. Altpeter, and last but not least the rare *Fundulus heteroclitus* shown by Mr. ——— (name deleted by censor).

So successful was this first attempt that plans are being made for a public exhibition to be held during the early spring.

A cordial invitation is extended to all Marylanders who are interested in goldfish and aquaria to become members of the Association.—P. C. Chambliss, *Secretary*, 731 Reservoir street, Baltimore, Md.

On Thanksgiving Day the Ridgewood Aquarium Society, of Brooklyn, gave its first public exhibition in the German M. E. Chapel, Woodward avenue and Grove street. All classes of aquarium fishes were well represented, from the tiniest "tropical" to the great Lionhead goldfish shown by Frank B. Johonnot.

The goldfish were judged by Charles E. Visel, and the tropical species by Joseph Froehlich, who made awards as follows:

Broadtail Telescopes: 1st, Hall & Kurzman; 2d, Charles Litchgi; 3d, R. W. Uhlig. *Moor or Black Telescopes*: 1st and 3d, Hall & Kurzman; 2d, Charles Litchgi. *Young Telescopes*: 1st and 3d, Hall and Kurzman; 2d, William Kreck. *Young Moors*: 1st and 3d, William Kreck; 2d, Frank J. Beilston. *Ribbon-tailed Japs, scaled*: 1st and 2d, Ed. Bleek; 3d, R. W. Uhlig. *Ribbontail Nymphs, scaled*: 1st, R. W. Uhlig;

2d, Ed. Bleek. *Broadtail Jap, Scaleless,* 1st, William Kreck. *Ribbon-tailed Japs, Scaleless*: 1st and 2d, Hall & Kurzman. *Broadtail Nymph, Scaleless*: 1st, V. Kreig. *Lionhead*: 1st, Charles Fabian. *Xiphophorus Helleri*: 1st, N. Edwards; 2d, J. Stefke. *Lebistes Reticulatus*: 1st, A. Hassler; 2d, J. Stefke. *Osphromanus Species*: 1st, J. Stefke. *Platypoecilus Maculatus Rubra*: 1st, N. Edwards. *Barbus Semifasciolatus*: 1st, C. Berneberg. *Daniorerio*: 1st, C. Berneberg. *Miniature Aquaria*: 1st, Deitz & Gartner; 2d, J. Solomon. *Ornamental Aquaria*: 1st, N. Edwards; 2d, Deitz & Gartner. *Balanced Aquarias* 1st, William Weber; 2d, Deitz & Gartner.

Exhibitors not in competition: Messrs. R. Peglow, E. Werner, J. Ehmer, Alex. Holzaphel and Otto Kenzel.—R. W. Uhlig, *Secretary.*

At the December meeting of the West Philadelphia Goldfish Fanciers' Association the following officers were elected: *President,* George E. Wilt; *Vice-president,* Dr. H. H. Cushing; *Secretary,* C. C. Vowhinkel, 5109 Catharine street; *Treasurer,* E. Weinreich, 5000 Larchwood avenue.

The January meeting was held at 5909 Market street, 3d floor. Broadtail Telescopes more than one year old were shown in competition.

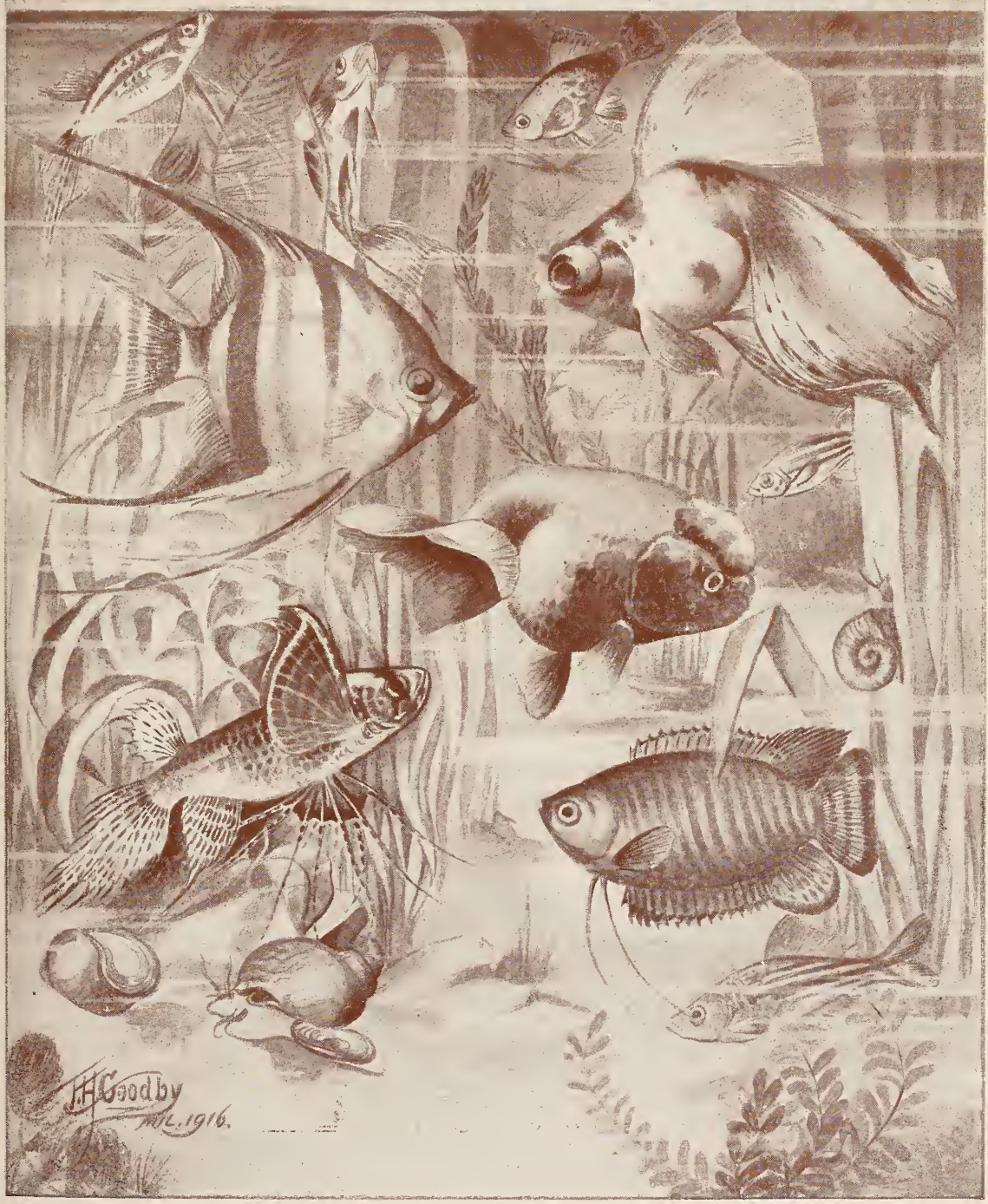
Keeping old customers is as important as getting new ones.

Success is largely a question of action and accuracy.

To err is human, to repent is divine; to persist—devilish.

February, 1918 10c Copy

Aquatic Life



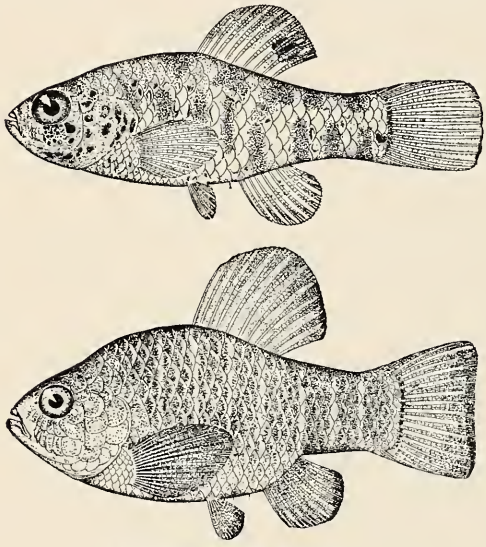
The Variegated Minnow

ERNEST LEITHOLF

The variegated or sheepshead minnow, *Cyprinodon variegatus,* is an abundant species along our Atlantic coast, ranging from Massachusetts to the Rio Grande. Stragglers may be found in salt water, but it seems essentially a fish of brackish situations, though it ascends the rivers in fresh water. This adaptability makes acclimatization in the fresh water aquarium a comparatively simple proceedure.

The dominating color in both sexes is olive, mottled on a silvery background in a suggestion of upright bars, those of the male being of a darker shade. The back of the male, between the head and the dorsal, carries a patch of shining pale blue. The pectoral fins are orange; ventrals, edged with light yellow; anal dusky at base, with orange border; dorsal dusky, front margin orange and rear black; caudal or tail fin with a dark bar at tip and another at base. The female is pale olive; whitish or yellowish below. The dorsal carries a black spot or ocellus at the rear toward the top; caudal reddish with a black basal bar; other fins pale. The female is smaller than the male, which may reach a length of three inches.

Our pair proceeded to spawn in an aquarium holding less than two gallons. The eggs were discovered scattered about the tank, adhering to the plants, indicating that they were expelled and fertilized one at a time. The fry appeared six to ten days later. I found them exceedingly difficult to raise. Though the tank contained but six inches of water, they struggled day after day to reach the surface, until finally I reduced the depth to an inch, and added a pinch of salt. They were the most helpless lot of fry that have come to my notice. The four that survived out of the original thirty did not swim freely until they were a month old. The lack of vigor may have been due to changed environment, the



The Variegated Minnow

Youngster above, mature male below

species normally spawning in brackish or salt water. After the fifth or sixth week the four babies developed a ravenous appetite, and devoured great quantities of mosquito larvæ and other foods. Growth was rapid, and when they were an inch long I placed them in my large community tank. The next morning they were dead! It is probable that this was due to the change of water.

(The variegated minnow has been successfully bred in salt water aquaria. Hildebrand, in a recent paper, observes that the eggs are produced at intervals of

varying length. Ten days to a month may pass, or eggs may be deposited daily for a considerable period.

The digestive tract is long and convoluted, equal to about two and one-third times the length of the fish, which indicates that it is vegetarian in nature, plants forming its principal food. This should be considered in breeding, and an old tank well grown with algæ should be provided. It is not, however, averse to animal foods. It is quite ferocious and will kill and devour fishes larger than itself, even its own kin. Like wolves, a number of individuals have been observed to make a concerted attack upon one common victim. From this it follows that it is scarcely a desirable fish for a "happy family" tank. Such species as *Fundulus heteroclitus* and *F. majalis*, themselves aggressive, are unable to withstand its attacks.—*Editor.*)

Dr. Shufeldt Returns to the Regular Army

At his own request, Dr. R. W. Shufeldt has been returned to the active list of the Medical Corps of the Regular Army, and has been detailed to the Army Medical Museum, in Washington. This is quite in line with his tastes and desires, but may necessarily cause a curtailment in certain other research work.

It is interesting to note that a sum of money has recently been made available for a resumption of the publications by the office of the Surgeon General of the Army. This new series has been founded for the purpose of opening an avenue for the publication of such contributions on human and comparative anatomy, both normal and pathological, as medical officers of the army may contribute, and which come up to the standard required by the Advisory Board, approved of by the Surgeon General and the Secretary of War. In this new series of Bulletins, the first to appear will be by Dr. Shufeldt, and is entitled "A Comparative Study of Certain Cranial Sutures in the Primates."

Dr. Shufeldt is at present writing a history of ichthyology for Aquatic Life. The first part, which concerns the work of Aristotle, has been received, and will be published in an early number.—*Editor.*

The Water Spider

The water-spiders are ordinary-looking members of their class, and can live quite well on land, but are at home in the water. Their bodies are covered with fine, close hairs, amongst which the air is entangled when they descend beneath the water. The air gives them a silvery appearance; hence the name Silver-spider.

The Water-spider constructs its nest beneath the water in an interesting manner. First descending, it spins a close web amongst the water-plants. When finished, it rises to the surface and protrudes the hinder part of its body, thus obtaining an air bubble, which it holds by means of its hind legs, and climbs down a thread spun for the purpose to the web, under which it releases the bubble which is retained by the web. This is repeated many times until the web is dome-shaped by the accumulation of air. The nest is now used as a refuge, winter quarters or to contain the eggs, though a special one may be built for the latter purpose. Water-spiders feed on small land and water animals, and occasionally on each other.

Love your neighbor and share your daphne with him; yet don't pull down your fence.

Salt Water Aquaria at Home*

IDA M. MELLEN, Secretary, The New York Aquarium

YOUNG TAUTOG OR BLACKFISH

A hardy and interesting fish for the marine aquarium

The peculiar beauty and charm of animal and plant life in the sea arouses in our minds a natural craving to enjoy it close at hand. This is a comparatively easy feat for residents of the coast, who may collect plants and animals for themselves and procure plenty of sea water; but for the inland aquarist it is a matter requiring more delicate care and closer concentration.

Salt water can be shipped inland from the coast with the animals and plants. Formulas for the preparation of artificial sea water have been devised, but we do not know of any one who has succeeded with them.

That salts in water are not subject to great evaporation, is illustrated by the eternal salinity of the seas, whose evaporation is replenished by water from the rivers that constantly flow into them; and though they acquire some additional salt from the rivers, their loss of that substance is so small that the new salt acquired really adds to their salinity. It is therefore quite practicable to replace loss through evaporation in the salt water aquarium with fresh water from the faucet once a week; and a watering can is very good for the purpose.

It is 75 years since the first salt water balanced aquarium was established in England, and many experimenters have been at work in the field since that time;

*Read at a meeting of The Chicago Aquarium Society. Published by permission of The New York Zoological Society, with courtesy of use of illustrations.

but for the effecting of a perfect balance of marine animals and plants it is still difficult to advanace any unfailing recipe. As with fresh-water forms, the animals depend largely upon the oxygen thrown off by the plants, while the plants take up the carbonic acid gas exhaled by the animals; and, as with fresh water, the aquaria whose capacities are measured by the gallon are more satisfactory than those holding only quarts. There is small danger from an excess of plants, but too much animal life is certain to prove fatal.

All-glass aquaria are the best for salt water, and are the only kind used at the New York Aquarium for small marine balanced aquaria.

A SELF-SUSTAINING SALT WATER AQUARIUM

Marine collections of the "happy family" order are successfully maintained at the New York Aquarium in eight-gallon jars, with two kinds of plants, and as many as eleven forms of animal life. The plants are the red alga *Soleria chordalis*, sometimes attaching itself to rocks, and

again living free at the bottom, and the green sea-lettuce (*Ulva latissima*) buoyed with bits of cork to cover two-thirds of the surface and allowed to hang down ten inches from the top on the side of the jar nearest the light. The animals are:

Northern white coral (colonies ranging in size from 2 to 6 inches in diameter).

Brown anemones (3 or 4).

White anemones (3 or 4).

Tunicates (*Molgula*) (3 or 4).

Killifishes, 2 inches long (2 or 3).

Variegated minnows, 2 inches long (2 or 3).

Prawns, 1¼ inches long (2 or 3).

Young eels, 3 or 4 inches long (1 or 2).

Mud snails (*Nassa obsoleta*) (1 to 12).

Oyster (1).

Little-neck clam (*Venus mercenaria*) (1).

Warning has been given the beginner by some aquarists to limit his animals one to the gallon of water. It can be seen from the list just given that a gallon will accommodate more than one animal—even more than four—but in experiments with marine aquaria too much moderation cannot be urged at the start.

Sea-lettuce is absolutely essential for the balanced aquarium. Other plants may be used with it, as the red alga called "Flame weed" (*Grinella americana*); and dead, sun-dried hydroids such as *Sertularia argentea* and *S. pinnata*, make good ornamental effects.

Other animals which can be successfully confined in balanced aquaria are small mussels—say a quarter of an inch in length, rock barnacles, annelids (especially the tube dwellers), and very small crabs. Large crabs tear the plants and catch the fishes, but small specimens of the mud and spider crabs one-half inch or so in diameter, are interesting (crabs being truly comical animals) and desirable, for they pick up scraps from the bottom; and the small hermit crabs are especially good scavengers.

It is well to place an inch or two of fine pebbles, white sand, or bird gravel on the bottom of the jar, and a few stones must be added for the attachment of anemones, and for the crabs to hide under. Care must be taken to wash the sand thoroughly. Bird gravel is very dirty, and will ruin the aquarium if put in before cleansing.

Hermit crabs should be provided with empty shells of a suitable size, so that when they outgrow the home they are living in and go house hunting for a large one, the new dwelling will be at hand. They are pugnacious, and two will fight hard for the possession of a desired shell.

Little-neck clams and oysters, whose siphons are always busy, are valuable as clarifiers.

Snails which consume vegetation are to be guarded against. The periwinkles do not thrive so well in standing water, but no balanced aquarium is complete without a few mud snails (*Nassa obsoleta*). These do not harm the vegetation appreciably, preferring animal food, and besides being excellent scavengers, are always interesting to watch, with their long inquisitive siphons traveling on before like an elephant's trunk, and specimens are often seen carrying around a little roof garden of minute green plants, an occasional snail being so thickly covered with the fine marine alga known as *Enteromorpha* that it might be mistaken at first glance for a sea mouse. The mud snail, found all the way from Massachusetts to Florida, is the commonest of small Atlantic Coast mollusks.

Young specimens of starfishes may be

kept. They live on mollusks, however, however, and a supply of the mud snails is necessary for them. With a starfish it would not be possible to keep alive an oyster, clam, or any other mollusk in the jar, and at best the starfishes are not long-lived in captivity.

Probably the most attractive of all small fishes is the sea horse; and the general desire to own one is so great that horses, tells us that he feeds them on *Daphnia*—the common water flea of the ponds—by taking the sea horses out of the salt water and the daphnia out of the fresh water, and putting them all into brackish water one-third salt and two-thirds fresh. Within an hour the sea horses are replaced in salt water, and this process he repeats each day. Fresh-water shrimps may be used in the same

SEA-LETTUCE (ULVA) AND RED SEAWEED

people even inquire if they could not keep one in the same jar with their goldfishes! The little creature is difficult to provide for except with running sea water and salt water *Gammarus*—the minute shrimp that infests the sea-lettuce. Some have succeeded in maintaining sea horses for a number of months in balanced aquaria by feeding them with fresh chopped prawn on the end of a stick, which the little fish soon grows tame enough to take. A New York dealer in aquaria and aquarium supplies, who sells sea way. During a shortage of *Gammarus* last winter we succeeded in enticing some of the sea horses to eat the fresh-water worm *Tubifex*, which will live for half an hour in salt water.

Other fishes, also crabs and prawns, annoy the sea horse, but it is possible to keep anemones, barnacles, oysters and clams in the same jar with them.

The salt water aquarium requires strong light, but should have very little direct sunlight—none in the summer, and not over an hour or two a day in winter.

The most useful cover is one made of glass, of the same diameter as the jar, with bits of cork glued to its edges at several places in such wise as to allow it, when set on the jar, to rest on the corks a quarter of an inch above the top of the aquarium. The cover prevents the escape of crabs, snails, etc., retards evaporation, and keeps out dust.

At the New York Aquarium animals in all balanced aquaria are fed three times a week with macerated clam, care being taken to drop small pieces on the end of a stick or with long wooden forceps, upon the tentacles of the corals and anemones, which may then be seen to carry the food to their mouths. All food not eaten within a few hours is carefully siphoned off with a glass tube.

For the inland aquarium dried shrimp, dessicated codfish after the salt has been soaked out of it, fresh-water mussels, or fresh fish, finely chopped, would serve. Fresh fish, however, is oily, and even an expert aquarist must take unusual care in using it.

A bit of wood stuck on the end of a stick, and covered with felt or cheese cloth, is useful to clean the inside of the glass. In the matter of impurities in the water, an ounce of prevention is worth many a pound of cure, particularly in the inland marine aquarium. Watchfulness for dying plants and dead animals, and their speedy removal, is highly requisite. For this a long wooden forceps is a convenient tool. Some aquarists advocate a bit of charcoal placed under the rocks as a clarifier. During a succession of gray days, the water may be ærated by lifting out a dipper full at a time, and letting it fall back from a height of several inches. When the sand appears dirty, it is well to siphon off the bottom with a rubber tube until about four inches of the water have been drawn. This can be used again by filtering through four or five thicknesses of cheesecloth, or letting it seep through a sponge placed in the bottom hole of a watering can. The same method may be employed if the water appears a trifle cloudy.

What is only difficult may appear to the novice impossible. He must not be discouraged if his first efforts fail, however, but remember that "Patience and perseverance overcome all obstacles," and, as a wise woman once remarked, the only difference between the difficult and the impossible is that the impossible takes a little longer time.

The Medaka

I notice in your December number a reference to the Japanese fish, Medaka. I am interested in knowing that the little fish lays eggs and is not viviparous like some of its American relatives. It does not belong to the genus *Haplochilus,* however, but is type of a distinct group which I have called *Oryzias,* because it swarms in the ditches of the Japanese rice fields (Oryza=rice in Greek). Its right name is *Oryzias latipes.*—David Starr Jordan.

The best advertising is what other people say about you, not what you say about yourself. What they say depends upon the sort of service you have given them. The strength of Aquatic Life lies in this accumulated balance of good-will in the "Bank of Reputation." This balance has grown to such an extent that the name "Aquatic Life" is the hallmark of accurate and interesting information on matters pertaining to the aquarium—and every aquarian and scientist recognizes it as such.

There is a difference between imitating a man and counterfeiting him.

Trichogaster Labiosus

WALTER LANNOY BRIND, F. Z. S.

This rather unfamiliar member of the LABYRINTHICI is a native of Southeastern Asia, and has been collected in Rangoon, Burma, Siam and Malacca. Specimens bred in the aquarium rarely exceed a length of two and one-half inches; wild individuals may measure an additional inch. I have two pairs at the present time and all are husky, plump, lively creatures with abundant vitality.

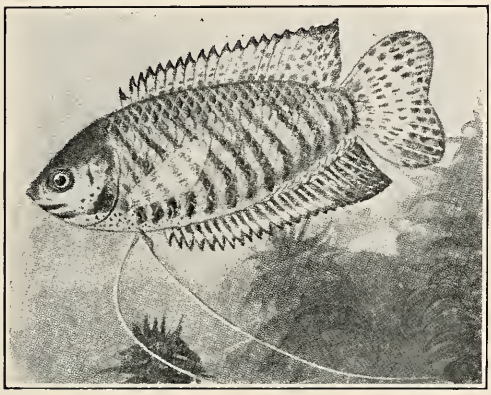
The coloring of the Thick-lipped Gourami is somewhat between that of the Striped Gourami (*T. fasciatus*) and the Dwarf Gourami (*T. lalius*). The back is olive-brown, while diagonal blue-green stripes cover the pinkish-red ground of the sides, merging into the silvery abdomen. On the cheeks of the male, as in the other species mentioned, appears a blue-green patch, which is hardly if ever present on the female. The iris of the eye is red. Both sexes have a sharply-defined orange-red to the anal fin. At times the vertical bars of blue green give place to a broken horizontal lateral stripe, just as the Fighting Fish will show ordinarily a double dark lateral stripe, which at times completely vanishes, particularly when the brilliant colors are assumed while mating. The male Thick-lipped Gourami is generally brighter in color than the female, and has the characteristic pointed dorsal fin.

Like other members of the genus it is quite shy, so care should be used not to frighten it by sudden movements or other disturbances. A shallow aquarium and healthy plants in old standing water is essential to its well-being. For breeding purposes a heated tank is advisable, as it is necessary to maintain a uniform high temperature for at least three months. One "cold snap" will frequently exterminate an entire brood, and all labor and prospects will be lost. Under favorable conditions a pair will spawn four or five times during the summer, but too frequent broods are inadvisable. The eggs are placed by the male in the usual nest

Thick-lipped Gourami **Trichogaster labiosus**

of bubbles. Here with abundant oxygen, in a uniform temperature of 75 degrees or more, the eggs will hatch in about three days. The fry hang tail down among the bubbles, and are zealously nursed by male. In about three days the young will outgrow parental control and scatter from the nest. It is now wise to remove the parent. The limit of his patience, and love, has been reached, and in his exasperation he will proceed to devour them. The female should have been removed as soon as the eggs were observed in the nest. Inasmuch as fragments of floating plants will be built into the nest, it is not always easy to discern the eggs, but when the female is observed in a

remote corner of the tank, from which the male dares her to leave under penalty of being roughly "pecked," it is safe to assume that oviposition has taken place. This rule is also applicable to the Dwarf Gourami, which uses a great quantity of broken vegetation over and among the



Striped Gourami **Trichogaster fasciatus**

bubbles forming a nest. Under no circumstances should the youngsters be removed from the tank until they show solid bodies and are at least half an inch long. As with all fishes, some of the youngsters will grow much more rapidly than others. To prevent these precocious ones from monopolizing the food, and indeed from eating their smaller brothers and sisters, abundant plant life, such as *Myriophyllum* and *Anacharis* should be introduced. An unfailing supply of infusoria must be present, and herein lies the value of using an old-established tank in which to breed. Then should follow screened Daphne, the tiniest one possible. While the species exhibits a preference for Daphne and other living foods, and is not averse to green algæ, it will also take good prepared foods.

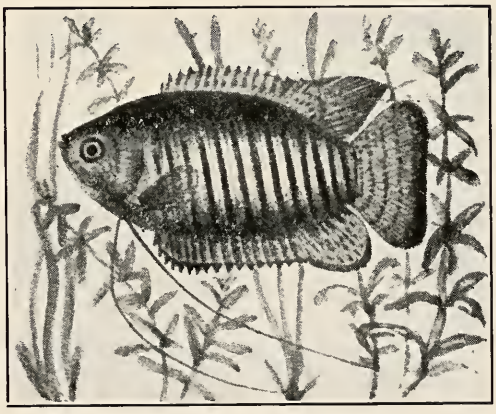
It is good luck to any man to be on the good side of the man that knows fish.—Izaak Walton.

The regular meeting of the Philadelphia Goldfish Fanciers' Society was held in Saull's Hall, 802 Girard avenue, on January 16th.

The competition was unique in the annals of the goldfish fancy. Only specimens that had been awarded a blue ribbon in previous competitions were eligible. The prize, a silver cup, was awarded to George E. Wilt for a scaleless broadtail Telescope. Judges—George B. Smith, Thomas Ayling and Francis X. Garcia.

The nickel-plated aquarium, complete with plants and fishes, offered by the Society, was presented to Mr. John Eck. Mr. Eck donated the fishes to the Society, to be sold at auction, and the sale materially helped to swell the receipts of the evening.

The February meeting will be held on the 20th. Exhibition of ribbon-tail Tele-



The Dwarf Gourami **Trichogaster lalius**

scopes and Japs, scaled and scaleless. Three ribbons will be awarded in each class.—Fred Richardson, *Secretary*.

A good start generally means a brilliant finish.

Justice is the science of obtaining human balances.

Ailments of Goldfish

GEORGE A. SCHENK

Every aquarist should be able to diagnose and treat the common ills of goldfish. This does not mean needless experimenting and doping, but the ability to recognize symptoms and take steps to check the disorders before a serious condition has resulted.

Under the most favorable circumstances an aquarium is "close quarters," and unless a diseased fish is promptly removed, others may become affected. Illness becomes apparent in a number of ways. The dorsal fin may droop and the fish show an inclination to rest on the bottom, the fins become bloodshot, and there is little evident desire for food. These are warning signs to the experienced.

Such symptoms are not necessarily dangerous, but they are certain indications that the fish is not in proper condition, and if allowed to persist will result in serious disease and death. If but one fish in an aquarium is so affected, it is quite probable that it is due to over-eating or constipation; if a number are ill it is certain that general conditions are wrong in one or more essential particulars, and an effort should be made to find and remove the cause. Carefully consider the foods used, the purity of the water, the oxygen supply (plants and condition of the bottom of tank), possible over-crowding and atmospheric conditions in so far as they influence changes in the temperature of the water.

Every aquarist should have at least one receptacle to serve as an isolation and observation tank or hospital. All-glass aquaria and enameled dishpans are excellent, as they can be thoroughly sterilized after having been used for the treatment of parasitic or contagious cases. If possible, it is well to have a planted aquarium to serve for convalescents in the interval between treatment in the hospital tank and their restoration to the

Broadtail Telescope Goldfish*

usual quarters. In this rest tank, which is often unoccupied, microscopic animal life (infusoria, etc.) develops in large quantities and, together with baby snails, which can be allowed to breed there, affords an excellent tonic for the convalescents.

For the treatment of constipation a minor and sometimes frequent condition, dissolve a tablespoonful or more of epsom salt in a gallon of water, taking care not to make it too strong. Place the fish in this bath for several hours if

*This splendid specimen, bred and shown by George E. Wilt, was awarded the silver cup at the last competition of The Philadelphia Goldfish Fanciers' Society. Only "blue ribbon winners" were eligible. Photo by H. W. Schmid.

necessarly. Then a rest of a day or two in a mild solution of epsom salt, with a little sea salt added, or a few days in the convalescent will usually restore health and activity. In a large measure constipation can be prevented by feeding live foods at intervals. Little trouble should be experienced when Daphne is available.

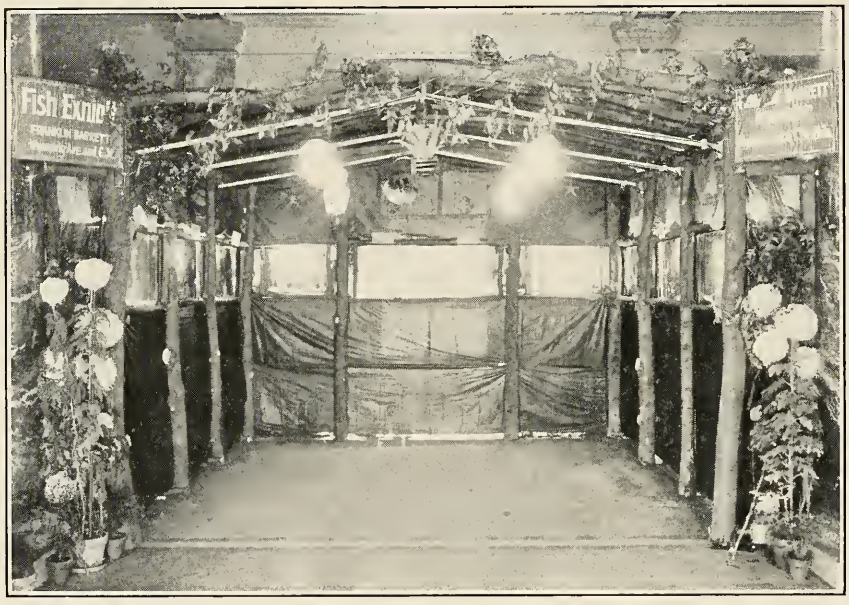
Fin congestion is the result of poor circulation of the blood through the fins, and may be caused by chilling, over-feeding, over-crowding, impure water, rough handling, intestinal disturbances and sudden changes in temperature. Some cases are chronic, yield to treatment and then return. In severe cases the tails, fins and even the lighter portions of the body, become fiery red; in a mild form the tails and fins will be bloodshot. For treatment add 10 to 20 drops of aromatic spirits of ammonia to each gallon of water in the hospital tank. The fish may remain in this solution for from 5 to 20 minutes, but should be watched continually, and removed before they show signs of serious distress. Transfer to a mild solution of permanganate of potas sium, repeat the ammonia bath to simulate the circulation of the blood, and then return to the permanganate. The patient may remain in the permanganate solution for several days, longer if deemed necessary, but a new solution should be made every twenty-four hours. When the congestion has entirely disappeared, a few days in the convalescent tank, or in green water, is desirable.

Tail rot is a serious and contagious disease following aggravated and neglected fin congestion. In the early stages it may be recognized by a grayish, curled and ragged appearance of the ends of the tails. Don't wait for the advanced stage This disease develops very rapidly and must be given immediate attention. Some aquarians advocate cutting away the affected parts with a pair of sharp scissors, or by laying the fins on a smooth board and trimming with a keen knife or razor. This has never appealed to me when only the tail is affected, for it is practically impossible to do it without spoiling the appearance of the fish for all time. When one or both of the pectoral fins are diseased, it may be necessary, owing to the difficulty of treating with the poisonous solution without getting it in the gills. I treated my first case of tail rot with nitric acid. I was instructed to carefully apply a little diluted nitric acid, with a cotton swab, to the edge of the tail. I used what seemed to be due care, but the acid consumed the greater part of the tail! Since then I have treated a number of cases successfully by dipping the tails in a saucer containing a mild solution of bichloride of mercury, washing this off very carefully, and then placing the fish in a large pan of water to remove further traces. Then follows a mild permanganate bath. Repeat the bichloride treatment the next day, and for a third time if necessary. Between treatments, and for several days afterward, keep the fish in the mild permanganate solution. A week to ten days in the convalescent tank should follow. If desired, one-half strength peroxide of nydrogen, or a mild solution of carbolic acid, may be used instead of the bichloride of mercury.

Fungus is a parasitic plant of a low order that gains a foothold on a fish where the protecting mucus has been rubbed away by injudicious handling or other causes. The spores of the plant are always more or less present in the water, but a healthy fish has the power to resist them. If taken in the early stages, it is easily cured, but if neglected it will spread to the gills, when death will ensue. Fungus will be clearly observed as white

or black spots, at times life a tuft of cotton, or the major portion of the body may seem to be covered with a slime. Kerosene oil, half-strength peroxide of hydrogen or a strong salt solution, applied with a cotton swab, will generally overcome the disease with one or two treatments. If a bad spot has been eaten away by the fungus, it is well to dry the

from the body. During the breeding season a fish suffering from this disease, especially in the earlier stages, is apt to be mistaken for a roe-bound female. The condition is caused by the presence of serum under the skin. Relief may be given by tapping and allowing the fluid to ooze out. This is done by carefully running a needle under the skin from



AN EXHIBIT BY FRANKLIN BARRETT AT A RECENT PHILADELPHIA FLOWER SHOW

place and coat it with Turlington's balsam. This material is insoluble in water, and acts as a protective covering while the wound is healing. It is well to remember this, because it can be used to cover bruises and wounds resulting from rough handling or accidents.

Dropsy manifests itself by a greatly distended and bloated appearance of the body. I recall one case, a large Lionhead, so severe that the scales were entirely raised and stood out at an angle

below upward. The thrust must not be deep. If thought is used, and the incisions made to either side in front of the anus, no harm will result. This may give relief for quite some time, or the serum may quickly form again, but it is the only means of prolonging the life of the fish. The formation of the serum is resultant from an internal disorder. No permanent cure is known.

Bladder trouble is a condition affecting the swim-bladder, which prevents the

contraction and expansion of the organ to make the fish of the same specific gravity or weight as the water. Complete recovery is rare, so unless the fish is highly prized, it is well to put it out of its misery at once. In some cases the specimen will be unable to rise from the bottom, which indicates a shrinkage of the organ; in others it may move with great effort, swim on its side or find it impossible to do other than float at the surface, the organ being abnormally inflated. Examples that are killed should be dissected and the condition of the bladder noted. Treat as for constipation, using a strong solution of epsom salt. Sometimes what seems to be bladder trouble is only a severe case of constipation. If it does not yield, little can be done, but comparative relief may be given in moderately warm, shallow water.

One of the bugbears of every breeder is a roe-bound female, and a season seldom passes without the loss of a choice specimen from this cause. Troemner, in a previous number of Aquatic Life, cites such an incident. He opened the fish and removed and weighed the eggs, finding them to be almost equal in weight to the body. Usually one hesitates to resort to stripping, lest a valuable fish be injured, hoping that nature will force the expulsion of the eggs. Until recently I had the same fear. Last spring a female that I highly prized became roe-bound. Several times I tried stripping, proceeding gently but without success. Finally, acting on the theory that I would lose her one way or the other, I used real force, so much so that the oviduct protruded. Then she was placed in an aquarium with a couple of males, who began to drive her immediately. One went under her tail and was plainly observed to bite at the protruding oviduct. Then the eggs came, clouds of them, and it was a very successful spawning. Since that time I have similarly treated others, always with success, as no harm resulted. I have even stripped males without injury to secure milt for experiments in artificial fertilization. The roes are just in front and to either side of the anus, hence a steady, even pressure should be exerted with the ball of the thumb toward it.

Parasites are frequently introduced into aquaria on new plants and fishes. They are most annoying to the fishes, who will be seen endeavoring to remove them by rubbing against plants and stones. They will usually succeed in this, and the parasites will be carried away if the fishes are kept in running water. If this is not possible, isolate the sufferers in a well-planted tank containing broad-leaf Sagittaria. Every day draw off water from the bottom, removing all sediment and excrement, replacing with water of the same temperature. When the fish has been cured, let the tank stand unoccupied for a couple of weeks to kill the parasites by starvation.

In handling fish out of water, which is necessary in some treatments, the gills should be covered with a soft, wet cloth, for if the gills are kept moist the fish will experience no serious discomfort.

At the annual meeting of the Aquatic Association of Maryland, held in January, the following officers were elected to serve during the ensuing year: *President,* Ernest A. Gill; *Vice-President,* W. H. Cassell; *Secretary,* P. C. Chambliss; *Treasurer,* Louis Hens.

It was decided that the Association would hold its first public exhibition during March. J. Shelton Hill was appointed chairman of a temporary exhibition

committee. The arrangements are fast taking shape. In connection with the show a campaign for members will be conducted.—P. C. Chambliss, *Secretary.*

The last meeting of The Aquarium Society, New York City, held January 25th, at the American Museum of Natural History, was one of great activity. The important feature was the election of officers and appointment of committees for the year. Result:

President, Richard Dorn; *Vice-President,* H. Kissell; *Secretary,* C. B. Ruch; *Treasurer,* John P. Lowel; *Librarian,* Charles E. Jenne.

German-speaking Branch: *President,* Dr. E. Bade; *Secretary,* Hugo C. Nelles; *Treasurer,* B. Berkitz.

General Press Committee, Hugo C. Nelles, Hans Forbriger and Carl Lazer.

The time and place for the annual dinner of the Society was discussed, it being decided to hold it at Pabst Harlem, West 125th street, New York City, on April 20th, 1918.—Hugo C. Nelles.

The regular monthly meeting of the West Philadelphia Goldfish Fanciers' Association was held in the hall of the organization, 5909 Market street, on January 4th. Though still in its infancy, it numbers among its members many prominent fanciers of the city, and in consequence the first competitive exhibition, held in conjunction with this meeting, was eminently successful. The judges, Messrs. Thomas Ayling and Joseph E. Bausman, made the following awards:

Professional. *Black Broadtail Telescopes,* blue ribbon, H. Kraus; red ribbon, M. J. Moylan. *Scaleless Broadtail Telescopes,* blue ribbon, H. E. De Muth; red ribbon, Walter Bell; yellow ribbon, M. J. Moylan.

Novice Class. *Black Broadtail Telescope,* blue ribbon to G. C. Vowinkel. *Scaleless Broadtail Telescope,* blue ribbon to Robert Corriston.

Our president, George E. Wilt, exhibited five splendid Broadtails that had won blue ribbons in other shows. They were not entered in the competition of the meeting.

The Association meets on the first Friday of the month in its hall at 5909 Market street. Everybody welcome. Take the Market Street Elevated to Sixtieth Street Station.—C. C. Vowinkel, *Secretary.*

The inventor of a new device for keeping fishes out of irrigation ditches gave a demonstration at the Washington office of the Bureau in November, employing for the purpose a working model. The essential feature of the device is the passage of a series of alternating electric currents through the water between successive pairs of electrodes placed on the opposite banks of the ditch. The voltage of these currents increases from the head of the ditch outward, so that a fish swimming into the canal would be subjected to a current of progressively greater potential and discomfort as it proceeds. The exhibition, which was witnessed by members of the Bureau's staff and by representatives of the Reclamation Service, demonstrated that fish would flee from the electrified areas always in the direction of decreasing potential, and that they would not pass from a neutral zone into a strongly electrified one.—*Fisheries Service Bulletin.*

She—"I wonder why my little goldfish never grows?"

He—"The intelligent little creature knows there would be no room for him in such a little globe. You should read Aquatic Life."

Aquatic Life

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

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Practical articles and notes on topics pertaining to the aquarium and terrarium are always wanted for AQUATIC LIFE. Readers of the magazine are invited to join in making it a medium of mutual help, and to contribute to it any ideas that may occur to them. The pages are always open for anyone who has anything helpful and practical to say. Manuscripts, books for review and general correspondence should be addressed to the editor.

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As a whale is a mammal, it is not a fish, and its flesh, which the Bureau of Fisheries is advising us to eat—if we can get it—is meat. The New Bedford and Nantucket sailors engaged in the whale industry always called themselves "whalemen," and were never called "fishermen" excepting by "off-islanders," as the Nantucketers contemptuously term all unfortunate outsiders. Some years ago, when a tariff law made fish oil free, William W. Crapo, of New Bedford, protested that a whale was not a fish, and his contention was officially recognized by the United States Government, and whale oil was excluded from the classification.—*Edward B. Hughes in* THE WRITER.

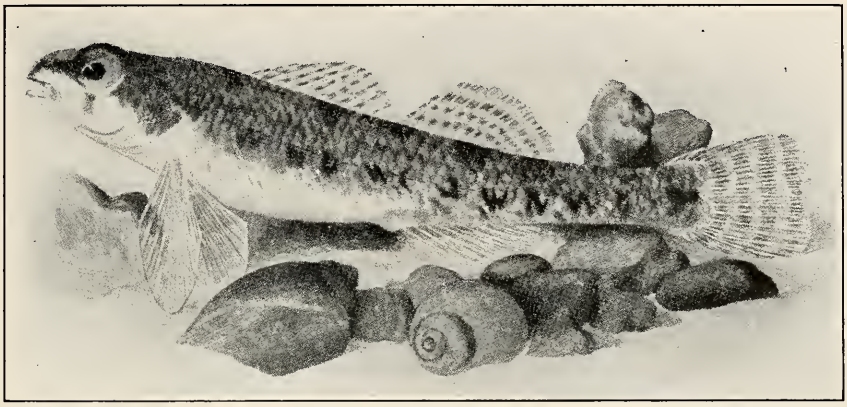
March 1918 10c Copy

Aquatic Life

CLASSIFYING FISHES

DAVID STARR JORDAN

Leland Stanford Junior University



Johnny Darter Boleosoma nigrum

A fish is a cold-blooded vertebrate animal, which is fitted for aquatic life, breathing the air dissolved in the water, by means of structures called gills. It differs from the Amphibia by spending its whole life in the water and in never having its limbs provided with fingers or toes.

At the bottom of the series are tunicates, lancelets and other primitive or degenerate forms, which hardly look like fishes. The lowest which would adorn an aquarium is the lamprey, long, slim and eel-like, with a row of gill holes along the side, and with no paired fins or limbs, and no jaws, its big round mouth a sucking disc, provided with rasp-like teeth. I never knew any one to put a lamprey into an aquarium, but they would be very interesting. You can find them in the spring in most of the northern States, running up the brooks to spawn, fastening their lips to a stone and staying fastened till they wear out, a picturesque feature of the river-floor to which Thoreau once called attention. It is also a grim lesson of the reward of devotion.

Bigger fishes are divided into the class of sharks and the class of true fishes.

Sharks do not thrive in a private aquarium. There is a little black sharklet that lives in deep bays in Japan, so far down that it is always in darkness. Its name is *Etmopterus lucifer,* and it is only a foot long. It has on each side of the belly a luminous patch, by which it sees its way. Dr. Schmidt, the Russian naturalist, put one in the aquarium, and then at night made a drawing of it by its own light.

Of the true fishes, there are twenty or thirty large groups called orders. Each order contains from one to a hundred families. Each family is made up of

genera, and each genus may contain from one to five hundred kinds of species. The scientific name of a fish is the *genus,* as a noun, followed by the *species* as an adjective. Thus the salmon of the Atlantic is a species of the genus *Salmo,* and its name is *Salmo salar,* the jumping salmon. The Rainbow trout of California is also a *Salmo* and its name is *Salmo irideus.* Sometimes scientific men ignor-

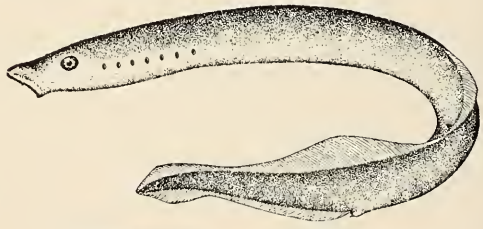
Sea Lamprey Petromyzon marinus

antly or carelessly name a fish which has already been named. If we allowed this there would be endless confusion. So in science we always take the oldest name, unless it has been used before for something else. Thus the Black Bass was named by different men, *Micropterus, Calliurus, Aplites, Huro* and *Grystes.* I like the name *Grystes* best, but it is wrong. *Micropterus,* "little fin," is the oldest, and must be used, though it has not much appropriateness.

Often we find it necessary to divide an old genus, as we might divide a county. This happens when we discover some new and important kind of distinction. Thus when we found large differences in the skull of the Eastern Brook Trout as compared with the black-spotted Trout and Salmon of Europe and of our Western mountains, we set off the Brook Trout and its relatives from *Salmo* as a new genus, *Salvelinus.* The species becomes *Salvelinus fontinalis* instead of *Salmo fontinalis.* Such divisions arising from better knowledge, and changes arising from using an older name, are common in science. They are confusing at first to the beginner, but to the scientific worker it is just as important to have the right name as it is to an aquarian to have clean water.

In the brooks of the world are multitudes of handsome and interesting little fishes all worth studying, and every one has a scientific name of two parts, and meaning in Latin or Greek something worth remembering.

My first aquarium studies were on the "Johnny Darters," which swarm in the brooks of the Middle West, the most interesting to me, of all fishes, because of their color and forms and the many species. There are just a hundred kinds known now, and probably thirty more are yet to be found. They are not the hardiest of fishes, for they cannot stand foul water. But they are the daintiest of fishes and the most inspiring. Some day I may tell you more about them. Their genera are *Etheostoma, Boleosoma, Hadropterus, Poecilichthys* and many others, and they live in the bottom of the little creek just back of your house, un-



Brook Lamprey Lampetra wilderi

less you live to the westward of the Missouri and the Rio Grande. There are none in the Rocky Mountain region, and none in the Sierras.

(In mentioning the Lamprey, in his book, *The Home Aquarium,* Eugene Smith notes that "in the aquarium they do fairly well, if given mud or sand to hide in, but they will be rarely seen. I put two young ones into a one-gallon tank, and did not see them again until more than a year afterwards, when, re-

moving the mud, both were found, one considerably larger than when put in. I have not the least idea upon what they subsisted during all this time. Possibly they fed on the refuse matter in the mud. They lived for some time afterward.

The adults are known to eat holes into the bodies of fishes, upon which they fasten themselves to suck out their juices, in this way doing great damage in streams and lakes. Lampreys, too, are nest builders; rearing small mounds of stones and pebbles in the streams."—*Ed.*)

The Steinhart Aquarium

A great public aquarium for San Francisco has been provided for in the will of Ignatz Steinhart, who died at his home in that city on May 15. The sum of $250,000 is bequeathed to the California Academy of Sciences, to be used for the erection of the aquarium building. By the express terms of the will the aquarium is to be in Golden Gate Park, adjacent to or adjoining the Museum of the California Academy of Sciences. It is to be called the "Steinhart Aquarium," and is to be under the management, superintendence, and operation of the California Academy of Sciences. The expense of maintenance will be met by the city of San Francisco, provision for which was made in a charter amendment voted by the electorate recently.

As the entire quarter of a million dollars will be put into the building, it is evident that San Francisco will have one of the greatest aquariums in the world. Mr. Steinhart was very desirous that, if he established an aquarium, it should be under non-political control. Until recently he had not been able to discover any entirely satisfactory method by which this end could be accomplished, and he had practically abandoned the project, when he heard through Dr. Barton Warren Evermann, director of the Museum of the California Academy, of the transfer of the management of the New York Aquarium from the New York Board of Park Commissioners to the New York Zoological Society, and the splendid success of that aquarium under the efficient directorship of Dr. Charles H. Townsend. Mr. Steinhart's interest at once revived. It was suggested that the California Academy of Sciences would probably be willing to accept the management of the aquarium he desired to establish, should he wish it to do so, and the suggestion met Mr. Steinhart's approval. Mr. Steinhart was one of the most philanthropic citizens of San Francisco, and his name will ever be held in grateful remembrance by the visitors to the great aquarium which his breadth of vision and liberality will have made possible.—*The American Museum Journal.*

The Mosquito Fish

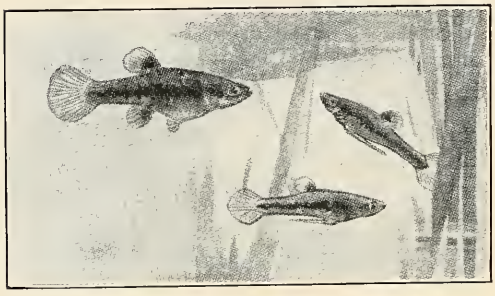
JOHN C. MURPHY

The tiny top minnow, *Heterandria formosa*, is one of the smallest of fishes —the smallest of the North American species, not even excepting the pigmy sunfishes. While aquarians class it as a "tropical," it is really a temperate fish, ranging from North Carolina to Florida in ponds and ditches. This indicates it as a desirable fish for those unable to supply the degree of heat demanded by those from warmer climes. It will get along nicely during the winter under ordinary home conditions, even though the room be uncomfortably cold.

This *Heterandria*, or Mosquito-fish, as it is sometimes called, is not remarkable for its beauty. The general color is brownish or greenish yellow, a dark band

running from the mouth to a darker spot at the base of the tail, the band being crossed by a few vertical streaks. The dorsal and anal fins each bear a conspicuous dark spot. The intensity varies, individuals at times being quite pale. The anal of the male is modified into an intromittant organ, like most live-bearing fishes. A full-grown female will measure an inch, the male being somewhat smaller.

The species being so tiny, the number of babies in a litter will be small. It should be handled like other live-bearing



Heterandria formosa

kinds, the female, when a delivery seems close at hand, being placed in a closely-planted tank. This fish is pre-eminently suited to the smallest aquaria, and will breed and be very happy in a globe. Feed it Daphne, young white worms and prepared foods. All will be taken if the particles be small—the principal requirement.

(*Heterandria,* different male; *formosa,* comely.)

On Telescope Goldfish

FRANK B. HANNA

Breeders of telescope-eyed goldfish are prone to comment on the apparent lack of development of the eyes of the modern show fish. It seems to have been overlooked that this seeming retrograde has been coincidental with the advance of the broad-tail type. Years ago we had more "big-eyed" specimens, but comparatively few broad-tails. These fish were what we now put into the "old-style telescope" class in competitions, long of body and with relatively short tails and fins, a combination fitting them for a long battle with the vicissitudes of life. They were strong, lived long and kept "in condition," even breeding when ten years old, because they were not cumbered with enormous fins, to sap energy and vitality.

Disregarding the occasional precocious example, the protruding eye does not attain full development until the fish is four or five years old, the growth paralleling that of the hood of the Lionhead, which takes six years. The present-day American transparent-scaled (scaleless) telescope goldfish has reached the maximum fin development, and is on the decline before it is three years old—there are few exceptions. From an exhibition viewpoint a fish three to four years old is, in nine cases out of ten, a sorry mess—no pep, fins ragged and streaked, while the eyes are not yet at the maximum. The long and short of the matter is not really that the eyes are being "lost," but that the life of the breed, the time necessary for the development of the eyes, has been shortened incidental to concentrating attention in breeding to the development of fins.

Two men were discussing as to what Noah did to pass away the time on board the Ark. "I guess he did a good deal of fishing," suggested the ardent angler.

But some one is always ready with a wet blanket. "He couldn't do much fishing with only two worms," was the retort.—*Ladies' Home Journal.*

The erosion of the shells of snails is often due to acidification of the water

Hemichromis Bimaculatus

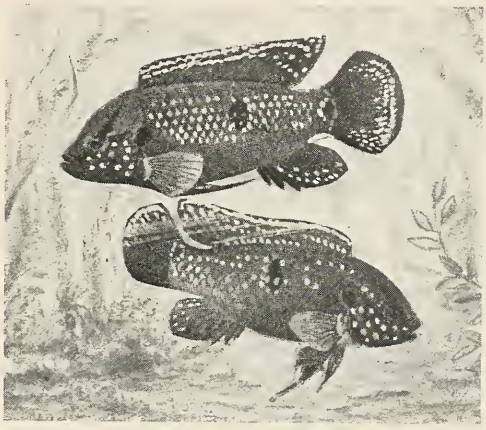
ERNEST LEITHOLF

Few of the many cichlids are more popular or better known than *Hemichromis bimaculatus*. It comes to us from Africa, where it has a rather wide distribution, ranging from Egypt westward and south to the Congo. In habits it does not differ from the familiar South American Chanchito, but propagation is apt to be fraught with more difficulties. But when success comes, and the aquarium is peopled with a school of this gorgeously colored fish, one is quite apt to pertinently remark that "the game is worth the candle."

The baby *Hemichromis*, six to eight weeks old, is striped, displaying two dark brown horizontal lines on a lighter ground of the same color. This changes into a dull bluish green on the back and sides, which merges into the dull yellow of the belly. The two spots indicated by its specific name, *bimaculatus*, now appear, one at its lateral centre, the other at the base of the caudal fin. However, the name *bimaculatus* is rather a misnomer, a third equally pronounced spot appears on the gill-cover, so the fish is really three-spotted, rather than two-spotted, as the name implies. Small, glistening spots are scattered over the upper half of the body and on the dorsal, anal and caudal fins.

When about half grown the back and sides become reddish brown and the throat first shows the brilliant red. With maturity, and particularly during mating and breeding activities, the color splendor of both sexes is amazing. The body from the abdomen upward becomes bright scarlet, blending into a rich olive on the back. Glistening emerald dots in broken lines bespangle the body and vertical fins, the latter edged with red.

It is a rather difficult task at times to persuade this fish to mate. The male is gifted with a quarrelsome disposition and a total lack of geniality, though sometimes it is the female that stands in the way of mutual understanding and team work. It is this lack of cohesion that makes breeding difficult. When the family scrap tends to become serious, it is well to separate the couple by placing a glass partition in the aquarium, feeding both well, and trying in this way to make them become more kindly disposed towards one another. We have had males that positively refused to mate, which would have killed every female placed with them. A method often successful is to rear a number of fishes together, selecting apparently congenial pairs when old enough to distinguish the sexes.



Hemichromis bimaculatus

If the quarrels of courtship pass and

love becomes paramount, the eggs will be deposited on a stone, to which they will adhere. During incubation one parent or the other stands guard, fanning constantly with the fins to create a circulation of the water and prevent any possible accumulation of sediment. Infertile eggs, or those that give evidence of a lack of normal development, are weeded out; sometimes all will be thus destroyed. We have had a well disposed pair, after successfully rearing several broods, devour the next one. Perhaps the babies were weaklings.

During the first three or four days the fry are unable to swim, so the parents fashion hollows in the sand, to which the babies are moved. Here they are guarded, that no harm befall them, one parent alternating with the other. When they are able to swim freely the male should be removed, though the female may remain with them from one to four weeks. The latter is not, however, necessary to their development, so she, too, may be placed elsewhere.

This species seems very susceptible to *Ichthyopthirius*, the infusorian parasite. An entire brood may succumb to its ravages in a short time. It is well to be on the lookout, and check it the moment it is noticed.

In breeding, provision must be made for infusoria, with Daphne to follow. Older fish will take prepared foods, but as the species in carnivorous, live material should dominate its bill-of-fare. A water temperature of 70 degrees will be suitable, except during breeding periods, when it should be five to ten degrees higher.

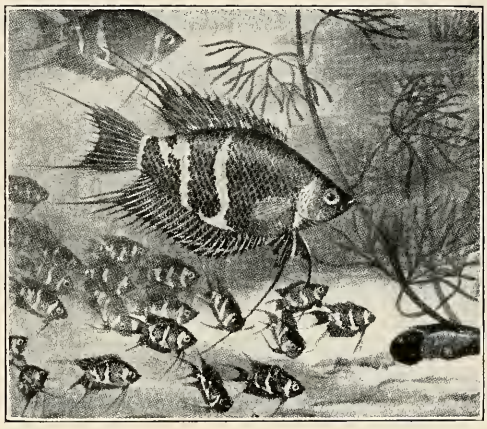
He is a wise man who never has a great head on the shoulders the next morning.

The Sumatra Gourami

C. J. HEEDE

This labyrinth fish is the rarest in the list of aquarium fishes, because it has been the good fortune of but one aquarian to possess it. Some years ago a fish fancier collected a number in Sumatra, while on a business trip. These did not long survive the journey, and apparently none have been collected since.

The species is described as having a reddish brown body, crossed vertically by



Osphromenus malayanus

several white streaks, the anal and caudal fins being prettily colored. When young were observed they were quite large and closely resembled the parents, which led the owner to conjecture that the species was a mouth-breeder, or perhaps live-bearing, the latter being rather unlikely. The largest adults were three inches long.

This article is in the way of a suggestion to the aquarians of California, who should be in a position to make frequent importations from the East Indies.

(*Osphromenus*, smeller, far-fetched, but apparently in allusion to the possibility of the long rays of the pectorals being used as feelers or sense organs; *malayanus*, pertaining to Malay, whence comes the species.)

Breeding the Goldfish

GEORGE A. SCHENK

Many lovers of things aquatic content themselves with beautifying their aquaria and with such pleasure as is obtained by watching the inhabitants and caring for them. The reward is great, as all aquarians know, but nothing compared to the joys of actually breeding and rearing fishes. Some have been deterred by the thought that they have lacked and could not readily acquire the necessary facilities. There is no limit, of course, to the extent to which one may go in this respect, from the single aquarium and a couple of dishpans to the elaborate conservatories of the wealthy or the specially constructed houses and outdoor tanks of the professional fish culturist, but much fun and knowledge may be gained with a few simple necessities, even in a city apartment. An aquarium of medium size, not much smaller than twenty gallons, a dishpan or two, and a tub or another aquarium, represents about the minimum in equipment, but this will successfully care for one spawning if the undesirables are weeded out at an early age.

It is not absolutely necessary to start with high-priced breeding fishes. There is much to be learned that only experience can teach, and this knowledge can be just as well gained from fish that are "just fish" as from costly exhibition specimens. But don't misunderstand me. I am not deriding the advantages of breeding from good stock, but, on the contrary, advise getting as good as the purse will permit. The mere fact that one's means are limited is no reason to forego the pleasures of breeding. Good breeding fish may be obtained for a few dollars each, or one may find rare and beautiful specimens actually worth any price the fancy of the owner may dictate.

The person who has never bred fish will naturally ask how to go about it, and

A Gravid Female Telescope Goldfish

what steps to take to induce the fish to spawn. The instinct to reproduce its kind is just as strong in the goldfish as in other living things, so all that is necessary is fair-sized quarters, proper feeding, well oxygenated water and fish of the opposite sex.

The males, when in condition to breed, bear small, white dots or tubercles on the gill covers and along the first ray of the pectoral fins. In gravid females the roes seldom develop evenly, making one side

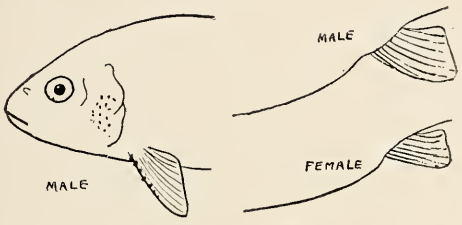
more distended than the other, a condition apparent in the accompanying illustration of a fish owned by George E. Wilt. Even before they are in condition to spawn, precocious males will often be

Blue Calico Telescope Goldfish View From Above. This Splendid Specimen Exhibits the Maximum Development of "Telescope" Eyes. Owned by Franklin Barrett

observed frantically chasing or "driving" the females in an effort to induce spawning. At times other than during the breeding season the sexes may be more or less accurately determined by an inspection of the anal region. The vent of the female and its surroundings presents a raised or swollen appearance, while in the male it is depressed. These differences are slight and negligible to the unpracticed eye, but exist nevertheless, though they are more pronounced in some cases, especially if the fish has been bred, than in others. (See illustration.)

While with special attention and

proper conditions the goldfish will spawn at almost any time during the year, spring is the natural season, with the months from March to July the most practical and favorable. Unsettled weather, fluctuating temperatures and the uncertainty of a continuous supply of live food for the young are serious drawbacks to earlier breeding. Young from eggs spawned later than July do not have a

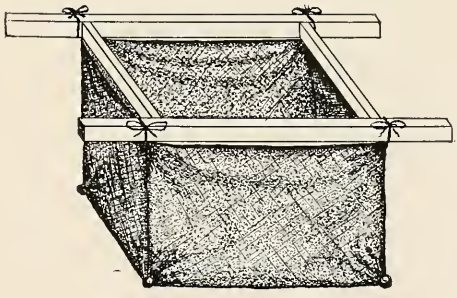


Sex Distinctions

sufficiently long period of favorable growing weather before the advent of winter, so it is hardly worth while bothering with them. At this time the experienced culturist is concentrating all attention on the select from his earlier spawnings.

To condition the fish for breeding they should be kept in as large an aquarium as possible, particular care being taken not to overcrowd. Where possible, have a little drip of water flowing constantly. If this cannot be arranged, a little fresh water added every day will help to stimulate them. Feed plenty of nourishing foods, such as Daphne, Enchytræids, raw chopped fish, the soft parts of oyster, fresh and dried shrimp, oatmeal and good prepared fish foods. Vary the diet as much as possible. The water temperature should be over 60 degrees. From 65 to 70 is best for spring spawnings. Radical and rapid fluctuations in temperature must be avoided. If the room in which the aquarium is placed is not evenly heated at all hours, the aquarium should be covered with a piece of glass. It is surprising how even a temperature can be maintained in this way, but the cover should be removed during the day if the tank gets considerable direct sunlight, otherwise the water will become too warm while it is shining as compared with the night temperature.

Within a few weeks the tubercles will begin to appear on the males, and the females will fill out as the roes develop. The males will begin to drive the females, in a rather perfunctory manner at first, but in earnest as the time for oviposition approaches. When this stage is reached the big event may happen any morning, and it behooves the owner to set the alarm clock for an early hour if he would be present. Soon after dawn the males drive furiously, forcing the female among the plants and butting her sides with their heads at every opportunity. When the first eggs are dropped the excitement of the males is intense. First they cease driving, stopping in their tracks to turn and hover over the spot.



Spawning Net

But after a moment they again give chase, often brushing her body with a peculiar sinuous movement as they fertilize the dropping eggs. If not interrupted the operation will continue for several hours, or until the males are exhausted, for the mere fact that the female has dropped all the ripe eggs is of no real concern to them, and it is quite possible for vigorous males to drive her long

after. It pays to watch, and when it appears that the female has finished, she should be taken out and placed alone in an aquarium to recuperate. The males must also be taken out or they will eat the eggs. They should have a rest of several days before being used again.

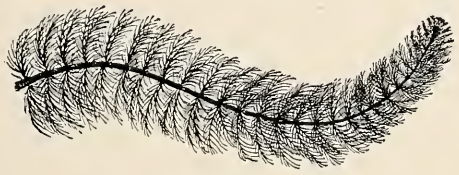
When a spawn is expected the culturist should make his selection of males, choosing two or three males to a female of the same size, three or four if she is much larger. The selected fish should be put into a tank by themselves. Large tubs of wood or fibre are excellent. If space is limited, the spawning net illustrated will prove useful. This is merely a cheesecloth bag, tied to a wood frame, which rests across the top of the tank or aquarium. The bag can be made of a size suitable to the tank, and twelve by twelve by eighteen inches will be large enough in any case. The fish are placed in the net, with several bunches of *Myriophyllum*, to which the spawn will adhere, the eggs and plants being removed to a hatching pan when the fish have finished. If it is not possible to provide tubs or nets, the fish may be allowed to start spawning in their regular quarters, transferring them at once, the female and selected males, to an enamel dishpan of the largest size. They will then go right on spawning, but they should not be previously placed in such small quarters. A mature adult goldfish will produce from 2000 to 5000 eggs during a season, and from 500 to 1000 or more in one day, the first spawning being usually the largest.

The Rearing Tanks in the Establishment of George E. Wilt Photograph by H. W. Schmid

Have two or three good-sized bunches of *Myriophyllum* or a couple of water hyacinths in the spawning receptacle. I prefer *Myriophyllum*, as it makes an admirable spawning bed, and may remain after the eggs hatch, helping to oxygenate the water and keep it sweet.

Unless the spawning has taken place in a well-planted, established breeding tank or aquarium, in which there is old water and an adequate supply of infusoria, provision must be made for its development as food for the fry. If the

eggs have been placed in a dishpan, infusoria powder may be sprinkled over the surface of the water at once, and the minute animals will be present by the time the fry are ready for them. This powder may be made by drying aquatic plants or lettuce leaves, and can also be purchased for a small sum. This microscopic food can be developed in separate



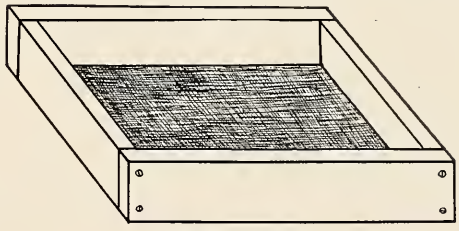
Myriophyllum

containers, such as quart preserving jars, and a little of this water added at intervals to the receptacle containing the fry.

The eggs of the goldfish are amber-colored, transparent and gelatinous, but infertile ones soon turn milky-white. These should be removed, for they are quickly attacked by a fungus, which may extend its activities to the fertile eggs. Hatching takes place from four to ten days after spawning, being dependent upon the temperature of the water, which must be kept as even as possible, and under no circumstances allowed to drop below 60 degrees.

When the fry appear the yolk-sac of the eggs remains attached until absorbed. This furnishes food for the first week or ten days, but they will develop faster if infusoria is present. From this time on they must be liberally fed. The growth and shape depends materially upon the food, both as to kind and quality, and it is truly amazing the amount they can eat. Tiny Daphne and Cyclops, strained through a fine-mesh wire cloth sieve, should follow the infusoria, and plenty of them.

It is well to have a storage tank for live foods. Outdoor tanks and tubs, to be used later in the season for rearing quarters, will answer the purpose. If a box of horse manure and straw, with some meat laid on top and held down with a piece of wire netting, is weighted and sunk in each tank, you will have your own miniature Daphne ponds. It is not to be expected that enough will develop to entirely feed the fry, but if well stocked in the beginning, and occasionally replenished, enough should be available to feed a number of young to a size of half an inch or more. Daphne from the ponds should be strained before putting it into the aquarium or storage tank, and obnoxious insects removed. A frame of wood, three inches deep and nine to twelve inches square, covered on the bottom with brass wire screen, can be floated in the tank, and the collection of Daphne poured into it. They will find their way through, but the larger insects will be retained in the sieve. Goldfish fry have many enemies among the aquatic insects

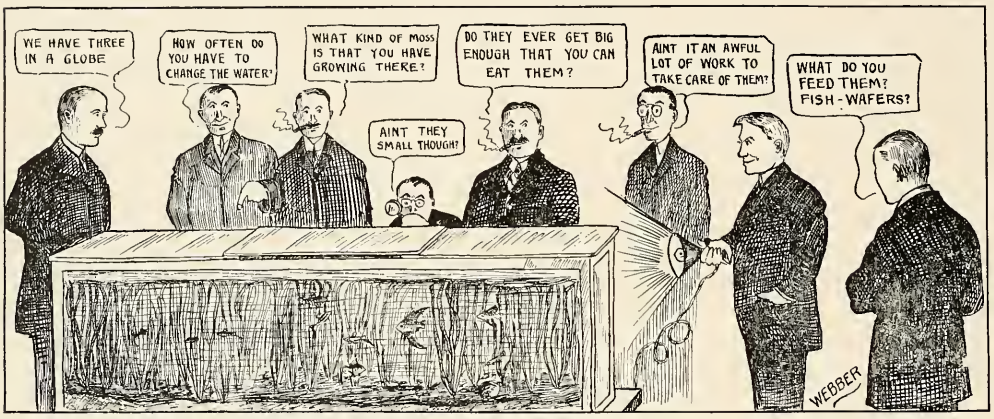


Daphne Sieve

—larval dragonflies, water boatmen, tigers—and their chance introduction into the rearing tank will have sad results. The culturist should be constantly on the lookout for them.

When live food cannot be obtained, use the yolk of an egg, boiled for twenty minutes, placing it in a little bag of muslin, and drawing it through the water. The dust from finely ground Chinese shrimp may also be used. This can be obtained by shaking a portion of the ma-

terial in a tumbler, and wiping off and using the fine particles that adhere to the sides. As they grow, finely ground fish food or puppy biscuit may be sprinkled on the water from a pepper shaker, or forced through cheesecloth. Tender earthworms may be chopped fine and ground with sand, using a piece of hard wood as a pestle. The ground worms can be separated from the sand by pouring them in water from one glass to another. Being lighter than sand, the worm



Thankless Occupations: Fred Orsinger Showing the Dawg-gone Big Tank to a Bunch of Boobs
Original cartoon by Frederick R. Webber, Chicago Aquarium Society

particles will remain suspended in the water, while the sand sinks to the bottom. In addition to live foods, the babies should be fed strained, cooked oatmeal, to which may be added, if desired, a small portion of shrimp or shredded codfish. This food should be placed in a soup dish on the bottom of the tank, which serves to keep it from scattering, the unconsumed portion being removed before it has soured, fresh being substituted.

With proper feeding and plenty of room the fry will grow apace, some faster than others, so they should be sorted frequently, else the larger will monopolize the food. At the age of six weeks form and color will be apparent. Freaks, cripples, single-tails and other undesirables should be disposed of as soon as detected, and all attention given to the most promising. Far better to raise a few good fish than a quantity of mediocre ones.

Gill trouble (inflammation of the gills) is the most dreaded disease of fry. It is well to take all pains to avoid it. The usual causes are too cold or impure water, overcrowding, improper feeding and direct drafts of cold air. One fancier lost several thousand fry by opening the ventilators in his conservatory on warm May days, the air blowing directly on his tanks. He resourcefully made frames of wood, covered with muslin, and screened his tanks with them. He had no further trouble. In rearing goldfish the greatest loss occurs during the first six weeks, but with care and attention a goodly number will reach this age in health and vigor.

Next month I will discuss the rearing of fish that have advanced beyond the stage of fry.

When a man sneers at success as being a matter of luck, you can generally set him down as a failure.

Breeding the Bitterling

Last year I imported a number of Bitterlings from Asia. During October they showed signs of spawning. I at once placed some mussels in the tank, and three days later the fish deposited their eggs in them. Unfortunately the mussels died before the eggs hatched, but this brief experience at least demonstrates that the species will accept an American mollusc.—*R. Borden.*

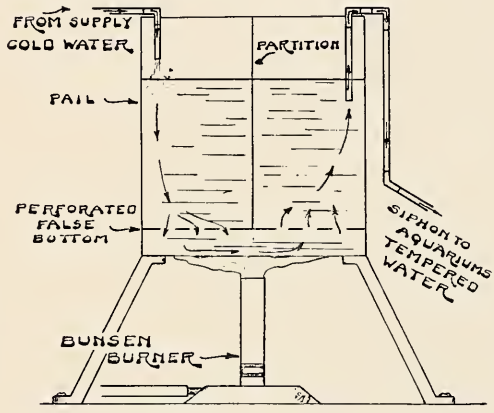
A reader of Aquatic Life asks for the number of species of fishes. An accurate answer is impossible because new species among all classes of animals are continually being recognized and described. A general estimate, in round figures, places the number of known animals as given in the appended list. It affords an interesting comparison of the relative abundance of the groups.

Mammals	7,000
Birds	20,000
Reptiles	5,500
Batrachians	1,800
Fishes	12,000
Mollusks	60,000
Insects	400,000
Arachnida	5,000
Crustaceans	8,000
Tunicates	300
Annelid Worms	4,000
Rotifers	350
Echinoderms	3,000
Thread-worms	1,600
Molluscoidea	1,700
Flat-worms	4,500
Coelenterata	4,300
Porifera	2,500
Protozoa	10,000

When a man knows his own imperfections he is just about as perfect as it is possible for a man to be.

The Essex Society

At the regular meeting of the Essex County Aquarium Society, February 15th, an informal talk on breeding the goldfish was given by Dr. Bachmann, Rev. Coltarti and Mr. Hedden. Mr. H. A. Van Cott, acting as interlocutor, kept the conversation in well defined channels, which contributed much to make the discussion a success. Many ideas were exchanged and every one added to their store of knowledge.



Among the new ideas, Mr. Hedden suggested the use of frayed sisal rope, properly sterilized, to catch the spawn, instead of the usual plants or willow roots. A simple and efficient device for raising the temperature of water, when a continuous flow from the city mains to the aquaria is desired, has also been evolved by Mr. Hedden, and is illustrated herewith. The container is a small garbage can, partitioned to cause the water to flow over the heated bottom, this and other details are indicated in the sketch. The cost of operation is said to be low.

On March 15th, Mr. Van Cott will give an interesting lecture on the lower organisms. All are welcome, and a good attendance is expected.

The following officers have been elected for the year: *President,* Max G. Ham-

Aquatic Life

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

W. A. POYSER.....Editor
JOSEPH E. BAUSMAN.....Publisher
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Practical articles and notes on topics pertaining to the aquarium and terrarium are always wanted for Aquatic Life. Readers of the magazine are invited to join in making it a medium of mutual help, and to contribute to it any ideas that may occur to them. The pages are always open for anyone who has anything helpful and practical to say. Manuscripts, books for review and general correspondence should be addressed to the editor.

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Vol. III **March 1918** **No. 7**

merschlag; *Vice-president,* Rev. B. J. Coltarti; *Secretary,* H. I. Hartshorn; *Treasurer,* Dr. William Bachman.—Charles M. Breder, Jr.

Japs, Japs, and still more Japs, scaled and scaleless, held forth their beauties at the February meeting of the West Philadelphia Goldfish Association. Harry P. Peters and George E. Wilt, judges, made awards as follows:

Novice Class: *Blue ribbon* to a scaleless blue calico, entered by Dr. Thomas W. Clarke.

Professional Class (scaleless fish): *Blue and red ribbons,* Charles Hinkel; *yellow,* Gus Armbruster.

Professional Class (scaled fish): *Blue ribbon,* M. Moylan; *red,* Gus Armbruster; *yellow,* Robert Corriston.—C. C. Vowinkel, *Secretary.*

At the January meeting of The Kensington Goldfish Society cut-out or ribbon-tail goldfish were shown in competition, awards being made as follows:

Scaled Japs: *Blue ribbon,* A. Miller; *red,* Joseph Tyler; *white,* J. M. Wacker.

Scaleless Japs: *Blue ribbon,* L. W. Rehbein; *red,* Joseph Tyler; *white,* L. W. Rehbein.

Scaled Telescopes: *Blue ribbon,* H. Somerset; *red,* Gus. Armbruster; *white,* Gus. Armbruster.

Scaleless Telescopes: *Blue ribbon,* L. W. Rehbein; *red,* H. Somerset; *white,* William Berry.

The Society meets on the fourth Wednesday of each month in Tyler's Hall, 2824 Kensington avenue. Everybody welcome.—Charles Harris, *Secretary.*

Tappan has another fine litter of collie puppies. Later they will cost more, so why not write about them now? Males, $10; females, $5.

Mother—"Johnny, you said you'd beer to Sunday school. Now I want to know how it happens that your hands smell of fish?"

Johnny—"I carried home the Sunday school paper, an' the outside page is all about Jonah and the whale."

Having produced a shallow brain, Nature usually tries to even things up by supplementing it with a fluent tongue.

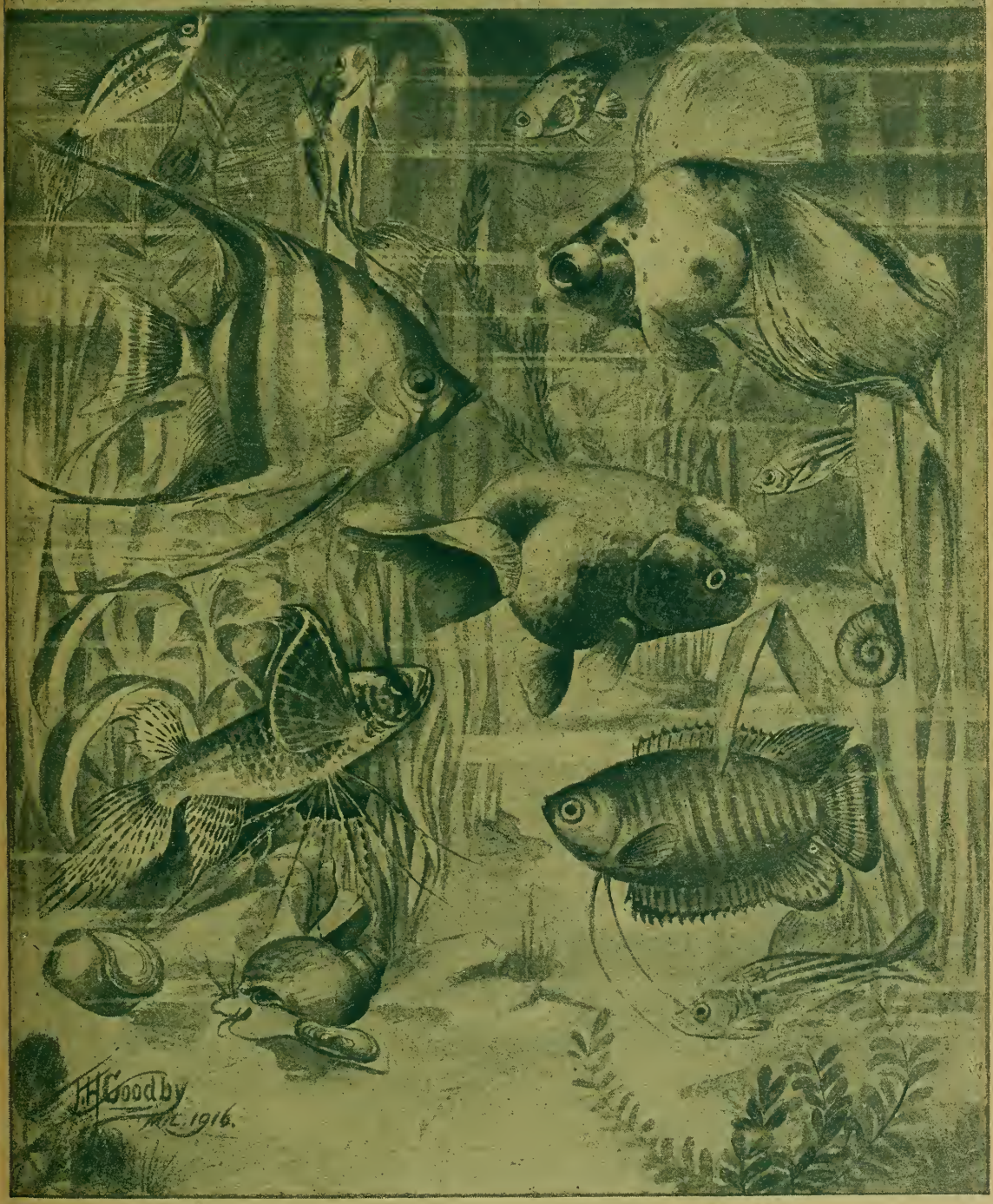
What will you pull out of it this year? Warm weather will soon be here, and the fishes will busy themselves with many offspring—more than *you* will need. If you would have the fishes help you bear the burden of the high cost of living, or, in other words, if you are not averse to an increased income this year, send for a copy of this interesting little brochure.—*A. Wise, Aquarist.* A postal to the publisher will be sufficient. Do it now!

Messrs. L. Cura & Sons, Bath Court, Warner street, London, E. C., England, are in the market for 50 extra large bull frogs, 200 to 500 assorted fancy goldfish and 200 four-horned snails (*Ampullaria gigas*). American aquarians able to fill all or part of the order, and in a position to arrange for transportation, should write at once, giving prices and other details.—*Advert.*

He that won't be counseled can't be helped.

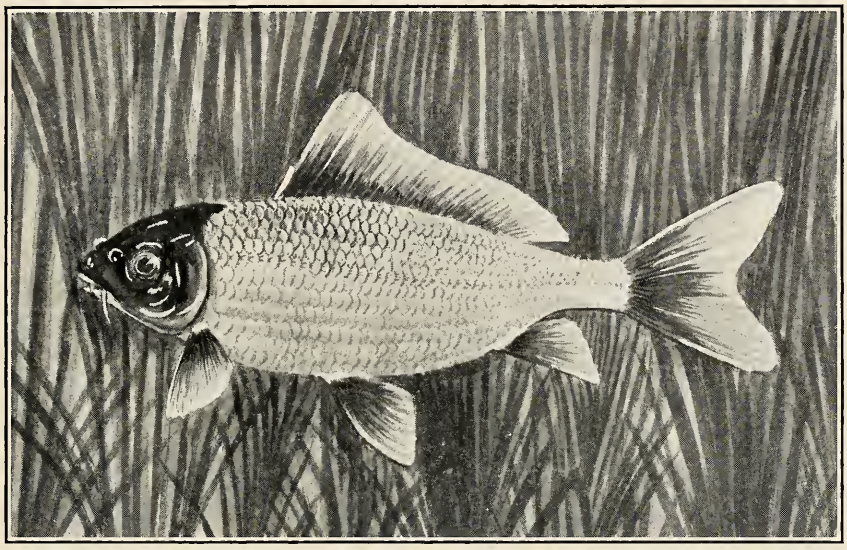
April 1918 10c Copy

Aquatic Life



The Optimum of Water

EDGAR R. WAITE, F. L. S.
Director, South Australian Museum



The "Liberty Bond Fish," Franklin Barrett's Famous Red, White and Blue Carp
From the original water color by the owner

If you place a quart of ale before two men, and each man drinks half, the result, as far as the individual is concerned, is much the same as though each man were supplied with a separate pint. From this we might not unnaturally argue that, as concerns the well-being of the individual, an equal result would be obtained by keeping two fishes in a quart of water as by keeping one fish in a pint. Though theoretically the argument would appear to be sound, in practice it is proved to be otherwise.

For their normal development all living beings require a certain minimum amount of space and, as we are now dealing with aquatic animals, we may say that all need their optimum of water. By keeping the tadpole of a frog in a limited quantity of water I have been able to so retard its development that it has remained as a larva for over a year, and similar result is within the experience of others also.

Though food may be plentifully supplied, a fish kept in less than a certain volume of water will never reach its normal development, while successive generations, reared under similar conditions, will be permanently dwarfed. "Miniature goldfish" are produced in this manner.

If one gallon of water be the minimum volume required for a certain fish, it does not follow that two such fishes would require two gallons of water; such quantity might satisfactorily support three or four fishes; the reason is obscure, but the fact remains.

On the Care of the Aquarium: An Exception

ERNEST LEITHOLF

While I enjoyed the article on the "Care of Aquaria," by George A. Schenk (January number), I consider the weekly addition of one and one-quarter teaspoonfuls of salt to each ten gallons of water excessive. Salt should be held in reserve and only used when really needed in treating a sick fish or when parasites are present in a tank. Fishes become accustomed to it when continually present, and fail to respond to its influence when diseased. Experience has convinced me that the excessive use of salt "on general principles" is detrimental to fishes, plants and snails. A few grains of salt dropped on a red snail will kill it, while plants will succumb when sprinkled with the saline solution.

In a heated aquarium holding ten gallons there will be a weekly loss of one to two quarts of water through evaporation, which further increases the salinity. This, however, is slight. But when we add one and one-quarter teaspoonfuls weekly, and only replace half of the water with fresh, it can readily be understood that the salinity of the water is growing denser by weekly steps, and it is not impossible for it to eventually be transformed from a fresh water aquarium to one of brackish or salt water.

Leaving the salt question aside, the weekly removal of one-third to one-half of the water in a balanced aquarium, and its replacement with new, raw water is a mistake and may work more harm than good. Such recommendations fail to take into consideration that water supplied towns for domestic purposes is of many kinds and degrees of purity and impurity, chemical and otherwise. Few cities are favored with uniformity—if any! Not a few aquarians have at times suffered serious losses resulting from water changes. This is manifestly the cause of the death of apparently healthy fish when taken from the establishment of one aquarian to another.

When the aquarium is doing nicely, the wise plan is to let well enough alone. All that is necessary is the removal of the accumulated sediment by means of a dip-tube or siphon or rubber hose, which can be accomplished with little loss of water, only sufficient new water being added to bring the water back to its former level.

Keen competition ruled the March show of the West Philadelphia Goldfish Fanciers' Association, held on the 1st, at 5909 Market street. Some remarkably fine telescopes less than a year old were entered. The judges, Joseph E. Bausman and William J. Christy, made decisions as follows:

NOVICE CLASS: *Blue ribbon* on a Black Broadtail to E. Weinrich; *blue ribbon* for a Calico Broadtail to B. Fogel.

PROFESSIONAL CLASS: Black Broadtails—*blue* and *yellow ribbons*, J. A. Krause; *red*, M. Moylan. Transparent-scaled Broadtails—*blue*, Charles Hinkel; *red*, H. E. Demuth; *yellow*, G. Armbruster.—C. C. VOWINKEL, *Secretary*.

Broadtail Telescopes, more than one year old, engaged the attention of the Kensington Goldfish Society at the February meeting. Ribbons were won by following:

SCALED: *Blue ribbon*, Gus Armbruster; *red*, W. J. Christy; *white*, Charles Harris.

TRANSPARENT-SCALED: *Blue ribbon*, H. Kempner; *red*, M. Moylan; *white*, H. Kempner.

The Society holds its meeting and exhibitions in Tyler's Hall, 2824 Kensington avenue, Philadelphia, on the fourth Wednesday of the month. An invitation to attend is extended to all aquarists.—CHARLES HARRIS, *Secretary*.

ACARA TETRAMERUS

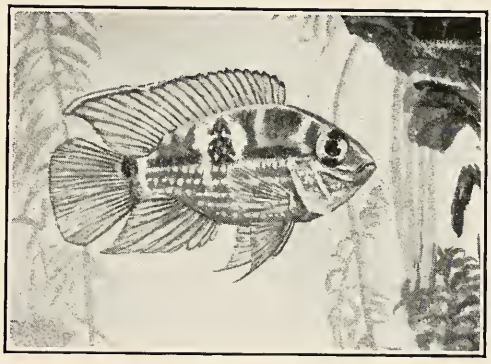
WALTER LANNOY BRIND, F. Z. S.

This handsome member of the Cichlidæ family is a native of Northern South America, ranging from British Guiana to the Amazon region of Brazil. It occurs in rivers and still water, and is particularly partial to flooded tracts of tropical forests, such as the Amazon River affords when it inundates hundreds of square miles of the low-lying forests that skirt its shores. The native esteems it as one of the best of food fishes, growing, as it does, in the wild state, to a length of eight inches.

The general color is olive green to dark greenish brown on the back, shading to bluish gray or light rosy red on the sides, with a violet suffusion near the throat. There is a dusky spot under the eye, and another surrounded by a ring of white spots at the top of the caudal. The scales are large, and lighter in the centre. The anal, ventral and dorsal fins taper toward the rear, which is more evident in the male than in the female. The tail or caudal fin is round, with a light olive ground color, with darker mottling, this coloration extending to the dorsal and anal, while the pectorals are large and clear.

Sexual differences are not very evident, as in most members of the family. In general the female is pale, more rounded in body, and the fins are not so prolonged as in the male.

Large specimens are inclined to fight, so the sexes should be kept separate until ready to breed, and when placed together they should be watched carefully, and again separated if one is inclined to be too violent. When they do spawn, as many as 1200 eggs will be deposited on the side of the aquarium, on a flower pot or a conveniently placed large stone. About four days later the young hatch, and are then placed by the parents, who carry them in their mouth, in holes previously excavated in the sand. After a few days, the yolk-sac having been absorbed, the fry are able to eat, rising from the bottom in a school around the



Acara tetramerus

parents, seeking infusorians. Although the old fish are prone to devour the young at slight provocation, they must be left with them for quite a while, as they prepare food for the young by chewing it into small particles. Unlike other cichlids, this species does not disturb the plants, a feature that commends it to the aquarian who is partial to large fishes.

Large insects are favored foods of the adults—mealworms, mosquito larvæ, etc. —while small rain worms will be relished, too. In a pinch it will eat scraped raw meat. The fry will do well on Daphne after the infusoria stage has been passed and until large enough to take the foods given the adults.

Regarding temperature, 75 degrees, Fahrenheit, suits this fish best, with a fluctuation of 5 degrees higher or lower as the limits of safety.

The generic *Acara* is based on a name given this group of fishes by the natives of Brazil; *tetramerus* means divided into four parts, doubtless given because, to the describer, the dark markings seemed to divide the fish into parts.

Propagating Daphne

W. E. SCHAUMBERG

The ordinary or "garden variety" of goldfish fancier is often at his wits' end for Daphne for his young fish. Why not, therefore breed it in the back yard? Methods that have been described in the past are beyond the reach of the average individual because they involve too much space. Last year I solved the problem in so far as space is concerned, and managed to propagate sufficient Daphne to supply the needs of 700 goldfish.

I secured a cistern measuring six feet in diameter and two feet deep. On the bottom I spread three inches of garden soil. Then I prepared a galvanized wash tub in the following manner: A layer each of manure, wheat bran, ground oatmeal (about 10 quarts), then a few pieces of old meat and some garbage from the kitchen and a final layer of manure. The tub so prepared was placed in the cistern and covered with a piece of one-fourth inch mesh wire netting. This was weighted to hold the contents down and prevent interference when collecting the Daphne. The cistern was then filled with water, and a portion of Daphne placed therein to start the good work.

Within a week the cistern was literally alive with them! When from constant netting they showed signs of diminishing, I boiled some oatmeal and corn meal to a paste, mixing it with about ten gallons of water before putting in the tank. In a few days the "Daph" were as numerous as before. I also found that cottonseed meal sprinkled on the water was apparently eaten by the Daphne.

The cistern furnished a continuous supply of Daphne for my young fish throughout the summer, and saved me many a weary trip when the sun was hot. I kept it covered with mosquito netting, which excluded obnoxious insects and made it safe to transfer the Daphne direct to the rearing tanks without fear of introducing enemies among the fishes. This method is well worth a trial by the city man with a small yard.

The Bureau recently furnished small lots of eggs of the chinook and humpback salmons for display at the aquarium maintained by Rothschild & Co., Chicago, Ill. This aquarium is visited daily by thousands of people. On the troughs containing the eggs memoranda were placed, showing the estimated pack of these species for the present season and information as to the value of canned salmon as food as compared with meats. On November 26 a miscellaneous assortment of over 800 fishes native to the Mississippi River was turned over in good condition to the Rothschild aquarium, the collection having been made in connection with the rescue operations conducted from the Bureau's Homer (Minn.) station.—*Fisheries Service Bulletin.*

A man may be self-possessed and still not have any taxes to pay.

When the fish gets your bait and you don't get the fish you are entitled to a re-bait.

REARING GOLDFISH

GEORGE A. SCHENK

The Author's First Out-door Tank

In arranging for the equipment for raising goldfish, prime consideration must ge given to the aims and purposes of the culturist. If one is breeding strictly for pleasure, and not from a commercial standpoint, he will naturally seek the beautiful, while one engaged in rearing for profit will be more concerned with practical and efficient means, regardless of appearances. Neither need entirely depart from either beauty or efficiency, but the latter is paramount to the professional, while to the amateur the fish in themselves represent but a portion of the pleasure.

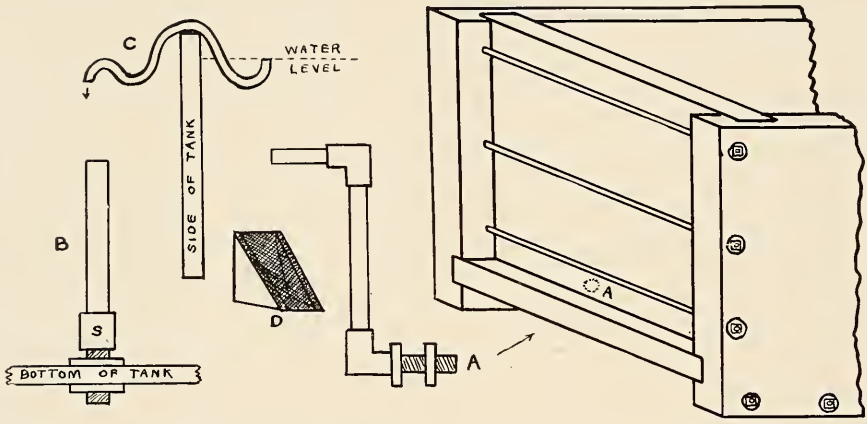
There are many opportunities for resourcefulness and individuality in planning and arranging quarters in which to rear goldfish. Even a single tub can be made an object of beauty, and so fixed as to form a miniature aquatic garden, or it may be made an integral part of a small formal garden. It may be sunken wholly or partially into the ground and the earth banked in a terrace around it, covering this with sod or flowering and foliage plants. One may partially conceal it with ornamental grasses and hardy bamboos.

If means and space permit, the charm of a concrete lily pool will well reward the effort, though pools of large size are not suitable for the development of the fancy breeds of goldfish. Water lilies are of easy culture, but are gross feeders, and require extremely rich soil. In the small pond or large concrete pool it is best that each be placed in a box two to three feet square and one foot deep. Use the best soil obtainable, and mix one-

fourth thoroughly rotted cow manure or one quart of bone meal to each bushel of soil. If the manure is not thoroughly rotted it will ferment and foul the water. It is safer to use the bone meal. Cover the soil with an inch of sand to prevent discoloration of the water. For smaller receptacles choose varieties adapted to tub culture, and plant in large lily pots or suitable boxes. Use but one plant in each pot, and give as much soil as possible. The charm of the water lily, together with the fact that it provides necessary shade during the hot midsummer, makes it the peer of outdoor plants for every aquarist. Catalogs and full cultural directions may be obtained from specialists. Henry A. Dreer, of Philadelphia, and William Tricker, Arlington, N. J., are leaders in this line, and will gladly send their catalogs to those seriously interested.

For rearing fine goldfish the successful breeder uses tubs or wooden tanks. These are placed out-of-doors in locations protected from the hot sun, or shade is afforded by water lilies or other means. Provision is made for running water. Wooden tanks of cypress, one and one-quarter or one and one-half inches thick, are best. The size may be varied to meet individual requirements, but those in common use range from eighteen inches to three feet wide by from three to eight feet long, with an inside depth of twelve to fifteen inches. Preference is given to small sizes when the same volume of water can be obtained by using a larger number. Small tanks are less liable to leak, are easier to handle, permit closer sorting of the fish by size, with the resultant reduction of competition for food, permit checking of disease before it spreads.

In making wooden tanks the sides are rabbeted to a depth of three-eighths of an inch to receive the bottom and end boards, and the end boards are rabbeted to the same depth to receive the bottom. The groove or rabbet should be one and one-half inches from the outer edge of the board. If it is necessary to use more than one board in making the bottom, they should be tongued and grooved, or slip-tongued and grooved, the latter making a superior joint. Give all joints a coat of thin white lead, following it with another coat twenty-four hours later.



In assembling slip the bottom into the grooves in the end boards, and then put the sides in place. Small tanks may be joined together with galvanized lag screws, using screws three by three-eighths for one and one-quarter inch

boards, and three and one-half by one-half for one and on-half inch boards. A metal washer of the proper size should be used to prevent the head of the screw drawing into the wood. To prevent splitting, a hole should be bored for each screw, using a bit one size smaller. Don't set a screw to its limit at once. Insert all in the holes and tighten each one in turn a little at a time, which will draw the tank together with an even, continuous pressure.

Lag screws have great pulling and holding power, and for tanks up to 100 gallons are sufficient in themselves. For larger sizes the sides should be drawn together by one-quarter or three-eighths iron rods, threaded at both ends to take nuts and washers. These are shown in the accompanying sketch.

Inasmuch as a trickle of water runs constantly into the tank, some sort of overflow must be provided. A good outlet can be made from three-quarter inch iron pipe and fittings as shown by figure A. This is inserted through the end board and held by nuts and washers. By raising or lowering the pipe any water level can be maintained in the tank. To prevent the fish from entering the pipe, the end at the bottom is covered by the arrangement shown at D, which merely consists of two triangular pieces of wood and a scrap of brass wire-cloth, held in place by a couple of thin brads. Figure C is a "constant level syphon," which is automatic in action; figure B requires no explanation.

In large rearing tanks it is well to provide partitions of wood or ground glass, which can be removed at will. These permit sorting while the fish are small, and do not require much space.

Wooden tanks should be well seasoned before being placed in use, giving several changes of water over a period of a week or more, the longer and more often the better. Concrete pools require a much longer time for the neutralization of chemicals fatal to aquatic organisms.

When the weather has settled, and all danger of the water dropping below 60 degrees has passed, it is safe to place fish six weeks old outdoors, giving them a small drip of water. The water should not fall directly into the tank, but upon a piece of glass below the faucet, which breaks its force and tempers it. While in the fry stage and feeding on infusoria, still water is conceded to be best, but when the fish are large enough to take Daphne, the slight trickle is decidedly beneficial in promoting growth.

An average goldfish six weeks old will have a body half an inch long, fins have started to develop, and its shape and color will be evident. At this period the breeder should discard all those with spiked dorsals, single tails and other malformations, setting aside the best of the remainder for particular attention. At the age of three months the youngsters will be lusty, healthy individuals, with well-rounded bodies, good fins and telescope eyes, and with the colors pronounced.

Young goldfish require a large amount of food, and they must have it to grow. Live foods, first infusoria and then Daphne and Cyclops, should be in the water at all times. They cannot consume a large amount at any one time, but, practically speaking, they are always eating. Daphne consume oxygen, and unless it is abundant they quickly die and pollute the water, so it is advisable to replenish the Daphne several times daily, rather than put in a day's supply at one time. In addition to live foods, don't overlook the benefits of oatmeal, mentioned in the previous article. When large enough the fish may also have chopped earthworms, raw chopped fish,

clams, mosquito larvæ, and an occasional feeding of prepared dry foods.

Some culturists succeed in developing their fish more rapidly than others in the same length of time. This is in direct proportion to feeding, temperature of water while in the fry stage, volume of water per fish, inherited predisposition to promising brother who receives only ordinary attention.

Ten or more species of *Danio* are known to science. Four of them, *D. rerio, analipunctatus, albolineatus* and *malabaricus,* have been bred by American aquarians.

A Few of Wilt's Baby Goldfish. Photo by H. W. Schmid

size from parent stock, and last, but by no means least, the thought and intelligent attention they have received. Granting this, the importance can be realized of making short work of all undesirables, and concentrating full effort and attention on the few picked specimens. Permit me to emphasize this point by saying that a fish with only fair possibilities can, by exceptional care and feeding, be developed into a better adult than his more

Your delightful Aquatic Life will be a great acquisition to our library, and will be of great interest and value to members interested in aquaria, as well as to the scientist.—H. E. Finckh, *Honorary Librarian,* Royal Zoological Society of New South Wales.

A good college text-book of zoology should be in the library of every progressive aquarian.

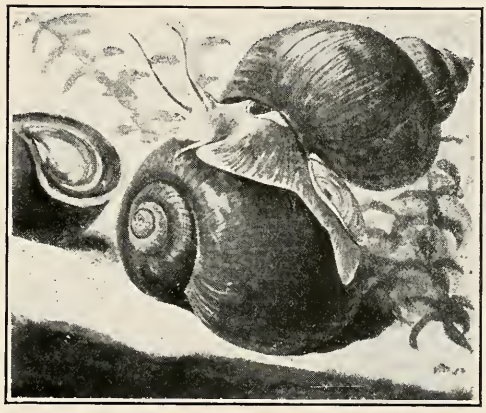
Our Interesting Friend the Snail

REV. FREDERICK R. WEBBER
Chicago Aquarium Society

Every observer of nature has at some time or other waded into pond or stream and captured a supply of snails. At the time he may not have been vitally interested in them. But then the day came when said observer's home was filled with aquaria. There were aquaria in every window, aquaria on the library table, aquaria in the kitchen, fish in the dishpan and fish in the laundry tubs. At this stage in his career, the fish fan has paused during his expedition for fleas and corethra larvæ, to gather a few snails and experiment with them in his tanks. He has found some of them to be just as good as a 15-cent department-store snail, while others from his catch have worked with the proverbial perseverence worthy of a better cause, eating his imported plants. At about this stage in the game the aquarium fiend has dug up his old school zoology in order to read up on the snail family.

The old text probably revealed the astonishing fact that his snails, like ancient Gaul and modern gall, are divided into three parts, the right-handed *Lymnaea,* the left-handed *Physa,* and the flat *Planorbis,* which was alleged to be neither right nor left, but coiled like a watch spring.

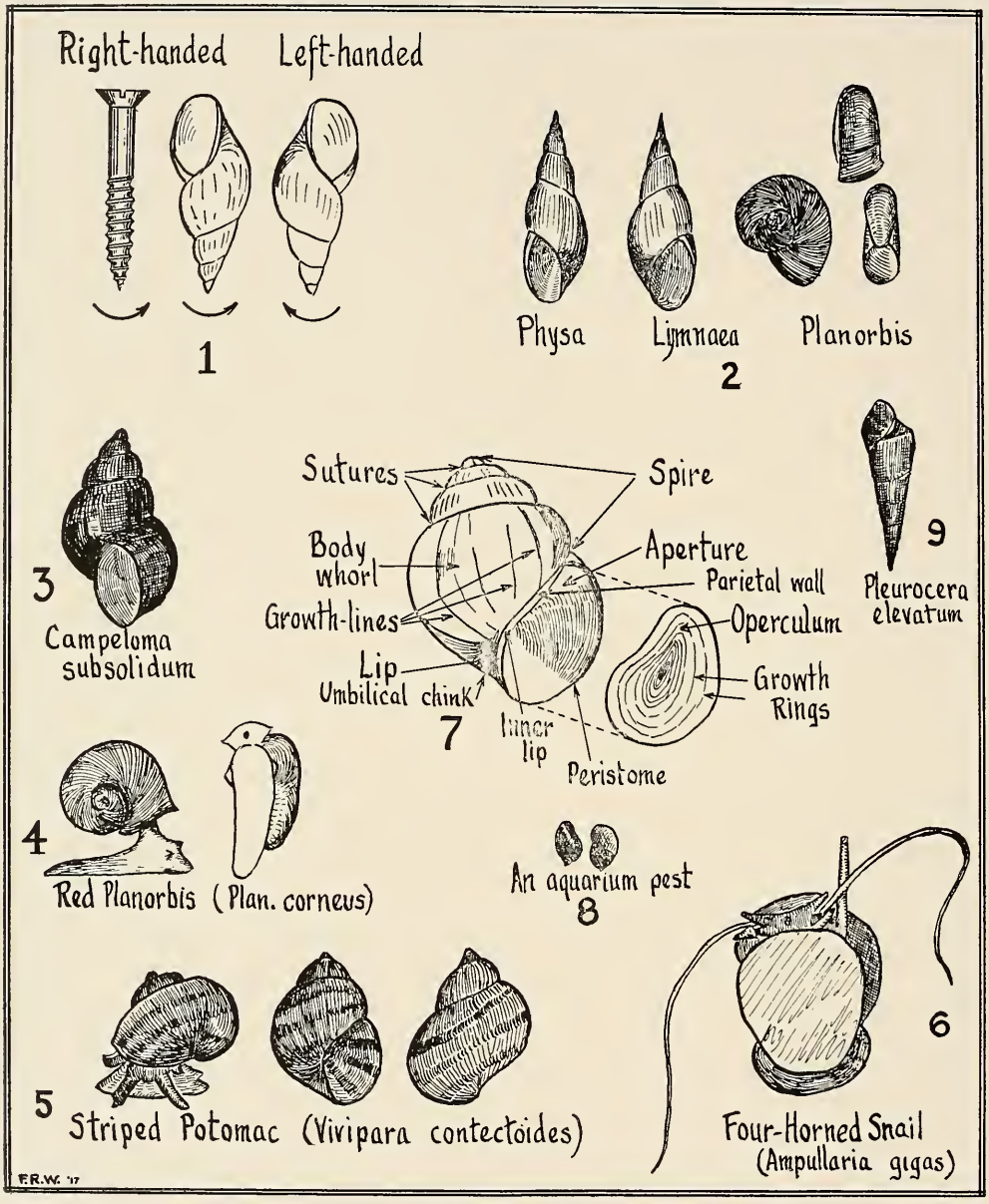
It is true that, like the long-suffering monkey wrench, snails may be either right-handed or left-handed. This may be observed by comparing the shell, point downward, with a common wood-screw, which is right-handed at present writing. But not all *Lymnaea* are left-handed, although the majority of left-handed *Lymnaea,* like children with the Little Eva disposition, are found only among the departed. Several species of these have been imported from Hawaii, and have even been reported to have been found in America. We have also heard of right-handed *Physa.* And if one examine *Planorbis* closely, he will discover that, although flat and wound like a watch spring, yet his aperture, or opening at the large end of the shell, inclines to the one side. Therefore even the infallible school zoology textbook is at times slightly fallible.



Ampullaria gigas

Roughly speaking, we may recognize Lymnæids by the elongated shell, pointed spire, usually with sharp tip, the ovate aperture, which sometimes is long and narrow, and the usual absence of the operculum, or trap-door, covering the open end of the shell. They come in assorted sizes. We have the small *Galba dalli,* which is less than three-sixteenths of an inch in length, to the *Lymnaea stagnalis,* which is two and three-eighths inches long.

A glance at Figure 7 (page 106) will



show the various parts of the shell of an operculate snail. Snails, like men, have mouth, eyes, gullet, stomach, intestines, heart, one or more kidneys, sometimes a lung, one or more sexual organs, a foot, a muscular system, a nervous system and a sense of touch. Their senses, in some cases, are not acute. For instance, a snail is not keen sighted. At least, like the fish, he is near-sighted. On the other hand, his sense of touch is good. The writer has found that the slightest touch will cause the four-horned snail to drop instantly to the bottom, and close his operculum. The sense of smell must also be good, for every aquarian knows the

quickness of the snail to discover a dead fish. The sense of hearing is probably not acute. In the case of the land-snail, the eye is at the end of a tapering, tubular organ, resembling the finger of a glove. This eye can be pulled in, much as in pulling off a glove, the tip might stick to the finger.

As a rule, the pond snail has no operculum, or trap-door. They are commonly plant and algæ eaters. They will eat vegetable matter, either living or dead, and will eat flesh from necessity or from choice. A practical joker recently cleaned a sardine from a can, and placed it in the writer's "big tank." In a very short time the sardine was alive with snails. They surrounded it until there was no room for the late comers. But we observed that they did not fight for places in the circle. Late comers waited patiently until there was an opening. There was no sign of eagerness, or of the larger ones displacing the smaller.

The snail's tongue is described as file-like in structure. It is flat and ribbon-like. Across it run a series of bilaterally symmetrical teeth, arranged in patterns. These patterns vary as widely in different snails as colors and shapes vary in tropical fishes. Each class, order, genus, species, and even sometimes different species in the same genus, differ in this respect. These varying tongue-patterns are valuable to scientists in classifying specimens, where exact work is desired.

Some snails are lung-breathers, while others breathe by gills. The lung-breather comes to the surface for his air. He rises suddenly to the surface, extends a tube-like organ above the surface film with an audible sound, and collects a supply of air, to be taken to the bottom and consumed at leisure. Operculates live on the bottom and breathe by gills. Those without an operculum are commonly air-breathers.

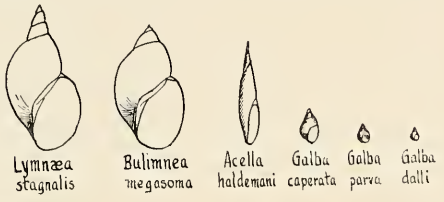
Water is not always necessary for the snail. Land snails do not require it for their habitat. River and pond snails, when dry weather comes, and the pond or stream dries up, bury themselves from two to four inches in the bottom. Some have even been found 18 inches in the mud.

Every now and again some aspirant for membership in the already crowded Ananias Club will record the fact that river and pond snails have been known to live for years in a tin box, or glued to a cardboard mount. But no conchologist would preserve a snail without first removing the body. River and pond snails will live for several days packed in wet moss. They have even lived in such a condition for two months, according to some authorities. One scientist mentions 45 days out of water as a remarkable incident. Some of the *Lymnaeidae* family have been known to live for some time without rising to the surface for air. And yet if one were to seal a snail in a bottle filled with water, he would soon die.

It is interesting to collect shells of dead snails from the bottom of one's aquaria, and clean them by gently brushing with a weak solution of oxalic acid and a toothbrush, being careful not to remove what epidermis remains. Or if one wishes to collect live snails, they may be quickly killed by plunging them in hot water. It's cruel, yet scientific. Upon examining the snail's shell one will observe more or less vertical, parallel striations on the shell, and rings on the operculum. These are growth rings. The snail adds growth rings after the fashion of a tree. Every now and then we will notice a dark line, or even a section of the shell, showing a different color. Some writers have held the opinion that this difference in sculp-

ture is due to varying food supply. However, the best authorities think it due to a change in environment. Most of our readers hold with the latter authorities. The difference in water—acidity, salinity or alkalinity—or the difference in the character of the river bed, pond bed, or aquarium bottom, is probably the true explanation of these differing sections of the shell.

The periostracum, or epidermis, is a thin, skin-like substance, covering the shell. The color of the shell is in this



Six Members of the Family Lymnaedae

epidermis. When it is removed the shell becomes chalky. In a clean aquarium, a shell will be bright, clear yellowish or brownish. When taken from a pond with a muddy bottom, with abundant decaying vegetation, it is almost black. In nature, shells range from dark brown to almost waxy white. One much eroded at the spire indicates acidity locally present in the water.

When a snail crawls, he leaves a trail of mucus behind him. A large four-horned snail, having escaped from a tank for some reason undiscovered, was traced across the room by a trail of shiny mucus. Some snails can crawl, shell downward, on the surface film of the water. The Paper Shell can sometimes be observed doing this. Other snails spin threads and suspend themselves from a plant, or even from the surface film. Still others can suddenly rise to the top, or sink to the bottom like a rock, simply by adjusting their specific gravity.

Some snails lay eggs: others are live-bearing. Some are males, some females, while others are normally hermaphrodites, that is, possessing both male and female functions. One writer records the fact that he observed a snail exercising the male function with a female, and the female function with a male at the same time. Still another instance is recorded of two snails mutually exercising the reproductive function. Even self-fertilization is said to be found among them.

Generally speaking, snails provided with an operculum are not harmful to plants in an aquarium. The four-horned snail, *Ampullaria gigas,* is an exception. A member of the Chicago Aquarium Society recently, at our advice, dropped two of them into a hydra-infested tank. We forgot to tell him to remove them when the hydra were gone. The result was that in a few days every plant in the (small) tank was destroyed completely. One of the members of the Chicago Aquarium Society positively declares that they will eat baled hay!

The writer once experimented with the minute wide-mouthed pond snail. They multiplied in the tank like the proverbial "chinch-bug" of Kansas. We could not get rid of them. The snails were very small, and it required patience to remove them. But every day we made it a part of the program to remove twelve snails. Before we had finished we had a layer a quarter of an inch deep, covering the bottom of a six-inch tobacco jar! Beware of this snail. He eats the green tissue out of the plants, leaving only an unsightly yellow skeleton. And he's almost impossible to eliminate, unless one remove all the water, burn the plants, scour the tank and begin anew.

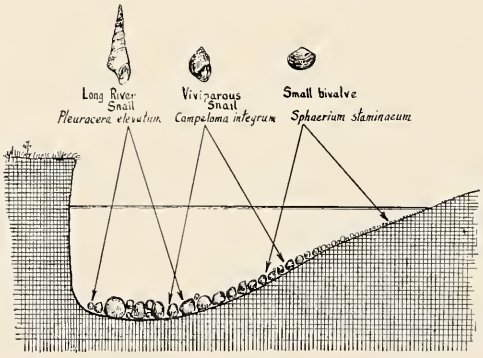
For the aquarium, the beginner will find the Striped Potomac, *Vivipara contectoides;* the Jap, *Vivip, malleatus;* the

Red Planorbis, *Planorbis corneus rubra,* the Paper Shell, *Lymnea auricularia;* and the commoner river operculates of value in his tanks. Snails in a small tank soon deteriorate in size. This is probably not so much due to inbreeding as to the concentration of certain salts in the water, as the water evaporates and fresh is added. The same is more or less true with fishes. Ergo: siphon a little water —always from the bottom—occasionally, and add a little lime (plaster of paris) for shell structure.

And now a word or two on ecology. Snails are distributed in communities. In a city we have the Gold Coast community, the German district, Swedish district, Irish section, ghetto, Italian colony and Polish community. With snails likewise. An illustration shows a cross-section of a stream at a bend. On the outside of the bend is a steep bank, deep water, current and large stones on the bottom. It is clinging to these stones that the long river snail, *Pleurocera elevatum* may be found. In midstream, with shallower water, less current, smaller stones and some gravel, we find the live-bearing *Campeloma integrum.* On the inside of the bend, with shallow water, little current, bottom of fine sand and gravel, we find the small bivalve *Sphaerium stamineum.*

The longitudinal section of a river is interesting. At and near the mouth we normally find a pond condition and animals of the pond community. Here we find sluggish water, sedimentary bottom, vegetation of the emerging and floating type, and decaying vegetation on the bottom. The snails and fishes here are of the still-water or sluggish water type. *Lymnaea stagnalis,* with black shell, is found here, and other eaters of decaying vegetation.

As we go upstream we find more current, fewer emerging plants, more of a rocky bottom, and a different type of snail. Then comes a condition still farther upstream, of more current, rocky or sandy bottom, vegetation only along the banks, etc. Farther on we find a shallow-water condition, more current, protruding rocks, and riffles here and there. The fishes and snails here are yet different. At the head of the stream is a spring-brook condition, with all the animal life that goes with it. It is said that if the upstream snails be brought downstream, and the downstream snails brought upstream, that they will gradually return to their original habitat. Local obstructions, such as dams or deep pools, may cause a local pond condition. On the other hand, a hard layer of rock may cause a rapids condition well toward the river's mouth. The snails here are of the respective kinds found in pools and in rapids.



Cross Section of a Sluggish Stream at a Curve, Showing Distribution of Snails

(By the Author, after Shelford)

Young ponds, with bare bottom, and no plants but possibly *chara,* contain very few snails. Older ponds, of the submerged vegetation association, with bulrushes on the border, and other aquatics coming in, become the homes of a few varieties of snails. These snails are of the gill-breathing type, contain no operculum, and may be relied upon to eat plants. In mature ponds, say of the

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

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Practical articles and notes on topics pertaining to the aquarium and terrarium are always wanted for Aquatic Life. Readers of the magazine are invited to join in making it a medium of mutual help, and to contribute to it any ideas that may occur to them. The pages are always open for anyone who has anything helpful and practical to say. Manuscripts, books for review and general correspondence should be addressed to the editor.

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emerging vegetation type, with reeds, bulrushes, cat-tails, floating *spirodela polyrhiza, Lemna minor,* etc., and an abundance of rotting vegetation on the bottom, are the homes of *Lymnaea stagnalis, Lymnaca reflexa,* and some species of *Planorbis* and *Physa.*

Observation on the part of the snail-seeker will be rewarded by much interesting information. A closer study of friend snail is well worth the effort.

The regular meeting of the Philadelphia Goldfish Fanciers' Society was held at 802 Girard avenue, March 20th. Transparent-scaled and scaled Telescopes, bred in 1917, competed for the Board of Directors Cup and the usual ribbons. Judges, H. E. Demuth, J. A. McDevitt and F. S. Leffman, made awards as follows:

Transparent-scaled Telescopes: *Cup, blue and red ribbons* to George E. Wilt; *yellow ribbon,* Charles Hinkle.

Scaled Telescopes: *Blue and yellow ribbons* to George B. Smith; *red ribbon,* Charles J. Hannig.

Elected to membership: Herman Kempter, Samuel MacFeeters, Robert B. Cathcart and Francis J. Rowe.

The competition at the next meeting, April 17th, will be for Japs, scaled and transparent-scaled, under one year. The C. J. Hannig Cup and six ribbons will be awarded. Officers for the ensuing year will be elected.

At the February meeting the Ribbontail Japs and Telescopes were judged by George E. Wilt, John Eck and Thomas Ayling. Result:

Scaled Telescopes: *Blue and yellow ribbons,* Gustav Armbruster; *red,* Charles C. Hampel.

Transparent-scaled Telescopes: *Blue,* Dr. L. W. Rehbein; *red,* H. E. Demuth; *yellow,* William J. Christy.

Scaled Japs: *Blue,* Dr. F. C. Leffman; *red and yellow,* John Krause.

Transparent-scaled Japs: *Blue and red,* Dr. L. W. Rehbein; *yellow,* C. C. Hampel.

At this meeting Mr. William Lynn, Jr., Philadelphia, was elected to membership.—Fred Richardson, *Secretary.*

Carnivorous fishes are usually characterized by a short intestine, while that of the omnivorous and vegetarian species is long. In the familiar Swordtail, *Xiphophorus helleri,* the intestinal tract is about twice the length of the body.

When you communicate with an advertiser, please say you saw "it" in Aquatic Life.

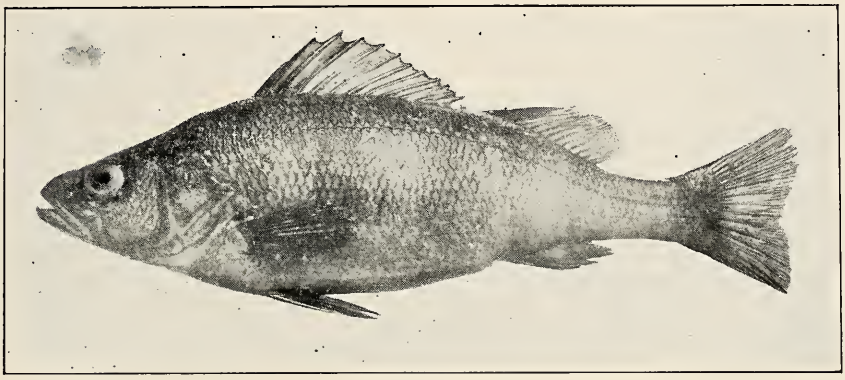
There's never so good a time to fish as when the fish are biting.

May 1918 10c Copy

Aquatic Life

The History of Ichthyology. Part 1

MAJOR R. W. SHUFELDT, Medical Corps, U. S. A.



THE YELLOW PERCH PHOTOGRAPH BY THE AUTHOR

That branch of the biological sciences which is devoted to the study of fishes, has long been known as Ichthyology, the term being derived from two Greek words meaning, when combined, a treatise on fishes. As in the case of any other group of animals, in studying them we not only turn our attention to the consideration of their external forms, their color, and the structure of their topographical parts, but, in addition thereto, the study of the geographical distribution of fishes; their anatomy as a whole; their habits and ecology, and, finally, as much as can be discovered through research of fossil fishes and their distribution in space and time—that is, palaeoichthyology.

Fishes are now divided into a number of classes, which, when taken on the whole, include all the back-boned or vertebrate types of animals almost entirely aquatic in habits, which breathe by means of gills or branchiae, the air thus obtained being dissolved in the water. Instead of limbs as seen in terrestrial animals, fishes have the structures known as fins to which are added, in many species, median or unpaired ones of like structure. The heart is two-chambered (atrium and ventricle); while, as a group, fishes are as a rule oviparous, the exceptional few being viviparous. Their skin may be smooth and scaleless, or covered, as in most cases, with beautiful scales, varying greatly in form, size, and coloration. Sometimes these scales are so large as to form veritable plates or bucklers, and in many instances are variously modified for special purposes. A consideration of all these departments of ichthyology covers an immense field for research, an extremely small part of which is at present known.

In tracing the relationships of fishes, we find that they almost imperceptibly pass into the Batrachia above them in the scale, while below they tend to merge

into the invertebrata.

In considering the anatomy or morphology of fishes, it is well to select a typical bony, or, as an ichthyologist would say, a typical teleostean form, from the center of some average group. For this purpose the common perch has long been the favorite form employed to meet this demand, not only in this country, but in other parts of the world. As will be seen in my photograph of the common yellow perch of our waters, reproduced as a cut to the present article, this species, in the matter of form and fins, very perfectly strikes the average teleostean fish; this also applies to its skeleton and to other parts of its anatomy. Particularly is the perch's skeleton the standard for ichthyan osteology in text books and popular works on fishes throughout the literature of the subject.

Apart from the special students of fishes, who have gone over some of the literature referring to them, there are few who appreciate how very old the study really is. The fact that it commenced far, far back in history, about the time when men began to interest themselves in other departments of natural history, goes without the saying. Perhaps of all the zoological writers, Aristotle stands among the very earliest, and he flourished nearly 2300 years ago. Think of a writer on fishes twenty-three hundred years ago, that possesses a very general and more or less accurate knowledge of the anatomy and distribution of such forms! Not only was Aristotle familiar with some 115 fishes found in the Agean Sea, but he had described them specifically, and studied their morphology. Unfortunately he possessed very hazy ideas in regard to specific definitions; and he accepted, on the whole, the names of many of those fishes that had been bestowed upon them by the fishermen of that region. As a consequence, it is now difficult to determine the species to which he referred in his works. Then, too, he frequently applied different specific names to the same fish at various stages of its growth, and when one comes to think that Aristotle used only the vernacular names in nearly all instances, it is plain to be seen how slender the chances are that we shall ever ascertain to which species he refers in any particular instance.

On the other hand, this ancient ichthyologist was remarkably accurate in such matters as referred to the habits of the fish he described; their different modes of propagation; migrations, economic values, and so on. When we come to consult this writer's works on fishes, we soon discover that he recognized the fact that such cetaceans as the whales and their allies were mammalalian forms and not fishes at all; that the former possessed lungs and mammæ, while true fishes had fins and branchiae. He knew that Muraena lacked fins, and that eels had but two of them. He knew further that the cartilaginous fishes, such as the sharks and dog fishes, possessed no operculum, but that nearly all true teleostean fishes had those bones on the side of the head to re-enforce the gill-slits and protect the branchiae.

Aristotle also pointed out that all fishes were hairless and featherless; that most of them were scaled, while others had only a smooth, or in some instances, a rough skin. He described the tongue of ordinary fishes correctly, and stated further that fishes never had eyelids. He knew that they used their entire body when swimming, and that ordinary fishes, or indeed any fish, ever had ears or structures that might be called nostrils. Fishes possess red arterial blood, and enjoy the senses of hearing, smelling and tasting. While they lack a urinary

bladder and kidneys, they nevertheless possess a liver, a gall-bladder, and a heart.

As Aristotle stated, "they vary much in the structure of their intestines; for, whilst the mullet has a fleshy stomach like a bird, others have no stomachic dilatation. Pyloric caeca are close to the stomach, and vary in number. There are even some, like the majority of cartilaginous fishes, which have none whatever. Two bodies are situated along the spine, which have the function of testicles; they open towards the vent, and are much enlarged in the spawning season. The scales become harder with age. Not being provided with lungs, fishes have no voice, but several can emit grunting sounds. They sleep like other animals. In most cases the females exceed the males in size; and in the rays and sharks the male is distinguished by an appendage on each side of the vent."

Thus we see that Aristotle was a very remarkable man, and far and away ahead of his time in his mastery of ichthyological lore. As a discover in zoology he had no equal, and those who followed immediately in his footsteps were nothing more than mere imitators or commentators. Even his disciples and contemporaries fell in the same category; they were quite content to fall in the class of mere copiers, and if they made changes at all, it was merely to convert the Aristotelian truths into vague fairy-tales and fabulous accounts. This being the case, zoology soon ran into an era of meagre production along such lines, with a consequent lack of interest in such subjects on the part of every one.

Thus things stood until the dawn of the middle of the Sixteenth Century, when Salviani, Belon and Rondelet appeared in the field. Each of these writers contributed to ichthyological science a volume of the greatest importance. These several works appeared almost simultaneously. Taken as one contribution, they accomplished at least one great end; for they fixed for all time what a species meant in zoological science.

In my next part the works of these three great ichthyological writers will be briefly touched upon.

Eleotris marmorata

C. J. HEEDE

The Far East has given many odd fishes to the aquarian, and not the least is the Marbled Eleotris, *E. marmoratus*. This peculiar species is found in the fresh and brackish waters of India, Sumatra and Borneo.

The body is grayish brown with a faint rose tint, overlaid with heavy brown or black markings, which also pre-

Eleotris marmorata

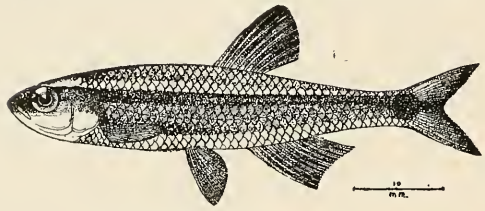
dominate on the caudal or tail fin; other fins with dark markings. The head is broad and the mouth capacious. Alert protruding eyes and well developed pectorals bespeak short, quick dashes for food. It reaches a length of three inches and is one of the smaller species of the genus.

This Eleotris is decidedly nocturnal in habits, spending the day hidden amongst the plants with which the aquarium should be well stocked. At night it sallies forth in quest of food and play. It is carnivorous and prefers Daphne and chopped earthworms—enchytraeids would be excellent. The water in the aquarium should be maintained at an average temperature of 75 degrees, Fahrenheit. The species has apparently not been bred under observation.

The Copper-stripe Dace

WILLIAM T. INNES

Notropis chrosomus was discovered by Jordan in 1876, and is a desirable inhabitant of the cold water aquarium. It was found in Georgia, and is common in clear brooks and outlets of springs throughout the drainage of the Alabama Basin. A closely related species, *Notropis metallicus*, is so similar that it is difficult for the amateur ichthyologist to distinguish one from the other. When the identification of any fish is in doubt, it is much the best plan to submit specimens to a competent ichthyologist. Erroneous identifications are veritable weeds to the scientific worker, who is thus put to great unnecessary labor in running down false trails.



Notropis chrosomus
Drawing by Henry W. Fowler

The following description is taken from the words of Jordan. The original or type specimen is in the collection of The Academy of Natural Sciences, Philadelphia.

Notropis chrosmus Head 4; depth 4¾; D 8; A 10; scales, 38 in lateral line to caudal base, and two more on later; 7 scales above lateral line; 4 scales below lateral line; 22 scales before dorsal; snout, 3 1-3 in head; eye, 3⅜; maxillary, 2⅞; interorbital, 2 4-5. Body elongate, well compressed, rather slender. Head moderate, compressed. Snout convex, slightly abrupt in front, length 4-5 of its width. Eye rounded, mouth inclined, rather large; lower jaw slightly protruding and upper protractile; maxillary reaches eye; interorbital rather evenly convex. Scales rather small and well exposed. Lateral line complete, decurved. Insertion of dorsal midway between eye-centre and caudal base. Anal inserted about opposite last third of dorsal base. Caudal well forked. Pectoral reaches ¾ to ventral; latter inserted well before dorsal and reaches vent. Color hyaline—green with bluish tints. Belly silvery. Head above and vertebral line golden; light narrow scarlet streak from opercle above to caudal base, and below this a silvery line. Row of black dots along lateral line, forming into small distinct caudal spot. Scarlet bar across anal, caudal base and dorsal. Spring males with muzzle and top of head tuberculate, and finer tubercles before dorsal. Length 2½ inches.

The writer kept six specimens for several months in water of moderate temperature. Their active habits and gentle nature, combined with attractive coloring of the fins and the copper and dark stripes along the sides, make them a delightful aquarium fish.

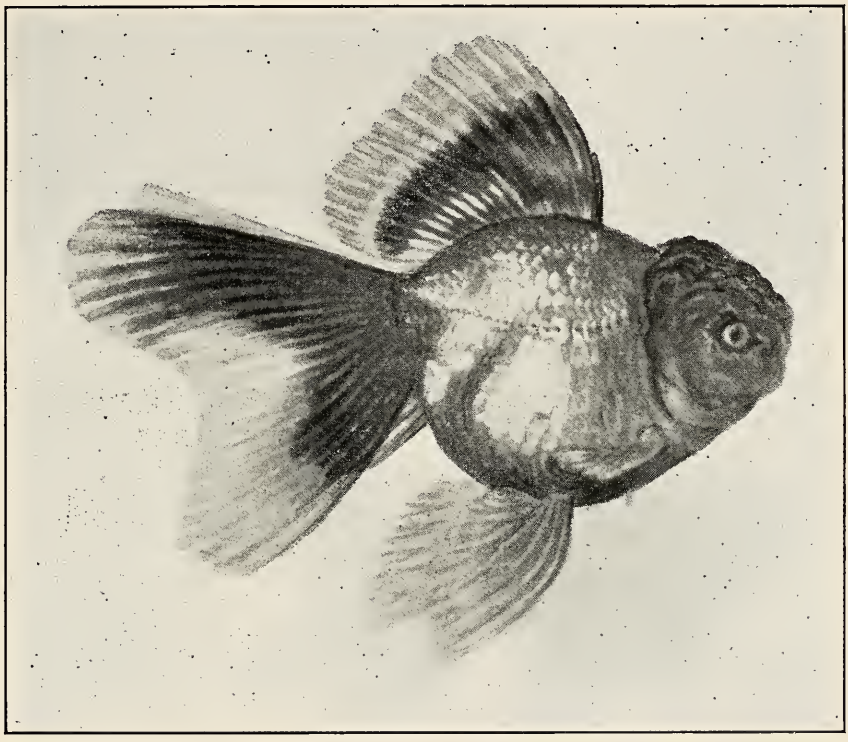
The fact of their coming from the South led aquarists at first to treat them as a tropical fish. Under these conditions they died rapidly. Since it has become known that they inhabit cool, spring-fed brooks, we now keep them in moderate to cool aquaria, where they do well, particularly with aeration.

To better handle their constantly increasing business, the Aquarium Stock Company, breeders and dealers in fishes and other supplies for the aquarian, have removed to larger quarters at 273 Greenwich street, New York City.

Several readers have written that Schaeffer's "Magic," a preparation to promote cultures of infusorians, is quite true to its name.

A Japanese Method of Breeding the Goldfish

EIICHIRO NAKASHIMA



JAPANESE BROADTAIL ORANDA OWNED BY FRANKLIN BARRETT

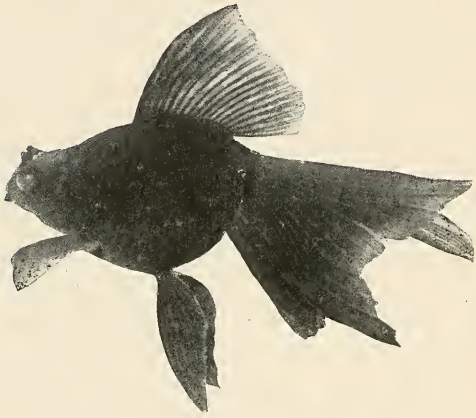
Propagating goldfish by "stripping" or artificial expression, that is, forcibly pressing the eggs and milt from the parent fishes, has been practiced successfully for several years by Japanese goldfish breeders. More than 80 per centum of the eggs are fertile. Usually it is only the rare and high-priced fishes that are handled in this manner.

The parent fish should be selected among those from three to five years old, and should be well formed and perfectly healthy. These should be kept separately, and from the end of autumn fed good, nourishing food, such as ground shrimp mixed with boiled corn meal, or worms, etc.

The breeding season depends upon the climate, weather, water, temperature and other conditions. When the season has so far advanced that the water temperature is uniformly more than 60 degrees, Fahrenheit, spawning commences. Whether or not the fish are ripe can be ascertained by a slight pressure on the abdomen, or by the actions of the male

when the sexes are placed together. If a spawning is soon to occur he will be swimming by her side, pressing her abdomen with his head and otherwise trying to drive her among the plants.

The wash pan or wood box in which the operation is to take place should measure three feet square and five inches deep, and contain two inches of clear water of the same temperature as that from which the parent fish will be taken. In this is placed the nest to catch the



Black Telescope Goldfish

eggs. The preferred nests are of *Myriophyllum,* water hyacinth, bark of the Japanese palm tree or the roots of the willow. Nests of the water plants, the two first named, should be placed for several days in clean water to eliminate snails, insect larvae and other enemies of the eggs and fry, and further cleaned by a weak solution of permanganate of potash. The last named materials should be boiled in water and washed clean. For artificial fertilization they are to be preferred to the living plants, as they can be used a number of times and are always clean and free from detrimental organisms.

Now take up the fish, the male in the right hand, and the female in the left, turning their heads in an inward direction as they approach each other. Then shaking faintly and giving just a slight pressure on their abdomens with the thumb and forefinger, scatter the eggs and spermatozoa all over the nest, that both may be well distributed to assist in fertilization.

In another method a very small quantity of water is used; just enough to keep the nest afloat in the receptacle. The eggs are pressed gently from the female and scattered over the nest, the sperm being similarly expressed from the male and the water then carefully stirred with a bird feather. Half an hour later add plenty of water of the same temperature. This method is rather troublesome, so the first is to be preferred.

If the weather is made unfavorable by great humidity, it is better to defer the operation, as there is greater possibility of the eggs being attacked by fungus, *Saprolegnia.*

The receptacle containing the nest and eggs should be covered with glass and placed in a sunny situation, where it should be protected against sudden changes of temperature. Fertilized eggs are transparent and white or yellowish, whereas the infertile eggs soon become opaque, milky-white and are attacked by the white fungus, *Saprolegnia.* These should be removed lest the fungus spread to the fertilized eggs.

The period from the first division of the egg cell to the appearance of the black spots (the eyes), is the most important as a slight touch is injurious. The period for incubation varies principally with the temperature, being usually as follows:

Water temperature	Incubation
60°—70° F.	8 to 10 days
70°—80° F.	5 to 7 days
80°—90° F.	2 to 3 days

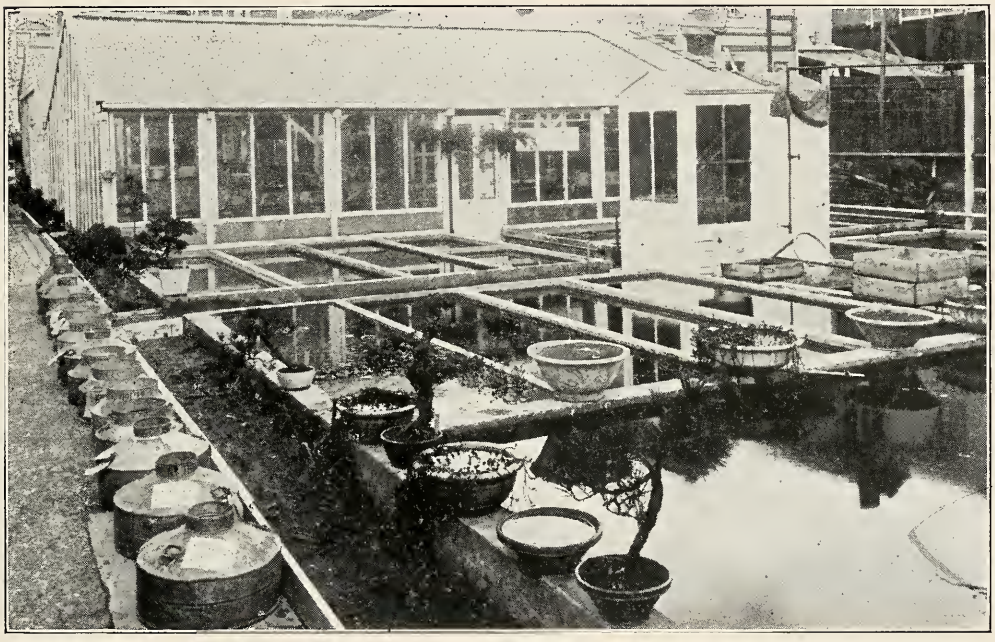
Eggs that take more than 10 days or less than three days to hatch, usually give fry that are not so strong as those which hatch on the 7th day.

When the tiny fry appears it has an abdominal yolk-sac attached which furnishes the needed nourishment for the first week. When this has been absorbed the nest should be removed, as the fry is now free-swimming. Every morning during the second week the yolk of a hard boiled egg should be fed by filtering it through cheesecloth. At times this may putrefy in the water, so *Daphnia* and *Cyclops* should be introduced as scavengers, besides they are the best foods for the fry large enough to eat them. These natural foods, including *Cypris* and mosquito larvae, should follow the hard boiled yolk of the chickens' eggs.

When a month old the fry have well developed bodies and fins. The good specimens should be selected, the water changed, and each ten fish allowed a gallon of water.

It is believed that a mature fish may produce about 110,000 eggs. Generally the first spawn is not large, and there is an inclination to weakness, but the second consists of great numbers of eggs, about 40 per centum of the whole, with high fertility and strong fry. Spawns continue at intervals until weather conditions become unfavorable, but the numbers of eggs become less and the fry not so strong as those produced earlier in the season.

(Mr. Nakashima is a graduate of the Imperial Fisheries Institute, Tokyo, Japan. He has had practical experience with K. Akiyama, whose goldfish breeding plant, in Tokyo, is the largest in the world, and is at present managing the plant of the Nippon Goldfish Co. Through Mr. Nakashima arrangements have been made to have photographs taken in Tokyo that will prove interesting to American goldfish Breeders.—*Editor*).



The Outdoor Pools and Conservatories of the Nippon Goldfish Co.

If you would be continuously happy you must know when to be blind, when to be deaf, and when to be dumb.

On the Use of Oxygen in Aquarium Aeration

ERNEST LEITHOLF

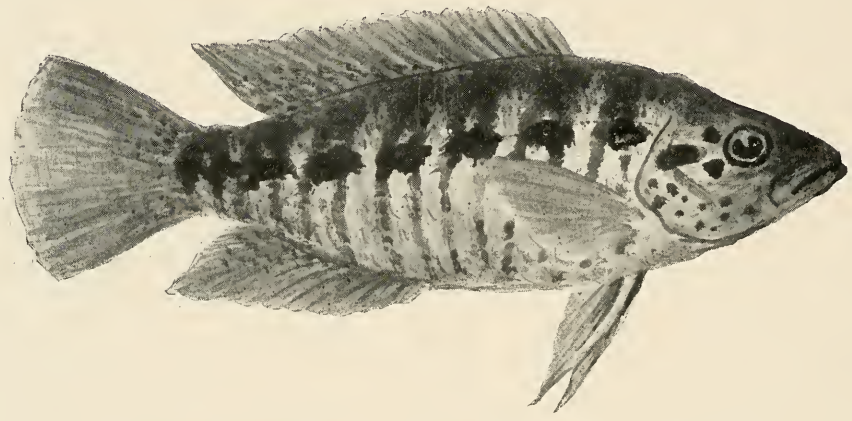
Desiring to install a syste mof aeration, Mr. Adolph Dormeier, of Pittsburgh, suggested compressed oxygen as a possible solution of the problem. While familiar with the use of this gas in cases of drowning and asphyxiation, and its employment in shipping live fishes in sealed cans, its suitability for our purpose seemed problematical, nevertheless, it was subsequently installed in our conservatory.

The outfit is exceedingly simple, consisting of a tank or cylinder of oxygen, a pressure regulator, a pipe line to the aquaria and some fittings.

The regulator we employed is the style used in welding. One gauge indicates the pressure and amount of oxygen in the cylinder, while the other serves to reduce the pressure to the "working point," at which it is desired to use it. This apparatus is expensive. A low pressure regulator, which can be adjusted to deliver the oxygen at the proper pressure for use, will serve the purpose just as well and costs but a third as much.

The discharge line from the oxygen tank to the aquaria was constructed of one-eighth inch iron gas pipe, with a T fitting at each aquarium. In the outlet of each T was placed a "crank case drain cock," and from the cock to the releaser or distributor in the aquarium, a length of rubber hose.

We are using two kinds of releasers. One is a cross-section of basswood inserted in the end of the hose in the aquarium, the other was made by Mr. Dormeier from a piece of hard carbon, such as is used in arc lights and dry batteries. Taking a piece 2 inches long and ¾-inch in diameter, a hole was drilled lengthwise, not quite to the other end. A short section of brass tubing was cemented in the hole to which to attach the rubber hose.



Cichlasoma steindachneri Original Painting by W. L. Brind

To assemble and operate the outfit, the pressure regulator is first attached to the cylinder of oxygen and connection then made to the discharge line running to the aquaria. Making certain that the regulator indicates zero, open wide the main valve of the cylinder. Then turn the adjusting screw of the regulator until sufficient oxygen is passed to aerate the aquaria.

Tanks or cylinders of compressed oxygen can be secured from the Linde

(Concluded on Page 120)

A New Subspecies of Thorichthys Helleri

WALTER LANNOY BRIND, F. Z. S.

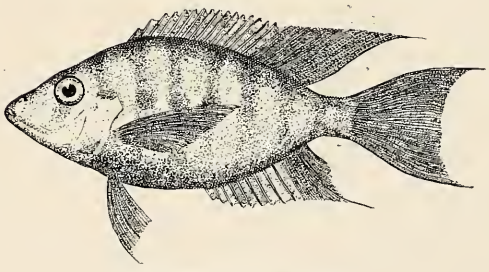
When Dr. Seth Eugene Meek was studying the fishes of Mexico he noted certain characteristics in several species of *Cichlasoma* that seemed to set them apart. For these he proposed his genus *Thorichthys,** designating *T. ellioti,* a new species, as the type. *Thorichthys* differs from *Cichlasoma* in having a "deep body, much compressed; mouth rather small; caudal fin lunate, its outer rays produced into a filament; pectoral fin long and pointed, about as long or longer than the head; *subopercle* with a black blotch, otherwise as in Cichlasoma" (Meek, Loc. cit.) He adds that *T. helleri*. and *T. ellioti* are very variable, though they represent quite a distinct type of cichlids.

Typical examples of *T. helleri* are light olive in color, with six rather indistinct dark cross-bars; side of head with small blue spots; a black spot on subopercle or lower margin of gill cover.

Thorichthys helleri meeki subsp. nov.

In May, 1917, a French sailor arrived in New York with 265 specimens which he had captured in the shallow reaches of a river near Progreso, Yucatan. These were soon distributed among aquarians and the fish became popularly known as the scarlet chanchito. The fish presents such a marked departure in color from the type that the writer proposes for it subspecific rank. Meek in his color description of the species, makes no mention of the presence of red. In our specimens a brilliant scarlet suffusion and striping extends from the throat and lower gill covers back and beyond the extremities of the pectoral fins, otherwise the coloration is much as in the type. It is more than likely that the fish is a local color variety, but the fact that so many specimens were collected, indicates that it is well established and is not to be regarded as an individual variation. The type specimen has been deposited in the United States National Museum, where it is recorded as Accession 61490.

For the aquarium the scarlet chanchito



Thorichthys helleri meeki

makes an attractive specimen. While its breeding habits have not yet been observed, it does not appear to be a difficult fish to maintain. It reaches a length of six inches, a goodly size as "aquarium fishes" go, so it follows that a roomy, shallow tank should be provided if one would have it flourish. As it comes from Yucatan, well within the Tropic of Cancer, it is a truly tropical species and should be treated as such, care being exercised not to permit the water temperature to drop below 70 degrees. While it will take dry prepared foods, preference should be given to tender worms and similar materials.

That the differences in the proportions and shapes of the fins of *Cichlasoma* and *Thorichthys* may be more apparent, in

*The Fresh-water Fishes of Mexico North of the Isthmus of Tehuantepec. Meek. Zool. Ser., Vol. 5, Field Columbian Museum, 1904.

addition to the illustration of *T. h. meeki,* one is presented of *C. steindachneri.*

The generic name *Thorichthys* is from two words meaning "to leap" and "fish;" hence "leaping fish" in allusion to the playfulness of the species.

Society News

At the meeting of the Essex County Aquarium Society, held March 15th, Mr. William Tricker gave a talk on water lilies, their history, culture and hybridization. Particular attention was given to the species suited to small ponds and tubs.

An interesting lecture on micro-organisms was given by Mr. H. A. Van Cott at the April meeting. He dwelt mainly on the trematode parasites that make life miserable for aquarium fishes.

In view of war time conditions the spring exhibit will be omitted, but a public exhibition will be given during the fall.—*Publicity Committee.*

The annual dinner of The Aquarium Society was held at Pabst Harlem, New York City, on April 20th, with Professor John Treadwell Nichols as toastmaster. Mr. William Beebe, Director of the Tropical Research Station of the New York Zoological Society in British Guiana, gave a talk about his work, illustrated with lantern slides. Mr. Richard Dorn, president of the Society, gave an outline of the objects and work of the organization.

The Dinner Committee was composed of Messrs. Hugo C. Nelles, Hans Forbriger and C. B. Rush.

The April meeting of the Philadelphia Goldfish Fanciers Society was held on the 17th, at 804 Girard avenue. Competition for Japs, scaled and scaleless. Judges, J. E. Van Stavern, F. C. Leffman and G. B. Smith.

Awards. The Charles J. Hannig Cup to H. J. Mackrell; blue and red ribbons, George E. Wilt; yellow, Dr. L. W. Rehbein. *Sealed Japs:* Blue and yellow ribbons, Dr. L. W. Rehbein; red, Charles Hinkle.

New members: Walter Waeltz and George Jackson.

Election of officers resulted as follows: President, Harry P. Peters; vice-president, Thomas Ayling; secretary and treasurer, Fred Richardson. Board of Directors, George B. Smith, George E. Wilt, Dr. F. C. Leffman, Francis Garcia and Dr. L. W. Rehbein.

The competition at the May meeting will be open to all breeds of goldfish. The prizes will be donated by the members and will be awarded to the best fish in each class.—Fred Richardson, *Secretary.*

(Concluded from Page 118)

Air Products Co., which has service stations in all the large cities. The size costing $2.00 furnished sufficient oxygen for eight aquaria for ten weeks, making the cost two and one-half cents per aquarium per week. A larger cylinder, costing $4.00, contains two and one-half times the quantity of oxygen and is therefore more economical.

We have convinced ourselves beyond all doubt of the practicability and efficiency of the scheme, not to mention the advantages of the low cost of operation. Its effect was particularly noticeable in the case of two aquaria stocked with *Cichlasoma facetum* and *Tetragonopterus rutilus.* All efforts towards cleanliness, notwithstanding, these were always murky, with a scum on the surface of the water. A few days of oxygen transformed them into healthy, crystal-clear tanks.

Air consists of approximately four parts of hydrogen to one part oxygen. It follows that when using pure oxygen instead of air, but one-fifth the quantity should be used, the releasers being made smaller accordingly.

Photographing Wild Fishes

BLENN R. BALES, M. D.

ARE YOU GOING TO PUT THEM ON POST CARDS AND SELL THEM?

One of the most fascinating phases of nature-study is that of photographing wild fishes. So many conditions enter into the making of a successful picture that a photograph of a wild fish, showing it in motion, with natural surroundings, calls for painstaking care and preparation.

The apparatus I have found to be necessary consists of a glass tank, 36 inches long, 17 inches high and 7 inches wide, though I sometimes use a smaller one. I have notches, a little wider than a pane of glass is thick, cut into the frame work at the ends, so that a piece of glass may be slipped into them, thus dividing the tank into halves or fourths, thereby bringing the fish close to that side of the tank which faces the camera.

Almost any kind of focusing camera with a speed up to a hundredth of a second, may be used, but I prefer a Graflex with a Zeiss-Tessar F 4.5 lens, and expose from 1-100 up to 1-265 of a second, the light governing the speed used. While I have had very good results from this lens, I believe a Graflex equipped with a Convertible Protar VII would be even better.

Other accessories should consist of a tripod, folding table on which to place the tank, a bucket or two, small net for removing fish from the tank, a rubber tube to siphon out the water, and a rubber window scraper with which to keep the glass sides and partition free from bubbles and drops of water.

Contrary to the rule of "first catch your rabbit," it is necessary to procure material for the bottom of the tank and

for the background of the picture, before catching the fish. The bottom material should be such as is found in the habitat of the species that is to be photographed; fishes that habitually live where the bottom is rocky should not be photographed with sand, pebbles or shells on the bottom of the tank. Next the material for the background should be carefully collected. If the fish is from fresh water, plants growing in fresh water should be used, but if the subject is marine, select seaweeds, sponges, coral, starfish, sea urchins and other salt water forms. The same background should not be used for two different fishes, but should be changed or at least rearranged for each subject. I have often found it advantageous to collect the materials the previous day.

The Bluefish, Pirate of the Seas
Pomatomus saltatrix

In most cases the partition glass can be inserted in such a manner as to divide the tank into two equal parts. The background can then be arranged in the half farthest from the camera, and any thrashing about by the fish will not disturb it.

Next catch your fish—this is no certain thing!

When taking pictures at the seashore I have resorted to three methods of procuring specimens; by going out with the fishermen to the pounds where fishes are caught for the market, by being present when they were using seines, and by the slower and less sure hook and line. It is necessary in these cases to have a live box or "fish car," as they are sometimes called, or a ventilating minnow bucket to keep the fishes alive until they are photographed.

Assuming that the fishes have been caught and the tank arranged, the important phase now is to get a picture that will repay the trouble. The light should be carefully considered. As it takes more light to illuminate glass and water than *thin* air, exposures should not be attempted before 10 A. M., or after 2 P. M., and between these hours only when the sun is at its best. Pictures taken earlier or later in the day are apt to show shadows or annoying reflections from the glass sides of the tank. Frequently the photographer will secure a fine reflected view of the camera as well as a picture of the fish.

It has been my practice to use no background outside of the tank, but when this is the case, there should be nothing but the sky. One should be careful to see that no person or object is behind the tank.

A great measure of patience is necessary to get the right results, for very frequently, when the fish is brought from the dark depths of the live box, it immediately drops to the bottom of the tank and will not move, or it may thrash about, spattering the water over the sides and getting into all manner of unnatural positions. A little patience and gentle coaxing will usually overcome all obstables and a good picture of the fish swimming leisurely along, with all fins spread, will result.

I usually take three views of each specimen with the hope that at least one will be good, and very frequently all are excellent. The expense of the two extra plates or films is repaid when it is con-

sidered that it might be years before that particular species could again be taken.

Many amusing as well as annoying incidents have occurred while I have been fish-picturing. The photographer at the seashore will usually be surrounded by a curious and inquisitive crowd, and will be asked all manner of foolish questions. One day I kept a list of the questions. Here are a few samples:

"Are you taking pictures for the Government?"

"Are you connected with the New York Aquarium?"

"Are you going to put them on postcards and sell them?"

"Are you taking moving pictures?"

"Are you going to put the pictures in school books?"

One day as I was surrounded by a curious crowd, a man quietly asked me "are

The Spade-fish Chaetodipterus faber

you doing research work or is this your hobby?" I replied, "hobby."

On one occasion I went with a boat crew to their pound very early in the morning in a very rough sea, securing some particularly fine specimens. When we returned the light was too poor for pictures, so I tied my live box to a piling some little distance from shore. Later, when the light was good, a rough sea was running and none of the regular boatmen would venture out for the box. Finally, for a consideration, I persuaded a strange-colored fisherman to row out and bring it in. After a hard pull he reached the box, pulled it from the water and placed it in his boat, rowing triumphantly to shore. It does not require much imagination to picture my feelings or the condition of the fishes for photographic purposes when they reached me.

An amusing incident occurred while off the Virginia coast last year. I was a regular passenger with a seining crew each day, taking with me the camera, tank and other paraphernalia. One day we caught a fish which belongs to that interesting family, called by the fishermen "swell toads." These fishes inflate themselves with air as soon as removed from the water and become almost like balloons. This particular one was about a foot long and very active. While I was transferring it from the live box to the tank, it began to inflate itself, and just as I was about to slip it into the tank it became caught between the side of the tank and the partition and, continuing to inflate, it finally broke the partition glass and cut a two-inch gash in its side.

Whenever I am located at any distance from a supply base I add half a dozen extra partition glasses to my equipment. One season I was quartered fifteen miles from the city, where I could buy glass. Every day that I took pictures I had the misfortune to break my partition glass and had to ride fifteen miles to replace it.

While fish photography is not by any means the easiest of the difficult art, I cheerfully recommend it to those who enjoy making pictures that are different.

Don't wait for the other fellow; be a self starter.

Aquatic Life

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

W. A. POYSER.....Editor
JOSEPH E. BAUSMAN.....Publisher
542 E. Girard Avenue, Philadelphia.

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

Practical articles and notes on topics pertaining to the aquarium and terrarium are always wanted for AQUATIC LIFE. Readers of the magazine are invited to join in making it a medium of mutual help, and to contribute to it any ideas that may occur to them. The pages are always open for anyone who has anything helpful and practical to say. Manuscripts, books for review and general correspondence should be addressed to the editor.

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Vol. III **May 1918** **No. 9**

The South Australian Aquarium Society was inaugurated in Adelaide on March 13th, when the convenor placed copies of *Aquatic Life* upon the table.

Mr. Edgar R. Waite, F. L. S., Director of the South Australian Museum, and a contributor to *Aquatic Life*, was elected the first president. The duties of the Secretary are to be undertaken by Mr. H. M. Hale, assistant at the Museum.

Small suckers make interesting fishes for the aquarium.

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, 1918.

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 (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 37th 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 37th 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 27th day of March, 1918.
(Seal) A. D. DEWEES.
(My commission expires February 19, 1921.)

Paullin is feeding his young *Pterophyllum scalare* on canned shrimp and making them grow. The use of this form of shrimp was recommended by Bennington, in the January, 1917, number of *Aquatic Life*.

Saying and doing have quarreled and parted!

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Aquatic Life

THE PEARL DANIO

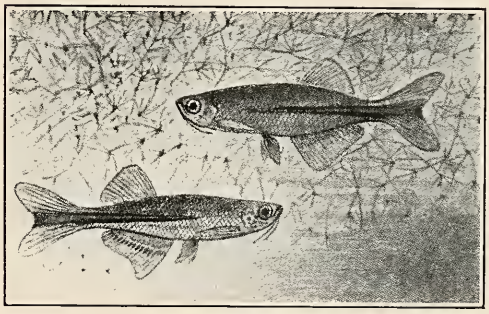
WALTER LANNOY BRIND, F. Z. S.

It was formerly considered quite an accomplishment to breed the Pearl Danio, *Danio albolineatus,* and many were the arguments as to the exact angle at which the sun's rays must strike the aquarium to satisfy the requirements of the fish. Be this as it may, the fish does require sunshine and plenty of it. My most successful spawning took place in a large, heated aquarium, 39 by 16 by 16 inches, that stood in a southwest window, through which the sun literally blazed all day. Such a large aquarium is not necessary. Otto Klemmer succeeded in securing spawn in a cylindrical all-glass tank about 14 inches in dameter. This was placed in a south window. The bottom was covered with marbles, with a spray of *Myriophyllum* added for "appearance sake." The eggs, being heavy and non-adhesive, dropped among the marbles and beyond reach of the adults.

A temperature of about 80 degrees should be maintained just prior to a spawning, and kept up for the eggs and fry some time after. Mature fish do well at an average of 75 degrees, and even 70, for this is a "hardy exotic," but low temperatures retard spawning.

The fry require plenty of microscopic animal life for about a week, and can then be coaxed to take dry prepared food, which must be as fine as possible. When they have grown a trifle they should be given the tiniest Daphne passed through a screen that none may be too large for them to swallow. From this time on, with abundant live food, they can almost be seen to grow.

It is safe to say that no fish is so popular as *Danio albolineatus,* not even its relative, *D. rerio.* It is beautiful, hardy and a good "happy family" fish. The general color, as the light strikes it, is a beautiful metallic turquoise blue; at another angle the blue turns to peacock green. When in breeding condition the male is flushed with salmon pink. From a point on the lateral line, just ahead of the dorsal, a pink stripe, bordered below



Danio albolineatus

with bluish violet, runs back and through the tail fin. In specimens preserved in alcohol the pink line becomes white. And as the species was probably originally described from preserved material, the origin of the specific name *albolineatus,* meaning white lined, is evident.

The males are usually more slender than the females and pinker. The anal fin of the male is longer and broader, with a deep rosy red horizontal stripe paralleled by dark green and canary yellow, though all these colors are more or less evanescent. Both are alike in size, reaching a length of two inches.

Some years ago I received from Europe a fish that the Germans then called "der neue Danio aus Singapore" (the

new Danio from Singapore). But when specimens were submitted to the great British Museum to receive a scientific name and the stamp of respectability, as used to be the custom with German aquarists before the war, it was pronounced a mere local variety of *D. albolineatus*. The "new Danio from Singapore" differed mainly in the imagination and seemed to me to be somewhat less brilliant than the type, a native of India.

Mosquito Larvae for Fry

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

We are all aware that to successfully rear young fish much depends upon the food, and that it should be living food. Much has been said about propagating *Daphnia*, the favorite food, and, although I have tried almost every way suggested, I am only fairly successful in breeding quantities in tubs. I now feed principally on mosquito larvæ (*Culex*), finding this very desirable, easy to secure, and easy to handle.

I once put a float or raft of eggs of *Culex* into a small jar to ascertain when they would hatch and, the following morning, was quite surprised at the quantity of minute larvæ (wrigglers) that had hatched in the interval. I emptied them into a tank containing quite small *Xiphophorus*, and although I had just added a feed of *Daphnia*, the young fish ate the wrigglers in preference, until all which I could note had disappeared. This gave me the idea of using wrigglers for quite small fish. To secure quantities of larvæ, I proceeded in this manner:

First I established a tub, containing fifteen gallons of water, which I made stagnant with horse and pigeon manure, having both handy. When, after a week, it had cleared, I added a handful of *Lemna* (Duckweed), to afford the mosquitoes a place upon which to rest while laying their eggs in the water. On the morning following I counted forty-seven egg-floats or rafts. These I spooned into two small glass jars containing two inches of water. Later, the weather becoming warmer, I averaged quite a hundred such floats daily. When the eggs hatch I merely pour the contents of the jar into an aquarium.

Now a float is said to contain from 200 to 300 eggs and, if we say 100 eggs to be conservative, and I collect 100 floats daily, it means that my fish eat 10,000 a day.

It is far preferable to breed the pest in the manner outlined than to permit the eggs to hatch in the tub, collecting the wrigglers in a net, as it is inevitable that some will manage to complete the metamorphosis and escape to plague you and your neighbors. Then again, if you require them larger, place eggs in a large jar and feed for a few days or until the desired size is reached.

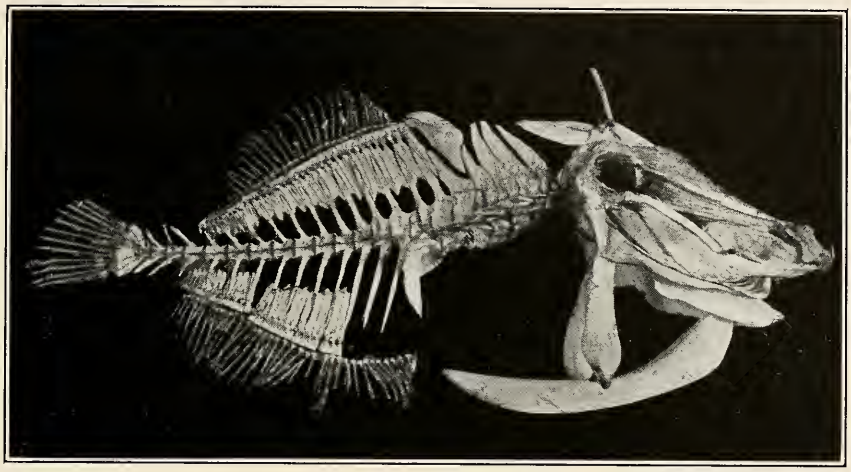
I certainly find my fishes doing well on larvæ, and the method is less troublesome than collecting and sieving Daphnia, not to mention the lessened likelihood of introducing organisms that may be detrimental to the fish.

I have reared young fishes quite successfully on artificial foods, but living food is better, not only because it is what nature provides, but because it must be sought by the fishes, and the exercise which is thereby taken cannot but be beneficial.

(The elongate eggs of the mosquito are laid vertically, side by side, in raft-like masses, which vary from ⅛ to ¼ inch in diameter, though capillary attraction may draw several together, thus making a seemingly larger individual float. Light in color at first, they become darker and soot-like as incubation proceeds. The larvæ emerge in five or six days.—*Editor.*)

The History of Ichthyology. Part 2

MAJOR R. W. SHUFELDT, Medical Corps, U. S. A.



MONOCANTHUS HISPIDUS THE FILE-FISH

Among the writers of ancient times on fishes—and especially those who followed after Aristotle—no name is better known, perhaps, than that of P. Belon, who flourished over 1900 years after him. Belon was at the height of his fame at about the time his *De aquatilibus libri duo* appeared in Paris, which was during the year 1553. Prior to the appearance of this celebrated ichthyological work, he had published several other less formal ones, they being based upon the specimens he had collected from 1547 to 1550 along the eastern shores of the Mediterranean Sea and in the rivers of the countries bordering upon it.

Some one hundred and ten fishes are described and figured by Belon, to which he gives the common as well as the scientific names; and he further paid, in his work, considerable attention to both external and internal structure. He knew the principal bones of the piscine skeleton, though he rarely defined them. Indeed, many of his fishes were classified according to size, while he came much nearer the truth when he referred them to two groups—those having blood and those that did not; and then subsequently employed, taxonomically, such characters as he was familiar with, or had personally for the first time described. Sometimes he would supplement the description of a fish with an account of its special habitat, thus fully establishing his reputation for adopting the methods of the scientific naturalist—whether of ancient or of modern times.

Following Belon, next in order of distinction was H. Salviani (1514-72), a Roman writer on the fishes of Italy (1554-57), the work being entitled

Aquatilium animatum historia. It was published in Rome, and at once came to be an authority on the subject of which it treated. Little regard, however, is evidenced for the value of specific characters in any of the figures on the 76 plates of the work, in which 92 forms of fish are described. In fact, the work of this able writer was more or less popular in style; and while it very materially advanced the science of ichthyology, in a way it, or rather its author, did not resort to technical description—a feature so conspicuous in the case of Belon who preceded him, or as did the better informed writers on the subject who were his contemporaries. Rondelet, for example (1507-57), was a far more scientific man than Salviani, for he not only graduated as a doctor of medicine in Paris, but he passed subsequently through a thorough course in anatomy under competent instructors. Still, as in the case of all his predecessors in ichthyology, Rondelet failed to grasp the true principles of taxonomy; indeed, throughout his two great works he employed the terms "genus" and "species" synonomously. In 1554 appeared his *Libri de piscibus marinis,* and during the following year his more formal production, *Universae aquatilium historiae pars altera,* both being published at Lyons. Here we find some 197 marine and 47 fresh water species described, all, with but few exceptions, being from European waters—in fact, a large percentage was from the Mediterranean Sea.

Rondelet's productions were an improvement upon those of Belon's in several respects, but more particularly in the matter of the accuracy of his pictorial work. It was distinctly his aim to present as attractively as possible all that was known about every form he undertook to describe. As a consequence his work, as a whole, taken in connection with that of Belon's, became the standard ichthyological treatises of the day; indeed, for upwards of a century they continued to hold such a place in scientific literature.

During this long period in history, however, no little attention was paid, from time to time, to the study of fishes. These investigations were even carried to New World forms, and especially those of the American tropics. Among the principal contributions to the science were Marcgrave and Piso; Malpighi devoted himself to the nervous system, and Swammerdam to the digestive system. Finally the respiratory apparatus in fishes was more or less systematically studied by Duverney.

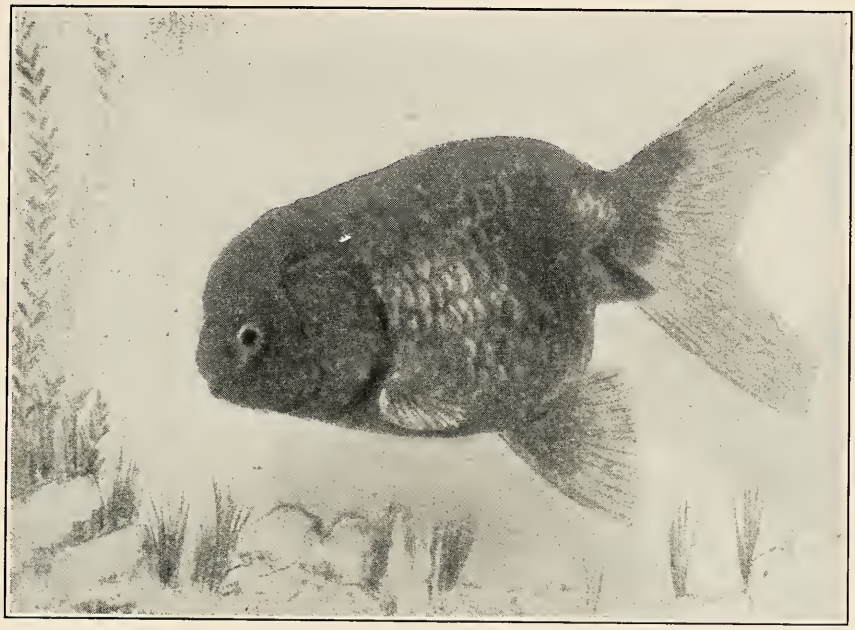
By this time the skeleton in many forms was more or less known, so that the bones in the more unusual types could all be named and their relations and articulations understood. So true was this that even as odd a form, osteologically, as a file-fish (*Monocanthus hispidus*), shown in the accompanying cut, was, in all probability, fully comprehended by ichthyologists. The specimen here shown was prepared by the writer many years ago at the New York Aquarium; it was taken in Bermudan waters, and was for a long time on exhibition in one of the tanks of that famous institution.

Ichthyology received an enormous impetus from about 1648 to 1730, during which era such astute naturalists as Ray, Willughby and Artedi came into the field. The science received rich additions from their several pens; and for the first time in zoological literature the true meaning of a "species" was fully defined. Then, too, the natural affinities of animals was better understood, their affinities being

(Continued on page 137.)

The Japanese Ranchu or Maruko

K. ITO, Japanese Artist and Ichthyologist
TRANSLATION BY MASA CHIBA



RANCHU OR MARUKO (LIONHEAD) OWNED BY FRANKLIN BARRETT

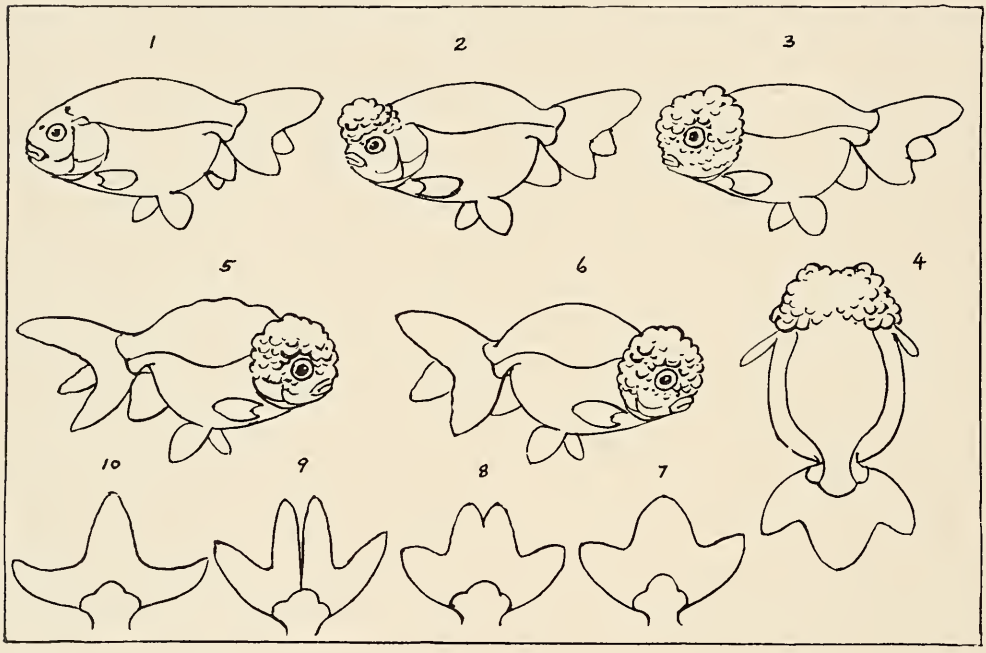
The properly arranged aquarium containing beautiful fishes and plants is really an object of art equally interesting to rich and poor, man and woman. All may and do enjoy it. Of all the aquatic animals the goldfish lends itself best to the conditions of the aquarium.

The popular breed in Japan is the Maruko, which means "the round-shouldered little fish." In fact it is the "exclusive" goldfish, no other so appealing to the fancier, who considers that it has many lovable characteristics. Rich in harmonious color, with a rather small, compact and symmetrical body, it is tame, intelligent and serene in its movements. The commercial value of the Maruko is consequently high, and at times a few thousand yen (yen, gold, about 99 cents; silver yen, 75 cents) will be paid for a rare specimen.

In most large cities of Japan there is a goldfish society, or rather a ranchu or maruko society, composed largely of people of influence and wealth. Though exclusive in character, any person interested in the goldfish and its culture may be admitted to membership. The organizations do not concern themselves with profits, and are purely interested in the Maruko as a priceless object of nature and art. The public exhibition, an annual occasion, is an important event to the enthusiastic members. Only quali-

fied second-year fish are displayed for study and judgment. These are classified according to the standard score card, awards made, and the owners of the winning fish warmly congratulated. The fish shown are not offered for sale.

I may here be permitted to briefly describe how the Maruko is reared in its native land. The usual spawning season is during the last of June and the beginning of July, so the process is carried on pleasantly in the open air. Fifty or more carefully selected fry, preferably from the first or second brood, are placed in a seasoned rearing box, about six feet square and one deep, containing seven or eight inches of water. This is placed in or above ground in a garden where there is much sunshine and a free circulation of air. The food consists of the yolk of a boiled egg, Itamimiyu—a thread-like earthworm—and mijinko or Daphne. The size of a meal to be fed should not be larger than the head of a given fish. At night the box is covered to avoid a possible change of the temperature of the water. When the young are about a hundred days old, the time of coloring, a strict examination is made, and all but possibly three or four are discarded for various reasons.



Forms of the Maruko from a Sketch by the Author.—1. Smooth-headed. 2. Hooded. 3. Lion-headed. 4. Angular-headed. 5. Malformed back; small caudal fin. 6. High shoulder; strong caudal fin. 7. Trypod tail. 8. Cherry flower tail. 9. Quarter tail. 10. Lobster tail. Figures 4, 7, 8, 9 and 10 are top views.

The ideal Maruko seldom becomes a realization. It is not unusual, in a lot of ten thousand or more young, not to find a single acceptable specimen. Preference is given to examples with a smooth, tender caudal fin, which is pendant when moving forward, fine bow-shaped hood, quiet color and even stay of the body when not in movement.

The opinion is generally held that the

(Concluded on page 138.)

BUILDING THE AQUARIUM

A. PISCATOR BUGG

A few years ago the writer wanted a "real" aquarium. After calling at all the local pet shops, being shown globes and "two by twice" tanks, when he wanted one four feet long, and getting information that there used to be a man here, there or elsewhere who used to build them, though they thought he was dead, etc., this particular individual was about disgusted. Finally he met a friend who had a friend who had made several tanks. This friend of a friend was indeed the fellow needed, and the information he gave enabled the said Bugg to build a very successful tank, and one that is different in construction and appearance. Since then twelve others have been built, ranging from three to six feet long, with success in each case. The plan called for a tank with no frame at the bottom, the glass setting into a groove in the base, which might be of marble, slate or reinforced cement. Frames for the larger tanks, four feet or more in length, are made from one-inch angle iron, while for the smaller sizes ¾-inch was used, the thickness of both sizes being ⅛ inch.

After deciding upon the size of the tank one proposes to build, the first step is to lay out and cut the necessary parts of the angle-iron frame. Assuming that it is to measure 35 by 15 inches, cut a mitre, 45 degrees, on the end of the strip of iron, which will then appear as at Figure 1. Next measure from point A—not from the end of the iron—fifteen inches, and mark on the iron on the inside. Then with a steel square mark a V, on the underside of what will be the top of the frame, the sides of this V will, of course, be at an angle of 90 degrees to each other and 45 degrees with the outer edge of the strip. Cut out this V with a hack saw (Fig. 1b). Set the corner of the steel square into this V and you will probably find that it is not true. Straighten the edges until the square fits loosely at the open end of the V, but make sure that it fits tight into the point of the cut. It will improve the finished corner if the point of the angle is cut slightly into the side (Figure 1d).

Figure 1. How the Angle Iron is Cut to Form the Top Frame.

Now measure 35 inches from mark D for the side of the frame. Cut another V at this point. Then measure 15 inches, cutting another V. This gives two ends and a side. Measure 35 inches for the other side, and at this point cut another mitre as at the other end, only reversed. Now we have a length of angle iron with mitred ends and three V's or notches. Put the iron in a strong vise, clamping it about 1-32 of an inch to the left side of mark D as the illustration appears to the reader, bending the iron at this notch until the two sides of the V meet. Drive the two sides together with a heavy hammer while bending with the hand, making the corner as square as possible. If you have cut the notch properly you will find that the sides close together, forming a perfect right angle. If the V has not been cut wide enough, the corner of the frame will not be square, which is necessary; if cut too wide it can be corrected in welding. Cut it wide rather

than narrow. Proceed as before and bend at each of the two remaining notches; you will then have a perfect oblong top frame.

Now cut four pieces of the angle iron, each fifteen inches long, with square ends, for the corner uprights (see Figure 2a). Then buy four carriage bolts, ⅜ by 2½ inches, threaded well up to the head.

Take the frame and have it welded to-

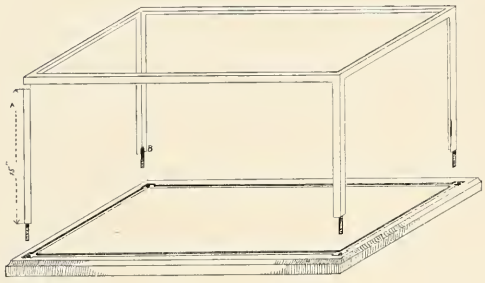


Figure 2. Slate or Marble Base, with Frame ready to Drop Into Place.

gether, the corner uprights *butt-welded* to the top frame, and the bolts welded to the lower ends of the uprights on the *inside*, as in Figure 2b. Caution the welder to be sure to have the top frame square and the corner uprights square with the frame. In welding the bolts he should avoid making a hump or spreading more iron over the frame than is absolutely necessary. A little surplus iron can easily be filed off. If the frame is not welded true it will be almost impossible to straighten it; hence the need of care in the process. Surplus iron at the corners can be ground off on an emery wheel or filed smooth. The frame is now complete and in one piece. This welding costs about two dollars.

Next paint the frame with red lead and *boiled* linsed oil, adding a little gold size for drier. Red lead is the only thing I have found that will not peel off in time. The finishing coat of paint of the desired color can be applied later.

Now comes the base. This can be made of marble, slate or cement. To use marble or slate proceed as follows:

Take the frame to a reliable man and have him lay out a base as shown in Figure 2, with corner as in Figure 3. The base should be 1¼ to 1½ inches thick; the groove to receive the glass ½ inch wide and ¼ inch deep, leaving the base extend 1½ inches beyond on all sides. At the corners of the groove cut a ⅛-inch offset to receive the angle iron uprights, and have holes drilled for the bolts. To allow the nuts to be screwed flush, the holes should be countersunk on the bottom or under side of the base. It is necessary to make the frame first, so that in case of slight variations the base may be made accordingly. This insures a true plane for the glass. The holes at the corners should be drilled to bring the outside of the corner uprights tight against the marble thus bringing the inner faces of the corner irons flush with the outside edge of the groove.

To assemble, place the bolts on the uprights in the holes at the corners, being careful to get each in its proper place. If the frame is not true, and the base has been made to meet the variation, the glass will not have the right plane if the ends of the frame are reversed. Lift each corner and press cement into the offset and bolt hole. Press the frame down firmly until the nuts catch the threads on the bolts, then set the nuts tight and cut the bolts off flush with the bottom of the base. Painting the groove with gold size before setting the frame will help the cement to stick.

When the frame is rigidly in place, the glass may be set. None other than plate glass should be used. One can get salvage glass very cheap; it is just as good as new for the purpose if care is taken to select pieces free from scratches. Use

a non-hardening cement mixed to the consistency of stiff putty. Set the side glasses first, making sure they fit before spreading the cement. It will be necessary to chip a little off the lower corners of the glasses in order to clear the bolts welded to the corner irons—watch this carefully, as the glass *must* clear the obstruction. Now lift out the glass and fill the groove in the base about half full of cement, and with a putty knife lay a little on the inside edge of the corner uprights from top to bottom. None will be needed on the top frame. Place the lower edge of glass into the groove and press down hard. This will imbed it securely and squeeze the cement up on either side. If necessary a light stick may be used as a lever against the top frame. Force downward until it will go under the top frame, then press against the cement on the corner uprights and the glass is set. Set the other long side in like manner. Now measure, cut and set the end

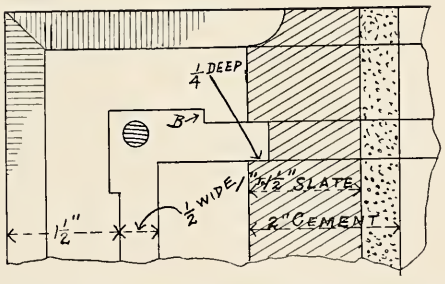


Figure 3. Details, Flat and Cross Section, of Corner of Slate, Marble and Cement Base.

glasses. These fit between the long sides and should set snug. The pressure of the water when the tank is filled will press out the sides and give room for their expansion.

When all the glass is set, tamp the cement thoroughly into the base grooves on the inside. Don't bother about the outside now. I have found that a leaf of an old automobile spring, with end ground square, is best for this purpose, but you can use a piece of wood with thin end—blunt, not chisel-edged. As an added precaution against leakage, roll cement into long pieces, a little thicker than a lead pencil, and press firmly from top to bottom in each corner where the sides and ends meet.

The aquarium is now ready for water. Let it fill slowly. It will be noticed that the pressure of the water against the glasses forces them tighter to the frame, the cement being forced up from the groove in the base and from the iron uprights. The cement in the groove on the inside has receded. Let the aquarium stand filled for an hour, then with a putty knife cut away the surplus cement from the outside even with the base, this coming away in a long string. Empty the aquarium and lay this string of cement in the depression in the groove on the inside of the glass. It will just about fill it. Tamp down thoroughly, so that the groove is full and the cement flush with the surface of the base inside, and then smooth with a putty knife. Should cement have been squeezed over the glasses from beneath the upright corners iron, trim it off even and smooth. Fill the aquarium and go to bed!

If an aquarium with a cement base is desired, a form in which to mould it is needed. In constructing it the bottom must receive first consideration. It must be smooth and rigid, as it must not sag with the weight of the cement. A simple plan is to use two pieces of dressed pine, 2 by 4 inches, and 4 feet long. Lay them flat and parallel, about 18 inches apart, and nail across them 7/8 by 6-inch tongued and grooved flooring, which has been cut into lengths of 28 inches. This makes a strong, smooth base 28 by 48 inches. Select two straight pieces, 2 by 2 inches by 4 feet for the sides, and two

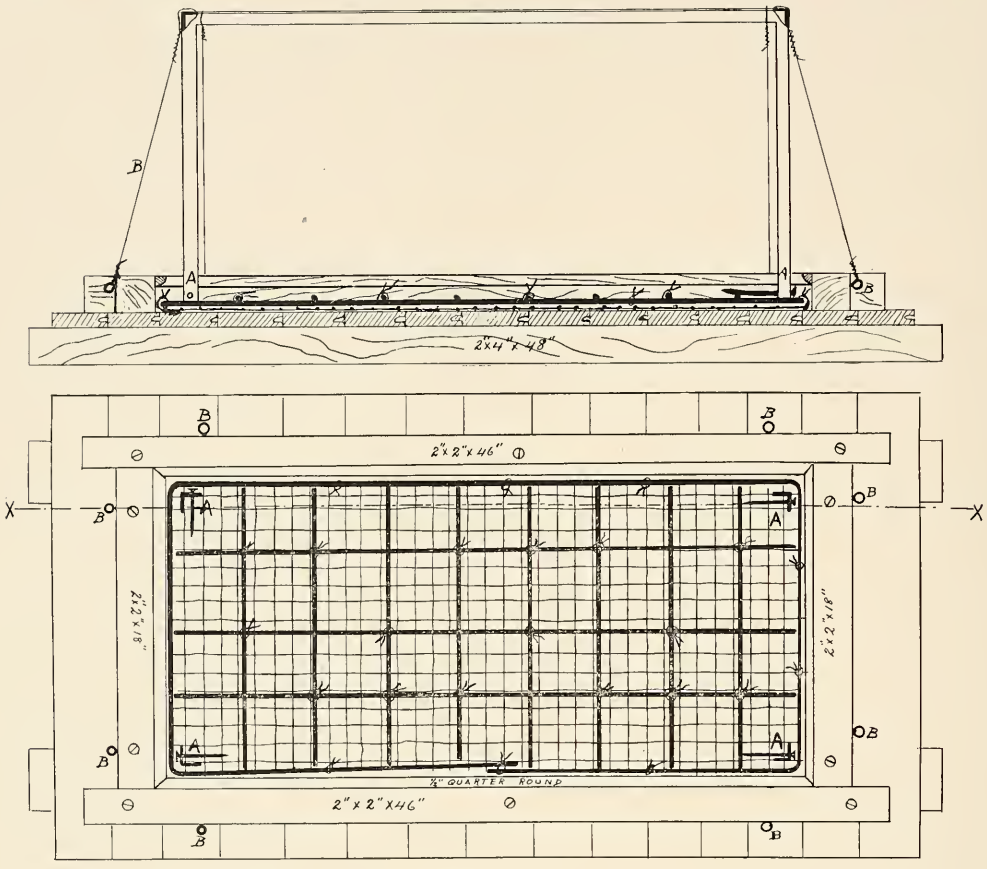


FIGURE 4. Above, Cross Section of Mould or Form for Cement Base at X—X, with Frame Stayed with Wire. Below, Ground Plan of Mould, with Reinforcing in Position.

pieces 2 by 2 by 18 inches for the ends. On the base or bottom of the form under construction lay out, with a pencil, a rectangle 38 inches long and 18 inches wide, being very careful to measure accurately and make a true rectangle. Then, with 3-inch screws, fasten the side pieces to the base, keeping them outside the rectangle but precise on the pencil line. Use three screws to each side. Next fit the two end pieces between the sides—outside the rectangle, but precisely on the pencil lines—and fasten each with two screws. You now have a shallow box 18 by 38 inches, inside measurements. The form is complete unless you wish to break a ½ or ¾-inch quarter-round moulding around the top inner edge of the ends and side pieces. This gives a certain finish to the base similar to a bevel edge. Reinforcing the cement base, which is necessary, is accomplished as follows:

Take a piece of iron or steel rod, 9 feet long, and bend it into a rectangle of such a size that it will drop loosely into the form. Then cut a piece of wire cloth (made of No. 14 wire, mesh 1 inch) and fasten with wire onto the iron rod frame, which it should just cover. Cut eight pieces of the iron rod, 18 inches long, and lay across the wire cloth at intervals of four inches. Across these lay, lengthwise of frame, three pieces 35½ inches

long. Where the rods intersect wire them securely to the wire cloth to hold all securely together. Not every intersection need be fastened, but just enough to keep the rods in place when the cement is poured. The wire cloth is probably extra reinforcement, not absolutely necessary, but it makes a good foundation for the rods.

When the reinforcing is complete, lay it in the mould and see that it is flat. Then set the angle iron frame of the aquarium into the mould, putting large nails or bolts through holes in each corner upright to hold or tie the frame into the cement, as indicated at A in Figure 4. If you used ½-inch quarter-round moulding, the corner upright irons of the frame will each be one inch from side or end of form. Now stay each corner of the aquarium frame with wire running from the top to the outside of the mould—drive nail or screw-eye into outside of mould (Fig. 4B), fasten wire to it and pull very tight. It must be tight to prevent any movement of the frame when the cement is poured. Now prepare four strips of wood, ½ inch wide and ¼ inch thick, of the proper length to fit between the corner uprights of the frame. These form the groove in the cement base, and are shown in place in Figure 5. Notice that the end pieces fit within the long or side strips; these strips are inserted after the cement is poured

Use a standard cement that you know is fresh and perfectly good. Mix clean, sharp sand 2 part, cement 1 part, and make a rather thin mixture. Two water pails of sand and one of cement will be ample. Mix thoroughly and pour into the mould, tamping it well. Work it thoroughly into the corners and edges by puddling around the edge with a small stick of wood. Spend a little extra time on this, as it will pay in the end to have clean, sharp edges and corners. The mould should be filled level with the top and the surplus scraped off with a stick long enough to reach from one side of the mould to the other. When the cement has been smoothed, insert the ¼ by ½-inch strips previously prepared. Press them down level with the surface of the cement and close against and within the uprights of the aquarium frame as shown in Figure 5. These strips are later removed, forming a groove for the glass, ½ inch wide and ¼ inch deep. Use care *not to insert* them so as to make a groove ½ inch deep. The strips should be absolutely straight and not warped or bowed. Trowel and smooth the surface of the cement. See that no surplus cement is left on top of the groove strips, and that they are pressed tightly against the corner uprights. Do not disturb the job for three days, except to clean off any cement that may have run over the top of the groove strips, which is important. Any surplus extending over these strips will, when they are removed, crack back and make ragged edges.

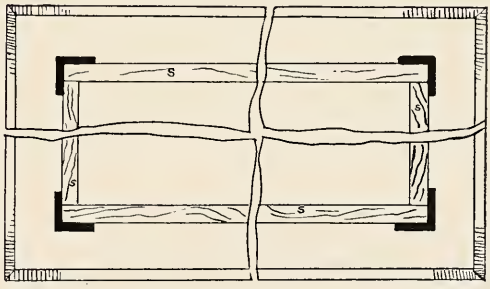


Figure 5. Top View of Cement Base, showing the Strips (S) Imbedded in the Cement, within the Angle Iron Corner Uprights, to Form Grooves for the Glass.

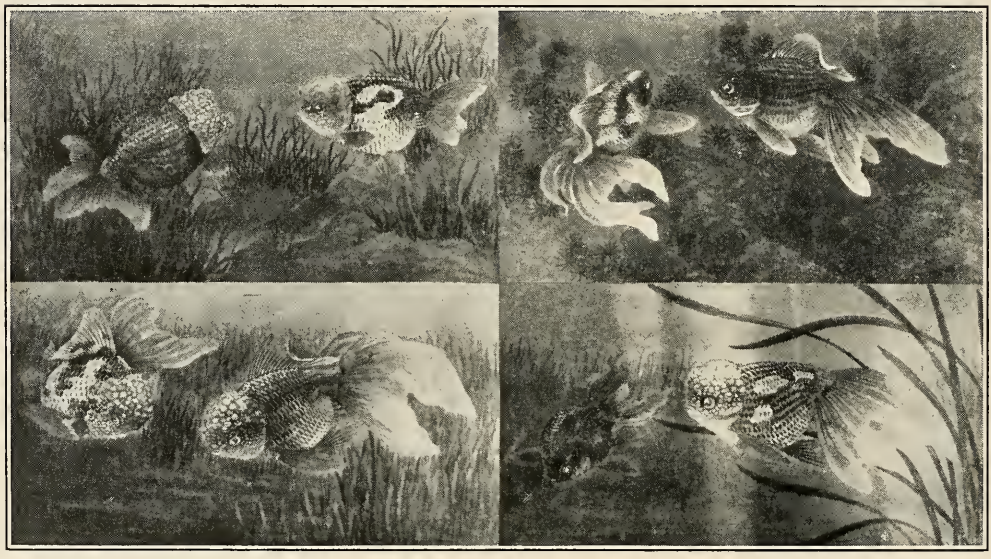
When it is certain that the cement has thoroughly set, take out the groove strips, exercising every precaution. If soft wood has been used they can readly be removed by first cutting a deep V-shaped

groove lengthwise. There is a tool used in wood carving that will do this quickly. After the first strip is out, the others come more easily, leaving clean, sharp, straight grooves. After the grooves have been painted with gold size, proceed to set the glass as directed with the marble or slate base. Leave the cement base in the mould until after the glass has been set. Figure 4 gives a complete plan of the form or mould, with the reinforcing in place and also the aquarium frame.

take about two pounds.

Should there be any objections to a cement base for the aquarium, it can be overcome by superimposing a glass bottom, setting with aquarium cement around the edge where it meets the glass sides.

If the aquarium is to measure 48 inches long, or more, it will be safest to provide for a tie iron across the top frame at the middle to prevent a possible spreading. For this drill a hole ⅛ inch



TYPES OF JAPANESE GOLDFISH—Original Paintings by K. Ito

Maruko or Lionhead — **Fringetail or Ryukin**
Oranda or Hooded Fringetail — **Shukin**

Aquaria with top frame alone are easier to construct than those with both top and bottom. I like the appearance better and the frame is stronger and more rigid than when bolted or riveted, especially in the larger sizes. No cement is visible between the glass and the base, especially when marble or slate is used, and the glass has an absolutely even surface against which to rest. I have used Cassel's cement for these aquaria and have never had a leak. It is non-hardening. A tank 15 by 35 inches will

in diameter and through the supper side of the top frame in the centre and close to the inner edge. Tap it to take a brass machine screw. For the tie iron get a strip ⅛ by ¼ inch and as long as the aquarium frame is wide. Drill and tap it to correspond with the holes in the frame of the aquarium and screw tight. This piece can be welded in place when the frame is made, but it is better to make the fit after the glass has been set.

The strips of wood that are inserted in the cement to form the grooves for the

glass may be painted with hot parafin, which makes them more easily removed and less liable to stick to the cement.

The cement base which I have described is very cheap, costing about $1.25. The wooden mould or form can be used over and over again.

(Continued from page 128.)

derived from a growing knowledge of their characters and morphology, as was evidenced in the writers of the times.

Of all the researchers in this field, in the period referred to, no single writer, or even a number of writers, could in any way rival the excellent work of Artedi. He was the great Nestor—in fact, father of the science of fishes. Zoologically and biologically speaking, he greatly furthered the true ends of ichthyology in all of its several departments, and especially along the lines of taxonomy, morphology, and what was meant exactly by the terms genus, species and subspecies.

Great as were the achievements of Peter Artedi, he was much beholden to the careful work of some of his predecessors, especially to that of Ray and Willughby. Artedi also derived much benefit from the fact that he had studied with Linnæus at Upsala. Unfortunately, his life was a very short one; at the age of twenty-nine he was drowned in a canal at Amsterdam (1734), in which city he was engaged upon some ichthyological work for a wealthy Hollander by the name of Seba.

In the next part, the Linnæan era in the history of the science of fishes will be taken up, and brief mention will be made of the writers on ichthyology of those times.

Electric lights, placed just above the water of the ponds at a Kansas fish hatchery, help to reduce the food bills of the institution. Thousands of bugs are attracted by the glare, and no small proportion of these drop into the water beneath.—*American Angler.*

These waters are the home of the giant black sea bass and swordfish that weigh from a hundred to over four hundred pounds, all taken with rod and reel. At the city pier these fish are hung on racks and photographed. A tourist seeing the huge fish for the first time looked a black sea bass of three hundred and fifty pounds over from fin to fin. Then, backing off he remarked: "The man who caught that fish is a liar."—*Catalina Islander.*

Several varieties of fish living near the surface of the sea carry light, among them being the "lantern fish" of the Malay Archipelago and another recently discovered in Jamaican waters. All these have a large, luminous organ just below the eye, emitting a greenish-white light, which flickers at regular intervals. Some deep-sea fish have the light attached to a long movable tip, while others, in addition to the chief light organ, are marked with patterns of smaller luminous spots of varied hues. Some of these are probably real lanterns, others decoys in the pursuit of prey, some protective, while some perhaps only distinguish male from female or one variety of fish from another. All these lights are absolutely heatless, something science has not yet produced.—*Popular Science Monthly.*

Investigations on the subject of protozoan parasites at the Bureau's biological station at Fairport, Iowa, during the past two summers have been productive of interesting results, promising to be of practical service to fish culture. H. S. Davis found that myxosporidia are quite

Aquatic Life

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

W. A. POYSER.....Editor
JOSEPH E. BAUSMAN.....Publisher
542 E. Girard Avenue, Philadelphia.

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Practical articles and notes on topics pertaining to the aquarium and terrarium are always wanted for Aquatic Life. Readers of the magazine are invited to join in making it a medium of mutual help, and to contribute to it any ideas that may occur to them. The pages are always open for anyone who has anything helpful and practical to say. Manuscripts, books for review and general correspondence should be addressed to the editor.

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Vol. III June 1918 No. 10

common on fish from the Mississippi River, and evidence seems to prove that they are to a degree seasonal in occurrence. Under certain conditions they may cause serious injury to the host, but in the case of buffalo fish, and possibly of other species, it is believed that danger from infection in ponds might be lessened by a proper rotation of the fish as the young seem to become infected from the adults placed in the same pond to spawn.

A hitherto undescribed species of *Coccidia* is believed to have caused the death of young carp after transference from one of the ponds to hatchery troughs, as an exceptionally heavy infection of the intestines with these parasites was associated with a serious degree of mortality. Although infection of the pond fish with the ciliate parasites *Ichthyophthirius, Chilodon,* and *Cyclochaeta* was quite common, a much heavier infection after transference of the fish from the ponds to the tank house, probably induced by change of environment, would seem to indicate that these parasites have been largely responsible for the previous heavy mortality of the fish in the tanks.—*Fisheries Service Bulletin.*

(Concluded from page 130.)

Maruko is extremely delicate, but as a matter of fact, if carefully fed and kept in water at an even temperature, it is just as vigorous as other varieties—and more interesting. Under proper conditions it will live and enjoy life in the aquarium for ten years or more. I have not seen a really fine example of the Maruko in the United States.

(Mr. Ito is a well-known Japanese artist, and is at present in the United States, executing a number of commissions for American institutions. He is now working on a series of water colors depicting the various breeds of Japanese goldfishes. Portions of four paintings are shown elsewhere in this issue. The originals can be purchased at a moderate figure. Mr. Ito may be addressed in care of Aquatic Life.—*Editor.*)

Plenty of Daphne during the warm months, but none when the thermometer registers zero. Be provident. Start a box of enchytraeid worms *now*. Next winter you will have an abundance.

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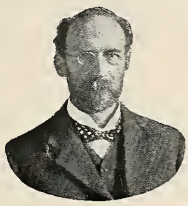


Aquarium Biochemistry

EDGAR R. WAITE, F. L. S.

President, South Australian Aquarium Society

A Pile of Goldfish Ashore and (right) others Gasping at the Surface of the Water
Photographs by the Author

Most people know that water is composed of two gases, hydrogen and oxygen, in the proportion of two to one. They also know that fishes breathe in oxygen to regenerate their blood, and they imagine, perhaps not unnaturally, that the fishes obtain it from the combination. This they cannot do, for as soon as the correct proportion of the two gases is disturbed, water no longer exists.

We must, in the first place, appreciate the difference between the chemical expressions "mixture" and "combination." Atmospheric air is formed of a *mixture* of two gases, nitrogen and oxygen, and we can vary the normal proportion (of about 79 to 21), within certain limits, without destroying the use of the mixture for respiratory purposes. Water, on the other hand, is produced, not by a mixture, but by a chemical *combination* of two gases in certain definite proportions, as already mentioned, which cannot be upset in the ordinary course of events; if the proportions are changed, say by means of electricity, resulting in the abstraction of a certain amount of oxygen, then twice that quantity of hydrogen is also set free, and a corresponding measure of water, as such, is destroyed. It will be evident, therefore, that fishes cannot breathe the oxygen which is a constituent of the water in which they live.

Water has the property of absorbing and retaining a certain amount of free oxygen, this amount varying under different conditions, especially of temperature, the warmer the water the less it can hold. Fishes cannot, therefore, live in water that has been recently boiled, because most of the breathable oxygen has been driven off. This boiled water, while cooling, will gradually reabsorb atmospheric oxygen, and the greater area of water exposed the more rapidly will absorption take place. Hence the process

is accelerated if the water be agitated, or if air be passed into it, a proceeding known as aeration.

If the water is not artificially aerated the upper layer only can act as an actual absorber, whence the oxygen is diffused throughout. Under conditions of oxygen starvation (due to heating, or too many animal breathers), the surface layer remains richest in oxygen, and the fishes crowd to the top, not to breathe atmospheric air, as many imagine, but to extract the dissolved oxygen, where it is most abundant.

In the goldfish-globe days, and unhappily they are not wholly a thing of the past, the assembling of the gasping fish at the surface was taken as an indication that the water "wanted changing," but the often fair and tender-hearted fancier did not realize that until this change was effected, the little fishes were undergoing torture comparable to that inflicted on the poor wretches of the historic "black-hole of Calcutta."

Nowadays we make good the withdrawal of oxygen from the water by the introduction of aquatic plants, and the use of the term "balanced aquaria" often leads people to suppose that an actual and delicate balance, between the amount of plant and animal life, must be maintained for the successful conduct of an aquarium.

Not so, the secret of success is plenty of plants, if they give off more oxygen than the water can absorb it simply passes into the air, and as more oxygen is required in warmer weather to counterbalance the feebler absorptive power of the water, the plants automatically develop increased energy and so supply it.

The accompanying photographs illustrate a similar condition, but on a prodigious scale. A large area of submerged land was being reclaimed, and the fishes, mostly gold carp, formerly spread over acres, were, by pumping out the water, confined to a deep drain. As the water was still further reduced it provided insufficient oxygen for the tens of thousands of carp, a few of which were photographed, all gasping at the surface. This drain was over a mile in length, and the fishes were gathered from the pump-intake pool at the rate of five tons daily for a whole week.—*Abstracted from the writer's inaugural address to the* South Australian Aquarium Society.

On Memorial Day a number of members of The Aquarium Society, New York City, held an outing along the Morris Canal, Little Falls, New Jersey, under the leadership of Mr. Richard Dorn. Many specimens of fishes, turtles and plants were secured.

No regular meetings of the Society will be held during July and August.—*Hugo C. Nelles.*

The Aquarium Stock Company has accepted the agency for "Art Aquaria," and are now displaying these unique tanks in their New York salesrooms. One of the several styles, a hexagonal form, with a superimposed fern receptable, is quite an improvement over the usual six-sided tank. From another type the corner cones may be removed without disturbing the tank when it becomes necessary to have them replated. Art aquaria are furnished in nickel, enamel and aluminum, and will appeal to those who want small tanks that are out of the ordinary.

An ingenious Spaniard says that rivers and the inhabitants of the water element were made for wise men to contemplate, and fools to pass by without consideration.—*Walton.*

The Mouth - Breeder

CHARLES M. BREDER, Jr.

Commonly known in the vernacular as the mouth-breeder, *Haplochromis strigigena* has long been a favorite because of its beautiful coloration and intensely interesting breeding habits. Their scaly sides display a riot of color, scintilating in the light, as they move about—usually with some definite object in view. It is well-nigh impossible to describe the colors, as they lay in no well defined pattern, each scale seeming to have a complete complement in itself. For this reason they have often been justly described as appearing to be set with precious stones. In addition to these prismatic colors there is a dull band running laterally from a highly-colored spot on the opercule back to the caudal peduncle, where it blends into the colors of the tail. The pectorals and ventrals are practically without color, but the dorsal and anal fins are as brilliantly hued as the body proper. The sexes vary only slightly in color and size, the female being somewhat duller and lacking the vermillion tip on the anal, which is usually present on the male. This sexual mark is well shown in the accompanying illustration. After a female has bred the lower jaw remains rather distended.

The mouth-breeder is truly a tropical fish, inhabiting the streams of Egypt and the Congo, so should not be subjected to a temperature less than 65 degrees. They do very well at 72 degrees, while for breeding purposes it is well to raise it a few degrees. It is not necessary to keep it as high as 80 degrees, but good results will be secured around that point.

The breeding habits are no less striking than the colors. In nature the fish prepares a nest by removing all the debris from a circular patch on the bottom, in this somewhat following the custom of our common sunfish, *Eupomotis gibbosus*, but is smaller as befits a fish that is seldom more than two inches long. In the aquarium this nest is often omitted, the tendency being seemingly correlated

Haplochromis strigigena

with the size of the receptable. The smaller the tank the greater the possibility of it being passed by. A certain pair when they spawned in a tank 18 by 12 by 12 inches, made no attempt at nest-building, but when placed in a tub 24 inches in diameter, a nest a foot in diameter was hollowed in the centre and cleared of all foreign matter. The conditions were likely more natural in the larger body of water, with the added advantage that they were not disturbed by the sight of people moving about, as in the case of a glass tank.

After the eggs have been laid and fertilized the female gathers them into her mouth, there to carry them during incubation, and the resulting fry until they have reached the free-swimming stage. During this period the female abstains from all food. As many as twenty days

may be consumed in the process, but with the examples under my observation, the average seemed to be ten to twelve. I believe that, within reasonable limits, the higher the temperature the shorter this period. Of course, this is an advantage, as it shortens the fast of the female. Her abstinence from food while carrying the eggs and fry is a serious tax on her strength, and may affect future spawns, so any method of shortening the process is well worth while from that viewpoint. After the female has taken charge of the eggs the male should be removed. His further presence will only serve to annoy her.

The number of young in a litter will sometimes be as many as fifty, but usually it is much less. It is best not to breed a female more than twice during a year, but a male may be bred successively to several females.

After all the care given the fry by the mother, after they are liberated to shift for themselves, she will be found as cannibalistic as the more vicious species of aquarium fishes. She should therefore be removed as soon as the young are swimming free. It is really a pitiful sight to see a school following their mother after release, unconscious of her dangerous tendency, disappear one by one down her ample throat.

The fry, after separation from the mother, should be treated like other species. Feed them liberally on infusoria until they are large enough to take small daphne and other foods. If prepared foods are used rather rich ones should be selected.

The pair that made such a large nest and spawned in the tub took a notion to change the order of procedure. After much evident fighting and fin-mauling, I found the female in a sad state, and the male in possession of the eggs! He assumed and successfully consummated the role of mother. At this writing I have a dozen little fellows that never wriggled about in the maternal mouth; they are none the wiser and none the worse for the reversal. They seem just as sturdy as the previous litter. The parents were young and rather small, which accounts for the number, there being about fifteen in the litter originally.

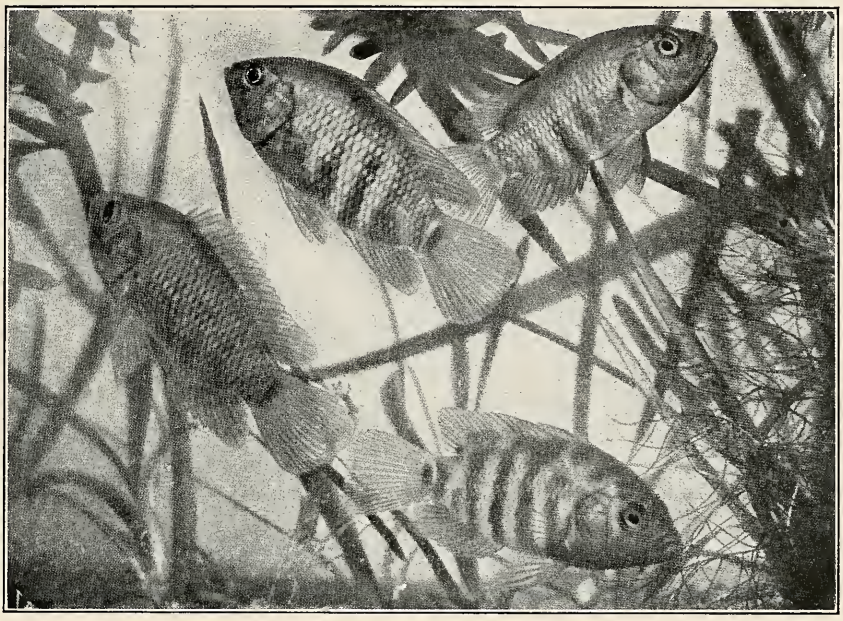
There must have been "considerable discussion" over the custody of the eggs, judging by the appearance of both adults. A branchiostegal ray of the female in some manner was ripped from its anchorage and protruded from under the gill cover. This I thought would finish her, but she lived to kill the male that did the damage.

The editor suggests that very liberal feeding helps to prevent "scraps," and the actions of my young fish tend to confirm this opinion. As an experiment I tried feeding double portions, and now find that I have no trouble in the fight direction, but the tank must be watched to see that no neglected food sours in the water. However, I believe that a great deal depends upon the temperament of the individual, and accounts for the wide difference in opinion regarding the disposition of the species. A particularly large female owned by the editor would carry the eggs several days and then eject them, eating them several hours later. It is not unusual for a female to swallow the eggs, but to reject them first is peculiar. She should have been muzzled!

These few notes give a slight idea of the great variations and peculiarities that may be found in the habits of individuals of a species. They suggest the greater pleasure of the study of the behavior and ecology of our aquarium inmates. Breed, therefore, not merely for increased numbers.

BREEDING THE CHANCHITO

DWIGHT WINTER



THE CHANCHITO

The Chanchito, *Cichlasoma facetum* (*syn. Heros*), is found in the ponds and slow streams which are tributary to the La Plata River, South America. In shape it is rather compact, resembling very much our local basses and sunfishes. In color it is glossy green to yellow, varying in different individuals, with broad black vertical bars, the color extending onto the dorsal and anal; caudal and dorsal fins dark; eyes greenish yellow, becoming reddish brown during the breeding season. During the periods of sexual excitement the colors become more pronounced and beautiful. Wild specimens may reach a length of nine inches or more, but those reared in confinement seldom exceed five inches.

It is not always possible to distinguish the sexes, in fact, more often impossible, as the colors and shapes of the fins are alike in both. However, in full-grown males, the ventral is slightly longer and reaches to the beginning of the anal fin. It is asserted by one writer that the abdominal line of the female is more rounded, but this is very hard to detect, except in very old fish. With the approach of the breeding season the female becomes much larger and thicker, and is then quite easy to distinguish from the male.

Owing to its hardiness—it can stand a great deal of knocking about—the chanchito has always been a great favorite with aquarists. I have kept them in water as low as 40 deg. F., but this is not to be commended. A temperature be-

tween 60 and 70 deg. suits them better. During breeding activities the temperature must be not less than 70 deg., preferably higher.

Breeding pairs should be provided with a fairly large tank, with plenty of sand in which to excavate the nests. Plants are not necessary, as they will persistently uproot them. The South American natives call the fish the shoat, which means pig, probably because they root about continually. The aquarium should contain two or three large stones or a flower pot laid on its side, on which they will deposit the eggs. I have found a flower pot useful because it affords a shelter for the female should the male become aggressive.

It is sometimes difficult to mate a pair, as the male will not always accept the female provided by the owner. I have found that the best way to prevent dissension is to divide the aquarium with a piece of glass, placing the male in one compartment and the female in the other. Thus they may see and become accustomed to one another. After a few days I remove the partition and leave them together for a short time. If they scrap the partition is replaced, the procedure being repeated until they become amiable. Having mated, they will proceed to dig large holes in the sand all over the aquarium, which is an indication that they are ready to spawn.

For the deposition of the eggs, they usually select one of the larger stones or the flower pot, and carefully clean it. In the absence of either I have known them to place the eggs on the side of the tank. The surface having been carefully cleaned, the female deposits the eggs upon it, dropping them in a circle. Then fertilization is effected by the male. Both adults guard the eggs in turn, hovering above and fanning with their fins to keep a constant circulation of water about them. In four or five days the parents move the eggs to a nest previously prepared; a mere hollow in the sand.

When the fry emerge from the eggs they are unable to swim, but manage to wriggle around in the nest, presumably searching for food. The brood is moved several times to new nests, being carried in the mouths of the parents. This movement is probably due to the exhaustion of the food, infusorians, in the region about the nest. After several days the young swim freely, and follow the parents in a shoal. At this stage the adults become very aggressive, and will attack anything they think may harm the young. Both parents are active in the care of the babies and return them to the nest every night.

Some aquarists advocate removing the male when the young are two or three days old, but I find that if well fed, both parents will take care of the brood until they are seven or eight weeks old. The young mature rapidly, and will breed when about nine months old.

Food should consist largely of animal matter, such as raw beef, rain worms and meal worms. If these are not available, they will eat the dry prepared foods used for other tropical fishes.—*Read at a meeting of the Pittsburgh Aquarium Society.*

How long do "tropical" fishes survive in our aquaria? It would be interesting to compile a list of species with the maximum length of life in confinement. Instances have been reported of *Danio rerio* and *Tetragonopteris rubropictus* living five years. Readers are requested to communicate their records to the editor.

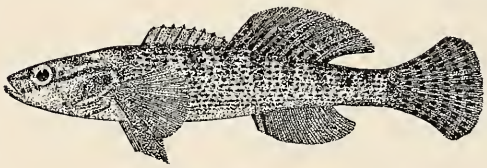
The wise aquarist preserves Aquatic Life for future reference. Do you?

THE FAN-TAILED DARTER

FRANK BAMFORD HANNA

"The darter of darters is the fantail (*Etheostoma flabellare*). Hardiest, wiriest, wariest of them all, it is one which is most expert in catching other creatures, and the one which most surely evades your clutch. You can catch a weasel asleep when you put your finger on one of these. It is a slim, narrow, black, pirate-rigged little fish, with a long, pointed head, and a projecting, prow-like lower jaw. It carries no flag, but is colored like the rocks among which it lives. It is dark brown in hue, with a dusky spot on each scale, so that the whole body seems covered with lengthwise stripes, and these are further relieved by cross bands of the same color. Its fins, especially the broad, fan-shaped caudal, are likewise much checkered with spots of black. The spines of the dorsal are very low, and each of these in the male ends in a little fleshy pad of rusty-red color, the fish's only attempt at ornamentation. The fan-tailed darter chooses the coldest and swiftest waters, and in these, as befits his form, he leads an active predatory life. He is the terror of water snails and caddis worms, and the larvæ of mosquitoes. In the aquarium this darter is one of the most interesting of fishes, for, though plainly colored, it is very handsome, and in its movements is the most graceful of all the darters. Its mouth opens wider than that of any of the others, and it is fuller of bristling teeth. Its large yellow-rimmed black eyes are ever on the watch. The least of a "fish" and the most of a darter, the fan-tailed is worthily left as a type of the genus *Etheostoma*, in which it was first place by its discoverer, Rafinesque."

Thus have Jordan and Copeland written of the fish that deserves to be more popular among aquarists, and particularly those who find pleasure in the study of our native species. The "darter of darters" has quite a wide distributions, and ranges from Quebec and New England down the Atlantic coast to South Carolina, westward by way of the Great



Etheostoma flabellare

Lakes and the Ohio basin to Missouri and northeastern Iowa, and southward to northern Alabama. It is practically within reach of most aquarists residing in the eastern half of the United States, the Gulf States excepted. Look for it in cool, rocky brooks; occasionally found in rivers and lakes, it shows a preference for small streams.

You will catch it most readily in a small minnow seine, though occasionally, if you are lucky, in a dip net. The collecting can must not be overcrowded, and should be kept as cool as possible. For a home, in your home, it asks a fair-sized aquarium, the water but a few inches deep; some aquarists say not more than four inches, but six will not be detrimental. Artificial aeration will be desirable, but if not possible, then half of the tank should be rather thickly planted with *Sagittaria subulata*, the small species, leaving the rest of the bottom space clear. The bed of the aquarium should be of clean, sharp sand, with a few rocks in the open area. If the tank is cool at

all times, and the food requirements met, then success may be expected.

The fantail practically demands a diet of live food, for on such it depends in its haunts. During the summer months give it mosquito larvæ—it will exhibit unexpected dexterity in catching them—vary with small pond snails, which may be had in abundance, and with caddis worms and daphne, or with the many small larvæ from a neighboring creek or pond. Winter will bring to an end the supply of some of these foods, but it will be possible to get daphne and Corethra larva, even though ice must be broken to reach them; a supply of snails may be kept in other tanks. Though we have not tried them it will probably relish "enchytræ" worms. High temperature will be the main summer difficulty, and lack of living food that of winter, but both can be overcome. The fan-tail will eat the dry foods, but they should be used sparingly, and only in a "pinch," in which case care must be exercised to remove unconsumed particles before the development of fungi, and to otherwise keep the bottom clean by the frequent use of the dip-tube. Changing a portion of the water occasionally will be advantageous.

Hydra: The Pest

HARRY COLQUHOUN

The pest of pests, in the opinion of the aquarist, is the freshwater polyp. Regardless of care it may be introduced into the aquarium containing one's most valued fry, and woe betide them! The Hydra is a relative of small marine jellyfishes, the Portuguese Man-of-war and some corals, and like them is abundantly provided with nettling organs with which to overcome its prey. Even the young of live-bearing fishes will succumb to the third attack; fry of egg-laying fishes end their career with one.

Hydra is tubular in form, and attached at one end to some object; at the free end is a hole, the mouth, which is surrounded by a number of tentacles, usually six or eight. A large specimen will have a body three-quarters of an inch long, with tentacles of equal length. From the tentacles are discharged the minute stinging threads, which paralyze and cause the death of any minute animal coming in contact with them. The body and tentacles are capable of great contraction, and when prey has been captured, the animal

Hydra Attached to Duckweed Drawn by Frank J. Myers

appears as a small lump, with a coronet of very short tentacles.

In the aquarium the Hydra reproduces freely (alas! too freely) by budding, a small excrescence appearing on the side of a mature individual, which gradually develops into a perfect organism. This young Hydra may remain attached until nearly as large as the parent, and may even in its turn produce buds, but all will eventually become detached.

The other method of reproduction is by eggs, which protrude as small globules from the lower portion of the animal. After fertiliziation these develop direct into new Hydra.

Many methods have been suggested to eliminate Hydra from an infested aquarium. The most satisfactory is to remove all the fishes and snails, and syphon out the water, then refilling to the top with new water at a temperature of 104 deg. This effectually kills the pest. Replace this with water of average temperature before returning the fishes.

Breeding Habits of Krefftius adspersus, the Purple-striped Gudgeon

ALBERT GALE
Royal Zoological Society of New South Wales

The purple-striped gudgeons in my aquarium, on which the following notes are based, are about five inches long. They have become the parents of between one thousand and two thousand children during the breeding season of 1913-1914. They first bred in 1912, and were then three years old. There was but one spawning in that year, and as a result of it, I have sixteen yearlings from one and one-half to two inches in length. These have all the color markings of the adult fish, though the males are somewhat lighter in color than the females.

In October, 1913, the coloration of a pair of my gudgeons became intensified, which indicated approaching fertility. Accordingly, they were placed in an aquarium which had been prepared for them during the previous autumn, and judiciously fed, but otherwise undisturbed. The tank was of glass, with perpendicular sides, and measured thirteen by fourteen inches on the surface of the water, which was thirteen inches deep. To make conditions as natural as possible it was well supplied with waterweeds and pond-snails, and the anchorage for the plants was composed of shell-grit, sand and humus, no clayey matter being introduced .

Early in the breeding season (15th November) the female deposited her first batch of eggs on the glass side of the aquarium, and others again on the 18th and 27th of December. In the following month, January, 1914, she spawned on the 7th, 17th and 30th, and now in March she has her tenth lot of eggs. Since last October the male has been tending the various batches of eggs for ninety days.

The following observations are based on one spawning only, that of February 17th. The details were obtained twice each day, at 9 A. M. and 9 P. M., with occasional intermediate visits. The evening visits were most instructive, being made by the light of two or three candles placed on the side of the aquarium opposite that on which the eggs were deposited, which clearly illuminated them, as well as the movements of the parent fishes.

On the 15th and 16th, the male made preparations for the deposition of the ova by removing confervoid growths and all foreign matter from the selected site. These he carefuly cleared away with his mouth. Meanwhile the female lurked in the weeds on the far side of the aquarium. At 9 A. M. on the 16th she visited and inspected the site. Approving of it, she placed herself in a horizontal position by it, her abdomen lying at an angle of about 45 degrees, so that the genital papilla had free play to eject the ova on to the glass. Her position also gave me a clear view of her every movement. When his mate had settled herself, the male drew near, and took up a position about one inch above her. His head pointed in the opposite direction to hers, and his abdomen lay at right angles to the prepared site; his genital papilla was immediately above that of the female.

On the morning of the 17th, the first ovum was emitted, and immediately afterwards, two others followed. These were conjoined by a fine hair-like film,

and were closely followed by a string of eight. She continued to eject strings of eggs until a circular patch of about two by two inches was covered. All the chains of eggs were placed horizontally, no one crossing another, and there were about twenty eggs to the lineal inch. Each egg had a genatinous base by means of which it adhered to the glass. As the ova were being deposited, the male hovered over the female, it being evident from the movements of his genital papilla that the spermatic fluid was being ejected, and fertilization taking place.

The spawning being completed, the male at once placed himself perpendicularly above the ova, frequently changing his position, his head being sometimes up, at others down. He remained over the eggs for nine days, the period of incubation, and I suppose he obtained his food at night, as he was never feeding at the time of my visits. In thirty-six hours the gelatinous base of each egg had become elongated into a peduncle, the eggs themselves being also larger, and provided with a globule of air on the yolks. On the third day he commenced to fan them continually by oscillating his pectoral and caudal fins. These actions kept the ova in a constant swirl, and were continued until the fry emerged and took shelter in the weeds.

On the morning of the 20th I noticed the first signs of eyes, and at 9 P. M. they were distinctly visible. On the 25th, at 9 A. M., the fry were emerging from the eggs, nine days after their deposition. For a while they hung, head downwards, from the empty egg-capsules, by means of their tails, which were bent like the curve of a fish-hook. The motions of respiration and a tremulous movement of the pectoral fins were the first indications of life when they came into the world. At 8 P. M. the following day they had all dispersed among the weeds, where they were further guarded by the male for another twenty-four hours. The temperature of the water at this time was about 80 degrees.

There were no sterile eggs in the first few nests, the first one being observed in the fourth. The eighth nest contained thirteen, and the number continued to increase as the season advanced.—*Reprinted by permission from* The Australian Zoologist.

With the caption, "Mysterious Fish with Strange Arabic Inscriptions," a recent magazine article presents a photograph of *Holacanthus nicobariensis* (*var. Semicirculatus*), caught at Zanzibar, where it created quite a sensation. The markings of the caudal fin form two distinct inscriptions in Arabic, reading on one side, "The Work of God," and on the other, "God Alone." The fish was bought in the market, and when the strange markings were noticed, it was taken to an Arabic scholar. It was afterwards shown to the Sultan, who also recognized the wording.

The lettering is plain, and the discovery caused wonderment among the local Mohammedans. They declare it portends something about to happen, possibly the end of the war. Fabulous prices were offered for the fish by the superstitious, but it finally came to rest, in formalin, in the Government laboratory. It was later placed on public exhibition.

What fishes may be associated in a "happy family" or community aquarium? The experiences of aquarists differ. Let me have a list of the species composing your "family," mentioning the size of the tank. This is a point on which many readers ask help.—*Editor.*

The History of Ichthyology. Part 3

MAJOR R. W. SHUFELDT, Medical Corps, U. S. A.

Passing from such influence as the progress of ichthyology received at the hands of such men as J. Ray and F. Willughby, from 1628 to 1672, we pass to a brief account of the achievements of a man who far outclassed either of them; although what he did for the science of fishes in his time was due to the accomplishments of the two writers just mentioned. Reference is made to the labors of Peter Artedi.

Now, Artedi was born in Sweden in 1705, and at the age of 29 he was accidentally drowned in one of the canals of Amsterdam, in 1734. In his brief lifespan he not only studied under Linnæus at Upsala, but he seized upon the published material left by Ray and Willughby, whose writings he thoroughly appreciated, and applied them to his own various lines of research in ichthyology. Owing to his sudden and early taking off, all this was left in manuscript; but, fortunately, there was a friend at hand to take care of this for him. This was Count Clifford, a wealthy Englishman, and the proof was edited by a no less distinguished naturalist than Linnæus himself, who was, as stated above, a friend of Artedi during the latter's brief career. So important were the works of Artedi, and so comprehensive for the time they were written, that many biographers refer to him as the father of ichthyology; and it would seem that he well deserves that distinction.

As gathered together, his works comprise five distinct treatises. First among these we find an exhaustive ichthyological biography as well as bibliography up to his time (*Bibliotheca Ichthyologica*). This is followed by a wonderful and systematic treatise on the anatomy of fishes and its application to taxonomy (*Philosophia Ichthyologica*). Then he gave us his *Genera Piscium*, in which no fewer

Portrait of Carl Linne, somewhat past middle age

than forty-five piscine genera are created, all of which seems to have held up to the present time—so accurate were the diagnostic differences defined. In his *Species Piscium* we meet with most excellent descriptions of seventy-two species of fish, which are quite as scientifically dealt with as his *Genera;* and, lastly, this remarkable authority compiled a great work on ichthyological synonomy (*Synonymica Piscium*), wherein we meet with a systematic arrangement of the works of all previous writers on

fishes up to his own day.

Few writers in biology have accomplished such an array of completed productions in so brief a period of time; even Linnæus, the best-known naturalist the world has ever seen, never succeeded in overshadowing Ardeti, in so far as the science of fishes is concerned. However, Linnæus did accomplish one great task in this field; for, taking the correctly described species of fish by Artedi, he not only added other species to the list, but he applied correct *binomial* names to *them*. Moreover, Linnæus, in the twelfth edition of his *System*, gives us a classification of fishes which is a very thorough one, considering the time it appeared. This part of the wonderful achievements of Linnæus is too extensive to reproduce in a short article like the present one.

Almost immediately after the works of Artedi and Linnæus appeared—indeed, inspired by them—this branch of zoological science took on a truly marvelous forward movement, which was manifested in the rapid appearance of many works on fishes from many pens of writers of very different nationalities. Omitting the feeble efforts of Klein and Gronow, both of whom were contemporaneous authors with Linnæus, we may name such writers as Thunberg; Brunnich (Mediterranean fishes); Kalm (American types); O. Fabricius (Greenland); Osbeck (Fishes of Japan and China); Forskal (Red Sea forms); Hasselquist (Palestine and Egyptian species), with a great many others, such as Duhamel, Pennant, Muller, Parra, Cornide, Neidinger, and others of less eminence. Next followed the great impress made on ichthyology by the writings and complications of such distinguished writers as M. E. Bloch (1723-1799), and Lacepede (1756-1826); while the morphological side of the science received the attention of numerous pens of authors skilled in comparative anatomy, wherein fishes were not neglected. For example, Hunter worked on the nerves; Camper and Haller took up other organs, but also paid some attention to piscine neurology. Munro produced a mass of excellent work on the general anatomy of fish, contrasting it with that of our own species. Electrical fish were studied by Allamand, Walsh, Reaumur, Bancroft and others. Even as early at 1764, Fleditsch both understood and practiced the artificial rearing of salmon and trout; and just previous to this time a great number of brochures appeared on what was being discussed under the general title of the mystery of the common eel.

Another enormous impulse was given the study of fishes when Baron Cuvier entered the field (1769-1832); this was at a time almost immediately after the writings of Lacepede and Bloch appeared. It will be remembered that G. Cuvier was the author of the great work, the *Regne Animal*, and his interest in ichthyology hinged upon his employing it in that famous treatise. A. Valenciennes was a pupil of Cuvier's, and in the year 1820 the former commenced his well-known work on the *Hirtoire Naturalle des Poissons*, the first volume of which was published eight years thereafter. Following Cuvier's death, Valenciennes continued the work, producing volume after volume, until the twenty-second one was out in 1848, which takes into consideration the salmon group of fishes or the *Salmonidae*. Notwithstanding its extent, this series of volumes is by no means complete. This does not mean, however, that the student of ichthyology can well dispense with it, for such is not the case.

In a brief article like the present one

CAROLUS LINNAEUS. M.D.
S.ae R.iae M.tis Suecice Archiater; Medic: et Botan: Profess.
Upsal: ordin. Horti Academ. Præfectus; nec non Acc:
Imper: Nat: Curios. DIOSCORIDES 2.dus Upsal:
Stockh: Berol: Monsp: et Paris: Soc:
Natus 1707. Maj. 13/24. Delin. 1748.

C.M. Bernigeroth Sc. Lipsiæ 1749.

it is quite out of the question to present the various classifications proposed by any of the above named ichthyologists, as that would occupy too much space. The readers of this short biographical history would gain nothing by it, for all of those classifications are, to a greater or less degree, now much modified by writers of modern times. The era between the years 1760 and 1860 was filled in by many writers in this field, the majority being, however, pre-Cuvierian ones. For example, we find the works of Patrick Russel, F. Hamilton, E. Donovan, A. Risso, and finally, in 1815, a work on the fishes of New York by S. L. Mitchell.

Although only seventy years elapsed between the days of Linnæus and Cuvier, the advances made in the science of ichthyology were simply enormous. These were principally along the lines of the knowledge—the accurate knowledge—of the significance of taxonomic groups, based upon distribution in time and upon morphological characters; upon the anatomy and physiology of fishes, and upon many of the extinct forms.

In concluding this part, it may be said, in truth, that, notwithstanding the brilliancy of the light shed on scientific ichthyology by Artedi, who preceded Linnæus, and the glorious contributions to the subject by Bloch, Lacepede and Cuvier, who followed him, it must be admitted that the impetus given the study of fishes by the *Systema* of Linnæus must ever be regarded as the great central light of the middle period of the eighteenth and nineteenth centuries. This being the case, we may well devote the illustrations of this part to the illustrious Swede, who accomplished so much that redounds to the credit of biological science. For the two portraits I here present of Linnæus to the readers of Aquatic Life I am indebted to the generosity of Col. C. C. McCulloch, Jr., of the Medical Corps of the Army, who is librarian of the Army Medical Museum of the Surgeon General's Office, and to Mr. Cary R. Sage, assistant librarian of that institution, who selected them for their present use. In this library there is a wonderful gallery of portraits, and these two of Carl Linne were selected from it, copies being made for me by Mr. Roy Reeve, the official photographer of the Museum. In Fig. 1 we have a portrait of Linne, somewhat past middle life, while in Fig. 2 he is considerably younger, or, as indicated in the legend, about 41 years of age. Historically, these portraits are of great value, and have not appeared anywhere in literature or biographical sketches for a great many years; they cannot fail of being appreciated by students of ichthyology in any part of the world where they may be seen.

The aquarian should at all times use the scientific names of fishes in preference to a manufactured or common name; then there will be no mistaking the particular fish about which he may be talking.

A little fish from Africa, recently made known to science, bears the tongue-twisting name of *Microstomatichthyoborus bashforddeani.* Written in "long hand" the name is just about twice as long as the fish.

Most exotic fish fanciers endeavor to breed a greater number of species than their equipment can handle. The usual result is under-sized fish, due to crowding.

The waters are nature's storehouse, in which she locks up her wonders.—*Walton.*

Aquatic Life

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

W. A. POYSER.....Editor

JOSEPH E. BAUSMAN.....Publisher

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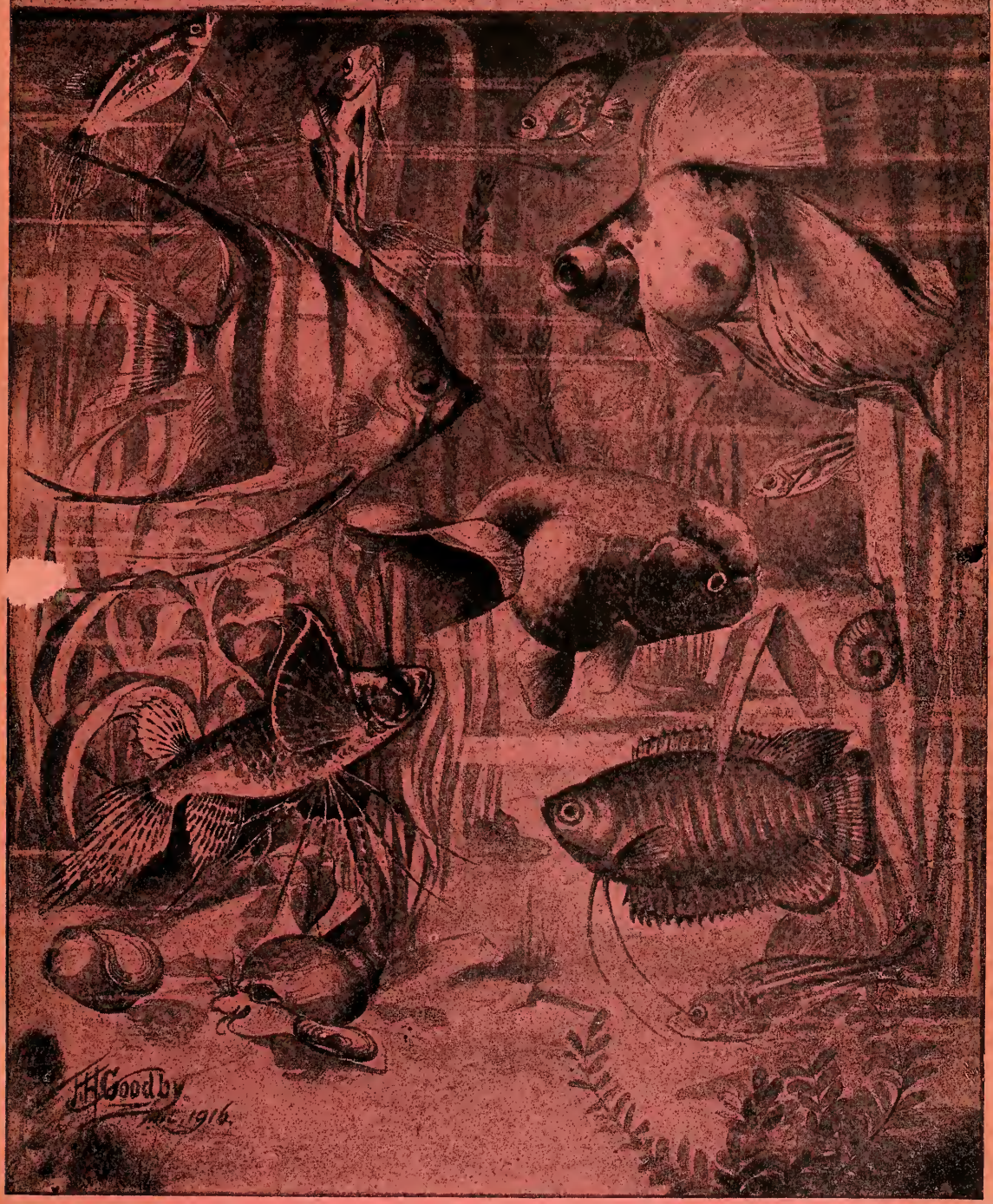
The Satin-fin or Shiner, *Notropis analostanus*, and the Red-fin, *Notropis cornutus*, are two common and widely distributed minnows. Spring or breeding males are quite attractively colored. Found in brooks and creeks east of the Rockies.

August 1916 10c Copy

Aquatic Life



ACARA BIMACULATA

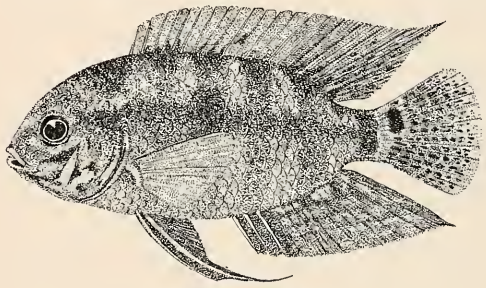
ERNEST LEITHOLF

The breeding activities of few tropical fishes, if any, are more interesting than those of *Acara bimaculata,* of South America. More shy but not as pugnacious as *Hemichromis* and other relatives, their breeding in the aquarium is not difficult.

The sexes are similar in coloration, but it is very changeable, quite contrasty transformations being effected. The ground color may be either olive or a greenish blue. A black lateral band has its origin at the gill cover, being followed by a number of spots of the same shade, the last located at the base of the caudal. Under oblique light the head, back, base of dorsal, and anal fin have a brassy sheen. Upright bars are visible at times, extending from the ridge of the back to the abdomen, which, like the lateral markings, may partially or completely disappear. The dorsal points and the base of the anal are blue, edged with black; ventrals black streaked with blue. In breeding examples the abdomen and sides may be black with a bluish sheen, the back becoming a rich olive crossed by bars of a darker shade.

The ventral points of the male, when folded, extend to the sixth ray of the anal, while in the female only the fourth is reached. In a pair I had under observation the dorsal and anal fins of the male, which he usually carried slightly folded, appeared somewhat larger and drawn into points, whereas in the female they were rounded and habitually carried erect.

This pair we placed, for breeding purposes, in a large tank of filtered and ærated water, which averaged 81 degrees Fahrenheit. This aquarium is heated by gas, the burner being placed in the lower end of a length of two-inch iron pipe, which is fastened to the bottom of the tank and extends above the water line. To prevent rust the pipe was coated with Portland cement, giving it the appearance of an upright submerged log.



Acara bimaculata

On the 29th of March, much to our concern, the pair were discovered fanning a nest of eggs which they had placed on the heating pipe. When, but two days later, they were observed picking them from this rather warm situation, we concluded they were indulging in a feast of boiled eggs! Noticing the adults alternately disappearing in a group of *Sagittaria,* I then perceived what resembled, in miniature, a swarming colony of bees. The eggs of a moment before were now a cluster of living, wriggling fry suspended from a leaf of *Sagittaria.* The force of expelling a mouthful of the young into the cluster by one of the parents would cause the other to violently vibrate their caudals to enable them to maintain their positions.

During the next five days they were transferred seven times, always being

assembled as described. There were approximately 250 young, and it required less than ten minutes to move them to a new location 18 inches away. On one occasion, having moved half of the family from the centre of the tank to a leaf close to the side nearest the observer, they, as we approached, apparently decided that the new location was unsafe, for immediately the youngsters were carried back to the old place.

In five days, seemingly without nourishment other than that furnished by the yolk-sac, the fry had doubled in size. On the sixth day they had begun to swarm about, keeping the parents busy as bees to prevent them from scattering. Stragglers would be picked up in the mouth of a parent and expelled back into the school. That night they were again assembled in a cluster. This putting to rest, as it were, was followed for two weeks. After this the youngsters disregarded parental restrictions and moved about at will, still, however, zealously guarded against harm.

How strong the parental instinct may be was well illustrated by a pair in the possession of Mr. Dwight Winter, of Pittsburgh, Pa. These mated and reared a family in a large community tank, yet they successfully guarded their offspring against all attacks.

When my young were three weeks old I removed the parents. The babies are quite robust, resembling in this particular, as well as in appearance, the young of the Chanchito. The care and feeding is identical, and was covered by Mr. Winter in his paper in the July number.

(Mr. Winter writes that his tank holds about 180 gallons, and contained at the time mentioned 4 *Fundulus chrysotus,* 3 *Gambusia holbrooki,* 8 *Lebistes reticulatus,* 2 *Phalloptychus januarius,* 30 *Mollienisia latipinna,* 8 *Platypoecilus maculatus,* 20 *Xiphophorus helleri,* 20 *Poecilia sp, incert.,* the breeding pair of *Acara* and one odd male. On June 13th, the young *Acara* measured from three-fourths to an inch long, and were still in the original tank, where Mr. Winter intends to keep them until they are much larger.—*Editor.*)

In the death of Rudolph Gallattovitz, on July 23d, the Aquarium Society, New York, lost an active and popular member. The remains were interred in St. Michael's Cemetery, Long Island.

Mr. Gallattovitz's son, Raymond, who recently received an honorable discharge from the U. S. Army, has become a member. While he was stationed at San Antonio, Texas, he made a goodly collection of snakes, turtles, horned toads and other lizards.—Hugo C. Nelles, *Chairman Press Committee.*

At the annual meeting of the Milwaukee Aquarium Society, the following officers were elected: *President,* Liborius Semmann; *Vice-president,* Alfred H. Schroeder; *Treasurer,* George J. C. Steffen; *Recording Secretary,* W. R. White; *Corresponding Secretary,* Arthur Simon; *Custodian,* Edwin F. Kieckhefer; *Librarian,* Jacob Merget; *Directors,* Max Jaehnert and Dr. R. G. Washburn.

The members of the Chicago Society Aquatic Life recently visited Milwaukee, and apparently found much to interest them in our collections.—Arthur Simon, *Corresponding Secretary.*

First autumn meeting of the Philadelphia Goldfish Fanciers' Society, Saull's Hall, 804 Girard avenue, September 18th. General "get together" and annual auction of fishes. Bring a few good ones and a little "spare change." Public invited.

On Transporting Living Daphnia

WILLIAM T. INNES

For several years a few fish breeders have been carrying their Daphne home on cloth stretchers or trays, instead of in pails of water. This method has such important advantages that its use should become more general. As all aquarists are not familiar with the scheme, a description follows, together with a statement of the results of a series of experiments made to test its efficiency.

Collectors of Daphne and mosquito larvæ have occasionally noted, when the net is kept moist over night, that the "insects" clinging to it will be alive the following morning. It has also been long known to the writer and others that quite a large mass of Daphne can be carried home in the net if it is not allowed to dry. These facts have brought about the development of the cloth tray or stretcher on which to carry any kind of pond food. The tray on which the food has been placed is carried in a tight receptacle which will prevent evaporation. Upon arrival home the food is washed from the tray into water. Any arrangement embodying these principles will answer.

The outfit I am using fills every requirement. The carrier is a tin bread box measuring 12 inches long, 9 inches deep and 8 inches wide. This holds nine trays, the frames of which are wood, ¾-inch square. These are about a half-inch shorter in width and length than the corresponding inside measurements of the carrier, which permits easy removal. Fine muslin forms the bottom of the tray. The edges of the fabric are turned over neatly and fastened to the outside of the frame with small copper tacks. Tacks of copper allow easy removal when new muslin is needed. In order to economize in weight I used soft white pine for the frames, giving them a coat of shellac to make them moisture proof. The box is enamaled white, because white absorbs considerably less heat than dark colors while standing in the sun.

When collecting, set a tray in the water rim up, placing the food in it as gathered. A tray will carry a layer 1-16 inch deep after the water has been drained. If not to be carried for more than an hour or two they may be piled ¼ inch deep. Let me say here that a quarter inch of "bugs" in a tray of this size is a big lot of food. It is about as much as can be carried in a large can of water for an hour without ice. In lifting the tray from the water proceed slowly, after spreading the contents as evenly as possible. The muslin should not belly downwards and allow the Daphne to work in under the frame, which it will do if too hastily withdrawn from the water.

To empty a tray invert it over a pan or tub. If a hose is handy, run the water first around the edge and then over the centre. This prevents washing the contents between the frame and muslin. In spite of care some will lodge there, but are easily removed by pressing the fabric slightly backward and pouring water on the edge. This removal is important. There have been complaints that the cloth soon rots and needs renewing. This, I think, is caused by the particles allowed to remain and decompose, or because the trays are not thoroughly dried after use. They should be stood apart in the air and not returned to the box while any

moisture remains. I have used my trays for some time, and they seem as good as new.

As each tray is emptied into water the water in turn should be passed through Brussels netting or brass wire cloth of the proper mesh to pass the Daphne and retain a great deal of the rubbish and detrimental insect larvæ that are usually taken. Such sieves are, of course, a part of the equipment of every well regulated breeding establishment.

In my experiments to ascertain how long Daphne could live under the conditions mentioned, I employed a single tray, placing a moist one above and below it. The carrier was placed in the cellar with a temperature of approximately 65 degrees. The Daphne was in a layer about 1-16 inch deep. At five different intervals the tray was dipped, end down, into a pan of water, each time washing off a new section, but without disturbing or moistening the balance. Portions were thus removed at three, seven, seventeen, twenty-seven and forty-one hours. At twenty-three hours practically all were alive, save such as were probably injured in collecting or dead or moribund when placed in the tray. At forty-one hours about three-quarters were dead, and no doubt all would soon have perished.

The fact that Daphne (and mosquito larvæ) can be kept in good condition for any reasonable length of time by this method, without ice, should make its use almost universal, especially when one considers the saving in weight. In one hand, with my outfit, I am certain that I can carry twice the quantity of Daphne as a man with two fifty-pound lard cans who must travel an hour to reach home, and mine will be in better condition.

A woman's idea of a square deal is one in which she comes out ahead.

Our President's Car

Oh, boy! Have you seen it—our President's car? Latest thing in Daph traps, got 'em all beat by far. No, it's not a one-lunger, though the fact seems untrue till microscopical examination shows up a wee two. The boat has four wheels, and three touch the ground, with rubber-band tires to make them look round. The self-starter's a pippin—nothing new, to be frank—for any fish fan can work it with eight turns of the crank.

Fred says it's a humdinger, and we agree with him in that. For daph hunting it's great, *if* you don't care when you get back. Folks call it Haley's comet, but for speed far be it from such; it's the flaming tail left behind when she's kickin' up the dust. Five miles from a gallon and ten minutes to the mile, really the dear ole sloop would make an iron man smile.

'Tis not a tin Lizzie, a flivver or a can, for the thing was created before H. Ford was a man. At night while Fred snoozes, and all nature seems dead, the ole buss is safely anchored right under his bed.

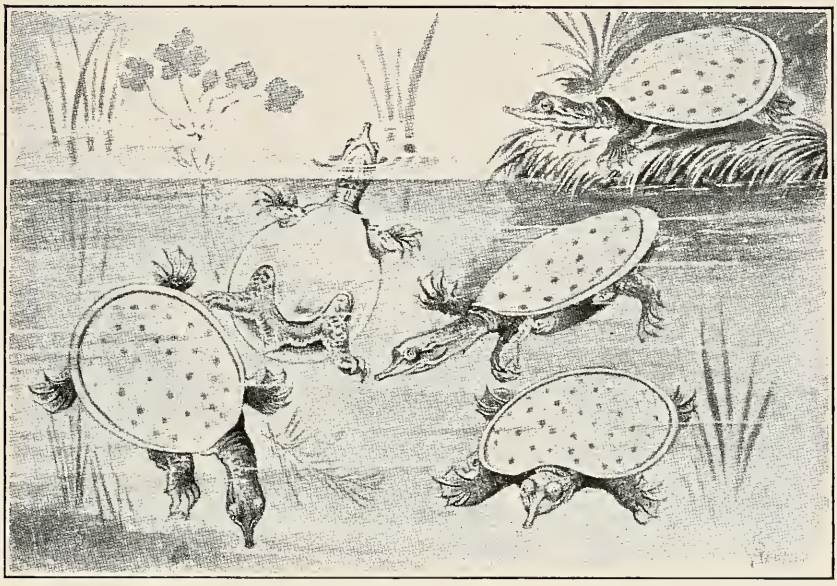
P. S.—With apologies to the Chicago Aquarium Society, and the Orsinger buss, which is none other than the original working model of the prehistoric Simple-X lemonzine.—*Bro. Bill.*

They're trying to christen *Mollienisia latipinna* the "flag-fin." Seems to me that the Philadelphia calico broadtail goldfish has 'em all beaten for flag-fins any way you look at it, not to mention that it sports the colors of liberty, red, white and blue!—Mose.

It is surprising from how far Aquatic Life brings business. We recently had a visit from a reader in Central America, who mentioned that he saw our advertisement in A. L.—*Crescent Fish Farm.*

The Southern Soft - Shelled Turtle

RICHARD DECKERT, New York Zoological Garden



YOUNG SPECIMENS OF TRIONYX FEROX

Turtles and tortoises are known to every one by their hard, horny armor, but there are a few species that do not possess this protective structure. The commonest American species is the Southern Soft-shelled Turtle.

The carapace, or shell, of this creature constitutes a soft, more or less cartilaginous or leathery covering in which the outlines of the vertebræ and ribs can be seen in thin examples, but which is perfectly smooth in well-fed ones. This covering bends easily at the edges. The outline is oval in the adult and almost circular in very young specimens. The head and neck can be withdrawn completely, as with most of the hard-shelled species.

The head is small, with a soft, pointed snout, and thick, fleshy lips, which conceal hard, sharp jaws. At the very tip of the trunk-like snout are the small nostrils, which can be closed when the turtle is under water. The feet are large, margined with broad, membranous flaps, the toes webbed beyond the tips, each foot having but three claws. The carapace is slightly convex, with a row of bony plates imbedded along the centre. The plastron or under side is flat, and also has several bony plates, which in old specimens are covered with large callosities. On account of the flat structure the species is called the "Flapjack Turtle" in some parts of the South.

Young examples are prettily marked with black spots and rings disposed more or less symmetrically over the upper shell

on a pale gray or fawn ground color; there is also a narrow dark margin around the edge. Adults are uniformly yellowish gray or brown. A yellow band on each side of the neck and head extends through the eye and unites with the opposite one in front of the eyes. The tail is thick and medium in length, and can be drawn sidewise under the shell.

Like all fresh-water turtles, they are carnivorous, and large examples do not belie their scientific name, *Trionyx*—three-clawed; *ferox*—ferocious.

In Florida they are called snapping turtles, the real "snapper" being known as the "alligator cooter." They are often found in shallow situations near the shores of the ponds and rivers, buried in the mud or sand, with just the head protruding. Upon the slightest disturbance they dart into deeper water, throwing up clouds of mud or sand with their broadly-webbed feet. They are remarkably rapid swimmers, and are no doubt aided in their progress through the water by their comparatively flat and thin form.

Small examples in an aquarium will lie for hours buried in the fine sand at the bottom, only rising to the surface occasionally, and then merely protruding the tip of the snout. Of the many specimens observed by the writer, not one has become as tame and confiding as most of our other fresh-water turtles. The slightest jar or a sudden movement on the part of the observer will send them scurrying to the farthest corner of the aquarium, where they burrow rapidly into the sand. As this turtle reaches a length of shell of nearly two feet, and a weight of more than thirty pounds, only very young specimens are suitable for aquarium inmates.

The food in captivity should consist of earthworms, and raw beef and fresh fish cut in narrow strips. If kept in a large tank, with about three inches of fine sand, and provided with a large log on which they can climb and rest, they will endure captivity for years.

We are learning to appreciate the direct and indirect value of small things in fish culture, as well as in other matters. The investigations of aquatic plants, which Dr. Emmeline Moore, professor of botany at Vassar College, and at times investigator for this Bureau, has been conducting for several years, are revealing a greater forage value of water plants than had previously been realized. An illuminating illustration of the indirect value of certain plants was presented in the course of her investigations at the Fairport laboratory last summer. It was observed that in June and July a certain species of insect larva (a chironomid, *Orthocladius nivoriundus*) feed almost exclusively upon a species of filamentous alga (*Mougeotia genuflexa*), and that at the same time this insect larva formed an important food of the large-mouth black bass. Thus, during these months, the small alga, which might have been thought to serve no useful purpose, was contributing in a material way to the support of the black bass.—*Fisheries Service Bulletin.*

A correspondent, writing of a visit to another town, says: "We were shown some beautiful high-brids (*sic*)—*Barbus conchonius* hatched from common goldfish eggs." Verily, there is no end to the hybrid stuff. A couple of years ago an article was submitted, based on one from a current German magazine, which asserted the production of a cross between an oviparous and a viviparous fish. The translator had failed to grasp that the original article was evidently a satire.

Breeding Habits of the Asiatic Red-bellied Newt

EDGAR R. WAITE, F. L. S.
Director, South Australian Museum

RED-BELLIED NEWT PHOTOGRAPH BY MAJOR R. W. SHUFELDT

On August 31st, 1904, I exhibited before the Society living examples of the Asiatic Red-bellied Newt (*Molge pyrrhogastra* Boie) and, though I kept them, in Sydney, until my removal in April last year, they showed no signs of breeding.

At the breeding season last year the Newts were exhibited at the New Zealand International Exhibition, but they were not then suitably housed for breeding purposes.

This season, however, they were returned to the tank in which I kept them in Sydney, and, with the exception of the exigencies of climate, they are under precisely similar conditions.

The first eggs were laid on October 10th, and hatched on December 12th; subsequent eggs also required about sixty days for incubation, the temperature of the water ranging from 55 to 65 degrees F. The tank is well suplied with plants, including *Vallisneria, Anacharis* and *Myriophyllum,* but in every instance the first-named was selected. The procedure does not appear to differ from that of the Crested Newt of Britain (*Molge cristata* Laur), as detailed by Rusconi and Bell, for though I formerly kept both adults and tadpoles of this species, I never actually bred it.

The Red-bellied Newt, as watched in my vivarium, usually employs a terminal floating portion of a leaf of *Vallisneria* and folds it upon itself, the leaf being often cracked in the process. The leaf is glued in this position, and the single egg, placed within the fold, is similarly secured. More rarely an egg is placed

between two leaves where they cross each other, the two being glued together. Occasionally a detached portion of a leaf is used, and fixed against the wall of the tank, always, however, at the surface of the water. If removed from the plant an egg sinks, but the primary object of the attachment appears to be protection, for I have intentionally detached some eggs and they have developed equally well on the bottom.

The larvæ have grown rapidly since they were hatched, ten days ago, but if their subsequent development is as slow as that of *Molge cristata,* as recorded by Higginbottom, it will be fully three years before they are mature, even if I am successful in rearing them.—*From the Proceedings of the Linnean Society of New South Wales.*

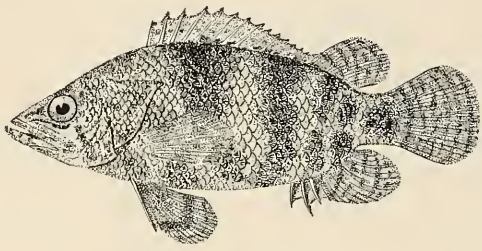
(The Red-bellied Newt, which American students prefer to place in the genus *Diemyctylus,* is often obtainable in the pet shops, selling for about twenty-five cents. It is quite a beautiful species, easily maintained in the aquarium, as it does not leave the water. Small tadpoles and worms are favored foods. Major Shufeldt's photograph illustrates the variations in the distribution of the brilliant orange-vermillion markings of the under side; above it is blackish-brown to black.—*Editor.*)

Nandus Marmoratus

WALTER L. BRIND, F. Z. S.

A glance at the illustration will give a good general idea of the appearance of *Nandus marmoratus.* In coloration it is quite handsome. The ground color is greenish brown, with brassy reflections, vertically marbled with three broad, patchy bands of dark brown, while a fourth crosses the caudal, though this may be present in the form of a blotch; narrow bands radiate from the eye, which is golden-green with narrow golden iris. Bands of dots cross the soft portions of the dorsal, anal and caudal fins. The mouth is capacious, as befits a bass, and is a sure indication that the possessor is a voracious fish, seizing its prey—small fishes—suddenly, and gulping them down like pills. The maximum length is seven inches.

The sexes are hard to distinguish, except during breeding season, when the female becomes distended and deeper in the abdomen. At other times, to the practiced eye, the females are more "curves," while the males are more angles.



Nandus marmoratus

In general habits the fish is not active, at least in so far as continuous motion implies activity. It spends much of the time concealed among the plants, from which, pickerel-like, it rushes forth to seize a passing minnow. It is a good pet for the aquarist who can supply unlimited Daphne and worms, though in a pinch it will eat raw beefsteak if cut into narrow strips and temptingly dangled before it to simulate a luscious worm.

Nandus has not been bred in confinement, though eggs have been deposited, but not fertilized.

This species is found in the fresh and brackish waters of India and Burma, where it is common in ponds and ditches and inundated fields. It is exceedingly tenacious of life if the proper temperature is maintained—not less than about 75 degrees.

The History of Ichthyology. Part 4

MAJOR R. W. SHUFELDT, Medical Corps, U. S. A.

Cuvier, in his writings, passed, to some extent, into the domain of fossil fishes, or palæoichthyology; he demonstrated the fact that the extinct *Palaeoniscus* was related to the existing gars and sturgeons, especially, in the first instance, to *Lepidosteus.* It remained for Louis Agassiz, however, to demonstrate to the world the value of the study of fossil form of fishes, and his work upon them —"Recherches sur les Poissons Fossiles" —is still the grandest monument ever erected to that department of the science of fishes (1807-1873). It was published as an elephant folio, with an atlas, at Neuchatel, between the years 1833 and 1843.

Agassiz established the now well defined group of ganoids (*Ganoidei*) principally through his exhaustive studies of the scales of many species of fishes.

This distinguished ichthyologist was totally unable to accept the law of organic evolution; as a consequence, his name in science must ever remain an example of that type of naturalist who accepted the Biblical account of the origin of living form on this planet: by special creation, at the command of a creator. Therefore his elaborate classification of fishes, based upon the form of their scales, was a failure and of no value to science.

Agassiz was followed by a broader ichthyologist, Johannes Muller (1801-1858), who pointed out, in his classical work, "Ueber den Bau und die Grenzen der Ganoiden" (1846), the structural differences of those fishes. This writer's researches markedly advanced the science here, being considered in not a few important particulars, additional light being thrown on the subject through the description of the remarkable form, *Cerotodus,* by A. C. Gunther, of the British Museum (Phil. Trans., 1871, II), and by Professor Huxley, establishing the correct place in the system for *Lepidosiren.*

In 1880, Doctor Gunther also published his well-known work, "Introduction to the Study of Fishes," a copy of which he presented to the present writer, as well as a copy of the famous monograph on *Ceratodus,* with other papers on fishes.

A number of years previous to this many important works on fishes had appeared, not only from the pens of writers in France, but in England as well, chief among the latter being those by Richardson, by Jenyns, and by Gunther (Challenger Reports "Fishes"). Indeed, as each year came and passed, the literature on this subject was ever on the increase, and a great many treatises and monographs were added to it. Both Yarnell and Couch described the fishes of Great Britain, while Heckel, Kner and Siebold described those of Germany. In 1866 Blanchard brought out his work on the fishes of France, while Steindachner worked up the fresh-water forms of Portugal and Spain, these being supplemented by B. de Bocage and Capello.

Schlegel, in 1850, paid considerable attention to the fishes of Japan (*Fauna Japonica,* 1850), while many writers worked up those of the East Indies, especially Ruppell, Playfair, Gunther, Day and P. Blecker, the last being a most

voluminous writer and author of the famous *Atlas Ichthyogique des Indes* (1862). This superb production, with its wealth of colored plates, was interrupted in 1878 through the death of its eminent author.

The fishes of Central and Eastern Africa received, in different works, the attention of Gunther, Petterick and W. Peters, while those of New Zealand were

Spencer Fullerton Baird

described by Hutton, Hector and others in 1872. Soon after their time, or in 1875, C. Lutkin gave his attention to the ichthyology of Greenland, and ten years previously A. J. Malmgren had devoted himself to the fishes of Spitzbergen.

As for the fishes of Cuba, my old friend and correspondent, Filipe Poey, of Havana, described a large number of them in his *Memorias sobre la Historia natural de la Isle de Cuba,* commenced in 1851, and his *Repertorio Fisico-natural de la Isla de Cuba* (1865), both of which works he presented to my private library. South American fishes were touched upon by Agassiz, Gunther, Castelnau and others, while the ichthyology of Mexico and Central America received the attention of such writers as Vaillant, Bocourt, Gunther and Steindachner, the two last-named principally to the fishes of Central and South America.

In our own country, we have had many distinguished and eminent contributors to the science of ichthyology, among the earliest of whom was J. Richardson. In Part III of his well-known *Fauna Boreali-Americana* (1836) he described not a few species of the fishes of British America.

In Part IV of his "Zoology of New York," De Kay, in 1842, described many of the fishes of that section of the country, and it was fully thirty years after that before other works of any importance began to appear. Chief among these latter was the five-volume *Report of the United States Commission of Fish and Fisheries*, which was published between the years 1873 and 1879. These reports long remained standard, and later on began to be supplemented by ichthyological papers, which were contributed to various journals and similar publications by writers on fish of those times. Fortunately for science, the Reports of our Government were frequently devoted to accounts of marine and fresh-water fishes of the United States, and these began to appear more often as time went on.

During these years, and earlier, the list of writers in Europe on the morphology of fishes was, indeed, a long one, and it would be quite out of the question to name even a part of them in this article. However, I may mention those with whom I was in direct correspondence; for example, W. Kitchen Parker and his two sons, W. Newton Parker and T. Jeffrey Parker, of Dunedin, New Zealand; Mr. Thomas Henry Huxley, Carl Gegenbaur, Hasse, C. Vogt, A. Gunther,

and not a few others equally prominent in such fields.

In the United States, too, we had many writers on both technical and popular ichthyology, nearly all of whom have now passed away. Earlier in his life, Jordan, associated with not a few co-authors, contributed many works on descriptive and systematic ichthyology, as Barton W. Evermann, Gilbert and others.

George Brown Goode

Carl H. Eigenmann worked up the fishes of tropical America, and Dr. Hugh M. Smith has given us many contributions to economical ichthyology, with papers on the fisheries of this country generally. W. O. Ayres, Tarleton H. Bean, and especially Theo. H. Gill, published long series of papers dealing with the taxonomy of fishes, describing many new species, genera, and families. Doctor Gill's work on the classification of this branch of the Vertebrata, when reviewed and collected into one volume, will have a profound influence on the science. Few possessed the far-reaching knowledge of fishes that he did, and it will be a lasting regret that he did not, during his long life, give us some general work on the subject.

Edward D. Cope, during his most remarkable career in the fields of American zoology and palæontology, touched very extensively on the science of ichthyology. He was one of America's greatest naturalists, and whatever he turned his attention to along such lines was sure of a marked advancement.

Prominent among the earlier writers was the well-known ichthyologist Girard, who was co-author with Professor Baird in some of his writings. In fact, speaking of the last-named ichthyologist, few, indeed, in American zoology did more towards furthering the interests of the science and economics of the fishes of this country than Spencer Fullerton Baird. Especially was this the case when he held the position of United States Commissioner of Fish and Fisheries, and, later, the secretaryship of the Smithsonian Institution. It was through his most generous encouragement that the present writer was enabled to publish his "Osteology of *Amia calva*," with some twenty other papers and memoirs on North American fishes. In those long-ago days, Doctor G. Brown Goode was Assistant Secretary of the Smithsonian Institution; he was a most tireless contributor to the study of the various groups of fishes of this country, as well as the deep-sea forms. Although but a few months past forty-five years of age at the time of his death (Feb. 13, 1851—Sept. 6, 1896), he had already published many minor papers on ichthyology, as well as such formal works as "Catalogue of the Fishes of the United States" (1879), "American Fishes" (1880), "The Fisheries and Fishery Industries of the United States" (1884), and

"Oceanic Ichthyology" (1894). Associated with him, in the latter work, was Dr. Tarleton H. Bean, to whom reference was made above.

In my private collection of the portraits of naturalists, I find unpublished photographs of both Professor Baird and Doctor Goode, personally presented to me. These were copied for me at the photographic gallery of the Army Medical Museum and Library, and reproductions of them illustrate the present papers. Many naturalists now living will delight in possessing these portraits; and, as a matter of fact, few American zoologists of the last decade were more universally loved and esteemed than these two most eminent scientists. Fortunately, their researches were carried on in an age when all the departments of American biology were at the acme of their development, and naturalists of the very highest order were producing works of the greatest possible importance. But now the world is in the throes of a mighty and most destructive war, and zoological science has, as a consequence, suffered enormously—in some ways irretrievably. One can well imagine what intense pain either of these men would have experienced, had they lived to see the felling of the magnificent and long-revered beeches, oaks and other grand trees close to the National Museum on the Mall—all of which was accomplished in a few hours as one of the military necessities of this war, to say not a word of the trees sacrificed in the park north of the Bureau of Fisheries, a department with which both Baird and Goode were so thoroughly identified. Indeed, Professor Baird was our first Commissioner of Fish and Fisheries (1871), and was, it may be said, the Nestor of that important industry.

Krefftius adspersus

Under present shipping conditions it may seem a far cry to talk of fishes of Australia, but the seemingly impossible has been accomplished. A few specimens of the Purple-striped Gudgeon have been safely transported to the United States. Incidental thereto we have received a splendid photograph of the fish, taken by Mr. H. E. Finckh, of the Royal Zoological Society of New South Wales, which is reproduced in this issue. This is apparently the first published photograph.

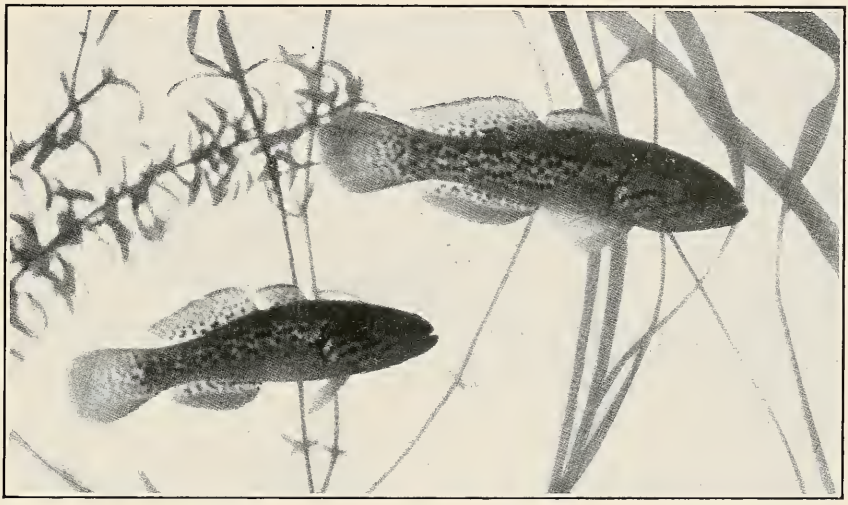
Mr. Finckh observes that the fish is a most considerate inhabitant of the aquarium. In his tanks the eggs were always placed on the front or room-side of the tank, making a close study of their development very easy. In a nest containing some two hundred eggs, all the fry were coiled round in the same direction, head down, and were thus on the eighth day at 9 A. M. and at noon. At 4 P. M. all, with a single exception, had turned head up. The next day the eggs hatched.

The fish gets its common name from the four purple stripes on the gill-covers. The body is marked with blue and brown, becoming more pronounced during breeding. The yellowish fins are plentifully bespeckled with the body colors. If this gudgeon proves well-behaved and suitable for the community tank, its future in America is assured, especially as it breeds readily and does not require a high winter temperature.

Carbon dioxide is the most important gas in freshwater. In small quantities it is essential rather than detrimental to aquatic animals. In large quantities it is rapidly fatal, acting as a narcotic. It is particularly injurious in the absence of oxygen, which absence is usually associ-

ated with it. Abundant oxygen decreases its toxity, because blood has a greater affinity for oxygen than for carbon dioxide, and the latter is crowded out of combination. On account of the fact that it is usually accompanied by lack of oxygen, putrescible muck bottom, etc., its presence in quantities greater than 6 to 7 cc. per liter, if accompanied by a bottom entirely of such muck would indicate that the water was unsuitable for trout, basses, sunfishes and crappies.

One of the most important characteristics of a water is its acidity or alkalinity. Protoplasm must maintain essential neutrality or it will die. It possesses a very effective physico-chemical mechanism based upon the presence in excess of very weak acids (carbonic and phosphoric) and alkalies in the form of carbonates and phosphates. Since protoplasm must remain nearly neutral, the acidity or alkalinity of the surrounding medium cannot be great. Thus Wells found that fishes do not live well in alkaline water, but become sluggish and inactive. Neutrality is likewise toxic to some fresh-water fishes. They require a certain amount of acid. The optimum acidity for different species differs. The optimum for the bluegill (*Lepomis pallidus Mit.*) is 1 to 3 cc. of carbon dioxide per liter and for crappies (*Pomoxis annularis Raf.*) 4 to 6 cc. per liter. Wells showed by using various other acids that the hydrogen ions are the important factor. In other words fishes require a certain concentration of hydrogen ion. Neutrality is avoided by fishes. In the absence of acidity they select alkaline in preference to neutral water. Fishes and various crustaceans will live in distilled water if it is slightly acid, while it is rapidly fatal if alkaline. The toxity of much ordinary distilled water is due to colloidal copper or other metal from coolers, in suspension in it.—Fresh Water Biology.



Krefftius adspersus **Purple-striped Gudgeon** **Photograph by H. E. Finckh**

The great majority of small specimens of aquatic animal life can only be seen microscopically, but there are a few sufficiently large to be seen with the naked eye. These are the rotifers and the nematoid worms. They all have soft bodies, and therefore come under the common designation of "aquatic worms," and are of special interest to those who study nature that is under the water. It is these animalculæ that sustain the upkeep, the health conditions, and the procreative powers of the larger denizens of aquarium life.

The economic value of these tiny animals is of such vital importance that they should be studied more closely than even the other inhabitants of our tanks. Nothing that will aid the laws of nature should be passed over slightingly. Nature, who so tenderly looks after all her children, from the great "leviathan" to the smallest microscopic mite, must have all the conditions her requirements need, otherwise the result is always more or less a failure. Remember that all organisms wholly depend on other organisms for nutrition wherewith to support their physical existence.

Rotifers are generally called wheel animalculæ. In the first description given of them a rotifer was said to be "an animal like a large maggot, on the tail of which appeared forceps like that of an earwig." The next description of it was "an animal with two wheels thick set with teeth, resembling the wheels of a watch." These two descriptions taken together will help us to recognize them. The common rotifers are one-fiftieth of an inch long; still they are the giants of the race. Of other members of the family, it takes 100 of them to the inch. They increase very rapidly. The female produces fifty young every thirteen days. The males live only three or four days, but the longevity of the females is from twelve to fourteen days. Increasing so rapidly, they can afford to die off quickly. When once a few of them are put in an aquarium no further trouble need be taken. They breed in the mud, and unless an aquarium be overstocked with fish the supply of them is well maintained for the rearing of young fish in their first stage of growth. They will be constantly seen rotating in the water, and it is amusing to note the baby fish chasing and feeding on them.

In appearance nematoid worms are very similar to the common earthworm. They fix themselves in the debris, live in colonies, and when once they make for themselves a home in the bottom of an aquarium they become extremely active. They have an oscillatory motion, and grow to about one and one-half inches in length; fully a third of their length is used as anchorage. They are various shades of red. Their appearance is by no means repulsive.

Their chief advantage in an aquarium is that they are splendid food for young carnivorous fish, and indeed for any fish. When the plant anchorage is constantly disturbed their increase is checked; therefore leave well alone, and don't disturb the plants.—Albert Gale.

All turtles are possessed of powerful jaws, and many of the sea-turtles are able to crush the clam and other hard-shell substance. But the loggerhead tortoise is champion of the turtles when it comes to hard biting. One of these creatures has been known to crush a steel gun-barrel which a sportsman had thrust into its mouth, while another of these tortoises has been known to split the handle of an oar, three inches in diameter and made of hardwood.

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