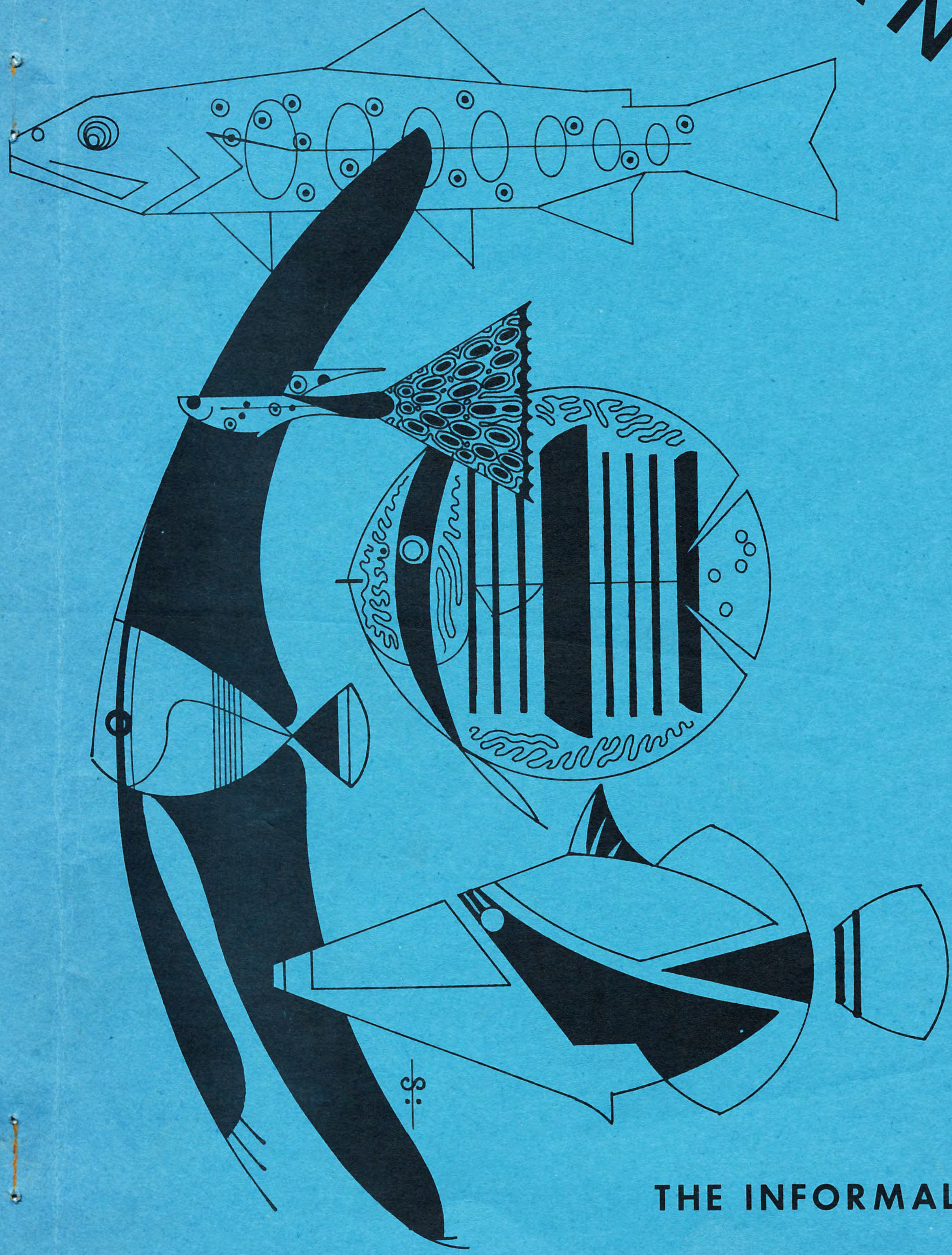
DRUM AND CROAKER



THE INFORMAL ORGAN

FOR AQUARISTS

MAY 1969

VOLUME 69 NUMBER 2

VOLUME 69, NUMBER 2 MAY 1969

D R U M A N D C R O A K E R

The Informal Organ

for

Aquarists

Manscript material received is reproduced with a minimum of editing, and is not returned unless requested.

We take credit for neither spelling, nor classification.

Send material to: National Fisheries Center
and Aquarium
Room 2013
Department of the Interior
Washington, D.C. 20240

Material herein may be reproduced unless specified otherwise. Please credit D&C, author, and photographer for material utilized. Reprints cannot be provided.

Art work by Craig Phillips, NFCA.

Prepared by the National Fisheries Center and Aquarium, U.S. Department of the Interior, Washington, D.C. 20240, under authority of Public Law 87-758, 76 Stat. 753, as a service to aquariums generally.

1970 JAPANESE AQUARIUM TOUR

One of the special items to be discussed during the Aquarium Symposium will be a proposal to all American aquarists to spend three weeks touring the principal Japanese aquariums and oceanariums. As many will know, the Japanese have almost 100 aquariums in their country and some of these are so far ahead of what's being done in other parts of the world that it is most startling. For example, the new Aburatsubo Marine Park is unsurpassed in many of its new types of displays.

Earl S. Herald
Steinhart Aquarium

BOOKLET ON LARGE AQUARIA

A new manual entitled *Some Guides to Designing, Building and Operating Salt Water Aquarium Systems* is available free of charge to workers seeking assistance with marine systems ranging from 100 to 100,000 liters in capacity. This booklet gives information on methods of construction, control of physical, chemical, and microbiological factors, and ecological and health conditions in large aquarium systems. It may be obtained from Triton Aquatics, Inc., 1435 Haines Road, Levittown, Pennsylvania 19057.

15th ANNUAL

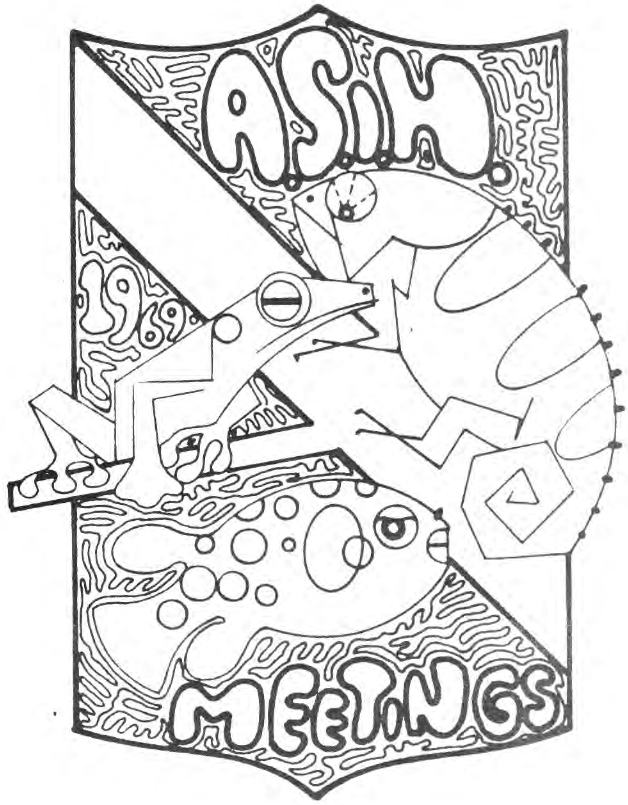
PROFESSIONAL AQUARIUM SYMPOSIUM

of the

American Society of Ichthyologists and Herpetologists

Whether or not you are a member of Ichs & Herps, you are welcome!

June 12 (2-6 p.m.)
American Museum of
Natural History



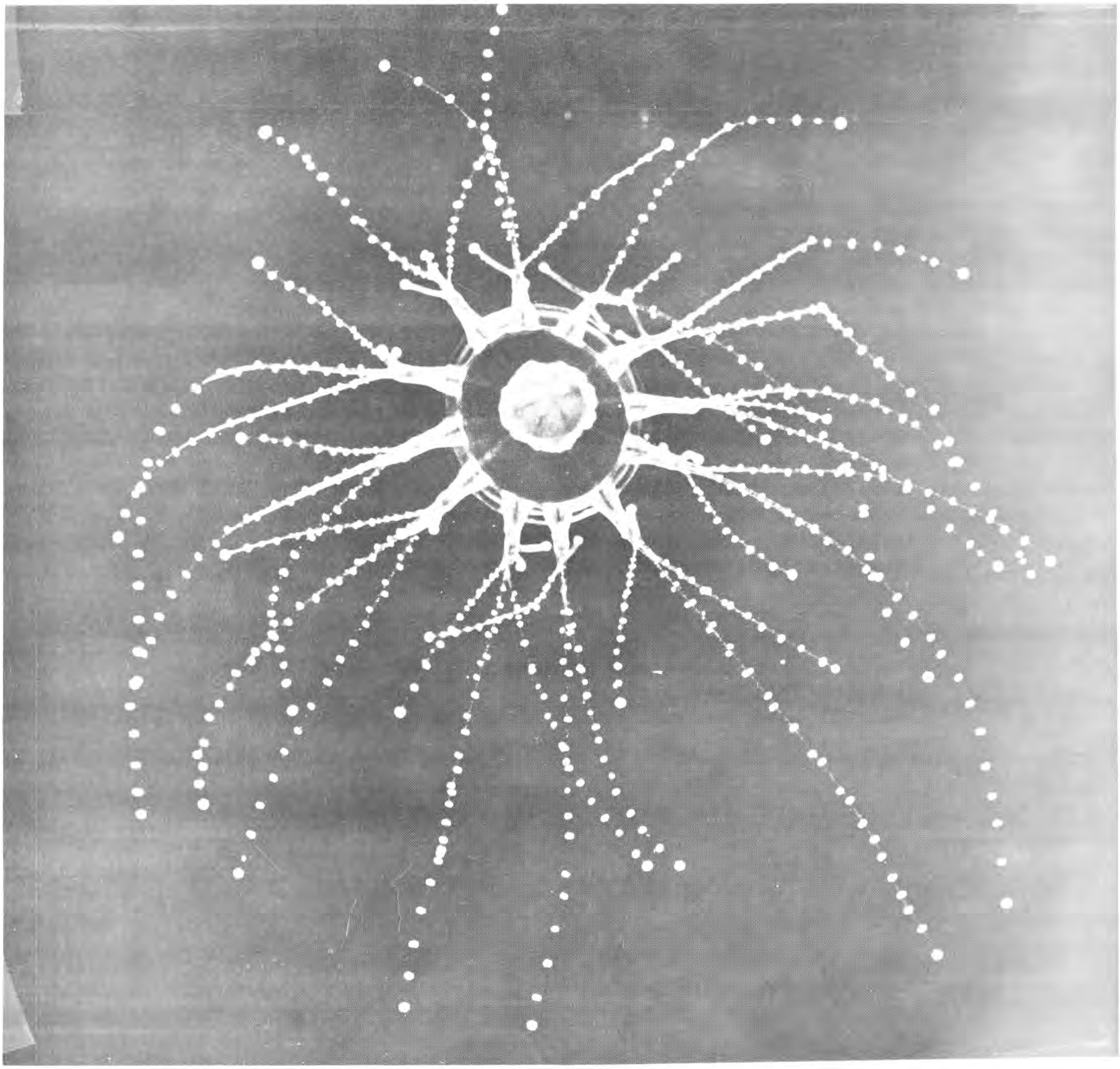
June 13 (2-6 p.m.)
New York Aquarium

On the Agenda:

Reverse osmosis, glass, water purification, salt water flora, Seaquarium films on marine symbiosis and sea horses, Pittsburgh's *Inia*, Steinhart's *Platanista*, Baffin islands Norwhals, collecting techniques, film on flounder locomotion, photographic techniques, the new Marine World and other aquarium reports. Sounds great!

SPAWNING ANEMONE (2x)

MAY 1969



MEDUSA (6x)

Photographs in studio aquaria by Charles Eames, Venice, California, for preparation of educational materials for the NFCA. (Not to be reproduced without permission.)

C O M M E N T

It is said that people do not truly appreciate things that are free. We do not know if this applies to our modest efforts with the DRUM AND CROAKER.

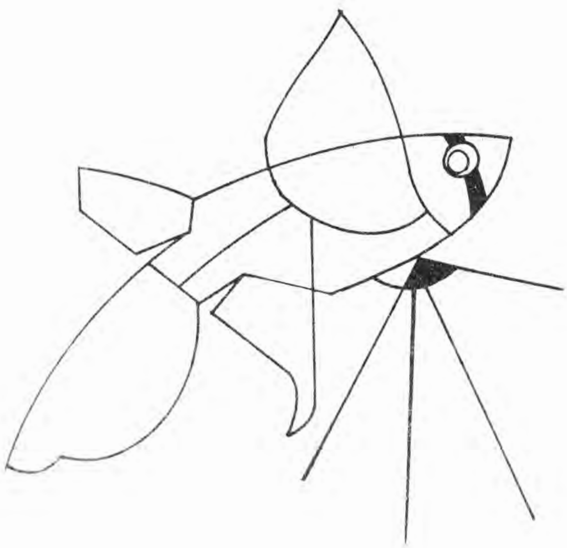
We have said that your cost for a subscription is contributions. Since we have undertaken the issuance of DRUM AND CROAKER, 26 on the mailing list have authored or co-authored 27 contributions for three 1968 issues and the January 1969 issue. Five of these were National Fisheries Center and Aquarium staff. Only one of you has contributed more than one article. We have "lifted" 18 items from other publications, and included 23 aquarium news items, most of which we had to wheedle from you.

To be of general interest, we need not only pertinent-subject articles, with black and white photographs, we must have personal notes -- personnel moves, collection trips, new techniques, etc.

HOW ABOUT IT?

DRUM AND CROAKER
May 1969

CONTENTS



MAY 1969

USE OF ULTRAVIOLET IRRADIATION IN THE TREATMENT OF ABRASION-INDUCED BLINDNESS

James S. Kepley, Aquarist
The Pittsburgh AquaZoo

Utilizing the informative articles contained in the DRUM AND CROAKER[1], we have been using longwave ultraviolet lighting in the prevention of disease in our display tanks. The results have been remarkable. *Oodinium* and exophthalmus have all but disappeared from our tanks since the addition of U.V. to our normal lighting.

Our display lighting consists of from one to four, forty-eight inch, double-tube flourescent fixtures, suspended twelve to fifteen inches above each tank; with one-hundred watt incandescant spotlights, as needed, for desired effects. In October of 1968, we equipped each fixture with one longwave F40BL ultraviolet tube, in addition to the regular gro-lux tube.

Recently, we have noticed an increase in the amount of eye fungus among our North American specimens. The underlying cause of these infections has been traced to the plastic plants we use as decorations. The fish scratches the cornea of the eye while pursuing foodfish through the plants and abrasion blindness results, followed by a secondary fungus infection. Normal ultraviolet lighting has been effective in combating this -- in most cases.

A recent case was a young, twenty-inch northern pike (*Esox lucius*) which we have had on display since obtaining it as a fingering in the early part of 1968.

[1]DRUM AND CROAKER; Vol. LXVIII, No. 1; January 1968.

The specimen was displayed in a 1,480-gallon tank equipped with two flourescent fixtures and two one-hundred watt spots. The flourescents were set up as described above. Abrasion blindness was first observed February fifth and the two gro-lux tubes were replaced with two additional F40BLs for maximum irradiation. By the fifteenth of February, the eyes were completely covered with fungus and the pike, though noticably hungry, was unable to capture live goldfish used as food. It was noticed that he spent a good deal of time hiding in the shadow of a large stump placed in a corner of the tank for decoration. On the nineteenth, the pike was moved to a white-bottomed refrigerator liner equipped with a sand-and-gravel filter and a fixture containing two F40BLs was suspended seventeen inches above the tank and filter bed. The entire system held ninety-five gallons and the lights were on for eight hours daily. Three large goldfish were added on the twenty-first, but no interest was shown by the pike. By the twenty-fifth, the right eye had partially cleared and the pike managed to catch and eat one of the goldfish. Noticable improvement followed, with feeding habits returning to normal and a complete recovery being observed by the first of March. The pike was subsequently moved to a larger reserve tank to make room for a medium-sized perch and a small walleye with similar conditions.

In conclusion, ultraviolet irradiation shows unlimited potential as a useful tool in the field of aquarium management. It can be used efficiently in the treatment of disease with pronounced success over former "hit-or-miss" treatments. The cost is nominal and a U.V. treatment tank can be set up with materials already on hand or easily obtainable. Ultraviolet irradiation may well be the answer to keeping the more delicate exotics healthier -- and longer.

BIBLIOGRAPHY

Bevan, Billie M., Zeiller, W.; Ultraviolet Irradiation of Marine Aquaria; Miami Seaquarium; Miami, Florida.

Herald, Earl S.; Ultraviolet Sterilization of Seawater; Steinhart Aquarium; San Francisco, California.

Lagler, K.F., Bardach, J.E., Miller, R.R.; Ichthyology, John Wiley and Sons; 1962; pp. 370-381.

Phillips, Craig; "Use of Neoprontosil Azosulfamide in Treating Abrasion Induced Blindness in Marine Fishes," The Drum and Croaker; No. 1; June 15, 1958.

THE TRAINING OF FISHES[1]

Shiro Takamatsu[2]

Edited by James Atz[3]

Goro walks out

In the previous two essays[4], I have told how I induced the Ishidai (*Oplegnathus fasciatus*) to perform tricks. About two years ago, these talented Ishidai made their first public appearance, and since then they have been good friends of the visitors, especially the children. About ten days after their debut, however, Goro, one of our stars, suddenly went on strike, and walked out on the show. Goro was the best entertainer among these talented fish, because he had the habit of stopping at the yellow hoop for a while before he went through it. Miss Seki, the witty toastmaster of the performance always made a comment about this and made the audience laugh -- "Look at Goro; he knows he has to stop at the stop sign."

The caretaker, the other scientists of our Aquarium, and I got together to discuss a counterplan for Goro's sudden strike. We examined him very carefully at first, but physically he appeared to be all right; no major change in appetite or frequency in respiration was observed. Since he showed a normal appetite at the time of feeding, it was certainly not a hunger strike in order to demand better treatment. The water quality of the aquarium was also examined, but this was not the

---

1) Translated by Mrs. Nao Saito (January 1969) from Monkii (Monkey) 12(1)(No. 99): 30-32, 1968.

2) The author is Curator of the Department of Ecology of the Oita Ecological Aquarium.

3) The American Museum of Natural History, New York.

4) Not available to, nor pertinent to D&C coverage.

cause either, as far as the results of the analysis indicated. Without finding any reason for Goro's strike, we prescribed the replacement of the aquarium water as a first step, and decided to seek more effective treatment. Discussing whether we should fire Goro and find a new face from our farm-team, or whether there might be a good way to have him call off the strike, we gave him an intensive course of training for several hours. Around nine o'clock that night, Goro finally gave up his strike and went through the hoops.

Recently, Dr. Kiyoski Uchibashi visited our Aquarium, and told us that a fish does not react to any stimulation while it is sleeping. Considering this fact, we now understand Goro must have been sleepy at the time. We really appreciated Goro's patience in taking the intensive course, and we learned much from this incident. Furthermore this suggested to us a new theme for the study of conditioned responses of fishes.

Behavior and rearing

Frankly, the rearing and management of fishes are very difficult. Dr. Horiie, the Director of our Aquarium, is a veteran (an expert) in fish-rearing and has devoted himself to taking care of aquarium fishes for more than several decades. He always tells beginners, "Fish are the most difficult animals to take care of satisfactorily. They may be more difficult to raise than any kind of terrestrial animals, as a matter of fact." Actually, no matter how much people learn about the fish in college, and know about water quality, bacteria, or viruses that cause trouble in rearing fishes, they can do almost nothing when they are really in trouble. This kind of knowledge is almost useless because fish diseases are caused by innumerable indeterminate factors that cannot be analysed by regular water quality procedures of analysis or bacteriological processes. In other words, these kinds of analyses are only useful in determining the cause of death after a fish has died, and is merely a means of explaining what was wrong with it. Therefore, at least at the present moment, we cannot predict the outcome of our fish-rearing by using this kind of technique.

Whenever a fish does not feed (itself), this means that the fish is in critical condition. In most cases, such a fish eventually dies. For this reason, one who notices the slightest change in the behavior of a fish while it still shows a normal appetite, and then takes prompt action is a true expert in fish-rearing because the behavior of a fish is mainly based on the conditioning that the fish is induced to undergo under the given circumstances. In short, it can be said that the expert keeper looks at fish behavior from the physiological point of view. In any event, no one can be an expert keeper from the beginning.

Deterioration of aquarium water and responses to conditioning and feeding

Now, the case of Goro suggests to us that changes in fish behavior can be caused by a slight, almost unnoticeable deterioration of the environmental water that does not affect feeding activity. We thought we could apply this fact in developing conditioned responses. We assumed that physically the condition of a fish can be divided into four stages; that is, the stages at which fish show (1) positive (+) conditioned and feeding responses; (2) negative (-) conditioned responses, but positive (+) feeding activity; (3) both negative (-) conditioned and feeding responses; (4) death. It is very difficult to take care of individual fish properly when many fishes are kept in a large single tank. We thought, if the assumption just mentioned is correct, that we could find a troubled fish more easily, before it slips into a critical condition.

First of all, we planned an experiment on the effect of an artifically-deteriorated environment on fish. The species used was the Kagokakidai (*Microcanthus strigatus*) which had been proved to be very clever by Mr. Yamanouchi. Mr. Nakajima of our laboratory tried to produce conditioning so that the fishes were fed whenever they went into a basket trap originally designed for a mouse. In addition to this, he induced the fish to learn the trick of "barrel-opening" and "box-opening." Within a couple of weeks, the fishes were completely conditioned, as we had expected in the beginning.

Finally, the main experiments were conducted. As a polluter, a certain ratio of ammonium chloride (sal ammoniac) was added every five minutes in one tank, and every ten minutes to another tank. Each time, the conditioned and feeding responses of the fishes were tested. As a result, as far as the results of these two experiments were concerned, we were able to prove that the suspension of the conditioned response always precedes that of feeding activity.

Experiment A

Time lapse (minutes)	0-80	90-120	130-140	150
Ammonium-N (ppm)	0-40	45- 60	65- 70	75
Conditioned response	+	-	-	Turning sideways
Feeding response	+	+	-	

Experiment B

Time lapse (minutes)	0-55	60-80	85-160	165
Ammonium-N (ppm)	0-55	60-80	85-160	165
Conditioned response	+	-	-	Turning sideways
Feeding response	+	+	-	

Conditioning to light

On the other hand, all the fishes in the large aquariums were conditioned to light. About seventy species, more than one thousand fish, were kept in twelve aquariums, which ranged from 1.4 to 30.3 (metric) tons in water capacity. Thirty seconds before feeding, each aquarium was lit by a 500-W flood-light, 80 cm above the water surface. At the time of feeding, which took place every other day, this conditioning was repeated over and over for about four months. As a result, almost all the species in the aquariums had been conditioned completely by the end of the fourth month. Furthermore, it was clearly observed that troubled fish showed a very slow reaction to the given condition even though they took food normally at the time of feeding. This phenomenon lasted about one to four days, and in most cases, the fish that showed this kind of abnormality died within two to eleven days. Frankly speaking, however, we had serious trouble in judging whether or not the reaction of a fish to the given condition was positive, or on the contrary, negative, as our judgment was mainly based on its distance from the fish gathered at the light of the lamp. If this judgment had been based on a more definite criterion than this, as seen in the conditioning of Ishidai to a basket trap, we would not have had such difficulty in judging whether the fish were reacting positively or negatively to the given condition. But in these experiments, since positive-negative judgment was very ambiguous, Mr. Nishi, the principal planner of these experiments, had serious trouble during their course.

To obtain more precise data, we think that we should develop other conditioning experiments in which we can judge more easily and more definitely whether or not a fish is responding to the given condition.

In reality, however, as seen in the case of the Mongarakawahagi (*Balistes conspicillum*) which occupy the best places in a tank beneath the flood-light and chase away other fishes coming near, many factors other than the positive-negative answer were involved in the planning of experiments. We cannot carry on this kind of experiment without considering the inter-specific, interracial, intermutual ecological relationship of the fishes. At present, we are still seeking the solution to this. We do hope, however, that some day we can plan better experimental procedures to solve this interesting aspect of the study of the conditioning of fishes.

The experiments mentioned above gave us a good suggestion for the management of aquarium fish; that is, as long as the fish is conditioned to light in the way we described above, there is no problem in transferring the fishes from one tank to another. What we previously did at the time of transferring was to reduce the amount of aquarium water, to chase the fish out of their hiding places, and to catch them by a net or basket. Sometimes, we were forced to pull the fish out of their hiding places by hand. The shock to the fish during transferral was, therefore, immeasurable, because they were often injured or frightened by such rough treatment. The keeper used to have many troubles after a transfer since this had a tremendously adverse influence on the fish.

Now the fish gathering toward the flood-light are caught in a polyethylene basket without showing any signs of injury or fright; if there is some food in the basket, they are willing to get into it. No matter how many times we transfer a fish, it always gathers under the flood-light whenever it is turned on. Needless to say, even under the flood-light, we have to be very careful not to harm any fish at the time of transferral.

In this way, we have been able to transfer about 70% of the entire fish population into a tank of 30 metric tons water capacity at the same time, without damaging any of the fishes.

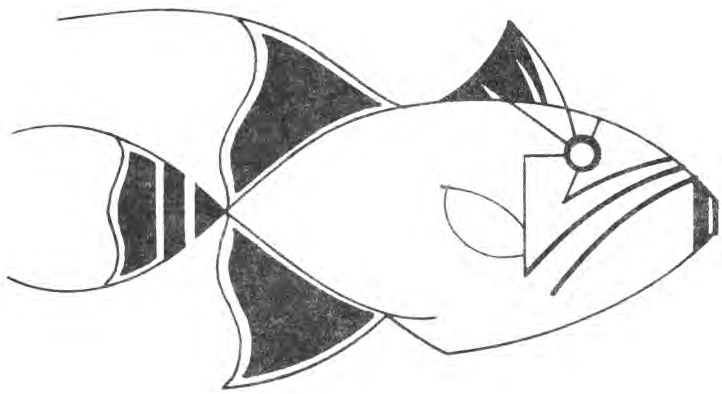
Incidentally, after the above experiments, the transferred fish (mainly the Kagokakidai, *M. strigatus*) were kept in a tank in the usual way for about three months, without being given any reinforcement of the conditioning. One day, we turned on the 500-W flood-light in order to take photographs of these fishes. Surprisingly enough, the fishes in the tank gathered swiftly under the lamp. Someone said, "It is amazing how clever fishes are," so I replied, "A fool tries to judge everything by the one thing he knows." What do you think about this incident?

Another thing we learned from this series of experiments was that the time lapse to require for the formation of conditioned response depends on the systematic position of fishes -- at the family or subfamily level. Furthermore, it was learned that groups of species requiring considerably long periods of time in order to become conditioned are as follows: the Family Pomacentridae, Holocentridae, Chaetodontidae (Subfamily Chaetodoninae?), Serranidae (Subfamily Epinephinae?) and others. All of these families are characterized by peculiar ecological features (peculiar ways of living), such as a habit of living in rather limited habitats (for example, caves, hollows, dens among rocks) or nocturnal habits under natural conditions. In other words, the formation of a conditioned response is closely related to the way of living of the fish under natural conditions. However, factors other than this, such as the combination (mutual relationship) of species, the number of specimens in the tank (population density), the age difference among the individual specimens, and others, considerably influence the conditioning of fishes.

Many problems in the management or rearing of fishes might be solved by applying "conditioning" or "training." Our previous studies on the conditioned response are slightly different from genuine academic study, and we must admit that our training project has a tendency toward the training of anthropocentric (personified) tricks. The gap between the learning of tricks and real academic studies is rather large, so that many problems still remain unsolved.

We sincerely hope that we can bridge the gap some day, and with our training project can contribute to the academic study of the conditioning of fishes.

Ed. Note: We have reproduced as a separate, the above section "Behavior and Rearing" in which we find words of wisdom for aquarists generally.



NEW AQUARIUM IN COLOGNE[1]

After more than ten years of thinking and planning, construction was started in 1968 on an aquarium, terrarium, and insectarium opposite the entrance to the Zoo. The structure is to be completed so that there will be enough time for the engineers, zoologists, gardeners and aquarists to be fully prepared for commissioning in the 1971 garden show year.

Plans were drawn up on the basis of the most modern ideas as to exhibition techniques, maintenance, and operation. Visits to other zoos and other aquariums assisted in many decisions which had to be made with respect to the technical equipment. The overall plan was discussed expertly in outstanding cooperation with Dr. Werner Ladiges, one of the best known aquarium designers in Europe.

The aquarium has a ground area of about 30 x 36 meters, and the terrarium about 30 x 30 m, built in a single-story design. They will be connected by a central lobby which will be of two stories.

The main room of the aquarium is 20 m long by 7 m wide with an adjoining 8 m wide display pool for fish of the Rhine River. Three 5.5 x 12 m side rooms will display specimens in three water categories, cold and warm salt, and fresh.

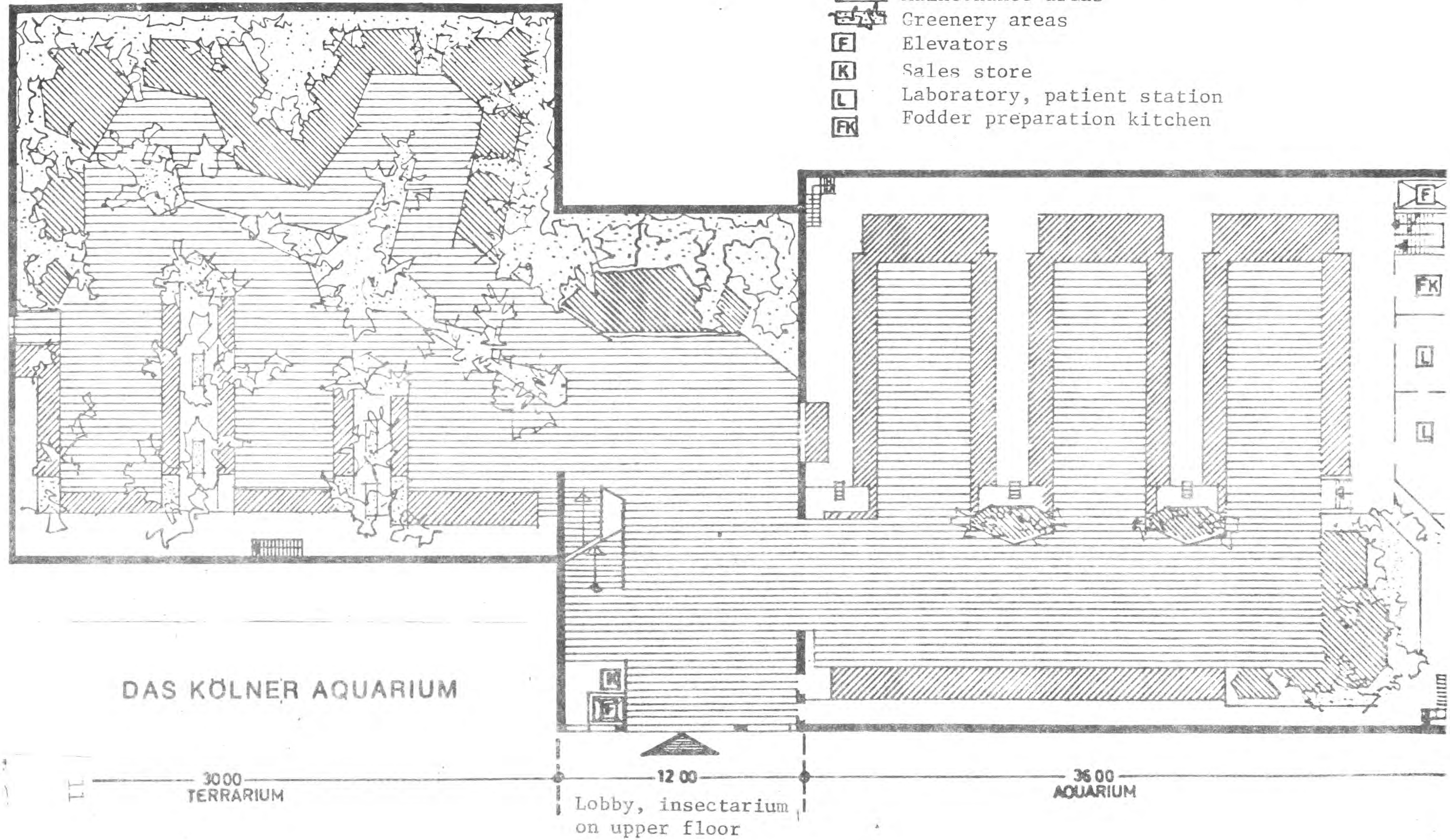
---

(1) Condensed from a paper by Eng Kurt Meywald, Freunde Des Kolner Zoo (Friends of the Cologne Zoo), Vol. 11, No. 2, Summer 1968, pp. 57-61.

Ground floor, ground plan, schematic layout

Scale about 1:300

- Visitor walkways
- Enclosed aquariums and terrariums
- Open-air animal installations and panoramas
- Maintenance areas
- Greenery areas
- F Elevators
- K Sales store
- L Laboratory, patient station
- FK Fodder preparation kitchen



Planned are small and large aquaria, but most have the same display windows with dimensions of about 1.10 x 1.10 m. A few special exhibits are glass-enclosed over their full width of 5.5 m. These will hold the big fish and turtles. Low sit-down walls surround two pools which will contain starfish, sea anemones, lobsters, etc.

In the walls will be a large number of very small aquariums, some of which have dimensions of only 15 x 25 cm and which are intended to display special species of interest to the hobbyist.

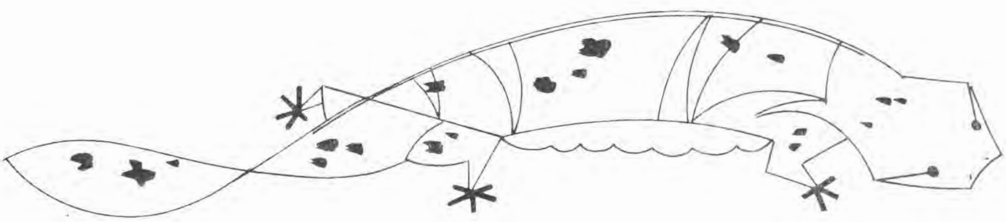
The visitor room will be illuminated by the reflected light only from the aquariums. Skylights -- which admit daylight, for contrast -- will be over three open pools.

In order to obtain an efficient working height for the personnel, along the rear portion of the exhibits, the floor will be about 1.5 m higher than the visitor floor. As a result, the basin edges are only .8 m above the work-area floor and the attendants can easily bend over and clean the aquariums. The aquariums are filtered individually or at most in groups of two. Thus, every group will have its own water circulation which is constantly cleaned by the filters, but which is supplemented daily only by that volume of water which was lost through cleaning or evaporation. About three or four times a year one-half or as much as two-thirds of the water will be renewed by pumping from the storage basins in the basement.

The water of Cologne contains too much lime and must, among other things, be softened. The ocean water will be prepared on the basis of tried prescriptions and will be stored for some time before use. Special formulations -- for instance, to simulate the Atlantic Ocean or the Adriatic Sea, the North Sea or the Baltic -- will be prepared at the individual aquariums. A ring system for all types of water will run through almost all rooms so that various parts of the sweet-water section can be converted for ocean water displays and vice versa.

One important aspect of the aquarium supply plan is represented by air, more specifically, air for the transport of the waters primarily from the filter to the aquariums and for the constant enrichment of water with oxygen. The air, which is compressed in air tanks to about 2 atm, by means of several compressors located in a separate room in the basement, is tapped at the aquariums with about 0.5 atm.

In connection with the many technical installations and requirements, a separate transformer station is being built for electric power supply and for the supply of an emergency power unit; emergency replacement units will be installed for all of the important machinery, such as pumps, compressors, etc., in order to prevent any losses of animals due to breakdowns in any of these equipment items. A specially drilled deep well will provide in-house water for the big open-air terrariums, the cold sweet-water basins, and for cleaning purposes.



DR. MALCOLM S. GORDON, who has been acting as Assistant Director for Research, National Fisheries Center and Aquarium since September 1968, is returning to the University of California, Los Angeles, to reassume his position as Professor of Zoology-Fisheries, Department of Zoology. During his tour with the Fisheries Center, Dr. Gordon established a new, but temporary, laboratory; formulated research projects leading to improved design of the Fisheries Center and of operating techniques; drew the plans for 15 laboratories and offices and attendant facilities for the new Fisheries Center; and outlined the research staffing pattern.

PROPOSED LEGISLATION ON DISEASE CONTROL(1)

On February 25, Senator Moss, Utah, introduced S. 1151, a bill to protect the fish resources of the United States, including freshwater and marine fish-culture industries, from the introduction and dissemination of fish and shellfish diseases. (Representative Dingell, Michigan, has introduced an identical bill in the House. As of the date of this DRUM AND CROAKER, no action has been taken on either bill.)

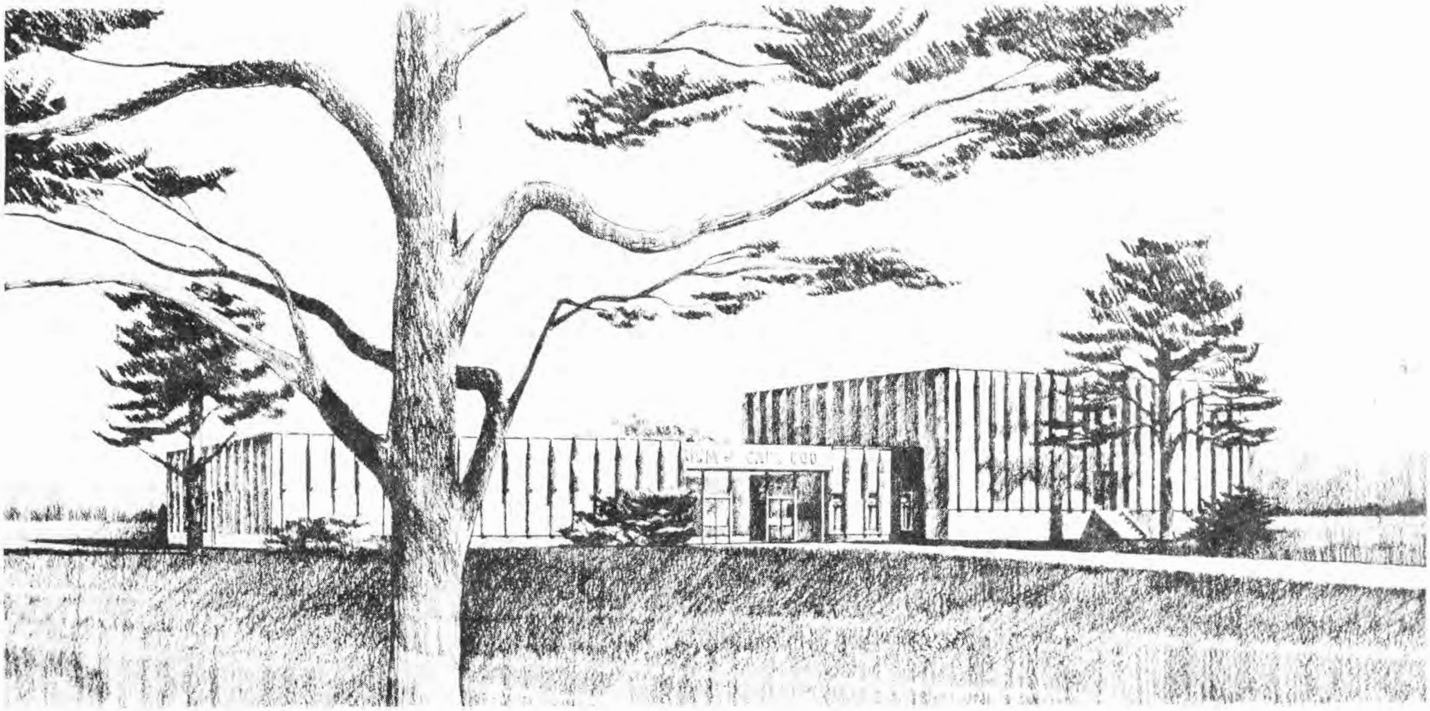
Senator Moss noted that the bill authorizes Federal fishery workers, whenever a serious outbreak warrants, to seize, quarantine, or dispose of any fish posing a disease threat to United States fisheries. This would include both imported fish and fish transported in interstate commerce.

The proposal calls for development of State-Federal cooperative programs to control fish disease. It prohibits interstate transportation of diseased fish or shellfish by common carrier or by personal means.

The bill spells out penalties for violation of fish disease-control laws. It provides protection for employes carrying out their assigned duties. It authorizes the Secretary of the Interior to compensate growers for losses due to fish disease-control programs.

Senator Moss also referred to 3 resolutions on fish disease control: One, passed at the U.S. Trout Farmers Association convention in October 1968, asks Federal assistance in controlling whirling disease of trout and other salmonids. The other resolutions, passed at the American Fisheries Society meeting in September 1965, asked for establishment of a national reporting service on fish diseases, and for help in preventing importation of viral hemorrhagic septicemia.

(1) From Commercial Fisheries Review, Vol 31, No. 3, March 1969.

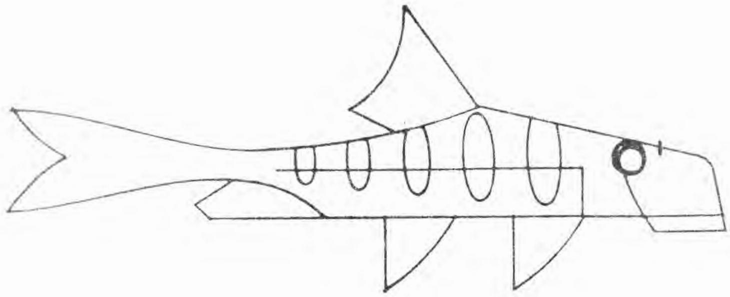


AQUARIUM OF CAPE COD
ON PARKER'S RIVER

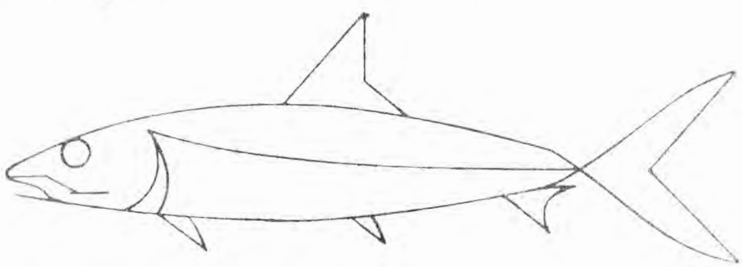
On February 1, construction of the Aquarium of Cape Cod, Inc., in West Yarmouth, Massachusetts was begun. The building is of precast concrete, 55' x 210', and consists of three major subunits. The east wing houses porpoise show and holding pools with stadium; the central portion, entrance gift shop, offices and laboratory; and the west wing numerous aquaria for the display of marine and freshwater animals. The sea water systems are semiclosed recirculating with vacuum diatomite filtration for the porpoise section and rapid sand filtration for the remaining exhibits. The sea water source is from a small tidal river connecting directly with Nantucket Sound. Architect is Donaldson Ray McMullin Associates, the general contractor, G. Arnold Haynes, Inc., both of Wellesley, Massachusetts. Aquarium Systems of Wycliffe, Ohio is acting as consultant to the owners.

The new aquarium is the brainchild of Cape Businessman W.W. Holmes who spent two years gathering background material on public aquariums. He was joined by J.R. Crimmins to form the Corporation and get the project on paper and into reality. Dave Miller is the Director-Curator. Construction is on schedule and opening is slated for June 15th of this year. (P.O. Drawer 10, South Yarmouth, Massachusetts 02664)

Dave advises us that the aquarium is expected to be completed and open to the public about July 1.



The NEW ENGLAND AQUARIUM has issued (April) its second AQUALOG, a newsletter for the Aquarium Family. It is easy reading about construction progress, school tours started late - April, 8,750 charter members, penguins nesting and a white shark experience.



CORRECTING OUR OWN MISTAKES

In the January 1969 issue, page 10, line 5, "weeks" for "days" --- "The first young animals hatched seven weeks later."

AQUARIUMS
AT
NATIONAL FISH HATCHERIES

Most of the 92 fish hatcheries operated by the Division of Fish Hatcheries, Bureau of Sport Fisheries and Wildlife, have some type of exhibition of aquatic life for the visitor. Twenty-six have separate aquarium buildings or areas set aside for public viewing.

The Millen (Ga.) National Fish Hatchery has an attractive building housing 26 aquaria of up to 500 gallons. There is a display of 52 species of fresh-water fish and 18 species of reptiles and amphibians.

Herb Reichelt, a former National Aquarium employee, is regional aquarium curator. He is in charge of the Millen Aquarium and oversees the aquariums at 14 other fish hatcheries in the southeastern states.

MARICULTURE

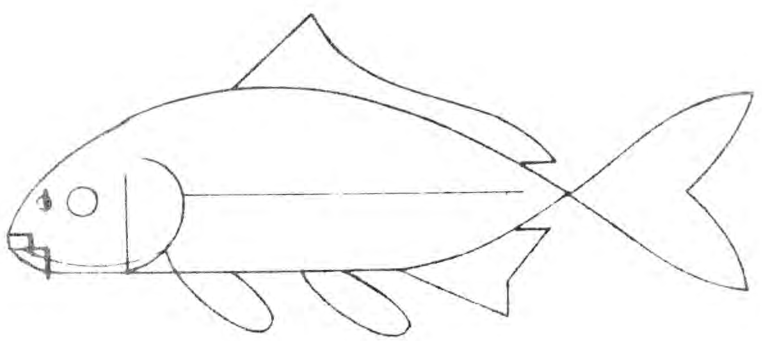
A new term has been added to fisheries nomenclature--"mariculture," the rearing under partially artificial conditions of commercial quantities of shrimp, oysters, pompano, and other marine fishes.

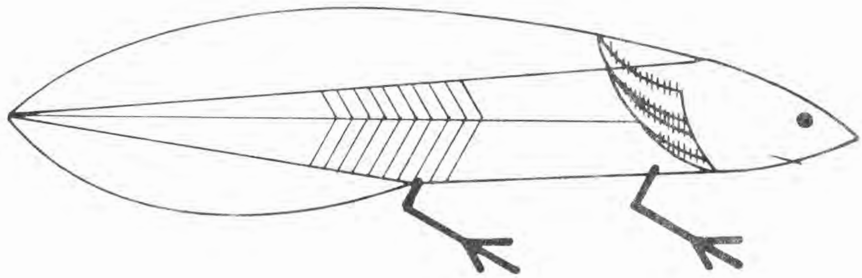
Late in January, forty-five interested people attended the first Conference on Mariculture at the Grande Terre Laboratory of the Louisiana Wild Life and Fisheries Commission. Their aim is to utilize known, and develop new, techniques to produce aquatic organisms on a commerical scale for marketing as foods for humans.

The problems facing this group are much the same as those encountered by the aquarist who wishes to exhibit or reproduce previously untried species. Some success has attended laboratory efforts in reproduction in some of the desired species.

The new group is headed by an executive committee of T.R. Leary, Chairman, Texas Parks and Wildlife Commission, Dr. Gordon Gunter, Gulf Coast Research Laboratory, Ocean Springs, Miss., Dr. S.R. Monroe, Veterinarian, Pensacola, Fla., and Dr. Harold Webber, Groton Associates, Inc., Groton, Mass.

Ed.: During the past several years a very sizable catfish farming industry has developed. It is quite probable that similar success can be achieved in marine farming if some of the unknowns become known, and if State laws do not present obstacles.





JUVENILE TROPICAL FISH RAISED IN LAB[1]

For the first time, eggs and larvae of important tropical fishes from the western Atlantic Ocean have been raised to juvenile size in the laboratory, reports the University of Miami's Institute of Marine Sciences.

Charles A. Mayo, a graduate student, succeeded in rearing 13 species of fishes, representing 12 fish families, from egg to juvenile. The fishes are herring, anchovy, sea trout, flounder, flyingfish, pigfish, grunt, sea robin, pinfish, spadefish, goby, dragonet, and trunkfish. All form important links in the sea's ecologic balance.

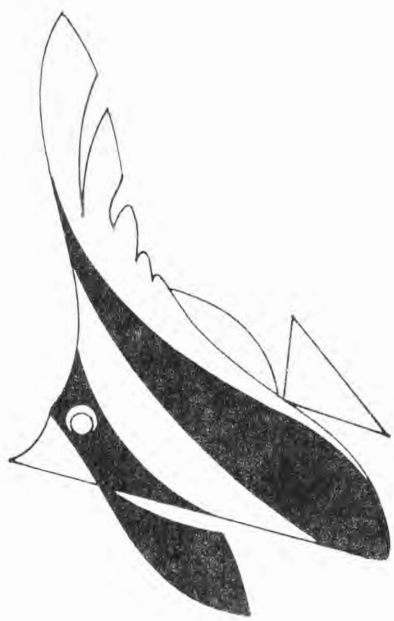
Dr. F. G. Walton Smith, Institute Director, stated: "This well-established success in rearing many species of young tropical Atlantic fishes is unprecedented. Furthermore, the techniques developed and proved successful by the Institute can be used for rearing species most often sought by commercial and game fishermen, including tuna, sailfish, marlin, dolphin, and king mackerel, and this is one of the goals of our study."

(1) From Commercial Fisheries Review, Vol 31, No. 3, March 1969.

Mayo's Work

Mayo collects eggs for his fish nursery by towing a plankton net far out in the Gulf Stream, and from the Institute's dock in Bear Cut. Once the eggs have hatched in laboratory tanks, the larval fishes feed on zooplankton. To provide an abundant supply of food, Mayo has created an "in-the-laboratory food chain." Zooplankton feed the fish larvae, and the zooplankton is fed phytoplankton maintained on organic and inorganic nutrients added to the tanks.

The development of eggs and larval fishes is watched closely by Mayo. He records observations, takes photos, and preserves individual specimens. Many fishes are difficult to identify until long after they have hatched, states the Institute. Data from this study provide information on the "functional structure, behavior, and growth of fishes in their early stages of development."



GLASS FOR UNDERWATER WINDOWS

David Miller
Director
Aquarium of Cape Cod

One of the nagging problems in the construction of tanks or pools for the display or holding of aquatic animals is the choice of the proper thickness and type of glass for underwater viewing windows. To partly clarify and wholly confuse this problem, I presented a paper at the Miami meetings in 1963. The barrage of requests (three) for reprints of this presentation has been so great that I felt it might be useful to submit the text to D&C, towards the furtherance of enlightenment in the field in the sincere hope that perhaps one budding engineer will read it and recall some of the essentials.

Basic to the confusion that exists in everyone's mind is the bewildering array of trade names used by manufacturers to describe their products. Although there are discrete genera of formulae for making glass and systematic families of properties, applications, and products, the nomenclature is essentially random. To further cloud the issue, each manufacturer has a different name for the same product. Thus, a single type of glass may have as many names as there are manufacturers. For that reason I will avoid the use of trade names and use the more generalized "common" names where possible.

According to Webster's, glass is an amorphous, inorganic substance consisting of a mixture of silicates, sometimes borates or phosphates, fused with a flux and a stabilizer into a mass that cools to a rigid condition without crystallization. Silica sand is the principal ingredient of most glasses. A number of basic types are manufactured: soda-lime, borosilicate, lead, aluminosilicate and 96% silica. Corning, for example, have in their files over one thousand separate and distinct formulations for what is basically glass.

Glass like other ceramics is non-ductile and does not plastically deform before failure. It never fails in pure compression; only from tension stresses. Its intrinsic strength is very high, perhaps as strong as steel; however, its ultimate strength is severely limited by surface imperfections. Fractures inevitably begin at the point of some surface flaw. Hence, the manufacturer takes normal surface depreciation into account when rating the strength of a particular type of glass.

The basic type with which we are concerned is polished plate glass. This is a soda-lime glass, drawn from a furnace in a continuous ribbon, passed through rollers which impart a textured appearance to both surfaces, then run through a series of grinders and polishers which make both surfaces smooth and parallel. Because of the size of the fabricating machinery, the maximum width is limited. The ultimate length of a panel is limited by the practical considerations involved in handling and shipping. Actual size limits are about 11' x 12' for thicknesses of one inch and greater. Maximum available thickness is 1 1/4". This is handy to know if architects propose monolithic panels 6' x 30' x 3". Such a panel would weigh about 7,000 lbs., by the way.

Polished plate glass is available in three strengths. Only two are available in thicknesses which aquariums might use. The strengths are dependent on the degree of tempering given to the plate, after it is initially formed. The least strong is "polished plate" or "annealed polished plate." More often than not the word annealed is not used. This kind of glass has several pseudonyms; plate glass, annealed plate glass, glazing quality plate glass, parallel-o-plate, but let's call it polished plate. Of the three types, this is the least expensive and the weakest. When polished plate fails, it fractures into non-uniform pieces. It may be cut on the job or your local dealer can cut it to your specifications from stock.

The second type is heat strengthened polished plate. This type of glass is only available in thicknesses of approximately 1/4" and so is not applicable to most aquarium glazing applications.

The third type is fully tempered polished plate which we know as "Herculite," or "Tuf-Flex." This type of glass has approximately 4 to 5 times the strength of polished plate. This increased strength results from a tempering process which puts the surface layers of the glass under compressive stress with balancing tension stresses in the center. On failure it fractures into small uniform pieces. This type of glass must be cut before the tempering process and so must be ordered from the factory in the size you intend to use. This is handy to know since a replacement panel cannot be obtained from a local distributor on short notice.

Comparing the physical properties of polished plate and fully tempered plate, we find only one major difference, the breaking strength or modulus of rupture if you prefer this less sanguine term. The breaking strength of polished plate is rated at 6,000 psi and for fully tempered 25,000 psi. The modulus of elasticity and rigidity, the specific gravity, specific heat, coefficient of linear expansion, index of refraction and hardness are approximately the same for both. Since most aquarists are concerned with the scratch resistance of glass, I might add that the two types are identical in their resistance to scratching. Corning is currently manufacturing a chemically strengthened glass which has a 20% greater scratch resistance than polished plate. This glass, however, is not yet available in thicknesses useful for aquarium glazing applications. The terms "soft" and "hard" glass used in the industry, indicate low and high softening temperatures, not mechanical hardness.

While engineering handbooks give 6,000 and 25,000 psi for the breaking strength of polished plate and fully tempered polished plate respectively, the figures to be used in computing the glass thickness for an underwater glazing application are 3,000 and 15,000 psi, when dealing with windows having a surface area of over 10 square feet. The reasoning is as follows: strengths are computed on the basis of thousands of tests performed on small pieces of glass. Actual experience with larger lights (panes) has shown that their breaking strength is somewhat less than that of small sample pieces. Therefore, if the opening to be glazed has an area of over ten square feet, the <u>lesser</u> value for the breaking strength should be used in computing the glass thickness to be used. In summary then, there are only two types of glass with which we have to be concerned, each composed of the same ingredients, but one 4 to 5 times the strength of the other although the remainder of their physical properties are the same.

The next order of business is laminates. Both polished plate and fully tempered polished plate can be fabricated as a sandwich of two or more sheets of glass with an adhesive vinyl plastic interlayer. The thickness of the interlayer varies with glass thickness, but is generally between .020 to .080". Thicker glass tends to warp somewhat during heat treating so that a thicker vinyl interlayer is required to allow for the slight uneveness of the glass. The purpose of laminates is not increased strength. Actually, manufacturers rate the strength of laminates as less than single sheets (monolithic) of the same thickness. Experimental work has shown that under long-term loading, laminates behave as individual sheets. Under short-term stress (impact stress), laminates behave as a monolithic sheets. The real purpose of laminates is "breakage safety."

Although breakage safety sounds antithetical, it is not. For example, the total failure of a monolithic panel could run all the way from a janitorial inconvenience to a disaster depending on the volume and depth of water behind the glass. Since personal injury is a bug-a-boo that keeps aquarists and administrators alike awake at night, the breakage safety offered by laminates is more effective in removing these symptoms than Nytol. When a monolithic panel fails, it fails completely, that is to say a crack will extend from the viewing surface through to the wetted surface. If it's not quite your day, the panel may fracture completely, leaving nothing between the water and viewing area but gurgling sounds. Laminated glass prevents this from happening. When a laminate fails, the failure is almost invariably confined to one of the several sheets, leaving the remaining intact. Further, the vinyl interlayer bonds the broken glass together and prevents the pieces from flying about. Since glass is perfectly elastic up to the point of rupture, it is not possible to tell from observation when a piece of glass is about to fail. Liminates, however, provide a built-in warning of complete failure. If you have installed a two-ply glass with a safety factor of 10, and the glass fails, you will be left with one ply intact, a safety factor of 5 and a strong suggestion that the window in question needs replacing. Furthermore, you have a finite time to replace the glass, board up the window, disperse the crowds, call your lawyer, or skip town, whichever seems appropriate. This is breakage safety!

Since the intent here is to deal in cold hard practicalities, it must be admitted from the start that the kind of glass that is finally used in your installation may not be what you think is correct or desirable. The final decision in all probability will be in the hands of an engineer or a profit-motivated administrator. This being the case, you should be in a position to make an independent judgment, make the decision yourself, or supply the manufacturer with the data he requires to make the decision. In order to do this you should know the following:

1. The volume of the tank above the lower sill of the window.

2. Where the water would go if the window broke.

3. All other consequences if the window broke.

4. The design load in pounds per square foot. (This can be computed by multiplying the distance from the horizontal centerline of the window to the water surface in feet, times the weight of water in pounds per cubic foot; 64 pounds for sea water and 62.5 for fresh water).

5. The ratio of width to height of the window.

6. The safety factor. (Between 8 and 10 is recommended.)

If this information is given to the manufacturer he can then recommend the type and thickness of glass that should be used. If you want to do the calculations yourself so that you have some figures to compare with the manufacturers, use the formula below.

$$t=\sqrt{\frac{0.75\ W\ B^2\ F}{S\ (1 + 1.61\alpha^3)\ N}}$$ where:

t= thickness (of each ply) in inches

W= design load in lbs/sq.ft.

B= short dimension of glass in feet

F= safety factor (8 to 10 recommended)

S= average breaking stress of glass (substitute 3,000 for polished plate and 15,000 for fully tempered polished plate for panels over 10 sq.ft.

N= number of plys in an equal ply liminate

$\alpha = \frac{b}{a}$

a= long dimension of the glass

b= short dimension of the glass

The above formula is not correct for this application, but has been used with an adequate safety factor.

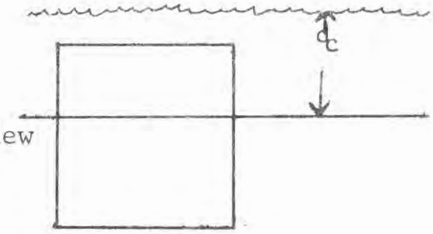
The design load may be computed as follows:

When the top of the water is above the top of the window, the design load (lbs./sq.ft.) = $d_c D$ where:

d_c = distance from horizontal centerline of window to top of water

D = 62.5 lbs./sq.ft.(fresh water), or 64 lbs./sq.ft. (salt water).

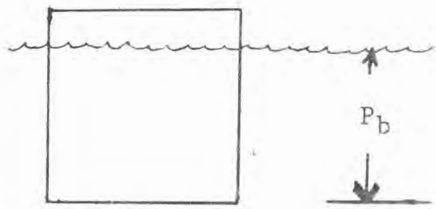
front view



When the top of the water is below the top of the window, the design load (lbs./sq.ft.) = $1/2 P_b D$ where:

P_b = the distance from the top of the water to the base of the window.

front view



Although manufacturers do not recommend monolithic glass for <u>any</u> underwater glazing application, I would personally recommend the following general practices. For glazing jobs where the water volumes are small, pressures are low, and where public safety is not a primary concern, I would tend to use single sheets of polished plate glass, using a safety factor of ten in computing the thickness required. When the panels are large, pressures are high, volumes are great, and public safety is critical, I would use fully tempered polished plate in a three-ply laminate, using a safety factor of

8 in computing the thickness required. It should be remembered too, that the formula for computing thickness is a very conservative one so that the glass thickness chosen should be the next commercially available standard thickness smaller than the answer given in the formula.

The preceding covers the simple essentials of choosing the type and thickness of glass for most underwater glazing problems an aquarist might routinely encounter. Remember, however, the choice of a proper type and thickness of glass does not guarantee a successful glazing job. The problems of gasketing, caulking, mastics, frame design, frame materials, fastenings, and so forth remain, and must properly be engineered and executed to insure a totally successful and workable job. When sufficiently motivated I shall launch an attack on these latter problems in a paper entitled "Through an engineer with a gun and hand grenade."

Ed note: As stated by Dave Miller, the formula given is not correct for this application. In fact, use of the formula with a supposed adequate safety factor has resulted in a number of aquarium glass failures. Walter West, NFCA engineer, two years ago detected the fallacies in the use of the formula and these were verified by a Corning Glass engineer. Subsequently, Walter developed a new formula which must be first checked in its mathematical computations by the Bureau of Standards before publication.

The formula in Dave's article will technically result in "the thickness of a beam supported at each end under a uniform load." Or in plain terms, similar to a piece of plywood supported by saw horses at each end and loaded uniformly with marbles. The formula does not cover the increasing load on vertical glass panels as the water depth increases, the fact that aquarium panels are supported on all four edges, greater height than width or vice versa, etc. Hopefully, a new and precise formula will be available in the near future.

TAX ENIGMA

EXCHANGE and SALE versus GIFT

We would like to hear from aquarists in other states who may face the same problem that we have in California. In this State if you exchange fishes or other animals with another non-profit institution, dealer, or friend, you must pay a sales tax on the market value of the animal. This is obviously true also of an outright sale. But a gift is non-taxable.

At Steinhart Aquarium we do not sell salt water which is taxable, but we do charge a pumping service fee which by odd coincidence is equivalent in amount to that charged earlier for salt water before we were enlightened.

What is needed now is a new term in the English language which will imply an open gift of a living animal without any visible strings attached. Please note that a thought process is non-taxable. Thus the recipient, after admiring his new acquisition, then suddenly feels compelled through mental telepathy communication to present you with something of at least equivalent value. The tax-free term for this sequence, that might in an unguarded moment have previously been called "exchange," is now recognized under a newly-coined word, TRANSBAR.

May all of your tax problems henceforth be transbar.

Earl S. Herald
Steinhart Aquarium

HAWAIIAN HOLIDAY

BILL BRAKER, DON ZUMWALT and crew from the Shedd Aquarium have been in the islands since mid-April on a collecting trip, expecting to be back in Chicago about June 1. Base of operations is the Kewalo Basin facility of the Bureau of Commercial Fisheries.

EARL HERALD, Steinhart, is spending May 17-24 at La Paz, Baja California, collecting -- and funning?

DR. JESSE WHITE has been appointed staff veterinarian at the Miami Seaquarium. He was formerly with Chas. Pfizer and Company.

ELMER TAYLOR, Curator of Fishes, New England Aquarium, has assumed the position of Curator.

The American Association of Zoological Parks and Aquariums held its annual meeting at Rochester, New York, April 1 and 2. No aquarium papers were presented. Three individuals from two major aquariums were in attendance.

The American Fisheries Society meeting will be at the Roosevelt Hotel, New Orleans, September 10, 11, and 12.

CONFERENCE ON EXOTIC FISHES AND RELATED PROBLEMS[1]

An important and unique invitational Conference, proposed by the Sport Fishing Institute, and jointly sponsored by the American Fisheries Society and the American Society of Ichthyologists and Herpetologists, was convened in Washington, D.C., February 18-19, 1969, to consider complex matters of importation and release of "Exotic Fishes and Related Problems." These noteworthy conference deliberations attracted a total of 57 registrants from a total list of 97 invitees. These, in turn, were carefully selected by the sponsors to be broadly representative of the variously concerned scientific, governmental, commercial, consumer, and conservation interests throughout North America.

A Joint Conference Steering Committee was appointed to manage the conference on behalf of the two sponsoring scientific societies.

A Conference Summarizing Committee was appointed at the outset of deliberations to give clear expression to any proposed resolutions and recommendations for purposes of final disposition by the conferees toward the close of their deliberations.

The group's task was twofold, viz: (1) to bridge the many communications gaps among the various concerned interests that have generated unfortunate confusion and mutual suspicions and, (2) to develop possible guidelines looking toward rational management of troublesome conservation problems arising out of poorly controlled importation and release of exotic fishes and other aquatic organisms.

(1) Condensed from the Sport Fishing Institute BULLETIN, No. 203, April 1969. An official account of the Conference proceedings will be issued later.

Various viewpoints toward importation of exotic species were discussed following brief statements presented by a taxonomist, a fishery research biologist, an aquarist, and a fishery management biologist. There was additional discussion about safeguards thought desirable to apply when using exotic species during research studies as well as about various implications of releases of exotics with respect to the fate of endangered native species and the aggravation of fish disease problems.

These proceedings were augmented by vividly-illustrated reports on the recent escape and rapid subsequent spread within Florida of walking catfish (*Clarias* sp.), imported into that state from Asia, and on the possible benefits or harm expected from release within American waters of "grass" carp from China and of various species of tilapia from Africa.

The background overview of the problem was amplified through a helpful review of applicable laws and available statistics on importations of exotic fishes and other aquatic organisms (at least 64,254,000 live fish, 180,400 mollusks and crustaceans, 170,600 amphibians, and some part of 1,950,000 reptiles imported into the U.S. in 1968, alone).

A spirited general discussion by the conferees covered a broad range of specific subjects. They centered principally around various problems of the aquarist trade, fish importers, and fish farmers. Much of the discussion reflected a surprisingly sympathetic atmosphere of apparent accommodation by the many concerned scientists and conservationists present. This seemed to be a temporary spin-off from a conciliatory attitude clearly evidence by the aquarist-importer-trader factions present. They expressed a desire to "legitimize" their industry and to accept their emerging responsibilities.

One of the resolutions and the recommendations that were subsequently adopted by the conferees are briefed below:

RESOLUTIONS:

1. OPEN WATER RELEASE OF EXOTIC FISHES

Recommend that each state, province, or federal agency, or academic, scientific, commerical groups, and individuals, should voluntarily submit to a Joint Committee on Introduction of Exotic Fishes and Other Aquatic Organisms, all proposals to introduce into open waters any exotic species for prior evaluation and recommendation before consummating such introductions; and

That said committee shall compile and cause to be publicized, a list of exotic species of fishes and other aquatic organisms considered to be undesirable for import into North America other than for scientific and educational purposes.

RECOMMENDATIONS:

1. The conferees recognized widespread concern about the effects on natural ecosystems of the rather widespread practice, past and present, of transplanting species native to North America. In some situations such transplants may have effects comparable to those resulting from the introduction of exotic species.

2. The conferees recommend that no living fishes or other aquatic organisms be imported except under a Federal license or permit issued to the importer and that a suitable license or permit be issued by the appropriate government agency to each importer.

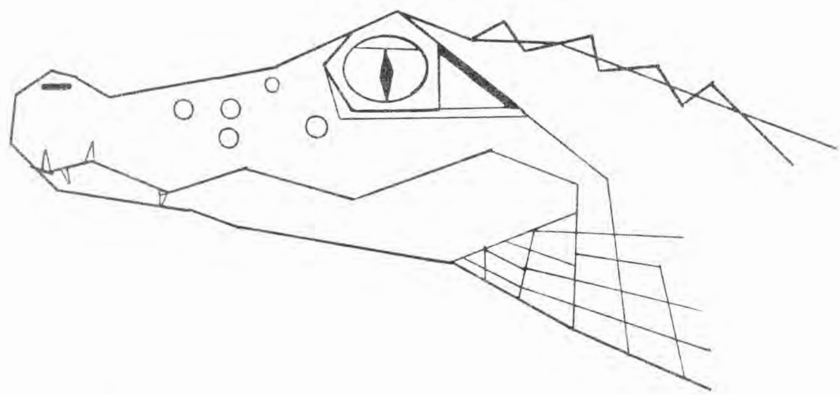
3. The conferees recommend that, after consultation with the proposed Joint Committee on Introduction of Exotic Fishes and Other Aquatic Organisms, the appropriate Federal governments limit the number of approved Ports of Entry in order to help control the introduction of exotic species in North America.

4. The conferees strongly recommend that the appropriate government agencies augment their current inspection and enforcement service with a competent identification service in order to accurately determine the composition of the importations of exotic species of fishes and other aquatic organisms and thereby assist the aquarium and bait fish importers to comply with State, Provincial, and Federal regulations.

5. The conferees recommend that agencies and individuals maintaining fishes and other aquatic organisms initiate and maintain adequate safeguards against accidental releases of non-indigenous organisms.

6. The conferees recommend that the government agencies and professional organizations work with the importers of exotic fishes and fish farmers in developing literature to point out and publicize the dangers inherent in unauthorized releases of exotic fishes and other aquatic organisms, and that this industry assist in the dissemination of this information to their customers.

Ed. Note: Public aquariums were represented by Bill Braker (Shedd), Earl Herald (Steinhart), and Warren Wisby (NFCA).



COLOR PRESERVATION IN FISHES(1)

Jerry LeTendre

A recent development in the preservation of fishes is the use of a chemical antioxidant Butylated Hydroxytoluene (BTH) commonly known as Ionol. Waller and Eschmeyer (1965) added from 1-20cc of Ionol to 4,500cc of both 40% Isopropyl Alcohol and 10% Formalin in separate experiments. The degree to which these additives retarded the loss of color in the six marine specimens tested was found to be best at the highest concentrations. The results of experiments utilizing Isopropyl Alcohol and Formalin as fixatives were found to be comparable.

Dr. Walter Whitworth at the University of Connecticut has informed me that he is getting excellent results preserving fish with the following method. He holds fish in a bath containing .5cc of Ionol per liter of 10% Formalin for 1-3 weeks depending on size of the fish. The specimens are then rinsed in .5cc of Ionol per liter of water to remove the excess Formalin. (This step may have to be repeated.) The fish are finally placed in 30% ethyl alcohol with .5cc/l. of Ionol additive. (At Cape Vincent we intend to use 40% Isopropyl Alcohol diluted from 95% because of the difficulty in obtaining ethyl alcohol.) This results in a well preserved collection of fish that are not too offensive to examine on a lab table.

LITERATURE CITED

Waller, R.A. and W.N. Eschmeyer. 1965. A method of preserving color in biological specimens. BioScience 15(5):361.

(1) Reprinted with permission from New York(State)Fish News, December 1968.

PIRANHA OUTLAWED

California fish and game laws restricting the importation, transportation, or possession of piranha have been ruled constitutionally valid in Los Angeles Superior Court.

The court held that the state has the power to prescribe the security measures it considers necessary to insure proper control of such restricted species.

The court also held that limiting the importation and possession of piranha to public aquaria for display purposes, and to scientific institutions for research purposes, did not violate constitutional standards.

The court based its decision on the fact that the restricted possession of piranha by public aquaria and scientific institutions did not enhance the likelihood that the fish, which is not native to California, would be set at large in California waters, but that their unrestricted importation and sale to the general public would greatly enhance that likelihood.

From Outdoor California, March-April, 1969.