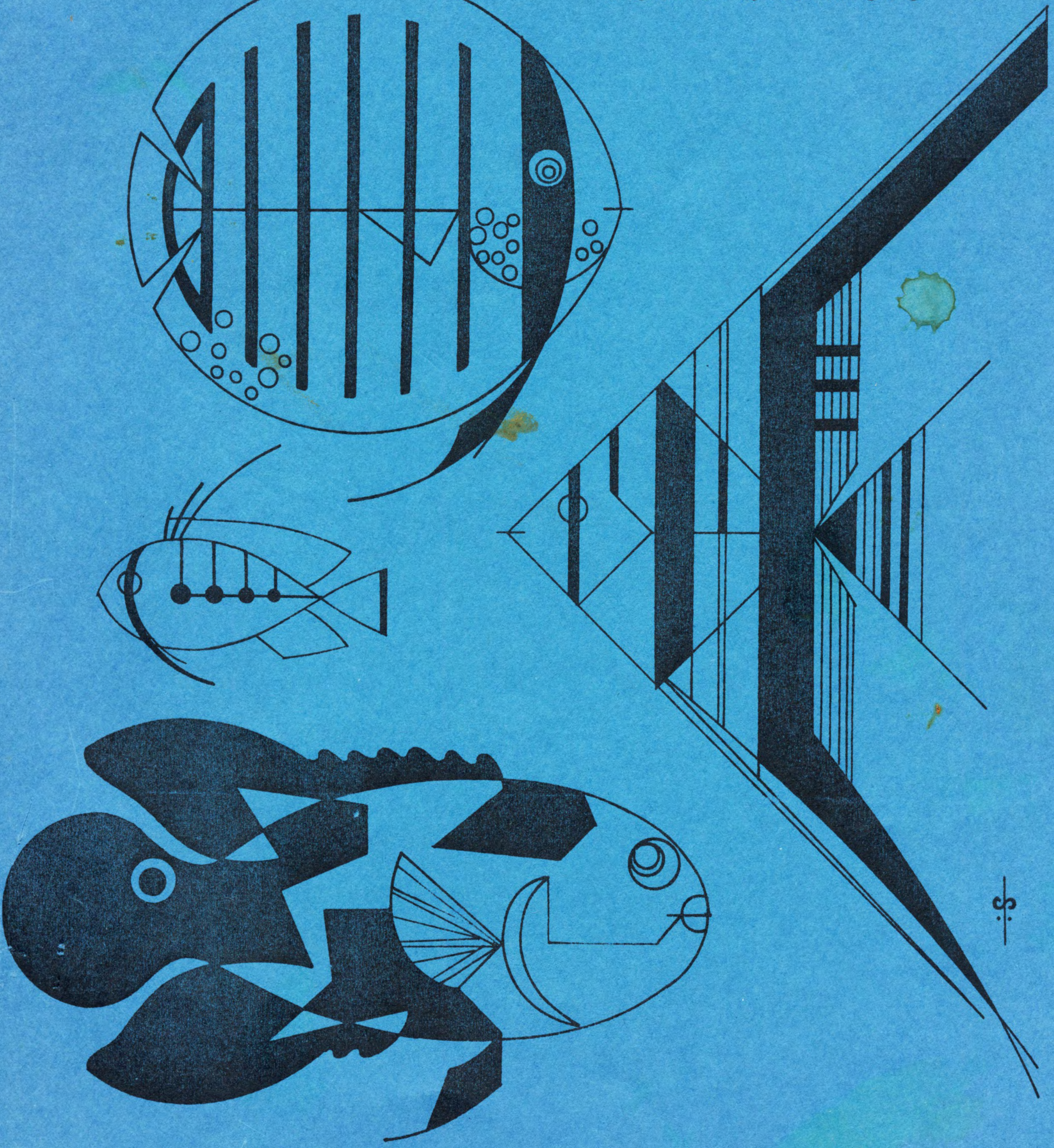
DRUM & CROAKER

THE INFORMAL ORGAN

FOR AQUARISTS



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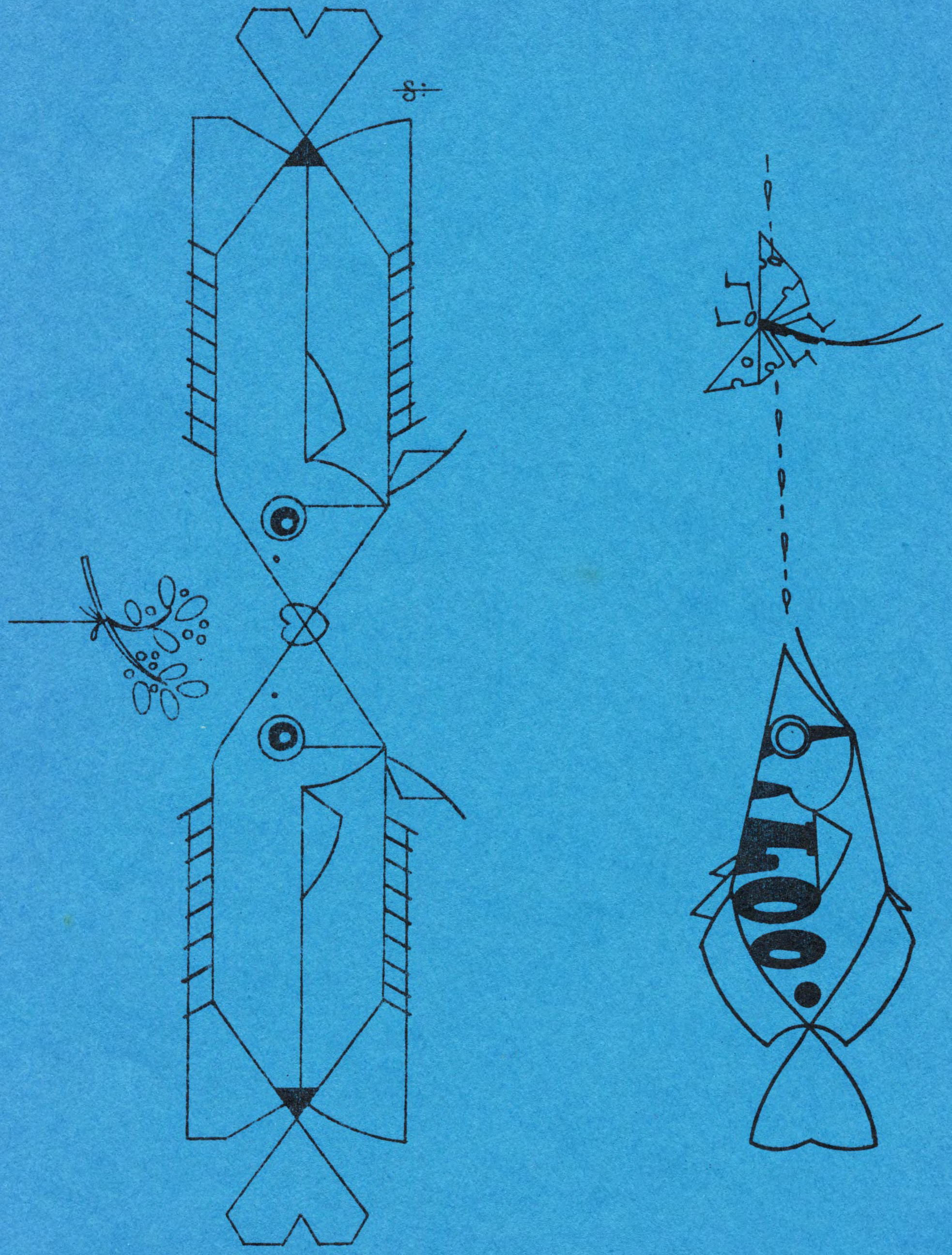

VOLUME 12 (71), NUMBER 1 JANUARY 1971

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

The Informal Organ

for

Aquarists

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Art Work by Craig Phillips, NFC&A.

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.

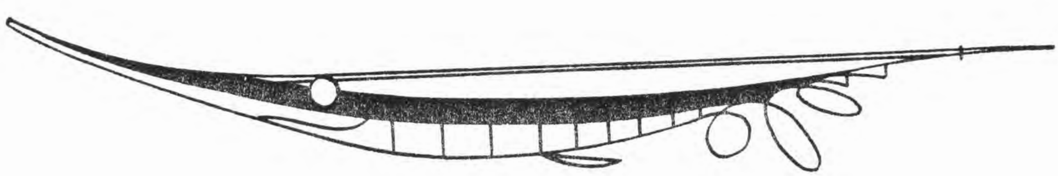
COMMENTS

We undertook to put together and issue the DRUM AND CROAKER in 1968. In that year and in 1969 and 70, we managed three issues each year, January, May and September. The periodical has been upgraded -- at least in the quality of the paper. We tried to upgrade it some, but not too much, and to keep it simple, but not too simple.

For reasons that will be evident, this issue of DRUM AND CROAKER is the last by the writer or the NFC&A. We have often enjoyed putting it all together, but more often have been discouraged by the lack of cooperation by subscribers (free). It is hoped that our successor will have it much better.

We hope that the Fisheries Center can some day, in the future, again assist with this publication. Doubts are many. In the meantime, we know that DRUM AND CROAKER is going to good hands.

Wm. Hagen - Editor
Assistant Director -
Operations
National Fisheries Center
and Aquarium



CONTENTS

DRUM AND CROAKER CHANGES HANDS

BILL BRAKER, Director, Shedd Aquarium, Chicago, has volunteered to take over DRUM AND CROAKER inasmuch as the Fisheries Center can no longer assume this task. Several aquarium directors agreed with this transfer.

Mailing lists for DRUM AND CROAKER as well as any hold-over material will be sent to Shedd. All articles, change of address requests, etc., should hereafter be sent to:

William Braker, Director
John G. Shedd Aquarium
1200 South Lake Shore Drive
Chicago, Illinois 60605

We wish you and your staff the best of luck with this first-time assumption of this task and know that improvements will be made in DRUM AND CROAKER.

PHASE-OUT OF THE NATIONAL FISHERIES CENTER AND AQUARIUM

The Fisheries Center, authorized by the Congress in 1964, and for which construction and operating appropriations have been provided, appears to be on the economy rocks.

In the annual budget message to the Congress there is the recommendation that planning for the National Fisheries Center and Aquarium be discontinued. This means that all activities directed toward accomplishment of this project shall cease. Minimum funds will be provided to close out all Fisheries Center activities. The possibility exists, remotely, that the project may be reactivated in the future.

All plans and specifications for the Fisheries Center are complete and the construction funds are available, but the funds no longer would be adequate for the present design because of inflation. It should be remembered, too, that this project was to be a rarity among Government projects -- both construction and operating costs were to be paid from admission charges.

The National Aquarium in the Department of Commerce Building will continue to function. Permanent personnel of the Fisheries Center presumably will be absorbed into the Bureau of Sport Fisheries and Wildlife.

RETIREMENT

BILL HAGEN, Assistant Director - Operations, NFC&A, and editor of DRUM AND CROAKER, will retire in the near future after 37 years, all with fisheries Bureaus of the Government.

AQUARIUM SYMPOSIUM -

AN END TO THE CONFUSION

Two national meetings attracted a good representation of aquarists last year: the American Society of Ichthyologists and Herpetologists meetings in New Orleans and the American Association of Zoological Parks and Aquariums meetings in Buffalo. It was apparent, in both places, that there was much concern over future meetings and permanent affiliations for our group.

In Buffalo, with the problem still unresolved, it was suggested by those present that I be chairman of a committee to autocratically select the site of our next meeting in order that we could all gather in one place to discuss and vote on our future plans.

After much correspondence and due deliberations it is the consensus of this committee that we should all meet in Salt Lake City on September (?) 1971, with the AAZPA.

Please make every attempt to attend, since it will be at this meeting that all the pros and cons will be discussed, and the decision will be made regarding the future of the Aquarium Symposium.

If you absolutely cannot attend, please send a letter expressing your point of view to the undersigned:

Mr. William P. Braker
Director
John G. Shedd Aquarium
1200 South Lakeshore Drive
Chicago, Illinois 60605

Results of the September meeting, and the various points of view will appear in a future issue of DRUM AND CROAKER.

EXPERIENCE IN BLUE
(SHARKS)

Louis Garibaldi and Ronald Lloyd (1)

Returning from a collecting trip to the Florida Keys, Louis brought back two baby bonnethead sharks, Sphyrna tiburo. The two sharks were among eight born early on the morning of August 21 in a holding tank maintained by Gerrit Klay at Sharkquarium, Grassy Key, Florida.

All of the youngsters measured approximately 260 m.m. in length at birth and all appeared to be feeding well in Gerrit's open-system, 4 ft. deep portable swimming pool.

Upon arrival at the National Aquarium on September 2 the young sharks were measured again. One we shall call "A" measured 262 m.m. The other, "B" measured 279 m.m. in length. It appeared that the smaller of the two sharks was thinner and possibly had not been eating.

One of the first steps taken by Ronald Lloyd, who was given care of the sharks, was to attempt to get the youngster to eat. Small strips of smelt, mackerel, squid, beef heart, and chunks of shrimp and clams were tried unsuccessfully. Appetite stimulant, amino-plex, was also tried with no success. Needless to say we were beginning to worry.

The two baby bonnetheads had been placed in a one-thousand gallons tank, approximately 6 ft, x 6 ft. x 4 ft. deep. The tank was one of eight fiberglass units of that dimension and a larger 2,500 gallon tank designed as marine aquariums and included in a recent renovating of the existing National Aquarium. The pigment of these tanks is an aqua-blue and they all have a six-inch inward recurve at the top to reduce splashing.

Upon initially being released into the 1,000 gallon tank both sharks began swimming at the surface near the edge of the tank with the head partially out of the water and the body sloping at approximately a 25° angle. However, there seemed to be no signs of distress. They were swimming strongly, but

(1) Respectively Acting Assistant Curator, and Biological Technician, National Aquarium

in swimming along the edge of the tank they were constantly bumping the sides of their heads against the wall. It appeared they were trying to turn into the wall. On occasion they would attempt to swim straight up the wall only to run into the overhanging lip.

The surface swimming was not a major concern since observations of this behavior had been made by Gerrit Klay. The wall bumping behavior did concern us. Toxic substances were ruled out by a series of tests. Placing one of the sharks ("A") into the 2,500 gallon tank yielded the same behavior and ruled out close confinement as the cause. The two sharks were again reunited in the 1,000 gallon tank. By this time (eight days after arrival) shark "B" had begun to take food with a preference for shrimp. On the tenth day shark "A" was found dead at the bottom of the tank. The only apparent cause of death was shock induced by a nutritional deficiency. It is possible that this animal had never eaten since birth.

Since we had solved the feeding problem for shark "B" we next tried to stop the head bumping. Several techniques were tried in order to keep the surviving shark from running along the walls. Artificial plants were hung along the walls and the light intensity was concentrated in the center of the tank so that the walls were darkened but with no positive results.

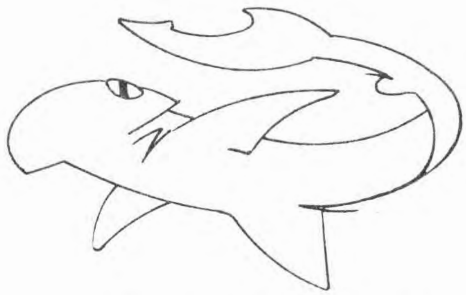
The next approach was that of color. Possibly the blue walls were attracting the shark. A panel of black plastic sheeting was hung in one of the corners and it was noticed that as the small bonnethead passed the black patch he moved away from the wall and then returned to the wall after passing that area.

This positive evidence led us to place a black strip of plastic under the lip and extending down six inches below the water level. Immediately the shark's swimming behavior was altered as he began swimming 3-4 inches away from the walls. Somehow the difference in color apparently elicited a change in behavior patterns.

Shark "B" continued to do well until on October 11 when he was accidentally killed when a small sawfish in the same aquarium pinned the bonnethead against the wall. He had grown to 290 m.m. in the 5 weeks we had kept him. We believe we could have kept him indefinitely had not the accident occured.

The significance of aqua-blue or blue aquariums should warrant further investigation. Possibly the dogfish we have all seen in aquariums with worn down noses were trying to swim into blue walls. Possibly animals which frequent murky waters may mistake bluish walls for murky waters. The bonnethead had never known the open ocean, but only the inside of an algae-encrusted swimming pool before being placed in our blue tank. He appeared to instinctively avoid dark walls such as those of the pool and our black border, but to him blue was something to turn toward.

If anyone has had similar or conflicting experiences we would all appreciate hearing about it.



JAPANESE AQUARIUM TOUR

The proposed professional aquarist tour of some 25 leading Japanese aquariums has been postponed until fall 1972. The University of California Extension Division under Dr. Nathan Cohen has tentatively agreed to organize the tour which will require about 20 days. They have handled previous Japanese biological tours and so are well qualified to organize an aquarium tour. A day of technical sessions is planned for Tokyo with participation of Japanese and other aquarists. The costs will be kept as low as possible and will range somewhere between $1,200 and $1,500 based on San Francisco departure. In many ways the Japanese aquarists are ahead of us, so this is a good opportunity to find out what they are doing.

Earl S. Herald

USE OF LAMINATED PLASTIC IN WOOD AQUARIUMS

Herbert W. Reichelt, Jr.(1)

We have experienced some trouble in the aquarium at Bureau of Sport Fisheries and Wildlife Hatcheries, Region 4 (Southwest), with blistering and peeling paint in display tanks. These are of wood construction and painted with epoxy resin. The front and rear of the aquaria are of glass (pressure sealed) with dry diorama backgrounds. Therefore, the only exposed painted surfaces we have to contend with are the sides. Generally speaking, one out of ten aquaria presented this problem of blistering and/or peeling. The situation generally persists in these "problem tanks" even after repeated attempts at sanding and repainting. Moisture in the wood causes this.

To correct this situation we have been gluing laminated plastic (commonly called "formica") to the tank sides. Several companies make a smooth texture, solid color, varying in shades of green and blue, suitable for aquarium use. The glue is contact cement. A sufficient bond can be arrived at by sanding the rough areas and gluing directly to the old paint.

Several tanks with the laminated plastic sides have been in use for over two years and no problems have been encountered. We are pleased with the results and feel another step has been made toward making the paint brush obsolete.

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(1) Regional Aquarium Curator, Millen National Fish Hatchery, Millen, Georgia.

FISH MEDICINE AT TEXAS A&M

Carl W. Lahser, Jr.

Texas A&M University, long a leader in agriculture and engineering, has recently taken steps to take the lead in yet another field--aquatic medicine. Dr. George W. Klontz, the only U. S. veterinarian working full time on fish diseases, is coordinating the program.

Many aquarists will be familiar with Dr. Klontz. He has been associated with the capture and medical care of 14 killer whales including the one recently transported to Galveston's Sea-Arama from Seattle. He is recognized as a pioneer in fish medicine with 20 technical papers on fish diseases and care of killer whales. He was raised near the Puget Sound oyster beds at Olympia, Washington. He received his BS in microbiology and an MS in immunology from the University of Washington and a DVM from Washington State University. Dr. Klontz worked for 10 years with the Bureau of Sport Fisheries and Wildlife and the Bureau of Commercial Fisheries in immunogenetics and immunopathology.

Research in aquatic animal diseases is the primary objective of Dr. Klontz. Besides fish, aquatic animals include invertebrates, reptiles, amphibians and marine mammals such as whales, porpoises and seals. The National Science Foundation's Sea Grant funds are financing the bulk of the research with other funds coming from the National Research Council, Texas A&M Research Foundation and Office of Naval Research. A new fishery research lab of about 1700 ft^2 is expected to be completed by January 1971.

The College of Veterinary Medicine at Texas A&M will offer a course in the spring semester of 1971 in viral, bacterial and parasitic diseases of fish at the graduate level (Vet. Micro. 661). Plans are being made to offer a basic survey course in fish disease to veterinary students at the undergraduate level and to offer other courses in marine, freshwater and invertebrate diseases.

Dr. Klontz is vitally concerned about fish farming and particularly the use of closed system fish raising facilities. "Intensive fish culture is in its infancy," said Dr. Klontz. "We are about where livestock medicine was in the early 1900's and poultry medicine in the middle 1940's."

Research is being carried out in fish diseases by research personnel from the veterinary departments of microbiology, pathology, parasitology, anatomy and physiology and pharmacology. In addition, the university has funded research to determine levels of pesticide and heavy metals from industrial sources in wild games fishes. The College of Veterinary Medicine will graduate specialists with advanced degrees in aquatic animal medicine.

"BY THE GRACE OF GOD, FORGIVE US . . ."

The Cabeza Prieta Game Range in southwestern Arizona, a wildlife refuge of the Interior Department's Bureau of Sport Fisheries and Wildlife, lies in a country that is among the cruelest on earth. About two inches of rain fall in a good year, so when the storage tank rain gage, which holds about a quart of water, was stolen at Saguara Gap this past summer, an explanation seemed in order.

The thieves did explain, in a note left behind in Spanish:

"By the grace of God, forgive us . . .

"We are two Mexicans who wanted to cross the desert so we could work in the U. S. and we ran out of water and we saw much hardship and we had to turn back to Mexico because we could not travel any longer and in order to stay alive we took the liberty of carrying with us the object which you stored here and excuse us but we have to save ourselves. Gracias."

THE MARINE AQUARIUM IN THE CLASSROOM

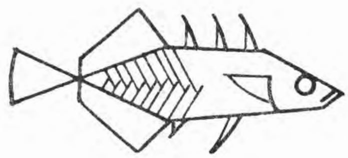
Rimmon C. Fay (1)
Venice, Calif.

A marine aquarium can provide a strong motivation to study the science of biology. It can introduce the concept of biological diversity and some of the properties of an ecosystem. Comparisons may be made between the behavior and interactions of the animals and their anatomical systems to gain an appreciation of the form and function of living organisms. The insights gained become firmly developed as the students have an opportunity to observe the aquarium and its inhabitants day after day and week after week. Students can relate their observations of this miniature marine world to the sea shore and then to the vastness of the oceans through the use of their library, audio-visual aids, and possibly field trips. It is important to learn that the ocean is the major part of the biosphere and that all living creatures share the biosphere; thus the lives of all organisms are related to the ocean in a number of ways. One dependent relationship which may be pointed out is that the plants in the ocean produce some 70% of the oxygen liberated to the atmosphere each year and that the majority of this oxygen is produced by microscopic marine phytoplankton. Another relationship is the control of weather as the ocean functions as a reservoir and distributor of heat. The ocean also serves as the major source of fresh water which falls on the land as rain or snow.

The model ocean must be well managed or pollution will be a problem. The marine animals excrete wastes, both soluble and solid which must be mineralized and stablized by microbes which live on the filter of the aquarium. If the waste loading exceeds the assimilation capacity of the environment, then pollution occurs just as it may occur in the ocean; the water becomes cloudy with bacteria and the plants and animals suffocate.

The comments which follow are intended to assist the instructor in setting up the marine aquarium in the classroom where it may be available to the students each day of the semester. When the aquarium is operational, and properly stocked, mini-dramas of life will occur continually in living color, fluid motion, and natural form.

(1) The complete paper, of special interest to biology instructors, may be secured from Dr. Fay, Pacific Bio-Marine Supply Co., Venice, Calif. 90291.



WILSON RETIRES AT PLYMOUTH

Dr. D. P. Wilson (Senior Principal Scientific Officer), Plymouth Aquarium, retired on August 7, 1969, after 42 years of service. Dr. Wilson has been Deputy Director since 1958 and curator of the Aquarium for some 40 years. Although he retired, he will continue to work in the laboratory. Dr. Wilson has made many important contributions to aquarium science.

A report in the Journal of the Marine Biological Association, U.K., 50(4), 1970, states that "The present widely acknowledged excellence of the public aquarium is entirely due to his work in redesigning the Aquarium in its present form and to the constant personal attention he has devoted to the selection and maintenance of the exhibits over a period of some 40 years."

Dr. G. W. Potts joined the staff on August 8, 1969, as a Senior Scientific Officer. His research will be in the field of fish behavior and he will also take charge of the Aquarium.

TOXICOLOGY OF COMMON METALLIC SALTS:

FRESH AND SALTWATER FISHES

Kym Murphy

The toxic effects of nearly all metallic salts on fresh and saltwater fishes (e.g. all chlorides and sulphates) is due to the action of the metallic cations and rarely attributable to the relatively harmless anions (e.g. sulphate, phosphate, etc.).

In simple solutions, metallic cations are quite toxic, but due to a process referred to as cation antagonism, solutions containing a variety of metallic salts show very little toxicity. (Note: The toxicity of simple solutions is graphically demonstrated by placing a saltwater specimen in a solution of sodium chloride at the appropriate temperature and specific gravity.)

Sea water is a good example of this antagonistic process. Though many of the individual constituents are extremely toxic, they act benign as a solution containing other ionic entities.

Consequently, fish which are capable of adapting to both salt and freshwater environments (euryhaline fish) are not immune to the individual ions in solution; rather they are highly adapted in osmoregulation. On the other hand, fish restricted to very narrow ranges of salinity (or mineral content) are poor osmoregulators.

While metallic salts prove to be relatively harmless in sea water and highly mineralized fresh water, they are extremely toxic in artificially softened fresh waters. This accounts for the problems encountered by certain fish hatcheries, oceanariums, etc., which utilize water softeners.

Most of these softeners employ a cation resin, and exchange sodium for other cations(e.g. Mg and Ca). The resulting simple solutions create toxic sodium levels without the antagonistic effect of other metallic cations. When soft water is preferred, it is imperative that the mineral content be well balanced.

The lethal action of most metallic cations has been ascribed, not to internal penetration, but to coagulation of mucous on the gill filaments and damage to gill tissue through the formation of insoluble metaloproteins.

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KYM MURPHY, formerly with Sea World is now Director of Aquatic Sciences, Aquaria Inc., 800 North Cole Avenue, Los Angeles, California 90038, Ho. 1-4433.

FROM THE MEDICINE CHEST
(Electric eel)

Louis Garibaldi (1)
National Fisheries Center and Aquarium

During last summer, August 5, 1970, the National Aquarium acquired an electric eel approximately six and one-half to seven feet in length. In late October this fine specimen began to develop ulcers or cysts on the body and most severely in the head region. Although he had gone on a hunger strike for a period of over two weeks he displayed an abnormally swollen abdomen and little activity. A series of medical treatments were tried to cure the skin sores. Treatments included formalin, methylene blue, malachite-green (as a bath and painted directly on the sores), gentian violet (painted on), acriflavine bath, and sulfathiozole sodium. None of these were effective so we contacted the Eastern Fisheries Disease Laboratory at Leetown. On November 3, slides were made from the lesions, blood was taken from the caudal vein, and a peritoneal wash sample was made.

Myxobacteria were found on the slides from the lesions. TSA and Ordahls media were innoculated with sterile blood from the caudal vein. Myxobacteria were found cultured in the Ordahls media which is indicative of a systemic myxobacterial infection.

The peritoneal wash (sterile saline injected into the body cavity and aspirated) was subjected to tissue culture techniques for viral agents with negative results.

On November 5, slides were again made prior to treatment with a new drug. These slides again showed myxobacteria. We then proceeded to give the eel a one-hour bath in a 1 ppm solution of Nitrofuran drug known as P-7138. (Nitrofuran Drug - Progressive Fish Culturist Vol. 32 #1, January 1970).

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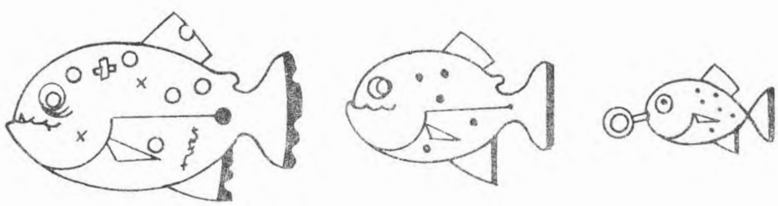
(1) Acting Assistant Curator, National Aquarium

Slides made the following day, November 6, did not contain any myxobacteria. On November 8, the eel accepted eight whole smelt, feeding for the first time in nearly a month. Within ten days the massive lesions had all but disappeared due to the remarkable regenerative powers of electric eels and their relatives.

At this writing, the eel readily consumes twelve to sixteen whole smelt a day and retains only darkened areas of skin where the lesions had been. The abdominal swelling is also gone.

The new drug is still experimental and is reported to have a narrow spectrum of activity. It is absorbed rapidly through the skin and the one-hour bath was sufficient to cure the systemic infection of the eel.



SECOND GENERATION PIRAHNA

Louis Garibaldi
National Fisheries Center and Aquarium

On November 23, 1970, fourteen baby pirahna (species) were removed from our pirahna display tank. The spawning of pirahna (for which we take no credit) is still an achievement, but this was a noteworthy spawning because the parents were obtained from Shedd Aquarium several years ago as fry which resulted from a spawning of their wild-caught fish. Therefore, fourteen fry were second generation domestic pirahna. Has anyone else had similar fortunes? The temperature was approximately 78° F and the pH 5.5 when the fry were removed. Conditions were perhaps different at the time of spawning.

CHLORINE +3 (1)

Louis Garibaldi
National Fisheries Center and Aquarium

One of the biggest problems in any aquatic system which supports fish, is the problem of disease. Aquarists, amateur and professional alike are forever seeking new and better solutions to the problem. There are new drugs and chemicals appearing on the shelves every day. The local fish dealer may soon need a pharmacist's license as the treatments get fancier and more sophisticated. Yet, with all this effort, no one "cure-all" has ever been found which lives up to its name and it is highly unlikely any will.

A great number of the traditional headaches concerned with freshwater aquariums have remedies available. However, on the scene comes a new craze, and this time it's here to stay. Marine aquariums are coming into their own and they are bringing unfamiliar headaches with them as well as new variations of the old ones.

The use of copper sulfate has been wide-spread for the treatment of marine ectoparasites. These are all invertebrates which are highly sensitive to the toxic copper ion. Copper ions, however, are also dangerous to fishes because the toxic limits are narrow. At concentrations below 0.1 ppm the benefits are questionable and many fishes may succumb to concentrations higher than 0.25 ppm after only a short period of exposure. In fact some species of fishes are sensitive to copper at even lower concentrations. This is not to criticize the use of copper sulfate for treating marine fishes nor to suggest it be discontinued, but it would be helpful to find a safer medication.

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(1) Reprinted from ANCHOR, October 1970, San Francisco Aquarium Society.

The classic concept of the marine aquarium has been one of sterile conditions to prevent diseases. We are now beginning to realize that closed marine systems are subject to the build-up of such toxic waste products as ammonia and nitrites. In a sterile system, the concentrations of these compounds continues to rise until they reach relatively low lethal levels. On the other hand, a closed system with a population of nitrifying bacteria does not have this problem. These bacteria convert toxic ammonia and nitrites into relatively harmless nitrates which are tolerated to a much higher degree by fishes. It is this effect which is utilized in a so-called biological filter. The biological filter provides a substrate on which bacteria may attach and grow. Thus, it is desirable to eliminate disease epidemics without totally destroying the environment necessary for biological filtration and conversion of toxic waste products.

Aquariums with open, or semi-open systems, do not build up toxic waste products because they are flushed from the system. Closed systems, on the other hand, present a different situation. It is essential not to destroy the micro-organisms necessary for good biological filtration and yet to reduce the problem of disease. This could possibly be compared to using pesticides against insects, while at the same time not destroying the necessary and wanted organisms, such as birds and fishes, which are also inhabitants of the biosphere.

In the search to find a solution to this problem, while Curator of Fishes at A.B.C. Marine World, (Redwood City, California) I had the opportunity to work with Bryce Anderson of Berkeley, California. An effort was made to find a chemical compound which would not be toxic to fishes, would inhibit epidemic disease conditions, improve the clarity of the water, not alter the chemistry of salt water significantly, inhibit the growth of algae to some extent and at the same time not destroy the saprophytes, thus permitting a biological equilibrium to establish itself.

One of the compounds studied was chlorine dioxide (ClO_2), a toxic gas. Bryce showed that chlorine dioxide dissolved in water of alkaline pH in reality was:

$$2ClO_2 + 2OH^- \rightarrow ClO_2^- + ClO_3^- + H_2O$$

Of the two major by-products, the chlorite ion (ClO_2^-) would be very beneficial for our needs while the chlorate (ClO_3^-) is known to be toxic. The next step was to try using another source of the chlorite ion which would be more convenient. Bryce suggested sodium chlorite ($NaClO_2$).

In use, sodium chlorite seems to achieve many of the goals we set out to achieve. Within a wide range of concentrations it has proven to be non-toxic to fishes and higher vertebrates. There is nothing in its chemical activity to suggest it might be toxic to fishes at reasonable concentrations. While it is a chlorine compound, the chlorine atom has a different valence (+3) than the chlorine atom in hypochlorous acid (+1), in common chlorine bleach, with which we are more familiar. As a result it does not react in the toxic manner we associate with chlorine.

Sodium chlorite at low concentrations (2.0 - 5.0 ppm) seems to limit bacterial, fungal and possibly protozoan populations. Thus, it prevents epidemics, but still allows biological filtration and activity. The water stays clear since bacteria and diatom blooms are inhibited. This may be attributed to the fact that, in normal sea water systems with a pH of 8.0 - 8.5, chlorite solutions have a 50% greater oxidizing power than hydrogen perioxide.

Ammonia (NH_3) concentrations at a toxic level do not seem to be a problem when chlorite ions are in a sea water system. Another possible side benefit, for those who can make use of protein separators or skimmers, is the fact that the chlorite ion does not break down amines or amino acids. These compounds are thus available to enhance the bubble stability of a skimmer's bubble chamber.

We used sodium chlorite, at A.B.C. Marine World, in the systems containing fishes at concentrations to 5.0 ppm.

In a recent communication from Robert Dempster at Steinhart Aquarium he was using chlorite more frequently and finds that it keeps the water in the dolphin tank very clear while apparently not affecting the animals in any way at concentrations to 2.0 ppm. He has tested its toxicity to fresh water fishes and finds that every fish tested so far has a tolerance of at least 12.0 ppm and probably would withstand a much higher concentration. He has kept kelp bass (Paralabrax clathratus) in salt water, treated at 5.0 ppm, for three days without any ill effect and further indicated that he has cured Ichthyopthirius with chlorite.

Experiments with chlorite have shown that uneaten food does not rot or fungus but just turns white. Aquarium water will not foul because bacteria blooms are inhibited.

An important condition, is that the system being treated should have a pH of 6.0 or higher. At a pH of 7.5, and higher, chlorite is very stable. At pH values of 5.5, and lower, it becomes unstable and may decompose thus:

$$5ClO_2^- + 2H^+ = 4ClO_2 + Cl^- + 2OH^-$$

Sodium chlorite should be handled with care. If it should come into contact with acid, sufficient chlorine dioxide may be given off to be explosive, as well as being a toxic gas. Sodium chlorite solutions can also create a fire hazard if spilled upon a combustible material, such as paper or cloth, and allowed to dry. Any spill should be well rinsed with large amounts of water immediately.

Robert Dempster has also worked out a formula for calculating the amount of sodium chlorite necessary to produce a given concentration of chlorite in water.

$$\text{Grams of sodium chlorite (80\%)} = \frac{V \times 6.34}{1000} \times \text{ppm}$$

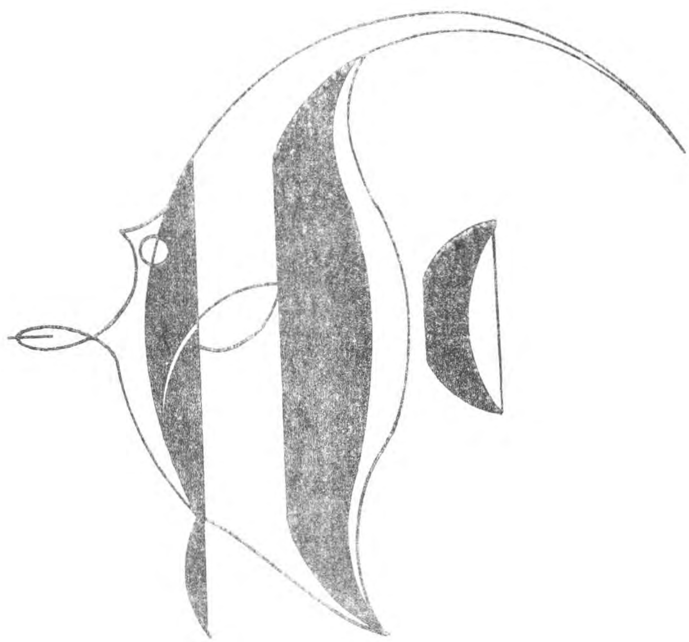
V = gallons of water to be treated
ppm = concentration desired
6.34 = a constant derived from the following:

$$\frac{3.785 \text{ (liters/gal)} \times 90.5 \text{ (MW* of sodium chlorite)}}{.80 \text{ (sodium chlorite purity)} \times 67.5 \text{ (MW of chlorite)}}$$

On first treating a system, the concentration of chlorite does not rise as one would normally expect. It appears that initial "amounts" react with organic wastes and bacteria accumulated in the system. The initial amounts clean the accumulated slime from the piping and filters in a large water system, which usually results in a cloudy water condition until all of this type of material has been removed. The water normally becomes crystal clear once the desired concentration of chlorite is attained in a system and it is very visible and will remain for some time. Subsequent additions of chlorite will raise the concentrations as expected.

Much more work is necessary to determine the full worth of this compound. For instance, how effective is it against protozoans and higher ecto-parasites? No compound is going to be "the" answer, but this one is a useful tool. This article is being published in the hope that more aquarists will try this compound under a wide range of experimental conditions and publish their results for the benefit of all.

*Molecular Weight



A DESCRIPTION OF THE METHOD USED TO DETERMINE THE PRESENCE OF CHLORITE IN WATER WHEN SODIUM CHLORITE IS ADDED TO A FISH TANK OR LARGE WATER SYSTEM (*)

Robert P. Dempster
Steinhart Aquarium

Bryce P. Anderson
Consulting Chemist

Sodium chlorite has proven to be beneficial at low concentrations in the control of water systems supporting aquatic life. This chemical should not be used, however, unless the pH of the water is above 6.0.

In order to determine the amount of sodium chlorite to add to a tank or water system to produce the desired concentration of chlorite, use the following formula:

$$\frac{V \times 6.34 \times ppm}{1000} = \text{grams of sodium chlorite (80\%) required.}$$

V=volume in gallons.
6.34 is a constant.
ppm=desired concentration.

After a carefully calculated amount of sodium chlorite has been added to a fish tank or water system, and has become well equilibrated, a test should be made to determine the actual chlorite concentration of the water resulting from the sodium chlorite addition. The calculated amount of sodium chlorite added does not, necessarily, always result in the chlorite concentration that was originally figured by calculation.

A relatively simple test has been perfected for the determination of this chemical in both fresh and salt water. The procedure for the test, as developed in the Steinhart Aquarium laboratory by the authors, is a modification of the Black and Whittle method of testing water for the presence of free and residual chlorine.(1)

* Reprinted from ANCHOR, October 1970, San Francisco Aquarium Society.

The reagents necessary for the test prepared as follows:

1. Leuco crystal violet (4,4',4" - Methylidynetris (N,N-dimethylaniline))*
   Dissolve 3 g (grams) of the above compound in approximately 500 ml (milliliters) of de-ionized water containing 7 ml of 70% perchloric acid. Dilute to 1 liter with de-ionized water and determine the pH, which should be in the range of 1.4 to 1.6.

   The initial solution of this compound in perchloric acid should be carried out in darkness, e.g., brown glass. It may be more desirable to make up a lesser amount of the indicator solution. If so, use aliquot amounts of those suggested here.

2. Saturated mercuric chloride
   Add 3.5 g $HgCl_2$ to 50 ml of de-ionized water and allow several minutes to dissolve. Some crystals will remain on the bottom which indicates a saturated solution. Prepare this solution in a small brown bottle equipped with a dropper.

3. Mixed indicator solution
   To 240 ml of the leuco crystal violet solution add 20 ml of the saturated mercuric chloride solution and mix. Store the mixture in a brown bottle protected from light. Remove approximately 50 ml of this to a dark bottle equipped with a dropper. This will be a convenient container for use in the daily chlorite tests.

4. Acetate buffer solution, pH4
   Dissolve 16.12 g of glacial acetic acid and 4.95 g of sodium anhydrous, or 8.25 g of sodium acetate hydrous, in deionized water and dilute to 100 ml. Dissolve 0.3 g of potassium iodide in 100 ml of the acetate buffer. Store this in a dark bottle and keep tightly closed when not in use. Transfer about 50 ml of this buffer solution to a small brown dropper bottle for the daily tests.

5. EDTA.2Na solution (Disodium ethylenedinitrilotetraacetate)
   Dissolve 20 g of EDTA.2Na in 100 ml of de-ionized water.

6. Sodium chloride solution
   Dissolve 35 g of sodium chloride in approximately 500 ml of de-ionized water and dilute to 1000 ml with de-ionized water.

   To perform the chlorite test proceed as follows:
   PREPARATION OF TEST SAMPLE

1. Rinse a clean 100 ml graduate with de-ionized water and add a carefully measured, calculated amount of water collected from a treated tank or water system. A method for determining this calculated amount is given at the end of the test procedure.

2. If the test sample has been collected from a salt water system, dilute to 50 ml with sodium chloride solution and add 50 ml of de-ionized water.

   If the test sample has been collected from a fresh water system, dilute to 50 ml with de-ionized water and add 50 ml of sodium chloride solution.

3. Pour into a 125 ml Erlenmeyer flask and mix thoroughly. Transfer 25 ml of this solution to another small flask for use in the following test procedure:

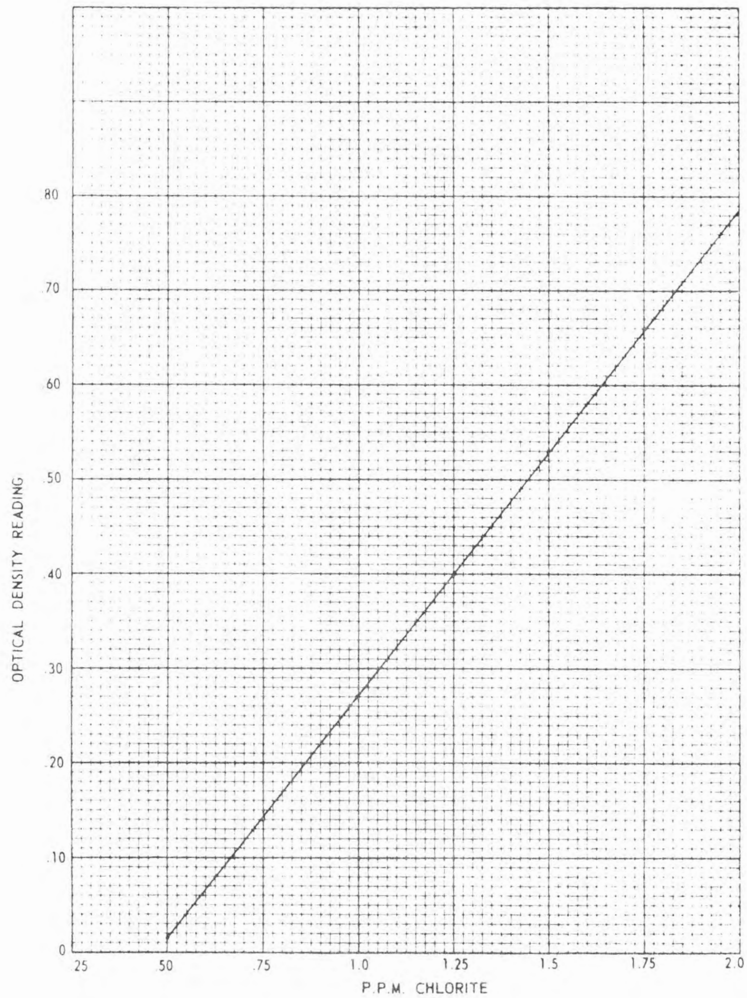
TEST PROCEDURE

1. Add 5 to 6 drops of acetate buffer solution and swirl to mix for about 1 minute. The pH of the resulting solution should be in the range of 3.8 - 4.1.

2. Add 2 drops of saturated mercuric chloride solution and swirl to mix.

3. Add 5 to 6 drops of mixed indicator solution and swirl to mix. If chlorite is present, the solution will almost become blue to purple. The intensity of this color is proportional to the amount of chlorite present.

4. Add 6 drops of EDTA.2Na solution, transfer the treated sample to a large test tube and allow it to age for 15 to 30 minutes for the development of full color.



80
70
60
50
40
30
20
10
0
OPTICAL DENSITY READING
25
50
75
1.0
1.25
1.5
1.75
2.0
P.P.M. CHLORITE

FIGURE 1

5. After the sample has set for the specified period, transfer a small portion of it to a spectrometer tube and read absorbance (optical density) of the solution at 575 mu in a Bausch and Lomb Spectrometer 20.

6. Determine ppm chlorite of the diluted water sample from the graph (Figure 1).

7. The chlorite concentration of the original water sample collected from the water system is determined as follows:

$$P^2 = \frac{100 \times P^1}{V}$$

P^1 = ppm of the diluted sample as determined from the graph.
P^2 = Actual ppm of the original sample.
V = volume of the water sample (ml) that was diluted.
100 = volume of the diluted sample.

Example:

V = 20 ml (volume of the undiluted sample used for dilution)
P^1 = 1.0 ppm (as determined from the graph)

Then:

$$P^2 = \frac{100 \times 1.0}{20}$$

Or:

5 ppm; actual chlorite concentration of the original water sample.

METHOD OF DETERMINING AMOUNT OF TEST WATER TO BE USED IN CHLORITE TEST PROCEDURE

This is an extremely sensitive test and consequently cannot be designed to cover a broad range of chlorite concentration. The most accurate range for this test is from 0.5 to 1.5 ppm. Higher concentrations produce colors that are too intense to measure in the spectrometer. Since the aquarist will most likely be working with chlorite concentrations from 1 to 20 ppm, it becomes necessary to dilute the water samples having 2.0 ppm, or greater chlorite concentration, before processing them. For testing samples having less than 2.0 ppm use 50 ml of sample.

To determine the amount of sample, which has a chlorite concentration greater than 2.0 ppm, which must be diluted in order to arrive at a chlorite concentration within a range of 0.5 to 1.5 ppm use the formula

$$V = \frac{100}{P}$$

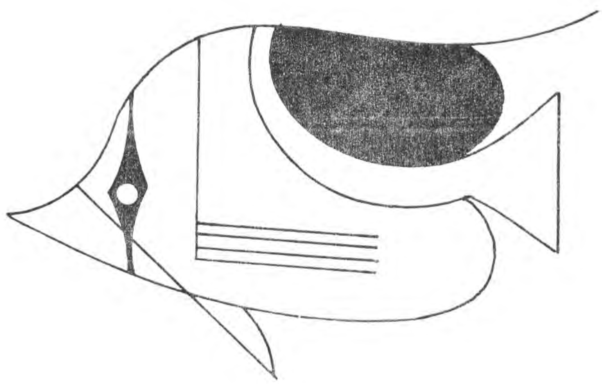
V = volume of sample required (ml)
P = calculated or estimated concentration of the sample (ppm)
100 = a constant

Example:
Calculated or estimated chlorite concentration of sample = 5 ppm

Then:
$V = \frac{100}{5}$ or 20 ml

Dilute 20 ml as described under PREPARATION OF TEST SAMPLE and perform the TEST PROCEDURE.

REFERENCE: [1]This test is a modification of a test titled "New Methods for the Colorimetric Determination of Halogen Residuals". Part 2. Free and Total Chlorine by A. P. Black and G. P. Whittle. Jour. AWWA. 59:607 - 619. May 1967.



USE OF COPPER SULPHATE AT MILLEN AQUARIUM

Herbert W. Reichelt, Jr. (1)

The aquarium at Millen is a closed-system fresh water installation, maintaining 26 displays of native Georgia fish. Water quality is rather good for chemical usage. (Hardness as C_aCO_3 is 130 and PH is 7.5, Cu. .08). The aquaria are of double glass design with false backgrounds. Because of algae and protozoan growth on tank glasses in the warm months (water temp. 72°-75°) cleaning was required every 5 to 7 days. Needless to say this was taking a lot of time and effort and we were continually disturbing our displays.

Various algecides were tried with copper sulphate giving best results. By maintaining an approximate concentration of .2ppm - .3ppm during June, July and August, we reduced glass cleaning activity by 62%. Also our usage of other chemicals, in connection with various prophylactic treatments for fungus, bacterial infection etc., was reduced by 43%. For experimental reasons, we ran this copper concentration for a nine-month duration one time to observe fish reaction, etc. After this nine-month exposure, feeding by all specimens was drastically reduced, and mortality did occur individually among selected species in this order: *Heterandria*, *formosa*, *Etheostoma*, *Erimyzon*, *Esox niger*, *Lepomis microlophus*, and *Cyprinus*.

We have been using the three-month exposure method for the last three years with good results and no adverse conditions.

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(1) Regional Aquarium Curator, Millen National Fish Hatchery, Millen, Georgia.

OF MANATEES AND OTHER THINGS

Earl S. Herald(1)
Steinhart Aquarium

Florida being the only place in the world other than an aquarium where one can observe manatees in clear water, the writer together with a photographic buddy, Jerry Meyer, descended upon west Florida's Crystal River to film the manatees. The clutter of photographers was amazing -- Philippe Cousteau with an eleven-man film crew, including an old friend Ron Church, the head cameraman; Marlin Perkins and his group in an adjacent area -- it almost looked as though there would not be enough manatees to go around. Mother Nature stepped into the picture by decrying warm weather so that the manatees would not come into the 72° spring, but remained downriver in the Anachris beds which provided impossibly turbid water. Woody Hartman, the manatee specialist, was there; his great hope is the establishment of a national manatee preserve in the Crystal Springs headwaters.

Later we moved to Miami and the Seaquarium manatee tank where the most famous inhabitant, one of three is Sewer Sam. This 1,400-pound brute had previously thrown the entire State into an uproar by clogging one of the main sewers in Miami. Sewer Sam proved to be more photogenic than any of the Crystal River animals. Incidentally, the Cousteau script called for Sam's ponderous body to be transported to Crystal River, and there to cavort with the usually non-receptive females. Warm weather ruined everything until next year.

Although Steinhart Aquarium was indirectly responsible for the first manatee chromosome count, we were not able to do much blood work. Thus I was happy to learn that Jesse White, Seaquarium's hard-working vet, is sitting on a wealth of unpublished manatee blood data. Anyone with sirenian health problems will need to consult his files.

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(1) Associate Director, California Academy of Sciences.

One of the great ichthyological sights of all time is to be found in the Seaquarium shark channel, not so much in the sharks themselves (although they do have three tigers), but in the remoras associated with them. A day of watching these fishes and studying their interrelationships will give one more knowledge of them than is to be found in any book.

I discovered some items I did not know about Seaquarium. While the rest of us are having troubles getting out a throw-away brochure in English, they have theirs in about six languages.

And for you fish photographers who are building up your color slide files, the best buy at the moment is a photo special which the Seaquarium concessionaire has available: 40 excellent Kodochromes of Florida fishes and a few invertebrates for $6.28, including tax and mailing charges. If you want this set (Packet No. Y), send your money to Warren Zeiller, Miami Seaquarium, Rickenbacker Causeway, Virginia Key, Florida, who will put them in the return mail. Warren has promised to attempt to put together a master set of about 200 slides covering most of the southwestern U.S. marine species, and we at Steinhart Aquarium will attempt to do the same for Pacific coast fishes. Hopefully someday we can have a large slide series covering all American species which can be purchased for a very nominal amount.

Before returning to the San Francisco grind, I drove to Fort Lauderdale for my first visit to Ocean World which turned out to be a very pleasant experience. The place was extremely clean, the shows were good in a folksy way, and it seemed to me that everybody was working with considerable spirit.

SIGNS AND SENSE (1)

George B. Rabb
Chicago Zoological Park

ABSTRACT

The stereotypy prevailing in labeling exhibits in zoos and aquaria seems to stem from traditions of the natural history cabinet. The focus is taxonomic, with perhaps a few words on common questions such as maximum size, food, etc. The ordinary format used for signs is a familiar and monotonous one: bold common name, followed by scientific name, and tiny text or standard map. Casual observation indicated that the usual signs at Brookfield Zoo were not making much of an impact, although the public may ask for the ordinary information because that is what they're accustomed to receive in zoos.

Experiments using different textual material, especially in regard to titles, indicate that the public does respond positively to different approaches. Subjects of new signs included the animals, their behavior, features of their artificial habitat, zoo husbandry and conservation practices, etc. Attention span at Brookfield Zoo's reptile house exhibits was doubled by good signs (600 timings at comparable exhibits or at the same exhibit with and without a well-conceived sign). Similar gratifying response to differently flavored signs was noted from 1400 systematic observations at other exhibits.

We recommend concentrated effort on all aspects of sign production: typographical format, content, vocabulary, length, color, shape, placement. But the effort must be measured by evaluation of its effects on the public. Feedback must be sought.

(1) Presented at the American Association of Zoological Parks and Aquariums, Sept. 1970.

Partly because of their general design limits as animal housing, aquaria seem to have fallen into even more of a uniform mold than zoos in regard to format and placement of labels. Generally a backlit label surmounts a tank; the label is often expensively illustrated with a colored picture of a particular species. The label placement above the tank makes for a very definite and distracting break in visitor attention, either to the written information or to the aquatic animal and its environment. Initial design of tanks with effective labeling in mind is thus in order. One technique that might be used is to have labels behind the tank. These need not be constantly visible, but could be intermittently illuminated, perhaps by the visitor pushing one or more buttons. Such a system could be very good for pinpointing habitat features, such as are sometimes duplicated in a dry section behind the wet tank.

Identification signs for communal tanks could be assembled in a rotatable rack or one-armed bandit machine. Simple taxonomic keys could also be so rigged for more visitor participation.

Thinking about the content of signs rather than just consulting Axelrod and other bibles leads to very fruitful thoughts about exhibits. The basic one is: why have a particular animal or exhibit at all? What biological, sociological or other point is being made? Are signs the way to communicate this point? Etc.

Unfortunately aquaria, like zoos, live with tight budgets. Devotion of much money and, more importantly, professional time and attention to signs and other educational devices has generally been eschewed in favor of solving husbandry, financial, or other management problems. Yet effective communication with the public about biology and man is extremely important, if not indeed the paramount reason for the continuing existence of zoos and aquaria.

FISH LOUSE NEEDED

Dr. Roger Cressey, who is the Associate Curator for crustaceans at the National Museum, is attempting to bring together all the knowledge about the American members of the fish louse genus Argulus. He needs some help from all of the aquarists.

Dr. Cressey is currently engaged in a research project designed to result in a taxonomic revision of the fish parasite genus Argulus and to produce a key to the American species. The National Museum of Natural History collections contain many of the known American species.

In order to make this work as comprehensive as possible and produce a key useful to fishery biologists in all parts of the country, however, Dr. Cressey needs material.

If you have collections of this parasite he would very much like to examine them. They will be returned with the identifications made (or verified) within six months of receipt.

Correspondence with or without collections should be addressed to:

Dr. Roger F. Cressey
Associate Curator
Division of Crustacea
National Museum of Natural History
Smithsonian Institution
Washington, D. C. 20560

S-E-A SCOPE®

SYSTEMS EXPERIMENTAL AQUATIC CULTURE

VOL. 1 NO. 1 NOVEMBER, 1970

To Our Readers:

This is the first issue of our quarterly newsletter, **S-E-A SCOPE**. It will be sent without charge to our customers, friends, and upon request, to all others interested in the problems of maintaining aquatic organisms in closed circulation systems. We hope it will become a forum for discussion of these problems.

Since our inception six years ago, we have served as a "clearing house" of information not only on the variety of species of marine life successfully maintained in closed circulation systems, but also on the new procedures and techniques developed to overcome the problems encountered in aquatic research. Through **S-E-A SCOPE** we shall now share, more widely than we have been able to in the past, the reservoir of knowledge and experience that we have accrued.

These past six years have seen a great change in laboratory practice involving living aquatic organisms. Laboratories many miles from the sea now routinely maintain supplies of sea urchins, aplysia, nudibranchs, mussels, etc., for research; and one in particular will attempt to keep squid with a system we have recently developed. Also during this period, instruction in the life sciences has more and more begun to utilize living marine material. Much of this has been made possible by the availability of our salts and culture systems.

We shall solicit articles for **S-E-A SCOPE** of 2000 words or less reporting on all phases of aquatic culture. Although the emphasis will be on marine research, we welcome articles dealing with fresh water as well. If you have done or are doing work in either medium we should be glad to have your report for consideration.

In addition to contributed articles, **S-E-A SCOPE** will contain: A permanent column edited by Dr. James W. Atz, Dean Bibliographer of the American Museum of Natural History of New York; S-E-A NOTES, to give important information on the operation of closed circulation systems; INSTANT OCEAN IN THE NEWS, to cite the accounts of our activites as reported in the press; S-E-A LETTERS, to give our readers an opportunity to record their views and ask questions on culture problems; and a NEW PRODUCTS INFORMATION Section.

It is our earnest hope that **S-E-A SCOPE** will be informative and helpful.

Sincerely,

Robert H. Moore, Jr.
Pres.- Aquarium Systems, Inc.

RHM:ws

BOOK REVIEW

Fish and Invertebrate Culture Water Management in Closed Systems

Stephen H. Spotte

There are copious amounts of shallow, popular literature and extremely deep, scientific data on the subjects of aquatic animal maintenance and water chemistry. Here at last is a collation of practical information, presented in an organized fashion and backed up with sufficient references.

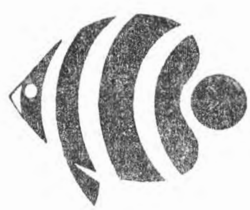
As so well put by Dr. James W. Atz, "Now, fish culturists experimental biologists, and amateur and professional aquarists have a firm bridge between their fish-keeping activities and the diverse chemical, biological, limnological, and oceanographic literature that bears on them."

This book is one that should be on every aquarist's bookshelf whether he is an amateur or a professional. The majority of problems concerning water management are dealt with clearly for the most part. Not only is one told what to do, but the author goes one better and explains the reasons for doing so.

For the professional aquarist there are some thought-provoking discussions, but the greatest achievement of this book is the gathering together in one volume of the current knowledge on closed system aquatic management.

Available from Wiley-Interscience, 605 Third Avenue, New York 10016, $8.95.

Louis Garibaldi



LIVE FISH TRANSPORT
(SHARKS)

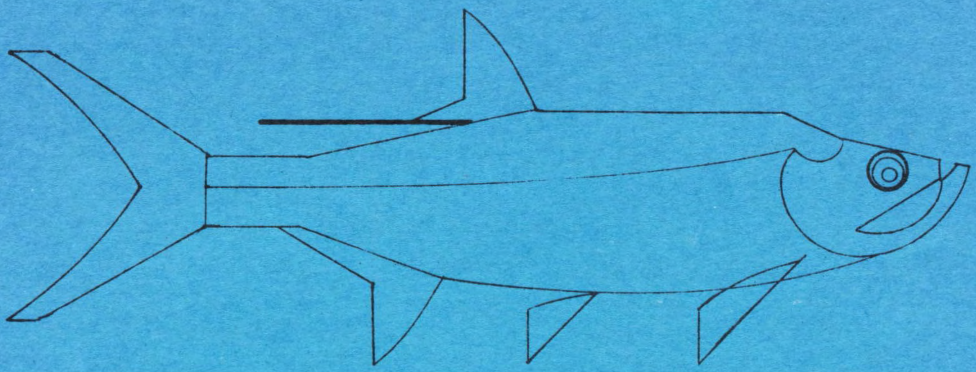
Six five-ft. sharks, caught off the Florida coast, were recently moved by air in specially-designed tanks containing only six inches of water. They arrived safely at an aquarium in Cleveland because of special arrangements to provide them continuously with an adequate supply of oxygen in assimilable form. Fitted alongside each tank was an oxygen bottle, the discharge from which was operated by a small battery. Associated with this was an aqualung adapted to squirt oxygen-impregnated water over the gills of the shark at regular intervals.

By means of this apparatus, a marked saving in weight was achieved as compared with the load that would have had to be taken if each shark had been fully immersed. The ultimate weight of tank, water, shark, and equipment turned out to be no more than 350 lbs--and so the whole consignment was easily lifted by a relatively small aeroplane. The specimens duly arrived in good condition 900 miles away. Although the main part of the life-system was automatic, one piece of treatment had to be done by hand in the course of the flight. This was regular massaging of the sharks through a hole in the top of the tank to make good the lack of movement and water friction.

This technique may serve as a useful foundation for a system of fast fish transport as projects for marine farming come to be developed and species new to a particular neighborhood have to be added to native stocks. Dover soles may never be acclimatized in the Pacific but comparable experiments can be eased by such means as Mr. Gerrit Klay of the Cleveland aquarium devised. (1)

Taken from NEW SCIENTIST, March 19, 1970.

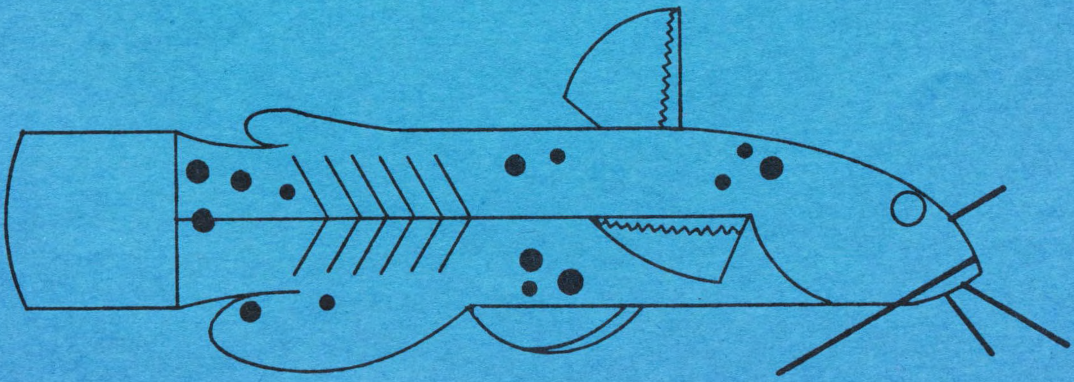
(1) Gerrit Klay is now at the Shark-Quarium Experimental Station, Marathon, Florida 33050.



MID-WEST FISH AQUISITIONS

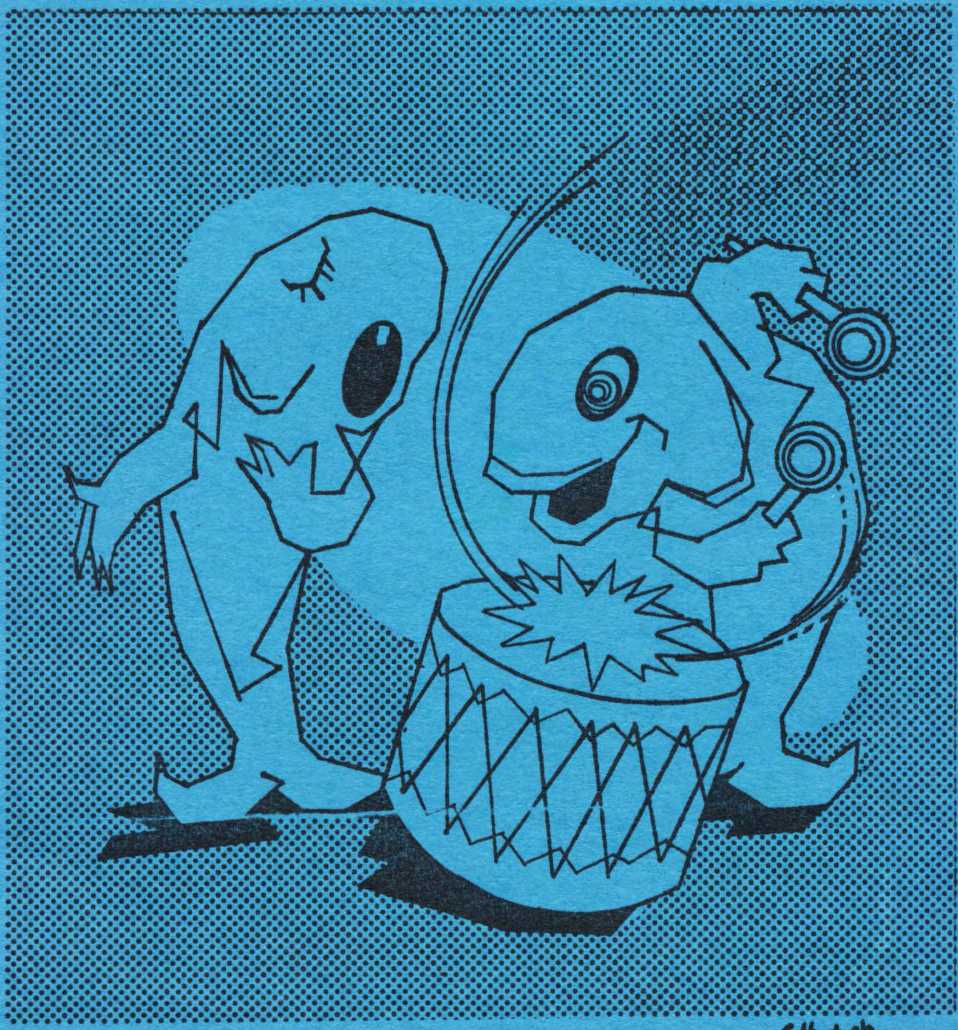
The Guttenberg, Iowa National Fish Hatchery has been closed. For many years public aquariums have been able to secure Mississippi River specimens from this station. Eldon Saeugling, Manager, has retired.

The National Fisheries Center has been advised by the Division of Fish Hatcheries, Bureau of Sport Fisheries and Wildlife, that every effort will be made to continue to provide specimens for public aquariums. Requests should be addressed to the Minneapolis regional office of the Bureau or to the Division of Fish Hatcheries, Bureau of Sport Fisheries and Wildlife, Interior Building, Washington, D. C. 20240.



O U R   L A S T   P E R F O R M A N C E ---

With this, the last issue of DRUM AND CROAKER *to be published by the National Fisheries Center, we pass the torch to the Shedd Aquarium. It has been a pleasure and a privilege to serve our fellow aquarists over the past three years.*



S.H. + C.P.