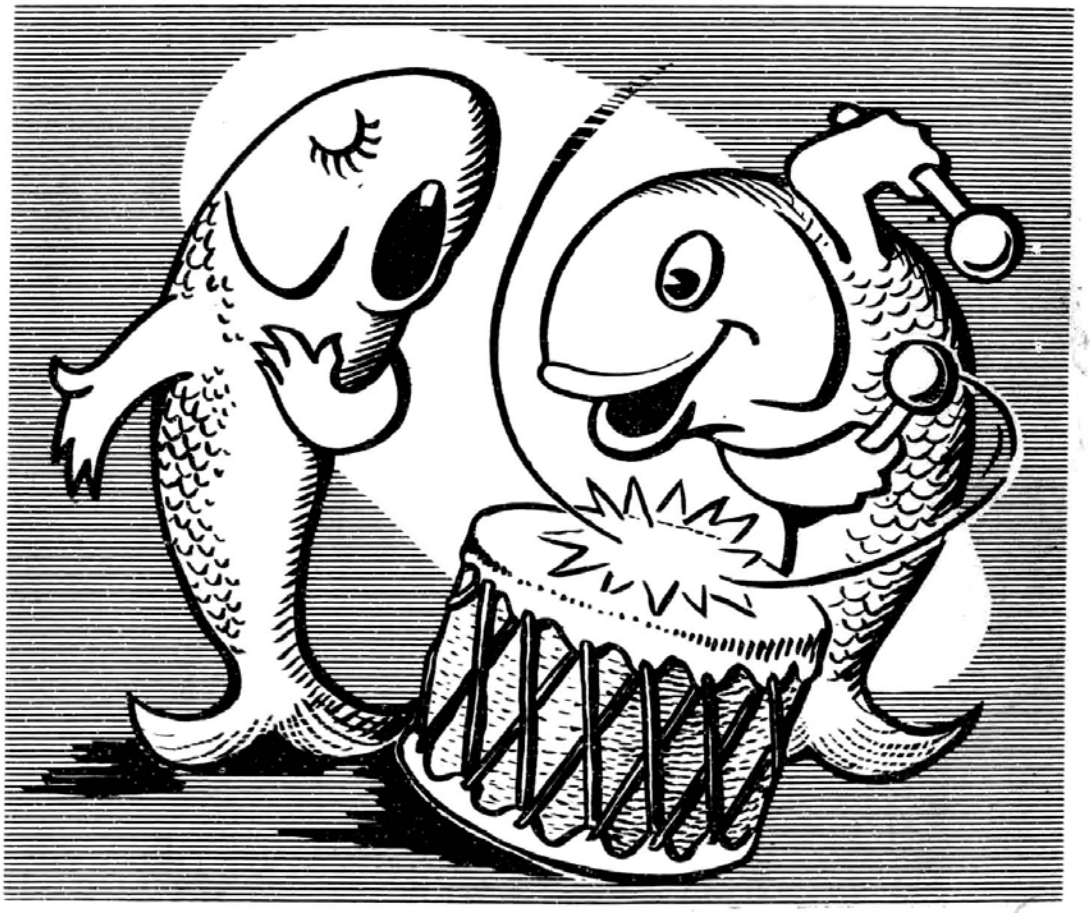
# The DRUM and CROAKER

## A Highly Irregular Journal for the Public Aquarist



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**DRUM & CROAKER**

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# AQUARIUM SYMPOSIA

## New York

I believe we must all acknowledge the success of the 1964 Aquarium Symposium. Both Lee Finneran and the New York Aquarium Staff deserve a thank you for the organization and execution of a very successful meeting. This was by far the best represented symposium ever held, thirty-five acknowledged participants from more than twenty-five aquaria were present. Although sometimes chaotic with multiple discussions occurring, a great deal of information was discussed.

Dave Miller has continued the work initiated by Lee Finneran and the first section of the "Report of the Aquarium Symposium, New York, 29 August 1964" was mailed in December.

## Chicago

Mr. Bill Braker, Director of Shedd Aquarium, Chicago, Ill., has extended an invitation, which has been accepted by the Aquarium Committee, to all public aquarists to attend an Aquarium Symposium at the Shedd Aquarium the 13th and 14th of June, 1965. Following the suggestions of the participants of the 1964 Symposium at New York, we have extended our meeting to two days. The tentative program will be:

| | | |
|---|---|---|
| 13 June, 1965 | 9:00 AM to 12:00 N | A tour of the Shedd Aquarium |
| | 2:00 PM to 5:00 PM | Submitted papers & discussion |
| | 5:30 PM | Cocktails |
| 14 June, 1965 | 9:00 AM to 12:00 N | Papers and discussion |
| | 2:00 PM to 5:00 PM | Round table discussion |
| | 6:00 PM | Dinner |

This Symposium will be on the Sunday and Monday before the National Meeting of the American Society of lchthyologists and Herpetologists in Lawrence, Kansas. There will, be ample time between the Aquarium Symposium and the A.S.I.H. National Meeting in Lawrence, Kansas, for those interested in attending A.S.I.H. to get from Chicago to Lawrence.

If you plan to attend, please contact Mr. Bill Braker for information on accommodations. Titles of papers to be presented should be mailed, preferably with an abstract, to Mr. William Braker, Shedd Aquarium, Chicago, Ill.

# OUR DELICATE FISH

James W. Atz
The American Museum of Natural History

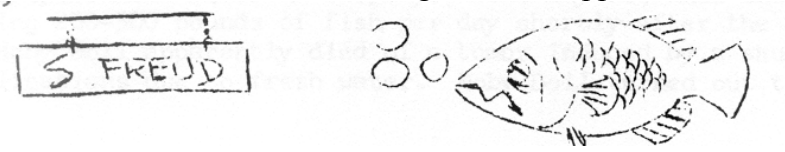
Preconceptions often hide the obvious. Fishes are usually considered to be lower vertebrates - cold-blooded forms with primitive nervous systems and inefficient circulations that compel then to be less sensitive and to react more slowly to changes in the environment than do mammals and birds. Most aquarists would vehemently disagree with this, of course. Anyone who has tried to keep a collection of fishes alive and healthy almost certainly comes to consider his charges devilishly susceptible to the slightest unfavorable condition. Within the last few years, physiologists working with fishes as laboratory animals have amply confirmed the aquarist's judgment about the sensitivity of fish. In fact, they have found fish to be so sensitive that even the aquarist may find himself surprised and thus of no mind to chide the experimentalist with an "I told you so."

About seven or eight years ago, French comparative endocrinologists discovered that just catching a captive carp was enough to change greatly the amount of adrenocortical hormone in its blood. These scientists were forced to "sneak up" on their fish when they wanted to see what an unactivated adrenal gland looked like (by waiting until the carp were asleep or by killing them right in their home tank with a massive electric shock) because changes in the adrenal occurred in the seconds that passed from the time a carp was first netted to the time it could be killed. At Wayne State University, Dr, Walter Chavin has found that simply netting a well-acclimated goldfish almost immediately affects its adrenal glands. When goldfish that were well adjusted to life in captivity were transferred to another aquarium, similar in all respects to the one in which they had been living, it took four days before the amount of glucose in their blood returned to a normal level. At the Bingham Oceanographic Laboratory, Dr. Anna Slicher is studying the blood of the common killie or mummichog (Fundulus heteroclitus). When these fish are brought into captivity, the red and white cells in their blood do not reach a normal state for at least five days, and some signs of disturbance can be detected as long as two weeks after capture.

Please note that these signs of extreme sensitivity occurred in the carp, goldfish, and mummichoq, which are three of the hardiest and most docile species. No wonder we get into trouble when we try to collect, ship, or otherwise handle the many more delicate species! Fishes ought to be given every opportunity to recuperate after being moved or handled. The greater use of tranquilizers and anesthetics also seems to be indicated.

## Reference

Chavin, Walter (1964) Sensitivity of fish to environmental alterations. Publication, Great Lakes Research Division, Univ. of Michigan, No. 11, pp. 54-67.



## NATIONAL AQUARIUM

Funds are presently available for completing the design and specifications of the Fisheries Center. First construction funds are expected to be available July 1, 1966. Construction is expected to he completed in mid-1968, with formal opening about September 1, 1968--if funds are forthcoming as planned.

Additions to the staff in the immediate future will be a chemist, to follow through on synthetic salt water research now under way, and a mechanical engineer with fish experience. Both are intended to be permanent staff.

Wm. Hagen, Acting Director
National Fisheries Center and Aquarium

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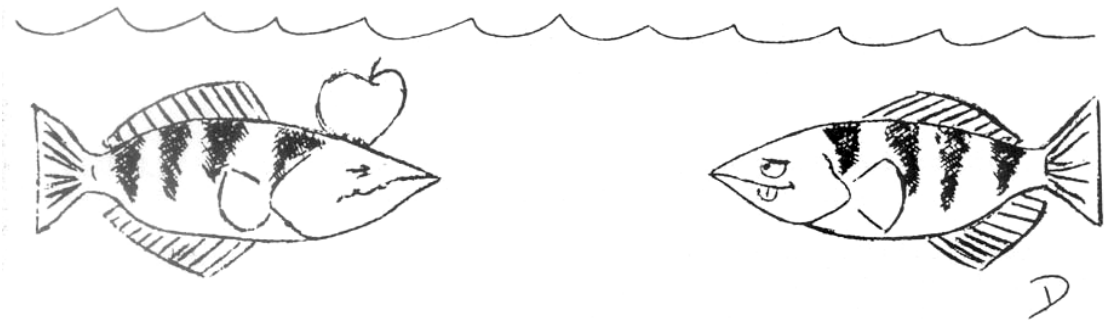
This may answer some of the questions about the National Fisheries Center and Aquarium but "whatever is doing ... with regard to the appointment of a director ..."

J.P.



MOBY DOLL - Murray Newman's killer whale has died since the Aquarium Meeting in New York. Murray's success has generated considerable interest in these animals for potential aquarium display. Some may not know that the Moby Doll began eating 200-300 pounds of fish par day shortly after the September Symposium. Moby Doll apparently died of a tumor induced by a skull fracture and skin complications due to fresh water. Moby Doll turned out to be a male.

# NOTES ON THE FRESH-WATER GOBY FROM A BAYOU OFF DAVIS BAY (Eleotris pisonis (Gmelin))

Laine M. Dimmick - 11 Years Old

INTRODUCTION: Late in July (25 July 1964), I set out my chubby-trap baited with smushed crab in the Research Laboratory's boat slip off Davis Bay near Ocean Springs, Mississippi, to try to catch same fish for my aquarium. After the trap had been on the bottom for about two days, the tide went cut and the trap had to be taken up to save the fish in it.

Eight fish were in the trap, 5 Eleotris pisonis (f resh-water goby), 2 Lagodons (pin-fish), and 1 Fundulus (killifish). One Eleotris was left on the ground accidentally and died (I found it the next morning) and another one died in the holding tank. Later, in my aquarium the two Lagodons and the Fundulus died. I swapped one of the remaining Eleotris for a Porichthys that I needed for my collection. That left me with 2 Eleotris to study. This paper contains my observations on these most interesting fish.

IDENTIFICATION AND LIBRARY RESEARCH: Dr. Gordon Gunter, Director of the Gulf Coast Research Laboratory, helped me identify the Eleotris pisonis. Charles M. Breder, Jr. calls them Fresh-Water Goby on page 256 of is Field Book of Marine Fishes. Dr. Gunther Sterba describes the Eleotris pisonis is in his book entitled Freshwater Fishes of the World on page 737. There is also something about caring for fishes in the family Eleotridae in the same book on page 747.

FIELD CHARACTERS: This fish has two long fins on its back and two long ones on the bottom of its stomach. His tail fin is long too. The fins behind his gills are long. He is long and narrow. He has small eyes, and his mouth is big and has long jagged teeth in it.

VIABILITY: He does not seem to get along too well in tap water, but in brackish water from the bayou he seems strong and healthy.

RESPIRATION: Its normal breathing is 24 times per minute. When you put him in tap water, he swims around, then stops. After a few minutes he begins to breathe once per second. I removed him after 5 minutes in tap water (because he was doing badly) and put him back into brackish water.

SIZE: All of my Eleotris are about 3 Inches long, Standard Length.

COLORATION: In dark sand, he turns black. In store-bought sand his back turns yellowish (about the color of the sand). When he is in my hand, he pales out even more, but, except for his back he is palish brown all over.

OBSERVATIONS: Both Eleotris pisonis did about the same thing when I first put them into my aquarium. First they stood still for about 10 or 15 minutes then started moving around very slowly. They went to the top of the tank, then came back down and changed colors then. They explored around a whole lot and then tried to bury up. First they move their bottom fins around to kick up the sand, then gulp water into their mouth and squirt it out of their gills and sink into

the sand. They go into the sand tail first and bury until only the eyes stick out. When they want to come out, they come out head first.

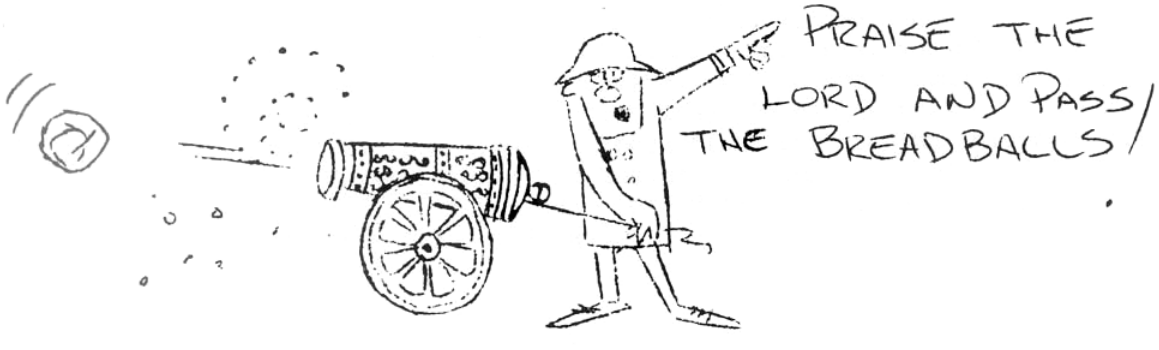
One fish has been chosen for closer observation and the other one has been left alone to swim around and enjoy himself. The one that has been left alone spends most of his time buried up. The other Eleotris was put into another tank with a Lagodon rhomboides. The Eleotris backed the Lagodon into a corner and the Eleotris got finned. I took the Lagodon out and put in a Micropogon (croaker) about one inch long. Next, I saw the Micropogon's tail appear into the Eleotris' mouth.

Later, I put the Eleotris in an aquarium with some bigger fish, 4 Oligoplites saurus (leather jacket), a Mugil (mullet), and a Menidia (silverside). There was also a Squilla empusa (mantis shrimp) in the tank. They didn't get along too well and the next day all of the other fish died and part of the shrimp's tail was eaten. My Eleotris was then put in with an Adinia xenica (striped killifish) and I saw the Adinia's tail disappear into the Eleotris' mouth.

The Eleotris hides himself by curving around oysters and mussels. He stands sometimes for 2 or 3 minutes on his tail. Sometimes he stands on his head, but not as long as he stands on his tail. He lies in the darkest corner and thinks you cannot see him. He behaves like an Opsanus (oyster fish) and moves very slowly. He has been fed shrimp, but I have to put it real close to his mouth so he can smell it real good before he will eat it. He will eat little fish of almost any kind.

I have enjoyed very much working with this fish and hope to continue these observations. They look very good in an aquarium and are easy to keep. I think that they live best in brackish water and will eat bread balls as well as little shrimp.

I would like to thank Mr. Bill Demoran for helping me take care of my aquarium and Mr. Malcolm Ware for helping me find papers and books in the Laboratory library on Eleotris pisonis and helping me get this paper in order.



# RECENT HELPFUL LITERATURE

Jim Atz

The mount of scientific literature put out these days can only he described as appalling. The library of the American Museum of Natural History receives each week about four feet of publications, that is, a stack about four feet high. The following are items extracted from that great pile that should be of help to aquarists:


Healey, E. G. (1964) Anesthesia of fishes. Pp. 59-70 of "Small Animal Anaesthesia." Edited by Oliver Graham-Jones. Macmillan-Pergamon, N. Y. (Good, practical data on MS 222 and urethane .)

McFarland, William N. (1959) A study of the effects of anesthetics on the behavior and physiology of fishes. Publications of the Institute of Marine Science (Port Aransas, Texas), Vol. 6, pp. 23-55. (The most extensive study ever made.)

Fry, F. E. J. & Kenneth S. Norris (1962) The transportation of live fish. Pp. 595-608 of Vol..II of "Fish as Food." Edited by George Borgstrom, Academic Press, N. Y. (Excellent theoretical treatment.)

Crandall, Lee S. (1964) "The Management of Wild Mammals in Captivity." University of Chicago Press. (Chapters on manatees, seals, sea lions, and walruses, but not on whales or dolphins.)

Snieszko, S. F. & Glenn L. Hoffman (1963) Control of fish diseases. Laboratory Animal Care, Vol. 13, No. 3, pp. 197-206.

Hoffman, Glenn L. (1959) Recommended treatment for fish parasite diseases. Fishery Leaflet, U.S. Fish and Wildlife Service, No. 486. 4 pp.

Saeki, Aritsune (19 7 Studies on fish culture in filtered closed circulation aquaria. Translation by E. R. Hope. T 77 J, Defense Research Board of Canada, Directorate of Scientific Information Services, Toronto. (Careful translation of Saeki's 1958 paper, which is still the most important quantitative study ever made on marine aquaria.)

Beyers, Robert J. (1964) The microcosm approach to ecosystem biology. The American Biology Teacher, Vol. 26, No . 7, pp. 491-498. (The space biologistsT interest in the so-called balanced aquarium.)

Clark, Eugenie (1963) The maintenance of sharks in captivity, with a report on their instrumental conditioning. Pp. 115-149 of "Sharks and Survival." Edited by Perry W. Gilbert. D. C. Heath and Co., Boston. (Based on personal experience and information from many aquarists.)

Russell, F. S. (editor) Advances in Marine Biology, Vols. 1 and 2 (1963 and 1964) Academic Press, N. Y. The first volume contains Loosanoff & Davis' article on the rearing of bivalve mollusks, and Blaxter & Holliday's data on the herring in captivity. The second volume contains James Shelbourne's article on rearing flatfishes in captivity.)

Gans, Carl & Aaron M. Taub (1964) Precautions for keeping poisonous snakes in captivity. Curator (American Museum of Natural History), Vol. 7, No. 3, pp. 196-205. (If you ever intend to keep sea snakes, you cannot afford not to study this article.)

## NEW YORK AQUARIUM

Chris Coates has retired.

The New York Aquarium at Coney Island has a new director. He is Paul L. Jacques Montreuil, who was named to succeed Christopher W. Coates. Mr. Coates became director emeritus and consultant.

The promotion was one of several announced by Fairfield Osborn, president of the New York Zoological Society, following the January meeting of the executive committee of the board of trustees.

Other promotions at the aquarium were: Dr. Carleton Ray, who was associate curator, to curator; Dr. Joseph Geraci, a pharmacology research associate at the aquarium, to associate curator.

### Other Changes

Lee Finneran - no longer at New England Aquarium - Dave Miller has been promoted and Lee is now public relations director at Marineland of Florida, St. Augustine. Lee has also resigned from the A.S.I.H. Aquarium Committee and its chairmanship.

Sam Hinton resigned as curator of the Wayland Vaughan Museum and Don Wilkie, formerly with Philadelphia Aquarama, has accepted directorship of the Museum and Aquarium at La Jolla. As far as known, Aquarama will operate without a staff biologist.

Bill Kelley, formerly with Cleveland Aquarium, is now exclusively with Aquarium Systems, Inc. of Wickliffe, Ohio. Their aquarium project at Niagara Falls is under construction and Win Brady has been hired as curator.

Taylor Pryor - It was announced that Taylor Pryor has assumed duties in addition to that of president of Sea Life Park, Hawaii. He is now a State Senator for Hawaii.

# DALLAS AQUARIUM

Jeff Moore

The original Dallas Aquarium was built in 1935-36 and opened to the public June 6, 1936 in conjunction with the Texas Centennial. At the time of opening, the following tanks were used for display:

Fresh water, water temperature 68 degrees; concrete construction

2 1000 gallon tanks
1 1500 gallon tank
7 2000 gallon tanks
4 3000 gallon tanks

Fresh water, water temperature 50 degrees; concrete construction

2 1000 gallon tanks
2 2000 gallon tanks

Fresh water, temperature 73 degrees, tropical fish; stainless steel and glass construction

12 25 gallon tanks
12 12 gallon tanks

Salt water, temperature 75 degrees; stainless steel and glass construction

4 50 gallon tanks (salt water exhibit discontinued after 4 years of display, fresh-water tropical fish used in lieu of salt water display)

Basically, the general construction of the Dallas Aquarium is patterned after the Shedd Aquarium. The lobby is straight, with a domed ceiling and handrails in front of all display tanks. Each tank has overhead lighted signs. Single pane glass in thickness of 1" was used for all large display tanks. Each display tank has its own reserve tank directly behind same, with a 5 foot concrete work area in between. This holds true in both the fresh and marine section.

Originally, both systems, chilled and natural fresh water were designed, having separate reservoirs. Water was pumped from the reservoir to the tanks on the roof. From there it flowed by gravity to the display tanks. From the display tanks it flowed by gravity to the filters, then back to the reservoirs. A short time later a well was dug directly behind the aquarium, and since then the natural fresh water, is used once, then dispersed to the lagoon across the street from the Aquarium. This has eliminated spreading of diseases in the natural fresh-water tanks. At the same time, the lagoon helps feed water back to the well. The chilled system still is used as a complete closed system, as originally designed. The original refrigeration unit, York Ice

DALLAS AQUARIUM (Continued)

Machinery, was replaced this year with a new type, 15 ton, Dun and Bush unit.

On March 15, 1963, ground was broken for construction of the marine addition to the existing building. The left end of the building was torn down and the new construction was joined to the present building.

After much research, it was decided to use synthetic sea water rather than hauling water from the Gulf off the coast of Texas. The formula which the Cleveland Aquarium brought over from Germany was used to prepare artificial sea water. The floor plan for the marine section called for two 5000 gallon mixing vats and 5 large reserve tanks, 8 fifty gallon aquariums were used for small reserves, and 23 display tanks of various sizes (60 to 7,000 gallons).

Each mixing vat has its own permanent pump so water can be recirculated until all chemicals have been dissolved. This same pump can be used to move water to the display and reserve tanks. A portable pump and water meter, is used to meter all water, as to the amount taken from any tank, so a constant check can be kept for all tests.

A complete closed system was designed by the architect and engineer for the seven large display tanks. The filters in use at present are made from a 55 gallon drum. We are now in process of making a wooden filter of 3/?" plywood to fit on back of the display tanks and reserves to replace the metal barrels, due to barrels rusting. The new wood filters will be 1 foot wide, two feet high and 4 feet long, with filter material of 1' x 3' x 3" deep. Water will be moved by airlift.

All display tanks in the marine section are lighted by fluorescent lights only, a mixture of Gro-lux and "warm" fluorescent bulbs. The light fixtures are hung by pullies from the ceiling and are attached to a winch, so the fixtures can be raised or lowered as needed. When a tank is being cleaned, these fixtures can be pulled completely out of the workers way, giving good head room to work.

At present we have had good success with our fish in the "Instant Ocean" mixture. Already fish have been maintained for some 14 months, here at the Aquarium. Note: 4 fifty gallon aquariums were set-up in September 1963 for experimental purposes, using Instant Ocean, and these same fish have been on display for the 1963 and 1964 State Fairs of Texas which run for 16 days during the month of October.

The racks designed to hold a double tier of aquariums were so designed by the mechanical engineers that the worker cleaning and maintaining these tanks, should be an octopus, having to climb and weave in and out of the stationary struts holding the tanks. (Editor's note: Apparently the same engineers have been all over the country.) We hope someday this can be corrected. The windows in front of the double tier of aquariums are so designed so they will swing open

and outward from the bottom, so the front of the aquariums can also be cleaned. These windows have piano hinges at the top so they will not sag. Note: The architectual designer at first had the racks so designed where each rack held 4 aquariums, 2 eighty gallon tanks an bottom, 2 sixty gallon aquariums on top, with each rack on casters, whereas the worker could pull this rack out from the front stationary glass to clean the front of the aquarium as well as the glass. The writer advised with this type of construction, an elephant couldn't pull the tanks out, not taking in consideration the sloshing of water, bending of the aluminum stands, etc. The architect maintained these racks could be easily moved while the tanks are allowed to remain full of water, display material as well as the occupants of the tank. I finally won that point, plus windows which would open to make cleaning easy.

Different types of display material are being used in the aquariums, coral in the small tanks; rocks and artificial backgrounds in the larger tanks. In the vicinity of Austin, Texas, rocks can be picked up lying on top of the ground which have holes throughout. After tests were run on these rocks, and found that fish could live with them, simulated coral reefs were built in some tanks and the small fish seem to delight in swimming in and out the holes. The larger fish are becoming accustomed to the reefs also and feel right home.

The second type of construction of background material was a "brain child" of one of the Aquarists here at the Aquarium. By taking measurements of the sides and end of a tank, frames were built, then rocks, paper and other material were placed within the frame. Over all this, burlap material was laid, rearranging the burlap until the desired pattern was formed. The Aquarist then made a mixture of raw cement, water, and 1/8 portion of acetic acid, and using a paint brush, painted on the burlap. After each coat is dry, he continues this process until the concrete becomes at least 1/4'-1/2” thick. Allowing all of this to dry, with careful handling, each panel is then placed into position. By using strips of burlap, he then joins the panels together, again, painting with the mixture of cement and water, until a good bond is joined. After allowing all to dry, the tank is filled with water and acid, giving ample time for the tank to cure, then the display is in readiness. Caves, reefs and shelves can be built in this manner, and it works in good with any rock work that one wants to use.

We have found that by using the same cement mixture and careful placing of rocks, almost any type of construction can be built in a tank. By using a mall amount of this type mortar, the display can be easily torn apart if needed and replaced in some other tank.

The temperature of the water is kept constant in winter by having thermostatic control heaters hung from the ceiling. In summer the temperature runs high, 80-84 degrees. At present exhaust fans are used to pull air across the tanks and this helps to maintain a lower temperature. The building has chilled water piped thruout and heat exchangers made of glass are planned to he used with the new filters, running the chilled water thru the heat exchanger.

## NEW NOTES

An Amazonian exhibit is planned for Pittsburgh but not yet under construction. (I do not know the details end any information will be appreciated.)

Paul Montreuil, Director of New York Aquarium, recently passed through Los Angeles on his way to Antarctica to capture Leopard, Crabeater or Weddell Seals.

Construction of the Osborn Marine Research Laboratory is to get underway this spring at the New York Aquarium and will be the best aquarium oriented laboratory yet developed.

Marineland recently began construction of a new walrus display tank. This tank will have a 200,000 gallon capacity and will provide underwater viewing. The walruses are now almost four years old and all are doing well. Woofy, the largest of the four, weighs approximately 1700 pounds and his tusks are 10-12 inches long.

Vancouver Aquarium is also to begin construction of the British Columbia Hall very soon. Murray has completed all the preliminaries and more details are available in the recent issues of the Vancouver Aquarium News Letter.

Note on Coelocanth at U.C.L.A. - Although not fit for an aquarium display, the ichthyology department at U.C.L.A. recently received a four foot specimen of Latameria from South Africa. For those in the vicinity, it is well worth the trip to U.C.L.A. to see this unusual creature. This is the first specimen in the U.S.

J.P.

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This is a paragraph quoted from a letter I received in response for D & C material requests:

"In case this letter reaches you prior to your departure for New York, I suggest you make a strong appeal there for some more material for the next issue of the D & C. I believe that some of the apathy among the aquarium people is because of an inferiority complex. Many curators, aquarists or caretakers think that their aquariums are too small and unimportant to get into the "spotlight", or that the work they might be doing is too unimportant. If you could convince these people somehow that the opposite is true, that their aquariums and their work are important in the overall picture, I am sure half of the battle is won."

J.P.

# R 7464, A NEW POTENT ANAESTHETIC IN FISH

D. Thienpont and C. J. E. Niemegeers
Société Royale de Zoologie d'Anvers (Belgium),
Janssen Pharmaceutica, Research Laboratorium, Beerse (Belgium).

During recent years anaesthesia in fish has been used as a matter of course, improving various fish handling techniques.

A slight, eventually long-lasting tranquilization, resulting in a loss of reactivity and in a decreased oxygen consumption, has been reported to be beneficial in stocking, distributing and transporting live fish.

A transitory but somewhat deeper level of anaesthesia, inducing immobility of fish is needed for routine biological investigations, such as tagging, marking, weighing, sexing, stripping, spawning, etc., while experimental more important surgical interventions necessitate a complete and sustained level of deep anaesthesia.

Various chemical substances possessing sedative or unaesthetic properties in fish, manifested by a decreased rate of metabolism, have lately been introduced (1). All these compounds, however, must be used with great care as the concentration level is critical, the most active compounds being effective in high concentrations only.

In view of the need for an active, polyvalent and safe anaesthetic agent for cold-blooded vertebrates, improving in many ways upon currently used compounds, we set up a large screening program in fish for uncovering such agents. The following criteria must, a priori, be met:

1. High solubility in fresh- and salt-water
2. High potency
3. High safety margin
4. Allowance for complete recovery
5. Allowance for inducing various and desired depths of anaesthesia, i. e. "polyvalency".

We wish to describe our results obtained, using one of our compounds, R 7464 (2), which we feel, comes close to fulfilling these prerequisites. These tests have been carried out primarily on the gold-fish (Carassius auratus), varying both the drug concentrations and immersion-time of the test animals.

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(1) McFARLAND, W. N.: The use of anesthetics for handling and the transport of fishes. Calif. Fish and Game, 46, 407-431 (1960).

(2) GODEFROI, E. F., JANSSEN, P.A.J., VAN DER EYCKEN, C.A.M., VAN HEERTUM, A.H.M. and NIEMEGEERS, C.J.E.: DL-1-(1-arylalkyl) imidazole-carboxylic acid esters, a novel type of hypnotic agents. J. Med. Chem., (1964) in press.

Preliminary trials have also been done with sun-fish, rainbow trouts, seafish and amphibians.

1. GOLD-FISH (Carassius auratus)

Materials and techniques: Gold-fish of 8 to 15 cm were selected and a minimum of 6 fish per experiment were used. The glass aquaria containing 10 1. tap water were kept at a temperature of 19° + 20° C and aerated by means of an airpump at a constant rate. Different amounts of R 7464 i.e. 0.63, 2.5, 10, 40, 160 and 640 mg, giving respectively the following concentrations: 1:16,000,000; 1:4,000,000; 1:1,000,000; 1:250,000; 1:62,500; 1:15,750 were tested and, prior to introducing the fish, were uniformly mixed with the aquarium contents. Immersion times at various concentrations were selected as follows: 1/64, 1/16, 1/4, 1, 4, 16 and 64 hours.

Recovery from anaesthesia was carried out by transposing the fish into clean aquaria containing aerated tap water.

Pharmacological results: Induction of anaesthesia: Our observations have led us to assign, rather arbitrarily, 4 different stages of anaesthesia:

Stage I: Increase of the respiratory movements, followed rapidly by a decrease in activity and respiration.

Stage II: Loss of equilibrium. At this point the respiratory rate is quite slow but response to strong vibrational stimuli, however, persists.

Stage III: Loss of righting reflex. The fish are laying on the bottom of the aquaria, respiration being superficial and irregular; the animals do not respond to manipulation.

Stage IV: Respiratory arrest. This stage can be obtained for a limited period of time, without fatalities occurring.

Phases, similar to the ones observed during induction of anaesthesia, were observed during the recovery period, in reverse order; quantitative evaluation of these stages, however, were much more difficult to delineate.

Stage IV: Slow respiratory movements to normalizing respiration.

Stage III: Regaining of the righting reflex.

Stage II: Recovery of equilibrium.

Stage I: Normalizing of the decreased activity.

Discussion:

a. Induction of anaesthesia

The degree of anaesthesia obtained in fish with R 7464 is closely related to the concentration used.

The concentration 1.16,000,000 seems to be devoid of anaesthetic properties and in our experimental conditions the lowest effective dose is 1.4,000,000. At this completely atoxic concentration, slower swimming and a decrease in respiratory movements are the main phenomena observed and occur after a short transitory period of excitation.

At concentrations 4 and 16 times higher (1:1,000,000 and 1:250,000 respectively) a somewhat higher degree of anaesthesia appears; an initial increase in respiratory movements is followed by a decrease in respiration and activity, a loss of balance and finally a loss of righting reflex. Respiratory arrest can be observed erratically in the concentration 1:250,000; furthermore this concentration is fatal, at least for some animals immersed for periods of 4 and 16 hours, while the concentration 1:1,000,000 is completely atoxic.

It may be noted that manipulation of fish, in which loss of righting reflex occurs, is very easy. At this depth of anaesthesia, which can be obtained in the 1:1,000,000 concentration, gold-fish can be removed from the water for several hours without harmful effects, the only precaution necessary being to enclose them in moist paper.

The two highest concentrations used were 1:62,500 and 1:15,750. Both concentrations lead rapidly to a complete respiratory arrest. Differentiations between the different stages of amesthesia, as defined earlier, are rather difficult, all fish laying on the bottom of the aquarium in less than one minute. As the concentration 1:15,750 is fatal in all animals immersed for one hour, higher dosages were not tested.

b. Recovery from anaesthesia

The recovery time from anaesthesia is much more difficult to evaluate. It depends primarily upon the concentration but also upon the duration of immersion; furthermore great individual differences in fish may occur. As a general rule, however, disregarding the duration of immersion, it may be said that the shorter the induction time of anaesthesia, the longer the recovery time and vice versa.

In summarizing our evaluations of the recovery periods as seen for different concentrations and different immersion times, the most striking phenomenon observed was certainly that respiratory arrest can be obtained for a limited period without fatalities. A complete recuperation of all

animals after respiratory arrest for periods even as long as 1 and 1/4 hour was observed in concentrations 1:62,500 and 1:15,750.

The "safe Immersion time" is the longest time of immersion in a R 7464 concentration without producing fatal effects for the experimental animals. It should be noted that even for an extremely high concentration (1:62,500) this time is longer than 1 hour and that for concentrations useful for transport the safe immersion time will exceed 16 hours.

2. EXPERIMENTS WITH OTHER COLD-BLOOD VERTEBRATES

- Sun-fish

Limited trials with sun-fish were performed in concentrations of 1.1,000,000 and 1:250,000. In the lowest concentration effects similar to those observed with gold-fish were obtained. At concentration 1:250,000, stages I. II and III occurred after 20", 1' and 3' respectively. The recovery was complete after a period of immersion not exceeding two hours, but in a non-aerated aquarium a four-hour immersion period was fatal to all animals.

- Rainbow trouts

In six adult trouts deep sedation was observed using a concentration 1:2,000,000 after an immersion time of 20 minutes. A concentration of 1:4,000,000 was still effective and produced loss of balance.

- Seafish

The effects obtained with R 7464 in a limited number of seafish were similar to those obtained in trouts.

- Amphibians

a. Frogs (Rana esculenta)

A concentration of 1:500,000 paralyzes the hind legs after an immersion period of 30 minutes. A concentration of 1:62,500 produces loss of righting symptoms within 10 minutes. The frogs allowed to recover in an empty aquarium start to react to strong vibrations only one hour later; they made some spontaneous movements after three hours, and became normal after six hours.

b. Salamanders (Triturus vulgaris, Triturus helveticus and Triturus cristatus)

Immersion of adult species of salamanders in a concentration of 1:250,000 during 15, 30 and 60 minutes was carried out without fatalities; loss of balance and loss of righting reflex was easily obtained after 5 and 20 minutes of immersion.

Independently of the time of immersion, the recovery of the stages III, II and I occurs in all animals after 30', 60', and 6 hours respectively.

SUMMARY

R 7464 is a soluble, potent, atoxic and polyvalent anaesthetic in fish and amphibians. Different degrees of anaesthesia can be easily obtained, depending upon concentrations used and immersion times allowed. The lowest concentration which will tranquilize gold-fish is 1:4,000,000. The highest concentration, producing deep anaesthesia (1:15,750), is atoxic for immersion periods less than 1/4 hour.

ACKNOWLEDGEMENTS

Special thanks are due to Dr. P. A. J. Janssen for his helpful advice and continued encouragement. The many suggestions given by Dr. J. Mortelmans and Mr. P. Van De Zande are herewith gratefully acknowledged.

Ed. Note - Mr. P. Van De Zande presented a talk on this new anesthetic at the New York Symposium and also demonstrated its use. Although not yet available in the U.S., it appears to be quite useful for transport and capture of fishes. It also is supposed to be quite inexpensive.

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## QUINALDINE
### Another "Old" Anesthetic

Although appearing in print in 1958, Quinaldine has only in the last two years become widely used. It is a very good collecting chemical although not the best chemical available for transporting. Quinaldine is not soluble in water and should be diluted 10:1 with isopropyl alcohol. It is very effective on most fishes at final concentrations of 5 to 8 ppm. Fishes recover very quickly when placed in untreated water.

J.P.

# EXPERIENCES WITH SIXGILL SHARKS (Hexanchus corinum) AT THE SEATTLE MARINE AQUARIUM

Eric Friese, Curator

Being faced with the problem of what to display in an empty 75,000 gallon outside marine mammal pool and the approach of the busy tourist season, an immediate solution had become imperative. Initially this pool was planned for a display of local porpoises (Harbour or Dall Porpoises), or as an alternative an enlargement of our show facilities, but because of organizational difficulties and the acute lack of time neither one of the two planned projects could be realized. We decided, finally, to convert this pool (32 by 48 feet, 5 feet deep) into a shark pen.

Next we had to consider what species to collect, and what collecting method to apply. Since our opening we have had the common Pacific dogfish (Squalus suckleyi) on display, but now we needed something different and of course something considerably larger. Clemens and Wilby list about ten different shark species in FISHES OF THE PACIFIC COAST as being native to our waters. Yet, only the sixgill shark (Hexanchus corinum) has occasionally been caught in the lower Puget Sound area. Accurate catch records were not available, and general reports about this species had been very infrequent and their reliability doubtful. Only the Point Defiance Aquarium in Tacoma has made serious attempts in the past to collect and display H. corinum. With Cecil Brosseau and Don Goldsberry's advice we finally decided to go after the six-gill shark.

Precise data about the availability of this species in the waters around Seattle was also unobtainable. For some preliminary tests we selected Elliott Bay as the collecting location. This bay covers an area of approximately 4 1/2 to 5 square miles, and is surrounded to the east by downtown Seattle, to the south by West-Seattle and Duwamish Head and to the north by Magnolia with its Navy piers and facilities. The 5000 yard opening to the west leads into the main flow of Puget Sound, which extends north and south, parallel to the city of Seattle. The actual bay area measures about 7500 yards in its longest north to south extension, and about 4500 yards from the edge of Puget Sound to downtown Seattle. The depth does not exceed 73 fathoms, and normally averages about 30 to 50 fathoms.

There had been some doubtful and unconfirmed reports that H. corinum had been taken in Elliott Bay on some rare occasions, but again reliable a data was not available. Local fisheries experts, who were consulted, expressed considerable skepticism, mainly in view of the relatively shallow water (previously sixgill sharks had seldom been taken in less than 100 fathoms) and the high fresh-water inflow from the Duwamish River and the city and industry sewage.

Nevertheless, we went ahead with our project and laid our first set line (1/4 inch manila hemp rope, with 6 foot 1/8 inch steel cable leaders and 6 inch shark hooks, spaced at about 12 to 15 foot intervals). To avoid the heavy commercial and recreational maritime traffic we selected a location about 500 yards into Elliott Bay north/east from Duwamish Head. The line was baited at night and checked the following morning. The first two mornings the bait was partly taken

(apparently by Squalus, since we caught two badly mutilated ones), but no sixgill sharks. The third night we also laid an additional line right off Pier 56, in other words right in our "back yard". The following morning, May 21, success was ours. The line off Duwamish Head produced a shark, 8 feet 9 inches long and about 350 lbs. Since this was the first time that such a large shark had been caught publicly in Seattle, this event was given considerable coverage in all local news media. Thousands of people showed up to see this "giant shark", and most of these people just simply could not believe that such large sharks existed right here in Seattle. With all the excitement of our first shark we did net get a chance to check our second line. This was done the following day, but the line appeared to be snagged at the bottom. Two skindivers went down to salvage the line, but much to our surprise two more sharks were hooked on this line and neatly wrapped around an underwater telephone cable. Upon surfacing, these two specimens measured 9 feet 4 inches and 10 feet 4 inches, with an exact weight (we used a large industrial scale) of 400 lbs. and 540 lbs. respectively. Two sharks caught just 500 feet away from Route 99, the largest and busiest interstate highway in the State of Washington!!

Unfortunately, neither one of those three specimens lived any length of time. We have a rectangular pool, with a wire fence partition on one side. The sharks used to get washed up against this fence or into a corner of the pool by the current of the incoming water, and they were unable to free themselves. An occasional push from our attendants used to get them swimming again for a little while until they hit another obstruction and were stranded again. Finally, after 6 or 7 days all three sharks were dead. Autopsies performed immediately upon death did not reveal anything. None of the vital organs or body tissue was ruptured, torn or otherwise forcefully dislocated, thus leaving no clues for the possible cause of these fatalities.

The handling of these sixgill sharks was done with the utmost diligence and attention. The time these sharks were actually out of water was kept to an absolute minimum, never exceeding 10 to 15 minutes. Immediately upon surfacing, these sharks were guided into a specially designed sling, and in this sling they were carried right into the pool. If unwilling or unable to swim, the well known shark walking method was applied until the sharks were able to swim under their own power.

To comply with the sudden, overwhelming demand from our local public to see sharks, we had to continue collecting sixgill sharks. However, the results were inevitably the same. The sharks would always die within a few days. Thirteen sharks of various sizes have been caught so far. This may seem a rather insignificantly mall number, but we are neither equipped nor prepared to handle mom than one or two of these sharks at one time. All handling, including the transfer into and out of the pool has to be done exclusively by muscle power and elbow grease! In fact, the last sixgill shark caught- the 750 pounder - was almost beyond our physical capabilities. The set lines were purposely kept down to no more than about ten hooks. But even with this gear limitation, a line was occasionally lost, presumably -and often with strong evidence - that

one or more sharks were already hooked.

This may have possibly lead to an interesting occurrence. The last shark off Duwamish Head was caught on 3 July. About a week prior to this date, two set lines were lost in that general area. After this date fishing was continued until early August, but no more sharks were caught there. Also, coinciding with this above occurrence is another interesting event. Because of some organizational problems we had to dispose of a couple of dead sharks right off Pier 56. We followed the example set by the many fish canneries along the Seattle waterfront, and dumped the carcasses back into the bay. The waste from the canneries - even though It increases the already bad pollution problem - provides excellent hook and line fishing for a number of different species of fish in this general area. However, since we disposed of the dead sharks we have not been able to get any more of these sixgill sharks in this vicinity until this very day (3rd week in August).

Grantedly, the evidence presented is far from being conclusive, nevertheless, it strongly resembles the various instances quoted by Dr. Perry Gilbert in his book SHARKS AND SURVIVAL. Dr. Gilbert lists a number of occurrences, reported by reliable sources, where either shark lines with a number of sharks on them were lost, or dead sharks left on the beach for the tides to wash away, have completely "burned out" the fishing grounds. It may sound unbelievable that the decomposition of shark flesh might act as a repellent, but the evidence seems to speak for itself. At the same time, however, Squalus fishing continued to be productive at its all time high!

Realizing our failure, we have currently discontinued our efforts to collect and display Hexanchus corinum, until we can come up with a solution that promises to be more successful. One of the deteriorating factors in our shark maintenance procedures may have been the extremely shallow water, thus exposing these essentially deep water fish to the bright sunlight. Another possible factor may have been the use of a rectangular tank, which seemed to offer too many obstructions to the swimming pattern of this shark. The Point Defiance Aquarium, for instance, has kept this species for several weeks, but there a large circular indoor pool is utilized.

Obviously we have not succeeded in solving a scientific mystery, yet our success in collecting this species so "close to home" has certainly stirred up the undivided interest of some local fisheries experts, and work on this shark may shortly be continued on a larger basis, at which time we will also resume our efforts. In the meantime, however, I would like to appeal to my learned readers and other skilled and experienced shark experts for any and all constructive advice available. All hints and possible "secrets" will be gratefully accepted.

# COLLECTING WITH PUMP AND GARDEN HOSE
(or, Sand in FT Armpits)

David C. Powell
Steinhart Aquarium

Among the most striking of marine animals are the burrowing or tube anemones. Their circle of delicate tentacles gives the impression of continuous graceful movement when displayed in a tank having the slightest current of water.

These anemones have been displayed for many years at the Naples Aquarium and have thrived and grown in size considerably since they were initially collected. Although quite abundant, the larger specimens all occur subtidally and consequently pose quite a problem to the collector.

Off the coast of California they are quite plentiful, and have been reported to have tubes six feet in length -- although two to three feet is more normal. The small anemones of around one foot in length can be collected somewhat laboriously by the diver, and if one waits for several years they will grow into respectably sized anemones.

For the less patient collector, there is a faster way to have a fine display. Full sized anemones, with tentacle spreads of a foot or so, can be collected by means of an anemone pump. This gadget was developed by John Prescott and myself as the result of considerable gastronomically-motivated research in an attempt to sample the culinary quality of a bed of giant gaper clams that burrowed deep in the bottom beneath the pier at Marineland of the Pacific. A garden hose connected to a faucet on the pier produced a delicious solution to the problem of rooting out the most stubborn of burrowers.

All one needs is a strong jet of water to blow the bottom away from the desired creature -- be they clams or tube anemones. In collecting for Steinhart Aquarium displays, however, one thousand feet of garden hose connected to a faucet obviously is not the answer -- faucets are not always conveniently placed along the coastline, especially where the anemones are most prolific. So we made a gas engine driven pump that can be operated from a skiff: a 2 h.p. Briggs & Stratton turning a 3/4 inch Jabsco neoprene impeller pump. When connected to a one hundred feet of 3/4 inch garden hose and fitted with a jetting nozzle, it does an excellent job of blowing the mud and sand away from the tube anemones.

The only problem with this technique is that as soon as the first stream of water hits the bottom, all operations must be carried out entirely by Braille as the visibility drops to around minus one foot. In addition to collecting the anemones, one also ends up with a considerable portion of the bottom -- together with several unidentifiable lesser animals inside one's wet suit.

However, the results are well worth a little sand in the armpits, and using this technique we at Steinhart have collected and are presently displaying many fine specimens of these beautiful burrowing anemones.

# AGE OF OODINIUM GIVES WAY TO PSEUDOMONAS

Earl S. Herald
Steinhart Aquarium

A student of trends in professional marine aquarium work might recognize the past fifteen years as the age or epoch of Oodinium. Anything that went wrong that couldn't quite be explained by laboratory or other investigation was often ascribed to the hidden effects of insidious Oodinium. But there are some changes in the making, and although Spencer Tinker is still officially recognized as the King of Oodinium, there is a new magic word creeping into the vocabulary -- Pseudomonas. If your most valued specimen slithers down the drainpipe and out to sea -- Pseudomonas! If your prized schooling fishes die of fatty degeneration -- Pseudmonas!

With any word being bandied about the way this one has been treated, we really should know something of this "bug's" prevalence, and unfortunately there just hasn't been too much of this kind of data. All of this big buildup is for one purpose and that is to call attention to a very essential section of Symposium on Marine Microbiology, edited by Carl H. Oppenheimer, published (1963) by Charles C. Thomas (Sringfield, Illinois)-- Chapter 57: "Host and Habitat Relationships of Marine Commensal Bacteria," by J. Liston and R. R. Colwell (pages 611-624).

Liston and Colwell report on studies of composition of the bacterial population on fishes and invertebrates in both Puget Sound and at Eniwetok Atoll. They studied 200 characteristics of bacteria taken In 743 pure cultures from 19 species of fishes and sharks covering 20 genera. Their principal breakdown was into 9 groups of bacteria, and what is important to the aquarist in the interpretation of his problems, is that Liston and Colwell's data show that Pseudomonas accounted for 40-55 percent of all bacteria present normally on these fishes and invertebrates as well. The aquarist concerned with marine bacteriological problems will find this article very interesting reading.

And speaking of bacteriology, Burton Clark has set up an ambitious study program of their large tanks at Seaquarium. The routine detailed monitoring of their tanks is to extend for more than a year. Perhaps we can arrange for a report on this from Curator Warren Zeiller at the next Aquarium Symposium.