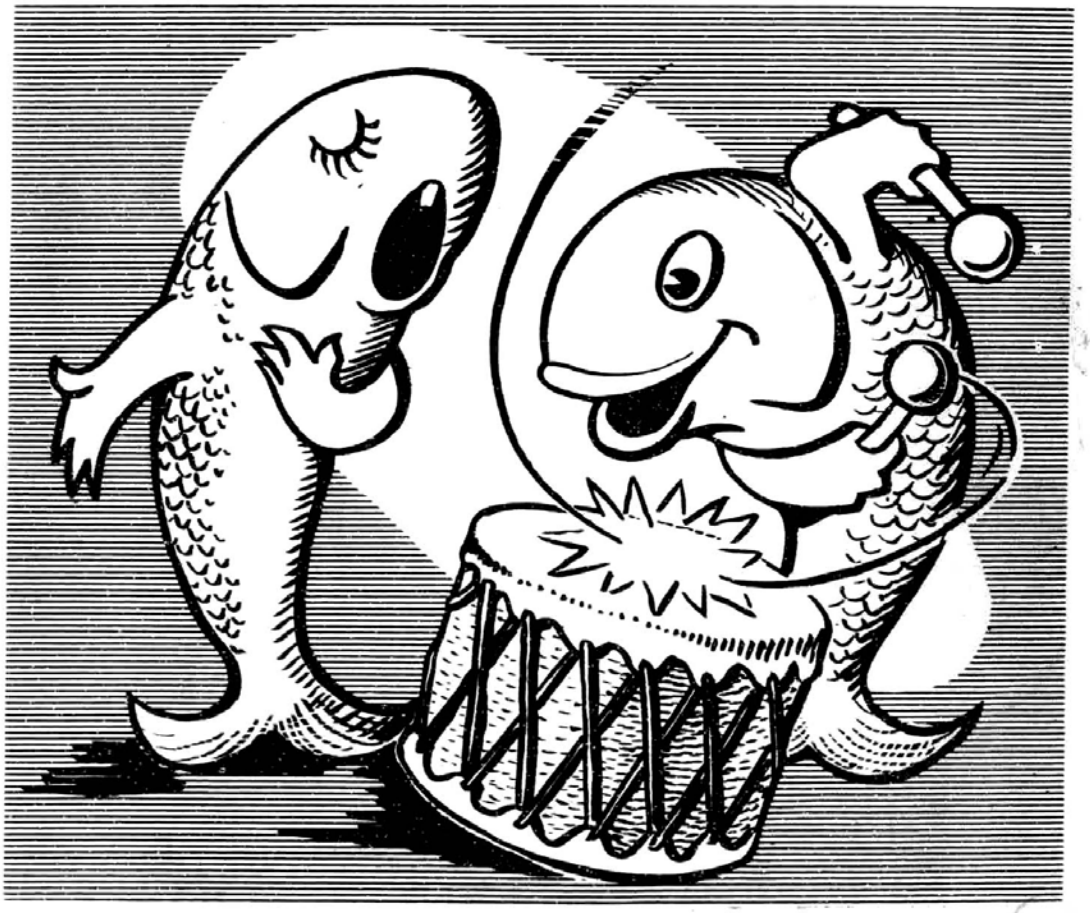
The DRUM and CROAKER

A Highly Irregular Journal for the Public Aquarist



Volume Sixty-Four, Number 1 [aka 6 (1):] **July 15, 1964**

DRUM & CROAKER

Volume Sixty-four
Number 1

Manuscript material published as sent to:

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Marineland of the Pacific
Palos Verdes Est., Calif. 90274

DRUM & CROAKER

15 July 1964

AQUARIUM SYMPOSIUM

29 August 1964

Mr. Christopher Coates has extended an invitation to the public aquarists to attend an Aquarium Symposium at the New York Aquarium 29-30 August 1964.

This is a one day meeting including an evening dinner. We have planned five sessions for Saturday, 29 August 1964.

I Filters & Filtration - Earl Herald

II Materials - Christopher Coates

III Collections & Animal Exchange - Donald Wilkie

IV Animal Maintenance - John H. Prescott

V Aquarium Design - Lee Finneran

If you plan to attend please contact Chris Coates or Lee Finneran to insure accommodations - which apparently are at a premium due to World's Fair.

Titles to be presented should be mailed, with an abstract, to Mr. Lee Finneran, Director-Curator, New England Aquarium, 6 Long Wharf, Boston 10, Mass.

This symposium will be the weekend before the national meeting of the American Society of lchthyologists and Herpetologists in Moorehead City, North Carolina. There will be ample time between the Aquarium Symposium and the A.S.I.H. meeting for those interested in attending A.S.I.H. to get from New York to Moorehead City.

OBSERVATIONS NEAR THE GILL COVER OR ICH!

From June 1963 to June 1964 we were treated "to an unprecedented expansion of the Aquarium - Oceanarium facilities of the United States.

Tacoma, Washington - Cecil Brosseau has put together the finest marine aquarium in the Pacific Northwest. There are about fifty tanks around a central tank some forty feet in diameter. The Tacoma display is limited to the endemic flora and fauna of Puget Sound. Vertebrates and invertebrates are well represented. Utilizing an open-unfiltered.systen has permitted the maintenance of many filter feeders yet to be displayed elsewhere. Although the open system also creates a tremendous turbidity problem it is one that will be solved shortly and yet permit the keeping of such unusual forms as scallops, feather duster worms, and clams. There are also plans to incorporate a cetacean display. Cecil Brosseau is now the Director of the Tacoma Aquarium and Zoo. I believe this is some sort of record. Generally aquariums have been absorbed zoos. The Tacoma aquarium opened in June 1963 at a cost of about $300,000.

San Francisco, California - Steinhart Aquarium reopened its doors after a complete renewal which closed the Aquarium for fifteen months. Earl Herald's reconstruction and new additions have made Steinhart a new experience from in front of the tanks as well as behind the scenes where most of the improvement dollars were spent. Everything inside the building is new and incorporates the latest materials and techniques. Ultraviolet sterilizers cast their eerie glow over thousands of feet of P.V.C. pipe and valves. For the first time marine mammals have gained access to the classical aquarium and dolphins and seals are displayed in one large tank.

*San Diego, California - The world's largest marine oceanarium opened, in Mission Bay Park. For details write Mr. Donald Zumwalt, Curator, Sea World, Mission Bay Park, San Diego.

*Honolulu, Hawaii - The world's largest and most complete marine oceanyarium opened at Makapuu Point, Oahu. For details write Mr. Taylor A. Pryor, Oceanics Foundation, Makapuu Point, Waimanalo, Oahu, Hawaii.

*No material was forwarded to the present editor regarding the display, construction or cost of the two last mentioned aquaria. See D & C June 1, 1963 for more details.

Sarasota, Florida - I have just received an announcement of an oceanarium to open along the gulf coast of Florida which will include a million gallon display tank. Presumably this will he the world's largest oceanarium.

Niagra Falls Aquarium -- Construction of a $1,000,000 aquarium - oceanarium was recently announced. Wm. E. Kelly, formerly of the Cleveland Aquarium, also announced that the commercial firm, Auuariums, Inc., backing the Niagra Falls Aquarium plans to branch out and will construct several branch aquariums. Construction of the Niagra Aquarium was to begin in July 1964.

Niagra Falls Aquarium (Continued)

The new aquarium will include a porpoise tank plus smaller displays of fresh-water and marine life. According to Kelley the displays will extol the natural abilities of the marine inhabitants. A total of fifty displays ore planned for the 30,000 square foot building.

NOTES

Mr. A, J. Gillies has informed me that the St. John Board of Trade, St. John, New Brunswick, Canada, is contemplating construction of an aquarium as part of the Canadian Centennial. He has also asked for pictures, lay-outs, etc., on aquaria from as many aquaria as possible,

STEINHART AQUARIUM
California Academy of Sciences
San Francisco 18

March 1, 1964

The many problems connected with the rehabilitation and reopening of Steinhart Aquarium (June 28, 1963), have delayed mailing of reprints. Since our last mailing, there have also been staff changes. Versatile writer and long-time staff member, Donald Simpson has now retired. Three new appointments have been made: David Powell (in charge of marine fishes, reptiles and amphibians); and Karl Switak (herpetologist).

If you are planning a visit to the Aquarium, may we suggest you arrive before the 10 a.m. opening time to allow viewing without the usual Influx of visitors. Unprecedented crowds have made it difficult to see the displays during open hours.

We maintain 3 reprint libraries: (a) Steinhart Fisheries Library; (b) Earl Herald, Supt.; and (c) Robert Dempster, Ass't. Supt.

With best wishes, THE STEINHART STAFF

T. WAYLAND VAUGHAN AQUARIU-MUSEUM
Scripps Institution of Oceanography
La Jolla, California

A re-arrangement of the staff at the T. Wayland Vaughan Aquarium- Museum, Scripps Institution of Oceanography, La Jolla, California, has worked out like this: Dr. Richard H. Rosenblatt, Scripps Research Zoologist, is Director. C. Carr Tuthill is Curator of the Aquarium, while Sam Hinton is Curator of the Museum. The personnel is still the same - Ben Cox and Monte Kirven, Aquarists; Dorothy Detrich, Secretary; Bill Goodell, Artist. The dual Curatorship does not indicate exclusive operation, of course; everybody pitches in on collecting operations, everybody takes a hand in turning out plastic kelp fronds for the museum's habitat groups, Sam does most of the aquarium's labels, and Dorothy keeps everything running smoothly.

PUBLICATIONS OF SOME INTEREST

The Dorsal Fin - The U. S. Fish and Wildlife Service has a small publication called The LDorsal Fin that is slanted particularity at fish hatcheries. Many of' their problems in keeping fish alive and healthy are similar to ones that aquarists encounter, and some of the articles on methods and gadgets are helpful or at least give a new approach to problems that plague us all. This publication is FREE: and one can get on the mailing list by writing to U. S. Dept. of Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, Branch of Fish Hatcheries, Washington, D.C.

--Carr Tuthill, T. Wayland Vaughan Aquarium and Museum, Scripps Institution of Oceanography in Jolla, California.

Wildlife Review - An abstracting service for wildlife management - Contains abstracts of recent publication of interest regarding Mammals, including marine, Birds, Reptiles and Amphibians. Obtained free from U. S. D. I. Fish & Wildlife Service, Bur. Sport Fisheries & Wildlife, Patuxent Wildlife Research Center, Laurel, Maryland.

Sport Fishery Abstracts - This abstract service Is intended to furnish fishery biologists a current review of literature in sport fishery research and management. This abstracting service is very comprehensive and extremely current. Again it is available from U. S. Fish & Wildlife Service, Bur. Sport Fisheries & Wildlife, Washington 25, D. C.

Marineland the Pacific has Isolated a bacteria, Pseudomonas sp., as the culprit infecting large serranids In the giant fish tank. Streptomycin has so far helped control the disease.

Pseudomonads also cause red leg disease in frogs, infectious abdominal dropsy, Hemorrhagic septicemia, and red mouth disease. [1, 2, &3]

1. Freshwater fish diseases caused by bacteria belonging to the genera Aeromonas and Pseudomonas, S. F. Snieszko & G. W. Bullock, U.S.D.I. Fish. Leaflet 459.

2. Description and treatment of a Psaudomonas infection in white catfish, J. D. Collar & F. P. Myer, U.S.D.I. Fish Farming Expt. Station, Stuttgart, Arkansas.

3. The large skil-fish Erilepis zonifer on display at Vancouver last year showed symptoms of a Pseudomonas infection.

Wm. Kelly reports that the artificial sea water developed at the Cleveland Aquarium is adequate for the maintenance of invertebrates, i.e. octopus, sea anemones etc., as well as fishes. The cost of manufacturing his formula is only a few cents per gallon.

NORTHERN FUR SEALS (CALLORHINUS URSINUS) AT THE SEATTLE MARINE AQUARIUM

By Eric Friese, Curator

In June 1963 the Seattle Marine Aquarium received through negotiations with the Point Defiance Aquarium in Tacoma and the Westport Aquarium a female northern fir seal. This animal was caught by a fisherman trolling for salmon off Westport. It was hooked on the lower jaw without doing any serious damage to the animal. Upon arrival at the Seattle Marine Aquarium three days after capture, the animal appeared to be unusually alert and the wound was hardly visible. Aftern another three days the wound disappeared completely. The weight of this female upon arrival at the Aquarium was an even 30 lbs.

As mentioned before, this animal was unusually alert, and did not resent to people being around it constantly. However, sudden movements and loud, noises in front of the enclosure were acknowledged with a somewhat frightened annoyed snarl. Fresh frozen herring offered as food on the day of arrival was refused. In fact this seal seemed to be more interested in investigating its new home, and taking a badly needed bath with all the accompanying grooming procedures to get the fur back into shape.

The second day fresh frozen squid was offered and immediately accepted. For the next 4 to 6 days about 5 lbs of this squid daily were fed to this animal, and slowly substituted with dressed herring. After about one week this female fur seal was on a diet of 6 to 7 lbs herring daily. Incidentally, the herring always had to be dressed fish with the heads left on were refused! The daily food rations were supplemented with arbitrary doses of Vitamin C, Vitamin B1, Vitamin A, D, and E about three times a week. Of course this was only a very temporary measure until an appropriate formula could be established.

One interesting feature was noticed upon arrival of this animal, and that was that the fur, especially along the back was covered with what appeared to be green algae. This seems to be an indication of a prolonged stay in water without touching land to dry out. After 10 days at the Aquarium this green gloss disappeared completely.

From the very first day this female fur seal was hand fed, and within a surprisingly short period of time (about 10 days!!) it was hand tame, i.e. the animal could be petted while taking food from the attendant. After one month this animal was transferred to the large community mammal pool with some California sea lions and a few hair seals. Feeding became occasionally a problem here, since the small fur seal was easily out-maneuvered by the considerably larger sea lions and hair seals. However, normally the fur seal female would come out of the water and accept the food directly from the attendant.

When the permit for this female northern fur seal was issued by the local Fish and Wildlife Service authorities the Aquarium also received a permit for two young males to be shipped directly from the Pribilof Islands in fall 1963.

NORTHERN FUR SEALS (Continued)

On 9 October 1963 the curator received a call from the Seattle/Tacoma Airport, informing him that two seals from St. Paul, Pribilof Islands, had arrived for the Seattle Marine Aquarium. Upon arrival at the airport the curator was welcomed by a really ferocious roar from two small fur seal males. These animals gave an entirely different appearance upon arrival than the female a few months earlier. They were highly irritated at their confinement, and anybody coming close to the two cages was wildly attacked by charging against the wire and trying to bite through it. The weight - established with considerable difficulty - was 51 lbs for the larger of the two, and 47 lbs for the smaller one.

Due to a temporary lack of space these two males were kept by themselves in a room with a large tub for a swimming area. The door leading to an outdoor enclosure was left open in case the animals should desire to sun themselves. Visitors to the Aquarium were not permitted in this area, and the animals were almost exclusively attended by the curator and his wife.

Food offered in form of herring or squid was completely ignored during the first 3 days. In fact these fur seals confined their activities to wild charges at anyone coming close to their little pool, into which they used to "escape" when they heard somebody approaching. On the fourth day the smaller one of the two males displayed some interest in a few herring, which were tossed into the pool. Eventually he swallowed these, and on the next day the larger seal followed this example. After one week both animals were on a diet of 7 to 8 lbs of herring.

Suddenly the Aquarium's frozen herring, supply changed to some extremely old herring - frozen approximately one year prior - and the need for an adequate vitamin supplement became urgent. The use of commercially available VIONITE was suggested by the local Fish and Wildlife Service, and Dr. Dollar from the College of Fisheries, University of Washington, recommended the formula of 1 oz of Vionate per 7 lbs of fish. Since this vitamin-mineral powder was often extremely hard to administer (stuffed in 3 or 4 large herrings per animal) it was changed for Vionate L, which is available in pellet form. This vitamin-mineral supplement seems to be highly effective, since a previously noticed fogging of one eye of the female fur seal disappeared immediately upon the use of this supplement.

With the approaching winter all three fur seals were taken inside the Aquarium, and put on display in the indoor mammal pool. This was the first time for the female to meet the two males, and both sides accepted each other gracefully and soon a harmonious community was formed. However, even, though the "boy meets girl" episode was uneventful, the two males objected to their change of enclosure with two weeks of absolutely neurotic behavior. The two males would constantly charge at the visitors, which were only separated from the animals by a cyclone fence, and more, than once their violent roar sent women and children on a screaming flight.

After about two to three weeks the two males would slowly calm down. Finally they reached a point where they would, pay no attention to visitors of the Aquarium.

The following winter months often had their trying moments with these three fur seals.

NORTHERN FUR SEALS (Continued)

Frequently, without prior warning, the animals would refuse herring, and the diet had to be changed to squid for several weeks, until herring - the some source and supply us before - was accepted again. During the curator's vacation the animals were attended by one of the aquarists and promptly refused to eat at all! Since December 1963 the amount of food has slowly been increased to about 8 lbs for the female and about 9 to 10 1bs each for the two males. Incidentally, this always constituted the maximal accepted amount, offered to these fur seals in three equal feedings a day. Previously, on occasion the two males had been fed another 2 to 3 lbs each at midnight in complete darkness, when these two animals appeared very active.

Now all three fur seals seem to have adapted to the Aquarium routine - feed during the daytime and sleep at night. Quite regularly these animals were found sound asleep and completely dry when the Aquarium was opened in the morning. Occasionally the two males were observed sleeping in the water in their typical rest position with one front fin and the two rear fins up in the air holding flippers!

Late in May 1964 all three fur seals were transferred to the outdoor pool again, in a separate enclosure, where their swimming space is about four times larger than it was inside the Aquarium. A large floating island is provided if the animals should desire to leave the water.

Almost immediately after this transfer from the inside to the outside the appetite of all three fur seals increased tremendously. Previously food was often taken with great reluctance and played around with, but now - in fact over night - these animals are extremely eager eaters. Their food demand has suddenly gone up to at least 12 to 13 lbs each - an increase of about 33%. It is also noticed that all three fur seals very rarely leave the water now, while in the past at the inside pool they spent a considerable time outside the water. The island is only used occasionally for play purposes - one animal establishes a territory and tries to push the other two off regardless of male or female. All three seals rest and sleep in the water. Other points of interest observed during the past few months are: The larger male was found to develop elongated small bumps (about 2 to 3 inches long and about 1/4 inch high) all over the body, especially the back, shortly after the transfer to the indoor pool. This was contributed to his extreme nervosity after the transfer, when for about one week he was not seen to groom himself like it would be normal for this type of seal. Apparently these bumps were either air or dirt pockets, which readily disappeared once the animal calmed down and the grooming habit was resumed.

It was also noticed that during the inside confinement (inside the aquarium that is), which contained a rather small pool, the larger male started to play a rather dominating role, and often roughed up the smaller male quite painfully. The female was always treated very gently. Now in their outdoor pool all three seals get along real fine, except for playful mock battles, which at times are carried cut with rather a high spirit. The female got herself a couple of "black eyes", which after two or three days completely healed up.

Obvious diseases did not occur among these three seals. The only physical disorder noticed was

NORTHERN FUR SEALS (continued)

an inflamed area around one tooth on the right lower jaw of the large male. This happened about 4 weeks after the arrival at the Aquarium. As a cure Penicillin tablets (one per day for one week) were given, and the inflamed area, previously dark red, returned to its rosy pink.

At the same time the smaller male developed a blister-like infection on the left front fin. The leather-like skin cracked, opening an exposed area the size of a nickel. This also disappeared after 5 Penicillin tablets were given, one per day.

The weight of the three fur seals on June 2, 1964 was as follows:

large male	72.5 lbs	(Oct. 9, 1963 = 51 lbs)
small male	60.5 lbs	(Oct. 5, 1963 = 47 lbs)
female	50.0 lbs	(June 1963 = 32 lbs)

Now after about 3 weeks of increased food consumption a sizeable increase in their weight is already obvious. The next weighing in early July is estimated to show an increase of about 5 lbs per animal, if the current appetite lasts.

The value of these animals as a rare exhibit is tremendous. All visitors to the Aquarium are certainly fascinated by the strange and different behavior of these fur seals. After all, who has ever seen a seal "wash" himself? The resting or sleeping position in the water by holding one front fin with the two rear fins up in the air is often interpreted as "holding hands"! The children quite frequently consider the throaty hissing sound made by the excited males as laughing! The highly streamlined form with the pointed head and nose is also frequently mistaken for sea otters.

Generally speaking the appearance and the behavior of the northern fur seal is so entirely different from the common exhibits of sea lions and hair seals, that they are a true asset in the Seattle Marine Aquarium's strife to present real educational value to the general public.

Has any public aquarist used the Sander Ozonizer & ozone to treat water or fish disease? Send your comments to D & C.

SUPPORT THE AQUARIUM SYMPOSIUM IN NEW YORK…

If you cannot attend
do not wish to attend
do not like the company
have any objective criticism
have any criticism, objective or not
write anonymously to D & C editor

TANK CLEANING MADE EASY

George E. Landis, Curator
Arthur C. Johnson Aquarium
Columbus Municipal Zoo

A long-standing problem at our institution has been the routine cleaning of large tanks and the fountain pool. The removal of sediment by means of a siphon hose has been, in the past, a slow and arduous task.

Recently we purchased some equipment which has proved most effective in removing the dirt without picking up the gravel and has reduced cleaning time by two-thirds.

This equipment is a portable electric filter of the type used on plastic back-yard swimming pools. It is manufactured by the Filter Flow Corporation, 1836 Gilford Avenue, New Hyde Park, N. Y. The model we purchased, number 1000, sells for $52.75 from the factory. The filter element is a pleated phenolic resin cartridge, with a filter area of twenty-four square feet. It is washable and may be re-used many times. Replacement filters are $1.60 each. The filter capacity is rated at 1600 G.P.H., but this would vary, of course, with the hydrostatic pressure. The unit is mounted on wheels for easy transport, but total weight is only 48 lbs, so that it can easily be carried by one person. A vacuum attachment is a necessary accessory. This consists of additional plastic hose, aluminum handles and a weighted head and nylon brush. The cost for this attachment is a $12.00.

This filter has several applications. Firstly, as previously mentioned, it is a rapid and efficient means of removing accumulated sediment from the bottom of tanks 500 gallons and over. The filtered water may be either returned to the tank or drained away. Secondly, it comes in handy for the rapid clearing of cloudy tanks. Thirdly, it provides a rapid siphon for draining a tank to a desired level or for transferring water from one tank to another.

Complete information is available from the manufacturer. Request a copy of the "Instruction and Pool Maintenance Guide", as well as the descriptive filter brochure and price schedule.

NATIONAL FISHERIES CENTER AND AQUARIUM

Wm. Hagen, Acting Director

I am sure many of the readers of Drum and Croaker would be interested in the progress being made toward the National Fisheries Center and Aquarium to be constructed in Washington, D. C.

As most of the aquarium people know, we have an authorization of $10 million to construct the Fisheries Center. Of this amount, $260,000 is presently available for preliminary plans and specifications. We hope to receive, July 1, an additional $500,000 which will be applied to completion of plans and specifications.

Craig Phillips and I have been planning for this facility for years. Since the receipt of initial funds we have had the excellent services of some twenty aquarium directors, curators, research people, architects and administrators to assist us in outlining the exhibits, sequence, research facilities, water composition handling, and turnover, and many other items. In other words, these consultants are advising us as to just what we should strive for with the money available. As you might expect, if we adopted and attempted to achieve all of the ideas of all of the consultants, we would, far exceed the $10 million. Nevertheless, these people have been of major assistance and probably no other aquarium has had the advantage of so many knowledgeable persons to assist with planning.

The Study Team composed of these consultants met last July in La Jolla at the Scripps Institution of Oceanography and in February and April in Washington.

A firm of architects and engineers has been employed to prepare a program which involves the space requirements for the various facilities, exhibits and research proposed for the Fisheries Center. It is anticipated that the final report of' the programmers will be available in mid-May.

Two firms of architects have been engaged by the General Services Administration to prepare final plans and specifications of the Fisheries Center. These firms will start their work on about May 15 and will complete these plans and specifications in sixteen months.

Allowing two months thereafter for invitations to bid on construction and twenty-three months for construction, we can expect the completion of this facility in late 1967. Thereafter, approximately four months should be required for the installation of exhibit materials, placement of specimens and general "shake down." Probably In about April of 1968, the National Fisheries Center and Aquarium will be open to the public. If funds are appropriated by the Congress as we anticipate, we can meet the opening date.

A great number of problems arise in a facility such as this. Firstly, we ere not striving for the largest in the world but we are attempting to include innovations in the way of exhibits, education, general presentation and major operational facilities that may be the best in the world. If we accomplish this, we can thank our many consultants aid the imaginative design of the architects.

NATIONAL FISHERIES CENTER AND AQUARIUM (continued)

As you, will understand, it is not easy to accumulate an experienced group of people to staff such a facility. We are attempting to secure likely prospects for responsible positions and have arrangements with several major aquariums for the training of these individuals. At the present time one of our people is on a nine-month training course at Steinhart with the full cooperation of Dr. Herald. We expect in the next two years to send several individuals for similar training to Steinhart and other major Public aquariums.

Inasmuch as we anticipate an average visitation per day of some 40,000, we have a real problem with people. Preliminary inquiry has suggested that we will require sixteen guards, a large cleanup crew for the public areas, and of course, labor behind the scenes plus qualified supervisory individuals.

In the research establishment, it is anticipated that thirty-two laboratory-offices will be available with the best possible common research facilities and equipment. Of these spaces, some six will be required for the permanent staff of the Fisheries Center, including pathologist, nutritionist, biochemist, water chemist, and taxonomist, all of whom will be concerned with the welfare of the specimens on hand but will be encouraged to engage in research. Space will be provided for researchers of the U. S. Fish and Wildlife Service plus qualified graduate students, professors and, visiting foreigners whose research projects nit pertinent to the specimens held and the purposes of the Fisheries Center. Research that can better be undertaken elsewhere should be done elsewhere.

It is our hope that the National Fisheries Center may be a point of exchange of specimens between aquariums in the country and that the research undertaken will contribute to aquarium operation and to the thousands of home aquarists.

Under the terms of the Act authorizing the Fisheries Center, it is required that the construction costs as well as the operational costs be repaid to the U. S. Treasury. We anticipate that with a very nominal charge for adults and individual children, and admitting all supervised student groups free, we will love no difficulty in meeting this requirement of the Act.

The above is a fairly quick summary of the status of the Fisheries Center and it is sent with the belief that many of your readers are interested.

D & C articles should be submitted to

John H. Prescott
Curator of Fishes
Marineland of the Pacific
Palos Verdes Estates, Calif.

All manuscripts should be typewritten and in a form suitable for D & C.

STATEMENT OF INTENT REGARDING THE COELACANTH: LATIMERIA CHALUMNAE

Earl Herald, Director-Superintendent

Steinhart Aquarium, as part of a recent reconstruction program involving the use of public funds totaling about $1,750,000, has had designed and constructed a special oval tank specifically for display and study of coelacanths. This tank has a capacity of 6500 gallons, and is equipped with two observation windows of 2.5-inch -inch glass, each measuring 5 ft x 5 ft. The water in the tank can be maintained at any temperature between 50 and 75 degrees (F.) and can function under three of the eight separate closed water systems in the building. In addition to the normal turnover as new filtered water comes into the tank, there is a separate system powered by a 4-inch pump, which operates whirlpool circulation patterns in either direction within the tank.

The important aspect of this tank is that it works as planned, and in recent months it has provided a variety of habitat conditions for both slow-moving as well as fast-moving fishes.

The next problem is to obtain two living coelacanths so that they can be studied in captivity. The Aquarium staff has prepared some preliminary designs of coelacanth transport chambers suitable for moving onto aircraft. The chamber uses 500 gallons of filtered temperature-controlled sea water and, as now designed, measures approximately 4 ft x 8 ft x 4 ft in height.

The final problem is to catch two coelacanths in good condition and quite frankly the Aquarium staff has been seriously concerned about the best way to accomplish this. Recently we learned that Dr. Malcolm Gordon, of the University of California at Los Angeles, expects to have the opportunity to study coelacanths in the Comoros with the "TeVega" as a base of operations -- all under the Indian Ocean Program.

If it is agreeable with the Expedition directorate and with the various governments involved, it is proposed that Steinhart Aquarium provide a good field man to work with the group, and in conjunction with the program, to attempt to procure the additional two specimens needed for live shipment to Steinhart.

The Aquarium would of course be expected to provide for the transport of the animals and to make them available for study under arrangements and conditions established by the Science Council of the California Academy of Sciences.

By way of background, Steinhart Aquarium is now in its 40th year and is a department of the California Academy of Sciences, which itself is in its 110th year. Funds for the operation of the Aquarium come entirely from taxes in the City and County of San Francisco. The Academy buildings including the Aquarium, all located In Golden Gate Park, have a very high visitor attendance which this year will exceed 3,000,000 people.

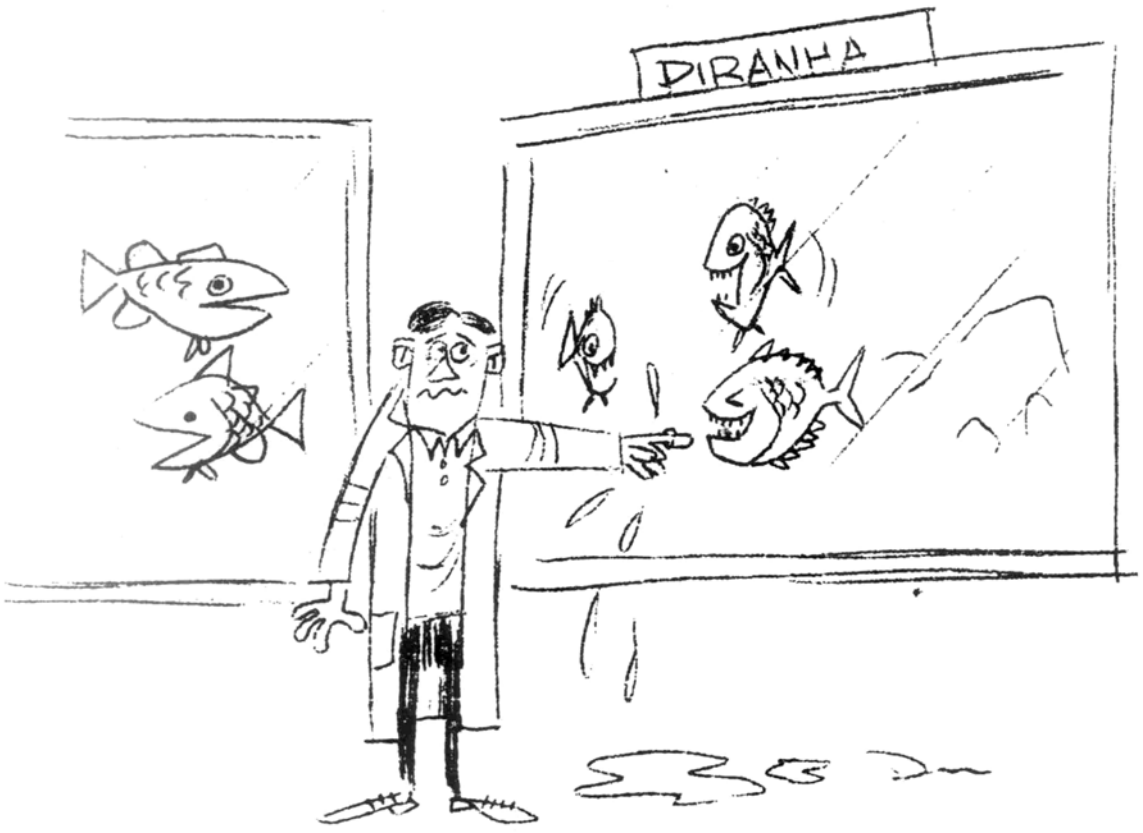
Editorial Meandering

The D & C is a highly irregular journal for the public aquarist.

However It should not be assumed that it is highly irregular to submit material for publication. The only way an editor can put out an issue is for unsolicited manuscripts to arrive in sufficient quantity to fill the space between the covers.

It has been more than one year since the last issue - it is not the responsibility of the editor to fill the pages - it is his responsibility to non-publish all material submitted - it is obvious that not too much has been submitted.

J.H.P.



BEHAVIOR OF PACIFIC BONITO SARDA CHILIENSIS AT MARINELAND OF THE PACIFIC

J. J. Magnuson and J. H. Prescott

Establishment of Pacific bonito (Sarda chiliensis (Cuvier)) in captivity et Marineland of the Pacific, Palos Verdes, California, has made it possible to study in detail and describe (1) swimming, feeding, courtship, and miscellaneous behaviors, (2) point out variations in the frequency of these behaviors during the day, and before and after meals, and (3) analyze the form and frequency of these behaviors suggesting their function or meaning.

1. Locomotion

Scombrids are noted for their rapid swimming speed relative to most fishes. Pacific bonito swam continuously in the tank against the current. The average speed 88.2 cm./sec. at a tail beat frequency of 1.42 beats/sec. Although speeds were considerably faster during feeding and courtship, 366 cm./sec., the bonito swam at the relative steady and, slow speed. Other scombrids have also been noted to swim slowly and speeds less than 100 cm./sec. are probably the rule and may perhaps be resting speeds.

2. Schooling

Although few quantitative observations were made on schooling behavior, the bonito usually formed a single school with one to three stragglers. The bonito did not mix with the other species of schooling fishes in the tank and swam at different speeds. Schooling behavior was disrupted during feeding and courtship periods but persisted at night.

3. Feeding

Bonito eat a maximum of roughly six percent of their body weight. They are the first species to reach and ingest food fishes tossed onto the surface even though barracuda, yellowtail and, tarpon were also in the tank. During feeding, schooling is disrupted, and each bonito had a change in coloration. The new coloration consisted of nine or 10 black vertical bars on the flanks superimposed over the typical diagonal striped color pattern. A yellowish mid-dorsal stripe also became intense from the tip of the snout to the base and sides of the first dorsal fin. The mid-dorsal stripe and the black bars faded as the bonito became satiated and the color changes were not released in sated bonito by additional food stimuli. While feeding, the bonito accelerated toward the food and took it head first or crosswise in the jaws. Often the feeding attack occurred at the surface and a stream of air bubbles escaped from the gill clefts as the fish swam downwards. A food fish crosswise in the mouth was turned with a sidewise jerking movement of the head. Generally the course of swimming was changed 180˚ after the strike, and before turning prey crosswise with mouth. Swallowing was accompanied by several sudden snapping movements.

BEHAVIOR OF PACIFIC BONITO SARDA CHILIENSIS (Continued)

The feeding behavior of bonito is similar to other scombrids and the transient vertically barred pattern is similar to that described for skipjack. Unlike the barring in skipjack which results in part from melanophore contraction of the diagonal stripes the bonito's dark bars were superimposed over the diagonal stripes.

4. Courtship

During the behavior observations it was possible to identify the bonito individually by variations in their diagonally striped color pattern. Among the identified fishes a dimorphism in behavior was distinguished. Nine exhibited an exaggerated wobbling type of swimming and ten exhibited a following behavior often associated with the vertically barred coloration described in the feeding section. We postulated that wobblers were females and followers were males. Verification was checked by spearing from the captive population one identified wobbler and one follower. Gonad examination agreed with the sexing by behavior.

Courtship was divided into general groups of movements in addition to the general wobbling and following.

Females

Wobbling: Females exhibited a form of swimming which described a series of waves and exaggerated tilting of the body at the outer extremes. The dorsal fin was depressed; tail beats more rapid and coloration normal.

Circle swimming: The path of the female formed a tight circle, about three body lengths in diameter often near the surface.

Fleeing: The female swam rapidly in an erratic course usually away from a group of males swimming just behind her.

Males

Tail nosing: A male swam up behind another fish, not always another bonito, so that his nose actually touched the caudal fin of the lead fish.

Following: The male swam immediately in tandem behind a wobbling female. At times the vertical barred coloration typical of feeding was present.

Circle swimming: A male, with or without the vertical barred coloration swam rapidly in tandem behind a circle swimming female.

Lateral threat display: Coloration of a male in the following position changed to an intense vertically barred pattern (identical to the feeding coloration) including the mid-dorsal stripe. The first dorsal and pectoral fins were extended. The lateral surface of the

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body was displayed to another male also in the following position. The second male also displayed but no physical contact was made between males. Only males exhibited the barred coloration pattern during courtship.

Positioning: A male in a group or pair of following males swam in an erratic path to bring him in following position. Each male in such a group exhibited the vertical barred coloration and the mid-dorsal stripe.

A typical sequence of the above behaviors was tail nosing by a male, wobbling by a female, following by the male and circle swimming by both. Another sequence was tail nosing by a male, wobbling by and female, and circle swimming by both. The sequence can be initiated by either male or female and often additional males are involved. When more than one male is present lateral threat displays and positioning by the males occur and occasionally fleeing by the female.

Three divisions can thus be distinguished in bonito courtship: (1) pairing (temporary wobbling and following), (2) defense of a female (aggressive threat display among males) and (3) a sequence of behavior leading to simultaneous and adjacent release of gametes (circle swimming to enhance the probability of fertilization during a period of gamete releasing).

General papers on spawning in pelagic schooling species have assumed that such fishes have no discreet courtship behavior and no pairing. It has been argued that stimulation of spawning in schooling fishes was of a general nature and in non-schooling fishes of individual stimulation. Detailed studies of cod have demonstrated definite courtship, pairing and aggressive behavior.

Prior to the present study virtually nothing was known of scombrid courtship. Pacific bonito do pair which is brought about by the stimulative effect of the behavior of one fish upon another. A lack of external morphological or coloration dimorphism between the sexes occurs and the discrimination of the opposite sex by behavior patterns is not surprising. The actual releasers have not been determined but it seems that tail nosing or following by males released wobbling in females; that wobbling by females likewise released following by the male; and the presence of a second male released aggression in the form of lateral threat displays. What aspects of the wobble and follow released circle swimming and the subsequent release of gametes were not clear.