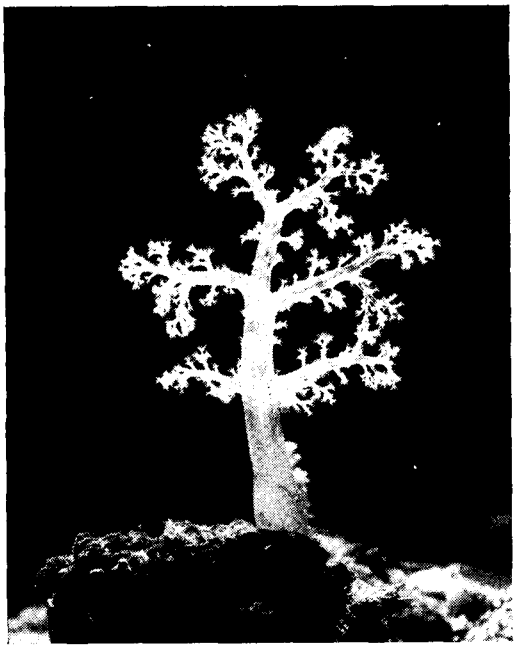
The Nouméa Aquarium

By R. Catala*

When my wife and I founded the Nouméa Aquarium in 1956 we had in mind three main objectives. These were (1) to allow the study of organisms under conditions as nearly as possible identical biologically with those of their natural environments, concentrating on organisms most typical of the lagoon fauna, in particular on coelenterates such as corals, alcyonarians, gorgonians, etc.; (2) to build up, as far as possible, a comprehensive photographic record of the animals and to make movie films of such species as may be regarded as extremely rare or of exceptional scientific interest; and (3) to allow visiting members of the public to learn about living and growing organisms of types generally unfamiliar to them—kinds of organisms which are not available in aquariums in other parts of the world. These goals have now largely been attained.[1]



A beautiful pink and white alcyonarian, Spongodes merleti, which comes from a depth of 40 metres, can expand until it reaches 2 feet or so in height or retract to a tenth of its volume.

THE MARINE biological station comprises an aquarium open to the public, a scientific laboratory, and the apparatus and pumping installations needed to ensure the continuous renewal of the sea water in the tanks. The aquarium section, at present, comprises a gallery with 24 glass-fronted tanks which are arranged in a rectangle around a service area in the centre. The largest of these tanks has a 10,000-litre capacity. A separate special gallery of ten tanks is devoted entirely to the presentation of organisms from deeper waters that fluoresce under ultraviolet light, such as true corals (Hexacorallia), false or alcyonarian corals (Octocorallia), anemones, echinoderms, sponges, and algae. Now, thanks to a grant from the French Government, an extension of both the public section and the laboratory has begun, which should double the size of the station.

Reserve tanks and aquariums especially designed for the taking of photographs are located outside the buildings. Adjoining the Aquarium is the laboratory, where biological experiments are carried out continuously along with the perennial investigations into techniques which are of direct interest in the management of the display tanks, for example, the culture of plankton (for food), etc.

Sea water is supplied in open circuit to the tanks at the rate of 400,000 litres per day. It is drawn off, at a distance of 120 metres from the shore, in the open water, beside a small, littoral, coral reef. The pumping station comprises two entirely independent installations so that if mechanical failure occurs or a break in the pipe line puts one out of action, the other is immediately available to take over and maintain the supply.

Plants, especially in the warmer weather, are abundant in the Aquarium, being represented by those species which are self-introduced into the tanks, per medium of the running sea water (for example *Valonia, Enteromorpha, Ulva, Gigartina,* calcareous algae, etc.) as well as by species which are deliberately introduced to serve as food for the animals or to help to maintain a balanced environment.

It is interesting to note that there is no artificial decoration whatsoever in the tanks: everything there is alive. Some of the organisms have been there since 1956. The water in the tanks is at sea temperature.

Inhabitants of the Aquarium

People are always interested to learn what can be seen in the Aquarium, and so the following list sets out, firstly, the permanent inhabitants that are almost always available and, secondly, the rarer species, generally those more difficult to maintain and which, therefore, can be regarded only as occasional or temporary inhabitants. It is among this latter group, naturally, that some of the most interesting and rarest animals are to be found.

Permanent inhabitants of the Aquarium include—

COELENTERATES: Hexacorals (stony corals), octocorals (gorgonians, alcyonarians, and pennatulids) and anemones. They come from shallower and deeper water habitats. Many coelenterates possess fluorescent pigments.

ECHINODERMS: such as starfishes like *Oreaster* (the Rhinoceros Star), *Nardoa* and Blue *Linckia,* crinoids of several kinds, e.g. *Comatula* and *Antedon,* many kinds of ophiuroid brittle stars, sea urchins such as the Needle-spined Urchin, *Diadema,* and bêches-de-mer or holothurians like the striped Water-bag *Synapta* or sea cucumbers *Stichopus* species and *Holothuria* species.

ANNELID WORMS are represented by sedentary types like *Spirographis* and the beautiful *Spirobranchus.*

ASCIDIANS or sea squirts are represented from shallower and deeper waters.

MOLLUSCA of many types are shown, including chitons, bivalves (like *Pinna, Pecten, Hippipus,* etc.), cephalopods (octopuses), and many gastropods of the prosobranch group.

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Among CRUSTACEANS perenially on show are marine crayfish (langousts), crabs, mantis shrimps, hermit crabs, and various shrimps.

VERTEBRATES are represented by about 450 fishes of 85 different species and constitute a selection of the most typical and spectacular species from the coral lagoon or from the edge of New Caledonia's Great Reef; reptiles are also regularly represented by turtles and sea-snakes such as *Aipysurus* species.

Temporary inhabitants include—

Rare deep-water SPONGE, COELENTERATES like the Portuguese Man-of-War (Physalia), large rhizostome jelly-fish with their attendant commensal fishes; deep-water BRYOZOA (lace corals, etc.); and MOLLUSCA such as the interesting nudibranchs, cuttlefish and Pearly Nautilus.

PROTOCHORDATE ASCIDIANS are represented sometimes by the deeper water species *Polycarpa aurita.*

Among the rare VERTEBRATES which are kept are sharks and rays (of the cartilaginous fish group) and members of the following families of bony fish: Plotosidae, Exocoetidae (Flying Fishes), Clupeidae, Hemiramphidae, Syngnathidae, Aulostomidae, Pegasidae, Siloginidae, Elopidae, Priacanthidae, Carangidae, Mullidae, Acanthuridae, Mugilidae, Sphyraenidae, Muraenidae (eels), and Antennariidae. Occasionally even mammals may be represented. Recently a dugong, 1.80 metres long, weighing 60 kg., lived for four months in the Aquarium.

Fluorescent Organisms

The phenomenon of fluorescence in corals from depths of from 30 to 40 metres was discovered in January, 1957. The two first specimens which responded to ultraviolet radiation by fluorescing were the corals *Euphyllia picteti* and *Cynarina lacrymalis.* Since then methodical prospecting for this phenomenon has been carried out both in the lagoon and outside the Great Reef. At the present time corals representing thirty or so genera are displayed in the Hall of Fluorescent Organisms. Some are colonial corals (*Alveopora, Goniopora,* etc.), others are solitary forms (*Cynarina, Trachyphyllia,* etc.).

Other coelenterates also exhibit very beautiful fluorescence, in particular some of the alcyonarians and anemones. Amongst the feather stars, some species of the genera *Comatula* and *Comanthus* have remarkable powers of fluorescence. Finally, deep-water sponges of the genus *Euspongia* must also be added to the list.

Preliminary research on fluorescent madrepore corals has revealed that three kinds of pigments are involved in the fluorescing processes—flavines, urobilines, and pterines. No doubt subsequent work will disclose others. Several theories have been advanced as to the rôle these pigments play in the living organism. It was thought, for instance, that an acceleration of photo-synthesis might take place to the evident advantage of the microscopic algae (Zooxanthellae), which coexist, in the flesh of the coral, with the pigment granules.

Another theory put forward is that these deep-water corals, because they cannot use other radiations, have to utilize the energy of the ultraviolet rays in their metabolic processes. In either of these two theories one must ask oneself why a considerable number of other coral species from similar depths and from biologically similar habitats do not manifest any fluorescent reactions under ultraviolet light.

Various other theories have been advanced about fluorescence but the scope of this article will not allow me to set them all out in detail. Whatever its function may be, this ability to fluoresce, which occurs in certain marine organisms, opens up exciting prospects of many lines of investigation into diverse fields concerned with its biochemistry, its physics, and its biology. It also offers a new technique for use in the field of taxonomy in a group like the corals which, up till now, has taken into account only the characters of the calcareous skeletons, when trying to determine the relationships and classification of species within the group. Studies of the living tissues show, in fact, that different patterns of fluorescence separate certain corals which up till the present have been considered as belonging to one and the same species.

While awaiting the complete solutions to the problems raised by the phenomenon of fluorescence, we may note that the list of organisms possessing this remarkable ability is still far from being complete, and meanwhile we can enjoy to the full the spectacle of extraordinary beauty which they present.

The Aquarium is open to workers of other countries who wish to engage in scientific research or to make observations on its inhabitants. Already specialists from many countries, including Australia, England, America, Japan, and France, have used its facilities. Here they have been able to study the deeper water fauna, which would have been very difficult or even impossible in the natural habitats.

The Work of the Aquarium

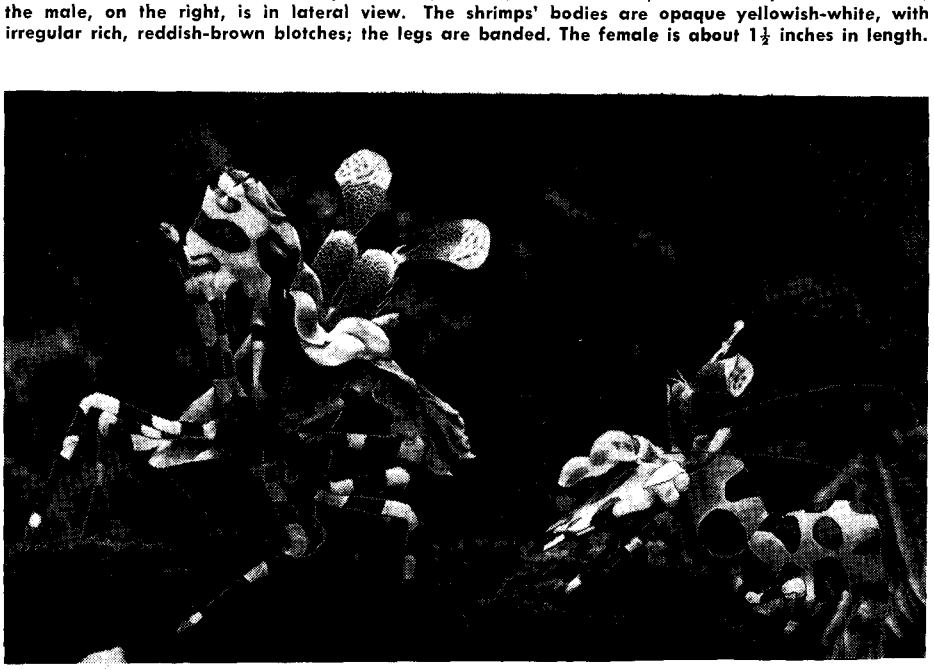
Through the offices of the Aquarium, already much of the New Caledonian reef and lagoon fauna has been collected and named or has been sent to specialists abroad for identification and documentation. Some of these specialists were attached to the Australian Museum, and others, notably Professor J. W. Wells, of Cornell University, Ithaca, N.Y., U.S.A., who identified the madrepore corals, in particular the fluorescent ones, or Madame Tixier, of the Paris Museum, who named the numerous alcyonarian corals, came from much farther afield.

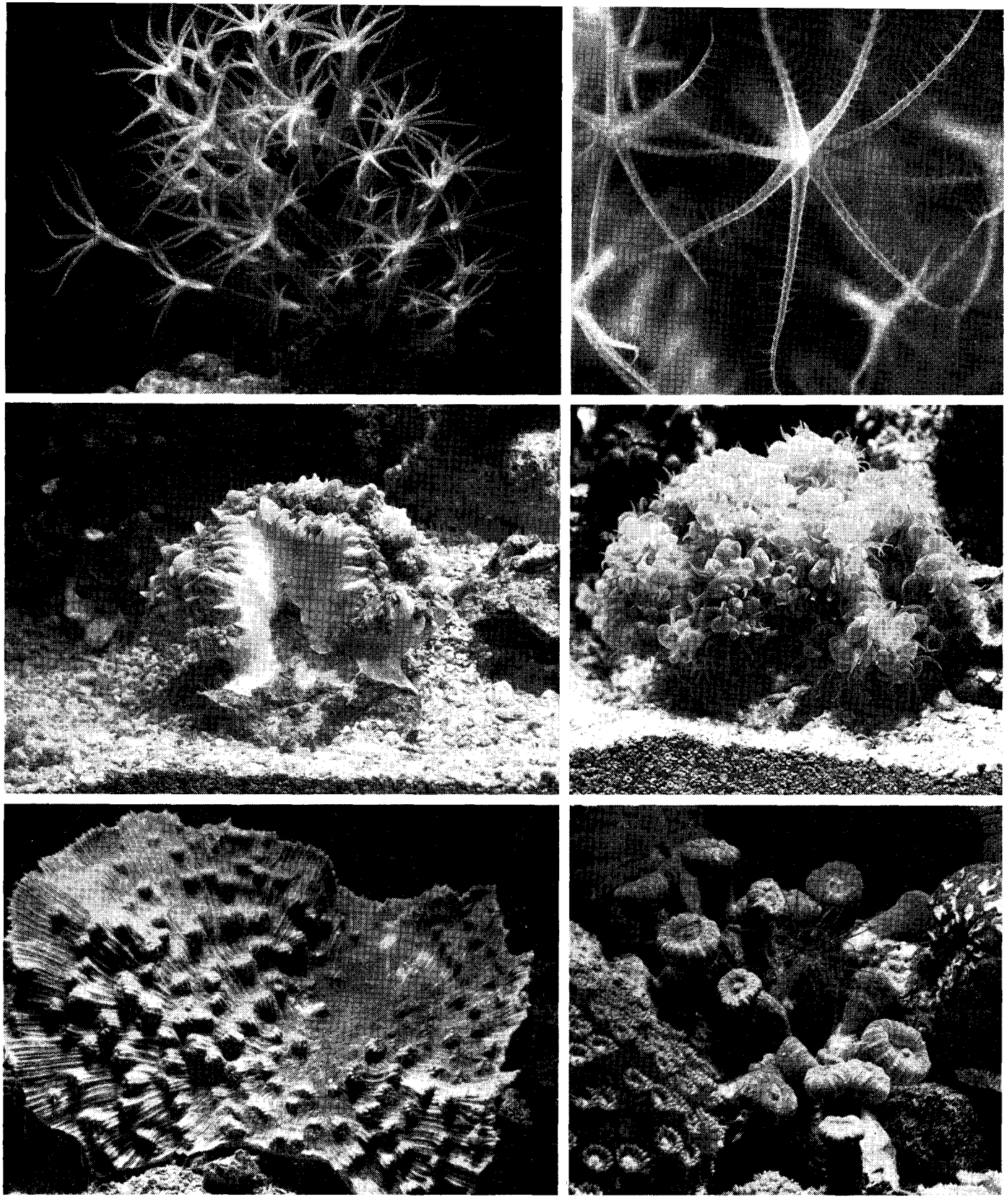
Another project has been the collecting and documentation of the local marine algae by Madame Catala, and this marine flora has been identified by Valerie May, of Sydney, New South Wales.

The photographic recording of the fauna has gone on ceaselessly, and a very large library of colour photographs has already been compiled. Invertebrates, particularly coelenterates, have received special attention and much has been accumulated on living stony corals and alcyonarians, both in daylight and under ultraviolet light.

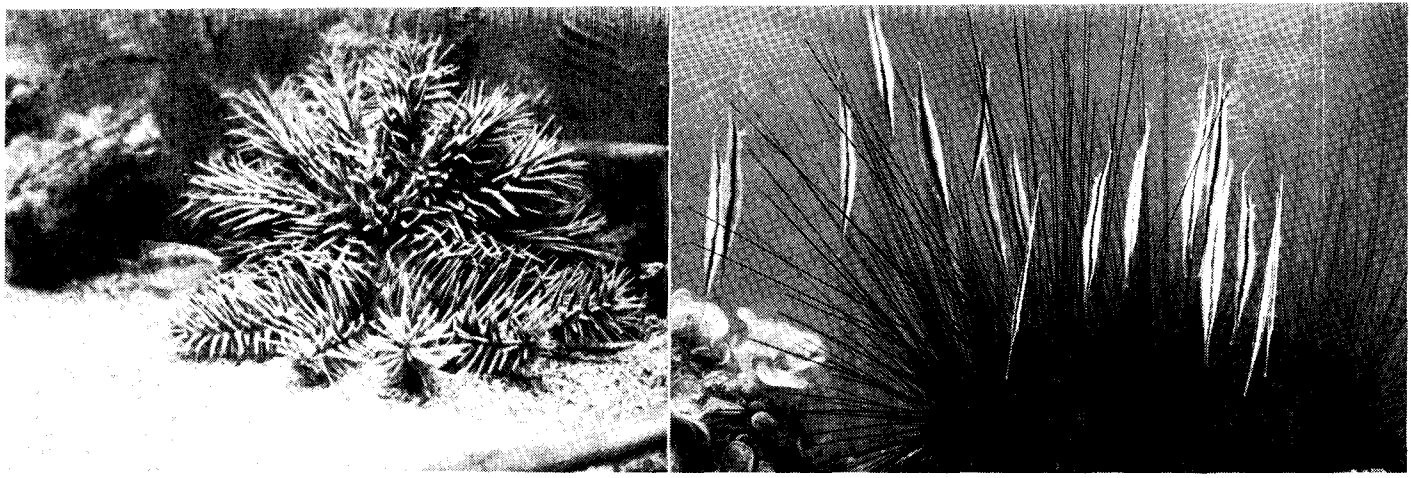
Many molluscs, especialy nudibranchs, have been recorded, and one recalls with pride that the first colour transparencies of living Nautilus were taken at the Aquarium. Very fine records have been

A pair of Elegant Coral Shrimps (Hymenocera elegans), a very rare animal, in the Aquarium of Nouméa, New Caledonia. The larger animal, at left, is the female, seen directly from the front; the male, on the right, is in lateral view. The shrimps' bodies are opaque yellowish-white, with irregular rich, reddish-brown blotches; the legs are banded. The female is about 1½ inches in length.





Some corals and alcyonarians from deeper waters. Top (left): The rare alcyonarian Alcyonium catalai, fully expanded, and (right) a close-up enlarged view of its polyps, showing the eight feathery tentacles, with batteries of nettle cells barely visible as white dots. Centre: Two views of the deep-water coral Plerogyra sinuosa, the left one showing flesh and tentacles retracted, by day, the other showing the polyps expanded, by night. Note the swollen bases to the tentacles. Bottom (left): A remarkable fluorescent coral, Mycedium elephantotus. Its all-over colour is brownish in daylight, but, under ultraviolet radiation, the most delicate tones of green are seen on the striated general surface while the rounded raised corallites are pink. Right: Corals from the Aquarium's display of fluorescent organisms. Daisy-like polyps of Goniopora lobata (bottom left-hand corner) glow with a greenish hue. Surrounding the central spidery-tentacled anemone is a group of stalked Caulastrea furcata corals which glow bright-green under ultraviolet, and towards the top-right a part of the brain coral Platygyra lamellina is seen. In the top left-hand corner is a simple coral, Cynarina lacrymalis (the first species discovered to fluoresce), which varies from peacock-blues and green to orange.



By night many echinoderms in the Aquarium of Nouméa become active. Left: A Crown of Thorns Starfish (Acanthaster planci) shows its spines, which can inflict painful wounds. Right: A group of Razor Fish (Aeoliscus strigatus) swim head downwards and find protection among the long spines of the Needle-spined Urchin (Diadema setosum).

obtained of rare echinoderms such as the crinoids and the Basket Star (*Gorgonocephalus*) and, in the Crustacea, of the rare shrimps *Hymenocera* and *Hippolysmata*. Finally, many photographs of marine polychaetes have been obtained, in particular of serpulids which are abundant in the lagoon of New Caledonia.

Important records in colour have been made showing live fish in natural attitudes. They cover the lagoon fauna or extremely rare species or even records of species new to science. The most remarkable changes in coloration during the course of growth and development have been observed and recorded for certain species of *Coris, Novaculichthys,* and *Cetoscarus*.

Cinematographic documentation has enabled us to produce a 70-minute-long 16-mm colour film which won several prizes, and when this film was projected recently in Australia, at the Australian Museum and the University of New South Wales, such interest was aroused at university level that the authorities and zoologists there have strongly urged us to write and add an English commentary to it, as it should have very wide appeal. This project was completed early in 1966. In this film, *Carnival Under the Sea,* the most remarkable of the Aquarium's animals are featured.

It was under this same title that a book which documents all the scientific findings of consequence made at the Aquarium appeared in October, 1964, published by R. Sicard, Paris. It comprises 141 pages of text, many black-and-white illustrations, and 28 colour plates. It is available in either a French or English edition.

Many magazines have published articles about the Aquarium with colour illustrations, including: LIFE—*The Wonders of Life on Earth*, New York, 1960; COURRIER DES MESSAGERIES MARITIMES, Paris, November, 1962; SCIENCE ET VIE, Paris, July, 1963; SCIENCE ET AVENIR, Paris, September, 1964; and MATCH, Paris, July, 1965.

Some of the illustrations reproduced on stamps may almost be regarded as scientific records of the marine organisms from the Aquarium. Some stamps of this type will continue to appear each year. Those genera which have already appeared on stamps are *Brachyurus, Lienardella, Glaucus, Spirographis,* and fluorescent corals; also the Nautilus, ascidians, *Hymenocera, Phyllobranchus, Paracanthurus, Coris angulata* (a set of three stamps showing the typical colour patterns of the same fish in the juvenile, the sub-adult, and adult stages), and the new alcyonarian species from deeper water, *Alcyonium catalai* Tixier.

This survey of the Aquarium of Nouméa and its work must perforce be restricted to mere essentials and must omit any account of the many fascinating ancillary activities associated with the proper maintenance and continuous display of so many diverse animals and the keeping of them in perfect condition—the frequent deep-diving projects, the excursions to fulfil feeding requirements, and so on. We can also mention only briefly the worth of the Aquarium to Nouméa as a tourist attraction. However, no account would be complete without acknowledging the financial aid which has been given on several occasions from Metropolitan France and help, in the form of grants-in-aid, made each year by the Territory and the Tourist Department and the Municipality of Nouméa.

Finally, it must be said how much the freely-given help received through the collaboration of foreign scientific institutes (in particular from the Australian Museum) has helped and proved a powerful driving force to the founders of this Station.

COVER PHOTO

Our cover . . . these four specimens of deep-sea fluorescent corals were photographed in the Noumea Aquarium by the Director, Dr R. Catala. The world-famous Noumea marine biological station was founded in 1956 by Dr Catala and his wife for the study of marine life in conditions biologically similar to those of their natural environment. The corals show—

Top left—**Bantamia merleti.**

Top right—**Favia** sp.

Bottom left—**Protolobophyllia** sp.

Bottom right—**Mycedium elephantotus.**

Together with other species of deep-sea corals these corals are on display in the gallery of fluorescent corals at the Noumea Aquarium, and were collected at depths of 100 to 115 feet in the lagoon of New Caledonia. They react with the most beautiful luminescence to ultraviolet rays.