

TE VEGA EXPEDITIONS
GENERAL NARRATIVE--INSTALLMENT 11

Long after dark on June 9th I arrived in Mauritius to rejoin TE VEGA after having been tending to shoreside business during her third cruise. I arrived with the hope, although hardly the expectation, that we might sail on the 10th. It was as I should now have expected it to be with ships--delay for the new generator motors to be installed, delay for parts for the refrigeration system to arrive from the United States, delay while attempting to find gremlins in the radar, delay for this and that, a total of two whole weeks of delay. However, it was not without some recompense. As the work progressed, the ship slowly improved and reached a condition not equalled since she left San Diego almost a year ago. Furthermore, the wait permitted contact with ANTON BRUUN, another American vessel working with the International Indian Ocean Expedition, which came into Port Louis during our stay. We were able to renew friendships and exchange ideas and gossip with her personnel. Finally, the delay gave me a chance to see something of the lovely island of Mauritius.

Through lectures that I gave to the Royal Society of Arts and Sciences of Mauritius and to the L.S.U. Alumni Association (Louisiana State University has about thirty graduates on this distant sugar-rich island), I gained a number of new friends who vied with each other to show me around Mauritius. Four or five sight-seeing trips allowed me to get an excellent impression of the entire small island, of the coral-rimmed coast, of the spectacular sheer mountains (one of them with a gigantic balanced rock on top, like a golf ball on a tee), of the rich sugar fields (some of them wrested from old lava flows by piling the boulders into huge pyramids at a prodigious cost of labor), of crowded towns with a bewildering mixture of European, Asiatic and African people and customs, of very British teas in the afternoon and very French dinners in stately homes at night. Best of all was a trip to one of the forest reserves under the guidance of the eminent botanist Dr. R. E. Vaughan, who showed me what Mauritius must have looked like in the days when the dodo was alive, and who helped me collect a dozen native orchids for the University of California Botanical Garden.

At last, on June 25th, we set sail from Port Louis and by next morning the spectacular peaks of Mauritius were no longer to be seen. After a somewhat rough crossing we entered Tamatave, the main port of Madagascar, in the afternoon of Sunday, the 28th. The scientific party had already departed for Nossi Bé to work at the IIOE laboratory there, pending our arrival, so we crated and loaded supplies on Monday, and sailed on Tuesday morning. By about noon on Friday we had come in through the beautiful entrance to Hellville, catching a few tunas and mackerels on our trolling line on the way, and dropped anchor off the town with

the totally undeserved name. As it turned out, the laboratory was on the other side of a peninsula just east of Hellville and we did not see it on our approach. It took considerable time to locate our people, but in the afternoon the ship moved to an anchorage off the station, and we went ashore to inspect the dugong in a large laboratory tank, the pet lemur, the chameleons and other interesting local animals.

The scientific party had been busy while awaiting our arrival. The immediate vicinity of the laboratory provided a plentiful supply of Periophthalmus sobrinus, the mud-skipper, a small fish that spends most of its time out of water. Agile and fleet as lizards, they are practically uncatchable in the daytime without an inordinate amount of physical exertion, but at night they fall easy prey to humans armed with flashlights. These half terrestrial, half aquatic animals presented many intriguing problems, and Dr. Malcolm Gordon, leader of the group, had led his people in a concentrated attack. They had carefully recorded many behavioral observations and had measured body temperatures in the field, they had studied water loss in the air in sun and shade, had determined the upper lethal temperature, had investigated body-weight changes on transfer from fresh to salt water, studied the blood concentrations in water of different salinities, measured the metabolic rate in and out of water and taken electrocardiograms to determine differences in the heart rates in water and in air. In short, they had been putting Periophthalmus through the physiological wringer, and they plan to do much more with the beast.

The crab, Cartisoma carnifax, another marine animal tending to develop terrestrial habits, also appeared to demand attention and had been getting its share. Dr. Warren Gross and Dr. Robert Lasiewski had been busy subjecting this form to salinity stresses, and had run a series of blood and urine analyses in order to elucidate the mechanisms of osmoregulation.

On Sunday, July 5th, some of us turned our attention to fresh water in an attempt to collect some cichlids. Dr. Trewavas, of the British Museum, had requested specimens of these fishes from Madagascar for anatomical investigations of the relationship between the ear and the swim bladder. Present knowledge indicates that such work would clarify the evolution of the family and perhaps point to the derivation of species in Madagascar from either Indian or African ancestors. In the hope of pushing back this particular segment of the border of the unknown, Paul Rudy, Don Raidt, Kelly Blackburn, Steve Gann and I, armed with a 25-foot seine, dip nets and rotenone, set out in a Land Rover belonging to the Nossi Bé laboratory. We went to the lower reaches of a small stream some three or four miles distant, and found a lovely spot of riffles and pools. In spite of

the fact that we were careful not to go into water deeper than the top of our boots, due to the abundance in fresh waters of the area of Schistosoma (a very unpleasant little blood fluke causing a serious disease), we managed to make an interesting collection of eight different species of fishes. Unfortunately there was only one very small cichlid in the lot, and we hope to try our luck again at a later date on the mainland of Madagascar.

A dividend from this expedition consisted of two specimens of a portunid crab which survived the poisoning without any difficulty. These intrigued Drs. Gross and Lasiewski no end. When a physiologist finds an organism of a marine type living in fresh water or terrestrially, he immediately wants to subject it to all sorts of indignities in order to determine what makes it tick in its unusual environment. These two specimens were put through the mill, and the scientists have demanded more of the crabs.

The work continued while a great assortment of gear was moved on board and instruments set up in both the wet and dry labs. Soon the entire complexion of the ship was changed. Centrifuges, osmometers, pH meters, respirometers, a refrigerated aquarium, precision balances, vacuum distillation apparatus, etc. etc. blossomed here, there, and everywhere. A large tank six-by-four-by-four feet in size was assembled and secured on deck, and a pump was installed by means of which we hope to be able to pump water from below the thermocline. This tank is intended to hold Latimeria chalumnae, the famous coelacanth fish that has brought us to this part of the world.

At last, on July 9th, we set sail for the Comoro Islands, and, with the aid of dramamine, managed to survive a rough trip across the Mozambique Channel. People had a hard time staying in their bunks, and they complained that it was the first time they had retired to become fatigued rather than refreshed. A small table in the mess was broken by one of the students being hurled against it, we took considerable water over the decks, a few things managed to come adrift in spite of being lashed down, but no critical instruments were broken and there was surprisingly little seasickness.

By the morning of Saturday, July 11th, we were in the lee of Anjouan Island and soon dropped anchor off the town of Mutsamudu. On going ashore to take care of entrance formalities we were immediately struck by the Arabic character of the town. Crowded, flat-topped, stone houses with steep stairs to the upper floors; crowded streets that were simply narrow alleys impossible for wheeled traffic, veiled women peeping through narrow slits at the strangers, red fezzes and white flowing robes of various types, everything reminded one of the Far East rather than of Africa. On an elevation

immediately behind the town was an old ruined fort with crenelated walls and muzzle loading cannon still protruding through some of the ports. Still higher were the scattered homes of the important Europeans, most of them with commanding views of the sea.

After entry, the first order of the day was to meet with the French officials and the local fishermen in order to arrange for the purchase of a coelacanth, if one could be caught. In spite of Dr. Gordon's impassioned arguments in fluent French, he could win no reduction in the officially established price, and we are now committed to pay 50,000 Comoran francs for a dead coelacanth and 100,000 for a live one (about \$200 or \$400 U.S.). This may seem a steep price to pay for one fish regardless of size (we would prefer small ones), but considering the rarity of the species and the extraordinary interest throughout the world in this living fossil from the Mesozoic, it would be well worth it to gain some knowledge of its physiology, which is totally unknown at present.

Of course we have not been content to depend entirely on the native fishermen, although they include a man known as Zema who has already caught four coelacanths and should therefore know the technique. We have been busy with set long lines, with hand lines and with free deep-water fish traps, which, after a period of several hours on the bottom, are released by the solution of a magnesium link and float to the surface to be retrieved there. These links have taken much longer to dissolve than they were supposed to, and we have had some anxious hours during which we thought that we had lost our gear. However, they eventually popped up about a day late, and we still have our original four. As with any new operation with unfamiliar gear, we have had our troubles, torn the traps, and made water hauls, but we have modified the gear and the technique of setting it, and we hope that our future catches will yield more significant results than the one magnificent vermilion shrimp from 1300 meters depth that represents our total catch so far.

While waiting for coelacanths to bite on our hooks or get into our traps, we have worked with more familiar gear; we have made some bathythermocasts occupied two hydrographic stations, and made a number of hauls with the Tucker trawl for organisms of the deep scattering layer. From these hauls a great many interesting forms have come on board, among them the rare "barrel-eye" fish (Opisthoproctus); the largest hatchet fish (Argyropelecus) that I have ever seen; large and perfect viper fish (Chauliodus) with dentition that would be the envy of a saber-toothed tiger; numerous representatives of genera (Idiacanthus, Malcosteus, Bathophilus, Astronesthes, Gonostoma, etc.) in related families

that are much rarer and scarcely less spectacular with their fearsome teeth, black color, chin barbules, and rows of light organs; big, transparent, ribbon-like, leptocephalus larvae of unknown eels; many bright red shrimps (Acantheephyra and related forms); an amphipod (Cystosoma) with a body as large as a golf ball and so crystal clear that it is absolutely invisible in water; large pelagic colonial tunicates (Pyrosoma) that, when stimulated with the finger, glowed with a bright cold light to justify their name, which means "fire body"; violet-brown jelly fish (Atolla) from the cold dark depths; big heteropods (Carinaria), pelagic snails with ridiculously small shells that swim with slow ungainly flapping motions and are so transparent that their eyes appear to be two detached black blobs. The roll call of fantastic, grotesque or beautiful forms is practically endless; we are getting a good impression of a world that most people scarcely know exists.

Some of these specimens that came up in fair condition have been placed in a refrigerated aquarium and are surviving surprisingly well. They are unique material for physiological experimentation. At present Dr. Inga Bøetius is measuring the respiratory rate of crustaceans from the deep scattering layer--probably the first time that such an investigation has been attempted. Others are sacrificed for biochemical work. Dr. Malcolm Gordon and Dr. Jan Bøetius have been processing muscle tissue from various deep-sea fishes for the determination of amino acids. The greater part of the catches are preserved for taxonomic and anatomical work by various specialists in shore laboratories at a later date.

The bottom falls off very steeply around this volcanic island and does not present ideal trawling ground. Even at 1300 meters the fathometer indicated about a twelve degree slope outward, but when we cruised parallel to shore the depth held even and there were no marked irregularities on the trace. We decided that it was worthwhile to try for a haul of deep bottom animals, so over went the beam trawl. Everything seemed to work fine until we got the line almost vertical in hauling in, and then the winch would simply not pull the trawl in. We were anchored. There was only one thing to do; we tried to break the gear loose by going slow ahead. Something gave alright, but it was not the obstruction on the bottom. When the end of the wire came in we found that we had snapped both of the wire cables of the net, and the trawl remained about three-quarters of a mile beneath the surface. In slight recompense for our loss, the fish traps set at the same depth have brought us a rare deep-sea shark (Euprotomicrus), a couple of conger eels, a number of large red prawns (some for science and some for food--and very good, too!), and a few small amphipods clinging to the remains of the bait.

Not all of our work has been in deep water. On Sunday, July 19th, we tried our luck on a fish-poisoning station on a reef close to shore. A vertical coral wall descended from about seven to twenty feet and was cut by a series of sharp little canyons. These provided good spots to spread the rotenone. The reef was not particularly rich, the water was rather murky with visibility limited to about twenty feet, but we were fairly successful, and everyone, particularly those to whom coral reefs were new and strange, enjoyed the adventure. We preserved a representative collection of colorful reef fishes, and Lorraine Morin, a lovely young student who is enamored of helminth parasites, had a wonderful chance to indulge in the pastime of pawing through fish anatomy for tape worms, flukes and such ilk. Strangely enough, she seemed to take a great delight in doing it. Such devotion to science should be encouraged and we shall have to see to it that she gets all the material that she wants.

On the evening of Monday, July 21st, we were excited to hear that a coelacanth had been caught at a town on the east coast about an hour away by car. One of the local entrepreneurs, who are always ready to arrange anything for a slight fee, took us to see the fisherman who had caught it and who just happened to be in town. After much flow of the Comoran version of Arabic, and its translation into French, we learned that the fish had been caught four days previously, that it was a bit longer than the man's arm, that it had been packed away in salt, that the body cavity had been opened and the internal organs preserved as well. It was not just what we wanted, but we thought that it should be looked at in any case with the possibility of purchase in mind. Accordingly it was agreed that we would pay for the transportation of the fish and the fisherman to Mutsamudu where we could see the specimen on the pier at 7:30 in the morning and decide what to do.

At the appointed time most of the scientific party, equipped with cameras, were on the pier, but there was no fish to be seen. We walked into the adjacent town square, and after a while our entrepreneur appeared to open his tiny shop. After waiting for some time for the fisherman, our helpful friend informed us that the fisherman would come to his home, so we all set out on a parade through ever-narrowing alleys which soon required us to walk in single file. At last we reached our guide's home and he talked to someone inside whom we did not see. Then we turned around and marched back and he talked to several people here and there, and finally, on the steps of the mosque he said that the fisherman had gone to the hospital. In desperation we got a "taxi," a truck with board seats on each side, and went to the hospital to find our man. They had never heard of him. What happened we still do not know for sure, but we

rather suspect that we have been given a Comoran run-around. Anyhow we returned to the ship and got to work once more.

We have been working very hard on this cruise, but there has been a chance to crowd in a few extracurricular activities. The day after our arrival was some sort of a local holiday, and that evening some of the ship's company went to a "bull fight," which was evidently not of the Spanish variety, but consisted of anyone who desired to do so worrying a distracted heifer at the risk of being knocked down. It provided a chance for mingling with the town folk. On Bastille Day, Dr. Gordon and I were invited to a "Sirop" given by the Mayor at the Palace of the Sultan. We figured it would be a dry Moslem affair, but there was a Moslem table with soft drinks and a European table with whisky and champagne. There were interesting pastries and tidbits for everybody. The palace was not an imposing building, but a bare and weather-worn block; the sultan was not present since he died some time in the thirties, but several of his relatives, resplendent in burnouses and full Arabian regalia, were there to enliven the party. It was a pleasant and interesting affair. One evening we all went to see an excellent under-water movie, the work of a French photographer who has been working in this area for some months. A number of people from the ship have been invited to dinner or for excursions on shore, and we have had numerous visitors on board. Everything is progressing normally.

TE VEGA GENERAL NARRATIVE

INSTALLMENT 12

The nicest diversion on Anjouan, as far as I am concerned, came on July 20th when Monsieur G. Mattias, of the Direction General de l'Agriculture, fulfilled his kind promise to take me into orchid country. Starting from Mutsamudu in his Land Rover, we drove along the north coast, then over a pass in the mountains and down again to the east coast, and along this almost to the southern end of the island. On this trek we covered most of the 40 km. or so of macadamized road on Anjouan, passing through commercial plantings of coconuts, ylang ylang (a tree grown for the essence of its flowers, which is used in perfume), sisal, bananas, cocoa and tea, as well as through forests, up mountains, down valleys with dashing streams, through villages and towns with stone or wattle walls and thatched or tin roofs lining streets barely wide enough to get through, which were crowded with people and goats and chickens. At last we turned off on a dirt road that twisted and climbed ever higher to provide a series of spectacular views of mountains and sea, until we came at last to an agricultural experimental station. Here we abandoned the Land Rover as unfit for the narrow, steep and rough trail ahead, and transferred to a jeep. Soon we left the bright warm sunshine and plunged into an eerie world of cloud at an elevation of about 2500 feet. The change in temperature was dramatic; five minutes previously we had been hot and sweaty; now it was definitely chilly. Visibility was cut to about one hundred feet by the dense fog, through which came a steady light drizzle that now and again turned into brief heavy downpours. Even here in these mountains, which from a distance seemed to be clothed in virgin jungle, a continual trickle of people on foot proclaimed that the overpopulation problem is not restricted to the better known areas of the globe; bananas were planted on the steep hillsides, and cattle tethered here and there showed the jungle not to be as untouched as I had supposed. In fact, the larger trees that had not been cleared away were fairly widely scattered. The dripping clouds and soggy ground provided a perfect habitat for ferns, mosses, liverworts and orchids, both epiphytic and terrestrial. They grew everywhere in this somber green and grey dream-world. While only two species of orchids, a beautiful white Angraecum and a hardly less striking pink Spathoglottis, were in bloom, I had no difficulty in collecting at least fourteen different kinds to gladden the hearts of the botanists at the University of California-- and my own as well.

On Thursday, July 23rd, we picked up our long line and fish traps for the last time on this visit and in the afternoon set sail for Nossi Bé to replenish fuel, water and provisions. Under a spanking breeze the start was auspicious, with the ship heeled far over and streaking along

with a very satisfactory bone in her teeth. Unfortunately, the wind began to fall within minutes, and that night the mainsail was furled and the engine started once more. After an uneventful crossing we arrived at Hellville on the afternoon of Saturday, July 25th, to be greeted by the personnel of the Laboratory with a welcome-back party featuring an elaborate buffet. Satisfying the inner man was only a part of the program which included dancing, guitar strumming by Kelly Blackburn, our marine technician, folk singing by all who thought they had voices, and the uninhibited practice of French-English conversation by everyone. It is amazing how effectively un peu words avec gestures and smiles can break down language barriers.

We immediately launched a collecting campaign for experimental animals (mud skippers, the crab Cardisoma, fresh-water portunids, small shrimps from the mud flats) and settled down to the busy routine of physiological investigations and evening lectures or seminars. That has been the established practice on this cruise. The students are now contributing to the seminar program, as well as to the field and laboratory work. Those who are far advanced in their graduate research report on their own investigations; those who are relative neophytes discuss some phase of their special field of interest or review one or more scientific papers. The accompanying comments, with everyone participating, are often free-wheeling, and sometime the give and take gets a little out of hand, but this is all to the good. For example, the other evening Rosemary McCarthy's discussion of the role of cytochrome-C as a taxonomic tool developed into a shouting, table-thumping argument over scientific methods, scholarship and ethics, and lasted far beyond the allotted hour. It was accompanied by dark looks, harsh words, snide remarks and much glee--a really stimulating free-for-all. In the end general agreement was reached and peace settled down once more without any residue of hard feelings.

The routine work has been interrupted several times by activities of a different character. Leaving a number of people behind to carry on experiments in progress, a number of us took the whale boat and made the twenty-plus mile crossing to the mainland of Madagascar in order to collect fresh-water fishes. Our visit to the native village was interesting, we found a lovely spot for our picnic beside a shaded stream where pools alternated with riffles, the bird watchers among us had a fine time ogling sunbirds (Nectarinia) and brilliant blue kingfishers (Alcedo cristata), drongos (Dicrurus) and herons (Ardeola idae), crested terns (Thalasseus bergii) and tropic birds (Phaethon), we took about twenty-five species of fresh and brackish-water fishes, including the strange eel-like blind goby Taeniogobius, and in general had a fine time, but we paid for it with seven hours of rough, wet and uncomfortable travel over and back.

Another day we moved the ship to Tanikely, a small island about seven miles away, and explored the island and the surrounding reefs. The coral in the western Indian Ocean is not as rich and varied as it is in the East Indian region, but it is good enough to evoke admiration from our scientific party, only two of whom have been lucky enough to have worked in more spectacular areas. The gorgoneans, on the other hand, leave nothing to be desired. At depths of forty to sixty feet we swam leisurely among tremendous brown sea fans, fantastic red shrubs, long black rope-like tendrils, and ridiculous tufts of blue fingers. We explored this submarine playground and noted the clams and cowries, the star fishes and sea cucumbers, the nudibranchs and flatworms, while all around us unconcerned colorful fishes displayed themselves, and an occasional large turtle paddled slowly away. We speared a few of the fishes and got one large purple-blotched sting ray (Dasyatis brevicaudatus) about four feet across. Unfortunately, the current in this area was so strong that an attempted poison station was an almost complete failure.

One day, while at anchor, a six-foot cub shark (Garcharhinus leucas) took the bait and provided some excitement in the landing. We got two remoras (Echineus naucrates) along with it, and Lee Morin had a chance for more tapeworms and flukes.

While we keep pretty busy there have been occasions for relaxation and recreation that have nothing to do with marine biology. There was the party that we gave for the people at the shore laboratory in slight repayment for their many courtesies to us. There was the early morning visit to the nearby National Forest Reserve to see the lemurs. We spotted approximately a dozen of them at a distance of only about twenty yards. They grunted and growled at each other, or possibly at us, swung their long tails, set the branches swishing by spectacular leaps from tree to tree, and stared at us through big round eyes in the uncertain light of dawn, apparently as interested in humans as we were in lemurs. There was the visit to the factory where the essence of the ylang ylang flowers is distilled for the perfume market. There was the basketball game between a team from TE VEGA and one from Hellville. Due, perhaps, more to our greater stature than to superior finesse, TE VEGA won by eight points! There was the superb dinner provided for the Captain and Senior Scientists by Dr. and Madame Pichon, the Sunday picnic on the beach at the northwest tip of Nossi Bé, the enjoyment of the blooming coffee plantations where for a few brief days the delicate pure white flowers were marshalled in ranks of military precision along each branch to form a striking contrast to the dark green leaves. Everyone has had the opportunity to sample, on more than one occasion, the flavor of this pleasant and exotic place, and to enjoy the generous hospitality of the resident population.

Our work in Nossi Bé was finished and we were due to depart for the Comoro Islands on August 10th, but, with the indifference to breaking promises so characteristic in this part of the world, the tanker did not deliver the water and fuel we needed until late on August 12th. On the morning of the 13th we sailed with a good supply of mudskippers and crabs to keep the scientific party busy.

Shortly after I had turned in that night, Dr. Gordon roused me out again. He reported that a school of fish was following the ship just at the leading edge of the illuminated cone thrown by our stern light on the water. Flashes of bioluminescence along the edge of the light certainly made it appear that this was the case, and since the wake of the ship was not particularly bright it seemed that the fish themselves must be emitting the light at intervals. After admiring the display for a time, we tried shining a flashlight into the water ahead of the line of fire, and were rewarded by more flashes that faded in about two or three seconds. We were not being patrolled by fishes but were sailing through a dense swarm of animals that were stimulated to glow briefly by the energy of a light beam. Each glow seemed to indicate an organism about the size of a cigarette package. We tried to catch some by means of a dip net, but fire streamed out of the end of it, and when the net was brought on board it contained only some phyllosome larvae, small amphipods and fragments of jelly that would not glow. The light producers were probably ctenophores or siphonophores so fragile that they passed through the meshes like custard. After making twenty-seven stop-watch determinations of the duration of the glow after both long and short stimulation (1.4-4.1 seconds, with a 2.3 second average), we suddenly left the unknown organisms behind and were left with only the memory of an interesting and beautiful phenomenon. It was only after they were gone that we thought of trying to stimulate them by means of sonar. That is a project for the next opportunity.

THE VEGA EXPEDITION
GENERAL NARRATIVE--INSTALLMENT 13

On August 15th we reached Mayotte, the easternmost island of the Comoro group. This is almost entirely surrounded by a barrier reef and, from its appearance on the chart and from verbal reports, promised to provide spectacular coral gardens and excellent fish-collecting sites.

As we approached, the wind, which had deserted us during the crossing, sprang up fresh and strong just when we did not welcome it. By mid-morning we were off the northern end of the island, where the western limit of a long line of breakers indicated the position of the narrow entrance of the Passe M'Zambourou. Once inside the reef, the chart showed a maze of coral heads and shallow patches, but buoys and range markers made the channel easy to follow. A little before lunch time we were safely at anchor in the Baie de Langoni, but by then the wind was heavy and kicking up a nasty whitecapped chop within a couple of hundred yards of the lee shore. A little scouting with a glass-bottomed box from one of the Boston whalers showed nice development of coral on the fringing reef, but the water was murky and the waves and strong current made conditions unsuitable for work. Attack on the outer barrier reef about five miles off shore was out of the question because of the heavy breakers. The time remaining for our second attempt to catch a coelacanth was running short, and we could ill afford to wait for conditions to improve. Consequently, with considerable regret we gave up the Mayotte venture that we had all looked forward to as an interesting break in our routine program, and early that same afternoon we left again without having set foot on the island.

By one o'clock in the morning of Sunday, August 15th, we were once more in our old stamping ground off the northern coast of Anjouan, with the Tucker trawl over for the first of two hauls. The catches were as expected, and by the time we dropped anchor off Mutsamudu in the predawn darkness, the respiration of deep-water shrimps was under investigation and samples of Chauliodus muscle were being prepared for biochemical analysis. Just after breakfast the deep-water traps were prepared and set, and the routine established on our earlier visit was under way.

Although we are only about twelve degrees from the equator, there is an appreciable seasonal temperature change. With the approach of the southern hemisphere spring, the temperature is appreciably warmer than when we left, and the saloon tends to become unbearably hot during the evening seminars. As an experiment we decided to try holding the meetings on the after deck. A piece of plywood made an acceptable substitute for the blackboard. A spotlight was rigged so that it was visible to all, and the speaker could refer to his notes without difficulty. In spite of the interference of rigging and the difficulty of finding a good place

for everyone to sit down, it was much more comfortable than the saloon. The little brightly illuminated academic patch in the velvety blackness of the tropical night, with gentle sea breezes providing satisfactory air conditioning, was appreciated by all concerned. It was literally a case of "no sweat" and it will probably be continued whenever weather and sea conditions permit.

We have modified our previous procedure somewhat. Instead of trawling during the daytime we have been trying it at night when the organisms of the deep scattering layer have migrated closer to the surface. The ship has therefore been riding at anchor during the daylight hours, which makes most of the laboratory work more comfortable and provides an opportunity for shore excursions or for different activities on board.

Sometimes the water at our anchorage is greenish and murky. At other times it is the clear deep blue that one associates with the open ocean far from shore, and then, unless the surface is broken by waves, one can spot a succession of small, almost invisible wraiths drifting past in the upper layers--equally spaced brownish spheres in long rows that turn out to be the stomachs of the otherwise invisible pelagic tunicate Cyclosalpa, linked together in brotherly chains; slight hints of pulsing movements in the water itself that betoken small medusae (Aequoria, Liriope, etc., or their close relatives); flashes of iridescence that can only be the ciliary bands of ctenophores; vague impressions of something unknown that demand investigation.

We have dipnetted a number of these and brought in a succession of weird and marvelous animals, most of them too fragile for preservation. The siphonophore Diphyes (or possibly Galeolaria) is a small jet-propelled double torpedo of glass trailing a long whip-like tail which, when the animal ceases its pulsing spurts, expands into a beautiful diaphanous plume made up of hundreds of astonishingly elongating tentacles from the feeding individuals of the colony. The ctenophore Cestum veneris, commonly known as Venus' girdle, has the form of a narrow ribbon-like band, visible only because the yellow or reddish gut extends as a transverse streak across the middle of the ribbon and the ciliated bands trace rose-colored iridescent double lines around the margin of the body. The largest one we caught was almost three feet in length; the smaller ones, less than a foot long, hardly merit the term girdle and they have become known on board as "Venus' garter-belts." They are all surprisingly active, swimming by serpentine movements of the entire body, rather than by ciliary action. We have also taken numbers of the sack-like ctenophores Beroë cucumis and B. forskalii and watched them swim with their mouths wide open, apparently hunting for prey. The latter species is one of the most brightly luminescent of all marine organisms,

and we kept a number in plastic pans until nightfall in order to observe this phenomenon. On agitation they put on a gorgeous display, with flashes and waves of brilliant green fire lighting up the entire containers and illuminating the faces of the observers.

From the very surface we dipped small Portuguese men-of-war (Physalia) and, placing them in trays of sea water, were able to observe the occasional slow rolling to right or left by means of which these animals manage to keep their floatation bladders moist, even on calm days under a tropical sun. Many of us, while snorkeling during the last few days, have had the unenviable experience of testing the potency of the stinging cells in the dark blue tentacles of these beautiful nuisances and have learned to respect them. We have also taken several specimens of the pelagic hydroid Porpita, a flat circular disk with a dense circlet of radiating tentacles. Floating on the surface this form looks for all the world like an elaborate stylized diagram of the sun done in blue ink. All of these marvelous pelagic organisms, variously transparent, blue or luminescent, came on board two days following our seminar on pelagic adaptation and the day after our discussion of coloration and bioluminescence. There could have been no more graphic illustration of a number of points made in the lectures.

The next day a number of new forms were added to our riches--blue by-the-wind sailors (Velella); blue pelagic snails (Janthina), with reversed countershading, hanging upside down from their frothy bubble-rafts; pale bluish-white gooseneck barnacles (Lepas) suspended from the snail shells; and finally the lovely light and dark blue nudibranch Glaucus, a real gem of feathery design. We now had an adequate sample of a complex surface community similar to the one that had engaged the attention of staff and students off the California coast, half a world away, on the first cruise of TE VEGA. We have noted an interesting fact concerning Velella. When oriented with the long axis pointing toward the north all of the specimens collected more than a year ago off America had the sail extending from NW to SE; all of the individuals collected here have it extending from NE to SW. Is this simply due to wind-sorting of randomly varying individuals, or could it possibly be that in some obscure way Corioli's force may have differentiated the populations of the northern and southern hemispheres? We rather doubt the latter possibility, but we shall continue to note the orientation of the sails in whatever geographical area we encounter these animals.

On the last day of our stay at Anjouan, while waiting for the deep-water traps to surface, we made a final fish collection. Scouting on previous days had revealed the presence of a room-like pit in the fringing reef near our anchorage. Its dimensions were roughly thirty by thirty feet, and it was also about thirty feet deep with vertical walls of coral rising to within two or three feet of the surface. Three narrow corridors led into the chamber, which had a flat sand floor. Although the fish population seemed to be

rather meager, it was an ideally protected situation in which the rotenone would not be dissipated too quickly, so we decided to give it a try.

Dr. Lasiewski and I donned SCUBA gear and, each armed with a plastic bottle of Noxfish, we were soon shooting dense brownish-grey smoke rings into the water. We first paid attention to the exits, cutting them off with curtains of rotenone, and then squirted the main chamber until it was so cloudy that visibility was cut down to about six feet. As soon as we returned our bottles to the whaleboat and exchanged them for short-handled dipnets we were joined by three other divers and a couple of snorkelers. We kept at the task of collecting until we ran out of air in our tanks and fishes from adjacent areas were moving in to compete with us for our catch. From the surface, the midwater and the bottom we scooped up bright crimson soldier fishes and black or gaudily striped surgeon fishes with scimitars on their caudal peduncles to make us beware, curious dragonettes and depressed flatheads, colorful butterfly fishes and long slender worm eels, beautiful but venomous lion fishes and long-snouted wrasses, bearded goat fishes and electric rays, viciously toothed lizard fishes and grotesque bulbous anglers. The prize was a one-and-a-half inch Solenostomus that Larry Oglesby almost passed up as a small piece of drifting seaweed until he noticed that it had an eye--a most unusual alga, or, for that matter, a most unusual fish! We filled our containers to overflowing, and when, some days later, the collection was preserved, sorted and packed for shipment home, we discovered that the apparently meager fish fauna of the small habitat sampled had yielded well over one hundred species belonging to more than thirty families.

On Saturday, August 22nd, we hoisted the anchor and headed NNW for Mombasa. The trip was uneventful and toward noon on Tuesday, the 25th, we began to encounter traffic and the low hills of the African coast loomed out of the haze. As we proceeded up the harbor under the guidance of the pilot, everyone was impressed by the evidences of civilization. We had become accustomed during the last couple of months to considering Hellville and Mutsamudu to be typical communities in this part of the world, and probably we all presumed that Mombasa would be a somewhat larger replica. To our surprise, instead of a squalid and decaying town we found Mombasa to be a modern city of one hundred eighty thousand with good stores, hotels, and facilities of all kinds, populated by an alert and business-like citizenry. Aside from mass-produced primitive wood carvings, lion-claw cufflinks, zebra-hide handbags and similar items beckoning the tourist's dollars from shop windows, there was little evidence at first that we had invaded darkest Africa. However, exploration away from the center of the city soon revealed native African sections with wattled huts and an Arabian quarter--ample evidence that we are not in America.

Plans for sight-seeing expeditions in this interesting country, for visits to the convenient game reserves, for climbing Kilimanjaro, for stopping at various places in Europe or Asia on the way back to the United States, or simply for a quick and direct flight home, were soon under way. By Wednesday evening the first two students had departed and the cruise was considered over.

In retrospect, this has been the best cruise so far. Our program was not hampered nor curtailed by serious mechanical troubles. We did not catch the coelacanth that we were after, but we were content to investigate other interesting organisms instead. An excellent and cooperative group of senior scientists and students worked together effectively, learned much about the sea and its inhabitants, accomplished a great deal of worthwhile physiological research, saw strange places, met new and interesting people, and had a busy, stimulating and good time. It is the first cruise with which I am fully satisfied, and it indicates that our fumbling period of trial and error is over. We should have smooth sailing from now on.