Kelp communities in the Chilean archipelago: R/V *Hero* Cruise 72-5

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The accounts of Darwin (1860) and Skottsberg (1941) and others of large beds of *Macrocystis pyrifera* (L.) J. Ag. in the waters of the southern Chilean archipelago suggested that the study of these communities would yield valuable comparative data with regard to the *Macrocystis* communities in the northeastern Pacific. Specifically, it was thought that there would be important comparative information with regard to the role of a top carnivore, because the northeastern Pacific *Macrocystis* communities have evolved in the presence of the sea otter, *Enhydra lutris* (L.), which never has occurred in the southern hemisphere kelp communities.

The effect of the sea otter at Monterey, California, and at Amchitka Island is to eliminate various species of herbivores, particularly sea urchins, that could overexploit their algal resource. After the sea otters were essentially eliminated by overhunting in the late 19th century, various species of asteroids, fish, and possibly other carnivores consumed enough sea urchins to allow large kelp beds to flourish in the absence of the sea otters (see North, 1964, for descriptions of post-1911 southern California kelp beds). We assumed that other, similar, carnivores controlled the herbivore populations in the Chilean kelp communities and allowed the growth of the reported luxuriant *Macrocystis* beds.

Hero Cruise 72-5 began at Punta Arenas, Chile, on October 26, 1972, and ended there on November 30. During the cruise, we logged 197 dives in exposed and semi-exposed areas from the Strait of Magellan to the Gulf of Corcovado and found that, contrary to our original expectations, the Chilean sea urchins apparently have few important natural predators. As might be expected, these sea urchin populations usually consumed almost all the noncoralline macro-algae.

Small *Macrocystis* beds

Thus, despite the nonquantitative early reports of large *Macrocystis* beds, the general pattern we observed was of rather small (usually less than 1 acre) beds of what appeared to be young plants. The few larger *Macrocystis* beds we saw were in the southern region of the Gulf of Corcovado where man is in the process of harvesting *Loxochinus albus,* the sea urchin that most efficiently overexploits the kelp beds. Although we are not now in a position to draw many conclusions from the data gathered on the cruise, the small kelp beds were in marked contrast to the large beds we expected. Rather than hypothesize a major change in the size of the beds, it seems equally reasonable to assume that Darwin and others observed the same small fringing beds we saw, but, not being familiar with the very large beds of the northeast Pacific, simply described the beds as large relative to their own experience.

We made many transects through the Chilean *Macrocystis* beds noting densities and sizes of the macro-algae and of the larger animals. Again, in contrast to the *Macrocystis* of California, which tends to grow at depths of 10 to 30 meters, the *Macrocystis* plants in Chile are much more shallow, usually occurring from the intertidal to about 5 meters and only rarely as deep as 10 meters. The algal understory beneath the *Macrocystis* canopy also was relatively poorly developed both in species diversity and in structural contributions. While the systematic work of Searles, Leister, and Browner is still under way, even a casual inspection of the *Macrocystis* community shows many fewer species than one sees in the northeastern Pacific, as the Chilean beds lack such conspicuous genera as *Laminaria, Pterygophora, Eisenia, Egregia, Costaria, Alaria, Nereocystis, Pelagophycus,* and *Pleurophy-*

cus. In each case there are in Chilean waters no ecological analogs of these northeastern Pacific genera. We also made preliminary qualitative food webs for the kelp community; again, these food webs are marked by a simplicity we have seen in no other kelp community.

Two experiments

In addition to our descriptive work, two types of experiments were initiated in a number of areas. First, the effect of the canopy species (usually *Macrocystis*) was tested by removing the canopy. These experimental areas will be compared to adjacent control areas in order to evaluate the role of the canopy in determining the structure of the associated assemblage. In the second type of experiment the sea urchins were removed or destroyed in areas with little biomass of fleshy algae to determine the potential role of the sea urchins in maintaining the improverished condition of the vegetation. Similar experiments were performed in several intertidal localities. In the intertidal situations the canopies were composed of *Lessonia* spp. and *Durvillea antarctica* (Cham.) Hariot. Growth measurements were made in several locations; samples of *Macrocystis* of various sizes were measured and tagged for future remeasurement. Some *Macrocystis* also were cut for experimental measurement of rates of regrowth.

This research is supported by National Science Foundation Grant GV-32511.

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Benthic marine algae in the Chilean archipelago: R/V *Hero* Cruise 72-5

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From October 26 to November 30, 1972, the authors participated in Cruise 72-5 of the research ship *Hero* in the first field work of an ecological and systematic study of the benthic marine algae of southern Chile. This cruise, which began and ended at Punta Arenas, emphasized the systematic part of the study. We went intending to assemble a representative collection of seaweeds from the subantarctic shores of Chile. The algae from the region are not well known and are poorly represented in U.S. herbaria.

Many previous collectors passed through the Strait of Magellan on their way to other regions of the world, and they made small collections. In two major antarctic expeditions, Skottsberg spent considerable time in southern Chile, but he pointed out (1923) that the coast of Chile north of the strait, including both the inner and outer channels, had been neglected. One notable party, the Lunds University Chile Expedition of 1948-49, explored this coast, and Levring (1960) published the phycological results, but almost all the collections were from the inner channels and were concentrated in the northern waters near Puerto Montt and Chiloe. No work north or south of the Strait of Magellan had been done along the southern Chilean coast using scuba. Because of the rugged subtidal terrain, scuba diving is far better than dredging for collecting and studying seaweeds in this region.

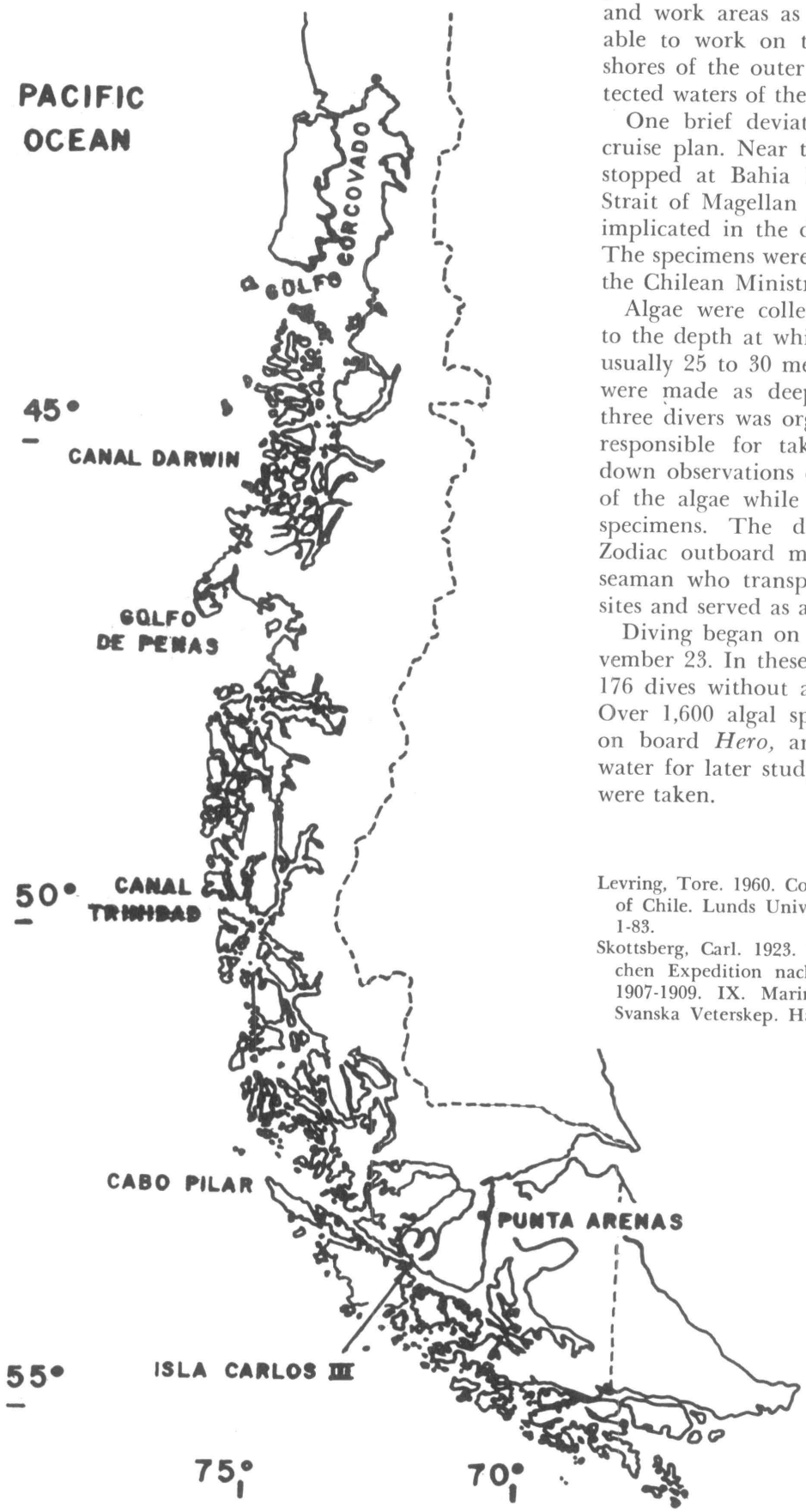
The cruise region chosen for *Hero* (see map) included two study areas in the Strait of Magellan west of the port of Punta Arenas. The first area was in the central part of the strait near Isla Carlos III. The second, abandoned because of foul weather, was at the western end of the strait at Cabo Pilar. Four study areas north of the strait were selected for visits of four or more days: Canal Trinidad, the Gulfo de Penas, Canal Darwin, and the Gulfo Corcovado. Brief stops were made at intermediate

points between these areas. By shifting anchorages and work areas as the weather changed, we were able to work on the exposed, high wave energy shores of the outer coast as well as the more protected waters of the bays and inner channels.

One brief deviation was made from the basic cruise plan. Near the start of the cruise, the ship stopped at Bahia Bell on the south side of the Strait of Magellan to collect specimens of mussels implicated in the deaths of three local fishermen. The specimens were frozen and later turned over to the Chilean Ministry of Agriculture for study.

Algae were collected from the intertidal down to the depth at which they appeared to be absent, usually 25 to 30 meters. Also, reconnaissance dives were made as deep as 40 meters. The team of three divers was organized so that one person was responsible for taking photographs and writing down observations on distribution and abundance of the algae while the other two divers collected specimens. The divers worked from inflatable Zodiac outboard motorboats operated by a *Hero* seaman who transported the divers to the diving sites and served as a tender during the dives.

Diving began on October 27 and ended on November 23. In these 28 days the three divers made 176 dives without accident or dangerous incident. Over 1,600 algal specimens were collected, sorted on board *Hero,* and preserved in formalin seawater for later study. Over 500 underwater photos were taken.



Island archipelagoes of southern Chile visited during Hero Cruise 72-5.

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