

Law of the Sea: Troubled waters

Despite its all-encompassing title, the United Nations Conference on the Law of the Sea has become preoccupied with only a fraction of the vast ocean — the 200-mile-wide “exclusive economic zone” that extends beyond a coastal nation’s shore. In turn, U.S. oceanographers have become preoccupied with what a coastal nation’s control over that zone will mean to oceanographic research. And, judging from a discussion at a recent meeting called “Will We Use the Oceans Wisely—the Next Fifty Years in Oceanography,” such control will mean, at best, cumbersome restrictions; at worst, curtailed research.

Marine scientific research, explains political scientist Edward Miles of the Institute for Marine Studies at the University of Washington, is seen by many developing countries who are negotiating the treaty “to translate into capabilities of ocean use and therefore a significant factor in income distribution.” As a result, he told the meeting at the Woods Hole Oceanographic Institution in Massachusetts, access to the 200 mile zone for the purpose of scientific research has become “a commodity to be traded” in the seven-year-old bargaining. Moreover, he says, support for the cause of unhindered science in the zone has been scant: Only the United States and the Soviet Union carry out ocean research that is both global and organized into programs.

The outcome of the negotiations weighs heavily in favor of the coastal nations, Miles notes. According to the current, still unapproved text, all research conducted within the 200 mile zone requires the consent of the appropriate nation, and that decision is nonreviewable. The country or institution that wishes to do research must provide, six months in advance of the project, complete descriptions of the ship, project, personnel and extent to which the coastal nation will be represented. In addition, the coastal nation is guaranteed a chance to participate in the research at no cost, access to all data and samples as well as all preliminary and final reports and the right to prevent publication of data that pertain to the country’s natural resources.

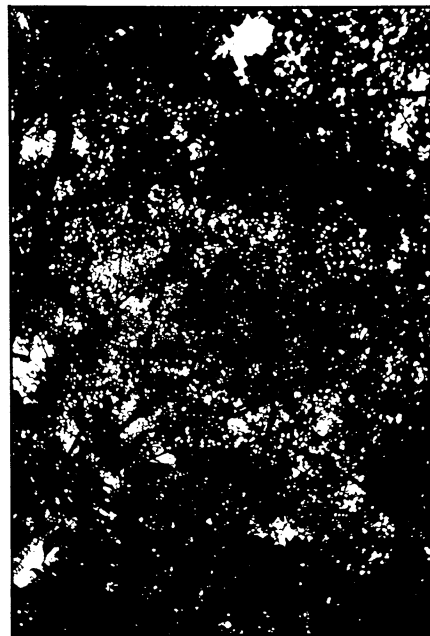
While not entirely unreasonable, the requirements hold the possibility of capricious and serious curtailment of U.S. oceanographic research, says Miles. Many such fears are based on the difficulties that researchers are already encountering. For example, a survey by Warren Wooster of the University of Washington shows that of 407 requests to enter foreign waters for research made between 1972 and 1978, 7 percent were denied and 21 percent of the projects were delayed while waiting for approval. And in the past two years, he says, the percentage of denials has risen from 5 percent per year to 11 percent per

year. Similarly, when researchers asked to take the research submarine *Alvin* (made famous by magazine articles and a television special) into the zone of an unnamed country, officials demanded 25 percent of all net receipts from the sales of pictures, film rights and other profits. Even worse, says Miles, is the cost that meeting such requirements will add to research and the loss—to both nations—of knowledge if such research is denied.

Nevertheless, says Miles, the United

States would only lose if it refused to agree to the requirements: “Other countries would be angry; they would hold the United States hostage to sign it and oceanography would be ground up in it.” The best philosophy, he says, is live with it. “We are moving from an era of relatively simplistic freedom to a new regime of complexity and confusion,” agrees Paul Fye of Woods Hole Oceanographic Institution. “We will learn to live with it and hope to find cooperation.” □

Ants take bearings from leaves



Hölldobler/Science

Primitive ants use a canopy with more conspicuous visual pattern (left) more effectively for homing orientation than a canopy with less conspicuous pattern (right).

The African stink ant finds its way home after foraging excursions by an unexpected method of orientation. It does not use time-compensated sun orientation or patterns of polarized sky light, as do the phylogenetically more advanced ants. Instead, this primitive insect takes a “snapshot picture” of the forest canopy when it leaves the nest exit, says Bert Hölldobler of Harvard University. The ant orients within the coordinate system of the picture and, after foraging 1 to 5 meters, returns precisely to the same exit from which it departed.

Canopy orientation was first detected by observations in the field in which ants were moved off their homing route or had their vision obscured by side or overhead blinds. Hölldobler confirmed this visual orientation behavior with more rigorously controlled laboratory experiments. Part of an ant colony was located at one end of a foraging arena that had termites in the middle and an unoccupied nest at the opposite end. Hölldobler put an artificial sky of black and white patterns above the arena.

When the sky consisted of black stripes reaching only halfway across a white

background or of a photograph of an asymmetric canopy pattern, the ants displayed typical foraging behavior. After leaving the nest, an ant would kill all the termites it could catch, stack three to five termites in its mandibles and return directly to the nest entrance from which it had departed. When Hölldobler rotated the sky 180° while the ants were killing termites, most of the ants, 46 out of 56, “homed” to the opposite side of the arena. Therefore, the visual cues of the canopy were stronger than olfactory or other cues.

Some canopies provide stronger cues than others. Rotation of a “less memorable” pattern, having fewer conspicuous patches of sky, did not affect the homing of most ants. Only 4 out of 21 went to the wrong side. Hölldobler says that in this case the ants used other cues.

“Canopy orientation, which appears to have escaped attention previously, is well suited to the peculiarly restrictive lighting conditions of tropical forests,” Hölldobler proposes in the Oct. 3 *SCIENCE*. “It seems likely to occur in other forest-dwelling insects and perhaps even in some vertebrates.” □