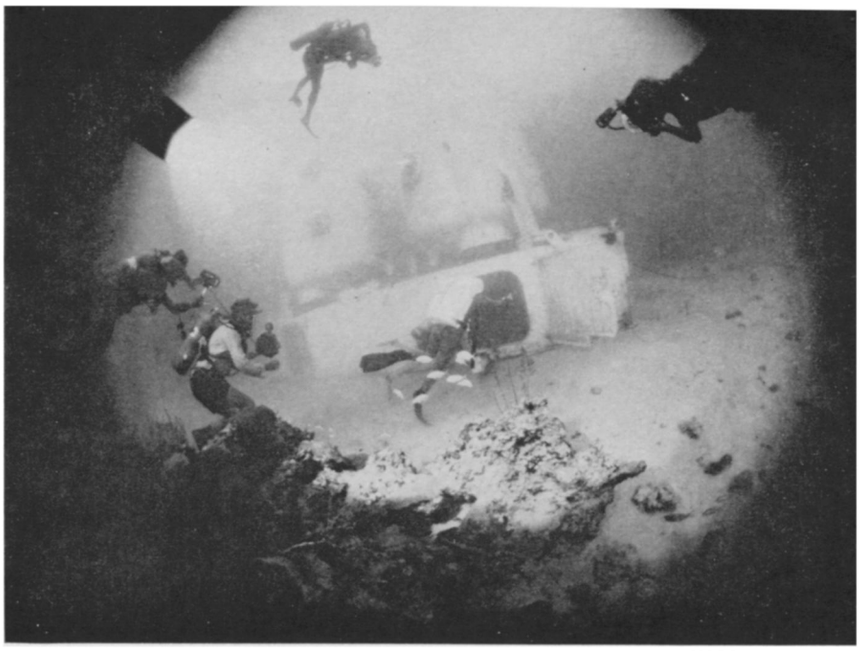
Seeking oneness with the undersea world

The Tektite 2 research project is demonstrating the scientific benefits of a manned habitat



NASA

Tektite 2: Saturation and rebreathers make divers reef residents.

Science advances in two virtually inseparable ways. The first is through the formulation of new theoretical concepts; the second is through increasingly refined technologies for observation. The observations confirm or refute the new concepts; they also provide the basis for yet newer ones.

The marine sciences have been nearly as hampered as nuclear physics in the difficulties involved in making accurate observations. The world below the surface of the oceans has been in many respects inaccessible to man's probing. The invention of a self-contained underwater breathing apparatus was a great advance over earlier hard-hat diving, but Scuba divers remained casual and short-term visitors, aliens still in an underwater world where pressure, cold, nitrogen narcosis and other problems strictly limited man's time and mobility under the water.

The Navy's Sealab experiments (SN: 3/8/69, p. 235) established the feasibility of saturation diving to allow men to work below the surface for long periods from an underwater habitat without having to spend much of their time decompressing after each dive. But Sealab had little scientific emphasis apart from the feasibility of saturation diving itself.

Textite 2 (SN: 8/8, p. 117), the Interior Department's undersea research project in the Virgin Islands (in cooperation with a number of other Federal agencies), scheduled to end in November, has been aimed almost wholly at enabling marine scientists to work for long periods in the underwater environment. Although Tektite has not been an unqualified success, the 40-odd scientists who have lived 50 feet under the sea in the twin cylinders of the Tektite habitat are almost unanimously enthusiastic about the value of such an approach. And they, as well as officials of the program, expressed concern about its continuation at hearings last week before a House oceanography subcommittee.

Dr. Sylvia Earle of the Los Angeles Museum of Natural History, leader of the team of five female aquanauts who occupied the habitat for 20 days this summer, was emphatic in her testimony before the subcommittee: "Tektite 2 divers began to develop the perspective of reef residents," she said. Such a perspective is of inestimable value in scientific observations, she stressed.

John VanDerwalker of the Bureau of Commercial Fisheries, scientific coordinator for Tektite 2, who spent 60 days in the habitat during last year's Tektite 1 project, also emphasized the sense of unity that saturation divers develop with the marine environment when they live in the habitat. But he, as well as Dr. Earle, also stressed more tangible aspects. For example, says VanDerwalker, scientists are well aware of the lethal levels of most pollutants in a marine environment; the dead organisms are clear-cut evidence. But the effects of sublethal levels are far more subtle and often are discernible only through the long-term, around-the-clock observations that become possible from a habitat.

In fact, two recent aquanauts, Dr. Richard Chesher of Westinghouse Marine Laboratories and Dr. Lawrence McCloskey of Woods Hole Oceanographic Institution, report that they have detected heretofore unknown significant reductions of oxygen production by marine organisms from sublethal levels of organophosphates which they applied when they did research from the habitat.

"This kind of baseline information on the effects of pollutants is of great importance and cannot be obtained any other way," says VanDerwalker, who has urged establishment of habitats at strategic points on the continental shelf at points all around the United States and possibly also in the Great Lakes. Such habitats could be used first to establish pollution baselines; then they could become pollution monitoring stations, he suggests.

But this is a practical goal, and others stress the value of the habitats to pure science. For instance, Dr. C. Lavett Smith of the American Museum of Natural History in New York City, who is now living in the habitat, is interested in marine communities, groups of different species of fish that appear to coexist without competition.

Analysis of stomach contents of the fish indicates that different species sometimes have the same diets and thus should be competitive. But they are not, and thus coexistence apparently relies on different feeding habits. Perhaps, says Dr. Smith, one species feeds at night, the other during the day. Or perhaps one feeds off slopes, the other off the horizontal bottom. Such a definition of ecological niches is possible only through the long, continuous observation made feasible by saturation diving.

The observational effectiveness of the Tektite 2 divers has also been greatly enhanced by use of a new General Electric rebreather. Scuba gear emits bubbles which frighten fish and other organisms. Previous rebreathing devices—machines which recirculate used air after carbon dioxide is removed and thus do not emit bubbles—have been hazardous and usable only by experienced and tough divers will-

ing to take the risk. But the new GE machine is fitted with elaborate electronic, as well as manual override, controls which make it virtually foolproof. Thus it can be used by scientists who are not primarily divers; it has amply proven itself on Tektite 2, says VanDerwalker. A further advantage is that the rebreather does not waste the large amounts of oxygen that Scuba does; thus divers can remain in the water far longer with a smaller oxygen supply.

Eventually, says Dr. Keith Cooksey, a University of Miami biochemist who was a surface colleague of members of a recent aquanaut team, marine biologists will be able to take a biome approach (SN: 9/5, p. 204) to marine ecosystems. That is, they will begin to construct mathematical models of all the interactions in the ecosystem, including energy and nutrient flows. Although Dr. Cooksey suggests research submarines may provide the ultimate means for such work, the habitats will also be of great importance.

Useful as the 50-foot habitat has been, it will not make economic sense on any permanent basis until self-contained support systems are developed. A habitat at the 50-foot depth is simply not cost effective, because of the present expense of elaborate surface-support systems; at 50 feet it is cheaper to work from the surface, despite all the drawbacks. But the cost-effectiveness curve rises sharply with greater depths. A 100-foot habitat, called the Minitat, was supposed to have been an important part of Tektite 2 early in the project, but equipment failures delayed its use.

The Minitat will test the assumption from work in hyperbaric chambers that men can breathe air at 100 feet for long periods without nitrogen narcosis.

The Minitat is now scheduled for its first mission in October. This schedule will allow only two, two-man missions before the end of Tektite 2 in November. There is little doubt, say officials, that the Minitat approach will produce greater benefits than it costs. But its limited use will be a major disappointment of Tektite 2.

But despite the delay of the Minitat, the undersea habitat approach has now been amply proven, most scientists believe. The question now concerns the future. This week the National Oceanographic and Atmospheric Agency became a reality as a new division of the Commerce Department. Tektite officials hope Commerce will carry on what they believe to be all-important manned undersea work.

"It is essential," says VanDerwalker, "that we not repeat the error of the past and do to the oceans what we have done to the air and the land. The scientists must get to the oceans before the developers do." □

PORNOGRAPHY REPORT

Once more, into the fray

Social scientists have become increasingly involved in recent years with making judgments and recommendations about major social issues. Their expertise has been called upon to help solve problems of poverty and welfare. Their research has filled a seemingly interminable series of reports on the roots and causes of violence.

This higher profile has brought into public view some of the difficulties involved in interpreting the results of social science research. Nevertheless, criticism of the involvement has been relatively muted, partly because the results have been disseminated in the kind of commission reports that regularly end up unread in dusty archives.

But this week, after more than a month of controversy, leaked excerpts, fulmination in Congress and elsewhere and even legal action, a commission report came out that is destined for more than usual attention. It is the report of the Commission on Obscenity and Pornography, an 874-page document that has all the earmarks of a bestseller. If there is one subject that is interesting enough to keep the reader slogging through hundreds of pages of technical and jargon-filled discussion, it is sex.

The commission was formed and funded two years ago by a Congress concerned with growing permissiveness toward the publication and dissemination of erotic and sexually explicit material—compounded by the mixed state of laws designed to control obscenity. The commission was asked not only to recommend ways of regulating obscenity and pornography but also to study its effect upon the public and its relationship to antisocial behavior. It was also called upon to investigate the scope and distribution of such material and analyze existing laws for controlling it.

The result of two years work and some 60 studies contracted by the commission to consider the behavioral aspects of pornography is a libertarian's dream. Empirical research, says the commission's panel on effects, has shown "no evidence to date that exposure to explicit sexual materials plays a significant role in causing delinquent or criminal behavior among youth or adults." Without that evidence, says a majority of the commission, there is not enough justification for attempting to legislate for adults in the area of obscenity. Thus it recommends that Federal, state and local legislation prohibiting the sale, exhibition, or distribution of sexual materials to consenting adults be repealed. Instead, emphasis should be placed on expanded sex education programs to satisfy in a responsible way the natural interest of adolescents and to bring information to adults as well as children. Such sources can compete successfully, says the commission, with potentially warped and inaccurate information from illegitimate sources.

In the storm of reaction to the commission's majority report, some of it from commission members themselves, two themes of attack have developed. The first one holds that, regardless of whether pornography has anti-social effects, it clearly threatens the moral fiber of the society, the legal defense of which is the duty of the government. The second, more serious for social science if not for the future of pornography, is an attack on the research on effects, and on the interpretations of that research by the commission in reaching its conclusions.

One of the more sensational experiments, for instance, involved exposing male college students to repeated amounts of pornography and measuring their physiological and psychological responses. The repeated exposure, report Drs. James Howard, Clifford Reifler and Myron Liptzin of the University of North Carolina at Chapel Hill, caused decreased interest in it, less response to it and no lasting effect from it.

But other commission-sponsored research, says Dr. Victor B. Cline of the University of Utah, shows that many patrons of sex movies and sex-book shops are regular customers, visiting them monthly or more often. Exposure may be satiating, he says, but obviously the satiation wears off.

The contradiction—there are others—points up one of the troubles of goal-directed behavioral research. The commission, to fulfill its mandate to make recommendations based on research, was forced to sponsor a vast number of short-term studies, put them together and draw conclusions. Normally such a body of data—it will fill 10 volumes to be published later in the fall—would be developed over a decade or more. Naturally, there are both defects and inconsistencies.

The commission recognized the problem. "I would hope there will be more research in this area," says Dr. Cody Wilson, the commission's executive director. "We have done the research on the observational level, and results are really quite consistent. Yet we really don't understand the psychological mechanisms involved in consuming these materials and what kind of function they play in the psycho-social economy of the individual." □