Oxygen changes in the Chesapeake

Since the early 1950s, the portion of the Chesapeake Bay that is anoxic—deficient in dissolved oxygen—for part of each year has increased tenfold, scientists report. They say the anoxic waters are related to changes in the amounts of phosphorous and nitrogen that enter the bay through runoff and sewage effluent, and to changes in the kinds of phytoplankton, or microscopic aquatic plants, that thrive in the bay. These conditions in turn may affect many of the fish that constitute the bay's lucrative commercial fishery.

Charles B. Officer of Dartmouth College in Hanover, N.H., Robert B. Biggs of the University of Delaware in Newark, Jay L. Taft of the Harvard University Herbaria in Cambridge, Mass., and colleagues present their analysis in the Jan. 6 SCIENCE. "It's an incredibly complex ecological web that we're fooling with here," Biggs said. "We can't prove a cause and effect. We can only see a correlation" between the low dissolved oxygen and changes in phytoplankton and in fish in the bay.

The oxygen-depleted waters occur each year from May to September in the central portion of the bay from Baltimore to the mouth of the Potomac. The condition, which involves five billion cubic meters of water, is related partly to the annual spring stratification of water, as fresh water from the Susquehanna River enters the bay, covering the salty bottom layer. The authors note that the layering of fresh and salty water appears to have changed little over the last 50 years. What has changed is the population of the tiny plants at the base of the food chain. Two kinds of phytoplankton — dinoflagellates and green algae — have increased, taking advantage of the abundant nitrogen and phosphorous from runoff and sewage effluent, while diatoms, a third kind of phytoplankton, have declined.

Because the dinoflagellates and algae are less appealing food to fish than diatoms are, the surplus organisms sink to the bay's bottom. As spring approaches, the water temperature rises and the dead organisms decay, a process that requires dissolved oxygen. The living dinoflagellates and algae, which can move to areas where oxygen is abundant, have an advantage over the diatoms, which are less motile and cannot move away from the anoxic water.

The increasing anoxia also affects bottom-living animals such as oysters, clams, worms and crustaceans, which may die when temperature and low oxygen exceed their tolerances, the authors report. The effect may be to eliminate some species and thus reduce the food available to fish and larger crustaceans that feed in the bottom waters.

In conducting their study, the researchers included anecdotal accounts by fishermen who have worked in the bay since World War II. These reports, while subjective, support the authors' hypothesis that many species of aquatic animals now are less plentiful in the bay's deeper waters. Crabs, for instance, which were caught in water as deep as 20 meters as recently as 1965 now often are scarce in water deeper than four meters. Some commercially important finfish species also have declined.

The study is related to the recently completed Environmental Protection Agency (EPA) study of the Chesapeake. The SCIENCE article corroborates the findings of the EPA study, but includes an analysis of the development and biological implications of the increasing body of anoxic water in the bay. —*C. Simon*

The brightest object

Near the north pole of the sky lies the brightest object yet observed. It is a quasar designated S5 0014 + 81. The number is actually the catalog number of a radio source discovered in 1981. In the Dec. 15 ASTROPHYSICAL JOURNAL LETTERS, Helmut Kühr, James W. Liebert, Peter A. Strittmatter and Gary D. Schmidt of the University of Arizona's Steward Observatory in Tucson, Ariz., and Craig Mackay of the Institute of Astronomy in Cambridge, England, report that they have identified it as an optical object, a quasar with a redshift of 3.41.

Study of S5 0014 + 81's visible emissions leads these observers to conclude that it is the most luminous object known, with an intrinsic magnitude about −33. They estimate its energy output in the visible range at 1.2×10^{48} ergs per second. In the radio range it emits about 2×10^{47} ergs per second, comparable to the most luminous radio quasar previously known. The redshift of 3.41, however, means that the object is also one of the farthest known, and its apparent visual magnitude is +16.5, which means that only fairly large telescopes can make it out. It lies at right ascension 0 hours 14 minutes 4.10 seconds and declination +81° 18′28.4″, in the constellation Cepheus. □

Moon sends ICE to comet

Except perhaps in some fiction, the moon is seldom regarded as a threatening body. Even so, the control room at NASA's Goddard Space Flight Center in Maryland was packed with people, waiting to see whether a little space probe heading to pass within 120 kilometers of the lunar surface would survive the attempt.

Only days before the Dec. 22 event, the International Sun-Earth Explorer ISEE-3 had been renamed ICE — the International Cometary Explorer — in honor of its mission to fly through the tail of comet Giacobini-Zinner in 1985. To get there, however, ICE would first have to swing around the moon for a gravity boost, which would mean spending nearly half an hour in the cold darkness of the lunar shadow (SN: 12/17/83, p. 391). Its battery was dead, so the heaters that could keep it from freezing could only work while the probe's solar panels were in sunlight. Five hours before it was due to enter the shadow, the heaters were switched to "high" in hopes of pre-warming the probe so that it would make it through the brief "night." Limited studies had suggested that the plan should work, but now was the first attempt.

With the heaters drawing their maximum power, John Spohr of Goddard turned off most of the probe's other equipment, and within a second of the predicted time, the craft entered the shadow and its transmissions ceased. The time for reemergence into sunlight passed with no renewed signal, but the engineers knew that it would take a few minutes for the craft to warm up to a functioning level. "I was getting a little fidgety there at the end," says Goddard's Robert Farquhar, who had devised the lunar swing-around maneuver. At last, however, a voice from a NASA tracking station in Guam reported that the voice of ICE was being heard.

All was well. And barring unforeseen difficulties, the first-ever flight through a comet's tail is due on Sept. 11, 1985. □

Submillimeter scope

Submillimeter astronomy, a branch of the science that has only recently become active, involves studying celestial objects through electromagnetic radiations they emit in the wavelength range just below one millimeter. With a grant from the National Science Foundation, the largest telescope yet built for the submillimeter range will be installed on Mauna Kea on the island of Hawaii.

The submillimeter range is the transition region between infrared and radio, and a combination of radio and optical techniques has to be used. In particular, reflectors for this range have to be almost as precisely shaped as optical mirrors to ensure proper focusing, and so building a fairly large one is something of an engineering feat. This one is a dish 10.4 meters (34 feet) in diameter. Its surface, made of aluminum honeycomb panels, is accurate to a thousandth of an inch or about a third the diameter of a human hair. The telescope was built at California Institute of Technology in Pasadena according to a design by Robert B. Leighton of Caltech. It is expected to be installed and in operation early in 1986. □