

depths near the Bahamas. From March 13 to 20, ichthyologist C. Lavett Smith of the American Museum of Natural History, and two companions, lived in the 16- by 8-foot habitat to study the microcosm around a coral reef.

Their research concentrated on trying to find how the various members of this crowded ecosystem compete for space. They found that various fish species share complex "schedules" of mating and foraging that permits the reef to support a dense population with minimum conflict. The two closely related species, brown and blue chromis, for example, spawn at different times during the day and thus do not have to waste energy chasing each other away in order to reproduce.

Eventually, Smith hopes these insights will help man understand how to preserve the fragile reef ecosystem and also lead to a better fundamental understanding of species evolution.

Finally, recognizing the growing importance of such research, the University of California at Berkeley has just approved the country's first full-credit "aquanautics" course. Organized by campus diving officer Lloyd Austin, the four-unit course will introduce students to underwater research techniques and teach them the fundamentals of scuba diving. Austin says the course represents a new commitment on the part of the university to further ocean research. □

## Vitamins and the fetus: The benefits of B<sub>12</sub>

Nutrition scientists interested in the well-being of unborn and newly born infants have focused largely on the effects of severe protein deficiencies. They have paid less attention to the effects of vitamin deficiencies. For these reasons Paul M. Newberne and Vernon R. Young of the Department of Nutrition and Food Science at the Massachusetts Institute of Technology decided to study maternal intake of vitamin B<sub>12</sub> during pregnancy and its long-range effects on the newborn.

Vitamin B<sub>12</sub> is one of the vitamins that animals and humans do not manufacture in their bodies but must take in with their foods. It is essential for a number of metabolic roles. It promotes growth in adolescence. It helps cells use DNA, the genetic material of life. It helps various enzymes, particularly liver enzymes, catalyze different reactions. Liver enzymes are one of the body's prime defenses against foreign toxic substances.

Newberne and Young mated rats, then gave some of the females a standard B<sub>12</sub> diet, and others a somewhat higher B<sub>12</sub> diet. Both groups received the same food during pregnancy. After giving birth, all the rats were put on the standard B<sub>12</sub> diet. After their progeny were weaned, they too were given a standard B<sub>12</sub> diet. This way the

researchers were able to measure the effects of a higher maternal intake of B<sub>12</sub> during pregnancy on the fetus, particularly as those effects carry over into the first months of life.

As Newberne and Young report in the March 23 NATURE, they found that a higher maternal intake of B<sub>12</sub> during pregnancy affected birth weight significantly. Pups born to mothers who had received more B<sub>12</sub> weighed more than the other pups, and this greater weight continued during the first year of life. The pups whose mothers had received more B<sub>12</sub> also had more protein per body weight than did the other pups. The animals whose mothers had had more B<sub>12</sub> also showed more active liver enzymes, suggesting they might be better protected against infection. Indeed, the pups whose mothers had received more B<sub>12</sub> experienced lower mortality and more resistance to infection during the first months of life than did pups whose mothers had received less B<sub>12</sub>.

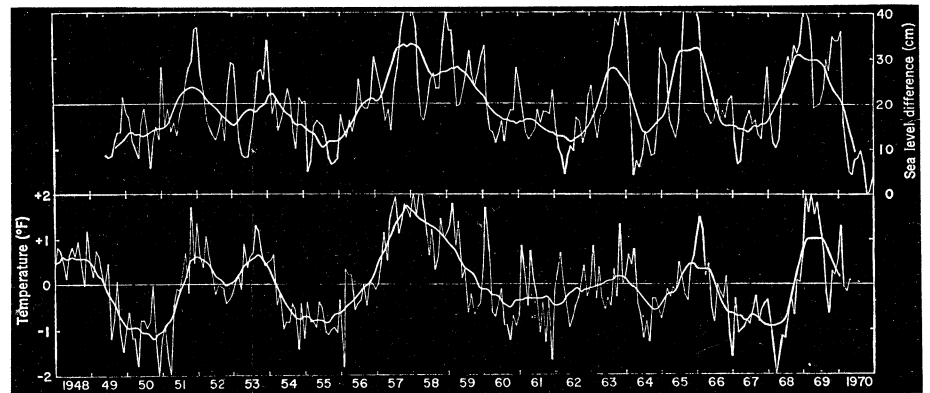
The authors believe that these results might be extrapolated to the human situation. In other words, the B<sub>12</sub> a woman consumes during pregnancy might affect the growth and health of her child, particularly if her vitamin B<sub>12</sub> intake during pregnancy is marginal and her baby is subjected to trauma or disease before or soon after birth. "Questions about many of the unexplained illnesses in children and

## A sea-level warning of El Niño's warming

In the opening months of each year in the north of Peru warm surface waters from the tropical Pacific spread over cooler coastal waters. The phenomenon is called El Niño, because "The Child" (Christ Child) is symbolic of the Christmas season. Periodically, in roughly seven-year cycles, the warm waters extend much farther south, displacing the cold Peru current and causing catastrophic destruction of plankton and fish life. Sea birds die of starvation and the annual guano "crop" fails, causing severe effects on agriculture.

University of Hawaii oceanographer Klaus Wyrтки has been studying the relationship between El Niño and the equatorial countercurrent, which flows eastward across the Pacific Ocean.

He has now shown a strong relationship over a 21-year period between the occurrence and severity of El Niño and variations in the quantity of water transported by the countercurrent, as measured by sea-level fluctuations thousands of miles out into the Pacific. Strong transport by the countercurrent of warm tropical waters from the west-



K. Wyrтки/April 6 Science

Sea-level difference across countercurrent (top) and off-coastal temperatures.

ern and central Pacific causes warm water to accumulate in the eastern tropical Pacific.

He found that coastal waters become warmer about three months after a peak in the countercurrent transport. This means that the countercurrent must be strong for an appreciable period of time before an effect on the surface temperature in the eastern Pacific Ocean becomes evident, says Wyrтки. "It may be possible to use observed sea-level differences to predict temperature trends thousands of kilometers downstream."

Wyrтки inferred the water transport of the countercurrent by means of sea-level gauges along the northern trough of the current at Kwajalein and Truk and along its southern ridge at Christmas Island and Canton Island. At times of peak flow the difference in sea level between the pairs of islands was as much as 30 centimeters greater than normal. "It is significant," says Wyrтки, "that the transport of a major ocean current can be monitored by very simple measurements such as those of sea level." □

the wide variation among individuals in their resistance to disease," the authors declare, "may conceivably be answered by more intensive study of the prenatal nutrient needs of mother and her fetus."

But they caution pregnant women not to dose themselves with large amounts of any vitamin, particularly the B vitamins. Studies have suggested that the 15-odd B vitamins work synergistically, that is, as a complex, and if one B vitamin is consumed in much bigger quantities than the others, the effects can be harmful. □

## White dwarf stars, not black holes?

Among the newest discoveries in X-ray astronomy are the pulsating X-ray sources that are identified with binary star systems. There is a current opinion that at least some of them may be black holes (SN: 1/13/73, p. 28). Another suggestion is now put forth in the March 15 *ASTROPHYSICAL JOURNAL LETTERS* by Kenneth Brecher and Philip Morrison of Massachusetts Institute of Technology. They favor degenerate white dwarf stars.

Brecher and Morrison argue for the superiority of their model on the ground that it predicts more characteristics of the observed systems. It makes a connection between the X-ray pulse period and the orbital period of the binary system, namely, that they are about equal. It permits a calculation of the luminosity of the X-ray source from the angular momentum, mass and magnetic field of the star.

The Brecher-Morrison model also explains the curious phenomenon of spin-up. At least two of the X-ray binaries show pulse rates that increase with time. According to theory this would mean that the source's rotation around its axis was gradually accelerating. The Brecher-Morrison calculation shows that in certain cases of flattened (ellipsoidal shaped) rotating bodies such a spin-up will occur. For rigid bodies like neutron stars (another possible candidate) spin-up will not happen.

Furthermore the model presents no dynamical problems about the existence of degenerate white dwarfs in bound binary systems. To produce a neutron star requires an explosion, which would have blown the binary system apart. Finally there is no need of a black hole even when the X-ray body is so massive that one might expect one, since "for any value of [mass] an equilibrium rotating stellar configuration exists for some value of [angular momentum]." The equilibrium would halt the object's tendency to collapse further and form a black hole. □

## Twice round the world by Boomerang balloon

High-altitude balloons fill a unique niche in space and stratospheric research. Altitudes of 80,000 feet and higher in the earth's atmosphere are too low for most satellites and too high for most aircraft. Besides balloons are much cheaper than either satellites or aircraft. NASA has been putting about a million dollars a year into research and development of balloon materials and techniques to exploit this area.

Now a milestone has been reached. Scientists recovered for the first time last month a balloon scientific payload after a long-duration, twice-around-the-world flight. The project is called Boomerang and is designed to demonstrate the feasibility of using balloons for long-duration research. The project is funded by NASA and managed by the National Scientific Balloon Facility of the National Center for Atmospheric Research.

The first flight was primarily an engineering test, but the balloon carried 90 pounds of scientific instruments to study cosmic rays and the effects of radiation on corn seedlings and other vegetation. The instruments also collected micrometeorite particles. Victor Hopper of the University of Melbourne is now analyzing the results.

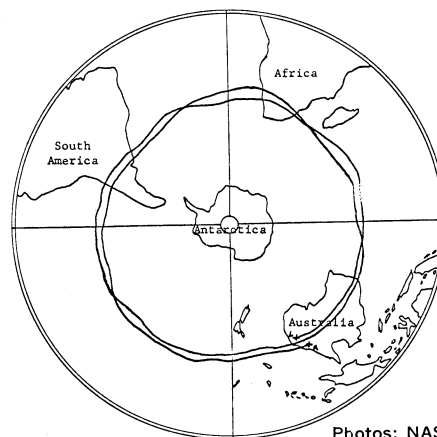
Boomerang I was launched Jan. 24 from an airfield at Oakey, Australia. The balloon made two orbits over Australia, South America and Africa in 36 days and covered 46,000 miles at altitudes of 80,000 feet. Conventional balloons are not capable of orbiting the earth. Boomerangs are. They are super-pressure balloons, 65 feet in diameter, made of bilaminate polyester 0.002 inches thick. They have a tensile strength of 10,000 pounds per square inch and are designed to float their payloads at constant-density altitudes. The ultimate goal of Project Boomerang is to build super-pressure balloons that will orbit at altitudes of 130,000 feet, stay aloft six months, and carry as much as 500 pounds of scientific instruments.

The Boomerangs are king-sized versions of the much smaller GHOST (Global Horizontal Sounding Technique) balloons, developed by Vincent E. Lally's group at NCAR (SN: 4/18/70, p. 393). The GHOST balloons are designed to provide information about atmospheric circulation in the Southern Hemisphere. Although they have stayed up for as long as 441 days and 35 orbits, they carry simple, light-weight payloads that are not recovered.

A second balloon in the Boomerang series was launched only four days after Boomerang I and is still aloft. Long-duration flights in the Southern Hemi-



Boomerang balloon ready for launch.



Photos: NASA

Orbital paths of the 36-day flight.

sphere can be made only during the summer months, December through March. During this time the easterly circulation in the stratosphere follows a pattern known as zonal flow—air at 80,000 feet moves around the globe at a constant latitude, veering neither to the north or south. The winds drop off sharply as the season ends. This is why the second balloon, launched only four days after the first, is taking about a month longer to complete its trip. When it finally finishes its second orbit over Australia later this month, engineers will release its payload by radio command from earth. □

## A problem on ERTS

The video tape recorder aboard the Earth Resources Technology Satellite (SN: 3/31/73, p. 214) has been turned off. The recorder developed sporadic bursts of noise that degraded the recorded images. Images transmitted live are not affected. If the recorder cannot be fixed, ERTS 1 coverage will be restricted to the North and South American continents.

Since its launch in July, ERTS has photographed the entire North American continent more than 10 times. It has also obtained images of all the major land masses on earth at least once. □