Biology

The water's always greener . . .

"Why bother?" This is the question scientists have long asked about the 128 species of fish known to migrate at various times in their life cycles between the ocean and fresh water. Large-scale migrations are generally considered a risky business in biology, with large expenditures of energy required and, in some cases, increased chances of mortality. Moreover, when migrations span fresh- and saltwater environments, fish need to make significant physiological adjustments to cope with the changes in osmotic conditions.

The reason for such persistence, researchers report in the March 11 SCIENCE, may be simple: The fish are hungry.

Scientists at the University of Toronto and at the Ministry of Agriculture and Fisheries in Christchurch, New Zealand, compared data on the global distribution of diadromas fish (fish that migrate between the ocean and fresh water) with patterns of primary productivity in various aquatic environments.

Recent studies have shown that anadromous fish—those that are born in fresh water, spend adulthood in the ocean and return to fresh water only to spawn — are more common in temperate and arctic latitudes. Catadromous fish — those that are born in the ocean, migrate to fresh water and return to the ocean to spawn — are more common in the tropics. The researchers reviewed known measures of aquatic productivity (measured in grams of carbon fixed per square meter per year and considered a good indicator of food availability) and found a strong latitudinal correlation similar to that describing fish migratory patterns. In the tropics, freshwater productivity is much higher than in marine waters, while marine productivity far exceeds that of fresh water in temperate and polar latitudes.

"Such a pattern in aquatic productivity [suggests] that some fishes in temperate latitudes may experience greater foraging opportunities in the oceans than in fresh waters, whereas certain fishes in tropical latitudes have greater foraging opportunities in freshwater habitats," the researchers report. They suggest that the benefits of finding more food, which has been shown to correlate with increased growth and higher egg production, outweigh the risks of the long commute.

Sandfly spit boosts parasite potential

Scientists experimenting with the salivary glands of sandflies are finding that a little spit can go a long way when it comes to enhancing parasitic infectivity. Researchers at Harvard Medical School and the Harvard School of Public Health in Boston report that the tropical sandfly, *Lutzomyia longipalpis*, which transmits through its bite a parasitic disease, has a component in its saliva that boosts the virulence of the parasites it injects into its mammalian victims.

The researchers injected mice with measured doses of the parasite *Leishmania major* with and without sandfly salivary extracts, and compared the sizes of resulting skin ulcers. They found that injections with saliva resulted in sores that were five to 10 times larger than those induced by parasitic organisms alone, and that the saliva-enhanced lesions had as much as 5,000 times more parasites within a month after inoculation.

Moreover, the effect appears to be very specific; while other insect salivas can cause inflammation and a decrease in platelet aggregation in a bitten host, the researchers report that salivary extracts from insects that transmit other parasitic diseases had no effect on lesion size or the final concentration of *Leishmania* organisms.

The mechanism by which sandfly saliva exacerbates leishmaniasis is unknown, the scientists say. The active ingredient is apparently quite potent, however, with as little as one-tenth of a salivary gland, or 50 nanograms of protein, sufficient to produce significant effects.

Biomedicine

Malaria vaccine trials are qualified success

The first vaccine against the disease-causing stages of the malaria parasite induced partial immunity in a small number of human volunteers, scientists report. Using a prototype vaccine made from three synthesized proteins, Manuel Patarroyo and his colleagues at the National University of Colombia and the Central Military Hospital in Bogotá reduced the severity of the disease in 3 of the 5 people who were given the vaccine in the trial, according to a report published in the March 10 NATURE.

Malaria is a major public health problem in developing countries, killing millions each year and causing the death of one-quarter of all children born in central Africa. Because some strains of the parasite have grown resistant to antimalarial drugs, many groups around the world have been searching for a vaccine.

The synthesized proteins in the Colombian vaccine were copies of proteins carried by the malaria parasite *Plasmodium falciparum* during its asexual erythrocyte stages. In these stages, which make up one phase of the parasite's complex life cycle, the organisms can multiply asexually in the host's red blood cells, or erythrocytes, damaging organs and causing fever.

P. falciparum enters the body when a mosquito injects the sporozoite form of the parasite while feeding on blood. The sporozoite travels to the liver and lodges there, emerging seven days later in the first of the asexual erythrocyte forms. While the new vaccine can provide partial protection against the symptoms that result from parasite reproduction in blood cells, it does not protect against the sporozoite form of the parasite. A vaccinated person could still be infected with the sporozoite if bitten by a carrier mosquito, but would not be totally debilitated by disease.

In an article in the same issue of NATURE, malaria researcher Louis Miller of the National Institute of Allergy and Infectious Diseases notes that human trials of vaccines against asexual forms of malaria carry risks for the subjects. Now that the Colombian trials have shown some success, he suggests, researchers should use monkeys to determine if they can improve the vaccine by using other malaria proteins and to test it against other strains of *P. falciparum*.

Advances in dental research, by gum!

A significant amount of adult gum disease may be inherited, according to scientists from the University of Minnesota School of Dentistry in Minneapolis. Preliminary results from a study of 30 pairs of fraternal and identical twins suggest that genetics may account for 50 to 75 percent of chronic adult gum disease. The researchers will continue to gather data from twins reared together and reared apart to learn how genetics and the environment contribute to gum disease. They presented their study, which was done in cooperation with the university's Minnesota Center for Twin and Adoption Research, on March 12 in Montreal at the annual meeting of the International Association for Dental Research.

A new method for detecting gum disease was also described at the Montreal meeting. Successful clinical trials of a temperature probe that rapidly detects gum disease were reported by scientists from the Forsyth Dental Center of Boston and ABIOMED, Inc., of Danvers, Mass. The device is a microprocessor-based probe with a disposable tip that measures gum temperature, correlating minute temperature differences with the presence of gum disease. The researchers predict that the device will enable dentists to detect gum disease before extensive gum damage occurs. The machine also monitored the decrease in gum disease following antibiotic treatment. It will be tested further before being marketed.