

Revising the record of island birds

"The Zoology of Archipelagoes will be well worth examination," wrote Charles Darwin in 1835. He was leaving the Galápagos Islands, consumed by dawning insights into the mechanics of evolution. His studies also were the forerunner of the modern discipline of island biogeography, some established tenets of which are challenged in the Aug. 13 *SCIENCE* by two researchers from the Smithsonian's National Museum of Natural History.

In the book *The Theory of Island Biogeography* (Princeton Univ. Pr., 1967), Robert H. MacArthur and Edward O. Wilson advanced an approach to the study of diversity and distribution of species on islands. Their theory describes a relationship between the numbers of species of a given life form on an island and the area of the island. The series of formulas they present has been incorporated widely into research on island biogeography. However, in the recent *SCIENCE* article Storrs L. Olson and Helen F. James suggest that the formulas do not apply to the populations of birds known on the Hawaiian Islands or, possibly, on other islands.

The problem stems from a misperception about the available data. It has been assumed that in 1778, when Europeans arrived on the islands and began keeping records, they were observing the full complement of species of native birds. Excavations over the last 10 years, however, show that the populations of birds already had been decimated by Polynesians who colonized the islands by A.D. 600.

"There is a deep-rooted assumption among scientists that prehistoric peoples did not have the devastating effect on their environments that modern peoples do," James says. "The effect of their settlements was thought to be fairly benign." Thus, the scientists were surprised when their excavations of thousands of fossil birds showed that more than half of the Hawaiian bird species became extinct in response to early clearing of lowland habitats and, to a lesser extent, predation by prehistoric man. The extinction rate accelerated with the arrival of Western man, James says. Up to one-third of the species present at that time have disappeared.

In general, extinction rates on islands are higher than those on continents but the rates on Hawaii are "exceptionally high," she notes. The percentage of extinct species may be even greater than currently thought because the fossil record still is incomplete. The number of species known on the islands from the beginning of recorded time may be as few as a third the number of species native to the islands before humans arrived.

Olson and James also find that the bird species once were distributed more widely than they were when record-keep-



On Oahu, researchers excavate fossil birds and artifacts of Polynesian culture. Inset: An owl pellet found on Kauai reveals fossils of three finch species, two extinct, one surviving. The pellets are a means used by owls to regurgitate indigestible matter.

ing began. For example, fossil deposits on other Hawaiian islands offer evidence of identical or closely allied species thought to populate only the Hawaiian leeward islands or the island of Hawaii.

The implications of the fossil record are significant because data on historically known birds on the islands corroborated

the theory that the number of bird species on an island is in equilibrium: the islands are saturated with bird species; they could not hold any more. If the Polynesians caused so many species to become extinct, James says, existing assumptions are not addressing a "natural condition."

—C. Simon

Benzene study: Under-the-table changes?

Rep. David R. Obey (D-Wisc.) last week charged that pressure from industry may be responsible for the recent modification of an international scientific panel's report on the hazards of benzene. The alteration resulted in a toned-down estimate of the risk of exposure to benzene, a cancer-causing major raw material of the chemical industry. That modified estimate, Obey said, could affect multimillion dollar lawsuits filed by cancer victims (who were exposed to benzene in the workplace) against their employers.

About 12 billion pounds of benzene (C_6H_6) are produced annually in the United States for use as a solvent, as a starting material or intermediate in the synthesis of various materials and as a gasoline additive. Several studies have shown benzene to be a carcinogen in rats and have indicated a relationship between workplace exposure to benzene and increased incidence of leukemia in humans.

Precisely what degree of cancer risk is posed at different levels of exposures to benzene is still a matter of debate; and part of the task of a group of 16 cancer researchers who were brought together last fall by the International Agency for Research on Cancer was to discuss this very issue.

After members of this IARC panel reviewed available data on benzene, they estimated that a minimum of 17 to 170 workplace-related leukemia deaths can be expected among 1,000 workers exposed over a working lifetime to an average airborne level of benzene ranging from 10 parts per million to 100 ppm, respectively. That estimate was in the panel's original report. The final document, which was released by IARC without the panel's approval, ex-

cluded reference to the 17 excess deaths associated with the 10 ppm exposure level — the Current Occupational Safety and Health Administration workplace limit. Rather, it stated, "Minimum estimates of 140 to 170 excess leukemia deaths per 1,000 workers exposed over a working lifetime were calculated for an exposure level of 100 ppm."

Obey and his staff launched an investigation of this benzene-report alteration after he obtained a company's internal memo that smacked of industry involvement in the incident. The memo, written by Curtis Smith of the Shell Oil Co. in Houston, Tex., states that members of the Chemical Manufacturers Association were to meet with officials of the National Cancer Institute — which contributes funds to the IARC budget — to raise their concerns about the "IARC risk assessment of benzene." It was hoped, the memo goes on to state, that NCI officials would in turn discuss these concerns with IARC.

Spokespersons from both Shell Oil Co., CMA and NCI acknowledge that representatives of their organizations met with each other, but maintain that the purpose of those meetings was to discuss IARC risk assessment in general, not to alter that agency's benzene report. Nonetheless, says Obey, he finds "it difficult to believe that the extraordinary steps taken by IARC staff in altering the findings of a scientific panel" were not at least partly due to pressure from NCI officials who in turn may have been pressured by industry representatives at those meetings. Later this month, Obey will present a detailed report of his staff's investigation to the House Appropriations Committee, which allocates funds for NCI.

—L. Garmon