

The use of quicklime for controlling *Acanthaster* must depend on the ability of coral polyps and other soft-bodied reef organisms to remove quicklime effectively from their bodies by mucus secretion or other mechanisms. I agree with North and Pearse that preliminary experiments need to be undertaken to determine the effects of quicklime on inhabitants of coral reefs. Quicklime may prove more serious to the ecosystem than the predacious *Acanthaster*.

RICHARD L. TURNER

Department of Zoology,
University of Maine, Orono 04473

References and Notes

1. W. J. North and J. S. Pearse, *Science* 167, 209 (1970).
2. V. L. Loosanoff and J. B. Engle, *U.S. Fish Wildlife Serv. Res. Rep. No. 2* (1942).
3. W. J. North, *Inst. Marine Resources Univ. Calif. IMR Reference 63-13* (1963).
4. V. L. Loosanoff, *U.S. Fish Wildlife Serv. Fish. Leaflet No. 535* (1962).
5. Experimentally, 313 and 940 kg per hectare have been used (2). I used 313 and 626 kg per hectare on *Mya* (five specimens at each concentration), and 447 and 895 kg per hectare on *C. frondosa* (12 specimens each). Particle size has also varied from powdered lime to coarse grades of particle diameter 0.5 to 5.0 cm (2). I used powdered reagent-grade lime.

2 February 1970

Initiation of the Breakdown to Turbulence

The review paper on clear air turbulence by Dutton and Panofsky (1) makes me wonder if I have been looking at another part of the same "elephant" (2). This part comprises the temporal course of winds, temperatures, and their vertical gradients as measured on towers, mostly in elevated layers near the ground, and especially during the hours following sunrise. On some fair mornings when the wind is not too strong, the transition to turbulence can be quite abrupt, as is seen in the record of wind-direction fluctuations. From the sequence of changes in gradients preceding these abrupt onsets, a process is hypothesized, termed "local shear destabilization," to explain the initiation of the breakdown to turbulence, in which relatively rapid enhancement of stability is a significant early event.

It might be useful to give more attention in studies of clear air turbulence to relative temporal sequences of flow parameters during internal frontogenesis. While the necessary measurements are difficult (but should be attempted) in the atmosphere at altitudes

at which clear air turbulence occurs, they are not so difficult near the ground, where flow patterns can also be made visible at selected times and heights.

R. C. WANTA

28 Hayden Lane,
Bedford, Massachusetts 01730

References

1. J. A. Dutton and H. A. Panofsky, *Science* 167, 937 (1970).
2. R. C. Wanta, *J. Geophys. Res.* 74, 5536 (1969).
9 March 1970

Birth Control for Economic Development?

Enke (1) proposes one "economic-demographic method of assessing what reduced human fertility might contribute to increased economic development." His proposal is based on a function that relates national output (V) to employed workers (N), capital stock (K), and improving technology (t). This function, when applied to an imaginary nation called Developa with a population of 10 million and an income per head of \$150 in 1970, yields two tables in which certain economic indices—the income per head, unemployment rate, savings from income and others—for the years 1985, 1989, and 2000 in situations of high fertility and low fertility are compared.

In the text certain assumptions are made; it is stated, "These various estimates are only suggestive. Their exact magnitudes are unimportant. What is significant is that combinations of alternative parameters indicate that declining fertility rates do contribute to economic welfare. . . . Twice as much labor and capital will not double output if there is a scarcity of equally useful land. . . . Conversely, a slowing rate of population growth accords more economic benefits than a slow growth rate. . . . Fewer children per family give each family member more potential consumption from the same family income. But actual consumption should rise less than the potential consumption. The difference is 'released' for investment."

From these statements and an economic-demographic model the author leapfrogs to a general conclusion that "Enough is known about the main parameters that a demographic-economic computer model can be used to assess the effects of declining fertility rates

on various indices of economic welfare in a typical less-developed country." He finally concludes that "the benefit to cost ratio [of] 80 to 1" is possible when a birth-control program is adopted for a less-developed country, inducing the reader to believe that governments should encourage contraception.

It is misleading to take a somewhat simple function of economic indices of developed countries and apply it to underdeveloped countries with very low income, as if the indices and ratios could be used without any further consideration.

1) The function considers only employed workers (N); it is a well-known fact in underdeveloped countries that employed workers are a fraction of the total labor force and that the major part of the workers in rural areas are not included in labor-force statistics. This might be overlooked in a hypothetical model but leads to another gap in the economic consideration of per capita income. A large part of the family income in underdeveloped countries is obtained as food provided directly from the land and consumed by the family. Thus it is not registered as cash economy, and the more the country is underdeveloped, the more highly distorted are the statistics.

2) The distortion of economic statistics adopted in the model becomes clear when one considers that in South America there is no country with a \$150 per capita income (the lowest is Bolivia with \$165). If there were such a country, there would be no family savings; it is unbelievable that this low income has any significance as a means for a person to feed, clothe, and shelter himself, if he had to pay for it. In other words, it is meaningless to speak of \$150 per capita income or of \$75 as a poverty index, and of saving income in such conditions.

3) Certain indices of development may only be obtained within a satisfactory population concentration. For instance, there is no return on investment on highways, communications systems, community electric systems, or services for water and sewage in a country where population density is below, say, five inhabitants per square kilometer and where no urban concentrations of a sufficient size allow economic concentration. Also, it is impossible to compare the trade of commodities representing economic activity

Science

Initiation of the Breakdown to Turbulence

R. C. Wanta

Science **168** (3931), 607.
DOI: 10.1126/science.168.3931.607

ARTICLE TOOLS <http://science.sciencemag.org/content/168/3931/607.1.citation>

PERMISSIONS <http://www.sciencemag.org/help/reprints-and-permissions>

Use of this article is subject to the [Terms of Service](#)

Science (print ISSN 0036-8075; online ISSN 1095-9203) is published by the American Association for the Advancement of Science, 1200 New York Avenue NW, Washington, DC 20005. The title *Science* is a registered trademark of AAAS.

Copyright © 1970 The Authors, some rights reserved; exclusive licensee American Association for the Advancement of Science. No claim to original U.S. Government Works.