Letters

When Caribbean and Pacific Waters Mix

In addition to Rubinoff's article (30 Aug., p. 857), the letter from John C. Briggs (1 Nov.) makes it even more important to describe the bioenvironmental studies that are being sought in connection with the sea-level canal investigation and certain factors that would tend to mitigate alarm over the biological consequences of linking the oceans.

Rubinoff leaves the unfortunate impression that little or no consideration is yet being given to the possible biological effects of an isthmian sea-level canal. To the contrary, our engineers have worked with the Smithsonian Institution in the development of recommendations for long-term bioenvironmental studies. In addition, the Commission is seeking the advice of the Marine Sciences Council and the Bureau of Fisheries of the Department of the Interior. If construction of a sea-level canal is recommended in the Commission's final report in 1970, it would still be 12 to 15 years more before such a canal could be completed. The ecological studies that we hope to see accomplished through 1970 should give us some measure of the possible biological consequences of linking the oceans. At the very least, they will provide a sound basis for developing a long-range program for consideration along with the Canal Commission's final recommendations.

Our engineers assure me that Rubinoff's reference to the possibility of a large inflow of warm Caribbean water into the Pacific through a sea-level canal is erroneous. . . . Although Pacific tides vary as much as 10 feet above and below Caribbean levels, mean levels differ less than 1 foot. The shortest canal route under study is about 40 miles long. Tidal currents in the canal would average no more than 3 miles an hour and would reverse direction every 6 hours. Thus, it appears impossible for a large amount of Caribbean water to reach the Pacific through such a canal. Possibly, density currents and turbulence in the canal will mix Caribbean and Pacific water throughout the channel, but the net northward movement of the water in the canal would always keep Pacific water predominant throughout most of its length. The Commission is also considering the merits of tidal regulating structures. Should they be used, there would be no great flow between the oceans in either direction.

Neither Rubinoff nor Briggs attempt to evaluate the transfer of marine life through the existing lock canal. In its 54 years of operation there have been and continue to be extensive transfers by three distinct means. First, swimming and drifting biota that thrive in both salt and fresh water readily pass through the locks and inevitably make their way across Gatun and Miraflores Lakes to the opposite oceans. Some have been specifically identified as having followed this path. Second, barnacles and similar clinging organisms pass in both directions every day on the hulls of ships. Third, and perhaps most important to the question of the biological impact of linking the oceans, is the daily transfer of fairly large amounts of salt water in ships' ballast tanks. This has gone on for more than a half century. Lightly loaded or empty ships approaching the canal are frequently required to take on ballast water before entering the locks. This is to deepen their drafts to make them easier to handle while in restricted canal channels. As a usual practice on leaving the canal a few hours later at the opposite ocean, this ballast water is discharged to lighten the ships to save fuel on the remainder of the trip. Thus, all the small swimming and drifting marine life, that would be found in these thousands of samples of sea water taken year in and year out since 1914, have made the trip across the isthmus in salt water in both directions. While a sea-level, salt-water channel between the oceans would vastly augment the movements of marine creatures between the oceans, the new avenue would appear to offer previously denied passage for only that portion of ocean life that could not transit by one or more of the three existing means. Some segments of the total spectra of biota in the two oceans have surely crossed the isthmus to the opposite ocean during the past half century and continue to do so daily. It follows that a large portion of the small swimming, drifting, and clinging creatures on both sides of the isthmus have long been exposed to inoculations of the same category from the opposite ocean. To date, no discernible effects have resulted. It seems reasonable to conclude that a sea-level canal would create little or no new threat to the lower links of the ocean food chain. New exposures would be limited to the larger swimming and drifting biota. Thus the area of danger of harmful biological changes when the oceans are joined is much less broad than it first appears.

The Canal Study Commission very much wants an objective evaluation of the possible biological effects of linking the oceans. We are optimistic that our joint efforts with the Smithsonian, the Department of the Interior, the Marine Sciences Council, and others will insure that such an evaluation is accomplished.

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It has come to my attention that Fig. 3, "Comparison of Balboa (Pacific) and Cristobal (Atlantic) tides," in my article may have led to some misleading conclusions about the amount of interoceanic flow of water which might result from a sea-level canal. For simplicity, the Atlantic and Pacific data were drawn from an abscissa of 0 feet, whereas, to be more truly representative, the two curves could have been adjusted for mean sea level which in this region differ between Atlantic and Pacific by about 1 foot. The maximum difference between Atlantic and Pacific tidal amplitude is therefore about 10 feet and not approximately 20 feet as may be inferred from the graph. Since the tide on the Pacific will be changing regularly every 6 hours the flow in a 50-mile-long canal may be relatively slow. It is unlikely that any large volumes of water will be exchanged, although it will, of course, be possible for certain marine organisms to swim back and forth.

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