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Work done at the Smithsonian Tropical Research Institute indicates sea snakes would proliferate in the Caribbean.

# Consequences of a sea-level canal

**A new study of sea snakes reinforces ecologists' concerns about the proposed canal**

by Richard H. Gilluly

Little is known of the possible ecological consequences of a sea-level canal across the isthmus connecting North and South America, and engineers tend to believe that because there is no evidence of possible ecological harm, none would ensue. The recent report of the Atlantic-Pacific Inter-oceanic Canal Study Commission (SN: 12/12, p. 445) devotes four pages to environmental questions and tends to pooh-pooh any possible dangers.

**Ecologists** are not nearly so sanguine. They point out the reason there is no evidence of possible harm is that studies have not been done. Dr. Howard L. Sanders of the Woods Hole Oceanographic Institution, Woods Hole, Mass., is disturbed about "apparent discrepancies in emphasis" between the commission report and findings of a National Academy of Sciences committee on the canal (SN: 4/11, p. 364). "There are thousands of possibilities of mixing of similar species from Atlantic and Pacific sides," he says. The results, he adds, are unpredictable and could be serious. Dr. Sanders and others, therefore, urge that if a canal is to be dug a foolproof-as-possible biological lock—preferably of heated fresh water—be incorporated and that the most thorough studies possible be done prior to construction.

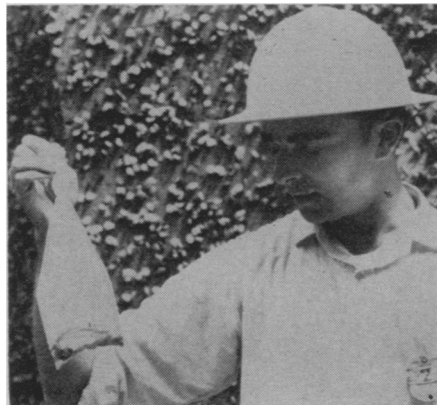
Although there has been little research to date on the ecological effects of the proposed canal, Drs. Ira Rubinoff and Chaim N. Kropach of the Smithsonian Tropical Research Institute in Balboa, Canal Zone, recently completed a study of *Pelamis platurus*, the highly venomous black and yellow sea snake that now inhabits the eastern Pacific

(SN: 12/5/68, p. 579). They conclude that if the sea snake got into the Atlantic, it would at first be attacked by Atlantic predators. But then these predators would evolve avoidance mechanisms and the snake would spread throughout the Caribbean.

Such an event could be disastrous to the tourist industry, says Dr. Sanders. Even if the sluggish and fairly nonaggressive snake did not attack humans—it generally does not in the Pacific—its psychological effect could be formidable.

Drs. Rubinoff and Kropach reported on their work in the Dec. 26 NATURE. The two researchers used tanks to expose the snakes to predators from the Atlantic and Pacific sides. The Pacific predators served as controls to measure how the behavior of the Atlantic predators, even though sometimes of the same species as the Pacific ones, differed.

The Pacific predators almost uni-



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Dr. Rubinoff: A high selection rate.

versally refused to prey on the sea snakes, even to the extent of starving if no other food was available. "On one occasion," the researchers report, "a snapper which had become conditioned to seize live food thrown from the surface ingested a snake as it hit the water, before it could have seen or smelt the snake below the surface. It immediately spat out the snake and paid no further attention to it."

Such avoidance mechanisms apparently evolved, they say, in the 2 million or 3 million years since the rise of the Panamanian Isthmus, at about which time the sea snake arrived in the eastern Pacific from the west Pacific. The reasons for the evolution of the mechanism became clear when the unadapted Atlantic predators were exposed to the snake.

**The Atlantic predators** approached the snakes without hesitation, and the more aggressive ones attacked. A snapper swallowed one of the snakes tail first, and just before it was completely swallowed, the snake bit the fish under the eye. The fish died 20 minutes later. One fish ate two snakes with apparent impunity, but died an hour later—apparently the victim of an internal bite. The snakes were regurgitated, and they survived. The researchers suggest that the extreme toxicity of the snake's venom may have evolved just so this would happen—to the predators, in their death throes, would regurgitate the snakes quickly before the snakes had been seriously hurt.

Predators often are encouraged to attack by observing other predators. But, say the two researchers, the avoidance mechanism in the Pacific predators



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*Fish tanks: Atlantic predators had fatal encounters with the sea snakes.*

is so strong that when sea snakes were offered to Atlantic and Pacific predators together, attacks by the Atlantic predators left the Pacific ones as indifferent as ever.

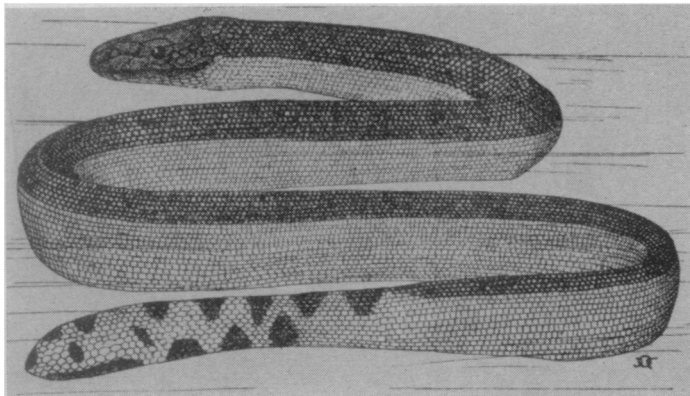
There are apparently visual, olfactory and gustatory aspects to the avoidance of the snakes by the Pacific predators. There are variations in the black, yellow and brown patterns of the sea snakes, but whether or not the variations are great enough to confuse predators, olfactory and gustatory clues seem to serve just as well. Pacific nurse sharks, for example, refused to have anything to do with *Pelamis platurus*, even when the snakes were wrapped inside the mantles of squid. Other predators refused the snake skinned, or with its markings greatly altered with marking pens.

Of 35 attacks by Atlantic predators on the sea snakes in the trials by Drs. Rubinoff and Kropach, there were three predator deaths. The two researchers say that just one fatality of 22 ingestions of sea snakes would be

a very high selection rate, and avoidance reactions would develop quickly in the Atlantic predators. Then, because other conditions in the Caribbean are similar to those in the Pacific, there would be no obstacle to the spreading of the snake.

Dr. Sanders says the findings of the Smithsonian researchers appear to be valid. He adds that the snake is sluggish and generally stays well off shore in the Pacific, feeding from windrows, lines of biological activity in oceans. But storms sometimes blow the snakes ashore. There is no reason why they would not also be blown to the shores of the numerous Caribbean islands, he says. Many of these islands rely almost entirely on the tourist industry.

Dr. Sanders emphasizes that the possible proliferation of the venomous sea snakes in the Caribbean is only a single adverse possibility among many in the building of a sea-level canal. Studies of these numerous other possibilities should be made before the canal is built, he emphasizes. □



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*Pelamis platurus: Highly toxic venom is an adaptation against predators.*

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