

museum and interpretive programs within the area. Fishing is a major activity within this recreational area and fishermen will benefit from the project findings, also.

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## DISCUSSION

### Caribbean and General Session

Discussion Leader: PAUL E. THOMPSON  
Discussion Panel: ERNEST HESS, W. D. HEYDECKER  
JOHN GEHRINGER, DURBIN TABB

### The Recreational Potentials of the Marine Fisheries

DANIEL JANZEN

- Q. Tabb: Could you comment on the possible hazards of pesticides on marine fisheries?
- A. Janzen: This question of pesticides is bothering us more and more every day; in the last six months we have been getting very worried. You all know about the fire ant control program here in the South. That has focused attention on the problem. But we had an indication during the past two years that we were dealing with a sort of Frankenstein, such as we have in the case of radioactivity. Pesticides are accumulating in the bodies of warm blooded animals or in their food and it is having an effect on reproduction. What it is going to do to marine sports fisheries, I don't know, but I expect it will be very serious. The need for pesticide research is very great.
- Q. Hess: In your work do you come in conflict with commercial fisheries?
- A. Janzen: The philosophy of those supporting the commercial fishery program and those supporting the recreational program are quite different but the biology of the fish is the same. The habitat for both is the same, too, and the most important thing is to save that habitat.
- Q. Heydecker: Is it not time to make some effort to find a common basis for a comparison of the economic value of fish caught by anglers with the economic value of fish caught by commercial fishermen? Such value of the commercial fishery has been computed customarily on the basis of the market value of the fish when landed, but in the determination of the value of the sport fishery, all the ancilliary factors of expenditures by anglers for travel, lodging, meals, tackle and bait, etc., have been brought into the picture. Therefore, the comparisons have not been on the same basis. Would you consider this a useful area of research?

- A. Janzen: Yes, I certainly would. The basic philosophy determining the value of recreational fish and wildlife has been that it is worth what the public is willing to pay for it. If the commercial fishermen haven't taken that viewpoint in their computation of the value of the fish, then they should.
- Q. Brady: How much of the Dingle-Johnson money has gone into research for marine sport fisheries?
- A. Janzen: The Dingle-Johnson program is financed with the excise tax on sport tackle. There are 22 D-J projects in eleven states, and in Alaska, Hawaii, Guam, Puerto Rico, the Virgin Islands, aimed wholly or partly at marine sport fishing. The total cost of the salt water projects is \$388,000 as of October 15, 1958. The total cost of the D-J Fish Research Program of all kinds is a little over \$3,000,000, so that about 12 per cent of the D-J money is going into salt water marine fish research.
- Q. Howard: How much of the Dingle-Johnson money comes from the sale of salt water fishing gear and how much from fresh water fishing gear? I am under the impression that a very large proportion of the funds come from tackle sold to salt water fishermen and yet only 12 per cent goes to salt water research.
- A. Janzen: The state conservation departments plan and carry out the projects, and they have to pay 25 per cent of it; they finance the whole thing and we pay back 75 per cent of the cost. It is probably natural that if a state does not have salt water angling licenses it will be reluctant to put fresh water angling receipts into marine fisheries research, unless they are very broadminded and looking to the future.

## **Canning Tuna in Puerto Rico**

ROLF JUHL

- Q. Tabb: Where do the fish come from which are canned in the Ponce area?
- A. Juhl: Surface-caught tuna come from the Pacific, but the Japanese are catching some by long-line in the Atlantic and Caribbean. About 30 per cent of our fish comes from the latter source and we would like to develop a tuna fishery in the Caribbean and tropical Atlantic. We have at the present time one ship fishing off Africa, which has been fishing for a month and a half and has close to 200 tons aboard. This is good news because it is the first U. S. ship that has gone there to fish. Undoubtedly if the trip is successful more boats will go there when the season is poor in the Pacific.
- Q. Gehringer: Why do you bring tuna from the Pacific to Ponce instead of to San Diego?
- A. Juhl: There are three reasons. It is about 3,000 miles from the fishing areas to San Diego and it is only about 1,200 miles to Puerto Rico. Transportation of the finished product from

Puerto Rico to the East and Gulf states is cheaper than by rail from California to the East and Gulf states. Finally, labor costs are lower in Ponce.

- Q. Mather: Do you expect a major shift of the tuna industry from California to Puerto Rico?
- A. Juhl: A large company from the West Coast has been looking over the island for a possible cannery site. If they move, some other canners from the West Coast might set up a base there.
- Q. Mather: What species of tuna are brought in to your cannery?
- A. Juhl: We have two species, the skipjack and the yellowfin. Sometimes the Japanese bring in some bigeye tuna, but these generally are too large for packing. They are also undesirable because of their color, which varies from pale green to orange, and sometimes tan and brown.
- Q. Whiteleather: How many tuna clippers are there operating from your plant, and are there any local plant boats at Ponce?
- A. Juhl: We have ten clippers, and six of these are the largest in the entire fleet. There is no local fishing boat unloading in Puerto Rico. Tuna fishing boats are quite elaborate, and the fisheries in the Caribbean would have to develop considerably to make it feasible for the local fishermen to catch tuna. One of the important factors in a tuna fishery is availability of bait. The islands are poor as baiting areas. The bait requirements of long-line fishing are less severe, but they would still need a costly boat.
- Q. Zaneveld: Can you tell us something more about the Japanese operation?
- A. Juhl: They started developing the long-line fishery in the Pacific. When their catches in the Pacific declined they extended their operation to the Indian Ocean. Now they are in the Atlantic, where I believe they have twenty boats. Until recently they had two boats in the Caribbean; now they might have more.

## Laboratory Experiments in Raising Tilapia in Salt Water

JACQUES S. ZANEVELD

- Q. Tabb: In these areas where you are contemplating introducing *Tilapia* are there not native species which might be equally acceptable as food?
- A. Zaneveld: None of the native fish, for example, the white mullet, *Mugil curema*, and the grey mojarra, *Gerres cinereus*, reproduce as rapidly as *Tilapia* does.
- Iversen:  
(Comment) It might be of interest that the U. S. Fish and Wildlife Service, Pacific Oceanic Fishery Investigations at Honolulu, have found the *Tilapia mossambica* to be quite good as tuna bait. There is a problem in the islands of obtaining sufficient native bait for skipjack fishing. Recent tests on commercial vessels have shown that *Tilapia* possesses sufficient de-

sirable qualities as a bait fish to suggest that this species may supplement the supply of wild bait.

## **Ecological Diagnosis of a Species and the Problem of Biological Constants**

G. L. KESTEVEN, HORACIO ROSA, JR. AND S. J. HOLT

- Q. Gehringer: Taxonomists use morphology predominantly in the descriptions. Will it not take a very long time before we have enough ecological information on which to base a species description?
- A. Rosa: For some species probably it will; however, for some others, particularly from the north Atlantic, there is considerable data, which may be sufficient for a biological diagnosis of the species. The morphological concept is basic and it is necessary. But by adding a biological diagnosis, even if the species can change from environment to environment, in size or in other factors, we may be able to establish limits for the range of these changes.
- Q. Rac: Dr. Rosa has left with us a stimulating idea which I am sure we will all want to think about a good deal, particularly after we can study his suggestions in more detail. But at first thought, I am left with the impression that ecological diagnosis is rather the end point than the means to the end; one may have to know all the facts before it can be meaningful. For example, for comparing the plaice and the flounder, I believe the following criteria were proposed: geographical limits, habitat, reproductive habit and life span. Now, it might be suggested that all these, to a greater or lesser degree, are influenced by fishing pressure in an area like the North Sea. Thus, man-made changes such as the intensity of fishing, the type of gear used, etc. will vary the diagnostic criteria and so the definition of the species. In a case of this sort, one may be categorising the economy of a fishery rather than any natural attributes of the fish.
- A. Rosa: That may be, but I wonder if the fisheries will completely change the biology of the species. It may be, however, that we will have to change the definition, but this in itself will be valuable data for the understanding of the biological changes caused by stress of fishing.

## **Research and Interpretation of Marine Areas of the National Park Service**

ORTHELLO WALLIS

- Q. Whiteleather: You have a problem of water in the National Park, and we are also concerned with this in connection with commercial fishery nursery grounds. It appears that there is

considerably more water needed in the Park than they have at the present time.

- A. Wallis: This is one of the major problems confronting us in Everglades National Park. It must be solved before it is too late.

### **Experimental Trawling for Red Snapper**

WARREN RATHJEN

- Q. Gehringer: Does the gear necessary for this type of trawling require any modification of the shrimp vessels so that they could be used for snapper fishing in the off season?
- A. Higman: Yes, modifications would be required. For example, the replacement of standard shrimp rigging with the fore and aft gallows frames and a new winch were the only modifications required to successfully convert a St. Augustine type shrimp trawler to fish trawling in the New England area. The changes necessary would not be too expensive. The present system used by the shrimp vessels involves two outboard booms butted directly on the mainmast and this arrangement is not sufficiently sturdy for snapper trawling.
- Q. Hess: What proportion of your catches were of red snappers compared with less desirable species?
- A. Bullis: The best snapper fishing areas generally produce very clean catches of snapper. The principal saleable fish caught with them is grouper.
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