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THE SHRIMP FISHERY IN NORTH CAROLINA CONSIDERED IN TERMS OF PRODUCTIVITY POTENTIALITIES

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That the production of a given species is but a link and often an end point in a complex production system, is an axiom well known to ecologists and prominent in discussions of fisheries theory. It is therefore evident that many fisheries questions cannot be analyzed without considering the dynamics of the production systems involved; yet we have seldom used this approach relative to a marine fisheries question. The reason is obvious. The facts needed are so far beyond the scope of our accumulated knowledge that we usually avoid generalizations along these lines, perhaps as a safeguard to our reputations as thorough and sound scientists.

The problem at hand, however, is one for which we must seek such a comprehensive analysis if a tenable solution is to be forthcoming. I refer to the North Carolina shrimp fishing practices as they affect the fin-fish crop of North Carolina and her neighboring Middle Atlantic States, which regularly harvest vast fish populations migrating from the North Carolina inshore nursery area. Shrimping activities have increased rapidly in these North Carolina waters in recent years. The shrimp trawls used bring in vast quantities of young fin-fish, including sea trout, spot, croaker and other commercially important forms. Almost invariably this harvest that "might otherwise grow to become a valuable commercial and sports product" is simply shoved overboard — dead. Obviously this has become a major fisheries issue, not only in states to the north that do not benefit from the shrimp harvest, but to sports fishermen and to many conscientious commercial men in North Carolina. Among the interested lay critics little thought is given to such questions as:

(1) what percent of the whole fin-fish population does this seemingly large waste actually represent?

(2) to what extent would these fin-fish have entered the harvest after such factors as natural mortality and intraspecies competition take their tolls?

And, of course, neither the fisherman nor his critics have consciously considered the baffling problem of potential production of shrimp compared to that of fin-fish; though the existing fishing practices may offer the most tangible answer to the question.

I propose that we consider the gross aspects of the food chain involved, speaking in terms of basic production by the phytoplankton, then primary, secondary, tertairy consumers, and so on up the successive food links. As a tool for thinking, let us say rather arbitrarily that taken as a whole consumers cannot convert into their own mass more than 10 percent of the poundage produced at the food chain level from which they feed. The basis for this percentage figure is admittedly open to question. As will be evident from the further development of this subject, it is preferable to work with a generously high figure in this case and it is expedient to use a "round number."

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To obtain a working percentage I relied primarily on the unusual food chain data presented and analyzed by Lindeman (1942) from intensive studies of Lake Mendota and Cedar Bog Lake. Furthermore, to defend 10 percent against those who might consider it a low estimate, I will ask the reader to compare the poundage of the food he consumes during his life span with the amount converted into his own body weight.

It is obvious that the losses at successive food chain links are of great ecological and, in the present case, of great practical importance. A 90 percent loss is suggested for the primary consumer level, a 99 percent loss at the secondary level, a 99 9/10 percent loss at the third level, and a 99 99/100 percent loss at the fourth level. From what little we know of their food habits, shrimp are to be considered as primary and secondary consumers or at least as being low on the food chain, whereas the commercially valuable fin-fish involved in this shrimp catch generally feed high on the chain, all of which suggests overwhelming potentialities in shrimp as compared to the fin-fish production.

From this analysis only a price differential greatly favoring the fin-fish would seem to justify any curtailment of shrimping; yet shrimp retails for about $1.00 a pound and these fin-fish for about 40 cents. It would be a serious mistake, however, if this were to stand as the final analysis. It is essential to know what proportion of the total poundage amassed at their respective food chain levels is represented by the shrimp and the fin-fish involved. It is also essential to have more quantative information on the food levels involved, including a better understanding as to what these fin-fishes are eating as young. However, as vague as our existing information is, it would be an even more serious mistake if we were to proceed with this problem on a species by species basis without regard to productivity potentialities as discussed here. Meanwhile, as a practical effort to relieve the conflict of the interests involve attention is being directed to savings gear such as the new Guthrie net, an attempt to develop a trawl for taking more shrimp and less fin-fish.

As with the shrimp fishery, experience has taught us to expect high yields from well managed harvests of oysters, clams, shad, herring, menhaden and other forms low on the food chain. From discussions, such as the above, of losses through successive levels of a food chain, it is obvious that there is a basic reason for this. We should not lose sight of such potentialities in planning where and how to expend our efforts for greater resource use.

Reference cited

Lindeman, Raymond L., 1942. The trophic-dynamic aspect of ecology. Ecology, Vol 23, No. 4, pp. 399-418.