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Preliminary Management Plan for the Striped Bass of the Atlantic Coast from Maine Through North Carolina

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PRELIMINARY MANAGEMENT PLAN
FOR THE
STRIPED BASS OF THE ATLANTIC COAST FROM
MAINE THROUGH NORTH CAROLINA

II. The Environment

B. Environmental Impacts

1. Physical

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Ecological theory dictates that an organism and its physical environment exist in intimate harmony. Changes in the environment should be reflected by changes in behavior, distribution or abundance; and fishery oceanographers have for years been intrigued with the concept that they could forecast stock abundance or distribution by monitoring environmental variability. Life history complexities and the intracacies of the environment have presented such a complex system of organism - environment inactions that most attempts have been thwarted. Only in those cases where a conceptual ecological understanding was apparent did the effort meet with success (Austin and Ingham, 1978). Even then the forecasts were off from year to year which led Cushing (1975) to develop the concept of timing or "match-mismatch". Basically, that the forcing environmental function, for example, (photo-period dependent) forage for first feeding larvae, may be right but the organism was spawned too soon, or too late to take advantage of conditions due to unseasonable warm or cool conditions. In their review of fishery-environmental forecast efforts Austin and Ingham (1978) noted that most successful ocean-fishery forecast models were linked to atmospheric variables.

Interannual variations in striped bass Morone saxatilis abundance have been empirically linked to cold winters (Merriman, 1941), river flow (Hassler, 1958; Turner and Chadwick, 1972; Stevens, 1977) and fluctuations in availability of forage (Hollis, 1952).

While the statistical relationships between juvenile indices or catch and environmental parameters was good there was no conceptual ecological link. Consequently it has been dangerous to attempt forecasting, further, most models were linear.

Heinle, Flemer, and Ustach (1976) noted that the detrital feeding copepod Eurytermora affinis was most abundant following cold winters, and they hypothesized, based upon energy balance studies, that the higher then normal ditrital loads available in the rivers due to intertidal ice scouring were what accounted for the population fluctuations. This relationship, they hypothosized, could also explain the larger than normal striped bass year classes following cold winters noted by Merriman (1941). Further when spring run off following a cold winter was higher than normal, with a heavy ditrital load, the young-of-the-year striped bass survival was enhanced. Subsequent studies by Boynton, et al (1977) Setzler, et al (1978); and Ulanowicz, Ali and Vivian (1979) have substantiated these fundings.

Boynton et al (1977) noted that the survival of later spawners was better than for the earlier spawn. This may be accounted for in the "match" of the young bass with the bloom of E. affinis. A similar relationship was reported by Turner and Chadwick (1972) with cooler Sacramento-San Joaquin River temperatures associated with higher run-off. Much of their run off is snow melt which may account for the lower temperatures. The lower temperatures would prolong the larval period increasing the chance for a "match" with the E. affinis bloom.

Sommani (1972) applied a Ricker spawner/recruit curve to the California stock and added river flow which provided a better fit to the curves. Kohlenstein (1980) reviewed the earlier stock/recruitment and environmental work of others and developed Ricker stock/recruitment curves modified by winter temperature anomalies previous to spawning, and spring (April-May) run off the year of spawning. He was able to account for up to 82% of the interannual variability in year class strength. He further showed that the relationship was strongest for the years of exceptionally large year classes.

Not only then are winter temperatures and run off important, but they must occur together and during the right water temperature regime.

Kohlenstein (1980) goes on to caution however, that while these relationships hold well in the Potomac River they do not for all the Maryland rivers of the Chesapeake Bay. The Potomac, on the other hand, drains the Appalachian mountains while other Maryland Rivers drain the coastal plain. The significance of this is not known, but could be related to the cooler waters (mountain snow melt) of the Potomac, causing better recruitment due to delayed larval development as noted by Boynton _et al_ (1977). This conflicts with the analyses of McFadden (1977) for the Hudson River as he suggested a rapid rise in temperature during embryonic development as the causitive factor promoting good year class survival. His hypothesis is that the shortened larval period reduces potential predation which appears to be greater in the Hudson than in the Chesapeake Bay system. It is possible then that different factors are at work in the Hudson as spawning is later, and June conditions are the Hudson River environment encountered by post larvae. Further, first feeding Hudson larvae depend upon phytoplankton grazing copepods *Diaptomus* and *Cyclops*, not the detrital dependent *E. affinis*.

Insufficient time series data of young-of-the-year abundance are available in Virginia's waters at this time to test the winter temperature/spring run off theory however the 25-year VIMS winter trawl data will be available shortly, and analyses can be initiated.

Other than Hassler's (1958) comments concerning river flow in the Roanoke there are no reports suggesting stock-environmental relationships for the North Carolina striped bass.

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