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Salinity Projections for the James, York, and Rappahannock Rivers

by Dr. Albert Kuo and Michael J. Oesterling

The movement of salt water into Chesapeake Bay and its tributaries is of great concern to all Virginians. As a result of reduced rainfall and subsequent decreased freshwater discharges, unusually high salinities are being recorded for Virginia rivers. All indications are that these conditions will continue through 1981 and possibly into 1982.

Salinity will determine the distribution of various marine animals, including both beneficial and harmful ones (Table 1). Oysters, clams, blue crabs and finfish all have specific salinity requirements and preferences. Increased salinities in some areas may permit these animals to expand their areas of preference and hence their distribution. This, in effect, could alter traditional fishing grounds.

Likewise, marine diseases and noxious animals may have their territories expanded by increased salinities. This is particularly true for oyster diseases (MSX and Dermo) and predators (drills). Along with higher salinities, increases in shipworms (borers) and stinging nettles (jellyfish) could be expected.

Table 1. Representative Chesapeake Bay marine organisms and their salinity tolerance limits. Those with upper limits of 35°/oo can survive in full-strength sea water or even greater in some cases. Lower limits are those salinities at which survival is questionable or death occurs.

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>SALINITY RANGE (ppt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSX (Minchinia nelsoni)</td>
<td>9°/oo - 35°/oo</td>
</tr>
<tr>
<td>Dermo (Perkinsus marinus)</td>
<td>9°/oo - 35°/oo</td>
</tr>
<tr>
<td>Oyster drills (Urosalpinx cinera, Eupleura coudata)</td>
<td>15°/oo - 35°/oo</td>
</tr>
<tr>
<td>Ship-worms (Bankia gouldi)</td>
<td>5°/oo - 35°/oo</td>
</tr>
<tr>
<td>Stinging Nettle (Chrysaora quinquecirrha)</td>
<td>6°/oo - 35°/oo</td>
</tr>
<tr>
<td>Hard Clam (Mercenaria mercenaria)</td>
<td>12°/oo - 35°/oo</td>
</tr>
<tr>
<td>Soft Clam (Mya arenaria)</td>
<td>7°/oo - 35°/oo</td>
</tr>
<tr>
<td>Oyster (Crasostrea virginica)</td>
<td>5°/oo - 35°/oo</td>
</tr>
<tr>
<td>Blue Crab (Callinectes sapidus)</td>
<td>2°/oo - 35°/oo</td>
</tr>
</tbody>
</table>

In an effort to help watermen better plan their fishing activities, predictions of possible salinities have been computed by Dr. Albert Kuo of the Physical Oceanography Department at the Virginia Institute of Marine Science. Using sophisticated computer modelling based upon present salinities and anticipated freshwater discharges, Dr. Kuo has computed salinities for the James, York and Rappahannock Rivers. Freshwater discharge was projected to be 30% below normal by the National Weather Service. If more rain falls than expected, these salinity rises would not be as dramatic as indicated. Conversely, if less rain falls, higher salinities could result farther up-river than originally projected. The following figures illustrate possible salinities through September, 1981.

Figures 1A and 1B. Salinity projections for the James River based upon computer predictions, assuming freshwater discharges to be 30% below normal for the remainder of the year. March readings are actual measurements; April, July and September projections. All salinities are in parts per thousand (open ocean salinity is approximately 35 ppt). River numbers are miles from the river mouth.

Figures 2A and 2B. Salinity projections for the York and Pamunkey Rivers based upon computer predictions, assuming freshwater discharges to be 30% below normal for the remainder of the year. No projections were done for the Mattaponi River. March readings are actual measurements; April, July and September projections. All salinities are in parts per thousand (open ocean salinity is approximately 35 ppt). River numbers are miles from the river mouth.

Figures 3A and 3B. Salinity projections for the Rappahannock River based upon computer predictions, assuming freshwater discharges to be 30% below normal for the remainder of the year. March readings are actual measurements; April, July and September projections. All salinities are in parts per thousand (open ocean salinity is approximately 35 ppt). River numbers are miles from the river mouth.
Figure 1A
Figure 2A