FISH MANAGEMENT SESSION

PEOPLE, PLANNING, AND POLLUTION

By Thomas D. McKewen, *Director*
Bureau of Resources Protection
Maryland State Department of Health

Our civilization could be symbolized by a man climbing a pile of trash to gain a better view of the stars. The view is magnificent, but the footing treacherous. Many of our waters are polluted; our air burdened with debris; and our lands littered. We did not reach this sorry state easily or quickly. Nature resists pollution. Her barriers can be overcome only by a persistent and intensive assault. From the time of the Industrial Revolution just such an assault has been carried out.

There have always been people who were aware of the consequences of man's destructive tendencies, but until recently they were the proverbial voices crying in the wilderness. Then the burgeoning population began to expand into the wilderness and the voices began to be heard. What was heard could be summarized in the immortal, if overly pessimistic, words of Pogo, "We have met the enemy and he is us." The reaction to this painful discovery has been relatively prompt and in almost all respects salutary--particularly when it has taken the form of legislation and money.

To illustrate what has occurred, I will concentrate on what could be called the institutionalizing of the long-range approach. I will also concentrate on that form of environmental insult which is most important to fisheries--water pollution. One of the basic problems in pollution control, and indeed in dealing with the environment in general, has been the differing time perceptions of the various people and groups involved. A biologist might consider the destruction of a species or habitat over the span of a century to be a rapid process. A geologist would consider it to be instantaneous. On the other hand, public works projects result from decisions by people who must concern themselves with such things as fifteen-year bond issues and four-year terms of office. Our political and financial structure tends to emphasize and give priority to near-future effects. This is not because the politician or financier, or for that matter the engineer, is inherently a more nearsighted individual than the biologist or geologist, it is just that a very elaborate and highly effective system has been developed based on the demonstrated fact that people expect to see a prompt and visible response when they part with an investment dollar or tax dollar.

Recognizing the need to act on concern over ultimates with the equally pressing need to respond to yesterday's complaint and today's crisis, several highly significant steps have been taken in the water pollution control field. They have been based largely on the growth of public demand for a halt to the destruction of the environment. They have also been influenced by a whole set of technological advances including the computer, new methods of wastes treatment, and the discovery of uses for wastes which puts them back into the economic cycle.

Until the past decade, the Federal Government took the rather detached attitude that water pollution was a local problem requiring local solutions. Suddenly, Congress and the President announced that they would help finance water pollution abatement. In reaction to this, many states which had formerly taken the attitude that their role was that of the advisor and policeman now announced that they also intended to become financial partners. In the brief period of a few years a Federal-state-local partnership developed which is reasonably effective now and gives indications of becoming even more effective in the near future.

To illustrate in more specific detail the events that are now occurring and which give reasonable assurance that the problems of water pollution will be solved, I will discuss actions which have been taken and trends which can be observed in Maryland. I choose Maryland because it is the state with which I am most familiar, and because

I believe (with no more than a trace of parochialism, I hope) that it represents one of the more progressive states in the control of water pollution.

In the simplest terms, a pollution control program must contain five elements:

1. The identification of existing and projection of future problems.
2. An analysis of the problems in order to develop possible alternate solutions and the selection of the most desirable alternates.
3. The construction of needed pollution abatement facilities indicated by the above analysis.
4. Effective operation of the facilities.
5. The monitoring and evaluation of all of these actions and activities to be certain that they are achieving the desired result in an efficient manner.

In practive, these sequential steps form a continuous loop since Step No. 5 merges into Step No. 1 to initiate a new cycle. Following is a brief sketch of the actions that have been taken to implement each step.

1. In 1966, legislation was adopted which requires all counties to develop comprehensive wastewater plans by January 1, 1970. Thereafter, each plan will be reviewed at least annually and updated if necessary. As a result, Maryland will have, for the first time, a set of coordinated plans covering all areas of the State. By examining population characteristics, land use patterns, water quality data, water uses, and related information, each county is identifying existing sewerage and water pollution problems and developing the best available forecast of future problems. Each county plan will present a schedule for the construction of sewage treatment plants and other facilities to correct existing problems and to prevent future ones. The State is contributing approximately one-half of the local cost of these plans and provides technical guidance to each county and coordination between counties. One of the most important features of these plans is that they will not simply serve as guides, but will be action plans which will be implemented on a definite time schedule. The plans, including construction schedules, are subject to State approval.

2. The county plans, as indicated above, will help develop and select alternate solutions. In addition, just a few months ago, the State authorized a four million dollar bond issue to supplement Federal grants for the preparation of comprehensive pollution control plans. These will coordinate the individual county plans on the basis of natural planning areas such as river basins and economic regions. This will assure that local needs will be met in compatibility with State and regional water quality objectives. This planning effort is now being designed and will be initiated early in 1969.

3. Maryland was one of the first states to supplement Federal grants to aid in the construction of sewage treatment facilities. To date bond issues totaling $176,295,000 have been authorized by the State for sewage treatment plant construction grants. Of this total, a fifty million dollar issue was authorized in 1967 and a one hundred million dollar issue in 1968, indicating the accelerating pace of the grant program.

Through the end of the 1968 fiscal year, these funds had helped finance 38 new sewage treatment plants for communities which had previously discharged raw sewage or had no sewerage system at all. Thirteen inadequate plants were replaced with modern ones, and three inadequate plants were remodeled or enlarged to provide a higher degree of treatment. Eight which had been operating beyond their design capacity were eliminated by extending interceptor sewers from areas served by adequate facilities. In addition, now under construction or scheduled for early construction starts are fifteen new plants, one replacement of an obsolete plant, and enlargement and upgrading of five existing plants.

Through June, 1968 a total of 220 grant applications had been received. Those included, in addition to the sewage treatment projects noted above, 145 other projects for sewage pumping stations, force mains, and interceptors which have eliminated or prevented discharges of raw sewage into waters of the State.

Largely as a result of the grant program, the backlog of sewage treatment needs which have developed over many generations will soon be eliminated. Present estimates are that by 1971 the sewage treatment facilities required to meet the

State's Water Quality Standards will either be in operation or in some instances nearing construction. From that point on, we will be striving not to catch up with existing needs but instead striving to keep ahead of demands caused by increasing population.

To supplement the grant program, a twenty-five million dollar loan program was authorized this year. Funds will be available at low interest rates to assist communities, particularly the smaller ones, to construct sewage collection facilities which are not eligible for grants. In many areas, this will make possible the abandonment of inadequate septic tank systems and thus provide better protection to both surface and ground water.

Comparable progress in the control of such obdurate pollutants as acid mine drainage and sediments, will be achieved more slowly. To pave the way for control actions, an inventory of all existing sources of acid mine drainage has been completed.

With Federal financial assistance, a demonstration project is being carried out to determine if municipal solid wastes can be used to effectively seal off abandoned strip mines and thus prevent acid production. A prime benefit of this operation is, of course, that the solid wastes are disposed of without causing water or air pollution, or nuisance conditions, and the regraded land will convert a liability into an asset.

Land use practices that contribute to sediment pollution are being reviewed, and Statewide regulations are being drafted to reduce the present heavy sediment loading on surface streams.

4. There is often a gap between expected performance of waste treatment plants and actual performance. To close this gap, legislation was enacted in 1967 to require that operators of waste treatment plants be required to qualify for certification. Training programs have been established at State expense at four strategically located junior colleges. In 1968, 198 operators took advantage of this opportunity. Interest in this program has been very gratifying. Over 230 operators applied for such training in 1969; however, financial limitations will restrict registration to 191. This new operator training and certification program should lead to substantial improvement in the performance of waste treatment plants.

5. The monitoring and evaluation activities include the sampling of streams and waste treatment plants, periodic engineering evaluations of the physical and operational adequacy of the plants, and comparison of the water quality impact of treated waste discharges with the State's Water Quality Standards. These activities have been severely hampered by inability to recruit adequate staff. To improve the effectiveness and administrative control of these activities, a computerized water quality management information system is being designed for early implementation. In effect, monitoring and evaluation are part of the problem identification activity listed as No. 1 above.

Underlying all of the actions and activities described above is the concept that no stream can be considered as a separate entity. All of the surface waters of the State are interconnected by hydrology, man-made structures, and interacting water uses. Therefore, decision on a proposed action on one stream must be considered in light of the consequences that will occur not just on that stream but in all other parts of the system that is formed by the surface waters of the State. Consideration must also be given to future as well as immediate effects.

Since there are several hundred individual sanitary sewage and industrial waste discharges, this means that hundreds of local government officials and industrial managers must not only be aware of the effect, for example, that increased nutrient loadings will have on the Chesapeake Bay decades from now, but must be willing and able to base today's decision on that future effect. They must also be willing and able to base their decision on the effect their discharge will have on other water uses. Many of these effects will be subtle and far removed in place and time from the original discharge.

Presumably, regulatory agencies can supply vision and coordinating control through planning, standard setting, and surveillance activities. But the nature of the regulatory role emphasizes the establishment of minimum goals to achieve acceptable

results. What is needed is management to achieve optimum results.

To accomplish this, a Governor's Commission to Investigate Water Pollution Control has recommended the creation of a State service agency known as the Waste Acceptance Service to take over responsibility for treatment and disposal of all liquid wastes in the State. This proposed agency would in no way limit local control of land use and waste collection facilities. It would permit much greater flexibility in deciding how and where wastes would be treated and discharged, promote the direct incorporation of broad public goals into the day-by-day decision-making process, and provide substantial economies of scale in both construction and operation. A feasibility report on the Waste Acceptance Service has been prepared for early consideration by the Governor and General Assembly.

Many people will no doubt consider this paper to overly optimistic. However, man has had to make many adjustments as he first invented civilization and then made it ever more complex. These adjustments have been sociological and technological rather than biological. In time, evolution, with an assist from genetic engineering, could possibly produce a human with lungs inured to air pollution, body immune to infection, and senses that do not react to stench and disorder.

The purpose of this paper is to present some evidence that man is not taking this passive and chancy route but is again adjusting his institutions and technology--not to adapt to a degraded environment but to reverse the process of degradation.

MOVEMENT, GROWTH, AND MORTALITY OF BROWN SHRIMP *(Penaeus Aztecus)* MARKED AND RELEASED IN SWAN QUARTER BAY, PAMLICO SOUND, NORTH CAROLINA[1]

By Edward G. McCoy
Division of Commercial and Sports Fisheries
North Carolina Department of Conservation & Development
Raleigh, North Carolina
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ABSTRACT

Brown shrimp *(Penaeus aztecus)* were marked with injections of biological stains and fluorescent pigments and released in the Swan Quarter Bay tributary of Pamlico Sound, North Carolina, to obtain population dynamics information including movement, migration, growth, and mortality. From July to September, 1967, 6,163 shrimp were marked and released. Of these, 1,030 (16.7%) were returned. The average interval between release and recapture was 12 days, and the average distance traveled during this time was 3 miles. Only one shrimp was recaptured in the Atlantic Ocean. These data do not clearly indicate the most probable route or routes of movement from the study area to the ocean. Modes of size distribution curves were at 115 mm total length during the eight-week mark-release phase of the study, indicating an apparent "level of equilibrium" condition. This level was maintained by movement of larger individuals from the area, immigration of small ones from upstream reaches, and growth within the area. The mean growth curve indicates brown shrimp reach a count of 70-per-pound (headless) in 12 weeks, 50-per-pound in 14 to 15 weeks, and attain an average maximum size of 15-per-pound. Total mortality estimates for two separate experiments indicate 71% and 63% per week were removed by the combined effects of fishing and natural causes.

INTRODUCTION

The basic aim of current shrimp research in North Carolina is to obtain information that will permit application of management techniques resulting in the

[1]This study was conducted in cooperation with the U. S. Department of the Interior, Bureau of Commercial Fisheries under P. L. 88-309 (Project No. 2-26-R).