MARINE SCIENCES RESEARCH CENTER
STATE UNIVERSITY of NEW YORK
STONY BROOK, N.Y.

DEVELOPMENT OF A RESEARCH PROGRAM FOR THE PECONIC BAY ESTUARY RESPONSIVE TO MANAGEMENT NEEDS

PHASE I

Report of a Workshop
26 November 1991

Project Directors
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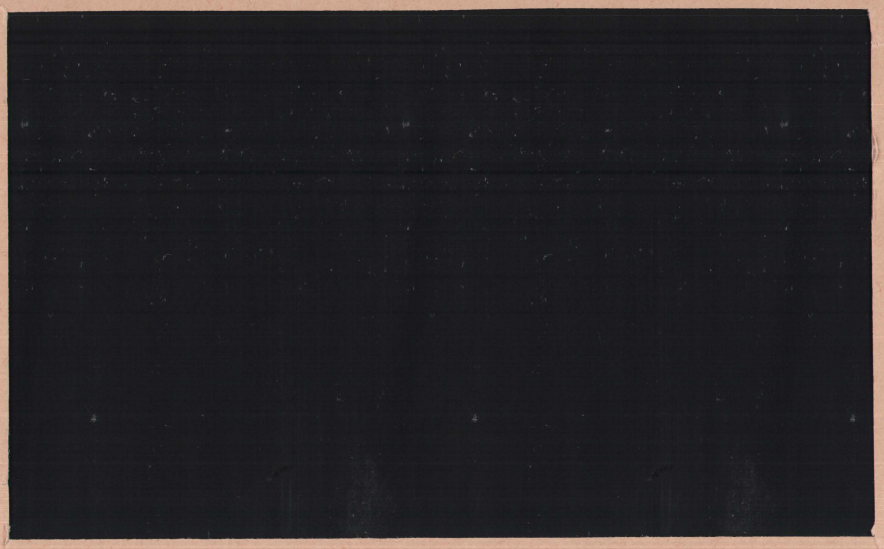

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Sponsors

Marine Sciences Research Center
Brown Tide Comprehensive Assessment
and Management Program Citizen's Advisory Committee
Cornell Cooperative Extension
The Nature Conservancy
New York State Department of Environmental Conservation's
Division of Marine Resources
New York Sea Grant Institute
Suffolk County Department of Health Services

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INTRODUCTION

On 26 November 1991, a workshop was held at the Marine Sciences Research Center to begin to develop for the Peconic estuary a research program responsive to management needs. The workshop was co-sponsored by the Marine Sciences Research Center, the Brown Tide Comprehensive Assessment and Management Program (BTCAMP) Citizen's Advisory Committee, Cornell Cooperative Extension, The Nature Conservancy, New York State Department of Environmental Conservation's Division of Marine Resources, New York Sea Grant Institute and the Suffolk County Department of Health Services.

The workshop was the first step in a collaborative venture involving all of these organizations to summarize existing scientific and technical information on the Peconic-Flanders Bays system and to define research needs to provide decision makers with the information they need to effectively manage the system.

Among the speakers who delivered introductory comments were Mr. Vito Minei of the Suffolk County Department of Health Services Office of Ecology. Mr. Minei summarized the status of the Brown Tide Comprehensive Assessment and Management Program (BTCAMP; see draft summary of findings, conclusions, and recommendations in Appendix A) and noted a number of additional research needs identified in BTCAMP (see Appendix B).

The Nature Conservancy and the BTCAMP Citizens' Advisory Committee also addressed the workshop. Sara Davison spoke on behalf of the Nature Conservancy regarding the initiatives and concerns of the Conservancy in establishing a Peconic Estuary Bioreserve, stressing not only the uniqueness and importance of the Peconic system as one of the "Last Great Places," but also the need to harmonize human uses with the natural ecosystem. Finally, Jeanne Marriner, on behalf of the BTCAMP Citizens' Advisory Committee (CAC), summarized the activities and concerns of the citizens, stressing the need for practical research in the Peconic system. Her remarks are included as Appendix C.

Following the introductory session, the participants broke up into a series of working groups to identify research needs. The groups, their facilitators and rapporteurs are listed in Table 1.

The agenda for the workshop is included as Appendix D; the participants are listed in Appendix E.

TABLE 1

Working Groups: Facilitators and Rapporteurs

Working Group	Facilitator	Rapporteur
Brown Tide	Robert Nuzzi	Robert Waters
Benthic Nutrient Regeneration	Kirk Cochran	Bruce Brownawell
Critical Habitat for Rare and Endangered Species	Robert Zaremba	Steven Morreale
Coupling of Land Use and Water Quality	Vito Minei	Walter Dawydiak
Habitat and Living Resource Characterization With An Emphasis on Finfish	Christopher Smith	Robert DeLuca
Habitat and Living Resource Characterization With An Emphasis on Shellfish	Kenneth Koetzner	Debra Barnes
Ad Hoc Toxics	Felix Locicero	--

REPORTS OF THE WORKING GROUPS

BROWN TIDE WORKING GROUP

Session Leader: Robert Nuzzi, SCDHS
Rapporteur: Robert M. Waters, SCDHS

Participants

Nick Fisher, MSRC
Cindy Lee, MSRC
Darcy Lonsdale, MSRC
John B. Mahoney, NMFS, Sandy Hook
Jeanne Marriner, Peconic Bay CAC
Alan Milligan, MSRC
Henry Moeller, Dowling College
Cornelia Schlenk, New York Sea Grant Institute
Al Siegal, LIU Southampton Campus
Max Streib, NYSDEC
J. Ral Welker, LIU Southampton Campus
Creighton Wirick, BNL

Issue Statement: This working group took as its charge a discussion of why "Brown Tide" occurs in the Peconic Bay Estuary, what investigations should be undertaken to better understand the brown tide and, what can be done to control it.

More specifically, the group addressed the following questions: (1) what are the parameters that trigger a bloom of the brown tide organism, *Aureococcus anophagefferens*? and (2) what allows it to outcompete all other phytoplankton species for extended periods of time over a large geographic area?

Five main topics involving possible research activities were developed: isolation and culture of *A. anophagefferens*; requirements for the growth of *A. anophagefferens* (growth stimuli); causes of bloom "crash" (death stimuli); monitoring activities; and evaluation of steps taken as a result of the BTCAMP recommendations.

Results of the discussions concerning these topics are outlined below.

Research Topics:

1. Isolation and Culture

To elucidate the growth requirements of *A. anophagefferens* it is necessary to obtain an axenic (bacteria-free) culture of the organism. This was felt to be a priority item relative to the culture of the organism now on hand.

Additional isolates, preferably from the Peconic system (the organism presently in culture was isolated from Great South Bay), should be developed and studied by a variety of laboratories. It was felt that it might be risky to make assumptions based on a single isolate which, because of its geographic origin and its history in culture, may not be truly representative of the organism as it exists in the Peconic system.

Isolation and culture of *A. anophagefferens* will allow attempts at elucidating the growth requirements of the organism in the laboratory and thus provide insight into its growth in the natural environment.

It will also allow for investigations of potential toxin production by the organism, and for studying the effects of the brown tide on zooplankton predators and shellfish.

2. Growth Stimuli

Evaluation of both laboratory and field derived data collected to date indicate the potential importance of organic materials and chelators for the growth of *A. anophagefferens*.

It was recommended that studies be undertaken to investigate the requirements of organics as both nutrient sources and as chelators. Do they serve as either? As both?

Laboratory research on the effects of trace metals and chelators should be continued and, in addition, the importance of specific metals to the growth of *A. anophagefferens* should be estimated by measuring the

intracellular accumulation of metals (as opposed to measuring ambient water column levels).

The relationship between the groundwater and bottom sediments relative to the bioavailability of metals, in particular iron and manganese (and perhaps zinc), should be investigated.

3. Death Stimuli

How is the population of *A. anophagefferens* held in check? What causes the bloom to crash? How does grazing affect the bloom? Do viruses cause the bloom crash? These questions should be the subject of laboratory as well as field investigations.

4. Monitoring

The biological, chemical and physical components of the ecosystem should be characterized and related to point and non-point sources of pollution. Water quality monitoring for typical parameters including salinity, temperature, dissolved oxygen, macronutrients, chlorophyll a and *A. anophagefferens* cell numbers should be continued and monitoring should be expanded to include:

Phytoplankton species composition (differential cell counts) - - Successional variations can be elucidated and provide information necessary for the interpretation of coincident variations in nutrient concentrations. It might also provide a mechanism for predicting a brown tide episode based on species succession.

Multi-depth sampling at selected stations to provide a better understanding of the system's structure.

Zooplankton population dynamics -- in an effort to better understand the role of zooplankton in controlling the brown tide.

Additional chemical parameters -- the measurement of urea and various amino acids may be of particular interest.

Additional emphasis on the physical characteristics of the waters within which brown tide occurs, and on local and regional meteorological factors which are involved in water chemistry and water mass movement.

Because local weather conditions appear to be important for many coastal phenomena and, because of the availability of relatively inexpensive recording meteorological stations, it was recommended that stations be located at numerous points within the Peconic Estuary System watershed. Measurements should include precipitation, temperature, incident solar radiation, wind direction and velocity. The collection of meteorological data is a potential area for citizen involvement.

It was suggested that a more detailed study of one area where *A. anophagefferens* has consistently bloomed might prove valuable. West Neck Bay, on Shelter Island, was recommended as the study site.

5. Evaluation

Any steps taken as a result of BTCAMP (or other) recommendations should be constantly evaluated relative to their effects on brown tide in particular, and on the Peconic ecosystem in general. Constant evaluation will allow for feedback, fine-tuning and modifications of steps taken, and the promulgation of additional recommendations. In short, management of the system must be dynamic.

BENTHIC NUTRIENT REGENERATION WORKING GROUP

Session Leader: J. Kirk Cochran, MSRC
Rapporteur: Bruce Brownawell, MSRC

Participants

Susan Antenen, The Nature Conservancy
Melissa Beristain, New York Sea Grant Extension
Karen Chytalo, New York DEC
Charles Nittrouer, MSRC
Gordon Taylor, MSRC

Issue Statement: The sources of organic carbon to an estuary are numerous. Particulate organic matter is added by weathering and transport of soil organics, sewage inputs and production *in situ*. Dissolved organic carbon and nutrients may be added *via* rivers and direct groundwater inflow. Exchange at the mouth of the estuary also can introduce organic carbon and nutrients. Decomposition of organic matter occurs both in the water column and in the bottom sediments. This process releases constituent nutrient elements (e.g. N, P) back to solution and also consumes dissolved oxygen. Based on research in other estuaries, the sediments represent an important component of a nutrient balance because they contain a reservoir or organic matter which progressively decomposes. The size of this reservoir and the ease with which it is decomposed or oxidized (that is, how "labile" the carbon contained in it is) determine how rapidly the estuary will respond to changes in organic matter loading. Such changes may be natural or brought about by management decisions. Thus the central question we must ask regarding nutrient regeneration in bottom sediments is:

HOW IMPORTANT ARE NUTRIENT FLUXES FROM PECONIC SEDIMENTS IN THE NUTRIENT BALANCE OF THE ESTUARY?

This question gives rise to the following specific research topics described below.

Research Topics:

1. ARE THERE EASILY MAPPED PROPERTIES OR CHARACTERISTICS OF PECONIC SEDIMENTS WHICH PERMIT PREDICTION OF NUTRIENT FLUXES FROM THE BOTTOM?

Evaluating the importance of nutrient fluxes from bottom sediments in the estuary requires measuring these fluxes at many sites. This can be a time consuming exercise. Thus we ask whether there are other, more easily measured sediment properties which might be used, in conjunction with a few direct measurements of nutrient flux, to predict the fluxes from larger areas. Such properties/characteristics include grain size, sediment accumulation rate, benthic faunal distributions and geochemical tracers of physical or biological reworking of the sediment.

Implications for Management:

Effective mapping of the nutrient flux allows managers to assess nutrient regeneration in sediments over large areas of the estuary. This is critical in constructing a nutrient budget for the system and in applying water quality models which predict how the system will respond to changes in organic matter loading.

2. IS THERE STORAGE OF LABILE, OR EASILY DECOMPOSED, ORGANIC MATTER IN PECONIC SEDIMENTS?

Measuring nutrient fluxes alone, directly or by proxy, does not indicate how fast the sediment carbon reservoir turns over. Degradation of fresh organic matter in the water column is likely to be rapid, but once such material is incorporated into the sediment carbon reservoir it may decompose more slowly. Such an effect could produce nutrient fluxes and oxygen uptake in sediments for a considerable time after any changes in organic matter loading had occurred.

Implications for Management:

Understanding how fast the carbon reservoir in the sediments turns over or is decomposed is critical to predicting the response time of the estuary to changes in organic matter or nutrient inputs.

3. WHAT IS THE RESPONSE OF THE BENTHIC NUTRIENT FLUX TO SEASONAL AND INTERANNUAL VARIATIONS (TEMPERATURE FLUCTUATIONS, EVENTS SUCH AS BLOOMS) AND TO UNUSUAL EVENTS (STORMS)?

The nutrient flux from sediments is not constant but varies in response to temperature or sudden inputs or organic matter introduced by blooms. Events such as storms may produce large releases of dissolved nutrients from sediments. Indeed these seasonal variations or aperiodic releases may dominate the annual nutrient flux from sediments. Depending on the time of year this occurs, the fate of the released nutrients may be very different. For example, release of nutrients during the winter when primary productivity is low may result in their export out of the system due to water exhange.

Implications for Management:

Studies of the temporal variations in benthic nutrient flux provide managers with an estimate of variance of this flux. Knowledge of the variance is critical to constructing a nutrient balance for the estuary and to modeling nutrient and oxygen distributions. It also helps determine the most effective strategies for monitoring the estuary.

4. HOW DO THE SEDIMENTS CONTRIBUTE TO THE NUTRIENT BUDGET OF THE PECONICS?

Fluxes of dissolved nutrients from sediments provide only one component of the estuarine budget of a nutrient element like nitrogen. The study of other influences must be expanded. For example, groundwater flow can introduce nitrogen to the estuary, providing an additional source. It also can modify nutrient fluxes from sediments by providing an additional means to transport nutrients released to sediment pore water out into the overlying water column. Removal of nutrients from the estuary also must be carefully estimated. For example, what is the role of wetlands as sinks for organic matter? Water circulation within the estuary must be better understood to predict the exchange of nutrients with the water outside the system.

Implications for Management:

A better understanding of the components in the nutrient balance of the Peconics will enable managers to better predict the effects of land use variations or remediation strategies. It will also facilitate planning the

temporal and spatial scales over which monitoring the system can be most effective.

CRITICAL HABITAT FOR RARE AND ENDANGERED SPECIES WORKING GROUP

Session Leader: Robert Zaremba, The Nature Conservancy
Rapporteur: Steven Morreale, Okeanos Foundation

Participants

Susan Antenen, The Nature Conservancy
Gordon Colvin, New York State DEC
Helen Hays, American Museum of Natural History
Amy Lester, The Nature Conservancy
William Wise, MSRC

Issue Statement: The biological extinction of a plant or animal species due to human activity is a moral and ethical tragedy, the most abject failure of humankind to acknowledge and accept responsibility of worldwide environmental stewardship. Extirpation of a species in a localized area, such as the Peconic-Gardiners Bay Complex (PGBC) and its watershed, reduces the region's biological diversity, may contribute significantly to worldwide extinction of that species, and is thus unacceptable.

Protecting rare and endangered species inhabiting the waters and watershed of the PGBC is a compelling societal responsiblity that should be given a high priority. Indeed, many argue that it should take precedence over most other management issues. Of greatest concern are species whose population levels are severely reduced worldwide and for which the PGBC and/or its watershed are known to provide important habitat.

Both the federal and New York State governments have developed lists of rare and endangered plant and animal species. Of these, a sampling of endangered species found in the PGBC and/or its watershed are listed in Table 1. In addition to such formally "listed" species, the future of other species in the region is of concern, species like the black duck, experiencing a population decline throughouts its range, and the bay scallop, locally threatened in the PGBC by the brown tide algal bloom. Special attention to habitat requirements may also be warranted for these species.

Of the organisms listed in Table 1, the several species of sea turtles most clearly satisfy the dual criteria of low worldwide population levels and the relative importance of the PGBC as a habitat to the world-wide population. Substantial numbers of these turtles arrive each summer from breeding grounds in the Caribbean to feed in the waters around the eastern end of Long Island. The PGBC is one of only a few estuaries along the US East Coast that are used by these animals as summer feeding grounds.

While overharvesting, nest raiding for eggs, and other disturbances on breeding beaches have been clearly implicated in the plummet of sea turtle populations throughout the world, mortalities incurred at sea elsewhere in their range are also of great concern. This is perhaps most true of the Kemp's Ridley turtle, whose current population is estimated at less than 500 individuals. It is believed that a significant number of these animals are present in east end waters during summer.

Table 1. Listed Endangered Species Occurring in the Peconic-Gardiners Bays Complex

Federal

Birds
roseate tern
piping plover

Reptiles
Kemp's Ridley turtle
loggerhead turtle
leatherback turtle
green turtle

Plants
sandplain gerardia
Nantucket shadbush*
NE blazing star*
bushy rockrose*

New York State

Birds
least tern
northern harrier
osprey
red-shouldered hawk

Reptiles
mud turtle

*candidate species, under consideration for listing as endangered by US Fish and Wildlife Service

The following research topics dealing with rare and endangered species and their habitat requirements in the PGBC focuses on species listed in Table 1. The Working Group was limited by available time and expertise in its ability to identify and evaluate similar issues important to other species of concern in the PGBC. In the opinion of the Working Group, management of some of these species (e.g. piping plover and roseate tern) should place priority on using existing knowledge of their habitat

requirements to afford them better protection from human intrusion, rather than undertake additional research to refine this knowledge.

Research Topics:

1. ARE KEMP'S RIDLEY TURTLES DEPENDENT ON SPIDER CRABS AS A FOOD SOURCE WHILE IN THE PGBC? WHAT WOULD BE THE CONSEQUENCES FOR KEMP'S RIDLEY TURTLES OF CHANGES IN SPIDER CRAB ABUNDANCE IN THE ECOSYSTEM?

There is evidence suggesting that Kemp's Ridley turtles feed selectively on spider crabs while foraging in the waters of the PGBC, preferring them to other large epifaunal species, such as lady crabs, even when the latter are much more abundant. Should this severely endangered animal have limited ability to switch to other food sources during times when spider crabs are scarce, its continued existence may be jeopardized.

2. HOW RELATIVELY ABUNDANT ARE SPIDER CRABS IN THE PGBC? WHAT ARE THEIR HABITAT AND OTHER ENVIRONMENTAL REQUIREMENTS AND DETERMINANTS IN THIS SYSTEM?

Should the Kemp's Ridley turtle prove to be a monospecific feeder on spider crabs, the present near-complete lack of information on the population biology and dynamics of spider crabs will be a serious impediment in assessing whether the turtle population inhabiting the PGBC is now, or could become, food-limited.

3. WHAT IS THE INCIDENCE OF BOAT-RELATED MORTALITY AMONG KEMP'S RIDLEY TURTLES SUMMERING IN EAST END WATERS?

Kemp's Ridley turtles entering east end waters are apparently all adolescent animals, survivors of the rigors of their juvenile years but not yet fully mature adults. Nevertheless, these are still sizeable animals and their natural mortality in these waters is undoubtedly quite low. Virtually all of the carcasses of these turtles washed ashore on the region's beaches bear evidence of boat-inflicted damage. Post-mortem examinations are generally not performed on these animals to assess whether these injuries were contributory to the animal's death or occurred after the animal had died. Development and implementation of sound and equitable regulations governing boat use in the PGBC to reduce mortality of Kemp's Ridley turtles must hinge on better documentation of the nature and extent of interactions between boats and these animals.

4. WHAT ARE THE ABUNDANCES AND ABUNDANCE TRENDS OF FORAGE FISH THAT ARE KEY FOOD ITEMS IN THE DIETS OF RARE AND ENDANGERED BIRDS, SUCH AS THE ROSEATE AND LEAST TERNS?

The sand lance has long been recognized as a major item in the diet of a number of colonial shorebirds, including several rare or endangered species. Once a major component of total fish biomass in coastal waters from Maine to North Carolina, sand lance populations have been declining in recent years. Anecdotal evidence indicates that many birds seem to be consuming larger numbers of other forage species, such as bay anchovies, silversides, etc., also found in abundance in the GPBC. A case cannot be

made that birds like the endangered roseate tern and least tern are presently feeling the impact of declining sand lance abundance. However, should attempts to increase the numbers of these birds succeed, issues of food availability among the region's forage fish assemblage may become more urgent.

5. WHAT WOULD BE THE EFFECT OF CONTINUED OUTBREAKS OF THE BROWN TIDE ON THE FINFISH FORAGE BASE IN THE PGBC?

Little is known about the impacts of the Brown Tide on finfish resources in Long Island's bay systems, although this is the subject of much speculation. Of particular concern here is the impact of the Brown Tide on the abundance of the small, schooling finfish that constitute the bulk of the diet of rare and endangered marine birds.

Larvae of some fish species prey directly on phytoplankton for a period of time and might be directly affected if the bloom was extensive in both space and time. Bloom-induced changes in zooplankton communities could impact the larvae and juveniles of most local finfish species, which prey on zooplankters. The turbidity associated with the Brown Tide could directly interfere with the feeding ability of larvae, juvenile and adults, particularly those feeding in the upper portions of the water column. Lastly, the loss of eelgrass habitat attributable to the brown tide could have a variety of consequences for local finfish communities. It should be noted, that sampling in Great South Bay during intense outbreaks of the Brown Tide in 1985 and 1986 did not reveal significant impacts of the bloom on either copepod abundances or icthyoplankton.

6. WHAT ARE THE HABITAT REQUIREMENTS OF THE EASTERN MUD TURTLE IN THE PGBC?

The eastern mud turtle is endangered in New York State; it is the only state endangered reptile in the watershed of the PGBC. Mud turtles are strongly aquatic and are not infrequently found in brackish waters. As with all turtles however, even the aquatic mud turtle can, and often does, make extensive forays on land. Each year in the spring, females leave the water and travel to upland nesting sites; peak egg laying for the mud turtle on Long Island probably occurs during the month of June. Upon hatching in the early fall, young mud turtles remain in the underground nest until the following spring. Adult mud turtles also occasionally leave their home pond and traverse upland areas in search of food or a mate.

It is clear that protecting pond habitat alone will not prove adequate to protect mud turtle populations. More information is required about the environments mud turtles use for nesting sites and the distances that females generally travel in search of these areas.

COUPLING OF LAND USE AND WATER QUALITY

WORKING GROUP

Session Leader: Vito Minei,
Suffolk County Department of Health Services
Rapporteur: Walter Dawydiak,
Suffolk County Department of Health Services

Participants

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Lisa P. Tettelbach, NYSDEC

Issue Statement: The link between land use and pollution contribution has been established in a number of previous studies. Most recently, the Brown Tide Comprehensive Assessment and Management Program (BTCAMP) has assessed the impacts of land use on groundwater and surface waters, focusing primarily on the environmentally stressed and poorly flushed western portions of the Peconic Estuary system.

Numerous specific pollutants related to land use have been identified in the Peconic Estuary system. For example, nitrogen loading is directly related to the intensity of land usage in given areas, which in turn correlates with groundwater and surface water quality. In addition, coliform loading from stormwater runoff is correlated with the intensity of land use. Pesticides have also been identified as problems in agricultural areas, with breakdown products of aldicarb detected in East Creek, indicating a groundwater contribution of the pesticide into the system is indicated.

Although groundwater contamination and stormwater runoff are major concerns with respect to land use, in many cases, point source pollution also correlates with land use. For example, industrial and sewage treatment plant discharges, which are associated with population growth and development, have contributed pollution to the Peconic Estuary system. Sedimentary deposition and subsequent pollutant flux, which significantly impact surface water quality, are also related to point sources.

The high degree of open space in the Peconic River and Flanders Bay watershed, which has not undergone drastic land use changes between 1976 and 1988, has undoubtedly spared the surface water system from the adverse impacts of pollution. However, the amount of vacant and developable land in the Peconic Estuary system highlight the need for planning future development and pollution control strategies to protect surface water quality. Since most of BTCAMP pollution and land use analysis focused on the Peconic River and Flanders Bay watersheds, it is imperative that the land use research performed for BTCAMP be refined and expanded for the Peconic Estuary system, with emphasis on detailed, localized investigations where warranted.

Research Topics:

1. GROUNDWATER INPUTS

The groundwater-contributing area boundary and the model of groundwater input to the Peconic Estuary system should be refined for the Peconic River and Flanders Bay areas and expanded in detail for the eastern portions of the Peconic system.

Importance

An informed assessment of the quantity and spacial extent of contributing groundwater is a crucial element in a comprehensive estuarine management program.

2. LAND USE ANALYSIS

Evaluation of the impacts of land uses on groundwater and, ultimately, on surface water quality should be conducted, especially in areas east of the Peconic River and Flanders Bay. Research should include land use tabulation, mapping, and monitoring of general and site-specific impacts of land uses (e.g., marinas, agricultural and residential areas).

Importance

Further land use analysis is needed to refine our understanding of land use impacts; expand BTCAMP efforts to the eastern Peconic Estuary system.

3. LAND USE MANAGEMENT AND GROUNDWATER IMPACTS

Options for reducing pollutant and nutrient inputs to groundwater should be evaluated, especially in locally sensitive areas. Areas of investigation could include land use management techniques and alternative on-site sewage disposal systems.

Importance

Informed management of land use-related pollutant inputs is critical in preserving surface water quality, because pollutants such as nitrogen are critical in terms of surface water quality impacts.

4. STORMWATER RUNOFF IMPACTS

The analyses of impacts of stormwater runoff on surface waters should be refined, especially in areas east of the Peconic River and Flanders Bay.

Importance

Further analysis is needed to refine site-specific understanding of stormwater runoff impacts; expand BTCAMP efforts to the eastern Peconic Estuary system.

5. STORMWATER RUNOFF MANAGEMENT

Alternative measures to control stormwater runoff pollution loading, especially bacterial loading, should be examined.

Importance

Stormwater runoff is a primary source of coliform bacteria -- an indicator organism used to determine bathing beach and shellfish area closures. Stormwater management is, thus, important in preserving estuarine resources.

6. TOXIC SUBSTANCES

Investigation of the potential presence and impacts of toxic substances and metals, and their relation to land uses, should be conducted in areas which may be affected by known sources of contamination, including Fish Cove and Sag Harbor Cove. In addition, a few other sediment and surface water sampling sites should be chosen to determine the potential presence of selected toxic substances or metals.

Importance

Toxics pose a potential threat to the welfare of the Peconic Estuary system, with several areas of known contamination already identified. As

a whole, toxic chemical contamination has not been comprehensively addressed in the Peconic system.

7. LEGAL ISSUES

Legal implications of land use recommendations should be examined.

Importance

Potentially controversial legal issues could be raised by future management recommendations, especially with respect to pre-existing land uses.

8. MONITORING AND MARINE SURFACE WATER QUALITY NITROGEN GUIDELINE

The marine monitoring program should be continued. The marine surface water nitrogen guideline, designed to ensure a minimum dissolved oxygen of 0.5 mg/l in the Peconic River and Flanders Bay, should be further refined, especially in conjunction with water quality benefits documented by additional sediment flux research and management alternative evaluations.

Importance

Monitoring data and the nitrogen guideline are crucial elements in establishing environmental conditions and shaping management recommendations.

HABITAT AND LIVING RESOURCE CHARACTERIZATION WITH AN EMPHASIS ON FINFISH WORKING GROUP

Session Leader: Christopher F. Smith, Cornell Cooperative Extension
Rapporteur: Robert DeLuca, Suffolk County, Office of Ecology

Participants

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Doreen M. Monteleone, MSRC
Alice Weber, NYSDEC
Peter M.J. Woodhead, MSRC
Chester Zawacki, NYSDEC

Issue Statement: The charge to this group was to develop a research agenda for fisheries of the Peconic Bay estuary. Presently, little is known about the fisheries of the Peconics. The body of knowledge that exists has been accumulated by sport and commercial fishermen and naturalists residing in the area. The majority of information has been generated by statistical surveys accomplished by the NYS Department of Environmental Conservation. The NYSDEC has been conducting ongoing trawl and seine fishery surveys throughout the system since 1985. This effort was organized as part of the Atlantic States Marine Fisheries Commission Weakfish Management plan. The trawl survey is comprised of 76 stations and utilizes a 16' bottom trawl, with a 0.25" mesh liner. The seine survey utilizes a 200' seine and collects from inshore stations. Water quality parameters collected during this survey include temperature, salinity, and dissolved oxygen. The seine survey utilizes a 200' seine and collects from inshore stations.

The fishery resouces of the Peconics can be separated into resident and transient species. The former includes winter flounder, bay anchovy, and silversides. The latter includes scup, fluke, weakfish and striped bass. The Peconic Bays system supports thriving sport and commercial industries year round.

Research Topics:

1. Determine abundance and distribution of fishery resources.

   Seasonal surveys of fishery resources should be conducted throughout the Peconics. In addition to trawl surveys, plankton

surveys would be conducted to quantify early life history stages (eggs and larvae). These efforts would elucidate the degree to which the Peconics acts as a spawning area and nursery for various fish species. It would also determine spawning seasons and rates of growth and survival of all life stages. Such a study would mesh with existing survey efforts being conducted by DEC.

2. Map fishery habitats and quantify their contribution as a nursery for various fish species.

   This effort would map bottom environments such as eelgrass beds, shell beds, gravel/rock beds to evaluate their interaction with fishery resources. This information would be used to assist in development of management actions such as designation of sanctuary areas, artificial reef siting and design. Of particular concern was to determine the degree of interaction of early life history stages with these environments.

3. Determine interaction of brown tide with fishery resources.

   These projects would determine mortality and sub-lethal effects of brown tide on adult and early life history stages of fish. Growth rates, feeding efficiency, and mortality should be quantified.

4. Determine winter flounder migration and stock identity.

   This project would focus an intensive effort on winter flounder. Genetic stock identity, migration patterns, tagging techniques and fishing mortality would be several recommended projects.

5. Establish the physiological condition of resident fish populations. Recently techniques have become available that utilize the physiological condition of fish to determine the degree to which the environment is stressing populations. Such things as egg and larval viability and contaminant levels could be determined.

HABITAT AND LIVING RESOURCE CHARACTERIZATION WITH AN EMPHASIS ON SHELLFISH WORKING GROUP

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Rapporteur: **Debra A. Barnes, New York State Department of Environmental Conservation**

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Issue Statement: The living marine resources of the Peconic Estuary System have been diminished for a variety of reasons. The working group suggested that from a managerial point of view, it would be most advantageous to work toward restoration and enhancement of these resources utilizing a combination of demonstration (e.g., sea grass plantings and scallop reseeding programs) and research projects. The Peconic Bays System is quite different from other systems and there is a lack of research and information available on the characterization of the shellfish, finfish, submerged aquatic vegetation (SAV's), trophic structure, predator communities and sediment characteristics of this system. Our existing survey of the literature suggests that the database for the Peconics Estuary is particularly limited, as compared to other east coast estuaries.

To characterize the habitat and living marine resources of the Peconic System, the following three step plan was proposed:

- What are the resources? An overall characterization of the abiotic and biotic components of the system (i.e., sediment type, benthos and SAV's) is needed.
- What is the best way to restore and enhance those resources which have been reduced or eliminated? Restoration and enhancement actions which would include jointly undertaken demonstration and research projects should be implemented. A plan needs to be developed to organize the re-seeding (e.g., scallop planting) activities taking into account such factors as the life stages of the shellfish, presence or absence of predator groups, scale of

plantings and ability to monitor their success. A second plan needs to be developed for the restoration of seagrasses (SAV's). The size and density of planting needs to be addressed and monitoring should be conducted for more than one year and on a seasonal basis.

- What are the mechanisms responsible for these reductions and eliminations? The working group agreed that research needs to be undertaken to determine how the brown tide impacts different species of shellfish. Other projects may need to be undertaken as specific stresses are identified.

Research Topics:

The following research needs were identified by the working group:

1. Development of a comprehensive characterization of the existing habitats and living resources, primarily sediments, SAV's and commercially important shellfish for comparison with the historic database. This research topic should include an assessment of community structure and trophic relationships. The working group agreed that it would not be possible to appropriately manage the resources of the Peconics until we have identified and characterized these resources.

2. In terms of restoration and enhancement, there needs to be an assessment of the reseeding efforts of commercially important shellfish species (e.g., scallops, clams and oysters) and submerged aquatic vegetation rehabilitation programs.

Emphasis needs to be placed on the development of guidelines for enhancement which should include a combination of small and large scale projects involving habitat manipulation and early planting of seed. This information would be important to managers in terms of the re-establishment of scallop populations in the Peconics System and once established, the ongoing management of the resources within this system.

3. Determine factors that control recruitment of shellfish (i.e., temporal and site-specific changes in abundance). These factors are important relative to both exploited resources (primarily molluscs) and predators of exploited species (e.g., crustaceans). We need to develop bioassays to determine the susceptibility of various species and life stages of shellfish to brown tide and anthropogenic influences, as well as, determining effects on growth. The testing should be conducted to identify thresholds and duration of exposure. This research would be useful to managers for the development of aquaculture in the Peconic System and in determining the importance of SAV's as nursery areas for commercially important shellfish species.

AD HOC TOXICS WORKING GROUP

Session Leader: Felix Locicero, US EPA

Participants

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Issue Statement: To date very little is known about the impact of toxic pollutants within the Flanders-Peconics Bay System (FPBS). While some site-specific data exists, the impact of toxics throughout the FPBS has not yet been assessed or addressed. It is generally assumed that toxics are not a problem. But careful assessment of available data is needed before managers should be comfortable with this assumption.

Research Topics: The first step should be the preparation of a "toxic characterization report." This report is the first step in an assessment of the impact of toxic substances on aquatic life and human health within the FPBS.

Toxics may enter the FPBS through atmospheric deposition, municipal and industrial wastewater discharges, urban and agricultural runoff, landfill leachate, groundwater infiltration and accidental spills.

The October 1991 draft "Brown Tide Comprehensive Assessment and Management Program: Summary" report identified: 10 municipal wastewater discharges; an industrial wastewater discharge's related impact to surface water; nine landfills; agriculture related pesticide impacts to groundwater and surface water; and the occurrence of numerous hazardous material leaks and spills within the FPBS. The need for site specific investigations of the impacts of many of these sources has been discussed in the section entitled: "The Coupling of Land Use and Water Quality."

While a comprehensive assessment of impacts of toxic substances on aquatic life, wildlife and human health within the FPBS has not been documented, the information that does exist suggests that further study is warranted.

The report should provide the following:

1) a summary of the existing ambient water column, sediment, and finfish/shellfish data;

2) an assessment of data quality;

3) a characterization of toxics based on the availability of ambient data, and evidence of input to the system. Where ambient data are available, a comparison would be conducted of ambient data vs. Federal, State, and local criteria, standards, guidelines, action levels, etc.

4) a list of "toxic substances of concern" based on the above characterization; and

5) the identification of data gaps and future research needs.

Specific Research Questions: Specific research questions should be based on the findings of the "toxic characterization report". Research may be necessary to determine fate and transport, and methods to reduce toxic substance related impacts for those listed as substances of concern

within the FPBS. Monitoring may be necessary to determine ambient water column and sediment quality.

Importance of Research in the Management of Toxics of Concern within the FPBS: To determine the appropriate management approach and develop management controls such as waste load allocations for point sources and load allocations for non-point sources of toxic substances, the regulatory agencies must have information on the sources, loadings, fate and transport, and methods to reduce the loadings and impacts of toxic substance of concern within the FPBS.

APPENDIX A

BROWN TIDE COMPREHENSIVE ASSESSMENT AND MANAGEMENT PROGRAM (BTCAMP)

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

I. BROWN TIDE AND NATURAL RESOURCES IMPACTS

FINDINGS/CONCLUSIONS

1. The Brown Tide is an algal bloom of particularly small and previously unknown species (Aureococcus anophagefferens) which has appeared in the Flanders/Peconic and South Shore bays systems.

2. The Brown Tide bloom is recurring in nature, and has to date been unpredictable in onset, duration, and cessation, often persisting for unusually long periods of time over large areas.

3. Advances have been made regarding the identification and characterization of the Brown Tide and its growth needs. Conventional macronutrients such as nitrogen are apparently not the direct causes of the onset of the Brown Tide blooms. Chemicals which have been implicated by research as potential contributors to Brown Tide's pervasiveness include specific organic nutrients, chelators such as citric acid, and trace metals such as iron, selenium, vanadate, arsenate and boron.

4. Viruses are suspected to be an agent in ending the growth cycle of the Brown Tide. Acrylic acid and dimethyl sulfide, which may be produced by the Brown Tide organism, may be toxic to zooplankton which would graze on the Brown Tide. Meteorological and climatological factors may also affect the Brown Tide.

5. The abundant Peconic Bay scallop population was virtually eradicated by the toxic, mechanical, and/or poor nutritional aspects of the Brown Tide. In addition, the eelgrass beds, which are a critical shellfish and finfish spawning and nursery area, were decimated, probably due to reduced light penetration caused by the Brown Tide. Other shellfish apparently impacted by Brown Tide include oysters, clams, and blue mussels.

RECOMMENDATIONS

1. Monitoring of water quality and Brown Tide concentrations in the Peconic Estuary and South Shore bays systems should be continued.

2. Theories relating to the onset and persistence of the Brown Tide should be further researched; this research should have greater emphasis on field studies. Areas of research should include specific organic nutrients; chelators such as citric

acid; trace metals such as iron, selenium, vanadate, arsenate, and boron; and meteorological and climatological factors. Laboratory research regarding the organism's physiology should also be continued.

3. Surveys and research on the toxic, mechanical, and/or poor nutritional impacts of the Brown Tide on shellfish should be continued.

4. Factors related to the control and subsidence of the Brown Tide, such as viruses and dimethyl sulfide/acrylic acid production, should be researched.

5. Restoration and monitoring should occur for Brown-Tide impacted natural resources; potential priority targets are scallops and eelgrass.

6. In general, all water quality management decisions should be accompanied by the maximum practicable level of protection and enhancement of affected natural resources.

7. In light of the diverse, abundant, and significant natural resources in the area, a comprehensive Peconic Estuary-specific natural resources inventory and management plan should be pursued.

II. MARINE SURFACE WATER QUALITY

FINDINGS/CONCLUSIONS

1. Based on analysis of Flanders Bay data which relates nitrogen concentrations to chlorophyll-a and chlorophyll-a to diurnal dissolved oxygen variations, a surface water total nitrogen concentration limit of 0.5 mg/1 will ensure a minimum dissolved oxygen of 5.0 mg/1.

2. Portions of the western Peconic system contravene the nitrogen guideline (typical nitrogen concentrations as high as 0.8 mg/1), but apparently do not exhibit characteristics of advanced eutrophication in terms of conventional nutrients. The system may be near the limits of the factor of safety incorporated in the nitrogen guideline.

3. Water quality in the eastern Peconics is excellent with respect to nitrogen concentration.

RECOMMENDATIONS

1. The general L.I. 208 Study marine surface water quality nitrogen guideline of 0.4 mg/l should be modified to 0.5 mg/l total nitrogen for Flanders Bay and the tidal portions of the Peconic River.

2. Incremental point and non-point source pollution and substantial groundwater degradation should be prohibited in the poorly flushed and environmentally stressed tidal portions of the Peconic River and western Flanders Bay areas.

3. As a long range goal, pollution abatement should occur so that the nitrogen guideline can be attained in the tidal portions of the Peconic River and Flanders Bay.

4. Pollution to the eastern portions of the Peconic Estuary system should be controlled such that existing water quality in the surface waters east of Flanders Bay is maintained.

5. Surface water modelling and refinement of the nitrogen guideline should be continued.

III. MAJOR POINT SOURCES

FINDINGS/CONCLUSIONS

A. SEWAGE TREATMENT PLANTS (STPs)

1. Because of the quantity and location of its discharge at the poorly-flushed mouth of the Peconic River, the Riverhead sewage treatment plant (0.7 mgd, 140 pounds per day total nitrogen discharge, of which 7 pounds per day are attributable to the scavenger waste facility) is by far the

most significant sewage treatment plant in terms of nitrogen loading.

2. Improvements in wastewater treatment and disposal at the Riverhead STP would result in a reduction of summertime surface water total nitrogen concentrations to near the 0.5 mg/l guideline in the western Peconic system.

3. Eliminations of the Riverhead STP surface water coliform loading could move the open shellfish area boundary on the order of an additional 1 km westward.

4. Previous efforts at sampling and modelling impacts of the Grumman and Brookhaven National Laboratory STPs have been limited. However, both of these facilities are environmental concerns because they discharge directly into the environmentally sensitive Peconic River.

5. Other STPs discharging to surface waters are not a threat to system-wide water quality because of their remote locations with respect to the western Peconics and their low nitrogen loading rates. However, localized impacts (e.g., Sag Harbor) may require further investigation.

RECOMMENDATIONS

1. In relation to sewage treatment plant expansion, no net increase in quantities of nitrogen discharged to surface waters should be allowed from Grumman, Brookhaven National Laboratory, and Riverhead STPs.

2. Pollution from other sewage treatment plants in the study area should be controlled such that existing water quality in the surface waters east of Flanders Bay is maintained.

3. A long-range management goal (beyond its currently proposed expansion of approx. 0.3 mgd; no net increase of nitrogen discharge recommended for the immediate proposal), the Riverhead STP should be upgraded so that the surface water quality nitrogen guideline can be attained. The upgrading should be implemented for the entire sewage treatment plant process stream at a time no later than the occurrence of any subsequent facility expansion.

4. The long-range Riverhead STP upgrade may be in the form of a groundwater discharge (10 mg/l total N), a relocated surface water discharge at central or eastern Flanders Bay (approx. 23 mg/l total N) or a surface water discharge at the existing location (4 mg/l total N); environmental impacts of alternatives would require assessment before selection. From BTCAMP's pollution control and natural

resources perspective, groundwater recharge is the most desirable alternative.

5. SPDES permits should be modified to require monthly reporting of effluent nitrogen concentrations for Peconic River-discharging STPs and quarterly reporting for all other surface water-discharging STPs.

B. PECONIC RIVER

1. Water quality in the Peconic River is excellent with respect to nitrogen concentration (approximately 0.5 mg/l at USGS gauge upstream of Riverhead STP).

2. Despite excellent water quality, as a result of its high flow, the Peconic River contributes substantial nitrogen (avg. of 130 pounds per day, range of 20 to 500 pounds per day) to an environmentally stressed area.

3. The high degree of open space in the Peconic River watershed (26% of 15,900 acres in 1989) has spared the river from excessive pollution; the watershed has not undergone drastic land use changes between 1976 and 1988.

4. Substantial potential exists for future development in the Peconic River area (34% of acreage developable in 1989.)

5. Mathematical modelling and sampling have established that increased development intensity adversely impacts groundwater quality. L.I. 208 Study modelling indicates that slight changes in groundwater quality have significant impacts on Peconic River nitrogen concentrations; as per current modeling, Flanders Bay nitrogen concentrations are very sensitive to Peconic River loadings.

6. The relationship between land use and surface water quality, coupled with the amount of developable land in the study area, highlights the need for stringent development controls to prevent degradation of Peconic River and Flanders Bay. An additional benefit of land use controls would be the added protection of invaluable natural resources of the study area.

RECOMMENDATIONS

1. Developable residential land in the Peconic River corridor should be upzoned to a minimum of two acres per unit. Additional natural resource protection could be attained by even more stringent land use controls, such as three to five acre zoning.

2. Commercial, industrial, and institutional land uses should be controlled so that the impact on groundwater is comparable to that of two-acre residential zoning.

3. Zoning controls should be implemented in conjunction with other land use management techniques, including cluster development, transfer of development rights, and programs related to land preservation, acquisition, and enhancement.
4. In addition to the land use controls noted above, Peconic River development plans should be reviewed utilizing the strictest practicable standards, which would include the requiring of open space dedications, maximum practicable setbacks from the river, and natural landscaping techniques to minimize fertilizer use.

C. MEETINGHOUSE CREEK

1. The elimination of Corwin Duck Farm's direct discharge to Meetinghouse Creek substantially improved water quality in the creek with respect to nutrients such as nitrogen, but nitrogen (15 mg/1 as compared with less than 2 mg/1 in other local creeks) and coliform concentrations in the creek remain elevated.

2. Current total nitrogen loading from Meetinghouse Creek is approximately 360 pounds per day.

3. Substantial reduction of Meetinghouse Creek nitrogen contribution (15 to 2 mg/l total N) would result in only moderate improvements in system-wide water quality (due

to the creek's location in a better-flushed area, only about 0.05 mg/l total nitrogen reduction as compared with 0.2 mg/l improvement associated with Riverhead STP upgrading).

4. Meetinghouse Creek improvements would have more system-wide significance if they were effected in concert with other pollution abatement efforts.

5. Improvements in Meetinghouse Creek coliform concentrations would result in only localized benefits.

RECOMMENDATIONS

1. Monitoring and remedial investigation of pollution at Meetinghouse Creek should be continued and remediation should be effected when technologically, economically, and environmentally feasible.

2. The evaluation of the effectiveness of on-site duck waste containment and treatment processes at the Corwin Duck Farm should be continued.

3. Sediment flux study should be conducted in Meetinghouse Creek to quantify actual impacts of sediment flux on water quality and to evaluate effectiveness of potential remedial measures.

IV. MAJOR NON-POINT SOURCES

A. SEDIMENT FLUX (i.e. chemical exchange between sediment and water column)

1. Summertime sediment flux nitrogen contribution, est. at 2,400 pounds per day, is greater than all other point and non-point sources of nitrogen contributions combined.

2. Changes in point source loading resulting from the implementation of management alternatives would eventually change the sediment flux rate, potentially resulting in significant water quality improvements.

3. More monitoring and study is needed to better characterize the dynamics of the relationship between pollution contribution and sediment flux.

RECOMMENDATIONS

1. Sediment flux sampling should be continued and expanded.

2. The dynamics of the relationship between pollution contribution and sediment flux should be studied so that ultimate short and long-term benefits associated with pollution abatement could be better documented.

3. The computer model of the estuarine system should be upgraded to include an improved sediment submodel.

B. STORMWATER RUNOFF

1. Stormwater runoff, which contributes approx. 30 pounds per day of nitrogen, does not appear to be a significant input with respect to nutrient loading.

2. As of 1990, 3,053 acres of shellfish beds are closed in the Peconic system; these areas are generally situated in semi-enclosed embayments and near shore locations or are located adjacent to STP discharges.

3. Stormwater runoff is the largest and most significant source of total and fecal coliform loading to the Peconic River and Flanders Bay. Other localized sources may include wildlife waste and sanitary systems.

4. Based on pollutant loading analysis and land use data, stormwater runoff coliform loading is correlated with land use intensity, with the North and South Flanders Bay areas, due to substantial residential acreage, each contributing a much greater coliform load than the less intensively developed Peconic River watershed.

5. Modelling indicates that the benefits from decreased stormwater runoff coliform loading do not justify the costs of system-wide

remediation. However, localized benefits might be realized from site-specific remediation.

RECOMMENDATIONS

1. On a system-wide basis, any action which would result in a substantial increase in stormwater runoff coliform loading to the Peconic Estuary sytem should be strictly prohibited.

2. Stormwater runoff remediation efforts should be undertaken on a site-specific basis pursuant to localized studies which demonstrate technological, economic, and environmental feasibility.

3. Proposals for new development within the stormwater runoff-contributing area to the Peconic Estuary system should be reviewed under the strictest scrutiny. In addition to on-site stormwater runoff containment requirements, vegetative buffers and sediment and erosion control plans should be considered as part of the approval process, with enforcement through the issuance and revocation of permits.

4. With respect to sources such as domestic animal waste and fertilizers, best management practices and public awareness should be promoted.

C. GROUNDWATER UNDERFLOW

1. North Flanders Bay, North Fork and eastern Peconic River regions have groundwater nitrogen concentrations which are substantially elevated (5 to 7 mg/l).

2. Western and central Peconic River, with their vast expanses of open space, have relatively low total nitrogen concentrations (1 to 1.5 mg/l) indicating excellent groundwater quality.

3. Pesticide contamination of private water supply wells is common in the eastern Peconic River, North Flanders Bay and North Fork regions (6.4 to 14.4 ppb avg.), where agricultural chemical usage was historically prevalent. Detectable pesticide levels in East Creek (up to 8 ppb) indicate that pesticide contamination has, to some degree, reached surface waters of the study areas.

4. The intensity of land usage in given areas is directly related to nitrogen loading and groundwater quality degradation. Both residential and agricultural land uses are responsible for substantial nitrogen loading in the Peconic River and Flanders Bay regions; medium-density residential and agricultural land uses have similar nitrogen loading rates.

5. The apparent significance of groundwater nitrogen contribution (approx. 580 pounds per day east of USGS gauge) is tempered by surface water quality data, computer modelling, and groundwater

infiltration sampling which indicate that groundwater nitrogen contribution is not having a significant impact on study area surface waters.

6. Although mitigation of existing groundwater conditions does not appear to be a priority with respect to surface water quality improvement, the prevention of substantial future degradation to existing groundwater quality is an important goal, especially in the Peconic River area.

RECOMMENDATIONS

1. Substantial degradation to existing groundwater quality should be prevented, especially in the Peconic River area (see III.B., "Peconic River").

2. Groundwater monitoring programs and the study of surface water impacts of groundwater should be continued, especially with respect to areas with known contamination (see V.A., "Landfills,." and V.B., "Hazardous Materials"AAA); estimation of groundwater inflow and its pollutant contribution to surface waters should be performed for the areas east of Flanders Bay and further refined in the western study area. Pesticide contamination related to agricultural practices is an area of special concern which warrants further monitoring and evaluation.

3. Best management practices, such as low-maintenance lawns, slow-release nitrogen fertilizers, modification of fertilizer application rates, and sanitary system maintenance should be promoted through public education.

4. Additional controls, such as fertilizer use restrictions, should be promoted in the Peconic River watershed.

V. OTHER SOURCES OF POLLUTION

A. LANDFILLS

1. The plume of contaminants which emanates from the North Sea landfill reportedly includes ammonia, iron, manganese, volatile organic compounds, lead and cadmium. This plume has reportedly adversely affected clam populations in a portion of Fish Cove.

2. With the exception of Shelter Island, the other eight landfills in the study area are classified as potential environmental hazards.

RECOMMENDATIONS

1. Remedial investigations of the North Sea landfill, as required by USEPA, should be conducted with full consideration of surface water impacts.

2. Monitoring of the surface waters and sediments of Fish Cove should be continued, and remedial measures should be implemented where feasible.

3. Monitoring of other landfills in the study area should consider potential surface water impacts.

B. HAZARDOUS MATERIALS

1. Activities at Brookhaven National Lab have resulted in significant groundwater contamination and subsequent remediation efforts.

2. Surface water impacts from existing industrial discharges have not been documented.

3. The inactive Rowe Industries facility is the source of a significant plume of organic chemical contamination which has reached its discharge boundary at Sag Harbor Cove, with unknown impacts.

4. There are not reports of surface water impacts resulting from accidental spills and leaks in the study area.

5. Household hazardous materials are a potential and largely undocumented source of pollution.

RECOMMENDATIONS

1. Groundwater monitoring programs at Rowe Industries, Brookhaven National Laboratory, and other sites of present and historical point source discharges should be continued; the relatively small store of data regarding hazardous materials impacts on surface waters should be expanded.

2. Where appropriate, monitoring and remedial investigations of hazardous material-contaminated sites should incorporate surface water and sediment monitoring with full consideration of surface water impacts incorporated in management decisions.

3. "Stop Throwing Out Pollutants" programs should be continued and enhanced to foster public education and reduce household hazardous material pollution.

C. MARINAS AND BOATING

1. Sanitary waste discharges from boating activities are site-specific and not well documented, but are suspected of contributing to surface water coliform loading, especially in environmentally sensitive waterways with poor flushing.

2. The implementation of the Suffolk Country law (Res. 946-88) to investigate public health nuisances at marinas would be a

useful first step in addressing the need to better understand and manage the contribution of marinas and boating to surface water pollution.

3. Oil and gasoline, marine paints, and debris are marine pollution sources which may warrant future evaluation.

RECOMMENDATIONS

1. The Suffolk County law mandating the investigation of public health nuisances at marinas should be implemented in the study area.

2. Greater use of shore-based toilets, holding tanks on boats, and existing and additional pump-out stations should be promoted, especially in areas with heavy boat traffic or in environmentally sensitive areas.

3. Implementation of other measures, such as designation of "no discharge zones" and enforcement for non-compliance with discharge regulations, may also increase usage of pump-out facilities and should be considered, especially in environmentally sensitive areas.

4. Marine projects should be scrutinized under the most environmentally sensitive standards or review.

5. Public education should be an integral component of boater-related surface water protection programs.

6. The impacts of oil and gasoline, marine paints, and floatables and other debris should be investigated.

D. ATMOSPHERIC DEPOSITION

1. Atmospheric deposition of nitrogen to surface water systems is approximately 160 pounds per day (wetfall and dry deposition); this estimate is approximately 5% of the system's overall (summertime) non-point source loading.

2. Modelling indicates that changes in regional air quality would have limited impact on the system's marine waters.

3. Although acid rain is not a primary concern with respect to direct impact on marine surface water pH due to the buffering capacity of the marine system, acid rain may directly impact the fresh waters in the study area and may indirectly impact marine waters by affecting the solubility/transport of material through sediments.

RECOMMENDATIONS

1. Monitoring of the direct and indirect impacts of acid rain on the surface waters of the study area should be conducted and studied, where appropriate.

VI. IMPLEMENTATION

1. The implementation of BTCAMP recommendations would best proceed as a cooperative effort between all levels of government with the support and guidance of the private citizenry.

2. The implementation program would be most effective with mechanisms to re-convene the BTCAMP Management Committee to periodically assess the progress of implementation of BTCAMP recommendations, to address potential future environmental concerns, and to identify funding sources for additional monitoring, research, and remediation.

RECOMMENDATIONS

1. Implementation of regulatory and/or remediation recommendations should be conducted by parties that have

current responsibilities and should be enacted/enforced by the agencies with current jurisdiction over the subject matter of given recommendations. For example, the STP recommendations should be enforced by NYSDEC and SCDHS through the SPDES permit process, with STP owners responsible for compliance. Meetinghouse Creek pollution should be addressed by NYSDEC and the Corwin Duck Farm with the assistance and guidance of SCDHS and the Soil Conservation Service (SCS). Land use regulations fall within the province of the Towns' regulatory authority, and stormwater runoff should be addressed at the town level at the subdivision review stage and by State, County, and town governments when concerning roadways in their respective jurisdictions.

2. In the case of non-regulatory issues, implementation should be conducted by organizations which are qualified in given areas of concern. Funding for research should be provided by all levels of government, and public education should be continued by the Citizens' Advisory Committee (a.k.a. "Save the Bays") and groups such as the Cornell Cooperative Extension. Future Brown Tide Management Committee meetings should be held periodically to assess the progress of implementation, address potential future environmental problems, and identify and pursue funding sources for future monitoring, study, remediation, etc.

3. Monitoring of groundwater and surface waters should be continued by SCDHS with respect to BTCAMP-type monitoring and NYSDEC and USEPA, where appropriate (e.g., shellfish program and finfish, superfund sites, projects should be cooperative efforts between town, County, State, and federal governments.

APPENDIX B

BROWN TIDE COMPREHENSIVE ASSESSMENT AND MANAGEMENT PROGRAM (BTCAMP) PROPOSED PECONIC ESTUARY SYSTEM RESEARCH AND INVESTIGATION PROJECTS

The following outline is a summary of the major research and investigation projects recommended by the draft Brown Tide Comprehensive Assessment and Management Program report. The projects would be carried on with funding from the proposed National Estuary Program. In addition, $100,000 of Suffolk County capital funds have recently been appropriated for Brown Tide-related research.

BROWN TIDE

ONSET AND PERSISTENCE

- Chemicals such as specific organic nutrients, chelators (e.g., citric acid), and trace metals (e.g. iron, selenium, vanadate, arsenate and boron).
- Physical factors such as meteorological and climatological patterns.
- Research concerning the organism's physiology.
- Greater emphasis on field studies.

IMPACTS ON SHELLFISH

- Toxic impacts (e.g., potential toxicity of acrylic acid and dimethyl sulfide, which may be produced by the Brown Tide, to shellfish larvae).

- Mechanical inhibition of scallop growth and reproduction (e.g., poor retention of small particles by shellfish feeding apparatus, structural features of Aureococcus which impair digestion by filter feeders).
- Nutritive quality of Aureoccocus to shellfish.

CONTROL AND SUBSIDENCE

- Investigation of zooplankton which would graze on and limit the Brown Tide (e.g. impacts of dimethyl sulfide and acrylic acid produced by the Brown Tide on the viability of a zooplankton population).
- Role of viruses in the subsidence of the Brown Tide.

SEDIMENT FLUX

- Continuation and expansion of sampling.
- Study of dynamics of the relationship between pollution contribution and sediment flux.
- Improvement of computer model of the estuarine system to include a sediment submodel which predicts benthic fluxes as a function of sedimentary particulate organic matter decay along with the mass transport and kinetics of dissolved nutrients.

NATURAL RESOURCES

- Surveys of shellfish and finfish resources
- Restoration and monitoring of Brown Tide-impacted natural resources (e.g., eelgrass and scallops).
- Preparation of a Peconic Estuary-specific natural resources inventory and management plan.

STORMWATER RUNOFF

- Investigation of the efficacy of localized stormwater runoff control measures.
- Refinement of assessments of stormwater runoff pollution contribution and impacts on surface waters, especially in areas east of Flanders Bay.

GROUNDWATER INFLOW

- Site-specific investigation of surface water impacts of groundwater inflow, especially in areas with known contamination such as the North Sea Landfill, the Rowe Industries site, Brookhaven National Laboratory, and East Creek.
- Continuation of monitoring programs.
- Refinement of assessment of groundwater inflow and impacts on surface waters, especially in areas east of Flanders Bay.
- Study of the extent and potential impacts of hazardous materials.

SURFACE WATER QUALITY

- Continuation of water quality monitoring.
- Further refinement of nitrogen guideline.

APPENDIX C

SUMMARY OF CITIZENS CONCERNS PRESENTED AT A PUBLIC FORUM ON THE PECONIC BAY ESTUARY

25 NOVEMBER 1991

SPONSORED BY THE PECONIC BAY BROWN TIDE CITIZEN TASK FORCE

by

Jeanne Marriner

I'm here this morning to convey to you the concerns of the citizens of Eastern Long Island with regard to the Peconic Estuary. Last night we held another one of many forums about the bays. Many people representing many more East Enders, shared their feelings about the problems of our coastal waters and the need for solutions to these problems.

During the past five years, the Peconic Bay Brown Tide Citizens' Task Force has held over 50 meetings, forums, and workshops dealing with the Peconic estuary's problems. The Bays are very important to all of us out East. The Peconic estuary has been called the engine of our economy and the heart of our East End quality of life. As you know, the Nature Conservancy recently designed the Peconic Bio-region as one of the "12 Last Great Places in the Western Hemisphere." We are pleased to receive this designation. Our pleasure was short lived, however, as another

prolonged episode of the Brown Tide enveloped our bays shortly thereafter. **It is obvious to us that our paradise is in jeopardy, and we need practical solutions to the pollution that threatens to destroy it.** That was the message given by the citizens last night.

In brief, our major concerns are:

1. Loss of shellfish and finfish productivity which has sorely impacted the commercial and sport fisheries and our tourist economy.
2. Degradation of water quality has had severe and far reaching economic impacts. Our real estate has been devalued and so has our lifestyle. Most of us depend on the bay for recreation and food. We fear that our health may be in jeopardy also.
3. We are concerned about the loss of tidal and inland wetlands which we sorely need because of the land locked nature and low flushing action of the estuary.
4. We are very concerned about all the "people pollution" that has affected the Bays during the last 10 years of rampant growth.
5. Most of all we are concerned that there has been little pollution control and remedial action because the political movers are waiting for the "scientific data" to act.

The citizens believe that the scientific community could help foster the political will necessary to generate action by assessing the research already completed by the Brown Tide Comprehensive Assessment and Management Program, and in other estuarine studies which substantiates the need for remedial action, land use controls, and enforcement of existing laws. We would like the scientific community to acknowledge

that the appearance of the *Aureococcus anophagefferens* in the Peconic Bays is related to **human influences**. There appears to be enough evidence in the literature to make that statement. A 2020 panel for the Chesapeake Bay recently determined that the causes of the Bay's decline were: people and their everyday actions, and land use decisions. The EPA's Science Advisory Board in an overview report entitled "Reducing Risks, Setting Priorities" has urged the EPA to give greater emphasis to protecting ecological systems. The report states: "There are strong linkages between human health and the health of wetlands, forests and estuaries. Ecological systems have a limited capacity for absorbing environmental degradation caused by human activities. After that capacity is exceeded, it is only a matter of time before those ecosystems deteriorate and human health and welfare suffer (SAB Report A-101 USEPA). Well, we who live in the Peconic Bio-Region feel that our welfare is definitely suffering and it is just a matter of time before the degradation seriously impacts our health.

You may know about the European study of damaging algal blooms. This study begins next year with funding from the Scottish and Northern Ireland Forum for Environmental Research. The Forum's members have voted to make this major research investment with the ultimate benefit of the community in mind because of their increased awareness of "people pollution" as a cause of concern for ecological and public health.

During the past five years, the Peconic Bay Citizens' Task Force has done in-depth research into other estuaries in this country. We know our situation is not unique. All over the world coastal waters are in jeopardy.

At our 1988 State of the Bays Conference, Francis Flanigan of the Alliance for the Chesapeake Bay told us that there was enough scientific evidence available for us to take action. Our actions have led to the upgrading of the Riverhead sewage treatment plant, to education programs and to lobbying for inclusion in the National Estuary Program. As you know we are waiting to hear from EPA that the Peconic estuary nomination has been accepted. We hope this happens soon because we need the NEP structure and financial resources to develop a plan for the entire estuary. Our recently completed BTCAMP study deals only with the western most stressed portion of the bay. We want the federal funding for corrective measures so we do not "lose" the bay. But at this time, as we work for acceptance, we are also wary that the federal funding needed for practical, mitigating action will be diverted to research that will not solve the Bay's problems.

We maintain active communication with the Long Island Sound Alliance, the Buzzards & Narragansett Bays citizens organizations, with the Chesapeake and Albermarle & Pamlico Sounds, and with groups in Oregon and California all dealing with environmental problems. We know that research exists from estuary studies that could be applied to the Peconics. We do not need the wheel to be reinvented. At this time we need the scientific community to:

1. Establish trends in land use chances and give us a scientific data base for controlling growth on the East End, including the means to counteract the Governor's recent proposal for a jetport at Calverton. We know that this can be done because the Union of Concerned

Scientists helped us win the fight to prevent a nuclear power plant at Jamesport. The people on the East End know how to use scientific data. The data base could include: a) centralization of current information, b) projections of effects of future development on water use, recreational use and the impact on rural/maritime character, which is our tourist attraction, and c) factoring issues such as sea level rise into the need to protect and increase wetlands, habitats, open spaces and environmentally sensitive areas.

2. Such a data base would provide estimates for changes in point and non-point source pollution as related to land use. To obtain this data, the water quality carrying capacity of the Peconic watershed area must be determined which includes reviewing waste load allocation, open space needs of the ecosystem and the use of land use techniques such as greenways.

3. The existing land-use protection strategies in the Peconic Bio-region need to be evaluated as to the need for private acquisition, easements, restoration of wetlands, economic incentives, regulations, local zoning, and other land use programs. We hope the scientific community will co-host a major land-use strategy conference on eastern Long Island in 1992-the third in a series of State of the Bays.

4. With all of the information available we need a regional Cape Cod Commission type model where coastal management decisions are based on the value of the coastal resources - not on real estate values. The citizens last night gave us some of the economic figures

and the resources are worth billions when the bay is healthy and productive.

We urge the scientific community to look into NOAA's National Estuarine Research Reserve Program which is a cooperative federal/state venture that establishes field laboratories within an estuary system. There are several such reserves in the Chesapeake Bay, and one in the Hudson River estuary. I'm sure there are many others nationwide. Establishing such an area in the Peconics perhaps on Robin's Island, would provide a permanent area for estuarine habitat and marine resource research which could be synthesized for use in resource management policy decisions and local government land use decision making policy. The objectives of NOAA's other new program, the Coastal Ocean Program may also merit investigation. These programs could provide research dollars so that NEP money could be used for demonstration projects and practical research. Last night at the Forum in Riverhead, the citizens spelled it out loud and clear that it is time to take all the studies already completed and use them to engineer solutions and to develop an ecologically based management strategy for the bay. We need to develop a baywide fishery management plan and research will be needed for this. We need to develop water quality and habitat guidelines for the bay's living resources and a baywide plan to monitor ecologically important and endangered species. **We need a strategy to restore, protect, and manage submerged aquatic vegetation, and demonstration projects to prove what can work.** We need the same for all wetlands in the watershed. **Most of all we need a strategy based on sound ecological data for managing growth in the Peconic Bio-region so that it remains**

one of the 12 Last Great Places in the western hemisphere. We know we need stormwater runoff controls and in confined areas marine impact mitigation measures involving demonstration projects to prove what works. **We also need funds for public education.**

As we heard last night, the citizens of eastern Long Island, (and every Town was represented), are tired of the old excuse and barrier to action that "the research is not complete". They believe there is enough evidence to take action before we lose the bay - the engine of our economy. They agree that there is some data missing concerning sediment flux and its role in water quality. We know we need to update information about circulation in the various bays within the estuary to determine **no discharge zones**. We realize we need continued monitoring to protect the marine resources. But mainly we need **research into understanding the interactions of humans with the coastal environment and the outcome of these interactions.** The brown tide is one example. We need research into growth management including managing human behavior and developing ways citizens can help. We also believe a task force of marine scientists, and commercial and sport fishing interests should be convened to develop best management practices for fisheries. Research information should support these actions. We also need best management practices for marinas and documentation of effects, if any, of boater pollution on creek and shellfish areas.

In conclusion, I repeat: the Peconic estuary is in jeopardy and we on the East End fear that our nearly land-locked, beautiful bay will become a

dead sea very soon. We ask that you find and engineer solutions to the problems brought about by increased population and land development which has brought an increase in every type of environmental assault on the land, air and water of our coastal zone. Your challenge is to help us manage growth; to provide us with the scientific evidence to substantiate growth management policies for the Towns that share the estuary. This is not a new idea. The 208 study of 1976 indicated that we would lose the bay if we did not implement strict land use controls. Unfortunately few people were aware of the environmental damage that humans could create back then.

So we ask you ladies and gentlemen of the scientific community, to send the message once again and spell it out loud and clear. Tell us that we must change our ways - the ways in which we produce and consume goods, develop and operate our towns, fertilize our farms, lawns, and golf courses, drive our cars, operate our boats, and take care of our waters.

The citizens of eastern Long Island have a vision of fishable swimable waters, with every person understanding their role as stewards of coastal resources. We also fear that time is running out on the Peconics. Thank you for inviting me to present the citizens' concerns to you. In closing I bring you the message given to me last night loud and clear: We do not need more academic, esoteric research. We need practical solutions to save the bay now.

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resources. We also fear that time is running out on the Peconics. Thank you for inviting me to present the citizens' concerns to you. In closing I bring you the message given to me last night loud and clear: We do not need more academic, esoteric research. We need practical solutions to save the bay now.

APPENDIX D

WORKSHOP TO DEVELOP A RESEARCH PROGRAM FOR THE PECONICS ESTUARY RESPONSIVE TO MANAGEMENT NEEDS NOVEMBER 26, 1991

0830	Coffee and Registration	
	Session I: Clarification of the Environmental Issues of Concern	
0900	Welcome, Introductions, and Overview of Objectives for the Day	J.R. Schubel
0915	Summary of Conclusions and Recommendations of the BT-CAMP	Vito Minei
	Summary of the National Estuary Program Nomination	
0945	Summary of the Goals and Objectives of the Nature Conservancy's Designation of the Peconics Estuary as a Bioreserve	Sara Davison
1000	A Summary of Citizens' Concerns	Jeanne Marriner
1015	A Recap of the Set of Environmental and Management Issues; and a Charge to Working Groups	J.R. Schubel
1030	Break	
	Session II: Working Groups to Develop Research Programs and Demonstration Projects for the Issues of Concern	
	Concurrent Working Group Sessions	

Issue Set A

	Brown Tide Working Group (Meets in Challenger 165)	Robert Nuzzi, Facilitator
	Benthic Nutrient Regeneration (Meets in Challenger 175)	Bruce Brownawell Kirk Cochran
	The Coupling of Land Use and Water Quality (includes the groundwater role) (Meets in Dutchess 150)	Vito Minei, Facilitator
	Habitat and Living Resource Characterization with an Emphasis on Finfish (Meets in Endeavour 113)	Chris Smith, Facilitator
	Habitat and Living Resource Characterization with an Emphasis on Shellfish (Meets in Challenger 165)	Ken Koetzner, Facilitator
	Critical Habitat for Rare and Endangered Species (Meets in Endeavour 139)	Robert Zaremba
1230	Working Lunch in Challenger 165	
1315	Resume Working Group Sessions	
1430	Reassemble in Plenary in Challenger 165 Brief Reports of Working Groups	J.R. Schubel, Facilitator
1530	Reform Working Groups to Address Other Issues Identified Before or During Workshop	
1630	Reassemble in Plenary for Brief Summary Reports of Working Groups	
1700	Workshop Summary	J.R. Schubel
1730	Adjourn	

APPENDIX E

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