

APPENDIX C: Readings and Maps

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***HABITAT REQUIREMENTS
FOR
CHESAPEAKE BAY LIVING RESOURCES***

Second Edition

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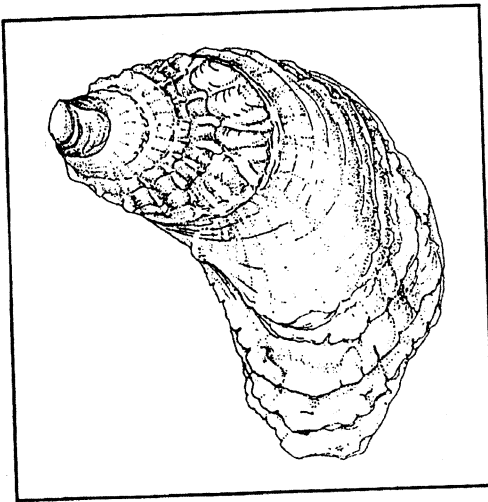
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EASTERN OYSTER

Crassostrea virginica

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The eastern oyster is a resilient estuarine species that is well adapted to its fluctuating environment in the Chesapeake Bay. It tolerates wide natural variation in temperature, salinity, suspended sediments, and dissolved oxygen, to the extent that environmental regulations protecting more active or more sensitive species like blue crabs and striped bass will probably protect oysters. It is fecund enough to produce billions of spat in the Bay if brood stock abundance is high, suitable hard substrate is plentiful, and climatic conditions are optimal. Predation causes high mortality of the young stages. High mortality rates also have been caused by diseases in recent years. Pollution is a local problem for oysters near industrialized regions of the Bay. Overfishing has led to depressed harvests, degraded oyster grounds, and a weakened fishery. To rehabilitate the resource, it will be necessary to understand aspects of oyster biology more completely (especially diseases), to rehabilitate the oyster grounds, to manage the

resource according to scientific principles, and to encourage the growth of aquaculture.

INTRODUCTION

The eastern oyster is a very fecund commercial bivalve that is well-adapted to an estuarine existence. Consequently, it is very resistant to the wide swings of temperature, salinity, turbidity, and dissolved oxygen that characterize its habitat. In addition to its fecundity, the species has morphological, physiological, and behavioral adaptations that, by colonial times, allowed it to persist in immense numbers in the Chesapeake Bay. European settlers reported that cemented agglomerations of oyster shells formed navigational hazards ("rocks") thrusting up from the soft Bay bottom.

The filtering activities of these massive concentrations of oysters may have resulted in the Bay harboring a much different assemblage of phytoplankton and zooplankton than at present. This assemblage may have contained fewer sea nettles, microplankton, and bacterioplankton, and the Bay waters probably were much less turbid than

now, thus allowing submerged aquatic vegetation to thrive.

Naturally, these immense beds of oysters began to be exploited by early settlers, to the extent that the Bay fishery was one of the most important in the U.S. at the turn of the 20th century.⁴³ However, politically directed management of the Bay's oyster resources at the behest of oyster harvesters resulted in virtually unregulated overharvesting and subsequent decline in the abundance of the species over the past century. In some heavily populated regions of the Bay, pollution and high sediment loads have also contributed to the decline. Oyster beds in unpolluted or relatively unpolluted regions (roughly from Eastern Bay south on the Eastern Shore, and in the Patuxent and Potomac River mouths on the Western Shore, with scattered populations elsewhere) are in danger of being overwhelmed by sediment because overfishing has led to excessive scraping of the substrate, leaving the surface of the beds projecting just above the sediment where it can be covered during storms.

The repeated warnings of numerous scientists and commissions of inquiry and their recommendations for conservation of the resource have generally been ignored by the Maryland and Virginia legislatures.^{43,44} Oyster farming (aquaculture) in Maryland has been discouraged for most of the 20th Century by passage of various laws. The potential for rehabilitation of the fishery has been greatly hindered by episodic incidences of lethal diseases over the past 30 years.

With over-exploitation and disease having depleted oyster stocks, the Bay fishery is a fraction of what it once was. Over 15 recent years (1971-1986), oysters have represented 21% of Maryland's total commercial fishery catch and 48% of dockside value. However, from 1983 to 1986, these proportions declined to 8% and 30%, respectively.⁸ Catches have declined dramatically from 14 million bushels in 1890 shortly after overfishing began to less than 0.5 million bushels per year since 1987. The market for Bay oysters has declined along with the harvest, so that an increasing market share has been captured by aquaculture industries on the Pacific coast of the United States and elsewhere.

Because it is highly adapted for an estuarine existence, and because the central Chesapeake Bay is so conducive to sustained reproduction, settlement, and growth of oysters, the eastern oyster could once again become a major natural resource in the Bay if aquaculture were encouraged and if resources were available to rebuild oyster beds in formerly highly productive habitat. The oyster is immobile for much of its life, and therefore does not have a high metabolic demand. As will be described later, it is resistant to all but the most extreme environmental fluctuations. Consequently, except perhaps for anthropogenic chemicals found near industrial population centers, water quality criteria established for more metabolically active and sensitive species such as the blue crab and the striped bass will undoubtedly protect the oyster as well.

BACKGROUND

The eastern oyster, also known as the American oyster or Virginia oyster, is a bivalve mollusk in the family Ostreidae, a family that is worldwide in distribution, and that supports numerous commercial fisheries in many nations. The eastern oyster ranges along the coast of North America from the Gulf of St. Lawrence to the Gulf of Mexico. It has been introduced to Hawaii, the west coast of North America, and other locations worldwide. Its typical habitats are estuaries, sounds, and bays, from brackish water to hypersaline lagoons. It is found in the shallows of the Chesapeake Bay from salinities above about 5 ppt in the upper Bay and its tributaries to the near-oceanic salinities of the Bay mouth.

Four recent reviews of oysters in general and the eastern oyster in particular are the authority for statements in this text, unless otherwise noted.^{2,33,44,48}

LIFE HISTORY

Reproduction

Adult oysters are immobile, but release eggs and sperm into the water where external fertilization occurs. Production of spawn (gametogenesis) depends on storage of glycogen, which begins after spawning in summer or autumn with the accumulation of nutrients and which slows or stops under winter conditions. Ripening (development of gametes) is rapid (over a few weeks in the Chesapeake Bay) as water temperatures warm above 10°C in spring. Temperature increase stimulates natural spawning, and spawning in the Bay may occur at 18°C (limited spawning) to 20°C and above.⁴⁵ The presence of sperm or eggs also stimulates release of gametes, as may the presence of some chemical (perhaps food-related) in the water pumped by adults.^{45,93} Where temperatures permit, females may spawn more than once in a season, with up to 20 million eggs (sometimes more) released at any one time by an individual female, depending upon her size and condition.

Larval Development and Settlement

Fertilized eggs develop into ciliated veliger (D-stage, straight-hinge) larvae in 24 hours or less, depending upon temperature. During the next two to three weeks the free-swimming larva grows until ready to settle. Before settlement occurs at about 260-300 µm, a foot develops (pediveliger stage). The foot is used to crawl and "explore" substrate before settlement and metamorphosis occurs. When a suitable substrate is found, liquid cement is extruded from a pore in the foot and the left valve becomes fixed in place. Subsequently the ciliated velum that allowed the larva to swim is discarded, the foot is reabsorbed rapidly, and gills and a digestive tract are elaborated. The attached juvenile oyster is called a spat.

Metamorphosis will be delayed if suitable substrate is unavailable (e.g., as a result of siltation, presence of noxious chemicals, etc.). The length of delay that can occur in nature is unknown, but Coon *et al.*¹⁸ have been able to keep competent-to-settle Pacific oyster (*Crassostrea gigas*) larvae in the laboratory for 30 days without settlement occurring. Settlement and metamorphosis in the eastern oyster are mediated by neuroactive compounds such as L-3,4-dihydroxyphenylalanine (L-DOPA), epinephrine, and norepinephrine.^{16,17} Anthropogenic substances in the water column that mimic or inhibit such compounds might stimulate settlement prematurely or inhibit it, but this possibility has not been explored at all.

The planktonic larval stage is the only mobile stage. Larvae can swim up or down in the water column, but are

carried more-or-less passively by horizontal water movements.

Growth

Fastest relative growth occurs in the early months of an oyster's life. Annual growth rate is affected by temperature (the rate increases from north to south), by food quality and quantity, by salinity, and by parasitic infection. Shell growth may be greatest in spring as water warms. Growth of the soft body tissues is greatest after spawning ends, as glycolytic reserves are built up in preparation for gametogenesis during the subsequent winter. Growth slows in the spawning season as energy is allocated to production of eggs and sperm.

ECOLOGICAL ROLE

Substrate

Because estuaries are areas of high sediment deposition, their basins are predominantly soft-sediment in nature, subject to continual sediment influx from the surrounding watersheds. As a result of its production of shell, the eastern oyster provides the greatest volume of hard substrate found in estuaries. In pristine or carefully managed habitats, oyster reefs can be massive, thus affording extensive attachment area for oyster larvae, as well as numerous associated species that, like oysters, require solid substrate. As a result of overfishing in the Chesapeake Bay, oyster shell substrate is usually limited to a relatively thin layer of dead shell and live oysters spread widely over Bay bottom. These damaged habitats are more readily covered by sediment because currents are slower near the bottom. In addition, reefs with many live oysters seem to remain freer of sediment for reasons that are not clear but may include the effects of water pumping and vigorous shell clapping by the resident oysters. Ultimately, over-exploited reefs disappear, overwhelmed by sediment, leaving less habitat available for oysters and other species that require hard substrate, such as hooked mussels, tunicates, bryozoans, and barnacles.

Principal Foods

As is characteristic of a species with planktotrophic larvae that depend on phytoplankton for food, oyster eggs are supplied with the minimum lipid reserves to support energy requirements until feeding and digestive systems develop and function. For the 2-3 weeks of larval existence before settlement, suitable planktonic food is necessary for survival and metamorphosis. Young spat grow rapidly after settlement and have low food reserves; an adequate quantity and quality of phytoplankton is required for the buildup of nutrient reserves to meet metabolic needs over winter. The adult also requires suitable food to support gametogenesis. Preliminary data on studies in the Choptank River indicate that Broad Creek and the Tred Avon River have sufficient food to support the presumed food requirements of any life history stage

of the eastern oyster (personal communication: R. Newell, Horn Point Environmental Laboratory).

Larvae, spat, and adults ingest predominantly living plankton. Oyster larvae can ingest food particles ranging in size from 0.2 to 30 μm , selectively ingesting 20-30 μm organisms.⁴ Adults are less efficient in retaining particles below 3 μm in diameter than in retaining larger particles.⁵⁰ The biochemical composition of algal cells as well as cell size is important. The detrital complex in the seston appears to supply very little of an adult oyster's carbon requirements in Maryland's Chesapeake Bay.^{19,74}

Role as a Filter Feeder

Recently, it has been proposed that over-exploitation of oysters in the Chesapeake Bay has reduced the important filtering role oysters play in the ecosystem, resulting in major biotic changes.⁷³ Oyster populations in the Bay are calculated to have declined since the late 19th century from a standing stock biomass of 188 million kg dry tissue to a present biomass of 1.9 million kg dry tissue. Where once the population in summer was capable of filtering the Bay's entire water column from surface to bottom in an estimated 3 to 6 days, present stocks require an estimated 325 days. The pre-1870 oyster population is estimated to have been capable of filtering 42-77% of the 1982 daily carbon production in Bay waters shallower than 9 m, compared with less than 1% filtered by the 1988 population.⁷³

Newell⁷³ hypothesized that the loss of such a major filtering assemblage may have been an important factor in the apparent shift to microbial food webs in the Bay and to an increase in zooplankton, including gelatinous zooplankton (ctenophores and jellyfish). Restoration of oyster populations by aquaculture and the careful management of public beds would improve water quality through the enhanced removal of particulate carbon by oysters. Oyster biomass would then be harvested, permanently removing the carbon from the system. Note also that many of the organisms commonly found attached to oyster shells (e.g., hooked mussels, tunicates) are also filter feeders whose numbers may also have declined as a consequence of the decline in oyster populations.

Predation

The oyster, like all bivalves that broadcast sperm and eggs into the water column, suffers over 99% loss of gametes, fertilized eggs, and larval stages before settlement occurs. Much of that loss is undoubtedly due to predation by ctenophores and other planktivores. Benthic carnivores that consume oyster larvae include sea anemones, the scyphistoma stage of sea nettles, and probably a variety of filter feeding invertebrates. Newly settled spat are consumed by the carnivorous flatworm *Stylochus ellipticus*, and by small crabs. Older spat and first year oysters may be eaten by larger blue crabs and some fish. In higher

salinity waters (>20 ppt), predatory snails and starfish feed on oysters, including the largest individuals. Finally, disease kills many oysters, usually those older than one year; salinities below about 12 ppt seem to protect oysters from disease. Water saltier than about 5 ppt is excellent habitat for oyster production because predatory snails and starfish are generally absent, with disease limited in low salinity years.

HABITAT REQUIREMENTS

A number of "physiological races" of the eastern oyster apparently exist along the western Atlantic coast.^{54,55,56,94} These races appear to differ in timing of gametogenesis and spawning as a function of geographic location and temperature regime. Studies are currently being conducted on these differences. Relatively few data on environmental requirements of the eastern oyster have been collected from Chesapeake Bay populations. Existing data have been collected as the result of experiments in Long Island Sound, Delaware Bay, and the Gulf of Mexico, so they may not be entirely accurate for Bay oysters. But these data do provide general insights into tolerances and adaptations of the eastern oyster. Table 1 summarizes habitat requirements for temperature, salinity, sediment, pH, and dissolved oxygen. These requirements are "best estimates" rather than exact values, but can serve as guides for managers.

Water Quality

Temperature

Temperature influences growth, development, reproduction, and feeding activity. It has not been reported to jeopardize oyster populations, except where industrial discharges release much warmer water than occurs naturally. Oysters cannot control their body temperature, and are subject to a temperature range of about -1°C to about 36°C throughout their geographic range. Oysters exposed to air at low tide in southern regions have briefly attained body temperatures of 46-49°C.³³ However, temperatures much above about 32°C would be stressful over a period of many hours or days and could be lethal in winter when oysters are acclimatized to cold temperatures.

The eastern oyster has a maximum rate of ciliary activity (responsible for pumping water for respiration and feeding) at about 24-26°C. Ciliary activity is usually disrupted above 32°C and feeding may cease below 6-7°C.^{33,52,70}

Efforts to determine lethal temperatures by Henderson³⁷ and Fingerman and Fairbanks³⁰ were environmentally unrealistic and did not produce data that are ecologically useful. No other studies on lethal temperatures of adults or spat have been reported. However, to simulate conditions of passage through power plant cooling condensers, Hidu *et al.*⁴⁰ subjected fertilized eggs, ciliated gastrulae,

and 2-day-old veliger larvae to temperature increases for periods from 10 seconds to 16 hours. Mortality increased with increasing temperature and exposure time. Fertilized eggs were least resistant to higher temperatures, followed by ciliated gastrulae, then veliger larvae. Maryland law governing temperature addition to estuaries should protect oysters from lethally high temperatures, and heated effluents are not allowed near oyster beds.

Temperature affects rate of larval development. In the Bideford River, Canada, oyster larvae required 30 days to reach 365 µm in length at 19°C, 26 days at 20°C, and 24 days at 21°C.⁶⁷ Maximum larval growth in the laboratory occurred between 30.0 and 32.5°C at Long Island Sound salinities between 10.0 and 27.5 ppt²², and larvae reached setting stage in 10-12 days at 30-32.5°C and 36-40 days at 20°C. Diaz²⁶ noted that a five-second exposure to a 20°C increase above 25°C (but not increases of 10 or 15°C) permanently impaired larval growth; his results would be applicable to larvae exposed to industrially heated water.

Increased temperatures (below lethal levels) influence setting success of pediveligers. In the Delaware Bay, an increase in temperature from 24 to 29°C for four hours increased the percentage of larvae that set.⁵⁹ Such temperature increases occur when water floods over tidal flats heated by exposure during ebb tide. Setting in Virginia was also found to be influenced by the age of larvae and degree of temperature increase above 25°C.⁴⁰

Salinity

Like temperature, salinity influences growth, development, reproduction, and feeding activity. Oysters tolerate a wide range of salinities and thrive in the mesohaline waters of Chesapeake Bay; they become less abundant toward the head of the Bay and in the upper regions of Bay tributaries where salinity falls below about 5 ppt. The most deleterious salinities are low salinities associated with freshwater flooding over a number of weeks.

Low salinity can be fatal, and can inhibit feeding, growth, and spawning. In an extensive study by Loosanoff,⁵¹ there were no differences in salinity tolerance among oysters of different ages, including spat. Oysters could feed at levels as low as 5 ppt if temperatures were cool, but no feeding was ever observed at 3 ppt or below. The crystalline style disappeared in oysters held in low salinities (a sign that feeding was not occurring) but regeneration occurred soon after the oysters were returned to normal salinities. Growth was limited or nonexistent at 5 ppt or less, retarded at 7 ppt, and unaffected at 12 ppt and above.

Salinities of 0 and 3 ppt totally inhibited gametogenesis in Loosanoff's experiments.⁵¹ At 5 ppt, gametogenesis was arrested in about 50% of an experimental sample, and depressed in the remainder of the sample. At 10 ppt, 12 ppt, and 27 ppt (control), oysters were ripe, with some

starting to spawn. If oysters were held in ambient conditions and allowed to grow until the gonads began enlarging (about three weeks before the normal onset of spawning) and were then placed in lower salinities, 0 to 5 ppt inhibited further gonad development. Normal gametogenesis proceeded at 7.5 ppt and above, with some oysters spawning at 7.5 ppt and with more intense spawning in higher salinities. Salinities of 7.5 ppt or above are necessary for gametogenesis and spawning to be even moderately successful.

Pumping rate (method of assessment not stated by Loosanoff)⁵¹ was strongly affected by sharp reductions of salinity from 27 ppt (control) but began to increase somewhat after additional exposure (acclimation) to the lower salinities. Rapid changes from low to high salinities had little effect. Oysters accustomed to living in lower salinities were more tolerant of the effects of even lower salinity (as measured by shell-closing behavior or by pumping behavior) than were oysters used to living in higher salinities.⁵¹

Optimum salinity and the salinity range for the development of oyster eggs into straight-hinge larvae is influenced by the salinity experienced by the parents during gametogenesis.²¹ Thus, adults acclimated at 26.0-27.9 ppt produced zygotes that developed over a salinity range of 12.5-35 ppt, with an optimal development at about 22.5 ppt. Parents acclimated to about 9 ppt produced zygotes that developed within a range of 7.5-22.5 ppt with optimal development between 10.0-15.0 ppt. Optimal larval growth occurred at 17.5 ppt for larvae whose parents were held at 26.0-27.9 ppt. Thus, optimal salinity conditions for larval development will differ with location in the Chesapeake Bay.

For older larvae (165 μm long) from parents acclimated to 26.0-27.0 ppt, Davis²¹ found good growth between 12.5 and 17.5 ppt and in the controls (26.0-27.0 ppt), and limited growth at 7.5 ppt (25% of control value). Setting was good between 12.5 and 17.5 ppt but non-existent at 7.5 ppt. No experiments were made with larvae from parents held in low salinity conditions.

Davis²¹ speculated that oyster populations in low salinity areas (< 10 ppt) may depend on the influx and settlement of nearly full-grown larvae from higher salinity areas. In upper Chesapeake Bay, Eastern Bay and the lower Choptank River are the northernmost regions with consistently good spat settlement success. Both these areas have salinities generally above 10 ppt during the spat settlement period, in contrast with the less saline Chester River further up the Bay which is not usually self-supporting in terms of spat settlement. Setting of oyster spat in the Bay varies directly with the cumulative high salinity during the spawning season in the central Bay.⁹⁷

When Chanley¹⁵ placed recently set spat (0.3-0.5 mm long) directly into salinities ranging from 2.5 ppt to "full salinity" (not specified) at 21-24°C, 100% died within two weeks at 2.5 ppt and 50% died at 5 ppt. Growth at 7.5 and 10.0 ppt was slow compared to growth in higher salinities. In a second experiment, spat (1.0-1.4 mm) that were transferred gradually to experimental conditions over a week experienced poor growth at 10.0 and 12.5 ppt and least growth at 7.5 and 5.0 ppt. At 2.5 ppt, only 19% survived, compared with 66% at 5 ppt and 80-100% at the remaining salinities.

Based on these studies^{15,21,51} one can expect larvae to grow well at about 12.5 ppt and higher whereas spat and adults should grow slowly from about 7 to 12 ppt and normally from 12-27 ppt.

Responses of different life history stages of oysters to salinity vary with temperature. For example, mortality in oysters subjected to fresh water and low salinities increases as temperature increases.⁵¹ Salinity also affects temperature tolerance of oyster larvae.²² At salinities from 10.0 to 27.5 ppt, the optimum temperature for larval growth was between 30.0 and 32.5°C, but was 27.5°C at 7.5 ppt. No well-defined optimum growth salinity was delineated; growth depended upon the experimental temperature. Reduced salinities reduced the temperature range that eggs and larvae could tolerate for development and growth.

Managers should understand that there is a synergism between temperature and salinity in relation to their effects on oysters. However, temperature regulations in Maryland seem adequate to protect oysters, and no salinity regulations seem to be required.

Suspended Sediments

The eastern oyster is well adapted to withstand erratic environmental increases in turbidity and sedimentation resulting from the effects of wind, currents, runoff from land, etc.⁶⁸ Most studies of sediment effects on the eastern oyster have involved sediment concentrations that are higher than usually encountered in nature.

Nelson⁶⁹ found the oyster to be capable of feeding rapidly in waters containing up to 0.4 g (dry weight) of suspended matter per liter. He described the efficient gill filtration system that allows for this, including the promyal chamber which is characteristic of oviparous oysters (genus *Crassostrea*), and concluded that the oyster (at least from turbid Delaware Bay) is able to feed in the presence of heavy loads of suspended sediment.^{71,72} However, oysters from less turbid Long Island Sound are more sensitive to high sediment concentrations.^{53,58}

Loosanoff and Tommers⁵⁸ provided quantitative estimates of pumping rates by oysters from Long Island Sound in

the presence of various concentrations of turbidity-creating substances. Feeding was most efficient when the water contained little suspended material. Additional studies reported by Loosanoff⁵³ showed that even for short exposures (3-6 hours), oysters demonstrated sensitivity to a variety of particulate materials. As particle concentration increased, the rate of water pumping dropped, reaching zero in high concentrations of suspended material. Upon return to clean sea water, oysters exposed for longer periods took longer to recover than oysters held in the same sediment concentrations for shorter periods. Loosanoff⁵³ assumed that the longer exposure period resulted in tissue damage to the filtering apparatus.

Oyster eggs and larvae can be killed by suspended sediment.²³ Concentrations of 0.25 gL⁻¹ resulted in 27% mortality, with 69% mortality at 0.5 gL⁻¹, and 97-100% mortality from 1 gL⁻¹ and above. Davis and Hidu²³ concluded tentatively that larger particles were primarily responsible for the mortalities. Larvae were more tolerant of sediment than were eggs. A concentration of 0.5 gL⁻¹ of sediment led to nearly 20% mortality in eastern oyster larvae after 12 days of exposure,²³ with 50% mortality between 1.0 and 1.5 gL⁻¹ and 100% mortality at 3 gL⁻¹. Eastern oyster larvae suffered reduction in growth in 0.75 gL⁻¹ of sediment, and growth stopped at 2 gL⁻¹. To place their results in an environmental perspective, Davis and Hidu²³ noted that eastern oyster larvae tolerated experimental turbidity levels higher than those normally encountered in nature. However, they felt that excessive turbidity caused by storms or activities such as dredging might be detrimental to oysters.

Dissolved Oxygen

Although limited experiments have been performed to evaluate the effects of low dissolved oxygen on oysters (whether measured in terms of survival, physiological activity, reproduction, or spat settlement) the eastern oyster seems to be a tolerant species. It is an oxygen regulator down to a critical oxygen tension of about 30 mm Hg at 20°C and 28 ppt.⁸⁸ Below 30 mm Hg, it becomes an oxygen conformer. Louisiana oysters (30-50 mm long) starved for 35-65 days remained resistant to anoxia, with their metabolic rate depressed to only 75% of the normoxic rate.⁹⁵ Values of LT₅₀ (days of exposure to anoxia causing 50% mortality) for these oysters when held at salinities of 10, 20 and 30 ppt were 28 days at 10°C, 18-20 days at 20°C, and 3-8 days at 30°C.⁹⁵ Compared with blue crabs (29-54 mm carapace width) from the same region, oysters were much more resistant to hypoxia and anoxia, both in terms of metabolic rate and of mortality.

Elsewhere, oysters have survived for up to 5 days (no temperature data given) in water containing less than 1.0 mgL⁻¹ oxygen.⁹¹ Presumably they underwent anaerobic metabolism during that time.³³ Median mortality times for anoxia-exposed larvae are 11 hours for 82 µm larvae and

150 hours for 16 mm spat.⁹⁹ Kennedy (personal observations) found that larval swimming rates after 12 hours at oxygen concentrations as low as 0.5 mgL⁻¹ were not significantly different from rates at saturation levels of oxygen. Also, oyster larvae avoided low oxygen water (exposure to about 1 mgL⁻¹ or less for one hour) by swimming upwards, an action that would bring them towards the surface where hypoxia is minimal.

Because of larval avoidance of hypoxia, and spat and adult resistance to low dissolved oxygen concentrations, short-term (days) intrusions of anoxic and hypoxic waters over shallow (<5-10 m) oyster beds are probably not deleterious. Should such intrusions kill less tolerant shell-fouling organisms, space would become available on the oyster shell for settlement by larvae. Regulations designed to protect blue crabs from low dissolved oxygen would serve to protect the oyster as well.

pH

Estuaries are generally well-buffered systems, with pH in unpolluted waters ranging from 6.8 to 9.25, depending upon time of day and season. Data on pH tolerances of oysters are meager. Oysters were found to spawn at pH 7.8 to 8.2 in Long Island Sound,⁷⁹ and not below pH 6.0 or above pH 10.¹³ Pumping rate in adults was normal at pH 4.4, but oysters at pH 4.25 remained open about 76% of the time and pumped about 90% less water than did controls at pH 7.75.⁵⁷ At pH 6.75 and 7.00, oysters initially pumped more than did the controls at 7.75, but the rate gradually declined to become less than in the controls.⁵⁷ Respiration is also affected by pH; at pH 6.5, oxygen consumption was 50% of normal, decreasing to 10% at pH 5.5.³³

Normal embryonic development occurs at pH 6.75 to 8.75.¹² Survival of larvae was more than 68% in the range of 6.25 to 8.75, with pH 6.00 being the lower limit for survival. Normal larval growth occurred from pH 6.75 to 8.75, with growth dropping rapidly below pH 6.75. Abnormal development of eggs and mortality of larvae increased rapidly at pH 9.00 to 9.50. Calabrese and Davis¹² concluded that successful recruitment of oysters requires a pH above 6.75. High concentrations of sediment lower seawater pH below 6.75 to 6.40. Thus, heavy sediment loads (or any pollutant lowering pH in tidal estuaries) may lead to failure of oyster recruitment.

Structural Habitat

Substrate

Even with an efficient mechanism for tolerating the often heavy sediment load in estuaries, oysters can be overwhelmed and buried by heavy sedimentation,⁷² with death by suffocation resulting. In general, oysters survive best on bottoms that are firm, such as those of shell, rock, and firm or sticky mud. Sand bottoms are subject to shifting activity, resulting in abrasion and valve injury. In

addition, shifting sand destroys young spat of the flat oyster, *Ostrea edulis*,⁸⁵ so presumably young eastern oyster spat would also be at risk in sandy environments.

Oyster shell is the most suitable substrate for spat settlement. The removal of whole oysters from the Bay and their transport to distant markets means that there is a constant drain of this cultch from the Bay. Alternatives such as buried shell are in finite supply, so if shell conservation is not practiced or if replacement material is not readily available, future spat settlement will be hindered.

Depth

In years past, oysters were dredged from the deeper waters of the Bay by sailboats, but most beds now are found in the shallows along the shore and in Bay tributaries where sediments are firmer and where the supply of dissolved oxygen is more reliable.

SPECIAL PROBLEMS

Overfishing

For the past century, management of the Bay's oyster industry has been influenced predominantly by political concerns rather than by scientific information.⁴³ The result has been a steadily decreasing harvest, degraded oyster grounds, and a diminished industry. It is not clear if the brood stock of the Bay has been depleted to the point that recruitment has been influenced negatively, but it may be significant that spat settlement has been poor during recent years when salinities have been low enough to inhibit disease organisms yet high enough to allow for normal reproduction. Many oyster beds are in danger of being smothered by sediments because they have been scraped so much that they barely project above the surrounding soft sediment. Silt-covered shells are not attractive to settling larvae.

Diseases

Mid-Atlantic Bight populations of oysters are subject to the diseases known as "MSX," "SSO," and "dermo".^{3,32,92} Except for the more marine SSO which does not occur in the Chesapeake Bay, these diseases have heavily depleted Bay oyster populations over the past 40 years. In addition to causing mortality, MSX inhibits growth and gametogenesis in spring. However, temperature-associated remission of infection may occur in summer and allow for gametogenesis and spawning to proceed.³¹ Similar results have been obtained for Louisiana populations infected by dermo.⁶² Of the two diseases, MSX is inhibited by salinity; salinities below about 10-15 ppt and above 30-32 ppt are associated with decreased parasite activity of MSX.³⁵ Dermo seems to be more tolerant of low salinity^{61,75} than MSX. One of the most pressing problems facing resource managers is that of understanding and combating these two disease organisms.

Contaminants

Overview

An extensive and hard-to-manage literature exists on toxicants, pollutants, pesticides, etc. It cannot readily be condensed for easy comprehension. Contaminants affecting oysters in Chesapeake Bay include heavy metals, pesticides, PCB, PAH, chlorine-produced oxidants, and petroleum hydrocarbons.^{6,36} Selected information has been compiled previously,^{42,44,66} and a comparative toxicology of marine organisms is available.^{77,81} Information on biological effects and body burdens of selected pollutants in the eastern oyster is summarized in Tables 2, 3 and 4.

It is difficult to generalize about the oyster's sensitivity, either to classes of contaminants, or relative to other species. However, adult and juvenile oysters appear to be somewhat more tolerant of most environmental toxicants than embryos and larvae, and more tolerant than some other estuarine species.

Judging from the diverse and inconsistent body of studies summarized in the Tables, the substances of most concern for toxicity to adult oysters in chronic exposures appear to be tributyltin (TBT), a few heavy metals, and petroleum hydrocarbons. Chlorinated pesticides and PCB (Arochlor 1016) caused acute mortality or sublethal effects in juvenile oysters at relatively low concentrations ($\sim 10 \mu\text{g/L}^{-1}$). Embryos were quite sensitive to mercury and silver, showed moderate sensitivity to copper and zinc, and were relatively insensitive to other metals and most of the pesticides tested. For the few substances tested, larval sensitivities were similar to those of embryos.

Interpretation of toxicity tests

Reischl⁸⁰ reviewed the use of laboratory tests for marine organisms. Acute toxicity tests typically measure the concentrations of a particular contaminant at which 50% of the test subjects die over a given period of time, usually 48 or 96 hours. This concentration is the LC_{50} for the substance. Chronic toxicity tests measure the effect(s) of sublethal concentration on one or more attributes, such as survival, growth rate, or developmental abnormalities. Problems in the standardization of these tests often limit their comparative value. Also, laboratory studies do not simulate field conditions very well, so that a contaminant's actual effect is likely to be different from what the bioassay predicts. However, short-term toxicity tests can be a valuable diagnostic tool for ranking toxicants.⁸⁰

Heavy metals and trace elements

The physiological aspects of heavy metal contamination in oysters have been summarized in the literature.^{20,29} Empirical data indicate wide variability in the toxicity of different metals to *C. virginica* embryos (Table 2). The relative toxicity of several metals is: mercury = silver > copper > zinc > nickel > lead > cadmium > arsenic >

chromium > manganese. Similar comparisons for larval or attached life stages cannot be made due to lack of data, except that mercury, silver, copper, and cadmium show acute toxicity to adults or larvae at relatively low concentrations. Comparisons between life stages reveal that embryos tend to be more susceptible than larvae for those metals which were tested on both life stages. Comparison between embryos or larvae and attached stages is not possible because acute assays were used for embryos and larvae whereas chronic tests were used for attached oysters.

Body burdens of heavy metals for oysters collected from Chesapeake Bay (Table 3) suggest that some metals (e.g., zinc) are accumulated out of proportion to their environmental concentrations. A few additional references are available for metal contamination in oysters from the Bay.^{7,27,36}

Pesticides

Kerr and Vass⁴⁶ summarized information on the accumulation of pesticide residues in aquatic invertebrates; a comprehensive treatment of the general toxicology of pesticides was given by Matsumura.⁶⁵ Differences in biological effects and toxicological endpoints measured preclude effective comparison of the relative toxicity of different pesticides (Table 2). However, acute toxicity data suggest that *C. virginica* is less sensitive to herbicides than to insecticides. An extensive list of acute toxicity of pesticides on various life stages of oysters can be found in Table 4.

Polychlorinated biphenyls (PCB) and polynuclear aromatic hydrocarbons (PAH)

Information is available on contamination of oysters and other shellfish in limited areas of Chesapeake Bay by the environmentally very persistent and ubiquitous PCB and PAH, which are both toxic and mutagenic^{5,6,28,36,78} (Table 3). Several PCB, along with other selected contaminants are monitored in oyster tissue at a few sites in the Bay by the National Oceanic and Atmospheric Administration's National Status and Trends Program; generally, shellfish body burdens in Chesapeake Bay tend to be lower than in several other contaminated U.S. estuaries.²⁵

Chlorine and chlorine-produced oxidants

These compounds (CPO) are produced by reactions of chlorine used for disinfection of water supplies and wastewater effluents with various compounds in the source water. Growth and mortality of adult oysters, chronic effects on spat, and larval responses have been measured at various concentrations of CPO.^{82,84,86} High mortality of juvenile oysters was observed in chronic exposures to a fairly low concentration of sodium hypochlorite (Table 2).

Petroleum

Petroleum hydrocarbons, especially the more refined products and contaminated waste oils, are very toxic to at least some bivalves (see HARD CLAM, this volume). Low concentrations of petroleum were lethal to adult oysters in chronic exposures, and to larvae in acute tests (Table 2). Additional information on oil pollution in marine environments and the effects of oil on estuarine organisms, including oysters, is available in the literature.^{1,49}

RECOMMENDATIONS

The eastern oyster is a highly resilient species that appears to be reasonably protected in Maryland by laws governing thermal discharge, effluent dechlorination, use of tributyltin, and dredging. It may be at risk in areas near industrial pollution, and laws establishing limits of pollution discharge in relation to oysters may be needed. Petroleum spills, chronic discharges of petroleum wastes, and diffuse low level loadings of some very toxic heavy metals (e.g., mercury) are possible, but undocumented threats to oysters, either locally or generally in Chesapeake Bay. But because it is not mobile for most of its life, the oyster's metabolic activity is such that regulations protecting more active species (e.g., blue crabs and striped bass) for the most part will protect the oyster. Perhaps the most pressing concerns involve improving our understanding of key aspects of the species' life history, especially disease, rehabilitating depleted oyster grounds, the basing of oyster management on scientific insight rather than on political pressure, and encouraging aquaculture.

Research

In their extensive review of the biology of the eastern oyster, Kennedy and Breisch⁴⁴ posed dozens of questions on biology and management that needed answers. Unfortunately, most of these questions remain unanswered, and it is difficult to manage what is not well understood. Particularly needed is a more thorough understanding of five major areas of oyster biology, namely larval biology, feeding and nutrition of all life history stages, genetics, disease, and the effects of pollutants. It is important that studies of disease and of genetics be pursued in order to counter the incidence of MSX and dermo in the Bay, especially if oyster farming is to be encouraged.

Improved management and rehabilitation of the oyster fishery requires thorough study of three components of oyster habitat. Here are some of the questions that need to be answered in each area:

Brood stock

What is the abundance of natural brood stock now available in different areas of the Bay? Has brood stock declined as a result of mortality due to recent disease epizootics? Is there an optimal brood stock concentration that ensures adequate spawning and is population age

distribution a factor in determining this optimal concentration, i.e., does one age group contribute more gametes than another age group?

Seed and cultch supply

How much cultch is now available in the Bay, and how much is optimal? What are the best concentrations on different bottom types or in different locations? Can any area of the Bay with a favorable current system and flushing rate be made into a good seed area, given suitable firm bottom and adequate cultch for settlement?

Growing and setting areas

The best areas still available for settlement and growth need to be determined and protected from loss of cultch and from pollution. It is not clear why some areas are historically conducive to setting (are they "larvae traps?"), but are not suitable for rapid growth and fattening, and vice versa, but the reasons must be clearly understood in order to utilize different areas effectively.

Management

As noted earlier, overfishing (and now disease) has reduced oyster populations to such a level that there are no more reefs. Rather, small mounds or relatively thin layers of shell are scattered over Bay bottom, with unproductive beds often becoming silted over. The supply of seed oysters is a limiting and critical factor in rehabilitation and management. Those areas of the Bay consistently producing adequate quantities of seed should be protected and expanded. A private oyster farming industry would encourage growth of a seed industry, as it has elsewhere in North America. Fresh shell should not be exported or used for anything other than as cultch for replenishment of the bottom because fossil shell used in Maryland's repletion program is a finite resource.

The present practice in Maryland of prohibiting dredging near oyster beds during the summer larval period helps protect oysters from excessive turbidity, as does the effort to prevent sediment from running off cleared land. Bagless dredging or the use of special boards towed just above the bottom can help to remove sediment from depleted oyster beds in the Bay. These techniques can reduce the potential for smothering spat and can clear substrate for settlement in summer.

Oyster beds must be re-established in formerly productive locations by building up a base of firm substrate into the water column, and covering that base with oyster shell and broodstock. Recent incidences of anoxia and severe hypoxia mean that attempts should not be made to rehabilitate oyster beds in deep water (below about 10 m), but rather should concentrate in the shallows where low dissolved oxygen is relatively rare or short-lived. Also, off-bottom culture should be undertaken.

Because these immense tasks will have to be supplemented by private enterprise rather than being left to public agencies, oyster farming should be encouraged. Aquaculture will enable the private sector to distribute the tasks of cleaning, shelling, and harvesting the beds among numerous individuals and entities, rather than leaving those tasks to public agencies and a heavily subsidized industry.

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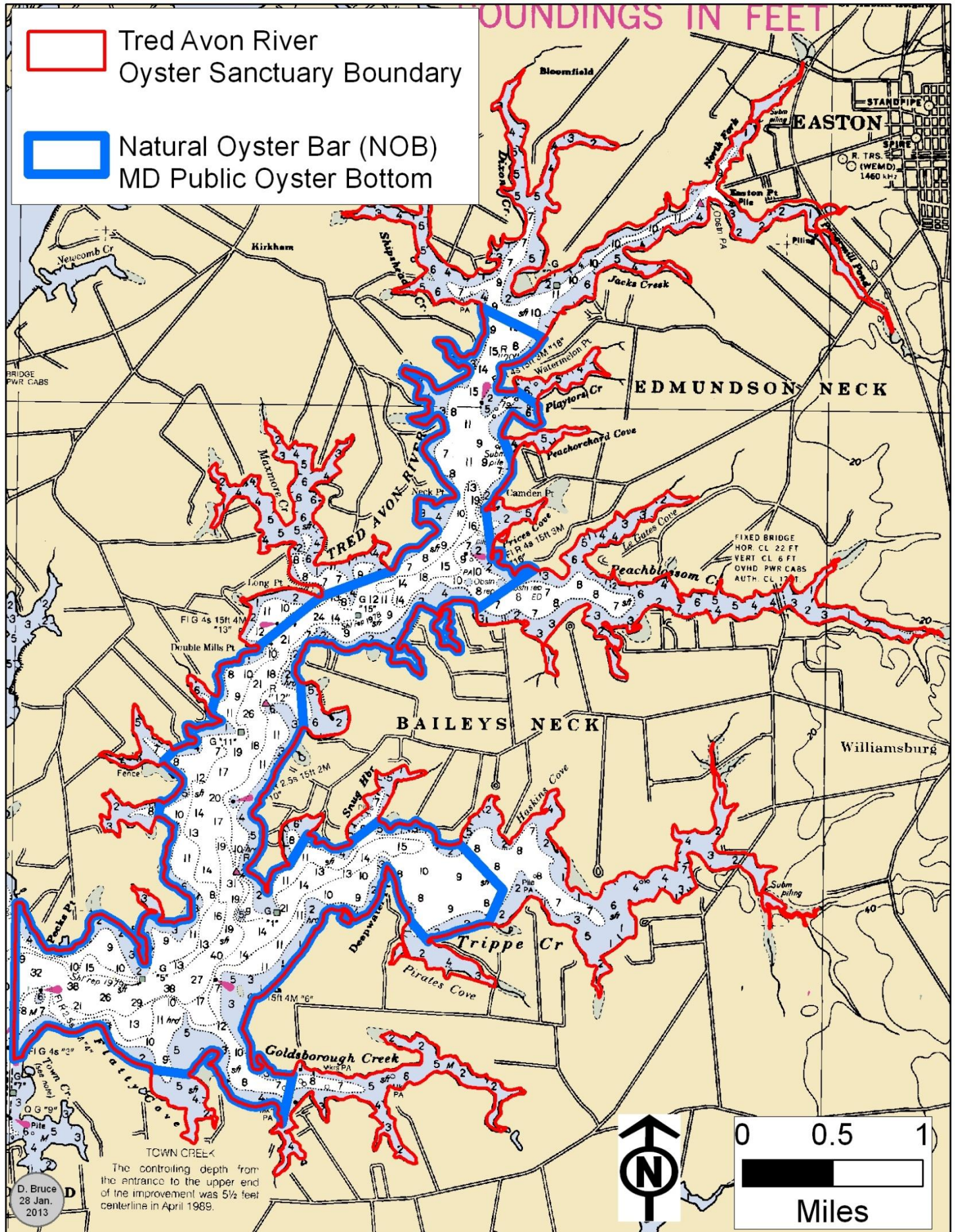
Harris Creek
Talbot County Maryland

Oyster Decision Support Tool Maps

 Tred Avon River
Oyster Sanctuary Boundary

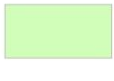
 Natural Oyster Bar (NOB)
MD Public Oyster Bottom

BOUNDINGS IN FEET

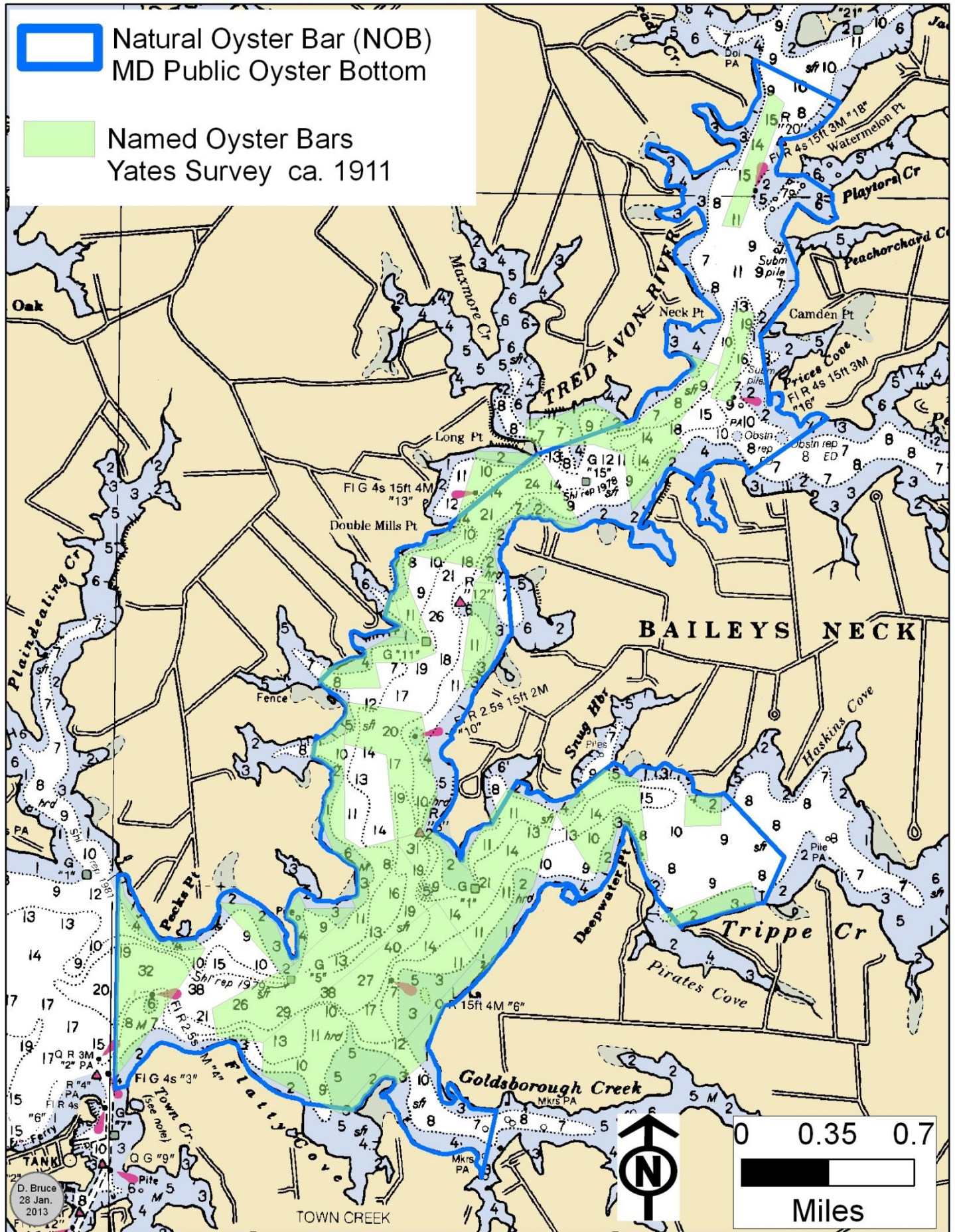




Natural Oyster Bar (NOB)
MD Public Oyster Bottom



Named Oyster Bars
Yates Survey ca. 1911



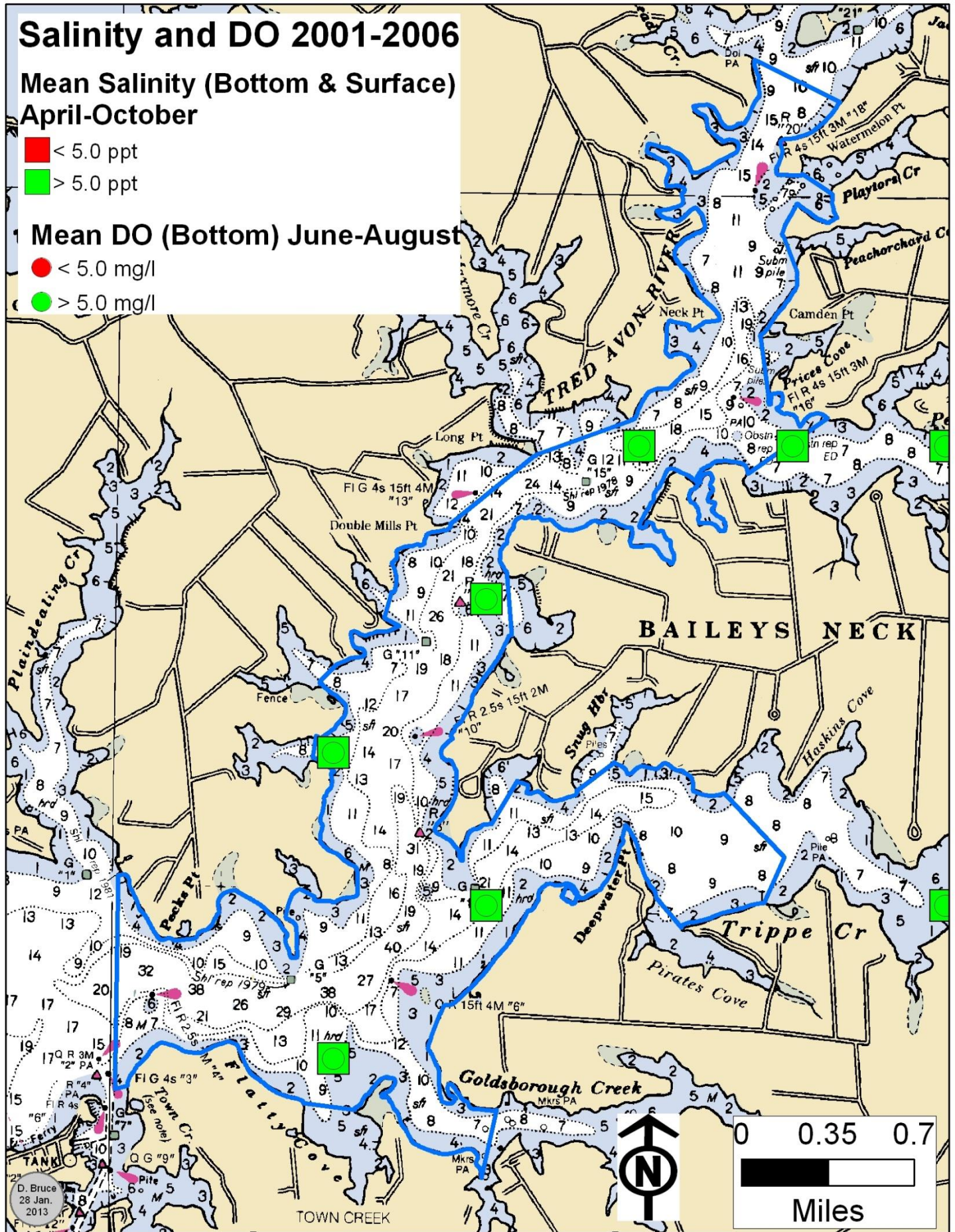
Salinity and DO 2001-2006

Mean Salinity (Bottom & Surface)
April-October

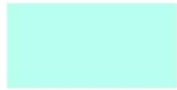
- < 5.0 ppt
- > 5.0 ppt

Mean DO (Bottom) June-August

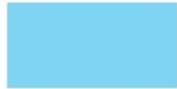
- < 5.0 mg/l
- > 5.0 mg/l



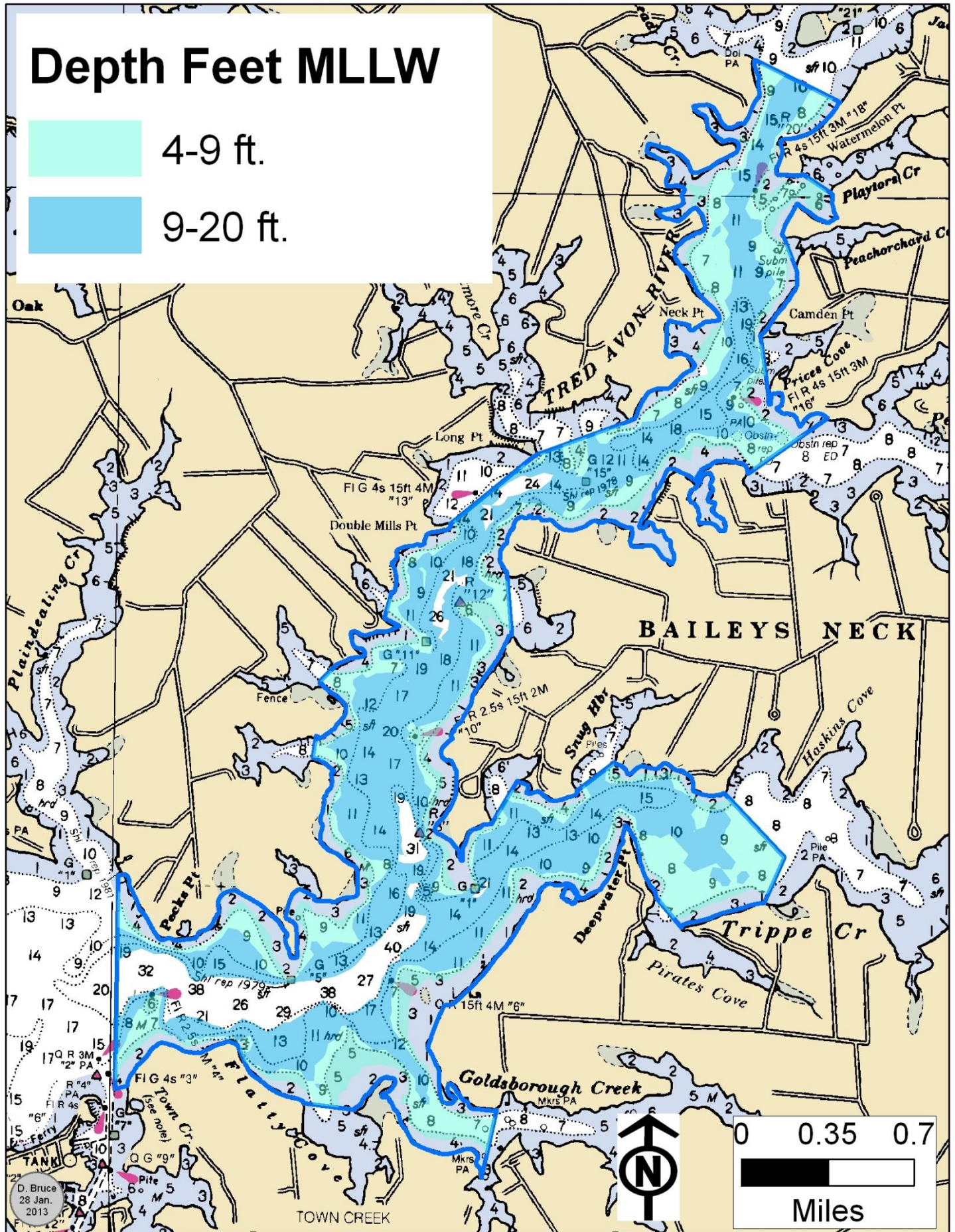
Depth Feet MLLW



4-9 ft.

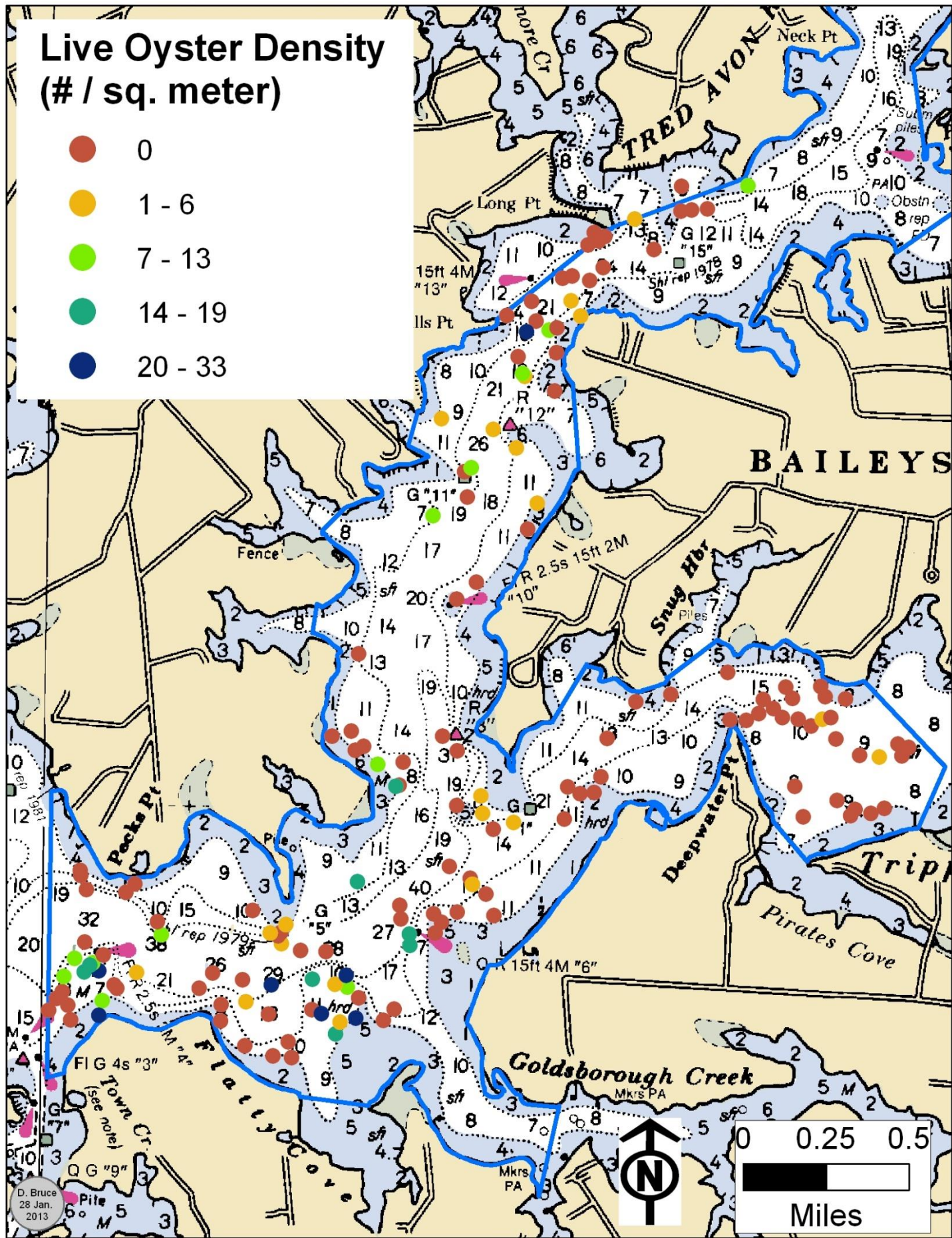


9-20 ft.



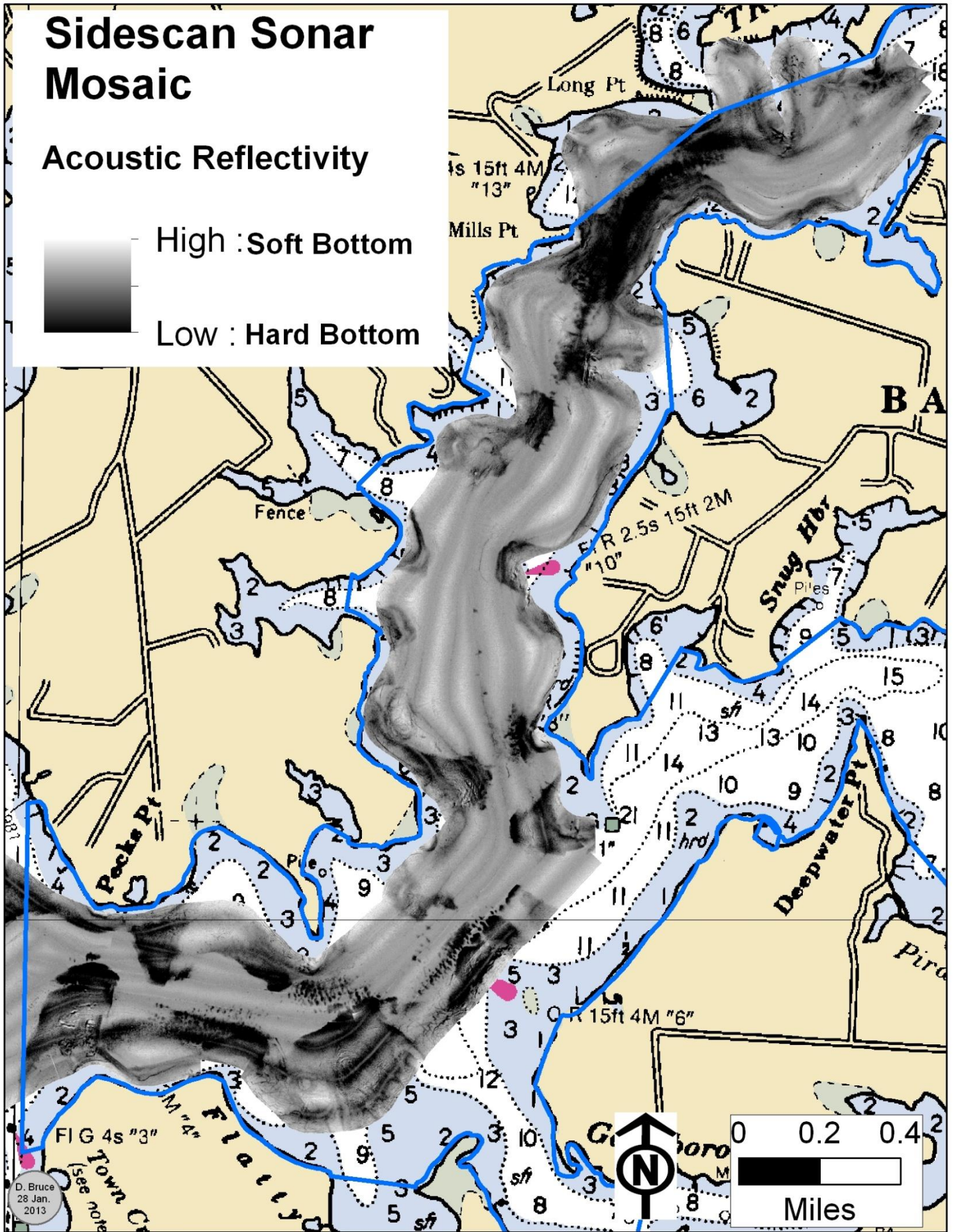
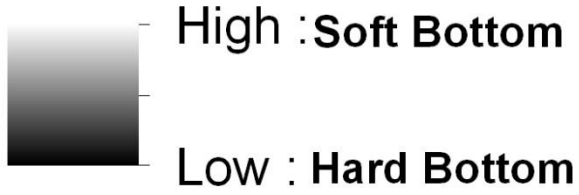
Live Oyster Density (# / sq. meter)

- 0
- 1 - 6
- 7 - 13
- 14 - 19
- 20 - 33



Sidescan Sonar Mosaic

Acoustic Reflectivity



Lafayette River
Norfolk, Virginia

Oyster Decision Support Tool Maps

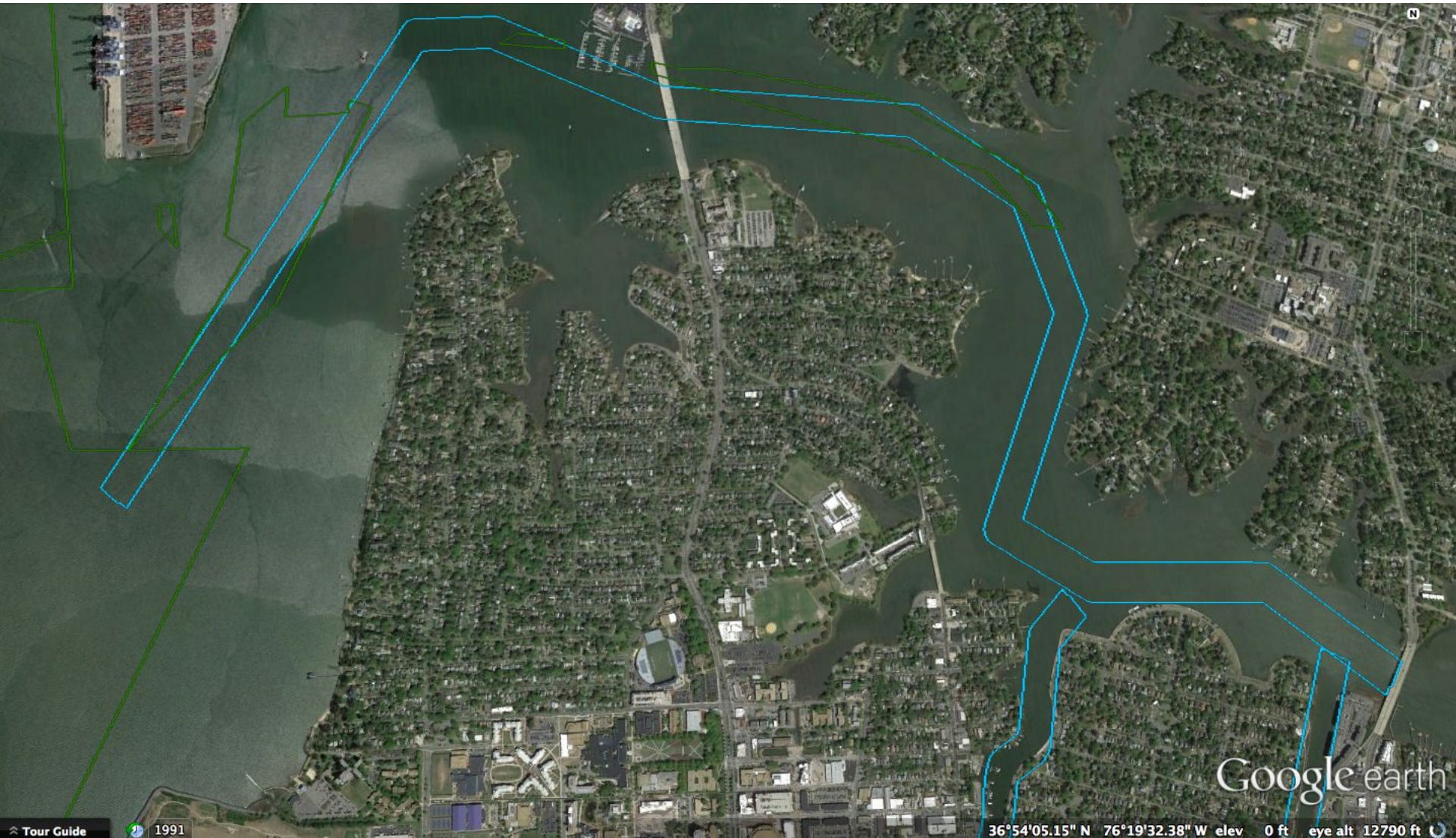
Restored Oyster Bottom 2015



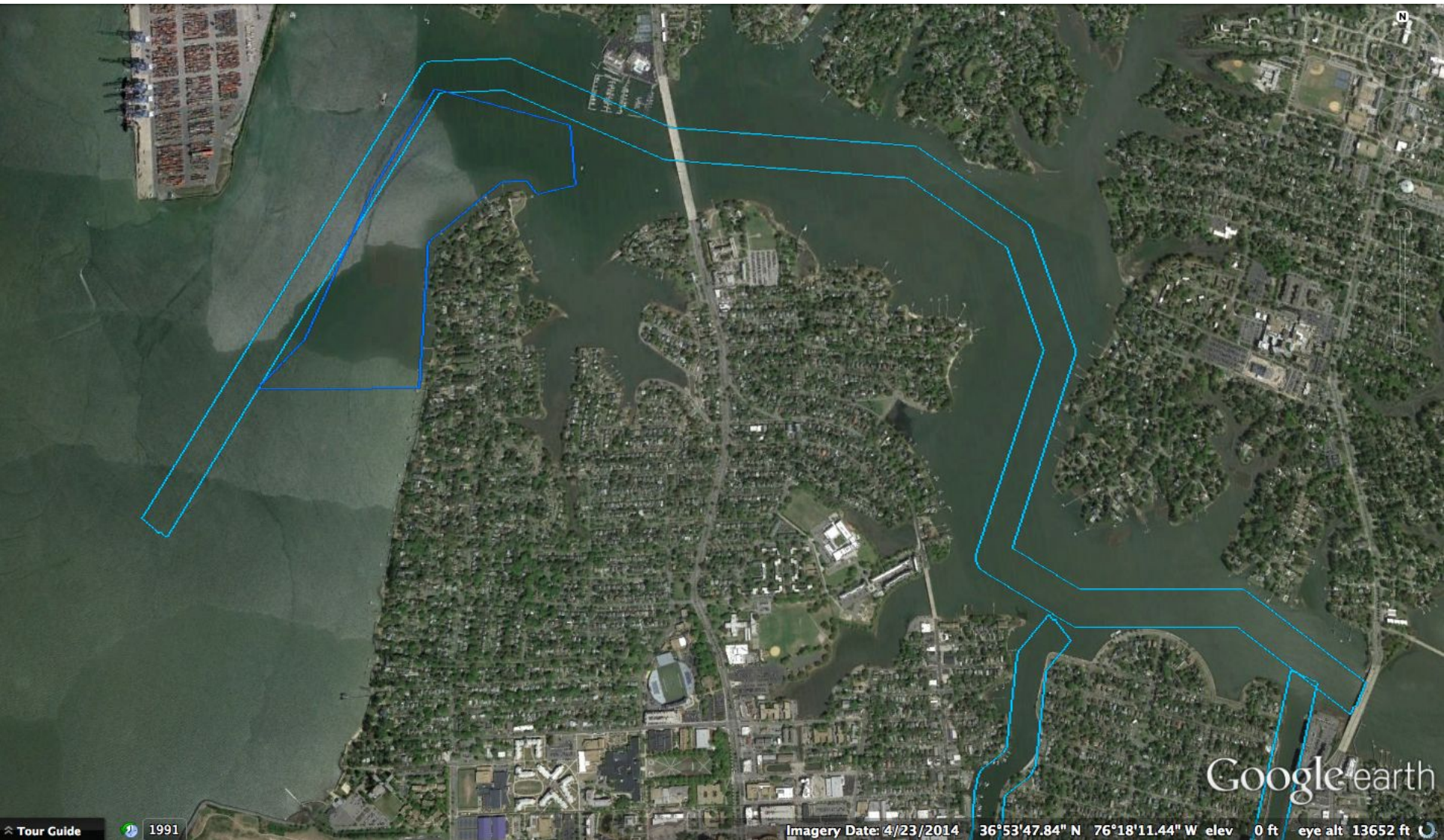
Harvest and Leasing – Restricted Area



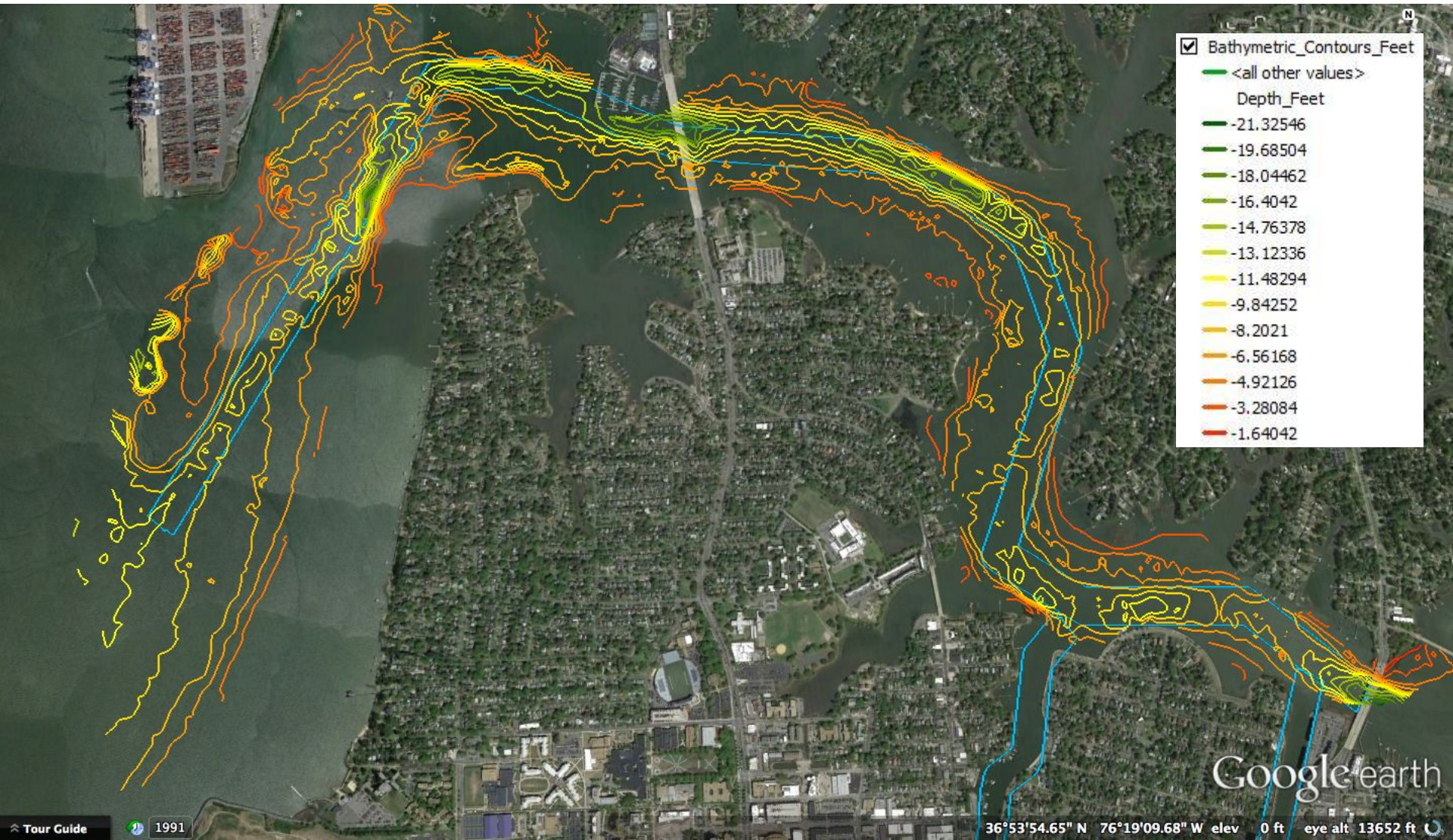
Baylor Public Oyster Bottom - 2014



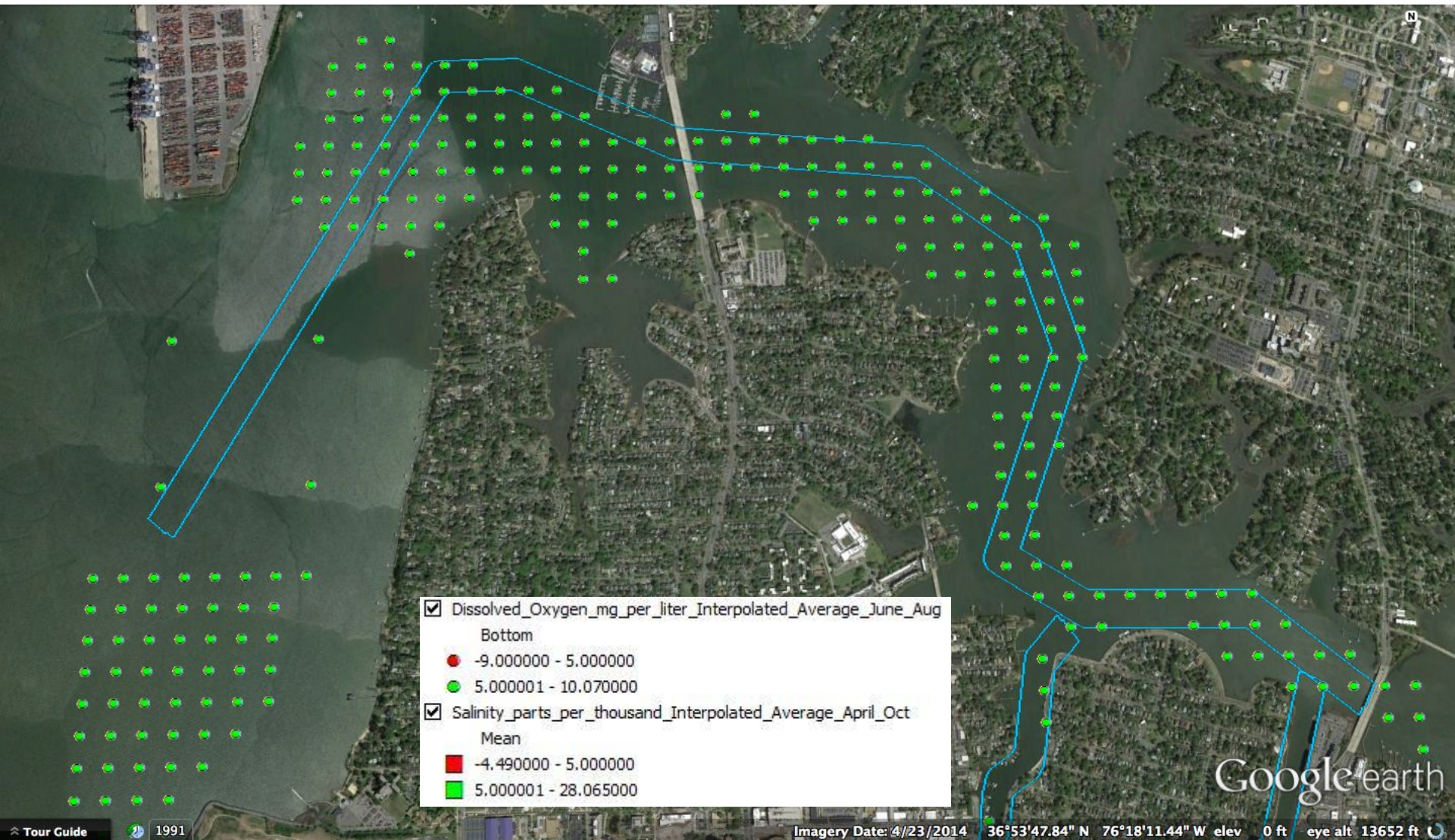
Private Oysters Lease - 2014



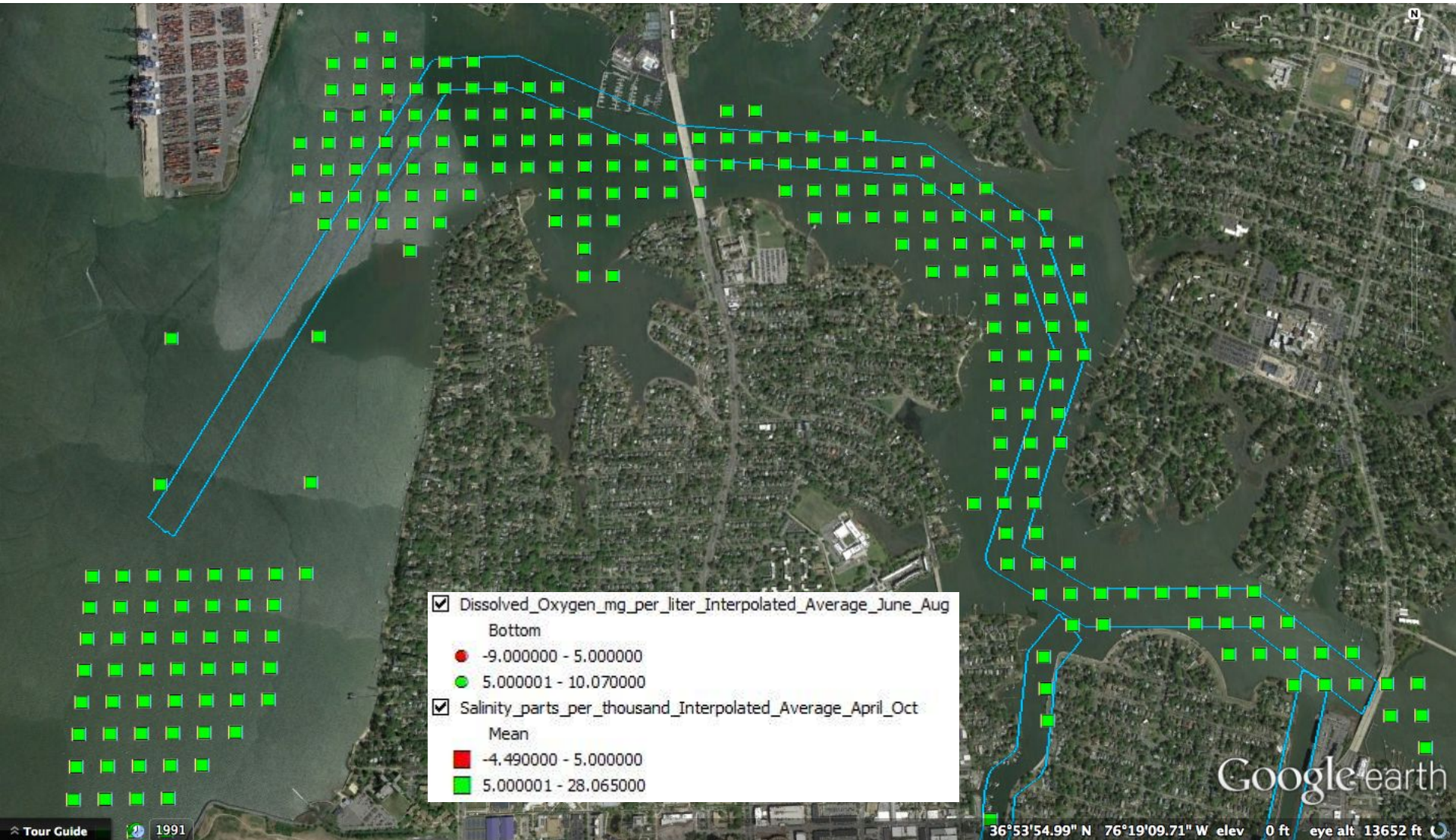
Bathymetry – Depth Countours



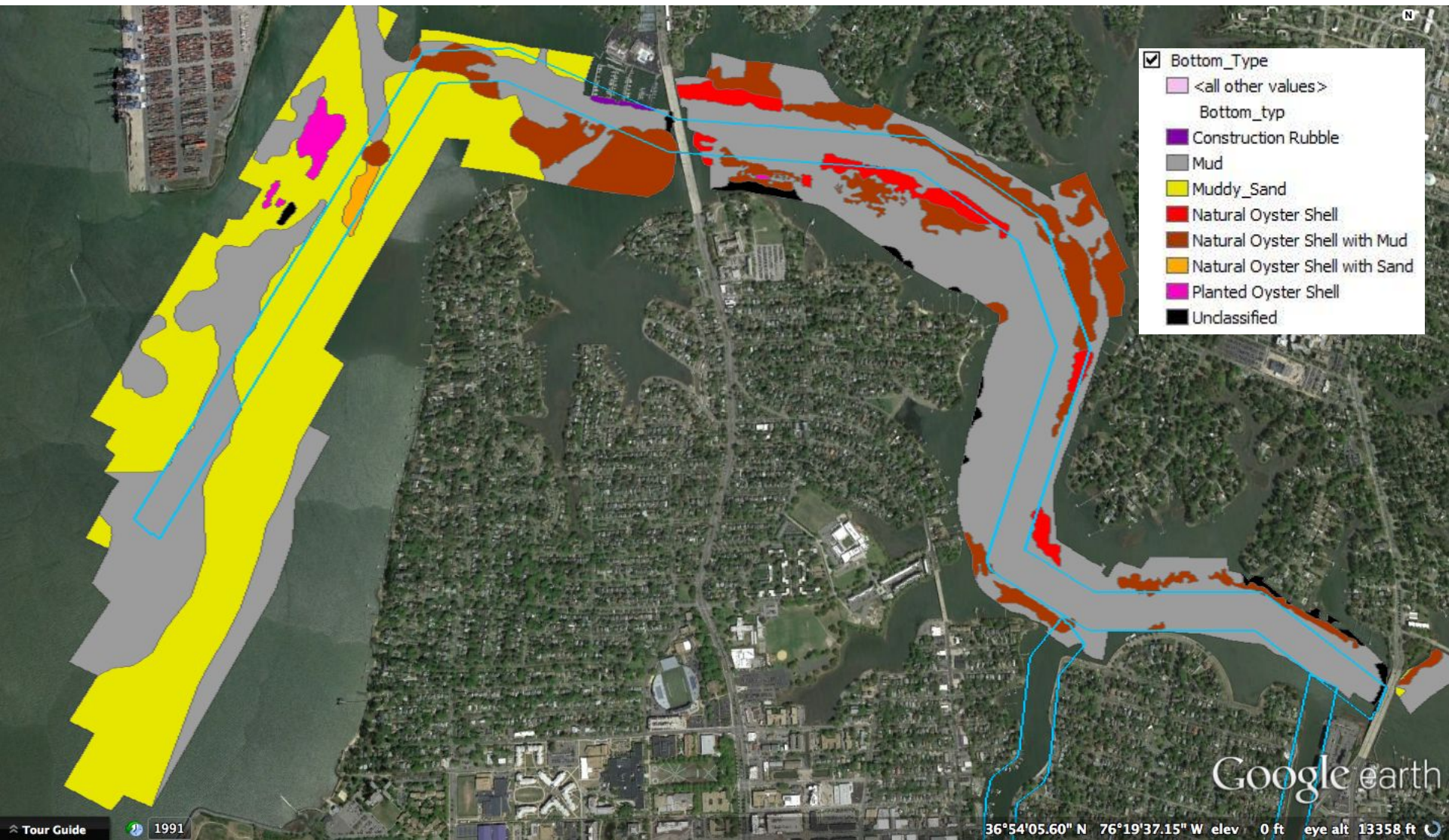
Dissolved Oxygen Average – June - August



Salinity Average April - October



Bottom Type

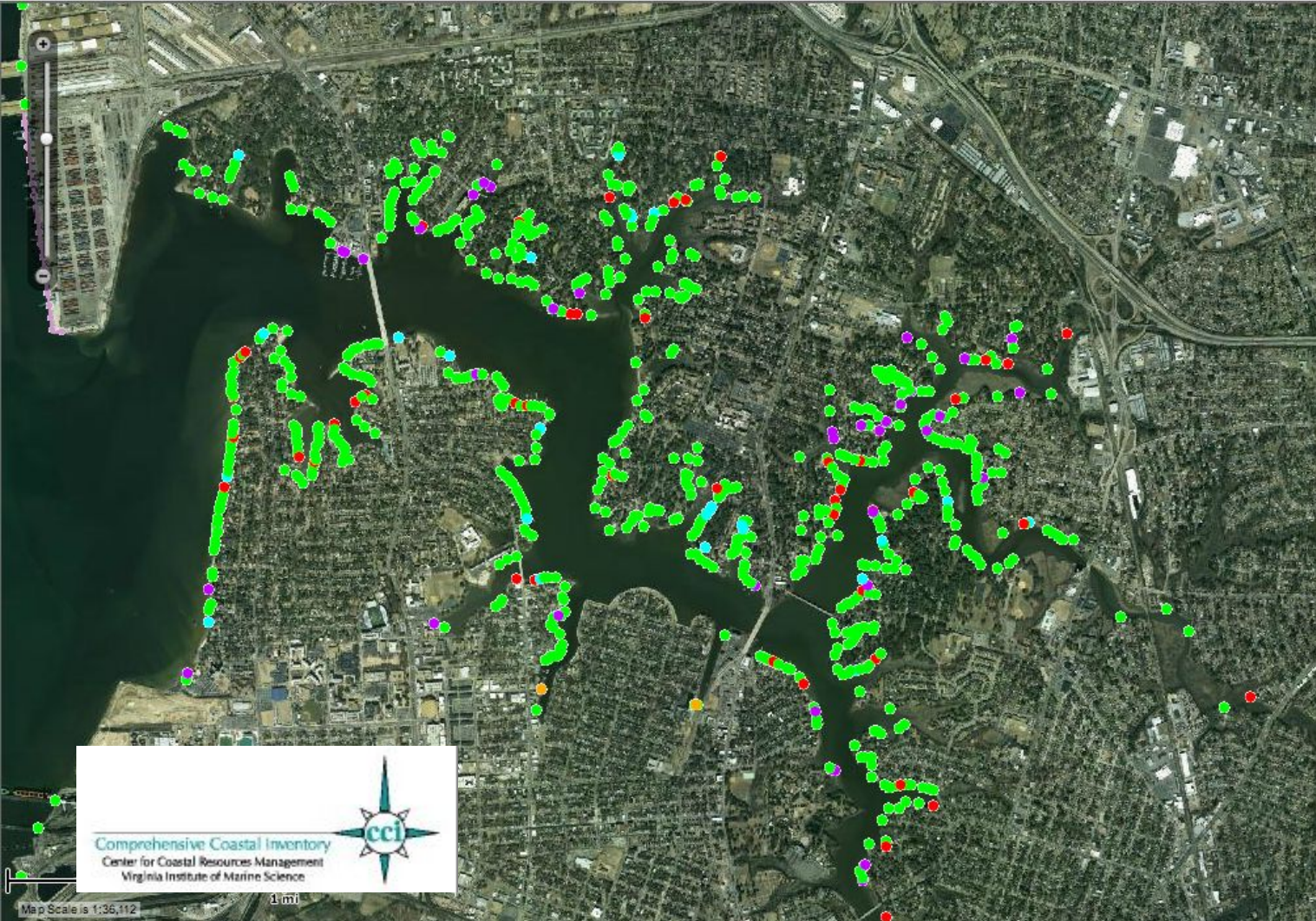


Shoreline Access

Center for Coastal Resources Management
Virginia Institute of Marine Science

City of Norfolk 2014 Shoreline Inventory Viewer

Clear Graphics River System Pie Charts Information/Help Swipe Tool Select print layout



Map Contents and Legend

Map Contents:

- Jurisdiction Boundary
- Shoreline Access Structures
- Shoreline Protection Structures
- Marinas
- Bank Height
- Bank Stability
- Bank Cover

Legend:

Shoreline Condition Layers

Shoreline Access Structures

- Boat House
- Dilapidated Dock
- Dock
- Private Ramp
- Public Ramp

Shoreline Access Structures

- Wharf

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science



Map Scale is 1:35,112 1 mi

Shoreline Protection



City of Norfolk 2014 Shoreline Inventory Viewer



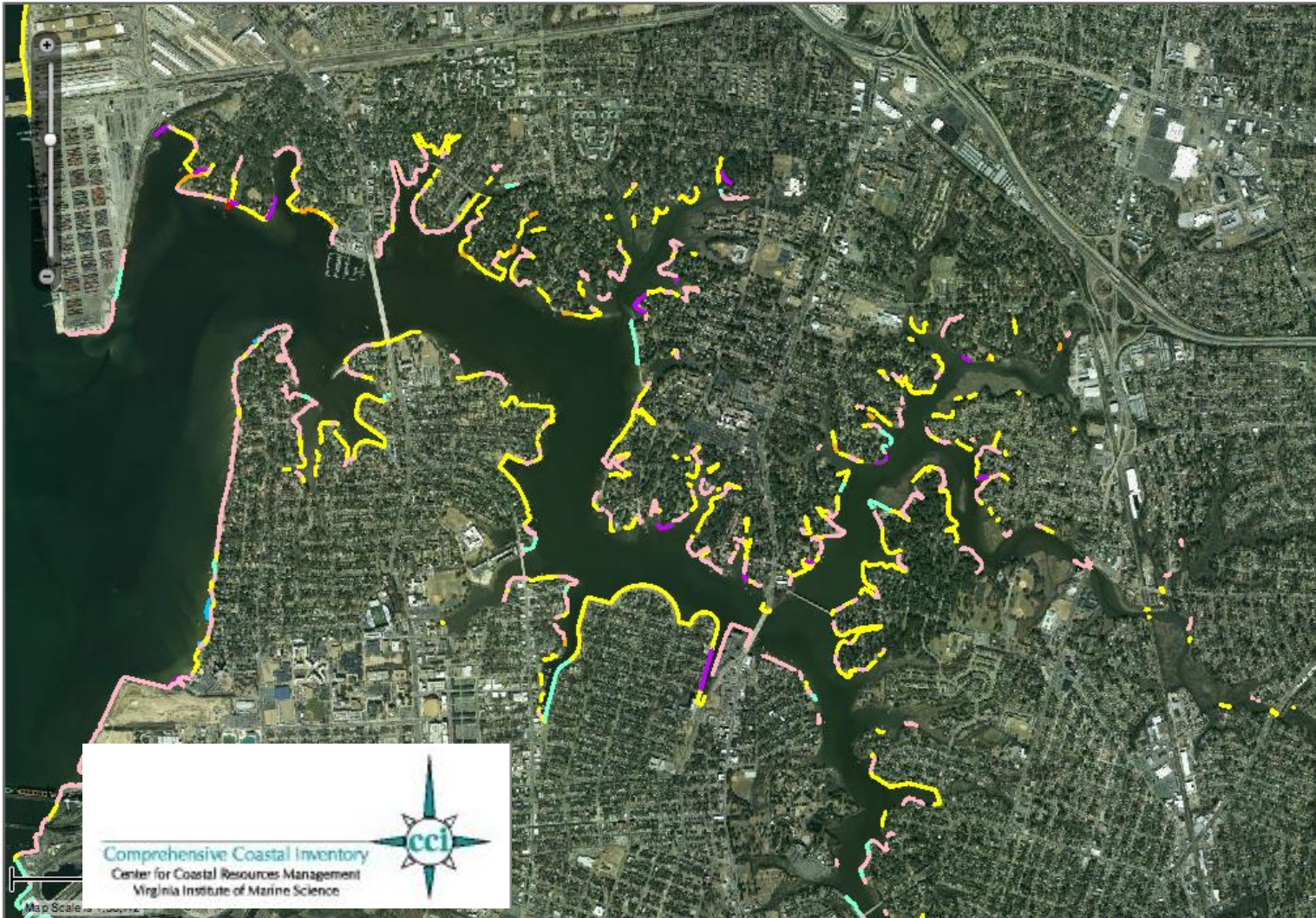
Clear Graphics

River System Pie Charts

Information/Help

Swipe Tool

Select print layout



Map Contents and Legend

Map Contents:

- Jurisdiction Boundary
- Shoreline Access Structures
- Shoreline Protection Structures
- Marinas
- Bank Height
- Bank Stability
- Bank Cover

Legend:

Shoreline Condition Layers

Shoreline Protection Structures

- Breakwater
- Bulkhead
- Debris
- Dilapidated Bulkhead
- Groin
- Jetty
- Marsh Toe
- Riprap
- Unconventional

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Center for Coastal Resources Management
Virginia Institute of Marine Science



Map Scale

Bank Height



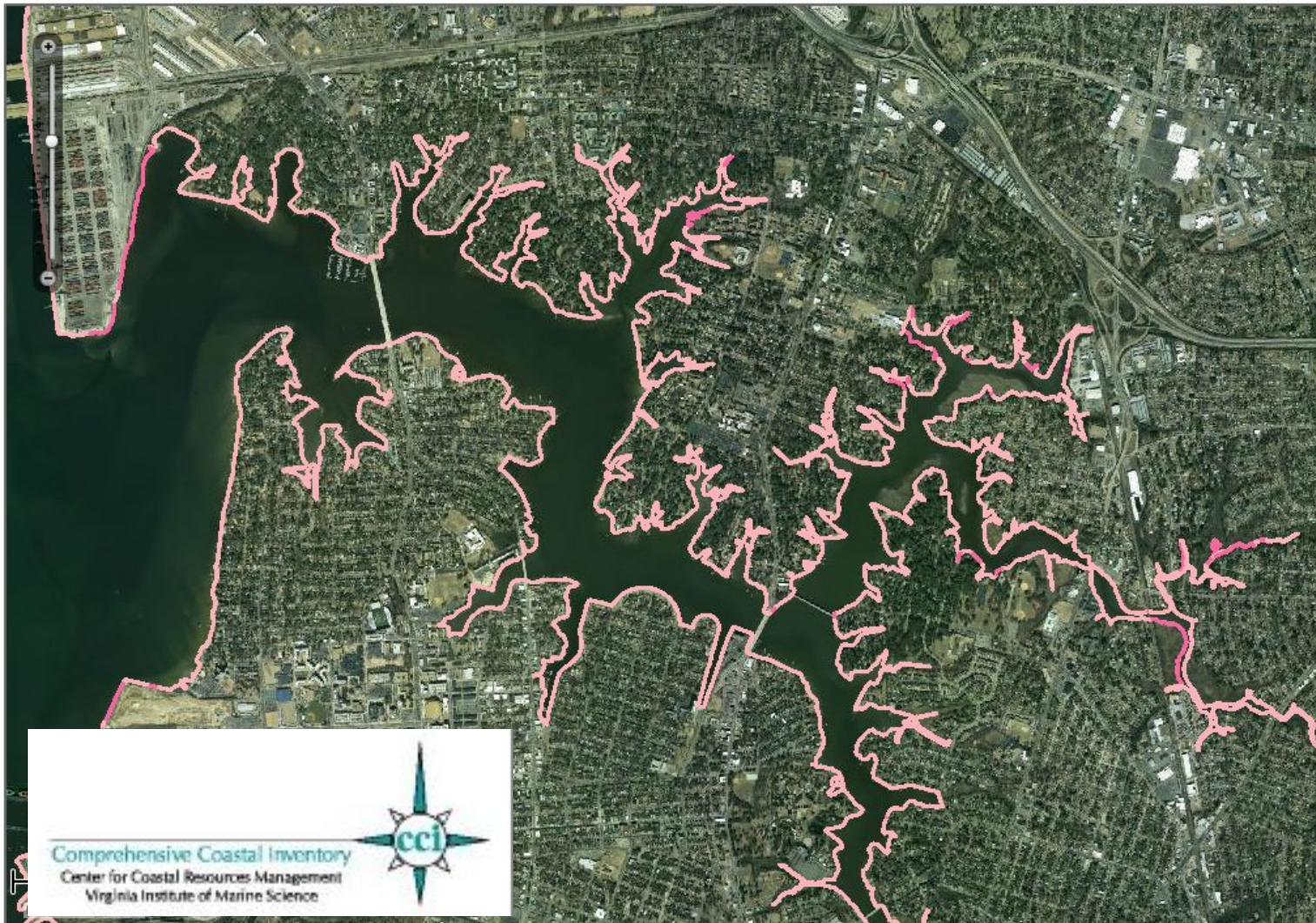
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River System Pie Charts

Information/Help

Swipe Tool

Select print layout



Map Contents and Legend

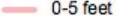
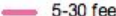
Map Contents:

- Jurisdiction Boundary
- Shoreline Access Structures
- Shoreline Protection Structures
- Marinas
- Bank Height
- Bank Stability
- Bank Cover

Legend:

Shoreline Condition Layers

Bank Height

-  0-5 feet
-  5-30 feet



Bank Stability



City of Norfolk 2014 Shoreline Inventory Viewer



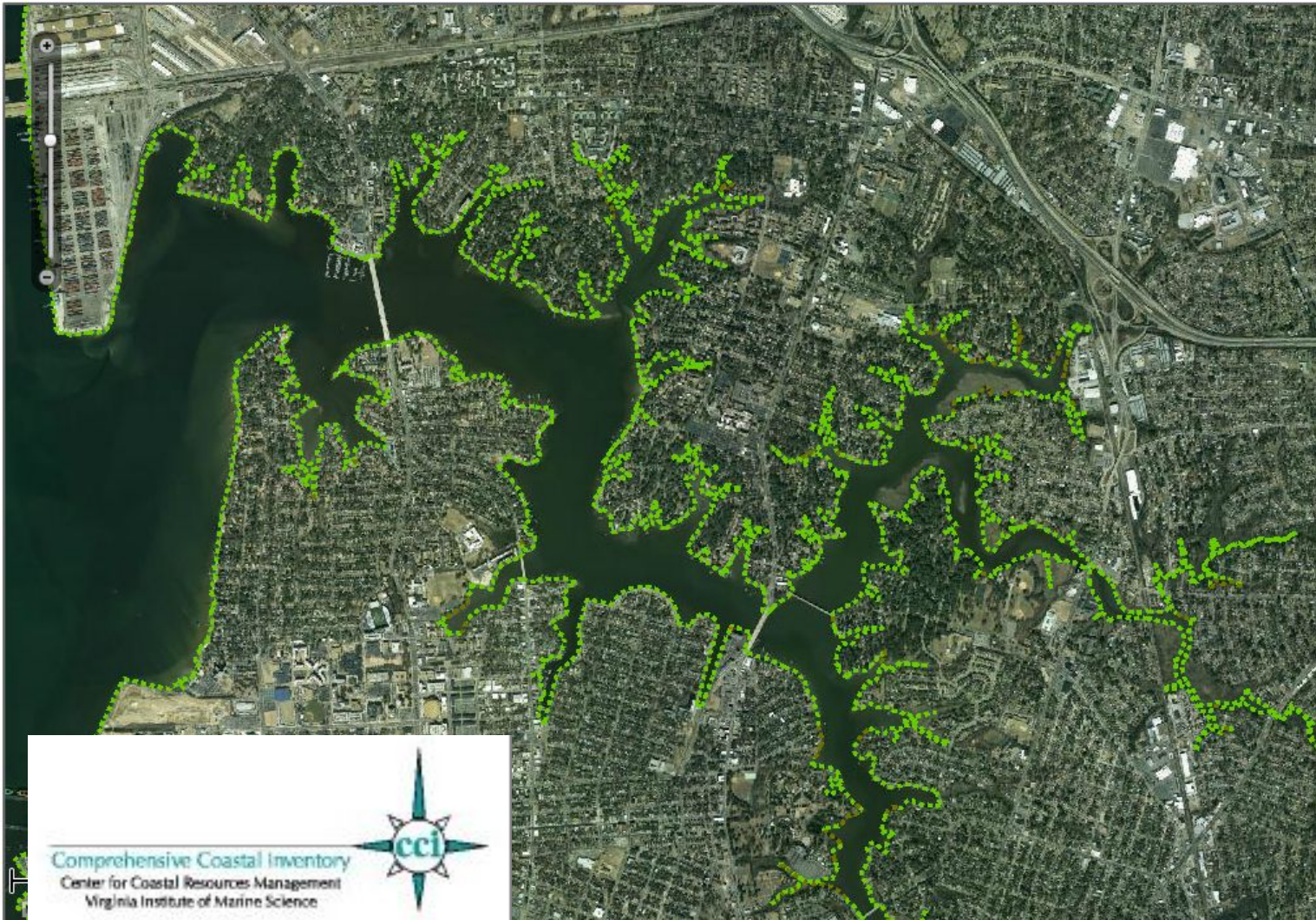
Clear Graphics

River System Pie Charts

Information/Help

Swipe Tool

Select print layout



Map Contents and Legend

Map Contents:

- Jurisdiction Boundary
- Shoreline Access Structures
- Shoreline Protection Structures
- Marinas
- Bank Height
- Bank Stability
- Bank Cover

Legend:

Shoreline Condition Layers

Bank Stability

- stable
- unknown
- unstable



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Center for Coastal Resources Management
Virginia Institute of Marine Science

Riparian Land Use/Land Cover

Center for Coastal Resources Management
Virginia Institute of Marine Science

City of Norfolk 2014 Shoreline Inventory Viewer



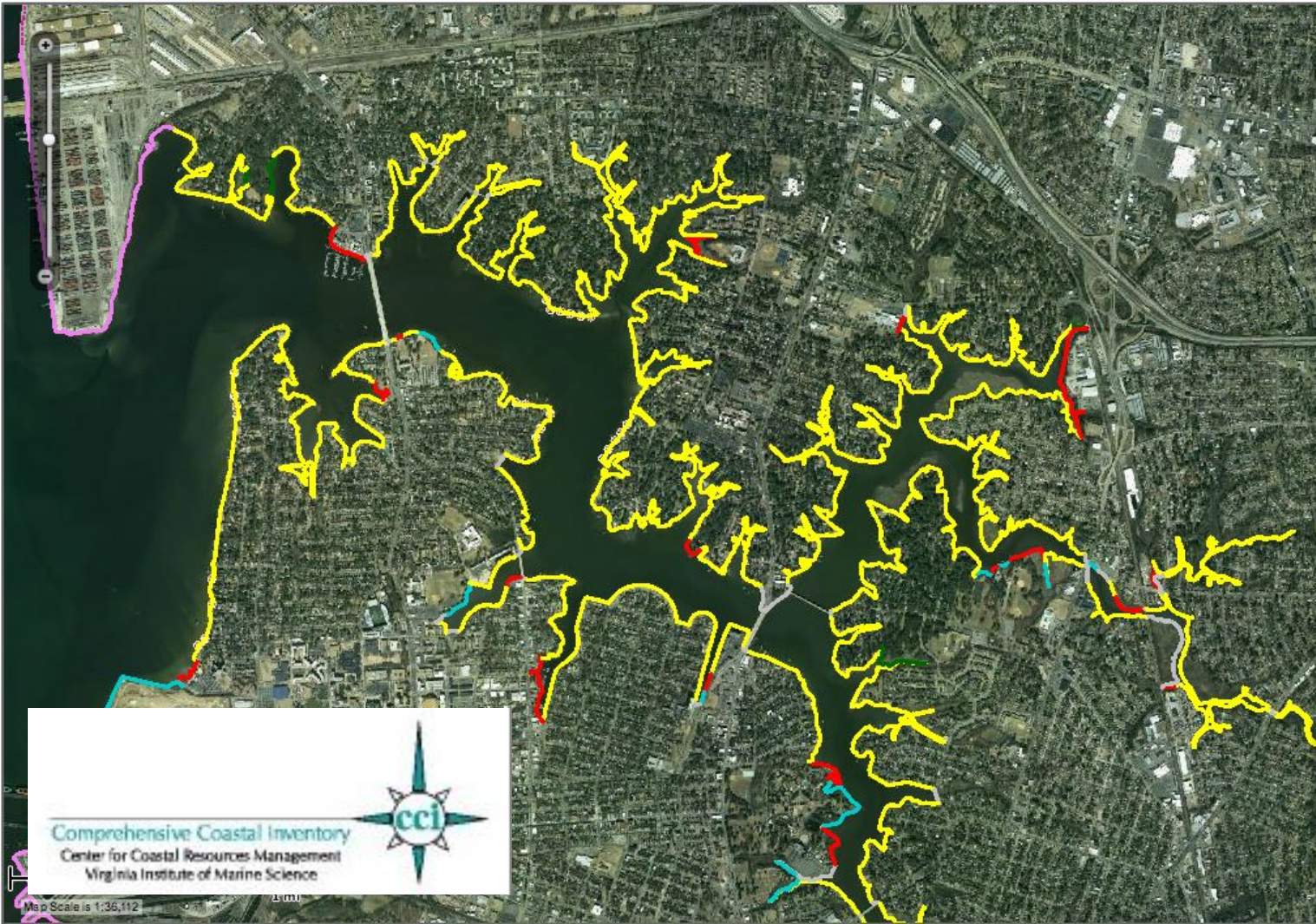
Clear Graphics

River System Pie Charts

Information/Help

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Select print layout



Map Contents and Legend

- Bank Height
- Bank Stability
- Bank Cover
- Phragmites australis*
- Beach
- Riparian Land Use/Land Cover
- Shoreline
- Riparian Tree Finge

Legend:

Shoreline Condition Layers

Riparian Land Use

- commercial
- forest
- grass
- industrial
- military
- paved
- residential
- scrub-shrub

Beach

- Beach



Map Scale is 1:36,112

Tidal Marshes



City of Norfolk 2014 Shoreline Inventory Viewer



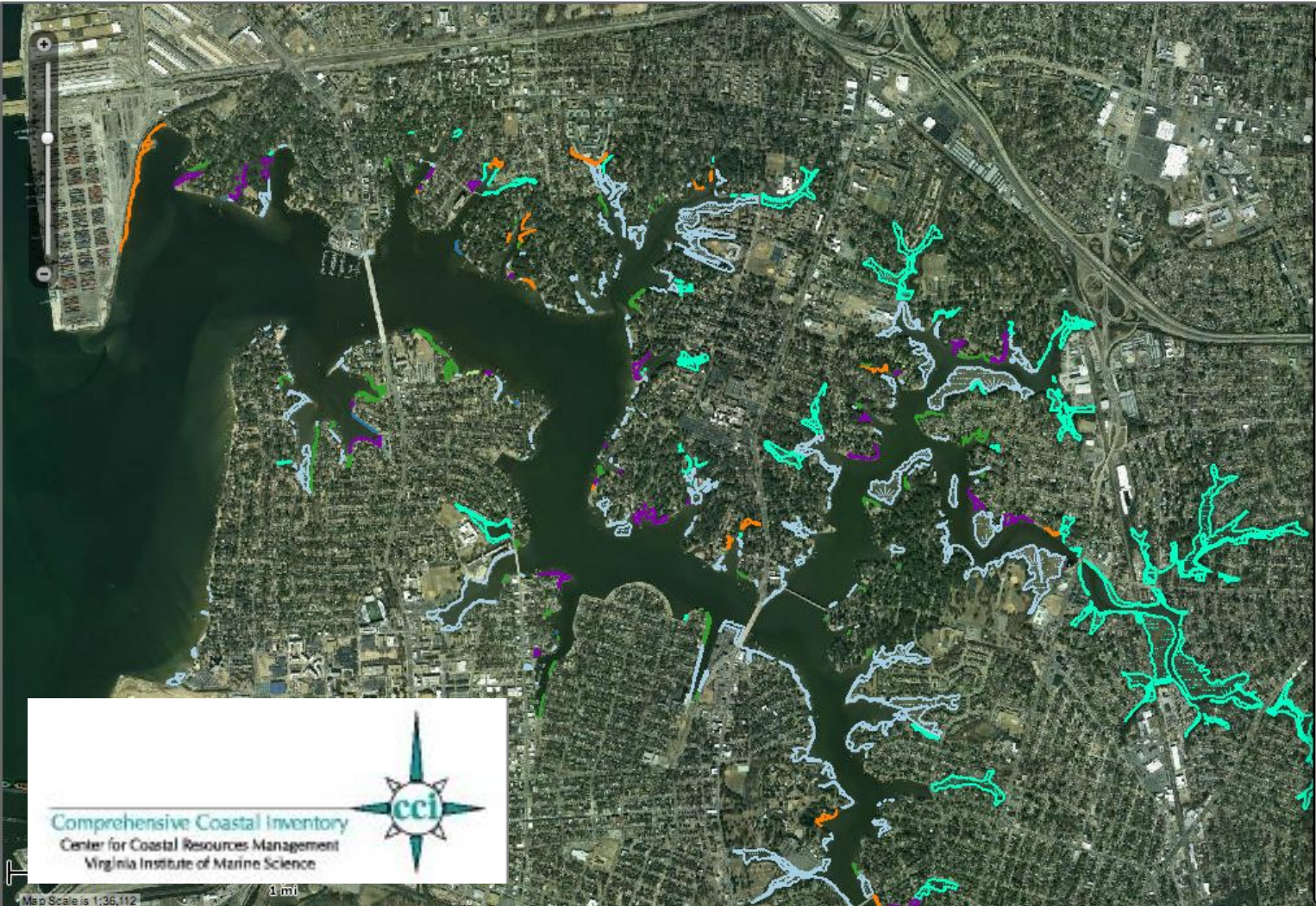
Clear Graphics

River System Pie Charts

Information/Help

Swipe Tool

Select print layout



Map Contents and Legend

- Shoreline
- Riparian Tree Finge
- River Systems
- Tidal Marshes
- Street Map
- VBMP 2013 Imagery
- VBMP 2011 Imagery
- VBMP 2009 Imagery

Legend:

Shoreline Condition Layers

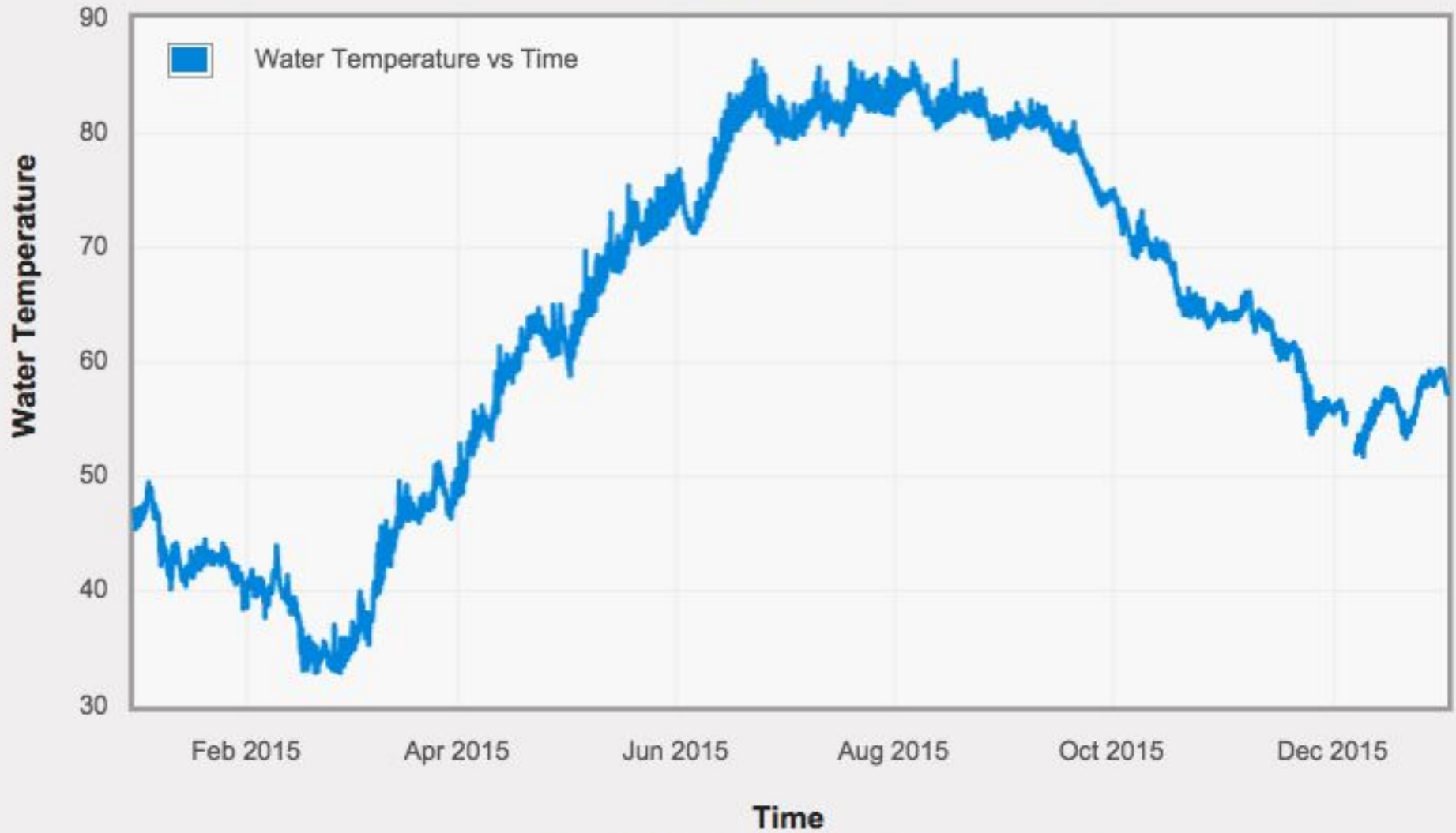
Norfolk Tidal Marshes

- Type I – Saltmarsh Cordgrass / low marsh
- Type II – Saltmeadow / high marsh
- Type III – Black Needlerush
- Type IV – Saltbush
- Type V – Big Cordgrass
- Type VIII – Reed Grass
- Type XII – Brackish mix
- Undetermined



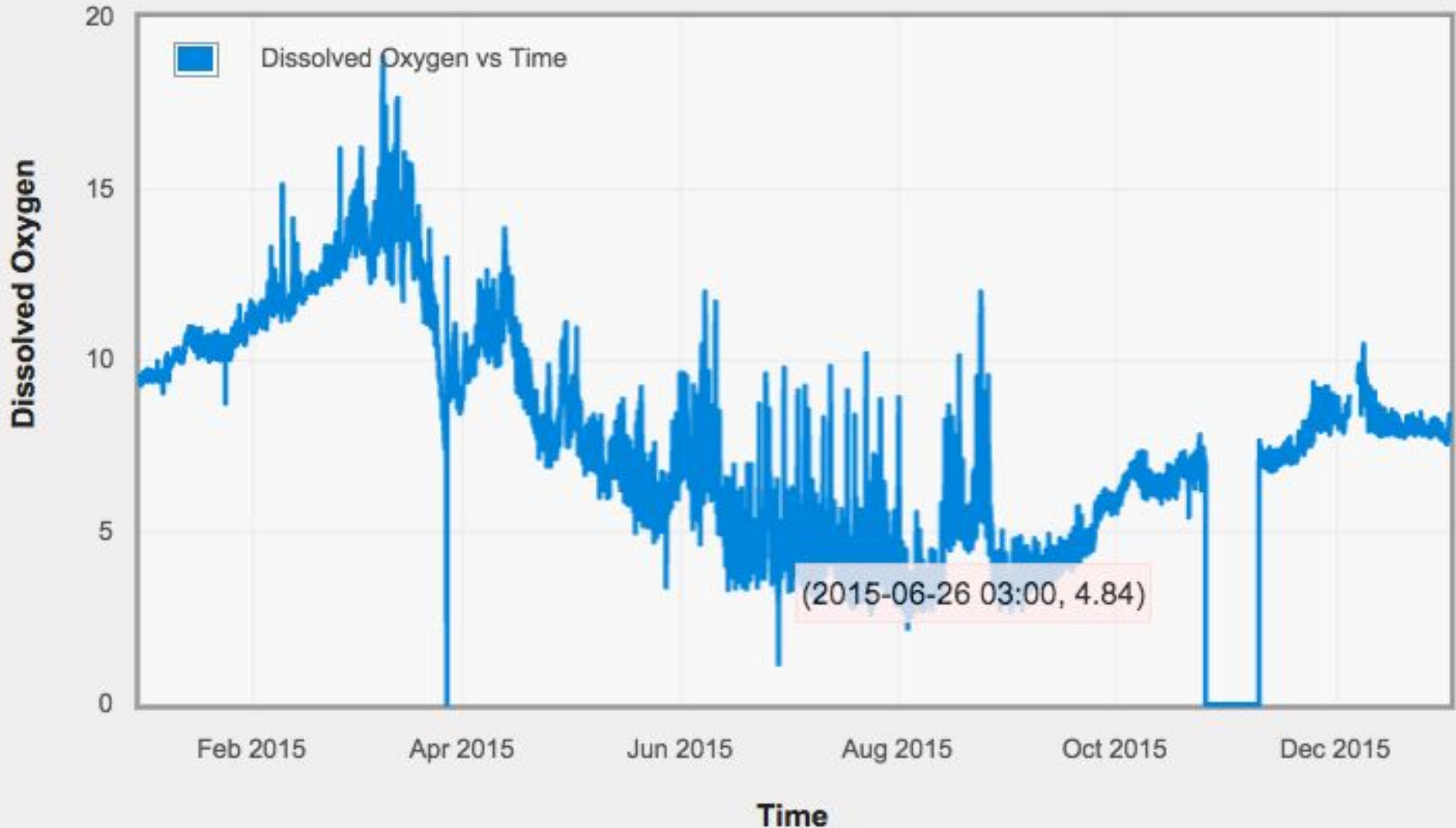
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Norfolk



From: 2014-12-31 19:00:00 To: 2016-01-01 18:59:00

Norfolk



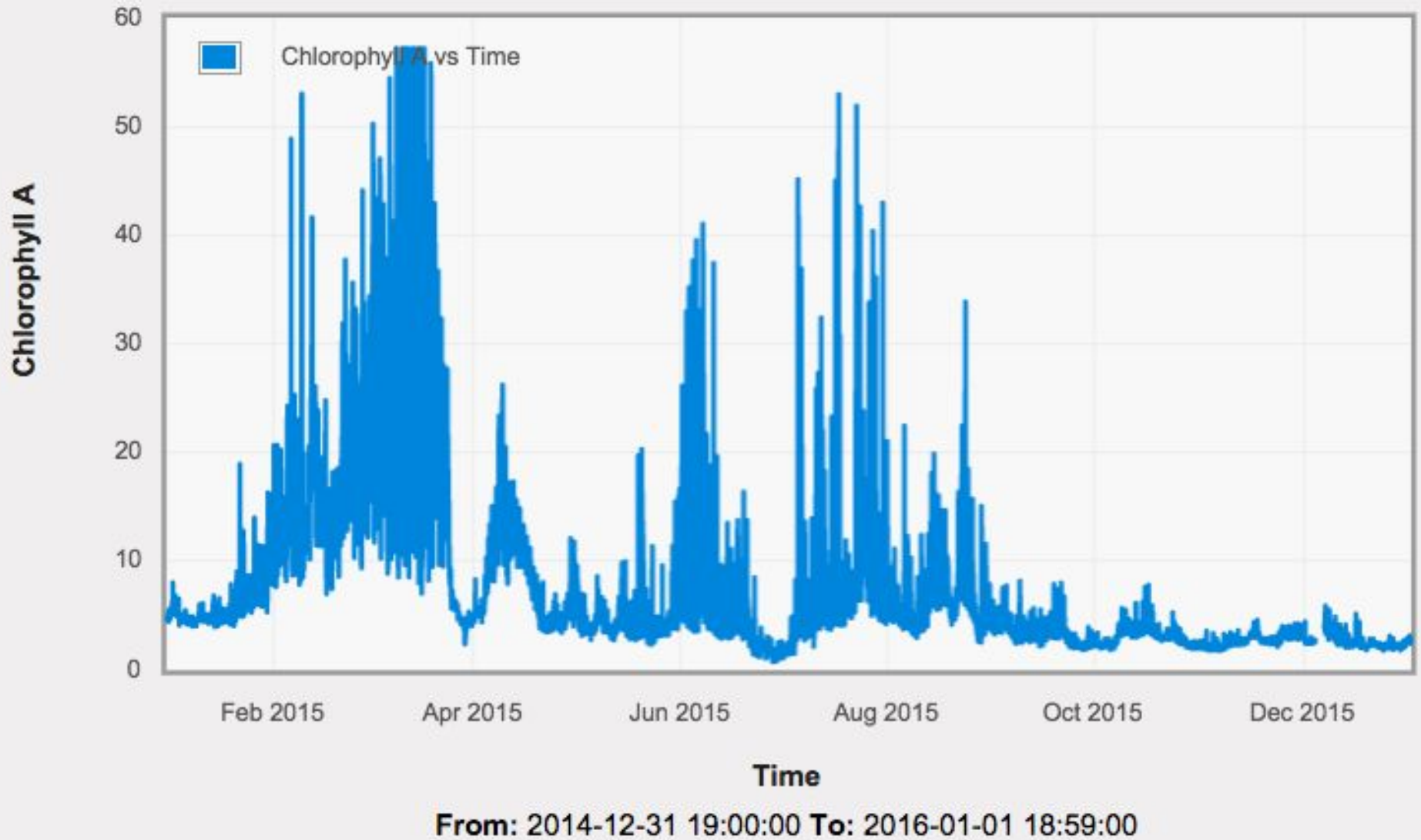
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Norfolk

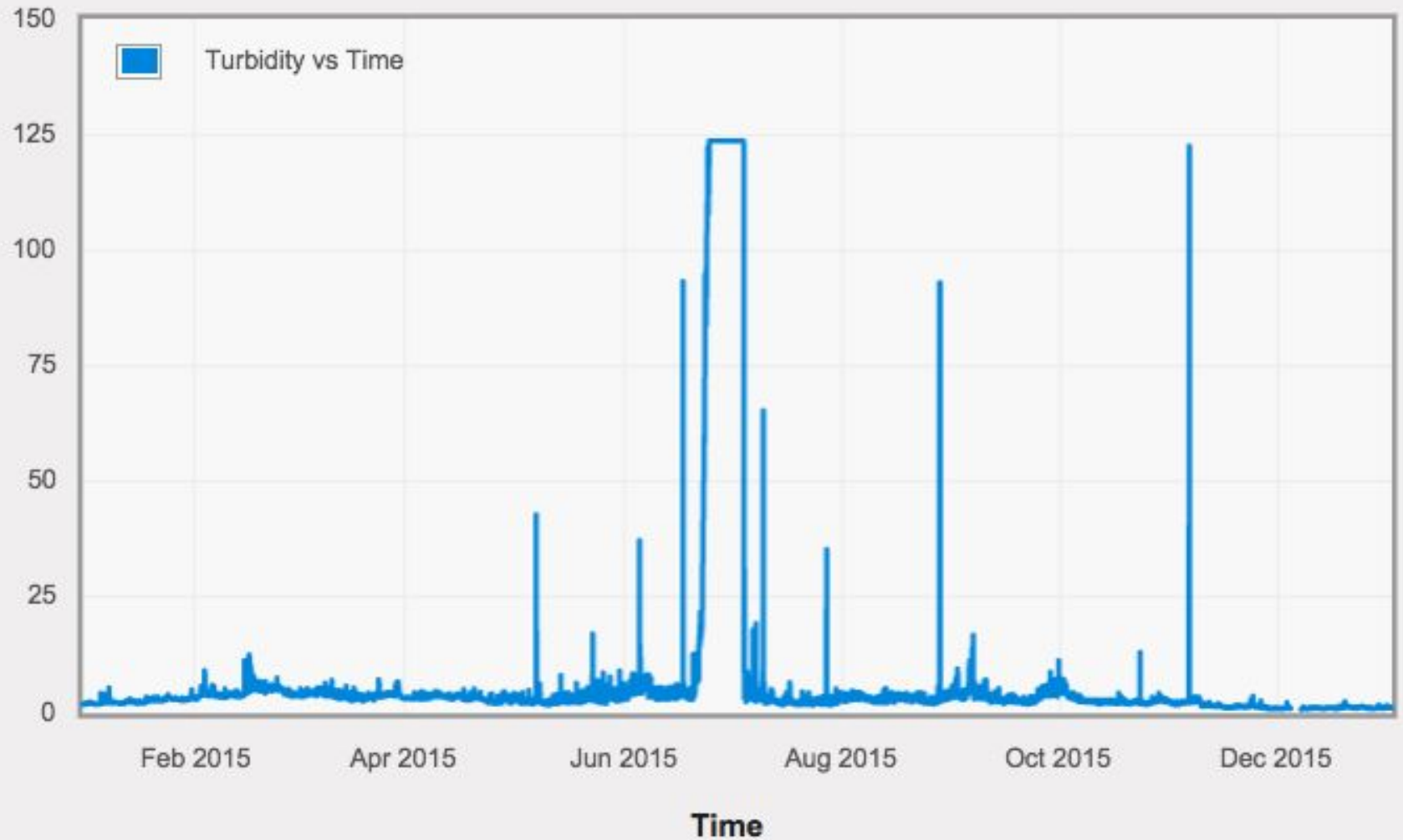


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Norfolk



Norfolk



From: 2014-12-31 19:00:00 To: 2016-01-01 18:59:00

MARYLAND DEPARTMENT OF NATIONAL RESOURCES

MARYLAND OYSTER RESTORATION
AND AQUACULTURE DEVELOPMENT PLAN
PUBLIC HEARING COMMENTS

HELD AT

CHESAPEAKE COLLEGE
TODD PERFORMING ARTS CENTER
ROUTES 213 AND 50
WYE MILLS, MARYLAND 21679

ON

THURSDAY AUGUST 5, 2010

FROM

6:05 P.M. TO 8:30 P.M.

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MODERATOR: MARTIN GARY, MARYLAND DEPARTMENT OF
NATURAL RESOURCES, FISHERIES SERVICES

REPORTED BY: LINDA JOYCE KRALLER, NOTARY PUBLIC IN
AND FOR THE STATE OF MARYLAND.

- - -

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P R O C E E D I N G S

(7:00 P.M.)

MR. GARY: We'll go ahead and get started.

And the first speaker we're going to have is Mr. Jim Molero (phonetic) and he will be followed by Captain Robert Newberry and Mark Connolly. And try to come up this side (indicating) if you don't. We are going in order in which folks signed up. Mr. Molero? And Bob will be next and then Mark Connolly.

MR. MOLERO: All right. My name is Jim Molero. I'm president of the **Corisca River Conservancy**, a non-profit organization with 670 members located down in Centreville. I am submitting these comments on behalf of the members of our organization. We have reviewed the proposed regulations and enthusiastically favor their adoption and implementation.

These regulations, long overdue, provide the

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best opportunity yet to restore a badly needed oyster population of the Chesapeake Bay. They, also, provide substantial support for watermen during the restoration period. In the long run, implementation of these regulations should greatly benefit both the watermen and the Bay. A healthy and prolific oyster population will provide a bounty for watermen who depend on harvesting oysters for their livelihood and will help restore the health of the Bay by filtering pollutants from the water.

Recent experience with managing the harvest of Blue Crabs from the Bay clearly demonstrates, in our opinion, the effectiveness of this approach.

Thank you.

MR. GARY: Thank you, Mr. Moloro. Our next speaker is Captain Robert Newberry followed by Mark Connolly and Keith McGuire.

CAPTAIN NEWBERRY: Good evening. I really don't know where to start on a situation like this on

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public comment but I've been involved with aquaculture since it started in Maryland here, not in the Bay proper, but I've seen how the process goes.

And I'm going to stand here in front of everybody in this room tonight and tell you this whole program is going to go belly up and it's going to go belly up bad. It's been too fast tracked. Bottom line, you've heard it here tonight, number one, we've got an enforcement problem in the state of Maryland. There's not enough boots on the ground.

Every DNR officer in this room knows it. How are we going to enforce all these sanctuaries? What, are they going to pull guys from Western Maryland over here to do it? I don't think so. You got retirement coming up, you have no DNR officers that can hardly enforce the laws that are there right now.

You can have all the technological things and advances, satellites, GPS tracking advices, unless

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these guys have boots on the ground and have officers in the field, it ain't happening. Second of all is how this has been fast tracked. And you heard it right here tonight in one comment I asked.

I said, number one, has Army Corps of Engineers been involved in this? Well, they're going to implement this program, they said, on September 6th. Secretary Griffin has not even met with Army Corps of Engineers yet. He swings a hammer on this to see if we can get permits. And bottom line, this whole thing is nothing but a political play on the oysters. And everybody in this room knows what happens when you mix politics and oysters. It ain't good.

We have a plan involved from the '50s in the Shell Program. I was talking with a gentleman out there tonight that's older than I am, L.T. I'm sorry, I didn't mean to offend you, but he commented and looked at the numbers on it. Back in the '50s when they started the Shell Program, (indiscernible) dots,

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they go up and down and up and down and up down.

Well, when everybody started harvesting them in the '70s there was a spike. Then the spike went down. That's because the Shell Program went down. Well, then you talk to them and, "Why did you kill the Shell Program?" And they said, "Oh, well, the dermo and MSX is killing the oysters." And I said, "Well, is it not," and the big word is "imbiquitous", into the water column which means everywhere in the Bay?" And they said, "Yes." I said, "Well, the oysters you bring up the Bay when I oyster down to Rock Hall, they were fine. They lived." I mean, anybody knows the word "Belvedere", Snake, all those areas up river, those oysters were fine.

Well, bottom line, they came to the point where, "No, we don't want to move the oysters." So the population went down, less people started harvesting. This program would work if it was implemented over a long period. I don't think any of

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these guys in this room are going to sit there and when you bottom line the aquaculture business --I raise fish on my farm. It's what I put into that fish and in this hand, what I get out of it. And I've run the numbers on oysters. I do not think anybody in this room is going to take and buy a bushel of oysters by the time you're done raising them with all the work that's involved and have to spend 80 to 90 cents a piece for an oyster, is what it's going to cost you to break even.

It ain't going to work. Where they going to get the money from? Historically, in the state of Maryland, the aquaculture program that we had before, we had over 150 practicing aquaculturists in the state of Maryland. Now, we're down to, like, 15. Bottom line, the money failed. It all went by the way side. It comes down to the dollar. Where we going to get the dollar from? We don't have overtime to pay DNR officers.

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This ten million dollars, like one gentleman said, it didn't last two weeks. Ten million dollars is going to start an aquaculture program in this State? That's a joke. They need to sit back, look at this, take their time on it, work with the watermen, show them how to do the aquaculture because I don't think anybody, after the 6th of September, in this room is going to be able to sit out there and go raise oyster on bottom in cage culture, float culture, anything. I really think DNR is really making political ploy out of this with that governor in trying to get re-elected --

(Applause)

CAPTAIN NEWBERRY: -- on the backs of the state of Maryland.

(Applause)

MR. GARY: All right. Thank you, Captain Newberry. Our next speaker is Mark Connolly followed by Keith McGuire and then Paul Rybon (phonetic).

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MR. CONNOLLY: My name is Mark Connolly. I'm a Talbot County waterman. I've been so for, I don't know, 15 years of my life. And Maryland Resources here, this is a joke, proposing a joke. What they've got going on here is a waste of money, a waste of tax payers money.

And if you guys, if the tax payers can't see that, I feel sorry for you guys. That's all I have to say about it. I think the proposal stinks.

(Applause)

MR. GARY: Thank you, Mr. Connolly. The next speaker is Keith McGuire followed by Paul Rybon. Is Paul is?

MR. RYBON: I'm waiving my --

MR. GARY: Paul is going to waive.

MR. RYBON: -- (indiscernible).

MR. GARY: All right. Paul has waived. Ken Hastings will then be next. And then Carol Jellet (phonetic).

MS. JELLET: I'll pass.

MR. GARY: All right. Get Mr. Hastings to come down. Mr. McGuire?

MR. MCGUIRE: I'm Keith McGuire with CCA, St. Mary's County. Everybody knows what CCA's position is on this. CCA applauds the Governor in taking the initiative to get the oyster recovery started. And we, also, applaud DNR's efforts in defining a plan, and Maryland Legislature for approving it.

But that's not really what my comment is. My comment is that I've been participating in the Maryland's Grow Oyster Program in St. Mary's County and Calvert County over the last couple of years. And it's amazing to me to hear and see the amount of public support that there is for this Oyster Recovery Program in regular, everyday citizens, not watermen, not charter captains, not necessarily recreational fisherman. But --

MR. GARY: Stop.

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(Whereupon, there was a brief recess.)

MR. GARY: And, I apologize, Mr. McGuire.

You have the floor.

MR. MCGUIRE: Thank you. My comment really is that I've observed a lot of support for the Program in the people who we've been working with through the Maryland Grows Oyster Program and other people in St. Mary's County. Thank you.

MR. GARY: Thank you, Mr. McGuire. Next speaker is going to be Mr. Ken Hastings, and Ms. Jellet passed. So the next speaker after that will be Wayne Wilson.

MR. HASTINGS: Good evening. My name is Ken Hastings. I'm here just representing myself. I'm more of an environmentalist, recreational fisherman. I really don't know great much about the oyster industry and I really don't need to because there's a whole room full of experts out here that know that.

I came here tonight, specifically, to make

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sure that the terms "oyster restoration" made it into that recording because the past decade I don't think I've missed very many oyster meetings and it's all been about the industry. Ninety-five percent of all the discussions from the last ten years, and certainly since the Oyster Advisory Commission stated in 2007, it's been all about the industry.

We never sit down and talk intelligently and objectively about oyster restoration. And, I think, that's a shame because, you see, I'm a stakeholder. I hear a lot about "you took this", "you took that", "you're putting us out of business", "you're taking our money". There's no entitlement here.

This resource is publicly owned. It's managed by the Department of Natural Resources and they have several charters. Most bureaucracies have more charters than they can keep track of. But the one I like to quote because it makes sense to me is the Department of Natural Resources. Their job is to

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manage the resources for all citizens for the good use, and best use, and enjoyment of all citizens.

I'm one of the citizens. I'm a stakeholder. It doesn't matter if I've never been on an oyster boat. I don't even know what a pair of tongs look like. I'm still a stakeholder. But the part of this that I'm really concerned about is the oyster restoration part. We've never had a plan before that made oyster restoration a priority in managing oysters.

But we don't have any oysters, very few oysters. And it doesn't matter whether you think the one percent number is wrong or, as Dr. Loren (phonetic) said, maybe .1 percent or ten percent. I can make a good argument that we shouldn't be taking any oysters from a resource that's so depleted that we're quibbling over it's one percent or ten percent.

The Department of Natural Resources, I believe, has done a good job in trying to balance all

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these issues. They've certainly been a public process. I think I've attended most of the meetings. And this is my second one of these just because, well, my wife says I don't have a life and, I guess, she's probably right about that.

But, I believe, the plan we have is a reflection of a mandate for change and it was thought it was going to be a change in 2007 when the Legislature unanimously voted to establish the Oyster Advisory Commission. How are you going to change this? It was supposed to be for the good of everyone. That's what the charter does.

We all want new oysters, we all want to buy them, DNR is supposed to manage them, and in the past maybe they haven't done a great job of it but right now I'm looking at the plan I've ever seen. It may not be the best plan. It may be a plan in transition. There may have to be things done to tweak it along the way. We've never had a plan.

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And someone once pointed out to me, if you don't have road map of where you're going along the same road will take you there. But if you don't know where you're headed it doesn't really matter how you go about it. You'll get there. You'll get somewhere.

I really don't care what form the industry ultimately takes. I hope it's a good form. I've met a lot of people over the last few months, a lot of really good people that they're working in this business trying to make a living. And I can't really relate to what they want but I want them to be successful. I want them to be prosperous and I want oysters to be a major economic driver for the State of Maryland.

But I want restoration to be the most important thing because that's what's closest to my heart. And people say, "Well, you're hard hearted. You didn't hear about the oystermen." Well, that's not true but there's an entire bureaucracy out there

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that seem to have nothing else in mind except to try to manage the oyster industry.

And I know it's important but I want my share of the pie, also. So it's not a perfect situation but my hat goes off to DNR for trying to balance all these various issues that are going on here and all the conflict and what not. I want to applaud the vision, the outstanding plan as far as it goes right now. And it's just an outline. It's going to be developed.

And without a doubt, this is the most comprehensive, all inclusive public process I've ever seen. And I've been watching regulations for a very long time. Thank you.

(Applause)

MR. GARY: Thank you, Mr. Hastings. Our next speaker is Wayne Wilson. Wayne will be followed by Ms. Stephanie Westby (phonetic) and Dorsey Shockley.

MR. WILSON: I'd just like to say that I

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can't see how the sanctuaries are going to work when the shells they want to reclaim get silted over and they want to restrict power dredging more and more. And power dredging will get the shells up in front of the silt but they're not addressing how to get the silt stopped.

I mean, the government let the developers and all have a silt plan but it doesn't get implemented until what, 2016 or something. So how they going to keep silt from getting on the sanctuaries without us working the bars? So that's all I got to say about that.

(Applause)

MR. GARY: Thank you, Mr. Wilson. Stephanie Westby is our next speaker followed by Dorsey Shockley and Carol Bean.

MS. WESTIE: Good evening. My name is Stephanie Westby and I'm a fishery scientist with the **Chesapeake Bay Foundation**. And I'm here tonight to

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speak in support of these regulations. The oyster plays an incredibly important ecological role in the Chesapeake Bay and we haven't heard too much about that tonight.

This is an animal that filters the water and makes it cleaner in the Chesapeake Bay. This is an animal that provides habitat for other species of fish and crabs. And the fact of the matter is, no matter how you slice it, we're down to about one percent in our historic level of oysters. That's one percent.

And we need a new management strategy while we still have something left to protect out there in our Chesapeake Bay. So I agree with the strategy of setting aside 25 percent of the productive oyster reefs, again, while we still have something left out there so these areas may recover on their own. Some of them are going to take a lot of incredibly intensive oyster restoration efforts, hatchery plantings, perhaps cleaning off sediment, the whole

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nine yards in order to make this work for our Chesapeake Bay.

We are committed to that as Chesapeake Bay Foundation. We have incredibly dedicated constituents who come out and they volunteer thousands of hours of time in their passion every year to make it happen. We are committed to keeping the pressure on the State and on the federal government to keep those restoration efforts moving forward even when we do have these sanctuaries in place. That's definitely not the end of the story, for sure.

We know we've got a tremendous water quality problem in the Chesapeake Bay. There's no question about that. The oysters can help be part of that solution but the solution needs to be a lot broader than that, as well.

The developers, the farmers, ourselves, all this pollution comes from tail pipes, from smoke stacks, from all throughout the waters and all the way

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up from New York state and all the way up to West Virginia and it ends up in the Bay. Needs to be a holistic, collaborative effort to stop that pollution from coming into the Bay.

But the oysters need to be a part of it and we need to have these sanctuaries in order to let them fulfill their ecological role in the Bay. So I'd like to remind everyone, too, that these oysters are, in fact, a public resource and they are owned equally by every citizen of Maryland.

So, I believe, that setting aside 25 percent of that publicly-owned resource in order to help improve the water quality in the Bay, and in order to try to help ensure a long-term sustainability of our oyster population is scientifically sound, it represents good management strategy, it's eminently reasonable, and it's long overdue, and it's actually in the best interest of not only the Chesapeake Bay but all the citizens who live in Maryland and enjoy

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the Chesapeake Bay on every level. Thank you.

(Applause)

MR. GARY: Thank you, Ms. Westby. Our speaker was scheduled to be Mr. Dorsey Shockley. Is Mr. Shockley with us or is he waiving his --

VOICE: (Indiscernible)

MR. GARY: Okay. He's waiving his option. So our next speaker is going to be Ms. Carol Bean to be followed by Luchi Gilmore and then Rich Haltman.

VOICE: Pass.

MS. BEAN: Wish I had a good name like Luchi. I just, like, want to make one comment which I heard Ken and Stephanie just say about this is, also, a public resource. And for some reason, I think they're under some misconception that, you know, when my husband goes out and catches 12 bushel a day that we're home eating 12 bushel a day.

The people in this room are catching oysters for the public, for other people who don't have a boat

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and who don't go out who want to enjoy seafood which is why we all, you know, these guys do what they do and why we love living here. It's one of these great benefits that we have for living here.

So, you know, you can, well, I guess, that's all I want to say.

(Applause)

MR. GARY: All right. Thank you, Ms. Bean. And our next speaker is Luchi Gilmore. Mr. Altman has passed so the next speaker will Ed Beggion.

MR. GILMORE: Hi, I'm Luchi Gilmore. When Tom, kind of, talked to me a couple years ago about the change in direction of the oyster business, the one thing I asked him was to not leave the watermen out. And in this program he has severely hurt our chances of making a living.

And the next issue is power dredging. I think we need more of that, especially in the upper Bay here where, especially Queen Anne's County where

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we've been left out of that. And the main thing that I see that's going to be a major problem is getting shell to do all these programs. Thank you.

(Applause)

MR. GARY: Thank you, Mr. Gilmore. Next speaker is Mr. Ed Beggion (phonetic) followed by Jay Falstad.

MR. BEGGION: I'm going to do my best not to repeat a lot of things everybody has said. So for that reason, my comments will be very short. I know one thing and I don't know one thing. I know that the program we've had on oysters in the Bay for the last 25 years is not working. That's one thing I know. The thing I don't know, quite frankly, and nobody in this room does, is for sure where the program that we're looking to going into is going to work.

I mean, if I knew that I wouldn't tell you, I'd be selling that information to Vegas. Okay? But, I believe, it's a good program for the information we

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have. Is it going to be tweaked? Absolutely. Will it work? I hope so. For that reason, I'm for the program. Thanks.

(Applause)

MR. GARY: Thank you, Mr. Beggion. Our next speaker is Mr. Jay Falstad followed by Mr. James Haddoway.

MR. FALSTAD: My name is Jay Falstad and I'm speaking on behalf of Queen Anne's Conservation Association. We are a non-profit 501-C3 and we have been in Queen Anne's County since 1970. And we concern ourselves with a wide array of environmental and conversation issues.

The Executive Committee of Queen Anne's Conservation supports the proposed oyster recovery recommendations as outlined by the Oyster Advisory Commission. We do not presume to understand all the many challenges that face today's watermen but we do recognize, from an environmental standpoint, that the

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Bay's oyster population is struggling.

And these struggles are caused by many factors but the oyster population is, nonetheless, a fraction of its historical levels. And anytime a species struggles to that degree it sometimes requires intervention and sometimes requires policy changes.

Just as policies were modified to help the crab population and the rock fish population, so, too, should policies be implemented to help other species in order to help maintain a viable fishery for future harvest. In order to ensure meaningful production of oysters for the future, Queen Anne's Conservation Association supports these proposed regulations.

Thank you.

MR. GARY: Thank you, Mr. Falstad. Is Mr. James Haddoway still with us? Not here. All right. The next one, I'm going to be a little challenged so hopefully you can help me out with this. Really can't make out the signature but it looks like a Mr. Riggs?

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Is that remotely close? Zal Riggs? Okay. I'm going to, hopefully we'll come back and pick him up. Grant Corbin, Mr. Grant Corbin. Mr. Corbin will be followed by Tommy Thompson.

MR. CORBIN: I'm Grant Corbin. Been a waterman for 52 years. And the main thing sticks in my mind is 40 million dollars and you've done nothing. My Lord, how much money does it take? Ten million will do something and 40 million you've wasted? Okay. If oysters, if the bottom does not work, it's just like farming.

These people talking about a program they don't know what they're talking about. Yes, on paper, if I didn't know nothing about oysters, it sounds like a good program. The oyster bottom (indiscernible). We were number one in the '50s and '60s. These people don't realize that is talking about things.

We were number one, the best because we had shell growing. We planted shells or spat

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(indiscernible). We took the spat up these rivers for
(indiscernible). Up the head of the Bay where spat
(indiscernible). That program will work and will
still work. You can take eight or ten of us watermen
and give us 40 million dollars, I'll guarantee you in
ten years we'd have oysters coming out of the bottom.

(Applause)

MR. CORBIN: Now, they, also, said power
dredges. They're going to study it for five years.
I've been doing it for 20. We have 95 percent of the
lower (indiscernible) on the whole Bay in Somerset
County. But there say power dredging, they don't know
if it works or not. Where else have they caught
oysters for 20 years, made a living, but on power
dredge piling.

I mean, these other people just don't know
what's going on. They read the paper and that's it.
But they don't know and they better find out soon.
That sounds like a grand organization. That woman

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claims they scientists. There's a lot of people here that's twice the scientist you'll ever be.

(Applause)

MR. CORBIN: Now, I'm not saying that to offend her but what I've read that they put on their web page is one of the biggest lies that ever has been put on anything to get these people don't know on their side. Forty-three percent, they say, has paid fines. That's a genuine straight up lie. I bet it's not two percent.

Now, that's got nothing to do with oysters. I just stuck that in there. But if anybody wants oysters back, look at the programs. The State has got the programs where they planted the shells. Matter of fact, I brought a copy the other day of how many shells to plant. How much spat.

People don't realize dredge boats, that we take two loads a day and they will transplant them and they will all come up rivers, and different public

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bars, and some private bars. Oyster program is no trouble to bring back. But if the State's wasted 40 million, and they brought nothing back, if they were running a business, would that CEO be gone or not? That's all I've got to say.

(Applause)

MR. GARY: Thank you, Mr. Corbin. All right. Our next speaker was scheduled to be Mr. Tommy Thompson. Is Mr. Thompson still with us? All right. And Mr. Thompson would be followed by, and I'll need your help again, Mr. Kellum Om (phonetic). Does anybody recognize that? Is that Kellum back there?

VOICE: I'll pass.

MR. GARY: Kellum is going to pass. And then Tommy, before you start, one more minute. And then Mr. Jerry Father? Jerry?

VOICE: Yes, sir, I'll pass.

MR. GARY: Pass. Okay. You can go up, Tommy, but just wait one second. And then Captain Boo

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Powley. I think I got that one right. Right, Boo?

VOICE: Yeah, I guess so.

MR. GARY: Okay. Tommy, Mr. Thompson, you have the floor.

MR. THOMPSON: All right. Name's Tommy Thompson. Worked on the water for probably, I don't know, some people might think a lot longer than I need, but 40-some years. I don't see what they're doing when they're taking natural oyster bottom, bars that we worked on in the lower Bay. And I don't know what there is to study there because they've taken where the oysters already are. They don't need to make any there because they're already there.

And it's going to hurt a lot of people, I think. And I don't know but, I think, they're going with the wrong approach. I think this seed program would be best. Thank you.

(Applause)

MR. GARY: Thank you, Mr. Thompson. Boo,

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before you start, let's get the next two down to the stage if we could, please so we keep things flowing. Mr. Powely, you can take the mic now. Next speaker after Mr. Powely will be Mr. Drew Coslow followed by Mr. Bunky Chance. If you both would come down, please. Mr. Powely, you have the floor.

MR. POWLEY: It's been a couple groups up here to speak in favor of this proposal, this regulation. I'm Vice **President, Dorchester Seafood Harvesters** and sit in on the **Chesapeake Commercial Fishermens' Association**. I've been a waterman for 38 years.

My ancestors go back to the 1670s. The people on the CCA say they'd like to see me go do a mechanic job on a bus or something. Well, honey, no buses up Hooper's Island. All we got is crab posts and one gentleman's store. I ain't got no where else to get a job. This is all I know. This is my living.

The CCA, the Chesapeake Bay Foundation, also

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said they got just as much interest as we do. No, they don't. My license this month is \$2,175 dollars, sir. How much you pay?

(Applause)

MR. POWLEY: I pay, I lease that bottom. I pay the DNR to lease that bottom \$710 a year just for mine to work the bottom. How much did you pay? Is any of these regulations going take any money out of your pocket? No, but it's going to take some out of ours. So why should a special interest group such as you, and that you were formed by the coal companies in the north. That's where you originated from, the CCA. You will not vote on a energy project because you're funded by energy propane. Well, Captain, I think the best thing that you can do is pack your bags and go down to --

(Applause)

MR. POWLEY: -- (indiscernible). Don't tell us and all what to do. I'm sick of it.

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(Applause)

MR. POWLEY: And, furthermore, this is government take over. The government's got the banks. The government's got the car industry. Now, they got the health care. They're going to take everything in our lives. Now, they're coming after a bottom that's been public. It won't be public no more. You all be lucky to even take your hook and line and go fishing on it, let alone sail across it.

That's a shame. We're losing freedom so fast it makes me sick to my stomach. So don't tell me you got just as much (indiscernible) as I, because you ain't because you don't pay nothing. It don't cost you nothing. So and the woman from the Chesapeake Bay Foundation -- this (indicating) is off their website. Let me read this to you.

"In 2008, 43 percent of the Maryland oyster harvesters were charged with a poaching violation."
Honey, I believe, that's a defamation of character

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because that's a bald face lie. We ain't a bunch of criminals. We want the State to leave us alone and let us make a living. And we know how to do it but they don't ask us.

They going to listen to special interests groups to pay lobbyists over here in Annapolis and you all need to get your asses over there and pay attention to the stuff that's working down in Dorchester County and Somerset County. We got oysters down there like you wouldn't believe and it didn't cost the taxpayers a dime. Not one penny.

But the waterman is a common poacher, direct on. And let me give you some examples. Limits on oysters. Forty-five bushel was put up by the waterman, not you. Not the Department. Limits on oysters was cut back to a bushel. That was put on by the watermen, not the Department. The watermen come up with the (indiscernible) and the crab pots, not the Department. We implemented that.

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On our quota on rockfish, we've never caught over our quota but the recreational fisherman catches every (indiscernible) every year.

(Applause)

MR. POWLEY: And you all going to tell us commercial what we're going to do? You do the spring trophy season (indiscernible) with their legs on? We don't even catch them until June. So you all catching them with their legs on. You ought to be ashamed of yourself.

(Laughter)

MR. POWLEY: Cownose skates. I told Rob and all of them, I said keep your records on how many skate you've killed this year, cownose skate. I've killed, up-to-date, 3,483. How many have you killed? Biggest predator we got in the Chesapeake Bay kills clams, digs up grass, kills soft crabs. What have you done, CCA, Chesapeake Bay Foundation?

(Applause)

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MR. POWLEY: You all, yeah, we're thieves? We're outlaws? I don't think so. Sponge crabs. We are the ones that didn't want to catch. Not them. We went to them and told them we didn't want to catch sponge crabs. But we're thieving.

So, ladies and gentlemen, I don't care a lot about saying things but I'm just tired of the government intervention. I think people across this Country with the tea parties and everywhere else is fed up with taxes, government takeovers, and that's all this is. Thank you.

(Applause)

MR. GARY: Thank you, Mr. Powley. Mr. Coslow, Mr. Drew Coslow is our next speaker. Before we start, just to reiterate, the comment period, it is your opportunity to be heard but all those comments, if you could focus them as best you can on the proposal, that's really what we're trying to hear feedback on. It is your opportunity to be heard.

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But, again, the proposal is what's being brought forward. So the more directed your comments can be to the proposal, that would probably be best. So Mr. Drew Coslow will be our next speaker. Drew, before you start, we then have Mr. Bunky Chance and then we need Ronnie Benton who will be the next speaker, come down please. Mr. Benton. Go ahead, Mr. Coslow, you have the floor.

MR. COSLOW: Good evening. My name is Drew Coslow and I'm a **Choptank riverkeeper**. I work for the **Choptank River Eastern Bay Conservancy**. We're a local non-profit organization with over 440 members. And I'm here tonight to support the Department's proposal.

I've been working on oyster restoration since 1999. I've worked with the Anne Arundel Hand Tongers Association to help them increase their catches, to put aside harvest reserve bars. And, you know, I've watched what's happened in this industry over a long time. I think that, you know, catching

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oysters out on the Bay, the commercial fishing on the Bay is part of our natural heritage.

And it's a shame where it is right now compared to where it's been. All of you all know that our resource is dwindling. And, yes, there are other causes. The way we live on the land impacts what's happening in the water. But our obligation as a society, as residents of the (indiscernible) is to try to do something to turn things around.

We all have an interest in a clean and healthy Chesapeake Bay. We all do. And when Captain John Smith came into the Bay, the dominant life in the Chesapeake was (indiscernible). It lived on the bottom. Oysters, and clams, and muscles. Today the dominant life force, the dominant life in the Bay is palagid. It's algae. Oysters eat algae.

We need to set aside sanctuaries to grow oysters to eat algae to clean the water. I support the proposal. I think it's a really good start. I

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think that when you have a sanctuary and you leave it alone, you have more oysters in one place. You have better reproduction. You have better spat set. And you're going to see that not just in the sanctuary but outside the sanctuary, as well.

So, I think, it's a good start and I look forward to seeing where we are in another five years. Thank you.

MR. GARY: Thank you, Mr. Coslow. Our next speaker is going to be Mr. Bunky Chance. Is Ronnie Benton in? Michael Husty (phonetic)? Okay. Michael, are you here?

VOICE: Yeah, but --

MR. GARY: You're going to defer?

VOICE: (Indiscernible)

MR. GARY: Okay. So you're deferring? Okay. Thank you. And then Gibby Dean. Mr. Gibby Dean. Then after Mr. Gibby Dean we'll have Mr. Dave Smith.

MR. CHANCE: Can you all hear this okay?

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First thing I'd like to say here this evening is I'd like to compliment DNR from O'Malley to John Griffin, right on down to the folks you see here tonight. Because they've done an excellent job. They've done an excellent job putting lipstick on a pig.

(Applause)

MR. CHANCE: If you folks have taken a fraction of the money that you have wasted on presentations, on words, and put that money into action, into programs that your own DNR knows and have documented that works effectively and efficiently, we wouldn't even have to be here tonight.

We'd be celebrating recovery of the Chesapeake Bay oyster and you know it, sitting right there look at me in the eye, each one of you know it. Christian put forth an oyster replenishment program study. Mr. Ken Hastings referred to the, oh, there's nothing that's been done.

There's been plenty done. Grant Corbin

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stood right here and referred to the oyster seed program. Well documented program. What did you do with that program? You stuck it on the back burner, put the man that wrote it out to pasture, put a new man in there that doesn't believe in it, and went on about your business to put the watermen out of business. You should be ashamed of yourself. You know better. Some of you know better. And, you, Tom, know better.

(Applause)

MR. CHANCE: As I look out on this crowd tonight I see a lot of faces I recognize, lot of watermen. And I see a lot of folks, concerned citizens that I don't recognize. Folks that have taken the time to speak here tonight, that have come out here tonight. And I applaud you folks for caring enough about the resources of this Bay to spend your evening out here tonight. To, for lack of a better phrase, for giving a damn because most folks don't.

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But I say to you folks, respectfully, that you're uninformed. You're informed but you're not completely informed. If you're going to take the time to invest your energy in this direction, give all your time to get all the facts. Don't just take propaganda because they've got a lot of money to get the word out.

The facts are there and you got to dig a little bit. Mr. Hastings, you claim you've been digging for all this time, you ought to sharpen your shovel up, Captain, because you ain't digging deep enough. As watermen, we all know we face an uphill battle. We all know that.

I'll tell you what. The watermen that are here and the watermen's families and so on and so forth, stand up here just for a minute. Can you take just a minute and stand up.

(Whereupon, all persons so identified stood, as requested.)

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MR. CHANCE: Now, the folks that aren't watermen here, take a look at these guys and these ladies. Take a good look at them. Don't just see them, look at them. Look at their faces and look in their eyes. These men and women are not poachers. They're not law breakers and they're not commercial interests.

These people are our neighbors. They're your neighbors. These are the men and women who are standing in front of you at the grocery store. They're the guys that are buying parts at the hardware stores. Buying fuel at the fuel company. An integral part of our economy. When you take a link out of the chain, the whole chain falls. We're all part of the same chain.

Now mind you, in so far as organization and lobbying ability goes, they're a weak link in the chain. That's why we're being picked on by the powers that be.

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(Applause)

MR. CHANCE: Couple hundred years ago this land that we so enjoy, this Chesapeake Bay area, was ruled by the British Empire, world-wide empire. And a handful of citizens stood up to that empire and they called themselves the Sons of Liberty.

Everybody laughed at them. Everybody said, you know what, you can't fight City Hall, can't believe you're running against the tide. And because those men stood up, 200 years later, 250-some years later we're all sitting here to enjoy the privilege of what they lived and died for, the democratic process.

But as many men and women that have died for that process, that process can be corrupted. And that process is being corrupted right here. For instance, what is this little get together tonight called? I believe it's called a, well, let's see here, four times Tom mentioned that we should go forward collectively, have public input to resolve issues,

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have public participation process and much of this is based on public input.

What we're having is a public input here tonight. But isn't it interesting that all the rules have already been drawn up and printed? Why are we here commenting on this aside from the fact that this is a dog and pony show that you folks can say, "Oh, Mr. O'Malley, we had a process."

What good is a process if it's not honest? How do you print laws before you get the public's input and then say the public had input? How's that work? Explain that to me. Suppose you folks were negotiating a contract and the day you went in there to negotiate that contract, in good faith mind you, you going to find out the contract's already been printed with your signature already on it. I don't imagine you folks would appreciate that but you represent that. That's what you're here tonight representing to the concerned citizens that don't know

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any better.

I hear the word "environmentalist" a lot. Let me tell you what an environmentalist is. An environmentalist is a man who makes his living from the environment and whether or not he pays his mortgage, the truck payment, and feeds his family is based on that environment.

Captain, that man's an environmentalist. Let me tell you, he cares a lot about the environment. That's these watermen out here. So don't let anybody, you folks, concerned citizens, ever tell you that these watermen out here are not environmentalists. Stakeholders. Tell you what they're stake is. Whether they eat steak tonight or not, that's their stake hold. Some of these other gentlemen up here have referenced the dredging prop that has been made. DNR claims they'd love to put us out. They'd love to take this bottom from us and study it. They know full well and got records on hand, plenty of it

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in Annapolis, we've all seen them, about the productivity of the dredging bottom that started from next to nothing that these watermen right out here, and this is just a fraction of the thousands of the industry represented here tonight, that they brought that bottom back from nothing and now the State wants to take it.

And the State knows these facts. That's the part that hurts my heart. The State knows these facts and, nonetheless, State wants 24 percent of our bottom.

Take a look at this map. Here's a map. The green area is the sanctuary. The yellow area is public bottom. As it stands, most all, most, not quite all but most of that bottom is now public. Now, let me ask you folks something. Little common sense here. Little mathematics. Do the green areas look like to you, fraction-wise, do the green areas look like 24 percent of the yellow areas or does it look

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more like half to you? This is DNR map, now.

VOICE: Looks like half.

MR. CHANCE: Look like half to you folks?

Look like 40, 45, 50 percent? Apparently, it's only 24 by their numbers. DNR's own map. I'll conclude and I apologize for taking so long. But I'm going to conclude with a couple sentences from the DNR's most recent sanctuary evaluation.

Here are those words. Here are those words, Mr. O'Connell. Your Department's most recent sanctuary evaluation. "Despite the numerous rehabilitation projects within the sanctuaries, many of the sanctuary populations tend to resemble natural populations in relatively short periods of time."

"Overall, it appears that the sanctuary program to date has fallen far short of its stated goal of contributing to the oyster biomass in the Chesapeake Bay." And for that you would take food off of these families table? It must be an election year.

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I have no more to say.

(Applause)

MR. GARY: Thank you, Mr. Chance. Our next speaker is going to be Mr. Gibby Dean followed by Mr. Dave Smith and then Mike Alberts (phonetic). Mike here still? Mr. Al? Not here. Then Larry Simms. Mr Simms, could you come down, please.

MR. DEAN: My name is Gibby Dean. I'm President of the Chesapeake Bay Commercial Fishermens' Association. And thank goodness I didn't have to follow Boo Powley up here. That was -- most of the comments, first of all, I wasn't even planning on speaking here tonight. I attended the meeting in Salisbury University and I pretty much put our two cents worth in there.

The comments I want to make tonight are more directed toward the general public. There's several misconceptions that I want to take the opportunity clarify. Most all the other issues regarding

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proposals, stuff you've heard about, I know you know all about how we feel.

For the record, I'm here to, as the President of the Association, to oppose the proposal as it's written. Now, first of all, there's nobody in this world that is anymore concerned about not only bringing the Bay back but the longevity of the oyster than we are. Now, some of us may have personal reasons for doing that but regardless of what they are, we're all here for the same thing.

I'm going to give you a little different spin on this proposal and tell you how we went about it. We tried to be, and, I guess, the current word is "proactive" in dealing with this proposal. When this thing hit our desk which didn't come out until December, it was pretty much a done deal.

Now, yes, and I don't recall if Tom mentioned tonight, we've had countless meetings anywhere from a hundred to 150. That's all true

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because, I believe, I attended most of them myself. And, trust me, there were some adjustments made and some, you know, slight modifications.

But the basic proposal was a done deal when it hit our desk. Now, in order to satisfy, we looked at this thing and said, "This is the hand that's been dealt us. And what's the best way we can tackle this where we, for the benefit of the commercial watermen, the environmental people, and the scientific community. So we had countless meetings with people from the University of Maryland to try and get the scientific side of it.

And, I think, I'm pretty sure it was March the 8th we came up with a proposal where we would agree to support this Plan. We submitted it to the DNR that three criteria. Now, before submitting that proposal, we met with Maryland Watermens' Association. We had their support on it. We met with representatives from Maryland Oystermen Association. We had their support

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on it.

It's sad to say that, and Stephanie, are you still here?

VOICE: Yes.

MR. DEAN: Not trying to single you out, but I personally drove to Annapolis and met with over, with Chesapeake Bay Foundation, Stephanie, and also Bill Goldsboro, showed them our proposal and asked them if they would consider supporting it or any part of it. I've yet to heard, I've never even had a return phone call.

We stuck our hand out. We tried to work with all the users groups to come up with a plan that would satisfy all these people involved. When we submitted the proposal to the DNR, we asked for three things. We would support the sanctuary program -- I'm not getting into the leasing thing. That should be a separate issue to begin with.

It should not have ever been combined on

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this particular issue. But there was three criteria that we asked them to meet. Number one, and the most important one was that they got agreement from each and every individual County affected by sanctuary on where those lines were to be drawn.

We, as an Association, from the get-go stayed out of drawing those lines. We left it up to the individual shell committees of the counties affected to come up with those lines and whatever they came up with we would support.

Now, when we left the negotiation table, to my knowledge and my understanding, there was only two counties that were still negotiating and unsatisfied with the (indiscernible). None of us were satisfied with them but we had a plan that we thought we could work with.

And those two counties was Talbot and St. Mary's. And, I think, they're still in negotiations on those. At least Talbot is anyhow. When the final

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draft came out, we noticed that Manokin River, Nanticoke River were included. Well, that one came as a complete surprise to us and even members from the Shell Committee.

So, now, you can add not only, I don't know the status of St. Mary's but you can add Talbot, Dorchester, Wicomico, and Somerset now that it's being, there's four counties right there where the lines have not been satisfied.

The second criteria was to set up regional management councils. Now, Tom spoke about those and he mentioned them in. We could foresee, and this was a brain storming operation. It was never anything set in stone but possibly four to six regional management councils spread throughout the Bay. Now, in those management councils, you would have people from the scientific community, you would have people from DNR, you would have representatives from the commercial fishing industry.

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Now, the combination of those three, we wanted them to be a regulatory body. For example, they would go in and take spat count. Before the season's over they would do oysters per meter. They would possibly set harvest limits on certain bars. We thought about what type of gear we could use.

We know how beneficial we think power dredging was and is. There was times even this last year when the commercial oystermen themselves were calling me asking, "Can we get a section of Mohanga (phonetic) River closed because we feel it's being over-harvested?"

If we had those regional management councils in place, we could do things like that. We could do bottom rotation. You know, it would be up to us, you know, to come up with these, the different techniques and strategies other than what we're using today. It would take, and when I called about having the river closed, it was a six-week process.

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You know, that was useless to us. Anyhow, there has been provisions in this proposal to have these regional management councils but they've been watered down now to advisory councils. And that's really not what we were looking for.

And the third and final thing was, if the sanctuaries themselves are so beneficial, now, we never were in favor of if they were going to be handled the way they have in the past. But we were told they were going to spend money whether to do bar cleaning, seeding, all these things of this nature and we could see residual benefits from that.

But if you're getting benefits from the sanctuaries of themselves, why not spend an equal amount of money on the public shellfish bottom where the sanctuary would get residual benefits from that? We started out asking for dollar-for-dollar match. There was a lot of contingency that would prohibit. But they did give us in so many words asked if we're

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going, you know, support the public shellfish bottoms through monetary means.

Because of these reasons, because they have not been met, you know, we have to, we've supported this plan in principal, we tried to work with them on this. I'm not saying whose fault it is or isn't, why it didn't get done but because of the final draft of the plan we cannot support it as written. Thank you.

(Applause)

MR. GARY: Thank you. We have three more speakers that have signed up and before we call them up to the stage I just want to apologize to the audience. Me, personally, to you. My job tonight was to facilitate this meeting and allow for you to be heard in a civil, constructive, cordial dialogue back to us addressing the subject, make sure you were heard.

In an effort to try to do that, unfortunately, I didn't put on the best performance

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and a few folks personalized their comments. And that's not in the spirit of what we decided tonight. So I want to apologize from me to you, the audience, and also I want to personally apologize to Stephanie Westie and to Ken Hastings, and our director, Tom O'Connell.

There's three people that I heard singled out tonight and I just want to let everybody know I don't think there's anybody in this room that doesn't care about the oyster resource in the Chesapeake Bay. I, also, don't believe there's anybody in this room that doesn't think there's a problem out there and that we should do something about it.

We may not agree on what it is but we need to address it. And I know whether you're a proponent or an opponent to these regulations that are being brought forward. We wanted to hear from you. And we have three speakers left and I will ask you can we finish this meeting out the way it was intended to be,

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civil and constructive, and respectful?

So I apologize to all of you. Our next speaker is going to be Mr. Dave Smith to be followed by Mr. Larry Simms and then Mr. Dave Sikorski, if you could take you place. Thank you.

MR. SMITH: My name is Dave Smith. I am the Executive Director of the **Maryland Saltwater Sport Fishermens' Association** and we support this plan. Let me take you through, kind of, the learning process and the discussions that we had as a board.

We have 14 chapters throughout the State stretching from Frederick County all the way to the Atlantic coast from southern Maryland all the way up to Pennsylvania. So we have a diverse group of individuals that come to the table each month and discuss issues.

It took us a while to come out and support this plan because we had to meet with our members, we had to meet with our chapter presidents, and we had to

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meet with the Department. And after a lot of discussions, we support the plan. There are two things that came up.

One, we all understood there was a problem. Two, we all understood we needed to do something about it. And this was the plan that was presented. We all agreed that from hearing this tonight, it's not perfect. But there's certain things in place within the plan for adaptability and flexibility. We know there's a problem that needs to be addressed. This is a start. This is a tough decision. Somebody's got to make it and the Department did.

Recreational anglers in this state provide many, many benefits. Tens of thousands of jobs, they provide a tremendous amount of money to this state. And we need to protect the fisheries that they go out and target. And having more oysters in the Bay, having more habitat is just going to increase fishery populations and we're going to have a beneficiary for

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recreational (indiscernible).

It's going to be a destination on the East Coast for recreational anglers and everybody is going to get out there and enjoy. So that was our thought process. We support this plan and thank you.

MR. GARY: Thank you, Dave. Next speaker is Larry Simms.

MR. SIMMS: Larry Simms, President of Watermen's Association. I'd just like to make some facts known here. Most everything been's said here tonight. But from the very beginning we haven't been against sanctuary planning. Everybody's profit is where they're going to make their sanctuaries.

And that's been our debate with DNR all along and we're still negotiating with them about it. Couple things. You know, when they take the very best bottom that we got to make a living on to make a sanctuary for an experiment that they're not whether it's going to work or not doesn't seem reasonable to

any of us.

We supported the sanctuary plan. We support a lot of areas but we don't support the very best areas that we harvest to get in those sanctuaries. That's where the conflict is. The other thing, if DNR is willing to sacrifice the bottom for experimental program and they don't have any scientific proof if the sanctuary will do anything at all, it's all just a guessing game, all we ask for is equal time.

We would like to have experimented with what we know works and that's give us before dredge bottom to do experiment with that. And they've been working with us with three different bottoms but we're not satisfied because they're not big enough to really prove anything.

What we'd like to see is a big area in Eastern Bay for experimental for power dredging. Yet we have a spat set in there. You got lots of shells in there but they're coming up with water blisters so

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the spat can't sit on them. So we're asking to do experiment in Eastern Bay, or big (indiscernible), not just a little postage stamp but a big area.

So they're willing to take 25 percent for experiment, we'd like to have 25 percent to experiment. (Indiscernible), their's is just a guess for (indiscernible). That's where we stand. We still talking. We still trying to negotiate something. It's been a done deal from the very get-go but we've had assurance from the Secretary that he's still willing to work with us. So that's what we have to go on.

So just want everybody to know we wouldn't be here arguing about oysters and not having any if all environmental groups did their job over the last 25, 30 years and kept the Bay from being polluted and silted over. So here we are, the final step is the watermens' fault. Well, it's everybody in this room's fault. If you turn over a piece of ground, that's

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silt coming out there. If you put fertilizer on your lawn, that goes out there.

All of that contributes to oysters not reproducing and, I think, it has effect on the disease that we have. So it's now all these environmental groups stand up here and support this plan because they failed. And that's why we're here. Thank you.

(Applause)

MR. GARY: Thank you, Mr. Simms. And our last signed-up speaker is Mr. Dave Sikorski.

MR. SIKORSKI: As he said, my name is David Sikorski. I'm CCA Maryland's representative from the Sport Fish Advisory Commission. And it's (indiscernible). This is second one of these meetings I've been to. I was at the initial one in Annapolis. Not much was said and that's why I made it a point to come here.

I live in Howard County. I spent a great deal of time on the Eastern Shore, a great deal of

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time on the Western Shore. Spend a great deal of time enjoying the outdoors and the recreation it provides. And I have great passion for the outdoors and the health of the Bay, the health of our ecosystems.

I've been on the Sport Fish Advisory Commission for about a year. And I've been absolutely amazed at finding that same passion I have that I know all of you in this room have for our ecosystem and for our Bay, within the people at DNR that work hard every day to do what's in the best interest for all of us in this room, all of us, and all of the approximately five million Marylanders who the Bay belongs to.

It's a privilege for all of use to be able to enjoy it the way we do. It's an absolute privilege for many in this room to be able to make a living on. I mean, that is the dream of many people in the State. I think the character of the Department that I have found and worked with was just exemplified by Mr. Gary's comments. His apology.

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That's the passion and the humbleness that this Department has. And they truly understand that they're not here to take jobs. I've about "you're putting me out of work, you're putting me out of work." My profession is a builder and a realtor. And I'm in an industry that has changed greatly over the last 30 years, my lifetime, 28 years. I'm 28 years old.

And Mr. Simms touched on something very proper. He said, you know, we can point fingers and point fingers. Until we're all willing to point our finger on (indiscernible), this is all just a waste of time. The Department has worked extremely hard, spent tons of time and a lot of resources to put together this plan. Is it perfect? Anybody in this room perfect? I don't think so.

It's as good as we're going to get. It's worth making an effort. I mean, it's a step in the right direction. And the aquaculture program, over 90

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percent of oysters consumed by the public are grown in aquacultures. The gentleman that asked, 80, 90 cents for an oyster. I paid a dollar an oyster that was grown by aquaculture in Cape Cod. Is this the answer? No.

But I don't think 24 to 25 percent sanctuary bottom to find out if there's a chance that oysters can survive and, you know, become disease resistant is asking too much. A hundred and fifty meetings. How many posters can reprint? How many maps? I mean, the respect that's been shown to this Department, or by this Department to the public has been, it's just amazed me and made me happy to be represented by those people.

You know Coastal Conservation Association, CCA, it's a dirty word with a lot of you guys out there. And, no, they're not on totally my (indiscernible). There's a lot of mis-truths that have, you know, happened in this room and it happens

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amongst all of us in this fisheries (indiscernible) in making regulation.

And if we all work together we can get something done and that's what this plan allows us to do. Dredge bottom, I've heard dredge bottom -- silt off bars and there's some truth to that. But, now, and that's great. The Department has given us three areas to work on it and finding a study what is truly happening. That's a step in the right direction.

So I thank the Department for their hard work and just having these meetings to allow people like me to stand up and, I'm a 28-year-old Marylander. I mean, am I the youngest angler man? I'm amazed that I can stand here and give my input to representatives. I see Secretary Griffin in the back.

I mean, it's an honor to be up here and, I think, you all should be honored that there are people like this representing us and working hard to try and make the Chesapeake Bay a better place. Status quo is

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not the option. It's not an option at all. It can't be.

For a hundred years we've been going down a slippery slope. Less than one percent of historical levels, we should be ashamed of ourselves, utterly ashamed. We need to do something. A lot of you have a lot of great ideas and I know the Department will listen. They have. They'll continue to.

I've been in plenty of meetings and I've seen change and I've seen, you know, an effort put out that I thank them for. Is everything perfect? Absolutely not but it's a step in the right direction. And on behalf of CCA Maryland, I fully support this plan and thank the Department for their hard work.

MR. GARY: Thank you, Mr. Sikorski. That was our last signed-in speaker. Time now is 8:17. We have the room until nine o'clock. Now, as we stated at the beginning of the meeting, the purpose of this meeting is make sure that you were heard and make sure

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those comments that you had, preferably directed at the proposed regulations, were heard and brought to our attention so that we can consider them before a final decision is made.

So with about 40 minutes to go, we want to make sure, we don't want to leave here tonight given we have until nine o'clock without everyone having the opportunity to be heard. So I would ask at this time if someone has not had the opportunity to come up and speak that they be given that opportunity. And can I have a show of hands of anybody that might like to come up? Secretary Griffin.

SECRETARY GRIFFIN: Good evening everyone. I first want to, on behalf of all my colleagues with the Department, thank every one of you for coming out here this evening on a hot, rainy, summer evening. Hot and humid, I should say.

We submitted this plan, proposed it initially December of last year. And my comments

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tonight are not going to address a lot of the continuing debate about what's true and not true, what facts are facts and what facts are fiction. I wanted to offer two comments, two or three general ones.

First and foremost, we have tried for these long seven or eight months, particularly with the industry and all of you who have come to depend on the value of the Chesapeake Bay for your livelihoods and those of your families, believe it or not, we do very much support that. And sometimes we try to make decisions which we think long term will rebuild the populations of fisheries, in this case oysters, to allow you to maintain a live style which most Marylanders value and appreciate, including all of us who work with the Department of Natural Resources.

I know at this time it's hard for all of you to appreciate, understand that, or even believe it but, trust me, I know most of the good people who work here in the Department, I know what they feel and

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believe, and try to do day-in and day-out. And it's not to put all of you out of work but it's to try to maintain a resource to a level where you can thrive in your own businesses and in the traditions that you've developed in your own families over generations and centuries.

But we have tried, I think, very hard to try to reach accommodations with the industry county-by-county, as Gibby Dean alluded to, sanctuary lines versus public fishery lines. I thought when the General Assembly session ended, as he alluded to, we were pretty close. I say that recognizing that none of the watermen in any of the counties were happy with the notion of sanctuaries that encroach on current public fishing areas. But, you know, compromise is in the nature of the government in my view and we have tried to do that. Obviously, we have not succeeded.

So the major thing I wanted to offer all of you tonight is the proposition that if you all can re-

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gather your forces and come back to us with something that represents some final things you'd like to see changed in this, and if you all can stand behind it, because I realize how difficult it is.

In each one of your associations, you have oystermen who oyster in different ways, they oyster in different areas. Every fisherman has his or her favorite spot, right? And so to try to get consensus even in one county, let alone among all the 11 counties where oystering takes place, is a difficult proposition.

And we've experienced that on our end as we've tried to reach compromises and later found out that other folks in a given county who are in their industry are not happy with it. The difference between patent tonging, and hand tonging, and power dredging. We have tired and we're not, certainly, perfect and you all, more than anybody else, are very good at pointing out all of flaws.

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But we have tried hard, I think, to try to reach compromises over a lot of months. So my offer to you, my proposition to all of you is if you can all come together and come back to us and say to us, "These are the final changes that we'd like to make," like to see you agree to, that respect some of the things we would say and we want to achieve, and make life a little easier on you, we're willing, certainly, to seriously consider that and work with you.

But, I think, at this point in the process to continue this effort county-by-county, as we tried to do, I don't know. It's just, you know, my sense is that's run its course. That all of you in this industry have to come together to iron out, if you can, some of your own individual and collective disagreements over this and tell us, finally, what you want to see in terms of some compromises.

You have my pledge. I know the Governor feels the same way. We would be more than anxious to

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review them with you and see if we can't, in good faith, resolve these. We are not interested in putting you out of work. You know, that's a very hard thing for anybody in a job like ours to want to do.

And, believe it or not, we try to avoid impacts where we can. I don't think the impacts from the facts that we know, and I know we may have a disagreement about this, are of a magnitude that all of you believe they are. But I, also, recognize the back drop here with a world-wide recessions, with the number of folks in this room who work on the water for a living hurting because resources of a declining economy is in bad shape around the world.

All your second jobs or your spouses second jobs may be impacted one way or the other. We understand the concern and the fear you have about the future and what this is going to mean for you. And we're trying our best to move in a different direction because we think what's been tried in good faith has

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not got us to where we need to be. So that's my offer to all of you.

We're going to move forward but we're certainly willing and able and interested in hearing a consensus, final set of changes you'd like to see. And we will seriously consider them. And, again, I want to thank not only everybody in the industry who is here tonight, but also all the other members of the public, those who represent organizations who have come here tonight to express their views.

This is a public resource. Yes, we all rely on it differently but we all contribute to it and we all have stake in this game. Thank you for listening and thank you for coming out this evening. And I, finally, want to say, you know, there's a lot of folks in DNR, far fewer than there used to be.

I've been here on and off for 30 years in State government. And I can tell you that the Fishery staff is one of the groups in this Department, if you

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total up the number of hours they've worked it would shock you. It would shock you with the amount of time that is spent not only on their own internally in the Department, but their interacting with all of you.

It is an amazing amount of work and I simply want to compliment Tom, Mike, Marty, everyone here from Fisheries for the hard work they do day in and day out. And they can disagree with you guys and you can disagree with them and me. I understand that. That's part of the democratic process. As Marty says, we try to do it with a sense of respect for one another. And we try to get compromises ironed out that meet reasonably what we want to do and what you want to do. And, so, I'll shut up. I wasn't really planning to speak but I just wanted to leave you with that message. This is not all for show. We are trying to get comments back that we think merit further discussion in terms of change. But, I think, at this point, industry, give us your best shot if

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you're willing and we will seriously weigh it in terms of any final decisions we have to make. Thank you very much.

(Applause)

MR. GARY: Thank you, Secretary Griffin.

Just two final comments. As Tom mentioned earlier in the presentation, the comment period official runs through August the 16th so there is an opportunity to submit your comments in writing to us, go to our website, or talk to any of our staff, provide you with that information, or send it in via email. And, finally, last not least, these comments for the record have been recorded and will be posted to our website within ten days. So, again, thank you for attending tonight. This concludes the fourth hearing for Proposed Oyster Regulations Aquaculture Development Plan. Thank you.

(Whereupon, at 8:30 p.m., the above-entitled public hearing was concluded.)

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CERTIFICATE OF NOTARY

I, Linda Joyce Kraller, the officer before whom the foregoing testimony was taken, do hereby certify that the testimony of said parties was taken by me by stenomask means and thereafter reduced to typewriting by me or under my direction; that said testimony is a true record of the testimony given by said parties; that I am neither counsel for, related to, nor employed by any of the parties to the action in which this testimony is taken; and, further, that I am not a relative or employee of any attorney or counsel employed by the parties hereto, nor financially or otherwise interested in the outcome of the action.

This certification is expressly withdrawn and denied upon the disassembly or photocopying of the

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LINDA JOYCE KRALLER
Notary Public in and for
the State of Maryland

My Commission Expires:

January 3, 2014

Ordering information for Maryland Oyster Restoration and Aquaculture Development Public Hearing transcript, taken on Wednesday, 7/7/10, due in ten-working days, by 7/21/10:

MR. MARTIN GARY
Maryland Department of Natural Resources
Tawes Office Building
Taylor Avenue
Annapolis, Maryland
410-279-0459

ORIGINAL, 1 ELECTRONIC COPY, AND 1 DVD TO PUT ON THEIR WEBSITE (not sure what you decided on the last DVD?).

Linda Kraller