GLOBAL DEVELOPMENT AND ENVIRONMENT INSTITUTE

COMMENTS ON EPA NOTICE OF DATA AVAILABILITY FOR PROPOSED REGULATIONS FOR COOLING WATER INTAKE STRUCTURES

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Cooling Water Intake Structure (Existing Facilities: Phase II)
U.S. Environmental Protection Agency
Ariel Rios Building
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Washington D.C. 20460

Re: Comments on Notice of Data Availability, EPA 40 CFR Part 125
Clean Water Act §316(b) – National Pollutant Discharge Elimination System –Proposed Regulations for Cooling Water Intake Structures at Phase II Existing Facilities; Notice of Data Availability, March 19, 2003.

Dear Sir/Madam:

We are pleased to have the opportunity to submit comments on the above-captioned notice of data availability. As we discuss below, in our view cost-benefit analysis is an inappropriate tool for adjudicating the policy questions currently facing the Agency. However, even if one accepts cost-benefit analysis as an appropriate means to determine the appropriate level of regulation for power plant cooling water intake systems, the magnitude of the omissions in the NODA renders the exercise meaningless. The difficulties encountered in the attempt at monetization of benefits underscore the need for other approaches to evaluation of policy options.

As we discuss in detail below, despite the large amount of analysis that went into the NODA, the document includes only a fraction of the data that EPA itself considers to be relevant for the regulation. Having discarded the approach to nationwide calculations it used for the original proposed ruling, in the NODA the Agency presents benefit calculations for just two regions of the country. Calculation of both use and nonuse benefits is attempted for only one of the two regions; and even this calculation omits consideration of key biological facts.

The lack of key information in the NODA does not reflect lack of effort in gathering and analyzing data. Rather, the shortcomings of the NODA illustrate the flaws in the methodology that EPA is now pursuing. The task of quantifying benefits will require significant further analysis, and involves methodological quandaries that will not be resolved easily. In our opinion, by converting its regulatory mandate into a lengthy and methodologically questionable program of data collection and analysis, EPA has

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failed to meet its responsibilities under the Clean Water Act. The Agency has, however, developed a substantial body of data and background information. These data can be applied usefully to developing sound regulations, which should take account of benefits without holding them to the unrealistic standard of precise monetization, as the Agency has done thus far.

1. Background

EPA's original proposed rule calculated estimated costs and benefits for seven possible regulatory options: a waterbody/capacity-based option with two possible tracks; the proposed rule, with "alternative less stringent requirements based on both costs and benefits"; impingement mortality and entrainment controls everywhere; all cooling towers; a dry cooling option; and a waterbody-based option. According to EPA's analysis, net benefits were positive for four of the options examined; they were negative for the "all cooling towers" and "dry cooling" options, and were not costed for the "waterbody-based option." EPA's calculated net benefits were highest, by a small margin, for the "proposed option." For another option, which would have placed more stringent controls on cooling water intake systems, estimated net benefits were more than 99% of the estimated net benefits of the proposed option.[2]

In our comments on EPA's original draft ruling,[3] we presented a number of criticisms. We pointed out that EPA's estimation of net benefits was seriously flawed, and that even conservative adjustments to account for some of EPA's omissions would produce significantly higher benefit figures, and would imply that a different regulatory option had the highest net benefits. In particular, we noted that EPA's use of an outdated "rule of thumb" for calculating nonuse value was misleading, and lacking in theoretical or empirical justification.

We noted that EPA had effectively valued large portions of aquatic resources at zero. One striking omission was the failure to place any value on the unharvested fish that regenerate the population from year to year. We also expressed concern that EPA overlooked important sources of value, ranging from commercial value of shellfish through ecological, recreational, and nonuse value of aquatic flora, bird life, and other organisms. We found EPA's consideration of threatened and endangered species to be a worthwhile, but limited, first step toward an analysis of this topic. We supported EPA's efforts to develop "habitat replacement cost" (HRC) as a methodology for developing more complete and accurate benefits estimates, but cautioned that this methodology requires a level of biological information that is often unavailable.

[2] See 316(b) Phase II EBA, Part D: National Benefit-Cost Analysis, Chapter D1: Comparison of National Costs and Benefits. Available at http://www.epa.gov/waterscience/316b/econbenefits/d1.pdf, visited May 2003. Estimated net benefits for the proposed rule were $452 million, while estimated net benefits for the "Impingement Mortality and Entrainment Controls Everywhere" option were $449 million.
[3] Comments submitted by Frank Ackerman, August 1, 2002.

2. What Changed in the NODA?

The NODA includes a number of adjustments in EPA's methodology. Some of these adjustments respond directly to our criticisms of the original analysis. However, additional methodological problems introduced in the NODA make it difficult to draw clear conclusions about whether EPA's analysis has, on balance, improved.

Important new elements that appear in the NODA include abandoning the outdated "rule of thumb" according to which nonuse benefits were formerly calculated as 50% of recreational use benefits; acknowledging the nonzero value of unlanded fish; and grouping several previously distinct categories of value together in a new "nonuse" category. However, there are also methodological setbacks, where EPA retreats from desirable features of its earlier analysis. For instance, EPA abandons the "Habitat Replacement Cost" method of estimating total ecosystem value; gives little indication of how it expects to calculate use benefits in six of the eight regions or nonuse benefits in seven of the eight regions; and does not attempt any calculation of the value of threatened and endangered species lost to impingement and entrainment in the NODA.

Due to these and other limitations, it is difficult to evaluate the changes in EPA's methodology represented in the NODA. In the absence of a completed national benefits analysis, it is not clear how benefits will be calculated for each region and for the country as a whole. For example, is EPA planning to perform analyses for all eight regions, comparable to the NODA estimates for the North Atlantic? If not, what method of extrapolation will be used to scale regional estimates up to a national total? Within regions, what methods will be used to scale estimates for individual plants up to regional totals? The reclassification of power plants, from waterbody-based categories in the original analysis to regional groupings in the NODA, means that category totals from the two analyses cannot be directly compared.

Despite these difficulties, we have made an approximate comparison of the NODA to the Economic Benefits Analysis (EBA) performed by EPA last year, by looking at the three plants in the North Atlantic region, Brayton, Pilgrim, and Seabrook, that were included in EPA's case studies for the EBA. We have compared the case study benefits for these three plants to the NODA benefits for the North Atlantic region as a whole, as shown in Table 1 (next page), using the average of high and low case benefit estimates throughout.

When benefits are expressed as dollars per cubic foot/second (cfs) of water flow, the North Atlantic regional benefits are now estimated at roughly $9,000 per cfs of flow. Since most of the region's plants (all but Pilgrim and Seabrook, in fact) are located on estuaries, the closest comparison may be to Brayton, the one North Atlantic estuary plant analyzed in the case studies. The benefit estimate for Brayton amounts to $10,350 per cfs, which is broadly comparable to the NODA value for the region as a whole. Thus we would guess, from the limited information available, that the NODA calculations introduce little change in aggregate estimated benefits. If this is the case, then the effort required to develop and implement the NODA methodology has little impact on the

bottom line evaluation of policy options. While some problems in the analysis have been fixed from last year, other problems have been introduced. We showed last year that reasonable adjustments to the EBA methodology would produce much larger benefit estimates; we will demonstrate below that reasonable adjustments to the NODA methodology would likewise produce much larger benefit estimates for the North Atlantic, and thus presumably for the nation as a whole.

3. NODA Benefits Analysis: Methodological Problems

In the NODA, EPA significantly revises the methodology it uses to calculate the expected benefits of the proposed ruling. However, the NODA includes only a fraction of the information that EPA itself considers to be relevant for the regulation. In our view, EPA has failed to develop a credible estimate of the benefits of the proposed regulation.

Our discussion of the NODA benefits analysis begins with issues of regional disaggregation and the role of meta-analysis. We then turn to the North Atlantic benefits estimates, where we focus on the missing categories of use value, the limited number of species included in the nonuse value analysis, and the geographical coverage of the nonuse value. Finally, we review some of the important categories of ecosystem value that are excluded from the NODA.

Among other points, we note that EPA's nonuse valuation of fish affected in the Peconic Bay estuary is highly incomplete; EPA inappropriately limits the geographic scope of its nonuse benefits analysis; and the NODA fails to consider key biological facts, including interdependence among species and precarious stock status for many populations. Minimal requirements for completing the analysis EPA has begun should include developing a use value for unharvested fish and completing the meta-analysis of existing studies on nonuse value. In addition, EPA must avoid placing an effective value of zero on categories of value the Agency does not have time or resources to analyze in detail.

Regional disaggregation and meta-analysis. In the NODA, EPA discards its previous system of categorizing power plants by water body type, and instead divides the country into eight regions. The level of detail provided for the North Atlantic region, and for the partial analysis of Northern California, together with the absence of any nationwide generalizations or extrapolations from this data, suggests that most data must be developed separately for each of the eight regions. However, EPA considers only two regions in the NODA: the North Atlantic region and the Northern California region. Furthermore, EPA attempts a full accounting of benefits for the North Atlantic region only; for the Northern California region, EPA has not yet looked at nonuse benefits.

One of the areas that required substantial, and creative, analytical effort in the NODA was the estimation of nonuse values for the North Atlantic region, a topic we discuss below. Unfortunately, the disaggregated NODA methodology suggests that a new analysis at this level of complexity needs to be done seven more times, once for each region. EPA's analysis suggests, though it never states explicitly, that nonuse values must be estimated on a locally specific basis. However, sufficient data may not be available for some regions; will nonuse values be declared to be zero for such regions? On a deeper level, the need for region-specific nonuse studies reflects the dubious assumption (discussed below) that nonuse values are only important in the immediate vicinity of the affected ecosystems. On the more reasonable assumption that nonuse values apply over much wider areas, it would be appropriate to develop a common national methodology to supplement the regional approach.

One way to develop such a methodology is to conduct a meta-analysis of the numerous existing studies of nonuse values. Meta-analysis is a well-established research technique, used in many scientific and economic analyses to evaluate and combine the body of data and results contained in a range of similar studies; the expanded database allows researchers to develop greater confidence and precision in their results. EPA began, but did not complete, a meta-analysis of nonuse values of water resources for use in this case. We recommend that EPA complete that meta-analysis, and use it to support and contextualize national projections of nonuse value. The raw data provided by EPA, from its initial work on the meta-analysis, makes it clear that substantial nonuse values for water resources have been estimated, in several regions of the country.[4] In addition, studies in other contexts consistently support the view that Americans place a high nonuse value on natural resources. Annual willingness-to-pay values for highly visible animals such as bald eagles, humpback whales, and gray wolves add up into the tens of billions; the existence of a less famous endangered species, the striped shiner, is reportedly worth an average of $6 per household per year to the American public, or more than $600 million annually on a nationwide basis.[5] The clear lesson of these studies is that nonuse values are substantial; thus, for a benefits analysis to be complete, nonuse values must be estimated for all the affected organisms.

[4] Tudor, et al., "Comparison of Non-use and Use Values from Surface Water Valuation Studies," Memo to the 316(b) Record (DCN 5-1011), March 12, 2003, Appendix A.
[5] John B. Loomis and Douglas S. White, "Economic Benefits of Rare and Endangered Species: Summary and Meta-analysis", *Ecological Economics* 18 (1996), 197-206; values from Table 1, p. 199.

North Atlantic benefits – use values. For more detailed comments on the NODA benefit estimates, we now turn to the North Atlantic regional benefits, the only complete benefits analysis offered in the NODA. The benefits, as estimated in the NODA, consist of commercial use values, recreational use values, and nonuse values. While commercial and recreational benefits are of great importance, they are not the only use values that could and should be estimated.

Another category was omitted in both the earlier analysis and the NODA, namely the use value of the "unlanded" fraction of I&E losses. Estimates of commercial and recreational values are based only on the fraction of fish lost to I&E that would have been caught ("landed") in the absence of cooling water withdrawals. Normally only a small fraction of fish, even of the most valuable species, are caught by commercial and recreational fishing each year. In other words, most of the fish lost to I&E would have survived – and therefore are not included in estimates of either commercial or recreational value. The unlanded fish not only survive, but also reproduce, creating the fish that will be caught in future years. In effect, they are the natural capital of the fishing industry, analogous to the capital goods that are used in manufacturing.

The NODA recognizes that unlanded fish have a nonzero value (NODA, p. 13567), but focuses on their nonuse value; EPA does not propose a methodology for adequately estimating the use value of the unlanded fish. In our comments last year, we demonstrated that even a conservative estimate of the value of the unlanded fraction of I&E mortality has a large impact on total benefits.

Other important categories of value were also omitted, both in the EBA last year and in the NODA, as discussed on pp.11-13 below.

North Atlantic benefits – species included in nonuse value. In the analysis for its Phase II proposal, EPA developed an estimate of nonuse value by using the outdated "50% rule." This rule arbitrarily sets nonuse value equal to half of the use value enjoyed by recreational users of a resource. As we have previously discussed,[6] in many cases nonuse value is likely to be significantly higher than this figure. Furthermore, it is misleading to develop a nonuse value estimate that refers solely to the recreational users of a resource, since many of the people who place a nonuse value on natural resources are not, in fact, recreational users.

In the NODA, EPA develops an estimate of nonuse value for commercially and recreationally harvested fish, as well as for forage fish and the unharvested portion of the harvestable population. This estimate is based on a willingness-to-pay (WTP) study of values placed on submerged aquatic vegetation (SAV) and wetlands in the Peconic Estuary. EPA's attempt to develop nonuse value estimates on the basis of the Peconic Estuary WTP study is a significant improvement over the arbitrary application of the 50% rule, but still presents serious problems. In particular, SAV and wetlands can serve to regenerate some species of fish, but are inappropriate habitats for others. Thus, some

[6] See Ackerman comments on the proposed rule, August 1, 2002.

species are not accounted for by a system in which SAV and wetlands are used as a proxy for fish abundance. Furthermore, data limitations forced EPA to base its analysis on a minority of the species that can regenerate in SAV or wetlands; other species might have greater requirements for SAV and wetlands.

EPA's analysis is based on I&E data collected at the Brayton Point and Pilgrim power plants. These data show levels of I&E losses for 37 fish species; apparently EPA did not consider non-fish aquatic organisms in this analysis. EPA attempted to estimate the amount of wetland and/or SAV habitat required to offset I&E losses of these fish species, "based on the amount of habitat necessary for a few species that could benefit from restoration of SAV and wetlands." Of the 37 fish species considered, "losses of seven species could be offset by tidal wetland restoration, and losses of six species could be offset by SAV restoration." EPA notes that these 13 species account for 45.7% of the total I&E losses in the North Atlantic Region.[7] The Agency apparently makes no attempt to calculate nonuse values for the other 24 affected species, accounting for more than half of the region's I&E losses.

Of the 13 fish species for which wetland and SAV restoration could be relevant, EPA was able to obtain sufficient information to proceed with the analysis for just six species: winter flounder, Atlantic silverside, and striped killifish as candidates for benefiting from wetland restoration, and threespine stickleback, northern pipefish, and scup for SAV restoration. EPA had no data on production rates in the relevant habitats even for these species, so the Agency estimated densities per acre based on abundance data. No abundance data were gathered for the remainder of the 13 species, which include some of the best-known and most valuable ones: American sand lance, grubby, striped bass, bluefish, Atlantic cod, weakfish, and pollock.[8]

In summary, in the attempt to generate data on the nonuse value of the fish lost to I&E in the North Atlantic region – losses that include at least 37 species – EPA estimated the relationship between acreage of two habitat types and likely density of just six fish species. EPA conducted no analysis whatsoever for the other affected species, even though well-known species such as striped bass, bluefish, and Atlantic cod are likely to have substantial nonuse values.

Having estimated area requirements for three species per habitat type (three for wetlands and three for SAV), EPA bases its final analysis on the species that, of each set of three, have the highest area requirements for regeneration. EPA expresses concern that this overstates the acreage required for the other two species for which calculations (in the same habitat type) have been done. But the greater concern is the potential understatement of requirements: there is no way of knowing whether EPA's calculation accurately represents the requirements for regeneration of the seven other species for which wetlands and SAV are relevant; and it explicitly does not include the other 24 species identified in the region's I&E mortality data, ones that cannot be regenerated by

[7] DCN 5-1010: Tudor, et al., "Estimating Total and Non-Use Values for Fish, Based on Habitat Values for Coastal Wetlands and Eelgrass (SAV)," memo to the 316(b) record, March 12, 2003, p. 3.
[8] *Ibid.*, p.4.

these habitats. Nor, of course, does EPA's analysis attempt to measure the value of losses of nonfish species, such as shellfish or smaller, but nevertheless vital, components of the aquatic food web.

Given these large omissions, EPA should, at the very least, state what percentage of total nonuse value for the region it has analyzed and multiply its results by a corresponding factor. For example, does the nonuse value calculated for the Peconic Bay estuary represent an appropriate value for 6 out of 37 species, or about one-sixth of the species identified in I&E loss data? It may be difficult for the Agency to estimate what fraction of the affected fish it has accounted for in its analysis, but if the Agency fails to factor in those it has not accounted for, it has, once again, effectively placed a value of zero on many affected organisms.

North Atlantic benefits – geographical scope of nonuse benefits. EPA then converted estimates of required habitat areas into dollar values on the basis of a survey in which people were asked how much they value wetlands and SAV. The researchers did not tell respondents which fish the wetlands and SAV were expected to regenerate, so responses presumably reflect respondents' general impressions about fish populations, rather than values placed on individual species.

EPA examines two overlapping populations that may place a nonuse value on the aquatic resources of the North Atlantic region -- the 3.65 million households located in the counties abutting affected water bodies, and the 4.2 million households living within a 32.4 mile radius of the affected water bodies. The Agency develops both total and per-household value estimates for each of these areas. Using the households in abutting counties, EPA calculates "a total WTP to reduce impingement and entrainment losses of $4.07 to $7.83 and non-use WTP of $3.44 to $6.52 per household residing in the counties abutting affected water bodies." Using the larger area, with the 32.4-mile radius, EPA finds that "implied WTP values to reduce all I&E losses range from $5.63 to $23.43 and non-use WTP range from $5.61 to $21.83 per household residing in the 32.4 mile-radius area."[9]

It is well known that people living a significant distance from a resource can still value that resource. For example, people throughout the US placed a substantial nonuse value on the ecosystems damaged by the Exxon Valdez oil spill – even though Prince William Sound was hardly a household word before the spill occurred.[10] The Grand Canyon has a powerful meaning to people who live outside Arizona; Yellowstone is important to people who live far from Wyoming. There is no reason to think that the aquatic resources of the North Atlantic region are an exception to this pattern. Indeed, both the Atlantic and the Pacific coasts of the US are generally considered to be a national resource and birthright. Schoolchildren across the country – not just in coastal communities – sing about "America the beautiful" stretching "from sea to shining sea."

[9] NODA, p. 13574-5.
[10] See Richard T. Carson et al., Contingent Valuation and Lost Passive Use: Damages from the Exxon Valdez, Report Submitted to the Alaska Attorney General (Nov. 1992).

All of this suggests that Americans across the country place a nonuse value on coastal ecosystems.

A model for the analysis of nationwide nonuse values for a local resource can be found in the early work of Robert Stavins. It provides an interesting contrast to his recent criticism of EPA's treatment of nonuse value (and his criticism of our earlier comments on the subject). In 1984 Stavins was the principal author of a cost-benefit analysis of a proposed hydroelectric development on the Tuolumne River, in California.[11] The analysis, which showed that the benefits of development were less than the costs, helped to defeat the proposed dam and to preserve the river in its natural state for recreation. The nonuse benefits of preserving the river were crucial to Stavins' analysis; without those benefits, his calculations would have strongly favored development.

Stavins argued that it was not surprising that the nonuse value of the Tuolumne was large:

> In the case of environmental resources, the so-called nonuser or intrinsic benefits may represent a substantial portion of the resources' total value.[12]

He employed a ratio of nonuse to use value, derived from other published studies, to estimate the per-capita nonuser value. Stavins' next step was to multiply the per-capita nonuser value "by an estimate of the number of people *in various regions of the country* who are likely to" assign a nonuse value to the resource.[13] His estimate of the number of "interested nonusers," as he called them, was the entire California membership of the Sierra Club (some of whom lived hundreds of miles away from the Tuolumne), plus half of the membership of the Sierra Club in the other 49 states. His calculations assigned a sizeable nonuse value to each of these individuals, even those who lived across the continent from the Tuolumne.

Alternatively, he discussed public opinion surveys suggesting that 40% of the US population feels strongly about the preservation of wilderness, and pointed out that his total nonuser benefit estimate could also be the result of 40% of the US population having a willingness to pay to preserve the Tuolumne of just $0.33 per person per year. After calling for more research to determine the nonuse value more directly, he concluded that

> In the meanwhile, however, these estimates represent, at the very least, a reasonable first approximation… [nonuse value] is too important to be ignored.[14]

Following the example of Stavins' early work, we recommend that EPA reconsider its restriction of nonuse value to the population living very close to the plants

[11] "The Tuolumne River: Preservation or Development? An Economic Assessment," Environmental Defense Fund, Berkeley CA, March 1984; hereafter cited as "Tuolumne River."
[12] "Tuolumne River," 158.
[13] "Tuolumne River, "161, emphasis added.
[14] "Tuolumne River," 163.

in question. Suppose, for instance, one accepted EPA's nonuse value for the population in bordering countries, and also assumed that the use value per household in the rest of the country is even 10% as high as in the bordering counties (or alternatively, one could assume that 10% of the households in the rest of the country have a non-use value as high as those in the bordering counties).[15]

There were 106.3 million households in the United States in 2001.[16] Of these, 3.7 million lived in the counties bordering the North Atlantic facilities in question, and 102.6 million lived elsewhere. According to the NODA, the nonuse WTP to eliminate all I&E losses was $20.73 to $33.97 per household in the bordering counties.[17] Thus, our 10% assumption implies that the nonuse WTP for the 102.6 million households in the rest of the country was $2.07 to $3.40 per household; this implies a total nonuse WTP, beyond the bordering counties, of $212.4 to $348.8 million. As shown in Table 2, this adjustment more than triples the total value of baseline losses due to North Atlantic I&E.

As Stavins accurately observed in 1984, the effect of nationwide nonuse value is too important to be ignored.

Ecosystem values omitted from the NODA. As in EPA's earlier analysis, the NODA omits important categories of ecosystem value – many of them acknowledged and listed by EPA itself. Thus the calculation of benefits of reduced cooling water take is necessarily incomplete; even if EPA had completed a cost-benefit analysis along the lines of the NODA, a comparison of complete costs with such incomplete benefits would be of little value in evaluating public policy options.

EPA notes that it has no information on the stock status of many of the species affected by I&E. For the North Atlantic region, EPA reviews the information available on stock status of 25 stocks (15 species) of groundfish, noting whether a given stock is "subject to overfishing (the harvest rate exceeds threshold)" or "overfished (stock size is

[15] A similar calculation could be done using EPA's estimates for households within a 32.4 mile radius. The result would be even larger total values than the ones we derive here.
[16] This is the number of occupied housing units, from American Housing Survey 2001, Table 1A-1, available at http://www.census.gov/hhes/www/housing/ahs/ahs01/tab1a1.html.
[17] NODA, p.13574.

below threshold)." Of these 25 stocks, fully 15 are categorized as "currently subject to overfishing," "overfished," "approaching an overfished condition," and/or "in an unknown condition with regard to overfishing."[18]

Thus, more than half of the groundfish stocks considered are in a condition such that, as far as EPA knows, further I&E losses could conceivably drive the population down to zero. While this will presumably not occur for all the listed stocks, a complete quantification of the baseline losses should include the possibility that a given stock of precarious (or unknown) status could be destroyed by continued I&E. Just as cost estimates include the possible shutdown of plants subject to regulation, benefit calculations should include some calculation of the probability that a population will collapse.

To be complete, a benefits analysis should consider all the organisms harmed by I&E losses. Like the analysis conducted for the original ruling, however, the NODA includes no attempt to quantify the value of damage inflicted on birds, or on fish-eating mammals. The NODA also does not look at ecosystem services provided by other organisms likely to be affected by I&E, such as small invertebrates. According to the scientists at Pisces Conservation, important services provided by aquatic ecosystems as a whole include recycling of human waste in waters close to human habitation; demobilization and detoxification of chemical waste products; stabilization and accumulation of sediments, preventing soft sediments from producing turbidity and sedimentation of channels; and support to terrestrial ecosystems (including exportation of biomass from water to the land via invertebrates, birds, and mammals).[19]

EPA gives some attention in the NODA to non-fish species such as lobsters and shellfish, but does not explore fully the range of possibility for these species. For example, EPA discusses the high-value lobster fishery of the North Atlantic region and notes that this fishery is currently subject to severe overfishing. However, EPA does not appear to factor into its analysis the possibility that the lobster fishery could collapse due to continued combined pressure from harvesting and from I&E losses. EPA notes that "the Northeast lobster fishery is second in commercial value after the multispecies groundfish fishery,"[20] so the Agency's decisions about how to analyze this population's fate are significant.

By its own admission, EPA consistently underestimates the number of fish lost to I&E.[21] Many of the data on which EPA bases its estimates are outdated, and were

[18] NODA, p. 13549.
[19] Pisces Conservation, Ltd., Technical Evaluation of US Environmental Protection Agency's Proposed Phase II Cooling Water Intake Regulation for Existing Facilities (including Comments on NODA), June 2003.
[20] NODA, p. 13550.
[21] See 316(b) Phase II Economic Benefits Analysis, Part C: National Benefits, Chapter C1: Case Study Introduction, Section C1-5.1: Data Limitations. Available at http://www.epa.gov/waterscience/316b/econbenefits/c1.pdf. EPA notes: "EPA's analysis is based on facility-provided biological monitoring data. These facility-furnished data typically focus on a subset of the fish species impacted by I&E, resulting in an underestimate of the total magnitude of losses. ... The

collected during a period when some fish stocks were severely depleted. Furthermore, even current data are misleading with regard to total baseline I&E losses, because many fish stocks have been depleted, for instance by years of continual I&E losses. If initial stocks were at natural levels unaffected by past and present I&E, estimated baseline losses would be higher.

In order to quantify the effects of I&E losses on aquatic ecosystems, an analysis must take into account the full range of trophic interactions. Boreman (2000) emphasizes that all fish in an ecosystem, including those considered "surplus," have ecological significance, noting that "use of 'surplus' production is essentially an allocation issue among competitors for that resource." Thus, 'surplus' can be used "for supporting fisheries, for allowing the population to hedge against bad times, for providing extra sustenance for natural predators, or for supporting other uses of the resource."[22]

Link (1999) describes several trophic phenomena that should be taken into account in analyzing the likely effects of anthropogenic damage to fish populations. One of these is the phenomenon of cycles, in which species A feeds on species B at one life stage, while B feeds on A at another life stage. These cycles can lead to "stock bottlenecks" and can create a negative feedback loop as populations change. Likewise, cannibalism, in which fish consume younger members of the same species, can also interact with these cycles to create negative feedback loops. Link constructs a simplified model of the food web in the northwest Atlantic system in which humans are just one of 75 distinct nodes (some of which represent tens or hundreds of individual species, as Pisces explains in their NODA comments). Link emphasizes the "stochastic nature of this ecosystem" and the "consequent uncertainty in the predictions...." emerging from a system with complex dynamics.[23] Strictly speaking, if we are to correctly carry out the goal of quantifying the benefits of saving an aquatic ecosystem, all the elements of Link's model should be examined and traced through to a service that can be quantified and valued. Examining all these elements may well be an impossibly or impractically large task; once again, this problem highlights the difficulty of using a flawed methodology to develop policy.

The NODA relies on other questionable methodologies as well. The grounds for discounting future environmental benefits are debatable; underwater ecosystems are not financial assets that can be consumed or saved, depending on an investor's rate of time

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facility-derived biological monitoring data often pertain to conditions existing many years ago (e.g., the available biological monitoring often was conducted by the facilities 20 or more years ago, before activities under the Clean Water Act had improved aquatic conditions.) In those locations where water quality was relatively degraded at the time of monitoring relative to current conditions, the numbers and diversity of fish are likely to have been depressed during the monitoring period, resulting in low I&E. In most of the nation's waters, current water quality and fishery levels have improved, so that current I&E losses are likely to be greater than available estimates for depressed populations."

[22] John Boreman, "Surplus production, compensation, and impact assessments of power plants," *Environmental Science and Policy* 3 (2000) S445-S449.

[23] Link, J.S., 1999, (Re)Constructing Food Webs and Managing Fisheries, in *Ecosystem Approaches for Fisheries Management*, Alaska Sea Grant College Program, AK-SG-99-01, at p.10.

preference.[24] The calculation of producer surplus, an important part of the estimated use value of fish killed by I&E, is based on a "rule of thumb" derived from just a few published studies – and is now estimated to be significantly smaller than in the EBA.[25] While these points do not have a large impact on the overall benefits estimate in the NODA, they are worth noting for future analyses.

4. Responses to Stavins Comments

In comments submitted in this docket, dated April 21, 2003, Dr. Stavins (who is now commenting on behalf of PG&E Energy Systems) responds in detail to our earlier comments on EPA's original cost-benefit analysis. Stavins repeatedly asserts, on the basis of his personal judgment, that we have confused positive and normative analysis or otherwise misunderstood basic principles of economics. Many, though not all, of the issues he raises remain relevant to the NODA. A point-by-point response is inappropriate here; suffice it to say that we continue to disagree on numerous aspects of the substance of the analysis, some of them discussed above.

Perhaps our most important disagreement concerns the magnitude of the environmental damages at stake. See, for instance, Stavins' statement that it was appropriate for him to estimate little or no nonuse value because only "*incremental* changes in the populations of various aquatic species" are involved in this case (April 21, 2003 letter, p.10, emphasis in original). Since EPA is valuing individuals, not populations, all the changes being analyzed are in a sense "incremental," though perhaps fairly big increments in some cases. Stavins' wording on this subject suggests a prior judgment that the increments at stake are, in fact, all so small that their nonuse value can be ignored.

We also want to respond briefly to Stavins' unfounded claims about the economics profession, and the extent of dissent within it. In effect, Stavins asserts that all reputable economists agree with him, and rejects our statements about the extent and influence of dissenting voices within the profession. To cite only the most important example, we mentioned that Amartya Sen, a recent Nobel laureate in economics (and the source of many provocative, innovative new approaches), rejected the idea of *individual* willingness to pay as a measure of the value of major environmental problems, because a rational individual's willingness to pay depends on what others are doing. Stavins suggests that we misinterpreted Sen, who, he says, was merely making a minor technical point about the free rider problem in the provision of public goods. Here is what Sen actually said on the subject:

> The philosophy behind contingent valuation [CV] seems to lie in the idea that an environmental good can be seen in essentially the same way as a normal private commodity that we purchase and consume. The valuation that is thus expressed is

[24] Frank Ackerman and Lisa Heinzerling, "Pricing the Priceless: Cost-Benefit Analysis of Environmental Protection," *University of Pennsylvania Law Review* 150 (May 2002): 1553.
[25] NODA, p.13548, 13556.

> that of achieving single-handedly – this is crucial – this environmental benefit. Consider, for example, a case in which it is inquired how much I would pay to save all the living creatures that perished as a result of the *Exxon Valdez* disaster, and I say $20. As interpreted in CV, it is now presumed that if $20 paid by me would wipe out altogether all these losses, then I am ready to make that payment. It is hard to imagine that this question and answer can be taken seriously by any practical person (with some idea of what the *Exxon Valdez* disaster produced), since the state of affairs I am asked to imagine could not possibly be true.[26]

5. Conclusion: The Need For Alternative Approaches

Comparison of costs and benefits is not a necessary part of the decision about regulation of cooling water intake systems. The language of the Clean Water Act does not require cost-benefit analysis; rather, like many other environmental statutes, it sets forth technology and performance-based standards for protection of our natural environment. Retrospective analysis has shown that technology-based regulation is not always the economic disaster that regulatory critics sometimes suggest. For example, a massive, peer-reviewed study found that the first twenty years of the Clean Air Act had monetized benefits of more than $20 trillion, or more than 40 times its costs.[27]

It is fortunate that good decisions can be made without cost-benefit analysis, because it is so often necessary. The problems we have cited in the analysis of the benefits of regulating cooling water intake systems are similar to problems that arise in many cost-benefit studies. Many costs are readily monetized, while many of the benefits of protecting life, health, nature, and future generations are, literally, priceless – not infinite in value, but rather, incapable of meaningful monetization.[28] A broader, multi-dimensional approach to decision-making is required to reflect society's true preferences in such cases; technical economic analysis alone cannot reliably produce the right answers to questions of regulation and environmental protection.

Here we restrict our attention to a narrower question of alternative methods: when a comparison of costs and benefits is desired, what methods should be used? In our previous comments, we recommended that EPA abandon the impossible effort to calculate monetary values for all relevant benefits and costs of regulatory options. Instead, we recommended that the Agency simply calculate the cost per household of implementing regulations to protect aquatic ecosystems. These cost calculations could then allow a comparison of aggregate (largely monetized) costs and aggregate (largely non-monetized) benefits. The aggregate comparison of dissimilar categories of value is more sensible than the attempt at disaggregation and monetization of every conceivable benefit. The aggregate comparison recognizes the broad political and social, as opposed

[26] Amartya Sen, "The Discipline of Cost-Benefit Analysis," *Journal of Legal Studies* 29 (2) part 2, June 2000, 931-952, quote from 948.
[27] US EPA, *The Benefits and Costs of the Clean Air Act, 1970 to 1990* (October 1997).
[28] Ackerman and Heinzerling, "Pricing the Priceless."

to narrow, technical and economic, nature of decisions about protection of natural resources.

The "break-even" methodology that EPA proposes in the NODA is a promising start in this direction, but does not go far enough. Recognizing that it is far easier to estimate complete costs than complete benefits, the break-even calculation identifies the cost per household of regulations. However, this cost is presented in the NODA as a hurdle that has to be cleared by the data-intensive calculation of benefit values. We recommend that EPA go further, presenting costs per household of different regulatory options as key inputs into public decision-making. These costs could be accompanied by quantitative and qualitative descriptions, in natural units (e.g., numbers of various species of fish killed, not hypothesized monetary values of those fish), of the benefits of regulation – a vastly simpler task than the NODA agenda of monetization, or even last year's cost-benefit calculations. Under our method, there would undoubtedly still be controversy about the details of the cost calculations, and of the description of benefits - but these would be far simpler, more transparent and manageable disputes than the ones surrounding cost-benefit analysis.

The ultimate problem is that the conventional methodology of cost-benefit analysis, no matter how carefully performed, is still a conceptually flawed and inadequate method. As Robert Stavins eloquently expressed it in his Tuolumne analysis,

> When particular categories of benefits and/or costs are systematically excluded from an economic assessment, benefit-cost analysis loses its value as an aid to societal decision-making… The B/C [benefit-cost] criterion is neither a necessary nor a sufficient condition for project investment… What is crucial to keep in mind is that the benefit-cost criterion should not be used as an absolute decision rule… Public-policy decisions regarding the use of the nation's scarce natural resources are ultimately political decisions, and should remain so.[29]

In the words of Amartya Sen,

> When all the requirements of ubiquitous market-centered evaluation have been incorporated into the procedures of cost-benefit analysis, it is not so much a discipline as a daydream. If, however, the results are tested only in terms of internal consistency, rather than by their plausibility beyond the limits of the narrowly chosen system, the glaring defects remain hidden and escape exposure.[30]

In conclusion, we regret that the limited scope of the NODA prevents us from commenting fully in advance of the final rule. The lack of information in the NODA creates a serious lack of transparency in EPA's decision-making process; we have no way to examine or evaluate the calculations that will, presumably, form the basis for EPA's final ruling. We recommend first, recognition that comparison of costs and benefits is not the only way to make good decisions, nor is it the method of decision-making set

[29] "Tuolumne River," 16, 31, 32, 101.
[30] Sen, "Discipline of Cost-Benefit Analysis," 952.

forth in the Clean Water Act. Second, when comparisons of costs and benefits are desired, we recommend that an alternative method of comparison be adopted, building on the foundation of EPA's break-even calculation and comparing monetary costs to environmental benefits. In our view, this will highlight the vast ecological benefits available from strict regulation of cooling water intake systems, at a very modest nationwide average cost – a bargain we believe the American people should, and would, accept.

Sincerely,

Frank Ackerman
Rachel Massey