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October 7, 2014

Rick Robins, Chairman
Mid-Atlantic Fishery Management Council
800 North State Street, Suite 201
Dover, DE 19901

Re: White Paper: "Managing Forage Fishes in the Mid-Atlantic Region"

Dear Chairman Robins:

On behalf of Omega Protein Corporation ("Omega"), we appreciate this opportunity to comment on the "Managing Forage Fishes in the Mid-Atlantic Region" white paper that the Mid-Atlantic Fishery Management Council ("Council") will consider on October 8th in Philadelphia. Omega's approximately 235 employees, its suppliers, contractors, and customers, and the citizens of the rural fishing community of Northumberland County, Virginia, all depend on the continuing health of the menhaden resource for their economic and social wellbeing. Therefore, Omega will continue to support a balanced, reasonable, and scientifically-based approach to fisheries management.

The information presented in the white paper is exceptionally concerning. While the paper contains a useful overview of forage stocks in the Mid-Atlantic region, the section on management alternatives for forage species lacks any balanced—if any—scientific grounding. No "one size fits all" approach applies to managing lower trophic level fish species as part of a true ecosystem-based approach. We urge the Council to consider only scientifically-based management strategies for all stocks in its fishery management plans.

I. BACKGROUND: PUTTING THE "LENFEST" REPORT IN GLOBAL SCIENTIFIC CONTEXT

At the outset, we would like to give some context to certain of the forage fish management initiatives that are now being discussed in several regions of the United States. These discussions were catalyzed by a 2012 report, which was commissioned by the Lenfest

Ocean Program, entitled "Little Fish, Big Impact."[1] Lenfest is a private foundation, managed by Pew Charitable Trusts, that funds fisheries research and widely publicizes its results. A member of the Lenfest Forage Fish Task Force is the lead author of the "Managing Forage Fishes in the Mid-Atlantic Region" white paper under consideration by the Council. The white paper cites to the Lenfest report on multiple occasions, and suggests similar management measures to those recommended by Pew and Lenfest. While one might never know it based on the one-sided press coverage the Lenfest report achieved, Pew's select Lenfest scientists were not the only ones considering "forage fish management" in 2012.

One of the most robust scientific analyses of forage fishery considerations also occurred in 2012—at an International Council for the Exploration of the Sea ("ICES") symposium. Leading researchers presented the most current information on approaches to managing forage fish, taking ecosystem principles into account, and results were published in a special journal this year.[2] The summary paper from the ICES symposium highlighted the need for additional data and research to support any novel management strategy. It also stressed that successful management of forage fisheries requires specific understanding of the spatial, temporal, and biological dynamics of predator-prey interactions in each unique ecosystem.[3] These ICES-convened scientists thus reached a far different conclusion from the "plug-and-play" recommendations of the panel of thirteen scientists, convened by Stony Brook University, who wrote the Lenfest report.

With all due respect to Pew's investments in its advocacy project, the situation is reminiscent of the kerfuffle that arose in 2006 when Dr. Boris Worm and colleagues erroneously predicted—in another Pew-funded, highly generalized study—that fish would disappear globally by the year 2048.[4] The enormous media attention that article garnered led to dramatic changes in fishery management laws and practices—only to have major methodological flaws found shortly thereafter and a revision published.[5] The unfortunate fact is this: regardless of the scientific errors in that paper, the American public and policy makers continue to cite the original and it continues to influence fishery management discourse. Fishing communities and seafood consumers suffer as a result.

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[1] Ellen Pikitch et al., Little Fish, Big Impact: Managing a Crucial Link in Ocean Food Webs, Lenfest Ocean Program (2012).

[2] Myron Peck et al., *Forage Fish Interactions: A Symposium on "Creating the Tools for Ecosystem-Based Management of Marine Resources*," 71 ICES Journal of Marine Science, at 1 (2014).

[3] *Id.* at 2.

[4] Boris Worm et al., *Impacts of Biodiversity Loss on Ocean Ecosystem Services*, 314(5800) Science 787 (2006).

[5] Boris Worm et al., *Rebuilding Global Fisheries*, 325(5940) Science 578 (2009).

II. BLANKET MEASURES FOR FORAGE FISH ARE NOT CONSISTENT WITH ECOSYSTEM APPROACHES TO FISHERIES MANAGEMENT

A. Arbitrarily Set Catch Limits for Forage Stocks Do Not Increase Ecosystem Health

The Mid-Atlantic Council defines the concept of the ecosystem approach to fisheries management ("EAFM") as "a fishery management approach which recognizes the biological, economic, social, and physical interactions among the components of ecosystems and attempts to manage fisheries to achieve optimum yield taking those interactions into account."[6]

When considered carefully, the Lenfest report actually espouses something far different. Using nine case studies of stocks from around the world, the Lenfest report broadly concluded that these fish were twice as valuable to other animals as they were for human nutritional, agricultural, and aquaculture uses. As a result, that report recommended cutting catch rates of forage fish in half across the board (and even up to 80% for "low information" stocks), to double the amount of forage fish left in the water for other fish, seabirds, and other predators. It also recommended closures for spawning and around seabirds that rely on forage fish, and that no additional fisheries be authorized on forage fish.

As the ICES summary report explained, however, marine ecosystems are unique and complex. Generalizations cannot be made about the potential effects of changes in forage fish abundance on other ecosystem components.[7] Placing undue emphasis on forage species actually represents the antithesis of the true ecosystem approach the Council hopes to achieve.

The policy advocated by Lenfest to reduce risk in targeted forage fisheries, to maintain forage stocks at levels above B_{msy}, or to adopt fishing mortality rate limits to define the overfishing limit ("OFL") at a level lower than the standard F_{msy} may sound great to the uninformed, but is far too simplistic to support science-based management. In fact, the ICES summary report concluded that a range of top predator responses to forage fish abundance has been observed, from observed changes in the sizes of female North Sea grey seals after birth that were correlated with the abundance of sand eel, to a constant level of energy delivered to common guillemot chicks that was independent of forage fish total availability over time. It noted that "single-stock [forage fish] collapses may not always be detrimental for predators in

[6] *See* Mid-Atlantic Fishery Management Council, *Ecosystem Approach to Fishery Management Guidance Document Draft Outline*, 2 (May 30, 2014).

[7] Peck at 3.

the long term." (Albeit no forage species under modern, active domestic management has come anywhere near to a "collapse.")

Further arguing against generalized management approaches, the ICES summary paper concluded that ecosystem services apart from landings (including supporting ecosystem structure and maintaining energy flow) cannot readily be evaluated or compared. While some presentations at the symposium found that the indirect utility of forage fish is probably greater than the direct utility in certain ecosystems in Europe, those presentations did not consider the value of forage fish in aquaculture.[8]

Compounding the inherent uncertainty associated with evaluating tradeoffs between management strategies is the fact that multiple recent studies have shown that fisheries pressure is not likely to be the primary driver of forage fish abundance. Papers from the ICES symposium and others have shown that population dynamics for forage fish species are primarily driven by bottom-up environmental processes, rather than fisheries removals.[9] The Mid-Atlantic Council's white paper's recommendation to scale the level of risk of overfishing based on whether the natural mortality rate ("M") assumed in the stock assessment is scaled to predator abundance, is more consistent with the information presented at the ICES symposium than the vague Lenfest-based management strategies for which that white paper then proceeds to advocate.

Taken in tandem, these findings suggest that adaptive management, rather than dramatic shifts in management practices, is warranted—particularly in light of the dearth of comparative evaluations of alternative forage fish management strategies.[10] As a large group of the ICES researchers cautioned, "policy developers should not consider the knowledge base robust enough to embark on major projects of ecosystem engineering."[11] The Lenfest report contributes little to the needed knowledge base. Instead, it consisted of a literature review and some basic computer modeling that attempted to reach generalized conclusions.

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[8] *Id.* at 2.

[9] *See* Georg Engelhard et al, *Forage Fish, Their Fisheries, and Their Predators: Who Drives Whom?*, 71 ICES J. Mar. Sci., at 90 (2014); Katyana Vert-Pre et al., *Frequency and Intensity of Productivity Regime Shifts in Marine Fish Stocks*, 110(5) PNAS 1779 (Jan. 29, 2013)

[10] Jake Rice and Daniel Duplisea, *Management of Fisheries on Forage Species: The Test-Bed for Ecosystem Approaches to Fisheries*, 71 ICES J. Mar. Sci. at 143, 144 (2014).

[11] Mark Dickey-Collas et al., *Ecosystem-Based Management Objectives for the North Sea: Riding the Forage Fish Rollercoaster*, 71 ICES. J. Mar. Sci. at 128 (2014).

B. Ecosystem Considerations Are Best Incorporated into Existing Assessments at This Time, As Councils Are Doing Nationwide

Given the lack of scientific support for sweeping changes in management for forage fish stocks, the best management strategy is to develop the most robust stock assessments possible. Biological reference points within single stock assessments can account for ecosystem interactions, including predation rates and removals. Accounting for the age and size structure of these removals as prey further increases the ability to predict impacts of alternative harvest levels.[12]

Even the Lenfest report explicitly states that:

> Acknowledging that M [natural mortality] is variable (and scaled to predator abundances) – and considering it in estimating fishing mortality and stock biomass targets and thresholds – provides the basis for a precautionary, ecosystem-based approach to maintain adequate forage fish biomasses.[13]

Many forage fish stocks in the United States, including some in the Mid-Atlantic region, already have robust estimates of natural mortality included in assessment and specification processes. Atlantic herring and menhaden, in particular, have extremely robust estimations of natural mortality included in their respective assessments. These assessments account for natural mortality, including predation, at different ages, life stages, and times of year. Both include consideration of predators, and both characterize and account for uncertainty in developing catch advice. The menhaden assessment also includes alternative prey population estimates. For other forage stocks, estimates of natural mortality are rigorously evaluated through scientific modeling and retrospective and prospective analyses of model performance. The stocks that support directed fisheries are routinely assessed on comparable schedules to those for higher trophic level stocks. The frequency and depth of such assessments is limited only by agency resources, as scientific information on the prey role of forage stocks through natural mortality is included to the extent to which it exists.

For its part, the Atlantic herring assessment includes a thorough consideration of factors affecting natural mortality. Age- and time-variable natural mortality was first included in the 2012 assessment. The terms of reference of that assessment required consideration of the implications of consumption of herring, at various life stages, to estimate M and inform the

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[12] Peck at 3.

[13] Pikitch at 13.

herring stock-recruitment relationship. The assessment panel addressed consumption of herring both indirectly (through the estimation of age- and year-specific Ms that were partially determined by using a Lorenzen curve) and directly (through estimation of annual consumption of herring by fish predators, which was treated as a fishing fleet in assessment modeling).[14] It also considered uncertainty in M estimation by using simulation methods to evaluate the consequences of alternative harvest policies, in light of uncertainties in model formulation, presence of retrospective patterns, and incomplete information on magnitude and variability in M.

The most recent benchmark assessment for Atlantic menhaden was released in 2010 (subsequently updated with data from 2009 through 2011), and included natural mortality rates that varied with age and time of year. The process for developing the estimates considers factors including predation, disease, toxic dinoflagellates ("red tide"), and anoxia ("fish kills"). Notably, population estimates of predators and alternative prey species are included in the analysis.[15] Similar, more-evolved work is continuing in the current assessment.

Among other U.S. stocks, the Atka mackerel and walleye pollock assessments for Alaska have rigorously evaluated estimates of M.[16] The East Coast squid assessments account for differential natural mortality by life stage and, along with the assessments for the whiting stocks, also directly incorporate mortality from the main sources of predation.[17] The Pacific and Atlantic mackerel assessments provide perhaps the least robust estimates of natural mortality, although the value assigned has performed reasonably well in retrospective analyses in the long term.[18] The Pacific sardine similarly uses an M that is not as fully evaluated, but that fits well in a

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[14] Northeast Fisheries Science Center, *Stock Assessment of Atlantic Herring – Gulf of Maine/Georges Bank for 2012, Updated through 2011*, at 18 (2012).

[15] Douglas Vaughan, Matthew Cieri, and Genevieve Nesslage, *Life-History Based Estimates of Natural Mortality for Atlantic Menhaden*, Southeast Atlantic Fishery Management Council Document SEDAR 20-DW03 (June 2009).

[16] Sandra Lowe et al., *Assessment of the Atka mackerel stock in the Bering Sea/Aleutian Islands* (2011); James Ianelli et al., *Assessment of the Walleye Pollock Stock in the Eastern Bering Sea*, NPFMC Bering Sea and Aleutian Islands SAFE, at 63 (2011).

[17] NEFSC, *51st Northeast Regional Stock Assessment Workshop Assessment Report*. NEFSC Ref Doc. 11-01, at 408 (2011).

[18] Paul Crone et al, *Pacific mackerel (Scomber japonicus) stock assessment for USA management in the 2011-12 fishing year,* Pacific Fishery Management Council Document (2011); Northeast Fisheries Science Center, *42nd Northeast Regional Stock Assessment Workshop stock assessment report, part A: silver hake, Atlantic mackerel, and northern shortfin squid*, NEFSC Ref. Doc. 06-09a (2006).

likelihood profile.[19] The Atlantic pollock fishery uses a rather basic M estimate based on observed survival at age.[20] The stocks that do not directly quantify predation in setting M typically fail do so because the indirect estimation methods have been determined to be more robust or because resources and data are limited. Of these forage stocks, the ones which support lucrative fisheries are assessed relatively often (some even annually). The assessments that account for predation in setting M would therefore reflect changes in variability based on predator abundance even in the short term.

The Lenfest report states that:

> An ecosystem based approach to management involves addressing bycatch, predator-prey interactions, and the multiple fisheries that occur within an ecosystem.[21]

As explained above, these factors are already largely or entirely being taken into consideration when setting catch limits for commercially prominent lower trophic species.

Not only do single-species assessments best account for predator-prey interactions, but they have been statistically tested for their ability to fit to data used in the management process, can incorporate information about changes in fishing effort spatially and over time, and have prevented the collapse of forage fish stocks in the United States. Ecosystem models, including the pre-published Ecopath models relied upon in the Lenfest study, have not.

III. <u>STRATEGIES MUST BE CAREFULLY TAILORED TO THE MID-ATLANTIC REGION</u>

A cornerstone value of fishery management in the United States is to allow for constructive and creative regional management approaches. As a result, fisheries managers around the country are taking ecosystem considerations into account in a variety of ways, whether it be through the specific development of an ecosystem-based plan or by more fully integrating ecosystem-based considerations into single species management models (such as by developing increasingly comprehensive estimates of natural mortality as described above). The

[19] Kevin Hill et al., *Assessment of the Pacific Sardine Resource in 2011 for U.S. Management in 2012*, Southwest Fisheries Science Center Document NOAA-TM-NMFS-SWFSC-487 (November 2011).

[20] NEFSC, *50th Northeast Regional Stock Assessment Workshop Assessment Report*, NEFSC Ref Doc. 10-09 (2010); NEFSC, *51st Northeast Regional Stock Assessment Workshop Assessment Report*. NEFSC Ref Doc. 11-01, at 408 (2011).

[21] Pikitch at 14.

Council should therefore not be considering special management for forage fisheries based on considerations that may be relevant in other regions (or other countries), but do not apply to the Mid-Atlantic.

One-size-fits-all forage-centric management focuses on only a narrow sliver of the trophic web. Although the Council should naturally consider forage fish's ecosystem roles in the development of EAFM for the Mid-Atlantic, special provisions that effectively lead to ecosystem engineering will produce adverse effects. Overall scientific understanding of how to manage at an ecosystem level is rapidly developing, and the Council must be sure to consider the best available science at every step in this process.

Ecosystem management is, in fact, developing in regionally-appropriate ways across the United States. The Pacific Council recently adopted its Fishery Ecosystem Plan ("FEP") for the U.S. portion of the California Current Large Marine Ecosystem, and the West Pacific Council has transitioned to managing through five regional FEPs. The North Pacific Council has developed system-level optimum yield limits, and has implemented an FEP for the Aleutian Islands, with other ecosystem work under development. Requiring special management of "forage" fish will render a holistic approach under ecosystem principles inoperable.

Special management provisions for forage fish are, moreover, very likely to lead to unintended adverse effects on an ecosystem level if not carefully considered and supported by robust, regionally-specific data. Studies at the ICES symposium showed that such unanticipated effects have been manifold in practice.[22] Even forage fish are predators at some stages of their life cycles. Forcing population targets that may be out of line with other ecosystem-specific factors can cause unpredictable ripple effects. Juvenile Atlantic herring opportunistically prey on fish eggs and larvae, and exhibit density-dependent growth. Increased population sizes could therefore lead to increased predation on other stocks or slower growth rates. This is but one example illustrating that a non-science based mandate to manage a class of stocks for higher biomass, without consideration for the state of other ecosystem components, will not have predictable or even positive outcomes.

As even the Lenfest report itself was forced to conclude:

> Filter-feeding fish, such as many forage fish species, often prey on fish eggs and larvae. In some circumstances, the eggs consumed can include a species' own young (i.e., cannibalism) or even those of fish that may become their predators later in life. In most cases, a balance is established in which both predator and

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[22] Peck at 3.

> prey can coexist. However, changes in the abundance of one of the species in the complex interaction, as has happened with cod in the Baltic, can lead to the development of a different balance of relative species abundances. In this case, released from predation by cod, sprats have proliferated and are preventing cod from recovering by consuming their eggs and larvae. Addressing these trophic interactions may involve both decreasing catches of the predator species and increasing catches of the prey species.[23]

As an illustrative example, menhaden in the Chesapeake Bay had experienced low recruitment over the past two decades—a fact which the Lenfest report highlights and uses as justification for the consideration of management measures such as those included in the Council's white paper. However, neither the Lenfest report nor the approaches outlined account for the fact that there has been a corresponding increase in striped bass over the same period. There can be little doubt the strong year classes of striped bass over this time have increased predation on young-of-the-year menhaden. In fact, menhaden recruitment indices and the Potomac River Pound Net index have been high in recent years, as striped bass abundance and recruitment have declined somewhat. Other factors also impact these stocks. Filter feeders, such as menhaden, are also predators, feeding on eggs and larvae of their own and other commercially important species. A LIDAR study in the Chesapeake Bay found billions of menhaden, numbers that can have a measurable impact on menhaden, striped bass, oyster, and crab recruitment. Moreover, the Lenfest Report shows that in the Chesapeake Bay, forage stocks actually have a higher value as direct catch, rather than support for other fisheries.[24]

Clearly, a systematic approach is needed to evaluate each potential approach to management of forage fisheries on a region- or fishery-specific basis, and only one major paper to date has drafted such an approach. These scientists concluded:

> [N]o win–win–win strategies emerge; choices of management strategies typically involve trade-offs among a range of objectives. Consequently, a systematic evaluation framework may be of substantial value in the early stages of choosing approaches for managing fisheries on forage species … our evaluation framework suggests that no one management strategy can be globally recommended.[25]

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[23] Pikitch at 15.

[24] Pikitch at 60.

[25] Rice at 150.

The Council must keep this conclusion in mind as it evaluates goals, policies, and management strategies for EAFM.

IV. CONCLUSION

For the reasons set forth above, the Council should consider the full scientific record in its deliberations on EAFM, particularly in regard to forage fish management strategies. EAFM need to consider the entire ecosystem and not single out individual stocks or trophic levels for well-intentioned, but poorly informed, policies that will have unanticipated impacts across the food web. The white paper must include much more of the available scientific record; in its current iteration, it does not constitute the best available science upon which the Council is required to base management decisions. Fisheries scientists around the world are rapidly gaining information about the dynamics of forage fish populations, and the best way to account for those dynamics given current data and modeling limitations is through the stock assessment process.

Assessing the costs and benefits of different management approaches is critical for developing an appropriate EAFM strategy. The Council must do so carefully and deliberately, in a way that takes local conditions into account, if it is to achieve success in this process. We appreciate the opportunity to provide comments on this important and complex issue. As always, please do not hesitate to contact us if you have any questions.

Sincerely,

David E. Frulla
Andrew E. Minkiewicz
Anne E. Hawkins

Counsel for Omega Protein