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GOODWIN | PROCTER

Elise N. Zoli
617.570.1612
ezoli@
goodwinprocter.com

Goodwin Procter LLP
Counselors at Law
Exchange Place
Boston, MA 02109
T: 617.570.1000
F: 617.523.1231

September 30, 2011

David Wrona
Chief
Projects Branch 2
Division of License Renewal
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Re: Indian Point License Renewal – Entergy's Comments on NMFS' Essential Fish Habitat Consultation Correspondence

Dear Mr. Wrona:

On behalf of Entergy Nuclear Operations, Inc., Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC (collectively, "Entergy"), this correspondence provides Entergy's legal and technical response to the National Marine Fisheries Service's ("NMFS") October 12, 2010 Essential Fish Habitat ("EFH") consultation to the U.S. Nuclear Regulatory Commission ("NRC") related to the license renewal applications for Indian Point Units 2 and 3 ("IP2" and "IP3," respectively; collectively "IPEC").[1] Entergy is providing this correspondence and its attachment for inclusion in the NRC record.

Entergy echoes NRC's December 3, 2010 response to NMFS, in which NRC identified certain concerns with and errors in NMFS' EFH Letter, concerns which we are not aware that NMFS has addressed.[2] Briefly, as detailed below, to the extent the EFH Letter describes, relies on or purports to implement the federal Clean Water Act or New York State law, particularly with respect to the design and construction of cooling water intake structures ("CWIS") and the discharge of certain regulated effluent (not subject to NRC's authority), Entergy concurs with the NRC's December 3, 2010 response to NMFS. In its response, NRC correctly states that the New

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1 *See* Letter from Peter Colosi, Assistant Regional Administrator for Habitat Conservation, NMFS, to Brian E. Holian and David J. Wrona, Division of License Renewal, NRC (Oct. 12, 2010) (hereinafter, the "EFH Letter") (EFH consultation pursuant to Magnuson-Stevens Fishery Conservation and Management Act [the "Magnuson Act"] regulations at 50 C.F.R. §600.905).

2 Letter from David J. Wrona, Division of License Renewal, NRC, to Peter Colosi, Assistant Regional Administrator for Habitat Conservation, NMFS (Dec. 3, 2010).

York State Department of Environmental Conservation ("NYSDEC"), subject to the oversight of the United States Environmental Protection Agency ("EPA"), is the agency with jurisdiction over CWIS at and certain discharges to the Hudson River from IPEC under the Clean Water Act ("CWA") and applicable New York law.[3] In this correspondence, Entergy provides additional support for NRC's position that NMFS' EFH Letter expressly exceeds NMFS' consultation authority under the Magnuson-Stevens Fishery Conservation and Management Act (the "Magnuson Act"), including to the extent that NMFS asks that IPEC be required to "[i]mplement the best available practicable technology to mitigate impingement, entrainment, and thermal impacts."[4]

In addition, as set forth in detail in the attached technical report, entitled *Response to National Marine Fisheries Service Comments on NRC's Essential Fish Habitat Assessment*, and prepared by leading fisheries scientists Drs. Lawrence Barnthouse of LWB Environmental Services, Inc., Mark Mattson of Normandeau Associates, Inc., and John Young of ASA Analysis & Communication, Inc., NMFS's EFH Letter is not supported, as it must be, by the best scientific information available.[5] To the contrary, the EFH Letter contains certain analytic, calculation and comparable technical errors, the individual effect of which is to contradict NMFS' conclusions in the EFH Letter and the cumulative effect of which is to undermine NMFS' EFH Letter on a technical basis.

The EFH Letter exceeds NMFS' jurisdiction

NMFS has no statutory or other authority to implement §316 of the CWA governing CWIS and thermal discharges, or state analogs.[6] Congress delegated to the EPA, and through EPA to delegated states, the responsibility to review and impose conditions for certain CWIS and thermal discharges, among the other discharges that such agencies may handle.[7] Conversely, in the Magnuson Act, Congress made no provision authorizing NMFS' review of or imposition of conditions relating to CWIS or thermal discharges on a parallel or supplemental basis. This is not law for law's sake; rather, NMFS' limited jurisdiction over marine species – and its inability to make determinations about species not subject to its jurisdiction – means that NMFS cannot

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3 This is not to suggest that NYSDEC or EPA's authority is plenary, but that, particularly relative to NMFS, their authority is indisputable.

4 NMFS EFH Recommendation Letter at 9.

5 *See* 50 CFR 600.920(d).

6 33 U.S.C. §§1326 and 1361 (conferring jurisdiction to EPA or, if appropriate, the State); ECL §15-0313 (conferring jurisdiction to establish water standards on NYSDEC); 6 NYCRR Part 704 (NYSDEC regulations relating to CWIS and thermal dischargers).

7 *See* 33 U.S.C. §1326.

engage in the holistic environmental decision-making that Section 316 of the CWA requires.[8] Thus, NMFS' opinion on CWIS and thermal discharges, based on its circumscribed review, cannot reasonably be interpreted to satisfy the CWA. Thus, NMFS' EFH Letter relating to IPEC's CWIS and thermal discharges is beyond NMFS' jurisdiction, as NRC properly concluded. Accordingly, NMFS' recommendation on such matters should be set aside as outside the scope of its authority under the Magnuson Act.

Moreover, NMFS' EFH statements, if accepted on their face, could be read to impermissibly suggest or require NRC to take action beyond its own statutory authority.[9] As a matter of law, NRC must defer to EPA or the state agency to which CWA permitting authority has been delegated on decisions regarding CWIS and thermal discharges, absent a nuclear safety concern.[10] In fact, the CWA specifically proscribes federal agencies from reviewing potentially significant environmental impacts regulated by the CWA during National Environmental Policy Act ("NEPA") review of their proposed federal actions.[11] Thus, NRC has no authority to review and impose conditions requiring the use of "the best available practicable technology to mitigate impingement, entrainment, and thermal impacts," as NMFS has requested. Again, therefore, the EFH Letter should be set aside as outside the scope of its consultation authority under the Magnuson Act.

NMFS' EFH Letter is technically flawed

As importantly, NMFS not only lacks the requisite authority to make such decisions as a matter of law, it also lacks the highly specialized knowledge necessary to make credible, scientifically supported decisions about the relevant holistic environmental conditions implicated by CWIS

8 *See* EPA, *National Pollutant Discharge Elimination System—Cooling Water Intake Structures at Existing Facilities and Phase I Facilities*, 76 Fed. Reg. 22174, 22202-03, 22207 (Apr. 20, 2011).

9 50 C.F.R. §600.925(a) ("NMFS will not recommend that state or Federal agencies take actions beyond their statutory authority.").

10 *See* Consolidated Edison Co. of New York, Inc., 13 N.R.C. 448 (1981) ("It is well established, by the terms of the Clean Water Act and Commission precedent, that the NRC must defer to final decisions of the EPA with respect to the type of cooling water systems to be employed by nuclear power plants."); see also Second Memorandum of Understanding Regarding Implementation of Certain NRC and EPA Responsibilities, Appendix A—Policy Statement on Implementation of Section 511 of the Federal Water Pollution Control Act (FWPCA), 40 Fed. Reg. 60115, 60120 (Dec. 31, 1975) (eff. Jan. 30, 1976) ("cooling water intake structure location, design, construction, and capacity . . . will [not] be considered by NRC" if a particular alternative is required by Sections 401 or 402 of the CWA).

11 *See* 33 U.S.C. §1371(c)(2) ("Nothing in [NEPA] shall be deemed to (A) authorize any Federal agency authorized to license or permit the conduct of any activity which may result in the discharge of a pollutant into the navigable waters to review any effluent limitation or other requirement established pursuant to this chapter or the adequacy of any certification under section 1341 of this title ... .").

and thermal discharge analyses, as well as the need for and comparisons among technologies that may be employed to address potential CWIS impacts and thermal discharges pursuant to §316 of the CWA. The inappropriateness of NMFS' statements in the EFH Letter is underscored in their inconsistency with findings by EPA and NYSDEC. In its recently issued draft proposed regulation under §316(b) of the CWA, EPA expressly identified IPEC's existing technology as state-of-the-art for impingement, and likewise expressly rejected implementation of closed cycle cooling on a nationwide basis for entrainment.[12] By contrast, NMFS' EFH Letter asserts that closed-cycle cooling is "the best available practicable technology to mitigate impingement, [and] entrainment."[13] EPA's conclusions are based on a detailed review of industry data and other information presented in a database consisting of many thousands of pages of information and analysis, as summarized in the three volumes that chiefly support the rule: the Technical Development Document, Economic Benefits Analysis and Environmental, and Economic Benefits Analysis in support of its draft rule.[14] NMFS offers no supporting rationale for its contrary assertion.

Similarly, NYSDEC Staff already has concluded that IPEC's thermal discharge assures the protection and propagation of a balanced indigenous population of fish in the Hudson River.[15] NYSDEC Staff have reviewed and evaluated comprehensive technical analysis of the IPEC thermal discharge and Hudson River prepared by leading thermal engineer and scientist Dr. Craig Swanson at Applied Science Associates, Inc. ("ASA"), made numerous inquiries regarding the information presented and issued a decision consistent with those analyses. ASA not only evaluated in-River conditions over a two year timeframe, but also developed a three-dimensional, state-of-the-art model to establish the absence of potential thermal impacts of IPEC

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12 *See* EPA, *National Pollutant Discharge Elimination System—Cooling Water Intake Structures at Existing Facilities and Phase I Facilities*, 76 Fed. Reg. 22174, 22202-03, 22207 (Apr. 20, 2011) (rejecting closed-cycle cooling as the best technology available ("BTA") for minimizing adverse environmental impact and concluding that modified Ristroph screens are the BTA for reducing impingement mortality, and that entrainment mortality is best addressed on a site-specific basis taking into account informational requirements set by EPA).

13 NMFS EFH Letter at 9.

14 *See EPA, Technical Development Document for the Proposed Section 316(b) Phase II Existing Facilities Rule (EPA-821-R-11-001 Mar. 28, 2011); EPA, Economic Benefits Analysis for Proposed Section 316(b) Existing Facilities (EPA 821-R-11-003, Mar. 28, 2011); EPA, Environmental and Economic Benefits Analysis for Proposed Section 316(b) Existing Facilities Rule (EPA 821-R-11-002, Mar. 28, 2011).*

15 *See* Letter from Mark D. Sanza, Assistant Counsel, NYSDEC to Hon. Maria E. Villa and Hon. Daniel P. O'Connell, Administrative Law Judges, NYSDEC (May 16, 2011) (updating administrative law judges on NYSDEC staff's review of IPEC thermal *information* and proposed amendments to IPEC's draft SPDES permit).

under extreme environmental conditions.[16] NMFS' assertions provide no supporting rationale for its contrary assertion.

In addition, the attached *Response to National Marine Fisheries Service Comments on NRC's Essential Fish Habitat Assessment*, the substance of which is not repeated here, provides a full analysis of the scientific and technical shortcomings in the EFH Letter, and demonstrates that NMFS' EFH Letter for IPEC lacks scientific merit, includes serious substantive errors and reflects a general lack of understanding of important technical precepts and information. Based upon its content, NMFS' EFH Letter cannot reasonably be considered to be based on the "best scientific information available regarding the effects of the action on EFH," as required by the Magnuson Act regulations at 50 C.F.R. §600.920(d). For these reasons, the EFH Letter should be set aside.

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As noted above, Entergy appreciates the opportunity to provide comments on the record relating to NMFS' EFH Letter. Entergy believes that the flaws in the EFH Letter are so fundamental to NMFS' scientific conclusions and consultation recommendation that it should be disregarded by NRC in light of the applicable law and the enclosed technical analysis. Entergy reserves its rights to contest any or all aspects of the EFH Letter and the related consultation under the Magnuson Act in any federal, state or municipal proceeding. If you have any questions regarding these comments, please do not hesitate to contact me.

Sincerely,

Elise Zoli (RHF)

Elise N. Zoli

cc: Peter Colosi, Jr., NMFS, Assistant Regional Administrator for Habitat Conservation

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[16] *See Final Report: 2010 Field Program and Modeling, Analysis of the Cooling Water Discharge from Indian Point Energy Center*, prepared by ASA and dated January 31, 2011; *Part 1 of Response to NYSDEC Staff Review of the 2010 Field Program and Modeling Analysis of Cooling Water Discharge from IPEC*, prepared by ASA and dated March 29, 2011; *Part 2 of Response to NYSDEC Staff Review of the 2010 Field Program and Modeling Analysis of Cooling Water Discharge from IPEC*, prepared by ASA and dated March 31, 2011, and *Alternative Mixing Zone Explanation and Request*, prepared by ASA and dated May 3, 2011.

Response to National Marine Fisheries Service Comments on NRC's Essential Fish Habitat Assessment

Lawrence W. Barnthouse, Ph. D.
LWB Environmental Services, Inc.

Mark T. Mattson, Ph. D.
Normandeau Environmental Associates, Inc.

John R. Young, Ph. D.
ASA Analysis and Communications, Inc.

September, 2011

1. Introduction

In an October 12, 2010 letter from Peter D. Colosi, Jr. of the National Marine Fisheries Service (NMFS) to Brian E. Holian and David J. Wrona of the U.S. Nuclear Regulatory Commission (NRC), NMFS provided an assessment of the potential impact of relicensing Indian Point Units 2 and 3 on Essential Fish Habitat (EFH) for various life stages of five (5) marine fish species: bluefish, Atlantic butterfish, red hake, windowpane, and winter flounder. NMFS concluded that relicensing of Units 2 and 3 could adversely affect EFH for these species, and that to mitigate these impacts the existing once-through cooling systems at these units should be replaced by closed-cycle cooling systems.

The intent of this response is to demonstrate that the scientific rationale underlying NMFS' conclusions is erroneous, and consequently that NMFS' recommended mitigation is unwarranted. NMFS' designation of the Indian Point region of the Hudson River as EFH for all of the five (5) species and life stages, with the possible exception of juvenile bluefish, is inconsistent with NMFS' own guidance for defining EFH. Data compiled from intensive monitoring of the Hudson River estuary over a period of more than thirty (30) years clearly demonstrates that these species and life stages occur only rarely in the Indian Point region, therefore, according to NMFS guidelines, this region should not be designated as EFH. In addition, NMFS' letter: (1) reflects significant mathematical errors in the entrainment estimates provided to NMFS by NRC that result in overstatements of entrainment losses by a factor of approximately 13,000; (2) does not address the fact that actual entrainment and impingement losses of these five species are negligibly small compared to commercial harvests of these species allowed by NMFS; (3) contains incorrectly characterized impingement survival studies performed at Indian Point that, if corrected, undermine NMFS' conclusions; (4) contains assertions concerning indirect effects of entrainment on the productivity of the Hudson River (and hence on EFH) that are not supported by any scientific analyses and are inconsistent with current scientific understanding of estuarine food webs; (5) includes characterization of the potential impacts of thermal discharges from Units 2 and 3 that do not reflect current technical information and contradict the New York State Department of Environmental Conservation (NYSDEC) staff's determination that IPEC's discharges comply with New York thermal discharge criteria, which requires that thermal discharges support balanced indigenous fish populations, and (6) reflects statements concerning potential releases of chemical pollution and low dissolved oxygen levels that conflict with readily available data concerning IPEC's discharges and the water quality of the Hudson River in the vicinity of IPEC. For these reasons, NMFS' EFH assessment contains serious technical errors that can and should be corrected.

2. The Indian Point Region should not be designated as EFH for Atlantic butterfish, red hake, windowpane, or winter flounder, and E&I impacts on bluefish EFH are negligibly small

By way of background, the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) defines EFH as "those waters and substrate *necessary* to fish for spawning, breeding, feeding or growth to maturity."[1] In its guidance on EFH consultations with federal agencies, NMFS (1998a) defines "waters" to include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate. The term "necessary" means the habitat required to support both a sustainable fishery and the managed species' contribution to a healthy ecosystem (NMFS 1998a). EFH does not include all habitats used by a species. Rather, EFH is logically "a subset of all areas occupied by a species" (NMFS 1998a). This is scientifically correct, because fish can often be found in habitats that are marginal or suboptimal for survival and reproduction.

NMFS guidelines for implementation of the Magnuson-Stevens Act by regional fishery management councils (NMFS 1998b) specify information regarding fish habitat that should be included in Fishery Management Plans (FMPs) prepared by these councils. The guidelines identify four (4) levels of information concerning habitat that may be used in FMPs to identify EFH for managed fish or shellfish species:

Level 1:Distribution data for some or all portions of the geographic range of a species
Level 2: Habitat-related densities of the species
Level 3: Growth, reproduction, or survival rates within habitats
Level 4: Production rates by habitat

[1] Section 104-297(10)

According to the NMFS (1998b) guidelines, EFH can be determined using any of these levels of information. If only Level 1 information is available, EFH should be identified as the habitats most commonly used by a species. Level 2-4 information, if available, should be used to identify EFH as the habitats supporting the highest relative abundance (Level 2), growth, reproduction, or survival (Level 3), or production rates (Level 4) within the geographic range of a species. Thus, according to the guidelines, the EFH designation should focus on the habitats most commonly used by a species or in which the abundance, reproduction/survival, or production is the highest. Higher level information should, if available, supersede lower level information. Therefore, if Level 2 or higher information is available concerning a species, EFH determinations should not be based on Level 1 information.

The October 12, 2010 NMFS letter cites potential impacts of entrainment and impingement (E&I) at Indian Point on EFH for bluefish, Atlantic butterfish, red hake, winter flounder, and windowpane flounder as problematic. However, as detailed below, four of the five species (Atlantic butterfish, red hake, windowpane and winter flounder) are marine species that rarely occur in the vicinity of Indian Point. Juvenile and adult bluefish, although seasonally present in the vicinity of Indian Point, are much less abundant in this region than in other parts of this species' range. Section 2.1 of this response uses data collected by the Hudson River biological monitoring program, which clearly are Level 2 data according to NMFS guidelines, to demonstrate that the Indian Point region is not EFH for any life stage of Atlantic butterfish, red hake, winter flounder, or windowpane flounder. Section 2.1 also shows that, even if the Indian Point region is designated as EFH for bluefish, only a negligibly small fraction of the mid-Atlantic bluefish population is susceptible to E&I at Indian Point. Section 2.2 evaluates the basis for NMFS' designation of the mesohalinezone of the Hudson River (the zone in which IPEC is located) as EFH for Atlantic butterfish, red hake, windowpane and winter flounder. These designations were based on inference, rather than on data, and should be superseded by the findings documented in Section 2.1.

2.1 Riverwide monitoring data show that the Indian Point region is not EFH for any species or life stage except for juvenile and older bluefish

As NMFS is aware, the Hudson River biological monitoring program has been collecting, under the direction and oversight of the NYSDEC, riverwide data on the abundance and spatiotemporal distribution of fish species that utilize the Hudson River annually since 1974. The quality of this dataset, particularly relative to its robustness and scope, has been well-recognized by regulators, scientists and the regulated community, and has supported various peer-reviewed assessments of Hudson River fisheries and fish populations. The following long-term data-sets are available for identifying EFH within the Hudson River:

- *Longitudinal River Ichthyoplankton Survey ("LRS").* This program samples eggs, larvae, and early juvenile fish, weekly from April through July. The region between the George Washington Bridge and the Federal Dam at Troy (Figure 1) has been sampled with only minor changes in methodology since 1974. In 1988, the LRS was extended to sample the region between the Battery and the George Washington Bridge. This program currently collects 3,522 samples per year (ASA 2011)

- *Fall Shoals Survey ("FSS").* This program samples juvenile and older fish in offshore habitats, on alternate weeks from the Beach Seine Survey (BSS). Approximately 200 samples are collected per week, from Manhattan to the Federal Dam at Troy. Prior to 1988, sampling was limited to the region between the George Washington Bridge and the Federal Dam. In 1988, the FSS was extended to sample the region between the Battery and the George Washington Bridge. The FSS uses two different gears in order to sample as much of the Hudson River as possible: a 1-m^2 Tucker trawl and a 3-m beam trawl. This program currently collects 2,130 samples per year (ASA 2011).

- *Beach Seine Survey ("BSS").* This program samples juvenile fish, on alternate weeks from the FSS from June through October. Sampling is conducted from the George Washington Bridge to the Federal Dam at Troy. The BSS has been conducted annually within only minor changes in methodology since 1974. This program currently collects 1,000 samples per year (ASA 2011)

For the purpose of accurately defining the spatial distributions of the various life stages of key species that utilize the Hudson River, sampling and data analysis focus on the 152 mile tidal river from the Battery Point to the Federal Dam, subdivided into 13 sampling regions (Figure 1). Because the lowermost and most marine sampling region (Region 0, beginning at Battery Point) is not included in the BSS, the LRS and the FSS are the primary data sets used here to evaluate EFH. The LRS focuses on sampling eggs, larvae, and small juvenile fish, and the FSS focuses on sampling larger juvenile and older fish. For reference, IPEC is located in river Region 4 (RM 39-46). Within this region alone, 19,017 samples were collected from 1979-2009.

From 1979 through 2009, the above three programs collected 191,503 net, trawl, and seine samples within the tidal Hudson River. These data, which constitute the most extensive data set available for any estuary in North America, clearly fit the definition of Level 2 data according to NMFS (1998b), because they provide habitat-related abundance estimates for the fish species of interest. They are substantially more direct, comprehensive and reliable than the limited data and "reasonable inferences" relied on by NMFS in its EFH determinations for Indian Point Units 2 and 3. The data are summarized in annual reports, which are submitted to NMFS.

This section provides estimates of the standing crops of each of the five species discussed in this response by region, life stage, and sampling event, averaged over all years since the extension of sampling to include the Battery region (1988 for the LRS and 1996 for the FSS). These standing crop estimates weight the density of organisms measured in each sample stratum (habitat x gear combination) by the total volume of that stratum. For example, the FSS samples juvenile and older fish using two gears: a Tucker trawl, which samples the water-column stratum, and a beam trawl, which samples the bottom stratum. To calculate the standing crop of a given species and life stage present in a particular region during a given bi-weekly sampling event, the densities of that species and life stage measured by the Tucker trawl and the beam trawl are multiplied, respectively, by the volumes of the water-column and bottom strata within that region, and then summed. The methods for performing these calculations are documented in Appendix D of the 2009 Year Class Report for the Hudson River (ASA 2011).

For each species and life stage, the standing crops for each region were averaged over all sampling events in which that species and life stage was present in the river. The resulting values are estimates of the average annual abundance of each species and life stage in each region, during the period when that species and life stage is present in the river. These values were used to estimate the percent of the total riverwide standing crop that was present in each region.

These river-region-specific percentages provide an objective method for distinguishing those regions of the river that might be considered EFH for a given species and life stage from those regions that, although they may occasionally be utilized, are clearly not necessary for spawning, breeding, feeding or growth to maturity. As discussed above, bluefish, Atlantic butterfish, red hake, windowpane, and winter flounder are marine species that are present within the Hudson only during certain seasons, and only in the marine and mesohaline zones of the river. As the salinity of the river decreases from downstream to upstream, the densities of these species also decrease. EFH for each species and life stage might be conservatively assumed to include those regions, starting with Region 0 (Figure 1), that cumulatively contain 95% of the average standing crop found in the river. In other words, the percent of the total standing crop present in Region 1 is added to the percent present in Region 0. If the sum of these percents is less than 95%, the Region 2 standing crop is added to the total. Additional regions are added until the total reaches 95% of the annual average riverwide standing crop. Those accumulated regions might then be identified as EFH for the Hudson. In the case of juveniles, the LRS and FSS surveys provide independent estimates of spatial distribution. Where these surveys provide different estimates of the regions that include 95% of the population, the more conservative survey would be used to define EFH. According to the NMFS (1998b) EFH designation guidelines, when Level 2 data are used to define EFH, the habitats with highest relative should be designated as EFH. The LRS and FSS sampling programs clearly provide high-quality Level 2 data. Therefore, Considering that all five of the species identified in the NMFS letter spawn offshore and are abundant in habitats outside the Hudson, the regions of the river that collectively support no more than 5% of the fish that enter the Hudson are not habitats with highest relative abundance and cannot be considered EFH.

The habitat utilization of each of the five species identified in the NMFS letter is discussed below, based on NMFS' own information and the Hudson River estuary studies.

Atlantic butterfish: According to NMFS (1999a), butterfish in the Mid-Atlantic Bight spawn offshore between the coastline and the edge of the continental shelf, but eggs are also commonly collected in high salinity parts of estuaries. Butterfish larvae have been collected in similar habitats (NMFS 1999a). Juvenile and adult butterfish are common in near shore waters and estuaries in the summer, but move offshore during the fall (NMFS 1999a).

Table 1 shows the distribution of butterfish eggs and larvae, according to LRS data collected from 1988-2009. Over this period, eggs were found only in Regions 0 and 1. Although larvae were collected as far upriver as Region 5, 95% of the total riverwide standing crop within the Hudson River occurred in Regions 0-2. Table 2 shows the distribution of juvenile and age 1+ butterfish, according to LRS and FSS data collected from 1988-2009. According to both surveys, 95% or more of the riverwide standing crop of juvenile and age 1+ butterfish occurred in Regions 0-2. Therefore, according to the criteria used here to define EFH, potential EFH for Atlantic butterfish eggs in the Hudson River is limited to Regions 0 and 1 (RM 0-23); potential EFH for Atlantic butterfish larvae, juveniles, and age 1+ is limited to Regions 0-2 (RM 0-33). Since IPEC is located in Region 4 (RM 39-46), Indian Pointis not included in even conservatively defined, percentage-based EFH for any life stage of this species.

Red Hake: Red hake eggs cannot be distinguished from eggs of other related species (NMFS 1999b). Hake eggs (*Urophycis*spp. and *Phycis*spp.) are found along the edge of the continental shelf during cooler months and across the shelf during warmer months (NMFS 1999b). Red hake larvae dominate the summer ichthyoplankton in the Mid-Atlantic Bight and have also been reported in the marine parts of several bays and estuaries, including the Hudson-Raritan estuary (NMFS 1999b). Juvenile and adult red hake are found most commonly offshore, but also occur in large bays and estuaries, including the Hudson-Raritan estuary (NMFS 1999b).

The LRS and FSS data sets do not identify hake eggs and larvae to species. All hake eggs and larvae are listed as "*Urophycis* spp." Juveniles and age 1+ red hake and squirrel hake are also listed together as "red hake/squirrel hake." Table 3 shows the distribution of hake eggs, juveniles, and age 1+ in the Hudson River, based on LRS and FSS data collected from 1988-2009. No hake larvae were collected in the river during this period, and abundances of other life stages were very low compared to other species discussed in this document. As shown in Table 3, eggs were collected in Region 0-2, but 98% of eggs were collected in Regions 0 and 1. Juveniles were collected only in Region 0, and age 1+ hake were collected only in Regions 0 and 1. Therefore, according to the criteria used here to define EFH, potential EFH for red hake eggs in the Hudson River is limited to Regions 0 and 1 (RM 0-23); potential EFH for red hake juveniles, is limited to Region 0 (RM 0-11), and potential EFH for age 1+ red hake is limited to Regions 0 and 1 (RM 0-23). There is no potential EFH for red hake larvae in the Hudson. Since IPEC is located in Region 4 (RM 39-46), IPEC is not included in even conservatively defined, percentage-based EFH for any life stage of this species.

Windowpane: According to NMFS (1999c), windowpane spawn in shallow nearshore water throughout most of the year, when water temperatures are suitable. Eggs, larvae, juveniles, and adults are common in shallow waters throughout the Mid-Atlantic Bight. Table 4 shows the distribution of windowpane eggs and larvae in the Hudson River, based on LRS data collected from 1988-2009. Table 4 shows that windowpane eggs have been collected in all 13 regions, and that larvae have been collected in all regions except Regions 9-11. However, standing crops of windowpane eggs and larvae are very low in all regions above Region 2. More than 99% of the average annual standing crop of windowpane eggs occurs in Regions 0 and 1, and 95% of the annual standing crop of windowpane larvae occurs in Regions 0-2. Table 5 shows the distribution of windowpane juveniles and age 1+, based on LRS and FSS data collected from 1988-2009. Juvenile windowpane have been collected as far north as Region 11, and age 1+ windowpane have been collected as far north as Region 6. However, more than 95% of the annual average standing crops of both life stages were collected in Regions 0-2. Therefore, according to the criteria used here to define EFH, potential EFH for windowpane eggs in the Hudson River is limited to Regions 0 and 1(RM 0-23); potential EFH for windowpane larvae, juveniles, and age 1+ is limited to Regions 0-2 (RM 0-33). Since IPEC is located in Region 4 (RM 39-46), Indian Point is not included in even conservatively-defined EFH for any life stage of this species.

Winter Flounder: According to NMFS (1999d), winter flounder spawn in inshore waters, including bays, coastal salt ponds, and tidal rivers throughout the Mid-Atlantic Bight. Larvae and juveniles are found in these same habitats. Adult winter flounder are found inshore during winter and spring, but move offshore to deeper, cooler water during summer. Table 6 shows the distribution of winter flounder eggs and larvae in the Hudson River, based on LRS data collected from 1988-2009. Table 6 shows that winter flounder eggs have been collected as far upriver as Region 4, and winter flounder larvae have been collected in all regions except Region 11. However, 99% of winter flounder eggs and 95% of winter flounder larvae occur in Regions 0 and 1. Table 7 shows that winter flounder juveniles occur as far upriver as Region 4, and age 1+ winter flounder occur as far north as Region 6. However, 97% of juveniles occur in Regions 0-3 and 96% of age 1+ occur in Regions 0-2. Therefore, according to the criteria used here to define EFH, potential EFH for winter flounder eggs and larvae is limited to Regions 0 and 1 (RM 0-23); potential EFH for winter flounder juveniles is limited to Regions 0-3 (RM 0-38), and potential EFH for winter flounder age1+ is limited to Regions 0-2 (RM 0-33). Since IPEC is located in Region 4 (RM 39-46), IPEC is not included in even conservatively-defined, percentage-based EFH for any life stage of this species.

Bluefish: According to survey data compiled by NMFS (2006), bluefish spawn offshore, between the coastline and the edge of the continental shelf. Eggs and larvae are abundant in near shore areas of the Mid-Atlantic Bight, however bluefish eggs and larvae have never been collected in the Hudson River (ASA 2011). Bluefish juveniles are abundant in near shore areas throughout the Middle Atlantic Bight, but also enter the Hudson River, where they have been collected as far upriver as Region 9 (Kingston).

According to NMFS (2006), adult bluefish utilize estuaries throughout their range, although no coastwide distribution data are provided by NMFS (2006). Table 8 shows the distribution of juvenile and age 1+ bluefish within the Hudson, according to LRS and FSS data collected from

1988-2009. As demonstrated in this table, Regions 1-6 include 98% of the average standing crop of juvenile bluefish according to the LRS, but only 92% according to the FSS. Therefore, using the highly conservative rule defined above, Regions 1-7 (RM 0-76) would be identified as potential EFH for juvenile bluefish. Regions 1-5 contain only 77% of the average annual standing crop of age 1+ bluefish present in the Hudson River; however, Regions 1-6 contain 100% of the age 1+ standing crop in the Hudson River. Therefore, using the highly conservative rule defined above, Regions 1-6 (RM 0-61) would be identified as potential EFH for age1+ bluefish. These classifications are very conservative, because the Hudson River constitutes only a small fraction of the habitat utilized by juvenile and age 1+ bluefish throughout the Mid-Atlantic Bight and, therefore, the percentage of individuals within the population as a whole that enter the Hudson River is very small (NMFS, 2006). As discussed in Section 4, annual average entrainment and impingement of bluefish at Indian Point, expressed as harvest foregone, is only 77 lbs., or 0.002% of the average annual mid-Atlantic harvest of bluefish.

Thus, none of the 5 species, except perhaps bluefish, reasonably are present in quantities that could conceivably, even under extremely conservative assumptions, be sufficient to classify the region in the vicinity of IPEC as EFH habitat. With respect to bluefish, the Indian Point region could be classified as EFH using the hyper-conservative rule applied to the other four species. However, a comparison of the numbers of bluefish entrained and impinged at Indian Point to the annual bluefish harvest reported in the mid-Atlantic states indicates that only a negligibly small fraction of the total population present in the New York Bight is susceptible to Indian Point.

2.2 The original designations of the Hudson River as EFH for Atlantic butterfish, red hake, windowpane, and winter flounder were based on inference rather than on actual data.

The NMFS Northeast Region's Guide to Essential Fish Habitat Source Documents (http://www.nefsc.noaa.gov/nefsc/habitat/efh/) provides links to documents defining EFH for all five of the species cited in the NMFS letter to NRC. Each of these documents contains a table identifying the utilization of east coast estuaries, including the Hudson River, by eggs, larvae, juveniles and, for some species, adults and spawning adults. All five of these documents cite a report by Stone et al. (1994) as the original source document for determining EFH within estuaries. Stone et al. (1994) is a summary of information on the distribution and abundance of fish and shellfish that utilize estuaries in the mid-Atlantic states. The document consists primarily of summary tables, derived from a combination of quantitative and qualitative information. The authors acknowledge (p. 6) that abundance information on some species was based on opinions of local and regional biologists, rather than on actual data.

Table 4 of Stone et al. (1994) provides the basis for NMFS' decision to designate the mesohaline zone of the Hudson River, which includes Indian Point, as EFH for Atlantic butterfish, red hake, windowpane flounder, and winter flounder. According to this table, one or more life stages of each of these species is "common" or "abundant" in the mesohaline zone of the Hudson:

- *Atlantic Butterfish*: juveniles, adults, and larvae are common
- *Red hake*: adults, juveniles, and larvae are common
- *Windowpane*: adults, juveniles, and larvae are common
- *Winter flounder*: adults, spawning adults, juveniles, larvae, and eggs are abundant.

Table 6 of Stone et al. (1994) provides assessments of the reliability of the information used to develop each of the above abundance characterizations. Three categories of data reliability are assigned to each species/life stage combination:

- *Highly certain*: considerable sampling data available. Distribution, behavior, and preferred habitats well documented within an estuary.
- *Moderately certain*: some sampling data available for an estuary. Distribution, preferred habitat, and behavior well documented in similar estuaries.
- *Reasonable inference*: little or no sampling data available. Information on distributions, ecology, and preferred habitats documented in similar estuaries.

Table 6 of Stone et al. (1994) assigned the following reliability categories to the abundance classifications of the 4 species discussed in this section:

- *Atlantic Butterfish*: classification of adults is moderately certain; classifications of larvae and juveniles are based on reasonable inference

- *Red hake*: classifications of all life stages are based on reasonable inference.
- *Windowpane*: classifications of all life stages are based on reasonable inference.
- *Winter flounder*: classifications of all life stages are based on reasonable inference.

Thus, except for adult butterfish, classifications of all of the species and life stages discussed in this section are based on inference from other estuaries, rather than on data collected from the Hudson River. Hence, Stone et al. (1994) provides no scientifically supported, site-specific evidence that any of these species is more common, abundant, or productive in the mesohalinezone of the Hudson River than elsewhere within their geographic ranges, or that the Hudson River satisfies the statutory definition of EFH for these species by providing habitat necessary to support sustainable fisheries or contributions to healthy ecosystems. These EFH classifications are clearly based on Level 1 data and should be superseded by the Level 2 data provided by the Hudson River Monitoring Program (HRMP).

3. Entrainment estimates provided to NMFS by NRC are seriously affected by mathematical errors that may have misled NMFS in its EFH evaluation

Table 5 of the NRC's Essential Fish Habitat Assessment Report (USNRC 2009) contains inaccurate estimates of the number of organisms entrained at Indian Point Units 2 and 3. Each entrainment estimate reported in Table 5 (reproduced here as Table 9) overstates entrainment by a factor of roughly 13,000. Those inaccurate estimates apparently are due to three calculation errors: 1) entrainment density estimates from Entergy apparently were assumed to be in units of number per m^3, rather than number per $1000m^3$; 2) the calculation was based on the sum of weekly entrainment densities rather than on the average of weekly entrainment densities; and 3) total volume of water withdrawn over each three-month calendar season was used in the calculation rather than week-specific values of the actual water withdrawn during the period of entrainment sampling. Furthermore, the seasonal total volumes apparently used in the calculation do not correspond to actual withdrawal volumes for the years of entrainment sampling. Details of the apparent calculation method (i.e., a method that produces the estimates in Table 5 of the NRC Essential Fish Habitat Report and is consistent with the method described in that report) are presented in Attachment 1 to this report. Table 10 of this response provides corrected entrainment estimates. The corrections are documented in Attachment 1.

The corrected values show that NRC's original submission grossly overstated the total entrainment of fish at Indian Point and also the entrainment of each of the 5 species for which NMFS asserted that EFH had been adversely affected by entrainment at Indian Point. Red Hake was collected during only 1 of the 14 sampling periods for which entrainment data are available, and no species was collected during more than 3 of these 14 periods. As discussed below, these losses are equivalent to negligibly small fractions of the annual commercial harvest of each species in the mid-Atlantic states.

4. Entrainment losses of bluefish, Atlantic butterfish, red hake, windowpane, and winter flounder are negligibly small compared to commercial harvests allowed by NMFS

The distributional data and entrainment loss estimates discussed in previous sections provide ample support for the decisions made by NRC, the United State Environmental Protection Agency (EPA), and NYSDEC to focus monitoring and assessment activities on the Representative Important Species (RIS) species discussed in Entergy's AEI report, (Barnthouse et al. 2008) not on red hake, Atlantic butterfish, windowpane, winter flounder, or bluefish. If, as concluded in the AEI report, Indian Point has had no measurable impacts on species that spawn within the Hudson and utilize the river for key stages in their life cycles, then there should be no measurable impacts on marine species that are only seasonally present during a small fraction of their life cycles.

The insignificance of IPECs' operations with respect to these species can be further understood in terms of fishing yields, which show that entrainment and impingement effects are *de minimis*. To demonstrate the biological insignificance of the corrected entrainment values documented in Table 10, the average annual loss estimates of bluefish, Atlantic butterfish, red hake, windowpane, and winter flounder were converted into potential reductions in harvest using the same methods used by the United States Environmental Protection Agency in its Section 316(b) Phase III Regional Case Study (USEPA 2006). First, the entrainment losses for each species were converted to equivalent numbers of one-year-old fish ("age-1 equivalents"). Next, the age-1 equivalents were converted to potential reductions in yields to fisheries ("foregone harvest").

These are hypothetical calculations that fail to account for environmental and biological variability, density-dependent mortality, and other factors that disrupt the presumed relationship between the losses of early life stages and subsequent abundance of older fish. However, they can provide a rough comparison of the relative importance of entrainment, as compared to harvesting, as an influence on the abundance of harvested species.

Table 11 provides estimates of the annual average numbers of each of these species entrained over the years 1981 and 1983-1987, together with estimates of corresponding annual age-1 equivalent losses and foregone harvest. To provide a context for interpreting these values, Table 11 also provides estimates of average annual landings of each species reported by the mid-Atlantic states (New York, New Jersey, and Delaware) for the years 1981-1987 (NMFS commercial landings database). As shown in Table 11, for all five species, the estimated potential harvest foregone due to entrainment at IPEC is 0.01% or less of the reported mid-Atlantic commercial landings for the years 1981-1987. These comparisons demonstrate that entrainment losses of bluefish, Atlantic butterfish, red hake, windowpane, and winter flounder are so small compared to actual harvests during the years for which E&I data are available that they could not conceivably affect sustainability of harvests for these species.

5. NMFS has incorrectly characterized impingement survival studies performed at Indian Point

On p. 6 of the letter, NMFS states that the installation of modified Ristroph traveling screens at Indian Point was "...predicated on assumptions made in a limited pilot study," and that "the actual performance of this gear has not been demonstrated *in situ.*" Neither of these statements is correct. In fact, as demonstrated below, the screens were installed only after a lengthy and rigorous study program conducted over a period of years, including a full-scale field demonstration at an operating intake bay, overseen by an independent scientist under contract to the Hudson River Fishermen's Association. Based on these operational tests, it was judged that comparable successful operation could be expected for all screen bays. Further, EPA's most recent draft rule governing cooling water intake structures relies on the studies conducted at Unit 2 and Unit 3, and based on those studies selected modified Ristroph screens as the basis for impingement mortality best technology available ("BTA) requirements for all existing facilities (USEPA 2011).

As part of the 1980 Hudson River Settlement Agreement (i.e., "HRSA"), the owners of Unit 2 and Unit 3 agreed to conduct a study to determine the feasibility of installing angled screens as an impingement mitigation measure. A subsequent report (Fletcher 1984) and peer-reviewed scientific publication by Fletcher (1985) demonstrated that an angled screen installation of the size required to protect the intake structures of Unit 2 and Unit 3, while allowing sufficient intake flow, would not be effective at reducing impingement mortality. Continuously rotating (Ristroph) traveling screens with fish conservation structures and a return system were recommended by Fletcher as an alternative to the angled screen system.

Ristroph-modified traveling screens were evaluated for impingement mitigation at Indian Point beginning in 1985, and continuing through 1994, under the direction of Dr. Ian Fletcher. Dr. Fletcher directed this evaluation independently under contract to the Hudson River Fishermen's Association. Normandeau Associates, Inc. ("Normandeau") supported Dr. Fletcher's evaluation by providing field, laboratory and analytical services under his direction while being reimbursed for the work under contract to Indian Point.

A single Ristroph traveling screen (Royce Equipment Company of Houston, Texas, Version 1) was installed in screen well slot 26 located at the north end of the Unit 2 CWIS on 16 January 1985 to begin an evaluation of impingement survival at Indian Point. Fish impingement survival studies were conducted daily throughout 1985 by comparing the survival of fish impinged on the Ristroph screen with the survival of fish impinged on the conventional (Rex) traveling screens simultaneously operating in screen wells 21-25 of the Unit 2 CWIS. The goal was to determine the improvement in survival of impinged fish if the conventional (Rex) traveling screens were all replaced with Ristroph-modified traveling screens and a state of the art fish return system at Unit 2 and Unit 3. These survival studies observed fish survival at 0, 6, 12, 24, 36, 48, 60, 72, 84 and 96 hours after impingement (Con Edison 1985).

In 1986, additional impingement survival studies were conducted to compare Royce Version 1 and Version 2 screens using mortality observations at time 0 and after eight hours of holding time. The Version 2 screens exhibited much improved fish survival compared to the Version 1 screens (Fletcher 1986; 1992), based on the eight-hour (i.e., "latent") mortality rates used by Dr. Fletcher. Peer reviewed scientific publications by Fletcher (1986; 1990) selected eight hour estimates as the most reliable time period for quantifying survival rates of impinged fish at Unit 2 and Unit 3 without the potential confounding effects of increased control mortality due to longer holding times, and reported these rates for abundant fish species impinged at Indian Point.

Ristroph screen evaluations continued annually through November 1994, under the direction of Dr. Fletcher, testing the fish survival, the debris handling characteristics, and the interaction between fish survival and debris handling for various modifications to the Ristroph screen mesh panels, spray headers, spray header alignment, and fish transfer bucket system (Con Edison and NYPA 1992; Normandeau 1996). The goal of these studies was to customize the construction, installation, and operation of the Ristroph screens and fish return system for the optimum survival of impinged fish. Beginning in 1989, and continuing into 1991, full-scale prototypes of the fish return sluice system for the Unit 2 and Unit 3 cooling-water intakes (CWIS) were built near the quarry adjacent to the Indian Point site (Con Edison and NYPA 1992). Each full scale return sluice system was tested to determine the best configuration of pipes and sluice flow to minimize the mortality of impinged fish during transfer from the Ristroph screens to the river. After the installation of the present Ristroph modified traveling screens at Unit 3 in 1991 and at Unit 2 in 1992, testing of the installed full scale sluice system continued through 1993 to determine the best configuration to minimize the recirculation and re-impingement of surviving fish that were released back into the Hudson River near the Unit 2 and Unit 3 CWISs (Normandeau 1993). Earlier studies to determine the distribution of fish near the Unit 2 and Unit 3 CWISs (Ross et al. 1987) formed the basis for these 1993 evaluations.

Following the completion of these final field-scale demonstration studies, NYSDEC, and EPA accepted the Ristroph screens with a fish return system as the Best Technology Available (BTA) for minimizing impingement at Unit 2 and Unit 3. EPA has concluded that "[p]erformance data for modified traveling screens with fish return systems show low levels of impingement mortality across a wide variety of water body types and fish species . . . [and that] modified traveling screens with a fish return system is a candidate best performing technology for impingement mortality" (USEPA 2011, p. 22202). As such, EPA's draft rule for cooling water intake structures bases the requisite impingement mortality standards on performance of modified Ristroph screens (USEPA 2011, p. 22187).

6. NMFS' assertions concerning indirect effects of entrainment on the productivity of the Hudson River (and hence on EFH) are not supported by any scientific analyses and are inconsistent with current scientific understanding of estuarine food webs

On p. 5 of the letter, NMFS criticizes NRC for failing to provide a thorough analysis of entrainment implications for "...fish eggs and larvae, copepods, and other invertebrate prey items that are described clearly as prey in the EFH vignettes included for red hake, winter flounder, windowpane, bluefish, and Atlantic butterfish." NMFS further claims that these entrainment losses "...would have indirect and cumulative adverse effects on EFH not just in the mid-Hudson, but extending into the marine portion of the coastal zone."

On p. 8 of the letter, NMFS criticizes NRC's assessment of impacts to EFH, and states that "...a more appropriate analysis extends the view of entrainment, impingement, and thermal discharge impacts to include mortalities and reduced productivity of forage species, diadromous species, and resident fishes; to assess their impacts on coastal fisheries including species for which EFH is designated downstream; and to discuss how the lost productivity out of the mid-Hudson represents a net reduction in forage opportunities for offshore and downstream resources." Later in the same paragraph, discussing organism loss and habitat degradation, NMFS states that "...at over 2 billion gallons of water consumed per day, the amount of prey available to fishes in particular would be significantly diminished through entrainment alone."

The implication of the above statements is that cooling water withdrawals at Units 2 and 3 are having indirect impacts on EFH by significantly reducing the prey available to managed fish species not only in the Indian Point region, but in downstream regions of the Hudson and even the marine portion of the coastal zone. NMFS provides no citations to support these assertions concerning the impact of IPEC on the productivity of the Hudson; moreover, these statements are based on a mischaracterization of the nature of entrainment and a misunderstanding of current food web theory.

Several recent studies have investigated the factors influencing the productivity of phytoplankton, zooplankton, and fish communities in the lower Hudson River. Howarth et al. (2006) discussed the influence of wastewater inputs, freshwater flows, and watershed characteristics on primary production in the Hudson. Caraco and Cole (2006) investigated the relative importance of in-river primary production and watershed-derived carbon as sources of fish production in the estuary. Pace and Lonsdale (2006) discussed the impact of zebra mussels on the abundance of zooplankton prey available to early life stages of fish. None of these authors identified cooling water withdrawals or thermal discharges as being significant influences on the productivity of the Hudson.

NMFS' assertions that prey availability is significantly diminished through entrainment fail to consider the fact that all entrained organisms are returned to the river, where they are still available for consumption by a wide variety of fish and invertebrates. The "over 2 billion gallons of water consumed per day" are not in fact "consumed" but just circulated. In contrast, evaporative cooling towers, which are NMFS' recommended alternative, do consume water and the entrained organisms are permanently removed from the river.

Entrained organisms contribute to aquatic food webs, even if they do not survive entrainment. According to Polis and Strong (1996), the food consumed by typical predator species is derived from a variety of sources, including both plant-based and decomposer-based production. The species consumed change depending on developmental stage and spatial location. Striped bass larvae, for example, feed primarily on small invertebrates such as copepods (Limburg et al. 1998), which are an important component of the zooplankton. Copepods, in turn, feed on both phytoplankton and on decomposer microorganisms growing on the surfaces of organic particles suspended in the water column. Juvenile striped bass feed on copepods, but also on larger invertebrates such as gammarids and chironomids (Gardinier and Hoff, 1982). These invertebrates feed on plants and decomposing organic matter, and in addition gammarids are active predators on zooplankton and even fish eggs and larvae (Poje et al. 1988).

The biomass represented by entrained organisms is retained within the ecosystem rather than being lost. If still alive, the entrained organisms are available for consumption by the same fish that would have consumed them if they had not been entrained. In fact, studies performed at Indian Point during the 1970s by the NYU Institute of Environmental Medicine (1974, 1976, 1977) demonstrated high entrainment survival rates for phytoplankton and zooplankton. If dead, the entrained organisms are still available for consumption either by the same fish or by other fish and invertebrates that are themselves susceptible to predation. Entrained organisms that are not consumed in this way are decomposed by bacteria, which in turn are a food source for a variety of invertebrates, including the copepods, amphipods, and other invertebrates identified by NMFS as being prey for EFH species. Neither NMFS nor any other source has provided evidence that the net availability of prey to fish downstream from IPEC has been reduced because of entrainment, and currently accepted ecological theories suggest that any such reductions may be small.

7. NMFS' characterization of the potential impacts of the thermal plume from Units 2 and 3 does not consider available site-specific information concerning the plume

On p. 6 of the letter, NMFS states that the discharge plume from Indian Point could "...induce noticeable changes in the current regime or perhaps induce changes in the local erosion and accretion rates that have unintended adverse effects such as losses of submerged aquatic vegetation, chronic disturbance that discourage settlement of tiny prey items, and similar effects." NMFS further states, in the same paragraph, that "...our EFH regulations compel us to assume the worst case scenario that the effluent is creating a barrier to migrating fishes and other unacceptable environmental conditions that would adversely affect the amount and quality of available EFH."

These statements conflict with well-known characteristics of the site that are documented in environmental reports available to NMFS and with a recently-completed study of the thermal plume discharged by Units 2 and 3 (Swanson et al. 2010). Because of the depth and turbidity of the river in the vicinity of Indian Point, no submerged aquatic vegetation is present along the river shoreline. Moreover, as demonstrated by Swanson et al. (2010), the thermal discharge from

Units 2 and 3 occupies a limited area of the Hudson River. The plume remains near the surface of the river and does not make contact with the river bottom. The plume extends up and down stream along the eastern shoreline of the Indian Point region of the Hudson River, depending upon the tides (Swanson et al. 2010).

The thermal study and hydrothermal modeling performed by Swanson et al. (2010) was reviewed by NYSDEC Staff. Based upon those studies, NYSDEC Staff concluded that the thermal plume from Indian Point satisfies applicable thermal water quality standards and mixing zone criteria (6 NYCRR 704). The thermal standards require, among other things, that the surficial extent of the plume not exceed 67% of the cross-river distance and that the areal extent of the plume does not exceed 50% of the river cross-sectional area. (6 NYCRR 704.2(b)(5)). Swanson et al. (2010) confirmed that the Indian Point thermal plume falls well within these parameters, even under the most extreme environmental conditions. From a functional standpoint, these results indicate that the maximum cross-sectional extent of the thermal plume does not extend longitudinally or within the water column to an extent that would block migration of any of the diadromous commercial species (i.e., striped bass, alewife, blueback herring, and American shad) that move past Indian Point between marine and freshwater habitats within the Hudson River (Swanson et al. 2010).

As a result of its review, NYSDEC staff approved a draft SPDES permit condition as follows:

> The water temperature at the surface of the Hudson River shall not be raised more than 1.5 degrees Fahrenheit (from July through September, when surface water temperature is greater than 83 degrees Fahrenheit) above the surface temperature that existed before the addition of heat of artificial origin (6 NYCRR section 704.2[b][5][iii]) except in a mixing zone of seventy-five (75) acres (total) from the point of discharge. The thermal discharge from the Indian Point nuclear facilities to the Hudson River may exceed 90 degrees Fahrenheit (6 NYCRR section 704.2[b][5][i] of the State's Criteria Governing Thermal Discharges) within the designated mixing zone area, the total area of which shall not exceed seventy-five (75) acres (3,267,000 square feet) on a daily basis.

Thus, NYSDEC Staff has concluded that Indian Point's thermal plume does not interfere with spawning areas, nursery areas or fish migration routes, and assures the protection and propagation of a balanced, indigenous population of shellfish, fish and wildlife within the Hudson River. (6 NYCRR 704.1; 6 NYCRR 704.3).

8. NMFS' statements concerning potential releases of chemical pollution and low dissolved oxygen levels conflict with readily available data concerning IPEC's discharges and the water quality of the Hudson River in the vicinity of IPEC

On p. 5 of the letter, NMFS questions NRC's conclusions concerning the insignificance of potential releases of chemical pollution and induction of low dissolved oxygen. With regard to chemical pollution, pollutant discharge limits applicable to IPEC are provided in SPDES Permit No. NY-0004472. This permit provides discharge limits for the following substances: pH, total residual chlorine, lithium hydroxide, boron, temperature, total suspended solids, hexavalent chromium, phosphates, fluorides, iron, copper, oil & grease, and total suspended solids. Hexavalent chromium is no longer used at Units 2 and 3, so the discharge limit for this pollutant is inactive (401 Response, Exhibit G). These permit limits are intended to protect designated uses of the Hudson River, which include primary and secondary contact recreation and fishing and should be suitable for fish, shellfish, and wildlife propagation and survival (6 NYCRR 864.6). These SPDES-authorized discharges are consistent with protection of designated uses of the Hudson, including propagation of EFH species.

Additional evidence that permitted discharges from IPEC are not affecting EFH is provided in New York State's §303(d) list. This list identifies waterbodies in New York that are considered to be impaired by pollutant discharges, and the pollutants responsible for the impairment. NYSDEC's 2010 §303(d) list identifies the lower Hudson River as being impaired for fish consumption (NYSDEC 2010). The chemicals listed as the cause of this impairment include PCBs, mercury, pesticides, dioxins/furans, and other heavy metals present in Hudson River sediment. The SPDES Permit for IPEC does not allow discharges of any of these substances (401 Response, Exhibits H and N).

With regard to dissolved oxygen, Brosnan et al. (2006) showed that oxygen concentrations low enough to adversely affect aquatic biota have historically been limited to urban areas, especially Albany and New York City. Moreover, data collected as part of the riverwide monitoring programs (ASA 2010, Table B-15) show that dissolved oxygen concentrations in the Indian Point Region are well above the 4.8 mg/L level specified by EPA (USEPA 2000) as being protective of marine biota.

9. Conclusion

NMFS' comments regarding impacts of the license renewal for Indian Point Units 2 and 3 contain significant errors of fact and greatly overstate the impact of Units 2 and 3, if any, on EFH for fish species managed by NMFS. Although NMFS claims that the region of the river on which Units 2 and 3 are located is EFH for bluefish, Atlantic butterfish, red hake, windowpane, and winter flounder, riverwide data collected for Entergy and cooperating generators and agencies since 1974 clearly shows that bluefish is the only species for which the Indian Point region could potentially be considered EFH, and only using very conservative definitions. Moreover, NMFS' estimates of entrainment of these five (5) species are compromised by mathematical errors that cause them to overstate entrainment by a factor of approximately 13,000. In fact, entrainment of all five (5)species is very low, and equivalent to only very small fractions of a percent of the mid-Atlantic commercial harvests of these species during the years corresponding to the entrainment data. In addition, NMFS inaccurately characterized the impingement survival studies performed in connection with the installation of the advanced Ristroph Screen technology at Indian Point. Assertions raised by NMFS concerning indirect impacts of entrainment on EFH are purely speculative and are not supported by any data or citations to published literature. Assertions raised concerning thermal plume effects, chemical discharges, and low dissolved oxygen are clearly contradicted by available data and analyses.

In short, NMFS has provided no credible information supporting its contention that potential impacts of relicensing Units 2 and 3, as currently configured, on EFH for managed fish species are significant. To the contrary, existing data from riverwide monitoring and other sources indicates that any such impacts are either nonexistent or negligibly small.

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Table 1.Riverwide distribution of Atlantic butterfish eggs and larvae. Based on the 95% criterion(see text), regions 0 and 1 are potential EFH eggs and regions 0-2 could be considered EFH for larvae.

Region (RM range)	Egg standing crop	% of riverwide total	Cumulative %	Larval standing crop	% of riverwide total	Cumulative %
0 (0-11)	558,477	81%	81%	103,699	64%	64%
1 (12-23)	129,775	19%	100%	46,174	29%	93%
2 (24-33)	0	0%	100%	3,066	2%	95%
3 (34-38)	0	0%	100%	2,334	1%	96%
4 (39-46)[a]	0	0%	100%	0	0%	96%
5 (47-55)	0	0%	100%	6,434	4%	100%
6 (56-61)	0	0%	100%	0	0%	100%
7 (62-76)	0	0%	100%	0	0%	100%
8 (77-85)	0	0%	100%	0	0%	100%
9 (86-93)	0	0%	100%	0	0%	100%
10 (94-106)	0	0%	100%	0	0%	100%
11 107-124)	0	0%	100%	0	0%	100%
12 (125-152)	0	0%	100%	0	0%	100%

[a]Includes Indian Point, located within RM segment 42

Table 2.Riverwide distribution of juvenile and Age 1+ Atlantic butterfish. Based on the 95% criterion(see text), regions 0 -2 are potential EFH for these life stages.

Region (RM range)	**Juvenile standing crop (LRS)**	**% of riverwide total**	**Cumulative %**	**Juvenile standing crop (FSS)**	**% of riverwide total**	**Cumulative %**	**Age 1+ standing crop (FSS)**	**% of riverwide total**	**Cumulative %**
0 (0-11)	185,806	65%	65%	89,649	69%	69%	6,844	22%	22%
1 (12-23)	54,505	19%	84%	26,864	21%	90%	15,894	52%	74%
2 (24-33)	33,308	12%	96%	8,695	7%	96%	6,621	22%	95%
3 (34-38)	1,971	1%	96%	1,749	1%	98%	1,066	3%	99%
4 (39-46)[a]	10,447	4%	100%	2,480	2%	100%	327	1%	100%
5 (47-55)	0	0%	100%	415	0%	100%	0	0%	100%
6 (56-61)	0	0%	100%	7	0%	100%	0	0%	100%
7 (62-76)	0	0%	100%	0	0%	100%	0	0%	100%
8 (77-85)	0	0%	100%	0	0%	100%	0	0%	100%
9 (86-93)	0	0%	100%	0	0%	100%	0	0%	100%
10 (94-106)	0	0%	100%	0	0%	100%	0	0%	100%
11 (107-124)	0	0%	100%	0	0%	100%	0	0%	100%
12 (125-152)	0	0%	100%	0	0%	100%	0	0%	100%

[a]Includes Indian Point, located within RM segment 42

Table 3.Riverwide distribution of red hake eggs, juveniles, and age1+ fish. Based on the 95% criterion(see text), regions 0 and 1 are potential EFH for these life stages. Red hake larvae were not collected in the Hudson River.

Region (RM range)	Egg standing crop	% of riverwide total	Cumulative %	Juvenile standing crop (FSS)	% of riverwide total	Cumulative %	Age 1+ standing crop (FSS)	% of riverwide total	Cumulative %
0 (0-11)	19,539	85%	85%	1,223	100%	100%	1,581	55%	55%
1 (12-23)	2,904	13%	98%	0	0%	100%	1,281	45%	100%
2 (24-33)	457	2%	100%	0	0%	100%	0	0%	100%
3 (34-38)	0	0%	100%	0	0%	100%	0	0%	100%
4 (39-46)[a]	0	0%	100%	0	0%	100%	0	0%	100%
5 (47-55)	0	0%	100%	0	0%	100%	0	0%	100%
6 (56-61)	0	0%	100%	0	0%	100%	0	0%	100%
7 (62-76)	0	0%	100%	0	0%	100%	0	0%	100%
8 (77-85)	0	0%	100%	0	0%	100%	0	0%	100%
9 (86-93)	0	0%	100%	0	0%	100%	0	0%	100%
10 (94-106)	0	0%	100%	0	0%	100%	0	0%	100%
11 (107-124)	0	0%	100%	0	0%	100%	0	0%	100%
12 (125-152)	0	0%	100%	0	0%	100%	0	0%	100%

[a]Includes Indian Point, located within RM segment 42

Table 4.Riverwide distribution of windowpane eggs and larvae. Based on the 95% criterion(see text), regions 0 and 1 are potential EFH eggs and regions 0-2 are potential EFH for larvae.

Region (RM range)	**Egg standing crop**	**% of riverwide total**	**Cumulative %**	**Larval standing crop**	**% of riverwide total**	**Cumulative %**
0 (0-11)	28,348,744	61%	61%	732,936	68%	68%
1 (12-23)	17,989,771	39%	100%	219,875	20%	88%
2 (24-33)	223,145	0%	100%	66,893	6%	95%
3 (33-38)	1,551	0%	100%	17,180	2%	96%
4 (39-46)[a]	1,330	0%	100%	26,688	2%	99%
5 (47-55)	487	0%	100%	10,793	1%	100%
6 (56-61)	91	0%	100%	2,917	0%	100%
7 (62-76)	199	0%	100%	716	0%	100%
8 (77-85)	381	0%	100%	84	0%	100%
9 (86-93)	526	0%	100%	0	0%	100%
10 (94-106)	308	0%	100%	0	0%	100%
11 (97-124)	247	0%	100%	0	0%	100%
12 (125-152)	456	0%	100%	144	0%	100%

[a]Includes Indian Point, located within RM segment 42

Table 5.Riverwide distribution of juvenile and age1+ windowpane. Based on the 95% criterion(see text), regions 0 -2 are potential EFH for these life stages.

Region (RM range)	Juvenile standing crop (LRS)	% of riverwide total	Cumulative %	Juvenile standing crop (FSS)	% of riverwide total	Cumulative %	Age 1+ standing crop (FSS)	% of riverwide total	Cumulative %
0 (0-11)	171,710	52%	52%	2,246	44%	44%	981	52%	52%
1 (12-23)	110,715	34%	86%	2,072	41%	85%	355	19%	70%
2 (24-33)	37,886	12%	97%	764	15%	100%	489	26%	96%
3 (34-38)	4,580	1%	99%	0	0%	100%	63	3%	99%
4 (39-46)[a]	1,694	1%	99%	0	0%	100%	0	0%	99%
5 (47-55)	523	0%	100%	0	0%	100%	11	1%	100%
6 (56-61)	148	0%	100%	0	0%	100%	0	0%	100%
7 (62-76)	1,202	0%	100%	0	0%	100%	0	0%	100%
8 (77-85)	0	0%	100%	0	0%	100%	0	0%	100%
9 (86-93)	0	0%	100%	0	0%	100%	0	0%	100%
10 (94-106)	0	0%	100%	0	0%	100%	0	0%	100%
11 (107-124)	289	0%	100%	0	0%	100%	0	0%	100%
12 (125-152)	0	0%	100%	0	0%	100%	0	0%	100%

[a]Includes Indian Point, located within RM segment 42

Table 6.Riverwide distribution of winter flounder eggs and larvae. Based on the 95% criterion(see text), regions 0 and 1 are potential EFH for these life stages.

Region (RM range)	Egg standing crop	% of riverwide total	Cumulative %	Larval standing crop	% of riverwide total	Cumulative %
0 (0-11)	308,579	91%	91%	1.66E+07	72%	72%
1 (12-23)	27,352	8%	99%	5,214,687	23%	95%
2 (24-33)	1,012	0%	99%	942,765	4%	99%
3 (34-38)	0	0%	99%	180,455	1%	100%
4 (39-46)[a]	2,337	1%	100%	47,679	0%	100%
5 (47-55)	0	0%	100%	3,102	0%	100%
6 (56-61)	0	0%	100%	2,051	0%	100%
7 (62-76)	0	0%	100%	694	0%	100%
8 (77-85)	0	0%	100%	338	0%	100%
9 (86-93)	0	0%	100%	463	0%	100%
10 (94-106)	0	0%	100%	3,537	0%	100%
11 (107-124)	0	0%	100%	0	-	100%
12 (125-152)	0	0%	100%	310	0%	100%

[a]Includes Indian Point, located within RM segment 42

Table 7.Riverwide distribution of juvenile and age 1+ winter flounder. Based on the 95% criterion (see text), regions 0-3 are potential EFH for juveniles and regions 0-2 are potential EFH for age 1+.

Region (RM range)	Juvenile standing crop (LRS)	% of riverwide total	Cumulative %	Juvenile standing crop (FSS)	% of riverwide total	Cumulative %	Age 1+ standing crop (FSS)	% of riverwide total	Cumulative %
0 (0-11)	158,444	44%	44%	2,246	44%	44%	981	52%	52%
1 (12-23)	115,009	32%	76%	2,072	41%	85%	355	19%	70%
2 (24-33)	63,670	18%	93%	764	15%	100%	489	26%	96%
3 (34-38)	15,355	4%	97%	0	0%	100%	63	3%	99%
4 (39-46)[a]	9,247	3%	100%	0	0%	100%	0	0%	99%
5 (47-55)	0	0%	100%	0	0%	100%	11	1%	100%
6 (56-61)	0	0%	100%	0	0%	100%	0	0%	100%
7 (62-76)	0	0%	100%	0	0%	100%	0	0%	100%
8 (77-85)	0	0%	100%	0	0%	100%	0	0%	100%
9 (86-93)	0	0%	100%	0	0%	100%	0	0%	100%
10 (94-106)	0	0%	100%	0	0%	100%	0	0%	100%
11 (107-124)	0	0%	100%	0	0%	100%	0	0%	100%
12 (125-152)	0	0%	100%	0	0%	100%	0	0%	100%

[a]Includes Indian Point, located within RM segment 42

Table 8.Riverwide distribution of juvenile and age 1+ bluefish in the Hudson River. Based on the 95% criterion (see text), regions 0-7 are potential EFH for these life stages. Bluefish eggs and larvae have not been collected in the Hudson River.

Region (RM range)	Juvenile standing crop (LRS)	% of riverwide total	Cumula-tive %	Juvenile standing crop (FSS)	% of riverwide total	Cumula-tive %	Age 1+ standing crop (FSS)	% of riverwide total	Cumula-tive %
0 (0-11)	76,968	20%	20%	5,495	7%	7%	52	3%	3%
1 (12-23)	49,611	13%	33%	14,655	19%	26%	72	4%	7%
2 (24-33)	94,573	25%	58%	15,727	20%	46%	243	13%	20%
3 (34-38)	84,434	22%	80%	7,219	9%	56%	374	20%	40%
4 (39-46)[a]	34,100	9%	89%	13,350	17%	73%	685	37%	77%
5 (47-55)	12,958	3%	93%	11,024	14%	87%	0	0%	77%
6 (56-61)	17,842	5%	98%	3,521	5%	92%	430	23%	100%
7 (62-76)	9,441	2%	100%	5,437	7%	99%	0	0%	100%
8 (77-85)	0	0%	100%	862	1%	100%	0	0%	100%
9 (86-93)	0	0%	100%	74	0%	100%	0	0%	100%
10 (94-106)	0	0%	100%	0	0%	100%	0	0%	100%
11 (107-124)	0	0%	100%	0	0%	100%	0	0%	100%
12 (125-152	0	0%	100%	0	0%	100%	0	0%	100%

[a]Includes Indian Point, located within RM segment 42

Table 9 (**reproduced from Table 5 of NRC 2009 EFH Assessment report**). Estimated Total Mean Numbers* (in millions) of Potential EFH Species and Other Fish Entrained by IP2 and IP3 from 1981 to 1987.

Year	Season	Red Hake	Atlantic Butterfish	Window-pane	Winter Flounder	Bluefish	Total Identified Fish	Mutilated Fish	Un-identified Fish
1981	2	--	--	--	--	--	3,270,000	89,000	289
1981	3	--	--	--	--	--	1,090,000	4,460	456
1983	2	--	--	--	--	--	3,970,000	182,000	6,921
1983	3	--	343	--	--	--	6,610,000	129,000	147
1984	2	--	--	--	--	--	5,100,000	15,000	6,010
1984	3	--	--	72.3	--	71.9	8,430,000	697	214
1985	2	--	--	--	2,160	--	1,640,000	74,400	4,490
1985	3	--	--	54.2	--	386	5,040,000	89,700	348
1986	1	--	--	--	--	--	110,000	199	110
1986	2	277	--	--	509	--	3,000,000	73,700	5,230
1986	3	--	34.8	--	--	--	2,800,000	409,000	947
1987	2	--	--	110	884	--	1,290,000	31,600	671
1987	3	--	--	--	--	--	3,800,000	41,300	69
Total		277	378	236	3,550	--	56,000,000	1,140,000	25,900

*Total mean numbers are the product of the total of mean weekly densities in each season and year, multiplied by the water withdrawn in that season and year: -- indicates no information for that season and year.

Season 1is January, February, and March.

Season 2 is April, May and June.

Season 3 is July, August and September.

Table 10. Table 9 **with corrected entrainment estimates and corrected annotation**). Estimated Total Numbers* (***in THOUSANDS***) of Potential EFH Species and Other Fish Entrained by IP2 and IP3 from 1981 to 1987.

Year	Season	Red Hake	Atlantic Butterfish	Window-pane	Winter Flounder	Bluefish	Total Identified Fish	Mutilated Fish	Un-identified Fish
1981	2	0.0	0.0	0.0	0.0	0.0	378,436.9	7,518.4	36.7
1981	3	0.0	0.0	0.0	0.0	0.0	1,059,980.6	359.5	43.7
1983	2	0.0	0.0	0.0	0.0	0.0	403,093.3	17,911.4	649.7
1983	3	0.0	18.3	0.0	0.0	0.0	366,450.0	7,229.2	8.5
1984	2	0.0	0.0	0.0	0.0	0.0	450,264.6	1,377.9	481.1
1984	3	0.0	0.0	3.9	0.0	3.9	436,190.7	37.5	10.8
1985	2	0.0	0.0	0.0	175.2	0.0	126,585.2	5,813.5	400.6
1985	3	0.0	0.0	2.9	0.0	19.7	265,563.3	4,710.5	18.5
1986	1	0.0	0.0	0.0	0.0	0.0	9,217.9	12.0	9.7
1986	2	11.2	0.0	0.0	14.6	0.0	250,303.9	6,032.4	347.1
1986	3	0.0	2.1	0.0	0.0	0.0	172,314.9	25,348.1	58.3
1987	2	0.0	0.0	7.1	40.9	0.0	82,017.0	1,985.7	41.5
1987	3	0.0	0.0	0.0	0.0	0.0	201,962.2	2,198.3	3.7
Total		11.2	20.5	13.9	230.8	23.6	4,202,380.4	80,534.6	2,109.9

*Total number is the sum of the estimated number entrained in each week. The number entrained each week is the product of the mean weekly entrainment density multiplied by the water withdrawal volume in the week.

Season 1 is January, February, and March (weeks 2-13).

Season 2 is April, May and June (weeks 18-26 in 1981 and 1983-84; weeks 17-26 in 1985; weeks 14-26 in 1986; and weeks 20-26 in 1987).

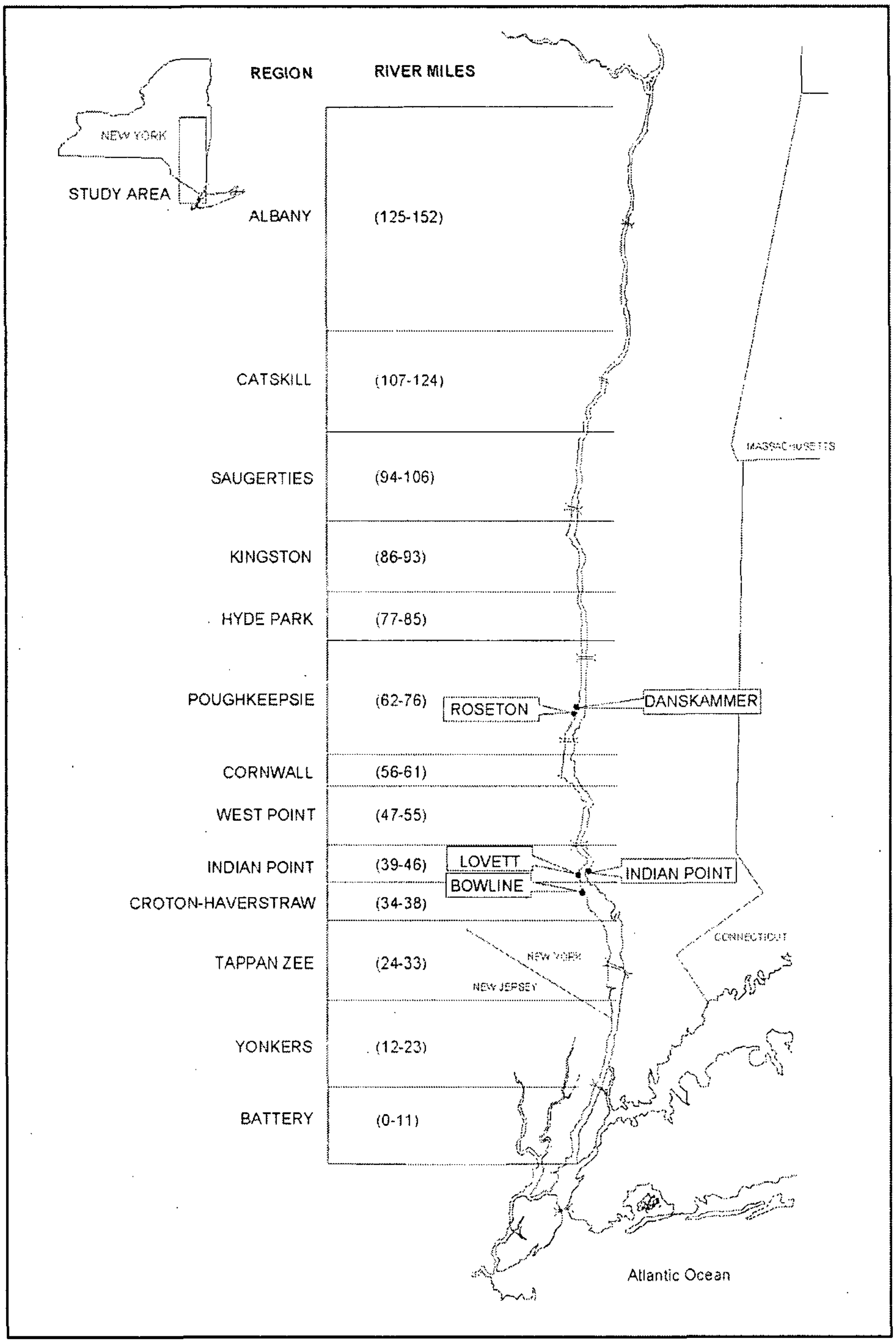
Season 3 is July, August and September (weeks 27-32 in 1984-87; weeks 27-33 in 1983; and weeks 27-35 in 1981).

Table 11. Average annual entrainment losses, age-1 equivalent losses, and harvest foregone for bluefish, Atlantic butterfish, red hake, windowpane flounder, and winter flounder.

Species	**Average annual entrainment losses**	**Average annual age-1 equivalent losse**[s]	**Harvest Foregone (lbs)**[b]	**Annual landings, mid-Atlantic states (lbs)**[c]	**percent annual mid-Atlantic landings**
Bluefish	3,900	49	77	4,099,206	0.002%
Atlantic Butterfish	3,408	1,757	72	1,701,300	0.004%
Red Hake	1,872	1	0.3	1,241,343	0.000004%
Windowpane	2,323	90	9	92,186	0.010%
Winter flounder	38,467	238	26	1,789,000	0.001%

[a]For years 1981 and 1983-1987
[b]calculated using methods and life history parameters from EPA (2006)
[c]average for years 1981-1987, from NOAA commercial landings database

Figure 1. Sampling regions defined for the LRS, FSS, and BSS monitoring programs.



Review of Estimates of Numbers Entrained
Presented in NRC 2009 EFH Assessment and 2010 FSEIS

Prepared by AKRF, Inc.

Table 5 of the Essential Fish Habitat Assessment report (NRC 2009) contains inaccurate estimates of the number of organisms entrained at Indian Point Units 2 and 3. Each entrainment estimate reported in Table 5 (reproduced below) overstates entrainment by a factor of roughly 13,000. Those inaccurate estimates apparently are due to three errors in calculation: 1) entrainment density estimates from Entergy apparently were assumed to be in units of number per m^3, rather than number per $1000m^3$; 2) the calculation was based on the sum of weekly entrainment densities rather than on the average of weekly entrainment densities; and 3) an total volume of water withdrawn over each three-month calendar season was used in the calculation rather than week-specific values of the actual water withdrawn during the period of entrainment sampling. Furthermore, the seasonal total volumes apparently used in the calculation do not correspond to actual withdrawal volumes for the years of entrainment sampling. Details of the apparent calculation method (i.e., a method that produces the estimates in Table 5 and is consistent with the method described in the NRC 2009 EFH Assessment report) are presented below. Also presented below is a revised Table 5 with corrected entrainment estimates. Table I-42 in Appendix I of the FSEIS (NRC 2010) also contains inaccurate estimates of the number of organisms entrained at Indian Point Units 2 and 3. Each entrainment estimate reported in Table I-42 overstates entrainment by a factor of exactly 1000 (i.e., the table entries should be listed as thousands of organisms, not millions). Those inaccuracies apparently are due to NRC's incorrect assumption that the entrainment density estimates provided by Entergy had units of number per m^3, rather than number per $1000m^3$. Table I-42 also contains two apparent typographical errors – Atlantic menhaden entrainment in 1985 and 1986 was not zero. Otherwise, the estimates in Table I-42 appear to have been calculated correctly.

Table 5 (**reproduced from NRC 2009 EFH Assessment report**). Estimated Total Mean Numbers* (in millions) of Potential EFH Species and Other Fish Entrained by IP2 and IP3 from 1981 to 1987.

Year	Season	Red Hake	Atlantic Butterfish	Window-pane	Winter Flounder	Bluefish	Total Identified Fish	Mutilated Fish	Un-identified Fish
1981	2	--	--	--	--	--	3,270,000	89,000	289
1981	3	--	--	--	--	--	1,090,000	4,460	456
1983	2	--	--	--	--	--	3,970,000	182,000	6,921
1983	3	--	343	--	--	--	6,610,000	129,000	147
1984	2	--	--	--	--	--	5,100,000	15,000	6,010
1984	3	--	--	72.3	--	71.9	8,430,000	697	214
1985	2	--	--	--	2,160	--	1,640,000	74,400	4,490
1985	3	--	--	54.2	--	386	5,040,000	89,700	348
1986	1	--	--	--	--	--	110,000	199	110
1986	2	277	--	--	509	--	3,000,000	73,700	5,230
1986	3	--	34.8	--	--	--	2,800,000	409,000	947
1987	2	--	--	110	884	--	1,290,000	31,600	671
1987	3	--	--	--	--	--	3,800,000	41,300	69
Total		277	378	236	3,550	--	56,000,000	1,140,000	25,900

*Total mean numbers are the product of the total of mean weekly densities in each season and year, multiplied by the water withdrawn in that season and year: -- indicates no information for that season and year.

Season 1is January, February, and March.

Season 2 is April, May and June.

Season 3 is July, August and September.

Table 5 (**with corrected entrainment estimates and corrected annotation**). Estimated Total ~~Mean~~ Numbers* (***in THOUSANDS***) of Potential EFH Species and Other Fish Entrained by IP2 and IP3 from 1981 to 1987.

Year	Season	Red Hake	Atlantic Butterfish	Window-pane	Winter Flounder	Bluefish	Total Identified Fish	Mutilated Fish	Un-identified Fish
1981	2	0.0	0.0	0.0	0.0	0.0	378,436.9	7,518.4	36.7
1981	3	0.0	0.0	0.0	0.0	0.0	1,059,980.6	359.5	43.7
1983	2	0.0	0.0	0.0	0.0	0.0	403,093.3	17,911.4	649.7
1983	3	0.0	18.3	0.0	0.0	0.0	366,450.0	7,229.2	8.5
1984	2	0.0	0.0	0.0	0.0	0.0	450,264.6	1,377.9	481.1
1984	3	0.0	0.0	3.9	0.0	3.9	436,190.7	37.5	10.8
1985	2	0.0	0.0	0.0	175.2	0.0	126,585.2	5,813.5	400.6
1985	3	0.0	0.0	2.9	0.0	19.7	265,563.3	4,710.5	18.5
1986	1	0.0	0.0	0.0	0.0	0.0	9,217.9	12.0	9.7
1986	2	11.2	0.0	0.0	14.6	0.0	250,303.9	6,032.4	347.1
1986	3	0.0	2.1	0.0	0.0	0.0	172,314.9	25,348.1	58.3
1987	2	0.0	0.0	7.1	40.9	0.0	82,017.0	1,985.7	41.5
1987	3	0.0	0.0	0.0	0.0	0.0	201,962.2	2,198.3	3.7
Total		11.2	20.5	13.9	230.8	23.6	4,202,380.4	80,534.6	2,109.9

***Total ~~mean~~ number is the sum of the estimated number entrained in each week. The number entrained each week is the product of the mean weekly entrainment density multiplied by the water withdrawal volume in the week.** ~~product of the total of mean weekly densities in each season and year, multiplied by the water withdrawn in that season and year: — indicates no information for that season and year.~~

Season 1is January, February, and March **(weeks 2-13)**.

Season 2is April, May and June **(weeks 18-26 in 1981 and 1983-84; weeks 17-26 in 1985; weeks 14-26 in 1986; and weeks 20-26 in 1987)**.

Season 3is July, August and September **(weeks 27-32 in 1984-87; weeks 27-33 in 1983; and weeks 27-35 in 1981)**.

Description of method apparently used to estimate numbers entrained in Table 5 of the NRC 2009 EFH Assessment report, and associated bias.

A method for generating unbiased estimates of the numbers of organisms entrained during the period of entrainment sampling is to sum weekly estimates of numbers entrained, where each weekly estimate is the product of: 1) the mean entrainment density for the week, and 2) the withdrawal volume for the week:

$$\hat{E} = \left(\sum_{w=samp_1}^{samp_2} \frac{D_w}{1000} \times V_w \right) \text{, where}$$

$\hat{E}$ is the estimate of numbers entrained during the entrainment sampling season,

D_w isthe mean entrainment density (number per 1000m^3) in week w,

V_w is the volume (m^3) of water withdrawn in week w, and

$samp_1$ is the first week of the entrainment sampling season, and $samp_2$ is the last week.

The method apparently used to generate the estimates in Table 5 was to multiply the sum of week-specific density estimates by the total water withdrawal volume for a season:

$$\tilde{E} = \left(\sum_{w=samp_1}^{samp_2} D_w \right) \times \dot{V} \text{, where}$$

$\tilde{E}$ is the estimate of numbers entrained during the three-month calendar season, and

$\dot{V}$ is the total volume (m^3) of water withdrawn during the three-month calendar season,

i.e., 13 times the average weekly water withdrawal volume: $\dot{V} = 13 \times \overline{V_w}$

Therefore, the estimates in Table 5 would overstate the numbers entrained during the entrainment sampling period by a factor of about 13,000:

$$\tilde{E} = \left(\sum_{w=samp_1}^{samp_2} D_w \right) \times \left(13 \times \overline{V}_w\right) = 13 \times 1000 \times \left(\sum_{w=samp_1}^{samp_2} \frac{D_w}{1000} \times \overline{V}_w \right) \doteq 13{,}000 \times \hat{E}$$

In addition, the estimate of total water withdrawn during each three-month calendar season apparently was not based on actual withdrawals in each year. The estimates in Table 5 apparently were based on the following values for total seasonal water withdrawals:

264,899,025 m^3 for Season 1 (January through March),

463,828,241 m3 for Season 2 (April through June), and

594,270,408 m3 for Season 3 (July through September).

(The use of these values generates the estimates reported in Table 5.)

The attached memo, prepared by ASA on 8/26/09, lists actual water withdrawal volumes. The discrepancies between the actual water withdrawals and those used for Table 5 introduce additional errors (albeit small compared to the errors generated by the other computational issues).

It should be noted that the three-month calendar seasons are artificial constructs that NRC super-imposed on the entrainment sampling data. The entrainment sampling designs were not intended to produce seasonal estimates based on three-month calendar seasons. The entrainment sampling periods were:

1981 – weeks 18 through 35,
1983 – weeks 18 through 33,
1984 – weeks 18 through 32,
1985 – weeks 17 through 32,
1986 – weeks 2 through 32, and
1987 – weeks 20 through 32.

These weeks of entrainment sampling were selected to bracket the periods of highest entrainment of most RIS. Accordingly, it is not valid to assume entrainment densities observed during these weeks are representative of entrainment densities in other weeks of the year.

Literature Cited

NRC 2009.Essential Fish Habitat Assessment.Indian Point Nuclear Generating Unit Nos. 2 and 3 License Renewal. Docket Nos. 50-247 and 50-286. U.S. Nuclear Regulatory Commission. Rockville, Maryland. April 2009.

NRC 2010.Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Supplement 38 Regarding Indian Point Nuclear Generating Unit Nos. 2 and 3. Final Report Public Comments Continued, Appendices. NUREG-1437, Supplement 38, Vol. 3. December 2010.

Comparison of Indian Point Cooling Water Flows in Entrainment and Impingement Files Provided to NRC

Prepared by ASA

In the impingement file provided to NRC, data were summarized by season. Seasons were defined as the yearly quarter (1, 2, 3, or 4) which include months Jan-Mar, Apr-June, July-Sep, and Oct-Dec respectively.

Data in the entrainment files are summarized by week, and include biological and flow data only for the weeks when sampling occurred. In order to compare flow totals in the two files, the entrainment flows were assigned to seasons as: weeks 1-13 (Season 1), 14-26 (Season 2), 27-39 (Season 3). This assignment does not exactly match the assignments for the impingement data.

Total flow from the entrainment file (converted to m^3 from the $1000m^3/min$ in the file) is typically less than flow from the impingement file (Table 1), because not all weeks were sampled for entrainment. The only exception was season 2 in 1986 in which the entire season was sampled for entrainment. Due to the way weeks were assigned to quarters for that year, the entrainment flow total for weeks 14-26 (April 6 – July 5) is slightly larger than the impingement flow which was based strictly on flow during the months of Apr-June.

Table 1 Comparison of Indian Point Seasonal Cooling Water Flow in Entrainment and Impingement Files Provided to NRC

Year	Season	Weeks Sampled for Entrainment and (# of unsampled weeks)	Total Seasonal Flow (m^3)	
			Based on Entrainment File provided to NRC	Based on Impingement File provided to NRC
1981	2	18-26 (4)	414,724,424	464,048,433
1981	3	27-35 (4)	476,309,004	594,880,676
1983	2	18-26 (4)	351,048,313	420,596,991
1983	3	27-33 (6)	232,587,827	427,693,336
1984	2	18-26 (4)	400,733,435	551,297,804
1984	3	27-32 (7)	188,994,568	400,204,962
1985	2	17-26 (3)	399,212,805	511,128,738
1985	3	27-32 (7)	187,169,923	400,359,374
1986	1	2-13 (1)	229,264,261	270,226,674
1986	2	14-26 (0)	399,552,568	378,622,376
1986	3	27-32 (7)	220,170,710	590,025,440
1987	2	20-26 (6)	235,429,460	386,131,723
1987	3	27-32 (7)	189,976,341	543,931,544