January 24, 2020

Submitted via Electronic Mail

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Re: Endangered Species List

Dear Mr. Racette,

We are writing on behalf of the Center for Biological Diversity, Riverkeeper, New York City Audubon, and Nadya Ali, to support the New York State Department of Environmental Conservation's (DEC) proposal to provide new or increased protections for 46 species through its lists of endangered, threatened, and special concern species. This proposal is particularly timely as the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services recently warned governments around the world that 1 million species are now at risk of extinction because of human activity. Urgent actions are needed to avert mass extinction in the coming decades. Yet, under the current administration, the U.S. Fish and Wildlife Service has extended protections to only 19 species under the federal Endangered Species Act, fewer than any other administration at the same point in the presidential term. Accordingly, we applaud DEC taking initiative and updating its list of state endangered and threatened species.

While we generally support the additions to the endangered, threatened, and special concern lists, we also urge you provide stronger protections for the Atlantic Coast leopard frog, eastern hellbender, American eel, American shad, eastern fence lizard, and eastern tiger salamander. In support of our request, we submit the following scientific information demonstrating that these species meet the listing criteria necessary to warrant stronger protection.

The Center for Biological Diversity is a national nonprofit organization dedicated to protecting imperiled species and wild places. The Center has more than 85,000 members and supporters in New York. Riverkeeper's mission is to protect the environmental, recreational, and commercial integrity of the Hudson River and its tributaries and safeguard the drinking water of nine million New York City and Hudson Valley residents. New York City Audubon is a grassroots community that works for the protection of wild birds and habitat in the five boroughs, improving the quality of life for all New Yorkers.

I. LEGAL BACKGROUND

New York State protects rare and imperiled species by adding them to its lists of endangered, threatened, and special concern species. Once listed as endangered or threatened, they receive an array of substantive protections, with the goal of recovering the species to the point where it no longer needs protection and may be delisted.

a. Listing

New York extends three levels of protection to imperiled species by adding them to lists of endangered, threatened, or special concern species. New York defines an "endangered" species as "a native species in imminent danger of extirpation or extinction in New York based on the criteria for listing in section 182.3(b) [of title 6 the New York Code of Rules and Regulations.]" *See* ECL § 11-0535(1); 6 NYCRR § 182.2(e). A "threatened" species is a "native species likely to become an endangered species within the foreseeable future in New York based on the criteria for listing in section 182.3(b)."[1] *See* ECL § 11-0535(1); 6 NYCRR § 182.2(y). To determine whether a species is endangered or threatened, DEC must consider the following factors:

1) Whether the current number of viable and self-sustaining populations of the species statewide is sufficient to ensure continued survival of the species in the state;
2) Whether the total number of reproducing individuals is currently sufficient to ensure the continued survival of the species in the state;
3) Whether the species is designated as a federal candidate species under the Federal Endangered Species Act or listed as endangered or threatened in any adjacent state or province;
4) Whether the species has declined non-cyclically throughout a significant portion of its range in New York;
5) Whether the present or threatened destruction, modification or curtailment of the species' habitat or range within the state threatens the continued survival of the species in New York;
6) Whether the overuse of the species for commercial, sporting, scientific, educational, or other purpose threatens the continued survival of the species in New York;
7) Whether disease, pollution, contaminants, predation, or interspecific competition threatens the continued survival of the species in New York;
8) The adequacy of existing regulatory mechanisms to protect the species or its habitat;

[1] New York also lists species as endangered or threatened if they are listed as endangered or threatened by the United States Department of the Interior in the Code of Federal Regulations. *See* ECL § 11-0535(1); 6 NYCRR § 182.2(e), (y).

9) Other natural or human-made factors affecting the species' continued survival within the state;

10) Whether the species is restricted geographically in New York; and

11) Whether the species' biology makes it highly susceptible to changes in its environment.

See 6 NYCRR § 182.3(b).

A "species of special concern" is a "native species of fish [or] wildlife found by the department to be at risk of becoming threatened in New York based on the criteria for listing in section 182.4(a)." *See* ECL § 11-0535(1); 6 NYCRR § 182.2(u). "Species of special concern do not qualify as either endangered or threatened . . . but . . . require some measure of protection to ensure that the species does not become threatened." *Id.*

According to DEC, a species of special concern is one that warrants attention and consideration but for which current information collected by the department does not justify listing as either endangered or threatened. To determine whether a species is a species of special concern, DEC must consider one or more of the following factors:

1) The species is designated as a federal candidate species under the Federal Endangered Species Act or is listed as threatened or endangered in three or more adjacent states or provinces;

2) The species is determined to be in some jeopardy due to adverse trends to which it is vulnerable, and if not monitored or ameliorated, could lead to more serious decline and listing as either an endangered or threatened species in New York;

3) The species appears to have undergone a serious, non-cyclical decline or could do so if protection or proactive management steps are not undertaken; and

4) The species is sufficiently uncommon or severely restricted in its range in New York that any reduction in its population or habitat may cause it to become threatened in the foreseeable future.

See 6 NYCRR § 182.4(a).

b. Protections

Once listed as endangered or threatened under New York's endangered and threatened species laws, species receive an array of protections for individuals and their habitat. For instance, New York law prohibits any person from "taking" an endangered or threatened species without a permit. *Id.* § 182.8. "Taking" includes "the pursuing, shooting, hunting, killing, capturing, trapping, snaring and netting of any species listed as endangered or threatened in this Part, and all lesser acts such as disturbing, harrying or worrying." *Id.* § 182.2(x). "Lesser acts" include harming, maiming, wounding or collecting any species listed as endangered or threatened, . . . any act which is likely to cause the death of or injury . . . , any adverse modification of habitat of any . . . , and any interference with or impairment of an essential behavior . . . ." *Id.* § 182.2(l). Specifically, a person may not alter occupied habitat of an endangered or threatened species where it "is likely to negatively affect one or more essential behaviors of such species." *Id.* § 182.2(b). Species of special concern do not automatically receive these protections, though state wildlife officials are authorized to regulate "the taking, importation, transportation, possession or sale of any species of special concern [they] deem[] necessary for the proper protection of such species." ECL § 11-0535.

c. Delisting

The ultimate goal for listing these species is to protect them so that they may recover to a point where they no longer need protections. A species may be downlisted from endangered to threatened, or from threatened to special concern, when "after applying the factors set forth in [section 182.3(b)], the department determines that the species no longer qualifies for" its existing listing status. 6 NYCRR § 182.3(d). A species may be removed from the list of species of special concern when "after applying the factors set forth in [section 182.4(a)] subdivision (a) of this section, the department determines that the species no longer qualifies as a species of special concern. *Id.* at § 182.4(b).

II. THE ATLANTIC COAST LEOPARD FROG SHOULD BE LISTED AS ENDANGERED.

While we are pleased that DEC is formally recognizing the Atlantic Coast leopard frog (*Rana [Lithobates] kauffeldi*) as a distinct species and one of special concern in New York, the best available science indicates that the species should be protected as endangered or threatened. The Atlantic Coast leopard frog was only recently discovered in 2012 (Newman et al. 2012) and described as a new species from a site on Staten Island, New York City, in 2014 (Feinberg et al. 2014). Although just recently discovered, this cryptic species is already at risk of extinction in parts of its range, including New York, Connecticut, and Pennsylvania.

In New York, the decline of the Atlantic Coast leopard frog has been particularly well documented over recent decades, with widespread extirpations identified across much of its historical range (Klemens et al. 1987, Kiviat 2011, Newman et al. 2012, Feinberg et al. 2014, Nicholls et al. 2017). As explained in detail below, these declines are likely due to a combination of factors including habitat loss, succession, invasion, and alteration; metapopulation disruption (by roads and fragmentation); disease; contaminants; and climate change including sea-level rise and saline intrusion (Schlesinger et al. 2018). Crucially, in coastal New York, where the most severe declines have occurred, unique ephemeral wet-meadow systems have become extremely uncommon and remain largely unprotected today, as evidenced by the recent filling of 100+ acres of prime breeding habitat at the SIMD/380 Development Site on Staten Island (NYC Audubon et al. 2017). These disappearing systems are key habitat for the Atlantic Coast leopard frog (Feinberg et al. 2014). Despite the species' vulnerability to current and future threats, the Atlantic Coast leopard frog does not receive protections under the federal Endangered Species Act, 16 U.S.C. § 1531 *et seq.*, or New York's endangered and threatened species laws, ECL § 11-0535(1); 6 NYCRR Part 182.

a. Species Background

i. Natural History

The Atlantic Coast Leopard frog is a medium-sized green-to-brown frog with leopard-like spots across its dorsum (Feinberg et al. 2014). It was first discovered in 2012 on Staten Island, New York, after having been previously confused for either of two closely related (and similar looking) species, the northern (*R. pipiens*) and southern (*R. sphenocephala*) leopard frog (Newman et al. 2012). While scientists originally thought the new species occurred exclusively in and around New York City, they soon discovered it had a larger, albeit narrow, coastal range from central Connecticut to northeastern North Carolina (Feinberg et al. 2014, Schlesinger et al. 2018). Throughout its range, the Atlantic Coast leopard frog is a habitat specialist, occurring primarily in coastal freshwater wetlands, tidal backwaters, and slow-moving riparian floodplain corridors (Feinberg et al. 2014, Schlesinger et al. 2018).

In New York State, spring breeding can occur from early March to early May, with activity commonly peaking for 2-3 weeks between late March and early-to-mid April (Feinberg et al. 2014). The Atlantic Coast leopard frog sometimes exhibits a second wave of breeding with the onset of cooler temperatures and heavy rains in late August, September, and October (Feinberg et al. 2014). During the breeding season, adult frogs congregate in concentrated groups, or leks; males call while floating in shallows with emergent vegetation, and females lay egg masses clustered in groups or near one another (Feinberg et al. 2014).

Little is known about non-breeding activity or dispersal for Atlantic Coast leopard frogs, but leopard frogs have been described as being fairly terrestrial on Staten Island (Feinberg et al. 2014). Diet is not specifically known but presumed to be similar to those reported for other regional leopard frog species (Feinberg et al. 2014).

ii. Status

In New York State, the Atlantic Coast leopard frog once occurred in at least 50-100 separate populations across 11 counties (Suffolk, Nassau, Queens, Kings, Manhattan, Richmond, Bronx, Westchester, Rockland, Orange, and Putnam); today, the species has declined dramatically (Klemens et al. 1987, Kiviat 2011, 2012, Newman et al. 2012) and is only known from fewer than 10 extant populations in three scattered counties (Richmond, Orange, and Putnam) (Schlesinger et al. 2018). The species now appears to be entirely extinct from Long Island, once considered a stronghold for leopard frogs in New York State (Schlauch 1978). The species also appears to be extinct from all other coastal islands and counties in New York State except for Staten Island (Mattei 2006), where three extant populations survive today (J. Feinberg, pers. comm.).

All three Staten Island populations are at considerable risk of extirpation. The largest of these populations occurs at the SIMD/380 Development site where the species was first discovered and described and where 100+ acres of prime ephemeral breeding habitat were recently filled to make way for a 330-acre warehouse and industrial park (NYC Audubon et al. 2017).[2] Another

[2] Plans for the development are publicly available online. *See* Staten Island Marine Development, *Development Plan*, http://simd.com/simd-development-plan/ (last visited Jan. 22, 2020).

population on Staten Island is alarmingly small, highly isolated, privately owned, and in an area of limited habitat (J. Feinberg, pers. comm.). The third population is tenuously protected as New York City parkland but has limited open-canopied habitat and is surrounded by heavy urbanization, roads, and ongoing development of adjacent non-protected natural habitats.[3]

iii. Overview of Threats

Because the Atlantic Coast leopard frog is a newly described species, a comprehensive understanding of threats and decline drivers is only recently starting to emerge. Several factors including disease, habitat invasion and succession, and contaminants have been assessed on Long Island. Among those factors, disease appears to have had a particularly important role as evidenced by die-offs of enclosure-raised tadpoles from three outstanding causes: chytridiomycosis (caused by chytrid fungus), ranavirus, and pathogenic perkinsea infections (Feinberg and Burger 2017, Schlesinger et al. 2018). There has also been a steep decline in open-canopied freshwater coastal marshlands in New York State, particularly on Long Island (Newman et al. 2012, Feinberg et al. 2014). Likewise, urban development has fragmented habitat and leopard frog populations (Klemens et al. 1987, Feinberg et al. 2014). Because dense breeding groups and strong metapopulation structure appear to be essential features of Atlantic Coast leopard frog demography (Feinberg et al. 2014), fragmentation, isolation, and associated road impacts (e.g. roadkill, runoff) could significantly harm existing populations.

Broader scale climatic events, including rising sea levels and increased storm frequencies and intensities, have the ability to alter coastlines and threaten proximate low-lying freshwater wetlands and any amphibian populations therein with saline inundation (Case et al. 2015). Such was the case when Hurricane Sandy overwashed most leopard frog populations in the New York-New Jersey coastal region in 2012 (Feinberg et al. 2015). Although there were significant increases in salinity levels after the storm, that single flooding event did not appear to cause any direct population extirpations. However, other population effects remain unclear and increasingly frequent salinity events and/or conversion to estuarine habitat would certainly have catastrophic effects on individual populations, especially those without alternative freshwater habitats to migrate to. An increase in emergence of the aforementioned chytrid fungus has also been linked to climate change, as climate variability and extreme weather events appear to provide an advantage to pathogens (Rohr and Raffel 2010). This phenomenon is contributing to the decline of amphibians worldwide (Rohr and Raffel 2010).

b. The Atlantic Coast leopard frog meets the listing criteria required to be listed as endangered or threatened.

The Atlantic Coast leopard frog should be listed as endangered, or in the alternative threatened, because it meets the listing criteria set out in the New York Endangered and Threatened Species Regulations. Each of these factors is explained in detail below.

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[3] Plans to develop existing habitat areas are publicly available online. *See* Push for Development at Teleport Complex, https://www.wsj.com/articles/push-for-development-at-teleport-complex-1421718602 (last visited Jan. 14, 2019); *See* Planning Commission Approves Sale of 8.5 Acres for New Commercial Commons. https://www.citylandnyc.org/staten-island-industrial-park-cpc-approves/ (last visited Jan. 14, 2019).

i. The current number of viable and self-sustaining populations of Atlantic Coast leopard frog does not appear to be sufficient to ensure the continued survival of the species in the state.

The number of Atlantic Coast leopard frog populations is both unstable and declining. First, Atlantic Coast leopard frog populations are largely unstable because habitat fragmentation isolates interdependent populations. Over recent years, observational data across the entire range of the species indicate that most populations display two common features: (1) they tend to harbor large aggregations of frogs that are often concentrated in dense breeding groups that may include 100+ frogs in larger populations; and (2) they encompass broad areas of habitat (typically 10+ acres in size). (Feinberg et al. 2014). Within areas of occurrence, smaller satellite breeding groups are often found; however, those groups are likely inextricably linked to—and perhaps repopulated regularly by—larger overall surrounding metapopulations (Feinberg et al. 2014). Normal metapopulation functioning in this species is likely destabilized when habitats are heavily fragmented, as fragmentation severs the smaller satellite breeding groups from the overall metapopulation (Feinberg et al. 2014; J. Feinberg, pers. comm.).

In addition to being unstable, Atlantic Coast leopard frog populations also reflect historic and ongoing declines in New York State, with the total number of populations contracting from at least 50-100 historical populations across eleven counties to fewer than seven current indepndent populations across three disjunct counties (Feinberg et al. 2014; J. Feinberg, pers comm.). In some cases, these declines are due to the sheer loss and degradation of habitat. On Long Island, for instance, western populations historically occurred in once-vast wetland habitats that no longer exist today (e.g., Flushing Meadows, Middle Village, Jamaica, Valley Stream, Glen Cove, Levittown) (J. Feinberg, pers. comm.). Farther east, where larger areas of undeveloped land still remain, some former habitats have succeeded to closed-canopy systems or become uninhabitable, possibly due to disease and/or increased salinity levels (J. Feinberg, pers. comm.).

ii. Available information indicates the total number of reproducing individuals is not sufficient to ensure the continued survival of the species in the state.

Among the seven extant metapopulations remaining in New York State, only one (Putnam) is known with certainty to harbor a large and robust Atlantic Coast leopard frog population. Another population, located at the SIMD/380 Development Site on Staten Island, was likely the largest overall population in New York State. However, the recent filling of 100+ acres of prime breeding habitat for a large-scale development project[4] had clear impacts on that population both in terms of geographic extent and overall numbers of frogs based on chorus size (J. Feinberg, unpublished data). The three extant Staten Island populations likely descend from a single original metapopulation but are essentially all independent from one another today due to highway and industrial fragmentation (J. Feinberg, pers. comm.). Accordingly, these populations may lack the necessary connectivity to remain viable over the long term; as such, the entire coastal population

[4] *See* Tracey Porpora, *New 200-acre industrial park to be developed on West Shore*, SiLive.com, Feb. 26, 2016, http://www.silive.com/northshore/index.ssf/2016/02/200_acres_to_be_developed_in_w.html (last visited Jan. 28, 2018); *see also* Staten Island Marine Development, *Development Plan*, http://simd.com/simd-development-plan/ (last visited Jan. 28, 2018).

segment of the Atlantic Coast leopard frog in New York should be considered unstable and vulnerable.

The four mainland populations in New York (Orange and Putnam counties) appear to be well protected in terms of coastal flooding and threats from imminent development; however, one population is on private property. Moreover, little is known about population size or stability of the three Orange county populations (J. Feinberg, pers. comm.).[5] While all four of these mainland populations appear to have adequate habitat protection, they may be vulnerable to disease outbreak and other non-habitat-dependent stressors. To determine whether these populations are viable and self-sustaining, further studies are required.

iii. *The Atlantic Coast leopard frog is not designated as a federal candidate species under the federal Endangered Species Act but is listed as endangered species in Pennsylvania and recommended for listing in Connecticut.*

The DEC had listed the southern leopard frog as a species of special concern, and it still remains on the list today. However, it is now believed that records of southern leopard frogs were actually the Atlantic Coast leopard frog misidentified.[6] Although both species may have co-occurred on Long Island historically, there is no clear evidence confirming southern leopard frogs were ever actually present on Long Island (Feinberg et al. 2014; J. Feinberg, pers. comm.).

The Atlantic Coast leopard frog has not received a federal endangered or threatened designation[7]; however, it did recently receive endangered status in neighboring Pennsylvania and is presently recommended and being considered for threatened or endangered status in Connecticut (D. Quinn pers. comm.).[8] Other than New Jersey, where the species is considered secure, the Atlantic Coast leopard frog is not known to occur in any other neighboring state (Schlesinger et al. 2018).

iv. *The Atlantic Coast leopard frog has likely declined non-cyclically throughout a significant portion of its range in New York State.*

Historically, Atlantic Coast leopard frog populations were robust and stable within their ranges, including places like Long Island (Latham 1971, referring to what is now considered *R. kauffeldi*) where the species in now believed to be extinct (Schlesinger et al. 2018). Recent declines in northern parts of their range (Newman et al. 2012) are more drastic than can be attributed to natural fluctuations. Disruptions to metapopulation structure from anthropogenic factors such as development and habitat fragmentation can leave isolated populations stranded

[5] Populations at the three remaining sites occur largely or partially within private property and are thus difficult to access and assess.
[6] *See* 6 NYCRR § 182.5(c)(4)(vii)(2018) (listing the southern leopard frog, rather than the Atlantic Coast leopard frog, as a species of special concern); *see also* New York State Department of Environmental Conservation, List of Endangered, Threatened and Special Concern Fish & Wildlife Species of New York State, http://www.dec.ny.gov/animals/7494.html (last visited Jan. 28, 2018).
[7] *See generally* U.S. Fish and Wildlife Service, Environmental Conservation Online System, https://ecos.fws.gov/ecp/ (last visited Jan. 28, 2018).
[8] Pennsylvania Fish and Boat Commission, Threatened & Endangered Species, http://www.pacodeandbulletin.gov/Display/pacode?file=/secure/pacode/data/058/chapter75/s75.1.html&d=reduce (last visited Jan. 16, 2020)

and too small to reconnect with other interdependent populations (J. Feinberg, pers. comm.). Moreover, field trials demonstrated clear *R. kauffeldi* die-offs due to multiple diseases (Feinberg and Burger 2017, Schlesinger et al. 2018) and historical literature and museum specimens reveal wider former distributions across the northeastern states of New York, New Jersey, Connecticut, and Pennsylvania (J. Feinberg, pers. comm.).

v. The present and threatened destruction, modification, or curtailment of the Atlantic Coast leopard frog's habitat in New York threatens the survival of the species in the state.

Habitat destruction and degradation is one of the greatest known threats to the Atlantic Coast leopard frog. The species' specialized habitat, which includes coastal freshwater marshes, ephemeral wet meadows, and interior riparian floodplains, is particularly susceptible to historical and ongoing urban development. The most recent example of habitat loss is occurring currently at the former GATX site, now known as the Staten Island Marine Development (SIMD) site or 380 Development Site, a 676-acre parcel located in northwestern Staten Island, New York City, where the species was first discovered in 2012. The site was previously home to a large fuel-tank field that operated during much of the 20th century and featured tanks arranged in grids of 4.5-acre cells that often retained standing water, which likely served as breeding habitat for the Atlantic Coast leopard frogs (Figure 1a). The tanks were subsequently removed, and the site remediated in the early 2000's, making it the largest undeveloped land parcel in New York City. Over time, the remediated fuel-tank areas reverted to unique wet-meadow ecosystems that covered more than 100 acres in total (Figure 1b) and supported robust populations of flora and fauna including the Atlantic Coast leopard frog (Mattei 2006, NYC Audubon et al. 2017).

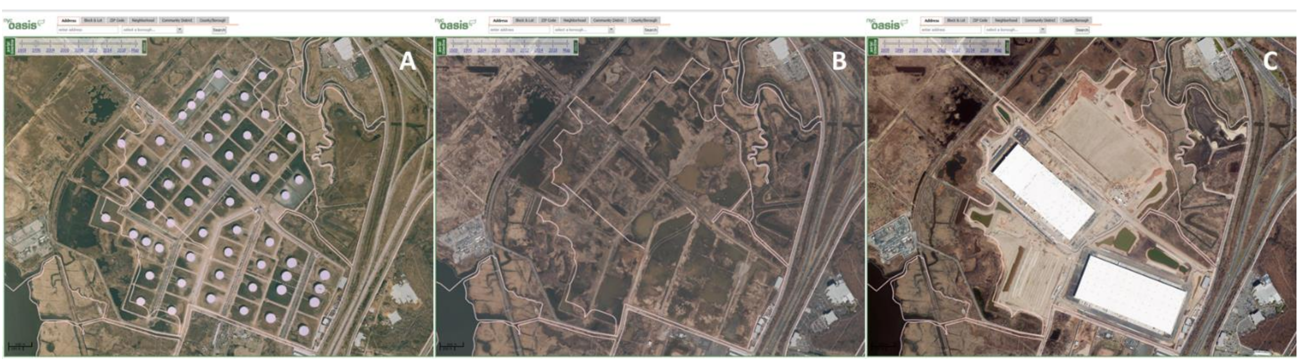

Figure 1. Views of the GATX/SIMD/380 Development Site in 1996 (a), 2014 (b), and 2018 (c).

When the frog was first discovered there, plans were already forming between the landowners, developers, and DEC to fill the remediated fuel-tank areas to create an elevated warehouse district atop 10-25 feet of fill. At that time, the Atlantic Coast leopard frog was actively occurring and breeding in those specific areas at extremely high densities (NYC Audubon et al. 2017). Within this habitat, two particular breeding areas became central to the species' 'type locality'—the specific location from which the frog was actually discovered and formally described (NYC Audubon et al. 2017). Tens of thousands of Atlantic Coast leopard frog tadpoles were apparently killed during construction because their ponds were filled during the species' larval period (NYC Audubon et al. 2017). As a result of these actions, most of the best habitat for the species lost, leaving less ideal permanent and deeper wetlands for the frog to breed in and fragmenting remaining key breeding sites from one another (NYC Audubon et al. 2017).

The habitat impacts that occurred on Staten Island are not unique. The loss of Atlantic Coast leopard frog populations in Richmond, Queens, Kings, Bronx, and Nassau counties can almost certainly all be attributed to the combined impacts of development and fragmentation (Feinberg et al. 2014; J. Feinberg, pers. comm.). This pattern likely explains the many pockets of leopard frogs reported in the 1970s-1990s on Long Island, all of which are gone today (Feinberg et al. 2014).

Continued commercial and residential development due to NYC's projected population growth and unsound development practices (e.g. unnecessarily large parking lots or non-decked parking) may spawn more development of the Atlantic Coast leopard frog's habitat. By 2040, New York City's population is expected to increase by over 700,000 people—an almost 10% increase. (NYCDCP 2013). New York City plans to build at least an additional 240,000 housing units across the five boroughs to accommodate this growth (NYCDCP 2013). A growing population will also inevitably spur economic growth and activity, particularly in industries such as retail, food services, and home care, which will require additional commercial development (OneNYC undated). For example, Staten Island's North Shore redevelopment project will bring more development, including tourist attractions, recreational parks, residential units, retail spaces, and shopping outlets, into a largely undeveloped area (NYCEDC, Downtown Staten Island report; NYCEDC, North Shore Plan). This continued growth, untempered by adequate consideration and balancing of conservation concern, will continue to restrict and degrade suitable habitat for the Atlantic Coast leopard frog. Likewise, broad commercial development in areas in or adjacent to natural areas will continue to contribute to habitat loss and degradation, habitat invasion by predators (e.g., bullfrogs and fishes) and pathogens, increased runoff from roadway surfaces, and greater metapopulation fragmentation.

vi. *The overuse of the species is potentially a threat to its continued survival in New York.*

Atlantic Coast leopard frog populations are potentially vulnerable to overuse. Several Long Island populations were linked to reports of historical collection for scientific supply houses; however, little evidence exists to corroborate these anecdotal reports beyond first-hand accounts from local residents (J. Feinberg, pers. comm.). Prospectively, the widespread media coverage of the Atlantic Coast leopard frog's improbable discovery in New York City[9] could make it a potential target for exploitation. Furthermore, as urban development increases, and likewise the interface between urban and natural environments, there will be increased opportunities for access to habitats and potential collection by hobbyists. With increased access and widespread knowledge of the species' uniqueness, rarity, and locations, exploitation could increase. More research is needed to determine whether collection is a current or future threat to the species.

[9] In 2014, the Atlantic Coast leopard frog's discovery was covered in many major outlets across the country. *See, e.g.*, Brandon Griggs, *New Species of Frog Found in . . . NYC*, CNN, https://www.cnn.com/2014/10/31/us/frog-species-new-york/index.html (Oct. 31, 2014); Deborah Netburn, *New species of frog found in New York City – first time since 1882*, LA Times, http://www.latimes.com/science/sciencenow/la-sci-sn-new-york-city-frog-20141029-story.html (Oct. 29, 2014).

Commercial collection of leopard frogs (*sensu lato*) by biological supply companies for dissections and scientific research is well documented across many parts of the United States and continues in some capacity to this day (S. Rasband, pers. comm.). Scientific literature documents historical and recent collection of wild leopard frogs in the northeastern United States, including northern portions of New York State, for scientific research (S. Rasband, pers. comm.; e.g., Weir et al. 2014, Phillipsen et al. 2011, Longcore et al. 2007, Gibbs et al. 2005, Hoffman et al. 2004, Clark et al. 1968, Linzey 1967, Hutchinson and Dady 1964, Whitaker 1961). The extent to which this industry both existed and impacted historical Atlantic Coast leopard frog populations in New York State is largely unknown. However, during a large-scale survey effort to assess the apparent extinction of leopard frogs from Long Island, NY, J. Feinberg (pers. comm.) learned of at least one reported commercial collection location for leopard frogs as detailed by a resident. The resident explained that leopard frogs were once common in the wetland across the street from his home on the north shore of Long Island, Suffolk County, but that the frogs later declined and ultimately vanished, perhaps as a result of the crew of collectors who would repeatedly visit the site and collect large quantities of the frog, reportedly for a scientific supply house.

vii. Other threats including disease, predation, and exposure to contaminants threaten the continued survival of the Atlantic Coast leopard frog in New York.

Among the 90 or more extirpated Atlantic Coast leopard frog populations in New York State, disease and/or contaminants almost certainly played a major role in in some cases particularly where habitats remain largely intact today and/or free of alterations from human activity and/or natural succession. On Long Island, researchers found the presence and direct impacts of three major anuran diseases on *R. kauffeldi* tadpoles raised in experimental enclosures (Feinberg and Burger 2017, Schlesinger et al. 2018). These diseases included chytridiomycosis resulting from chytrid fungus (*Batrachochytrium dendrobatidis*), ranavirus, and perkinsea, all of which have been linked to amphibian die-offs and/or global declines (Daszak et al. 1999, Daszak et al. 2003, Skerratt et al. 2007, Lesbarrères et al. 2011, Chambouvet et al. 2015). These diseases wiped out most or all of the tadpole cohorts used in field trials repeated four times over six sites and three years (2007-2009). In most cases only one disease affected a particular cohort during a particular site trial, but in several cases, multiple concurrent diseases were documented from a single site trial (Feinberg and Burger 2017). The threat of disease may be amplified by increased human access as development encroaches on leopard frog habitat, increasing the likelihood of incidental disease transmission through human transport. Climate change has also been implicated in stimulating the emergence of infections amphibian diseases (Raffel et al. 2013, Rohr & Raffel 2010, Li et al. 2013).

Contaminants and pollution are known to have a large range of negative effects on amphibian populations. Pesticides, herbicides, fungicides, and fertilizers from agricultural runoff have been correlated with a general decline in a number of amphibian species (Gardner 2001), as well as the feminization of male frogs in the closely related northern leopard frog (Hayes et al. 2002, 2003). Experimental studies have also reported negative effects of polychlorinated biphenyls (PCBs) on feeding rates and larval development in several amphibians (Gutleb et al. 2000, Glennemeier & Denver 2001). Dietary exposure to mercury has also been shown to have adverse effects on developing southern leopard frogs, which may contribute to population impacts, particularly when exacerbated by other factors such as habitat destruction, disease, and climate change (Unrine et al. 2004). Exposure to copper has also had demonstrated negative effects on the survival and development of southern leopard frog embryos and larvae (Lance et al. 2012). Road salt has also been shown to impact embryonic and larval survival among amphibians in New York State (Karraker et al. 2008) and is a concern that is certainly amplified in urban areas with more roads.

Tests for contaminants on Atlantic Coast leopard frog populations have also been conducted, although it has proven difficult to sample for extremely short-lived pesticides. Data from more persistent chemicals and heavy metals have been collected from the same sites where the disease work was conducted and a variety of contaminants were found in both enclosure-raised tadpoles and native amphibians that naturally occur at those sites (Lockett et al. 2018, J. Feinberg and J. Burger, unpublished data).

Fish stocking may also negatively impact Atlantic Coast leopard frog populations in New York. Fish stocking and introduced fish are universally known to negatively impact amphibians, causing population declines and extirpations (e.g., Knapp and Matthews 2000, Pilliod and Peterson 2001, Pilliod et al. 2010, Knapp et al. 2001, Bradford et al. 1993, Rosen et al. 1995, Matthews et al. 2001, Denoel et al. 2005, Martínez-Solano et al. 2003, Tiberti and von Hardenberg 2012, Cruz et al. 2015, Hamer et al. 2002, Gillespie 2001, Smith et al. 2013, Hartel 2007, Sexton and Phillips 1986). Introduced predatory fish can impact amphibians through direct predation, competition (Eby et al. 2006, Finlay and Vredenburg 2007), and disease transfer (Kiesecker et al. 2001, Mao et al. 1999, Petrisko et al. 2008).

The DEC annually releases approximately 900,000 pounds of fish into more than 1,200 public streams, rivers, lakes and ponds across the state to enhance recreational fishing opportunities and restore native species to waters they formerly occupied.[10] In 2017, DEC released approximately 6,600 fish in Rockland County; 4,200 fish in Nassau County; 35,700 fish in Orange County; 18,700 fish in Suffolk County; 10,300 in Westchester County; and 25,200 in Putnam County.[11] DEC also runs 12 fish hatcheries that raise walleye and several trout, salmon, and muskellunge species.[12] Private landowners may also stock private waters after applying for a stocking permit.[13] These fish introductions could negatively impact Atlantic Coast leopard frog populations through increased competition for invertebrate prey and direct predation on tadpoles and frogs.

At Connetquot River State Park on Long Island—an historical location for the Atlantic Coast leopard frog—both a fish hatchery and long-standing trout-stocking program exist.[14] Despite vast

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[10] New York State Department of Environmental Conservation, Fish Stocking, http://www.dec.ny.gov/outdoor/7739.html (last visited Feb. 6, 2018) [hereinafter NY Fish Stocking].
[11] New York State Department of Environmental Conservation, Spring 2017 Trout Stocking for Rockland County, http://www.dec.ny.gov/outdoor/23294.html (last visited Feb. 6, 2018); *id.* at http://www.dec.ny.gov/outdoor/23311.html; *id.* at http://www.dec.ny.gov/outdoor/23300.html; *id.* at http://www.dec.ny.gov/outdoor/23286.html; *id.* at http://www.dec.ny.gov/outdoor/23278.html; *id.* at http://www.dec.ny.gov/outdoor/23296.html.
[12] See NY Fish Stocking.
[13] *Id.*; New York State Department of Environmental Conservation, Stocking Privately Held Waters, http://www.dec.ny.gov/outdoor/57966.html (last visited Feb. 6, 2018).
[14] *See, e.g.*, Friends of Connetquot River State Park Preserve, Press Release, *Hatchery to Reopen and Restore Trout Fishing on Connetquot River State Park*, http://www.friendsofconnetquot.org/IPNNews.asp (Oct. 23, 2014).

expanses of ideal riparian habitat throughout the park, leopard frogs have been absent since at least the early 2000s (J. Feinberg, unpublished data). Moreover, recent bioacoustic surveys (2017) returned no frog calls along the river in early March. These results indicate not only the absence of leopard frogs but also the absence of the otherwise extremely common spring peeper (*Pseudacris crucifer*), which was absent from all survey locales aside from one backwater wetland near Bunces Bridge (J. Feinberg, unpublished data). Similar bioacoustic survey results, pointing to the absence of both leopard frogs and spring peepers, were documented by Feinberg (unpublished data) at fish-stocked wetlands in Belmont Lake State Park, along the Nissequogue River in Caleb Smith State Park, and along the Carmans River in Southaven County Park; all of which are historical Atlantic Coast leopard frog locales. Although it is impossible to conclusively link the disappearance of leopard frogs to fish-stocking directly in these cases—especially when other factors were likely at play across Long Island—the absence of the highly abundant spring peeper is noteworthy and suggests that fish stocking programs may pose some impact to Long Island frog populations.

viii. Existing regulatory mechanisms are inadequate to protect the Atlantic Coast leopard frog and its habitat.

Existing regulatory mechanisms fail to protect the Atlantic Coast leopard frog and its habitat from continued human impacts. The Atlantic Coast leopard frog is not listed as endangered or threatened either federally or in New York State, meaning it receives no species-specific protections.[15] Although the Atlantic Coast leopard frog is listed as a High Priority Species of Greatest Conservation Need in DEC's Draft Final State Wildlife Action Plan (DEC 2015), this listing has not afforded the species any meaningful protections. The absence of formal protection as endangered or threatened has led to direct mortality and large-scale habitat destruction as seen historically across Long Island and recently on Staten Island where several major projects have occurred at sites known or likely to support leopard frogs.[16,17,18,19] If the Atlantic Coast leopard frog had been protected as threatened or endangered, wildlife officials would be required to consider impacts of development on the species and its habitat before issuing permits. *See generally* 6 NYCRR, Part 182.

As evidenced by the historical and ongoing loss of the Atlantic Coast leopard frog's wetland habitat, more general environmental laws such as the National Environmental Policy Act, 42 U.S.C. § 4321 *et seq.*, and Section 404 of the Clean Water Act, 33 U.S.C. § 1344, which governs the filling of wetlands, have also failed to protect critical habitat. This is particularly true where

[15] The "special concern" listing given to the southern leopard frog does not benefit the Atlantic Coast leopard frog because they are now understood to be distinct species.
[16] SIMD / 380 Development Project. *See* Staten Island Marine Development, Development Plan, http://simd.com/simd-development-plan/ (last visited Jan. 28, 2018).
[17] Teleport Development Project. *See* Planning Commission Approves Sale of 8.5 Acres for New Commercial Commons, https://www.citylandnyc.org/staten-island-industrial-park-cpc-approves/ (last visited Jan. 14, 2020).
[18] Old Place Creek Wetland Mitigation Project. *See* A remote corner of Staten Island braces for major changes, https://ny.curbed.com/2018/10/11/17963696/staten-island-new-york-wetlands-restoration-amazon-photos (last visited Jan. 19, 2020).
[19] South Avenue Retail Project. *See* Project Information: Forest & South Avenues Retail Development, https://a002-ceqraccess.nyc.gov/ceqr/ProjectInformation/ProjectDetail/9827-17DCP030R (last visited Jan. 19, 2020).

the Atlantic Coast leopard frog occurs in isolated and ephemeral wetlands not typically protected by federal law.

New York's Freshwater Wetlands Act, ECL §§ 24-0101–24-1305, is also inadequate to protect the Atlantic Coast leopard frog's habitat because the law only provides protection to wetlands larger than 12.4 acres, and many of the frog's ephemeral wetlands are unlikely to be large enough to qualify for protection. Moreover, simply protecting wetland habitat from urban development, without active habitat management, may be inadequate to protect the species as open canopied wet meadows can succeed to close-canopied conditions within a few decades (*see* Howell et al. 2019).

ix. Other natural or human-made factors threaten the Atlantic Coast leopard frog's continued survival in New York.

Given that the Atlantic Coast leopard frog occurs in one of the most urbanized regions on earth, roadways almost certainly have impacts on the species through habitat fragmentation, vehicular mortality, and contaminated runoff (e.g., road salts, petrochemicals, etc.). Although such factors have not been studied specific to the Atlantic Coast leopard frog, they have been linked to a wide range of impacts on other amphibians (Glista et al. 2007, Egea-Serrano et al. 2012, Croteau et al. 2008), and severe road mortality events have been observed on Staten Island during migratory periods (J. Feinberg, pers comm). Moreover, the species exhibits strong metapopulation structure (Feinberg et al. 2014) and, as such, may be severely disrupted by roads especially in places like Staten Island where major highways now separate all remaining populations—which were likely part of one large historical metapopulation.

The Atlantic Coast leopard frog will also likely be negatively impacted by the multifaceted effects of climate change, including rising temperatures, increasing frequency of heat waves, increasing frequency of extreme storm and flooding events and general sea-level rise. Climate change may also exacerbate existing threats such as disease and habitat degradation (Corn 2005, Li et al. 2013, Rohr and Palmer 2013).

Coastal regions such as those in southeastern New York are particularly threatened by increased flooding due to sea level rise and storm surge events. Global average sea level rose by seven to eight inches since 1900, and sea level rise is accelerating in pace (USGCRP 2017). The 2017 Climate Science Special Report estimated that global sea level is likely to rise by 1.0 to 4.3 feet by the end of the century relative to the year 2000, with sea level rise of 8.2 feet possible (USGCRP 2017). This poses a real threat to coastal populations of the Atlantic Coast leopard frog, especially in a place like New York, where little alternative freshwater habitat remains for imperiled populations to migrate to (Lawler et al. 2010, Feinberg et al. 2014).

Sea-level rise caused by climate change will directly impact the Atlantic Coast leopard frog. Eighty-nine percent of *R. kauffeldi* locations were found within 20 km from the ocean, bays, and estuaries (Schlesinger et al. 2018). Storms may cause saltwater inundation into freshwater habitats. In some places, such as Oyster Pond in Montauk, the last confirmed site for the Atlantic Coast leopard frog on Long Island, sea-water inundation may have inextricably altered the habitat beyond sustainability (J. Feinberg, pers. comm.). Storms along the Delaware Bay caused altered coastlines that allowed for inflow of saltwater, which was believed to have led to the disappearance of large calling choruses of the Atlantic Coast leopard frog in that area (Schlesinger et al. 2018).

North Atlantic hurricane activity has increased since the 1970s in parallel with rising sea surface temperatures (Elsner et al. 2008, Saunders et al. 2008, USGCRP 2017). As the climate warms, hurricane and typhoon intensity is projected to continue to increase, as is the frequency of the most intense storms (Bender et al. 2010, USGCRP 2017). Hurricane-generated storm surge events have also become more frequent and severe in recent years (Komar et al. 2012; Grinsted et al. 2012) and major storm events like Hurricane Sandy—which struck New York only months after the Atlantic Coast leopard frog was first identified in 2012—have already doubled in response to climate warming during the 20th century (Grinsted et al. 2013). Atlantic hurricane surge events are projected to increase in frequency by twofold to sevenfold for each 1°C in temperature rise (Grinsted et al. 2013). In the case of Hurricane Sandy, all coastal wetlands with populations of Atlantic Coast leopard frogs appear to have been over-washed by tidal flooding and exhibited elevated post-storm salinity levels as a result (Feinberg, Kiviat, Schlesinger, and Burger, in prep).

Climate change has also been implicated in stimulating the emergence of infectious amphibian diseases. Increases in climate variability and extreme weather events resulting from climate change appear to provide an advantage to pathogens, such as chytridiomycosis (chytrid fungus) which is driving amphibian declines worldwide (Rohr & Raffel 2010). Raffel et al. (2013) found a causal link between increased temperature variability and chytrid-induced mortality in frogs, which in the context of other studies linking chytrid outbreaks to temperature shifts, provides compelling evidence for a climate-change role in amphibian mortality from chytrid fungus (Li et al. 2013). Several recent studies indicate a role of climate change in amphibian population declines, in combination with other stressors (Rohr & Raffel 2013).

x. The Atlantic Coast leopard frog is restricted geographically in New York.

The Atlantic Coast leopard frog is restricted geographically to the southeastern corner of New York State (Feinberg et al. 2014). Today, this species occurs in only three disjunct counties: Richmond, Orange and Putnam. This restricted range, in a largely developed and fragmented area, makes the Atlantic Coast leopard frog vulnerable to extirpation in the state, especially in the coastal population segment, which includes three remaining populations—all on Staten Island.

xi. The Atlantic Coast leopard frog's biology makes it highly susceptible to changes in its environment.

Amphibians have experienced drastic global declines in recent decades from both direct and indirect human impacts. Fundamentally, these declines are due in large part to biological limitations in how amphibians handle such impacts. In the case of the Atlantic Coast leopard frog, its complex habitat needs and metapopulation structure leave it particularly vulnerable to the effects of habitat loss, fragmentation, and succession as well as road mortality and impacts from genetic drift (Gardner 2001, Feinberg et al. 2014, Schlesinger et al. 2018). Amphibians also have highly permeable skin and rely on external sources to regulate body temperature, making them susceptible to environmental contaminants and changes in climate (Collins and Crump 2009).

Likewise, amphibians' gelatinous eggs are susceptible to desiccation (Dickerson 1969). Also, because many amphibians are small-bodied and slow-moving compared to other vertebrates, they are unable to respond to rapid changes in their environments via rapid movements (e.g. to avoid automobiles) or long migrations to find new suitable habitats (Babbitt 2005, Gibbs 1998, Trenham et al. 2003). These collective traits make amphibians prone to local extinction, particularly when their habitat is heavily impacted by human activities (Trenham et al. 2003; Nicholls et al. 2017).

The biology of amphibians also makes them particularly susceptible to the effects of invasive species. Introduction of invasive competitors and predators has also had a significant effect on population sizes and has even led to the collapse of entire communities (Fellers and Drost 1993, Fisher and Schaffer 1996, Hecnar and M'Closkey 1996). On Staten Island, where a series of storm-water retention ponds has now replaced previous wet meadow habitats at the SIMD/380 Development site, leopard frogs may be ill-equipped to contend with competitors and predators such as bullfrogs and fishes or the water-fouling effects of geese, all of which have the potential to become established in those habitats in the absence of wildlife management actions (J. Feinberg, pers. comm.).

The life history of many amphibians are dependent both on terrestrial and aquatic ecosystems and the Atlantic Coast leopard frog is no exception. In fact, compared to other congeners in New York State (e.g., green frogs, bullfrogs), leopard frogs require a much greater mix of both aquatic and terrestrial habitats. Consequently, the timing of activities is important, with aquatic habitat being particularly important and vulnerable during the breeding and larval development periods from March to July, when adults and larvae are fundamentally reliant on wetlands for their short-term and long-term survival (Feinberg et al 2014). The fact that the Atlantic Coast leopard frog breeds in large dense aggregations is also important to consider as a potential vulnerability because such behavior could put an entire breeding population at risk from a localized disturbance, especially compared to other amphibian species that breed in less concentrated groups that may be more evenly distributed across sites and landscapes.

c. Conclusion

We respectfully request that DEC add the Atlantic Coast leopard frog to the list of endangered species set forth at 6 NYCRR § 182.S(a)(4) or, alternatively, the list of threatened species at 6 NYCRR § 182.S(b)(4). The frog meets the criteria for listing as "endangered" because it is a native species that is in imminent danger of extirpation or extinction in New York, having declined from at least 50-100 historical metapopulations (across 11 contiguous New York counties) to seven metapopulations across three scattered counties today. *See* ECL § 11-0535(1); 6 NYCRR § 182.2(e). Nearly half of those remaining known populations—all on Staten Island—are at risk from development of existing breeding habitat, sea-level rise and intrusion, fragmentation of metapopulations, invasion by fishes and bullfrogs, and the potential for disease outbreaks. Alternatively, if DEC disagrees that the frog warrants protection as an endangered species, it certainly meets the criteria for listing as "threatened" because it is likely to become endangered in the foreseeable future throughout all or a significant portion of its range in New York. *See* ECL § 11-0535(1); 6 NYCRR § 182.2(y).

Protection as an endangered or threatened species is crucial for the Atlantic Coast leopard frog because these designations carry protections that "special concern" status does not. For instance, New York law prohibits any person from "taking" an endangered or threatened species without a permit. *Id.* § 182.8. "Taking" includes "pursuing, shooting, hunting, killing, capturing, trapping, snaring[,] . . . netting, disturbing, harrying, or worrying" a protected species. *Id.* § 182.2(x). It is also unlawful to alter or modify occupied habitat of an endangered or threatened species if it is likely to negatively affect one or more the species' essential behaviors. *Id.* §§ 182.2(x), (b). For the foregoing reasons, we ask that DEC consider listing the Atlantic Coast leopard frog as endangered or, in the alternative, threatened.

III. THE EASTERN HELLBENDER SHOULD BE LISTED AS ENDANGERED.

While we are glad DEC is proposing some protections for the eastern hellbender by putting it on the threatened list, the species warrants listing as endangered under New York's endangered and threatened species laws, ECL § 11-0535(1) and 6 NYCRR Part 182. The hellbender meets the criteria for listing as "endangered" because it is a native species that is in imminent danger of extirpation or extinction in New York, having apparently declined across its range in New York state. *See* ECL § 11-0535(1); 6 NYCRR § 182.2(e). As set forth below, the best scientific information available shows the eastern hellbender meets the criteria for endangered listing set forth in New York's Endangered and Threatened Species Regulations. *See* 6 NYCRR § 182.3(b).

a. Species Background

i. Natural History

The eastern hellbender is a large, entirely aquatic salamander found in fast-flowing, cool, highly oxygenated perennial streams. Known by colorful names like "devil dog," "snot otter," "grampus" and "Old Lasagna Sides," the eastern hellbender can grow up to 2 feet long. Its nicknames reference the loose, frilly skin along its sides and its mucus-like secretions. Historically, the species was widespread across 15 states from northeastern Mississippi, northern Alabama, and northern Georgia northeast to southern New York, with disjunct populations in east-central Missouri (USFWS 2018).

The eastern hellbender's habitat requirements include fast-flowing, cool, and highly oxygenated streams with unembedded boulder, cobble, and gravel substrates. To survive and reproduce, hellbenders need abundant prey and large, flat rocks that are partially embedded with a single opening facing downstream, for nests and shelter. Adult eastern hellbenders eat crayfish, and to a lesser extend small fish, insects, and larval and adult frogs. Larval hellbenders mainly eat aquatic insects. Hellbenders breathe through their skin but also have lungs for breathing in certain situations. They are not well-adapted to low-oxygen environments (USFWS 2018).

Eastern Hellbenders reproduce via external fertilization. First, females deposit eggs under a nest rock, and then males fertilize the egg clutch and defend the nest from other hellbenders. Hellbenders generally breed between late August and early October (USFWS 2018).

ii. Status

According to the U.S. Fish and Wildlife Service, the eastern hellbender is suffering massive declines that will continue into the foreseeable future (USFWS 2018). The countless threats causing the hellbender's decline remain unabated, and there is no scientific information indicating conditions will improve. Recent surveys in Alabama, Indiana, Maryland, New York, North Carolina, Pennsylvania, and West Virginia documented hellbender declines or apparent extirpations (USFWS 2018, surveying Burgmeier et al 2011, Foster et al. 2009, Graham et al. 2011, Keitzer et al. 2013, Levine 2013, Olson et al. 2013, Pitt et al. 2017, and Terrell et a. 2016, among other studies).

The Service's own assessment of the eastern hellbender's status, based on expert scientific input, concluded that 40% of all historical hellbender populations have been extirpated and another 38% are declining, meaning only 22% of remaining hellbender populations are healthy USFWS 2018). These declines and extirpations are severe and ongoing, and they are occurring nearly uniformly across the hellbender's range (USFWS 2018).

The Service projects even more declines and extirpations in the future, with a consistent downward trend in hellbender populations over the next 25 years, resulting in a 47–71% loss of the historical hellbender populations (USFWS 2018). Under the most likely scenario, hellbender populations will decline from 345 populations at present to 217 populations in 25 years (USFWS 2018). The Service has concluded that "[r]egardless of the scenario, the number of healthy populations is predicted to remain well below historical conditions" (USFWS 2018 at 65).

iii. Overview of Threats

Threats to the eastern hellbender include sedimentation, water quality degradation, habitat destruction and modification, disease, direct mortality or permanent removal of animals, climate change, increased abundance of predators, and vulnerability associated with small populations, population fragmentation, and isolation. These threats likely have individual and synergetic effect on individual eastern hellbenders and their populations. A detailed description of these threats is available in the U.S. Fish and Wildlife Service's recent species status assessment for the eastern hellbender (USFWS 2018).

b. The eastern hellbender should be listed as Endangered.

i. The current number of viable and self-sustaining populations of eastern hellbender may not be sufficient to ensure the continued survival of the species in the state.

The U.S. Fish and Wildlife Service predicts decreased viability and possible extirpation of hellbenders in a geographic area including New York (USFWS 2018). In its species status assessment, the Service evaluated New York's hellbender populations within a geographic adaptive capacity unit for the Ohio River and Susquehanna River Drainages (called OACU for short) (USFWS 2018). When evaluating the viability of OACU, the Service found that of the 249 historically documented populations, only 42 (17%) are currently healthy, 126 (51%) are functionally or presumed extirpated, and 81 (32%) are declining (USFWS 2018). The Service concluded that hellbender resiliency in OACU is substantially lower than historical conditions and will likely remain so in the future and that area-wide "extirpation is still plausible within the next 25 years due to the threat from a disease epidemic" in the Ohio River and Susquehanna River Drainages (USFWS 2018).

ii. The eastern hellbender is not designated as a candidate species under the federal Endangered Species Act, nor is it listed as endangered or threatened in any adjacent state or province.

The eastern hellbender is not designated as a candidate species under the federal Endangered Species Act. On April 3, 2019, the U.S. Fish and Wildlife Service denied Endangered Species Act protection to the eastern hellbender species, 84 Fed. Reg. 13,223 (Apr. 4, 2019), even though the data in its own species status assessment indicated protections were warranted (see USFWS 2018). Pennsylvania is the only state in the eastern hellbender's range that is adjacent to New York, and it has not listed the species as endangered or threatened. 58 Pa. Code §§ 75.1, 75.2. These failures to designate the species as endangered or threatened federally or in Pennsylvania do not indicate that the species' status is stable. Arguably the hellbender is more imperiled due to these failures to protect it.

iii. The eastern hellbender has likely declined non-cyclically throughout a significant portion of its range in New York State.

The eastern hellbender has likely declined non-cyclically throughout a significant portion of its range in New York State, as indicated by several studies in the state. For example, Foster et al. (2009) documented the population status of eastern hellbenders in the Allegheny River drainage in New York (Foster et al. 2009, entire). They reported an apparent decline of eastern hellbenders in the Allegheny River drainage over the preceding 20 years (Foster et al. 2009 at 584). Using comparable methods of capture to those used to gather similar data in the 1980s (rock turning), in addition to other methods (trapping, bank searching, and night listening), the scientists captured fewer hellbenders than were captured historically (Foster et al. 2009 at 580, 584). Additionally, hellbenders were discovered to be extirpated from a single site, and the ecological density (number of individuals per 10 m^2 of habitable area) decreased in several other sites (Foster et al. 2009 at 584).

Terrell et al. (2016) collected eDNA samples from a total of 59 sites in New York's Allegheny and Susquehanna watersheds, representing 3 known, 22 historic, and 34 potential hellbender localities (Terrell et al. 2016 at 11). Of these sites, 22 (37%) tested positive for hellbender eDNA, including all known sites, 10 historic sites, and 9 potential localities (Terrell et al. 2016 at 11). Rock-turning surveys were conducted at 20 eDNA-negative sites and 9 eDNA positive sites; hellbenders were only found at 3 eDNA-positive sites, where they occurred at relatively low abundance (<0.2 catches per hour) (Terrell et al. 2016 at 11).

Quinn et al. (2013) contrasted habitat elements between historically occupied and apparently unoccupied sites throughout the Susquehanna River Basin in New York. They reviewed occurrence data obtained from the New York Natural Heritage Program database, which describes 22 historic population sites compiled from previous surveys in New York, and examined regional-scale variables in the Susquehanna River and Allegheny River watersheds in Pennsylvania (Quinn et al. 2013 at 78–79). Only 2 eastern hellbenders were located during field surveys at 59 sites across 5.9 km of river (involving 614 person-hours) (Quinn et al. 2013 at 81). This represents 3.3 hellbenders per 1,000 person-hours searched (Quinn et al. 2013 at 81). Both individuals captured were mature females (Quinn et al. 2013 at 81). The first was found at a historically occupied site thought extirpated since 2000 (Quinn et al. 2013 at 81). The second female was located at a previously undocumented site identified in this study as a high-priority site (Quinn et al. 2013 at 81).

These apparent declines extend across state lines. For instance, Pitt et al. (2017) used a combination of eDNA and historical data to sample for hellbender extirpation at 24 sites in the Susquehanna River drainage in Pennsylvania, and found that hellbenders were extirpated from all but 10 out of 24 sites.

In New York, the eastern hellbender is found solely in the Allegheny and Susquehanna River drainages, and studies indicate they are declining in both drainages. There is no indication that these declines are cyclical in nature, and some declines have been documented until population extirpation. Accordingly, the eastern hellbender has declined non-cyclically throughout a significant portion of its range in New York state.

iv. The present and threatened destruction, modification, or curtailment of the eastern hellbender's habitat in New York threatens the survival of the species in the state.

Construction of artificial impoundments threatens the eastern hellbender by modifying its habitat—reducing upstream streamflow, increasing sedimentation, and subsequently lowering dissolved oxygen (USFWS 2018). Sedimentation also reduces available substrate for hellbenders and their prey (USFWS 2018). Dams are pervasive throughout the eastern hellbender's range, including major dams, navigational locks and dams, and low-head dams in the Allegheny watershed and major dams and low-head dams in the Susquehanna watershed (USFWS 2018). Impoundments have specifically been implicated in population declines and local extirpations throughout much of the range of the Eastern Hellbender, including in the Susquehanna River system in Maryland, Pennsylvania, and New York; and the Allegheny River system in New York (USFWS 2018; Bothner and Gottlieb 1991). Stream and riparian habitat alterations such as channelization have also specifically been implicated as causes for eastern hellbender declines and are continuing threats in the upper Allegheny River system in New York (USFWS 2018; Foster et al. 2009).

v. The overuse of the species is potentially a threat to its continued survival in New York.

Historically, eastern hellbenders were widely collected as educational specimens and for the pet trade (USFWS 2018). For instance, Swanson (1948) reported that he commercially collected more than 750 eastern hellbenders from an Allegheny River tributary in Pennsylvania between 1932 and 1948, noting that the collection apparently diminished the number of hellbenders in the wild (USFWS 2018). In the past, collectors have used technical literature to locate significant populations of eastern hellbenders (Nickerson and Briggler 2007, USFWS 2018). Collection and sale of eastern hellbenders continues to be a documented threat to the species, with the Japanese pet market considered the largest market for the species (USFWS 2018).

vi. Other threats including disease, predation, and exposure to contaminants threaten the continued survival of the eastern hellbender in New York.

The eastern hellbender continues to be threatened by disease, predation, and exposure to contaminants. Disease has been documented in hellbender populations in several states across its range, indicating a general susceptibility to disease. For instance, *Batrachochytrium dendrobatidis* (*Bd*), which causes the devastating amphibian disease chytridiomycosis, has been documented in every state where testing has occurred, including New York (USFWS 2018). Though studies suggest that wild hellbenders do not normally manifest clinical symptoms of chytridiomycosis or die from the disease, there has been at least one report of hellbender mortality associated with *Bd* (Eskew et al. 2014). *Bd* may also negatively affect hellbender populations through co-infections or interactions with other stressors (Eskew et al. 2014). Populations in various states have shown presence and/or effects of *Bd* (Bodinof et al. 2011; Goynor et al. 2011; Chatfield et al. 2012; Souza et al. 2012; Williams and Groves 2014; Bales et al. 2015; Seeley et al. 2016).

Two studies documented presence of *Bd* in the Allegheny and Susquehanna River drainages. Wu (2015) tested for the existence of *Bd* in hellbender populations in the Allegheny and Susquehanna River drainages of New York and Pennsylvania from samples from 2004–2014. The overall *Bd*-positive rate in New York and Pennsylvania was 15.3%, with 24 out of 157 samples testing positive (Wu 2015 at 28). No *Bd*-positive hellbenders were found in the Susquehanna River drainage of Pennsylvania in this study (Wu 2015 at 28). By comparing tail samples, the prevalence of *Bd* appeared to increase from 4.2% before 2010 to 7.7% after 2010 (Wu 2015 at 28). The two earliest positive samples were from 2004 and 2005, from the Allegheny River drainage in New York, suggesting the *Bd* pathogen has existed in the eastern Hellbender populations there for at least 10 years (Wu 2015 at 28). The *Bd* positive rate from swab samples (25 in total) was 56.0% in New York (Wu 215 at 29).

Regester et al. (2012) assessed the occurrence of *Bd* among populations of hellbenders associated with four streams within the north-central region of the Susquehanna River drainage and four streams within the Allegheny-Ohio River drainage in Pennsylvania. They found widespread occurrence of Bd among eastern hellbenders in both major river drainages supporting breeding populations of hellbenders in Pennsylvania (Regester et al. 2012 at 91). Forty-three percent of pooled samples assayed provided positive test results for the presence of *Bd*, indicating the occurrence of *Bd*-infected hellbenders in four of the five counties examined (Regester et al. 2012 at 91). They detected *Bd* among hellbender populations in two watersheds associated with the Allegheny-Ohio River drainage, and two watersheds associated with the Susquehanna drainage (Regester et al. 2012 at 91). They did not encounter any hellbenders with indications of morbidity or other obvious symptoms of poor health (Regester et al. 2012 at 91). The study underscores the need for studies examining ecological predictors of *Bd* occurrence and changes in *Bd* prevalence and survivorship within and among populations (Regester et al. 2012 at 91–92).

Eastern hellbenders may also be susceptible to parasites. Jensen and McMillan (2014) observed an adult eastern hellbender in the main stem of the Allegheny River in New York with a fresh laceration from a lamprey, presumably the Ohio lamprey (*Ichthyomyzon bdellium*), which is the only parasitic lamprey species native to the Allegheny River (the invasive sea lamprey has not been detected in the drainage) (Jensen and McMillan 2014 at 289). The scientists suggested that lamprey parasitism "may be a confounding factor in hellbender declines since open wounds from lamprey bites may lead to secondary infections like fungal infections; however, at least one study suggests open wounds are not linked to contraction of infections like chytrid fungus and ranavirus (Jensen and McMillan 2014 at 289). Additional research is needed to determine the rate of lamprey parasitism on hellbenders and whether such parasitism increases the chance of contracting disease or infection (Jensen and McMillan 2014 at 289).

There is also a documented increase in the abundance of predator species, which threatens the eastern hellbender. Some native predators of the eastern hellbender, like raccoons, have increased in abundance due to human influences like eliminating top predators and habitat changes (USFWS 2018). Predation by river otters, mink, and raccoons is suspected to be especially intense during periods of drought when water levels are low (Briggler et al. 2007).

Non-native predators are also a threat to the species, including predatory fish stocked for recreation, such as rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*) (USFWS 2018). Optimal habitat for trout and hellbenders often overlap (USFWS 2018). Trout stocking occurs in New York in counties where hellbenders have been sighted. For instance, in 2019, New York stocked tens of thousands of brown trout and rainbow trout in waters in Cattaraugus County,[20] Broome County,[21] Chenango County,[22] Otsego County,[23] and Delaware County.[24] Non-native trout species are believed to directly affect eastern hellbenders by preying on eggs, larvae, sub-adults, and adults, and indirectly affect them by competing for resources (USFWS 2018). Non-native trout are also thought to be more threatening than native ones because larvae may not recognize non-native trout as predators (USFWS 2018; Gall and Mathis 2010).

Pollution and related water quality degradation also threaten the eastern hellbender (USFWS 2018). Degraded water quality can directly kill eastern hellbenders and also alter physiological processes and increase vulnerability to other threats (USFWS 2018). Major sources of pollution include domestic wastes, agricultural runoff, and unpermitted industrial discharges, all of which have been identified as threats to Eastern Hellbenders (USFWS 2018). Additionally, chemical spills can extirpate populations (USFWS 2018). Endocrine disrupting compounds (EDCs) may also threaten eastern hellbenders by causing male feminization, decreased survival, and increased susceptibility to disease (USFWS 2018).

vii. Existing regulatory mechanisms are inadequate to protect the eastern hellbender and its habitat.

Existing regulatory mechanisms fail to protect the eastern hellbender and its habitat from continued human-caused impacts. The eastern hellbender is not listed as endangered or threatened either federally or in New York State, meaning it receives no direct, species-specific protection for itself or its habitat. Although the hellbender is listed as a special concern species, this status provides no substantive protection. A significant source of habitat degradation comes

[20] New York State Department of Environmental Conservation, 2019 Trout Stocking for Cattaraugus County, https://www.dec.ny.gov/outdoor/23335.html.
[21] New York State Department of Environmental Conservation, 2019 Trout Stocking for Broome County, https://www.dec.ny.gov/outdoor/23336.html.
[22] New York State Department of Environmental Conservation, 2019 Trout Stocking for Chenango County, https://www.dec.ny.gov/outdoor/23331.html.
[23] New York State Department of Environmental Conservation, 2019 Trout Stocking for Otsego County, https://www.dec.ny.gov/outdoor/23297.html.
[24] New York State Department of Environmental Conservation, 2019 Trout Stocking for Delaware County, https://www.dec.ny.gov/outdoor/23327.html.

from agricultural, silvicultural, urban, and suburban runoff into streams, which is not adequately regulated by existing water quality laws.

viii. Other natural or human-made factors threaten the eastern hellbender's continued survival in New York.

The eastern hellbender will likely be negatively affected by the multifaceted impacts of climate change, including rising temperatures, increasing frequency of heat waves, increasing frequency of extreme storm events and sea-level rise. Climate change may also exacerbate existing threats to the hellbender, including habitat degradation and disease.

Current levels of greenhouse gas emissions are causing widespread climate change harms worldwide. Key impacts include rising temperatures, the increasing frequency of heat waves and other extreme weather events, the flooding of coastal regions by sea level rise and increasing storm surge, the rapid loss of Arctic sea ice and the collapse of Antarctic ice shelves, declining global food and water security, increasing species extinction risk, ocean acidification, and the global collapse of coral reefs (Melillo et al. 2014).

Extreme weather events are striking with increasing frequency, most notably heat waves and heavy precipitation events (Coumou and Rahmstorf 2012; IPCC 2012; Herring et al. 2017; USGCRP 2017). For example, summertime heat extremes which covered much less than 1% of Earth's surface between 1951 and 1980 now cover about 10% of the Earth's land area (Hansen et al. 2012). A growing body of attribution studies has determined that human-caused climate change is a significant driver of many recent extreme weather events (Herring et al. 2017). In the contiguous United States, extreme temperatures are expected to increase even more than average temperatures, heat waves will become more intense, and most regions will have 20 to 30 more days per year above 90°F by mid-century under a higher emissions scenario (USGCRP 2017). Heavy precipitation events are projected to continue to increase in frequency and intensity across the United States, with the number of extreme events rising by two to three times the historical average by the end of the century under a higher emissions scenario (USGCRP 2017).

Due to its biological traits as an amphibian, the eastern hellbender is likely to be negatively affected by the effects of climate change. As ectothermic animals, all aspects of their life history are strongly influenced by the external environment, particularly temperature and moisture. Many studies have documented climate-associated shifts in amphibian phenology, range, and pathogen-host interactions (Corn 2005), with emerging evidence for climate change-related declines (Rohr and Palmer 2013). Li et al. (2013) reported the results of 14 long-term studies of the effects of climate change on amphibian timing of breeding in the temperate zone of the U.S. and Europe. This meta-analysis indicated that more than half of studied populations (28 of 44 populations of 31 species) showed earlier breeding dates, while 13 showed no change, and 3 populations showed later breeding dates, where spring-breeding species tended to breed earlier and autumn-breeding species tended to breed later. Several studies indicate that shifts in timing of breeding can have fitness and population-level consequences. For example, amphibians that emerge earlier in the spring can be vulnerable to winter freeze events or desiccation if they arrive at breeding sites prior to spring rains (Li et al. 2013).

Climate-associated shifts in amphibian ranges can be particularly problematic for restricted range species like the eastern hellbender that have specific habitat requirements and limited options for movement (Li et al. 2013). In light of these predicted range shifts, protected habitat in New York that is currently suitable for the eastern hellbender may not be suitable as climate change worsens. Thus, reliance on the availability of currently suitable habitat for the hellbender when assessing its viability may be misplaced. As greenhouse gas emissions continue to grow, studies project high turnover of amphibian species as habitats become climatically unsuitable. For example, Lawler et al. (2010) projected 50% or greater climate-induced turnover of amphibian

Climate change has also been implicated in stimulating the emergence of infectious amphibian diseases. Increases in climate variability and extreme weather events resulting from climate change appear to provide an advantage to pathogens, such as chytridiomycosis (chytrid fungus) which is driving amphibian declines worldwide (Rohr & Raffel 2010). Raffel et al. (2013) found a causal link between increased temperature variability and chytrid-induced mortality in frogs, which in the context of other studies linking chytrid outbreaks to temperature shifts, provides compelling evidence for a climate-change role in amphibian mortality from chytrid fungus (Li et al. 2013). Several recent studies indicate a role of climate change in amphibian population declines, in combination with other stressors (Rohr & Raffel 2013)

ix. The eastern hellbender is restricted geographically in New York.

The eastern hellbender is at the northernmost edge of its range in New York and restricted to isolated areas in the southern part of the state in the Allegheny and Susquehanna River basins (Lyons-Swift and Howard 2010). See Figure 8 from Lyons-Swift and Howard (2010), below.

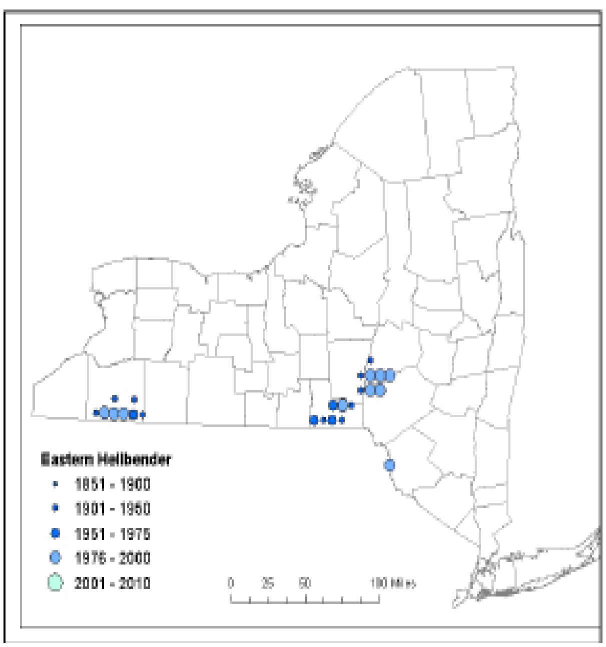

Figure 8. The earliest observations of Eastern Hellbender Salamander within each USGS quadrangle. Quads with only more recent observations have larger dot sizes.

x. The eastern hellbender's biology makes it highly susceptible to changes in its environment.

Amphibians have seen drastic declines globally in the past thirty years due to direct or indirect human impact. Habitat loss and fragmentation has led to mortality on roads, population fragmentation, and genetic drift (Gardner 2001; Schlesinger et al. 2017 (in review)). This is likely due to their collective biological traits that make them exceptionally vulnerable to changes in the environment. Amphibians' highly water-permeable skin and reliance on external sources to regulate body temperature make them susceptible to environmental contaminants and changes in climate (Collins and Crump 2009). Also, because many amphibians are small-bodied and slow-moving compared to other vertebrates, they are unable to respond to rapid changes in their environments (Babbitt 2005, Gibbs 1998, Trenham et al. 2003). These collective traits make amphibians prone to local extinction, particularly when their habitat is heavily impacted by human activities (Trenham et al. 2003; Nicholls et al. 2017).

For example, urban and agricultural pollution, which contributes to acidification of ground water, pond water and rainfall, has been correlated with reduced egg and larval growth & mortality, delayed hatching times, reduced reproduction and reduced adult body size in amphibians (Gardner 2001). Introduction of invasive competitors and predators has also had a significant effect on population sizes and has even led to the collapse of entire communities (Fellers & Drost, 1993; Fisher & Schaffer, 1996; Hecnar & M'Closkey, 1996a).

Additionally, climate change-related fluctuations in hydrological regimes (e.g., alterations in stream flow, lake depth, pond hydroperiods, and soil moisture) and warming temperatures are predicted to have largely negative effects on amphibian breeding success and survival, dispersal, and habitat suitability (Blaustein et al. 2013, Walls et al. 2013). Migration as an adaptation to climate change is unlikely for eastern hellbenders because of their limited mobility, high site fidelity, restriction to defined stream systems, and the extensive network of impoundments throughout their range (USFWS 2018). According to the NatureServe Climate Change Vulnerability Index, release 2.1 (http://www.natureserve.org/prodServices/climatechange/ccvi.jsp), the Eastern Hellbender is highly vulnerable to climate change.

Because they are fully aquatic and reproduce externally in water, eastern hellbenders are particularly vulnerable to changes in water quality and quantity. They also have limited options for migration in response to warming climate.

c. Conclusion

The eastern hellbender appears to be declining throughout its limited range in New York state, and threats to the species are ongoing and unmitigated. For these reasons, we assert that the species is endangered and respectfully request that that DEC consider adding the eastern hellbender to the list of endangered species set forth at 6 NYCRR § 182.5(a)(4).

IV. THE AMERICAN EEL SHOULD BE LISTED AS THREATENED.

We are pleased DEC has proposed recognizing the American eel (*Anguilla rostrata*) as a species of special concern in New York; however, it is likely that even greater protection is necessary to protect the species as it has experienced significant declines and faces increasing persistent threats.

Prior to the late 1980s the American eel was one of the most dominant freshwater species in many waterbodies, and also supported robust commercial fisheries. For example, historical records show that the American eel once comprised the dominant biomass in Hudson River tributaries and were often found comprising more than 25% of stream fish biomass and up to 40 percent of the near shore fish biomass in regional lakes, and up to 50% in Lake Ontario (Dittman et al. 2010). An excerpt from historical records of the Drowned Lands in the uppermost reaches of the Wallkill River noted that, "[t]he fall of 1807 was remarkable for the numbers of eels that came down the ditches. Eel-weirs were plenty, but there was hardly a night that season in which everyone was not filled to overflowing with eels, some of which weighed eight pounds apiece. One weir in Hampton milldam captured over two thousand in one night."[25]

But more recently the species has been in significant decline due to a combination of habitat loss, food web alterations, predation, turbine mortality, environmental changes, toxins and contaminants, disease and parasites, all in combination with over-harvest (ASMFC undated). Native to all New York watersheds, the American eel has now been extirpated from the Allegheny River and has declined to levels below detection in the Chemung and Susquehanna Rivers (NYSDEC undated). The species has also been greatly reduced throughout the watersheds of the Great Lakes (NYSDEC undated). In the St. Lawrence River and Lake Ontario, eels have declined by 98%, mostly due to hydroelectric turbines and a series of navigation locks (Casselman 2003).

The American eel's declines coincide with rapid dam building and habitat alteration. In New York State there at least 6,000 dams listed in the NYS Dam Safety database. Dams change the hydrology of the rivers and undoubtedly restrict the eel's upstream movement and delay their downstream movements. Hydropower dams without proper preventive measures can kill unknown number of sexually mature silver eels when they are entrained or impinged by turbines. Furthermore, the mere presence of dams and other forms of river manipulations can delay downstream migration of eels, causing an accumulation of fish in the impoundment, potentially leading to increased disease or parasite transfer and enhanced predation risk from piscivorous birds and fish. When added to the synergistic effects of threats including commercial harvest, habitat degradation and modification, predation, parasites, contaminants, and climate change, this already declining species is at risk of continued decline and extinction without conservation intervention.

Accordingly, the American eel warrants listing as threatened under New York's endangered and threatened species laws, ECL § 11-0535(1) and 6 NYCRR Part 182, rather than as a species of special concern, because it is a native species that is likely to become endangered in the foreseeable future throughout all or a significant portion of its range in New York, due in large part to habitat destruction and alteration from dams. *See* ECL § 11-0535(1); 6 NYCRR § 182.2(y).

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[25] The History of Warren and Sussex Counties, New Jersey with Illustrations and Biographical Sketches of its Prominent Mend and Pioneers. James P. Snell. Philadelphia, 1881.

a. Species Background

i. Natural History

American eel are a facultative catadromous species, which effectually means they are readily found in brackish estuaries, near-shore marine habitats, in addition to freshwater habitats. During their lifecycles, American eels undergo several morphological changes upon hatching, transitioning over the course of their lifecycle from larvae (leptocephali), to glass eel, to elver, to yellow eel, and finally becoming a sexually mature silver eel. American eels become sexually mature at the silver eel stage, whereupon they will return to the Sargasso Sea to spawn.

Between larval and adult stages, American eels complete a long-distance, circuitous migration route covering thousands of miles between marine and riverine habitats while encompassing numerous jurisdictional boundaries, thus making the species very difficult to study and manage. Soon after hatching, leptocephali begin their migrational movements towards coastal rivers using passive entrainment in ocean currents. It is believed they transition into glass eels over the continental shelf, where upon detraining from ocean currents, they actively swim towards coastal rivers and streams. Glass eels do not home to specific estuaries or rivers, and it is unknown what cues cause them to detrain when they do, but it is likely they can detect the smell of freshwater sediments or the odor of elder conspecifics. Shortly after entering estuaries and rivers, glass eels become pigmented and quickly transform into elvers as they head upstream into freshwater. Yellow eels mature in fresh and/or brackish water anywhere from 3 to more than 30 years before metamorphizing and returning back to the Sargasso Sea as silver eels.

The best available data indicate American eel are a panmictic species, which consist of a single metapopulation that lacks distinct structure but breeds in one location and shares a common gene pool. The species exhibits phenotypic plasticity that allows eels to adapt to a wide range of habitat types, from estuaries to freshwater habitats. As a result of this environmental flexibility, the species is widely distributed in accessible lakes, rivers, streams, and estuaries ranging from eastern Canada to Venezuela.

In addition to other unique characteristics, American eels are semelparous, which means that after completing an arduous return migration to their natal waters, they spawn once and subsequently die. Female eels may defer spawning for up to 20-30 years in order to become large fecund specimens that can make the long-distance migration and compensate for the reproductive postponement. However, semelparity for an American eel abstractly means that all mortality occurring within their freshwater range happens prior to spawning, and their beneficial alleles are removed from the gene pool.

Aside from being semelparous, eels are also an ambisexual species, whose sex determination is believed to be dependent upon density and to a lesser extent latitude (Helfman et al. 1987). This suggests that eels in northern ranges, such as those found in New York State's waters, may be disproportionately important in providing highly fecund females supporting range-wide recruitment. Conversely, the loss of these highly fecund females from the northern portion of its range, and the distant upstream sections of watersheds, may cause reductions in recruitment and potential range-wide population reductions (Casselman 2003).

ii. Status

According to the Atlantic States Marine Fisheries Commission's (ASMFC) 2017 American Eel Stock Assessment, the status of the American eel remains depleted, at historical lows in U.S. waters. The assessment continues that eels have precipitously declined or have been extirpated over portions of their historical freshwater habitats during the last 100 years mostly due to loss of habitat, turbine mortality, environmental changes, food-web alterations, predation, toxins and contaminants, parasites, and disease often in combination with over-harvest (ASMFC 2017).

iii. Overview of Threats

American eel face a synergistic combination of threats that are similar to the European eel (*Anguilla anguilla*), which is now critically endangered. Commercial harvest occurs at all American eel life stages (glass, elver, yellow, and silver). Blockages and obstructions that limit upstream migration of American eels have reduced habitat availability and limited the range of the species. Freshwater habitat degradation resulting in reduced food productivity increases mortality of the freshwater life stages. Predation by fish, birds, and mammals can impact eel populations during all life stages. The non-native swim bladder parasite, *Anguillicoloides crassus*, can damage the fish's swim bladder, decrease swimming ability, impair the silvering process, and reduce the silver eel's ability to reach the spawning grounds (Kirk 2003). Contaminants also may reduce the reproductive success of American eels because they have a high contaminant bioaccumulation rate (Couillard et al. 1997). The Hudson River is still recovering from the PCBs contamination, the effects of which can impair the health and reproductive function of eels (Jurgens et al. 2015).

Licensed eel fishing in New York occurred primarily in Lake Ontario (prior to the 1982 closure), the Hudson River, the upper Delaware River, and in the coastal marine district. A slot limit (greater than 6 inches and less than 14 inches to limit PCB exposure) exists for eels fished in the tidal Hudson River (from the Battery to Troy and all tributaries upstream to the first barrier), strictly for use as bait or for sale as bait only. Due to PCB contamination of the main stem, commercial fisheries have been closed on the freshwater portions of the Hudson River and its tributaries since 1976. The fishery in the New York portion of the Delaware River consists primarily of silver eels collected in a weir fishery. In 1995, New York approved a size limit in marine waters. Maine and South Carolina have glass eel fisheries. Since 2011, there has been a growing international demand for glass eels for aquaculture purposes, which has increased landing and price per pound (ASMFC 2019).

Dam building and habitat alteration are a significant threat to the American eel. In New York State there at least 6,000 dams listed in the NYS Dam Safety database and possibly many hundreds more. The Hudson Valley is the most heavily dammed region of the state, with an estimate of as many as 1,600 dams, all of which fragment not just the respective creeks, but entire watersheds and ecosystems. On the Wallkill River starting from its confluence with the Rondout Creek—within boundaries of NYS—there are eleven dams starting with the Sturgeon Pool hydropower dam that rises 109 feet high. This series of dams does not account for the dams in New Jersey or legacy dams that are not listed on the DEC Dam Safety databases. The high number of dams built on the Wallkill River is representative of the problem facing many of the 70 tributaries of the Hudson River and many other rivers in the state.

Dams change the hydrology of the rivers and undoubtedly restrict the eel's upstream movement and delay their downstream movement. For instance, Machut et al. (2007) discovered that in-water barriers in Hudson River tributaries dramatically reduced eel densities and disrupted migration into suitable upstream habitat. Hydropower dams without proper preventive measures can kill unknown number of sexually mature silver eels when they are entrained or impinged by turbines. Furthermore, the mere presence of dams and other forms of river manipulations can delay downstream migration of eels, causing an accumulation of fish in the impoundment, potentially leading to increased disease or parasite transfer and enhanced predation risk from piscivorous birds and fish. Rivers used for the generation of hydropower have been associated with high eel mortalities due to increase in pressure, sudden change in flow velocity, cavitation and damage from turbine rotor blades (Russon et al. 2010).

Infestation by the non-native swim bladder parasite, *A. crassus*, has increased in intensity and as well as prevalence since it was first detected in wild eels. The level of infection in NYS and coast wide is on the rise since it was first reported in wild populations. Since its first discovery in a wild-caught American eel from South Carolina in 1996, *A. crassus* has spread to many areas along the Atlantic coastline of North America (Hein et al. 2014). The long-term effect of this exotic, invasive parasite is unknown, but it is suggested that it may decrease swimming ability and impair vertical depth adjustment and thus reduce the silver eel's ability to undertake an arduous return migrations and reach the spawning grounds. Studies on European eels have shown infection *A. crassus* had a significant effect on the swimming behavior of European eels. It is also conceivable that with reduced swimming ability due to parasitic infection, eels would be vulnerable to piscivorous predators. Additionally, it has been noted that moralities have been reported in eel farms in addition to reduced growth rate (TISI undated). Consequently, with the American eel population in precipitous decline, the increasing intensity *A. crassus* may negatively impact the long-term survival of this species.

In addition to all the other threats, it is also suggested that contaminants also may reduce the reproductive success of American eels because they have a high contaminant bioaccumulation rate (Couillard et al. 1997).

Climate change and attendant oceanographic changes may influence larval drift and migration, which in turn may reduce year-class success (Friedland et al. 2007; Castonguay et al. 1994). American eels depend on consistent currents to carry their young from spawning grounds in the Sargasso Sea to inland freshwater habitat where they mature. Because the American eel has evolved over eons and long flourished at exceedingly high levels of abundance and panmictic aggregations to sustain the coast wide metapopulation, an irreversible collapse could occur should the stock fall below a certain critical mass. When the population collapses it is often too late to triage the species to prevent an extinction event.

Since all anthropogenic and eel mortality occurs prior to spawning, reproduction can be reduced by these cumulative pressures on the metapopulation. But what is most concerning is that while American eels are already at historically low levels, and they are being increasingly challenged by the spread of a pernicious, invasive, parasitic nematode whose long-term effects on the population are unknown. Hence, doubt is cast on ability of the species to remain resilient in the face of these mounting problems.

b. The American eel should be listed as threatened.

The American eel should be listed as threatened because it meets several of DEC's listing criteria.

i. The current number of viable and self-sustaining populations of American eel does not appear to be sufficient to ensure the continued survival of the species in the state.

The American eel was once widespread and highly abundant throughout New York State but has since experienced dramatic declines over a significant portion of its range. Although trends in abundance are highly variable, strong declines have been observed in the past several decades, leading to historical lows and a depleted population status. Continuing habitat degradation, especially from dams and turbines, pollution, exploitation, predation, climate change, and an exotic parasite may be constraining recovery of the species and leading to a continued decline of the species.

ii. The American eel is not designated as a federal candidate species under the federal Endangered Species Act, nor is it listed as endangered or threatened in any adjacent state but is listed as threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), endangered in the province of Ontario, and threatened in the province of Quebec.

In 2004, due to extreme losses of American eel populations in the northern portions of its range, the Atlantic States Marine Fisheries Commission requested that the U.S. Fish and Wildlife Service and National Marine Fisheries Service conduct a population review of the American eel and petitioned to protect the species under the Endangered Species Act. In 2007, The Services announced the completion of a Status Review for American Eel. The report concluded that protecting eels as an endangered or threatened species was not warranted at the time. The Service did note that while the species' overall population was not in danger of extinction or likely to become so in the foreseeable future, the eel population has "been extirpated from some portions of its historical freshwater habitat over the last 100 years and the species abundance has declined, likely as a result of harvest or turbine mortality, or a combination of factors."(ASMFC 2017). In 2015 the service found that the American eel did not warrant Endangered Species Act protection.

The American eel is listed as threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), endangered in the province of Ontario, and threatened in the province of Quebec.

The American eel is also currently listed as endangered on the ICUN Red List (Jacoby et al. 2017). While the Red List is meaningful, it is not legally binding.

iii. The American eel has likely declined non-cyclically throughout a significant portion of its range in New York State.

Trend analyses of abundance indices of American eel throughout their range indicate large declines in abundance of yellow eel during the 1980s through the 2016. In viewing the results of the DEC surveys: HRE Monitoring Program, DEC Striped Bass Beach Seine Survey, DEC

Alosine Beach Seine Survey, NY Western Long Island Sound Survey all show a downward trend since the 1980s (ASMFC 2017).

iv. The present and threatened elimination, modification, or curtailment of American eel habitat in New York threatens the survival of the species in the state.

Eel passage have been hindered or prevented from accessing ancestral habitat by in-water infrastructure such as dams and hydroelectric power plants throughout their range. In addition, dams can delay downstream migration by causing an accumulation of fish in the impoundment on the approach. This would lead to reduced water quality, increased disease transfer and enhanced predation risk from piscivorous fish and birds. The upstream migration of fish has been aided by the construction of fishways and eel ladders to bypass obstacles such as dams, weirs and locks, however downstream passage facilities are much less advanced. In a study of hydroelectric dams by Carr and Whoriskey (2008), it was demonstrated that 100% of entrained eels suffered mortality.

v. The overexploitation of the species is potentially a threat to its continued survival in New York.

Exploitation of the species is likely to have some impact on the population. Since the approval of Addendum IV (2014), silver eel fisheries are only permitted on a limited basis in the Delaware River (NY). The Delaware River eel weir fishery is restricted to nine annual permits, which were initially limited to those who fished and reported landings from 2010 to 2013 (ASMFC 2017).

Glass eel fisheries along the Atlantic coast are prohibited in all states except Maine and South Carolina. While the harvest of glass eels is prohibited in New York State waters, over the last seven years there has been an increase in the demand for glass eel due to concerns over population status of European and Japanese eels, as well as tighter restrictions on the export of European eel, which has increased as the average market price has risen to over $1,000 per pound with peaks exceeding $2,000 per pound. With prices at this level there is a potential for illegal fishing for glass eels in NYS waters.

vi. Other threats including disease, predation, and exposure to contaminants threaten the continued survival of the American eel in New York.

A Japanese swim bladder parasite, *Anguillicola crassus*, appears to be on the increase in New York waters (Machut and Limburg 2008; Waldt et al. 2013). For instance, by 2013, in the Hannacroix creek, *A. crassus*, was observed in eels of all size classes with nearly 50% infection rate (Waldt et al. 2013). Eel become infected with the *A. crassus* when they eat host species containing larval parasites. The infective larval stages of the parasite enter a new eel host through ingestion of infected intermediate hosts such as copepods and ostracods and penetrates through the alimentary tract to reside in the swim bladder wall. This penetration through the swim bladder wall initiates an inflammatory response causing the wall to become thickened and fibrotic (Kirk 2003). Sanguivorous feeding by the adult nematode reduces the oxygen carrying capacity of the host's blood resulting in additional damage to the swim bladder.

The long-term effect of *A. crassus* on wild eel populations is unknown, but evidence suggests it can harm and kill individual eels, particularly when combined with other stressors. In European eel, heavy infection or damage caused by *A. crassus* prevented individuals from reaching the spawning grounds (Lefebvre et al. 2012). *A. crassus* can also severely impair swim bladder function and has caused mortalities in both farmed and wild populations in the presence of other stressors (Kirk 2003). Other studies have shown that parasitic infection of *A. crassus* in European eels causes pathological damage to the swim bladder, which potentially compromises their ability to cope with hypoxic conditions (Gollock et al. 2005). It is believed that impaired functioning of the swim bladder is likely an insurmountable handicap for fish having to swim across a large swath of the Atlantic Ocean while engaging in diel cycle depth adjustments to reach their reproductive site in the Sargasso Sea thousands of kilometers (Lefebvre et al. 2012).

vii. *Existing regulatory mechanisms are inadequate to protect the American eel and its habitat.*

The American eel is a challenging species to conserve or manage for a range of reasons. During their life-history eel traverse through and reside in a variety of habitats that cross many jurisdictions. Life history characteristics such as late age of sexual maturity and a tendency to congregate during certain life stages further confounds conservation efforts and makes them vulnerable to harvest pressure. Loss of critical habitat and river manipulation have virtually eliminated the species from much of its ancestral habitat and have made an arduous life history all the more difficult.

viii. *The American eel's biology makes it highly susceptible to changes in its environment.*

The American eel relies on ocean currents to complete its life cycle, including for the passive delivery of leptocephi to their coastal rivers (USFWS undated). It is also highly probable that migrating silver eels use some sort of current convection to assist in the long-term migration. We are already seeing weakening of crucial currents in the Atlantic Ocean (Caesar et al. 2018; Thornalley et al. 2018). The Gulf Stream is at its weakest in 1,600 years (Thornalley et al. 2018), and the potential for alteration of critical current for the passive delivery of the larval stage could have catastrophic results for American eels.

c. Conclusion

While we support DEC's proposal to extend protections to the American eel, based on the information and criteria listed above, the species warrants a higher level of protection. Accordingly, we ask that DEC consider listing the American eel as threatened rather than special concern.

V. THE AMERICAN SHAD SHOULD BE LISTED AS A SPECIES OF SPECIAL CONCERN.

The American shad (*Alosa sapidissima*) once supported the largest and most important commercial and recreational fisheries along the coast (ASMFC 2019). The American shad was the fish that fed the early European settlers of the United States. The Latin name of the American shad, *Alosa Sapidissma*, means most delicious. Because the fish was considered a delicacy and filled the springtime rivers with a staggering abundance, the American shad was harvested and stored for later usage throughout the year. Historically, it was the American shad whose migration up the Schuylkill River in the spring of 1778 saved the Continental Army at Valley Forge from starving after a winter of privation.[26] When it was too hazardous for American fishermen to venture offshore during World War II due to threats from German U-boats, it was the in-river harvest of American shad that once again fed the American people (Figure 1). Coastwide the arrival of spring was heralded by shad festivals and planked shad cooked over wood fires. However, shadless shad bakes are the new normal, especially in the Hudson Valley.[27]

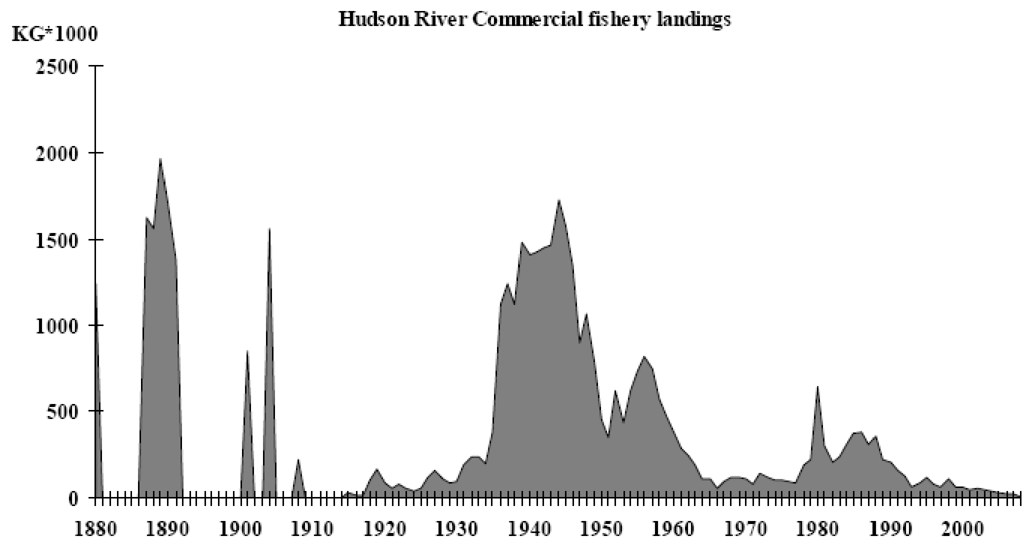

Figure 1. Hudson River American shad landing 1880 - 2005 (ASMFC 2007).

Since colonial times, the blockage of spawning rivers by in-water barriers, combined with habitat degradation and over-exploitation have severely depleted the shad populations (ASMFC 2019). Coastwide the American shad population is in significant decline, and the New York American shad population is at an all-time low since records were kept in 1880 (Hattala and Kahnle 2009). It is conceivable that the numbers of shad in the 1880s were but a shadow of the virgin Delaware and Hudson River shad production that met the first people to settle this continent, meaning the shad has experienced even greater declines than those recorded.

Over the course of human settlement of this country the single greatest factor that contributed to the decline of shad contributed to the decline in American shad in East Coast rivers is over-harvest, as demonstrated in harvest records from the 1950s to the 1970s (Talbot 1954). In concert with habitat loss, over-harvest has caused American shad stocks to continue to decline in many coastal rivers, especially in the Hudson and Delaware Rivers in New York. To appreciate the scale of the fishery on the Hudson River during the 1950, in New York State alone there were nearly 400 drift nets and over 1,000 stake nets operating six days a week. The figures do not include fishing from New Jersey.

[26] American shad: https://pafoodways.omeka.net/exhibits/show/farm/articles-2/american-shad
[27] https://www.nytimes.com/2008/04/30/dining/30shad.html

The last coastwide stock assessment for American shad was completed in 2007, and it was revealed that stocks are currently at all-time lows, representing less than 5 percent of their historic populations along the East Coast (ASMFC 2019). They do not appear to be recovering (ASMFC 2019). A benchmark stock assessment was initiated in 2017 to analyze the stock status, with results expected in the fall of 2020 (ASMFC 2019).

In New York Waters, the American shad was historically found in the Delaware River and Hudson River in extremely high abundances (ASMFC 2007). However, in the past several decades the Hudson and Delaware populations of American shad have declined precipitously. Despite restoration efforts, population size is much smaller than historical levels as a result of dams, overfishing, and water pollution, reduced spawning habitat (ASMFC 2007). The last stock assessment shows that the Delaware River was low and stable, but the Hudson River was not showing any signs of recovery (ASMFC 2007). American shad has been declining in the Hudson for many years because of overfishing, pollution and other anthropogenic effects (such as entrainment and impingement from a series of power plants like along the Hudson River and the East River) (Henderson and Seaby 2015).

Measures curtailing recreational and commercial harvest and reducing commercial bycatch in the intercept fishery have failed to spur the recovery for shad in the Delaware and Hudson River. However, the Hudson is fairing far worse than the Delaware River and is not showing any signs of recovery (ASMFC 2007). The Hudson River population of American shad has all the characteristics of a population heading towards localized extinction (Henderson and Seaby 2015). Weak rules and continued mortality will not save the species in the light of the current threats unless greater protection is granted to the American shad.

Accordingly, we believe that the American shad warrants listing as "special concern" under New York's endangered and threatened species laws, ECL § 11-0535(1) and 6 NYCRR Part 182. The American shad meets the criteria for listing as "special concern" because it is a native species that is at risk of becoming threatened in New York based on the criteria for listing in section 182.4(a)." *See* ECL § 11-0535(1); 6 NYCRR § 182.2(u). "Species of special concern do not qualify as either endangered or threatened . . . but . . . require some measure of protection to ensure that the species does not become threatened." *Id.*

a. Species Background and Threats

i. Natural History

American shad is an anadromous, pelagic, highly migratory, schooling species (Collette and Klein-MacPhee 2002). These shad are the largest of the North American species of anadromous herrings (*Alosa*) that range from Labrador to Florida (Fuller and Neilson 2020). They may live to 13 years and usually become sexually mature after 2-6 years at sea.

They have a well-developed homing ability, which directs them to spawn in the same waters where they were born and return to sea after spawning. American shad spend most of their lives in marine waters, with adults migrating into coastal rivers and tributaries to spawn (Greene et al. 2009). Most spawning occurs in May in the upper estuary in the Hudson. American shad in New

York are found in the Hudson River and Delaware River and are part of the mid-Atlantic population.

ii. Status

Coastwide the American shad is classified as depleted (ASMFC 2019). The regional spawning stocks are still in decline. In New York State waters, most notably in the Hudson River, the American shad is showing no recovery despite the cessation of commercial and recreational fishing. In the Delaware River, shad remain stable at low numbers, but are not showing great increases (ASMFC 2019).

iii. Overview of Threats

One of the main threats to diadromous fishes and shad in particular is their dual habitat requirement, which has placed their populations and ancestral freshwater habitat at odds with the human activity and made them susceptible to river manipulations. Unlike many marine fishes that have few but large, geographically widespread populations, anadromous fishes have numerous but smaller river-specific populations, which render them more susceptible to population-level extirpations., If these extirpations occur serially, species extinction may occur (Limburg and Waldman 2009). The main known cause of the decline in Hudson River American shad is historic overharvest by commercial and recreational fisheries combined with habitat loss and alteration, which most likely affected the potential for abundance of American shad in the Hudson River Estuary (ASMFC 2007).

Substantial destruction of potential shad spawning and nursery habitat occurred from the late 1800s through the mid-1900s from dredge and fill in the upper third of the Hudson River estuary during development and maintenance of the navigation channel from New York City to Albany and Troy (Miller and Ladd 2004). Habitat destruction through the continued filling of shallow water spawning habitat and water quality problems associated with pollution, which in turn create low oxygen blocks in major portions of the river, have further contributed to the decline of American shad in the Hudson River (Hattala and Kahnle 2009). Habitat loss from dredge and fill operations in the Hudson River were a problem in the early 1900s, and losses during that time may have influenced the current rate of stock recovery. It is estimated that about 57% of the shallow water habitat in the Hudson River was lost during that time (ASMFC 2007). The loss of this spawning habitat undoubtedly impacts the reproductive effort by shad in the Hudson River.

There is some speculation that the introduction of the zebra mussel (*Dreissena polymorpha)* into the Hudson River may have decreased zooplankton numbers decreasing prey available for juvenile shad (ASMFC 2007). Zebra mussels are filter-feeders, and the large introduced population in the river caused the amount of plankton to decrease by 80%, which represents roughly 1,000 tons of potential fish food removed (Strayer 2011). Notably, there was a decrease in observed growth rate and abundance of young-of-the-year fishes, including American shad. It is not yet clear how this constraint affects annual survival and subsequent recruitment (Hattala and Kahnle 2009). Because plankton are one of the important foundations of the food web, juvenile shad were undoubtedly affected.

Exotic round gobies (*Neogobius melanostomus*) are now present in the Mohawk River, and if they were to enter the Hudson River, the outcome for shad could be catastrophic. Adult gobies are known take over prime nearshore spawning sites and aggressively prevent use by native species whileravenously consuming their eggs (NYISI undated). Long-term impacts are expected to include declines in native species populations. *N. melanostomus* has a well-developed lateral line which may give it a competitive advantage over native species feeding in turbid waters. Round gobies are also prolific breeders, spawning every 20 days during the spawning season.

While commercial ocean fisheries that targeted American shad were closed in all Atlantic coastal states in 2005, in-river fishing still occurs in some watersheds (Kahnle and Hattala 2010). Losses of young and adult shad to ocean commercial bycatch could be a factor in the decline, but the magnitude of these losses is uncertain.

In the Hudson River alone, water withdrawals on the Hudson River amount to over 5 billion gallons of water per day, which collectively kills billions of fish, larvae and eggs per year (Kahnle and Hattala 2010). American shad eggs, larvae, and young-of-the-year are also lost to a series of in-river cooling water intakes and water withdrawals on the East River (Henderson and Seaby 2015). Impingement and entrainment studies of the Con Edison East River Generating Station showed that millions of fish and billions of eggs and fish larvae were entrained on the East River (Calaban 2009).[28]

A mixed stock fishery occurs in Delaware Bay. American shad are known to stage prior to the spawning run at the mouth of Delaware Bay and are targeted by an intercept gillnet fishery. Even though fishing for Hudson River shad is prohibited, microsatellite analysis has determined many specimens in this fishery have a Hudson River provenance. Though many captures in this fishery show are indeed Delaware River spawners, a significant proportion of the catch includes a Hudson River contribution nearly equal to that of the Delaware Bay, which indicates a substantial take on the otherwise protected Hudson River population (Waldman et al. 2014).

Shad have also been experiencing an early maturation schedule (Maki et al. 2002). Because fish evolve in opposition to the greatest bias imposed on them, they may be attempting to compensate for the loss of the largest and most fecund fish. It is widely known that in-river gillnetters were targeting female shad, since they were prized for their roe and because they would be the largest of the sexes. Fishery induced evolution would cause the fish to mature earlier and young than previous cohorts. A continuing condition also hints at a mid-water trawl fishery for other species that still poses a threat to the American shad population coastwide.

The most disturbing sign when assessing the health of the American shad in the Hudson River is that the population has experienced recruitment failures in eighteen of the past nineteen years (Figure 2).

[28] Information from a biological fact sheet – Cooling water intake structure, East River Generating Station, SPDES #: NY-000 5126, Michael J. Calaban, DEC Bureau of Habitat, Steam Electric Unit, Dec. 10, 2009, p. 2, provided by DEC to Petitioner Riverkeeper's attorney Rachel Treichler pursuant to a FOIL request.

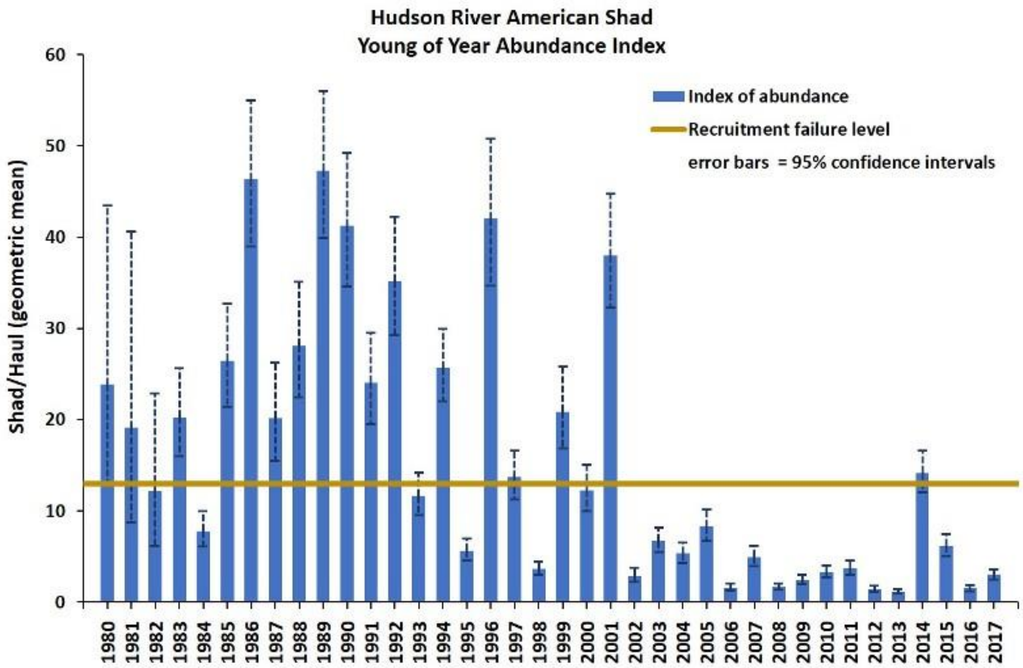

Figure 2. Hudson River Young-of-Year Abundance Index. Eighteen of the past nineteen years have shown recruitment failure. The last two spawning seasons are not shown in this graph. (Courtesy of NYSDEC)

Recruitment is the mechanism by which populations renew themselves and grow. But, having so many failures in a row delays potential recovery and portends to an ominous future if these trends continue.

Currently the American shad is not listed or protected by any adjacent states, but it is listed as a mid-priority by Committee on the Status of Endangered Wildlife in Canada (COSWEIC) and is protected under NOAA's Anadromous Fish Conservation Act (AFCA). The AFCA (16 U.S.C. 757a *et seq.*) authorizes the Secretaries of Commerce and/or Interior to enter into cooperative agreements with the states for the conservation, development, and enhancement of the Nation's anadromous fishery resources. The Act authorizes federal grants to the states or other non-Federal entities to improve spawning areas, install fishways, construction fish protection devices and hatcheries, conduct research to improve management, and otherwise increase anadromous fish resources. The Trustees may be able to take advantage of the provisions and funding of AFCA in order to leverage anadromous fish restoration plans and projects (NOAA undated).

Despite the efforts to reduce fishing pressure through strict regulations, the American shad remain in decline coastwide and most notably in the Hudson River where they are showing no recovery at all. It is conceivable that ecological conditions in the river present too great of an obstacle for the shad to overcome. It is also conceivable that the bycatch in the mid-water trawl fishery is greater than reported. The excessive mortality of the last 20 years perpetuates almost a century of successive periods of overfishing on the Hudson River stock of American shad. Results of this fishing pressure have left the stock in a historically depressed condition with high uncertainty regarding its recovery (Waldman et al. 2014). What is logical is that if the American shad continue to decline, there could be a tipping point where populations could collapse and go extinct long before the last of the species is lost. However, before a complete collapse, the population would remain unstable and less resilient to perturbations and/or recovery.

b. Conclusion

Based upon the information presented, the American shad warrants listing as "special concern" under New York's endangered and threatened species laws, ECL § 11-0535(1) and 6 NYCRR Part 182. The American shad meets the criteria for listing as "special concern" because it "do[es] not qualify as either endangered or threatened . . . but . . . require[s] some measure of protection to ensure that the species does not become threatened." *See* ECL § 11-0535(1); 6 NYCRR § 182.2(u). Consequently, we urge the NYSDEC to consider raising the proposing protections for the American shad as a "species of special concern."

VI. THE EASTERN FENCE LIZARD SHOULD NOT BE DOWNLISTED TO THE SPECIAL CONCERN LIST.

We also ask that DEC reconsider downlisting the eastern fence lizard from threatened to special concern status. The species status assessment for the lizard indicates there has been evidence of decline in the northern part of the species' range since was listed (citing Brittingham et al. 2005). New York is the northernmost edge of the eastern fence lizard's range, and as the assessment further indicates, the state has no monitoring efforts in place for the species. Consequently, DEC has no evidence of recovery such that downlisting the species is warranted at this time.

The species also appears to remain vulnerable to extinction because of the extremely low number of remaining populations. Additionally, there is no indication that the threat from habitat loss through succession has been addressed in a meaningful way that would remove the threat to the species' viability. The eastern fence lizard needs an actively implemented, comprehensive recovery plan before it can be removed from the threatened list.

VII. THE EASTERN TIGER SALAMANDER SHOULD NOT BE DOWNLISTED TO THE THREATENED SPECIES LIST.

We also ask that DEC reconsider downlisting the eastern tiger salamander from endangered to threatened. Available science suggests that this species is continuing to decline. For instance, DEC's own species status assessment states that researchers failed to find tiger salamanders during recent surveys at over a third of historically documented breeding locations, with another third having viability rankings of fair or poor. It also concludes that the statewide population "has been steadily declining" and that "a variety of management actions have been unsuccessful." Accordingly, available science supports maintaining the eastern tiger salamander's endangered status.

VIII. CONCLUSION

Thank you for this opportunity to comment on DEC's proposed changes to the endangered, threatened, and special concern lists. We heartily support increased protections for many of the state's most imperiled species; however, we ask that you consider stronger protections for the Atlantic Coast leopard frog, eastern hellbender, American eel, and American shad. We also ask that you reconsider downlisting the eastern fence lizard and eastern tiger salamander, as the best available science does not indicate they have recovered, thus warranting lesser protections. If you have any questions, please contact Elise Bennett at ebennett@biologicaldiversity.org or (727) 755-6950. We can provide copies of the literature cited in this comment upon request.

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