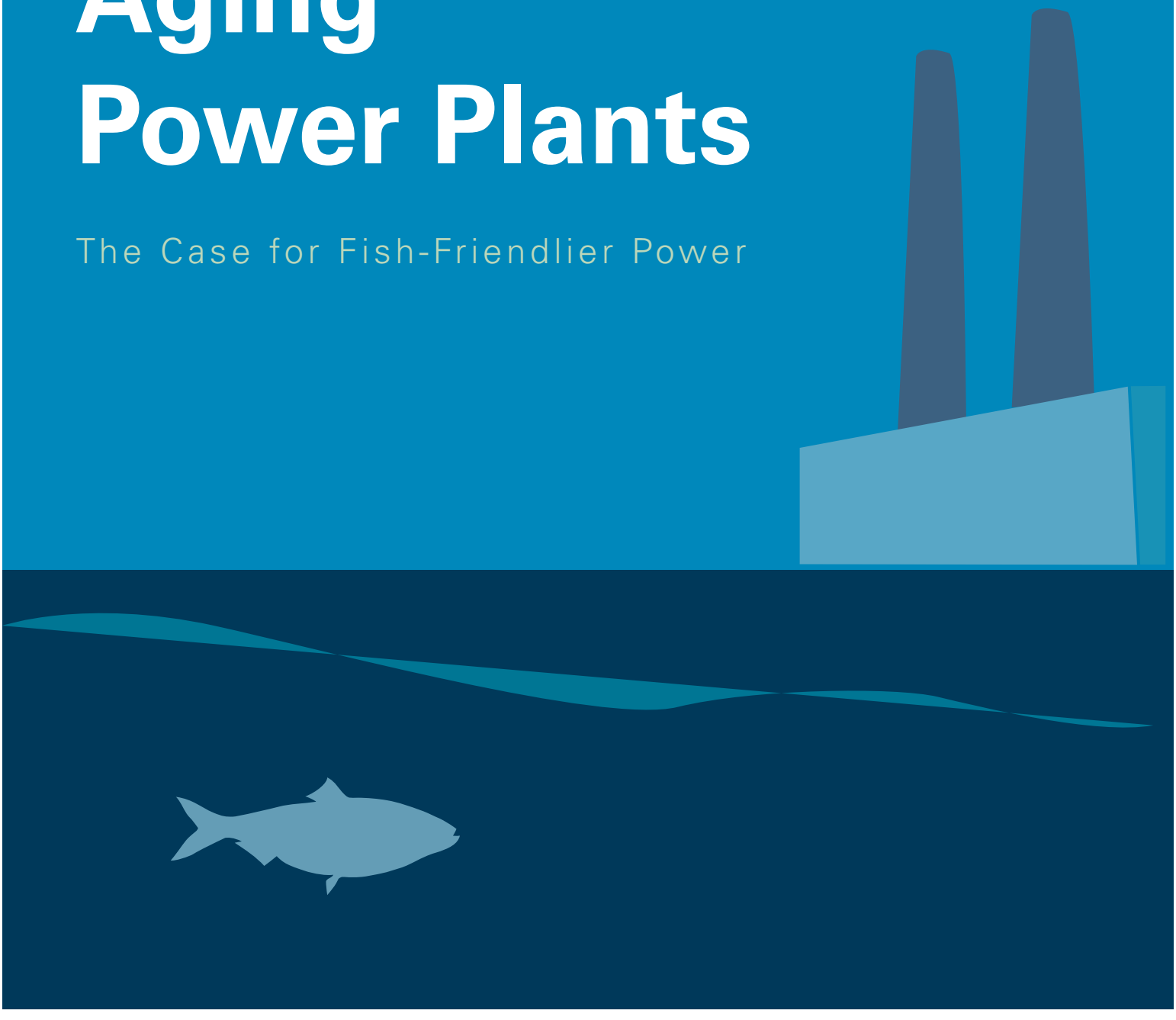
Reeling in New York's Aging Power Plants

The Case for Fish-Friendlier Power



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Report Credits

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Note: This report was prepared with the best information available at the time of writing. We welcome any new information and comments as we strive to make this report as accurate as possible. Any errors or omissions are the responsibility of the Network for New Energy Choices.

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Photo: Tom McCavera

ABOVE: Recreational fishing on the Western Bays in Long Island's South Shore Estuary. The E.F. Barrett Power Station in Island Park looms in the background, while a home with solar panels points toward a clean energy future.

EXECUTIVE SUMMARY

Power plants that draw in cooling water from rivers, lakes and estuaries kill fish, and older plants in particular kill them in enormous numbers.

Whether it's American shad in the Hudson River, winter flounder in Long Island Sound or lake sturgeon in New York's freshwaters, aging power plants can kill and injure anything living in the massive volumes of water that they withdraw.

Power plants that date as far back as the 1940s are responsible for the destruction of billions of aquatic organisms in New York every year. A fleet of 25 power plants that rely on outdated "once-through" cooling systems can withdraw up to nearly 16 billion gallons of water every day from the state's rivers, lakes and estuaries. In the process, nearly **17 billion** eggs, larvae and young hatched fish can be sucked into the power plants' cooling water intake pipes and killed each year, while another **171 million** larger fish and other aquatic species are injured or killed annually when they are trapped by screens intended to keep them out of the cooling systems.

This aquatic destruction has a simple solution: by modernizing existing power plants to recirculate cooling water, rather than continually take in more water, the harm to fish and other waterborne life is dramatically reduced. Closed-cycle cooling is a proven technology that reduces power plant water intake by up to 98 percent, thereby reducing the damage to aquatic life by up to 98 percent.

The power industry has consistently balked at upgrading outdated once-through cooling systems, claiming this will lead to plant outages and soaring electricity rates, but those claims are overblown and often unsubstantiated. Retrofitting to an environmentally responsible closed-cycle cooling system can take place while the power plant or unit continues to operate — only the final system tie-in requires a brief shut-down. This final phase of the retrofit process can be coordinated with routine maintenance outages to minimize the amount of time that the power plant is offline.

Meeting environmental standards — for example, by reducing mercury and other toxins from power plant air emissions — is a well-established responsibility of power companies. Yet despite both federal Clean Water Act provisions and a state permitting process intended to minimize the damage caused by cooling water intake systems, New York's power plants have been allowed to destroy aquatic life at an astonishing rate, mostly unchecked, for decades, due to an unclear regulatory landscape. This is a direct affront to taxpayers who have invested billions of dollars in the restoration of the state's waterways, and to fishermen who are adjusting their practices to restore the state's fisheries.

Power-plant-specific permits issued by the New York State Department of Environmental Conservation (DEC) and forthcoming new regulations from the U.S. Environmental Protection Agency (EPA) for cooling water intake structures present opportunities to end this needless destruction, and to hold the power industry to account. Since the new federal regulations are not expected to be complete until 2012, and state permits run on a five-year schedule, the power industry will not have to make overnight decisions on whether to retrofit, repower or close New York's older power plants that rely on once-through cooling. There is adequate time for power companies to plan ahead and modernize these plants, or to find other ways to meet demand.

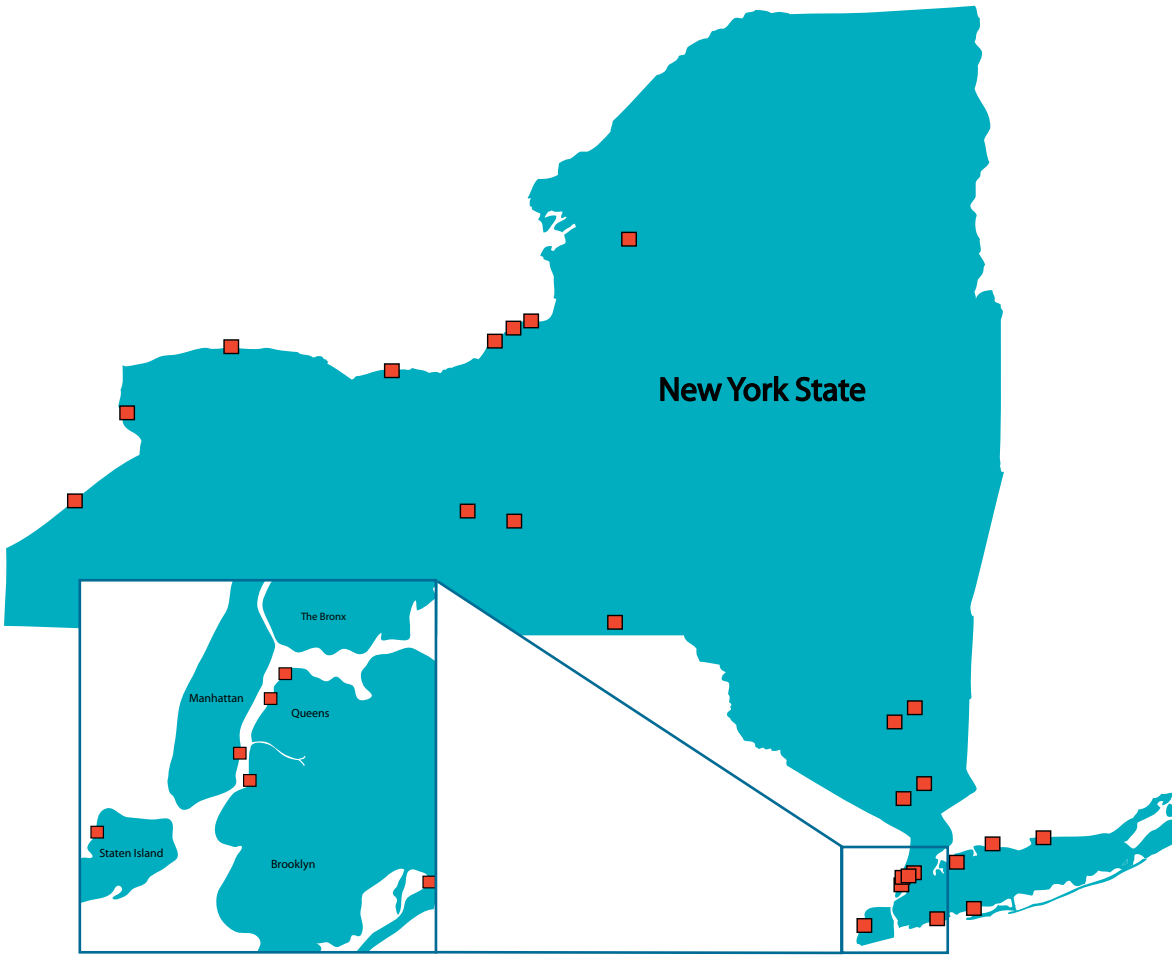
The DEC and EPA must require the 25 power plants in New York that rely on once-through cooling to retrofit to closed-cycle cooling. The power industry should closely examine the options of repowering or shutting down antiquated plants, and replacing them with new, efficient generation. The industry should also consider redirecting their investments to clean, renewable energy production to help fulfill the state's renewable energy goals. Not only will the grid become more reliable, emissions of carbon dioxide and other greenhouse gasses will be reduced.

INTRODUCTION

Power Plants and Water

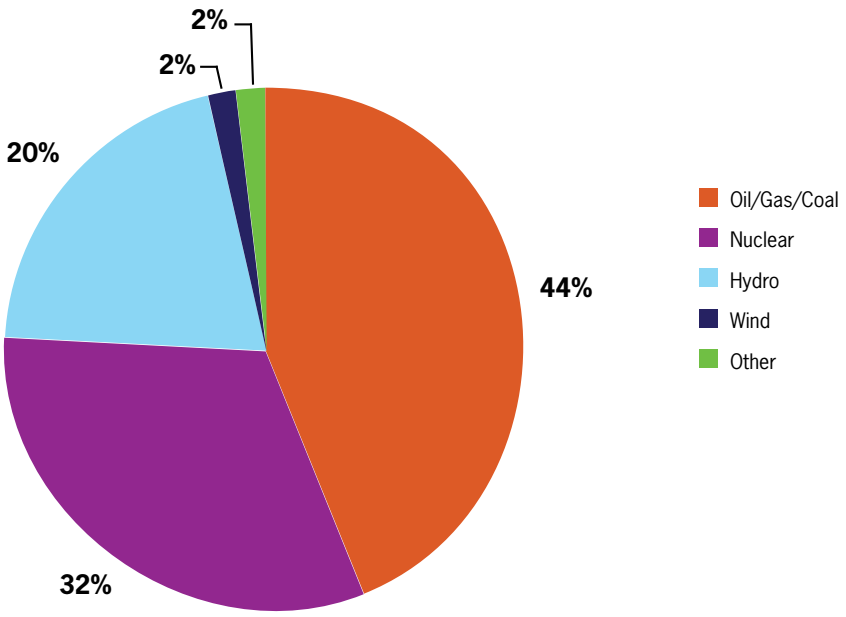
The United States' aging steam-electric power plants — fossil fuel- or nuclear-powered facilities that use steam to turn turbines and generate electricity — withdraw tremendous amounts of water for their cooling systems. These power plants account for 49 percent of all water withdrawn in the country, more than any other category including irrigation and public water supplies combined.[1] New York's steam-electric power plants withdraw a particularly large amount of water, ranking it third highest among the 50 states.[2]

Power plants that withdraw water for their cooling systems are subject to federal regulations issued by the U.S. Environmental Protection Agency (EPA) pursuant to Section 316(b) of the Clean Water Act. These regulations are designed to minimize the impact that these water intakes have on aquatic ecosystems. The first phase of the Section 316(b) regulations requires



ABOVE: Locations of the 25 New York power plants that rely on once-through cooling. For an interactive map with more details on these 25 plants, please visit www.newenergychoices.org.

Figure 1: New York Power Plant Electricity Generation (in Gigawatt Hours) by Fuel Type



Source: "2010 Load and Capacity Data," New York Independent System Operator, April 2010.

nearly all new power plants constructed after January 2002 to use modern technology, called "closed-cycle" cooling, which drastically reduces the amount of water withdrawn. However, there are not yet federal regulations governing cooling systems for power plants built prior to that time. There are 25 such power plants in New York that rely on "once-through" cooling, an antiquated and water-intensive technology that harms aquatic life in the state's coastal and inland waters. Installation of closed-cycle technology at these existing plants could take place with minimal time offline.

New York's Electric Power Generation

In 2009, power plants located in New York generated 136,500 gigawatt hours (GWh) of electricity (the average New York household uses six megawatt hours, or .0006 GWh, per year).[3] As illustrated in Figure 1, nearly half was generated using fossil fuels such as oil, natural gas and coal, 32 percent was generated using nuclear power, and another 20 percent was generated using hydropower.[4] Non-hydropower renewable energy sources, including wind, biomass and solar, generated just four percent of the state's electricity that same year.

Often power plants comprise more than one electricity generating unit. The 25 New York power plants discussed in this report are home to a total of 53 units, two-thirds of which are at least 40 years old (See Table 3 in the appendix).

ONCE-THROUGH COOLING SYSTEMS

Overview

Steam-electric power plants boil water to produce high-pressure steam that turns turbines, producing electricity. After powering the turbines the steam is cooled by a condenser, which typically uses water drawn in from a nearby lake, river or estuary. The steam that is condensed back into water can be boiled again to generate more electricity. In a once-through cooling system the cooling water is not reused, so the power plant must constantly withdraw enormous amounts of water and then discharge it back at a higher temperature. All told, New York power plants that use once-through cooling withdraw up to **16 billion gallons** of water every day. That's more than the amount needed to fill 24,000 Olympic-size swimming pools.

How Once-Through Cooling Systems Harm Aquatic Life

While smokestacks serve as highly visible reminders of the greenhouse gases and other air pollutants emitted by power plants, hidden underwater at most of those same facilities an intake structure with a voracious appetite quietly devastates aquatic habitats. Once-through cooling systems harm the full spectrum of life in aquatic ecosystems, from tiny photosynthetic organisms to fish, shellfish, and even threatened or endangered animals like sea turtles.[5]

Through ***entrainment***, eggs, larvae and young hatched fish and other aquatic species, all of which are essential to the food chain, are vacuumed into intake pipes. The eggs and larvae are exposed to extremely

BELOW: A simple illustration of a once-through cooling system. A tremendous amount of water is withdrawn to cool the plant — killing and/or injuring an enormous amount of aquatic life in the process — and then discharged at a far warmer temperature than when it was drawn in, further harming aquatic life.

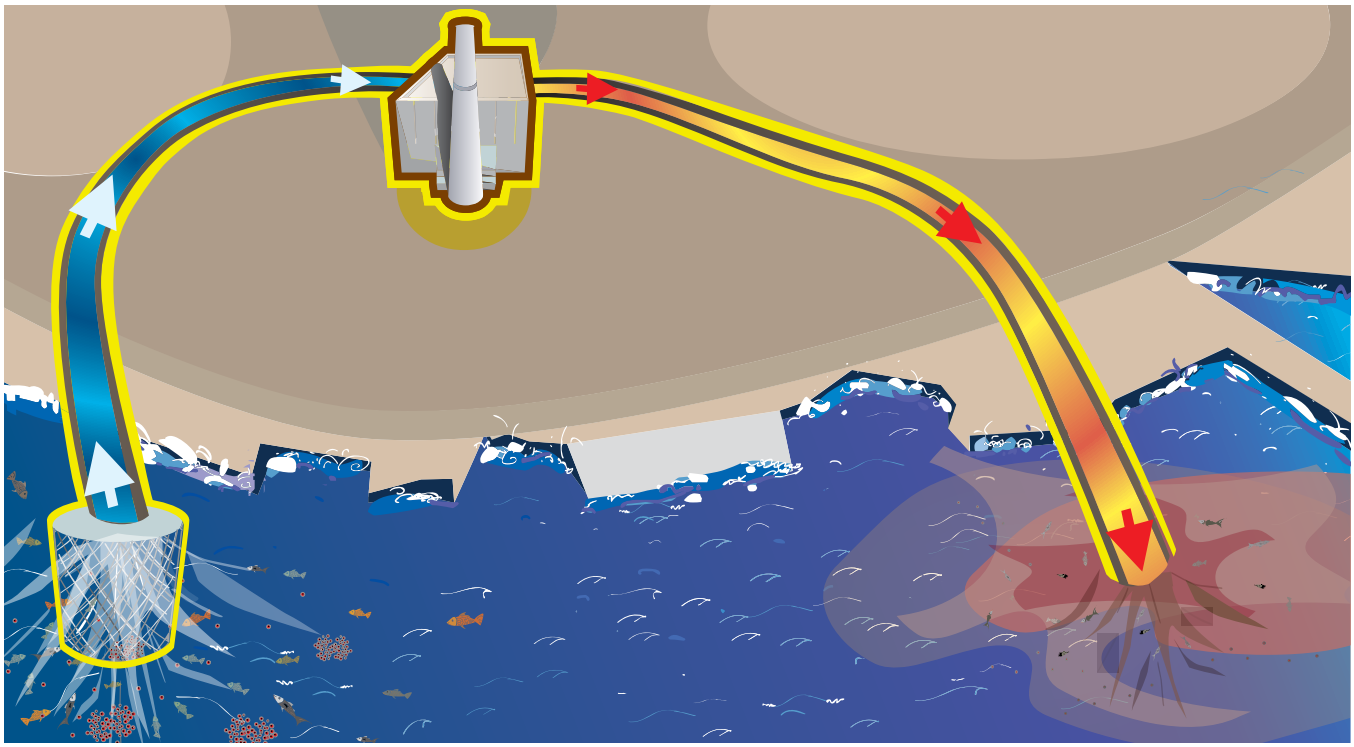


Illustration: Weiling Fu

hot water and toxic chemicals, and battered about by mechanical equipment. Few, if any, survive.[6]

Through ***impingement***, larger fish and other species that are pulled into the powerful currents flowing into a power plant's intake structure become trapped on screens intended to keep them out of the cooling systems. When aquatic organisms crash into the screens, they can be injured or killed.

The next generations of aquatic life needed to replenish decimated fish stocks are continually destroyed by these power plant withdrawals and heated discharges, undermining species recovery and diminishing a significant source of food for other species. The loss of early-life-stage fish and shellfish, and reductions in other species lower on the food chain, affect not only recreational and commercial fishing, but the overall health of the ecosystems.[7]

The Aquatic Toll in New York

The ecological toll on aquatic life caused by New York's 25 once-through cooling power plants is astonishing. As shown in Appendix Table 1, nearly **17 billion** fish in the early stages of development are entrained each year statewide. An additional **171 million** larger fish are impinged annually.

To put the 171 million impinged adult and juvenile fish in perspective, the National Marine Fisheries Service estimates that New York's recreational fishermen caught 21.5 million saltwater fish in 2009.[8] If any of these fishermen were to be caught with an undersized fish, or found fishing out of season, they could be fined and even lose their fishing license. Yet power plants indiscriminately harm or kill billions of fish every year, regardless of size or season, without any sort of penalty imposed.

Estuaries and tidal rivers provide essential habitat and nursery areas for the vast majority of commercially- and recreationally-important species of fin and shellfish, including many species that are subject to intensive fishing pressures.[9] The U.S. Environmental Protection Agency (EPA) specifically points to tidal rivers, estuaries, oceans and the Great Lakes for their susceptibility to environmental damage from cooling water intake structures.[19] As illustrated in Appendix Table 2, the north and south shores of Long Island, the East and Hudson Rivers and Lakes Erie and Ontario are all home to multiple power plants with once-through cooling systems.†

While we can tally statistics from individual power plants to offer a rough idea of how they affect particular water bodies, the true cumulative effect of numerous power plants withdrawing water from the same source is not well researched and warrants further study. In a Final Environmental Impact Statement regarding three once-through cooling systems sited along the Hudson River, the New York State Department of Environmental Conservation (DEC) expressed concern about "the cumulative degradation of the aquatic environment" by multiple cooling water intake structures operating within the same watershed.[11] The Atlantic States Marine Fisheries Commission and recreational fishing organizations have also voiced their concerns about the effects of cooling water intake structures on aquatic ecosystems.[12,13]

There is also a potential cumulative effect from once-through systems withdrawing water from already-compromised ecosystems. Of the 25 power plants discussed in this report, 22 withdraw water from rivers, lakes or estuaries that DEC classifies as "impaired."[14] The EPA's Environmental Appeals Board has recognized that, "in certain cases, even if the technology standard does not require closed-cycle cooling, a state's water quality standards may."[15] Under New York State's water quality standards, certain water bodies must be suitable for "fish propagation and survival." Given the damage to aquatic ecosystems caused by once-through cooling systems, closed-cycle cooling is necessary to protect the designated uses of these water bodies.

Overfishing, habitat loss and pollution have led to the decline of numerous recreational and commercial fish species, including American shad in the Hudson River, winter flounder in Long Island Sound and lake sturgeon in New York's freshwaters. However, fish and other aquatic organisms may be even more vulnerable to these threats because of the negative effects of one or multiple once-through cooling water systems.[16] Initial attempts at conducting large-scale investigations of these effects have suffered because of inadequate data.[17]

The anticipated results of unmitigated climate change — accelerated sea level rise, increased water temperatures, ocean acidification — could make aquatic ecosystems even more vulnerable to harm by cooling water intake systems in the future.

† This report avoids direct comparisons between individual power plants because the data are station-specific and gathered during different years using methodology that varies to some degree.

REGIONAL OVERVIEWS

As described in the previous section, numerous once-through cooling water systems withdrawing water from the same water body or watershed can be particularly damaging to those ecosystems. Following is an overview of the impact that these multiple power plant cooling water withdrawals have on five regions of New York State. Numbers cited below are found in Appendix Table 2.

Photo: Kyle Rabin

Long Island

Long Island is home to five large power plants, all owned by National Grid. On the north shore, three plants withdraw water from Long Island Sound, while two others take in water from the south shore estuaries. Each year, these five power plants kill or injure approximately 10.6 billion fish in the early stages of development through entrainment, and nearly 400,000 more mature fish through impingement.

In a hopeful sign for Long Island's fisheries and those statewide, on December 23, 2009, the New York State Department of Environmental Conservation (DEC) issued a draft permit requiring closed-cycle cooling as the "Best Technology Available" (BTA) for the E.F. Barrett Power Station.[18] This was only the second time in its history that the DEC made a BTA determination requiring closed-cycle cooling.

New York Harbor

Four power plants withdraw estuarine water from the East River, while a fifth withdraws water from the Arthur Kill tidal strait. Collectively, the five plants in the New York Harbor region are estimated to entrain 3.8 billion fish eggs and larvae annually, while impinging nine million adult and juvenile fish.

The Poletti Power Project, an 875 megawatt power plant sited along the East River, closed in January 2010. Before it shut down, the plant entrained over 600 million fish eggs and larvae each year, and impinged another 38,000 adult and juvenile fish.

Hudson River

There are four power plants along the Hudson River that rely on once-through cooling. Together, these four plants entrain 2.2 billion fish eggs and larvae each year, while impinging another 1.4 million adult and juvenile fish.

TOP: Northport Power Station (Huntington, NY). BOTTOM LEFT: Ravenswood Generating Station (Queens, NY). BOTTOM RIGHT: Indian Point Energy Center (Buchanan, NY).

Photo: Robin Madel

Photo: Robin Madel

The battle over fish kills caused by power plants dates back to the landmark Storm King Mountain legal case and resulting Hudson River Settlement Agreement (HRSA). Under the 1980 settlement, Consolidated Edison agreed to abandon plans for a hydroelectric power plant at Storm King Mountain in exchange for environmentalists' agreement to not immediately force the utility to install closed-cycle cooling technology at its existing power plants.

Since the HRSA expired in 1991, Riverkeeper, Inc. and other organizations have been working to persuade regulatory agencies to require that power plants sited along the Hudson River end their destruction of aquatic life. Both the closing of the Lovett Generating Station and the repowering and transformation of the former Albany Steam Station into the more efficient Bethlehem Energy Center — which uses closed-cycle cooling — stand as significant accomplishments.

Great Lakes

There are five power plants that employ once-through cooling systems along the shores of Lake Ontario, in addition to one on Lake Erie and one on the Niagara River, which connects these two Great Lakes. Collectively these seven power plants entrain 300 million fish eggs and larvae each year, while impinging over 160 million adult and juvenile fish. The Huntley and Dunkirk plants, in particular, impinge a tremendous number of fish, at 97 million and 63 million adult and juvenile fish each year, respectively.

New York's power plants are not alone in this region. Numerous other plants that use once-through cooling sit along the shores of Lakes Erie and Ontario, and are located in three states and one Canadian province.

Inland Waters

Four power plants sited on Lakes Seneca and Cayuga, the Susquehanna River and the Black River rely on once-through cooling systems. Collectively these plants entrain four million fish eggs and larvae annually, and impinge 40,000 adult and juvenile fish.

Photo: Brian Smith

ABOVE: Huntley Power Station (Tonawanda, NY).

Photo: Nuclear Regulatory Commission/ Courtesy Entergy Nuclear

ABOVE: James A. FitzPatrick Nuclear Power Plant (Oswego, NY).

CLOSED-CYCLE COOLING SYSTEMS

Overview

By modernizing existing power plants to recirculate water, rather than continually take in more water, the harm to fish and other waterborne life is dramatically reduced. The "Best Technology Available" to end this environmental destruction — closed-cycle cooling — reduces power plant water intake by up to 98 percent through recirculation, thereby reducing the destruction of aquatic life by up to 98 percent.[19]

There are two main types of closed-cycle cooling systems. In a **wet closed-cycle cooling** system, water is first circulated through the plant to absorb heat, and then moved through the cooling towers to release heat to the atmosphere, primarily through evaporation. The condensed water is then recirculated through the plant. A **dry closed-cycle cooling** system uses air flow, rather than the evaporation of water, to transfer heat from the power plant.

In 2001, the EPA established closed-cycle cooling as the industry standard when it promulgated its regulations on cooling water intake structures at new power plants. The regulations require nearly all new plants to reduce their water withdrawals to a level "commensurate with that which can be attained by a closed-cycle recirculating cooling water system."[20]

BELOW: A simple illustration of a wet closed-cycle cooling system. When a power plant uses a closed-cycle cooling system, it withdraws up to 98 percent less water because it recirculates the cooling water, reducing the amount of aquatic life killed by the cooling system by up to 98 percent.

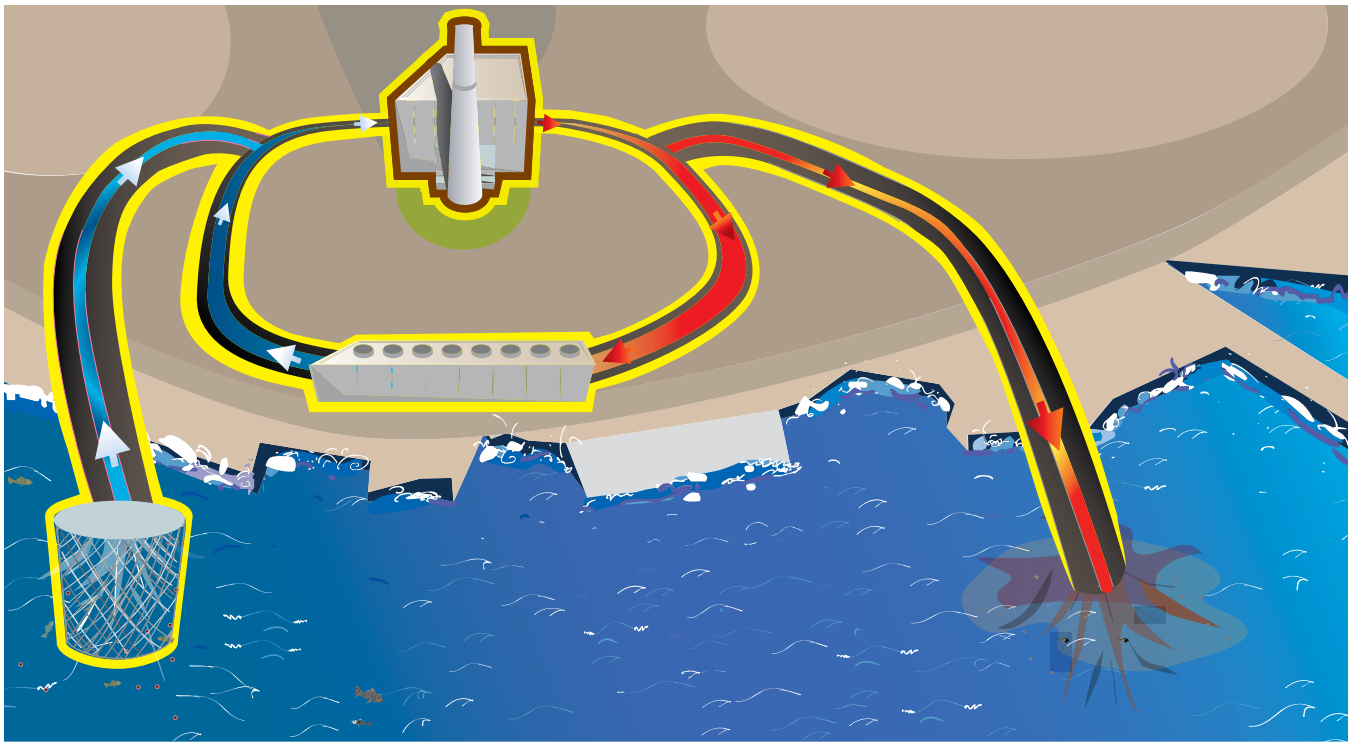


Illustration: Weiling Fu

The Facts about Converting to Closed-Cycle Cooling

In the past, power plant owners have made claims about the negative effects of installing closed-cycle cooling systems. Here are the facts:

- **Closed-cycle cooling cells are visually unobtrusive and quiet.** The looming power plant cooling towers made famous on "The Simpsons" are outdated. Modern plume-abated cooling cells are 50 to 60 feet tall and likely smaller than the buildings on site at existing power plants. Plume-abated cooling cells do not release visible plumes of steam, either. And by using ultra low noise fans, which are available from several manufacturers, cooling cells operate quietly.[21]

- **Retrofitting a plant with a closed-cycle cooling system does not require long outages.** Little or no unscheduled outage time is necessary for plants to retrofit to closed-cycle cooling systems. The entire cooling cell and piping construction process can occur while the plant or unit continues to operate. A short shutdown is then required only to allow final tie-in of the new system at each unit. This tie-in of the new cooling system can be coordinated with outage periods scheduled for routine maintenance, and/or can be done during non-peak-demand periods.[22]

- **Retrofitting a plant with a closed-cycle cooling system will not adversely affect electric system reliability.** Because new federal regulations are not expected to be final until 2012, and the relevant New York State permit is issued on a five-year cycle, power companies will not have to immediately retrofit, repower or close older power plants that rely on once-through cooling. Reliability of the electric system will not be adversely affected because there is adequate time for the industry and the system operator to plan and schedule for the modernization of these old, destructive plants.

- **Closed-cycle cooling technology does not require a lot of space.** While the amount of space required is site-specific, most power plant properties — even smaller sites — can accommodate closed-cycle cooling structures. Whether it be a little-used section of a parking lot or a building that is housing retired generating units, there are a number of options to consider for siting the necessary equipment.

- **Closed-cycle cooling technology may not affect electricity prices.** The relationship between the cost to a power plant's owner to install a closed-cycle cooling intake system and retail electricity prices is complicated and depends on a number of factors that are beyond the scope of this report. Those factors include: fuel source, participation in the wholesale electricity market, relative financial health of the power plant, and the type of power supplied. One study conducted in 2002, to review the effects on electric rates from retrofitting a power plant in Massachusetts with closed-cycle cooling, revealed that the increase per household would be less than the price of a postage stamp.[23] In short, requiring the installation of closed-cycle cooling will not necessarily lead to an increase in the retail price of electricity in New York.

- **Closed-cycle cooling should not increase air emissions.** The switch from once-through cooling to closed cycle cooling will cause a very minor loss, one to two percent, in a plant's net electrical output.[24] For example, Long Island's Port Jefferson plant, with 385 megawatts in operating capacity, would experience a reduction in output of about 3.5 to seven megawatts† as a result of converting to closed-cycle cooling. This modest loss of capacity can be replaced with an investment in renewable geothermal, solar or wind resources, a strategy in line with New York State's aggressive renewable energy goals.

- **Closed-cycle cooling does not require groundwater or municipal water use.** A power plant that installs a closed-cycle cooling system can simply continue to use the existing intake structure and withdraw from the same water source. The only difference is a precipitous drop, up to 98 percent, in the amount of water withdrawn. Where feasible, switching to a water source such as treated effluent from a wastewater treatment plant will completely eliminate any impacts on aquatic life from cooling water intake.

- **Modern Cooling Cells Minimize "drift."** Drift, the mixture of water vapor and particles, such as salt, that a cooling tower may emit, can be minimized by advanced "drift eliminators" that are incorporated into tower design. Modern eliminators reduce the amount of drift to just a half-gallon for every 100,000 gallons of cooling water circulated through the power plant.[25]

† One megawatt of power plant output will produce electricity roughly equal to the amount consumed by 400 to 900 homes in a year. (Source: *Alexander's Gas and Oil Connections*, July 10, 2003 http://www.gasandoil.com/goc/features/fex32816.htm.)

WHAT LAWS APPLY TO COOLING WATER INTAKE STRUCTURES?

Federal Policy History

Although once-through cooling systems have been in use for more than a century, and the size of U.S. power plants dramatically increased after World War II, it was not until the late 1960s that federal policymakers turned their attention to the environmental damage caused by these large-volume water withdrawals. Congress considered the aquatic impacts of intake structures during extensive hearings on the effects of waste heat discharged from industrial facilities,[26] and in 1967 Senator Warren Magnuson of Washington State warned that, "by 1980 thermal power plants throughout the nation will require an amount of cooling water greatly in excess of the average flow of the mighty Mississippi at St. Louis."[27] The White House was similarly concerned, and in 1968 President Lyndon Johnson's staff issued a report explaining that, "the large volumes of water withdrawn in once-through cooling processes [can have] as much or more effect on aquatic life than the waste discharges on which control measures are required."[28]

In the early 1970s, a number of well-publicized massive fish kills occurred at intake structures around the country. For example, in 1972 *The New York Times* reported that the Indian Point No. 1 nuclear plant on the Hudson River had killed 1.3 million fish over a 10 week period.[29] Troubled by that extraordinary number, Senator James Buckley of New York sought to ensure that regulatory agencies could require closed-cycle cooling at power plants. During the Clean Water Act (CWA) debates in Congress, Senator Edmund Muskie of Maine, the chief architect of the Act, assured Senator Buckley that the U.S. Environmental Protection Agency (EPA) would have that authority.[30] In October of 1972, just two weeks after that exchange, both houses of Congress voted overwhelmingly to override President Nixon's veto, passing the Clean Water Act. The new law fundamentally transformed the nation's water pollution control strategy, and gave EPA the authority Senator Muskie had promised. As a result, the Clean Water Act, which has been a mainstay of federal environmental law ever since, not only addresses the discharge of pollutants into our waterways, but also regulates withdrawals from those waters for cooling.

Clean Water Act Section 316(b)

The key CWA provision related to power plant cooling is Section 316(b), which requires "the location, design, construction, and capacity of cooling water intake structures [to] reflect the best technology available for minimizing adverse environmental impact."[31] As discussed above, those adverse environmental impacts are primarily the entrainment and impingement of fish, shellfish and other forms of aquatic life, along with the return of heated water to its cooler source — as thermal pollution. The "Best Technology Available" to minimize these effects is closed-cycle cooling. Section 316(b)'s technology requirements for power plant intake structures are implemented through the National Pollutant Discharge Elimination System (NPDES) permitting program. Power companies must install closed-cycle cooling or any other protective technologies only if they are specifically required to do so by the terms of a NPDES permit issued pursuant to the Clean Water Act.

Permitting Power Plants in New York: DEC and SPDES Permits

In New York, as in many other states, NPDES permits are issued by a state agency — here, the New York State Department of Environmental Conservation (DEC) — which has been delegated this responsibility by the EPA. When issued by the DEC, these are referred to as State Pollutant Discharge Elimination System permits ("SPDES" permits). The EPA is required to facilitate the DEC's permitting process by establishing national regulations identifying which

technologies are the "best available" for minimizing environmental impacts. However, those regulations have been very slow in coming.

The EPA's "Phase I" regulations, issued in 2001, dictate that closed-cycle cooling is the best technology available for all newly built power plants. But there are presently no federal regulations covering large existing power plants, even though they are the most damaging facilities, with some of them withdrawing as much as three billion gallons of water each day. EPA took decades to issue its first attempt at "Phase II" regulations in 2004, which would have covered those plants, but those regulations were impermissibly weak, and in 2007 a federal appeals court panel returned the regulations to EPA to repair the many deficiencies. The 2004 regulations have been suspended for almost three years, and although new regulations are expected in draft form in 2010, they will not be finalized until at least 2012.

In the absence of Section 316(b) regulations, the New York DEC must issue permits on an ad hoc, case-by-case basis, by determining what requirements are appropriate for the cooling water intake structure at each power plant. The DEC's Bureau of Habitat in Albany includes a group of biologists, known as the "Steam-Electric Unit," which seeks to minimize the mortality to fish caused by the operation of cooling water intakes.[32] The DEC is supposed to "stand in the shoes" of the EPA when it makes these decisions, which are known as "Best Technology Available" (BTA) determinations, but the DEC lacks the resources and technical expertise (and often the political will) to force owners to make significant upgrades to their plants.

New York's Waiting Game

In the past, the DEC sat on SPDES permit renewal applications for years — sometimes for decades — without making a BTA determination, despite the Clean Water Act's requirements that NPDES/SPDES permits be reevaluated every five years.[33] When permit evaluations do commence, they typically extend over many years and during that time the power industry avoids technology upgrades. The DEC has allowed many power plants to continue operating with antiquated intake structures under "administratively extended" permits that should have expired and been replaced long ago. Thus, the Indian Point, Roseton and Bowline power plants on the Hudson River are still operating under permits issued in 1987. Those permits should have been updated in 1992 and every five years thereafter. Starting in 2001, Riverkeeper, Inc. and other environmental groups filed a petition with the DEC for prompt action on certain permit renewals, and then sued the agency in state court to compel it to take action on long-dormant permits. That legal pressure prompted the DEC to start taking action on expired permits, but the agency has still not issued a final SPDES permit requiring a power plant to retrofit to closed-cycle cooling.

Even when the DEC has made BTA determinations for power plants, the vast majority of those decisions have used one excuse or another to allow once-through cooling to continue killing billions of fish and other forms of aquatic life. Indeed, rather than proposing strategies to move past that antiquated, highly destructive, and wholly unnecessary cooling method and embrace modern technology that will protect aquatic resources and meet legal requirements, New York's 2009 State Energy Plan touts the state's efforts to do just the opposite — to permit once-through cooling to continue.[34]

Nearly four decades have passed since the Clean Water Act was signed into law. An evasive power industry, an absence of EPA regulations and resource-starved states struggling with an ineffective, ad hoc approach, have left Congress' goal of minimizing the damage wrought by power plants on the nation's waters unfulfilled.

CONCLUSION

The annual loss of billions of fish and other aquatic life forms into the antiquated cooling water intake systems of New York's power plants is unacceptable because it is easily stopped with existing technology. Since the passage of the Clean Water Act, municipal, state and federal governments have invested billions of tax dollars in the restoration of the nation's waters. Since the passage of the Magnuson Fishery Conservation Act in 1976, the recreational and commercial fishing industries have had to adjust their practices — at their own expense — in an effort to restore the nation's fisheries. Yet the power generating industry has not been held to this same set of standards of accountability for its needless destruction of aquatic life.

The devastation caused by New York's aging power plants compounds the poor condition of some of the state's most ecologically vulnerable water bodies. The water drawn into once-through cooling systems comes from rivers, lakes and estuaries that are often polluted and have lost critical habitat. Typically, there are numerous cooling intake structures associated with several power plants sited along a single water body, each one drawing in hundreds of millions of gallons of water per day and straining it of life. The damage caused to the state's rivers, lakes and estuaries is not just limited to fish stocks; the disruptions to the food chain harm the overall health of entire ecosystems.

Modern closed-cycle cooling systems are visually unobtrusive, quiet and do not require much space. Power plants that retrofit to closed-cycle cooling systems require only a short shutdown to allow a final tie-in and, as a result, do not adversely affect electric system reliability. The switch to closed-cycle cooling results in only a one to two percent loss in a power plant's electrical output. And New York State's five-year SPDES permitting schedule allows the power industry plenty of time to plan ahead for the phase-in of new federal regulations — expected to be finalized in 2012 — for existing power plants with once-though cooling water intake structures.

Repowering, or in some cases shutting down the antiquated power plants in New York's fleet and replacing them with more efficient generation, including investing in clean, renewable energy production, will help to restore the state's rivers, lakes and estuaries, while cutting emissions of carbon dioxide and other greenhouse gasses, helping to combat climate change.

It's been nearly 40 years since the passage of the Clean Water Act and its provision addressing the environmental devastation caused by cooling water intake systems. The power industry must stop evading its well-understood responsibilities under the law, and the New York State Department of Environmental Conservation and the U.S. Environmental Protection Agency must regulate and enforce the provisions of the Clean Water Act. If the 25 power plants in New York that currently rely on antiquated once-through cooling technology are to continue operating, they must be required to end their needless destruction of aquatic life.

ENDNOTES

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APPENDIX

Appendix Table 1: State Overview

Power Plant	Owner	Capacity (Megawatts)	Water Withdrawn Million Gallons/Day	Water Body	Entrainment†	Impingement‡
AES Cayuga	AES	306	219	Cayuga Lake	576,000	NA
AES Greenidge	AES	161	113	Seneca Lake	NA	29,000
AES Somerset	AES	675	279	Lake Ontario	141,469	12,445
AES Westover	AES	146	102	Susquehana River	3,900,000	10,200
Arthur Kill	NRG Energy	842	713	Arthur Kill	1,548,314,607	4,406,742
Astoria Generating	Astoria Generating	1,290	1,254	East River	629,832,154	2,916,328
Barrett (E.F.)	National Grid	384	294	Barnum's Cove	906,259,233	176,044
Black River Power (Fort Drum)	Black River Power	50	55	Black River	41,000	0
Bowline	Mirant	1,139	912	Hudson River	127,000,000	30,000
Brooklyn Navy Yard	Con Ed	286	55	East River	38,998,201	0
Danskammer	Dynegy Northeast	491	457	Hudson River	161,019,074	144,429
Dunkirk Steam Station	NRG Energy	600	579	Lake Erie	47,940,000	62,778,786
East River Generating Station	Con Ed	317	369	East River	1,342,191,677	1,500,873
Far Rockaway	National Grid	109	84	Jamaica Bay	117,662,685	6,560
Fitzpatrick	Entergy	825	596	Lake Ontario	18,004,625	239,357
Ginna	Rochester Gas & Electric	496	490	Lake Ontario	28,616,000	35,612
Glenwood	National Grid	210	179	Hempstead Harbor	177,879,210	9,562
Huntley	NRG Energy	760	846	Niagara River	105,500,000	96,700,000
Indian Point	Entergy	1,910	2,801	Hudson River	1,200,000,000	1,180,000
Nine Mile Point	Constellation	1,757	490	Lake Ontario	86,700,000	1,061,900
Northport	National Grid	1,522	939	LI Sound	8,430,808,238	127,118
Oswego Steam Station	NRG Energy	1,700	1,399	Lake Ontario	12,824,104	1,246
Port Jefferson	National Grid	385	399	Pt Jeff. Harbor	1,014,950,951	76,104
Ravenswood	TC Ravenswood LLC	2,410	1,391	East River	199,000,000	82,303
Roseton	Dynegy Northeast	1,200	926	Hudson River	712,000,000	44,096
Totals	–	–	***15,941***	–	***16,910,159,228***	***171,568,705***

Source: New York State Department of Environmental Conservation, "Best Technology Available (BTA) for Cooling Water Intake Structures," draft policy from March 4, 2010.

† Annual number of fish eggs and larvae.

‡ Annual number of fish.

Appendix Table 2: Regional Overview

Power Plant	Capacity (Megawatts)	Water Withdrawn Million gallons/day	Water Body	Entrainment†	Impingement‡
Long Island					
Barrett (E.F.)	384	294	South Shore Estuary	906,259,233	176,044
Far Rockaway	109	84	South Shore Estuary	117,662,685	6,560
Glenwood	210	179	Long Island Sound	177,879,210	9,562
Northport	1,522	939	Long Island Sound	8,430,808,238	127,118
Port Jefferson	385	399	Long Island Sound	1,014,950,951	76,104
Totals	**–**	***1,895***	**–**	***10,647,560,317***	***395,388***
New York Harbor					
Arthur Kill	842	713	Arthur Kill	1,548,314,607	4,406,742
Astoria Generating	1,290	1,254	East River	629,832,154	2,916,328
Brooklyn Navy Yard	286	55	East River	38,998,201	0
East River Generating Station	317	369	East River	1,342,191,677	1,500,873
Ravenswood	2,410	1,391	East River	199,000,000	82,303
Totals	**–**	***3,782***	**–**	***3,758,336,639***	***8,906,246***
Hudson River					
Bowline	1,139	912	Hudson River	127,000,000	30,000
Danskammer	491	457	Hudson River	161,019,074	144,429
Indian Point	1,910	2,801	Hudson River	1,200,000,000	1,180,000
Roseton	1,200	926	Hudson River	712,000,000	44,096
Totals	**–**	***5,096***	**–**	***2,200,019,074***	***1,398,525***
Great Lakes					
AES Somerset	675	279	Lake Ontario	141,469	12,445
Fitzpatrick	825	596	Lake Ontario	18,004,625	239,357
Ginna	496	490	Lake Ontario	28,616,000	35,612
Huntley	760	846	Niagara River	105,500,000	96,700,000
Nine Mile Point	1,757	490	Lake Ontario	86,700,000	1,061,900
Oswego Steam Station	1,700	1,399	Lake Ontario	12,824,104	1,246
Dunkirk Steam Station	600	579	Lake Erie	47,940,000	62,778,786
Totals	**–**	***4,679***	**–**	***299,726,198***	***160,829,346***
Inland Waters					
AES Cayuga	306	219	Cayuga Lake	576,000	NA
AES Greenidge	161	113	Seneca Lake	NA	29,000
AES Westover	146	102	Susquehana River	3,900,000	10,200
Black River Power (Fort Drum)	50	55	Black River	41,000	0
Total	**–**	***489***	**–**	***3,941,000***	***39,200***

Source: New York State Department of Environmental Conservation, "Best Technology Available (BTA) for Cooling Water Intake Structures," draft policy from March 4, 2010.

† Annual number of fish eggs and larvae.

‡ Annual number of fish.

Appendix Table 3: Unit Age and Fuel

Power Plant	Generating Unit	In Service Date	Fuel	Gigawatt Hours Generated (2009)
AES Cayuga	1	1955	Coal	790.1
	2	1958	Coal	840.0
AES Greenidge	3	1950	Coal	3.0
	4	1953	Coal/Wood/Natural Gas	435.2
AES Somerset	–	1984	Coal	3,368.3
AES Westover	7	1944	Coal	0.0
	8	1951	Coal	247.5
Arthur Kill	ST 2	1959	Natural Gas	446.7
	ST 3	1969	Natural Gas	444.8
Astoria Generating	2	2001	Natural Gas	6.4
	3	1958	Natural Gas	528.1
	4	1961	Natural Gas	543.3
	5	1962	Natural Gas	330.1
Barrett (E.F.)	ST 01	1956	Natural Gas/Oil	508.0
	ST 02	1963	Natural Gas/Oil	407.9
Black River Power (Fort Drum)	–	1989	Coal	77.4
Bowline	1	1972	Natural Gas/Oil	114.0
	2	1974	Natural Gas/Oil	13.5
Brooklyn Navy Yard	–	1996	Natural Gas	1,828.1
Danskammer	1	1951	Natural Gas/Oil	12.4
	2	1954	Natural Gas/Oil	10.7
	3	1959	Coal/Natural Gas/Oil	767.5
	4	1967	Coal/Natural Gas/Oil	1,271.9
Dunkirk Steam Station	1	1950	Coal	368.9
	2	1950	Coal	366.7
	3	1959	Coal	999.5
	4	1960	Coal	889.4
East River Generating Station	6	1951	Natural Gas/Oil	401.3
	7	1955	Natural Gas/Oil	240.1
Far Rockaway	ST 04	1953	Natural Gas/Oil	101.5
Fitzpatrick	–	1975	Uranium	7,398.1

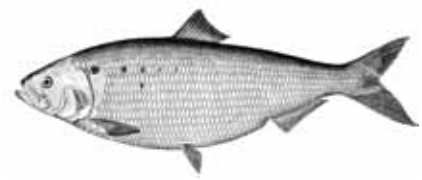
Source: 2010 Load and Capacity Data, New York Independent System Operator, April 2010.

Appendix Table 3: Unit Age and Fuel *(Continued)*

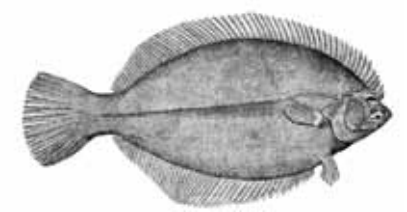
Power Plant	Generating Unit	In Service Date	Fuel	Gigawatt Hours Generated (2009)
Ginna	–	1970	Uranium	4,635.6
Glenwood	ST 04	1952	Natural Gas	33.4
	ST 05	1954	Natural Gas	31.7
Huntley	67	1957	Coal	996.7
	68	1958	Coal	1,030.9
Indian Point	2	1973	Uranium	8,837.4
	3	1976	Uranium	7,704.9
Nine Mile Point	1	1969	Uranium	4,991.4
	2	1988	Uranium	9,919.6
Northport	1	1967	Natural Gas/Oil	734.1
	2	1968	Natural Gas/Oil	719.6
	3	1972	Natural Gas/Oil	655.9
	4	1977	Natural Gas/Oil	1,153.0
Oswego Steam Station	5	1976	Oil	26.6
	6	1980	Oil	48.0
Port Jefferson	3	1958	Natural Gas/Oil	304.5
	4	1960	Natural Gas/Oil	251.0
Ravenswood	ST 01	1963	Natural Gas/Oil	626.6
	ST 02	1963	Natural Gas/Oil	193.8
	ST 03	1965	Natural Gas/Oil	832.3
Roseton	1	1974	Natural Gas/Oil	207.9
	2	1974	Natural Gas/Oil	223.5

Source: 2010 Load and Capacity Data, New York Independent System Operator, April 2010.

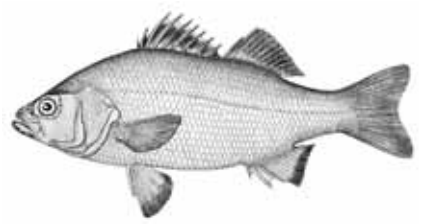
Appendix Figure 1: A Selection of Fish Species Entrained and/or Impinged by New York Power Plants



American Shad

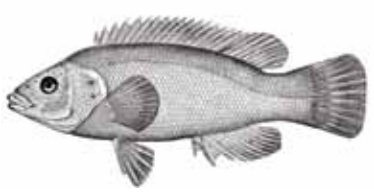


Winter Flounder



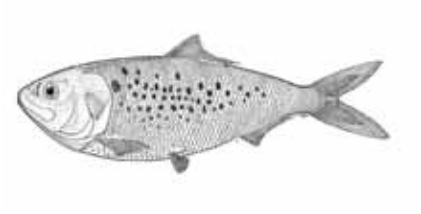
White Perch

Short Nose Sturgeon

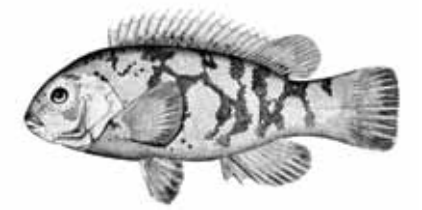


Cunner

Bay Anchovy



Atlantic Menhaden



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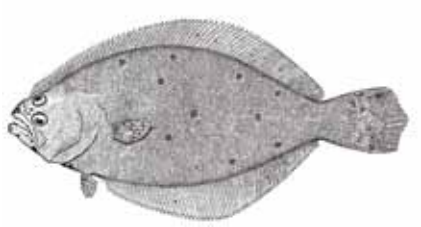
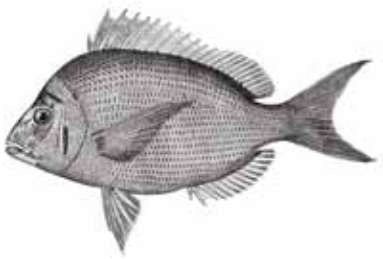


Summer Flounder



Scup

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