LI Sound Futures Fund 2011 - Education & Small Grants - Submit Final Programmatic Report (Activities)
Grantee Organization: Connecticut Zoological Society, Inc.
Project Title: Beardsley Zoo's "Trout in the Classroom" (CT)

Project Period	09/01/2011 - 02/01/2013
Award Amount	$7,000.00
Matching Contributions	$14,000.00
Project Location Description (from Proposal)	The project will take place at the Beardsley Zoo in the City of Bridgeport, Fairfield County, Connecticut. Latitude: N 41° 12' 27.3203" Longitude: W 73° 11' 1.9675
Project Summary (from Proposal)	Engage students and the public to learn about the interrelationship between Long Island Sound and the lower Pequonnock River through the raising and release of brook and brown trout. Project will result in 2 signs at the Zoo, e-newsletters, partner websites, and public access cable.
Summary of Accomplishments	The Beardsley Zoo's Trout in the Classroom program was a huge success. Major accomplishments include: successful completion of 16 workshops/classes; the highest rate of successful trout release in the state this year (according to CT DEEP); re-introduced a native species that had been wiped out completely from the Pequonnock River over the past 200 years (30 trout were released during the program year); provided a valuable conservation education experience to female students and minority students- 75% of participants were female and 100% of participants were racial/ethnic minorities (primarily African American).
Lessons Learned	Reintroduction of trout into the Pequonnock River can be a successful conservation strategy and a valuable educational opportunity for young people. Small "boutique style" learning experience works better for this type of topic; program will incorporate more hands-on interaction and less classroom intervention in future years.

Conservation Activities	Education
Progress Measures	# of workshops, webcasts, webinars, special events, meetings associated with activity
Value at Grant Completion	18
Conservation Activities	Education
Progress Measures	# schools involved in activity
Value at Grant Completion	3
Conservation Activities	Education
Progress Measures	# of educational signs
Value at Grant Completion	1
Conservation Activities	Successful Raising of Brook Trout
Progress Measures	Other Activity Metric (% of trout successfully raised and released into water system)
Value at Grant Completion	85

The story of the wolf: past, present and future
A Co-evolving Relationship

Fishing Methods

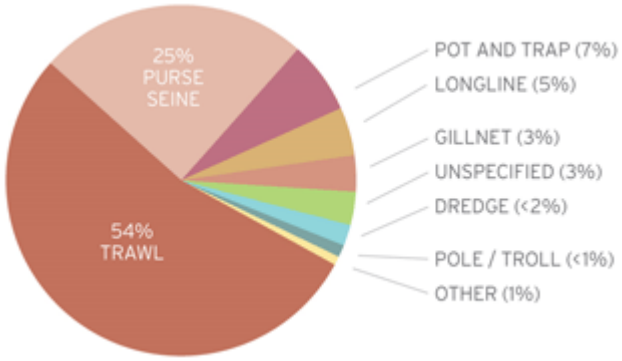
How We Fish
Fishermen use a wide range of gear to land their catch. Every type has its own effects on the ocean. By selecting the right gear for the right job, the fishing industry can help minimize its impact on the environment.

- Pole/Troll
- Purse Seining
- Gillnetting
- Longlining
- Trawls and Dredges
- Traps and Pots
- Harpooning
- Trolling

How We Farm Fish
In the next decade, the majority of fish we eat will be farm-raised, not wild. Global aquaculture includes over 100 species, farmed in everything from traditional earthen ponds to high-tech tank systems. Each farming system has its own distinct environmental footprint. By choosing seafood from better farms and production systems, consumers can play a positive role in reducing aquaculture's potential negative impacts.

- Open Net Pens or Cages
- Ponds
- Raceways
- Recirculating Systems
- Shellfish Culture

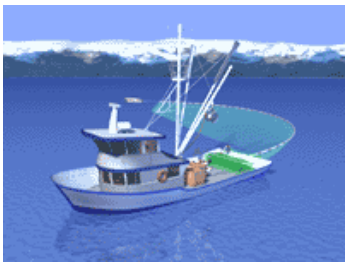
Types of fishing gear used in U.S. fisheries



Most seafood in the U.S. is caught using nets dragged behind boats, such as purse seines, trawls and dredges (NMFS, 2009).

Fishing Methods

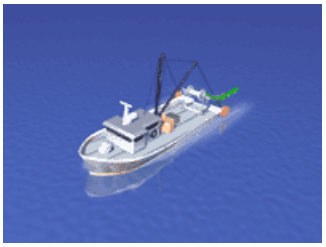
Pole/troll fishermen use a fishing pole and bait to target a variety of fish, ranging from open ocean swimmers, like tuna and mahi mahi, to bottom dwellers, like cod. Pole/troll fishing is environmentally responsible and a good alternative to pelagic longlining. Unlike pelagic longlines, which catch sharks, marine mammals, sea turtles and seabirds as bycatch, pole/troll fishermen have very low bycatch rates.



Purse seining establishes a large wall of netting to encircle schools of fish. Fishermen pull the bottom of the netting closed—like a drawstring purse—to herd fish into the center. This method is used to catch schooling fish, such as sardines, or species that gather to spawn, such as squid. There are several types of purse seines and, depending on which is used, some can catch other animals (such as when tuna seines are intentionally set on schools of dolphins).

Gillnetting uses curtains of netting that are suspended by a system of floats and weights; they can be anchored to the sea floor or allowed to float at the surface. The netting is almost invisible to fish, so they swim right into it. Gillnets are often used to catch sardines, salmon and cod, but can accidentally entangle and kill other animals, including sharks and sea turtles.

Longlining employs a central fishing line that can range from one to 50 miles long; this line is strung with smaller lines of baited hooks, dangling at evenly spaced intervals. Longlines can be set near the surface to catch pelagic fish like tuna and swordfish, or laid on the sea floor to catch deepdwelling fish like cod and halibut. Many lines, however, can hook sea turtles, sharks and seabirds that are also attracted to the bait. By sinking longlines deeper or using different hooks, fishermen can reduce the bycatch problem.



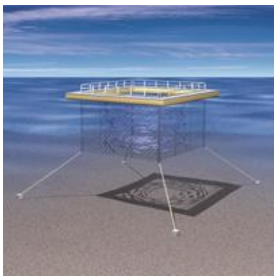
Trawls and dredges are nets towed at various depths to catch fish or shellfish. Trawl nets, which can be as large as a football field, are either dragged along the sea floor or midway between the floor and the surface. Trawlers catch fish such as pollock, cod, flounder and shrimp. Bottom trawling can result in high levels of bycatch. Dredging involves dragging a heavy frame with an attached mesh bag along the sea floor to catch animals living on or in the mud or sand; catches include scallops, clams and oysters. Dredging can damage the sea floor by scraping the bottom and also often results in significant bycatch.

and hold them alive until fishermen return to haul in the catch. Traps and pots are usually placed on the ocean bottom, often to catch lobsters, crabs, shrimp, sablefish and Pacific cod. They generally have lower unintended catch and less sea floor impact than mobile gear like trawls.

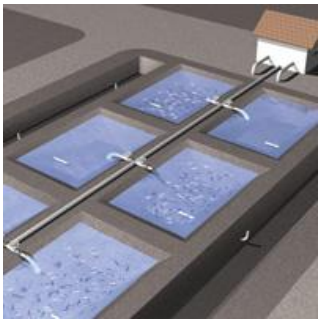
Harpooning is a traditional method for catching large fish—and it's still used today by skilled fishermen. When a harpooner spots a fish, he thrusts or shoots a long aluminum or wooden harpoon into the animal and hauls it aboard. Harpooners catch large, pelagic predators such as bluefin tuna and swordfish. Harpooning is an environmentally responsible fishing method. Bycatch of unwanted marine life is not a concern because harpoon fishermen visually identify the species and size of the targeted fish before killing it.

Trolling is a hook-and-line method that tows fishing lines behind or alongside a boat. Fishermen use a variety of lures and baits to "troll" for different fish at different depths. Trollers catch fish that will follow a moving lure or bait, such as salmon, mahi mahi and albacore tuna. Trolling is an environmentally responsible fishing method. Fishermen can quickly release unwanted catch from their hooks since lines are reeled in soon after a fish takes the bait.

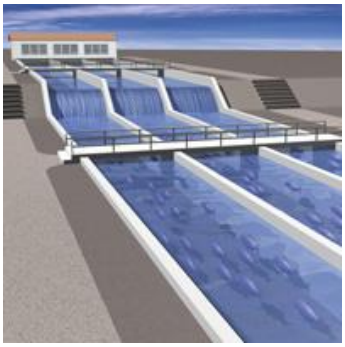
Fish Farming (Aquaculture)



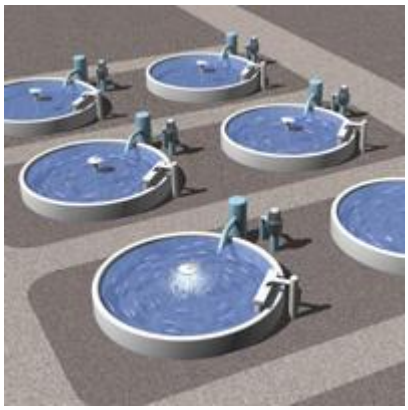
Open net pens or cages enclose fish such as salmon in offshore coastal areas or in freshwater lakes. Net pens are considered a high-impact aquaculture method because waste from the fish passes freely into the surrounding environment, polluting wild habitat. Farmed fish can also escape and compete with wild fish for natural resources or interbreed with wild fish of the same species, compromising the wild population. Diseases and parasites can also spread to wild fish living near or swimming past net pens.



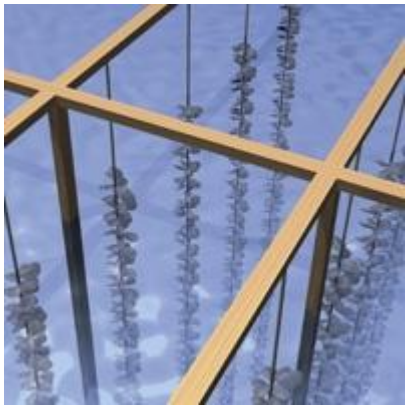
Ponds enclose fish in a coastal or inland body of fresh or salt water. Shrimp, catfish and tilapia are commonly raised in this manner. Wastewater can be contained and treated. However, the discharge of untreated wastewater from the ponds can pollute the surrounding environment and contaminate groundwater. Moreover, the construction of shrimp ponds in mangrove forests has destroyed more than 3.7 million acres of coastal habitat important to fish, birds and humans.



Raceways allow farmers to divert water from a waterway, like a stream or well, so that it flows through channels containing fish. Farmers usually treat the water before diverting it back into a natural waterway. Some governments require strict regulation and monitoring of on-site and nearby water quality. In the U.S., farmers use raceways to raise rainbow trout. If untreated, wastewater from the raceways can contaminate waterways and spread disease. Farmed fish can potentially escape and compete with wild fish for natural resources. Escaped fish can also interbreed with wild fish of the same species, putting the health of the wild population at risk.



Recirculating systems raise fish in tanks in which water is treated and recycled through the system. Almost any finfish species such as striped bass, salmon and sturgeon can be raised in recirculating systems. Recirculating systems address many environmental concerns associated with fish farming—fish cannot escape, and wastewater is treated—but they are costly to operate and rely on electricity or other power sources.



Shellfish culture means that farmers grow shellfish on beaches or suspend them in water by ropes, plastic trays or mesh bags. The shellfish farmed using these methods—oysters, mussels, and clams—are filter feeders and require only clean water to thrive. Filter feeders can actually filter excess nutrients out of the water, but farming shellfish in high densities in areas with little current or tidal flow can lead to the accumulation of waste. Also, historically, some shellfish culture has been responsible for the introduction of exotic species that can sometimes out-compete native species for natural resources.

Pollution of Lakes and Streams

Pollution is defined as "to make something impure"—in this case, the fresh water in lakes, streams, and groundwater. The pollution of water restricts its use for some human need or a natural function in the ecosystem.

Types of Pollutants

Physical

Physical pollutants to lakes and streams include materials such as particles of soil that are eroded from the landscape or washed from paved areas by flowing water. Once in a lake or stream, some particles settle out of the water to become bottom sediments. Chemical pollutants adsorbed (bound) to the particles are also incorporated into the sediments, where they may be permanently buried, or be carried by the water currents to other locations.

Another type of physical pollutant is heat that may be discharged from an industrial source, or runoff from hot surfaces in warm weather. The overclearing of shade trees along the shoreline of a lake or stream may also permit sunlight to warm waters above the normal temperature range.

Chemical

Fresh waters naturally contain chemicals dissolved from the soils and rocks over which they flow. The major inorganic elements include calcium, magnesium, sodium, potassium, carbon, chlorine, and sulfur as well as plant nutrients, such as nitrogen, silicon, and phosphorus. Organic compounds derived from decaying biological materials may also be present. In addition, nearly all fresh waters contain some human-made compounds, such as pesticides and other industrial and consumer products.

Chemicals resulting from human activities that increase the concentration of specific compounds above natural levels may cause pollution problems. Too much of a plant nutrient may lead to excessive plant growth, while synthetic organic compounds may cause physiological changes in aquatic organisms, or may become lethal at high concentrations. Pollutants can be taken up by plants and animals through contact with contaminated sediments, or directly from the water. Plants and organisms that become contaminated from these sources can pass the contamination up the food chain as predators consume them.

Biological

Although living organisms themselves are not generally thought of as pollutants, bacteria and plants that grow to nuisance proportions can impair the use of fresh waters. Such problems often arise when the plants die and decay, which is when bacterial decomposition consumes oxygen needed by aerobic aquatic organisms. An

overabundance of algae or other plants provides more decaying material, and hence a greater reduction in oxygen as the material decomposes. Moreover, nonnative plants and animals that are introduced as a result of human activities can change the basic ecology of a lake or stream, often to great detriment.

The accidental release of cyanide from a precious metals recovery facility in Romania contaminated the Tisza River in 2000, killing aquatic and terrestrial animals, such as this horse who drank the poisoned waters 3 weeks after the spill. The pollution not only traveled downstream through Romania, Hungary, and Yugoslavia, but also entered the Danube River and ultimately the Black Sea. The release of an estimated 100 metric tons of cyanide caused what the United Nations called one of the worst pollution accidents in Europe.

Point Sources of Pollution

Point sources of water pollution are defined as those that originate from a known point, such as a pipe from which a pollutant may enter a lake or stream.

Nearly every city, town, and waterside settlement discharges some type of pollution to surface waters . Human wastes that are collected in sewers and piped to municipal sewage treatment plants ultimately are discharged to surface waters as treated wastewater. Older systems with combined sewer and stormwater systems discharge untreated sewage to rivers or lakes during heavy rainfall that overwhelms the drainage system. But in general, treatment processes remove solid material, many of the chemical pollutants, and then disinfect the treated sewage to kill disease-causing organisms before releasing the treated wastewater to the receiving waterbody.

Almost every industry uses water in its manufacturing process or in the production of raw materials and energy. Water can pick up pollutants when it is used to make a product or clean a manufacturing area. The pretreatment of wastes prior to discharge to sewers or directly to surface waters can recover metals and other valuable chemicals that save companies money while reducing pollution.

Large volumes of water are drawn from rivers and streams to remove excess heat from industrial processes. Cooling water is passed over heat exchange surfaces that transfer heat to the water, which increases the water temperature. The electric power industry is the largest user of cooling water in steam-electric power plants. Although the cooling water itself is not boiled to steam, its temperature may rise several degrees. If the temperature exceeds regulatory limits, the water must pass through cooling ponds or towers that lower the temperature of the water before it is discharged.

Nonpoint Sources of Pollution

Nonpoint sources of water pollution are those that cannot be traced to a specific point, such as an outfall pipe. Nonpoint pollution flows and seeps untreated into lakes, streams, and groundwater from urban lawns and gardens, paved surfaces, construction sites, hillsides, agricultural fields, forests, and other land areas.

Urban

In urban areas that have a high percentage of land covered by roofs, streets, and parking lots, rain and melting snow rapidly run off into lakes and rivers through drainageways and storm sewers. This urban runoff may contain nonpoint-source pollutants such as trash, pet wastes, lawn fertilizers, and herbicides, as well as oils, heavy metals , de-icing salts, and other pollutants from vehicles. In addition, the large volume of stormwater that rapidly enters streams from paved surfaces can produce flooding that erodes streambanks and destroys natural habitats.

Everyday activities such as doing the laundry, flushing the toilet, and using the in-sink garbage disposal add chemical and microbial pollutants to household (domestic) wastewater. If not treated and disposed properly via a septic system or a municipal sewage treatment plant, domestic wastewater can pose environmental and public health threats.

Agriculture

Modern agriculture depends on chemical fertilizers, pesticides, and irrigation to produce high-quality crops for animal and human consumption. To maximize the crop yield, nitrogen-based fertilizers are spread on the land. In addition, phosphorus and other essential minerals also may be applied where they are lacking or have been depleted in the soil. To improve production, herbicides to kill weeds and insecticides to kill insects are frequently applied to croplands. Not all of the fertilizers and pesticides stay where they are applied; consequently, some are released to the atmosphere, seep into groundwater, or are carried to lakes and streams by runoff, where they may create pollution problems.

Particles of soil that erode from tilled land can be carried by flowing water into lakes and streams. There, the fine particles fill the spaces between natural sand, gravel, and stones, thereby changing the surficial sediments comprising the benthic (bottom) habitat to a finer-grained silt and mud. Not only can bottom-dwellers be smothered by the fine particles, but sediment-water interactions can be changed.

Animal wastes create water pollution, such as when cattle or sheep are allowed to graze near streams. Wastes deposited by the animals can introduce nutrients and disease-causing organisms into the water, posing problems for aquatic organisms as well as human populations that use the water

Confined disposal facilities, such as this one in Lake Erie, are areas where dredge spoil is disposed. Although the waste material is contained, contaminants still may seep into the receiving waterbody.
for domestic purposes. Feedlots often collect wastes from thousands of animals and store the wastes in central facilities from which they may be withdrawn and applied as fertilizer or soil conditioner. While this practice recycles nutrients to the soil, improperly maintained storage facilities or improperly applied fertilizer can create water pollution problems.

Airborne

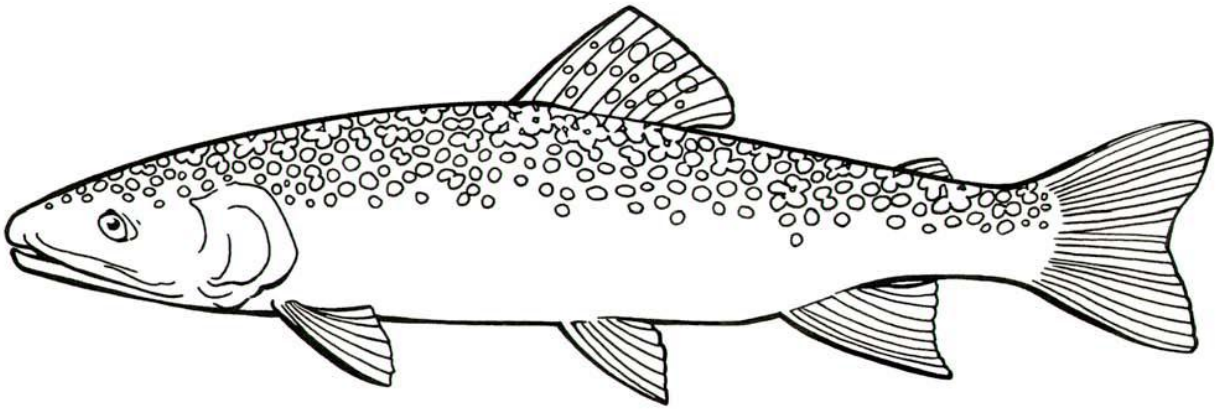
Rain and snow are considered by some individuals to be relatively "pure," yet gases and particles introduced into the atmosphere by human activities and natural phenomena, such as volcanoes, can contaminate precipitation that falls back to Earth. The combustion of fossil fuels adds carbon dioxide to the atmosphere as well as nitrogen and sulfur compounds that tend to make precipitation more acidic. In areas of the world where the geology does not contain minerals that buffer the effects of the acids, the acidity of lakes and rivers may be increased as a result of "acid rain," derived, for example, from industrial areas. In addition, precipitation may also contain nutrients, heavy metals (e.g., mercury) and organic compounds that have entered the atmosphere and become entrained into precipitation.

Types of Impacts

Regardless of the type or source of a pollutant entering a lake or stream, the overall consequences to the environment may be the same—be it the degradation caused by soil erosion that eliminates the habitat of a stream organism, or the discharge of a chemical that interferes with a species' reproductive cycle. The use of water by humans can be compromised whether toxic chemical pollutants necessitate the treatment of drinking water, whether nutrients promote the growth of nuisance aquatic weeds that choke waterways, or whether bacteria close beaches.

The solution to water pollution is the elimination of pollutants at their source. This can be accomplished by reducing the use of polluting chemicals in the home and industry, by treating point sources to remove pollutants, and by each individual being more mindful of how human activities affect the landscape and the aquatic environment.

Brook Trout *Salvelinus fontinalis*



Brook Trout are born in cold freshwater streams. As they mature they may move down into larger streams or into coldwater lakes. The life cycle is completed when the adult fish move upstream again to reproduce by spawning. In a few populations along the coast the Brook Trout may move into saltwater as they mature. These populations are anadromous just like the Atlantic Salmon.

Life Cycle:

During the summer months adult Brook Trout are usually found in larger streams and lakes. In late summer and early fall as the length of the day begins to shorten the Brook Trout begin to migrate out of the lakes and up the larger streams into the smaller headwater steams. Here they seek out a spawning location in gravel beds in streams with cold, well-oxygenated water. Brook Trout seem to seek out areas where upwelling springs occur. The streams are usually fairly shallow, but not so shallow that the bed will be damaged by ice during the winter. Some Brook Trout may remain in lakes and spawn in gravel beds over upwelling springs.

Spawning usually begins in October and continues into the fall. In spawning the female Brook Trout prepares a depression in the gravel of the stream using her tail fin. This depression is called the redd. Hovering over the redd the female releases 15-60 pea sized eggs into the redd. As the eggs settle into the redd the male, who hovers nearby, releases a cloud of sperm, or milt, and the eggs are fertilized. The female then uses her tail fin to sweep the gravel back over the eggs and then moves on to construct another redd. The total number of eggs a female lays depends on her size, larger females laying more eggs. A half pound female will usually lay about 400-600 eggs.

Brook Trout are not genetically programmed to die after spawning as are the Pacific species of salmon. Spawning is however difficult and dangerous and many fish do die during spawning.

The length of the incubation period varies according to the temperature - at lower temperatures the incubation period is longer. For example, in 35 Fº water, the incubation period is about 144 days; in 50 Fº water, the incubation is only 44 days. The effect of temperature on the length of the incubation period is adaptive. No matter when during the fall/winter the eggs are laid, it allows the eggs to hatch in March and April when food for the larvae becomes abundant.

Newly hatched trout are referred to as alevin. They somewhat resemble tadpoles because of the pendulous yolk sacs protruding from their undersides. Alevin remain in the protective gravel of the redd as they use up the stored nutrients in the yolk sac.

When the nutrients are gone the young salmon emerge ("swim-up") from the gravel. At this stage they are referred to as fry. The fry leave the redd area and move to shallow water where they can find some protection from predators. After several weeks a series of dark vertical bands called parr marks appear along the sides of the young trout and they are now referred to as parr. The Brook Trout lose these marks as they grow, eventually becoming juveniles, then adults.

Prey and Predators:

Brook Trout will eat almost any small animal they can get in their mouths. They are carnivores and they are opportunistic. As tiny fry they feed mainly on microscopic crustaceans and then later on small insect larvae. As parr they begin to feed on mid-sized insect larvae such as mayfly or caddis fly larvae. As juveniles they begin to include larger insect larvae, and as young adults begin to feed on small fish. Larger adults feed mainly on fish such as minnows and sculpins. A complete list of what they eat is essentially a list of everything that is available. Brook Trout are cannibals and often eat smaller members of their species.

Because they use eyesight to hunt their prey, most feeding takes place during the day, especially in the early morning. On nights when the moon is bright, feeding may also take place at night.

The Brook Trout are themselves food for many predators. Larger fish, especially larger Brook Trout, are the most important predator. Other predators include river otters, herons, and kingfishers.

Aquaculture vs Wild Caught

Aquaculture, or farming of fish and other seafood, holds great promise as a solution to the ever-increasing pressures on our ocean resources.

Today, half of the seafood eaten in the U.S. is farmed, and the practice is growing fast. Just as we raise cattle and chickens to eat, we're now raising seafood to meet the growing global demand.

But the environmental impact of fish farming varies widely, depending on the species being farmed, the methods used and where the farm is located. When the environment is considered and good practices are used, it's possible to create sustainably farmed seafood. Such operations limit habitat damage, disease, escapes of non-native fish, and the use of wild fish as feed.

Aquaculture Issues:

Wild fish: Many of our favorite fish are themselves fish eaters. When we farm these carnivores, we need lots of wild fish to feed them. On average it takes over three pounds of wild fish to grow a pound of farmed salmon. Alternative feeds are being developed to reduce this dependence on wild fish. But the best solution may be farming shellfish and non-fish eaters like tilapia and catfish.

Pollution & disease: When fish are farmed in open net pens, byproducts are released directly into the environment. This includes fish waste, uneaten food, disease, parasites, pesticides and antibiotics that can be harmful to the environment. In contrast, "closed" systems collect and manage these byproducts and have less impact.

Escapes: Each year, millions of fish escape from aquaculture operations, and their impacts aren't known. These escapees compete with native fish and, in the worst case, may interbreed with them—changing forever the gene pool of the native species. Reducing the use of open systems can help.

Habitat damage: Farm location is important. Rich coastal waters have been polluted by open net pen farms and hundreds of thousands of acres of coastal mangrove forests have been lost by conversion to shrimp ponds. Protecting important habitats and the species that rely on them for survival are key to sustaining the oceans.

Management: The aquaculture industry is growing quickly. Innovative practices as well as careful oversight are needed to reduce impacts on the environment and ensure a sustainable future.

Wild Caught:
While it may seem that there are plenty of fish in the sea, it's a different story just below the surface. Overfishing, lack of effective management and our own consumption habits are just a few factors contributing to a decline in wild fish.

Evidence of these problems abounds. Overfishing has resulted in nearly all commercial fish populations being well below natural levels. In just the past decade, Atlantic populations of halibut, bluefin tuna, swordfish, haddock and yellowtail flounder all joined this list of species at all-time lows. The cod fishery, once a backbone of the North Atlantic economy, collapsed completely in the early 1990s. The breeding population of Atlantic bluefin tuna has been declining steeply and may disappear completely in a few years without significant, immediate management changes. Other harmful effects of fishing—some of which are preventable with

modifications to gear—impact the oceans, including the accidental catch of unwanted species (bycatch) and habitat damage from fishing gear.

How Did We Get Here?

One reason is the advent of industrial-scale fishing, which began in the late 1800s and has been accompanied by significant declines in the size and abundance of fish. By the mid-1990s, these fishing practices had made it impossible for natural fish stocks to keep up. Seventy percent of the world's fisheries are now fully exploited, overexploited or have collapsed. Meanwhile, demand has continued to rise, to about 110 million tons in 2006—over eight times what it was in 1950. It's estimated that by 2030, the world will need an additional 37 million tons of farmed fish per year to maintain current levels of consumption.

Out of Sight, Out of Mind?

Because the oceans seem so vast and their resources limitless, these threats are often "out of sight, out of mind." But overfishing issues are not just for future generations to endure; they're very real problems threatening our current seafood supply and the health of our oceans. The good news is that there is much we can do—if we act now

Overfishing: Simply put, we're removing fish from the ocean faster than they can reproduce. More boats on the water and more effective fishing practices have worked together over the last 60 years to shift the advantage to fishermen. Decades of overfishing have driven fish populations to levels so low that recovery, when possible, is a long-term proposition.

Illegal fishing: Experts estimate that illegal, unreported or unregulated fishing—sometimes called pirate fishing—accounts for a quarter of the world's total catch of wild fish. Many fisheries that may otherwise be sustainable ignore and violate regulations, leading to overfishing.

Habitat damage: The habitat that fish need to survive can be destroyed by some types of fishing gear, for instance when large nets or trawls are dragged along the seafloor, sweeping up everything in their paths.

Bycatch: The process of bringing a fish to market can be messy. Large nets and longlines intended for one species often catch others by mistake. Fish, sea birds, turtles and marine mammals are included in this "bycatch," and are usually thrown back dead or dying.

Management: Worldwide, regulation of the fishing industry is weak, non-existent or not well-enforced. Rules intended to deal with overfishing, illegal fishing and the related issues of bycatch and habitat damage are ignored, and species like tuna that travel long distances are not managed consistently over their range.

Final Programmatic Report Narrative

Instructions: Save this document on your computer and complete the narrative in the format provided. The final narrative should not exceed ten (10) pages; do not delete the text provided below. Once complete, upload this document into the on-line final programmatic report task as instructed.

1. Summary of Accomplishments

In four to five sentences, provide a brief summary of the project's key accomplishments and outcomes that were observed or measured.

The Beardsley Zoo's Trout in the Classroom program was a huge success. Major accomplishments include: successful completion of 16 workshops/classes; the highest rate of successful trout release in the state this year (according to CT DEEP); re-introduced a native species that had been wiped out completely from the Pequannock River over the past 200 years (30 trout were released during the program year); provided a valuable conservation education experience to female students and minority students- 75% of participants were female and 100% of participants were racial/ethnic minorities (primarily African American).

2. Project Activities & Outcomes

Activities

- Describe and quantify (using the approved metrics referenced in your grant agreement) the primary activities conducted during this grant.
- Briefly explain discrepancies between the activities conducted during the grant and the activities agreed upon in your grant agreement.

Trout in the Classroom conducted 16 workshops with 16 students from two Bridgeport charter schools (Park City Prep and the Bridge Academy). The curriculum used was developed and delivered to students by Zoo staff in partnership with the Trout Unlimited program, DEEP volunteers, and other contributors to the program. 75% of participants were female and 100% were racial and ethnic minorities, a major accomplishment that the Zoo is particularly proud of in our quest to open up the field of habitat and wildlife conservation science to traditionally marginalized groups. Four students were dismissed from the program for not maintaining a minimum GPA requirement in their other classes.

While a variety of topics were covered in the curriculum, one constant throughout the program was that students had water chemistry/trout husbandry as a learning component and part of the class rotation. Students monitored and tested the tank conditions for ammonia, pH, and nitrate values, and compared that with the Pequannock River conditions. Throughout the year, guest presenter volunteers provided hands-on learning opportunities that enhanced curriculum learning.

While students participating in the workshops/classes came from two specific schools, during the year the program engaged students from the Bridgeport Aquaculture School to learn about the program and trout husbandry and become spokespersons for the TIC program during visitor hours at the Zoo.

At the end of the program, 85% of the trout (30 total trout) that were successfully raised were released into the Pequannock River. According to the State DEEP, this was the highest rate of successful trout release in CT for the year.

Public education efforts had to be curtailed due to two factors: damage to the Wolf Den, where the trout exhibit and signage were housed, and Hurricane Sandy, which forced the cancellation of the public event around the release of the trout into the Pequannock. One sign was developed during the project period, and a video showcasing the TIC trout release was produced (which can be viewed at http://www.youtube.com/watch?v=laUTA9ZetGA). The exhibit had to be moved to the Zoo's Research Center due to the damage to the Wolf Den, as well as a black mold problem in the tank that

had to be contained. These factors prohibited the program from moving the exhibit back to the Wolf Den. However, the public till had access to the tank in the research center.

Outcomes

- Describe and quantify progress towards achieving the project outcomes described in your grant agreement. (Quantify using the approved metrics referenced in your grant agreement or by using more relevant metrics not included in the application.)
- Briefly explain discrepancies between what actually happened compared to what was anticipated to happen.
- Provide any further information (such as unexpected outcomes) important for understanding project activities and outcome results

1) The program expected a 50% success rate with the trout as our benchmark…we achieved an 85% success rate- the highest in CT that year.

2) The TIC program was able to document the presence of diverse and robust macro-invertebrates in the river…even though the Pequannock is an urban river, it is a surprisingly healthy river based on the presence of these documented species (Stoneflies, mayflies for example). It is healthier than people give it credit for, and a great living laboratory and a proper release site for this species of trout.

3) While we anticipated only working with 2 schools, students from the Bridgeport Aquaculture School and the Zoo's Conservation Discovery Corps also became involved. They were trained on the purpose and activities of the program and became spokespersons for the program with the public during visitor hours at the Zoo. This helped to enhance the public education component of the project.

4) While 16 students were enrolled in the TIC program, 25% were dismissed because of their inability to maintain a minimum GPA in their other classes- a requirement of the Zoo's TIC program.

5) **The TIC a**llowed the Zoo to refine its husbandry practices with this very environmentally sensitive species. The partnership with students allowed the Zoo staff to improve its raising and rearing practices- a great opportunity for staff development as well as for the students and the habitat.

3. Lessons Learned

Describe the key lessons learned from this project, such as the least and most effective conservation practices or notable aspects of the project's methods, monitoring, or results. How could other conservation organizations adapt their projects to build upon some of these key lessons about what worked best and what did not?

Major lessons learned include:

- Using river water to raise the trout makes a huge difference in success rates, as opposed to trying to replicate the river's chemistry out of tap water.

- Using large student groups was not an effective conservation practice. TIC's effectiveness comes in large part due to its "boutique", small group aspect. When the class size was reduced from 16 to 12, students felt more engaged and the quality of the work being done in monitoring the tanks/trout improved. Keeping it small kept the education quality high;

- Writing skills and public speaking improvement among the students was noted by staff. As students learned more about the habitat and about trout raising, they became effective speakers and writers about the subject.

- Students in TIC became very interested in continuing conservation education. More than half inquired about enrolling in the Zoo's Conservation Discovery Corps and the Bridgeport Aquaculture School.

4. Dissemination
Briefly identify any dissemination of lessons learned or other project results to external audiences, such as the public or other conservation organizations.

The Zoo recorded and posted the trout release onto You Tube, and students served as ambassadors to the public during Zoo visitor hours throughout the project period. An update on the program and its results was included in the Zoo's newsletter. Further dissemination after the program was completed was hampered by damage caused by Hurricane Sandy to the Zoo—staff were dedicated to animal maintenance and facility repair for a long time after the storm and did not have adequate time to continue dissemination of results.

5. Project Documents
Include in your final programmatic report, via the Uploads section of this task, the following:

- 2-10 representative photos from the project. Photos need to have a minimum resolution of 300 dpi and must be accompanied with a legend or caption describing the file name and content of the photos;
- report publications, GIS data, brochures, videos, outreach tools, press releases, media coverage;
- any project deliverables per the terms of your grant agreement.

Attached to this report are 5 curriculum segments taught during the project and 6 photos of students engaged in TIC activities. One of the pictures shows the signage developed for the project.

POSTING OF FINAL REPORT: *This report and attached project documents may be shared by the Foundation and any Funding Source for the Project via their respective websites. In the event that the Recipient intends to claim that its final report or project documents contains material that does not have to be posted on such websites because it is protected from disclosure by statutory or regulatory provisions, the Recipient shall clearly mark all such potentially protected materials as "PROTECTED" and provide an explanation and complete citation to the statutory or regulatory source for such protection.*