Have anadromous trip, see you next spring

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http://www.njaudubon.org/education/PDF/EventfulJourney.pdf
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Background

In an ecological (or even anthropological) context, migration is defined as the seasonal movement of an entire population of animals from one area to another. The most famous migrations, of course are the seasonal movements of birds; everyone knows that most birds fly south to warmer climates in the fall, spend the winter there, and then in the spring begin the long journey back to their breeding grounds in the temperate regions. The record holder for bird migrations is the diminutive Arctic tern, which flies basically from pole to pole and back again every year, a round trip of about 22,000 miles. Another famous migrant is the monarch butterfly, which every fall begins the long journey south from both coasts of North America to its wintering grounds in the mountains of Michoacan State in central Mexico. This journey is so long that it takes 2 generations to complete; the butterflies that begin the journey south in the fall will die before they return in the spring, leaving the return journey to their offspring.

Wings are not a requirement for migration, however. Many species of land mammals, especially large herbivores such as wildebeest or caribou, undertake huge migrations to avoid seasonal droughts. Along the way, the herds brave many hazards, especially river crossings where the dangers include swift currents and hungry crocodiles that in some cases wait all year for the migrating herds to pass through.

Less well known is that many species of fish migrate, as well. This can take the form of a bird-like North South migration, like the bluefish will head south in the fall, but it may also be a vertical migration from deep to shallow water, or maybe from far offshore to shallow water. Many species of fish migrate not in a specific compass direction but to a particular place: the Nassau Grouper, a medium sized reef predator in danger of extinction from over fishing, gathers once a year in specific spots in the Caribbean where the entire species spawns at the same time. Other fish, among them the local favorite, the striped bass, migrate from one habitat to another. Hatched from eggs in freshwater far up rivers, the young fish move to the ocean, living the majority of their life in estuarine or salt water, but returning once a year to their natal river to spawn. (You may have seen pictures of salmon leaping up waterfalls, perhaps with bears trying to eat them- this is the same thing).

In New York, the hands-down champion migrant is the American eel. An eel lives the majority of its life in a pond, lake, or sometimes river, spending years, often decades in their freshwater home. At a certain point in their life, the eels develop an urge to move to the ocean to spawn, and at this point the eels will make their way to the ocean by any means necessary, slithering through rivers, streams, drainpipes, even for short distances across wet ground to do so. Once they reach the Atlantic, the eels make their way to a point thousands of miles off shore to a strange, weed-filled area of the ocean south of

Bermuda called the Sargasso Sea. (Part of this area, for you superstitious types, is also known as the Bermuda Triangle). Once there among the Sargassum, the eels, joined by their relatives, the European eels, all spawn, although the exact location within this vast area is unknown. Exhausted by the journey but with their life's purpose fulfilled, the adult eels will soon die. The eggs, meanwhile, hatch into larval eels (Leptocephalus), which drift and swim in the current, eventually moving back into freshwater as a transparent form called glass eels. This journey can take up to three years and cover close to 4000 miles. When you consider that the larval eel is less than an inch long, this is roughly the equivalent of a newborn baby crawling from Miami to Seattle. Wow! See table 1 for a partial list of migratory fish in New York State.

There are a variety of mechanisms and cues that may initiate or enable migration patterns. In many cases it may be as simple following a seasonal food source. In many other cases, water temperature- either rising or falling- seems to be the main cue that kicks off migration. Specific chemical cues enable a fish to identify the stream or river of its birth when it is time to return to spawn. For other fish, certain periods of the moon or changes in light levels, for instance dusk or dawn, may be responsible. This latter is especially utilized in vertical migrations of certain fish species to/from the surface from safer water, typically following invertebrate prey.

Migration is very dangerous process. For instance, in such a long exhausting journey through unfamiliar territory that can change from one year to the next, starvation is a constant worry. (Think about it, are you hungrier after you've been exercising all day or sitting around). As always, predators are a constant risk- the ocean is a dangerous place for a fish, and those dangers don't ease up during migration. Other natural phenomena can play a role as well- unfavorable currents, temperature extremes, etc. can turn a dangerous journey into a fatal, incomplete journey. For fish that must continue their trip into rivers or other new habitats, different hazards such as strong tides, waterfalls, dried up creeks, or unfamiliar predators (e.g. bears) all increase the risks. Other hazards may be present in shallow water which are not an issue in deep water, such as birds or surface predators such as needlefish.

These hazards multiply exponentially when you factor in human-associated (anthropogenic) risks. Such risks can be direct, for instance gill net or long line fishing, or even unscrupulous anglers (hook and line fishermen) who don't obey regulations. Risks can also be indirect: for instance, overfishing of prey species such as shrimp or herring may make finding sufficient food for the journey impossible. Other man-made hazards include chemical pollution, which can impact health and sometimes directly cause injury to fish, or nitrogen runoff which causes algal blooms that suck all of the oxygen from the water, leading to suffocation. Habitat destruction also impacts fish migration: excessive bottom trawling destroys sensitive bottom habitats, destroying areas where migrating fish may feed or rest. Filling in ponds or streams destroys fish habitats directly as well as cuts these areas off from migration routes. Salt marshes are also important feeding and spawning areas for migrating fish, as well as important habitats where juvenile fish grow up- these habitats are all too frequently destroyed to make way for development. Last but not least, man-made barriers may also disrupt migration: dams, for instance, can form an impenetrable barrier, preventing fish from reaching their preferred spawning grounds. When spawning is interrupted like this, entire generations, and eventually entire

populations, will be lost. It goes without saying that fewer fish migrating means fewer fish for people to eat as well as fewer jobs for fishermen.

Fortunately, there is still plenty of hope. Many dams in our area have begun to install fish ladders, devices which allow migrating fishes the ability to get above the dam. Stricter laws are limiting pollution, and efforts are underway to restore some salt-marshes. Ichthyologists- people who study fish- are learning more and more about fish migration by tagging fish and other means. Tagging is the process of marking a fish in one location and recording the location and other information of interest when the fish is recaptured somewhere else. The more scientists learn about migration, the more steps they can take to protect the fish. Anglers like you can do your part by ALWAYS following all state and federal regulations - http://www.dec.ny.gov/outdoor/7894.html, saltwater; http://www.dec.ny.gov/outdoor/7917.html, freshwater – properly dispose of all trash, and make sure to thoroughly disinfect gear before moving to another site to prevent the spread of disease and invasive species. Please report illegal fishing or dumping to the proper authorities. In New York you may report violations to Environmental Police Officers- violations may be reported at http://www.dec.ny.gov/regulations/393.html or call 1-877-457-5680 to speak to the dispatcher. As a consumer, please pay attention to where your fish comes from and please try to purchase seafood that is harvested in the least destructive way possible.

Key terms:

Anadromous: Most of life spent in salt water, returning to rivers or other freshwater to spawn.

Amphidromous: migrate between salt and freshwater at some point in the life cycle, but well before final maturation and spawning

Catadromous: Most of life spent in freshwater, returning to ocean to spawn.

Diadromous: Blanket category referring to any migration between salt and fresh water or vice versa.

Ecology: The study of ecosystems

Fish v. Fishes: *"Fish"* either refers to one individual fish or one species of fish; *"fishes"* refers to multiple species of fishes. *Example- Fish:* Did you see the school of fish? I think they were bluefish. *Example- Fishes:* There are many fishes on the Great Barrier Reef.

Ichthyology: The study of fishes

Landlocked: Population of diadromous fish with no access to ocean that reproduces in freshwater

Migration: the seasonal movement of an entire population of animals from one area to another

Table 1: Sampling of migratory fishes found in New York State

Species common	Species latin	Migration Route	Maximum known distance
Bluefish	Pomotomus saltatrix	N-S Atlantic coast	2000 km
American eel	Anguilla rostrata	Catadromous-inland waters to Sargasso Sea	6000 km
Atlantic Mackerel	Scomber scombrus	Offshore-Inshore; N-S Atlantic Coast	~ 1000 km
Atlantic Sturgeon	Acipenser oxyrhyncus	Anadromous	Depends on spawning river
Striped bass	Morone saxatilis	Anadromous; variable in ocean	Variable; ~500 km
Cownose Ray	Rhinoptera bonasus	Oceanadramous	~1000 km
Summer Flounder	Paralychthys dentatus	Deep- shallow	~100 km; to 155m depth
Alewife	Alosa pseudoharengus	Anadromous; oceanadromous N-S migration as well	unknown
Spiny dogfish	Squalus acanthias	Deep-shallow; N-S	~2000 km; to 120m depth
Rainbow smelt	Osmerus mordax	Anadromous	<100 km
Atlantic salmon	Salmo salar	Anadromous; also extensive feeding movements	Variable; up to ~500 km

Suggested reading:

Limburg, K.E & J. R. Waldman 2009. Dramatic declines in North Atlantic diadromous fishes. Bioscience: 59:955-966

Helfman, G.S., Collette, B.R., and D.E. Facey 1997. The Diversity of Fishes. Blackwell Science, Malden Ma. P. 384-406