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ATLANTIC SALMON (Salmo salar)

Atlantic salmon were once abundant in most larger New England rivers and in many smaller streams. The Hudson River in New York was possibly the extreme southern limit of their range, which extended as far north as the Arctic Circle. Today there are only remnants of the New England runs, in the Penobscot and Dennys Rivers and a few streams in the eastern part of Maine. In Canada, rivers of the Maritime Provinces still have substantial runs. Destruction of the runs in New England was due to heavy fishing, deforestation, pollution, and construction of dams and other barriers to migration.

Half a century ago, Penobscot River and Penobscot Bay produced almost 30 tons of Atlantic salmon a year, but by the 1940's the annual yield was barely a ton. Commercial fishing for salmon in Maine has been prohibited since 1947, though some salmon are taken accidentally in floating traps set for other fish. Commercial catches continue in the Gulf of St. Lawrence, in Newfoundland, and in southern Labrador. On the European side of the Atlantic, Norway, Scotland, and Sweden catch salmon commercially.

As a sport fish the Atlantic salmon is highly prized on both sides of the Atlantic. In Europe, rod-caught salmon are taken as far south as Spain. Scotland produced the largest Atlantic salmon on record--it weighed 84 pounds. The Wye River of Wales has yielded over 6,000 rod-caught salmon a year, though the average has been about 2,000 a year since the 1920's. Most of the fish are caught in March and April, but some are taken in every month except November.

The Miramichi River in Canada has produced 30,500 rod-caught salmon in a single season. Most Miramichi salmon are taken in September, though fish fresh from the ocean are caught in the spring. There is no known explanation why some rivers have spring runs of salmon and others fall runs.

In Maine, where adult salmon average a little better than 10 pounds, most rod-caught fish are landed in the latter part of May and in early June. Bangor Pool on the Penobscot has a sport-fishing history that dates from 1893; the catch has been as high as 354 in a season but averages about 75 a year. For many years it has been the custom to send the first Maine catch to the President of the United States.

Atlantic salmon are anadromous. Born in fresh water, they go out to sea, and when mature they return to the fresh-water streams of their birth to spawn. After spawning, many go back to the ocean and return in subsequent years. Some may live as long as 8 or 9 years, and they may spawn 3 or 4 times. In this, they differ from Pacific salmon, which always die after the first spawning.

Adult Atlantic salmon enter the rivers on the spawning migration between April and September. When they start their upstream journey the salmon are usually very fat. They are silvery, with many black spots or crosses on their sides or backs. During the summer the ripening salmon of both sexes lose their silvery sheen and take on a dull brownish or reddish hue. Their bellies acquire tints of red, and larger black spots appear.

The jaws of the mottled and spotted males grow longer; the lower parts become so hooked that only the tips come together. With their slab-sided bodies, thickened fins, and slime-covered skin, they are caricatures of the beautiful silvery creatures that came in from the sea.

By the time the male salmon have undergone this change, the females are ripe, and spawning begins, usually in October or early November. (The first spawn-taking at the United States Fisheries Station at Craig Brook, Maine, for the last 5 years has occurred on October 31 when 25 to 33 percent of the females were ripe).

In small streams salmon may spawn only a short distance above the head of tide; in large, unobstructed rivers they may run upstream more than 200 miles. Salmon spawn in riffle areas that have coarse gravel or stone bottoms. The female digs the nest by turning on her side, and using her tail in a flailing fashion. This washes out sand and gravel and forms a U-shaped pit, called a redd, a foot or two in diameter and as much as a foot in depth. When she is ready to spawn, the female swims close to the bottom of the redd, and a male quickly moves in alongside. Eggs and milt are deposited at the same time; the eggs are fertilized almost immediately and drift to the bottom of the redd.

Eggs are deposited a few at a time between intervals of digging, which covers the eggs spawned and makes a new pit for more eggs. When spawning is over, the spent fish, known as kelts, slinks, or black salmon, are thin, weak, and so exhausted that some of them die. In small rivers, most of the survivors drop down to the sea after spawning. In large rivers many linger over the winter, improving somewhat in condition and becoming more silvery, though they take little food. Not all survive the winter; those that do, go downstream to salt water the following spring.

The large thick-shelled salmon eggs lie loose in the gravel of the redd and develop so slowly in the low temperature of winter that hatching does not take place until late the following April or early May. The newly hatched larvae, 0.6 to 0.7 inch long, carry a very large yolk sac upon which they subsist for about 6 weeks. They hide among the pebbles of the spawning bed and take no food. When the yolk sac has been absorbed, the little fish, now known as parr, begin to swim and feed.

Most of the salmon of the Penobscot River spend 2 years as parr, though a few spend 3 years. Parr move downstream any time from late spring to fall, but probably make the journey in June and July in Gulf of Maine streams. As they near tidewater, they put off their barred and spotted pattern and assume the silvery coat that is worn during their stay at sea.

Little is known about the salmon's movements at sea. Studies have shown that the smolts, as they are known at this period, remain about the shores near the mouths of rivers and in estuaries for some time, then disappear. There is no reason to believe that many of them go far out to sea. Gulf of Maine salmon appear to continue rather closely localized, not only within the coastal belt but within the zone of fresh-water influence from the particular river systems from which they come. On the other hand, five salmon tagged in the Annapolis River system were recaptured on the east coast of Newfoundland, a minimum distance of 900 miles, and a sixth from the same lot was taken at Ramah on the outer coast of Labrador, more than 1,900 miles away. This last is the most spectacular case of wandering yet reported for a Gulf of Maine or Gulf of St. Lawrence salmon.

It is not likely that these wandering salmon return to their home rivers; probably they are lost permanently from the breeding population. The much greater numbers that remain localized not very far from their parent streams are thought to follow the same routes on their return journeys as they used when they went to sea. It seems evident from the recapture of tagged fish that the majority do return. Some salmon return after spending only a year at sea; these fish, weighing 2 to 6 pounds, are known as grilse, and seldom include females.

A cooperative program of salmon rehabilitation and a study of research and management methods is under way in Maine by the Fish and Wildlife Service and the Atlantic Sea Run Salmon Commission of the State of Maine. Conditions apparently have improved on some of the rivers to the

point where the restoration of salmon appears to be practicable. Once-cultivated land has reverted to forest; this has increased stream flow and lowered water temperatures. As logging operations declined and fishways were constructed at many permanent dams, rivers were less obstructed. There has also been a decrease in sawmill wastes and other pollution.

Along with the State hatchery at Tunk Lake, the United States Fish Cultural station at East Orland, Maine, is hatching and rearing salmon for stocking certain Maine rivers. To reestablish runs, experimental plantings of salmon fingerlings have been made in Little Falls Stream and the Machias and Narraguagus Rivers, as well as the Penobscot, Sheepscot, Dennys, Arrostook, and others. Special provision has to be made for the procurement of salmon eggs, since they come from wild fish. In some years salmon are trapped in fishways of the Penobscot and Machias Rivers, and transferred to the East Orland hatchery, where they are retained until sexually mature in the fall. Some Canadian salmon eggs have been obtained.

The success or failure of any salmon-restoration program lies in the condition of the streams. The salmon must be able to migrate up and down stream without undue harm from dams, water diversions, or pollution. A stream must contain spawning areas of suitable large gravel or rubble in the riffles where the current through the stones will aerate the eggs during their long incubation period. Young Atlantic salmon live principally in shallow riffles where aquatic insects are most numerous and where they are safest from their enemies. Such nursery areas are imperative.

If a stream is to provide satisfactory Atlantic salmon angling, it must have sufficient flow to permit adults to ascend during early summer, and it must contain deep, cool pools in which the early-running fish may spend the summer maturing their eggs and milt while awaiting the autumn spawning season. Abatement of pollution, construction of fishways, and screening of water diversions may eventually restore many rivers. With river conditions better today than in former years, it is hoped that the runs can be restored eventually in much of the Atlantic salmon's former territory.

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