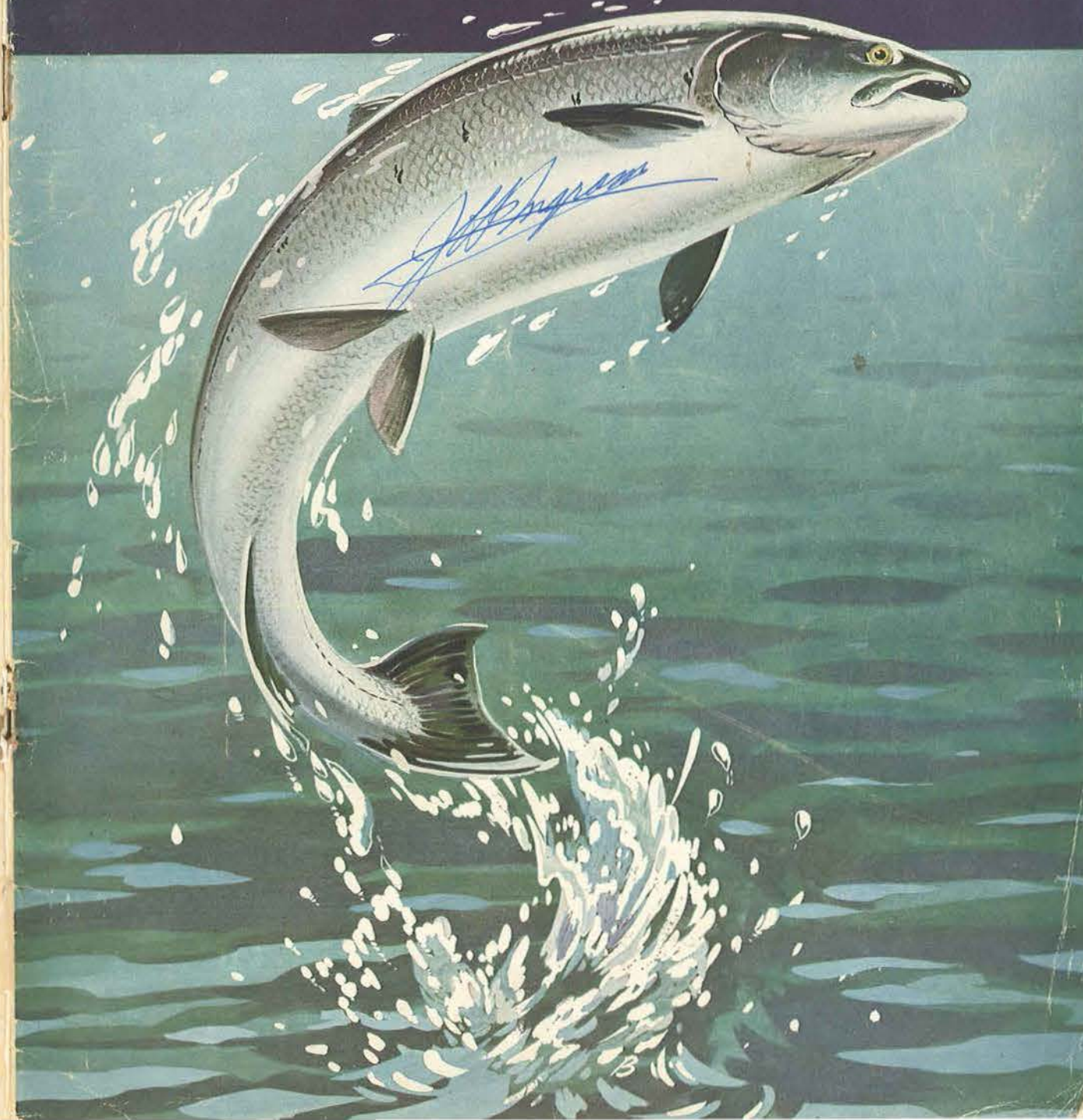


Canada's *ATLANTIC SALMON*



OTTAWA
EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
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FOREWORD

The Atlantic salmon has fascinated man for centuries. It has been studied by naturalists, sportsmen and those who live by fishing. Much has been written about it, and much more no doubt will be written, because it still withholds from us many of its mysteries.

Apart from being one of the most intriguing fish, it provides Canada with a valuable resource, a renewable one, but one which is particularly vulnerable. It is both a commercial and a sporting asset, and as such is under double attack, — in the seas and in the narrow rivers.

Wise governments preserve such resources by hedging them with protective legislation, continuing research and intelligent management. Many species of fish are well understood and not difficult to protect, but the Atlantic salmon is not one of these. If the public is to be asked to support conservation measures for salmon, the public must first be informed. The purpose of this booklet is to tell as clearly as possible as much of the salmon story as is known.

S. R. Clark

Deputy Minister,
Department of Fisheries of Canada.

Canada's ATLANTIC SALMON

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by F. H. WOODING

The Salmon by J. V. Jones - 1959

- (1) spawning in tank proceeded to completion when water between $2^{\circ}\text{C} + 6^{\circ}\text{C}$ but slowed in river the temperature is high as 10°C
- (2) Water velocity which seemed most favorable was between 12 + 15 inches per second at the surface. Salmon would not spawn when the velocity was reduced to 2 or 3 inches per second.
- (3) The "covering up" is usually continued as the beginning of the next spawning sequence. As many as eight such sequences, each further upstream than the previous one, may be carried out before the female has deposited all her eggs.
- (4) In the absence of an adult male the female does not proceed further than the early exploratory acts (the presence of a ripe male from is not enough, though he is perfectly able to fertilize her eggs if she could be persuaded to lay them).

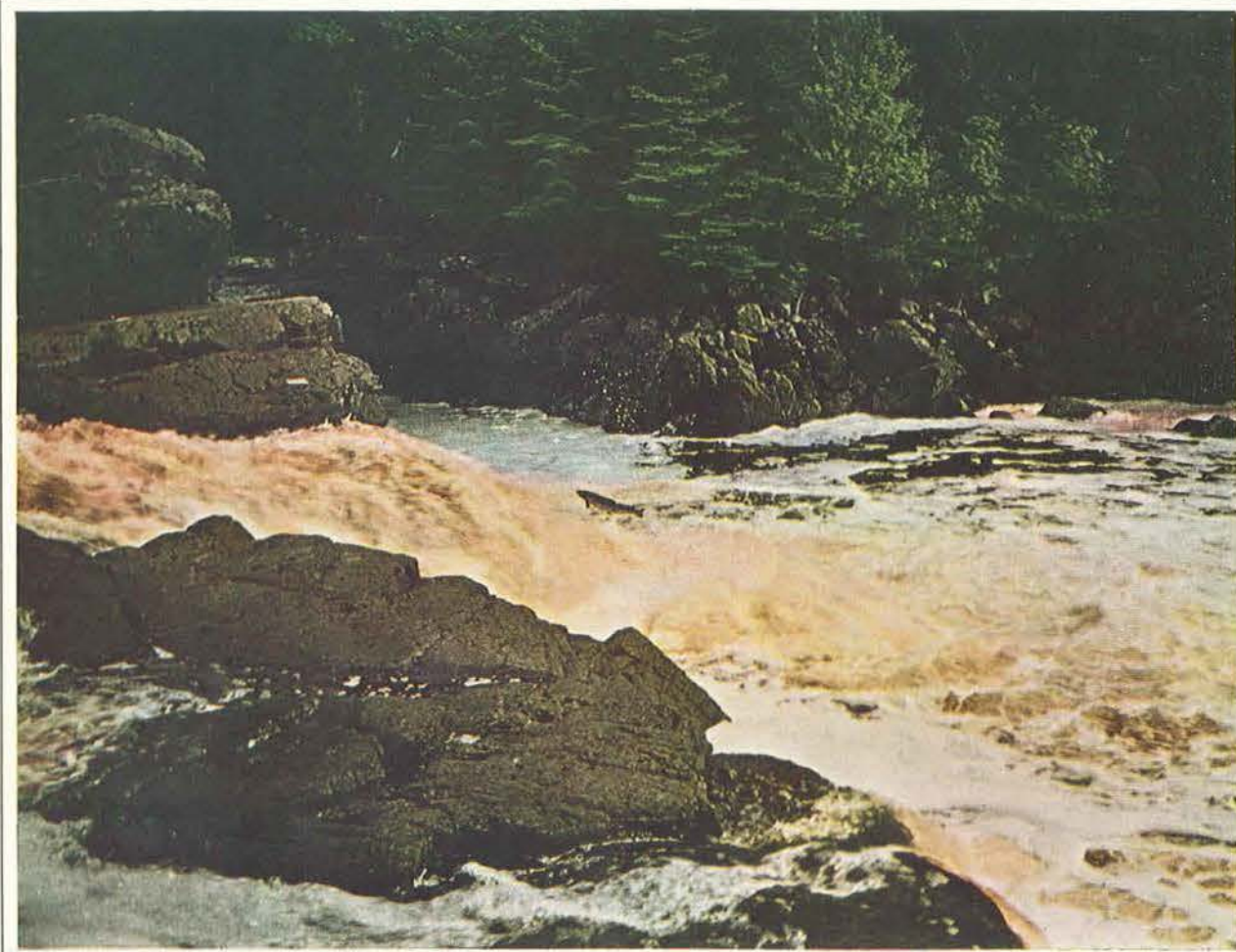
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DEPARTMENT OF FISHERIES OF CANADA



OTTAWA



Colour photograph by Dr. C. J. Kerswill

SALMO THE LEAPER

"To watch them pit their own relatively fragile strength against the powerful rush of the torrent, and to watch them succeed, is to watch the salmon at what must surely be the peak of their courage."

Canada's ATLANTIC SALMON

by F. H. WOODING

MANY thousands of years ago a great ice field covered much of what we call the northern hemisphere. Over the long ages, during successive advances and retreats, this colossal weight transformed vast portions of the earth's surface. Whole mountain ranges were shaped and re-shaped, plateaux and lowlands were altered again and again, and the waters of the land were moved to form new seas and lakes and rivers. Then at last the ice sheet again retreated, leaving the hemisphere much as we know it today.

During that time, the creatures of the seas experienced remarkable environmental changes.

Many fishes that were once inhabitants of salt water found themselves in freshwater areas, some of them without access to the sea; others were moved from one side of the world to the other. Thus it was with the most interesting family of them all — the Salmonidae: the salmon, trout, and char.

Scientists believe that the Salmonidae were once migratory fish of the Arctic and that great movements of the ice fields took them out of their original habitat and left them scattered throughout Europe, Asia and North America. To give weight to this theory is the fact that, aside from human transplantation of some



CANADA'S ATLANTIC SALMON

stocks to certain countries below the equator, species of the Salmonidae family are found only in the northern hemisphere.

At one time, it is thought, the Pacific side of the Arctic was the exclusive home of the salmon; but as geological changes took place one member of the family found itself in a new environment — the Atlantic ocean. This salmon — which became known as the Atlantic salmon — flourished in its new abode. Not all of the genus was moved, for the Steelhead fishes of the Pacific, including the sea-run Steelhead and its brother, the Kamloops trout (which spends all of its time in fresh water) are so similar in make-up and characteristics that they are considered by some scientists as being blood brothers of the Atlantic salmon.

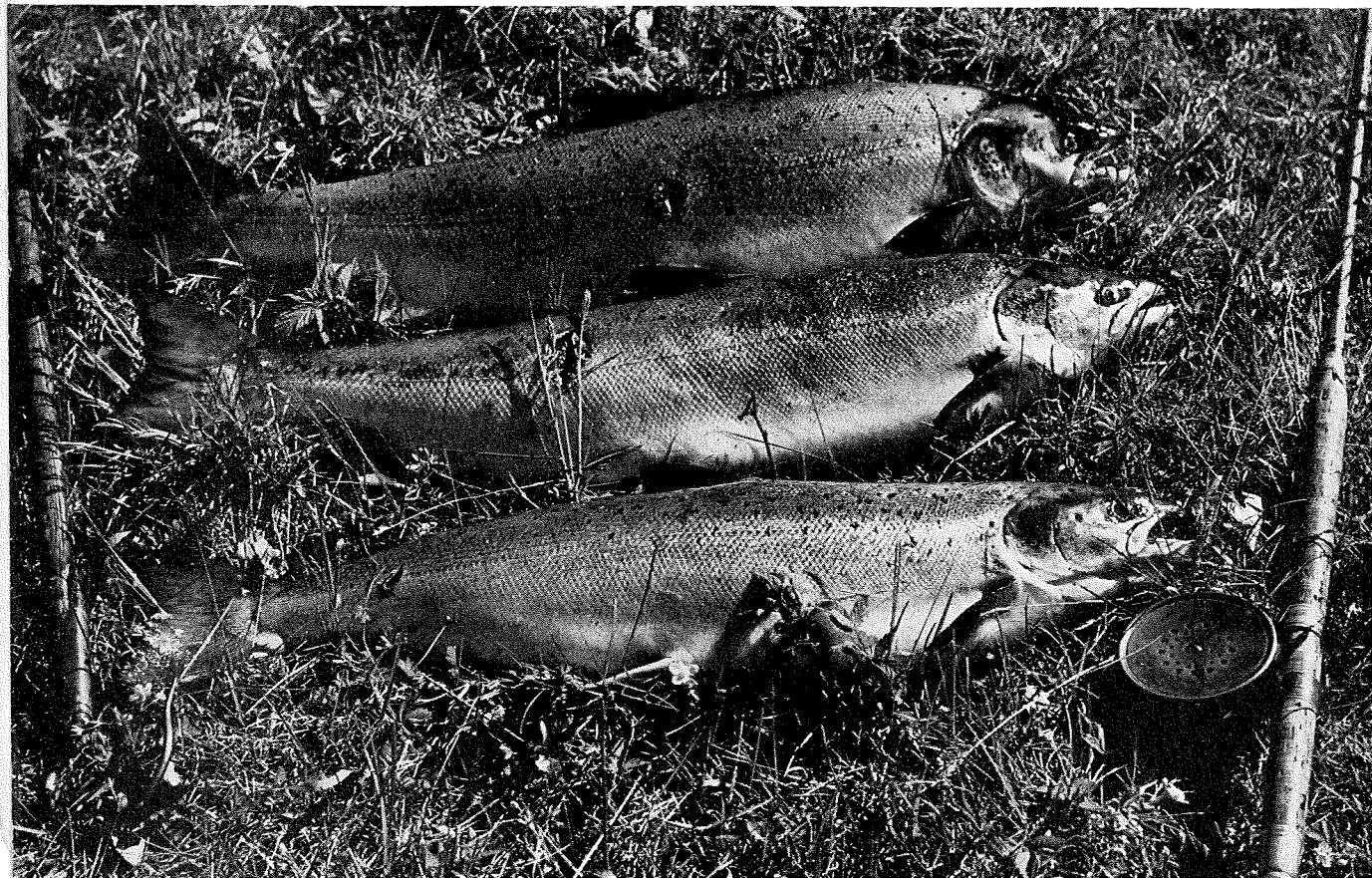
In any event, the Atlantic salmon prospered not only in numbers but in fame as well. It is, indeed, one of the best known and one of the most honoured of all fishes. Even as far back as the days of the cave man, it won recognition. This is borne out by a discovery made not many years ago by a group of archaeologists

digging in the Pyrenees in southern France. There they unearthed a piece of reindeer bone on which was carved a picture of a salmon. Discovery of the bone was important in itself, but what was more important was the fact that it had been carved about twelve thousand years before the birth of Christ!

Centuries after the cave man made his carving, Julius Caesar led his victorious armies into Gaul and as they spread over the country they saw great hordes of fish leaping in the rivers. These fish were new to the Romans and so enthralled were they by their grace and beauty that they gave them the name *Salmo* — a derivative of the Latin word *salire*, meaning "to leap."

Salmo salar, as they finally became accepted in scientific nomenclature, appear and reappear throughout the history and literature of the past several hundred years. References to salmon are common in the literature and mythology of Scotland and the literature of Ireland, England and Wales; there are references to them in continental literature as well. Three

Atlantic Salmon — the Romans called them Salmo.



Angling in Harry's River, Newfoundland.

hundred years ago a salt salmon trade existed between Scotland and England, for governances regarding such a commerce were once a part of Scottish laws. As the years passed, however, the popularity of the salmon as a food appears for a time to have suffered. So plentiful did they become in Europe and in North America that contracts for labour stipulated that they were to be served only an agreed number of times each week. During the seventeenth century they were so abundant that they were served to domestic help almost every day and came to be regarded as much a staple as potatoes and bread.

But the salmon of the Atlantic were to face an uncertain future — a future that in some areas is probably forever ended and in others is still in doubt. For powerful in strength though they may be, and capable of amazing feats of endurance and courage in their remarkable migrations from river to sea and return,

the salmon need what is a basic requirement of all fish — clean water, and what is particularly necessary to their survival — free access to spawning grounds. Over the years, on both sides of the Atlantic, civilization has dealt the salmon heavy blows, for in many places where man has settled he has carelessly and needlessly stopped free passage of migrating fish or has so polluted the water that none but the lowest of aquatic creatures can survive.

The decline of the Atlantic salmon has been a North American problem for many years. When first this continent was settled by Europeans these fish were common as far inland as Lake Ontario and were known, in fact, to spawn in the headwaters of the Don River not far from the present city of Toronto. Salmon swarmed in such New England rivers as the Hudson, Connecticut, and virtually every Maine river flowing into the sea. Gradually, however, their frontiers were pushed back

as communities grew and more and more river-side industrial plants sprang up. The building of dams, the spewing of waste into rivers for easy disposal, reckless deforestation that left streams warm or dried up — these conditions and others spelt death to migrating or spawning fish. That they are now secure mainly in the maritime provinces of Canada (and even in certain areas there they are dangerously few in numbers) is attributable more to slower industrialization than to past foresight or wise management.

But whatever the faults of the past may have been, there is today a full awareness of the urgency of rebuilding the salmon resource. This is important to commercial fishermen, who have a logical claim to at least a portion of the stocks; it is equally important to the sportsmen who properly hold to their rights to salmon as a means of recreation. But salmon are, primarily, a food and no nation, in these days of critical world shortages, can stand idly by and allow a food resource to perish. Canada, although rich in other supplies of protein, is conscious of her responsibilities in this connection.

And so the challenge of the salmon has become a challenge of major importance to many Canadians. Governments, both federal and provincial, and sports and commercial fishermen as individuals and as organized groups, are tackling the problem with new determination. For the first time, there is hope that the turning point in the depletion of the salmon is being reached.

To understand the Atlantic salmon is to understand, too, something of the Pacific salmons. There is but one Atlantic salmon — *Salmo salar* — but there are five distinct Pacific species, each differing in size, habits and quantity — but each in fabulous abundance. These five species are: sockeye (*nerka*), pink (*gorbuscha*), coho (*kitsutch*), chum (*keta*), and spring (*tschawytscha*) and all belong to a genus bearing the scientific name *Oncorhynchus*. The Atlantic salmon and the Pacific salmons are, of course, anadromous; that is, they are born in fresh water, spend part of their lives in salt water and then return to fresh water to spawn. But the interesting difference

is that the Pacific salmons spawn but once and then die, whereas some Atlantic salmon may live to spawn again and again.

The Life Cycle

In the autumn, in several hundred rivers and streams in Quebec, New Brunswick, Nova Scotia, Newfoundland and Labrador, mature salmon, having arrived that year from the sea, leave the quiet of the deep pools and move to shallower and faster waters. There, heavy with milt or ova, they begin one of the most fascinating of all Nature's spectacles — their spawning.

Gone now is the iridescent sheen of steely blue that covered their trim backs, and gone, too, is the silver of their bellies. Their spawning garb is more in tune with the sombre woodland colours that follow the brilliant shades of autumn, and they blend into the mottled bottom of the river bed.

The males, especially, are creatures of changing forms. Sleek and beautiful when first they enter the rivers, they tarnish rapidly under the influence of fresh water and the passing of the weeks. As spawning approaches, their lower jaws develop pronounced hooks and their teeth become enlarged and razor sharp; in these characteristics they are much like their Pacific cousins.

At spawning, the salmon, in pairs of male and female, build their nests or "redds" in the gravel of the river bed. As the male stands guard, the female turns on her side and by fanning her tail scoops out a hollow some twelve to eighteen inches deep. When this has been accomplished, both fish settle over the depression. Soon the female expels a few eggs which are then covered by the whitish milt of the male. Then the eggs, carried by the current, find their way into cavities of the redd. A number of such nests may be made and several days pass before the spawning has been completed. It is believed that each female deposits about 800 eggs for every pound of her weight.

The spawning act is an ordeal for the salmon and sometimes the mortality rate in both sexes is high. But those that do survive either return to the sea before the freeze-up comes or remain in the deeper pools throughout the long winter months. The seaward migration of the winter-

bound fish, which are then known as spent salmon, kelt or black salmon, takes place early the following spring just before the main runs of incoming salmon begin.

Meanwhile, in the eggs that were spawned in the fall, rapid development takes place. The throbbing creatures within grow larger as they assume the distorted, but nevertheless certain, shapes of small fish. Early in the spring the eggs hatch and the fry or "alevins" break out

with black spots extending down the sides with a few red spots in the vicinity of the lateral line; their bellies are light grey, cream, or silvery, depending on their habitat. Usually from nine to thirteen dark bars show clearly on each side. At this stage they are known as "parr" and look not unlike the young trout with which they freely mingle in the streams. Growth is slow and when they are ready to leave fresh water for their journey to the sea



Top:—Salmon parr look not unlike young trout.

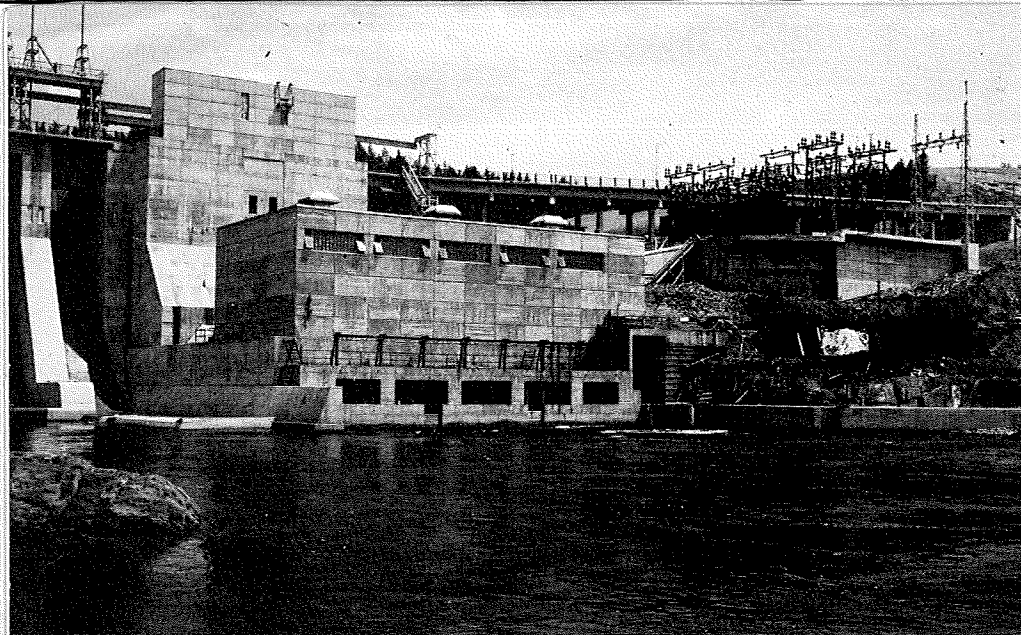
Bottom:—From parr to smolt, and now ready for the sea.

of their shells. For about a month they are dependent for nourishment upon a yolk or food sac, but eventually this is absorbed. At that time they emerge from the protection of the redds to become free-swimming and to find their food from the microscopic life of the streams.

As they grow, they acquire brownish backs,

the young salmon, two to seven years of age, may weigh only a few ounces and be no longer than three and a half to seven inches.

Young salmon begin their journey to the sea in the spring and as they head for the brackish water at the river mouths, their bodies take on a silvery colouring. Their tails lengthen noticeably and become less forked. At this stage they



Industrial development is compatible with conservation of the salmon. Left: a hydro-electric power station at Tobique Narrows, New Brunswick, showing fish escapement at power house face. Below: part of the fish escapement through which salmon ascend the eighty-foot dam.

are known as "smolts". Eager, full of the perfection of youth, they seem to sense the great adventure before them. Now there is no lingering, and often it takes but one rise and fall of the tide to carry thousands of them into the obscurity of the sea that will be their home until they respond to the call of their own spawning.

Science knows little about the wanderings of salmon at sea, but it is known that once in saltwater, they grow at a terrific rate. Food is plentiful and the young salmon gorge themselves on the smaller creatures such as fish, shrimp, sand eels, and various kinds of marine worms and crustaceans. As the months pass, they turn to more substantial fare, like the herring, a fish that is itself highly nourishing and that probably contributes more to their rapid growth than anything else.

But as the salmon prey upon other creatures so, too, are they preyed upon. In fresh water they have to contend with a wide variety of natural enemies, such as kingfishers, mergansers, eels, and trout; in salt water they meet new predators — conger eels, seals, tuna, swordfish, and not infrequently cod. Nature, however, works out her own balances and where man does not interfere both predator and prey usually manage to survive and even flourish.

The sea life of the salmon varies from a year to five years and during that time they grow anywhere from three to sixty or seventy pounds in weight. But age does not always de-



termine size, for occasionally a three-year fish will attain a weight twice that of a fish that has been in salt water a year or two longer. Whether this is an inherited condition or one that is determined by other factors, such as water temperature and availability of food, is not known. As a general rule, salmon returning after about a year at sea attain a weight up to six pounds, a two-year fish may weigh from ten to twenty pounds, and a three- to five-year fish may be correspondingly heavier. The average size of a mature salmon, however, is about fifteen

pounds, although specimens of thirty and forty pounds are not uncommon. It is only rarely that a fish of much greater size is taken.

But whatever their age or their size salmon return to their native rivers with a great abundance of stored-up energy.

Even before the floods of the early spring — which carry to the sea those fish that remained in the river following the previous year's spawning — the first incoming runs begin. These early fish are always in magnificent condition and are the most eagerly sought by commercial fishermen and anglers. Their bodies are strong, well-proportioned, blue-black and silvery in colour, and their flesh is red and firm. Shortly after this first run the "grilse", or "jumpers", make their appearance. These are fish weighing from three to six pounds that have spent about a year at sea. Usually, they enter the rivers in a body and, while they are thinner than the full-grown salmon, they are freer and more graceful in their movements and more inclined to make the long and spectacular leaps out of water. Then follows run after run of mature salmon, slackening somewhat during the hot days of August, and renewed again in September and October when the late fish leave the sea.

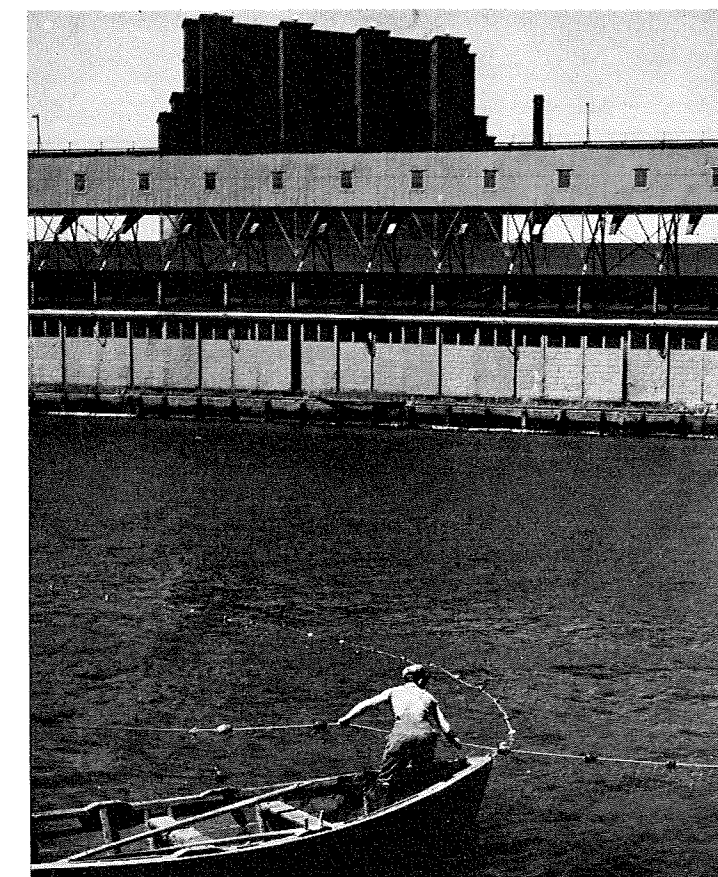
The early runs move upstream slowly, migrating mostly at night. In them the milt and roe have barely begun to develop and so they do not have the same sense of urgency that characterizes the later and more fully developed fish. The first salmon find the going easy, for an abundance of water in the rivers makes it possible for them to move freely over the long, flat stretches and to climb the numerous rapids and falls along the way. Often these fish will stay for days at a time in the same spot, motionless except for the movement of their fins and gills. Then, just as suddenly as they appeared they disappear, to be seen in another pool or resting place farther upstream.

As the season advances the rivers enter the low-water stage. Many of the resting places of the early run fish are now high and dry and the once deep channels are shallow and narrow. New arrivals in the estuaries, their spawn heavy and well developed, impatiently cruise in and out with the tide, waiting for rains to

raise the water levels and make it safe for them to begin their journey upstream. Once they enter fresh water they press forward and often they can be seen, their dorsal fins out of water, literally pushing their way over the shallows.

The speed of the upstream migration depends on water conditions and the distance the fish have to travel. Like the Pacific salmons, most Atlantic salmon are believed to return not only to the river that gave them their birth, but often to the very stretch of gravel where they were spawned. And so the journey may be long or short. Salmon that spawn in the lower reaches may arrive at their destination within a few days, there to remain for the rest of the summer and fall before spawning. Other fish, with longer journeys ahead of them, may travel for weeks and have only a short time to rest before their seeding begins. On the other hand, a late-run fish, still bright with the silver of its saltwater livery, and perhaps still carrying sea-lice, may be found in a pool with fish that came in early and have become blackened by their long stay in fresh water.

The upstream migration is often difficult, for there are few salmon rivers that are without rapids and treacherous waterfalls. Such a



A commercial fisherman in Saint John, New Brunswick, harbour.

river is the La Have in Nova Scotia. A good salmon river, it contains several long stretches of turbulent rapids, culminating at its upper reaches in falls with a drop of about fifteen feet. Salmon by the score congregate at the foot of this obstacle, known as Indian Falls, and singly, or several at a time, they strive to leap the great height. It is a fascinating sight, a spectacle of rare determination and high endeavour. To watch them pit their own relatively fragile strength against the powerful rush of the torrent, and to watch them succeed, is to watch the salmon at what must surely be the peak of their courage. It is a humbling experience.

With the coming of early winter the last of the spawning salmon will have reached their destinations. Save for an occasional late-comer, most of the lower pools are now empty. The tides in the estuaries rise and fall, but in them no salmon are to be found. But at the headwaters, often deep in the forests, a great horde, disfigured and bearing the scars of long journeys, completes the fulfilment of its supreme task. New life comes from old as millions of eggs — the salmon of the future — are seeded in the gravel beds. Wearily the parent fish slip back to still waters to live or to die, whatever their destiny may be.

The Commercial Fishery

In the ocean at all times are stocks of salmon of various age groups. Some are young fish that have been in salt water only a short time, others are fish that have spent several years in the ocean's depths growing, maturing, and awaiting their time to return to the rivers to spawn. And so every season runs of salmon head for fresh water in great homeward migrations. The routes they follow are generally well-established, and it is along these routes that commercial fishermen operate.

The commercial salmon fishery, as it is carried on today, is relatively new, although the taking of salmon by various means dates back several hundreds of years. It is a fishery with a very short season and unpredictable returns. But the fishery that does operate is well organized and brings to those who pursue it a ready market for their catches. Atlantic salmon,

because of their delicate flavour, their rich, firm texture and high protein content, have a world-wide renown, but never are there enough supplies to meet consumer demands.

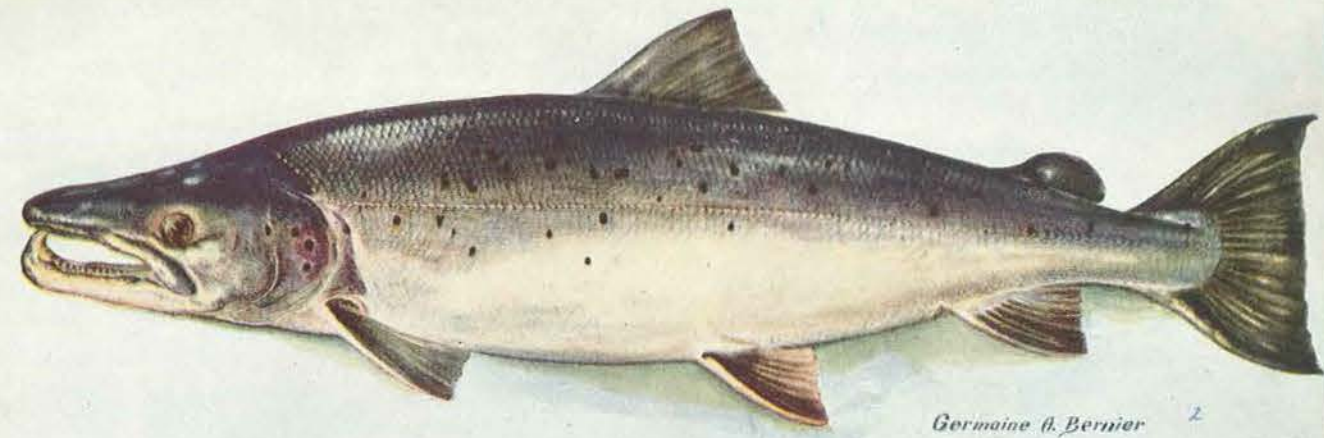
The commercial fishery has three main methods of operation: by drift-nets in off-shore waters, by trap-nets along the shore, and by trap and set-nets in estuarial waters.

Drift-net fishermen, operating in open waters from small power-driven boats, set out nets ranging from 300 to 675 fathoms in length. These nets, with a minimum mesh extension of four and a half inches, float vertically in the water, the top being held up by a series of floats and the bottom held down by a series of weights. Usually the drift-net fishermen also attach another but smaller net to the salmon net for the capture of mackerel, and in this way they supplement their earnings.

Normally, drift-net fishing is most effective on dark nights when there is a moderate breeze blowing. These conditions help to make the net practically invisible to the fish, and when they swim into it they get caught in the mesh, usually by the gill covers, and are unable to break free. Since the net is fairly flexible, their struggles only entangle them more securely.

The skipper of the boat, which carries a crew of two or three men, relies entirely on his own judgment when he sets out his net. Rarely do Atlantic salmon jump when at sea, and since they cannot otherwise be seen, there is no way of predicting whether the net will be hauled in with a good catch or a poor one; only when the net is taken in the following morning can success be measured.

When the salmon leave the open sea and reach the shallower coastal waters, many of them swim fairly close along the shore-line until they arrive at the river they will ascend. Along this course they are confronted with the fishermen's trap-nets. These extend at various distances from the shore and are made in such a way as to lead the fish into a box-like net to seaward where they become trapped. If they escape these nets by swimming around them, they encounter the same obstacles in the estuarial waters. In estuarial waters, especially upriver, they also run into the set gill-nets. These are attached to the shore and extended



With the approach of the spawning season male salmon develop long heads and hooked lower jaws. This fish was caught in fresh water.

outwards in a stationary position, and the salmon get caught in the meshes of these in the same way as they get caught in the meshes of the drift-nets.

Commercial fishing for salmon falls under certain regulations, not only covering sizes of meshes, lengths and depths of nets, but also open and closed seasons. Such regulations are necessary to assure proper escapement of spawning fish, for without a balanced seeding each year the stocks would rapidly be wiped out.

The commercial catch fluctuates in size from season to season, but the average annual catch is approximately 4.5 million pounds, with a value of \$2.5 million. The catch is sold mainly in fresh form, although limited quantities are canned, smoked and salted.

Atlantic salmon is an epicurean delight and not infrequently choice specimens are shipped by air to various parts of the world as gifts to

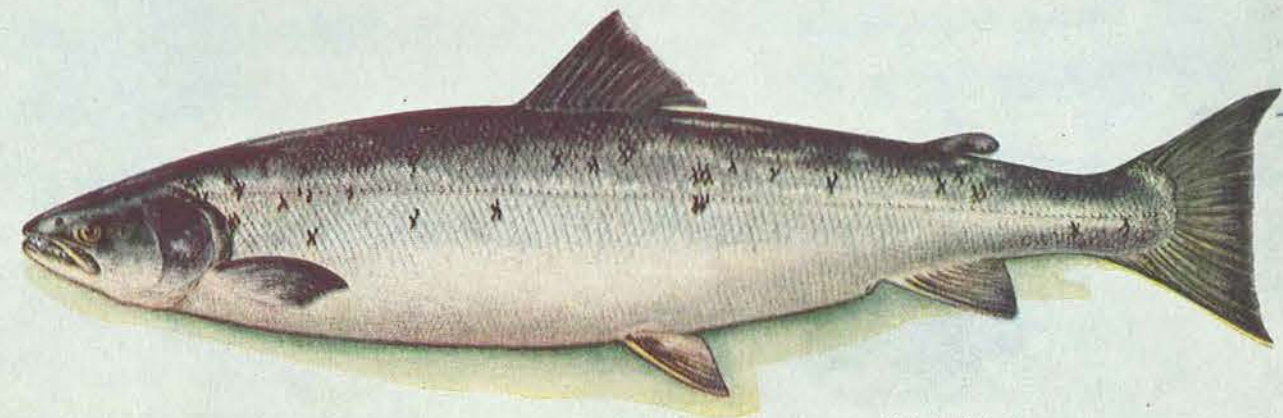
kings and queens, famous statesmen and others. It is, on such occasions, a good-will ambassador for Canada.

The Sports Fishery

Important though salmon may be commercially, their attraction as game fish also produces considerable revenue for the maritime provinces.

In British Columbia the Pacific salmons, in runs of hundreds of thousands, are essentially commercial fish. The salmon fisheries of that province have an annual marketed value of over \$60 million and give direct employment to some twenty thousand people. Their value as sports fish is, however, significant, but is probably reckoned more in terms of international prestige than in terms of dollars left in the province. Only two of the species — cohos and springs — respond regularly to the anglers' lures.

In their prime, salmon are sleek and beautiful. This female was caught in salt water.



Germaine A. Bernier



Taking salmon from a trap-net, Miramichi estuary.

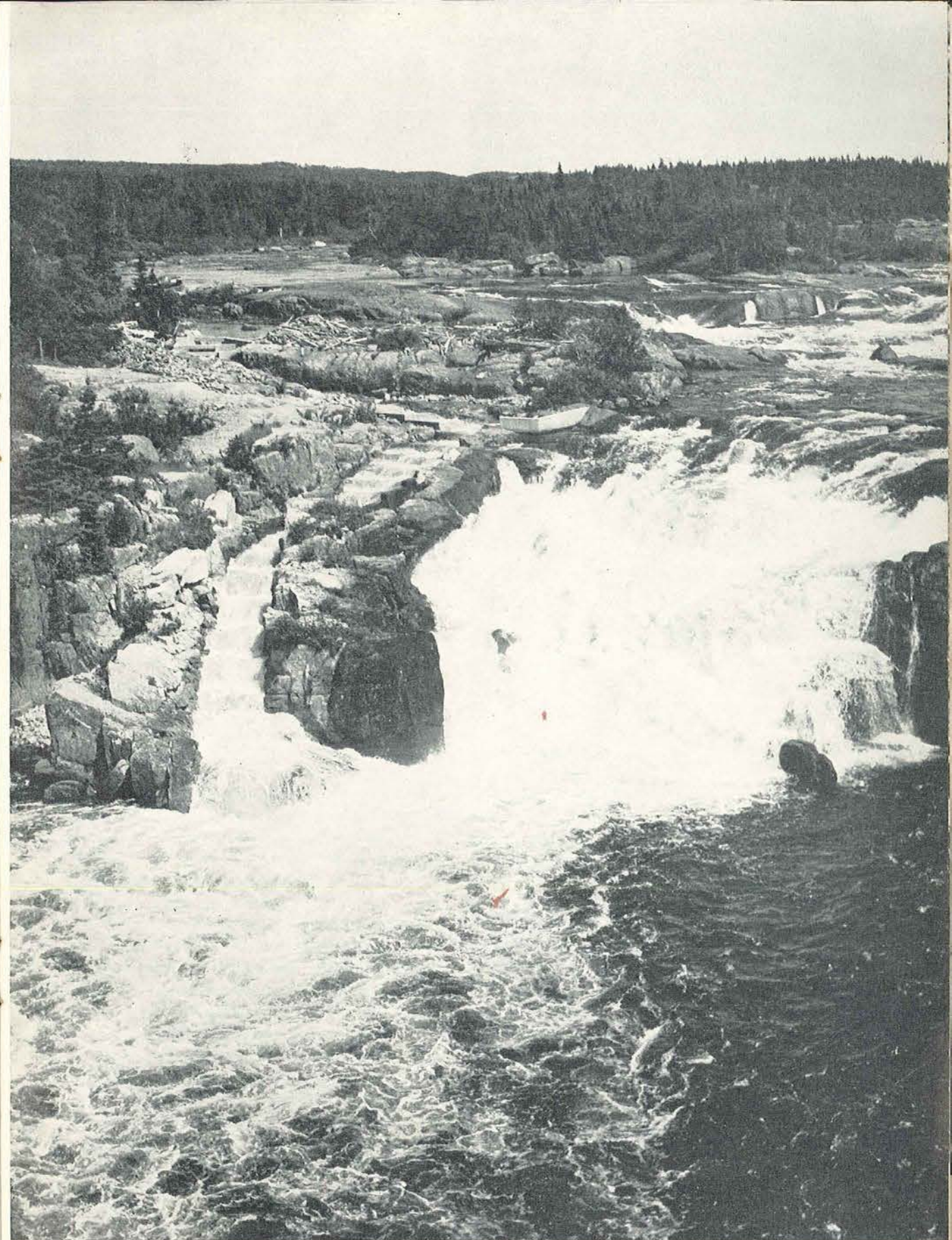
The Atlantic salmon, on the other hand, attract great numbers of sportsmen from various parts of Canada, the United States and other countries. Sizable sums of money are spent every year in each of the provinces by men and women eager to match their wits with the strength and cunning of these noble

creatures. In addition, private clubs, lodges and other establishments catering to anglers have a heavy investment in buildings and equipment. The operation of these establishments provides employment for a large number of local guides and other help.

The Atlantic salmon, long considered the peer of game fish, have given international recognition to otherwise obscure rivers—for example, Nova Scotia's Margaree and St. Mary's; New Brunswick's Miramichi and Restigouche (location of the famous Restigouche Salmon Club, believed to be the wealthiest and most exclusive club of its kind in the world); Quebec's Bonaventure and Matane; Newfoundland's Humber and Terra Nova, and Labrador's Eagle and Forteau. These, and many others, are famous salmon rivers.

Salmon return to the rivers in the peak of condition, but once in fresh water they practically cease feeding and draw entirely on their stored up fat and energy. Why they respond to artificial flies during their long periods of river fasting is as baffling as it is remarkable. Is it inspired by their salt water feeding habits? Do they have vague memories of the eager feeding of their youth? Do they seize flies out of curiosity or irritation? No one knows for sure. But time after time examination of stomachs has shown no trace of

Atlantic salmon drift-net boats.



Natural obstacles to migrating salmon, such as the big falls on the Terra Nova River, Newfoundland, are often overcome by the construction of "fish ladders". This escapement, built by the Federal Department of Fisheries, represents one of the many projects in the Atlantic salmon restoration program.



A courageous, determined fighter.

recognizable food. That they do respond to artificial flies, whatever the inexplicable compulsion, is, to an angler at least, all that matters.

A wide variety of flies is used in salmon angling. There are wet flies for high water, wet flies for low water, and there are dry flies. They come in different sizes, in different patterns, and in an overwhelming range of colours. Their names, too, are exciting; names like Jock Scott, Parmachene Belle, Silver Doctor, Greenwell's Glory, Black Dose, March Brown and a host of others. There is wet fly fishing, dry fly fishing, greased line fishing and drift cast fishing, and there are different techniques for each method. To understand all these things, and to understand, too, the ways of the rivers and the salmon that are in them, requires a lifetime of study and first-hand experience.

But whether expert or novice, the angler who succeeds in raising and hooking an Atlantic salmon finds himself in touch with a creature possessed. The salmon is a courageous, determined fighter that will submit only when its strength is gone; even then its will to live may provide the energy for a final surge sufficient for the fish to regain its freedom from momentarily careless hands. The salmon's long rushes, and frenzied leaps out of water, seldom fail to give the angler everything he could expect in the way of thrills.

There is no adequate explanation of the lure of salmon fishing. To some it is the call of the quiet places, of the cathedral forests of spruce and pine and birches, of the gentle flow of clear, lovely streams, of the sheer poetry of a salmon's rise rather than the struggle that ensues; to others it is the satisfaction of companionship, of salmon talk, of hard strikes and pulsating battles. But whatever its appeal, it is a complicated, demanding art that is as often fraught with failure as it is blessed with success.

The Future of the Resource

The control of a fishery — any fishery — is one of the most complex problems in the whole area of wildlife management. Man yet knows little of the mysteries of aquatic life, and when these are augmented with the mysteries of the sea, the problem increases a hundredfold.

While much is known about the salmon,

there are still many unknowns. Science, working diligently over the years, has been able to record the existence of certain established habits in behaviour and development during stream life; as far as the salmon's sea life is concerned there is still an abysmal lack of knowledge and it may be that Nature will never reveal all her secrets. The sea, despite clever scientific instruments devised by man, has imponderable depths which human vision may never be able to penetrate.

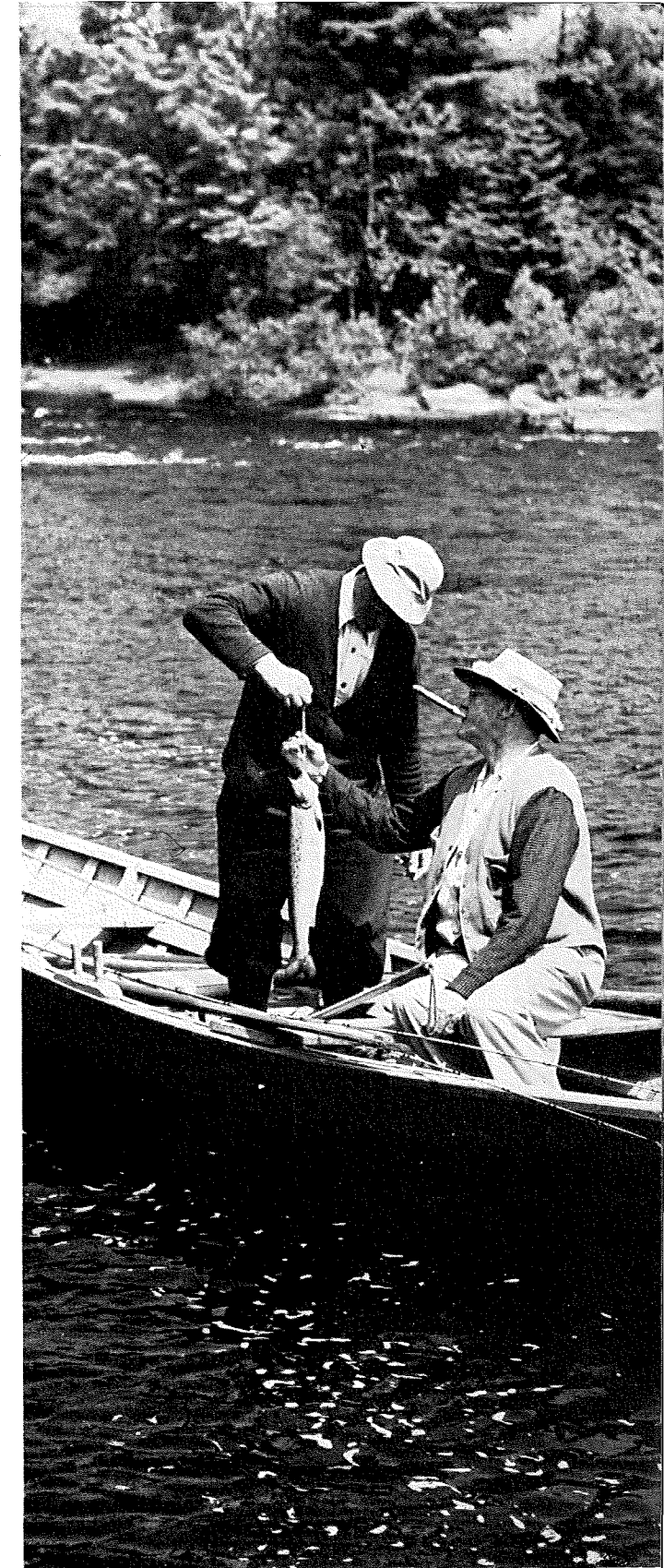
And so known facts, for the present at least, can be supplemented only by surmises. The challenge that faces the scientists is to acquire new knowledge, and this knowledge can be gained only by long and painstaking research and experiment.

One fact, however, is clear: there has been a decline in Atlantic salmon during the past twenty years. The problem now is not only to arrest this decline but to rebuild the stocks.

The starting point of such an undertaking may be anywhere throughout the complicated range of the salmon's life cycle. But there are many factors other than the fish themselves, factors such as predators, water levels and water temperatures, water pollution, both natural and man-made obstacles, size of commercial and angling catches, and the sea itself.

While the problem is essentially one that belongs to the federal government, its solution is also of vital importance to all of the provinces concerned. And so the Department of Fisheries of Canada, together with its Fisheries Research Board, is working closely with provincial fishery authorities and scientists in a united effort to find that solution.

One of the results of this federal-provincial co-operation has been the creation of the Atlantic Salmon Co-ordinating Committee, a body composed of federal and provincial deputy ministers of fisheries, administrators, and scientists. This group formulates policy for recommendation to governments and decides on research and management programs. The practical work, in turn, is carried out by a scientific sub-committee, a unit made up of scientists of the federal and provincial departments concerned with fisheries and of the Fisheries Research Board.



A small one, but worthy game.



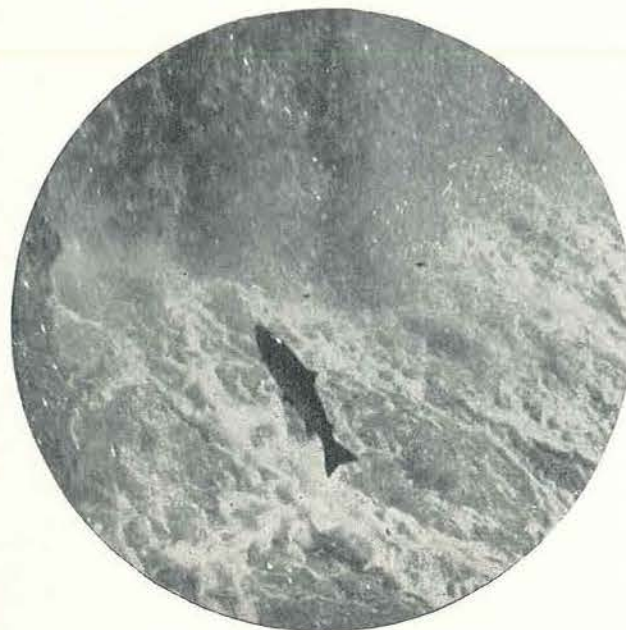
Indian Falls, on the LaHave River, Nova Scotia, before the Department of Fisheries constructed a salmon escapement.

The committee, and its sub-committee, have the co-operation of private groups and individuals. Prominent among these is the Atlantic Salmon Association, an organization of anglers affiliated with the Salmon and Trout Association of Great Britain. This Association, created in 1948, has shown a keen interest in the welfare of the resource and in the salmon rehabilitation program. In addition, help has come from various fish and game clubs, from commercial fishermen, outfitters, guides and anglers.

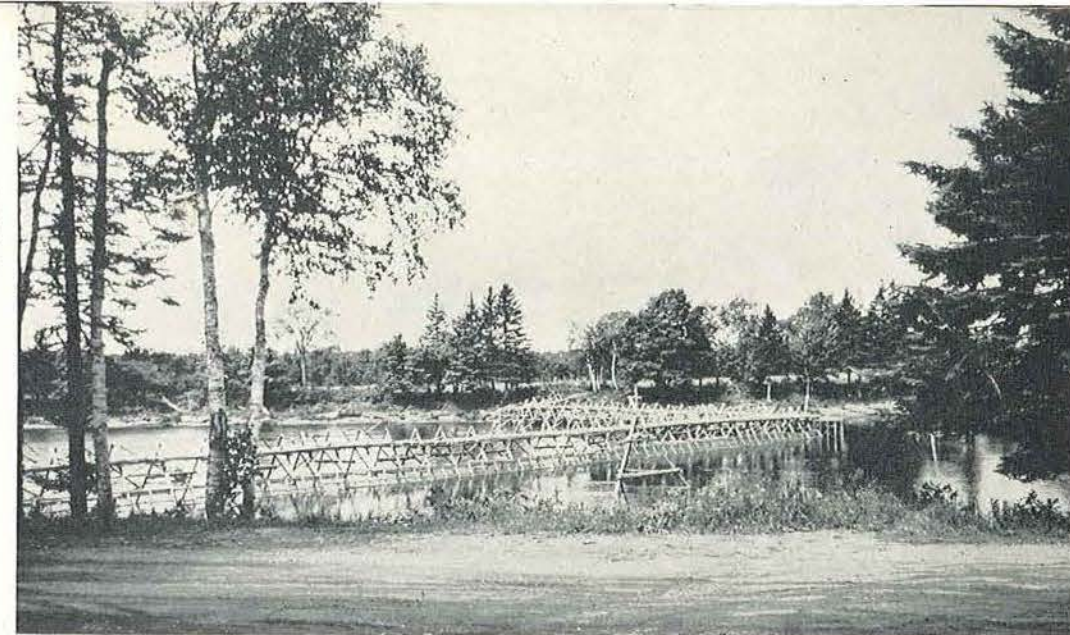
Reduced to its simplest terms, the objective

of the undertaking is to rebuild the stocks of salmon wherever declines have been noted. This involves a whole set of problems, complicated by the fact that no two rivers are ever alike and no simple formula can fully answer every need. And so each river requires its own special study and its own special remedy.

But for every river there are certain basic requirements. A river can successfully propagate salmon only if its water is clean and fresh, with a steady flow throughout its length. Its nursery areas must be sufficient in extent to meet the needs of spawning fish and these areas must be protected so that they will safely hatch the eggs deposited in them. A river must be reasonably free of predators — of the trout that eat the eggs and fingerlings, of the kingfishers, otters, mergansers and other creatures that destroy the parr and the smolts. It must be free of impassable barriers that block the ascent or descent of migrating fish, and it must be without pollution. In the estuaries leading to the open sea there must also be clean, unpolluted water. And along its whole course, it must be without that human destroyer — the poacher. With all these, along with a regulated sports and commercial fishery, a salmon river may be said to be in ideal condition. But still there remains the sea itself, the hidden depths where salmon spend about a third of their lives. What happens to



Atlantic salmon counting fence on the Northwest Miramichi River, New Brunswick.



the salmon once they reach these unknowns? Here, indeed, is the great imponderable.

The resource, itself, is a complex one with Nature maintaining controls around which most man-made controls must revolve. Studies made of the Atlantic salmon show that natural mortality is high. It must be assumed that before man began to exploit the resource, regardless of the number of eggs spawned and hatched, only two — one of each sex — escaped the many natural causes of destruction along the way and returned to the rivers as adult fish, there to spawn and carry on the race.

This "two for two" ratio, which applies to all other forms of wildlife, is Nature's own system of management, and in itself is sufficient to perpetuate all creatures in proper balance. When the ratio is upset and becomes much less than two for two, declines follow. Presumably, that is what has happened in the case of the salmon.

The question is, then, what has upset the ratio? In their natural state, before the coming of man and the encroachment of his civilization, rivers were believed to have supported tremendous runs of fish. With man's arrival things happened. He cleared the forests, often to the rivers' edges, taking away the protection that prevented silting and the drying up of river beds; he built communities alongside rivers and used the water for the

disposal of human and industrial waste; he built dams and other establishments that completely altered water levels, with never a thought to the needs of migrating fish, and he killed fish for food or for sport.

Any one of these conditions can adversely affect a fishery; pollution alone, for example, is sufficient to destroy runs of migratory species, even though beyond the pollution area other fish may flourish. This applies to dams that block free movement to and from the sea. But a river free of poisons and obstructions can still be ruined by other man-made causes. Natural



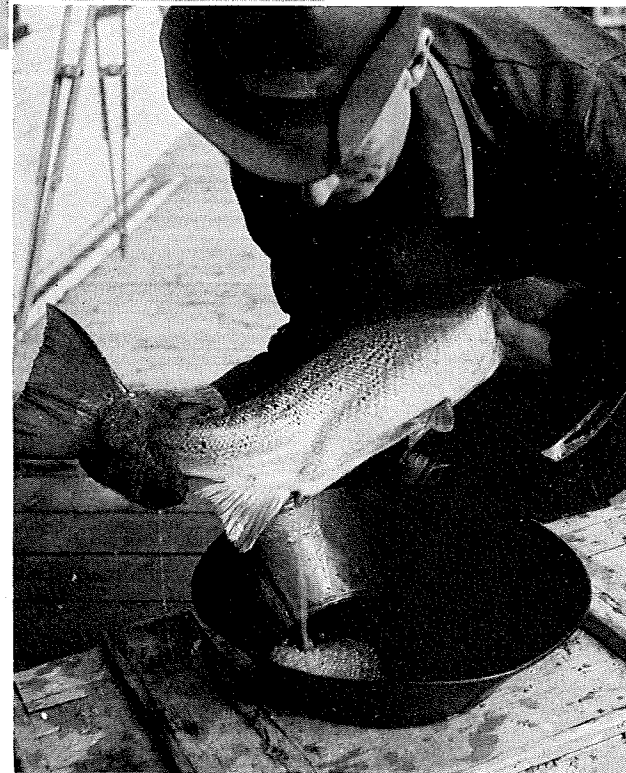
Mature salmon are held in special tanks prior to stripping.



Female salmon prior to stripping. Below, stripping is painless and does not injure the fish.

predation, such as that by animals, birds and fish, normally would not be serious, but when this predation is added to other causes of destruction it is a matter of much concern. Scientists now know that the successful rehabilitation of salmon in any river calls for the management of the *whole* river, not merely a part of it.

The program being evolved by the government-sponsored Atlantic Salmon Co-ordinating Committee is a long-range undertaking. Some of it is new, some of it a continuation of the regular work of the federal and provincial departments of fisheries and the Fisheries Research Board. In any event, studies are now being made of all of the factors involved. Rivers are being surveyed from their sources to their mouths to determine their salmon population capacities, to ascertain location of problem areas and, where possible, to remove such problems. Predator control work, such as reduction of unduly large populations of kingfishers and mergansers, so destructive of parr and smolts, is underway on an experimental basis, and is being carried out with the approval of the authorities responsible for the administration of the Migratory Birds Convention Act. Marking of smolts and tagging of adult fish to acquire further knowledge about migration is also underway, as is the counting, by means of specially constructed "fences", of incoming and outgoing fish. Millions of healthy young salmon are being produced in government-operated hatcheries through artificial propaga-



tion and released in selected rivers. In the future, as in the past, fishways will be provided wherever impassable barriers occur, or are created by industrial development.

But the project is both complex and difficult. As in all fishery problems, much of the knowledge sought by scientists is concealed behind the curtain of deep water. To link the known with the unknown and to obtain correct answers demands both skill and patience.

It cannot be too emphatically stated, however, that the rehabilitation of the Atlantic salmon is not alone the job of governments.

CANADA'S ATLANTIC SALMON

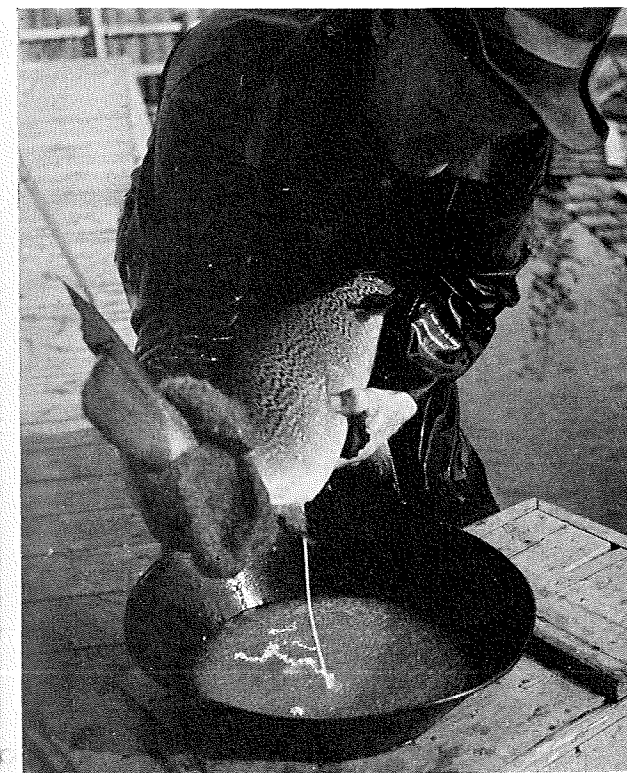
Scientific research, the building of fish escape-ments, control of catches, supervision of rivers and artificial propagation of new stocks, among other measures, are all essential but in themselves are not sufficient. It is an undertaking that will succeed only if there is understanding and co-operation from the public. This applies particularly to sportsmen and commercial fishermen and to water and forest users.

Industrial growth in all of the Atlantic maritime provinces, especially that calling for the harnessing of water power for hydro-electric purposes, will bring many problems, as

will increased population and continued use of forest resources. But these problems can be overcome. In British Columbia where extensive development at one time threatened the great runs of Pacific salmon, experience has shown that it is not necessarily fish *versus* industrial growth, but fish *and* industrial growth. It has been clearly demonstrated that freedom to develop one is compatible with freedom to conserve the other.

The salmon are a part of our great renewable resources and, like all living elements, depend for growth and reproduction on sun, soil, and water. Successful management of agriculture demands intelligent management of soil; successful management of soil demands intelligent management of both woodlots and water. Similarly, successful management of fisheries demands intelligent management of rivers. Experience has shown that most of our living resources are interdependent and are part of an integral whole. To develop or exploit one resource without thinking of the possible detrimental effects on others is to endanger the future of all. Thus, "multiple use" management plans have largely replaced the "single use" plans which have been proved to be neither sensible nor economic. The conservation of salmon need not retard hydro-electric progress or forest cropping, although on occasions the various interests may have to agree to certain compromises.

As the studies continue, it may be found necessary to redefine existing regulations regarding open and closed seasons and limits of catch, and from time to time the takers of



Stripping the male salmon, showing the milt fertilizing the eggs. Right, the hooked jaw of the male salmon indicates spawning maturity.





Artificial propagation is an important phase of salmon rehabilitation program. Spawning shed and salmon ponds of Miramichi Hatchery, N.B.

salmon may find their traditional privileges upset. But whatever is done will be done with one objective in mind: to restore the Atlantic salmon in numbers sufficient to permanently overcome the decline and to provide

greater stocks for the benefit of all concerned.

When this has been achieved commercial fishermen will benefit through greater economic returns for their labours and anglers will benefit through vastly improved recreation.



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A New Brunswick salmon stream full of promise.