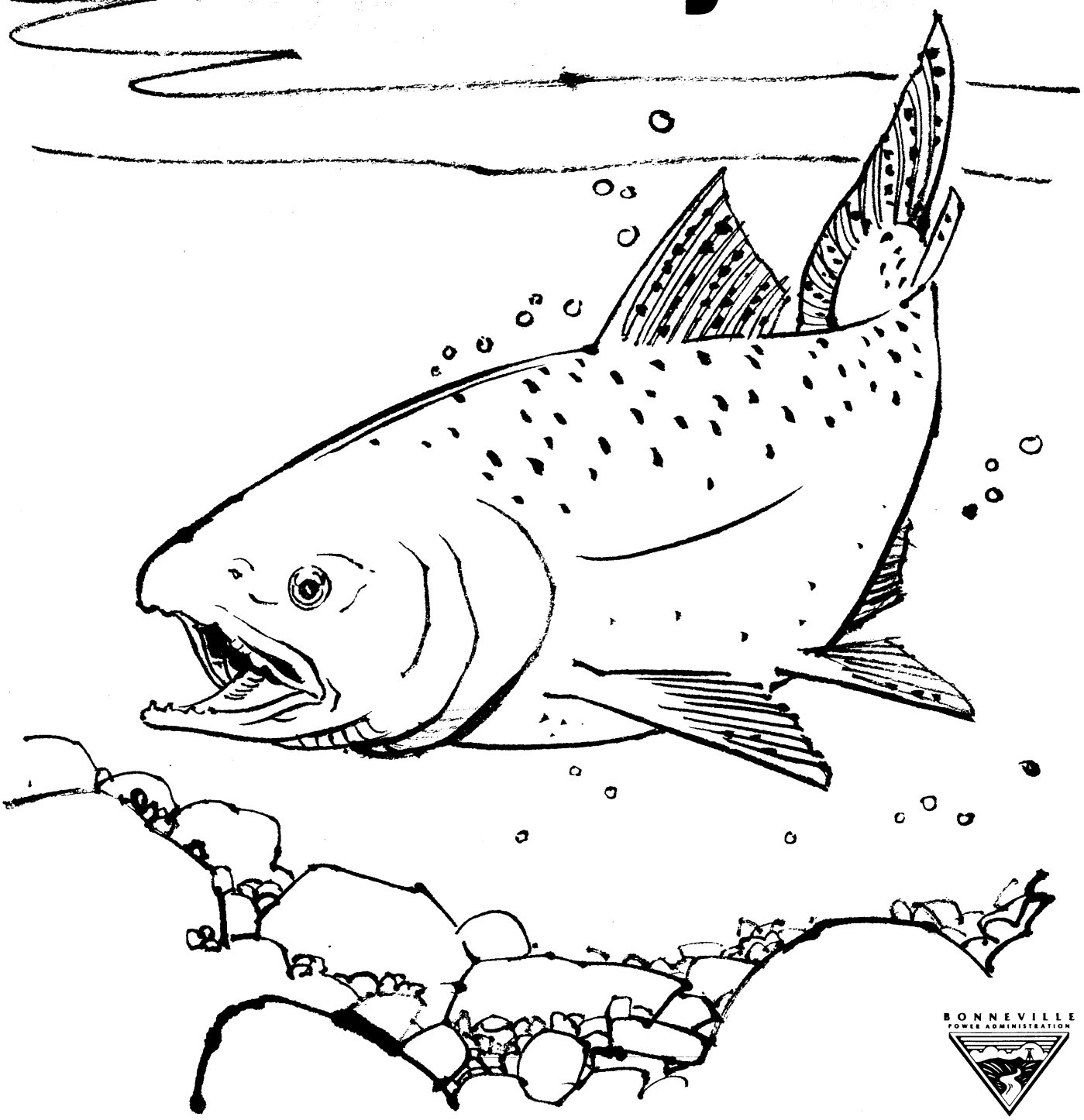
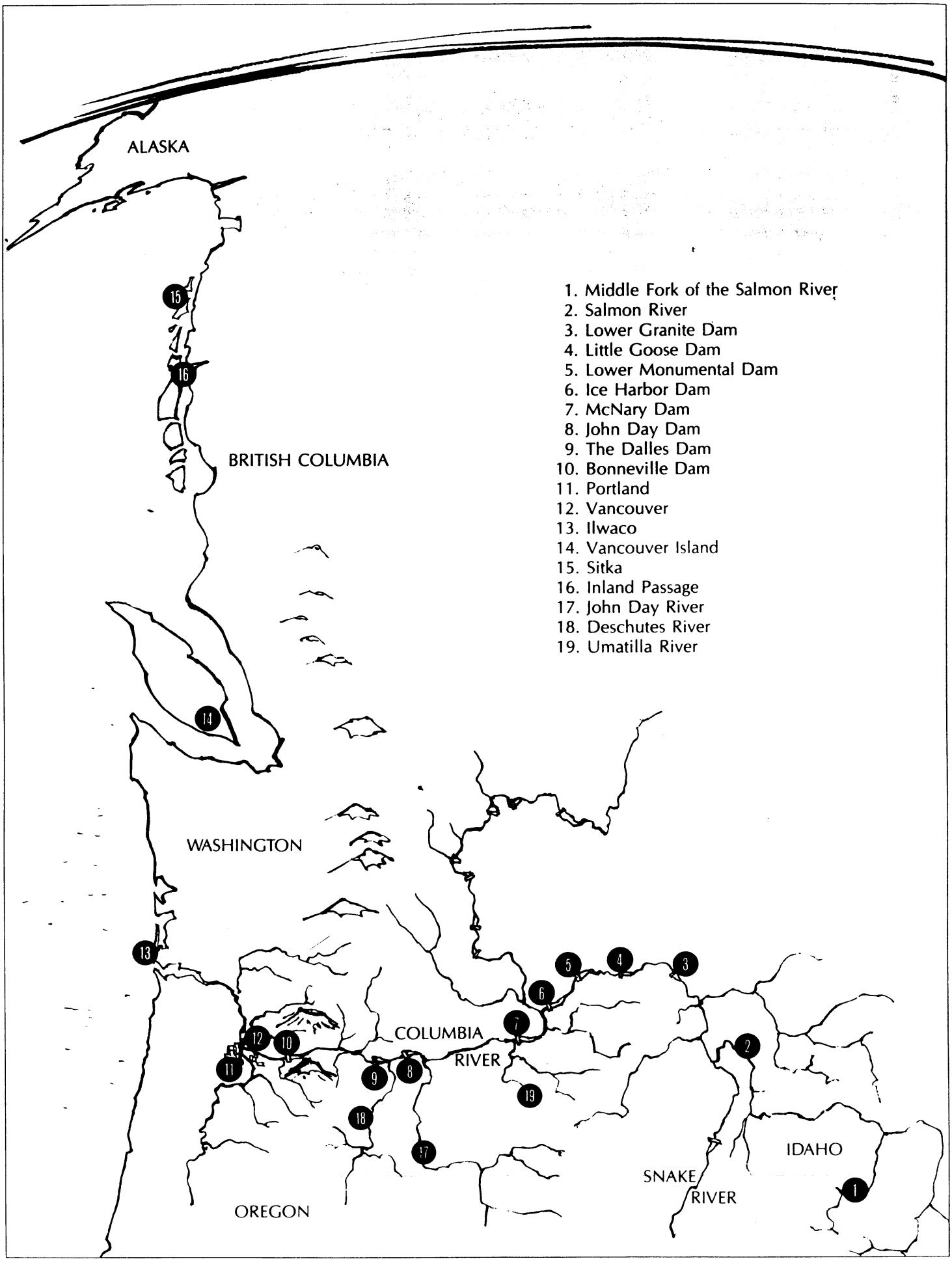
A PUBLICATION OF THE BONNEVILLE POWER ADMINISTRATION

The Magnificent Journey



BONNEVILLE
POWER ADMINISTRATION

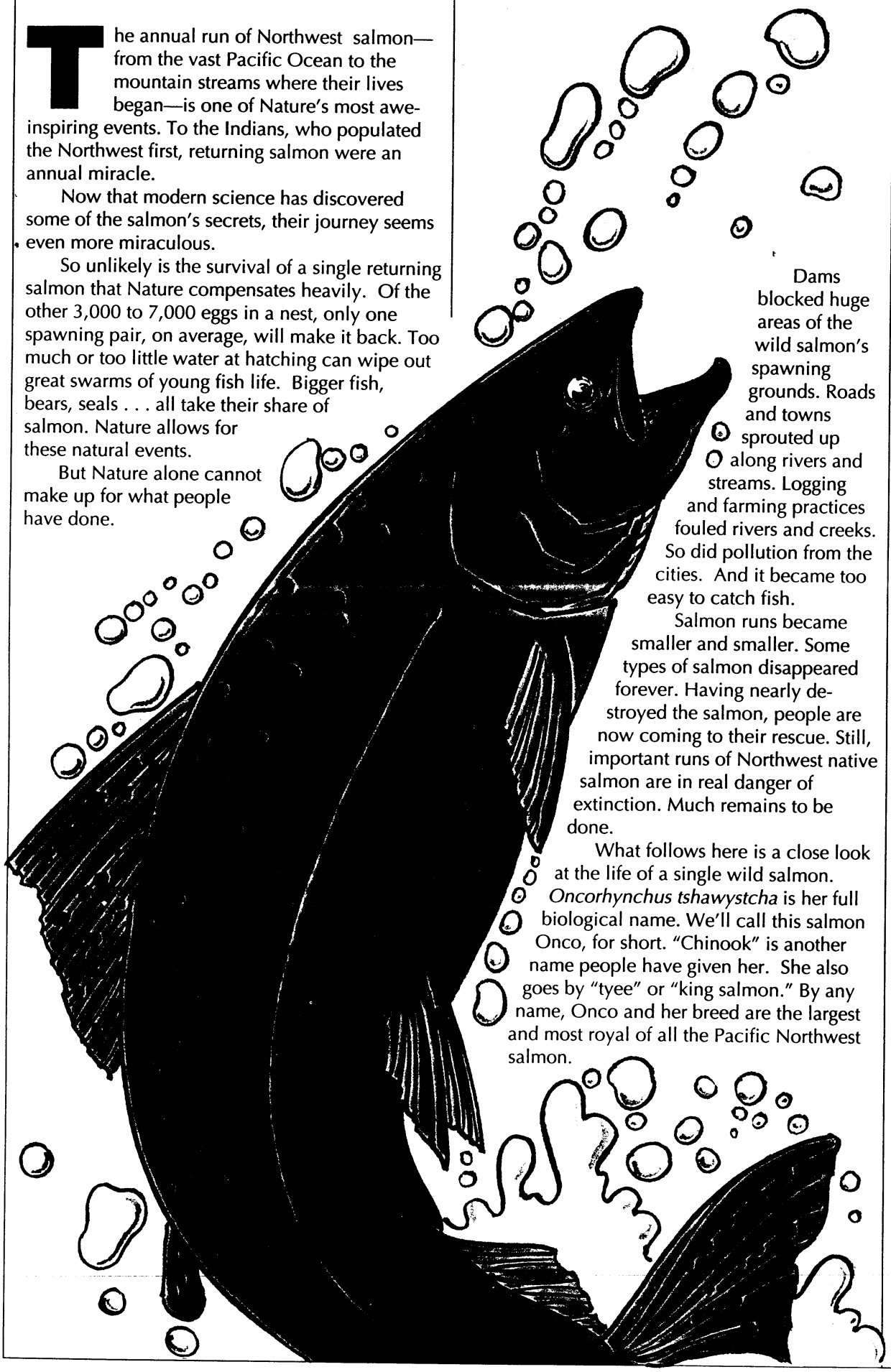

ALASKA
BRITISH COLUMBIA
WASHINGTON
OREGON
IDAHO
COLUMBIA RIVER
SNAKE RIVER
1. Middle Fork of the Salmon River
2. Salmon River
3. Lower Granite Dam
4. Little Goose Dam
5. Lower Monumental Dam
6. Ice Harbor Dam
7. McNary Dam
8. John Day Dam
9. The Dalles Dam
10. Bonneville Dam
11. Portland
12. Vancouver
13. Ilwaco
14. Vancouver Island
15. Sitka
16. Inland Passage
17. John Day River
18. Deschutes River
19. Umatilla River

The annual run of Northwest salmon—from the vast Pacific Ocean to the mountain streams where their lives began—is one of Nature's most awe-inspiring events. To the Indians, who populated the Northwest first, returning salmon were an annual miracle.

Now that modern science has discovered some of the salmon's secrets, their journey seems even more miraculous.

So unlikely is the survival of a single returning salmon that Nature compensates heavily. Of the other 3,000 to 7,000 eggs in a nest, only one spawning pair, on average, will make it back. Too much or too little water at hatching can wipe out great swarms of young fish life. Bigger fish, bears, seals . . . all take their share of salmon. Nature allows for these natural events.

But Nature alone cannot make up for what people have done.



Dams blocked huge areas of the wild salmon's spawning grounds. Roads and towns sprouted up along rivers and streams. Logging and farming practices fouled rivers and creeks. So did pollution from the cities. And it became too easy to catch fish.

Salmon runs became smaller and smaller. Some types of salmon disappeared forever. Having nearly destroyed the salmon, people are now coming to their rescue. Still, important runs of Northwest native salmon are in real danger of extinction. Much remains to be done.

What follows here is a close look at the life of a single wild salmon. *Oncorhynchus tshawystcha* is her full biological name. We'll call this salmon Onco, for short. "Chinook" is another name people have given her. She also goes by "tyee" or "king salmon." By any name, Onco and her breed are the largest and most royal of all the Pacific Northwest salmon.

The Start of a Cycle

High in the mountains of central Idaho runs a creek too remote to have a name. The water flows shallow and cold, clear and swift. Glaciers, receding toward Canada after the Ice Age, left behind this gravel stream bed at the bottom of a broad, U-shaped valley.

In late August, the leaves on streamside trees are yellowing. The smell of fall and colder weather is in the air, and morning frost collects on the bank. A reddish-brown female chinook idles under riffles of rushing water. She looks battered and exhausted. She's just waiting here, maybe resting.

A second salmon appears. He is darker than she is. Cream-colored splotches mark his body. He moves in beside her, upstream and parallel to her body. These salmon are spawning.

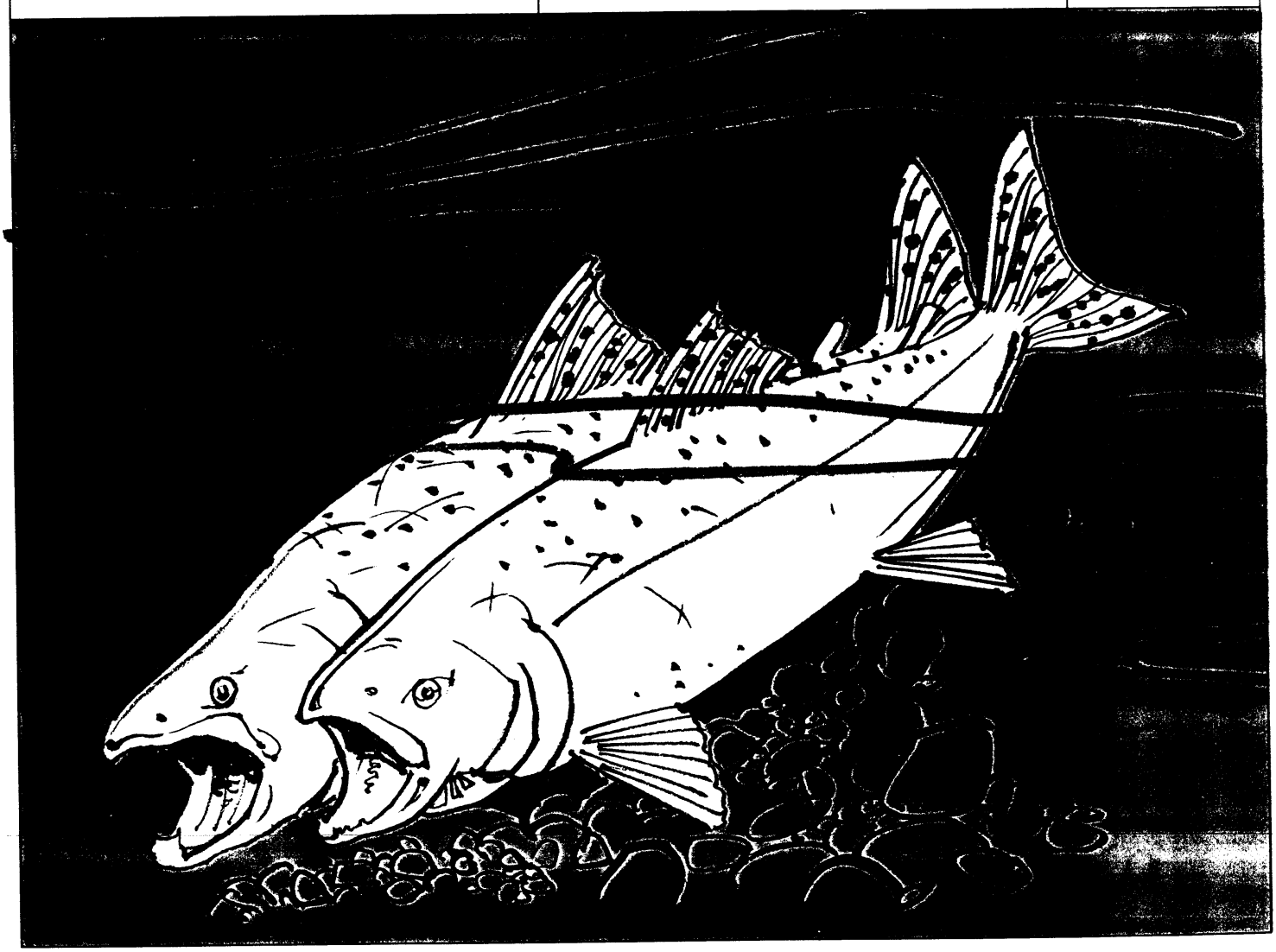
The female chinook deposits about 5,000 bright pink eggs in the gravel bottom of her nest—called a redd. After the male fertilizes the eggs, the female moves upstream from her redd. With her tail, she kicks up pebbles that drift downstream to settle over the redd.

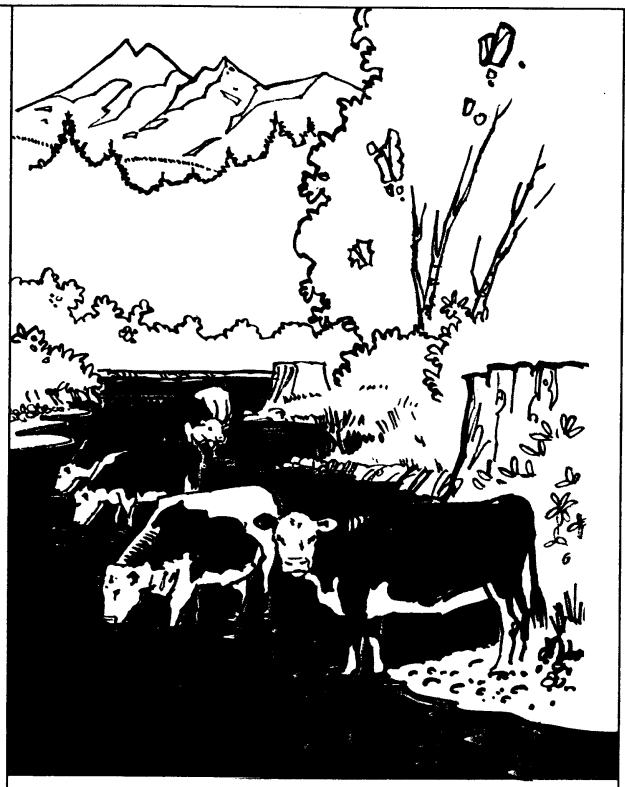
The eggs now are covered. They are protected from direct sunlight and strong current. For the next four weeks or so, the eggs are very fragile. The slightest bumping of the redd can destroy them.

By mid-autumn, the eggs begin to develop. Eyes begin to form. And somewhere among these closely-packed lives in the redd lies Onco. Onco the Lucky.

Onco is fortunate that the water temperature is only 55 degrees Fahrenheit. That's within a few degrees, up or down, of what her system can handle. She's lucky, too, that there is no sudden torrent of water in the creek. A heavy storm could dislodge the stream bed rock and crush her.

A female chinook deposits about 5,000 bright pink eggs in the gravel bottom of her nest, or redd. A male fertilizes the eggs.





Grazing cattle can trample the stream banks, their muddy footprints releasing silt. Silt covers gravel and chokes off the oxygen supply. Eggs suffocate.

Upstream from Onco's redd, riffles mix air with water to give the eggs a rich oxygen supply. Without oxygen, the eggs would die.

Ducks and other birds hunt for salmon eggs. Raccoons find the same reward in shallow gravel. Adult trout, too, love salmon eggs if the trout can get to them. But they do not find Onco in the gravel-covered redd.

Aside from these natural hazards, the developing salmon egg has to survive some unnatural hazards.

In another creek like Onco's, a mining dredge once ripped up the stream bed. Now, each year the loose soil releases silt which spreads far downstream. Silt covers gravel and chokes off the oxygen supply in the water. The eggs suffocate.

Grazing cattle can trample the stream banks, their muddy footprints releasing even more silt. Pesticides applied to upstream crops can drain into a creek and poison fish. A road built alongside a stream can change the way water runs off. The stream is more apt to flood after a big rain. Where once there were trees and shade, the sun hits the water directly. Direct sunlight can warm the water more than salmon eggs can stand.

Careless logging can ruin a salmon spawning stream. Branches and debris can block fish movements. Logs dragged along a slope, or a log truck crossing the smallest trickle, can churn up more silt. Of course logging removes trees and shade. Some of the worst damage was done before people quite understood how shade and plants are important to salmon.

Lucky for her, Onco's creek is in pretty good shape. For one reason, there are laws now that help protect salmon habitat—the natural environment salmon need to survive.

Dredge mining has been outlawed through most of the Northwest. Road-building codes are tighter.

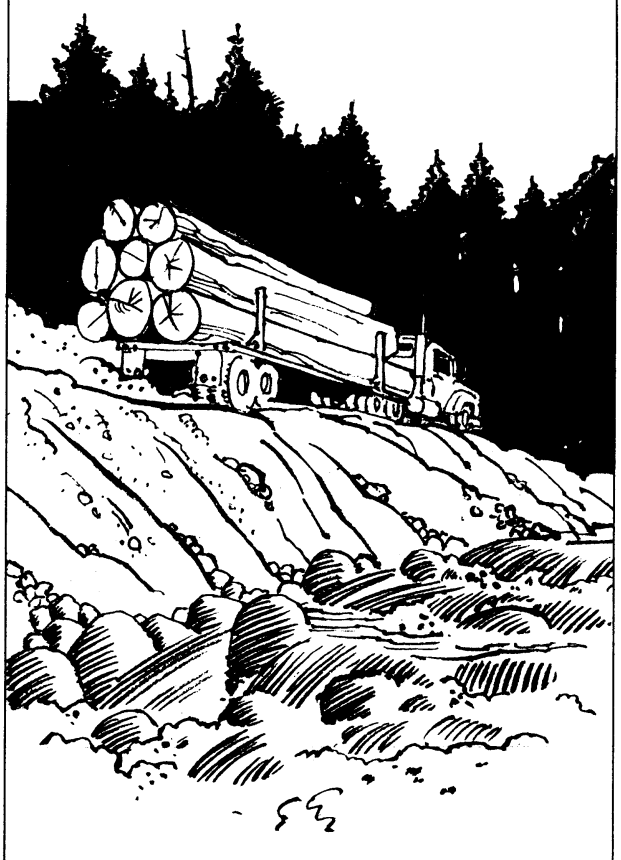
In some places, logging is cleaner. People are working to protect streamside vegetation.

Things have changed. Many now realize that more wild salmon will become extinct if people don't back off and give them some room. We have to strike a balance between our needs and the needs of other living things.

Not that we can strike such a balance without paying for it. If it's tougher for a logger to get to logs, somebody ends up paying more for lumber. Outlaw dredge mining, and it costs more to get the minerals.

On the lower river, irrigators, power producers and bargers are changing the way they work—and having to charge more for their goods—to help protect wild salmon runs. Everybody must pay their share if Onco and her kind are to survive.

Sometimes it takes more than just backing off. People passed laws to rebuild some salmon streams that were destroyed by careless mining or logging. In some places, hatchery fish are being put back into streams where the wild salmon disappeared years ago.

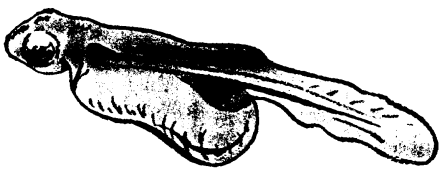


Careless logging can ruin a salmon spawning stream.

From Egg to Fry

Winter sets in at Onco's redd. A light blanket of snow covers the ground. Thin, jagged sheets of ice cling to the banks where water meets the shore. To look at this silent and apparently lifeless scene, you'd never know what's going on within the gravel of the redd. Yet new life is stirring here.

The hatchlings stay under the gravel. Onco, by Valentine's Day, is a homely and helpless little creature called an alevin. Her eyes are huge compared to the size of the rest of her body.

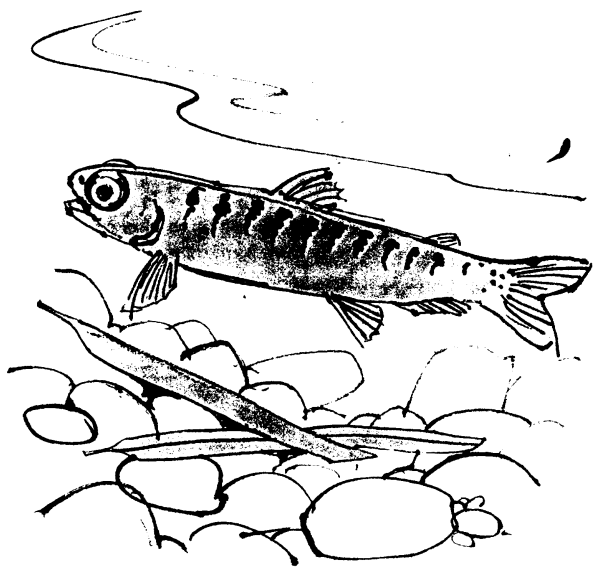


The yolk sac that hangs from an *alevin's* body gets smaller as the fish grows.

An orange yolk sac, sticking out from her belly, contains a balanced diet of protein, sugars, vitamins and minerals. As Onco grows, the yolk sac gets smaller.

Then one night in March, Onco slips upward through the gravel and emerges as a tiny fish called a fry. She's about the length of a fir needle and not much fatter.

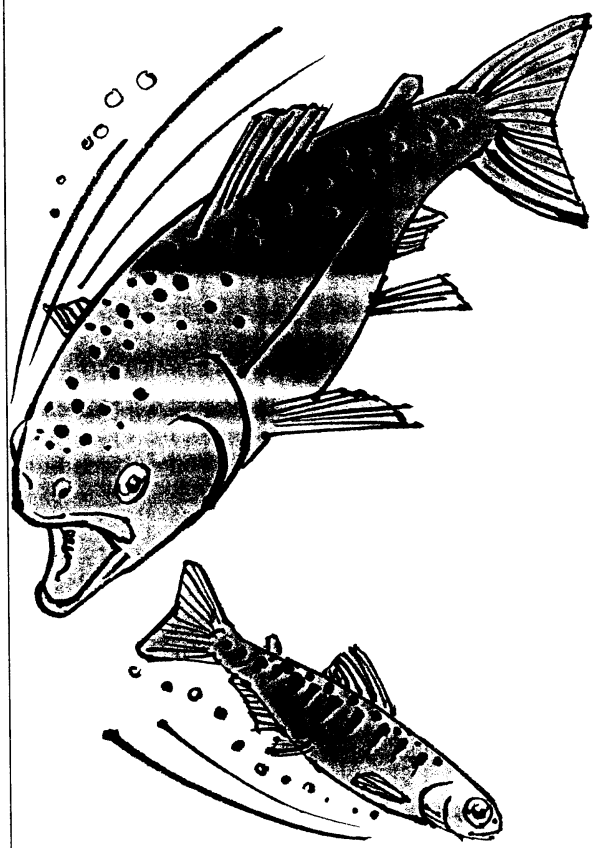
Her eyes are still bugged out, and she avoids sunlight. She stays in shallow pools near the edge of the creek, where the current is not so strong.



Fry — young fish fresh from the gravel — are about the size of a fir needle.

Onco is tiny and she must be very quick. As she darts around feeding on even tinier creatures, she is wide open for sudden death. Fry are easy prey for trout and other large fish. Ducks and herons, even crows, devour fry.

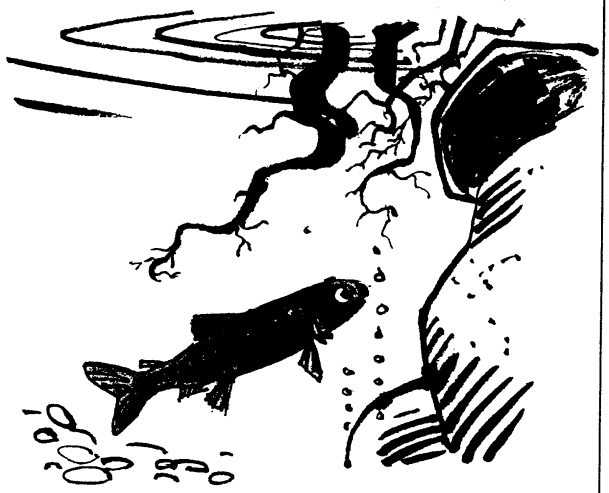
Some chinook fry mature early. They migrate to the ocean in the first May or June of their lives. Others, like Onco, take their time. They stay in fresh water for one more full spin of the seasons before heading out to the Pacific.



Fry are easy prey for trout and other large fish.

Through her first summer, Onco pokes around her shallow home creek. In the fall, with colder water, she lets the current take her downstream. She's in no hurry and makes several stops along the way. Root wads, fallen trees and boulders make good resting and feeding places. By the time winter sets in, she finds herself in the Middle Fork of the Salmon River.

Onco is now about the length of a human adult's finger. Fish her size are called fingerlings. Scales protect the side of her body. The scales are covered by a slimy layer of mucus that protects Onco from disease and helps her slide through the water as if she were greased. She has faint vertical stripes along her silvery sides to help her hide from predators.



Fingerlings hide and feed near root wads as they move through the stream.

Onco is big enough now to be more of a hunter herself. She snaps up mosquitoes and other insects that come near the water surface. She nabs an ant unlucky enough to have fallen into the stream.

Her mouth is important not only for eating but for breathing as well. She takes in water through the mouth and forces it out through the gills on each side of her head. The feather-like gill filaments are full of blood vessels which—like the lungs in humans—take up oxygen and release carbon dioxide.

Onco doesn't have ears but she can hear. Low frequency sound waves vibrate through the water to a row of small holes along each side of her body. These holes open to nerves that let her "hear" danger. Salmon have nostrils and a good sense of smell. They can smell predators and food.

Onco can smell home, too. As Onco works her way from the spawning site, she senses where she has been. She's learning how to get back, years later. This is called homing. Biologists are not exactly sure how it works. Somehow, the unique chemical qualities of Onco's home stream become lodged in her memory.

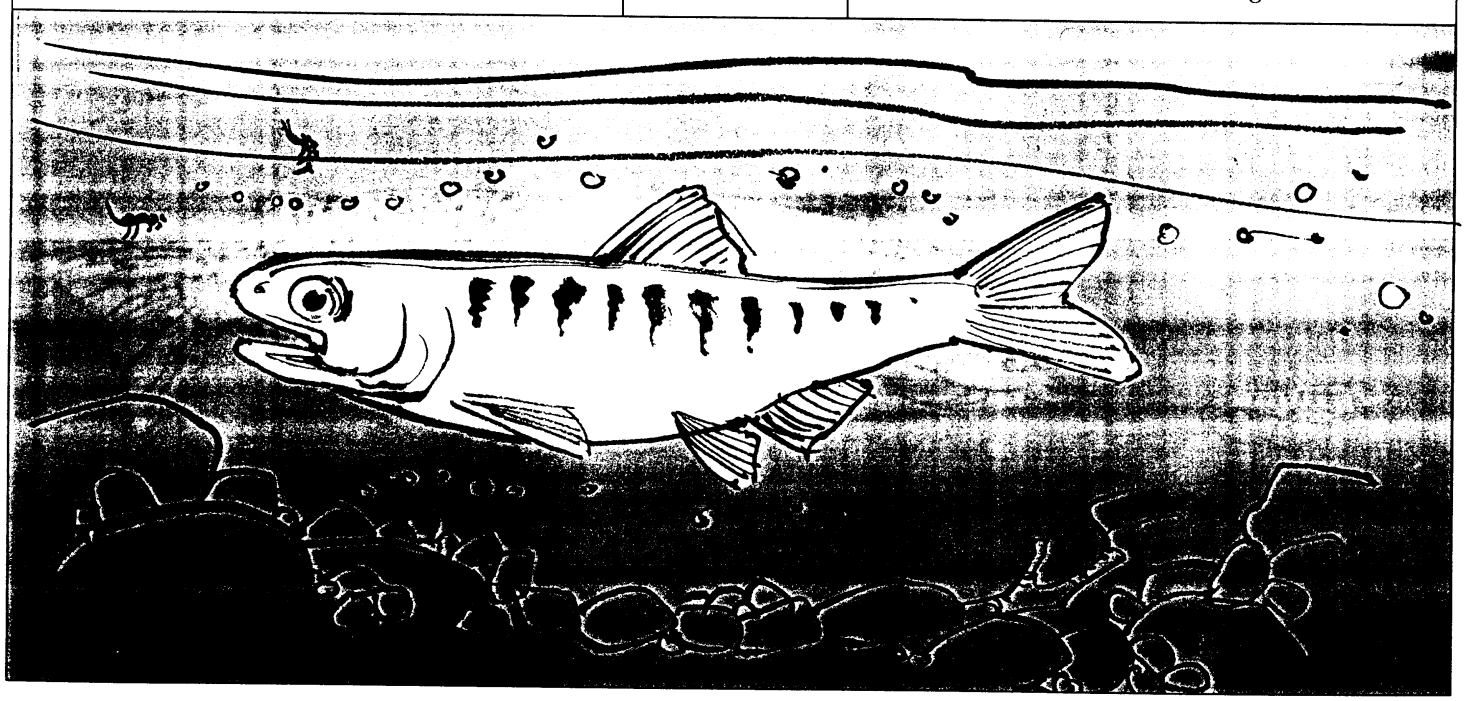
Kingfishers and other birds eat young salmon.

Onco must always be alert. In the summer of her first year, a kingfisher perched on a branch above her takes aim and dives. Thanks to Onco's big protruding eyes, she has good vision. Just as the bird hits the water, Onco darts away. She escapes. Not every young salmon is so quick or so lucky.

When young fish reach the size of a human finger, they are called fingerlings. Vertical strips along their silvery sides help hide them from predators.

In fact, only about 10 percent of the eggs in a redd make it through the fry stage. Conditions for Onco and her redd-mates are better than average. Fifteen percent of the eggs grow into fry and survive that first spring and summer.

Of the original 5,000 in Onco's "family," only 750 are still alive and feeding.



Migrating Downstream

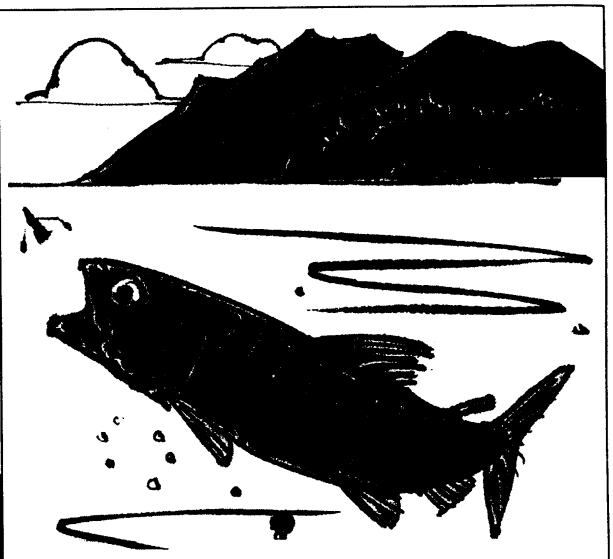
A fingerling's growth slows in the winter of its first year.

Young fish—known as smolts — drift backward as they migrate downstream. They travel mostly at night to avoid predators. As they go, they feed on midges, worms and snails.

Onco's growth slows in the winter of her first year. Food is less abundant, and she needs less. Her body is idling, waiting for another spring. The snowpack builds in the mountains.

In late April, snow starts melting. Spring rains begin. The water level rises and the annual spring runoff sweeps young salmon downstream.

Onco drifts backward with her head upstream. She travels mostly at night to avoid predators who hunt by sight. As she goes, she feeds on midges, worms and snails. Her fingerling stripes slowly



fade. She is changing inside, too, to make the transition from fresh water to salt water. With these changes she is called a smolt.

From the Middle Fork, Onco enters the Salmon River. Then she comes to the Snake, a bigger river that forms the border between Idaho and Oregon. Great crowds of smolts from other tributaries join her in a mass migration to the sea, as if they were rushing out of separate classrooms into one main hall toward recess.

Mingling with Onco now are smolts that look like Onco but got a different start in life. Instead of hatching in the wild, they are the offspring of adult salmon whose eggs and milt were combined at a fish hatchery. They grew to be fingerlings in man-made rearing ponds. Spared the hazards of the wild, a greater percentage of them survived.

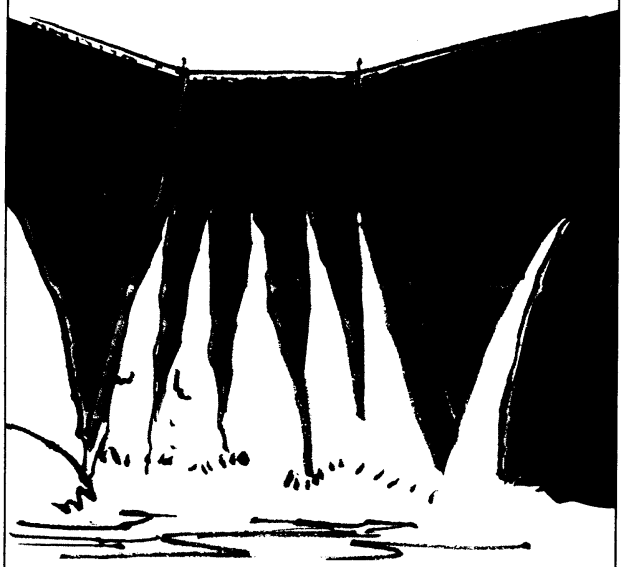
But now, released in real streams, they face the same predators and natural perils that Onco

does. And they're not yet as sharp at hiding or finding food as she is.

Hatchery-bred salmon raise the total numbers of returning salmon. But they also compete with wild fish for food and habitat. Because of their genetic diversity, wild salmon are more resistant to disease and carry the mix of genes that are critical to long-term survival of the breed.

The Snake River runs northward, brown and swift. Suddenly the river is no longer rushing. Onco has entered the reservoir upstream from Lower Granite Dam.

This is the first major barrier to her swift migration out to sea. A salmon is designed to expect an unbroken spring flush to the ocean.



Before dams, Onco's trip out might have taken three or four weeks. Now it could take closer to two months.

To speed their trip, many smolts are caught in pens at Lower Granite Dam and loaded into barges for a free ride downriver to below the last dam. Onco, ever wary, avoids capture and must do it the hard way.

Beyond Lower Granite Dam on the Snake River, she finds other dams: Little Goose, Lower Monumental and Ice Harbor. When the Snake joins the Columbia River, there will be four more: McNary, John Day, The Dalles, and Bonneville. These dams were all built within the last 50 years and they have been terrific—for people.

Dams make electricity by holding back water and then running it through turbines. Falling water spins the turbines to generate electricity that is clean—no smoke, little pollution—cheap and abundant. Locks at the dams enable tugs and barges to navigate all the way to Lewiston, Idaho. Dams also hold back water to irrigate farms during the dry summer months and help prevent flooding downstream.

From Onco's point of view, however, dams are not at all terrific. The Columbia River becomes a series of flowing lakes instead of the continuous fast river she would prefer. Squawfish thrive in the slower water conditions and they eat smolts. So do walleye and bass.

Just as dangerous for Onco is the act of passing each dam itself. At Lower Granite, a fish screen catches Onco just in time and guides her away from the whirling blades of the turbines.

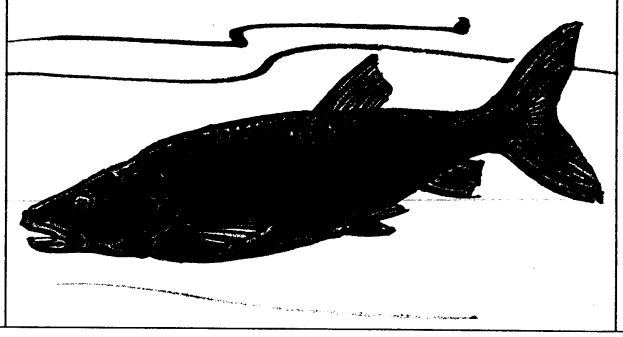
At another dam the water is high enough that it is spilling freely over the dam. Onco is stunned for a second by a fifty-foot drop into the churning pools below. But she regains her senses in time to avoid scavenger gulls that circle and squawk in the air above her, looking for an easy meal.

Onco's luck holds on this dangerous downstream trip. At each of the eight dams, about 10 to 15 percent of the smolts don't make it. But Onco does.

To help salmon along, more screens and better bypass systems are being installed at the dams. From April to June, when smolts need faster flows, extra water is released from reservoirs upstream. People who would otherwise want to save that water—to irrigate farms, float barges and generate power—have to adjust.

Everybody helps pay for salmon passage. When the electric utilities set aside water to help salmon, for example, it means there is less water for power when people need it the most. Electric rates go up.

Efforts to move young salmon safely past the dams are meant to strike a balance between the needs of people and the needs of salmon.



Some fish follow water that is spilling freely over the dam. Others are collected into barges for a free ride downriver.

Dams make electricity by holding back water and then running it through turbines. Screens catch fish and guide them away from the whirling turbine blades.

Squawfish thrive in the slow reservoir waters; they eat smolts.

To the Estuary

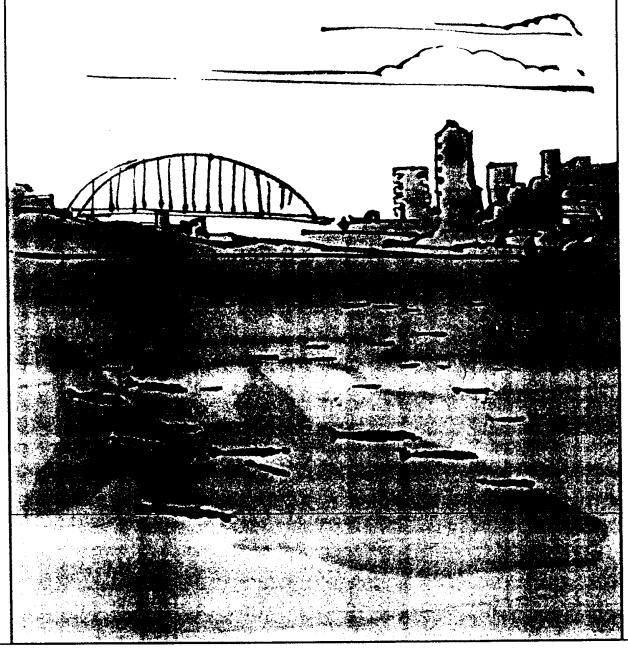
Onco makes it past Bonneville, the last dam in her path. From here to the ocean she has free passage. Along the way, she passes between Portland and Vancouver. These are not the first cities on her journey, but they are the biggest and produce the most pollution.

In cities, rainwater hits rooftops and pavement. Instead of soaking gradually into the ground, water shoots off these smooth surfaces and straight to the nearest storm drain. From there it goes into the river. Pollutants are carried with it: grit from rubber tires, the detergent used to wash a car, fertilizers from gardens and lawns. But these days, cities are more careful to clean up industrial waste and human sewage before pouring them into the river.

Downstream from Portland, more rivers join the Columbia. More smolts flow in from each of them.

Downstream from Portland, more rivers join the Columbia. More smolts flow in from each of them. The Columbia, riding high and brown on its springtime banks, is teeming with life.

Suddenly — What's this!?— Onco finds herself being carried the "wrong way" by the current. This is the river's estuary, where seawater mixes with fresh water. Twice a day the incoming tide pushes seawater back up the wide throat of the river.



Portland and Vancouver are not the first cities the smolts pass, but they are the largest and produce the most pollution.

The estuary is rich in food that is new to Onco. Algae, crab larvae, shrimp and small fishes thrive here. She stays here for a couple of weeks.

This is Onco's first experience with salt water. She learns to process the denser salt water for her water supply. She is still only about six inches long and has to avoid larger fish. There are pelicans and other fish-eating birds at the estuary.

In the slack water near Ilwaco, Onco joins a school of thousands of other silvery smolts near the surface of the water. They practice jumping, but not to catch food. It looks very much like play, with no other purpose than to celebrate being a healthy smolt.

Onco deserves to celebrate. She had to be lucky and a good survivor to get this far. From the 750 fry from her redd, only 200 smolts survive.

Out to Sea

After a shimmering blue day in June, something triggers an alarm in Onco's inner clock. It is time to begin the next stage of her life cycle. She rides the night tide across the Columbia River bar and swims into the ocean. Onco will not see this place again for another three years.

In the sea, there is new food to catch. At first Onco's diet is heavy with zooplankton—tiny animals suspended in the ocean water. Later she eats shrimp and other crustaceans. Her body absorbs the shrimp shells' pink color, changing her flesh from white to pink. As she grows, she begins to feed on anchovies, herring and other fish.

Predators lurk everywhere. Sea birds, tuna and even larger salmon feed on seawater smolts. As she grows into adulthood, Onco becomes vulnerable to one other group of predators: people.

In her first August at sea, Onco passes the Strait of Juan de Fuca off Puget Sound. She is the size of a pan-sized trout, about a pound and a half. Suddenly, she finds herself in the midst of a thick group of fish of all sizes, getting drawn together by a huge net. Above her, like a dark cloud, looms the broad shadow of a fishing boat.

Onco slithers among trapped bodies within the net. Just barely, she manages to slide through one of the square openings in the net. Saved only by her small size, she escapes.

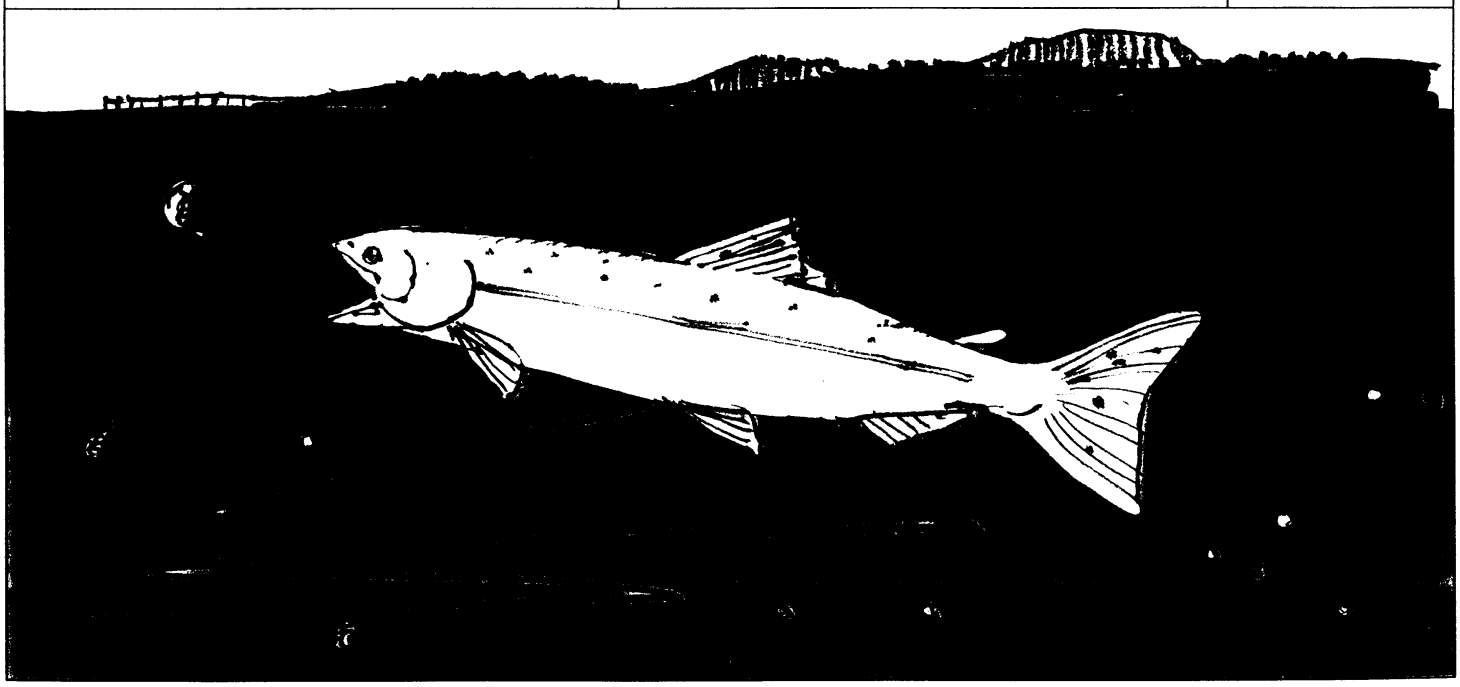
Yet fishermen will be a factor from now on. As she grows she becomes more valuable to commercial and sport fishermen. The well-placed net or the well-disguised hook can take her.

Salmon ride the night tide across the Columbia River bar and swim into the ocean. Predators lurk everywhere.

Fishing is not meant to be "bad." Humans have always taken fish. The earliest people in the Northwest left behind fish bone knives, fish bone combs and other evidence that salmon were an important part of their lives. As long as they did not take too many, Nature could keep the balance.

But the number of people in the Northwest has grown at a rapid rate over the last two hundred years. People found better and better ways to catch more and more fish. Huge fish wheels scooped up great numbers of fish running up the rivers. Larger boats took fishermen farther out to sea. Nets were made bigger and stronger. Over the years, the balance was tipped.

The growing salmon eat shrimp. Their bodies absorb the shrimp shells' color, changing their flesh from white to pink.



In 1941, the commercial fishing industry took over 23 million pounds of chinook. Today, they take about one-sixth of that amount.

In 1941, the commercial fishing industry took over 23 million pounds of chinook from Columbia River runs. Today, they take about one-sixth of that amount each year. It is not because fishermen are losing their touch, but because fewer fish are available. Many laws regulate how many of the remaining salmon can be harvested each year.

Everyone argues about the laws. Indians argue for their share of returning fish. Americans blame Canadians for taking too many Columbia River salmon. Canadians, in turn, say that Americans harvest too many of their salmon. Russians, Japanese and Americans haggle about who should fish where and for how many fish.

Sport fishermen complain about commercial fishermen, and vice versa. You would think everybody was being cheated.

Yet the basic idea is understood by all. There must be limits. If too few salmon get back to their spawning sites, everybody loses. So the laws set limits on how much can be harvested, in what seasons, where and by whom. It is complicated, and no doubt sometimes unfair. But Onco benefits from strict new fishing laws and international treaties that give her a fighting chance.

Onco, unaware of all this, forges steadily northward. She passes the north tip of Vancouver Island off the coast of British Columbia. A clever hunter and a voracious eater, she doubles her weight every three months in her first year in the ocean. By the time another August rolls around, she is a sassy 12-pounder roving off the coast of Sitka, Alaska.

Ocean Routes

One of the great mysteries in the cycle of salmon is how these fish know where to go when they get to the ocean. They couldn't have "remembered" their ocean migration route, because they have never been there.

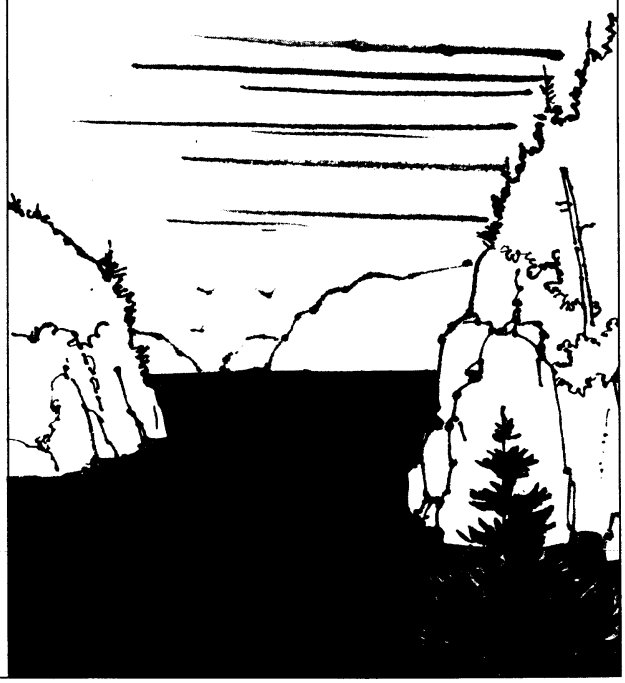
Scientists have learned some things about where they do go, by tagging the fish and by monitoring their ocean movement with electronic instruments. Yet very little is known about how salmon navigate. Onco may take day-to-day directions from the angle of the sunlight as it penetrates the seawater, or from water temperatures and ocean currents. The earth's magnetic fields might have something to do with it.

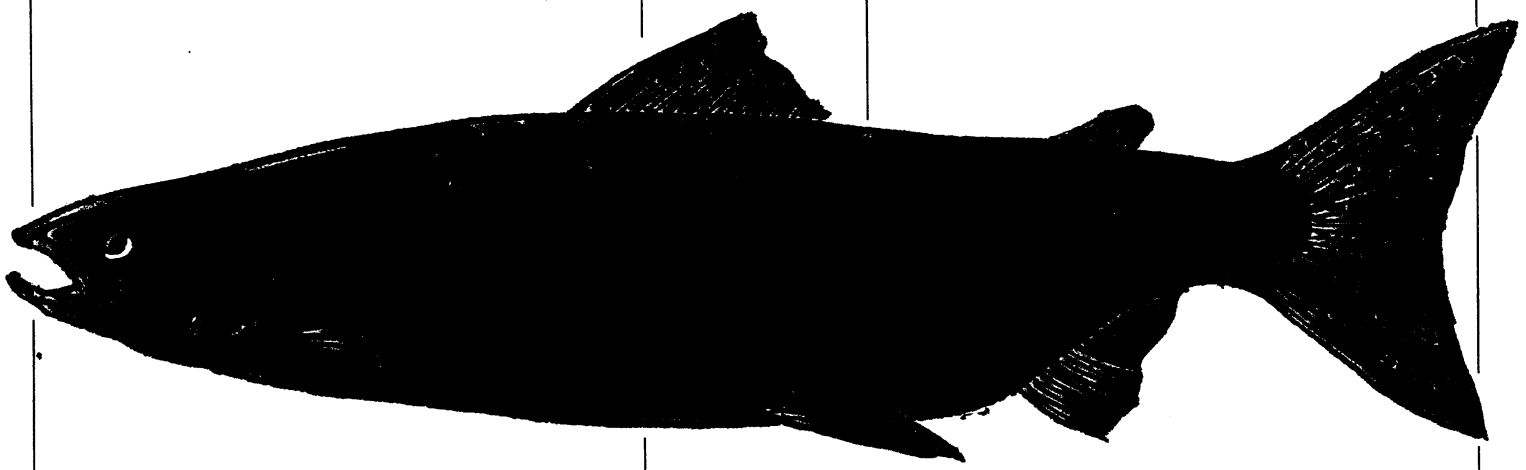
But the best guess seems to be that they have a basic instinct imprinted in their genes. They just know without ever having had to learn.

Different breeds of salmon follow different migration routes in the Pacific. Chinook are different from chum, sockeye or coho. Even among chinook, not all follow the same route as Onco. As far as scientists can tell, most chinook stay fairly close to shore. Some even take the Inland Passage, protected by green-wooded islands, up the coast of British Columbia and off the tail of Alaska.

That's where Onco goes, swimming up to 15 miles a day. After two years in the Pacific—during the third year of her life—she has passed Anchorage and the Kenai Peninsula.

As far as scientists can tell, most chinook stay fairly close to shore during their ocean journey. Some take the Inland Passage.





At 21 pounds, she measures two and a half feet long and has a blue-green back and silvery-white belly. The two-tone coloring helps conceal her from enemies. Seen from above, she blends with dark ocean waters; from below, she blends with lighter sky.

By now, she knows sea lions by sight and smell and avoids them. She has been chased by killer whales. Onco survives.

During her third year in the ocean, she turns around and heads back down the coast. Traveling in a counter clockwise loop, she stays farther out at sea than before, but not by much. Less than 200 miles separate her from land's edge. As if responding to mysterious natural music that only salmon can hear, Onco knows to return to the Columbia River. She swims faster now. She is still eating and gaining weight. The cold ocean current is going her way and she covers up to 30 miles a day for months on end.

Every salmon has its own time to return to fresh water. Not all kinds of salmon stay in the ocean three years. Sockeye and steelhead trout stay two or three years. Coho salmon seldom stay out that long. Even among chinook, the time spent at sea varies. Some chinook stay in the Pacific as much as five years before heading back home to spawn, but most stay out two or three years.

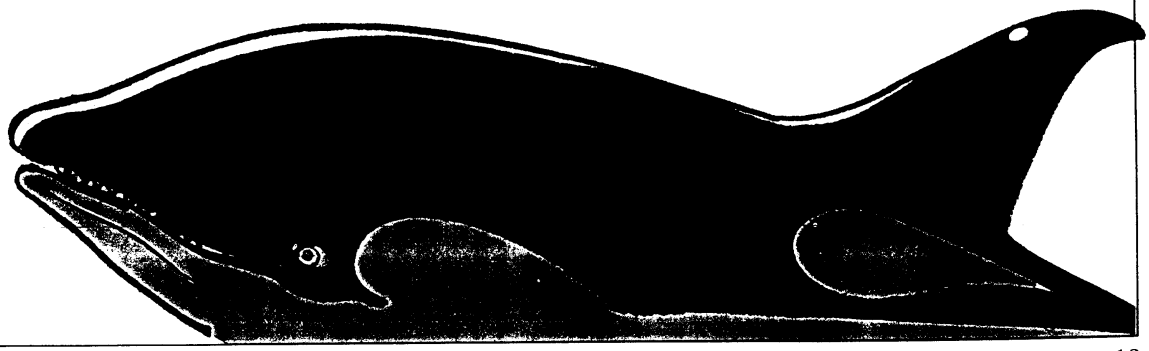
And not all chinook come in at the same time of year. There are spring, summer and fall chinook. These are different runs of chinook. Each is named according to the season they return from the sea.

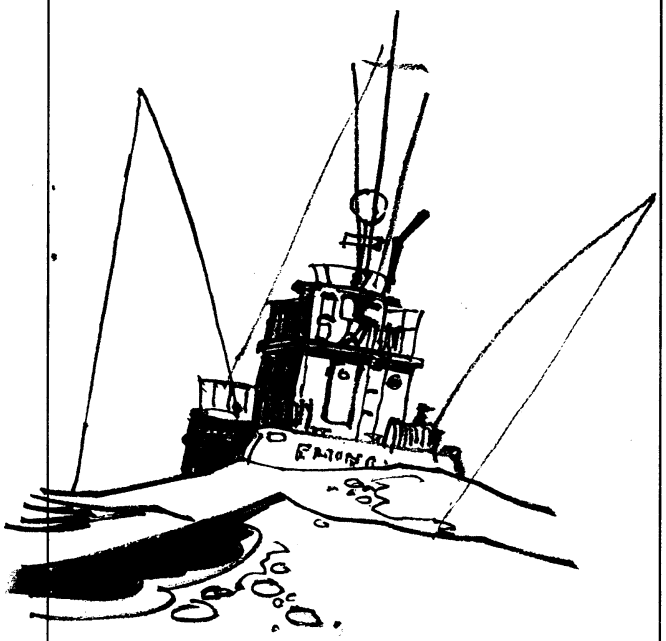
Onco is a spring chinook. Just before Easter in her third year at sea, she enters the mouth of the Columbia.

Firm, plump, pink-meated, she's at the prime of her life. She weighs 28 pounds and is just a little less than three feet long. Onco is not the biggest fish here, but she is large.

She carries scars from her adventures at sea. Behind the large fin on her back are tooth marks from a sea lion that just missed. A row of sea lice clings to her body, like tiny barnacles to the hull of a ship. Still, she is strong and healthy.

Two-tone coloring helps conceal the salmon from enemies. Seen from above, they blend with dark ocean waters; from below, they blend with lighter sky.





Of the 200 smolts from Onco's redd that made it out to sea, only nine managed to avoid all the ocean perils and came back to the Columbia.

That's not bad, considering the odds. In fact, it's better than average in recent years for adult fish returning. But not all of these fish will return to spawn.

Luckily, Onco misses a short gill-netting season by one day. But she has not yet escaped the hooks of other fishermen.

Sportsmen patrol these waters waiting for the salmon. Their boats crowd together over "hot spots" where the fish are biting and where the law allows fishing. Onco would be a prize catch.

Onco snaps at an apparently disabled anchovy. Sure enough, the anchovy has double hooks in it. A line is attached!

Onco's first reaction is to dive deep and to swim away from the pressure on the line. That sets the hook deeper into the flesh of her mouth. At least she did not swallow it. Only one of the two hooks got her.

When her deep dive doesn't work, Onco rises toward the surface. She slashes and twists, sometimes breaking the surface of the water, to rid herself of the hook. Whenever she rests, she gets reeled in closer to the boat. She dives again, rises again, trying to get loose. In fact, the hook is working loose. If only she can muster enough strength to keep this fight going.

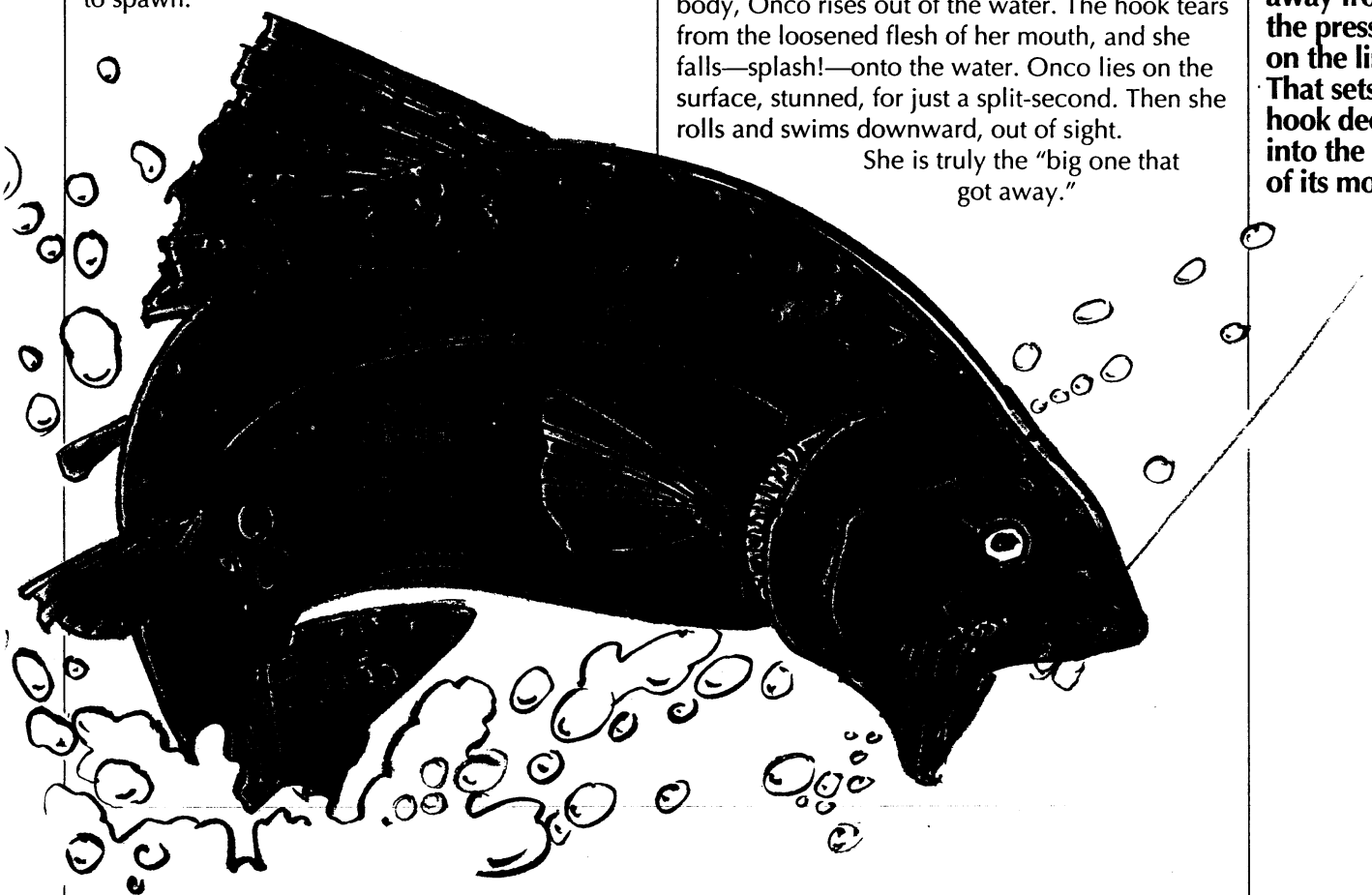
After 20 minutes, Onco is exhausted. She's very close to the boat, now. She sees a large silver hoop-on-a-handle, with green nylon netting, pointed her way.

With one ferocious leap and twist of her body, Onco rises out of the water. The hook tears from the loosened flesh of her mouth, and she falls—splash!—onto the water. Onco lies on the surface, stunned, for just a split-second. Then she rolls and swims downward, out of sight.

She is truly the "big one that got away."

Sportsmen patrol the lower Columbia River. Their boats crowd over "hot spots" where the fish are biting and where the law allows fishing.

The salmon's first reaction is to dive deep and swim away from the pressure on the line. That sets the hook deeper into the flesh of its mouth.



Race to the Redd

Fish climb up Bonneville fish ladder's broad, flat, smooth-flowing water stairs.

The female chinook starts on a race upriver. She has one purpose—to get back home and spawn. Eggs are growing inside of her.

Over 123,000 spring chinook swam past the Bonneville fish counter's window this year. Spring chinook are running stronger up the Columbia in the 1980s than they did in the 1970s.

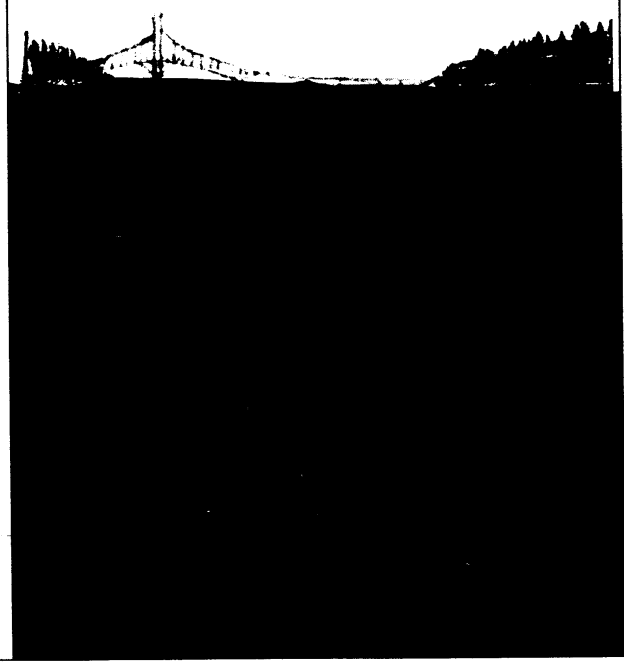
Onco wastes no more time in the lower Columbia. With the first good rain the river rises. Its smell and color change and the magnificent final push of Onco's journey begins.

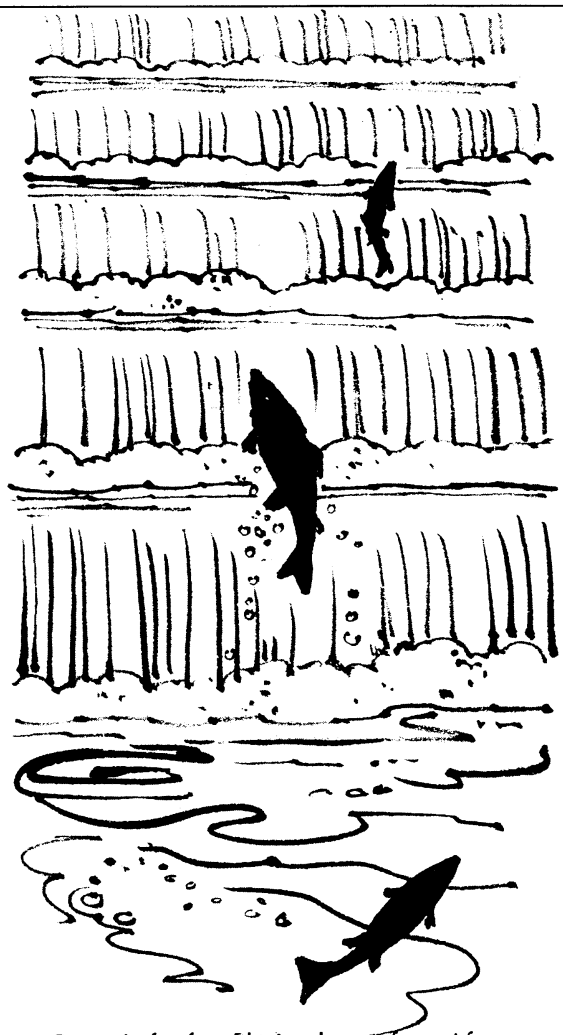
Onco starts on a race upriver. Bucking strong current, she is like a fish with blinders on. She has one purpose—to get back home and spawn. Eggs are growing inside of her.

She does not eat along the way. She might snap as if in anger at a fisherman's bright lure, but she is no longer interested in food. She has stored up enough energy to make it all the way back to Idaho. Now is the time to spend that energy.

On April 20, she finds the entrance to the fish ladder at Bonneville Dam. She climbs up the broad, flat, smooth-flowing water stairs. Alongside a window below water level, she passes a woman whose job is to count fish as they pass. Onco is spring chinook number 28,669 this year. The spring chinook total will reach about double that number before the end of May.

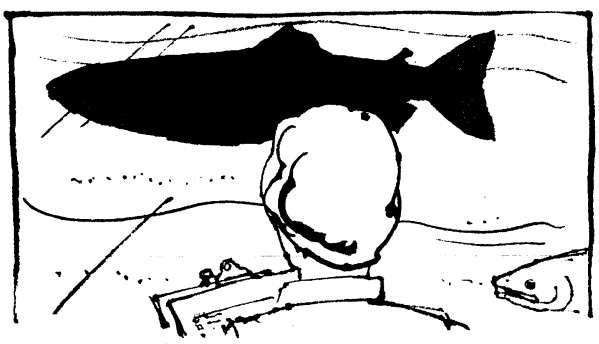
The numbers sound good. In fact they are better in the late 1980s and early 1990s than 20 years ago. But most of these adults are hatchery fish. The total numbers mask the fact that wild runs like Onco's are still in serious trouble. For all the tougher fishing laws, habitat improvement and special water releases, the wild salmon still need help.





Onco is far from being home free. After Bonneville, she enters the reservoir behind the dam. The lake-like conditions confuse her, but she finds another fish ladder at the The Dalles Dam.

Although the flow of the river is different than it was before dams, it is not necessarily harder work for salmon. After all, before dams there were cascades and rapids in the Columbia. At one time, one of the biggest problems with dams was that water spilling over the top took on too much nitrogen. A fish absorbing too much nitrogen is like a diver getting the "bends." Nitrogen in the bloodstream can kill. But for the most part, fish biologists and engineers have solved this problem.



An Idaho chinook travels some 900 miles downstream to the ocean, over 4,000 miles at sea, and another 900 miles to battle its way back to the stream of its birth.

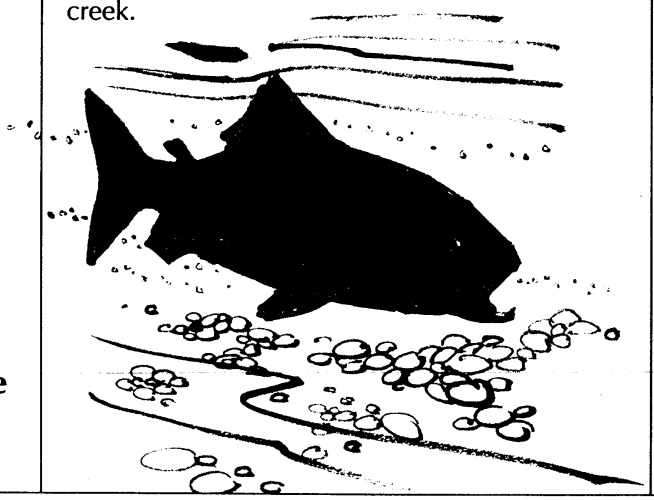
Along the way there is some fishing, but it is severely restricted. Mostly it is Indian people taking fish for food or ceremonial rites.

As Onco fights her way upriver, she uses up her energy reserves. She becomes haggard and skinnier.

At every fork in the river, she knows which stream to take. Guided by her homing instincts, Onco says no to the Deschutes River, no to the John Day, no to the Umatilla. Then comes the Snake River. The Snake River "smells" right to her. She leaves the Columbia to follow the Snake.

One hundred fifty miles later, she comes to the mouth of the Salmon River. She waits a couple of days for rain to make the river right. Her stomach is empty. She has not eaten for a month. It's June now, and she is little more than a cargo vessel for a load of ripening eggs.

She swims up the Middle Fork of the Salmon River. A week later she heads into the tiny no-name creek in which her life began. Onco has traveled roughly 900 miles downstream to the ocean, over 4,000 miles at sea, and another 900 miles to battle her way back to this shallow creek.



Of the nine redd-mates that made it back into the Columbia, five are left.

Now she has to leap one last four-foot shelf—not quite a waterfall, but a steep little rapid—in the creek.

It hardly seems possible that a fish in Onco's gaunt condition could leap over a distance nearly twice her body length. But she does, just as she has conquered all the the other hurdles on her heroic journey to and from the sea.

Of Onco's nine redd-mates that made it back into the Columbia, two ran head-on into a gill net and couldn't back out. One other was caught on a fisherman's hook. Another became disoriented at a dam. Instead of climbing the fish ladder, she died of exhaustion trying to find a way through the concrete.

Five are left. These five salmon are not just the luckiest, but also among the fittest. Only the genes from good strong fish will be passed to the next generation.

Spawning

The river runs low and clear this July, and Onco returns in good time to the place she began life. She idles, waits. She is ripening.

In late August, male and female salmon pair off to spawn. Since there are three males and only two females here, there is rivalry in the shallow riffles of the creek. The males jockey for position, trying to run each other off.

There is also a much smaller male called a jack. The jack returned after only one year in the ocean. In spite of his size, he is fully capable of spawning, in case full-sized males don't make it back to fertilize the eggs.

The bigger males are dark and blotchy and have hooked snouts. They consider the jack a nuisance. When he drifts into their range, they lunge and nip at him. They send him scampering upstream over and over again until he seems to get the idea that he is not wanted here.

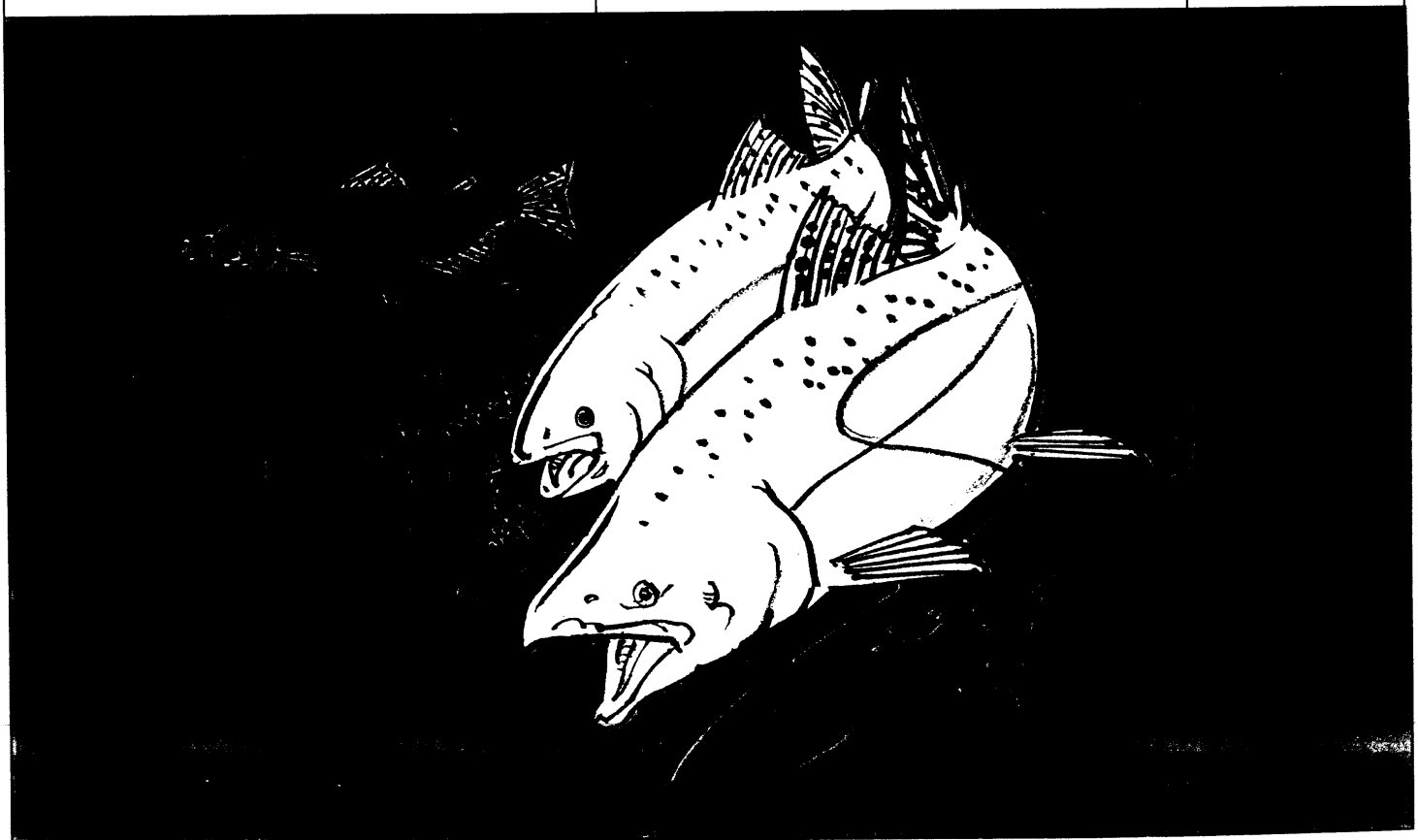
Onco ignores this contest. She has her own job. She builds the redd.

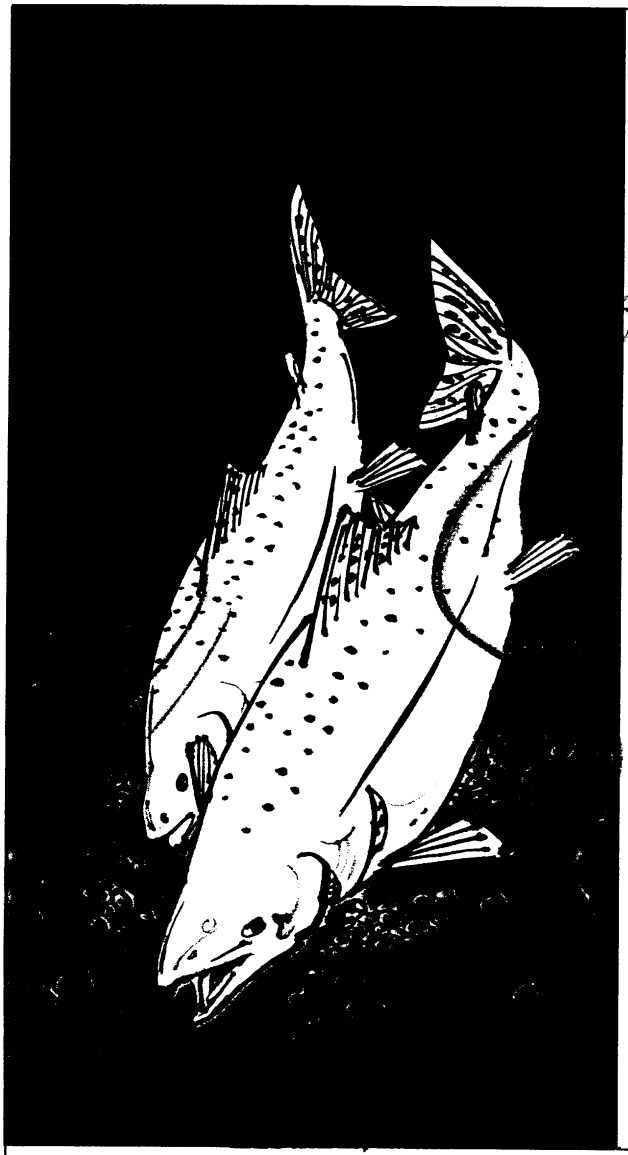
She chooses a ripply spot where the stream bed gravel is clean and fine. With her broad tail she begins sweeping gravel aside. She scoops out a kind of trough, in the general shape of her body and twice as long. She tests it by settling into the depression. Then she moves upstream and swishes more gravel around until it feels just right. The redd has a downstream ridge where she can rest.

The female builds a redd. She chooses a ripply spot where the stream bed gravel is clean and fine.

Meanwhile, two of the males, having driven off the others, begin a courtship dance around Onco and the other female. They circle slowly. They approach and move away again. This goes on for hours around the purplish-brown form of Onco, who idles in her redd.

The big males are dark and blotchy and have hooked snouts. There is also a smaller male called a jack. In spite of his size, he is fully capable of spawning.





These salmon are not just the luckiest, but also among the fittest. Only genes from good strong fish will be passed to the next generation.

With one last effort, the female struggles out of the redd. Just upstream, she swishes her tail in the water. Fine gravel now covers and protects her eggs.

Finally, a male swims in beside Onco, just upstream from her. His body presses hers against the ridge of the redd. Both adult fish seem to shudder at this moment which ushers in both life and death.

Onco trembles. Her body deflates. The pink eggs come out and drift down into the redd. Almost immediately, a white cloud of sperm, or milt, issues from the underside of the male. Milt spreads to cover Onco and the eggs. The eggs have been fertilized, and the whole cycle will begin again.

Leaves on the surrounding trees are turning yellow. It is the same time of year that this story began. Onco is five years old.

Onco, with one last tired effort, struggles out of the redd. Just upstream, she swishes her tail in the water. The action of the water lifts small pieces of gravel up and into the redd. Fine gravel now covers and protects the eggs.

Then Onco dies. The current she has fought all the way has become her master. Reduced to just skin and bone, she is so dry that her flesh falls apart in the beak of a crow. Her body, decomposing, drifts downstream. It provides nourishment to the smaller life forms that Onco once fed upon as a fry.

And so Nature's circle closes in on itself. With death comes life. The magnificent journey of Onco the Lucky is complete.

For More Information

For more copies of this brochure or more information on BPA's fish and wildlife effort, contact your nearest BPA District office, BPA's Environment, Fish and Wildlife office, or the BPA Public Involvement and Information office. BPA maintains a mailing list of people who want to keep abreast of the agency's fish and wildlife activities. If you want to be on that list, contact BPA's Environment, Fish and Wildlife office at the number listed below.

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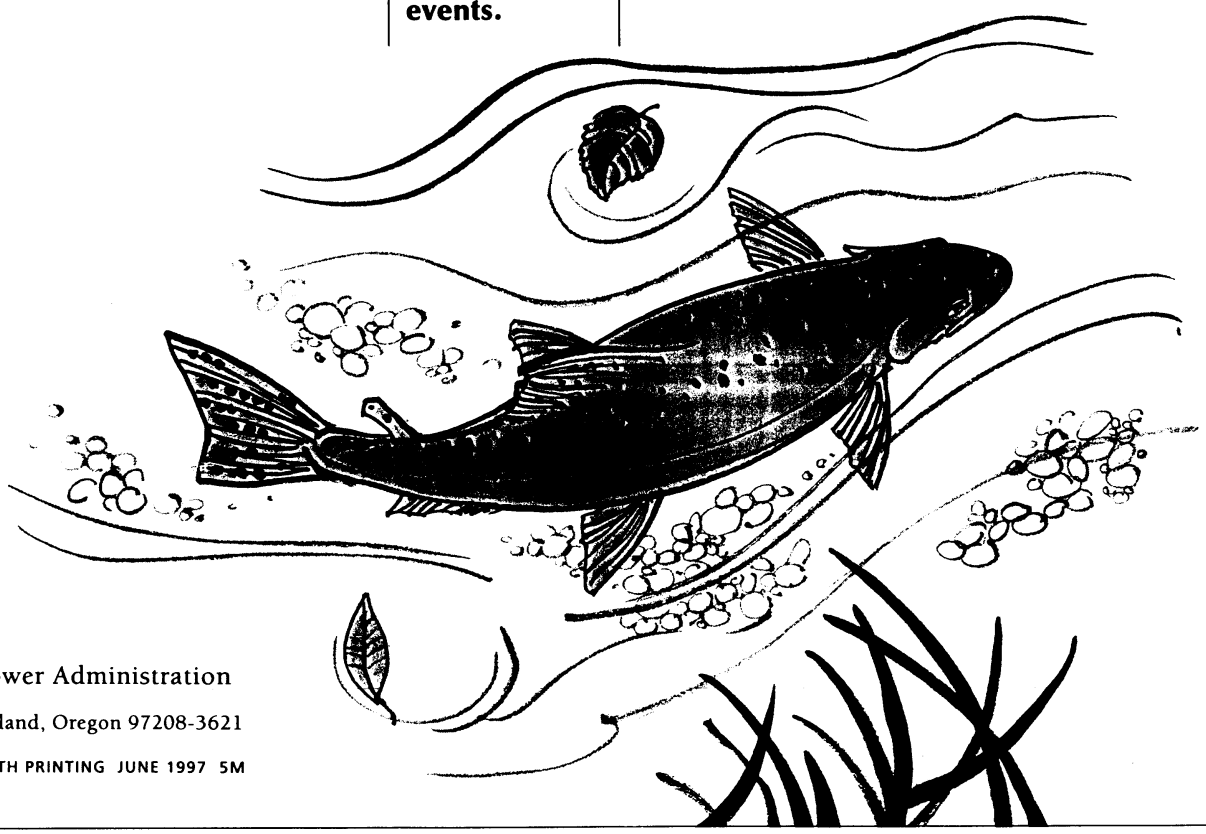
(206) 216-4272

Spokane, Washington
(509) 353-2515

Boise, Idaho
(208) 334-9137

Washington, D.C.
(202) 586-5640

The annual run of Northwest salmon — from the vast Pacific Ocean to the mountain streams where their lives began — is one of Nature's most awe-inspiring events.



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