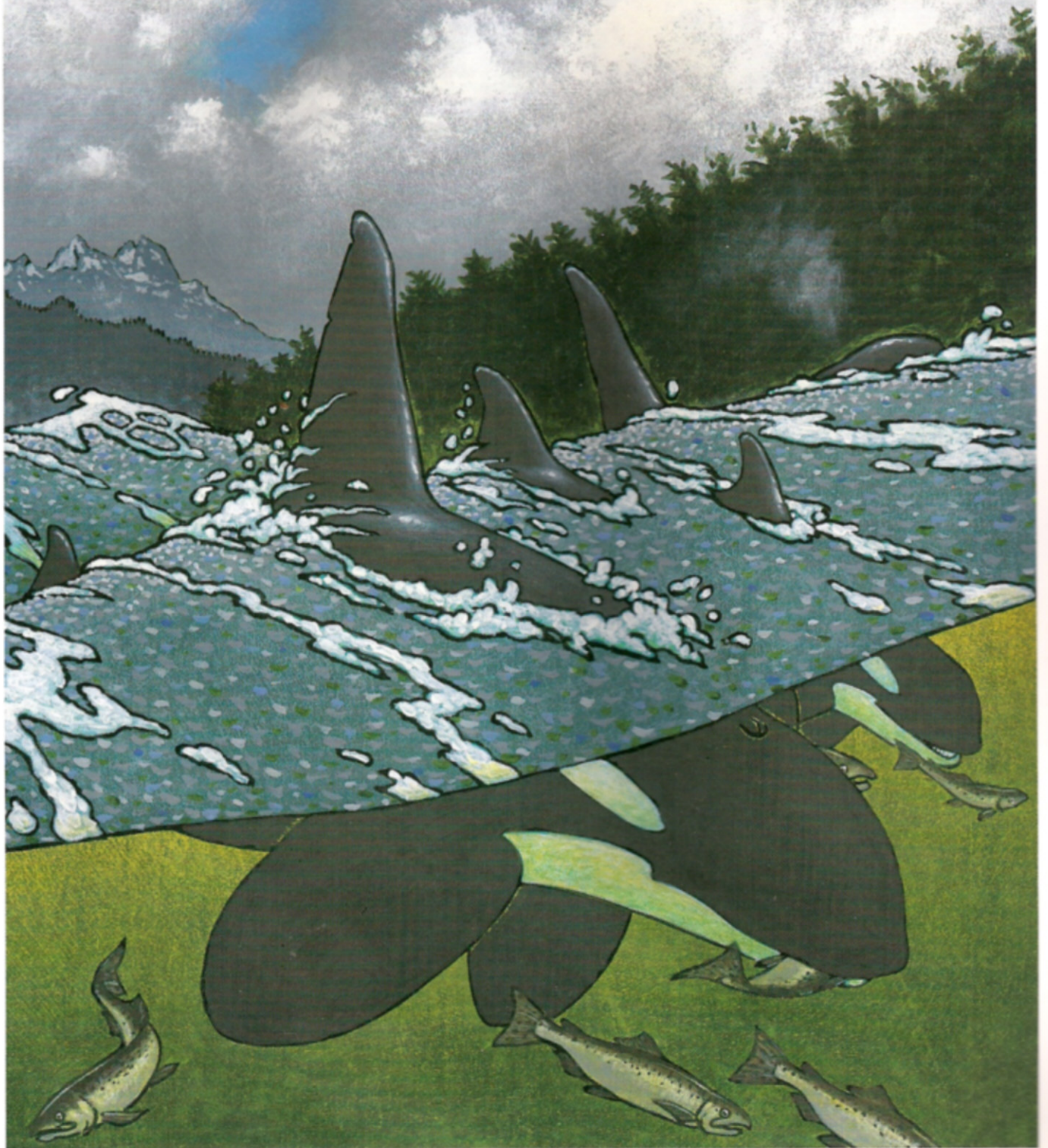
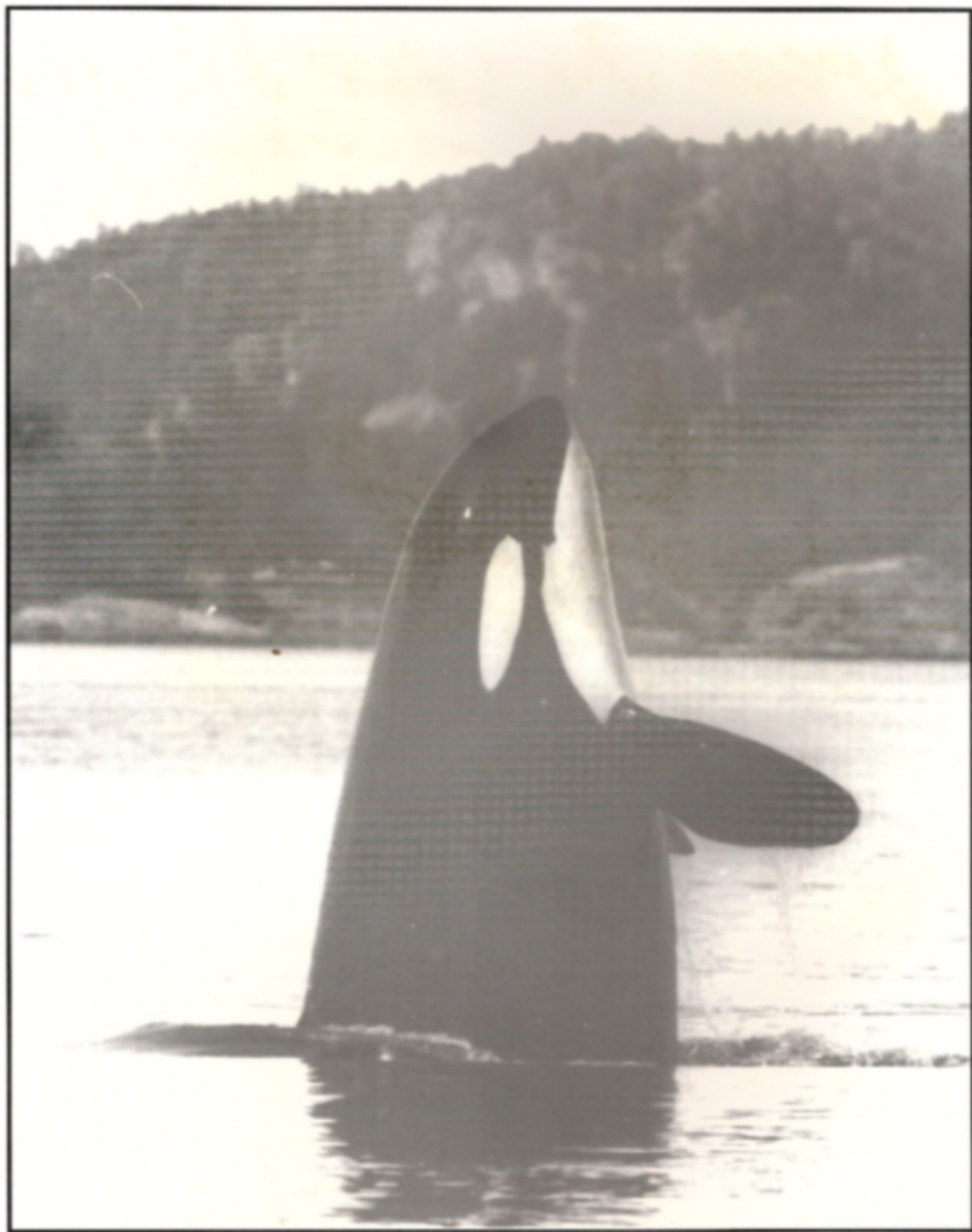


Orcas In Our Midst

The Whales That Share Our Inland Waters

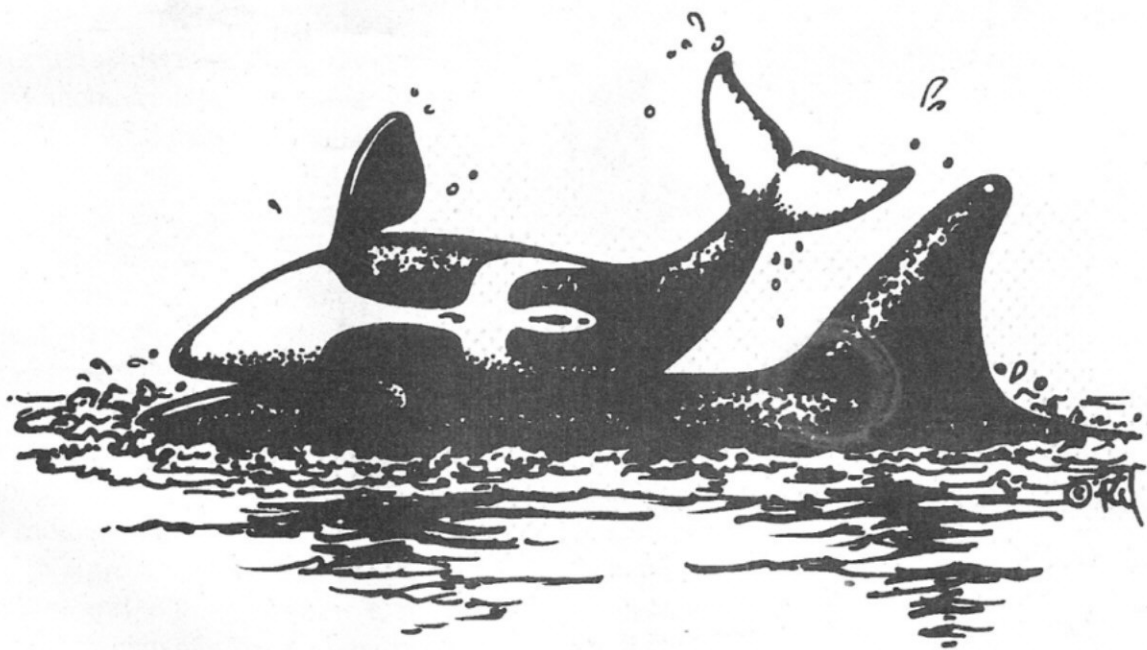




An unidentified female orca lifts her body half way out of the water, possibly to get a good look at the photographer.

Orcas In Our Midst

The Whales That Share Our Inland Waters



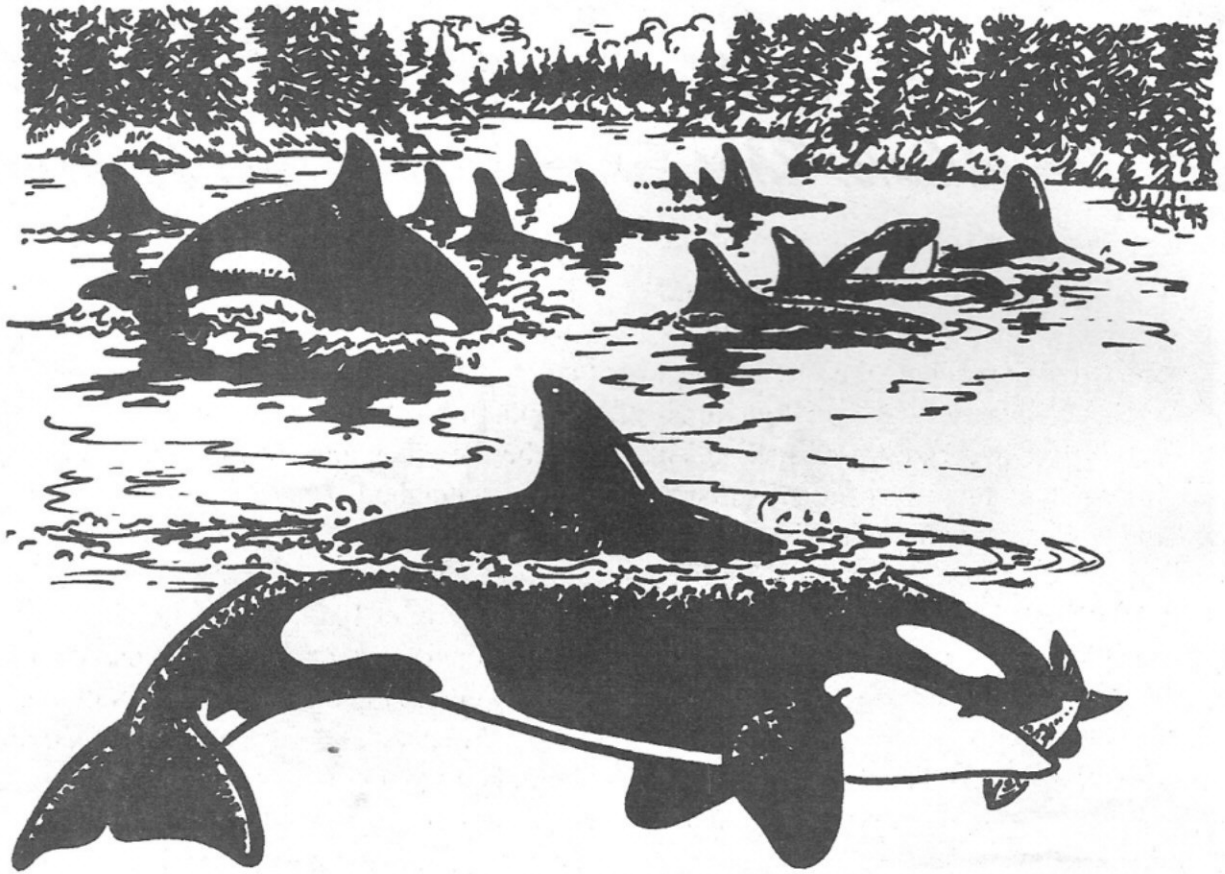
Prepared for readers of all ages who share an interest in the orcas that inhabit the inland waters we live by – to celebrate the whales' presence here, and to help our orca neighbors live healthy lives in their chosen home.



*By Howard Garrett
Illustrations by Kelley Balcomb-Bartok*

*Produced by
Center for Whale Research
Friday Harbor, WA*

*With a grant from
The Bullitt Foundation
Seattle, WA*



The tip of the black dorsal fin first slices up through the ripples to about a foot above the surface. It travels straight ahead like a submarine's periscope for twenty feet until the mighty downstroke of the flukes lifts the almost six feet of dripping wavy fin into the air. The huge torpedo-shaped head and blowhole then push out just far enough for a rapid blast and quick breath of air to refill the orca's lungs before it arcs back down beneath the surface.

It's J6, a male about 40 years old, rising to breathe beside his family. His mother's sister plows up next to him to heave an

explosive blow, followed by three more generations of J pod orcas, all closely related, inseparable their entire lives.

Wispy clouds of vapor linger twenty feet over their heads as they pass under the lighthouse at Whale Watch Park. One of them twists in tight circles pursuing a large salmon, then they all dive down into the kelp to rub the long soft strands along their backs and into the notches of their tails, and see if any salmon are hiding in the shadows. Above them the stark snowcapped Olympics stand watch over this vast inland sea, wearing purple hues in the early morning sun.

This habitat we call home

We live in an amazing paradise. Our homes and highways and cities cling to the shores of an immense fountain of life that extends from south of Olympia, Washington to far north of Vancouver, B.C., from the peaks of the northern Cascades and Canada's Coast Range to the misty Olympics and across the water to the gentle slopes of Vancouver Island's Insular Mountains. Beneath the forested mountainsides lies a vast inland sea, actually a huge estuary, swirling with organic mountain runoff and surging seawater from the mother Pacific. Snow and rain and cool temperatures keep the forests moist. Gentle streams and brawny rivers ripple to the sea. At the margins between mountain and sea are rocky cliffs and sandy bluffs hundreds of feet high, along with broad tidal mud flats and beaches of sand and gravel.

Nature flourishes here. Appearing occasionally at the water's reflective surface, a clan of almost a hundred orcas – killer whales – travel the length and breadth of the inland waters, slowing occasionally to rest, play or forage for salmon. Bear and deer and cougars, owls and eagles and thousands of other forest creatures walk, scurry, crawl and fly under and over the forest cover. Crabs and squid and uncounted thousands of sea creatures make their living here. Seals and sea lions snatch fish from the depths, then haul out onto rocky reefs.

Salmon are woven through it all, streaming in by the millions



from the open Pacific to struggle up rivers and into the same small streams they emerged from years earlier. Having completed the cycle of their lives, they will die within a few days, nourishing mountain dwellers with their bodies, feeding eagles and bears, and fertilizing trees and grasses. Their decaying bodies even feed the insects that will nourish their own young salmon fry in the months to come. The salmon are of vital importance, not only for the health of the the orcas, but for the vitality of the entire watershed.

This vast watershed we live by was carved by massive glaciers grinding southward over 10,000 years ago. This lush bioregion is one of the last expanses of mostly undisturbed and bountiful Nature in North America. It is our home. We depend on it. But we don't have a name for it.

This living, breathing, swimming, spawning, flowing basin is made up of four mountain ranges and four inland seas that all have names. There is Puget Sound, and Georgia Strait, and the Strait of Juan de Fuca, and the Northwest Straits, as the waters around the San Juan Islands are called. And there are names for all four mountain ranges that surround this enormous, teeming estuary. But no single name calls to mind all those noble peaks, ridges and valleys, and includes the living and life-giving inland sea between their shores.

It's really all one system of interacting habitats and life forms – one unique ecosystem. We need a name

for it that includes in its meaning the physical geography – the immense watershed and inland seas, the rocky peaks and grinding glaciers, the tumbling clouds and wind and wafting rain – and all the living things as well, like the delicate mushrooms and insects, the towering trees and even invisible microbes that grow in the forest soil. Soaring eagles and diving loons, as well as shellfish, herring and sandlance, porpoise and minke whales all find food and security in its sheltered seawater. Especially important are the phytoplankton that soak up solar energy and carbon dioxide in the top hundred or so feet of seawater and ultimately feed virtually every living thing in the sea. The list of plant and animal species could go on for many volumes.

This vast ecosystem's name should include the Fraser River and its tributaries that together drain most of southern British Columbia into the inland sea, as well all

Glowing whales – told by Kelley Balcomb-Bartok

Three of us out in a little boat, the sun setting, we find whales. Water is calm. The pod is spread out. J6 finds us, and turns toward home, very slowly. Soon it's dark. We can only hear them blow, and see strobe-like glimpses of blows and dorsals in the sweep of the lighthouse beacon. A little calf comes by in pitch blackness. *The contours of the head and fins are illuminated with turquoise bioluminescence, streaming behind with every graceful wave of a fin.* We all drop to our knees, mumbling, fumbling, awestruck.

One of the adult males comes by in a long glide, arcing up toward us. A slight dip in his pectoral fins gives off a burst of effervescent radiance that trails behind for 10 or 20 feet in curlicues. A family of three flows by, their rostrums, dorsal fins and pectorals aglow with slight turbulence as they effortlessly sail into the depths.

The realization swept over us that the whales live in this luminous glow each and every night of their lives.

the other rivers and streams that pour into the muddy deltas, bays and straits. When we hear the name we should picture the whole mountainous, island-studded, ocean-filled basin.

According to archeological evidence, around four thousand years ago many tribes migrated from the interior valleys to the shores of this newly-thawed estuary. They spoke variations of a root language known as Salish (pronounced SAY-lish), which was spoken across much of western North America. Since their languages are related, these indigenous tribes are defined linguistically as the “Coast Salish.” They became part of the flow and cycles of nature over the years.

Recently the name “Salish Sea,” based on the Coast Salish-speaking peoples, has been coined to describe the overall inland sea, from southern Puget Sound to northern Georgia





A herring "baitball" attracts birds, mammals, and more fish.

Strait. "Salish Sea" fits for the inland sea itself, but we need a name that includes the Salish Sea and also reaches upstream to the entire wooded, dripping watershed, from mountain peak to flooded fjord. The term for a place where snow and rain falls on mountains and flows into rivers and lakes, or into an estuary like ours, is 'watershed,' so watershed should be part of the name.

A good way to refer to this place of wildness and natural beauty, therefore, is the "Salish Watershed."

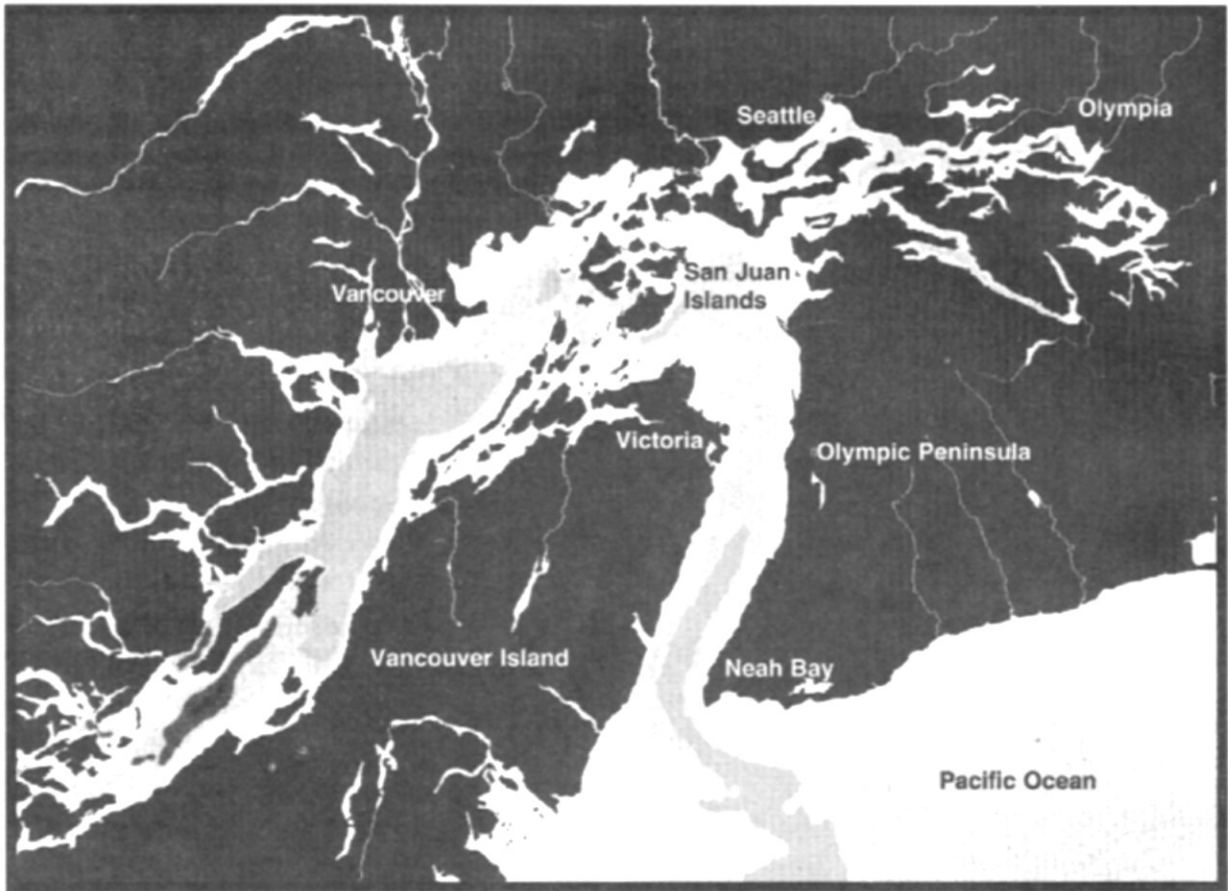
The Orcas of Salish Watershed

Long before the ice ages began over two million years ago, there were orcas swimming throughout the world's oceans. Over fifty million years ago their ancient ancestors were four-footed land mammals that were among the first of the large mammals to appear after the dinosaurs disappeared 65 million years ago.

One branch of these early mammals looked a little like a cross between a wolf and a hippopotamus. They spent much of their time wading and swimming in marshy swamps, and gradually their bodies adapted to a sea-going life. Over the next few million years they became streamlined. Their forelegs became flippers, their hind legs disappeared, and their nostrils moved up to the tops of their heads.

These early whales, called "cetaceans" (se-TAY-shuns) in scientific literature, rapidly branched into many different species. Some grew long fringed baleen plates in place of teeth, while some kept rows of teeth for snatching and ripping their prey. By 15 million years ago there were dozens of species of cetaceans inhabiting every possible niche in the world's oceans.

If there had been whale watchers ten million years ago, they would have seen whales that look much like the ones we see



The Salish Watershed

As viewed from the orcas' point of view, entering from the Pacific Ocean.

today. Then, as now, most were toothed whales, and more than half of those were dolphin species, including orcas, actually the largest of the dolphins. Today orcas are found in all the world's oceans, whether shallow or deep, cold or warm, though they prefer cooler waters along continental shelves where fish and other prey tend to be more plentiful.

All of the toothed whales, from five-foot long harbor porpoises to sixty-foot sperm whales, make high-pitched, rapid-fire clicks to "see" with sound. By aiming the clicks in certain directions and changing the frequency and volume they are able to

read the echoes from rocks or fish. In that way they continually get a "sound picture" of any objects around them. This ability is called "echolocation".

Most species of whales and dolphins show curiosity toward people and objects, and rarely display any signs of aggression or agitation. They are thought to be thinking, reasoning, intelligent animals. Orcas in particular appear to be very conscious of themselves and their surroundings. Captive orcas, for instance, show intense interest in photos and drawings depicting orcas, but ignore images of other animals.

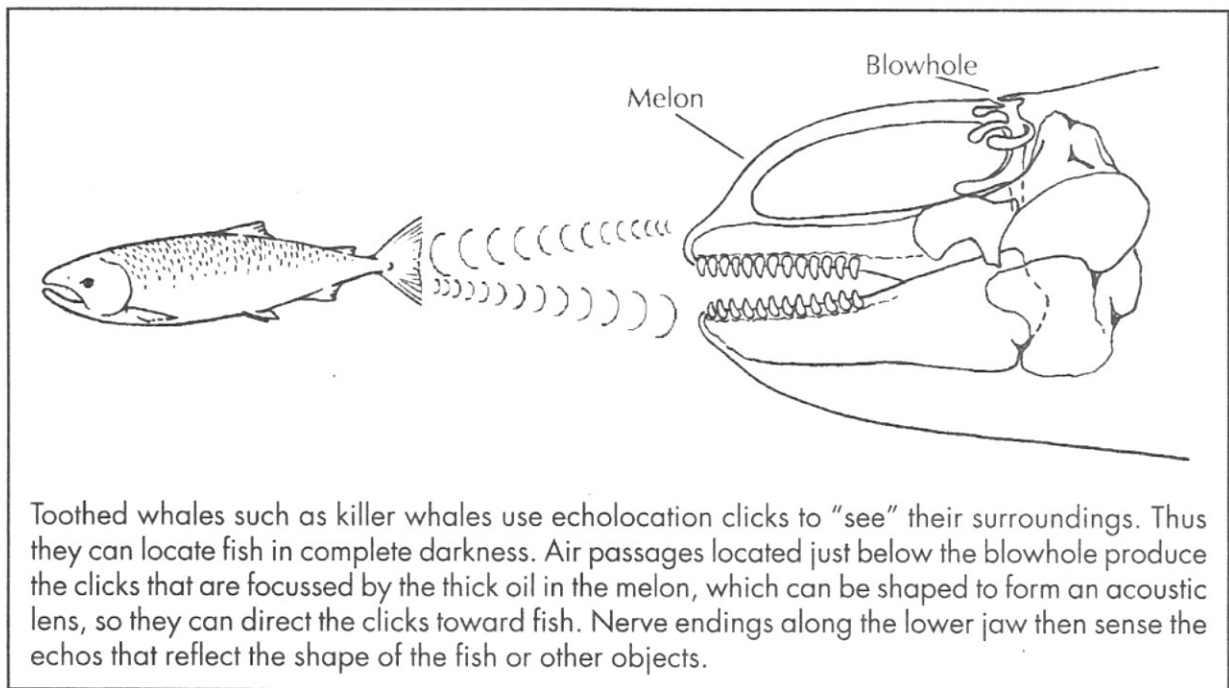
Each time a whale breathes, the blow is carefully timed to coincide with their motion toward the water's surface. In fact they must remain awake and alert in order to breathe, which raises the interesting question: Can whales sleep? We don't know the answer.

In female orcas, ovulation cycles are unpredictable and thus also appear to be under conscious control. With their ability to look inside each other's bodies using echolocation, they may be very aware of any health problems, pregnancies and even mental states at all times. With such intimate knowledge always available, it is doubtful that they can deceive or conceal much from each other.

As soon as the glacial grip on the inland waters was released about 8,000 years ago, an extended family or community of orcas probably split off from a larger offshore community and investigated the freshly thawed Salish Sea.

The reason a community of orcas would move into the Salish Watershed is not hard to understand. It's about salmon. Although they will also eat other species of fish as well as squid, if the resident orcas have a sense of what is important to them (and they probably do) they must consider salmon the central and most essential part of their world, after their pod and family members.

For thousands of years huge numbers of salmon pouring into the Salish Sea's enclosed waters and collecting near the mouths of rivers before heading upstream have provided a plentiful and predictable feast of high-energy food for orcas. The whales live about as long as humans, and for hundreds of orca generations the Southern Residents, as this community is known, have thrived on salmon in the waters of the Salish Sea. Their continuing presence here depends on a steady and abundant supply of salmon.



Fish that hatch in freshwater rivers and lakes, migrate to the sea, then return upstream to spawn are called "anadromous." There are six species and hundreds of stocks of anadromous salmon along the west coast of North America. Almost every river, lake and stream has, or once had, at least one salmon population that evolved to suit the temperatures, currents and other conditions there.

When salmon begin to feel the need to spawn toward the end of the cycle of their life, they find their way, with legendary determination, to the streambeds in which they hatched. The males fight for access to nest-building females, then court them by quivering and repeatedly crossing over their backs.

When the nest is ready, the winning male moves alongside the female and together, visibly trembling, they release eggs and milt. The female spreads from a few hundred to thousands of sticky pink-orange eggs into the nest. She then digs a

new nest a few feet upstream, which moves light gravel onto the eggs already laid. She will defend her nest until she is too weak to do so.

Back when the Salish Sea's glaciers melted and streams began to thaw and gurgle with runoff, they filled with gravel ground up by glacial action. Vegetation sprang up along the streams, providing shade and filling the streams with microscopic



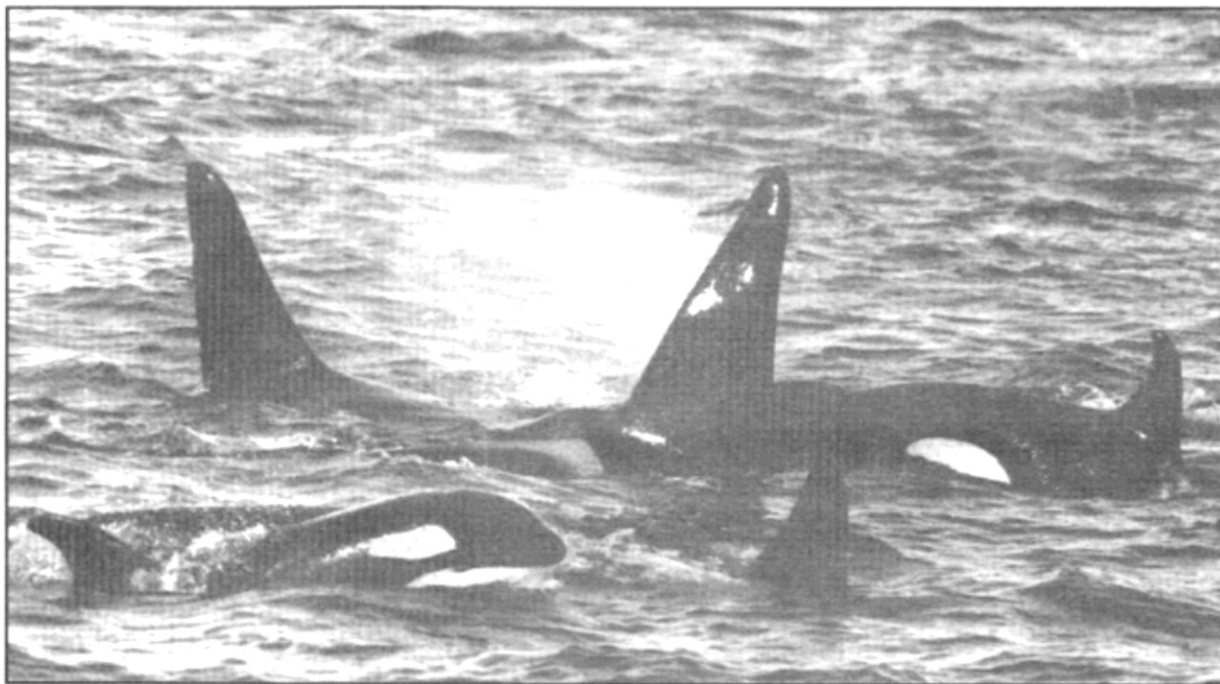
Patricia G. Hume

nutrients just right for young fish. The result throughout the watershed were streams that were perfect for spawning salmon. The streams were soon discovered and colonized by the approximately 5% of salmon populations that defy legend by exploring new streams each year.

Such massive processions of big, juicy fish certainly must have been noticed by Pacific orcas. The whales soon moved in and made these inland seas their home for much of every year. Over the millennia they forged stable cultures of tightly-bonded extended families and communities.

J14 introduces her baby – told by Howard Garrett

On December 31, 1994, orcas were seen near Vashon Island. An orange-tinted newborn was among them. Researchers found J pod as they swam north along San Juan Island on January 2, 1995. The 21-year-old female J14 was with her newborn calf, called J30 at first sighting. The calf looked healthy and frisky. Within a few minutes the mother and calf, who were a few hundred yards ahead of the research boat, turned completely around and swam to within a few feet of the idled boat, circled around the boat, and then mother and calf continued on their way. J14 may have been showing her new calf the things he or she would need to know about, including the boat she knew so well.



Members of J pod in 1976. J3, the male in the center of this photo, was in his early to mid twenties in 1976. He died in May, 1995. J1, just behind J3, is still alive at about age 44. J16, in the lead, was 4 years old then. She is now the mother of four year old J26.

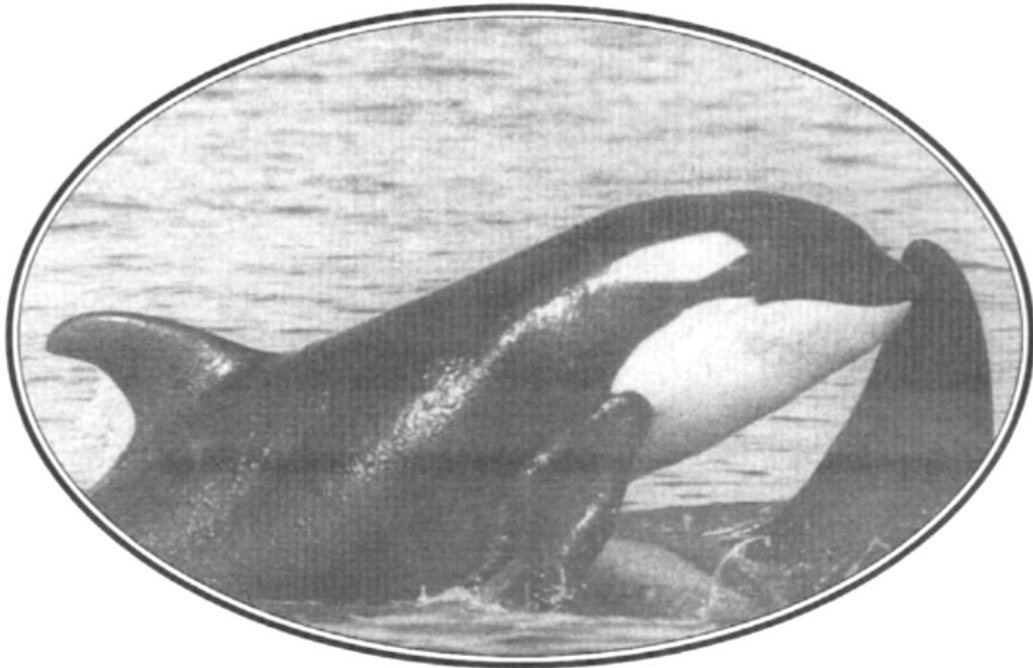
The Study of Orcas

Studying whales is like investigating an elephant through a keyhole. Whales swim and live in oceanic expanses that we can barely see into, even with all our diving technology and sensing devices. Orcas are at the surface only about five percent of their lives, and they move constantly, day and night, covering fifty to a hundred miles in any given 24-hour period.

Until recently science knew very little about orcas. Was there just one big population across the entire Pacific Ocean? Do they live to the age of twenty? forty? a hundred and forty? Will they viciously kill and eat any living thing they may find, including humans? No one knew the answers to these or almost any other questions about wild orcas.

The study of free-ranging orcas began in 1971 when Dr. Mike Bigg, a Canadian biologist, was asked by his government to find out how many orcas lived in the inland seas of British Columbia. Since 1965 dozens of orcas had been removed by the captive orca display industry. Most of the captured orcas had already died by 1973, and marine parks planned to capture many more. The government wanted to find out how many were left before allowing any more captures.

Dr. Bigg counted about 250 in the Northern and Southern Communities, although in the beginning he didn't know they were two separate groups. He tried photographing each whale and by 1973 he had discovered that he could identify all the individuals in the inshore population using photographs.



L91 at about six months, with his mother, 21 year-old L47.

Then he noticed that there were far fewer males than females. This was easy to see because the adult males have dorsal fins up to six feet tall, more than twice the size of female fins. The assumption among biologists at the time was that the males fought each other for control of harems of females and that the losing males either died or moved out of the area. But researchers never saw any fighting between adult orcas of either sex, nor were there battle scars or any obvious aggressive displays, except for females occasionally disciplining their youngsters.

In 1976 Orca Survey, (now part of the Center for Whale Research) began with a seven month federal contract awarded to Ken Balcomb to count Washington State's resident orcas. Balcomb also used the photo-identification method to get an overall picture of the community, as Bigg had done in British Columbia. In 1977 Bigg

and Balcomb found eight new calves in the Southern Community. Each year thereafter they watched the young orcas grow up. By 1983 they had noticed with some amazement that even at seven years of age, none of the young whales had left their mothers' sides.

It's difficult to tell if a young calf is male or female, but by about 1983, five young whales that had been small calves ten years earlier began to "sprout," or grow tall dorsal fins, showing that they were males approaching adulthood. They too were almost always seen right alongside their mothers. Balcomb and Bigg compared notes and photographs regularly, and after almost a decade of documented observations, both began to wonder if earlier assumptions about male aggression for possession of harems was correct.

They soon realized that unlike any other mammal known (except pilot whales, a

The Southern Resident Community

How they are doing in the fall of 1995

The Southern Resident orca community is actually a large extended family, or clan, comprised of three pods: J, K, and L.

The population has been slowly but steadily growing since field studies began in 1973. As of October, 1995, the population totaled 95, which is a 40% increase compared to its size of 68 when first documented in 1976. All three Southern Resident pods lost many members during 1967-73 as a result of captures for marine parks. Between 34 and 58 Southern Residents, most under six years of age, were taken or killed during captures.

The Southern Residents are often seen during the summer in the protected inshore waters of the Salish Watershed, usually moving from south of San Juan Island to the mouth of the Fraser River and other rivers in Georgia Strait. They usually travel in Haro Strait, west of San Juan Island, but may also use Rosario Strait, or occasionally San Juan Channel, between San Juan and Lopez Islands.

J pod, with twenty-one members, is

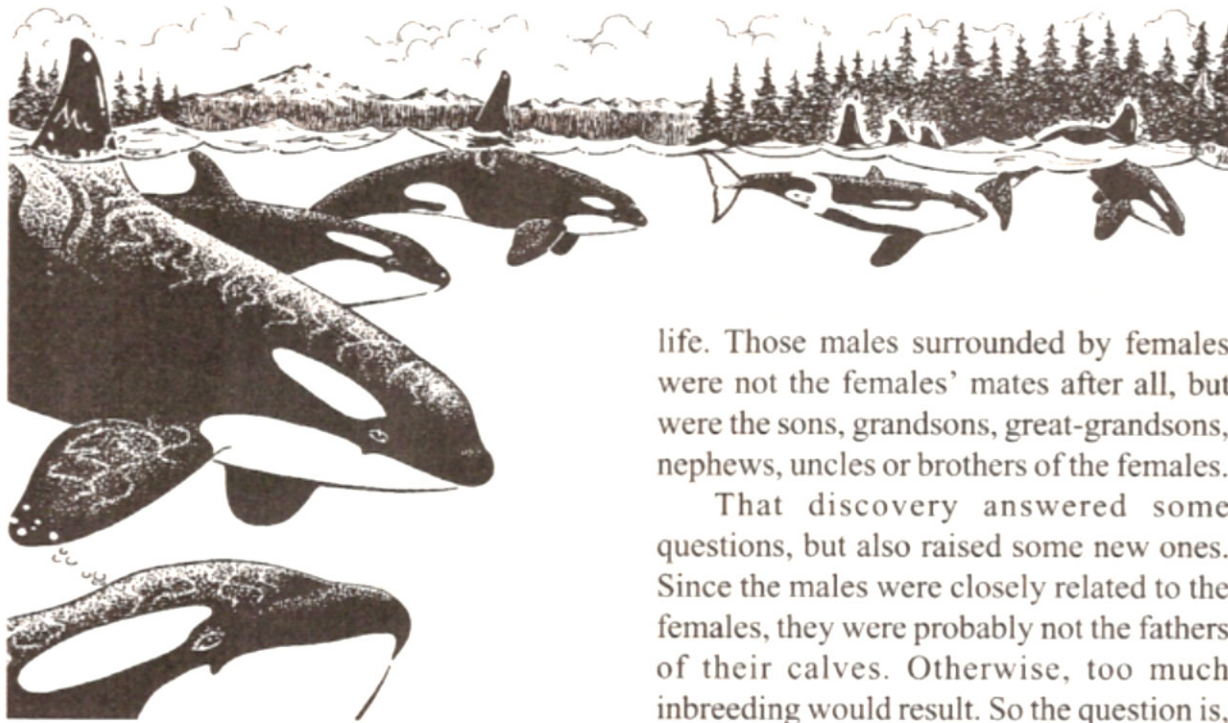
often seen traveling in winter months in the lower Puget Sound near Vashon Island, and in Georgia Strait at the mouth of the Fraser River. J pod tends to frequent the west side of San Juan Island in mid to late spring, and often can be seen from Whale Watch Park. The oldest member of J pod is J2, estimated to be in her early eighties. Three J pod whales are mature males, ranging from 18 to approximately 44 years old. There are currently five calves under six years of age.

K pod now has 18 members, of which only one is a mature male. K pod's two new calves of 1994 were the only newborns that year. One was observed with a fish in its mouth this year. The oldest matriarch of K pod is K7, also estimated to be in her early eighties.

L pod, with 56 members, is by far the largest resident pod, though the pod often splits into 2 or 3 subpods that may travel separately. L pod has nine mature males, and eleven calves under six years of age. Four new babies have been born to L pod mothers since 1994.



This photo, taken August 5, 1993, shows L2, at about 50 years of age, in the lead. Behind her is her son L39, born in 1975, and her two-year-old, L88. The sprouting male in the middle is L58, born in 1980. Females live an average of about 50 years, and some may live to the age of eighty or more. Males average about 30 years, and may live to fifty or sixty years old.



closely related species), both male and female orcas stayed with their mothers for

life. Those males surrounded by females were not the females' mates after all, but were the sons, grandsons, great-grandsons, nephews, uncles or brothers of the females.

That discovery answered some questions, but also raised some new ones. Since the males were closely related to the females, they were probably not the fathers of their calves. Otherwise, too much inbreeding would result. So the question is, which males mate with the females that have calves? And since males don't fight each other for mating rights or ever leave

A gray day in Norway – told by Astrid van Ginneken

It was a dark and gray day when we set out. We soon sighted whales and I cheered as I saw a male push a little orange calf to the surface. It took a few minutes for us to realize that the male was pushing a little dead calf around. It was a sad sight. The orca was accompanied by three other females and a juvenile. They were close together and moved slowly. I felt I was witnessing mourning orcas, sharing the grief over the loss of their little family member. Quietly, we saw the male surface, and at times we saw him push the calf in front of him. The other whales swam at his side. We watched them, hardly moving, to see what happened. The whales started to spyhop around us. They made no clear attempt to leave us. One moment, one of the females spyhopped and she was immediately followed by the male. When he rose up, we saw the little calf slip away from his rostrum and slide back into the water. The whales spyhopped many times and at one instant two females spyhopped simultaneously.

A little later, a few other females joined and the male and the female started to leave the group. The remaining whales made several surfacings and turns in unison, seven whales breaking the surface simultaneously. They formed almost a circle with heads turned inwards. Then after one or two dives, they suddenly lined up again and surfaced in one row. Again the whales came close together and were all directed to something in the center. Suddenly, the little dead baby orca was visible in a flash. Apparently, the whales were around the little calf and taking part in a mutual activity of nudging the baby. We had the feeling we were witnessing something that seemed some sort of ritual. Several hours later, the whales broke up into several smaller groups.

The Art and Etiquette of Watching Orcas

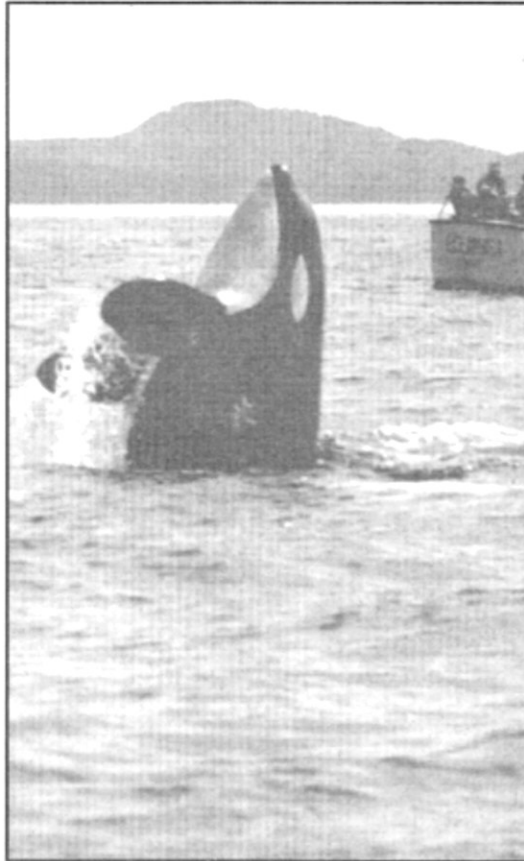
As the Southern Resident Community of orcas becomes better known and more popular, the number of boaters hoping to see them will inevitably increase. If you are watching whales by boat, please remember that you are a visitor in the whales' habitat. Courtesy is needed to avoid disturbing or intruding upon them. Patience and careful boat handling also optimize your chances of seeing the whales engaging in their natural behaviors. Proper boat handling near whales requires knowledge of the whales' behavior and a respectful attitude, neither of which may not be obvious to the first time whale watcher. Here are some tips:

Whales orient themselves to their surroundings, to food sources, and to each other, primarily by their sense of sound. Boat noises are much louder underwater than through the air. Avoid speeding toward whales or trying to intersect their course. Gradually slow your boat to idle speed when you are

within a mile or so of whales. There may be other whales much closer than the ones you last saw. Try to approach slowly, from behind and off to one side, in a course that will gradually bring you parallel with them and about 100 yards away from them.

Avoid moving from one group of whales to another, and avoid "leapfrogging" directly into their path. With patience you are just as likely to see whales when they surface if you remain where you are or continue on the same course and speed when the whales dive. When it is safe to do so, the best whale encounters may be experienced with the engine turned off. When you leave a whale or group of whales, wait for them to surface safely away

from you before crossing their path behind them. If there are lots of boats around the whales, the best thing to do may be to stay a good distance away. Crowding around whales is rude and dangerous to both the whales and other boaters.

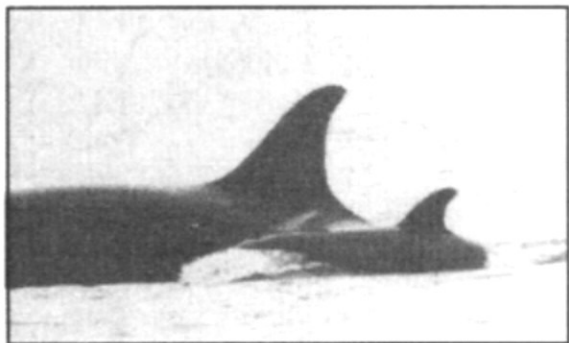


An orca spyhops, as if to see who's taking pictures!

Please report whale sightings to: 1-800-562-8832

The growth of J18.

Male orcas' dorsal fins begin to "sprout" in their early teens. By their late teens the fin has nearly reached its full height, but may remain slightly curved. There are many shapes and sizes of dorsal fins in males, some wavy, some rounded at the top and some more pointed, but less than 1% of wild orcas' fins ever flop over.



*J18 alongside his mother, J10, in **1977**, the year of his birth.*



*J18 in **1980**, at three years of age. The fin still gives no indication of gender.*



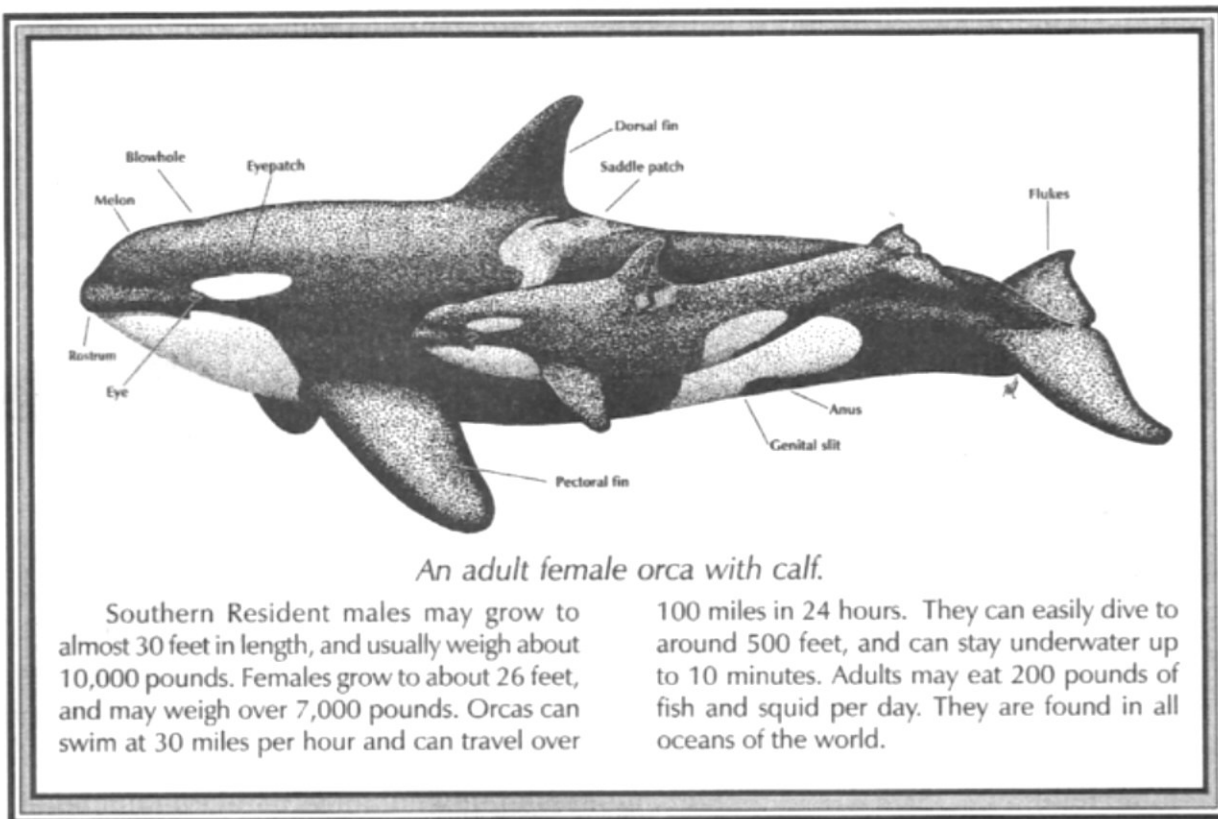
*J18 in **1985**, at eight years old, swimming beside his mother.*



*J18 in **1990**, thirteen years old. The fin has now begun to grow tall.*



*J18 at eighteen years old in **1995**, with his mother, J10, in background.*



An adult female orca with calf.

Southern Resident males may grow to almost 30 feet in length, and usually weigh about 10,000 pounds. Females grow to about 26 feet, and may weigh over 7,000 pounds. Orcas can swim at 30 miles per hour and can travel over

100 miles in 24 hours. They can easily dive to around 500 feet, and can stay underwater up to 10 minutes. Adults may eat 200 pounds of fish and squid per day. They are found in all oceans of the world.

their pod, why are there fewer males than females?

The answers remain completely unknown. It is now known that males don't live as long as females, but we still don't know why. Males may live to about fifty years of age, but females' *average* lifespan is fifty years, and some live eighty or more years.

Along with the photographs of each side of each whale, researchers from the Center for Whale Research also record the orcas' behaviors. Whenever one breaches (leaps clear of the water), or does a cartwheel (swings their tail out of the water) or lobtails (slaps the water with their tail, often upside down), or circles (arching in tight circles, probably chasing a fish), the behavior is recorded on the log sheet and later becomes part of the computerized

database for that day's orca encounter.

Orcas also engage in some fascinating and mysterious social activities. The Southern Community sometimes engages in a "greeting ceremony," in which the pods line up facing each other, then come into the center of the formation one by one or in small groups and begin intermingling in a flowing, rolling dance of whales. Intermingling sessions may continue sporadically off and on for days or weeks during autumn.

One of the most fascinating discoveries to come out of two decades of field research on orcas is that each community uses its own "dialect," or vocabulary of calls, which can be heard with underwater microphones. The Southern Community, for instance, makes about 26 distinct types of calls, plus a wide range of other calls during

J4

J19

J8 J6

J2

J12

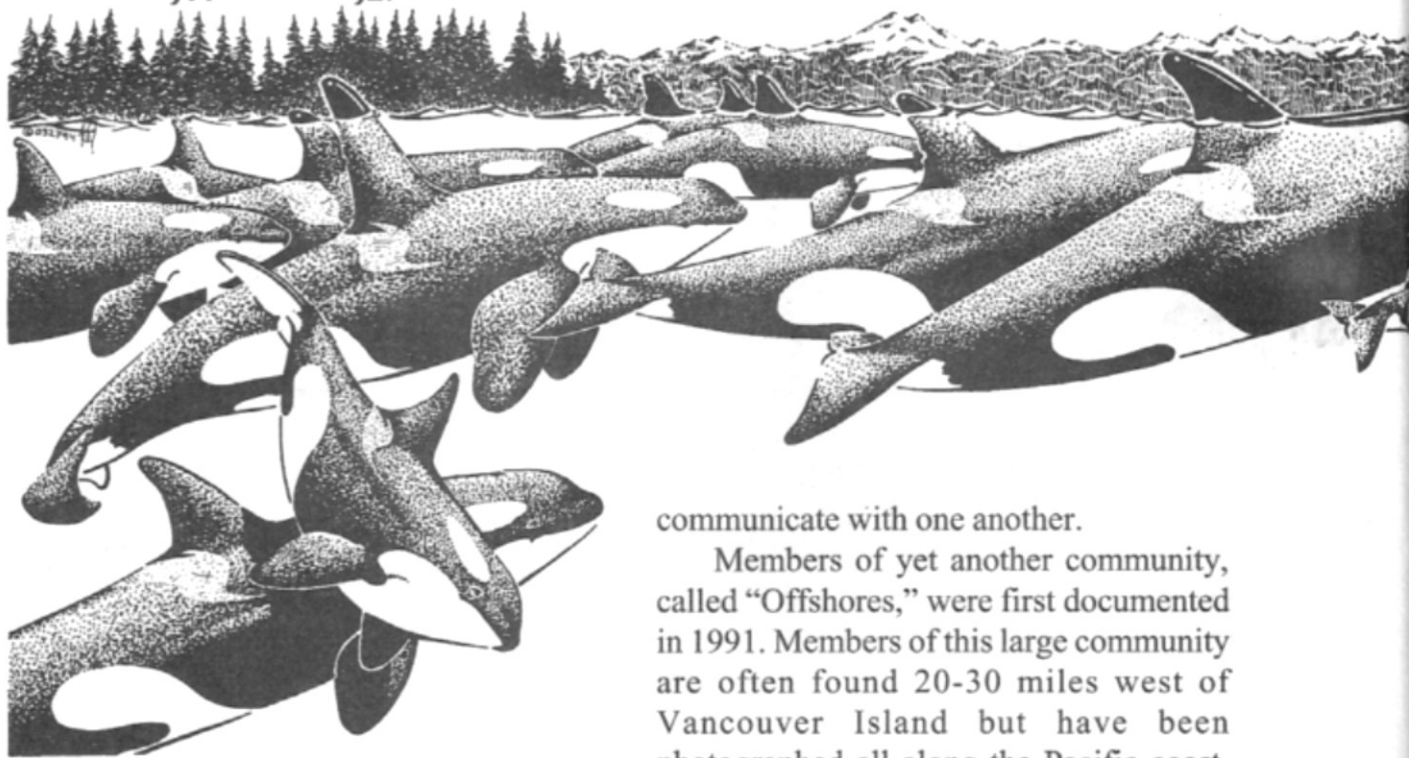
J14

J5

J17

J11

J27



enthusiastic socializing sessions. Whenever any of these 26 characteristic calls is heard, there can be no doubt that whales from J, K, or L pod are somewhere within about ten miles.

The Northern Community of resident orcas, found from north of the Salish Sea to Southeast Alaska, makes about 43 separate calls, none of which are similar to the Southern Resident calls. Northern Residents are not known to communicate with Southern Residents.

Another community of orcas, known as Transients, are found occasionally in the Salish Sea. Transients prey primarily on seals, sea lions and porpoises. They tend to keep their pod size to five or fewer (better for sneaking up on seals and sea lions). They also use a completely unique set of calls to

communicate with one another.

Members of yet another community, called "Offshores," were first documented in 1991. Members of this large community are often found 20-30 miles west of Vancouver Island but have been photographed all along the Pacific coast, from southern California to Southeast Alaska. The Offshores also share a set of calls completely different from those of any other community.

Studies of orca communications have barely begun, but it's already clear that as young orcas grow up, they learn and use the calls of their and community, much like humans do. These vocabularies of calls may be similar to human languages in the way they use certain sounds that mean something, but they may also be very different in ways we don't understand. In fact, very little is known about the nature of orca dialects. Just imagine how very different orca dialects must be compared to human languages, after fifty million years of development in a marine environment, separated from our land-dwelling ancestors literally by an ocean.



What we do know is that as they travel, forage, socialize or play, they almost constantly communicate with each other, so that each orca knows where every other member of the pod is at all times. They may communicate about family relationships, food sources, social gatherings, and probably some of the features of their undersea surroundings. It would be interesting to know what Southern Community orcas think about the ships, boats, and kayaks filled with humans that they encounter so often as they travel along their accustomed routes.

One obvious advantage of belonging

to a large, extended orca family is the ability to herd fish. The larger adult males often seem to scout along the edges of the pod, possibly investigating with sound, while others examine the canyons and crevices along the way. All the while they communicate with each other so that the entire pod probably knows about whatever may be discovered by any individual whale for many miles around. The simple comfort and enjoyment of each other's company may also encourage the formation of large, extended orca families. The historical abundance of salmon in the Salish Sea may simply have made large communities

How to be a whale researcher

Q: We want to work with whales when we grow up. Can you tell us how to get started?

A: There are many ways to work with whales. To get started, figure out what you have fun doing. Do you like arts and crafts? Maybe you would like to be an illustrator or model-maker for educational materials about whales. Do you like mathematics? Maybe you would like to help make sense of all the numbers obtained from wildlife research projects. Interested in video, film, CDROM or photography? Maybe you could bring images of whales and dolphins into people's lives. Perhaps you would like to volunteer at a school or museum to give talks or lead guided tours through exhibits. The most important thing to do is to actively pursue your interest. Set aside time to read or watch whatever you can about whales. Ask questions. Stay in school and study hard in your science classes. Learn how to use your library to find books, periodicals and video tapes that teach about whales. Whatever you do, put your heart into it; some day you may become a leading expert on some aspect of whale studies!



On the far side is J14, with her newborn J30 in the middle. J19, not directly related, is in foreground.

possible.

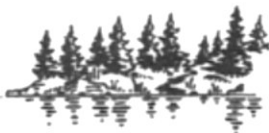
Family ties among most toothed whales (porpoises, dolphins, pilot whales, belugas, narwhals, sperm whales, and others) are so strong that if one whale becomes stranded on a beach, the rest usually will not leave, even if it means the entire family may perish. When Namu, the first performing orca, was being towed in a floating pen from Canadian waters to Puget Sound in 1965, about a hundred family members followed him most of the way, after which a female and two juveniles (probably his mother and two siblings) stayed with him all the way

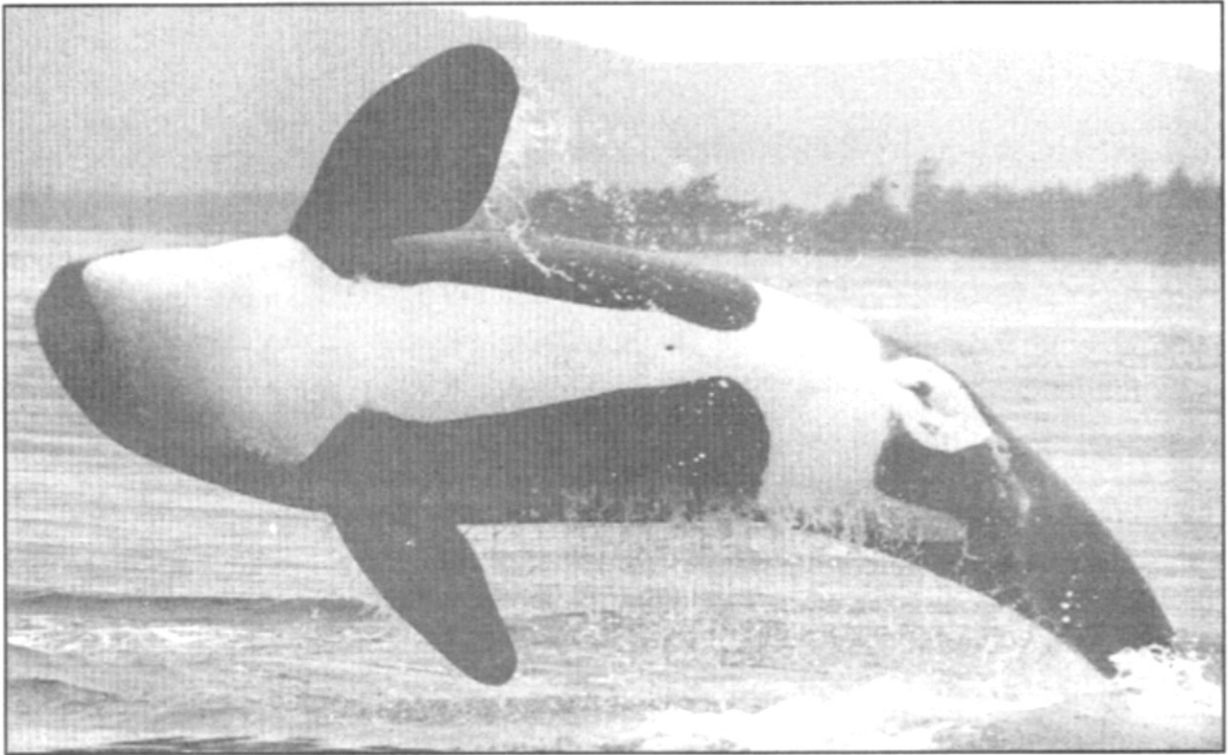
to Bainbridge Island and remained near his pen for over two weeks.

This “pod cohesion,” as it is known, raises an interesting question. Orcas are constantly on the move, every hour of every day and night (they use echolocation clicks to navigate, so maneuvering around rocks and catching fish in darkness are not problems). The pod may suddenly turn around, or begin swimming very fast, or they may group together into a resting formation. Before every change of direction or new group behavior there has to be some kind of group decision-making process, so that they will all make the change together.

But who decides? Which whale, or whales, tells the rest of the pod which way to travel, when to play, when to socialize, when to spread out and look for food, and when to rest? Unfortunately, although it is suspected that the older females may be in charge, scientists still don't know for sure. Instead of using body language or facial expressions that observers might be able to

interpret, whales communicate mainly with vocalizations, and we still don't know what any of the calls mean or even which whale is making which call. In the next few years research that combines acoustic and video recordings may help





An unknown female explodes from the water in a full breach. It is not known why orcas and other whales spend so much energy leaping from the water. It may be a way to emphasize a communication, or to herd fish, or just enthusiastic play.

reveal the politics of leadership among orcas.

When the ancestors of today's whales and dolphins ventured into the seas, they found stable environments and reliable food sources. The approximately 75 species of cetaceans alive today have specialized to inhabit every conceivable nook and cranny in the marine environment.

Orcas have even apportioned marine habitats and resources among communities, so that for instance, in the Salish Sea the residents eat only fish, while transients eat only marine mammals. The whales' live-and-let-live mode of habitat usage seems to have worked well for many millions of years. In this way they almost always avoid conflicts. There appears to be some sort of

agreement between the various orca communities to divide up the habitat and resources. The Southern Residents seem to know how far they can go to the north, and the Northern Residents know how far they can go to the south. In June of 1994, the only time the Southern Residents have been seen in the Northern Residents' waters, they were traveling very fast and headed due south, until they reached their own waters in the Salish Sea.

The Southern Community is like a tribe, separate and distinct from the other communities of orcas that inhabit the waters around Vancouver Island, off Alaska, and elsewhere. They are our neighbors in the Salish Watershed. They live in our midst.

Human cultures began during the

We Are Not Alone

By Billy Frank, Jr., Chairman
Northwest Indian Fisheries Commission
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We are not alone, and we will not survive alone. The world does not belong to us. We belong to it. These have been the beliefs of Indian people for thousands of generations. This has been a fundamental difference with the nonIndian society, which has made every effort in its western expansion to "conquer" Nature. An attempt by people to conquer Nature is, in our view, an attempt to conquer themselves. It makes no sense.

People must understand that we live in a delicate system of life in which every creature is important. The health of people is in the long run far more dependent on the survival of this system than its reliance on economic booms. Over the past few generations populations have skyrocketed and people have placed ever-increasing pressures on our precious environment. The focus has been placed on the exploitation of the last remaining oil reserves, the final parcels of property around rivers and lakes, the final drops of water and the last of the

ancient trees. What good would a strong economy be in a world starkly devoid of life and natural resources? We must ask this question of ourselves as

we make decisions that will affect the next millenium.

We need the bald eagle. We need the gray whale and the grizzly bear. We need the whooping crane and all other creatures that have been saved from extinction by laws such as the Endangered Species Act, the Clean Water Act and the Timber/ Fish/ Wildlife Agreement. Around the world, species are going extinct each and every day and others are on the brink of extinction.

For the past 200 years, western society has forced change on the American Indian. In fact, we have been an endangered species. All this time we have spoken about the need to respect Nature, rather than just view her as something to be used. It is only through this respect that any of us, Indian or not, will survive.

Those who only relate to economics must come to the realization that economics are based on sound natural resources. Jobs and a strong economy are critically important, to be certain, but in the long run these things are just as dependent on healthy fish and wildlife as is our spiritual and natural heritage. We must realize that every time any species of fish or wildlife dies, a part of us dies with it.



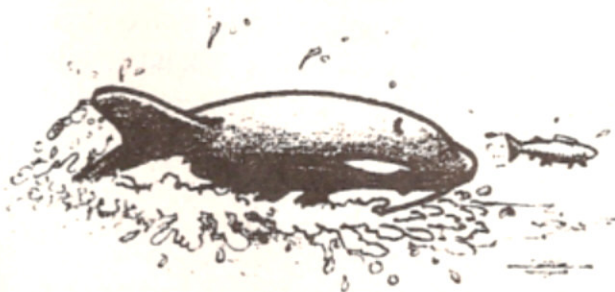
Guided through the fog – told by Ken Balcomb

As we motored slowly out of Admiralty Inlet and headed across the Strait of Juan de Fuca, we ran into a thick blanket of fog which reduced visibility to about 50 feet. On this particular morning, the whales were heading north out of Puget Sound, probably bound for Haro Strait. I didn't relish this crossing in the blind, but home was on the other side.

Ten minutes later, a group of killer whales converged rapidly upon us in the fog and crowded right around the boat, causing us to slow to idle speed. It was J, K, and L pods again, numbering more than 80 whales in all. There was no way we could have found them in the fog, but they had no problem finding us. They gathered more and more tightly around us until the closest were only inches away from the hull on either side and in front of the bow. There they remained, swimming slowly with us for two hours until the fog cleared.

Did they know that we couldn't see well enough to navigate from land bearings? Were they guiding us around the shoals of Smith Island? I knew that wherever they were, there was enough water depth for our boat. It was a very moving experience. Many times before my associates and I had felt that we were accepted in the orcas' midst, but this time it was they who had initiated the encounter, and we who were the ones being escorted. Only when the fog lifted did the whales disperse and proceed to Haro Strait.

Pleistocene ice ages, which were characterized by over 2 million years of extreme weather changes, forcing desperate struggles and dangerous migrations. Scientists still debate whether the demise of most large mammals in North America about 11,000 years ago was due to climate changes or was caused by the first humans on the continent. At the same time that groups of nomadic peoples migrated across the temporary land bridge from Asia, more than 70% of the large mammal species of North America became extinct, including horses, camels, ground sloths, elephants and many other large mammals.



Humans arrive in the Salish Watershed

Native Americans who settled along the shores of the newly-thawed Salish Sea 4 to 5,000 years ago found temperate sea breezes and meals of fish and shellfish that must have seemed limitless. For centuries their diet was heavily dependent on salmon as they moved from river to river, feasting on each run.

Later, when they developed preservation techniques, a family could catch and store enough salmon in a few months to last an entire year, allowing them to set up permanent settlements along major rivers. Families prospered and multiplied, becoming large clans and tribes, and they perfected their techniques for preserving fish, until they began to overharvest the salmon. It wasn't long before many runs were nearly fished out, and the people who lived along those rivers and depended on salmon for survival began to starve.

From that hard experience they learned

The oil that spilled from the Exxon Valdez

In Prince William Sound, Alaska, resident orcas were first documented in the late 1970's. In September, 1988, there were 36 members of the largest pod, called AB pod. AB pod orcas were well known to researchers because they didn't seem to mind the presence of research boats. Some AB whales even came over to the boats for a closer look now and then. On March 24, 1989, 11 million gallons of crude oil spilled from the Exxon Valdez when the supertanker strayed 8 miles off its course and struck Bligh Island.

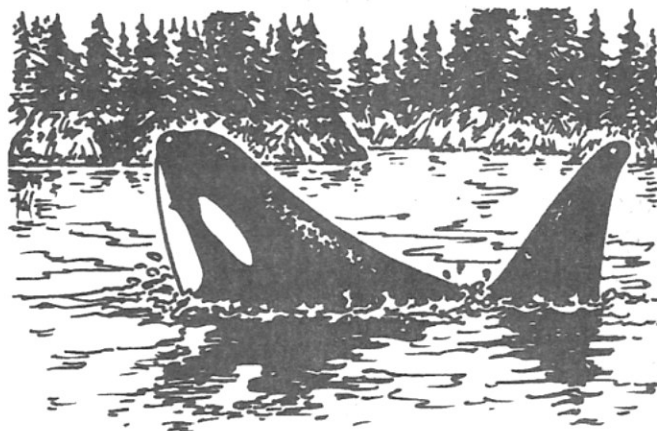
Seven days later, four juveniles and three adults had died, including two mothers. By early 1990, another mother, a maturing male and four more juveniles had died. One more young male died by 1991.

AB pod went from 36 to 22 members within a year after the spill. The pod apparently got caught in the spreading globs of thick crude oil, in some places over a foot thick. It is believed that as the whales inhaled, they pulled oil into their lungs, coating delicate tissues and causing massive inflammation.

It is more difficult to document the deaths of transient orcas, because they travel widely and may split off from their birth pod occasionally, but a total of nine transients apparently disappeared and probably died as a result of the oil spill.

In a 1994 update, Prince William Sound researcher Craig Matkin reports that 5 additional whales have been lost from AB pod since 1991. Two of these were young ones whose mothers had died soon after the spill. Another whale that died was an adult male whose dorsal fin had collapsed just after the spill. Also dead is a female who lost most of her close relatives at the time of the spill, and a calf that was born in 1993. A subpod consisting of six whales seems to have split off and joined another pod. According to Matkin, "...this renews concern that the losses to AB pod at the time of the Exxon Valdez oil spill may have doomed this friendly and approachable pod."

Many thousands of sea otters were also killed by the spill, along with hundreds of Steller sea lions, harbor seals, and an unknown number of humpback whales. Whole populations of migratory and resident birds were also killed. The spill destroyed huge portions of a beautiful and very important ecosystem for years to come. Once a major oil spill occurs, efforts to stop the spread of oil or clean it up are useless. We need to prevent such a spill from ever happening in the Salish Sea.



to catch only what they needed, and to allow enough fish to return upstream each year to spawn new generations. They learned to restore the salmon runs and to harvest the fish at sustainable levels. They applied this understanding of nature's ways to other resources, so that, for instance, when birds' eggs were taken for food, two or three were always left behind, so there would be more birds. When shellfish were harvested, some were purposely left in the sand, so there would always be more clams and oysters. The first peoples gained a spiritual understanding of the web of life, and their cultures reflected the need to protect and honor the interwoven lives of the plants and animals they depended on.

With streams and rivers again running full of salmon, early Salish people enjoyed leisure time, and developed traditions of artistic and refined cultures. Salmon were celebrated as living symbols of greater powers and as fellow beings in a spiritually interconnected universe.

When Native Americans were beginning to live in the Salish Watershed, Southern Community orcas were already here feasting on salmon. The whales also depend on salmon, and may also feel a deep connection to them. For millenia orcas have anticipated salmon runs and have observed how many returned upstream to spawn each year. Orcas may have understood salmon life cycles long before the Salish Watershed was even formed. They often prepare the salmon by shaking the head and entrails off before eating them. Like native tribes, orcas may regard the salmon as vital sustenance and an essential part of nature.



J6, also known as Ralph, alongside his relatives.

Problems in the Biosphere

Beginning around three hundred years ago, a new wave of European immigrants started arriving on the shores of the Salish Watershed. These settlers built very productive farms, mills, factories, towns and cities, but they didn't ask the native people how to live according to the area's natural cycles and biological limits.

Their dominance was accomplished not only with efficient weapons and massive use of technology, but also with philosophies of "manifest destiny" which meant human supremacy over nature and European authority over indigenous peoples. They began to sell the timber, fish and land for maximum monetary gain, and they weren't very concerned about running out of resources. They thought there would always be more trees and more salmon.

In the first half of this century they built dams across hundreds of rivers to power their machinery and irrigate their farms. But very few salmon can get past most dams to

spawn. Some manage to find fish ladders, but smolts heading downstream are held back by dams or become battered by turbines. Salmon find their way in streams according to the direction of the water's flow. When a dam creates a lake, the flow slows so much that the fish can't find their way. A delay of a few weeks in an artificial lake can cut salmon survival rates significantly. Today, as a result of dozens of dams, only about 2% of native stocks remain in the Columbia River system.

Dams are not the only cause of salmon depletion. For over a hundred years, especially in the past two decades, lush, green mountainsides of fir, cedar, spruce and yew have been stripped down to dirt and rocks for timber sales. As a result, exposed forest soils have turned to mud, which washes into streams. Muddy streamwater, heated by too much direct

sunshine from lack of trees, often covers gravel bottoms with drifting silt. Any salmon eggs that may be deposited there slowly cook to death or become suffocated under muddy sediment.

Compounding the impacts of habitat destruction, when complex forecasts or quotas are not correctly estimated, commercial and sports fishing may take so many fish that even if habitat is available for them, not enough fish may escape the nets and hooks to replenish stocks, although quotas and regulated openings may prevent overfishing.

The demands of increasing human populations are putting tremendous pressures on natural habitats. For thousands of years until the early 1800's only about 100,000 people lived along the shores of the Salish Watershed. Now about six million people live here, and the population

A festival of orcas

In June, 1994, researchers observed a gathering of all three pods of the Southern Resident Community. They socialized in small groups of 5 to 15, spread out over 5-10 square miles of ocean surface. At any one time as many as five or six such groups could be seen. The whales seemed to mix and mingle without regard to pod association. Calves and juveniles joined the adult males and females in rubbing together, slowly slapping the water with every appendage, spyhopping, and pushing each other to the surface. They moved in a slow motion, ballet-like pace.

Groups were not seen to come together at the surface; rather when a group began to



appear at the surface, the members were already tightly gathered and engaged in tactile behaviors. When at the surface, there was

usually a rush of ten or more shallow blows per whale over the course of 2-3 minutes, then the group would sink and in many cases not reappear as a group. Individuals, or small groups such as mothers and calves were sometimes seen travelling

from group to group, always eventually merging together into newly formed associations. They vocalized incessantly in unusual whistles, squeaks and honks.

This tactile play was observed on several occasions in mid-June, and has been observed in spring and fall in previous years.



Although logging has provided many needed products, the damage to forests and watersheds is often severe.

is still increasing. During the 1980's the population of Puget Sound grew about 10%, but in that time car-miles traveled grew 80%. Thousands of miles of roads and huge parking lots have been built, and in the process streams have been paved over, channelized or degraded. About 2,400 road culverts in Washington have eliminated 3,000 miles of stream habitat, according to the state Department of Fish and Wildlife.

We've diminished salmon runs in other ways as well. For millennia freshwater wetlands have nurtured a vast array of life forms and fed nutrients into rivers and streams throughout the Salish Watershed. Wetlands also moderate streamflow, storing and slowly releasing water.

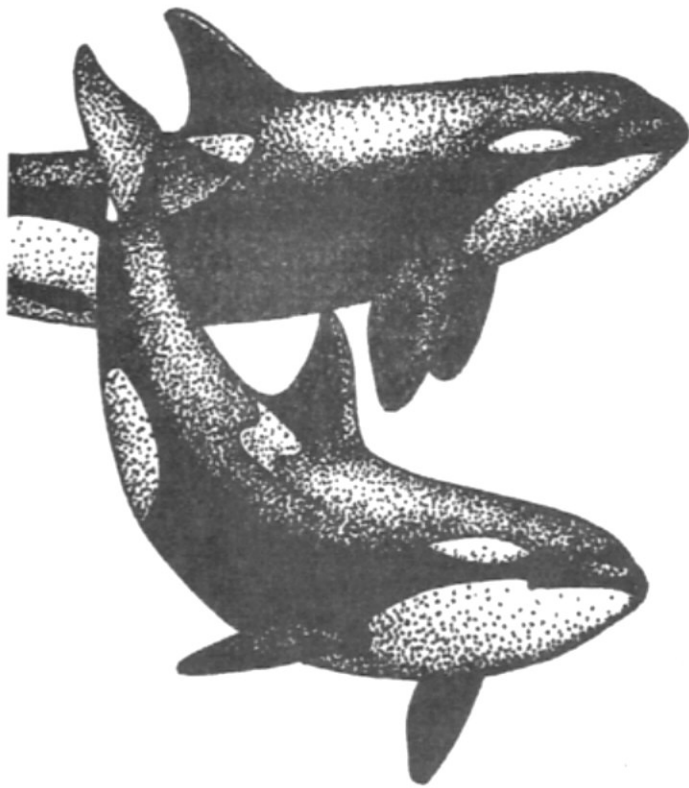
Until recently, however, wetlands were thought of as wasted land, and much of it

was either filled in for roads or buildings or severely polluted. Over 60% of tidal wetlands and muddy flats in Puget Sound have been filled in or dried up. Loss of wetlands can wipe out populations of shellfish, birds and young fish, including salmon fry. When salmon smolts beginning their journey to the sea are forced out into deep water too soon, they lose food sources and the protection from predators provided by shallow, grassy water.

Further habitat degradation comes from toxic pollution by oil products, PCB's, heavy metals, radioactive material and sewage discharges. Some pollutants can cause reproductive problems or immune deficiency in fish and in marine mammals. Some chemical pollutants may build up in the bodies of whales, then be flushed out in the milk given to firstborn calves, seriously harming the immune system of the calf.

Some sources of pollution can be located and reduced or eliminated, but others are non-point, meaning they come from homes, roads and businesses in the course of everyday activities. Non-point pollution includes household paints and weed killers and automobile exhaust, and may require that everyone make changes in their daily habits to reduce the use of damaging pollutants.

When young salmon have washed downstream to the Salish Sea, they usually linger there in shallow water for weeks or months, eating voraciously, before heading out to sea. The larger a young salmon grows before heading out to the Pacific, the better



are its chances of survival to adulthood and the opportunity to spawn. Thus, any damage done to the overall food chain in the Salish Sea may damage the fish even months after they have gone to sea.

Salmon and their habitat are inseparable. If the fish disappear from a watershed, streams and lakes are not as biologically productive and diverse – in other words, not as healthy. Bears and eagles, and even trees and mushrooms, will not be as well nourished. Even if a stream is restored to a suitable habitat for salmon, years may pass before it will again fill with native fish. While habitats are being restored, however, it may be possible to “jump start” the salmon's return with small hatcheries that raise the fish to fry or smolt stages, protecting them from predators and extremes of weather until they can be released, thus greatly increasing survival

rates.

There are dangers, however. Hatchery fish can change the genetic makeup of native salmon. Abundant hatchery fish may also increase the overall size of the population, thus encouraging higher fishing quotas, which in turn take a greater number of native fish. Dense hatchery populations may also harbor diseases that may spread to native stocks. A combination of factors, including dams, hatcheries, net sizes and sports fishing (by throwing back the smaller ones) has led to much smaller average salmon sizes all along the Pacific coast.

We've made life very difficult for native salmon, and now the lack of salmon is starting to make life difficult for us and especially for the Southern Community of resident orcas. In 1994, with salmon stocks already in steep decline, unusually high ocean water temperatures south of Alaska contributed to a near total collapse of Oregon, Washington and British Columbia salmon stocks. Most stocks of coho salmon south of Alaska have now almost disappeared. Only one healthy stock of sockeye remains in the entire state of Washington. Chinook have disappeared from most river systems.

Scientists estimate that 38% of overall Pacific salmon habitat has been destroyed. About half of Puget Sound's wild salmon stocks are gone or nearly gone, and another ten percent are critically low. Only about 20 of the 100 fish-producing streams feeding into the entire Strait of Georgia have not been damaged by development. Of approximately 400 native salmon stocks in

Washington, Oregon, Idaho, Montana and California, most are seriously depleted, and about 40% are already extinct. Only 121 stocks have at least 10% of the salmon they would have had in the absence of human impacts, according to a study released in 1994.

Alaskan salmon populations are still strong, but the future of salmon fishing in Salish Watershed is at a critical stage, and good fishing in the future will depend on our efforts to protect and restore stream habitats and nurture returning salmon. Fish ladders, hatcheries and other technological fixes alone can't keep salmon populations high. Biologists now know that hatcheries are only a partial solution at best, and can actually hasten the decline of native fish.

Native fish are able to smell their way back the waters they hatched in. They know how to avoid fast currents, and where the best hiding places are. When hatchery fish are released into the sea they die at 2 to 10 times the rate of native fish. Mass numbers of nearly identical hatchery fish also lack the genetic diversity needed to quickly adapt to changing conditions. Ocean climates vary from year to year. Some stocks of salmon may do well in warmer water, for example, while others do better when upwellings cool the surface water. Only a wide range of diverse stocks of salmon from hundreds of different rivers and streams can ensure that a good portion of the fish will survive to adulthood and



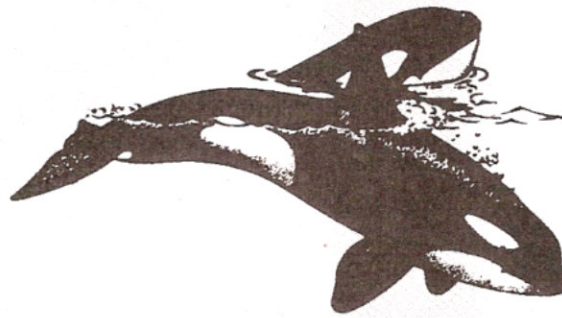
manage to spawn in a variety of conditions.

In times past, with diverse salmon stocks heading up every river and stream, there were almost certain to be some available for the orcas almost any time of year. Now, with only a few stocks of native and hatchery fish arriving in the Salish Sea each year, the orcas may often be going hungry. If we humans can't find healthy fish in our home waters, we have other options.

Although orcas may eat fish other than salmon, none are as large, easy to catch and nutritious as salmon. We have no way to feed the whales or to warn them of toxic pollutants we have poured into their food chain.

The Salish Watershed's orcas are now beginning to show signs that they don't have enough to eat. In 1994 six juvenile and young adult orcas from the Southern Community died. In 1995 three more died. All those that were seen just before they disappeared had lost much of their blubber layer in the last days they were observed. Of the nine orcas that died in 1994 and 1995, the youngest was four years old, and the oldest was a female in her late forties.

The whales' behavior shows that they are searching harder for food these days. In the late 1970's, Southern Community orcas tended to spend an hour or so each day resting ("resting" is when they are lined up in family groups, side-by-side, remaining close to the surface and swimming together at a slow pace). After resting, they often socialized for an hour or so ("socializing"



What We Can Do

There are lots of things all of us can do in our daily lives to help enhance the natural health and beauty of the Salish Watershed. Sometimes it may be simply saving electricity or water. Sometimes it may be taking a stand on an environmental issue or joining a big project to restore a special stream or valley. You may also find you can influence elected officials or government agencies.

Here are some ideas.

- Speak up and help organize for salmon restoration. Request that U.S. Fish and Wildlife Service or Washington State Fish and Wildlife provide adequate stream flows, forest cover and other habitat protection.
- Volunteer for stream enhancement and restoration projects with state and federal agencies and any of the many other groups and organizations (See list, next page).
- Be an informed consumer. Don't use products that are harmful to the environment where safer alternatives exist.
- Don't dump antifreeze, motor oil, or other chemicals into street drains. Many drains empty directly into rivers or into the Salish Sea!
- Conserve water and electricity; recycle and reuse paper products. Reducing demand will help save habitat and fish.
- Report violations of fishing laws and seasons.
- Anglers: Know the difference between trout and salmon smolts, and release any smolts you catch.
- Avoid boating, canoeing, kayaking, or walking through spawning areas when adult salmon are in the river.
- Enjoy watching salmon courting and spawning from a distance, using glasses with polarized lenses. Salmon may be frightened from their nests if you approach too closely.
- Educate others about salmon and what they can do to help.
- Support habitat-sensitive agricultural and business practices.

Groups working to protect and restore salmon habitat

To take care of the orcas of the Salish Watershed, we need to bring back the salmon.
Listed below are restoration groups you can join. There are many more.

- Adopt-A-Stream:** Trains "stream-keepers" to monitor and improve streams in their neighborhoods. Goal is to have every stream adopted. Call T.R. Morris at (206) 388-3487.
- Bellingham Parks and Recreation Greenways Project:** Volunteer planting and non-native plant removal projects. Call (360) 647-6380.
- Citizens For A Healthy Bay:** Does estuary restoration projects in Tacoma. Call (206) 383-2429; email: chbwa@igc.apc.org.
- GREEN (Global Rivers Environmental Network):** Promotes watershed stewardship through training, computer networking and local partnerships. Call Lisa Bryce Lewis at (360) 676-8255; email: greennw@aol.com.
- Hood Canal Coordinating Council:** Maintains directory of Hood Canal watershed restoration projects. Call Donna Simmons at (360) 877-5747.
- IMAPAL Foundation:** Does restoration projects year-round; loves to work with young people. Call John Beal at (206) 762-3640
- Kids for Puget Sound:** Leads kids and others to protect and restore Puget Sound. For newsletter with restoration events and other activities, call Stephanie Raymond at 1-800-PEOPLE-2; email: sound@eskimo.com.
- King County Surface Water Management (SWM):** Sponsors workshops, maintains restoration directory, and grants funds for projects in the SWM area. Call Jo Goeldner at (206) 296-836; email: jo.goeldner@metro.kc.gov).
- Long Live the Kings:** Demonstrates salmon restoration techniques at several sites across the state. Call John Sayre at 206-788-6023; email: longlive@aol.com.
- Native Plant Salvage Project:** Restores native plants in watersheds. Call Ernie Paul at (360) 786-5445.
- Nisqually Indian Tribe:** Maintains fisheries program including hatchery available for tours. Call David Troutt at (360) 438-8687.
- Nisqually River Council:** Promotes protection of Nisqually River. Call Peter Moulton at (360) 407-6783; email: speech@igc.apc.org.
- Northwest Indian Fisheries Commission:** Offers educational materials and speakers bureau. Contact Steve Robinson at (360) 438-1180 (email: tmeyer@nwifc.wa.gov).
- Olympia Salmon Club:** Works on salmon habitat projects. Call Harold Wright at (360) 352-3779.
- Padilla Bay National Estuarine Research Reserve:** Has a full calendar of nifty kids' programs. Call (360) 428-1558.
- Pipers Creek Watershed Interpretive Project:** Offers programs and materials to increase public awareness of issues affecting Seattle's Pipers Creek Watershed. Call Beth Miller at (206) 684-0877.
- Save Georgia Strait Alliance:** Educates to protect and restore streams and rivers that pour into Georgia Strait. Call Laurie McBride at (604) 753-3459.
- Stream Teams:** In Olympia call Cedar Wells at (360) 753-8598; in Lacey call Jared Burbidge at (360) 438-2687; in Thurston County, call Susie Vanderburg (360) 754-4681.
- Thurston Conservation District:** Works with farm habitat restoration projects. Call Sheila Engelhard at (360) 754-3588.
- Trout Unlimited:** Protects and restores salmon habitats. Call (360) 754-2131; troutu@aol.com.
- Washington State Dept. of Fish and Wildlife:** Conducts aquatic education. Call (360) 902-2200.
- Wild Olympic Salmon:** Promotes restoration and education in northeastern Olympic Peninsula. Call (360) 385-9329.

is breaching, splashing and actively mixing in small or large groups), They would then often forage for fish, spread out a half mile or so for a few hours, then perhaps travel for several hours to a new location several miles away, where the pattern would often be repeated.

In the past few years, however, the pods have usually been spread out miles apart, each whale traveling and foraging alone or in small groups, apparently scouring the undersea crevices and canyons, searching far and wide for fish. They don't seem to have much time for resting and socializing these days.

The web of life is unfathomably complex, with interconnected strands running in all directions, strung in an intricate pattern that holds the overall design together. Strands are torn when salmon runs are severely depleted, when the Earth's protective ozone layer is eroded with airborne chemicals, or when whales are hunted to extinction. Each such disaster may precipitate a series of other disasters. Regardless of the cause, if too many strands are torn at once, the whole web may be

weakened.

But even if it is ripped to shreds, the living energy on this blue-green planet will weave new webs, as has happened again and again for billions of years. Nothing we humans can possibly do will ever end all life on earth. Indeed, resourceful salmon will also eventually find ways to regrow new generations, regardless of how we may rip and plunder our environment. Salmon are amazingly resilient. They are quick to investigate, colonize and adapt to new streams, as long as the essential conditions for living there are present. They only need clean running water fed by forested mountains, with access to the sea. Mudflats and wetlands upstream and near the mouths of rivers are also important to help nourish and protect the salmon small fry. Big rocks and fallen logs help slow the water's flow and provide hiding places. With reasonable catches allowed at sea, the salmon themselves will do the rest to repopulate the streams, the Salish Sea, and the entire Pacific Ocean.

What Can We Do?

The question now is, how can we act together to help Nature grow? How can we help regenerate the forest plants and animals? How can we bring back the salmon, and take care of the orcas?

Destruction of stream and river habitat is the #1 cause of salmon depletion, and habitat restoration is the #1 solution. Almost everyone within the Salish Watershed lives a few

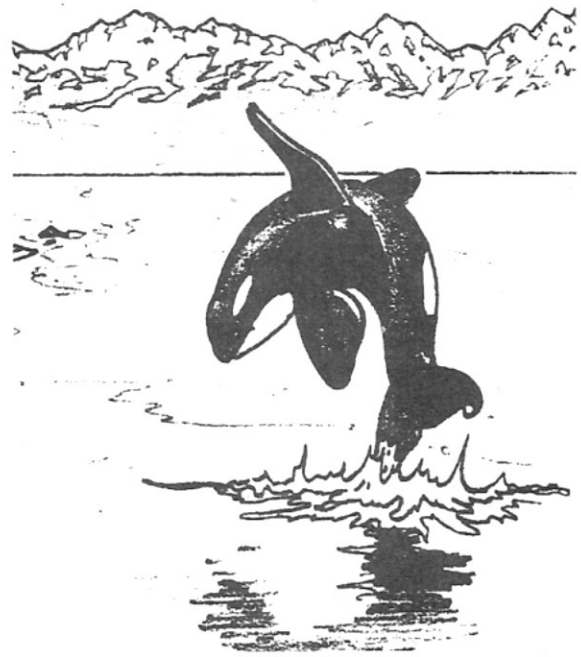


miles from a stream or river. Almost every stream is now or once was a salmon stream. The best way to tell if a stream is healthy is to find out if there are fish in it. If there are no fish now, maybe you have a neighbor or relative who remembers and will tell you about when fish were plentiful in your stream. You may learn some ideas for how to bring your stream back to life.

A healthy stream has clear, running water, with insects crawling and buzzing around it and a variety of plants and animals along its banks. How does your neighborhood stream look now? The rocks and gravel along the bottom should be visible, without layers of silted mud. If your stream fits this description it probably contains plenty of dissolved oxygen and suspended organic particles from far upstream that salmon fry need on their journey to the sea. If there is also open access to seawater from your stream, spawning salmon probably use it. If they don't, maybe you can find out why.

There are ways to restore the natural environment, but if we don't do it, it won't get done. Ideas and projects to help protect and care for habitats are springing up all around the Salish Watershed. There may be a salmon restoration project already underway in your watershed area that you can join. If not maybe you can contact one of the groups listed on page 29 or help organize a neighborhood effort to revitalize your stream and bring the salmon back.

In towns and neighborhoods throughout the Salish Watershed, people are beginning to put streambeds and riversides back into natural working order. In Everett, people have learned how to improve streams in their neighborhoods, including



Pigeon Creek, which had no salmon for over 30 years. In 1987 pioneer salmon showed up in Pigeon Creek after four years of restoration efforts. Maxwell Creek on Whidbey Island is now beginning to nurture its first salmon in many years. There are many such success stories, and many more projects that are just getting started.

We can start caring for the earth by bringing back the salmon, creek by creek, river by river. When fish again run in steady procession in rivers and streams, we can be sure that the mountainsides are alive with trees, and with animals, flowers, insects and birds, and that the Salish Sea is healthy and full of life. We will also be protecting and improving the lives of the orcas of the Salish Sea. It's an adventure we all can share, with the prospect of abundant nature and healthy, well-fed whales for our reward.



Glossary

Some words that may come in handy when you want to talk about orcas, salmon and habitats

Abysal zone: Bottom zone of the ocean.

Agricultural waste: Waste material from producing plants and animals for food; including manure, fertilizer, pesticides and herbicides.

Algae: Simple one-celled or many celled plant, usually aquatic, capable of photosynthesis. Considered the foundation of the food chain.

Algae bloom: Population explosion of algae in surface waters.

Anadromous: Describes fish that hatch in fresh water, spend their adult lives in ocean water, then return upstream to spawn.

Aquaculture: Cultivation of water-living plants and animals for human use.

Baitfish: Small, schooling fish that attract larger predator fish or whales.

Biodegradable: Capable of being broken down by bacteria into basic elements.

Biological magnification: Buildup in concentration of some substance, such as DDT or PCBs, in successively higher trophic levels of the food chain or web.

Biomass: Total weight or mass of all living matter in a particular habitat or area.

Blowhole: The air passages, or nostrils, of whales, usually located on top of the head.

Channelization: Changing the course of waterways with dikes or fills.

Clear cutting: Removing an entire timber stand from an area.

Ecology: Study of the relationships of living organisms with each other and with their environment.

Ecosystem: An interrelated community of natural forces and living things.

Effluent: A waste liquid that enters the environment from a point source.

Estuary: An area in which freshwater drains into a semi-enclosed body of seawater.

Food chain: Sequence of transfers of energy in the form of food from organisms in one trophic

level to those in another.

Food web: Complex, interconnected series of food chains.

Forage: To search for food.

Fry: Juvenile salmon are called fry until they reach about 3 inches, then they are called fingerlings.

Gene pool: Total genetic information possessed by a given reproducing population.

Habitat: A place in which plants and animals naturally live, that satisfies their needs.

Indigenous: People, plants or animals that are native to a particular habitat or region.

Landfill: Place where earth or solid waste is dumped, usually to create new land for development or to dispose of garbage.

Littoral: Area on or near the shore of a body of water.

Minke whale: A baleen whale that grows to about 30 feet; often seen in the Salish Sea.

Mutation: Process of change in the genetic material that determines the characteristics of a species.

Niche (ecological): A plant or animal's place in its food web or ecosystem.

Phytoplankton: Plant plankton, usually blue-green algae, found in the upper layers of all the world's oceans.

Plankton: A floating plant or animal, usually microscopic.

Pod: An extended family of orcas or other toothed whales that remains in close association.

Stock: A genetically and regionally isolated population.

Upwelling: Area adjacent to a continent where nutrient-rich bottom waters flow to the surface.

Watershed: An ecosystem in which water drains into a common body of water in a natural basin.

Wetland: Freshwater or saltwater swamps or marshes that act as reservoirs of water, thus controlling runoff year-round.

ABOUT THE CENTER FOR WHALE RESEARCH

The **Center for Whale Research** was founded to promote, support and conduct benign scientific research on marine mammals of the Order Cetacea – whales, dolphins and porpoises. The research method is primarily long term (multi-year) photo-identification of individuals within populations, which provides baseline data for demographic and behavioral studies. The knowledge gained from these studies is provided to the scientific community, to governments, to the public and to conservation organizations.

The principle studies underway as of 1995 are **Orca Survey** – a long term study of killer whales in the Pacific Northwest since 1976; **Pacific Humpbacks** – a study of humpback whales since 1986, with other cooperating researchers, to determine migratory patterns, stock identity and population status in the Eastern North Pacific; and **Bahamas Marine Mammal Survey** – a general survey of marine mammals in the northern Bahamas, with particular emphasis on bottlenose dolphins, and beaked whales.

Membership in the Center for Whale Research helps to provide funding for the projects listed above as well as other field research on cetaceans. Members will receive current information about cetaceans, research projects, and events in the marine mammal scientific community. CWR is active in researching, reporting and advocating issues concerning cetacean conservation as well as habitat protection and restoration.

Center for Whale Research
P.O. Box 1577
Friday Harbor, WA 98250

Books about orcas you might like:

For young readers:

Davy's Dream by Paul Owen Lewis

In the Company of Whales by Alexandra Morton

Siwiti by Alexandra Morton

Storm Boy by Paul Owen-Lewis

For young and adult readers:

Killer Whales by Ford, Ellis and Balcomb

Orcas, Eagles and Kings by Steve Yates

Orca, the Whale Called Killer by Erich Hoyt

Whale Tales compiled by Peter Fromm

About salmon:

Reaching Home by Natalie Fobes, Tom Jay and Brad Matsen

Sockeye Salmon – A Pictorial Tribute
by Shiromi Naito

The front cover art for *Orcas In Our Midst* is graciously contributed by author/artist Paul Owen-Lewis.

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