

THE Blackfish Sounder

No.20 - 2012

NEWSLETTER OF THE VANCOUVER AQUARIUM WILD KILLER WHALE ADOPTION PROGRAM



G clan whales travelling closely together in a silent group as they make their way along the rugged coast line of the Great Bear Rainforest.

PHOTO: LANCE BARRETT-LENNARD

Celebrate!

We turned 20 this year! That's 20 years of connecting with wonderful supporters like you and raising funds to protect wild killer whales. Find out more on page 2.

The constant of change

I'm writing this message in a pretty anchorage on the B.C. central coast. It's early in the morning and the only sounds are the calls of ravens, the patter of seabirds, the occasional plop of a jumping fish and the gentle lapping of water against the hull of the *Skana*, our trusty research boat.

The quietness of the air on the coast contrasts with the constant noise of the underwater environment. In the last two months of field work, we've listened to the croaks of rockfish, the hissing of barnacles and mussels on rocky shores, the tumbling of gravel on distant beaches, the strident chirps and squeaks of dolphins and the excited calls of feeding killer whales.

We've also heard the whine of outboard engines, the rumble of distant tug boats and the din of freighters. All marine mammals and some fish need to hear sounds to hunt, navigate and communicate. As I reflect on the slow

recovery of our coast from overfishing, pollution and poor logging practices, I'm struck by the barrage of noise these creatures will face if the sounds of oil tankers are added to the mix, as may happen in the next few years.

Several of the articles in this, the landmark 20th edition of *The Blackfish Sounder*, touch on underwater sound—as did one in the first edition and many others over the years. It's a topic that we researchers find endlessly fascinating—I hope you agree!

Dr. Lance Barrett-Lennard
Head, Cetacean Research Program
Vancouver Aquarium



PHOTO: LANCE BARRETT-LENNARD

The Vancouver Aquarium Wild Killer Whale Adoption Program launched in 1992 raises funds to support groundbreaking research on wild killer whales—research that is proving essential in the effort to protect these magnificent animals and their habitat.





PHOTO: VANCOUVER AQUARIUM ARCHIVE

Dr. John Ford conducting field work in Johnstone Strait in the early days of the Wild Killer Whale Adoption Program.

Mike's three-day adventure

This past winter a new—and controversial—way to track the movements of the endangered southern resident whales was tried, with limited success.

On Feb. 20, a research team from the U.S. Northwest Fisheries Science Center shot a small GPS tracking unit into the dorsal fin of 21-year-old **Mike** (J26) while J-pod was traveling in Juan de Fuca Strait.

The tag unit includes barbed darts that were designed to stay in place for up to three months. The tag fell off after three days, but stayed on long enough to show Mike and presumably the rest of J-pod swimming back and forth off the mouth of Juan de Fuca Strait.

The intent of the study is to learn more about the whales' winter habitat and prey. Critics say that scientists already know what the whales need—more chinook salmon—and that the risk of injury or infection from the dart outweighs the possible benefits.

The research team has been permitted by the U.S. government to tag up to six southern resident killer whales.

Mike (J26) photographed after the satellite tag came off.



PHOTO: VALERIE SHORE

HAPPY BIRTHDAY TO US!

The Vancouver Aquarium Wild Killer Whale Adoption Program celebrates its 20th anniversary this year!

It all started in 1992 when Dr. John Ford, head marine mammal scientist at the time, asked Vancouver Aquarium CEO Dr. Murray Newman if he could conduct more field research on killer whales. John had been involved in killer whale field work since the late 1970s and the work was becoming increasingly relevant to conservation.

The answer was simple: "Yes, but we don't have any money to support it." And that's how the Adoption Program was born. We're proud to say we've stuck close to our roots and, although our mandate has expanded slightly, our goal is still the same—to support the long-

term field research needed to make informed decisions about the future of B.C.'s marine mammals and their habitat.

Twenty years has given us the opportunity to connect with people around the world, from young children to the elderly. It's a joy to share accounts and stories about real whales that we know individually. We also know that our updates can bring tears when a beloved whale passes away—testimony to the strong passions these magnificent animals evoke. Your support of the Adoption Program makes our ongoing research possible. Thank you and we hope you are looking forward to the next 20 years as much as we are!

WHALES WIN—AGAIN

Protect killer whale habitat—it's the law.

That, in a nutshell, is what Fisheries and Oceans Canada (DFO) has been told—for the second time—by a federal court.

This February, the federal Court of Appeal dismissed an appeal by DFO to part of a precedent-setting 2010 ruling by a federal court judge that the government agency had failed to legally protect critical killer whale habitat as required by Canada's Species at Risk Act (SARA).

The other party in the appeal was a coalition of environmental groups represented by Ecojustice. "In

upholding the original ruling, the Court of Appeal has confirmed that it's time to get on with the business of actually protecting these killer whales," said Margot Venton, a staff lawyer at Ecojustice.

In Canada, southern resident killer whales are classified as endangered and the northern residents are listed as threatened. Under SARA, a recovery plan must be implemented for all listed species.

In dispute was whether "critical habitat" under SARA extends to food supply and the quality of the marine environment, and whether other laws were adequate to provide protection.

STUDY REVEALS KILLER WHALE HOTSPOT

We now have a partial answer to that lingering mystery—where do B.C.'s resident killer whales go when we're not seeing them, especially in winter?

For years, it's long been suspected that Swiftsure Bank at the mouth of Juan de Fuca Strait is important to the whales. So what better way to find out than to anchor an autonomous recorder (hydrophone) to the ocean floor and eavesdrop 24/7 on passing whales? And that's exactly what Fisheries and Oceans Canada researcher Dr. John Ford did.

"The seasonal movements of the whales are very well known off eastern and southern Vancouver Island," says Amalis Riera, a University of Victoria graduate student working with Ford. "We want to know what happens out there year-round. When do killer whales use the area and who are they?"

Riera analyzed more than a year's-worth of data collected by the hydrophone. She used sound spectrograms—voice pictures generated from the

data—to identify killer whale calls in the recordings and then logged who they were, when possible.

She also devised a system to separate one whale encounter from another, and to assess whether the whales were just passing by or spending quality time there to feed or socialize.

The results? Swiftsure Bank is a hotspot for killer whales—all year round. Southern residents are there every month of the year, especially summer. Transients are there year-round, more so in fall. The biggest surprise—northern residents also hang out there a lot, mainly in spring and fall.

"We knew we would find killer whales at Swiftsure, but we were all surprised at how many and how often," says Riera. "Clearly this area is important to them."

"This study has gone a long way toward collecting the data needed to designate this area as critical habitat," says Ford. "It might even be considered future critical habitat for both resident populations."

SLICING THE CHINOOK PIE

It's estimated that up to 1.8 million chinook salmon will be needed annually to support the recovery of B.C.'s resident killer whale populations.

Problem is, since the late 1970s, chinook abundance on the BC coast has dropped by almost 50 per cent.

So how can we balance the needs of killer whales, chinook salmon and humans?

That was the focus of three workshops hosted this past winter by Fisheries and Oceans Canada and the US National Marine Fisheries Service. Among those attending were fisheries managers and marine mammal scientists, including the Wild Killer Whale Adoption Program's Dr. Lance Barrett-Lennard.

A fourth workshop is scheduled for this fall. "It will focus on whether and how fisheries plans can be adjusted to ensure that killer whales have enough food," says Barrett-Lennard.

Chinook stocks originating from the Fraser River system are of the greatest overall importance for resident killers. But the whales rely on a range of chinook stocks along the coast at different times of the year.

"We need to know what time of year the food bottlenecks are happening," says Barrett-Lennard. "There is consensus emerging that winter is usually the hardest time of year for the whales, so our first task may be to ensure a good supply of chinook in the winter."



PHOTO: JOHN FORD

Why do killer whales rub?

The question is actually why do northern resident killer whales rub, since no one has ever seen southern residents or transients engage in this behaviour.

Only a few beaches are used for rubbing, all of which are steep and feature highly polished stones about 1.5 inches in diameter—some flattened, some resembling large Smarties.

The whales typically get very excited when approaching them, vocalizing often. Once they reach the beach they expel big burps of air, sink to the bottom, and one or two at a time, sensuously rub their bellies and flanks along the pebble bed.

Rubbing sessions usually last about 20 minutes and are very ritualized, says the Aquarium's Dr. Lance Barrett-Lennard. "It's not a free-for-all. There seem to be conventions or rules about how they do it."

Only the whales know for sure why they rub. But all signs point to it being a shared cultural event that reinforces group cohesion. "It's similar to us eating a meal together or going to church," says Barrett-Lennard. "These types of things demonstrate our willingness to follow group conventions, whatever they might be."



A southern resident playing with its food.

PHOTO: VALERIE SHORE

A playful little whale

"She was one of the most darling and affectionate little whales in this endangered population," says Ken Balcomb of three-year-old L112, whom he christened "Victoria" for the city near where he first saw her in 2009. "She will be sorely missed by humans and the whale population."

Victoria's loss is doubly tragic because as a future mother she was a bright hope for the recovery of L-pod, which has few young females.

Everyone waited anxiously this spring for news of Victoria's close relatives, especially her mother, L86, and her seven-year-old brother, L106. Victoria never swam far from them. Were they also injured or killed?

Thankfully, Victoria's family members were all identified in an April 29 encounter off Westport, Washington. But it deepens the mystery. Considering the nature of Victoria's injuries, how did the other whales escape unscathed?

Three other southern resident whales are missing this year—two older L-pod females and teenage male J30. "Their disappearances may have nothing to do with what happened on the outer coast," says Balcomb, "but it's all part of the discouraging trend of this population to not recover."



A US Navy ship passing through southern resident critical habitat

PHOTO: VALERIE SHORE

ANOTHER BLOW FOR SOUTHERN RESIDENTS

What killed L112?

It's a mystery that has raised some disturbing questions about the safety and long-term future of the endangered southern resident killer whale population.

The battered body of the three-year-old female calf washed up on a beach on the outer coast of Washington State on Feb. 11. A necropsy showed significant bruising and swelling on both sides of her head and along the right side of her body.

What caused these fatal injuries remains unknown, but many experts believe the wounds were consistent with a powerful percussive force hitting her right side.

"I think there was an explosive or intense acoustic pressure wave that this little whale was too close to," says Dr. Ken Balcomb, director of the U.S.-based Center for Whale Research. "It was not a vessel strike kind of event, which leaves a noticeable dent or abrasion."

L112 likely died somewhere near the mouth of the Columbia River, which lies within a large military training range used for bombing and sonar exercises by the U.S. Navy. To the north—at the mouth of Juan de Fuca Strait—is a training range used by the Canadian

Navy for similar exercises. The region is a designated dumping ground for military explosives.

Both navies deny any involvement in the whale's death, although the Canadian Navy confirms that in early February it used sonar and two "small" underwater charges as part of an anti-submarine warfare exercise in Juan de Fuca Strait.

Both navies stress that they use established marine mammal mitigation protocols when deploying explosives or sonar. But critics argue these measures are inadequate and that these types of military exercises should not be taking place in the critical habitat of an endangered species.

"It's clear to me that if the whales are not in inside waters, they're along the outer coast," says Balcomb, a former Navy man. What happened to L112 may never be fully known, but Balcomb vows to keep pushing for answers. At the very least, he notes, L112's sad demise has galvanized "whale defenders" to keep a sharper eye on where the whales are and what sort of human activities are taking place on the coast.

OCEAN NOISE—A GROWING CONCERN

In the Pacific, background (or ambient) underwater noise levels have doubled every decade over the past 40 years. What are the sources of these sound? What are their potential effects? And what knowledge gaps do we need to fill to better manage marine sound disturbance?

These and other questions were the focus of a two-day workshop this February on ocean noise in Canada's Pacific, convened and sponsored by the World Wildlife Fund-Canada. In attendance were almost 40 researchers, regulators, and representatives of port authorities and conservation interests.

Among the organizers was Vancouver Aquarium research associate Kathy Heise, who has studied marine mammals and acoustic disturbance for more than 25 years.

"Intense sound does more than disturb marine mammals," says Heise, who co-authored the workshop report. "It can affect their ability to feed, breed and communicate, or temporarily or permanently damage their hearing. And a deaf marine animal is a dead marine animal."

Sessions on the first day looked at potential impacts of noise from shipping, industrial activity, seismic exploration and naval exercises in B.C and described

current research and monitoring activities. Second-day sessions looked at case studies of noise management in other areas and ways to incorporate noise into future decision-making.

Presentations by whale researchers who live in remote, quieter areas of the coast struck an emotional chord with participants, says Heise. "The images were stunning and the audio hauntingly beautiful. They were a vivid reminder of why we should care about the noise we are introducing into the marine environment."

On a less positive note, but equally compelling, was a presentation on over twenty emerging projects on the B.C. coast, including oil and gas transport, port expansions and renewable energy. "I think everyone in the room was surprised at how many developments are being proposed, especially for the north and central coasts."

The workshop was an invaluable first step in bringing together people with diverse but significant interests in anthropogenic noise, says Heise. "It was clear that we must continue to work toward bringing this issue into future marine planning processes."

For more information visit www.wwf.ca/conservation/ocean_noise_workshop.cfm

Study measures ocean noise

How noisy is the environment that killer whales live in?

This is the main question driving a multi-year study of ambient noise in the critical summer habitat of southern resident killer whales off southern Vancouver Island.

"Using various techniques, our study is measuring natural and manmade noise levels at various time scales ranging from hourly to seasonal," says Dr. Harald Yurk, a cetacean acoustics specialist and research associate with the Vancouver Aquarium. He's working with Paul Cottrell, marine mammal coordinator with Fisheries and Oceans Canada in B.C.

Natural noise sources in the ocean include rain, wind and seismic events such as earthquakes. Manmade noises include marine construction, military activities and shipping, which has tripled over the last four decades.

"When noise from human sources is added to natural noise it impacts the ability of the whales to navigate, locate food and communicate," says Yurk. "It's important to know when that happens and how often so that we can determine what impact this may be having on their survival."

"The results will be used to identify effective ways to deal with ambient noise levels for killer whales based on where, when and what type of mitigation is appropriate," says Yurk.

The study will eventually be extended to cover areas in the critical habitat of northern residents.

L112 in 2011 breaching high out of the water

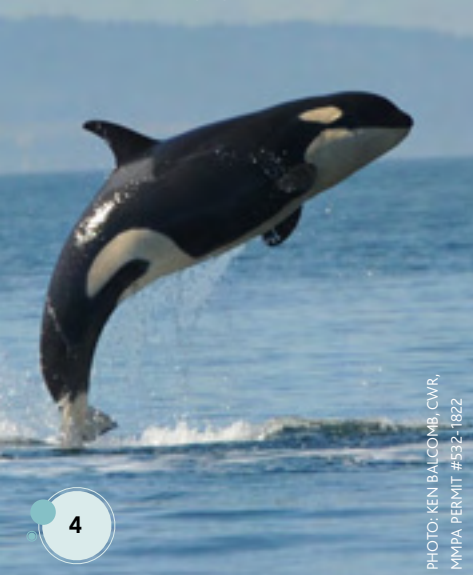


PHOTO: KEN BALCOMB, CWR, MMPA PERMIT #532-1822



J pod traveling in a tight group in Haro Strait - a major shipping channel for large vessels making their way into Vancouver harbour.

PHOTO: BARBARA BENDER, CWR, MMPA PERMIT #532-1822

Celebrating a remarkable rescue

This past July the 10th anniversary of the only successful rescue and release of a wild killer whale, **Springer** (A73), was celebrated in Telegraph Cove, B.C. Memories were shared, making everyone—whether they were originally involved or not—feel like they had been there.

A common sentiment was that the operation worked because all parties involved came together to do what was best for the whale. Putting differences aside, they trusted each other to work towards the common goal of getting Springer healthy and reunited with her family.

“Everyone cheered when Springer was released, yet she wasn’t immediately accepted back by her family,” recalls the Adoption Program’s Dr. Lance Barrett-Lennard, a member of the rescue team. “She shadowed her relatives for the better part of a week before she was finally taken into the matriline of her great aunt **Yakat** (A11)”.

Ten years later Springer is healthy and well socialized. Everyone is waiting with fingers crossed for the day she has a calf of her own. A 15th-anniversary celebration is already in the works.

PHOTO: LANCE BARRETT-LENNARD

ORCA UPDATE

2011 was a good salmon year, which made for happy, plump resident killer whales. But unfortunately that bounty didn’t translate into any significant growth in resident populations, and southern resident numbers remain precariously low.

In contrast, the increase in the transient population that we told you in the last issue (no. 19) has continued, and transients are now seen more regularly along some parts of the coast than resident killer whales.

In 2011 there were five new mothers in the adoption program. The A30 matriline welcomed **Clio’s** (A50) third calf, **A99. Sunny** (A70), in the A11 matriline, has her first baby, **A100. Kimsquit** (R13) is keeping the R7 matriline going with the birth of her second calf, **R57**. And **Sharbau** (G31), the matriarch of the G31 matriline, welcomed her fourth youngster, **G96. Tasu** (T2C) is contributing to the transient killer whale boom with the birth of her third calf, **T2C3**.

Six youngsters, all born in 2010, join the adoption program this year.

- **Rainy** (A96) is the sixth calf of **Simoom** (A34);
- **Kalect** (A97) is the first calf of **Nahwitti** (A56);
- **Kiwash** (D26) is the second calf of **Fisher** (D17);
- **Nuchatlitz** (G94) is the first calf of **Tatchu** (G52);
- **Notch** (J47) is the first calf of **Tahlequah** (J35);
- **Radar** (G84), a young male born in 2007, is the third calf of **Sharbau** (G31).

Nasparti (B17) with his uncle Yuculta (B14)



PHOTO: LANCE BARRETT-LENNARD

Amid the good news, we say goodbye to a few old friends this year. Last year’s update reported that **Nodales** (A51) and her second calf **A98** were missing. Sadly they have not been seen since and are now presumed dead. We also bid farewell to **Skeena** (A13), **Raven** (B15), **Cosmos** (C17) and **Sunday** (A92). Skeena was in his thirties, which is fairly old for a male killer whale, but Cosmos and Raven were in the prime of life and Sunday was just a youngster.

Among the southern residents, 47-year-old **Tanya** (L5) is missing and presumed dead.

In other news, we now know that **Hope** (A80) and **Nasparti** (B17) are boys, and **Kestrel** (C24) is a girl! It’s rare to know the gender of young killer whales but researchers have a trick that sometimes gives them a hint—if a young calf travels more closely with an older male rather than its mother, it’s likely the calf is a boy. Nasparti, who’s only four years old, was regularly seen traveling with his uncle **Yuculta** (B13) instead of his mother and a glimpse of Nasparti’s belly last year confirmed his gender.

And boys will be men! **Rocky** (T2C1) has started to “sprout,” the term used to describe the upward growth of a male’s dorsal fin as he approaches sexual maturity.



Nahwitti (A56) and her first calf Kalect (A97)

KILLER WHALE CULTURE

The most fascinating thing about killer whales is, arguably, the existence of distinct populations that rarely if ever interact or mate. Killer whales are highly mobile animals – so what keeps them apart?

Answer: the same thing that separates many human societies, cultural differences. Killer whales associate and mate with individuals with which they share vocal dialects and other cultural traditions.

In humans, languages carry traces of the history and movement of populations, with recently-separated populations sounding most similar. Using the same logic, a new study led by Dr. Olga Filatova, a Moscow-based researcher who served two terms as visiting scientist at the Vancouver Aquarium, compared resident killer whale dialects to determine whether geographically-close populations split most recently and thus sounded more similar.

To their surprise, Filatova and her colleagues found no relationship between geographical closeness and dialects.

RESEARCH WITH A PORPOISE

As the smallest and most bashful cetaceans on the BC coast, harbour porpoises don’t generally stir the same passions in us as their larger and more charismatic killer whale cousins.

Well, Carla Crossman might disagree. She’s a master’s student at the University of British Columbia and she’s looking at the relatedness between groups of harbour porpoises on the BC coast to see whether there are smaller isolated populations or one single large population. The results of her study, which is funded by the Adoption Program, can help policy-makers make decisions about harbour porpoise conservation.

The porpoises—which are dusky grey-brown in colour and about 1.8 metres long—are common year-round in coastal areas of B.C. They share this habitat with the

Furthermore, they found that the number of “monophonic” calls, used for short distance communication, was greatest in large populations like the Kamchatka residents of the Russian Far East, while the numbers of longer-distance “biphonic calls” was greatest in small populations like the southern residents of B.C. and Washington.

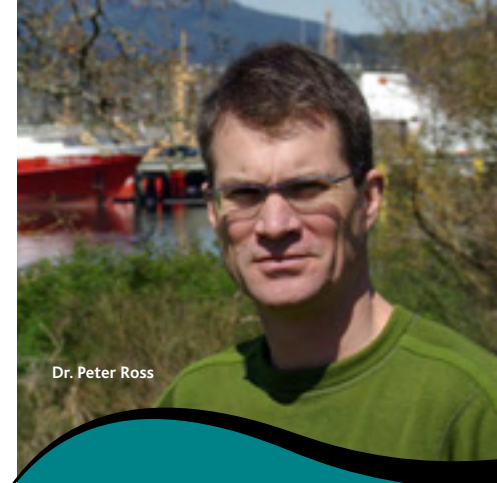
Biphonic calls may reduce inbreeding by helping individuals recognize their close relatives so they can avoid mating with them. If so, the lower risk of inbreeding in large populations may mean they need fewer biphonic calls. It will take more research to determine whether forces driving the evolution of monophonic and biphonic calls have eliminated traces of population splits or whether populations tend to move away from each other after splitting.

In this study, like so many others, killer whales have proven to be extraordinarily complex. Take home message: killer whale research, fascinating as it is, is not for the faint-hearted!

more extroverted Dall’s porpoise, a black and white speed demon that often likes to ride on the bow wave of passing boats.

Crossman has been collecting DNA from skin samples taken from stranded harbour porpoises to determine how closely related they are in a given area. The results so far are surprising. “We already knew there are harbour-Dall’s porpoise hybrids, but it appears there are many more than we originally believed. Sometimes hybrids look distinct, and sometimes they don’t.”

What does this mean for harbour porpoise biodiversity? Stay tuned for more updates as Crossman learns more about this enigmatic species.



Dr. Peter Ross

Contaminants research takes a hit

One of the world’s leading experts on environmental contaminants—and a familiar name to anyone who follows the fortunes of B.C.’s killer whales and their marine environment—is losing his job as Fisheries and Oceans Canada (DFO) axes its entire contaminants research program.

As a research scientist with DFO’s Institute of Ocean Sciences near Victoria, Dr. Peter Ross has led investigations on everything from pollutant trends in harbour seals, to the effects of pesticides on salmon, to contaminant risks in traditional seafood of First Nations and Inuit peoples.

Ross is perhaps best known for his landmark studies on contaminant levels in resident and transient killer whale populations. These studies show that B.C. killer whales are among the most contaminated marine mammals on the planet, with heavy loads of chemicals such as PCBs, dioxins, and flame retardants (PBDEs) in their blubber.

“These animals are sentinels for the state of our global environment,” says Ross. “They’re telling us that there is something very wrong about the quality of our food chain.”

“The withdrawal by the federal government from research, monitoring and enforcement related to ocean pollution is disappointing. This ultimately places at risk the food supply for endangered killer whales, as well as the Aboriginal communities that rely heavily on coastal resources.”

PHOTO: NEIL FISHER



Lance operates the Skana, an essential member of our research team, through Hakai Pass off the remote BC Central coast.



PHOTO: JEREMY LEVIN

COASTAL EXPLORATIONS

by Meghan McKillop

Someone pinch me! It can sometimes be hard to think of field work as part of your day job or actual “work.” Don’t get me wrong, it’s not always fun and games—the days are long and the weather can be challenging at times, but when you’re surrounded by a group of killer whales off the rugged B.C. coast, it’s a reminder of how lucky I am to have a job I love.

In 2008 the Vancouver Aquarium Cetacean Research Lab acquired a brand new research vessel—generously donated by an Aquarium research supporter from Alberta, Matt Campbell—specifically for wild killer whale research. The vessel was named ‘Skana’ after the first killer whale kept at the Vancouver Aquarium and is loosely based on the word S’qana which means killer whale in the Haida language.

Having our own research vessel has opened doors for more research opportunities. In summer 2009, Dr. Lance Barrett-Lennard, head of the cetacean research program, extended his killer whale field studies to the remote and stunningly beautiful waters of the Great Bear Rainforest

on B.C.’s central coast.

“It’s an area I’ve been interested in for many years and it hasn’t been covered well by other research colleagues,” says Barrett-Lennard. Working with Aquarium research staff, associates and volunteers, he’s documenting how the whales use the area. And, as part of a 25-year collaboration with Fisheries and Oceans Canada, he’s contributing to B.C.’s long-term killer whale monitoring project.

The central coast is a vast area and one thing we’ve realized is how much things can change from one year to the next. The past four field seasons have shed some new light on the importance of the region to killer whales. For example, the northeastern part of Queen Charlotte Sound near Calvert Island appears to be a summer feeding hotspot for northern residents.

“I’m very enthused about the area and plan to continue studying its killer whales—and other marine mammal species—for many years to come,” says Barrett-Lennard.

Acknowledgments

On the 20th Anniversary of the Vancouver Aquarium Wild Killer Whale Adoption Program we’d like to extend a very big thank you to the following people who continue to lend their time and energy to the adoption program: Graeme Ellis, for giving us access to the northern resident and transient ID photos; Ken Balcomb for giving us access to the southern resident ID photos; Jared Towers, John Ford, David Ellifrit, Ken Balcomb, Alexandra Morton and the many other contributors to the photo ID study that makes this program possible. A very special thank you to the following adopters and extended members who have been with us since the first year the program started; Heidi Alberti, Jon Bartol, Mark and Susan Bullock, B. Burke, Shaunna and Phil Chagnon, Bonnie Dvorchik, Carolyn Gunstone, Jack and Anne Hamilton, Karen and Stan Hutchings, Janet Johnson, Barbara and Melanie Keen, Gary Kohl, Sharon Newman, Amelia Orr, Bridget Pavitt, Tyler Peacock, Lorna Schreiber, Barbara Solberg, the Graham Family, the Nesbitt Family, Gail Graham, Sandra Tombu, Mark Trevorrow, Joan Wilson, Brad Prostebby, Sarah Gerow, Jeremy Broadfield and Darlene Sherritt. And thank you to the following research ambassadors who made very generous contributions in 2011; Matt Campbell, Barbara Lemberger, Nomad Travel, Aplin & Martin Consultants Ltd and TMA Resources Inc. Finally, a heartfelt thank you to all whale adopters for continuing to make this program possible.

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