



Marine Mammals Are Complex Creatures

Orca Intelligence

By Heir Abirami Subramanian, November 2019



Imagine you are in the ocean swimming. You are not a human. You are a graceful black and white creature chasing after your prey and you are trying to target your prey by sending out sound waves through the ocean. Oh! The sound waves you sent through the water hit something that is moving and is coming back to you from the same place you last sighted your prey. You have located your prey and are now rushing after your tasty meal. But then you hear a noise. A huge cargo ship is coming your way. You send out a sound of warning to your group, but you can't hear anything coming back. You are so confused, as loud sounds bombard your brain. There is nowhere to go. You are an orca, and this is your life. My name is Abi and, is it only me, or do loud sounds put your thoughts off track and make you think "what, what?" and feel a little confused. And then you blame that truck that passed by as you think "you truck, you ruined my train of thought!". Well think of this but 10 times worse. This is what orcas are feeling on a daily basis every time a ship passes by. My name is Abi, and I love these amazing creatures called orcas who are complex creatures that are like us.

Orcas are marine mammals. As one of the top predators, they are a key part of the marine ecosystem, which would be very different without them. But at the same time, they are social and

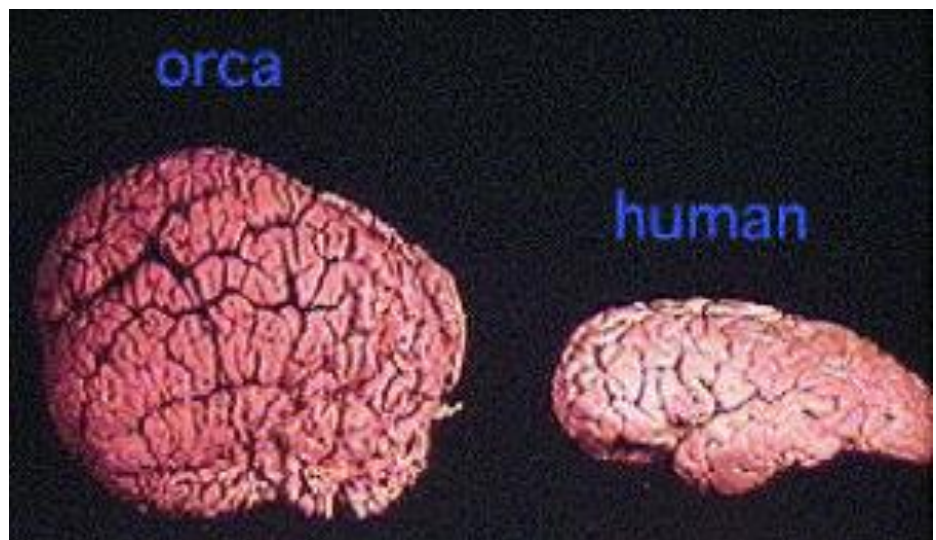


Figure 1: Orca brain compared to a human brain

Source: Center for Whale Research

emotional beings. Orcas (which is how I will refer to them in this paper) are also known as "killer whales", and their scientific name is *Orcinus orca*. They are the largest dolphins. They can reach sizes from 8.5 meters (27.88 feet) for females up to 10 meters (32.8 feet) for males in length and a weight of about 16,500 pounds (7,500 kg) for females and 22,000 pounds (10,000 kg) for males.^[1]

Now, here is a question for you. How many times bigger do you think an orca's brain is compared to ours? The answer is around 4 times bigger. If we have big brains, then orcas have HUGE brains! Because of these big brains, orcas and other cetaceans have formed complex emotional and social lives.^[2] In this paper, I am excited to share with you what I have learned about orcas, and in fact, how similar they are to us in so many ways that most of us are unaware of.

Different Dialects

Did you know that there are many different orca populations around the world? Orcas are split up into different global ecotypes. An ecotype is a group of organisms, normally a subordinate



Figure 2: The numerous ecotypes of orcas

Source: NOAA Fisheries

division of a species, that is adapted to a certain habitat. Orcas, as a species, are split up into 10 different ecotypes:

1. Antarctic Type A Orca
2. Pack Ice Orca
3. Gerlache Orca
4. Ross Sea Orca
5. Subantarctic Orca
6. Resident Orca
7. Transient/Bigg's Orca
8. Offshore Orca
9. Type 1 Eastern North Atlantic Orca
10. Type 2 Eastern North Atlantic Orca

Each one of these ecotypes have unique markings, prey preferences, and other characteristics that separate them and define who they are and what habitat they live in.^[1]

This is kind of like us, right? We populate the world and each of our global populations adapt to our surroundings through what clothes we wear, what we

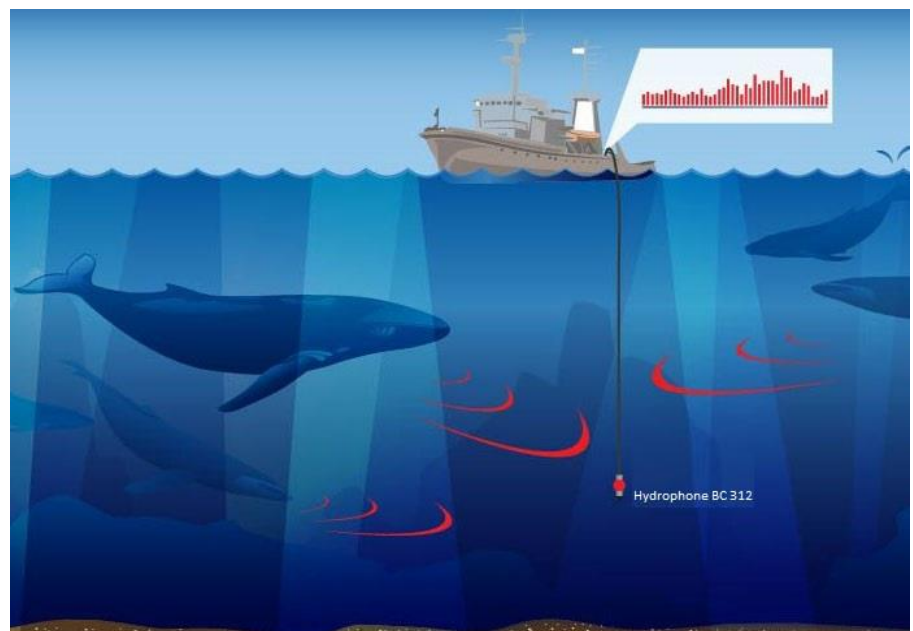


Figure 3: An example of how scientists use hydrophones

Source: ZETLAB

eat, how we act, and so on. Considering this, there is one trait we share with orcas (and other cetaceans, which include dolphins, porpoises, and whales) that most of us are not aware of - language.

According to the New Scientist, a Canadian scientist Dr. John Ford, found that orcas “speak” numerous “languages” or “dialects.” Dr. Ford is a curator of marine mammals at Vancouver Public Aquarium. He says that these dialects are composed of sounds that are emitted when orcas echolocate or communicate underwater by emitting sound waves. Dr. Ford has studied a population of 350 orcas which were living off the coast of British Columbia and northern Washington state. These orcas are separated into two different communities- the Northern Resident community which is made up of 16 pods and ranges from north of mid-Vancouver Island to the southern tip of Alaska; and the slightly smaller Southern Resident community which is made up of 3 pods that range from the border of the northern community all the way south to places like Puget Sound and Gray’s Harbor near Seattle. Since sounds made by orcas are audible to the human ear, Dr. Ford has found it easy to record their communication. He dangles a device called a hydrophone over the side of a boat. This takes the sounds from these orcas, amplifies them, and records them digitally. Through this process, Dr. Ford has been able to classify the calls - the dialects - of each of these pods. He has found that often times a pod makes 12 distinct calls and that all members of the pod can make the full set of 12 sounds. Dr. Ford said that this system of calls, both in quantity and quality, differs from those of other whale and dolphin groups. What Dr. Ford believes is that the calls form a complex code of pod identity and that this is especially important when many pods swim

together, forming a superpod. He said: “I think as time goes on, we’ll get a much better appreciation of just how remarkably adapted whales . . . are to their unique environment.” I personally think that we are on our way to just that. ^[3]

Complex Relationships

Here are some questions for you: Who is the head figure of your family? How close are you with your

parents? Have you been with your parents your whole life? Not surprisingly these questions apply to the social life and relationships

between orcas as

well. Let’s start with



Figure 4: A pod of orcas swim

Source: The Washington Post

the first question; who is the head figure of your family? Orcas are part of a matriarchal society, so every orca is a part of a specific pod that follows the lead older female. Professor Darren Croft, who is a behavioral ecologist at the University of Exeter in the United Kingdom and some of his colleagues looked at southern resident orcas. These orcas are in groups of 80 individuals and spend most of their time in waters around Seattle, Washington and feed mainly on salmon.

Using observational data for the southern residents from 1976, the team determined that menopausal females acted as group leaders during movements in and out of their foraging areas. Through this, they found that females are more likely to lead the group than males and that females over 35 years of age often lead more than younger ones. Not only this, the older these females get, the more related they become to their group. This is because all of these females have had time to have children who integrate with the pod rather than a new female who is not at that stage yet. “A lot boils down to how the groups are structured,” says Professor Croft, “it is also an advantage to have a menopausal orca stick around and help their relatives survive, in the context of evolution.”^[4]

Second question, especially male orcas need their mothers to survive. According to *Science*, a study of almost 600 orcas shows that having a mother around increases a son’s chances of survival.



Figure 5: An example of orca fin identification

Source: Orca Network

Starting in the 1970’s, a group of scientists led by Prof. Darren Croft did a study tracking orcas that lived off the coasts of Washington and British Columbia. These scientists took pictures of orcas’ dorsal fins and used those pictures to map out patterns of births and deaths. Then, after analyzing these data, Professor Croft and his team did independent calculations for orcas whose mothers had passed versus orcas whose mothers were still alive. They found that for

sons, losing a mother was a huge impediment. In fact, younger males were likely to pass the year after their mother passed. And if males are over the age of 30 their chance of death increases by 8 times if they lose their mothers. Younger daughters, on the other hand, are not affected at all by the passing of their mother; but older daughters are 2.7 times more likely to die. Researchers do not know why mother and son orcas share such a strong bond compared to mother and daughter but what we do know, as Robert Pitman a marine ecologist at the National Marine Fisheries Service in San Diego said, is that “For them, just like us, family matters.”^[5]

Implications of Noise Pollution

A recent study to understand noise pollution done by observing Southern Resident orcas found that “Combined with dwindling salmon stocks and persistent chemical pollutants, noise is one of the top threats to the remaining resident orcas.” In fact, “At the noisiest times in their critical habitat, southern resident killer whales can lose an estimated 97 percent of their opportunity to communicate in their close-knit pods, which is critical to coordinating their hunting, staying safe and finding mates.” Mid-late last year, for about 2 months, there was a slowdown planned and enacted upon in the Haro Strait between San Juan and Vancouver Islands where more than 60% of vessels complied and noise pollution was reduced by 44% (2.5 decibels). The overall goal set by the International Whaling Commission nearly a decade ago was 3 decibels (53% reduction). As biologist Rob Williams of the Oceans Initiative said, “What we have to do next is to have some really uncomfortable conversations. . . about how much of this acoustic space do we think it is fair to ask the whales to give up and how much are we

willing to give up to have killer whales persist?"^[6] We now eagerly await the results of all this work.

A Call to Action

I think that we need to build on this good work and go further. We start by approaching big companies like Amazon and make them more aware of this issue and have them comply more broadly for longer periods of time. The idea of oceanographer and ocean acoustics expert Scott Veirs of grading ships depending upon the level of underwater noise they generate resonated with me and is a great idea to build upon.^[6]

Towards this, as an Heir To Our Oceans, I request all of you to join me in raising awareness of this issue. Please support my petition to request Amazon.com to increase their awareness of this issue and commit to choosing quieter container ships. (Details of the petition here).

I want to end my paper on a modified version of a message one of my experts offered me regarding the successful return of the Harbor porpoise to the bay area. As Bill Keener of the Golden Gate Cetacean Research said "If you clean it up, they will come." My modified hopeful message is "If we reduce the noise, they (the orcas) will come."

Heirs To Our Oceans is creating the next generation of environmental leaders.



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