

**CONTRIBUTIONS TO
THE GLOBAL
MANAGEMENT
AND CONSERVATION OF**

MARINE MAMMALS



**INGRID NATASHA VISSER
JORGE CAZENAVE
(ORGANIZERS)**



**EDITORIA
ARTEMIS
2021**



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PREFACE

Contributions to the Global to Management and Conservation of Marine Mammals.

I write the introduction to this book after just having returned from a day out researching wild orca along the New Zealand coastline. During that encounter I had the opportunity to not only see the orca hunting for rays in the shallow waters, but an adult male orca, known to me since he was born, became stranded as he followed his family over a sand bank. His calm demeanour was indicative to me that he had experienced such an event before. Whilst stranded, he patiently tested the water depth, and his ability to get off the sand bank, by gently rolling from side to side every 10 mins or so. During the time that he was stranded our team poured water over him in order to prevent his skin drying out. Eventually the tide had returned enough for him to focus all his energy into getting off and into deeper water. Within minutes of freeing himself he was back with his family and within an hour he was catching rays again. It struck me as I was watching him, that he was around 30 years old, older than I was when I started studying his family. The changes he had seen in his lifetime are changes that I've documented too. Encroachment into his habitat with new marinas, wharfs, reclamation and dredging. Exclusion from prime hunting area from all of these man-made features as well as aquaculture farms expanding so fast it is hard to document them all. He has seen the numbers of vessels increase exponentially and the volume of noise pollution expand with it. He has experienced raw sewage flowing around him when he has entered into harbours and he has swum past floating garbage and viewed sunken junk discarded in his home. He has seen members of his social network drown when entangled, die when stuck on a beach and suffer from severe wounds when hit by boats. It is a wonder he has survived as long as he has with all this and more that he must contend with. But, despite all these negative aspects, there is some hope; New Zealand now has more than 30 marine reserves (protected areas to prevent fishing and habitat destruction). Although they are comprised of only a tiny part of the entire coastline, they are a start. I also see a growing number of scientists, lawyers, researchers and field biologists interested in contributing towards conservation and management issues. My hope is that this volume will provide a platform for some of those studies to reach a wide audience and to make a difference for individual cetaceans, their populations and the habitats that they not only live in but require to survive. The book is arranged by author, rather than, species, region or topic as the first two categories ranged across multiple species and around the globe and yet at times also overlapped, whilst the topics were just as diverse.

Ingrid N. Visser (PhD), New Zealand

In December 2019, the Society for Marine Mammalogy (SMM) and the European Cetacean Society (ECS) jointly hosted the World Marine Mammal Conference in Barcelona, Catalonia, Spain. That conference, the starting point for gathering the authors of this book, was the largest gathering of marine mammalogists that had ever occurred, with over 2,700 registered attendees, from more than 90 countries. It was only the second World Marine Mammal Conference, with the first being in 1998 in Monte Carlo, Monaco (and where approximately 1,200 people from 50 countries attended). With the Covid-19 pandemic now rampant across the globe it may be many years before such a similar gather occurs again. Regardless, the work of all those conference attendees will continue and this volume is just one of the many published works that are resulting from ongoing research.

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CHAPTER 1

ARGENTINEAN ORCA (*ORCINUS ORCA*) AS AN UMBRELLA SPECIES: CONSERVATION & MANAGEMENT BENEFITS

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ABSTRACT: When apex predators, and their habitat, are appropriately protected they can act as 'umbrella species' enhancing potential ecosystem-wide benefits. If combined with long-term studies of individually recognised animals, the positive spin-offs expand. At Punta Norte, Península Valdés, Argentina, a

unique ecotype of orca intentionally strands to capture sea lion pups. For 16 years our team of researchers has photographed individuals and documented their hunting. We have recorded multi-generational groups, the complexities of social networks and the success of individuals as parents and as hunters. Recognising a need to prevent tourists from disturbing their main prey in the area, the Punta Norte Orca Research team secured private donations and installed over 12 km of fencing to protect sensitive beach zones. Since the installation of the fence the number of orca have increased two-fold. However, the population is still at a critically low number of approximately 20 key individuals. We call for official recognition of this unique orca ecotype and their listing as endangered by the Argentinian Authorities as well as in the Red Data list of the IUCN.

KEYWORDS: killer whale (*Orcinus orca*), conservation, photo-identification, tourism impact, umbrella species

ORCA ARGENTINA (*ORCINUS ORCA*) COMO ESPECIE PARAGUAS: BENEFICIOS DE CONSERVACIÓN Y MANEJO

RESUMEN: Cuando los depredadores ápice y su hábitat están adecuadamente protegidos, pueden actuar como 'especies paraguas' y aumentar los beneficios potenciales para todo el ecosistema. Si se combina con estudios a largo plazo de

animales reconocidos individualmente, los efectos secundarios positivos se expanden. En Punta Norte, Península Valdés, Argentina, un ecotipo único de orca se encalla intencionalmente para capturar crías de lobos marinos. Durante 16 años, nuestro equipo de investigadores ha fotografiado individuos y documentado su caza. Hemos registrado grupos multigeneracionales, las complejidades de las redes sociales y el éxito de los individuos como padres y como cazadores. Reconociendo la necesidad de evitar que los turistas molesten a sus principales presas en el área, el equipo de Investigación de Orcas de Punta Norte consiguió donaciones privadas e instaló más de 12 km de vallas para proteger las zonas de playa sensibles. Desde la instalación de la cerca, el número de orcas se ha duplicado. Sin embargo, la población todavía se encuentra en un número críticamente bajo de aproximadamente 20 individuos clave. Pedimos el reconocimiento oficial de este ecotipo de orca único y su inclusión como en peligro por las autoridades argentinas, así como en la lista Red Data de la UICN.

PALABRAS-CLAVE: conservación, foto-identificación, impacto del turismo, especies paraguas.

1. INTRODUCTION

A. STUDY SITE

The Argentinean orca who intentionally strand to capture pinnipeds do so predominantly at Punta Norte (42°05'S, 63°46'W, Figure 1) which is found inside Estancia La Ernestina (an ecotourism lodge and sheep farm) on the north-eastern tip of Península Valdés. The peninsula is situated approximately 900 km south-west of Buenos Aires and is a UNESCO World Heritage Site in Patagonia. Protruding into the Atlantic Ocean, Península Valdés is characterized by a narrow isthmus, flanked to the north and the south by large gulfs, almost creating an island. Along the entire coastline there is a diversity of habitats, from high sandstone cliffs to large rock platforms with both sandy and gravel beaches between (e.g., see Bunicontro et al., 2017 for Golfo Nuevo examples).

The peninsula was lifted above sea level by the rise of the Andes (Codignotto, 2008) and it has two large inland salt lakes below sea level. The Andes mountains, along the western border of Argentina, capture most of the moisture streaming in across South America from the Pacific, creating a terrestrial biogeographical barrier (Aragón et al., 2011). As such, when the west winds blow they are typically dry by the time they reach the Atlantic side of the country, where Península Valdés is situated. The peninsula is also exposed to the cold southerlies roaring up the coast from Antarctica and, combined with the blustery winds coming in from the Atlantic, these generate a regional climate with scarce rainfall, strong (and often salt-laden) winds and cool temperatures. Although there is a narrow band of slightly increased rainfall (during extremely limited singularities and typically within June-August) along the coastline, the result creates a marine influence

on the vegetation (Coronato A., et al., 2017). However, overall the area is windswept, dry, dusty and is cool in the winter (average day and night temperatures of ~7°C in July) and warm in the summer (average day and night temperatures of ~18°C in January) (Coronato F., et al., 2017), although there are isolated pockets on the coast where the temperatures have been known to reach more than 25°C (Coronato F., et al., 2017).

The terrestrial biodiversity of the area is well recognised with at least 200 species of insects and spiders, 139 species of terrestrial birds, 23 species of native land mammals and 12 species of reptiles inhabiting the island-like peninsula (Daciuk, 1977; Baldi & Cheli, 2017, UNESCO Peninsula Valdés 2001-2017).

In addition to its terrestrial importance, it is a site of significance for a diverse range of marine macrofauna (Irigoyen et al., 2011) and megafauna including 29 species of teleost marine fishes (Galván et al., 2009), at least 10 species of elasmobranchs (Chiaramonte, 1998; Menni et al., 2008) and more than 15 species of shorebirds and seabirds (Daciuk, 1977; Couve & Vidal, 2003). This includes a minimum of four colonies of Magellanic penguins *Spheniscus magellanicus*, one of which is located inside Estancia La Ernestina at Punta Norte (Boersma et al., 2009), and at least seven species of marine mammals (López & López, 1985; Würsig & Bastida, 1986; Campagna et al., 1993; Nowak, 1999; Daneri et al., 2011; Zerbini et al., 2016).

When Peninsula Valdés was nominated and later ratified as a UNESCO Site, the listing specifically included four marine mammal species, emphasising how important these were to the biodiversity but also for the conservation and management of area;

*“Península Valdés contains very important and significant natural habitats for the in-situ conservation of several threatened species of outstanding universal value, and specifically its globally important concentration of **breeding southern right whales**, which is an endangered species. It is also important because of the **breeding populations of southern elephant seals and southern sea lions**. The area exhibits an exceptional example of adaptation of hunting techniques by the orca to the local coastal conditions.”* [emphasis added] World Heritage Committee (1999).

Southern right whales (*Eubalaena australis*) gather between June and December in the two gulfs that abut the peninsula and orca attacks on the species have been documented since at least the 1970's (Cummings et al., 1972; Thomas & Taber, 1984; Sironi et al., 2008). The peninsula has the only known continental reproductive colonies of Southern elephant seals (*Mirounga leonina*) worldwide. They come ashore between late August to early November to breed and give birth (Campagna et al., 1993). Although South American sea lions (*Otaria flavescens*) can be found around the coastline of Peninsula Valdés all year round, they concentrate in reproductive colonies, including at Estancia La Ernestina, in December and pup in January to early February (Vila et al., 2008).

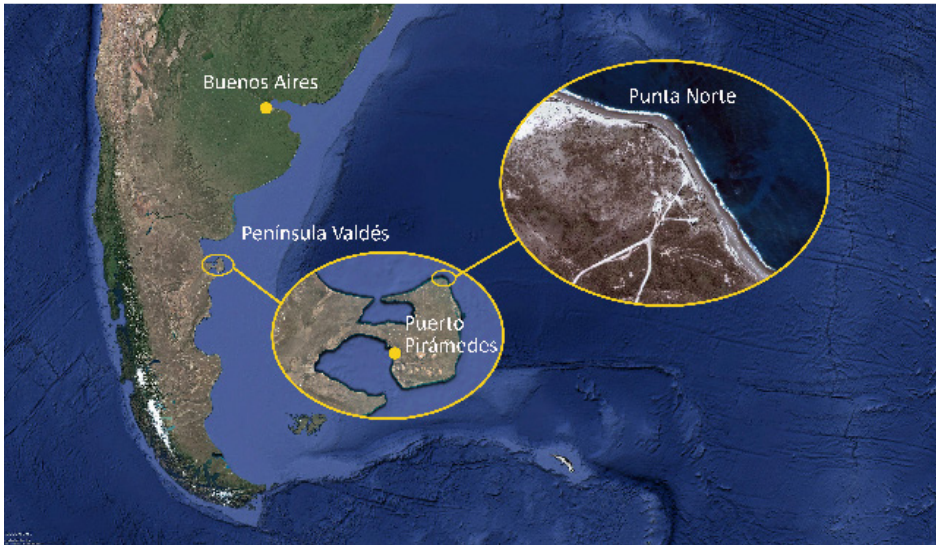


Figure 1. Punta Norte is on the northernmost tip of Península Valdés, situated approximately 900 km southwest of Buenos Aires. The whole peninsula, including the small township of Puerto Pirámides, is a UNESCO World Heritage Site, in Patagonia, Argentina. Image created by Punta Norte Orca Research, using Google Earth (2020).



Figure 2. An adult female known as Maga (catalogue # PTN-004) is accompanied by her daughters Valen (PTN-009) (middle) and Mica (PTN-008) (left), as she intentionally strands to capture a South American sea lion pup, at Estancia La Ernestina, Punta Norte, Península Valdés. Photo © Jorge Cazenave (2012).

B. ORCA BACKGROUND

Orca are perhaps one of the most recognisable of all the cetacean species (Ford, 2018). Although unlikely to be confused with other species, within the genus *Orcinus* there is substantial variation of morphological features at a population-level. These distinct populations, which have been defined not only by their morphology but also by

their genetics and ecology (with a strong emphasis based on their dietary differences), have resulted in what can be characterized as a 'species-complex'. Within that, the terms 'subspecies', 'races' 'populations', 'sub-populations', 'forms', 'geographic forms' 'morphotypes' and 'ecotypes' have all been used to describe the variations that can be found around the world (e.g., Reeves et al., 2002; Jefferson et al., 2015; Ford, 2018; Würsig et al., 2018).

In the UNESCO online listing for Península Valdés, the local orca and their specialised hunting method is highlighted a number of times, including some of the species which are prey for the Punta Norte orca;

"The small local population of Orca has developed a spectacular hunting method by intentionally stranding on the shores to catch offspring of Southern Sea Lion and Southern Elephant Seals." World Heritage Committee (1999).

We describe our more than 16 years of research on the orca who intentionally strand to capture sea lions (Figure 2). These orca exhibit what is arguably the most recognized hunting technique of the species, globally. Although individuals from this population have been documented along parts of the southern Atlantic coast of South America (Lichter, 1992b), this population is seen most frequently at Punta Norte, Península Valdés, Argentina (Figure 1) and as such they are known locally as the Punta Norte orca.

Yet, despite the population's notoriety and international exposure through multiple documentaries (e.g., see www.pn-orca.org/documentaries), for reasons unknown this ecotype is typically overlooked (or at best just briefly mentioned). For example, when the species-complex *Orcinus* is discussed, including on orca ecotype identification 'posters' or in general marine mammal reference and guide books, they either don't appear (e.g., Reeves et al., 2002; SWFSC & NOAA, 2011; Jefferson et al., 2015) or receive only a cursory mention (Ford, 2018; Würsig et al., 2018).

Regardless, the Punta Norte orca clearly are not only a distinct ecotype but they also are a draw for some of the hundreds of thousands of tourists who go whale watching in Argentina each year (Hoyt & Iñíguez, 2008). It has long been recognised that humans can have an impact on wildlife (both negatively and positively, e.g., see (Lalas & Bradshaw, 2001; Madden, 2004) and references therein). This is no different for whales and dolphins who can be negatively impacted (Orams, 2002; Gales et al., 2003) or positively impacted, both directly or indirectly, e.g., through a switch from whale hunting to whale watching (Hingham & Lusseau, 2008; Chen, 2011) or via improved education, marine protected areas and conservation movements to improve habitat (Hoyt, 2005; Fonseca et al., 2014; García-Cegarra & Pacheco, 2016; Smith J.S. et al., 2019) as well as through legislation (Valentine et al., 2004; Lukesenburg & Parsons, 2014).

In the case of the Punta Norte orca, these individuals have been threatened by live captures, hunting and impacted by tourism, but conversely the orca have also helped produce positive impacts, including as sentinel and ‘umbrella’ species. By managing and conserving their habitat and the prey they rely on, these orca provide direct and indirect protection for this ecological community.

2. LONG-TERM RESEARCH

A. HISTORIC RESEARCH

The first studies of the Punta Norte orca started in the 1970’s, when Juan Carlos and Diana López, local Guardafaunas (Park Rangers), started documenting individuals as they patrolled the coast. They noted specific characteristics for each orca, such as the shape and size of their dorsal fin, cuts or notches in the trailing edges of the fin or distinctive scars or markings on their bodies. They sketched these distinctive features or took photographs and over a period of years identified several individuals in three different groups (López & López, 1979). Over the next decade they amassed a wealth of data, including details on the incredible foraging strategy the Punta Norte orca had developed. This resulted in the first scientific publication on intentional stranding by orca (López & López, 1985). From their description of the pre-attack strategies and the attack methods the orca used, including cooperative hunting, it was clear that the 568 hunting attempts they had witnessed gave them a strong understanding of the phenomenon.

But López and López (1985) had also flagged that during the more than 900 times they had observed the orca, it was the same individuals returning time and time again. They had identified 26 individuals by this point but estimated that there were “*probably not more than 30 adult and juvenile animals*” in the population.

The next publication compared the orca of Punta Norte to those found near Vancouver, Canada, as part of a PhD thesis by Rus Hoelzel. Again, the unique situation of being able to see the orca capture their food ashore allowed for not only identification of the prey, but who was doing the hunting and how successful they were (Hoelzel, 1989). Hoelzel found that of the three groups he observed, one group excluded the others from the hunting area and that “*Energetic calculations suggested that the rate at which these whales captured sea lion prey was just sufficient to sustain them.*” He also added another layer of information by looking at their DNA and found that orca within groups were more closely related than orca between groups. Hoelzel then published a paper exclusively on this population, focused on their hunting strategies and included details of food-sharing and provisioning (Hoelzel, 1991).

Still concentrating on their hunting behaviour, but using acoustics to try and better understand how these predators were selecting their prey, John Ford, one of the founders of orca acoustic research, collected recordings in the early 1990's (Ford, 1992). He discovered that the whales were silent prior to their attack "*perhaps ... as a strategy for surprise attack*" and that there was a lack of echolocation clicks as the orca milled about waiting for their prey. Ford speculated that "*perhaps the whales locate prey by listening for their splashing sounds as the sea lions swim in the shallows*" and he confirmed that the orca were very vocal after a successful hunt.

Local cetacean researcher Miguel Iñíguez spent nearly 40 weeks waiting for orca during the sea lion pupping seasons of 1988-1997. During these nine years he spotted them at Punta Norte on 125 days. He also documented three groups, but now there were only 17 animals who regularly used the area (Iñíguez, 2001). As his study progressed the numbers dropped; with two groups and a total of only 10 orca visiting the area at the end of his research. He also described the seasonal distribution of the orca, stating that "*most [orca] leave Punta Norte after May*".

During all of this time, the researchers were working on the coastline abutting the sheep farm Estancia La Ernestina, where the Copello family has resided since 1907. The senior author grew up with the orca swimming past this farm and vividly recalls seeing them when he was younger, including a juvenile which was discovered dead on the beach not far from the Copello family home (Figure 3).



Figure 3. Juan Copello (left) with a dead juvenile orca on 12 June 1988, near the homestead of Estancia La Ernestina. Photo © courtesy Copello archives (1988).

B. CURRENT RESEARCH

In 2004, recognising the need for a long-term research project to build on these historic studies, Punta Norte Orca Research (PNOR) was founded and is based at Estancia La Ernestina. As a wildlife conservation and science organization, it not only researches the orca whom it is named after but also promotes protection of their habitat and the other animals who live in the vicinity.

Like earlier researchers, we use photo-identification to monitor the presence of individuals and to document the behaviour they are exhibiting. The value of long-term studies, where individuals are identified and monitored has been recognised since the 1930's when birds were ringed and monitored as individuals (Nice, 1934; Kluijver, 1951). Such studies allow us to answer fundamental questions about animals and their lives (Clutton-Brock & Sheldon, 2010). Nowadays, with advanced camera technology and powerful zoom lenses, photography allows for precise individual identification and monitoring of changes of scars over time and for 'capturing' details that were never possible before. For example, we are able to capture images of calves when they are only days old and follow their development, including when they first begin practice stranding (Figure 4), or when they capture their first sea lion.



Figure 4. At only four years old, Shotel (catalogue # PTN-026), remains the youngest orca we have documented who intentionally strands. Although born in 2014, as yet we don't know if Shotel is a male or a female, but we do know his/her mother is Llen (catalogue # PTN-010), who is a proficient hunter. Practicing stranding, not just in calm waters, but also in larger waves which 'dump' onshore, helps the animals become successful hunters. Photo © Juan M. Copello (2018).

Collecting what might be considered ‘basic data’, such as which individuals show up each season, who is seen with whom and when calves are born, can be painstaking but the rewards are impressive if you are willing to put in the effort. We have witnessed extraordinary events, such as when more than 70 attempts were made to capture sea lion pups in a single day, the most hunting ever recorded in a 24 hour period at La Ernestina (Copello et al., 2019). Monitoring each attack by an individual can show us who is a great hunter (or who is rarely successful). We have recorded six different prey species taken at Punta Norte (in order of prevalence; South American sea lions, Southern elephant seals, Southern right whales, Magellanic penguins, Southern giant petrels (*Macronectes giganteus*) and cormorants (*Phalacrocorax* sp.) (Copello et al., 2019)).

By recording mother-calf pairs we have constructed family trees (Figure 5) and can monitor changes over time. Following a single orca for decades gives insight into their lives, not only providing information on how many offspring they have but also their grandchildren. We can establish the dynamics of social networks and begin to understand the driving forces behind group fission and fusion and link that to hunting abilities. We can observe when a matriarch dies, how the remaining orca function and if they continue to maintain family bonds or fracture into smaller groups.

By 2008 we had documented 15 orca and photo-identified them with high-resolution images of both their left and right dorsal fins, saddle patches and eye patches (Punta Norte Orca Research, 2008) and noted that seven of those were stranding to capture sea lions. One was an iconic adult male, known as Mel (catalogue # PTN-001), (Figure 6). He was first documented as a youngster on 4 May 1975 (López, 2000) and has continued to be a part of all the historic studies, as well as the current one by PNOR where his role in the social network was documented in our database. Mel became world famous in the mid 1980’s when he featured in magazine articles and documentaries, in which his prowess as a hunter was showcased (Gentry, 1987; Lichter, 1992a; López, 2000). His story includes being shot in the dorsal fin by Government employees (creating a permanent slight bend to his left side), having his DNA profiled by Hoelzel and becoming a movie star (Lichter, 1992a; López, 2000, In Press). Mel was so iconic that the first logo we designed for the research project featured him in profile (Punta Norte Orca Research, 2008).

He was at least 50 years old when he was last seen in 2011 and although we are unsure if Mel fathered any of the orca seen at Punta Norte today, his legacy lives on, not only in the generations of people he inspired through his appearances in the media, as well as ‘in person’ at the Mirador (lookout) at Punta Norte but also in the scientific data he contributed throughout all the research projects.

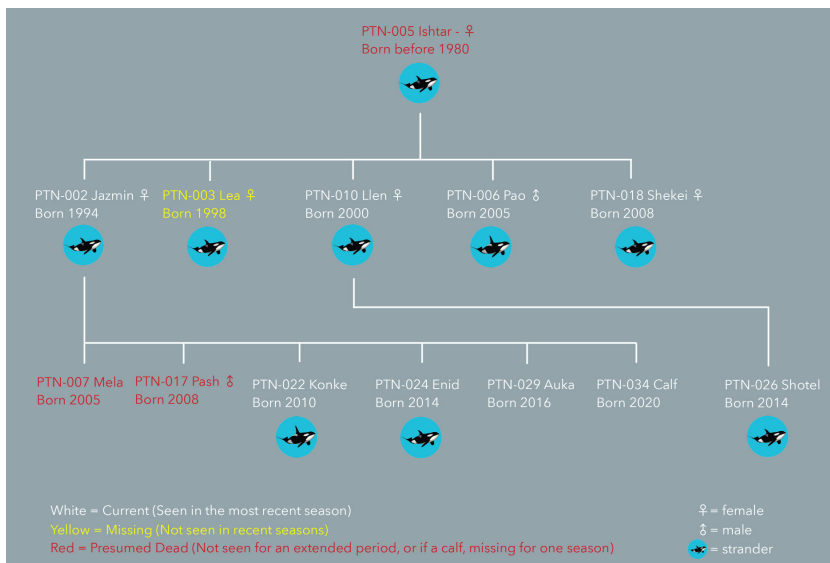


Figure 5. The family tree of Ishtar's group at the end of the 2020 sea lion pupping season. She was alive at the start of our research and produced at least five calves, four of which were documented in 2020 (white names, top line). She had seven grandchildren (red and white names, bottom line), five of which were documented in 2020. Three of those have already begun to intentionally strand to capture sea lions (indicated by the orca icon circled in blue). Graphic by Mark Enarson, for Punta Norte Orca Research 2020 ID Guide.

By 2020, more than 30 orca had been photo-identified (Copello et al., 2019), albeit that during the intervening years some, like Mel, were no longer seen and therefore this was a cumulative number. For example, in the 2020 season, 12 previously catalogued orca were no longer seen (Punta Norte Orca Research, 2020). Like previous studies we too documented three main groups, however one, known as Maga's group (Figure 2), had 12 members in 2020, five more than the total number of orca documented in the 1987-88 study (Hoelzel, 1991) and three more than the total number in the most recent study in the 1990's (Iñiguez, 2001).

As this research project has now been running for more than 16 years, we have a database of information that is robust and will only get stronger as it continues to build. The advantages of persistent and continuing field research on wild animals has been recognised for other long-term studies (Clutton-Brock & Sheldon, 2010). For example, spending hours watching animals allows us to also recognise personalities. Some individuals will have particular styles of hunting or never even attempt certain methods of foraging. There are times when we can predict who will be the most likely to play or who is more likely to intentionally strand, who is likely to just 'scare' the pups out of the water and who is likely to capture a pup and take it to the others in the group to help affirm social bonds through 'food sharing'. This 'intimate' data also allows us to recognise conservation challenges that these animals face.



Figure 6. The iconic adult male orca known as Mel (catalogue # PTN-001) was first recorded at Punta Norte in 1975 and has featured in all the research projects since then. We photographed him from the inception of our research in 2004. He was last documented in 2011 and only one adult male orca has been recorded intentionally stranding to hunt since then. Photo © Ingrid N. Visser.

3. CONSERVATION CHALLENGES

Clutton-Brock & Sheldon (2010) noted six key benefits to long-term studies that, like this one, were based on individually recognised animals. But they also highlighted a number of challenges for these projects. For one, they stated “*Researchers based in national parks and natural reserves are often subject to restrictions on their activities and many conservation authorities have become increasingly sceptical of the value of long-term research unless it provides direct guidance to management.*” They also noted “*Of all the obstacles faced by long-term studies, the greatest single problem is the difficulty of maintaining funding without interruptions.*” John Ford, one of the early founders of orca research, in a chapter specifically discussing long-term studies of marine mammals noted similar challenges for their research on the orca who traverse the boundary between Canada and the USA;

“As with most long-term studies, finding sufficient and reliable funding has, at times, been a struggle. Each year, many weeks of on-the-water field work are needed. Analysis of identification photos and updating of databases requires many more weeks of work in the laboratory. The annual photo-identification effort can appear to be rather mundane to funding agencies, but it is critical to the success of our studies as well as to the conservation of these populations. For example, longterm unbroken effort to maintain a precise annual registry of individuals in the population enabled us to detect subtle year-to-year changes in age-specific survival rates in resident killer whales, and to link these to varying prey abundance. Although not considered a funding priority by federal agencies on either side of the border, a sharp decline in the abundance of resident killer whales in the late 1990s resulted in a listing under the Canadian Species at Risk Act and the US Endangered Species Act.”

PNOR has faced similar challenges and more. Research permits are only issued for a one-year timeframe and applications involve direct face-to-face consultation with the authorities for each renewal, with proof of 'outputs' from the previous season. Recommendations for management improvements are typically not implemented and PNOR receives no funding from the Government, Universities, or corporate sponsors. The duration of the PNOR project, now more than 16 years long, illustrates the tenacity of the project members, who desire to see these animals and their habitats protected. As impacts such as marine heatwaves (Oliver et al., 2018; van den Berg et al., 2020), ocean acidification (Rios et al., 2015), over-fishing (Ainley & Blight, 2008) and the like continue to increase and accumulate, these fragile ecosystems face harsher times and higher chances of collapse. A study such as the PNOR research project provides a data set of a key sentinel species and highlights where issues may lie.

Around the world, and no matter the species, the risks for top predators are often linked to anthropogenic sources. In the case of cetaceans, entanglements are one of the high-impact risks, including in the Península Valdés region where Southern right whales have been entangled (Bellazzi et al., 2012). So far, no orca in the Punta Norte population have been found entangled, but entangled orca often die (Visser & Hupman, 2019) and their bodies may not be recovered as they tend to sink upon death (Dahlheim & Matkin, 1994), so the orca no longer sighted by us may have succumbed to this fate, particularly as we know at least some spend time outside of the Punta Norte region.

But these world-famous orca have not escaped the other high-risk threat to cetaceans; that of boat strike (Van Waerebeek et al., 2007). At least three orca from the Punta Norte population have been hit by boats. One, a calf born in 2019 was struck sometime between when it left the Punta Norte area at the end of the sea lion season and its return in March 2020. The calf, whose sex is not yet known, survived but it sustained at least four strikes from a boat propeller and lost the end of its left tail fluke (Figure 7).

Boat strikes at such a young age have been known to impact an orca for the rest of its life, including stunting growth and slowing swimming capacity (Visser, 1999). The long-term monitoring of this calf and how its family supports it is part of our ongoing research plan. It is likely, if it cannot hunt proficiently, that it will be provisioned by the other members of the group, as has been documented for other orca who have been injured or have mobility issues (Visser, 1999; Stenersen & Similä, 2004).



Figure 7. A young calf, offspring of Maga (catalogue # PTN-033 and born a year before these photographs were taken), was run over by a boat. Although it has survived, the long-term impacts from such an injury could be extreme. The propeller cut into the calf at least four times (white arrows, left), and sliced off the end of the calf's left tail fluke (right). Photos © Juan M. Copello (2020).

There are no boat-based whale-watching tours to see the orca off Punta Norte, so the injury the calf sustained must have occurred elsewhere. Boats of any kind are severely restricted around the UNESCO Site, with the exception of licensed tour operators departing from Puerto Pirámides, who focus on watching Southern right whales during the breeding season (and other wildlife outside of this time and therefore they only occasionally encounter the orca). These operators have a 'Code of Conduct' and regulations with speed restrictions and the maximum number of boats near the whales at any one time (Provincial Laws No 2381/84 & No 2618/85).

But the pressure is high to see orca as they are considered "... among the most spectacular of all animals to see in the wild" (Duffus & Dearden, 1993). With the high profile that this specific population of orca has, based partly on their impressive method of hunting, they have become one of the 'must see' wildlife attractions in Argentina. Although the data is dated, by 2008 about 35% of visitors to the peninsula were hoping to see orca as "*Punta Norte is a legendary site for watching orcas beach themselves.*" (Hoyt & Iñiguez, 2008). Since the founding of PNOR we have seen a dramatic increase of both domestic and foreign tourists at the Punta Norte 'Mirador' (Figure 8), where at times buses and cars overflow the parking area and spill out onto the main road and it can be hard to find a spot along the fence line when the orca swim by.

Although the key sites to watch wildlife on the peninsula are patrolled by uniformed Guardafauna and all tourists entering the Península Valdés UNESCO Site are informed of the rules (e.g., to stay within the designated wildlife watching areas and not to go down to the beaches to view the wildlife up close), an increasing number were found in the off-limits areas. Most of these sites are highly sensitive areas, for example where breeding sea lion colonies form, pups are born and youngsters learn to swim or where elephant seals give birth or moult. Tourists were not only parking on the side of the road and walking down to

the beach but also driving across the pebble 'platforms' (large flat zones from previously uplifted beach areas, e.g., see (Pedoja et al., 2011)), crushing vegetation and shore bird nests. Their cars would get stuck and tow trucks or tractors would have to come to remove them, creating even more damage. Years later these tracks are still visible (Figure 9). But the interloper's impacts didn't stop there. Nearly all of them disturbed the sea lions to the point where the whole colony would stampede into the water, potentially crushing pups along the way, but also exposing the youngsters to an elevated chance of predation from the orca if they were nearby. It got to the point where PNOR and Guardafauna were extracting tourists on a more or less daily basis from the key areas where the orca hunt.

The long-term implication of constantly disturbing the sea lions and elephant seals was of course that the colonies would be abandoned. If there was no prey, the predators would stop coming. The cascade effect would include animals that might not even be considered by the tourists that were interfering with the ecosystem, such as the scavengers who feed on the discards from orca; not only sea and terrestrial birds (Quintana et al., 2006; Pavés et al., 2008; Formos et al., 2019), but also sea creatures such as starfish, amphipods and other benthic scavengers – e.g., see Smith et al., (2015); Quaggitoo et al., (2017). It was therefore abundantly clear that that something needed to be done to curb these disturbances.



Figure 8. A visitor respectfully watching for orca at the designated wildlife area, the 'Mirador', Punta Norte. From here, although orca are often the species most sought after, elephant seals, sea lions, a multitude of bird species, terrestrial animals such as armadillos and foxes, can all be seen. Photo © Ingrid N. Visser (2013).



Figure 9. Vehicle tracks on the pebble platforms (uplifted previous beaches). The vehicles crush slow-growing specialist vegetation as well as potentially kill ground-nesting birds and/or crushing their eggs. Their tracks are visible years later. Photo © Ingrid N. Visser.

4. CONSERVATION & MANAGEMENT BENEFITS

As the pressure from tourists continued to rise, in 2013 La Ernestina and PNOR joined forces with private donors and fenced the roadside along the beach area from near the Mirador to the southern boundary of the ranch – a distance of more than 12 km. Attached to the fence were signs warning people not to trespass. Once the fence was completed, there wasn't a single instance of a car on the pebble zone and people walking down the beach have been reduced significantly, with perhaps just one or two culprits during an entire season.

We have seen an apparent increase in the number of sea lions and elephant seals using the beach areas and although this cannot be shown to be directly linked to the installation of the fence, as other factors may be at play, a lack of one would have seen the disturbances continue. Furthermore, now that they are no longer disturbed by people rushing down onto the beach, the pinnipeds have grown habituated to the research team and ecotourism guests, with some individuals coming up the beach to check out our temporary human colonies (Figure 10).



Figure 10. Three sea lions approach the PNOR research team with accompanying ecotourism guests. The pinnipeds have become habituated to the team and will at times fall asleep in the middle of us, demonstrating how comfortable they now are with the researchers. Photo © Ingrid N. Visser

It may also be only a coincidence, but there has been a rise in the number of orca who intentionally strand since the fence was installed. A potential increase in prey for the Punta Norte orca may be linked to this current population growth as pregnancy success was directly linked to availability of prey for the endangered Southern Resident ecotype (Wasser et al., 2017).

In the past studies at Punta Norte, and in the early years of ours, in any given year there were typically less than eight orca within the population who intentionally stranded to hunt this way. At times, successful orca would provision the rest of the group and some of these unfortunate pups were batted into the air (Figure 11), perhaps to affirm social bonds, to debilitate the pup or to loosen the skin for ease of removal. By 2020, there were 15 confirmed stranders, the highest number ever documented in a season, with four of those forming their own group.

It could be argued that the pinnipeds were acting as the umbrella species, because the fence directly protects them, not the orca. However, in reality, as much as the fence protects the pinnipeds, ultimately it was concern for the orca that was the motivation behind its installation. It would, nonetheless, be logical to consider that the result occurs due to a combined and overarching multi-species umbrella effect.

No matter the driving force behind the growth in orca numbers, the population is still incredibly small. Fewer than 20 core members have visited the area in the past few years. Although this is higher than found for previous studies, this population is incredibly vulnerable. It would only take one oil spill or one outbreak of disease (within the orca or their prey) and the whole population could go extinct in less than a generation (Dahlheim & Matkin, 1994; Matkin et al., 2008). Outbreaks of disease are at the forefront of most people's minds with the global pandemic of SARS-CoV-2 (Covid-19). Of concern is that cetaceans are also susceptible to coronaviruses, with two species of bottlenose dolphins (*Tursiops truncatus*) (Wang et al., 2020), (*Tursiops aduncus*) (Woo et al., 2014)

and beluga (*Delphinapterus leucas*) (Mihindikulasuriya et al., 2008), each having their own novel coronavirus, albeit so far only in captivity. However, the risks for cetaceans are clearly high; one study found there was a 'cluster' of dolphins at a facility in Hong Kong who tested positive and the results indicated that the coronavirus was associated with acute infections (Woo et al., 2014), while the beluga died after generalized pulmonary (respiratory) disease and terminal acute liver failure (Mihindikulasuriya et al., 2008). Another study, investigating the risk to animals from Covid-19 found that orca fell into the category of 'high', where their protein sequences had a propensity for binding to the amino acids corresponding to the known Covid-19 residues, i.e., they are at high risk of contracting the virus should it enter their environment (Damas et al., 2020). Furthermore, orca as highly social animals are frequently in 'respiratory contact' by passing through the breaths of one another, which would amplify the spread of a respiratory disease like Covid-19. Simulations of an infectious disease spreading through the endangered Southern Resident orca ecotype resulted in predicted mortality rates being at least twice the maximum annual mortality (Weiss et al., 2020). The vulnerability of the Punta Norte orca is increased if their pinniped prey is also susceptible to Covid-19 (Damas et al., 2020), including through reverse transmission from humans (Damas et al., 2020; Barbosa et al., 2021).

To help increase stakeholder investment in the preservation of this population, PNOR has engaged with the local community through school groups, who choose the names of the orca, as well as presentations for the public (including online webinars). We collaborate with documentary film crews in order to have quality productions increasing the public's knowledge about Punta Norte and the orca. Our social media presence continues to grow and we have a number of educational projects underway. Our website (www.pn-orca.org) naturally has a focus on the Punta Norte orca ecotype, including a high-definition identification guide. But it also lists a range of scientific publications our team members have produced regarding orca populations around the world, as a way to help widen the public's understanding of the species and the risks they face. A global perspective also helps to emphasise how unique the Punta Norte orca ecotype is, particularly with their iconic intentional stranding culture (Figure 12).

Not discussed in detail within this chapter, but of relevance to ensure that the free-ranging orca are protected, is the work done by PNOR team members with regards to the controversy of keeping orca in captivity. Argentina has only one orca held captive in a marine theme park, therefore the problem is not expansive. However, 'only one orca' is an issue in itself, given the species is so highly social and the one adult male has

been kept in conspecific isolation for decades. Although our team have been involved in varying degrees with legislation, reports and workshops for the Government and ongoing discussions with the industry and other stakeholders, no viable solution has yet been found to move the orca, known as Kshamenk, into a sea pen sanctuary. However, the wild population is now protected by law from any captures and individuals cannot be exported. The probability that another orca (even from a rescue) could be kept in captivity in Argentina is now negligible. As such, this commercial industry will eventually expire in Argentina through a lack of new animals and the public's growing awareness of the issues (Visser et al., 2021, Chapter 5, this volume).

Also, as part of our wider outreach the PNOR team members are involved with the health and welfare of orca (and other cetaceans) via a range of other initiatives. Two of our team are veterinarians specialising in wildlife, including cetaceans, and they collaborate with a network of other wildlife vets, conducting necropsies and publishing research on their findings (e.g., Alzugaray et al., 2020; Raverty et al., 2020). Within Argentina, and internationally, we have founded and run a range of rescue networks specialised in this area of marine mammal conservation at a local and international level. Many, if not all of the cetaceans we rescue would die without assistance. The effects are far-reaching; with one orca who was rescued in 1997, resighted in 2020 (Visser et al., 2021, Chapter 6, this volume) and although this occurred in New Zealand, the evidence of such long-term success validates rescues. For the PNOR orca, they have their own success stories from rescues; On 7 December 1990, Ishtar (catalogue # PTN-005), along with another orca, stranded on the rocky reef in front of the Mirador, while foraging for sea lion pups (López, 2000). The Guardafaunas and members of the public kept them both wet and waited five and half hours for the tide to return so that they could be refloated. Both the orca survived and Ishtar went on to become a mother of five (Figure 5). She was last photographed in the season of 2010 and is now presumed dead, but her legacy survives through her five grandchildren alive in the 2020 season. We can only now, 10 years after her death, really begin to recognise the contribution her rescue has made to ensuring the viability of this ecotype. Ishtar was the founder of two core matriarchal groups comprised of more than 50% of the current orca population seen around Punta Norte today. This emphasises how important it is to consider these animals at not only the population level, but also at the individual welfare level. It also emphasises the importance of long-term studies of individually recognised animals and how they can contribute to long-term conservation and management models. It provides examples of success where rescue measures were implemented effectively.



Figure 11. An orca hits a Southern sea lion pup into the air. The likelihood of the pup surviving this is minimal as they typically suffer broken ribs and internal organ damage. Some make it back ashore, only to die. Photo © Ingrid N. Visser (2013).



Figure 12. Sheuen, a female orca (catalogue # PTN-021), begins to turn seaward after capturing a sea lion pup at Punta Norte. Although the population has been growing slowly, it is comprised of an incredibly small number of <20 core individuals in 2020, making this ecotype one of the rarest in the world. Photo © Jorge Cazenave.

5. CONCLUSIONS

Clutton-Brock & Sheldon (2010) identified six key benefits from long-term studies based on individually recognised animals;

- (i) *analysis of age structure;*
- (ii) *linkage between life history stages;*
- (iii) *quantification of social structure;*
- (iv) *derivation of lifetime fitness measures;*
- (v) *replication of estimates of selection;*
- (vi) *linkage between generations.*

Given the incredibly long lifespans of free-ranging orca - in the order of 80 years for females and 70 for males (Olesiuk et al., 1990; Olesiuk et al., 2005), our project is only in its infancy, especially if we are to analyse multi-generational data. Adding in that the Punta Norte ecotype is comprised of a very small number of individuals who concentrate their visits close to shore during certain parts of the year, there are constraints to this land-based research. Despite these restrictions, the PNOR project has already succeeded in contributing towards benefits (i), (ii), (iii), and (vi), with aspects of (iv) under investigation (e.g., number of surviving offspring).

Península Valdés was listed as a globally significant heritage site due in part to it being a hotspot for marine mammals. That listing specifically included the Punta Norte orca and their hunting methods;

*“Península Valdés in Patagonia is a site of global significance for the conservation of marine mammals. It shelters an important breeding population of the endangered southern right whale as well as important breeding populations of southern elephant seals and southern sea lions. **The orcas in this area have developed a unique hunting strategy to adapt to local coastal conditions.**”* [emphasis added] UNESCO Site listing #937.

Combined with the historic studies conducted on this population, a clear picture has emerged and been reinforced. These orca are unique and the population is comprised of an extremely small number of individuals. As such, they are particularly vulnerable to catastrophic events at an individual or population level, but also susceptible to more subtle changes such as marine heatwaves and prey shifts.

Protecting them, as well as their habitat, has already shown to provide a suite of benefits. Continued land-based observations will build on this current project, however expansion by using new technologies such as drones will increase the data that can be gathered during intentional strandings. Additional non-invasive research, such as boat-based surveys and hydrophones will improve our ability to monitor them. Hydrophones

can, for example, not only gather data 24/7 but also improve our understanding of the social complexities of the groups. Surveys conducted on the water will allow researchers to gain a better understanding of the movements of these orca outside of the core Punta Norte region. However, a precautionary principle should be applied and only non-invasive research methods used, while invasive research should be strictly prohibited. There is precedence for this type of restriction as, for example, tagging has been directly linked to the death of an orca from another endangered population (Raverty & Hanson, 2016) and a dolphin who was biopsied died (Bearzi, 2000) and in both cases the invasive research was halted.

All orca deaths in Argentinean waters, no matter the cause, should involve comprehensive necropsies and recovery of samples as well as collection of skeletal material, using best practise protocols for each of these scenarios. The issuing of longer-term permits to established research teams would benefit all cetacean research throughout Argentina. Ultimately, expanding the zones where research is conducted should help answer questions about the home range of this population and may provide insights into their diet outside of the Punta Norte region.

The Punta Norte orca were once shot at with Mauser guns by Government Officials, nowadays they are shot with HD cameras. They were once vilified as 'enemies' and 'intruders' and moves were afoot to kill them with explosives. Today they are extolled as icons and tourist drawcards, all the while now also being recognised as the rightful apex predators that they are. The time is ripe for the next steps to be taken. The Punta Norte orca must be acknowledged formally as a distinct ecotype and with that should come the recognition of their extremely small population. As such, we call for the Punta Norte orca ecotype to be officially 'listed' as endangered by the Argentinean Authorities as well as added to the endangered inventory in the Red Data list of the IUCN (International Union for Conservation of Nature).

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ABOUT THE ORGANIZERS

Ingrid N. Visser

Ingrid has had a passion for cetaceans since she was a child. She gained her first University degree, in Zoology, after having spent her teenage years sailing around the world. This was soon followed by a Masters degree also in Zoology. When she started her PhD in Environmental and Marine Science, with the topic of the New Zealand coastal orca, she founded the Orca Research Trust. That non-profit continues to this day and is the foundation for the data collected in Chapter 6. Her research has featured in a number of documentaries, for companies such as BBC, National Geographic, Discovery Channel. Ingrid has observed more than half of the worlds marine mammals and visited all seven continents in her quest to learn more about these fascinating animals. She has published more than 30 scientific articles, along with numerous popular-style articles for wildlife magazines and children's books and an autobiography. Since 2010 she has divided her time between working with wild cetaceans and advocating for those in captivity (see Chapter 5). As part of that work, Ingrid has observed 15 different species of cetaceans (plus other marine mammals; i.e., pinnipeds, sirenians, marine otters and polar bears), in 50 facilities around the world. She has appeared as an expert witness in Environmental and High Courts, as well as before Governments who are investigating the issues of keeping marine mammals in captivity. As part of her conservation work, she has founded (or co-founded) seven non-profit organisations, all with a focus on marine mammals, such as Punta Norte Orca Research (Chapter 1) and Whale Rescue (Chapter 6).

Jorge Cazenave

Jorge started his professional career as a lawyer in Argentina, however after 10 years in this field he switched to tourism. He co-founded (and was President of) Agricultural Tour Operators International and was on the board of the National Tour Association, both whilst photographing wildlife. As an experienced naturalist, he currently guides guests to view and photograph wildlife around the world, specialising in apex predators such as puma, jaguar and orca. His expertise is sought after by documentary making companies such as the BBC, ZED and National Geographic. Since 2001, Jorge has been photographing the unique orca of Punta Norte on the remote Península Valdés, Argentina (see Chapter 1), who exhibit a range of unique behaviours including intentionally stranding to capture sea lion pups. His work with conservation extends to include collaboration with several projects in different regions of Argentina, including Punta Norte Orca Research, of which he is a board member.

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