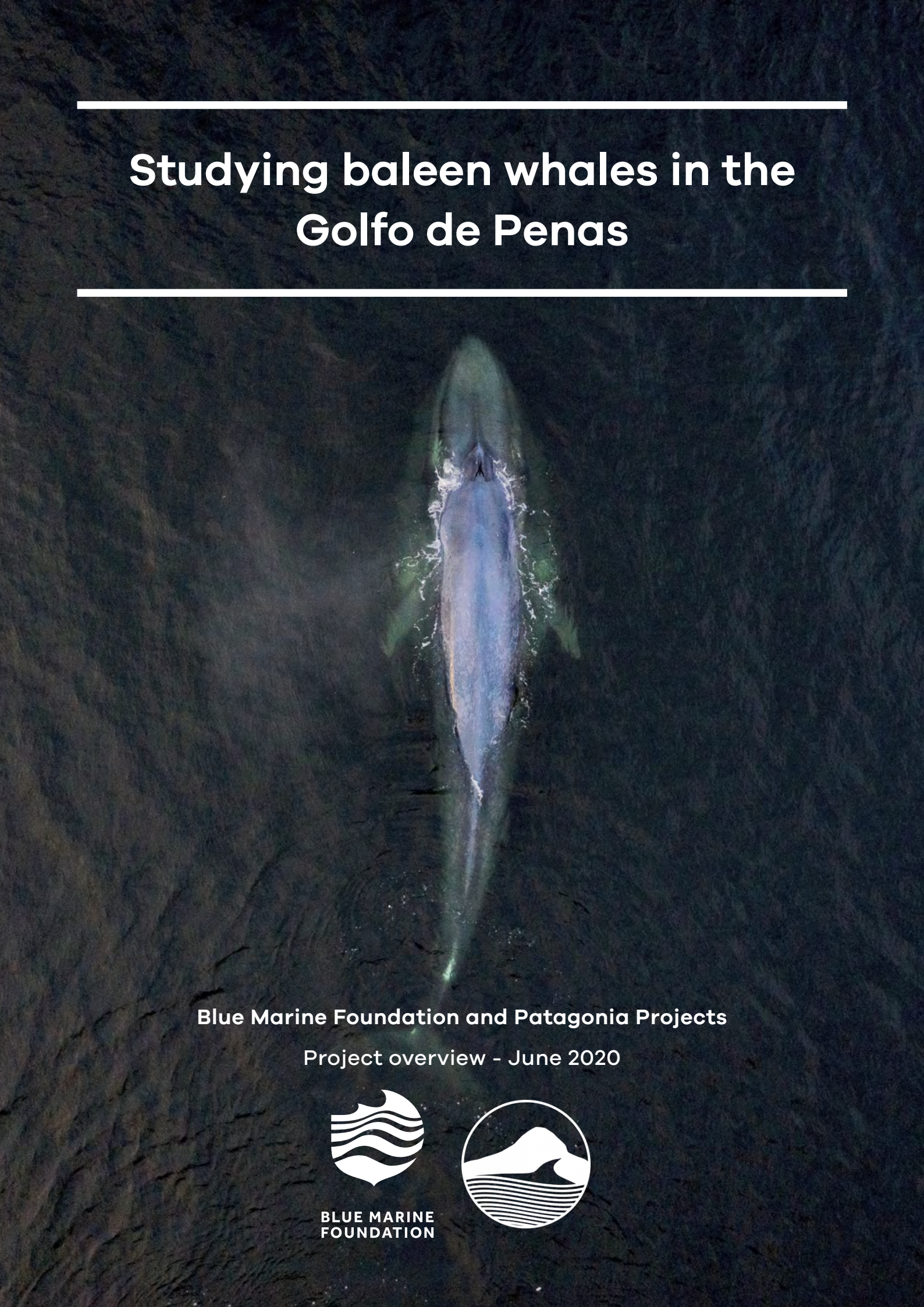
Blue Marine Foundation and Patagonia Projects

Project overviews - June 2020

BLUE MARINE FOUNDATION

Studying baleen whales in the Golfo de Penas



Blue Marine Foundation and Patagonia Projects

Project overview - June 2020

BLUE MARINE FOUNDATION

Studying baleen whales in the Golfo de Penas

Headlines

- Baleen whale populations were decimated by industrial whaling and are recovering at different rates.
- Southern hemisphere baleen whales are thought to spend the summer feeding in Antarctic waters, and migrate to low latitude breeding grounds in the winter.
- The annual presence of baleen whales in the Golfo de Penas is still unknown.
- Although the high latitude Golfo de Penas would normally act as a summer feeding ground, Patagonia Projects has anecdotal data that some whales may feed there year-round (when conditions allow).
- In November 2018, Patagonia Projects were the first to document a blue whale in the region.

Story

Baleen whales are migratory in nature, feeding at higher latitude areas in the summer months and travelling to the tropics to breed and calve in the winter. While studies on humpback and blue whales in northern Chilean Patagonia suggest that these species spend from December to around May in these areas before migrating north, virtually nothing is known about the endangered sei whale's seasonal migrations and habitats throughout Chile. The Golfo de Penas is a high latitude ecosystem of fjords and inner channels, which has high levels of primary productivity and therefore krill and prey abundance for cetaceans. However, apart from opportunistic sightings in the past by the Patagonia Projects team, there are no published papers on what species of baleen whales are found in the fjords and inner channels of the Golfo de Penas. In November 2018, Patagonia Projects set up a protocol for on-effort sightings, recording cetacean behaviour and taking photo ID data of both baleen and toothed whales (dolphins and orca). The aim was to better understand which baleen whales inhabit the area, whether they are residents and whether there is high site fidelity (do they return each year?), and what they are feeding on in the area. Data from the mass mortality event in 2015 suggested that the sei whales were feeding on copepods, euphausiids, amphipods in the Patagonian fjords, but that diet as well as migratory patterns vary between individuals. The first observation of the endangered blue whale was documented in the area in November 2018, and even better it was observed lunge-feeding in the inner fjords, indicating that it might be familiar with this area and that there was prey available. A short publication will soon be submitted on this blue whale's presence and the fact that the Patagonia Projects' photo-identification data was able to match it as an individual from the Chiloe region further north, where there is a blue whale feeding ground that has stimulated much focus and protection debates.

- (Also linked in the "Media & Art" project summary) Short film of the November 2018 trip by Will Darwin was presented at the World Marine Mammal Conference in Barcelona, in December 2019 https://www.youtube.com/watch?v=qcnlqWjqSFM
- This film was also selected to be shown at the World Whale Film Festival, Hawaii, February 2020.

Top image: A sei whale in the Golfo de Penas. Credit: Keri-Lee Pashuk
This image: A blue whale surfaces next to the Saoirse. Credit: Keri-Lee Pashuk
Front cover: Aerial shot of a blue whale. Credit: Will Darwin.

Papers

Directly from Patagonia Projects expeditions:

- Clegg, I. L. K, Pashuk, K. Greg Landreth, G., Darwin, W., Espanõl, S., Galletti Vernazzani, B., Haussermann, V. (Manuscript in preparation). “Blue whale observation within the fjords of the Golfo de Penas, Chilean Central Patagonia and connectivity with Isla de Chiloe sightings: another mid-latitude feeding site for Chilean blue whales?”
- Reiss, L., Häussermann, V., & Mayr, C. (2020). Stable isotope records of sei whale baleens from Chilean Patagonia as archives for feeding and migration behavior. Ecology and Evolution, 10(2), 808-818.

From Patagonia Projects scientists on the same topic:

- Försterra, G., & Häussermann, V. (2012). Report on blue whales sightings (Balaenoptera musculus, Linnaeus, 1758) in a narrow fjord during autumn-winter in southern Chile (Mammalia, Cetacea, Balaenopteridae). Spixiana, 35(2), 237-45.

Activities

- Document the species and location of all cetacean species encountered on-effort or opportunistically.
- Conduct “on-effort” observations where at least 1 observer is following a standardised visual transect.
- Take photo ID data (dorsal, tail and markings) for sei whales and blue whales to start with.

Targets

- Collect data on species, abundance and seasonality for the Golfo de Penas.
- Develop standardised transects to follow when in-transit as part of on-effort observations.
- Starting with sei whales and blue whales establish photo ID catalogues of individual animals.
- Investigate pairing of behavioural data with blow sampling and tagging of sei whales.

Outcomes

- Publish the first data on cetacean species and abundance in the inner Golfo de Penas.
- Understand which individual sei whales, blue whales are sighted in the Golfo de Penas each year: is there high site fidelity?
- Analyse sei whale hormone levels and pathogen load through blow sampling with drones.
- Understand where sei whales are going after they leave Golfo de Penas through deploying tags.

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Benthic marine life in Chilean Patagonia

Blue Marine Foundation and Patagonia Projects

Project overview - June 2020

BLUE MARINE FOUNDATION

Studying and protecting the benthic marine life in Chilean Patagonia

Headlines

- The Patagonian fjords are a surprising hotspot for cold water corals.
- Patagonia Projects scientist Dr Vreni Hausserman has discovered more than 100 new benthic coral and invertebrate species in Chilean Patagonia.
- The fjord conditions for the shallow corals are already as acidic as the world's oceans are predicted to be by 2100, making them a potentially useful model for climate change impacts.
- In collaboration with the Huinay Foundation, Patagonia Projects scientists have already documented a mass die off of corals in the fjords, likely due to climate change and/or aquaculture impacts
- The next goal is to use a Remotely Operated Vehicle (ROV) to explore the benthic life

Story

The waters of Chilean Patagonia are some of the least studied on Earth. Scientists are starting to map the biodiversity of this area but efforts are strongly focussed on marine life at the surface or in the pelagic zone. In cold waters such as those in Chile, the benthic zone – beginning at the shoreline and extending along the sea floor – has been found to be a surprising biodiversity hotspot. Dr Vreni Häussermann from the Huinay Foundation has been collaborating with Patagonia Projects since 2015 to explore the uncharted depths of the Chilean fjords, and has discovered dozens of new species each year, including many corals. Interestingly, the fjord conditions for the shallow corals are already as acidic as the world's oceans are predicted to be by 2100, making them a potentially useful model for climate change impacts. However, the benthic community in Patagonia is also under threat: Dr Häussermann documented a mass die-off of hydrocorals in the fjords, which coincided with increased Harmful Algal Blooms (HABs). The increasing HABs have been linked to the mass mortality of 350 sei whales around the Golfo de Penas region in 2015. Through teaming up with Patagonia Projects, Dr Häussermann hopes to document and monitor the benthic species in the Golfo de Penas in order to better protect them from the direct and indirect effects of human activity.

- Vreni Häusserman, Rolex Awards Laureate, 2016: https://www.youtube.com/watch?v=eJWz8t9kQ2U
- Vreni Häusserman, CNN article July 2020 https://www.cnn.com/2020/07/15/world/vreni-haussermann-c2e-spc-scn-int/index.html

Top image: Lowering the ROV into the water.
This image: Diver and cold-water corals.
Front cover: Corals and diver in the Comau fjord.
Credit: Vreni Häusserman & Günter Försterra

Papers

Directly from Patagonia Projects expeditions:

- Krapp-Schickel, T., Häussermann, V., & Vader, W. (2015). A new Stenothoe species (Crustacea: Amphipoda: Stenothoidae) living on Boloceropsis platei (Anthozoa: Actiniaria) from Chilean Patagonia. Helgoland Marine Research, 69(2), 213-220.
- Ceseña, F., Meyer, R., Mergl, C. P., Häussermann, V., Försterra, G., McConnell, K., & Melzer, R. R. (2016). Decapoda of the Huinay Fiordos-expeditions to the Chilean fjords 2005-2014: Inventory, pictorial atlas and faunistic remarks. Spixiana, 39(2), 153-198.

From Patagonia Projects scientists on other expeditions, on the same topic:

- Häussermann, V., & Försterra, G. (2007). Large assemblages of cold-water corals in Chile: a summary of recent findings and potential impacts. Bulletin of Marine Science, 81(3), 195-207.
- Häussermann, V., Försterra, G., Melzer, R. R., & Meyer, R. (2013). Gradual changes of benthic biodiversity in Comau fjord, Chilean Patagonia–lateral observations over a decade of taxonomic research. Spixiana, 36(2), 161-171.
- Häussermann, V., Spano, C. Thiel, M. and Lohrmann, K. (2015): First record of the sea anemone Diadumene lineata (Verrill, 1869) (Cnidaria: Anthozoa: Actiniaria) from the Chilean coast. Spixiana 38 (1): 39-42.

Activities

- Scuba diving biodiversity transects (down to 30m) of the benthic zones around the Golfo de Penas region and Canal Messier.
- Remotely Operated Vehicle (ROV) biodiversity transects of benthic zones at 500m around the Golfo de Penas region and Canal Messier.
- Invertebrate species sampling to define geographic distribution.
- BBC and CNN documentaries on marine biodiversity and threats in Chilean Patagonia.

Targets

- First publication on different benthic invertebrate of Chilean Patagonia defining provinces and ecoregions.
- Publications about mass mortality, ecology and life history of the coral.
- Further publications on effect of Patagonian Ice field Shrinkage on Coastal and fjord Ecosystems (PISCES project).

Outcomes

- Defining ecoregions using biodiversity data will be invaluable to the spatial planning of MPAs in Chilean Patagonia.
- Protection of some coral species on the IUCN Red List.
- Increased public awareness and stakeholder engagement regarding benthic biodiversity and PISCES.

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Cetacean acoustics in the Golfo de Penas

Blue Marine Foundation and Patagonia Projects

Project overview - June 2020

BLUE MARINE FOUNDATION

Cetacean acoustics in the Golfo de Penas

Headlines

- Sound travels five times faster in water than in air, making it the most effective method of communication for cetaceans.
- Patagonia projects deploys short and long-term hydrophones to monitor which species' vocalisations are present in the Golfo de Penas.
- The Patagonia Projects team were part of the first documentation of sei whale vocalisations in the south eastern Pacific.
- The frequency of sei whale vocalisations in the Golfo de Penas ranged between 35.6 – 105.6 Hz
- Pairing acoustic and behavioural data will help us to understand which cetaceans are in the Golfo de Penas and what they are using the area for.

Story

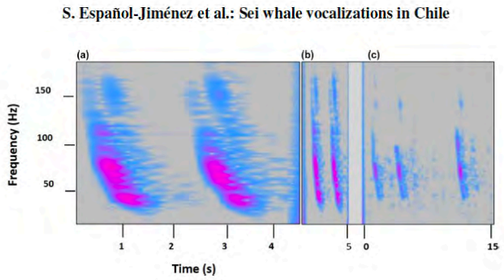
The remote location, unpredictable weather and large size of Patagonia Project's study area around the Golfo de Penas makes it difficult to study the whales and dolphins (cetaceans) that use the area. Since sound travels five times faster in water than in air, and given that both toothed whales (e.g. orcas, dolphins, sperm whales) and baleen whales (e.g. sei, blue, humpback) use sound to communicate and navigate, acoustic data is the ideal tool to help answer our questions. Given the complete lack of research on cetaceans in the Golfo de Penas region, the Patagonia Projects team is collaborating with acoustic scientists to ask which species are in the area, when they are present and whether they are feeding or just passing through. This knowledge will be invaluable in proposing appropriate protection for the area. A concurrent goal is to pair the acoustic data with behavioural observations, to investigate which vocalisations are paired with certain behaviours (see killer whale footage). OceanSonics (Halifax, Canada) have collaborated with the team to provide several cutting-edge hydrophones, where some can be left under the water for months at a time, and others are deployed in the short term and can feed real-time data back to the boat using WiFi. The scientists working on data collected on Patagonia Project expeditions- Dr Sonia Español (Fundacion Meri) and others- have been the first to characterise the sei whale calls found in this area. The next goal is understand the abundance of sei whales and other cetaceans in the Golfo de Penas over the year, to understand which species may be transient, resident, or show some site fidelity to the area- all critical information in terms of establishing marine protected areas (MPAs).

Top image: The hydrophone is deployed by the team. Credit: Keri-Lee Pashuk
This image: A pod of killer whales. Credit: Will Darwin
Front cover: Putting out the hydrophone. Credit: Keri Lee Pashuk

Papers

Directly from PP expeditions:

- Español-Jiménez, S., Bahamonde, P. A., Chiang, G., & Häussermann, V. (2019). Discovering sounds in Patagonia: characterizing sei whale (Balaenoptera borealis) downsweeps in the south-eastern Pacific Ocean. Ocean Science, 15(1), 75-82.



By PP scientists on the same topic:

- Español-Jiménez, S., & van der Schaar, M. (2018). First record of humpback whale songs in Southern Chile: Analysis of seasonal and diel variation. Marine Mammal Science, 34(3), 718-733.

Activities

- Deploy long-term (one week+) hydrophones in Golfo de Penas to collect multi-species acoustic data.
- Deploy hydrophones when cetaceans are observed on expedition, to be able to pair acoustic with behavioural data (from the boat and from drones, killer whale video).
- Analyse past acoustic data to study cetacean abundance (engage Chilean and International students).

Targets

- A near-constant hydrophone presence in the Golfo de Penas.
- Develop software to automatically detect sei whale sounds from acoustic data.
- Match cetacean sounds to observable behaviours such as socialising and feeding.

Outcomes

- Provide new information on sei whale acoustics and behaviour.
- Understand what times of year sei whales and others are in the Golfo de Penas.
- Based on this data, advocate for an MPA of the inner fjords (possibly seasonally) and higher level MPAs for the Gulf.

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Community engagement in marine conservation issues

Blue Marine Foundation and Patagonia Projects

Project overview - June 2020

BLUE MARINE FOUNDATION

Community engagement in marine conservation issues

Headlines

- Patagonia Projects works together with the Puerto Eden community to spread information about the marine environment.
- Locals in Puerto Eden collaborate with Patagonia Projects where they send photos of cetaceans that pass through or that they observe while fishing.
- Patagonia Projects regularly presents their results to the Puerto Eden community (March 2016, May 2016, November 2018, August 2019).
- Patagonia Projects has given drone demonstrations to the children and explained how it helps to study the whales .
- Patagonia Projects held several music workshops in 2018, and Keri-Lee Pashuk teaches music to some Puerto Eden residents.

Story

The famous quote by Baba Dioum says that “In the end, we will conserve only what we love; we will love only what we understand and we will understand only what we are taught”.

Patagonia Projects is committed to simultaneously advancing scientific knowledge of the marine life in Chilean Patagonia, as well as to share that information with the local communities. In addition, it is increasingly recognised that efficient and effective marine planning and conservation policies must include and can benefit from the knowledge of the local fishing communities. Patagonia Projects has started to interview local fishermen and those encountered while on expedition in the Golfo de Penas to collect information about cetacean sightings and behaviour. For example, the fishermen interviewed in November 2018 shared valuable information about their observations of orcas attacking sei and other baleen whales in the area. In addition, Patagonia Projects is working towards collecting such data from tourist boats that pass through the area. The goal of this citizen science project is to disseminate forms to tourist vessels so that they can fill them in and send photos back to Patagonia Projects when a noteworthy event is observed.

- November 2018: interviews conducted with fishing vessels in Golfo Tres Montes (Puerto Barroso).
- Presentation of results to the Puerto Eden community in March 2016, May 2016, November 2018, August 2019.
- Several community music workshops held, in February 2018 and April 2018 in Puerto Eden and Puerto Williams, co-hosted by Errante Ecolodge.

This image: A group photo of first meeting with fishermen. Credit: Keri-Lee Pashuk
Front cover: The crew of Don Adrian. Credit: Will Darwin

Papers

From Patagonia Projects scientists on the same topic:

- Anbleyth-Evans, J., Leiva, F. A., Rios, F. T., Cortés, R. S., Häussermann, V., & Aguirre-Munoz, C. (2020). Toward marine democracy in Chile: Examining aquaculture ecological impacts through common property local ecological knowledge. Marine Policy, 113, 103690.

Activities

- Regularly share Patagonia Projects' results with the Puerto Eden community.
- Take local students for outings on Patagonia Projects' boat.
- Conduct interviews with the fishermen encountered in Golfo de Penas region.
- Collect information on cetacean observations from tourist boats that pass through Puerto Eden.

Targets

- Engage the Puerto Eden community in the marine life and conservation issues in their area.
- Fishermen interviews will help understand what they fish, at what time of year, and their observations of cetaceans in the area Starting with sei whales, blue whales and orcas, establish photo ID catalogues of individual animals.
- Develop a citizen science observation form for tourist boats to fill in their sightings, and pass to the Patagonia Projects team.

Outcomes

- Greater understanding of the issues by the local community will better equip them to directly and indirectly protect the environment.
- Tap into the fishermen's knowledge and sightings of cetaceans in the Golfo de Penas region.
- Monitor what the fishermen are catching, how and when, to further understand the Golfo de Penas ecosystem as well as the permitting of fishermen in the area.

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Documenting species and biodiversity in Chilean Patagonia

Blue Marine Foundation and Patagonia Projects

Project overview - June 2020

BLUE MARINE FOUNDATION

Documenting species and biodiversity in Chilean Patagonia

Headlines

- High biodiversity is a sign of a healthy ecosystem.
- The species diversity in the Golfo de Penas has hardly been studied: we don't know exactly what species are there.
- Patagonia Projects scientist Dr Vreni Hausserman has discovered more than 100 new benthic species (sea floor) in Chilean Patagonia.
- Through their studies on the Mass Mortality of sei whales in the Golfo de Penas, Patagonia Projects believe that the area may be a feeding hotspot for the endangered sei whale.
- In 2018 Patagonia Projects documented the first blue whale seen in the area

A new coral species. Credit: Vreni Häusserman & Günter Försterra

This image:Documenting Peale's dolphins. Credit: Keri-Lee Pashuk
Front cover: South American sea lions. Credit: Isabella Clegg

Story

The waters and surrounding environment of the Golfo de Penas constitutes one of the most remote and understudied regions of the world. Therefore part of Patagonia Projects work is facilitating the documenting of species that live in this area, whether at the water's surface or below. This is key to establishing a biodiversity baseline, against which to monitor climate change and more direct anthropogenic impacts. Findings of species not seen before in this area, or even totally new species, have been a common event since the start of Patagonia Project's work. In November 2018, the Patagonia Projects team observed a blue whale feeding in the inner fjords of the Golfo de Penas: the first time this endangered species had been observed in the area. High-quality photographs of the whale's dorsal and flukes allowed us to establish that it was in fact an individual that also visits the Isla de Chiloe feeding ground, around 500km north of Golfo de Penas. These findings have allowed us to propose the Golfo de Penas region as a new feeding location for the largest animals on the planet.

Dr Vreni Häussermann from the Huinay Foundation has been collaborating with Patagonia Projects since 2015 and has discovered dozens of completely new species of benthic (sea floor) corals and invertebrates each year. Other discoveries of known species' behaviour in this region also contribute to our understanding of the biodiversity: for example, Dr Häussermann published observations of hummingbirds bathing in hot springs in the Valdivian rainforests on the shores of the Chilean fjords, something which has not been documented anywhere else in the world. Another example is the study by Dr Carlos Hermosilla (another Patagonia Projects collaborator), Dr Häussermann and others who studied South American sea lions (Otaria flavescens) in Chilean Patagonia and found that they host many parasite species as well as several anthropozoonotic pathogens. They may act as "reservoirs" for these pathogens, and therefore the findings have implications for public health policy as well as conservation.

- Vreni Häusserman, Rolex Awards Laureate, 2016: https://www.youtube.com/watch?v=eJWz8t9kQ2U
- Vreni Häusserman, CNN article July 2020 https://www.cnn.com/2020/07/15/world/vreni-haussermann-c2e-spc-scn-int/index.html

Papers

Directly from Patagonia Projects expeditions:

- Krapp-Schickel, T., Häussermann, V., & Vader, W. (2015). A new Stenothoe species (Crustacea: Amphipoda: Stenothoidae) living on Boloceropsis platei (Anthozoa: Actiniaria) from Chilean Patagonia. Helgoland Marine Research, 69(2), 213-220.
- Ceseña, F., Meyer, R., Mergl, C. P., Häussermann, V., Försterra, G., McConnell, K., & Melzer, R. R. (2016). Decapoda of the Huinay Fiordos-expeditions to the Chilean fjords 2005-2014: Inventory, pictorial atlas and faunistic remarks. Spixiana, 39(2), 153-198.
- Clegg, I. L. K, Pashuk, K. Greg Landreth, G., Darwin, W., Espanõl, S., Galletti Vernazzani, B., Haussermann, V. (Manuscript in preparation). "Blue whale observation within the fjords of the Golfo de Penas, Chilean Central Patagonia and connectivity with Isla de Chiloe sightings: another mid-latitude feeding site for Chilean blue whales?".

From Patagonia Projects scientists on the same topic:

- Häussermann, V., Spano, C. Thiel, M. and Lohrmann, K. (2015): First record of the sea anemone Diadumene lineata (Verrill, 1869) (Cnidaria: Anthozoa: Actiniaria) from the Chilean coast. Spixiana 38 (1): 39-42.
- Schlatter, R., Häussermann, V., & Försterra, G. (2015). Some like it hot–hummingbirds making use of hot springs in Chilean Patagonia. Spixiana 38 (1): 48.
- Hermosilla, C., Hirzmann, J., Silva, L. M., Scheufen, S., Prenger-Berninghoff, E., Ewers, C., ... & Taubert, A. (2018). Gastrointestinal parasites and bacteria in free-living South American sea lions (Otaria flavescens) in Chilean Comau Fjord and new host record of a Diphyllobothrium scoticum-like cestode. Frontiers in Marine Science, 5, 459.

Activities

- Scuba diving biodiversity transects (down to 30m) of the benthic zones around the Golfo de Penas region and Canal Messier.
- Remotely Operated Vehicle (ROV) biodiversity transects of benthic zones at 500m around the Golfo de Penas region and Canal Messier.
- Invertebrate species sampling to define geographic distribution.
- Cetacean observation transects, recording of behaviour.
- Documenting all observed mammal and bird species on each Patagonia Projects trip.

Targets

- Biodiversity baseline for the area: record of species present in the area, and estimated abundance.
- Publications on any new species or on new findings of known species.

Outcomes

- Effective conservation policy based on established biodiversity baseline.
- Protection of some coral species on the IUCN Red List.
- Increased public awareness and stakeholder engagement regarding biodiversity in area.

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Dolphin and orca behaviour studies and individual identification

Blue Marine Foundation and Patagonia Projects

Project overview - June 2020

BLUE MARINE FOUNDATION

Dolphin and orca behaviour studies and individual identification

Headlines

- Toothed whales include dolphins, whales and belugas.
- Chile has an endemic dolphin species, the Chilean dolphin (*Cephalorhynchus eutropia*), and there are thought to be less than 5000 left in the wild.
- Each dolphin or orca has a unique pattern of notches and marks on their dorsal fins.
- Patagonia Projects started their orca ID catalogue in 2018 and have 14 individuals documented.
- The ability to identify individuals allows site fidelity to be studied: which species live in the Golfo de Penas, and how often do they return to the area?

Story

Very little is known about which odontocete species – toothed whales – frequent the waters of Chilean Patagonia around the Golfo de Penas. In addition, there are past observations of orca hunting sei whales (to the point where they strand on beaches and die) in this area. This prompted the Patagonia Projects team to more closely investigate and document orca behaviour, as well as any other dolphin species encountered.

In November 2018, Patagonia Projects collaborated with Dr Isabella Clegg and set up a protocol for on-effort sightings, recording cetacean behaviour and taking photoID data. The aim was to better understand which cetaceans inhabit the area, whether they are residents and whether there is high site fidelity (do they return each year?), and what they are using the area for. For this project, Patagonia Projects started using drones to monitor the animal's distinct markings, group sizes and behaviours. The first killer whale photo ID catalogue was established. This catalogue compiles photographic data of the orcas encountered, where each one can be identified by the unique pattern of notches, scars and other marks on their dorsal fins, similar to a fingerprint. Other dolphin species that the Patagonia Projects team will be monitoring in the area include Dusky dolphins, Peale's dolphins, and Chilean dolphins.

- (Also linked in the "Media & Art" project summary) Short film of the November 2018 trip by Will Darwin was presented at the World Marine Mammal Conference in Barcelona, in December 2019 https://www.youtube.com/watch?v=qcnlqWjqSFM
- This film was also selected to be shown at the World Whale Film Festival, Hawaii, February 2020

Top image: A researcher launching the drone. Credit: Isabella Clegg
This image: A killer whale playing with sea lion intestines. Credit: Keri-Lee Pashuk
Front cover: A pod of orcas, which can be identified using their dorsal fins. Credit: Isabella Clegg

Papers

Directly from Patagonia Projects expeditions:

- A scientific poster was presented at the Ciencias del Mar Conference, from 27th-31st May 2019 in Iquique, Chile. The poster was called “Learning more about the killer whales of Chilean Patagonia: ID catalogue for Golfo de Penas region and documented hunting behaviours” (Clegg, I. L. K., Pashuk, K., Landreth, G., Moore, R. & Haussermann, V.)

From Patagonia Projects scientists on the same topic:

- Häussermann, V., Acevedo, J., Försterra, G., Bailey, M., & Aguayo-Lobo, A. (2013). Killer whales in Chilean Patagonia: additional sightings, behavioural observations, and individual identifications. Revista de Biología Marina y Oceanografía, 48(1), 73-85.
- Pérez-Alvarez, M. J., Olavarría, C., Moraga, R., Baker, C. S., Hamner, R. M., & Poulin, E. (2015). Microsatellite markers reveal strong genetic structure in the endemic Chilean dolphin. PLoS One, 10(4), e0123956.

Activities

- Document the species and location of all cetacean species encountered on-effort or opportunistically.
- Conduct “on-effort” observations where at least one observer is following a standardised visual transect.
- Take photo ID data (dorsal, eye patch and markings) for orcas.

Targets

- Collect data on species, abundance and seasonality for the Golfo de Penas.
- Develop standardised transects to follow when in-transit as part of on-effort observations.
- Establish photo ID catalogues of individual orcas.

Outcomes

- Publish the first data on cetacean species and abundance in the inner Golfo de Penas.
- Use the orca photo ID catalogue to reveal their “site fidelity” to the area.
- Understand the frequency of orcas hunting sei whales in the area, to establish whether this may be a conservation concern.

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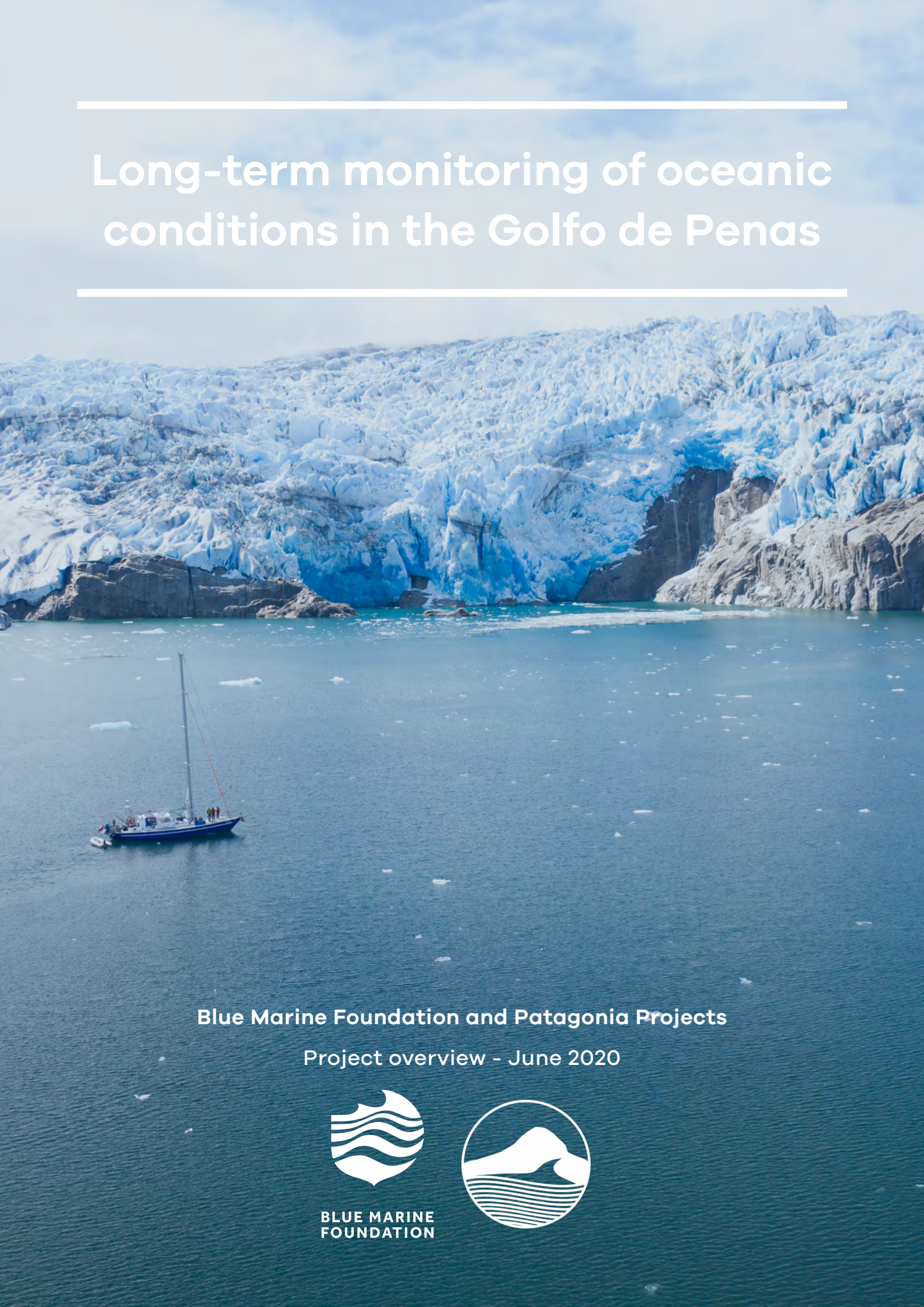
Long-term monitoring of oceanic conditions in the Golfo de Penas



Blue Marine Foundation and Patagonia Projects

Project overview - June 2020

BLUE MARINE FOUNDATION

Long-term monitoring of oceanic conditions in the Golfo de Penas

Headlines

- Chile has 80,000km of coastline, and one of the largest fjord systems in the world.
- The Golfo de Penas is influenced by Pacific ocean currents, river runoff and glacial ice melt.
- Three tectonic plates meet at the Golfo de Penas (The Antarctic, South American and Nazca plates).
- The Golfo de Penas has high levels of primary productivity, which supports many different species in its ecosystem.
- El Nino conditions and human activity are impacting oceanographic conditions in the Golfo de Penas and need to be monitored.

Story

The Golfo de Penas sits on a tectonic triple junction and is part of one of the most extensive fjord systems in the world, characterised by river run-off that meets tidal currents and sometime ice-melt to cause nutrient-rich upwellings. This leads to high levels of primary productivity, which subsequently supports phyto- and zooplankton and their food chains. Primary productivity is impacted by environmental factors such as El Nino, which in turn can intensify Harmful Algal Blooms (HABs) like the ones that likely caused the mass sei whale mortalities and the hydrocoral die-offs in this area.
To protect this area effectively, it is therefore crucial to understand the environmental factors that dictate the primary productivity in the area. This will also help to monitor the effects of glacial melting due to climate change, which will cause increased fresh water in the Golfo de Penas system. Patagonia Projects aims to achieve this by facilitating long-term monitoring of oceanic conditions through CTD (Conductivity, Temperature, Depth) data, on-land weather stations, and marine invertebrate sampling. In the past, Patagonia Projects has also facilitated geological studies, where scientists collected data to understand the age and stratification of the sea floor in the Golfo de Penas. This information all contributes to improving our knowledge of the oceanic environment and conditions in this unique area.

Top image: Invertebrate sampling. Credit: Isabella Clegg
This image: Dropping the CTD. Credit: Keri-Lee Pashuk
Front cover: A boat and glacier in the Golfo de Penas. Credit: Will Darwin

Papers

Directly from Patagonia Projects expeditions:

- Encinas, A., Moreira, R., Nielsen, S., & Bravo, X. (2015). Estratigrafía, edad y ambiente de sedimentación de los depósitos Neógenos del Golfo de Penas y Península de Taitao sur de Chile (47 S). In XIV Congreso geológico Chileno Coquimbo Actas 1e4 (Vol. 269).

Activities

- Take CTD (temperature, depth and salinity) data at multiple locations on each expedition.
- Sample marine invertebrates for species and abundance.
- Collect long-term weather data from land stations.

Targets

- Set up long-term, small land stations (have identified sponsors) to collect weather data.
- Collect several years worth of data on oceanographic conditions of the Golfo de Penas.

Outcomes

- Understand how primary productivity varies with sea temperature, salinity and depth.
- Understand whether primary productivity predicts whale abundance in season to season.
- Discover which marine invertebrates are present in the area and which species correlate with the sei whales' (and others') arrival.

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Photo, video and art outreach for marine conservation in Patagonia

Blue Marine Foundation and Patagonia Projects

Project overview - June 2020

BLUE MARINE FOUNDATION

Photo, video and art outreach for marine conservation in Patagonia

Headlines

- Patagonia Projects' short film has been shown at two international conferences/ festivals.
- Keri has held seven exhibitions for her photos and artwork, and has had six works shown in the Palacio de Moneda Gallery in Santiago as part of the Ballenas - Voces del Mar de Chile.

Story

Spreading conservation messages through art has been shown to be an effective tool for engaging the public. Keri, the co-founder of Patagonia Projects, has taken many photographs during the Patagonia Project expeditions and often shows them in exhibitions in Chile and beyond. Her latest exhibition will be held in the National Monuments Museum in Coyhaique in 2021. She also encourages expedition participants to take photos and footage to submit to festivals: one such film highlighting the conservation issues of the Golfo de Penas was shown at the World Marine Mammal Conference in Barcelona, December 2019, and the same film was invited to be shown at the World Whale Film Festival in Hawaii, in February 2020.

- Short film of the November 2018 trip by Will Darwin was presented at the World Marine Mammal Conference in Barcelona, in December 2019 https://www.youtube.com/watch?v=qcnlqWjqSFM
- This film was also selected to be shown at the World Whale Film Festival, Hawaii, February 2020
- Keri-Lee Pashuk's art exhibitions:

THE SEA AND ME: Moments from my Life on the Ocean
April 2013, Dreams, Punta Arenas, Chile
July 2013, Dreams, Puerto Varas, Chile

FOREST DANCE
La Galeria
Punta Arenas, Chile

THE COLOURS OF DEATH AND LIFE OF A WHALE
January 2017, Dreams, Punta Arenas, Chile
March 2017, Dreams, Puerto Varas, Chile
November 2017, El Centro Cultural El Austral, Valdivia, Chile

AGUA
June 2017, Centro de Arte Molino Machmar, Puerto Varas, Chile

BALLENAS - VOCES DEL MAR DE CHILE
Six - Ltd Edition Prints from "The Colours of Death and Life of a Whale"
August 2018 - November 2018, Centro Cultural La Moneda, Santiago, Chile (as part of an large exhibition on whales in Chile co-created by the MERI Foundation and the Cultural Centre La Moneda in Chile's parliament building).

HEMISPHERES APART

AGUA art exhibition. Credit: Keri-Lee Pashuk
This image: Whale art photos at Palacio de Moneda. Credit: Keri-Lee Pashuk
Front cover: Documentation through photography. Credit: Will Darwin.

Activities

- Document the Patagonia Project expeditions through photo and video footage wherever possible.
- Look for the artistic elements in Patagonia Project's conservation work and share them with the public.
- Post photos and videos regularly to Patagonia Project's social media pages and website.

Targets

- Spread the message of the Golfo de Penas's biodiversity and conservation issues through art.
- Enter film festivals and competitions with Patagonia Project footage.
- Continue exhibiting Keri's artwork.
- Gain new followers and support, and spread the message using social media.

Outcomes

- Multidimensional conservation campaign for Golfo de Penas.
- Extend Patagonia Projects' network and support through using social media.
- Engagement and awareness of marine conservation issues through art

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Monitoring the after-effects of the largest baleen whale mass mortality event ever recorded

Blue Marine Foundation and Patagonia Projects

Project overview - June 2020

BLUE MARINE FOUNDATION

Monitoring the after-effects of the largest baleen whale mass mortality event ever recorded

Headlines

- Sei whales (*Balaenoptera borealis*) are IUCN listed endangered species and the third largest whales in the world.
- The largest baleen whale stranding ever recorded happened in the Golfo De Penas in 2015 (Patagonia Projects study area).
- Over 350 sei whales were found stranded on the shorelines.
- The likely cause was toxic poisoning from a Harmful Algal Bloom (HAB).
- HABs are increasing in frequency.

This image: A new beached sei whale. Credit: Keri-Lee Pashuk
Front cover: A baleen whale skeleton on the Golfo de Penas shoreline. Credit: Isabella Clegg

Sampling a whale skull. Credit: Keri-Lee Pashuk

Story

Large mass mortality events (MMEs) are well known for toothed whales but are rare in the less gregarious baleen whales. In 2015, the largest baleen whale Mass Mortality Event (MME) ever recorded occurred right in the Golfo de Penas region, where more than 350 sei whales were found dead on the shorelines from the outer to inner fjords. The Patagonia Projects team, in collaboration with Dr Vreni Haüssermann, were the first to discover this unprecedented event which has significant consequences for the conservation of the endangered sei whale. The Patagonia Projects team were able to document more than 30 of the whales, taking samples where possible, and providing valuable on-the-ground photo documentation of the event. Subsequently the whales were counted from a small airplane, and then using Very High Resolution satellite (VHR) imagery in the first application of this technology. Although some results are still being analysed, the cause of the MME was concluded as Parasitic Shellfish Poisoning (PSP) caused by a Harmful Algal Bloom (HAB) building El Ninõ.

The MME was the catalyst in establishing Patagonia Projects as advocates for marine conservation, and they were driven by the question of why the HABs were happening, and whether it was going to happen again soon. Patagonia Projects' discovery of older whale skeletons in the Golfo de Penas region, as well as new whale carcasses in the years since 2015, suggests that this is a current threat to the sei whales. The sheer number of these whales that were shown to have died close to shore (as opposed to being washed in) suggested that the Golfo de Penas is a feeding ground for this species, who were previously thought to stay in the open ocean environments. Indeed, stable isotope analysis revealed that the sei whales were feeding on copepods, euphausiids, amphipods before they died, but that diet as well as migratory patterns vary between individuals. Through collaborations with Dr Carolina Gutstein, Dr Carlos Olavarria and others, conducting expeditions every year to the MME site and documenting any old and new carcasses, Patagonia Projects is providing invaluable information on the ongoing mortality of sei whales in the area and how the skeletons are eroded and transported over time.

Papers

Directly from Patagonia Projects expeditions:

- Haüssermann et al. (2017), Largest baleen whale mass mortality during strong El Ninõ event is likely related to harmful toxic algal bloom. PeerJ 5:e3123; DOI 10.7717/peerj.3123
- Reiss, L., Häussermann, V., & Mayr, C. (2020). Stable isotope records of sei whale baleens from Chilean Patagonia as archives for feeding and migration behavior. Ecology and Evolution, 10(2), 808-818.
- Suarez Santana, C.M., Fernández Rodríguez, A.J., Llinas, D., Arbelo Hernández, M.A., Español-Jiménez, S., Herrera, G., Durán-Torres, S., Kean, M., Pashuk, K.L., Landreth, G. and Häussermann, V., 2017. Expedición para el estudio de las poblaciones de ballenas sei (Balaenoptera borealis) en el Golfo de Penas y parque nacional Laguna de San Rafael (La Patagonia, Chile). Mayo 2017. X Congreso de la Sociedad Española de Cetáceos (SEC). Valencia, España, 29 and 30 September 2017 / editado por Natalia Fraija Fernández, p. 85

From Patagonia Projects scientists on the same topic:

- Fretwell PT, Jackson JA, Ulloa Encina MJ, Haüssermann V, Perez Alvarez MJ, Olavarrìa C, et al. (2019) Using remote sensing to detect whale strandings in remote areas: The case of sei whales mass mortality in Chilean Patagonia. PLoS ONE 14(10): e0222498. https://doi.org/10.1371/journal.pone.0222498

Activities

- Document all new whale carcasses in the Golfo de Penas region (photos, measurements, GPS), and take samples of baleen, bone, and flesh where possible.
- Establish a whale skeleton catalogue, where all skeletons are tagged with an identification number.
- On each expedition, take samples of invertebrates at several locations in the area to test for PSP from HABs.
- Use drones to take aerial photos of the whale skeletons each year.

Targets

- Understand which species of whales are stranding, how often and at what times of year.
- Correlate results to HAB data (from SERNAPESCA as well as own invertebrate sampling).
- Tag and identify all observable skeletons on the shorelines of the Golfo de Penas region, so that new skeletons can be more accurately identified.
- Aerial drone photography of old, identified whale skeletons.

Outcomes

- An understanding of the baseline level of mortalities in the area.
- Discover whether the HAB presence is correlated to mortalities.
- A catalogue with individual IDs for each whale skeleton.
- Data on the movements and decomposition of whale skeletons over time.

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