Things we always wanted to know about Antarctica

FAQ Handbook on Antarctica

APECS Association of Polar Early Career Scientists

ANTARCTICA DAY

This booklet has been created by the APECS Antarctica Day Project Group 2021.
Katharina Heinrich (design and content), supported by: Azamat Tolipov, Mareike Bach, Mathieu Casado, Jilda Caccavo and the APECS ExCOM and the APECS Directorate

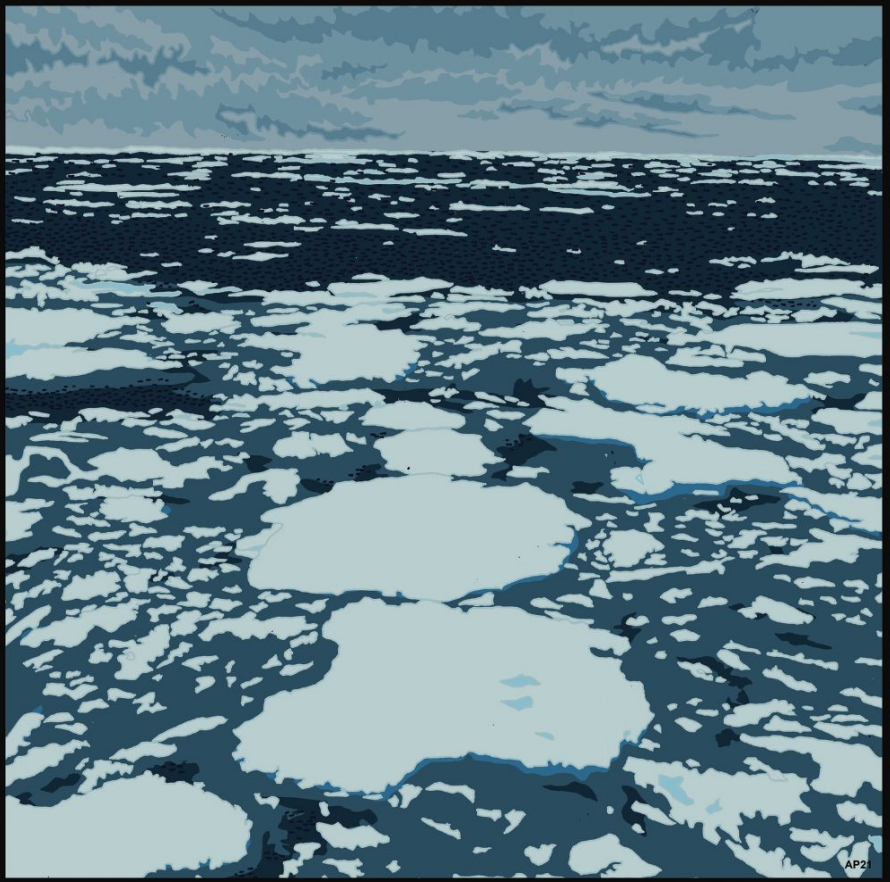
The information contained in this handbook are based on a PolarTimes Podcast episode that has been recorded in collaboration of the APECS Antarctica Day Project Group and the APCES Podcast Project Group.

The artwork and graphics were contributed by:
Autun Purser (Alfred-Wegener Institute) and Bronte Harrison (University Centre of the Westfjords)

APECS Association of Polar Early Career Scientists

ANTARCTICA DAY

- INTO THE ICE -



- POLARSTERN EXPEDITION - PS124 - COSMUS -

- STREAKS OF SEA ICE AND A RAPID DROP IN TEMPERATURE -

- 71 03 59 S , 27 57 54 W - 16:33:30 UTC - 09/02/2021 -

Antarctica on a quick glance

Antarctica is a continent located on the Southern Hemisphere. It is a landmass covered with an ice sheet, which even extends beyond the continent in the Southern Ocean. This ocean surrounds the Antarctic Continent.

Antarctica has no native population but has permanent human settlements, where scientists and staff members live for part of the year on a rotating basis.

The continent does not have any countries and technically does not belong to anyone. Yet, there are seven nations that claim parts of the continent (New Zealand, Australia, France, Norway, United Kingdom, Chile, and Argentina), which are mostly based on the history of exploration or geographic proximity. In addition to that, two nations reserved their right to make claims to the Antarctic continent (USA and Russia) under the treaty. Some states disagreed with these claims, so the international community established a unique system. It is known as the Antarctic Treaty System under which the territorial claims are frozen.

As such, Antarctica is designated as a nature reserve and as a space devoted to science and peace.

- FALSE ISLAND -

- POLARSTERN EXPEDITION - PS124 - COSMUS -

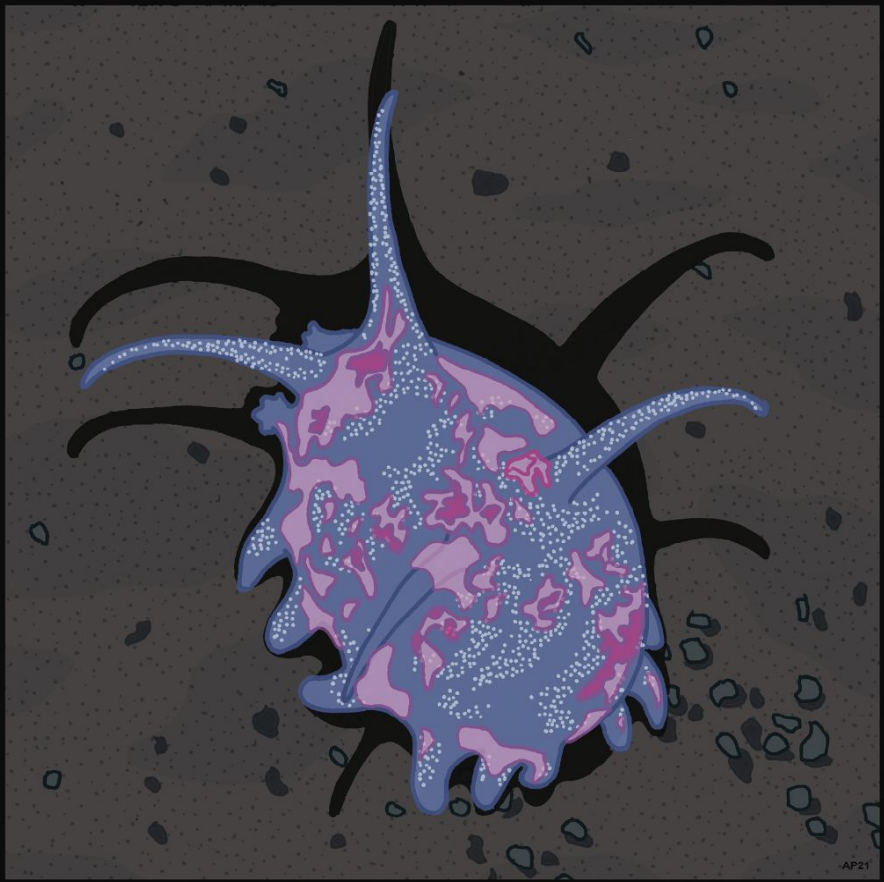
- NOT GRANITE CLIFFS, BUT ICY SLOPES -

- 76 03 12 S , 30 59 59 W - 17:49:56 UTC - 02/03/2021 -

My Favorite Thing about Antarctica

- Animals
- Abundance of marine life
- Penguins
- Research community
- Exploration history
- Coldness
- Vastness
- Remoteness
- Snow
- Ice
- Its beauty

- SEAPIGS FROM BENEATH THE A74 ICEBERG -

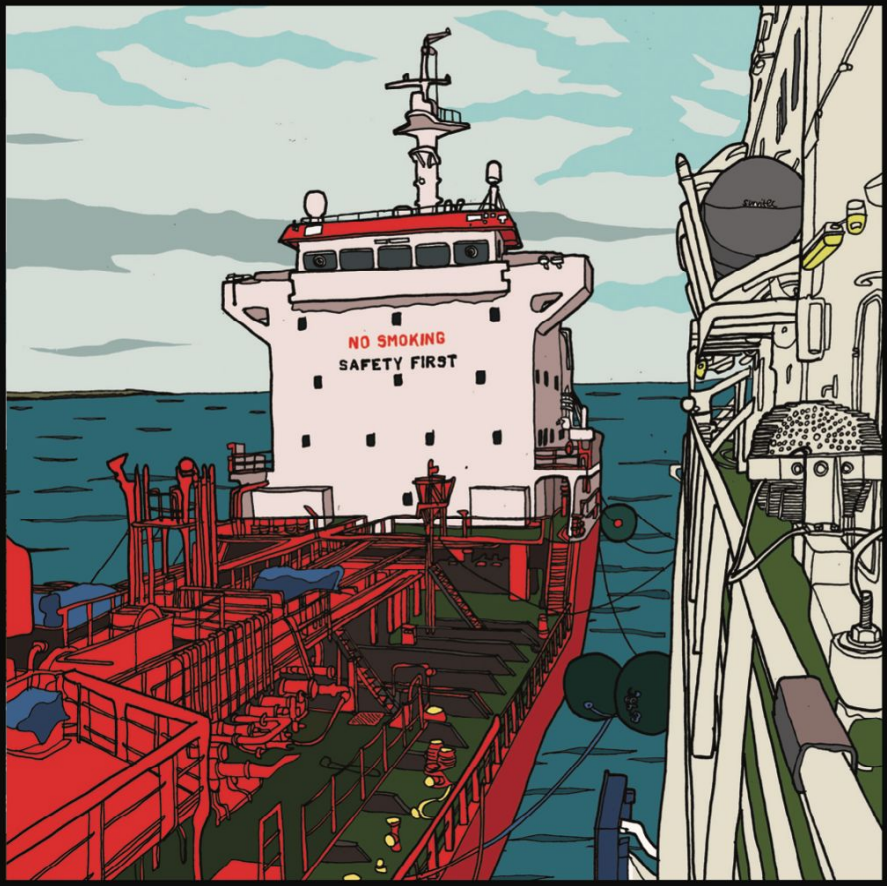


- POLARSTERN EXPEDITION - PS124 - COSMUS -

- ABUNDANT, COLOURFUL, MOBILE, REGAL, MAGNIFICENT -

- 75 15 05 S , 24 40 00 W - 11:10:00 UTC - 14/03/2021 -

- THE FALKLAND ISLANDS - TAKING ON DIESEL -



- POLARSTERN EXPEDITION - PS124 - COSMUS -

- 12 HOURS TO FILL THE TANKS , SOON TO HEAD SOUTH -

- 51 39 56 S , 57 46 14 W - 17:05:10 UTC - 03/02/2021 -

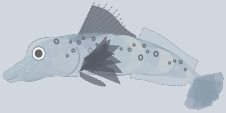
Humans in Antarctica

Are there any people living in Antarctica?

There is no Antarctic native population, but a number of scientists, researchers and staff personnel live at Antarctic scientific research stations. To date, the continent hosts around 70 bases that represent 29 countries. Some of the researchers stay for a whole year, others are stationed in Antarctica just for a few months of the year. During the winter months, the number of researchers in Antarctica reduces drastically. During this time only basic research and maintenance of the stations are carried out.

How do people in Antarctica deal with the harsh climate?

Special equipment and gear supports the scientists to withstand the harsh climate and weather in Antarctica. Supplies are brought to various Antarctic stations by ship or plane, and are stored in their depots. Especially, when scientists undertake fieldwork, which can be conducted far away from the station, researchers need to rely on their gear and always need to be prepared for bad weather. Flexibility, teamwork and adaptability are key terms for Antarctic research projects and any other trips to the frozen continent.



Humans in Antarctica

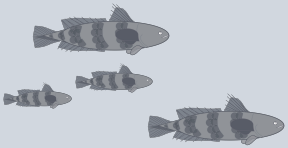
Is Antarctica totally explored?

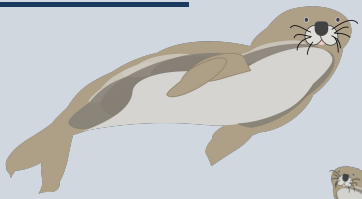
Due to its extreme weather conditions, remote location and the fact that it is covered in complete darkness half of the year, Antarctica is not totally explored yet. Especially, the marine environment and ecosystems in the Southern Ocean are largely unexplored and new species are regularly found during research expeditions.

Can we live in Antarctica and build cities, for example?

Based on the Antarctic Treaty System, the continent belongs to no specific country. Under this system, the access to Antarctica is regulated: when an expedition to Antarctica is planned, the government of the country under which the project is run, needs to give permission. In addition, it must be ensured that the environment is protected. The impacts of activities, such as building research stations, need to be assessed beforehand to ensure that there is no damage to the environment. Therefore, it seems unlikely that there will be cities built as long as the Antarctic Treaty is in place, but who knows what the future will hold for the continent and whether some day cities will start emerging.

Humans in Antarctica





What is being researched in Antarctica?

Antarctica is a fascinating place that holds a wide range of unknown information and species. By undertaking research in different fields, the science community aims to gain an enhanced understanding of Antarctica's role in the Earth system. As such, scientists collect data that help us understand the unique ecosystem that is present in Antarctica and to better understand how climate is changing. For example, biologists are doing research on living species from microorganisms to large mammals, oceanographers are investigating the ocean currents that are characterizing the Southern Ocean, and glaciologists and geologists are investigating the ice sheets, and use different methods to measure the ice to understand how it behaves. Further, there are meteorologists investigating how Antarctica's weather is connected to the weather in the rest of the world. But of course, this is not an exhaustive list. All aspects of Antarctica, which include the terrestrial (land) and marine (ocean) spaces and are intrinsically linked to each other, are being researched to gain a better understanding of the continent.

Humans in Antarctica

Are there property rights in Antarctica?

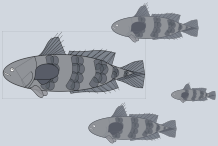
As the Antarctic Treaty freezes the territorial claims that have been made by some states in the past, the continent belongs to no one specific. Thus, there are no specific property rights. The lucky few who get to go to Antarctica are act and are held accountable under the law of their own country. Generally, everyone is free to conduct science in Antarctica, which is done by countries through their research stations. However, significant resources are needed to travel to Antarctica and to conduct research. If a country does not have a research station located in Antarctica, they are encouraged to use an approach called “piggy backing”, which means that different countries are sharing a research station and other property for collective research efforts. Interestingly, the Concordia station is jointly operated by France and Italy, which makes it the only station run by two countries, to date. Cooperation as well as the exchange of information and staff are common among Antarctic research stations. With the piggybacking approach, countries with less financial and/or research resources also have the opportunity to participate in Antarctic research.

- ANCIENT AND ELEGANT CRINOIDS -

- POLARSTERN EXPEDITION - PS124 - COSMUS -

- ORDER AND SYMMETRY IN MOBILE CHAOS -

- 74 55 10 S , 29 25 50 W - 04:58:56 UTC - 12/02/2021 -



Wildlife in Antarctica

What animals live in Antarctica?

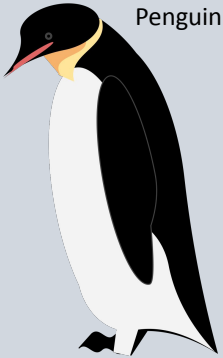
Despite the hostile and cold environment, Antarctica is full of life. Living organisms are ranging from small bacteria, algae, mosses and lichens and worms to fish, birds and larger mammals. Crustaceans, such as krill are an integral part of the Antarctic ecosystem and there are also many fish species. The Antarctic toothfish, for example, is particularly interesting as it has an antifreeze protein in its blood. The birds include penguins, wandering albatrosses and storm petrels among others. Lastly, there are, of course, marine mammals such as many whale species and seals represented in Antarctica. This is, of course, not an exhaustive list of species present in Antarctica, as there are so many more species that cannot all be listed here.

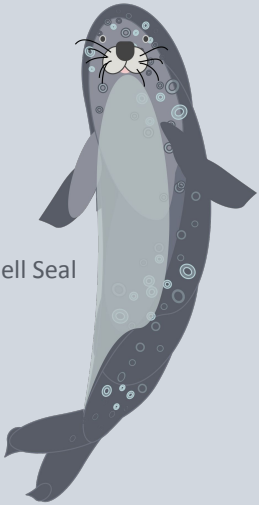
What is under the ice?

The ice shelves represent the greatest unexplored habitats of the Southern Ocean. It was believed that under the ice, away from the open ocean and light, life is less abundant. But when scientists studied the environment below the ice, they found fish, worms, jellyfish, sea spiders, sponges, sea cucumbers and krill, to just name a few. But also unexpected species such as sponges were found. Under the ice that covers the landmass of the Antarctic continent, however, moving water, such as subglacial lakes and rivers, and even microbial life can be found. In addition to that, many fossils are found under the ice, which indicate that Antarctica was once covered by a temperate rainforest.

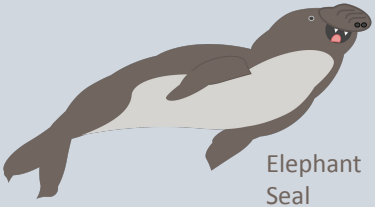
Wandering Albatross

Penguin

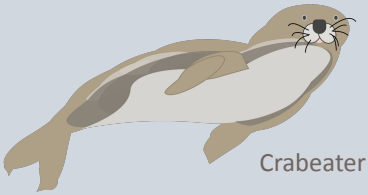




Weddell Seal



Elephant
Seal

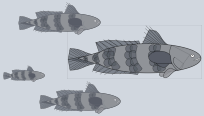


Crabeater Se

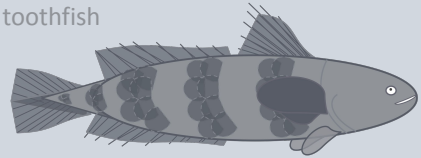
Wildlife in Antarctica

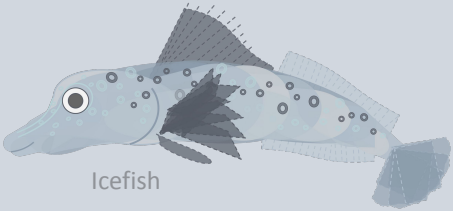
Are fish and marine mammal populations around Antarctica declining, and if so, what are the causes?

Already in the early 18th century, the whale populations in Antarctica were targeted by whalers. As a consequence of intense whaling, many species were close to extinction. Also, the valuable Antarctic toothfish was heavily fished and the stocks declined rapidly. While the fish stocks in the Antarctic are still being exploited, there have been successful management measures put in place, such as catch limits and protected areas where fishing activities are prohibited. Today, Antarctic krill is a species that is in the interest of many countries. Especially, due to its importance for the ecosystem, we need to monitor the stocks closely and act in time to ensure that the stocks are maintained at a healthy and sustainable level. This should generally count for every species that is commercially exploited. The fishing activities in the Southern Ocean are regulated by the Commission on the Conservation of Antarctic Marine Living Resources (CCAMLR) and the International Whaling Commission (IWC). Marine protected areas (MPAs) are an additional tool for the management of commercially valuable resources and the protection of marine biodiversity in the Southern Ocean.

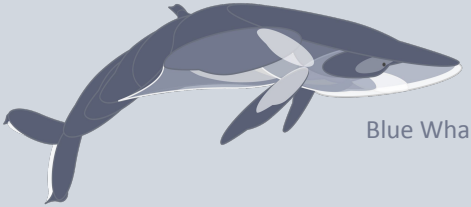


Patagonian toothfish

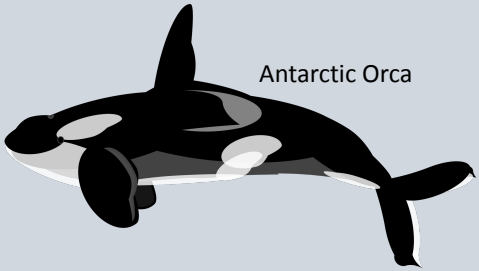




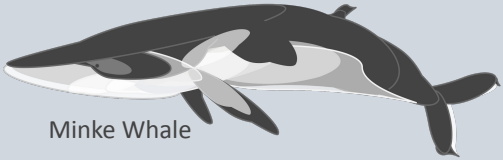
Icefish



Blue Whale

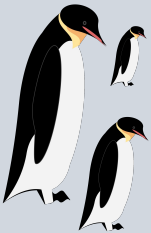


Antarctic Orca



Minke Whale

Wildlife in Antarctica



Why are there no polar bears in Antarctica?

Polar bears live in the northern hemisphere. In contrast, penguins are found in Antarctica and on other continents in the southern hemisphere, such as South America, Africa and Australia. Likely reasons for the absence of polar bears in Antarctica are evolution, location and climate. The fact that Antarctica is such an isolated continent and that it was separated from other continents before the evolution of polar bears might be another reason, as well.

- SHATTERED ICEBERGS -

- POLARSTERN EXPEDITION - PS124 - COSMUS -

- REMNANTS OF SHELF ICE, HINTS OF SEA ICE -

- 70 25 02 S , 29 59 56 W - 14:20:00 UTC - 08/02/2021 -

Climate Change Impacts and Weather

How does climate change impact Antarctica?

As a global process, climate change has impacts on Antarctica and the Southern Ocean, too. Especially, the west coast of the Antarctic Peninsula has experienced rapid warming over the past 50 years. In fact, it is one of the most rapidly warming parts of the planet. Such warming influences the physical and living environment of the continent. For instance, due to changing sea-ice conditions, a change in penguin colony distribution has been recorded. Glaciers have retreated, ice shelves decreased in size or even collapsed completely. However, the East Antarctic Ice Sheet, for example, has been relatively stable, compared to other parts of Antarctica and Greenland Ice Sheet.

What will happen to Antarctica if climate change doesn't stop?

This is a very big and important question, but the answer is not obvious. Scientists have tried to predict future scenarios, but because there is still a lack of data from observations and due to the complexity of the earth's systems, uncertainties for predictions remain. To make better projections of Antarctica's fate, climate, ice sheet and ocean models need to be enhanced. This requires more data to be collected in Antarctica. All in all, it can be said: changes in Antarctica will likely affect the rest of the world, as well as changes in the rest of the world will continue to have impacts on Antarctica.

Climate Change Impacts and Weather

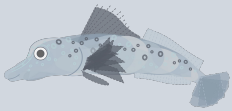
How big was Antarctica before climate change?

The size of Antarctica is often connected to its sea ice extent. Sea ice extent, however needs to be distinct from the continent and itself, as well as from ice sheets, which are glacial land masses. The sea ice changes through the seasons. It extends in the darker winter with colder temperatures and shrinks in summer, which is characterized by warmer temperatures and longer days. Even though climate change impacts on air temperature and ocean temperature have been seen in Antarctica and the Southern Ocean, scientists have found that the area of sea ice around Antarctica has remained relatively stable over the past 100 years. Impacts of climate change in Antarctica are very complex and scientists are still working hard to get and analyze more data to learn more on how climate change affects the continent. To illustrate this complexity, here a brief example: the distribution of sea ice can be monitored via satellites, but ice-thickness is harder to measure because you need measurement on site.

Climate Change Impacts and Weather

How much did the temperature rise in the past years and how much will it rise in the future?

Due to climate change, the ocean and air temperatures are globally warming, with devastating effects on ecosystems and regions. Scientists found out that Polar Regions are warming at a much faster rate than the rest of the world. The Intergovernmental Panel on Climate Change (IPCC) is a body of leading experts related to climate science that publishes reports about the recent status and knowledge on climate change, its impacts and future risks. Such a report showed that the Antarctic Peninsula is one of the most rapidly warming places on the planet. Air temperatures have increased by 3°C and the upper ocean temperatures west of the Antarctic Peninsula have increased over 1°C since 1955 (IPCC). This is three times more than the average temperature increase of the entire planet. In fact, the Antarctic Circumpolar Current, which regulates the climate in the Southern Ocean, Antarctica, and around the whole globe, is warming more rapidly than the global ocean as a whole. It has been difficult to detect signs of warming in the interior of Antarctica, due to the small number of research facilities. However, with a warming Peninsula and Southern Ocean, it is likely that the interior is also already under the influence of climate change. The temperature increase, however, is still largely uncertain, and past, current and future climate change impacts are being intensively studied.



Climate Change Impacts and Weather

How can we save Antarctica and the animals living there?

Science communication and education are crucial to motivate the protection of the earth's ecosystems, including the Antarctic. Therefore, as a starting point, awareness of Antarctica could be increased among governments, policy makers, businesses, students and the general public by emphasizing the frozen continent's important role in global processes. This might be done through increased outreach programs, for example. Also, different management tools can be used to protect the ecosystems and biodiversity. One tool that is commonly used for ecosystems and biodiversity protection is the establishment of Marine Protected Areas (MPAs). There are different kinds of MPAs and under the highest protection level, no commercial activities are allowed within the area. These are also called no-take MPAs. The largest MPA is actually located in the Southern Ocean, particularly in the Ross Sea, and includes different protection zones.

- THE FALKLAND ISLANDS - EAST FALKLAND -

- POLARSTERN EXPEDITION - PS124 - COSMUS -

- ROBUST AND WINDBLASTED, SHEEP AND SILENCE -

- 51 41 31 S , 57 49 14 W - 13:40:00 UTC - 01/02/2021 -

Further Resources and Links

Our Spaces – The Foundation for Good Governance of International Spaces

Available information on the Antarctic Treaty Summit and available education resource in many languages

https://ourspaces.org.uk/resources/

Discovering Antarctica

Short, concise and informative information on Antarctica (including climate change, governance, science and exploration, ecosystems etc.)

Also includes student activities

https://discoveringantarctica.org.uk

Cool Antarctica

Pictures, Facts, History and Travel (including resources and activities for schools)

https://www.coolantarctica.com

Frontiers for Young Minds

Article: Are warm ocean current melting the ice in Antarctica?

https://kids.frontiersin.org/articles/10.3389/frym.2020.00124

This handbook is intended to be a living document. If you would like to translate it into a different language or like to add information or edit provided information, feel free to contact info@apecs.is or katharina.heinrich1@gmx.net

Make sure to also check out the APECS Podcast PolarTimes on all platforms available for more news on the Polar Regions.

Here the link to the connected podcast episode:
https://open.spotify.com/episode/5AkXNxs3WZXB41AO4KRcTg?si=54796c7f5a374e56