

DESCRIPTION OF THE ENVIRONMENT

1. DRONNING MAUD LAND

1.1 *Background*

1.1.1 General

Dronning Maud Land (DML) is a huge area, reaching from about 20°W to 45°E, and from the South Pole (90°S) all the way up to the coastline at about 70°S (see map). The area mainly consists of ice sheets with some mountain ridges and nunataks, which date back to Pre-cambrium.

1.1.2 Ice

The Antarctic ice sheet on the high plateau of DML (2500-4000 m.a.s.l.) drains towards the sea, forming the shelf ice when it reaches the sea. Jutulstraumen, a large ice stream, is 400 km long, 40-100 km wide and have an average thickness of 2,500 meter. Jutulstraumen moves with a speed of 500 meter per year and transports huge quantities of ice to the sea (c. $5,6 \times 10^{10}$ ton/year).

The coastline consists mainly of floating shelf ice, 50-400 metres thick. The ice shelf often extends hundreds of kilometres from the coast before it ends in vertical walls, usually 10-30 meters high. Fimbulisen and Riiser-Larsenisen are the two largest ice shelf areas along the coast of DML. There are usually numerous icebergs in the sea, originating from the ice shelf. The high and steep ice shelf makes it difficult to find an area where ground transportation from the sea ice up to the shelf ice is possible. However, in some areas, old, large, snow filled crevasses, provide gentle slopes where track vehicles and skidoos are able to travel. One such area is Rampen, usually used for transportation of Finnish and Swedish expeditions to their stations. Norway uses different locations.

The ice shelf is in some areas grounded, e.g. Kvitkuven close to Rampen. One result of such grounding is the creation of numerous large crevasses, since the ice sheet bends over the ground. The Rampen crevasse is a result of such a process. There are a lot of large crevasses around Kvitkuven, which is very important to take into account when establishing the route to the stations.

The boundary between floating and grounded ice, e.g. the boundary between the ice shelf and the ice sheet, is called *grounding line*. Also in this area are there often crevasses, since the ice sheet is bent and different parts of the ice moves with different speed. Transportation routes passing the grounding line must therefore be properly reconnoissanced.

DML is mainly covered by a thick ice sheet, which has an average thickness of 2,000 metres. In some areas there are lots of large crevasses, but it is normally no problem finding areas suitable for ground transportation.

1.1.3 Climate

DML has a cold continental climate, with temperatures normally below 0°C also in the summer. On the plateau the temperature varies between -30°C in the summer to -80°C in the winter. The coastal areas are somewhat warmer, but here there are often strong winds. At the Nordic stations the temperature in the summer varies between 0°C and -20°C.

1.1.4 Fauna and flora

A chain of mountains and nunataks is found approximately 100-250 km from the coast. The Nordic stations are all located on nunataks in this chain of mountains. Troll at Grjotlia in Jutulsessen, Tor at Svarthamaren in Mühlig-Hofmannfjella, Aboa and Wasa (very close to each other) on the nunatak Basen, and Svea on a small nunatak in the mountain ridge *Heimefrontfjella*. Jøkulkyrkja in Mühlig-Hoffmanfjella is the highest mountain in DML and reaches 3 148 m.a.s.l.

All nunataks are of great importance for plants and animals and should be treated thereafter. Mosses and lichens are the most abundant plants. There is also algae and fungus. No fanerogams have been found so far. A number of invertebrates have been found, such as protozoans, bacteriums, cyanobacteriums, nematodes, rotifers, tardigrades and arthropods (i.e. insects, mites (*Acari*), springtails (*Collembola*) and fleas (*Siphonaptera*)).

Among birds Antarctic petrel (*Thalassoica antarctica*), Snow petrel (*Pagodroma nivea*) and South polar skua (*Catharacta maccormicki*) are the most abundant species. They normally have their nesting grounds on steep cliffs and the petrels often breed in huge colonies, consisting of hundreds to many thousands pairs. The world's largest Antarctic petrel colony, with 250.000 breeding pairs, is located at Svarthamaren in Mühlig-Hofmannfjella in DML, 200 km from the sea. Wilson's stormpetrel (*Oceanites oceanicus*) has also been observed a number of times, but just a few nests have been observed so far.

Emperor penguins (*Aptenodytes forsteri*) and Adelie penguins (*Pygoscelis adeliae*) are the only penguin species breeding in DML. Emperors breed on the sea ice at three different locations in DML: Riiser Larsen-peninsula, Lazarev Ice Shelf, and close to the German station Neumayer. In the eastern part of DML there are a number of small colonies of Adelie penguins.

Among seals Crabeater seal (*Lobodon carcinophagus*) is the most common. There are also Leopard seal (*Hydrurga leptonyx*), Weddell seal (*Leptonychotes weddelli*), and Ross seal (*Ommatophoca rossi*) in the sea ice along the coast of DML.

Care should always be taken to all areas where plants and animals are present. Plants are always sensitive to physical contact and you should make it a rule avoiding trampling on plants. The birds might seem to be fearless, but a disturbance often causes increased heart rate (which means higher energy consumption), possible de-

creased resistance to diseases, etc. Frequent disturbances can therefore lead to decreased breeding success. For more information about how to behave in the areas frequently visited during Nordic expeditions, see the Environmental Guidelines in this chapter.

The stations are, as mentioned, located on bare ground on nunataks. The area just around the stations, e.g. about the nearest 500 metres, are usually influenced quite a lot by human activities, and it would be to unrealistic to believe that this is possible to avoid. However, care should always be taken *everywhere* and therefore management plans have been or will be developed for the different stations (see chapter 8).

2. BOUVETØYA

The 50 km² island Bouvetøya is the tip of a volcano that rises out of the Southern Ocean at the southern extremity of the Mid-Atlantic Ridge at 54° 25' S, 3° 21' E (see attached map). More than 90% of the island is covered by ice, but there are rock cliffs on the north, west and south-west sides, as well as a few projecting rocky headlands.

The island is located near the Antarctic convergence and the relatively warm water from the north ensures that sea ice rarely accumulates around the island. The annual average temperature at sea level is around -1°C and the humidity and precipitation are high on the island.

Bouvetøya is quite barren. In general the flora is made up of moss and lichen. The green algae *Prasiola crispa* is abundant, especially in areas fertilised by seals and seabirds. Other algae are associated with the supra-littoral zone, as well as the fresh-water systems in the area.

Large colonies of Antarctic fur seal (*Arctocephalus gazella*) are found on the west side of Bouvetøya, the largest one in the Nyrøysa area. Elephant seals (*Mirounga leonina*) are also found on the island, but in much smaller numbers.

Twelve sea bird species are known to breed on the island, of these two penguin species, namely the Maccaroni penguin and the Chinstrap penguin.

Norway has established a research station unit near the highest point of the beach platform Nyrøysa on the western side of Bouvetøya (54°24.6' S, 3°17.2' E). Regular expeditions are made to implement monitoring of the seal and seabird colonies at Nyrøysa within the framework of CCAMLR's Environmental Monitoring Program (CEMP).

3. SENSITIVENESS OF DIFFERENT TYPES OF ENVIRONMENT

3.1 *Ice covered areas*

Ice covered areas are the least sensitive type of environment in the Antarctic, since there is little or no life. However, since ice moves and melts, waste, wastewater, spills etc. on the ice will sooner or later reach some other type of environment. It is therefore important to avoid littering/contaminating the ice.

3.2 *Snow covered areas*

Regarding snow covered ice, see above (Ice covered areas). In areas where snow covers the bare ground there is often life below the snow cover, and litter/contamination to the snow will at some point usually reach the ground where it might influence plants, micro fauna, etc. *Walking* on snow, however, does not have substantial impact and is preferably compared to walking on bare ground.

3.3 *Bare ground*

Since only one percentage of the Antarctic surface is bare ground, this is a very important environment for flora and fauna. Lichens usually grow extremely slow in the Antarctic and even the tiniest specimen might be hundreds of years old. Some birds build their nest in gentle slopes, i.e. snow petrels, and walking on bare ground might destroy theirs nest, since they are usually hard to discover. Always avoid walking on bare ground if possible. In chapter 10 you will find management plans for some areas that are often visited during Nordic expeditions. You should stick to the regulations prescribed in these plans.