Proposal to Enhance Cooperation in the Research and Monitoring on the Population Dynamics of Penguins in the Ross Sea Region

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**Working Paper submitted by China**

***Summary***

Emperor Penguin (*Aptenodytes forsteri)* and Adelie Penguin (*Pygoscelis adeliae)* are key indicators of the Antarctic ecosystem in the Ross Sea Region. The historical data reveals that the rise and fall of the populations of penguins in this region are largely influenced by the natural climatic and environmental variation, and migration of populations in different colonies. The population size of Emperor Penguins in the Ross Sea region have been increasing with fluctuation in the recent 2 decades, while Adelie population shows a steady increasing trend. It is proposed that ATCM and the CEP further encourage Parties/members to Enhance Cooperation in the Research, Monitoring and assessment on the Population Dynamics of Penguins in the Ross Sea Region to inform the decision-making on relevant topics, and incorporate the related science needs into relevant their work Plan.

***1. Significance***

Emperor Penguin (Aptenodytes forsteri) and Adelie Penguin (Pygoscelis adeliae), as important endemic species to Antarctica, are key indicators of the Antarctic ecosystem (Taylor and Wilson 1990). Adelie Penguin and Emperor Penguins are the only penguin species in the Ross Sea Region, which supports 25-30% of the population of Emperor Penguins and 30% of Adelie Penguins.

The genetic structures of Emperor Penguins and Adelie Penguins in the Ross Sea region are different from those in other regions. SNP molecular markers show that the genetic structure of Emperor Penguin in the Ross Sea region is significantly different from other meta-populations. The Ross Sea region is the only such a region with record of penguins in the Last Glacial Period. Adelie Penguins inhabited Beaufort Island and areas along Scott Coast can be dated back to 45,000-26,000 year ago (Emslie et al., 2007). The earliest records of penguins since the Pleistocene was found at Terra Nova Bay as early as 8,500-8,200 ago (Gao inlitt., Lambert et al. 2002，Parks et al. 2015), matching the time of the retreat of ice shelf in the region.

The historical data reveals that the rise and fall of the populations of penguins are largely influenced by the natural climatic and environmental variation, interactions among atmosphere-ocean-ecosystem, and migration of populations. The primary control factors might vary in different spatial and temporal scales. It is found that the falls of penguin populations in some areas usually coincides with the rises in other areas, and climate change may also drive penguins to move to new suitable breeding sites.

***2. Population Dynamics***

The analysis of scientific data and information demonstrates that the population size of Emperor Penguins in the Ross Sea region have been increasing with fluctuation in the recent decades, while Adelie population shows a steady increasing trend.

There are seven main breeding colonies of Emperor Penguin in the Ross Sea region. The populations of Emperor Penguins in the colonies demonstrated an increasing trend with relatively great fluctuation. The greatest record in the numbers of chicks and adults were respectively 65220 and 79253 breeding pairs in 2012, while the records in 2011 were the second, with 56512 and 77845 breeding pairs respectively.

The long-term and systematic monitoring started in 1981. The extent and duration of sea ice in the Ross Sea region has been increased in the past 40 years, resulting in the increase of population size of Adelie Penguin. Despite the individual population size varied among colonies, the populations of Adelie Penguins in the largest colonies in the Ross Sea region e.g. Cape Adare, Cape Crozier, Cape Bird, Beautfort Island, and Possession Island, have been increasing. The population size of Adelie Penguins in the Ross Sea region was estimated to be 1,080,000 breeding pairs through aerial image during 1981-1987; and average population size was estimated to be 855,625 pairs through aerial image during 1981-2012. The breeding population in the 24 breeding colonies in the Ross Sea region was estimated to be 1,175,271 pairs combining with field survey and satellite image.

***3. Conclusion***

Emperor Penguin and Adelie Penguin are key indicators of Antarctic ecosystem, especially in the Ross Sea region. On the basis of the analyses on available data, it can be concluded that: (1) The population size of Emperor Penguin has been increasing in the whole Antarctica. An increase since 2000 is obvious with fluctuation because of natural change and logistics of survey. (2) The size of Adelie Penguin is in a stable increase at the main colonies in the Ross Sea region.

The survey data shows large variations of population sizes of some breeding penguins, and also reveals the risk of instability. The fluctuation of population sizes at some colonies could reflect the real situation, while the difference of methods and accuracy, or the migration of populations among the colonies could not be excluded. Therefore, the regional and/or the species-scale status and trend may not be fully reflected in the result of the surveys

China has surveyed and protected the population of Adelie Penguin on Inexpressible Island in recent years in cooperation with neighboring stations, with the support of existing temporary facilities at the new station in the Ross Sea region. With the construction of new station in the Ross Sea region, more scientific research programs could be conducted to contribute to the research and monitoring on the penguin populations and the ecosystems in the Ross Sea region, with a view to support cooperation of Parties in developing appropriate and effective management measures.

***4. Recommendations***

ATCM and the CEP further encourage Parties/members to promote international cooperation and data sharing:

1) to conduct a comprehensive, coordinated, long-term, and accurate research, monitoring and assessment of the population dynamics of Emperor Penguins and Adelie Penguins in all breeding colonies across the Ross Sea area, on the basis of systematic planning and comprehensive collaboration, reducing local population variation caused by migration, investigation methods, etc. and include environmental factors such as sea ice, temperature, and productivity of ocean to reveal the patterns of population change and the dynamics of drivers. Establish the status and long-term trend of Emperor Penguins and Adelie Penguins through international collaboration and data sharing, with the aim to inform the decision-making on relevant ATCM and CEP topics.

2) to incorporate the relevant science needs into relevant ATCM and CEP work Plan.

**Attachment：**Population Dynamics of Emperor Penguins and Adelie Penguins in the Ross Sea Region