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C-BIRDS: Counting seabirds from Cruising ships: A protocol for monitoring climate change impacts on Antarctic biodiversity

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ABSTRACT

C-BIRDS is motivated by the general concern about the resilience of Antarctic ecosystems facing ongoing climate changes. In particular, the ability of seabirds to track the geographic distributions of their ecosystems will determine their fate in a warming future. Being at a top position of food chains, seabirds respond to whole-ecosystem changes in space and time, and thus form an excellent candidate as an operational indicator for biodiversity conservation in polar regions. To calibrate this indicator, models relating the spatial distributions of seabirds need to be built based on a simultaneous monitoring of birds, climate, sea properties and proxies of food resources a set of variables that are so essential for marine ecosystems that they were called ""essential oceanic variables"" (EOV). The necessary data critically need three conditions: be easy to acquire in any ship with basic EOV sensors, be recorded in a wide range of environmental conditions and geographic locations, be reproducible to warrant comparisons in space and time. This standard of quality is well achieved on Antarctic bird colonies, but reproducible bird data associated with EOV measurements are currently recorded only along a handful of research vessel or supply ship routes. This is where Ponant can help. In the C-BIRDS project, we believe that the novel gateways to Antarctica provided by Le Commandant Charcot have a tremendous potential to gather protocoled and reproducible data on seabirds and EOVs. We therefore propose to elaborate and test a standardized seabird counting protocol reproducible on any cruising ship equipped with at least basic EOV sensors. Using the highest standards of ecological modelling, C-BIRDS will investigate which minimum set of EOVs is needed to predict spatial variations in abundance, composition and diversity of seabird assemblages foraging in the Antarctic and sub- Antarctic seas. These models will then be used to perform a range of forecasts on the fate of seabirds' key foraging conditions under climate change. Crucially, C-BIRDS data and models will form a benchmark for comparison with future surveys, offering the opportunity for a long-term monitoring of seabirds on cruise ships through an ecosystem approach. In addition, C-BIRDS will take advantage of Charcot's ability to explore areas rarely visited by research vessels to generate new knowledge on data-deficient seabird species. Notably, we will gather photographic data on prions, a data-deficient group of species that are notoriously difficult to separate at sea. Using calibrated databases of birds identified on their breeding grounds, we will train an artificial intelligence algorithm to identify prions in photographs taken from the Charcot and to assist ornithologists

involved in future similar surveys. Published results from C-BIRDS will pave the way for long-term at-sea monitoring observatories onboard Ponant' and ARICE's cruising ships. Simultaneously, C-BIRDS public broadcast will aim to raise awareness to seabirds and their fabulous, yet precarious lives at sea.