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JUST A SAILING SUPERSTITION? WILSONâ S STORM PETREL PRESENCE AT COMMERCIAL TRAWLERS AT GOLFO SAN JORGE, ARGENTINA AND ITS RELATIONSHIP WITH WEATHER CONDITIONS

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Running head: The Wilson Petrel and the weather conditions

ABSTRACT

Wilson's Storm Petrels spend the austral winter and spring (May to October) at sea. Studies in the Golfo San Jorge, Patagonian Shelf, showed the presence of this petrel in seabird assemblages associated with commercial trawlers. A sailing superstition holds that the appearance of storm petrel foretells bad weather. By way of confirming this traditional belief, the aim of this study is to relate the appearance of the Wilson Storm Petrel with the weather conditions at sea and the feeding behaviour implications. Information about the presence and abundance was gathered on board from a total of 253 hauls during 2005, 2006 and 2008. A total of 65 individuals were recorded in 30 (11.86%) of fishing hauls. The number and presence of Wilson Storm Petrels be correlated with low atmospheric pressure. Given that they are among of the most abundant seabirds of the world, detailed data on interactions with fisheries and weather conditions at sea are not only interesting for analyze their association with fisheries or foretells bad weather, but may also be useful for monitoring the Southern Oceans.

Key words: Wilson Storm Petrel, trawl fisheries, weather conditions, Patagonia.

Introduction

Wilson´s Storm Petrel (*Oceanites oceanicus*) is an abundant summer resident in the southern oceans, breeding around the Antarctic coast and on most Antarctic and sub Antarctic islands (Watson et al 1971; Marchant and Higgins 1990). The species feed on surface plankton (Quillfeldt et al. 2005; Croxall et al. 2009), typically "fluttering" or "hovering" over the water surface while feeding (Roberts 1940; Watson 1966). Early sailors named these birds "Mother Carey's chickens" (Murphy 1936; Marchant and Higgins 1990) because they were thought to warn of oncoming storms. In fact, a sailing superstition holds that the appearance of storm petrels foretells bad weather (Eyers 2011), linking thus the appearance of these birds with worsening weather conditions at the sea.

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Wilson´s Storm Petrels spend the austral winter and spring (May to October) at sea after finishing the breeding season, many crossing the equator and reaching the northern hemisphere (Marchant and Higgins 1990). Previous studies in the Golfo San Jorge, Patagonian Shelf, reported the presence of the Wilson´s Storm Petrel in seabird assemblages associated with commercial trawlers targeting Argentine Hake (*Merluccius hubbsi*) and Argentine Red Shrimp (*Pleoticus muelleri*) (González-Zevallos and Yorio 2006, González-Zevallos et al. 2007, 2011). In these waters, captains and sailors commonly associate the presence of these birds around the fishing vessel with the worsening of weather conditions. In this paper we examine the relationship between Wilson´s Storm Petrel presence at fishing vessels and weather variables.

Materials and Methods

The Golfo San Jorge, Patagonia Argentina (Fig. 3), includes an area of ca. 32 200 km^2 which is subject to several human activities, including commercial fisheries. Their waters are used by about 80 double-beam trawlers targeting Argentine Red Shrimp and about 20 ice trawlers targeting Argentine Hake (Góngora et al. 2012) and Argentine Red Shrimp. Information about the presence and abundance of Wilson Storm Petrels and weather conditions was gathered on board vessels from both fishing fleets for a total of 253 hauls during 2005 (n = 32), 2006 (n = 189) and 2008 (n = 32). The information gathered in each haul included number of individuals associated to the vessel, atmospheric pressure (Hpa), ambient temperature (°C), wind speed (Km h^{-1}) and latitude/longitude. Counts were made from the top deck of the vessels, covering up to 200 meters radius. All weather variables were recorded also from the top deck just before each bird count.

Intermittent in situ observations do not allow the characterization of weather patterns. In addition, it is expected that errors will occur in these measurements, owing partly to the presence of the ship and partly to its irregular movements in the seaway. To make up for these limitations, hourly time series of surface meteorological variables at each observational position derived from a regional climate simulation were used (Giorgi et al; 2012). Finally, the spatial weather pattern associated to Wilson Storm Petrel presence was estimated from mean sea level pressure European Centre for Medium-Range Weather Forecasts (ECMWF) reanalysis composite (Dee et al. 2011). Hauls in which at least one Wilson Storm Petrel was present were grouped in six periods (S1: 1 January- 2 February 2005; S2:

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23 February- 1 March 2005; S3: 3 April- 9 April 2005; S4: 5 April- 30 April 2006; S5: 10 July- 16 July 2006; S6: 29 May- 5 October 2008).

Results & Discussion

A total of 65 Wilson´s Storm Petrels were recorded in 30 (11.86%) of the 253 fishing hauls, with an average of 0.26 ± 0.81 individuals/haul (range = 0-6; n = 253). Wilson´s Storm Petrels often associate to coastal trawlers in Golfo San Jorge to obtain small prey which fall off the net during haulback, and frequently capture marine organisms brought to the surface by the perturbation of the vessel and net during towing (Yorio and Caille 1999; González-Zevallos and Yorio 2006; González-Zevallos et al. 2011).

Although in general terms all meteorological variables considered showed a good correlation between observed and simulated values, only sea level pressure was retained, being this variable a key indicator of changes in weather conditions. There was a high correlation between the observed and simulated atmospheric pressure values (r = 0.89; Fig. 1) implying the ability of the model to capture the in-situ aspects of atmospheric pressure variability and encouraging the use of model results for describing atmospheric pressure evolution during the observation periods S1 to S6. Figure 2 shows the temporal evolution of atmospheric pressure during S1 to S6, it is possible to infer from both graphs that most Wilson's Storm Petrel presence was associated with drops of atmospheric pressure below the mean value; only S2 shows two Wilson's Storm Petrel observations associated to an increase of atmospheric pressure. The model shows that observations of Wilson's Storm Petrel presence were associated to periods with large, slow and sustained decreasing pressure (suggesting a low pressure system is passing some distance away). In fact, during all observation periods but one, atmospheric pressure was not only under the monthly mean value but under the "reference" value of 1005 hPa. Nevertheless, period S3 shows significant Wilson's Storm Petrel presence during a period of slow and sustained rise in pressure. One possible explanation of this behaviour could lie in the fact that over an extended area, even when passing from a low pressure system and its replacement with a high pressure system, the wind can still be fierce. In fact, *in situ* observations indicated that sea state was 4 on the Beaufort scale (indicating moderate wind and small waves with breaking crests averaging 1-1.5 m high). The association of Wilson's Storm Petrel presence to "bad weather" is also visible at regional scale. Composite of the atmospheric pressure anomalies (dai-

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ly departures from the long term mean) for all observation periods with Wilson's Storm Petrel presence shows a closed system (depression) over the Southwestern Atlantic Ocean (Fig. 3). These low-pressure systems (extra-tropical cyclones), that cause windy weather, are associated with frontal activity.

This study suggests that the presence of Wilson´s Storm Petrel around trawl vessels operating in Golfo San Jorge is related to low atmospheric pressure. Analysing the flight behaviour of these birds, Withers (1979) concluded that their particular way of feeding by "hovering" over the water surface is possible only under calm conditions, when ambient wind velocity is less than 5 m s^{-1} (18 km h^{-1}, sea state <3 according Beaufort scale). During fishing trips in Golfo San Jorge, this bird was found in the lee of vessels during sea conditions exceeding a state of 5 according the Beaufort scale (29-38 km h^{-1}), but was generally observed actively feeding during calm to moderate sea conditions (D. González-Zevallos, pers obs). These conditions would likely facilitate the detection of prey at the sea surface and allow the use of their particular "pattering" feeding behaviour (Ashmole 1971). It is also well known that air moves from areas of higher density (high pressure) to areas of lower density (low pressure), so that the presence of Wilson´s Storm Petrel, associated with low pressures, would serve as a predictor of worsening sea conditions. Results suggest that storm petrels are more likely to be attracted and seen behind vessels during calm periods with moderate sea conditions (which are likely to be followed by stormy weather) which are more adequate for feeding on small marine organisms brought to the surface in the turbulence generated in the vessel's wake. Our understanding of the relationship between Wilson´s Storm Petrels and fishing vessels or weather conditions at sea is still very limited. Given that they are among of the most abundant seabirds of the world (Beck and Brown 1972), detailed data on interactions with fisheries and weather conditions at sea will increase the knowledge about this species which may also be useful for monitoring the Southern Oceans.

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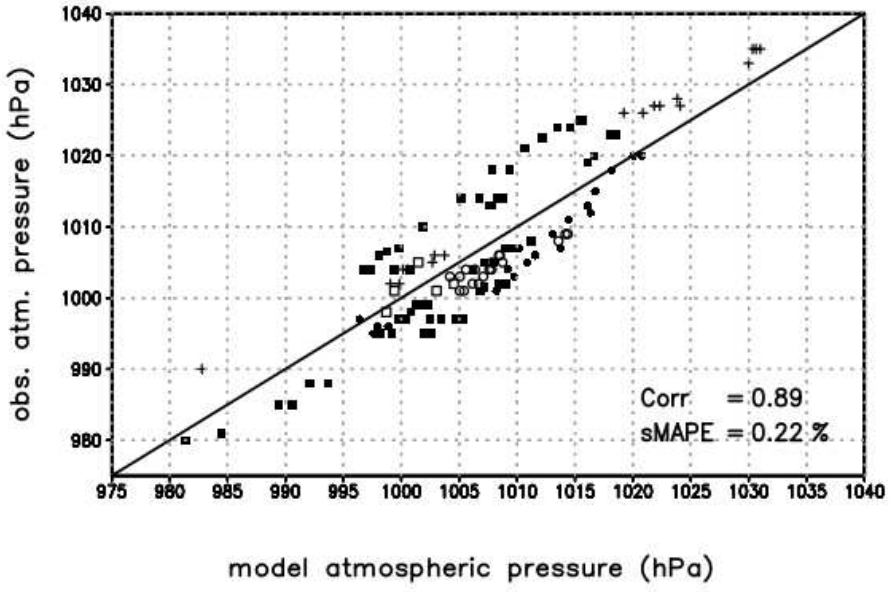
Figure 1. Scatterplot of atmospheric pressure observations on board fishing vessels at Golfo San Jorge, Argentina, versus values simulated by the model.



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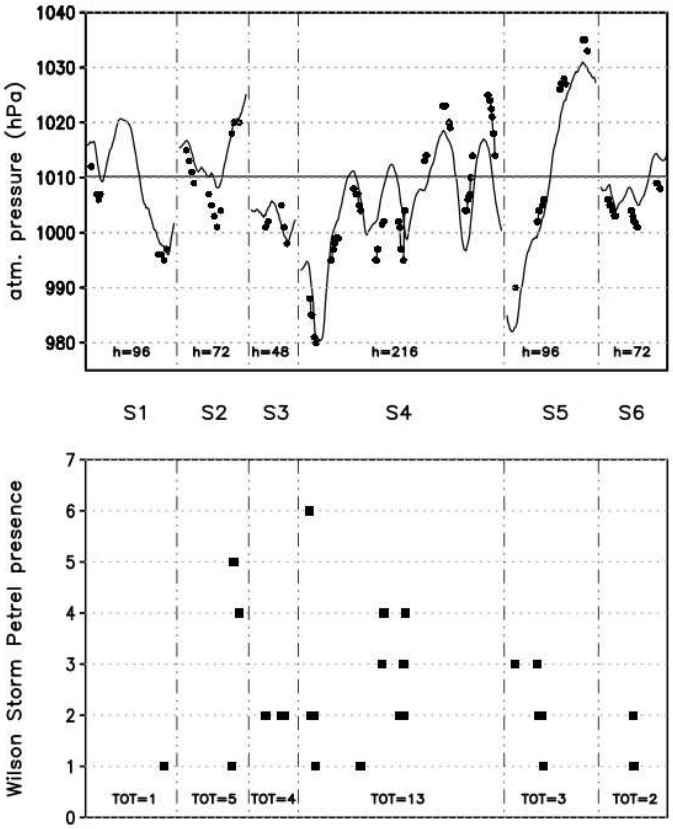

Figure 2. Presence of Wilson's Storm Petrels in relation with atmospheric pressure (hPa) during observations at fishing vessels operating in Golfo San Jorge, Argentina. In the top panel is indicated at the bottom of the graph the hours involved in each period (h); dots are in situ observations and continuous lines are hourly series of atmospheric pressure simulated by the model. The straight line indicates the mean 2005-2008 atmospheric sea level pressure.

Figure 3. Study area and European Centre for Medium-Range Weather Forecasts anomalies of sea level pressure composite for the observation periods on board fishing vessels operating at Golfo San Jorge, Argentina.

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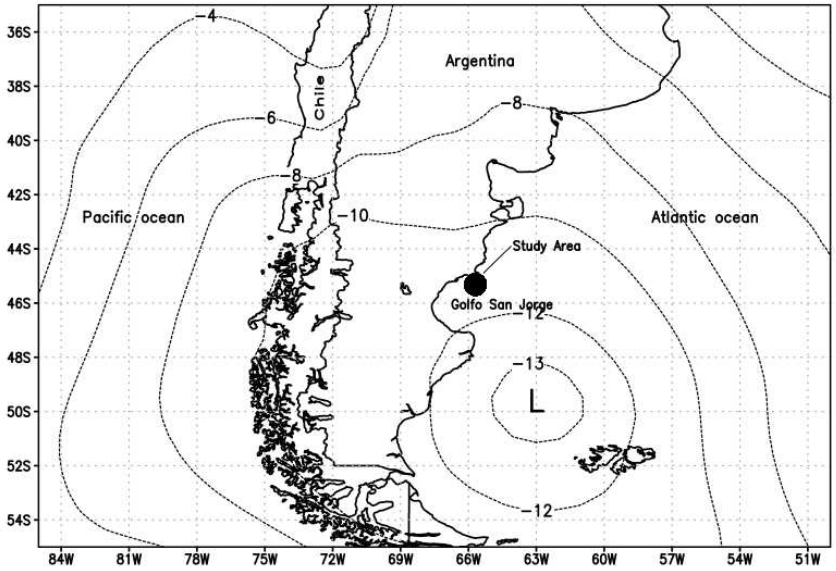

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