

# PTEROPODS, CHAETOGNATHS AND SALPS IN ADMIRALTY BAY, KING GEORGE ISLAND, ANTARCTICA

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**Abstract:** Among the organisms that make up the marine holoplankton are species of Pteropods, Chaetognaths and Salps, which are widely distributed in oceanic areas and represent important predators of this ecosystem. A total of 105 samples were collected in 3 consecutive oblique tows of 5 minutes each at 30 m depth carried out in Admiralty Bay, King George Island, Antarctica, during the summer of 2009/2010. Twenty pteropods, 51 chaetognaths and 132 salps were recorded.

**Keywords:** Holoplankton, Spatial Distribution, South Shetland.

## Introduction

Zooplankton plays a significant role in the recycling of nutrients in the ocean and it is considered an important source of food for many organisms of this ecosystem. They are divided into meroplankton (living part of their life cycle as plankton) and holoplankton (living all their life as plankton). Among the constituent organisms of the marine holoplankton, species of Pteropods, Chaetognaths and Salps occur from coastal waters to more than 1000 m depth (Boltovskoy, 1981). Salps of the Order Salpida have a solitary asexual phase and a colonial sexual form that may occur from surface waters to more than 1000 m depth (Boltovskoy, 1981). Pteropods belong to the Order Opisthobranchia with wide distribution in oceanic regions and are important predators in this ecosystem (Crelser *et al.*, 2010). Chaetognaths have an elongated body varying from 1 to 16 mm in length and are hermaphroditic with direct development (Kuhl & Kuhl, 1965; Øresland, 1986). They are considered specialized predators with wide distribution in oceanic regions (Horridge & Boulton, 1967). With the purpose of contributing to the monitoring program of the INCT- APA - Thematic Module 3, this study aims to provide data on density of holoplankton species in the

coastal environment of Admiralty Bay during the summer 2009/2010.

## Materials and Methods

Samples were collected from five shallow areas at Admiralty Bay in the summer 2009/2010 (December 2009 and February 2010). Locations of sampling stations were: #1 - 62°05'13"S; 58°23'01"W; #2 - 62°05'46"S; 58°19'58"W; #3 - 62°05'22"S; 58°28'11"W; #4 - 62°09'12"S; 58°29'06"W; #5 - 62°09'23"S; 58°27'56"W (Figure 1).

Plankton samples were collected in three replicates in all stations with five minutes oblique tows at 2 knots from the sea bottom (30 m) to the water surface. A conical net with 150 µm mesh size and 60 cm diameter equipped with a flowmeter was used. Samples were preserved in 4% buffered formaldehyde. Zooplankton organisms were identified in lower taxonomic levels when possible. The values have been corrected to a standard 100 m<sup>3</sup> (Freire *et al.*, 2006).

Density data were evaluated with *Man-Whitney* (months) and *Kruskal-Wallis* (stations) test. Multiple Comparison p values were conducted in order to identify differences from one station to the other.



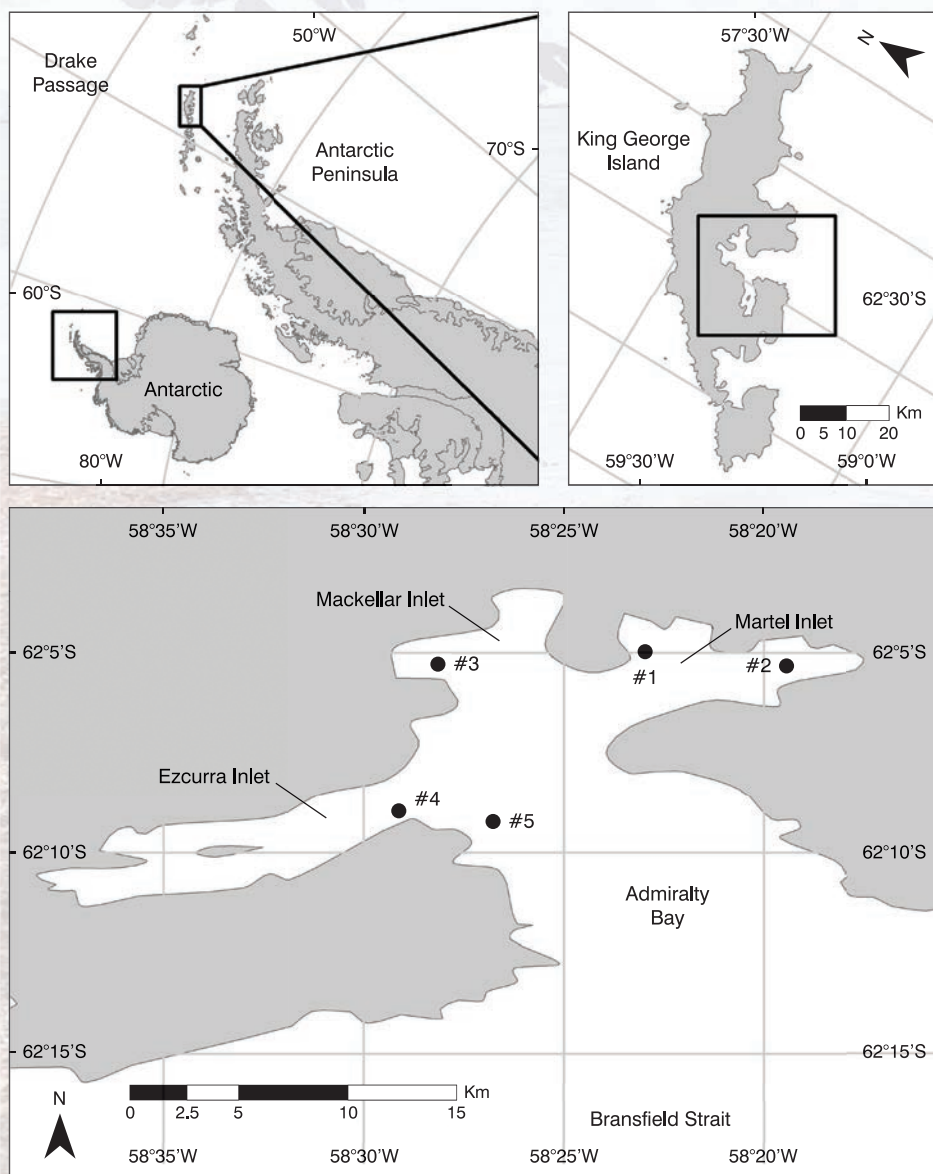


Figure 1. Location of sampling stations in Admiralty Bay.

## Results

One hundred and five samples were collected and a total of 21 pteropods, 51 chaetognaths and 132 salps were sorted.

### Pteropods

Two species of pteropods were observed in Admiralty Bay - *Clione limacina* and *Limacina helicina antarctica* (Figure 2) with mean density of  $0.29 \pm 0.83$  individuals. $100m^{-3}$ . Significant differences ( $p = 0.02$ )

between December/2009 ( $0.17 \pm 0.72$  individuals. $100m^{-3}$ ) and February/2010 ( $0.50 \pm 0.97$  individuals. $100m^{-3}$ ) were observed (Figure 3). Significant differences ( $p = 0.54$ ) among spatial distribution of sampling stations were not observed ( $p = 0.54$ ) (Figure 4).

### Chaetognaths

The mean density of  $1.49 \pm 3.27$  individuals. $100m^{-3}$  was observed for Chaetognaths. Significant difference

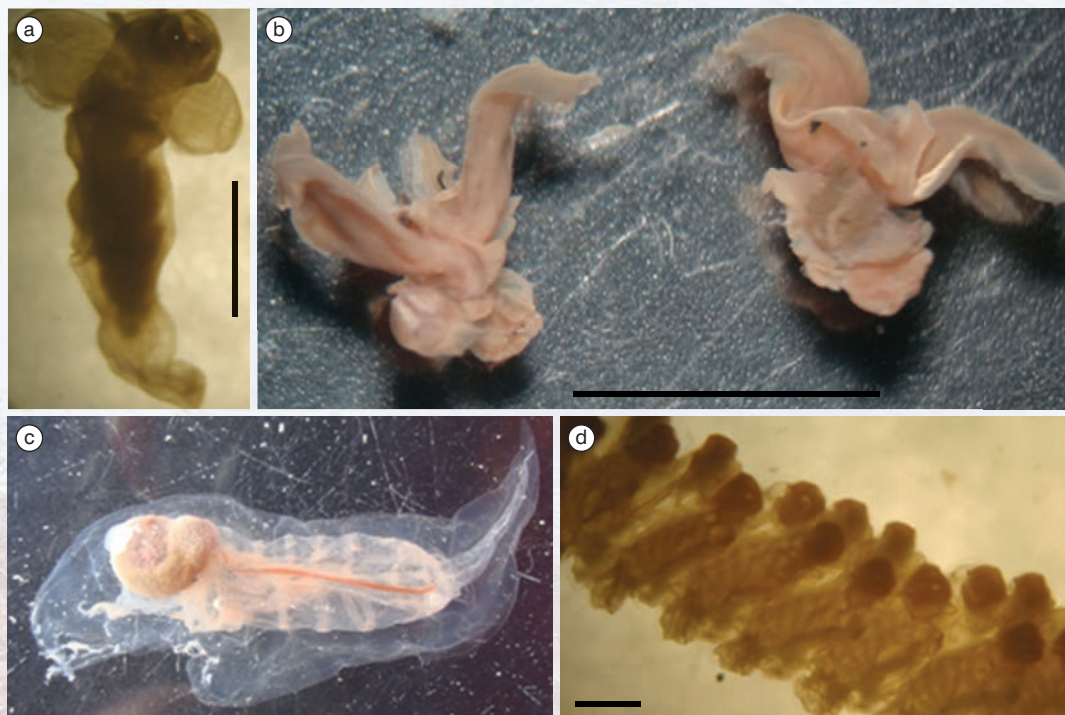


between December/2009 ( $1.75 \pm 3.88$  individuals. $100\text{m}^{-3}$ ) and February/2010 ( $1.02 \pm 1.59$  individuos. $100\text{m}^{-3}$ ) was not observed ( $p = 0.65$ ) (Figure 3). Significant difference in spatial distribution of density among sampling stations was observed ( $p < 0.001$ ) (Figure 4).

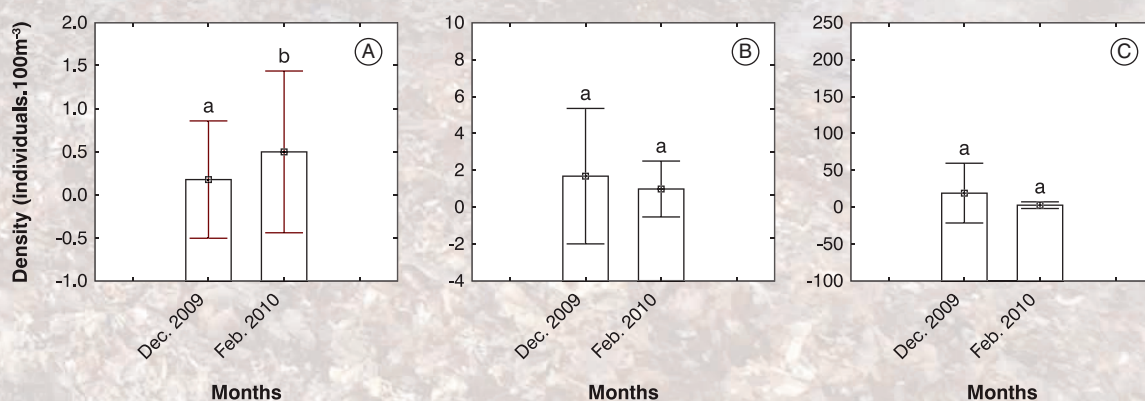
### Salps

During the summer of 2009/2010, the presence of salps in both reproductive phases (asexual and

sexual) was observed (Figure 2), with mean density of  $15.42 \pm 120.39$  individuals. $100\text{m}^{-3}$ . During the studied months, significant differences ( $p = 0.43$ ) between December/2009 ( $21.46 \pm 149.56$  individuals. $100\text{m}^{-3}$ ) and February/2010 ( $4.35 \pm 11.49$  individuals. $100\text{m}^{-3}$ ) were not observed (Figure 3). Significant difference in density among sampling stations was observed ( $p < 0.001$ ) (Figure 4), with larger density in the station #4.

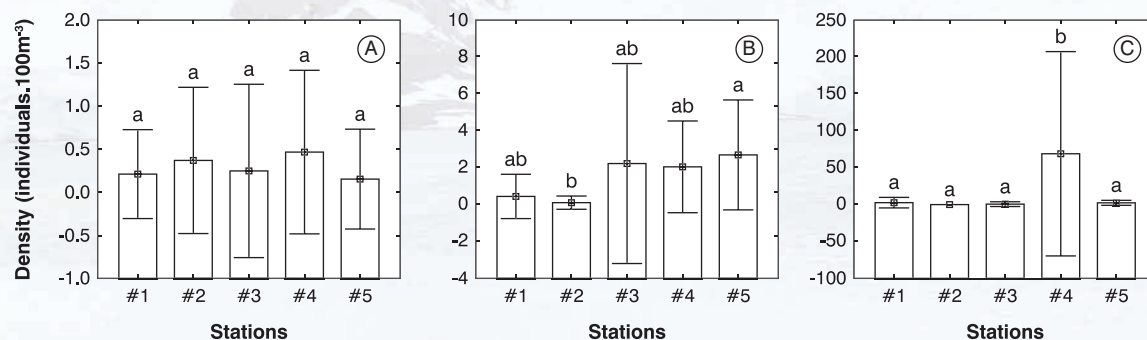


**Figure 2.** Holoplankton species in Admiralty Bay in the summer of 2009/2010. a - *Clione limacina*; b - *Limacina helicina antarctica*; c - oozoid stage (asexual phase) of salp; d - blastozoid stage (sexual phase) of salp. Scale: 1 mm.



**Figure 3.** Holoplankton density per months in the summer of 2009/2010. A – Pteropods; B – Chaetognaths; C – Salps; lowercase letters indicate statistical difference. □ – mean; 1 – error.





**Figure 4.** Holoplankton density per stations in the summer of 2009/2010. A – Pteropods; B – Chaetognaths; C – Salps; lowercase letters indicate statistical difference. □ – mean; I – error.

## Discussion and Conclusion

In relation to the studied groups, low pteropod density was observed in the summer of 2009/2010 in Admiralty Bay inner region, with two species identified (*Limacina helicina* and *Clione limacina*). Kittel *et al.* (2001) identified two species of pteropods (*Limacina helicina* and *Spongiobranchaea australis*) in four points of Admiralty Bay (two in Ezcurra inlet and two in Admiralty Bay outlet). This may indicate that density of those organisms can be associated to the water inflow from the Bransfield as pteropods are predominantly oceanic species. Another factor that indicates the occurrence of the species in this area may be the search for food, since high abundance of microalgae (diatoms and dinoflagellates) and copepods has been observed in this place (Froneman *et al.*, 1966; Tenenbaum *et al.*, 2011; Tenório *et al.*, 2011; Kern *et al.*, 2012). Studies by Gilmer & Harbison (1991) observing the diet of *Limacina helicina* in the Arctic region indicated that the main items of the diet of these organisms are small copepods and microalgae (diatoms and dinoflagellates).

Higher density of chaetognaths in the #3, #4 and #5 close to the outlet of Admiralty Bay was observed also related to the water inlet from the Bransfield. The presence of holoplanktonic species associated to the characterization of Antarctic water mass has been also described for foraminiferans and copepods (Boltovskoy, 1975). Salps have an alternation between an asexual phase (oozoid), where individuals have solitary forms, and a sexual phase (blastozoid), where an aggregated form occurs (Deibel & Lowen, 2012). This type of reproductive cycle in Thaliaceans allows for very fast reproduction when environmental


conditions are favorable (Alldredge & Madin, 1982; Deibel & Lowen, 2012). The highest densities of salps in the #4 can be related to the location of this sampling station which is near the outlet of the bay, taking into account that salps are a group that inhabits oceanic areas (Boltovskoy, 1981). Another factor that might have contributed to the presence of salps in areas of Admiralty Bay is the feeding habits of these organisms. According to Alldredge & Madin (1982), they are mainly filter feeders of particles between 4 - 16  $\mu\text{m}$ , through the production of mucus nets. Studies carried out in the stations have indicated that copepods and microalgae are abundant, especially diatoms and dinoflagellates (Tenenbaum *et al.*, 2011; Tenório *et al.*, 2011; Kern *et al.*, 2012), thus indicating an association between the abundance of these species and the presence of Thaliaceans in these places.

This work showed that the occurrence of some species of the holoplankton of Admiralty Bay are influenced by the water inflow from the Bransfield Strait. To confirm the influence of the water inflow mass from the Bransfield Strait on the variation and abundance of holoplankton during the summer of 2009/2010 in Admiralty Bay, future studies are required, particularly integrating climatic and hydrographic data with the variation of holoplanktonic species observed in the present study.

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