

BACKGROUND

Polychlorinated biphenyls (PCBs) belong to a group of compounds known as Persistent Organic Pollutants (POPs) due to their:

- Persistence in the environment
- Long range atmospheric transport (LRAT)
- Bioaccumulation
- Potential toxicity

Their use increased from the 30s until the 70s, when they were first detected in the Antarctic continent. Included in the "dirty dozen" by the Stockholm Convention, PCBs were banned in 2001.

Polar species have adapted to the harsh conditions in which they live, increasing their lipid content for thermal insulation and as an energy reserve with great variability year-round.

Considering the lipophilic nature of PCBs, polar species are the ones at greatest risk of accumulating and remobilizing them with the adipose tissue during the year.

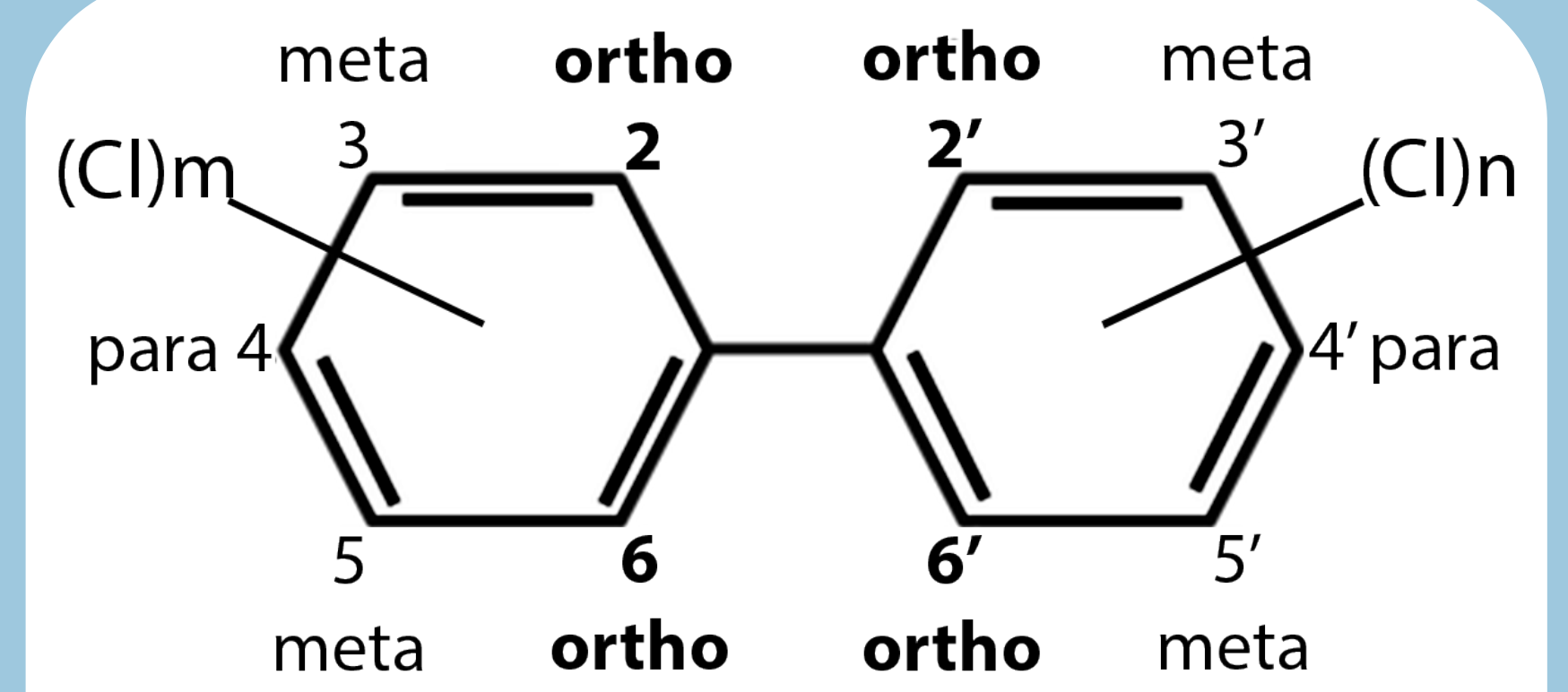
PCBs

209 congeners

Conformation:

- non-ortho-chlorinated*
- mono-ortho-chlorinated*
- non-coplanar

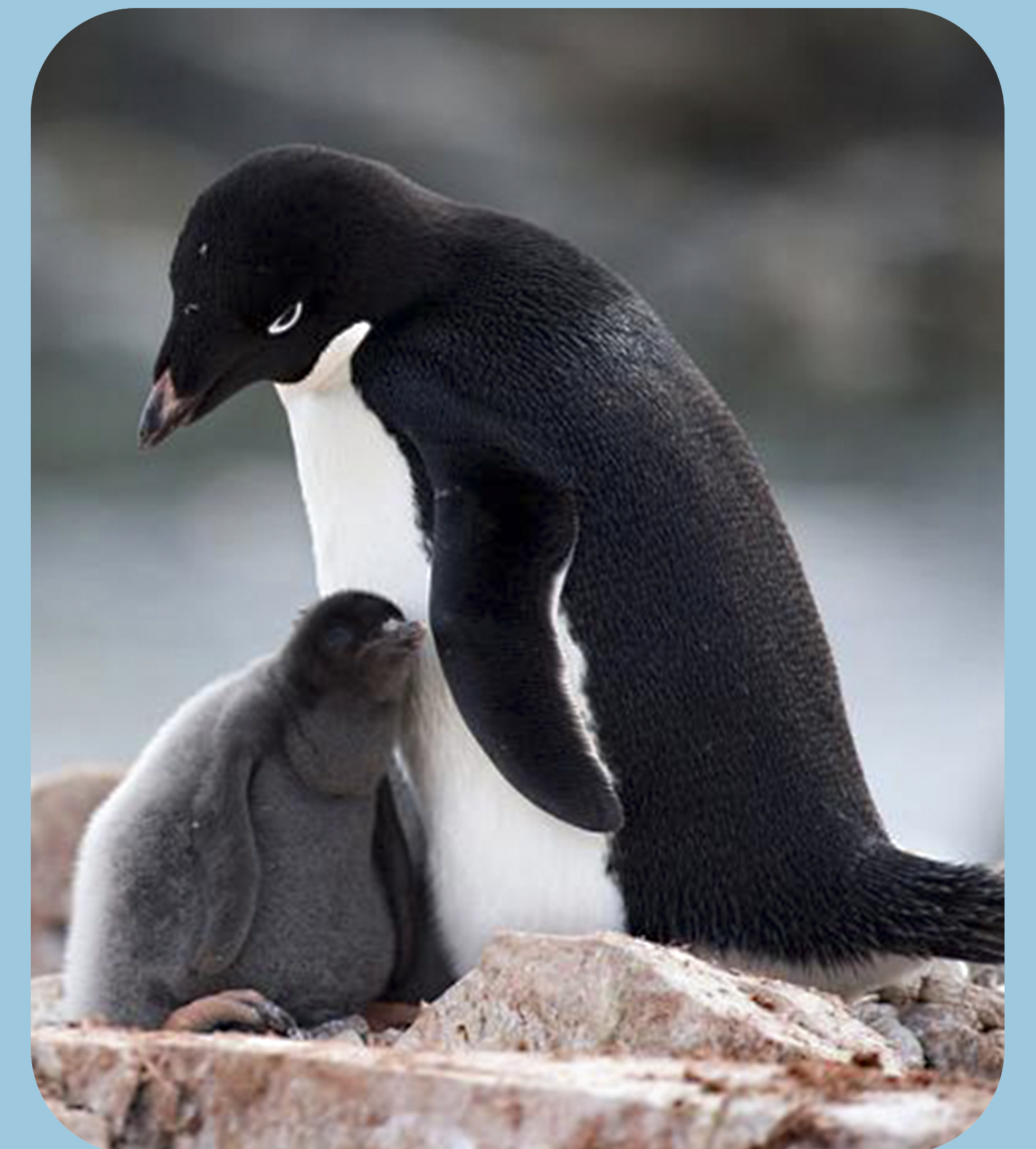
*Include 12 compounds known as Dioxin-like PCBs (IARC Group 1): reproductive and development problems, immunotoxicity, endocrine disruption, carcinogenesis.



Number of chlorine (n+m): $1 < n+m < 10$

ADÉLIE PENGUIN

- Antarctic resident species
- Feeds on local species: 99 % krill (*E. superba*), 1 % fish
- Relatively elevated trophic level
- Life expectancy: 10 - 20 years
- High repeatability of the breeding colonies
- Easy to sample
- PCB intake through diet, seasonal variations unknown
- Least Concern (IUCN Red List)
- Antarctic Treaty (1991): prohibits harming wildlife. New sampling approach required.

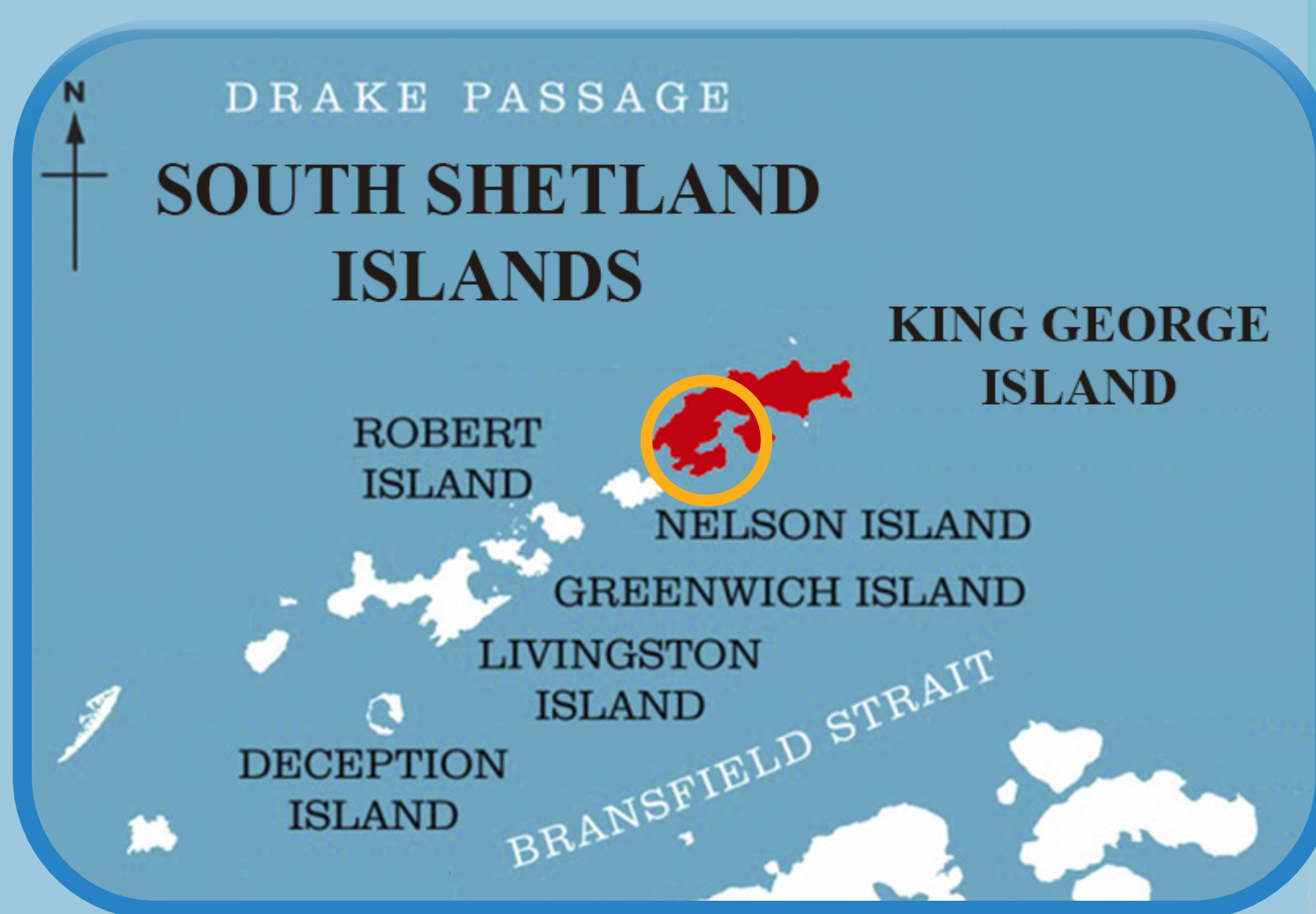


EGGS
BLOOD
TISSUES

Sampled in Admiralty Bay:
2003 - 2005; Σ PCB 12 ng/g ww¹
2004 - 2005; Σ PCB 12 ng/g ww²
2004 - 2006; Σ PCB 32.5 ng/g ww³
2010 - 2012; Σ PCB 57.3 ng/g lw⁴

¹(Corsolini et al. 2011), ²(Schivone et al. 2009)
³(Cipro et al. 2010), ⁴(Mello et al. 2016)

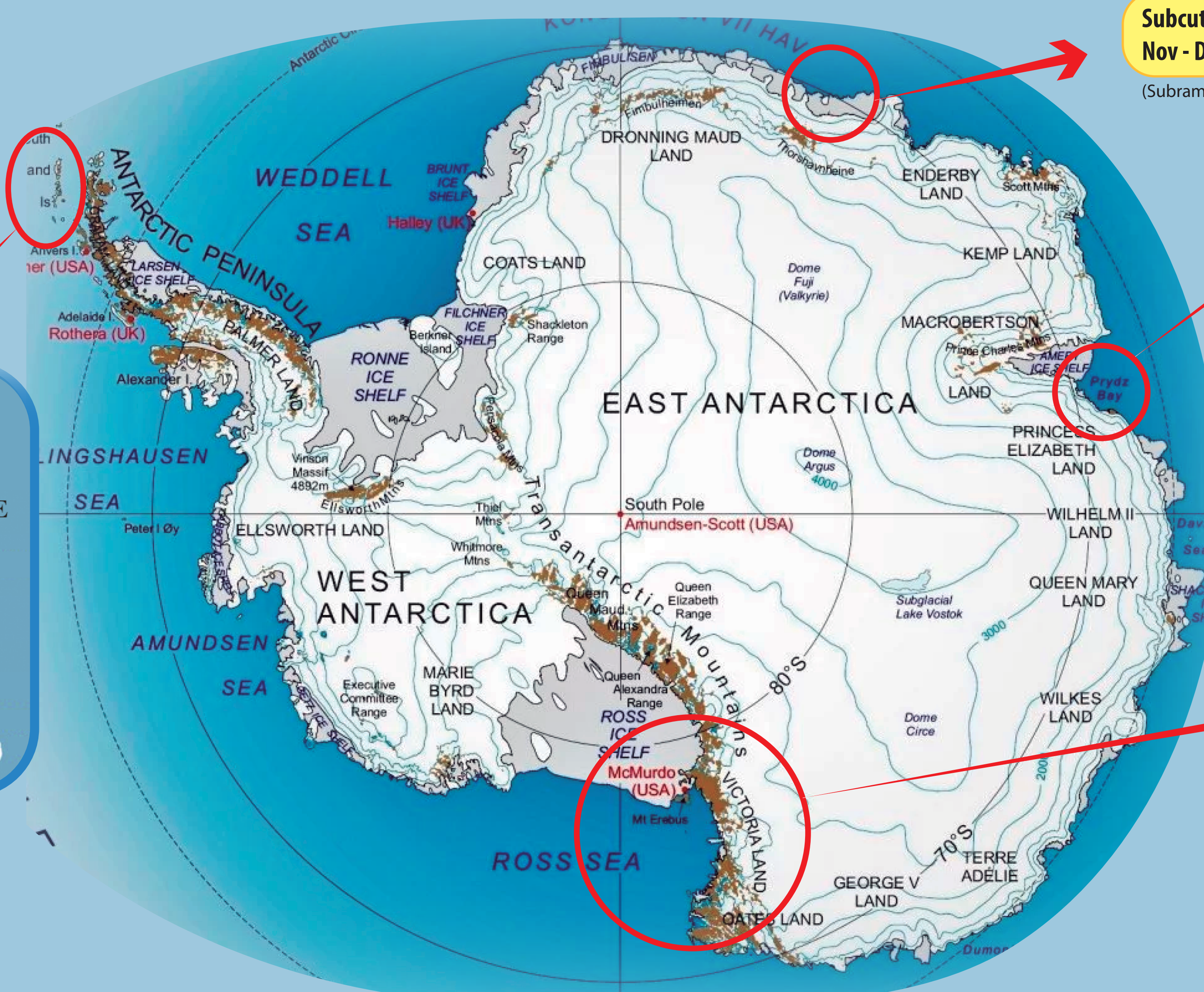
Sampled in Admiralty Bay:
Feb, 2004; Σ PCB 9.8 ng/g ww
(Corsolini et al. 2007)



Subcutaneous fat sampled in Admiralty Bay:
2006 - 2007; Σ PCB 114 - 325 ng/g ww¹

Pectoralis muscle sampled in Barton Peninsula:
2008 - 2009; Σ PCBs 2.56 - 5.65 ng/g lw²

¹(Montone et al. 2016), ²(Kim et al. 2015)



Subcutaneous fat sampled in Rumpu Island rookery, Queen Maud Land:
Nov - Dec, 1981; Σ PCBs Males: 32.1 - 89.2 Females: 37.1 - 107 ng/g lw
(Subramanian et al. 1986)

Composite sample, collected in Larsemann Hills, Prydz Bay:
2009; Σ PCB 144 ng/g lw
(Mwangi et al. 2016)

Liver sampled in Ross Island:
1988 - 1990; Σ PCB 39.6 ng/g ww
(Court et al. 1997)

Sampled in Edmonson Point:
Nov, 2001; Σ PCB 2.59 ng/g ww
(Corsolini et al. 2007)

1988 - 1990; Σ PCB 8.8 ng/g ww (Cape Bird, Ross Island)¹
1995 - 1996; Σ DL-PCBs 3.3 ng/g ww (Edmonson Point)²
1995 - 1996; Σ PCB 24.9 ng/g ww (Edmonson Point rookery)³
1995 - 2005; Σ PCB 21.99 ng/g ww (Coulmann Island and Inexpressible Island)⁴

¹(Court et al. 1997), ²(Kumar et al. 2002), ³(Corsolini et al. 2006), ⁴(Corsolini et al. 2011)

CONCLUSIONS

- Antarctic pollution includes several more compounds than PCBs, but there are **no studies on their synergic effect** on the species.
- The levels of pollutants presented by **Adélie penguins are among the lowest reported in the world for birds**, but considering the remoteness of their environment, they are still of concern.
- A **new increase** (90s-2005) in PCB levels could be related to the release of historic pollutants trapped in glaciers **due to Climate Change**.
- Antarctica versus Arctic: **Lower number of studies and wider range of time covered** in the former (influencing the analysis methods and their sensitivity).
- **No consensus in the units** used nor the significance of "total PCBs", difficulting comparisons between studies.
- **No clear temporal trend**, unknown impact of the legislation implemented.

To understand the impact that PCBs have in this species and many others in the continent, it is necessary to carry out more studies and implement common units.