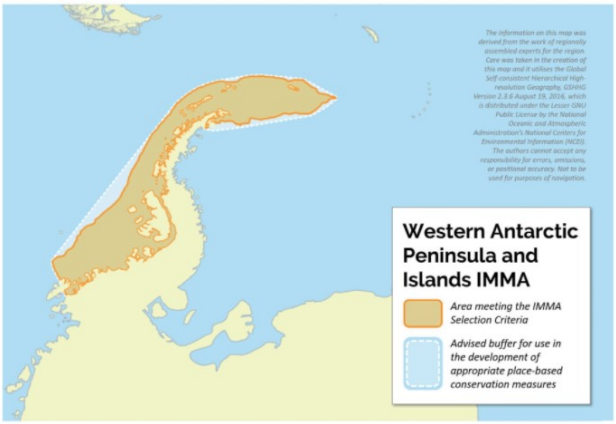
Western Antarctic Peninsula and Islands IMMA



Area Size

2,441,313 km²

Qualifying Species and Criteria

Humpback whale – *Megaptera novaeangliae*
Criteria B2, C2

Fin whale – *Balaenoptera physalus*
Criteria A, B2, C2

Antarctic minke whale – *Balaenoptera bonaerensis*
Criterion C2

Killer whale – *Orcinus orca*
Criteria B1, B2, C2, D1

Antarctic fur seal – *Arctocephalus gazella*
Criteria B2, C1, C2

Southern elephant seal – *Mirounga leonina*
Criteria C1, C2

Leopard seal – *Hydrurga leptonyx*
Criteria B2, C1, C2

Crabeater seal – *Lobodon carcinophaga*
Criteria B2, C1, C2

Weddell seal – *Leptonychotes weddellii*
Criteria B2, C1, C2

Marine Mammal Diversity (D2)

Arctocephalus gazella, Balaenoptera acutorostrata, Balaenoptera borealis, Balaenoptera musculus intermedia, Balaenoptera physalus, Berardius arnuxii, Eubalaena australis, Hydrurga leptonyx, Hyperoodon planifrons, Lagenorhynchus cruciger, Leptonychotes weddellii, Lobodon carcinophaga, Megaptera novaeangliae, Mirounga leonina, Orcinus orca

Description

The Western Antarctic Peninsula and Islands IMMA area encompasses inshore and offshore waters of the Western and Northern Antarctic Peninsula and the South Orkney and the South Shetland Islands, which are critical habitat for a variety of marine mammal species. Some of the highest rates of warming have been recorded in this region (Oreskes 2004; IPCC 2007, 2013), with recent cooling in the last couple of decades (Turner et al., 2016; Oliva et al., 2017). Such climate variability has been associated with changes in winter sea-ice duration and extent (e.g. Stammerjohn et al., 2012), which in turn affect primary productivity and cause fluctuations in the abundance of Antarctic krill (Loeb et al., 1997; Brierley et al., 1999; 2002). Krill is a keystone species in the Antarctic ecosystem and main prey for many upper trophic level species, including large whales and seals (Mackintosh 1970; Kawamura, 1994). Prey availability, in turn, has been linked directly or indirectly to population effects on seals (Siniff et al., 2008) and whales (Seyboth et al., 2016).

The Western Antarctic Peninsula ecosystem is influenced by the Antarctic Circumpolar Current, especially by intrusions of warm and nutrient-rich Upper Circumpolar Deep Water over the continental shelf, which increase biological productivity (Hofmann and Murphy, 2004). The complex bathymetry associated with the shelf break around islands and the continent, as well as embayments and troughs, result in dynamic circulation features including oceanic gyres and the interaction between Weddell Sea water with inshore currents from Gerlache and Bransfield Straits. Such characteristics create a rich foraging environment of extremely high krill biomass, supporting high densities of marine mammals (Nicol et al., 2000; Ducklow et al., 2007; Orgeira et al., 2015). All marine mammal species listed for this IMMA use the waters and marginal ice zone of the area for feeding.

The islands along the Antarctic Peninsula feature several important breeding and moulting grounds for

the region's pinnipeds (Bengtson et al., 1990; Croll and Tershey 1998) and a resting place for ice-breeding species during the post-breeding period (Laws 2009). The ice in this region serves as a breeding area for three pack ice seal species: Weddell (*Leptonychotes weddellii*), crabeater (*Lobodon carcinophaga*) and leopard seals *(Hydrurga leptonyx*) (Siniff and Stone 1985; Bengtson et al., 1992; Plötz et al., 2001). Given current trends of warming in this IMMA, pack-ice seals are the most likely species to be affected by sea-ice retreat and habitat change.

The South Shetland Islands support Antarctic fur seal and southern elephant seal breeding colonies, along with a large diversity of other marine mammals and other large predator populations that feed on the abundant krill in this region and use the area as resting sites during migration. These islands mark an important transition zone between Antarctic and Sub-Antarctic habitats. The presence of an efficient krill fishery that operates within the foraging range of breeding Antarctic fur seal and penguin colonies makes this a critical site for ecosystem monitoring.

Criterion A: Species or Population Vulnerability

This IMMA hosts high post-whaling densities of Vulnerable fin whales (*Balaenoptera physalus*) (Herr et al., 2016;Viquerat and Herr 2017). Fin whales were heavily exploited in the Southern Ocean during the commercial whaling period. Catch data suggest that they once were one of the most abundant Southern Hemisphere whale species and that they were reduced to ~2% of their pre-whaling population size (Clapham and Baker, 2002). Today, the recovery status of the Southern Hemisphere fin whale population is unknown. Based on IDCR/SOWER data from surveys between 1991 and 1998, circumpolar fin whale abundance south of 60˚S was last estimated at 5,445 (95 % CI 2,000–14,500) individuals (Branch and Butterworth 2001). However, this estimate almost certainly represents only an unknown fraction of the total abundance of Southern Hemisphere fin whales, as they are assumed to be extensively distributed in latitudes between 40˚S and 60˚S (Reilly et al., 2013) and less common south of 60˚S. Recently, high sighting numbers and observations of large aggregations of fin whales in the area of Western Antarctic Peninsula have repeatedly been reported (Burkhard and Lanfredi 2012; Joiris and Dochy 2013; Santora et al., 2014; Baumann-Pickering et al., 2015; Edwards et al., 2015; Orgeira et al., 2015; Herr et al., 2016: Viquerat and Herr 2017; Seyboth 2018). In 2013, abundance of fin whales around the South Shetland Islands alone was estimated at 4,898 (95% CI 2,221–7,575) animals (Herr et al., 2016) based on an aerial line-transect survey. This estimate may be indicative

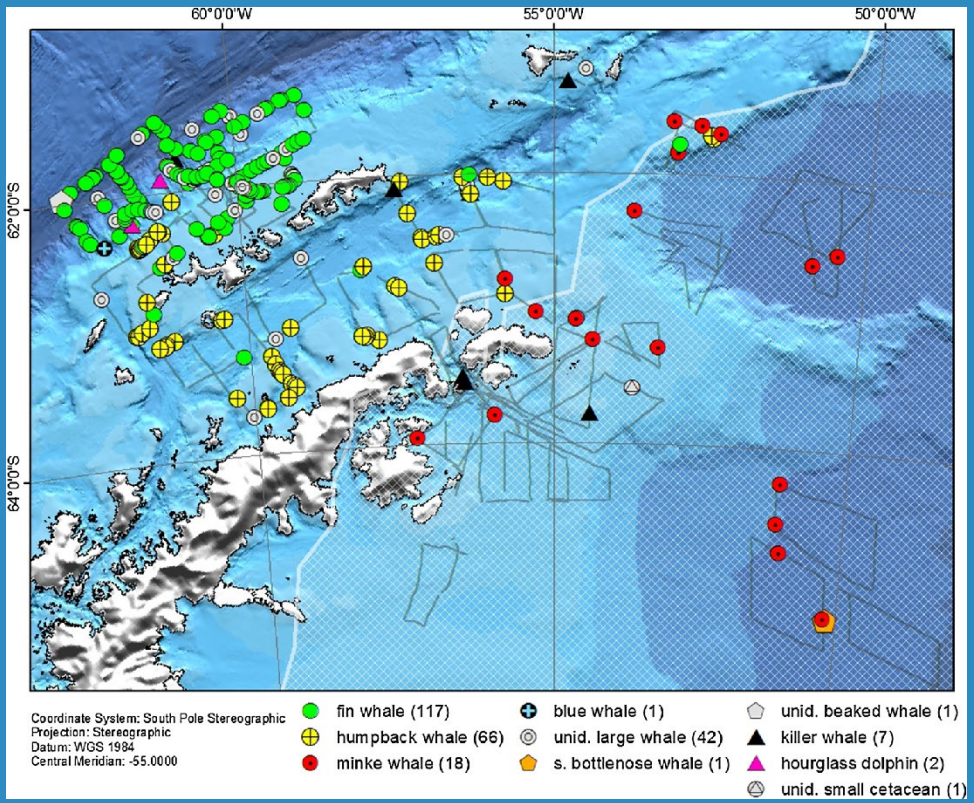


Figure 1. Distribution of cetacean sightings during an aerial survey around the Western Antarctic Peninsula in Feb/Mar 2013. From Herr et al. 2016.

of a large distributional change, with increasing numbers of fin whales moving to this area in the austral summer. Alternatively, this number may be related to population recovery and increasing numbers of fin whales, returning to an area that was known for high fin whale densities during the whaling period (Kemp and Bennet, 1932). Regardless of these possible explanations, the number of fin whales using the shelf waters of the West Antarctic Peninsula between January and June is indisputably high and certainly represents a large fraction of the Southern Hemisphere fin whale population. The animals coming to the northern West Antarctic Peninsula in austral summer use the area as a feeding habitat, which apparently is capable of providing for a potentially recovering population and high numbers of individuals who rely on the high krill biomass of this region. Very recently, increasing use also of the inshore waters of the Bransfield Strait by fin whales has been observed (Seyboth 2018; Dalla Rosa et al., unpublished data).

Criterion B: Distribution and Abundance Sub-criterion B1: Small and Resident Populations

The Gerlache type B killer whale (B2) is currently known only from the Western Antarctic Peninsula (Durban et al., 2016). Although all killer whale ecotypes that occur in the IMMA region migrate to low latitudes, they spend relatively little time there, returning to Antarctic waters following short seasonal migrations (Durban and Pitman 2012; Pitman et al., unpublished data).

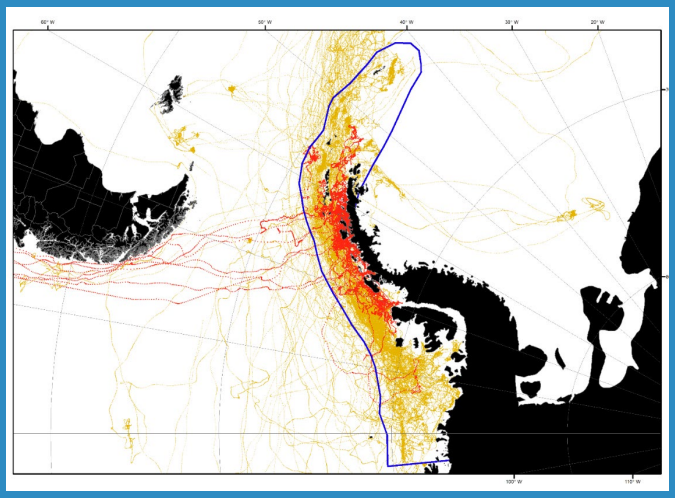


Figure 1: Tracks of southern elephant seals (mustard yellow) and humpback whales (red) within the IMMA. Adapted from Roupert-Coudert et al., 2020.

Criterion B: Distribution and Abundance Sub-criterion B2: Aggregations

High densities of marine mammals in the West Antarctic Peninsula IMMA are supported by the extremely high krill biomass in this area (Nicol 2006; Ducklow et al., 2007; Orgeira et al., 2015; 2017). Historical whaling records underline the importance of the area for whales, with large numbers of catch records indicating high abundances of humpback, fin and blue whales before over-exploitation by commercial whaling (Kemp and Bennett, 1932). Fin whales regularly aggregate in the shelf waters along the continental shelf break around the South Shetland Islands, Elephant Island and the South Orkney Islands between January and June (Burkhard and Lanfredi 2012; Joiris and Dochy 2013; Santora et al., 2014; Reyes et al., 2014, 2015; Baumann-Pickering et al., 2015; Edwards et al., 2015; Orgeira et al., 2015; Herr et al., 2016; Viquerat and Herr, 2017; Seyboth, 2018). Densities have been estimated at 0.0268 ± 0.0183 ind. km² around Elephant Island, and at 0.0588 ± 0.0381 ind. km² around the South Orkney Islands based on a shipboard visual survey in 2016 (Viquerat and Herr 2016). A ship-based helicopter survey estimated fin whale density at the South Shetland Islands at 0.117 (0.053–0.181) ind. km² (Herr et al., 2016). The high occurrence of fin whales in the IMMA has been related to krill distribution and favourable oceanographic parameters (Santora et al., 2014; Herr et al., 2016; Viquerat et al., 2017; Seyboth, 2018). Humpback whales occur in high densities throughout the inshore waters of the area, particularly in the Bransfield Strait, the Gerlache Strait, and other straits and bays further south (Secchi et al., 2001; 2011; Friedlaender et al., 2006; 2011; Dalla Rosa, 2010; Dalla Rosa et al., 2012; Nowacek et al., 2011; Johnston et al., 2012). Abundance has been estimated for just a portion of Bransfield Strait at 865 (95% CI 656 -1,141) individuals in 2006 (Secchi et al., 2011,) and at 3,024 (95%CI 944–5105) individuals for the Bransfield Strait and adjacent areas in 2013 (Herr et al., 2016).

High encounter rates of killer whales, especially Gerlache type B, have been registered in the Gerlache Strait, although they may be found regularly throughout the West Antarctic Peninsula (Pitman and Ensor, 2003; Dalla Rosa et al., 2007). Tracking data has revealed the importance, during post-mating dispersal, of the South Orkneys and Antarctic Peninsula regions to the male Antarctic fur seals that breed on South Georgia. These male seals have been tracked as far south as Adelaide Island where

numbers of males hauling out have increased over the last three decades (Lowther et al., unpublished). The connectivity between the largest breeding population, which represents 95% of the world population, and the South Orkney Islands is evidenced by the build-up of large numbers of males after the December mating season (Carlini, 2006). This movement by nearly 50% of the world's population of this species represents a significant immigration to and use of this region. The accessible beaches and pack-ice in this region provide important substrate for these animals to haul-out to rest, thermoregulate and avoid predation. Additionally, female Antarctic fur seals from Cape Shirreff are central place foragers in the region during the summer months (December-April, Hinke et al., 2017; Goebel et al., 2000). Females tracked from this site during the non-breeding period also utilise the Marguerite Bay region in April/May prior to migrating further north (Arthur et al., 2017, 2018). Approximately 15% of the crabeater, 15% of leopard and 24% of the Weddell seal population (from surveyed areas) reside, breed and forage in the Western Antarctic Peninsula(Southwell et al., 2012).

Criterion C: Key Life Cycle Activities Sub-criterion C1: Reproductive Areas

The Western Antarctic Peninsula IMMA is a breeding area for a proportion of crabeater, leopard and Weddell seal populations (Southwell et al., 2012). Also, the most southerly Antarctic fur seal and southern elephant seal breeding colonies are located in the South Shetland Islands and Elephant Island (Le Boeuf and Laws 1994; Goebel et al., 2000).

Criterion C: Key Life Cycle Activities Sub-criterion C2: Feeding Areas

The region is characterized by complex bathymetry and circulation, which favours enhanced biological productivity, influencing the distribution and abundance of cetaceans (e.g. Friedlaender et al., 2006; Dalla Rosa, 2010). The area is known to support high predator densities and serves as a feeding ground for several baleen whale species which migrate from their breeding grounds in more temperate waters to feed on krill during the austral summer. Satellite tracking of humpback (Dalla Rosa et al., 2008; Curtice et al., 2015; Weinstein and Friedlaender, 2017) and fin whales (Dalla Rosa et al., unpublished data) has shown that individuals consistently use this area for extended periods of time during the feeding season. Large aggregations of up to 60 surface feeding fin and humpback whales have been observed in the proposed area, preying on krill (Nowacek et al., 2011; Burkhardt and Lanfredi 2012; Joiris and Dochy, 2013; Herr et al., 2016). Their distribution has been proposed to be linked to high densities of krill (Santora et al., 2014; Herr et al, 2016). For humpback whales, the area encompasses the major part of the feeding grounds of Breeding Stock G (Stevick et al., 2004; Dalla Rosa et al., 2012; Acevedo et al., 2017).

All Antarctic killer whale ecotypes also use this area for feeding. Differences in foraging ecology or prey preferences have helped to distinguish among them (e.g. Durban et al., 2016). Approximately 15% of the crabeater seal population (from surveyed areas) reside, breed and forage in the Western Antarctic Peninsula(Southwell et al., 2012). The majority of crabeater seal feeding dives occur within the top 50 m, although they can dive up to 600 m with a maximum duration of 24 minutes (Burns et al., 2004; 2008). They appear to favour foraging locations on the continental shelf within the 50 to 450 m depth range, with a tendency to avoid depths of 600 m or greater. Crabeater Seals feed primarily on Antarctic krill (*Euphausia superba*), which accounts for over 90% of their diet, with the remainder made up of fish and squid. Deeper dives at dawn and dusk indicate that their feeding activity is tied to the daily vertical migrations of krill. Daytime foraging appears to exploit zooplankton schools compressed along the bottom. Winter tracking data suggests that they alter their behaviour to accommodate seasonal and/or annual fluctuations in seasonal sea ice and associate with bathymetric features likely to concentrate prey patches (Burns et al., 2004). They are most likely located in nearshore waters where bathymetric gradients and ice concentration are high (Burns et al., 2004).

The Western Antarctic Peninsula is home to 24% of the Weddell seal population (from surveyed areas, Southwell et al., 2012). The abundance of prey and availability of suitable sea-ice habitat makes this area ideal for this pagophilic species. Weddell seals are generalist predators, and their diet likely varies at a regional scale. They are known to feed on Antarctic krill, notothenioid fish (icefishes), particularly the Antarctic silverfish, but the diet also includes Antarctic toothfish, myctophids and cephalopods. Weddell seals typically forage within two depth layers, surface waters (0-160m) and near the bottom.

While both pelagic and benthic diving occur during daylight, seals forage almost exclusively in the upper water column at night (Plötz et al., 2001).

Leopard seals have a circumpolar distribution concentrated in, but not limited to, the Southern Ocean. They are most commonly found in and around the outer fringes of the pack ice or close to the Antarctic Continent. The Western Antarctic Peninsula represents 15% of the surveyed populations (Southwell et al., 2012). They are top predators in the Antarctic marine ecosystem and feed on a diverse range of prey that varies seasonally, spatially and ontogenically including krill, fish, squid, penguins and other pinnipeds. Penguins are eaten throughout the year but form an especially large proportion of the leopard seal diet in January to March, when these birds are breeding (Siniff and Stone, 1985). Newly weaned crabeater seal pups can also be an important part of the diet in the pack ice near the Antarctic Peninsula (Siniff and Stone, 1985). Leopard seal predation has been implicated in slowing the recovery of the Antarctic fur seal population at Elephant Island (Boveng et al., 1998). At Cape Shirreff, studies monitoring leopard seal predation on Antarctic fur seal pups suggest that they consume up to half of the annual pup production within this area. In addition to fur seal pups and penguins, leopard seals were found to take certain demersal fish and scavenge carcasses of fur seals and penguins.

Male Antarctic fur seals from South Georgia have been tracked traveling to and moving within the South Orkney Islands and Western Antarctic Peninsula region (Boyd et al., 1998; BAS unpublished). This southwards migration of a large predator biomass has significant implications for consumption of krill, fish and penguins within the region (Davis et al., 2006). The growing body of at-sea movement data shows that male fur seals at South Georgia display some level of central place foraging alternating time at sea with periods ashore resting, very similar to lactating females. These seals also predominantly foraged on-shelf, close to their haul out locations (<100 km), and so have a greater spatial overlap with penguins than the more pelagic foraging female seals. Post breeding males often have very poor body condition resulting from their prolonged fast whilst competing for territory and potential mates. The abundant food resources and accessible haul-out locations in the IMMA create ideal habitat for these predators. The post-breeding foraging areas of southern elephant seals are close to their breeding grounds for both males and females (Huckstadt et al., 2012; Muelbert et al., 2013; Hindell et al., 2016). They feed along the continental shelf and in the trough areas, and satellite tracking shows they range throughout the entire IMMA.

Criterion D: Special Attributes Sub-criterion D1: Distinctiveness

Though three killer whale ecotypes frequently occur in this area (Pitman and Ensor, 2003; Dalla Rosa et al., 2007; Durban et al., 2016), the IMMA is particularly important for Gerlache type B ecotype, which are only found around the Antarctic Peninsula (Durban et al., 2016).

Criterion D: Special Attributes Sub-criterion D2: Diversity

Species richness and abundance of seabirds and marine mammals and areas that are persistently attractive to top predators have been demonstrated to be within the IMMA (Lazaneo et al., 2013; Santora and Veit 2013). At least 9 marine mammal species occur regularly in the proposed area (humpback, fin, Antarctic minke and killer whales, Antarctic fur, leopard, Weddell, crabeater and elephant seals). The highest cetacean diversity has been recorded in the northern Antarctic Peninsula, including the area around Elephant Island (e.g. Lazaneo et al., 2013). Additional records of marine mammals throughout the proposed area include encounters of sei whales (*Balaenoptera borealis*) (Secchi et al., 2001), dwarf minke whales (*Balaenoptera acutorostrata*) (Acevedo et al., 2011), Antarctic blue whales (*Balaenoptera musculus intermedia*) (Herr et al., 2016) and southern right whales (*Eubalaena australis*) (Stone and Hammer, 1988; Aguayo-Lobo et al., 2008; Johnston et al. 2012; Dalla Rosa, unpublished data; Herr et al., unpublished data). Odontocete species that have been reported from the IMMA include hourglass dolphins (*Lagenorhynchus cruciger*) (Santora 2012; Dellabianca et al., 2012), southern bottlenose whales (*Hyperoodon planifrons*) (Santora and Brown 2010; Herr et al., unpublished data) and Arnoux's beaked whales (*Berardius arnuxii*) (Johnston et al., 2012; Friedlaender et al., 2010; Herr et al., unpublished data).

Supporting Information

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