

# LME 61 – Antarctica



**Bordering country:** Antarctica  
**LME Total area:** 3,486,169 km<sup>2</sup>

## List of indicators

LME overall risk	2	Nutrient ratio	7
Productivity	2	Merged nutrient indicator	7
Chlorophyll-A	2	POPs	7
Primary productivity	3	Plastic debris	7
Sea Surface Temperature	3	Mangrove and coral cover	8
Fish and Fisheries	4	Reefs at risk	8
Annual Catch	4	Marine Protected Area change	8
Catch value	4	Cumulative Human Impact	8
Marine Trophic Index and Fishing-in-Balance index	4	Ocean Health Index	9
Stock status	5	Socio-economics	10
Catch from bottom impacting gear	5	Population	10
Fishing effort	6	Revenues and Spatial Wealth Distribution	10
Primary Production Required	6	Climate-Related Threat Indices	10
Pollution and Ecosystem Health	7	Governance	11
Nutrient ratio, Nitrogen load and Merged Indicator	7	Governance architecture	11
Nitrogen load	7		

## LME overall risk

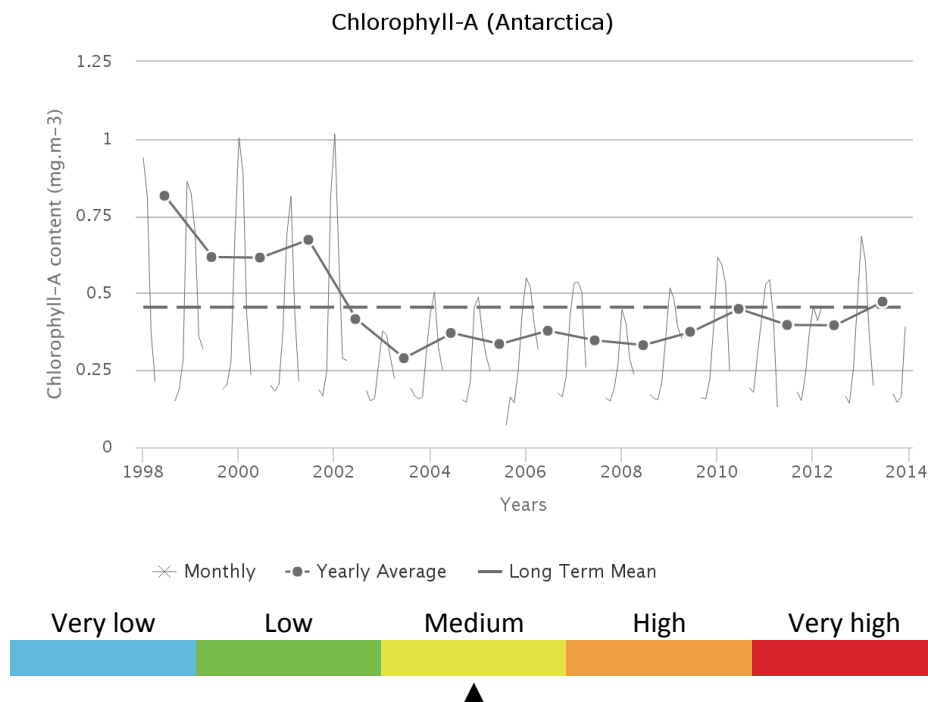
This LME falls in the cluster of LMEs that exhibit high percentages of rural coastal population, high numbers of collapsed and overexploited fish stocks, as well as high proportions of catch from bottom impacting gear.

Because this LME does not have resident citizens, it has no Human Development Index and no risk score.

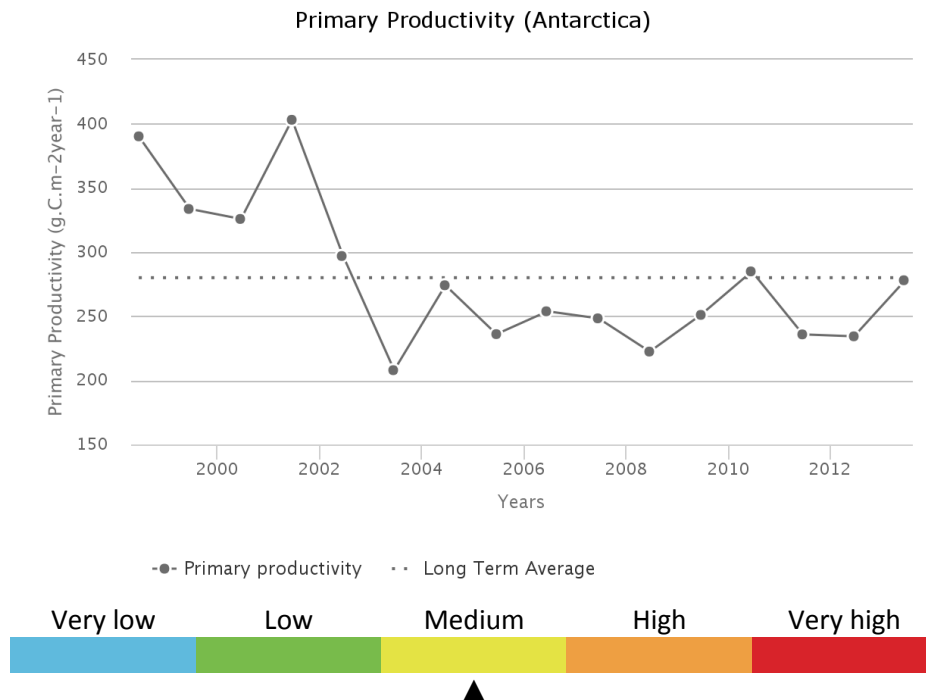
## Productivity

### Chlorophyll-A

The annual Chlorophyll a concentration (CHL) cycle has a maximum peak ( $0.543 \text{ mg.m}^{-3}$ ) in February and a minimum ( $0.145 \text{ mg.m}^{-3}$ ) during October. The average CHL is  $0.454 \text{ mg.m}^{-3}$ . Maximum primary productivity ( $403 \text{ g.C.m}^{-2}.\text{y}^{-1}$ ) occurred during 2001 and minimum primary productivity ( $208 \text{ g.C.m}^{-2}.\text{y}^{-1}$ ) during 2003. There is a increasing trend in Chlorophyll of 17.8 % from 2003 through 2013. The average primary productivity is  $280 \text{ g.C.m}^{-2}.\text{y}^{-1}$ , which places this LME in Group 3 of 5 categories (with 1 = lowest and 5= highest).



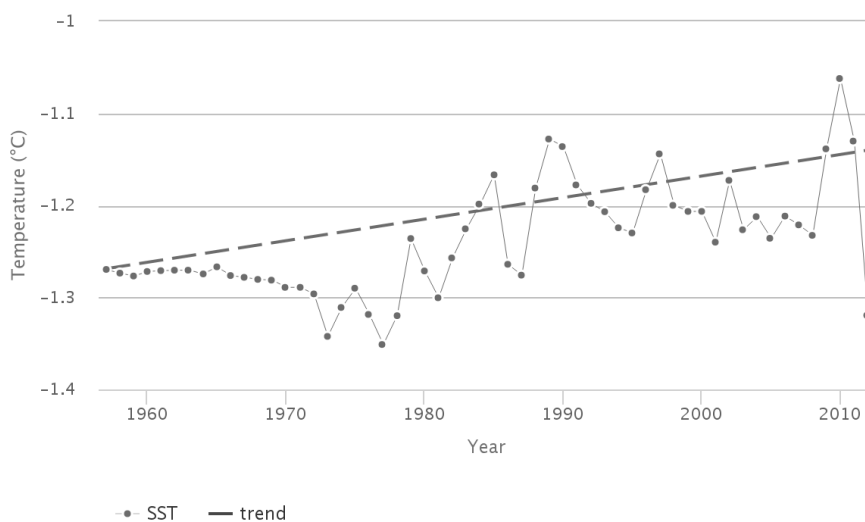
## Primary productivity



## Sea Surface Temperature

From 1957 to 2012, the Antarctica LME #61 has warmed by 0.12°C, thus belonging to Category 4 (slow warming LME). The long-term stability of the Antarctic Zone is striking. It can be explained by the insulating effects of the Antarctic Circumpolar Currents and winds that blow around the Antarctica. The currents and winds can insulate the Antarctica from relatively rapid changes elsewhere. Yet this stability may be just an appearance, not reality, because of the perennial sea ice cover in the near-coastal zone where the Antarctic LME is largely located. The thermal history of this LME was not detailed in the previous analysis (Belkin, 2009) since the near-coastal zone is covered by drifting sea ice, landfast ice, and icebergs almost year round; therefore SST data here are deemed severely contaminated by the presence of ice. The extremely rapid cooling since 2010 might have resulted from the concomitant increase of the Antarctic sea ice cover extent and concentration.

SST (Antarctica)

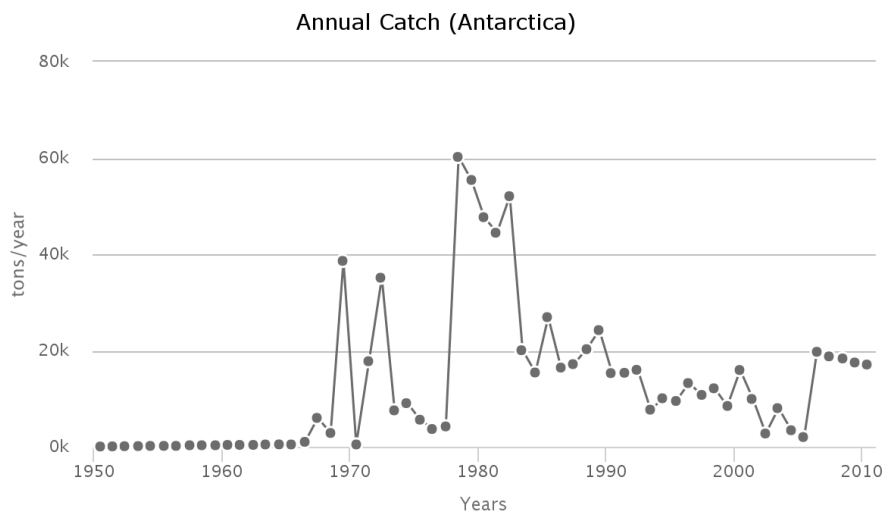


## Fish and Fisheries

Major interest in the Antarctic’s marine living resources developed after the 1959 Antarctic Treaty. Species caught include krill (*Euphausia superba*), which has dominated the reported landings since early 1980s, rockcod (*Notothenia rossii*, *Lepidonotothen squamifrons*), icefish (*Champtocephalus gunnari*, *Chaenodraco wilsoni*) and toothfish (*Dissostichus mawsoni*). The catch data from this LME are too crude for ecosystem indicators such as PPR, MTI or FiB index to be computed.

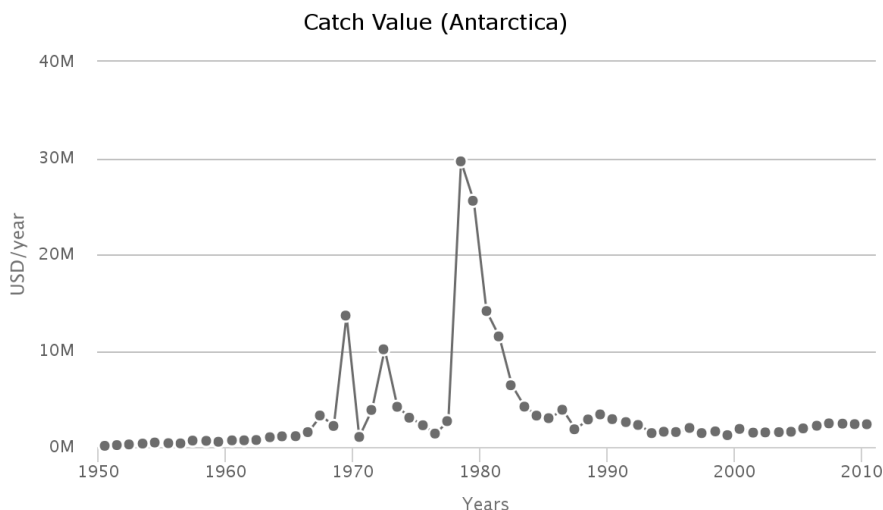
### Annual Catch

There have been major fluctuations in the reported landings in this LME, with a major peak at 60,000 t in 1978. When the Soviet Union was dissolved in 1991, its components republics drastically reduced their fishing activities in the Antarctic. Nevertheless, the decreasing total landings in recent years can be attributed to stock depletions.



### Catch value

The trend in the value of the reported landings closely mirrors the landings, with a major peak of about 30 million US\$ (in 2005 real US\$) in 1978. However, given the large amounts of unreported catch from this LME, these estimates express only a small fraction of the value of Antarctic fisheries.

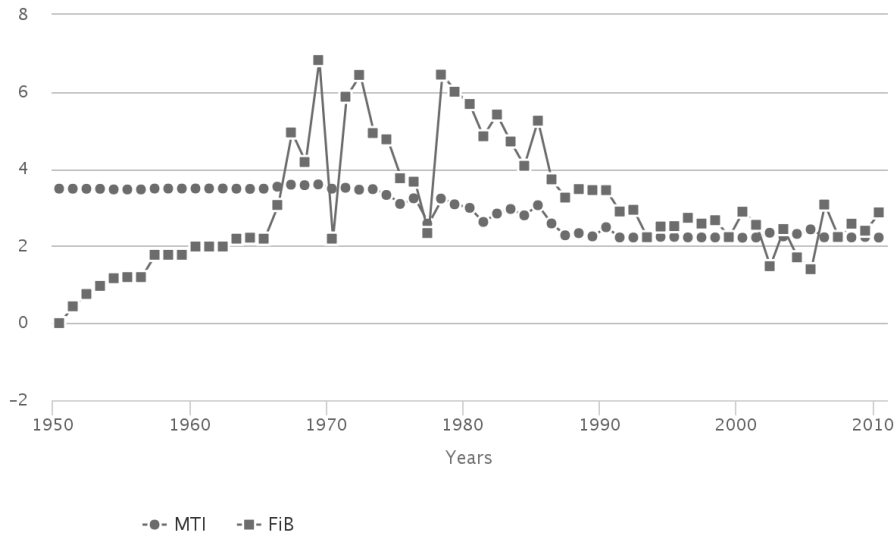


### Marine Trophic Index and Fishing-in-Balance index

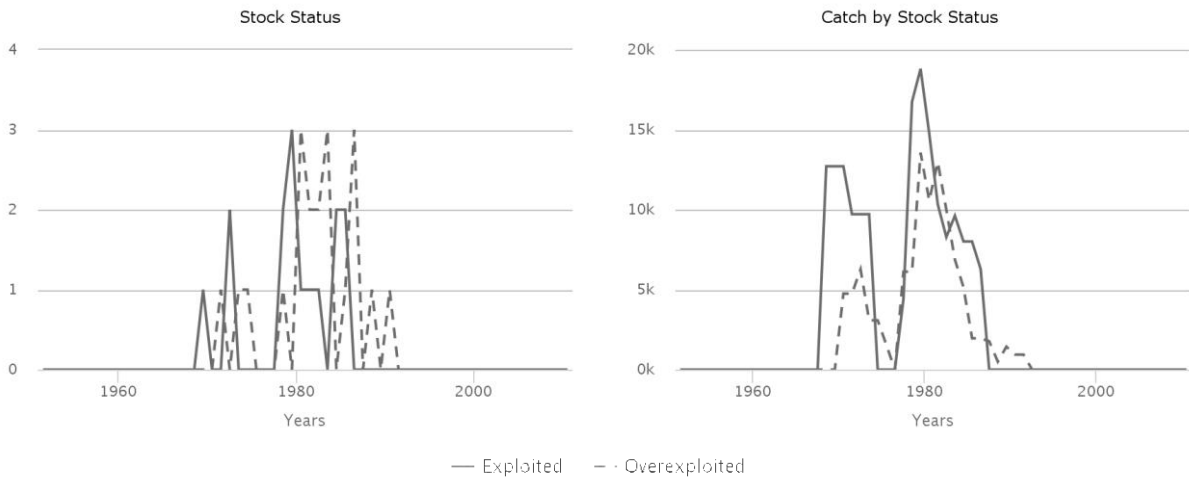
Although based on partial catches the MTI shows a rapid and strong decline in the 1970s and 1980s, reflecting the transition in landings from fish (mainly rockcod) to krill, while the FiB index remains

stable, suggesting that no geographic extension took place since the early 1970s.

MTI and FiB (Antarctica)



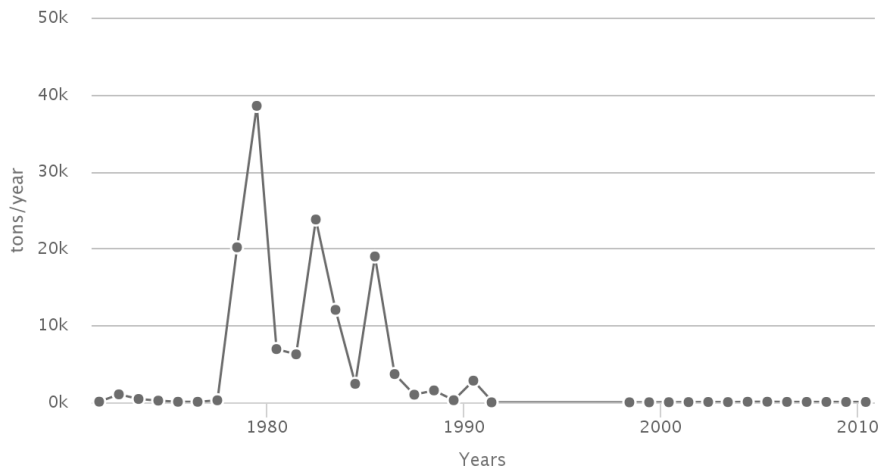
**Stock status**



**Catch from bottom impacting gear**

The percentage of catch from the bottom gear type to the total catch reached its peaks at 70% in 1957 and 1963, respectively. Then, the percentage fluctuated around 1% in recent decade.

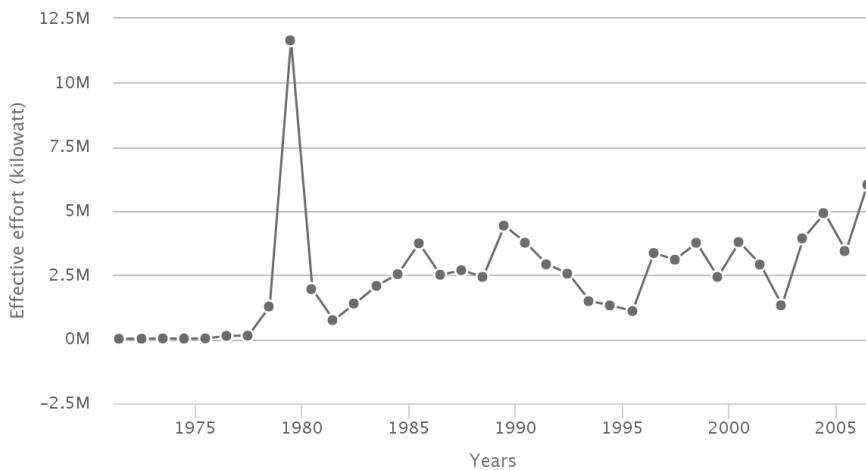
Catch from bottom impacting gear (Antarctica)



**Fishing effort**

The total effective effort reached its peak at 12 million in 1979 and then fluctuated around 4 million in the recent few years.

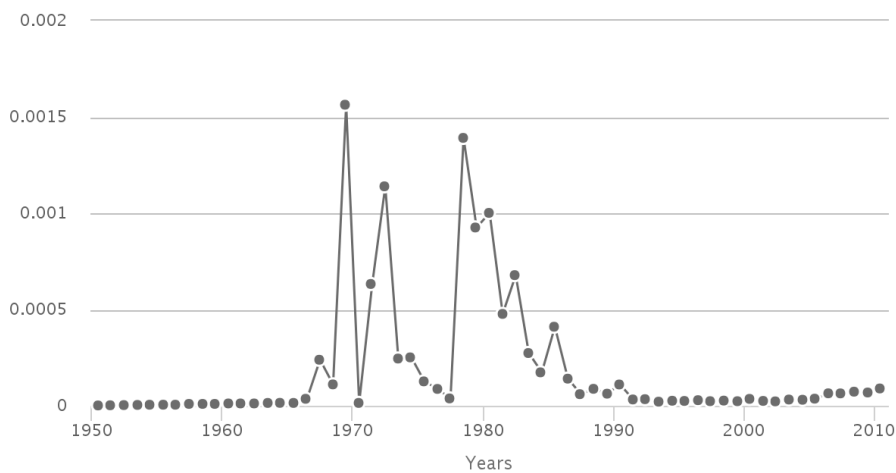
Fishing effort (Antarctica)



**Primary Production Required**

Primary production data in a format suitable for estimating the primary production required (PPR) to sustain the reported landings are not available for this LME.

Primary Production Required (Antarctica)



## Pollution and Ecosystem Health

---

### Pollution

---

#### **Nutrient ratio, Nitrogen load and Merged Indicator**

Human activities in watersheds are affecting nutrients transported by rivers into LMEs. Large amounts of nutrients (in particular *nitrogen load*) entering coastal waters of LMEs can result in high biomass algal blooms, leading to hypoxic or anoxic conditions, increased turbidity and changes in community composition, among other effects. In addition, changes in the *ratio of nutrients* entering LMEs can result in dominance by algal species that have deleterious effects (toxic, clog gills of shellfish, etc.) on ecosystems and humans.

An overall nutrient indicator (*Merged Nutrient Indicator*) based on 2 sub-indicators: *Nitrogen Load* and *Nutrient Ratio* (ratio of dissolved Silica to Nitrogen or Phosphorus - the Index of Coastal Eutrophication Potential or ICEP) was calculated.

#### **Nitrogen load**

No data for this LME.

#### **Nutrient ratio**

No data for this LME.

#### **Merged nutrient indicator**

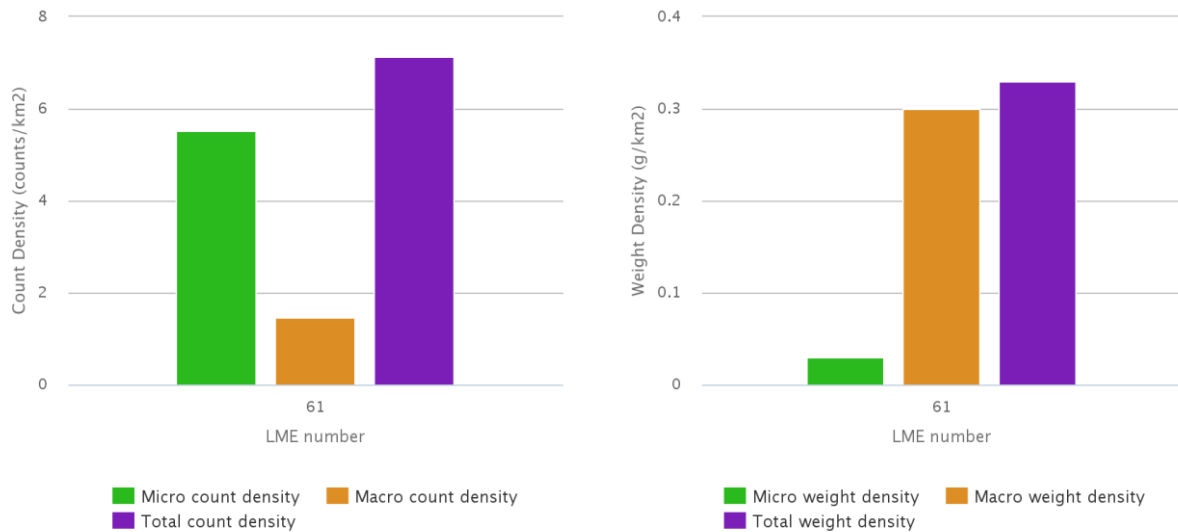
No data for this LME.

#### **POPs**

No pellet samples were obtained from this LME.

#### **Plastic debris**

Modelled estimates of floating plastic abundance (items km<sup>-2</sup>), for both micro-plastic (<4.75 mm) and macro-plastic (>4.75 mm), indicate that this LME is in the group with the lowest plastic concentration. Estimates are based on three proxy sources of litter: shipping density, coastal population density and the level of urbanisation within major watersheds, with enhanced run-off. The low values are due to the remoteness of this LME from significant sources of plastic. The abundance of floating plastic in this category is estimated to be over 400 times lower than those LMEs with the highest values. There is evidence from sea-based direct observations and towed nets to support this conclusion.



## Ecosystem Health

---

### Mangrove and coral cover

Not applicable.

### Reefs at risk

Not applicable.

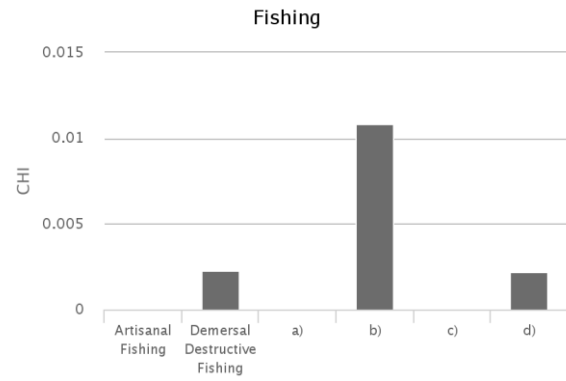
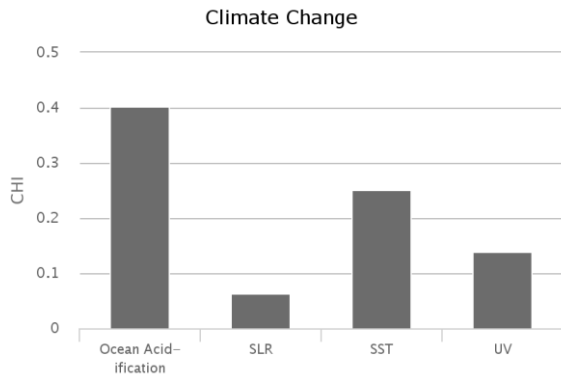
### Marine Protected Area change

Not applicable.

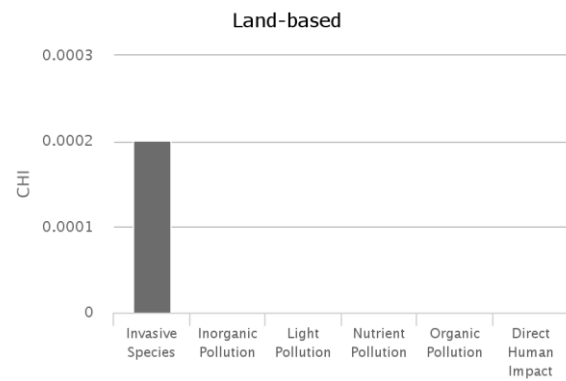
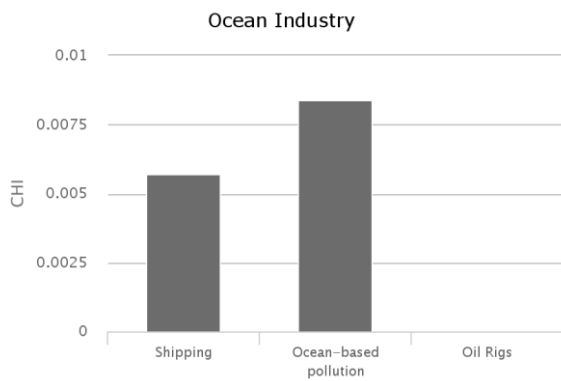
### Cumulative Human Impact

The Antarctica LME experiences one of the lowest overall cumulative human impact (score 0.88; maximum LME score 5.22). It falls in risk category 1 of the five risk categories (1 = lowest risk; 5 = highest risk). This LME is most vulnerable to climate change. Of the 19 individual stressors, three connected to climate change have the highest average impact on the LME: ocean acidification (0.40; maximum in other LMEs was 1.20), UV radiation (0.14; maximum in other LMEs was 0.76), and sea surface temperature (0.25; maximum in other LMEs was 2.16). No other stressors had any significant impact in this LME.

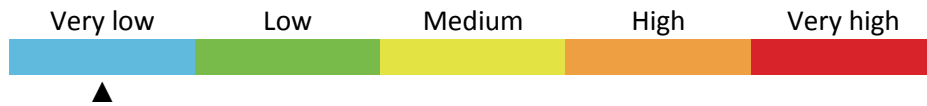




- a) Demersal Non-destructive High Bycatch Fishing
- c) Pelagic High Bycatch Fishing
- b) Demersal Non-destructive Low Bycatch Fishing
- d) Pelagic Low Bycatch Fishing



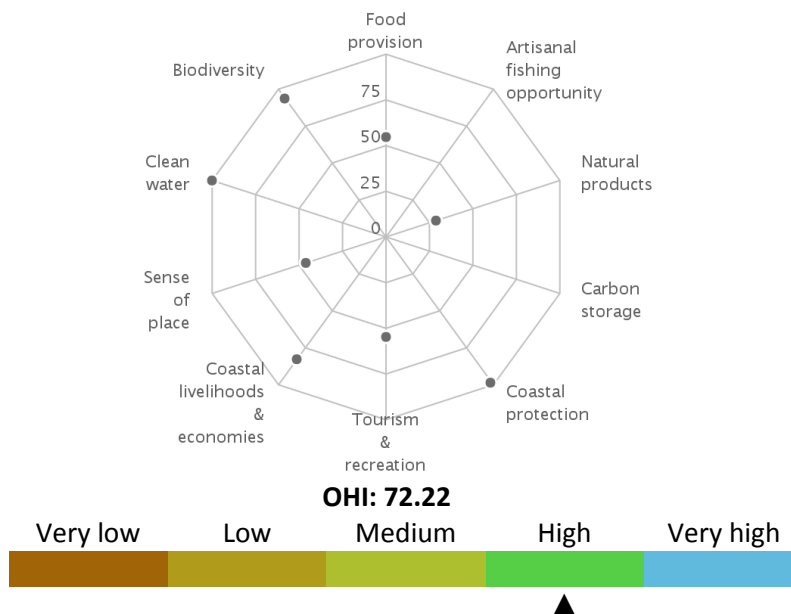
**CHI: 0.88**



**Ocean Health Index**

The Antarctica LME scores [relatively level] on the Ocean Health Index (score XX out of 100; range for other LMEs was 57 to 82). This score indicates that the LME is [far from] its optimal level of ocean health, although [there are some aspects that are doing well/there are still areas that need improvement]. Its score in 2013 [improved/decreased] compared to the previous year, due in large part to changes in the scores for [GOALS]. This LME scores lowest on [LIST GOALS] goals and highest on [LIST GOALS] goals. It falls in risk category X of the five risk categories, which is a [level] level of risk (1 = lowest risk; 5 = highest risk).

### Ocean Health Index (Antarctica)



### Socio-economics

This LME has no resident population so population-related indicators are not evaluated. However, nearby countries and distant fishing nations utilize this LME for fishing and tourism, the revenues for which are reported here.

### Population

Fishing and tourism depend on ecosystem services provided by LMEs. This LME ranks in the very low-revenue category in fishing revenues based on yearly average total ex-vessel price of US 2013 \$2.4 million for the period 2001-2010. Its yearly average tourism revenue for 2004-2013 of US 2013 \$1 229 million places it in the very low-revenue category.

### Revenues and Spatial Wealth Distribution

Fisheries Annual Landed Value	% Fish Protein Contribution	Tourism Annual Revenues	% Tourism Contribution to GDP	NLDI
2,362,484	No data	1,229,157,306	No data	No data

Legend: ■ Very low    ■ Low    ■ Medium    ■ High    ■ Very high

### Climate-Related Threat Indices

Climate Threat	2010		2100	
	Contemporary Threat	SSP1	SSP3	
	No data	No data	No data	No data

Legend: ■ Very low    ■ Low    ■ Medium    ■ High    ■ Very high

## Governance

---

### Governance architecture

Given that decision making for the entire Antarctic Treaty System (ATS) rests primarily with the Antarctic Treaty Consultative Meeting, transboundary issues within this LME appear to be highly integrated, despite the scoring for individual agreements within the Treaty system. Consequently, this LME has been assigned an overall integration score of 1.0.

The overall scores for the ranking of risk were:

