



# How to deal with climate change Lessons from Antarctic fish

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**CNR**

Consiglio Nazionale  
delle Ricerche



**ISMAR**

Istituto di Scienze Marine

# Outline

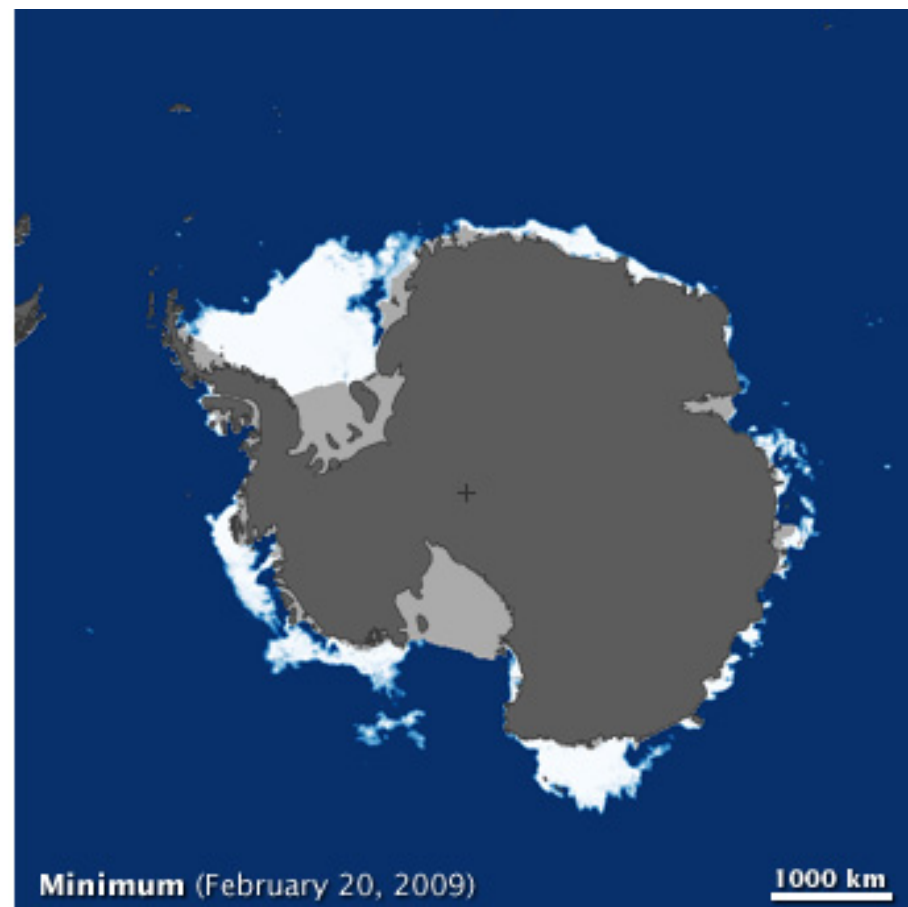
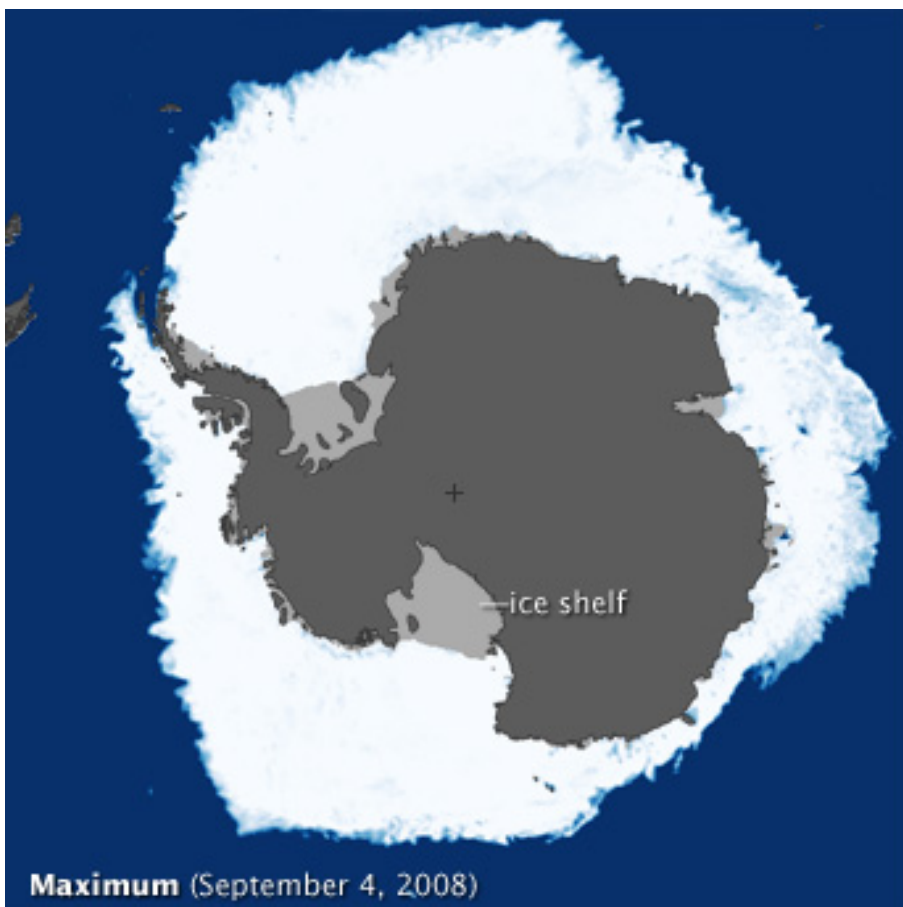
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- A story of change
- Biological responses to change
- Antarctic fish in polar education and communication



# Antartic Region

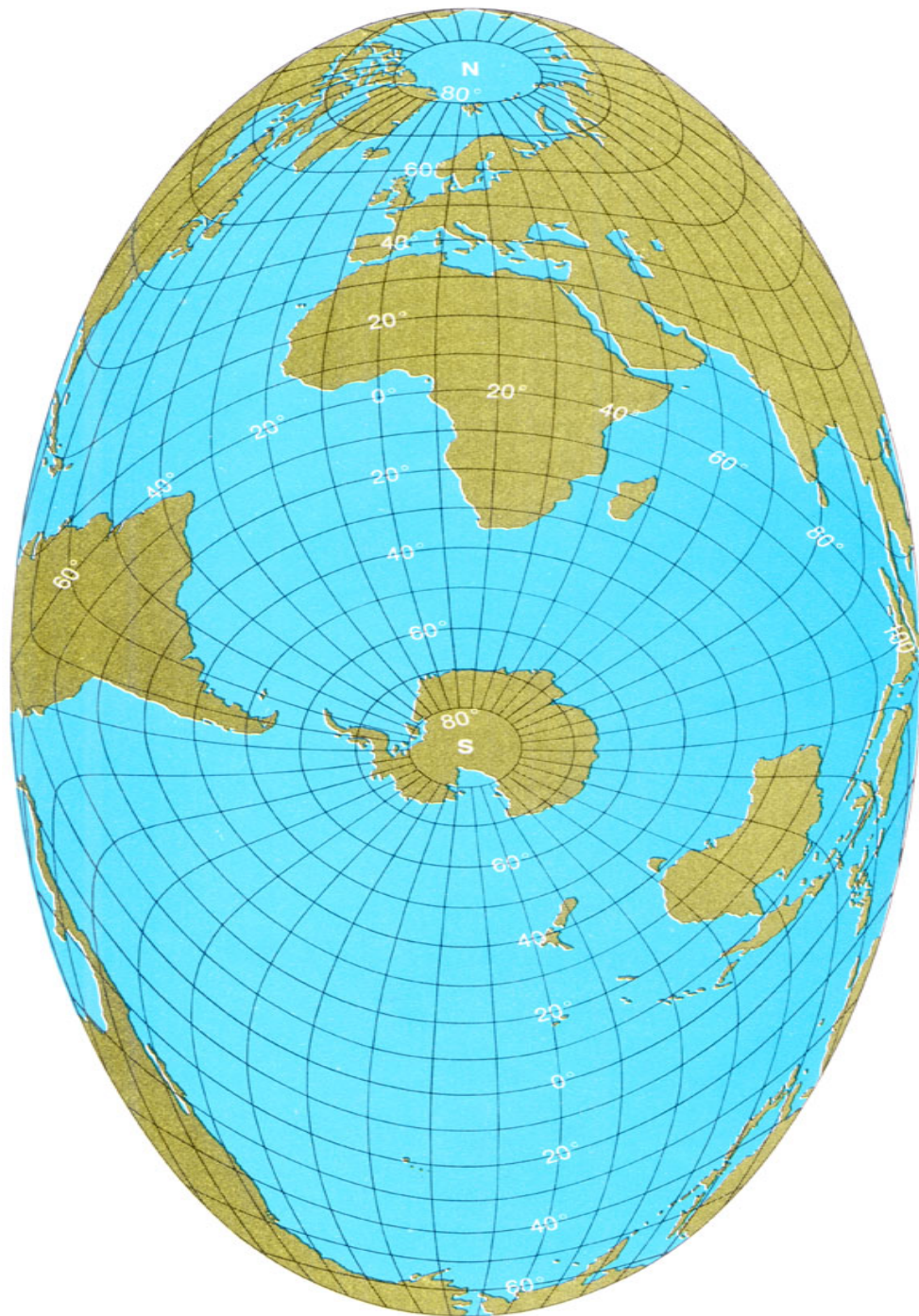




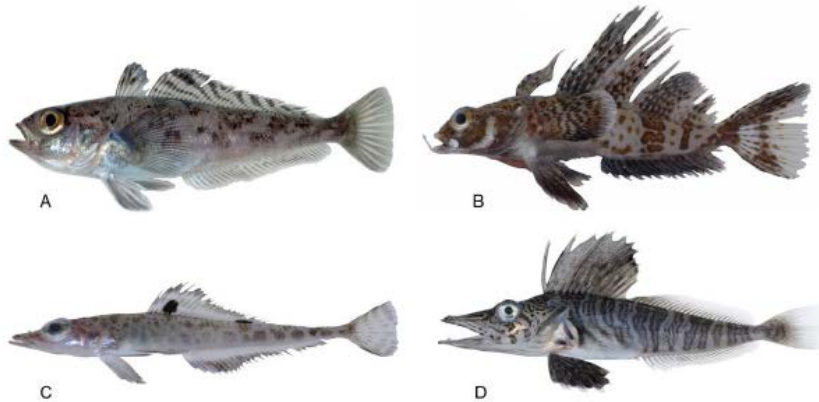


max: 18 million  $\text{Km}^2$  (winter)

min: 3 million  $\text{Km}^2$  (summer)



The Southern Ocean fish fauna is dominated, in diversity and biomass, by a teleostean group, the **Nototheniioidei**



No representatives in the Arctic polar ichthyofauna

# in the Southern Ocean.....

	n. species	%	biomass %
Notothenioidei	45,1		90-95
Liparidae	31,4		
Zoarcidae	10,8		
Others	12,7		



Notothenioids are important component of Antarctic marine biodiversity

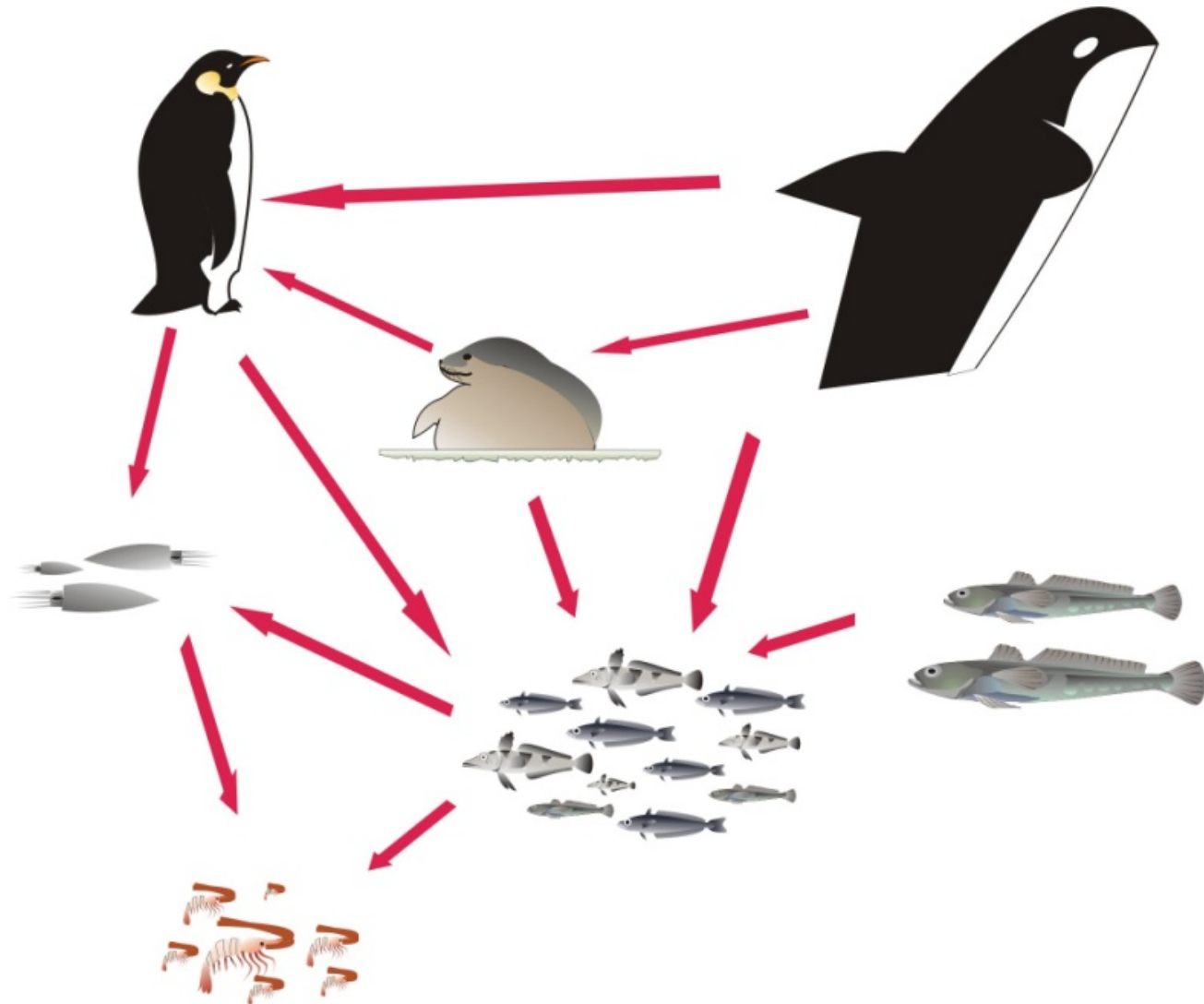




Some notothenioid species are related to the sea ice cover (cryopelagic community)



# Antarctic fishes play central roles in the Antarctic food webs



Antarctic fish are living resources for humans.  
Some species are target of commercial fishing





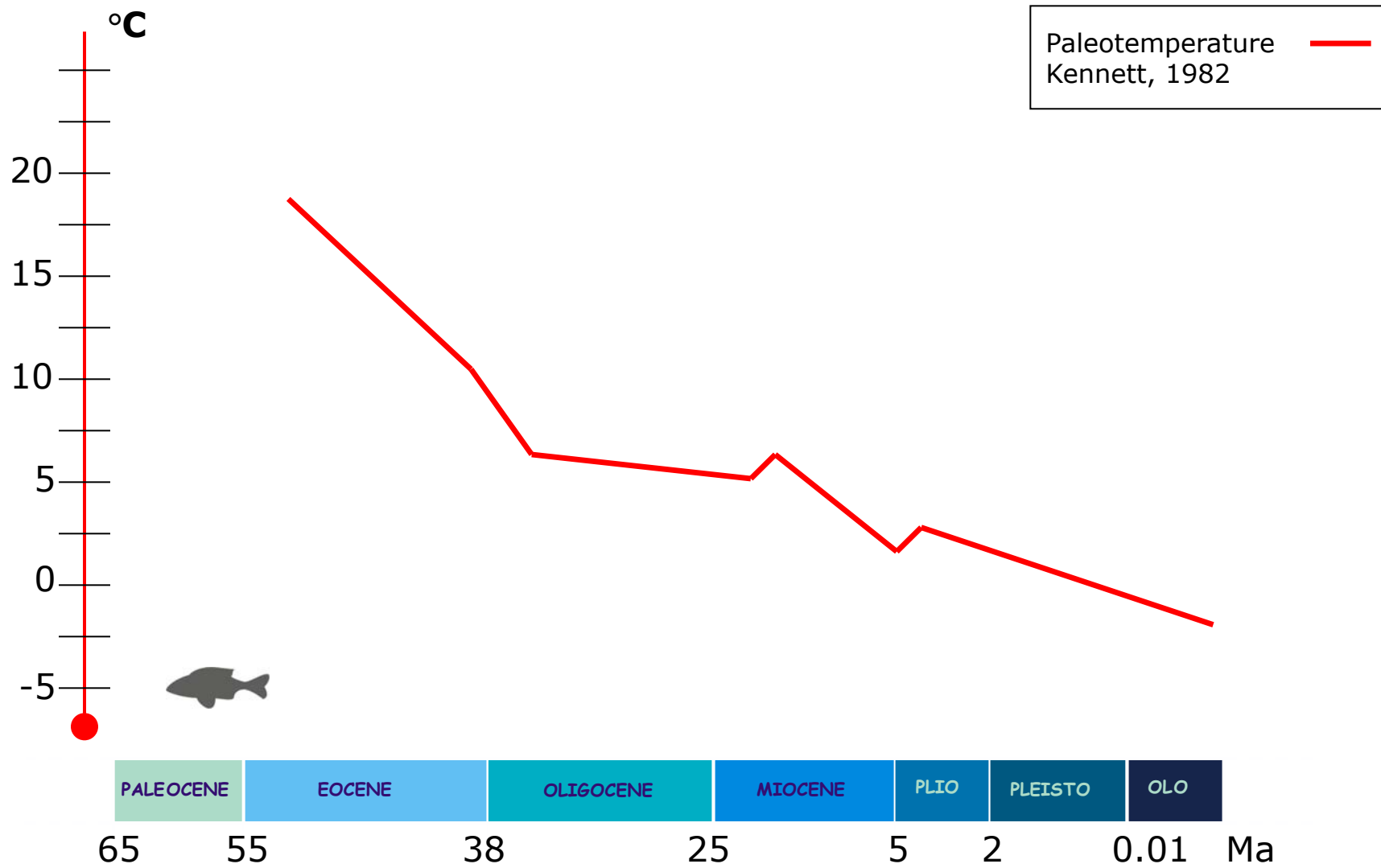
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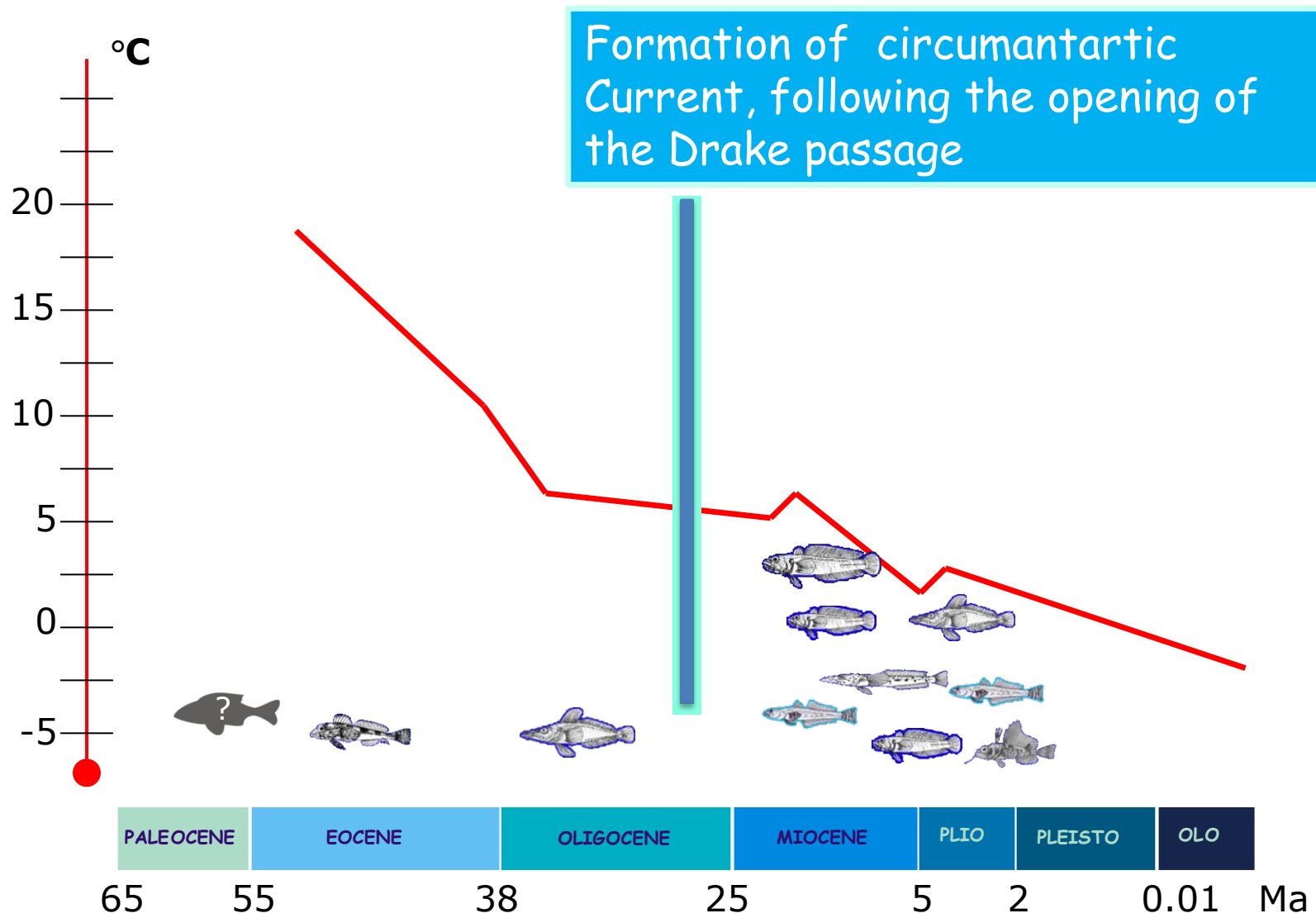


Antarctic fish are the survivors of long history of environmental change related to the formation of the Antarctic continent and its drift to Sud

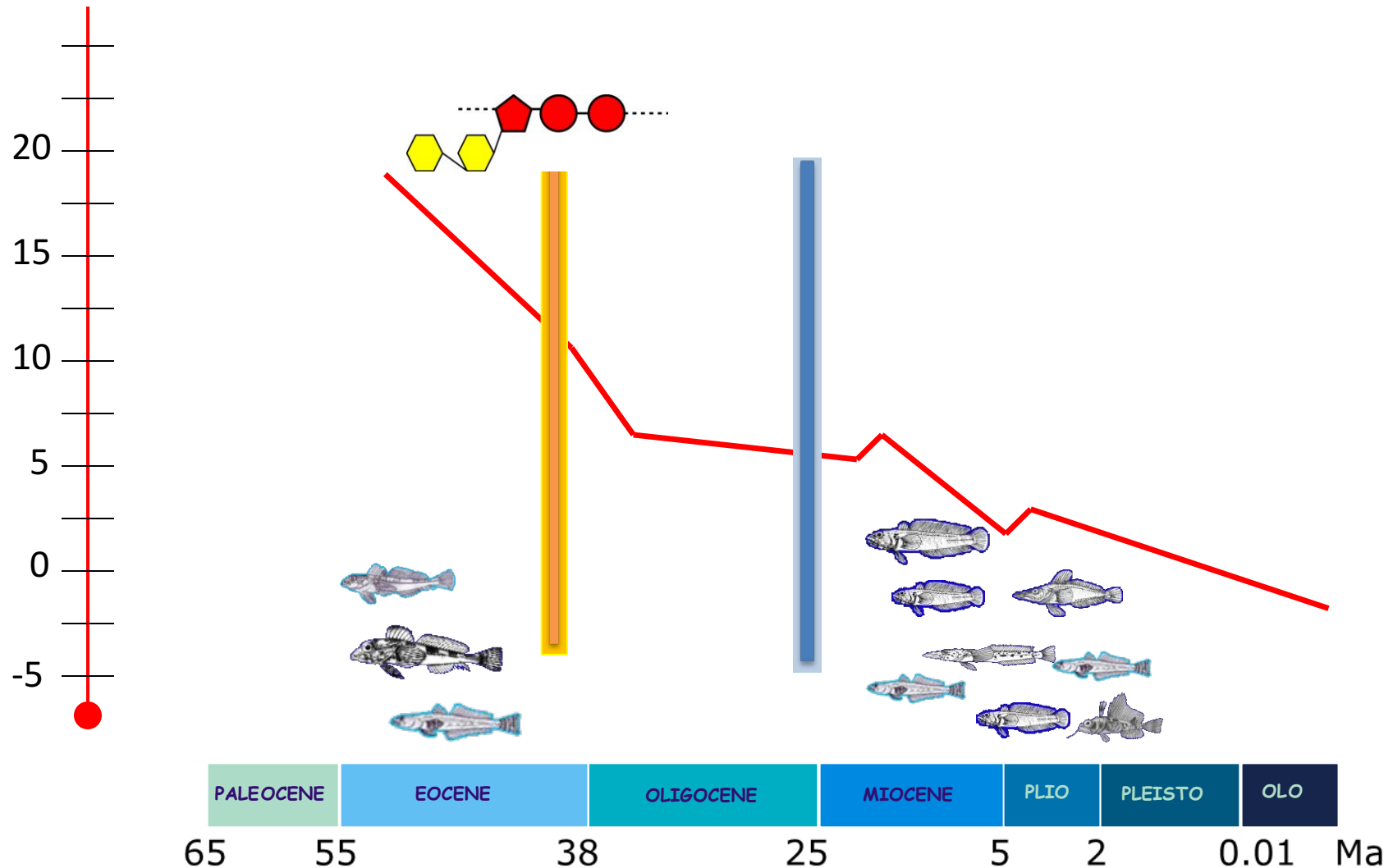




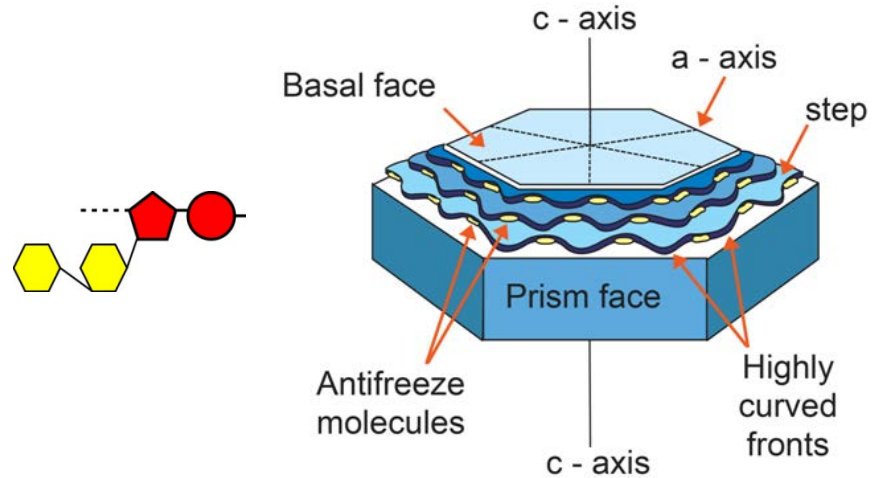




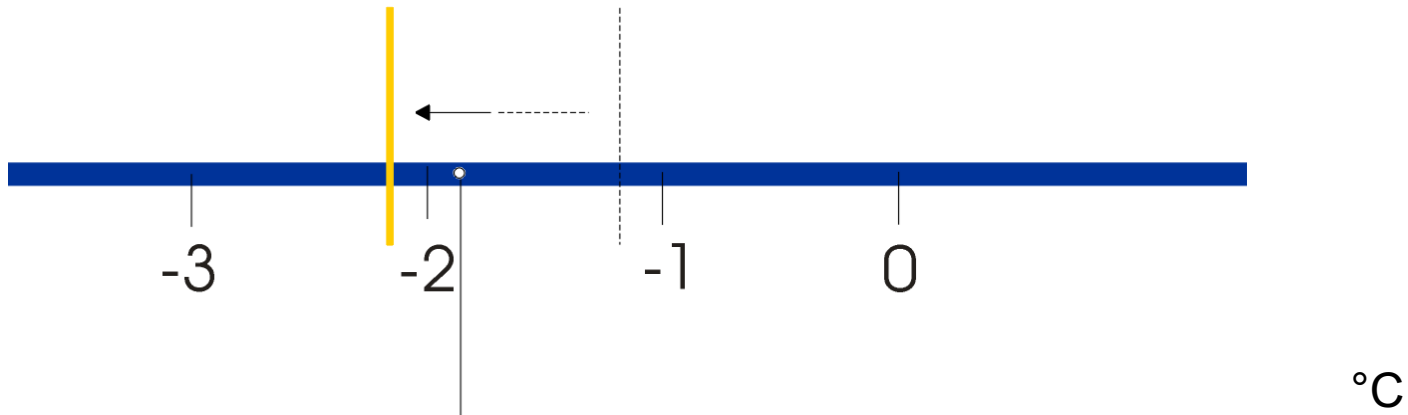
# A key biological event during environmental cooling, the antifreeze glycoproteins (AFGPs)



Antifreeze proteins bind to ice crystals in formation and lower the fish body freezing point below the sea water temperature

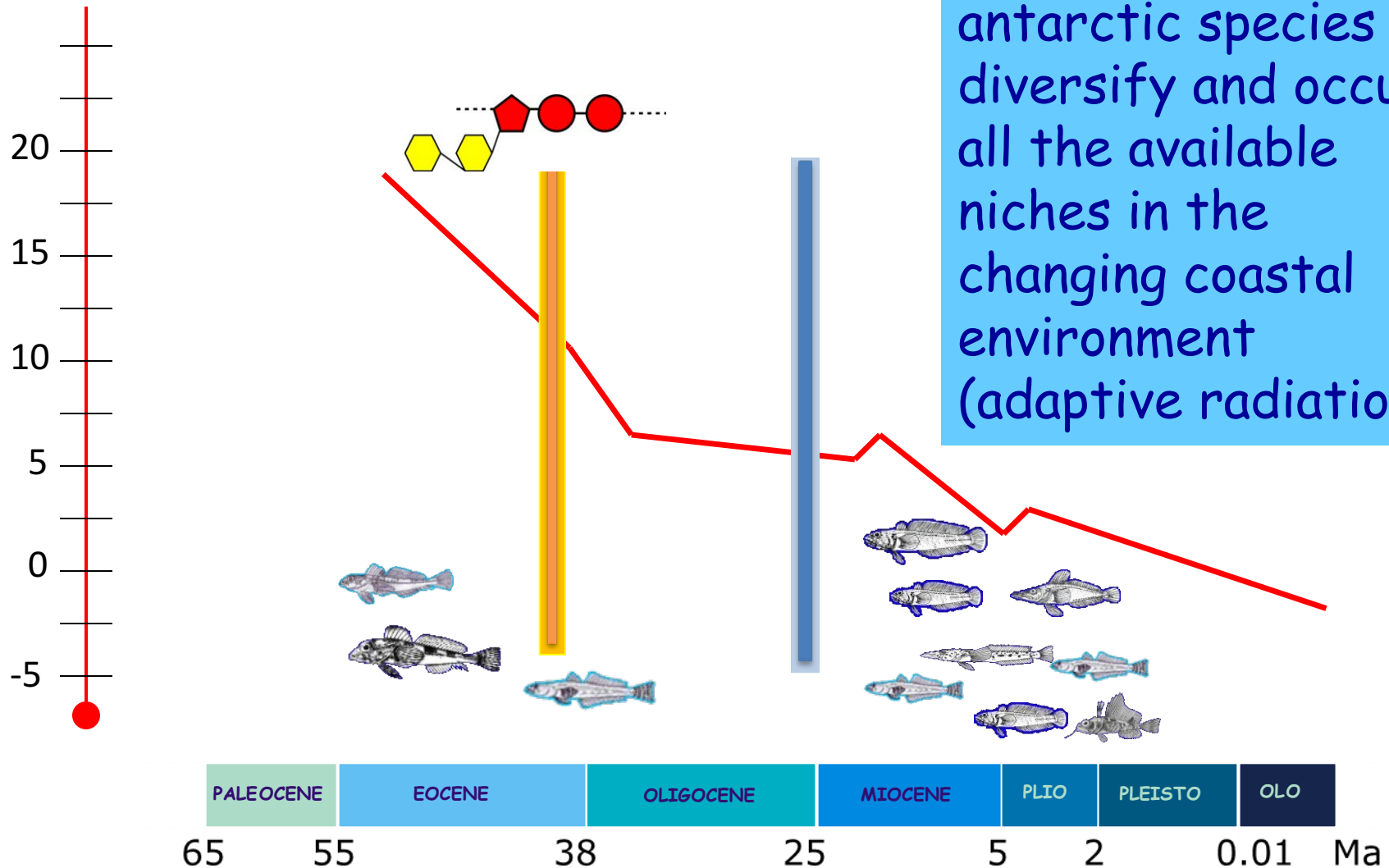


Freezing point with  
AFGPs

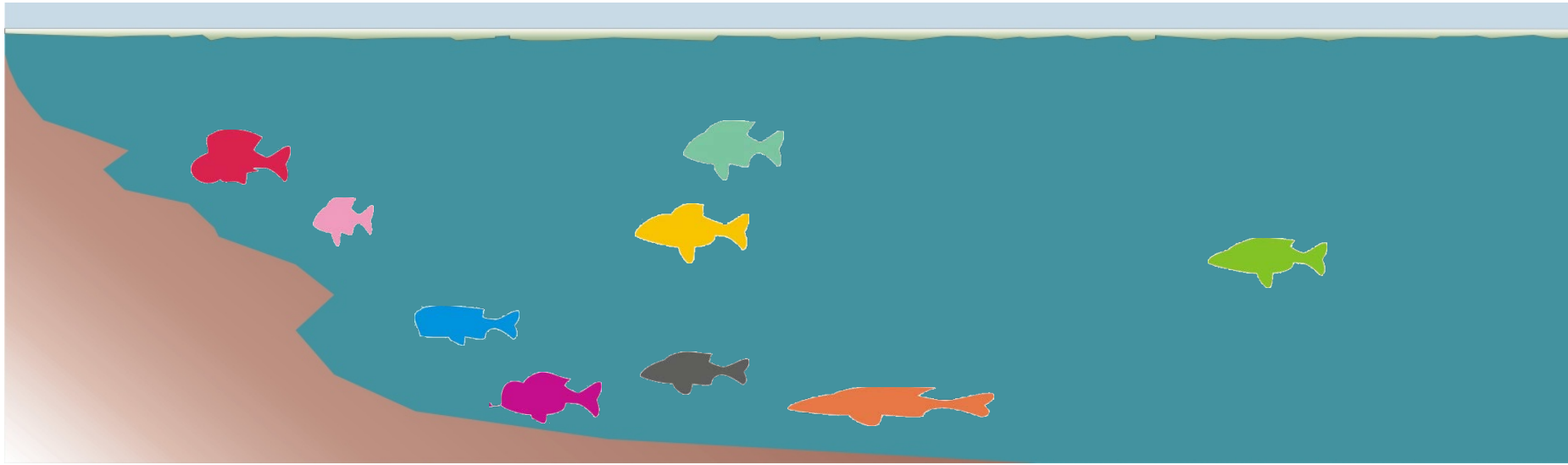




The absence of competitors allowed cold adapted antarctic species to diversify and occupy all the available niches in the changing coastal environment (adaptive radiation)



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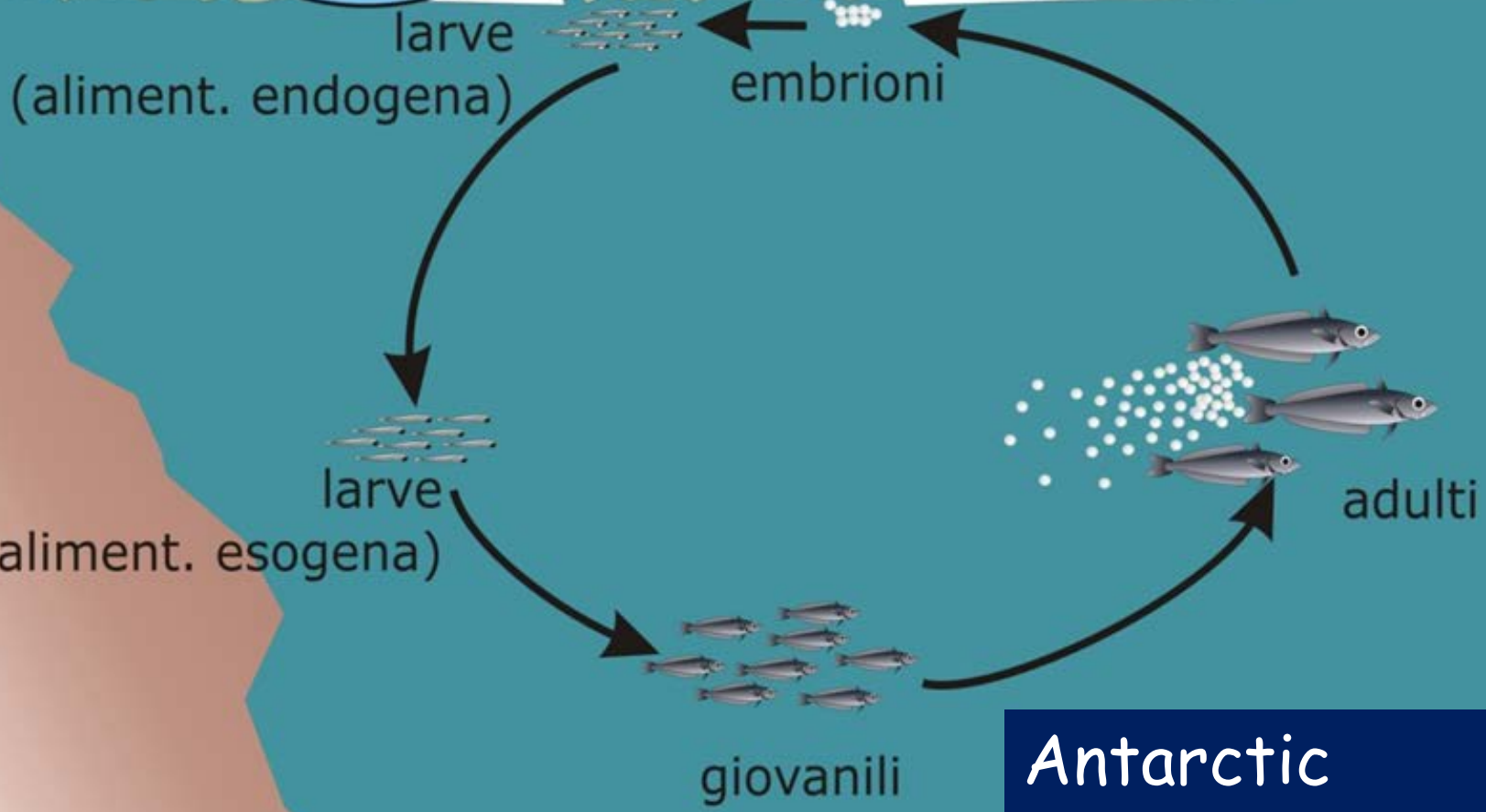
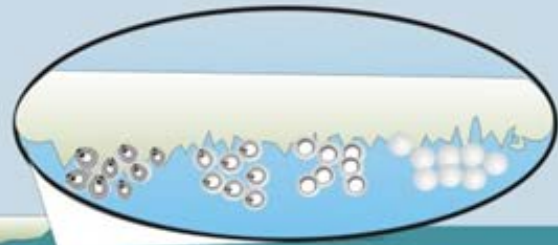
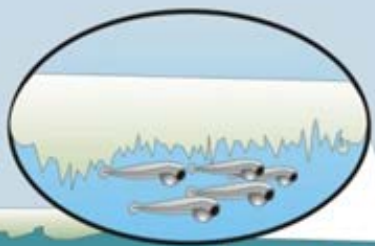




During adaptation to the new environmental and climatic conditions Antarctic fish changed very deeply from their ancestors

Es. Although devoid of swim bladder some of them have adapted to pelagic environment. This has been acquired through deep changes in skeleton ossification and lipid accumulation

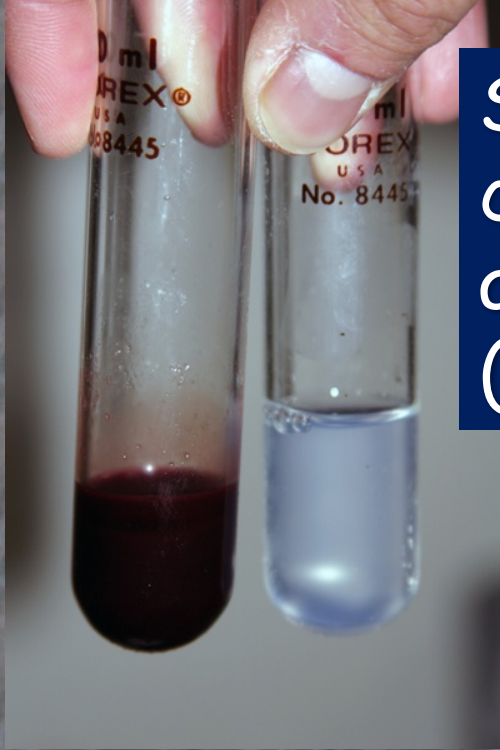




Antarctic  
Silverfish life  
cycle

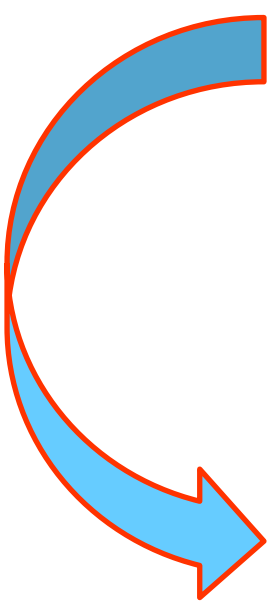


Some of them (icefish) have lost the capability to synthesize haemoglobin and have no red cells in their blood (white-blooded fish)



In the oxygen-rich Antarctic waters they have compensated a potentially lethal mutation with changes in their heart and vessel system.





Antarctic fish are successful  
biological responses to  
environmental changes  
(occurred at evolutionary pace)

They are important models to study the  
flexibility of complex biological systems  
facing ongoing and future climate change

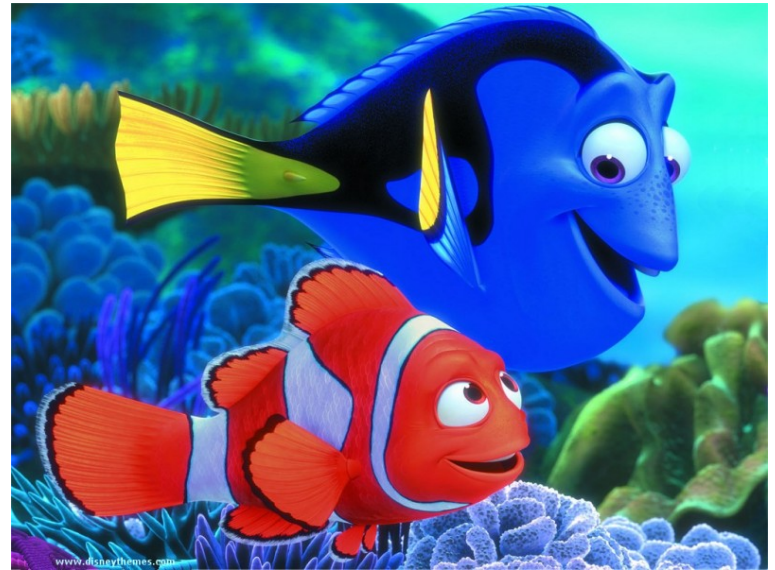
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# Fish and communication

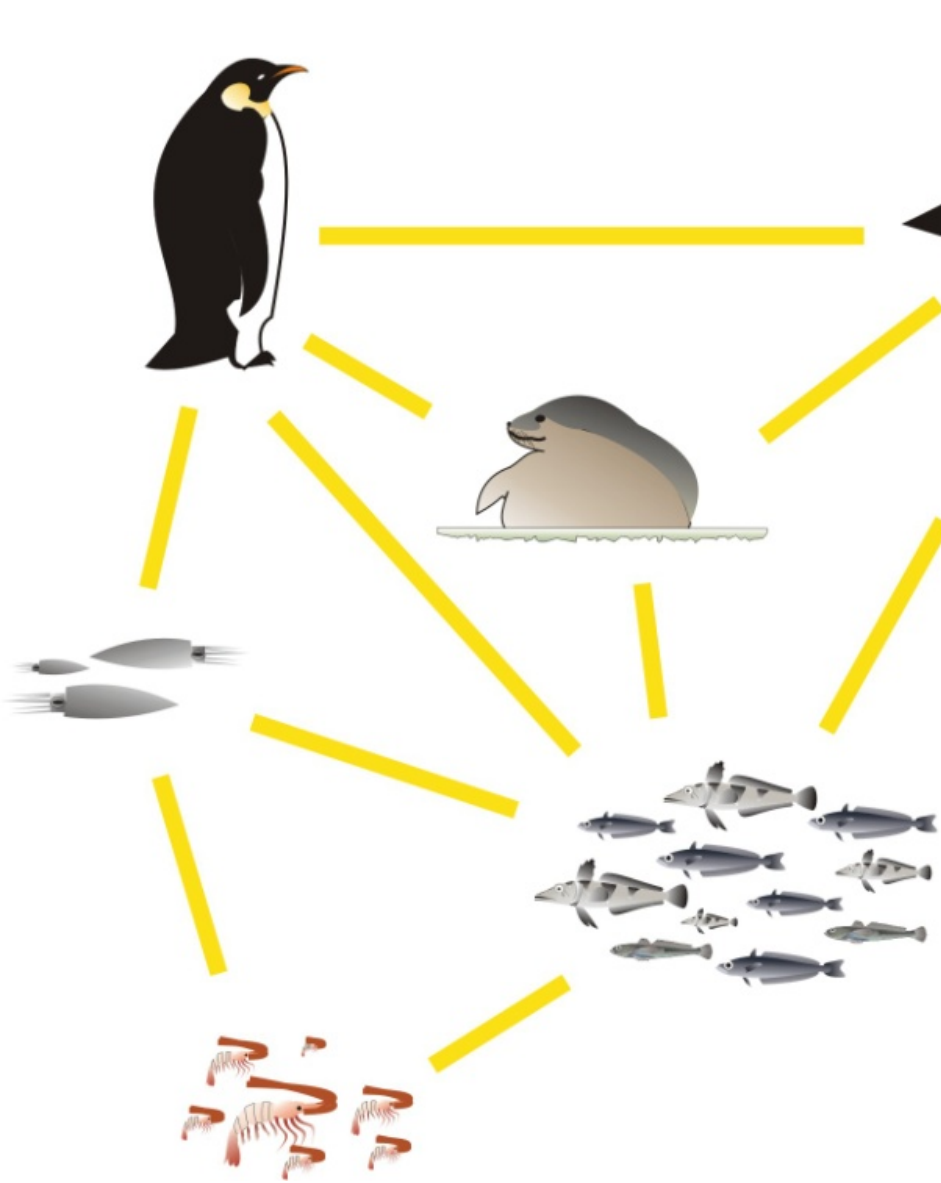
Fish are popular  
and can be very  
effective in  
communication to large  
audience





Members of Swiss trade union Unia protest against what they call "financial sharks".





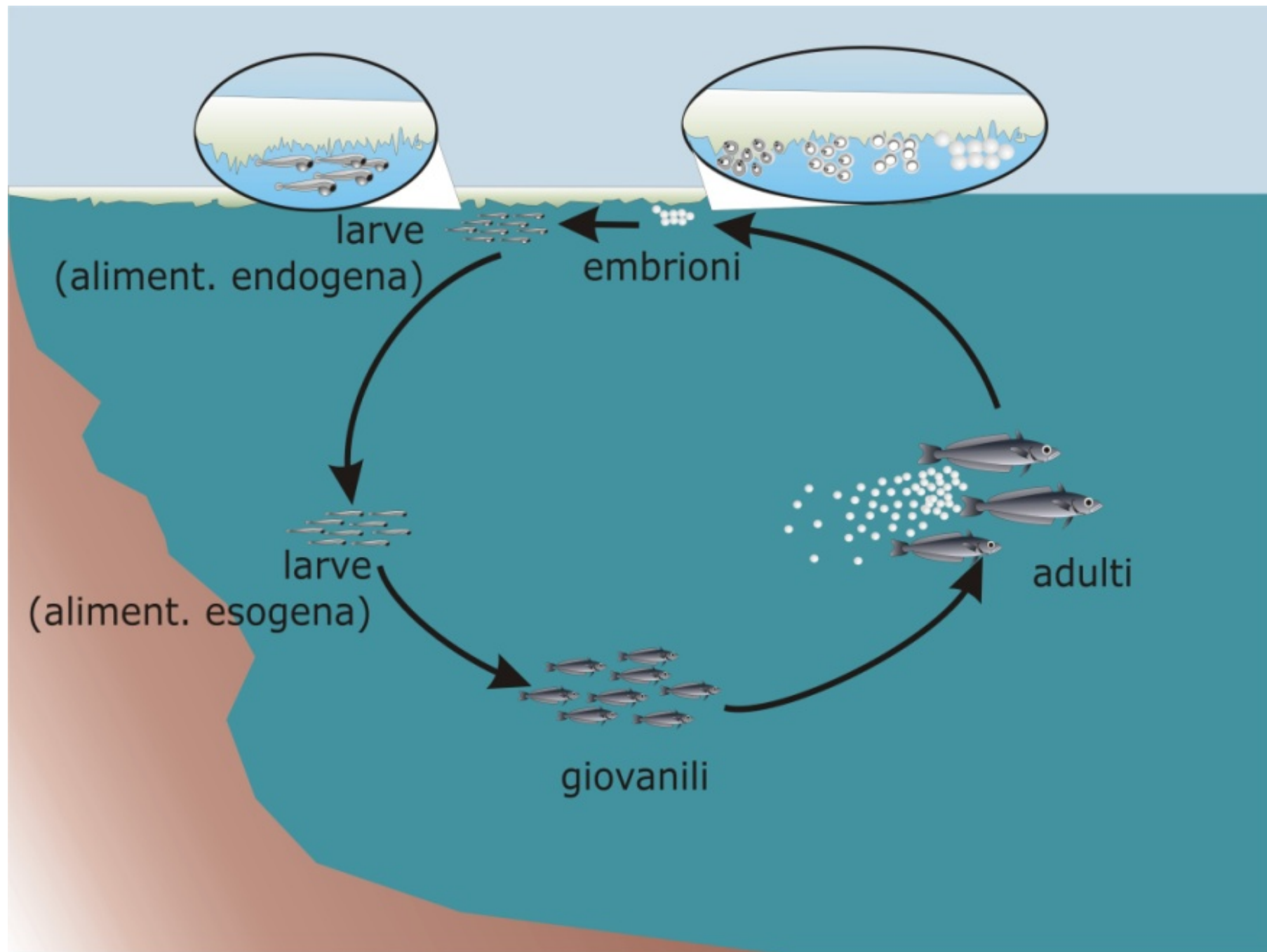
Fish are consumers at the intermediate trophic level, and preys of the large vertebrates at the top of the food chains. This peculiar dual role makes them ideal educational players to illustrate in a direct and intuitive way the ecological interactions in polar marine ecosystems, and the implications of climate change on marine life.



Il pesciolino argentato  
Viaggio alla scoperta del  
mare dell'Antartide


SAGEP, 2013

The life journey of two small Antarctic silverfish.....





# The life journey of two small Antarctic silverfish .....



Tra loro c'è una pesciolina  
con un grande sogno:  
esplorare il mondo  
che la circonda ...

E chi è questo pesciolino curioso  
che la guarda?

Il suo nome è **Ross.**

Ecco l'amico con cui partire  
alla scoperta del mare.

Ormai manca poco...

il ghiaccio comincia lentamente a sciogliersi:

la primavera sta arrivando...

Eccola qui!

Si chiama **Sesi**



**È primavera.**

Il viaggio di Sesi  
alla scoperta del mare antartico ha inizio!

Guarda...  
un riccio di mare...



E là sotto...  
un ragno di mare  
dalle 8 zampe lunghissime...

E laggiù?  
un gruppo di conchiglie...

Questa cos'è?  
Una spugna...

Seguilo e scoprirai  
i segreti di questo gelido mare





Quanti animali vivono  
nel freddo mare dell'Antartide:

il  
**pesce antartico**  
dal sangue bianco...

le stelle marine...  
le cozze...



le meduse...



Avranno visto  
la sua amica?

Da che parte sarà meglio andare?



Alla scoperta dei pesci  
antartici. Discovering  
Antarctic fishes

Il Piviere , 2016

A virtual dive in the Ross Sea...





*Y. K. P. 2012*













THANKS

2013

