



Istituto Veneto
di Scienze, Lettere
ed Arti

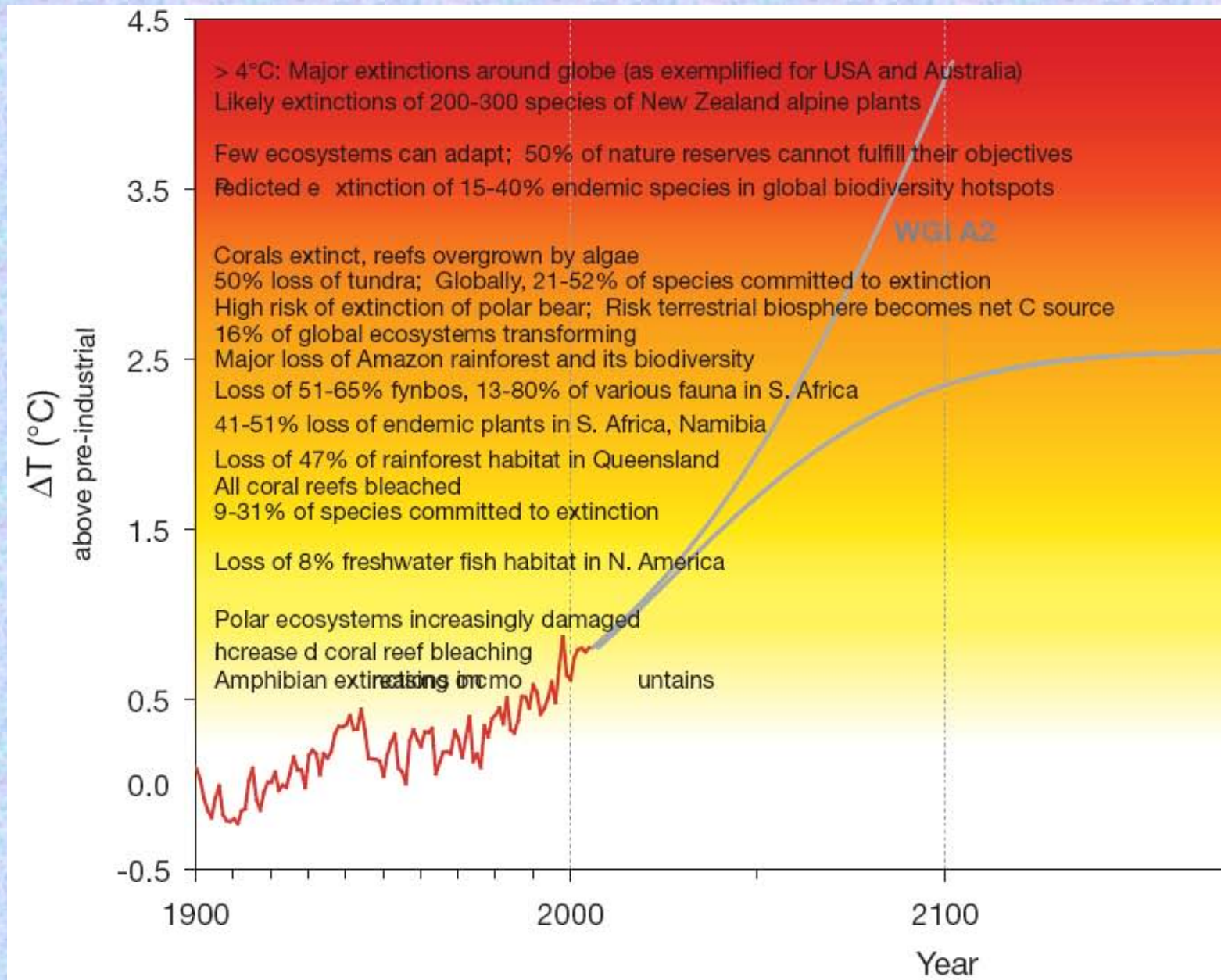
CHIARAMENTE SCIENZA

EFFETTI DEI CAMBIAMENTI CLIMATICI SULLA BIODIVERSITA'



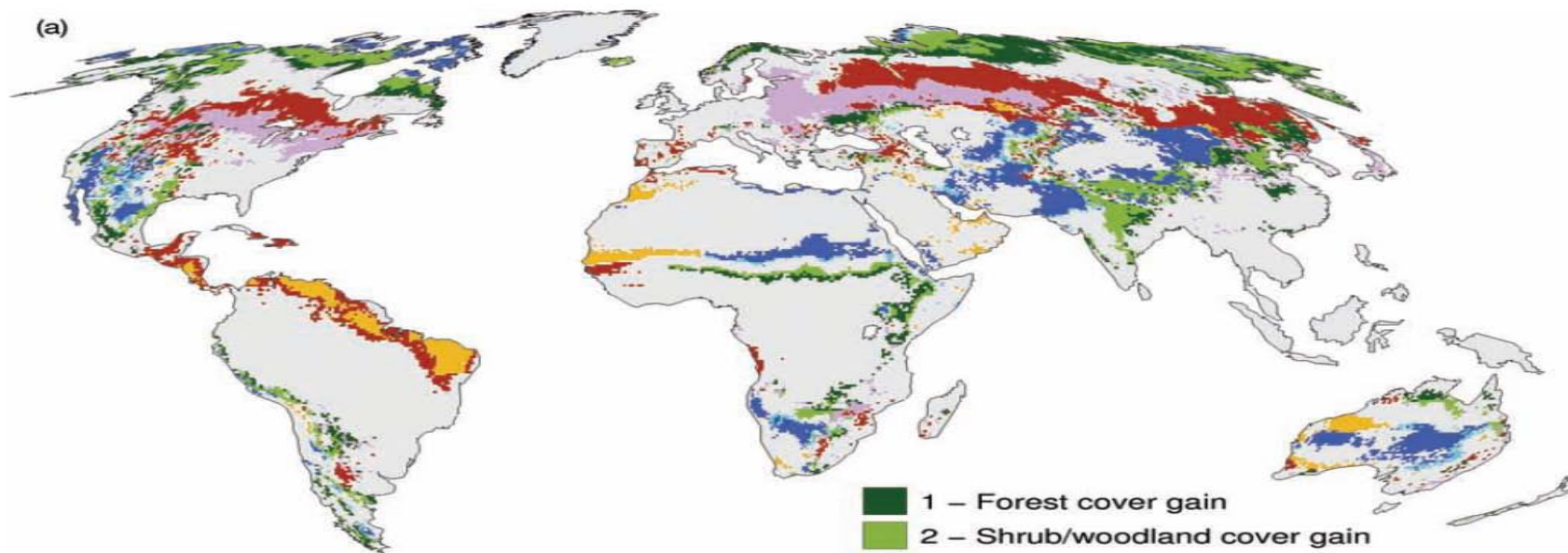
UNIVERSITÀ
CA' FOSCARI
VENEZIA

Patrizia Torricelli
Ca' Foscari University, Venice
Department of Environmental Sciences



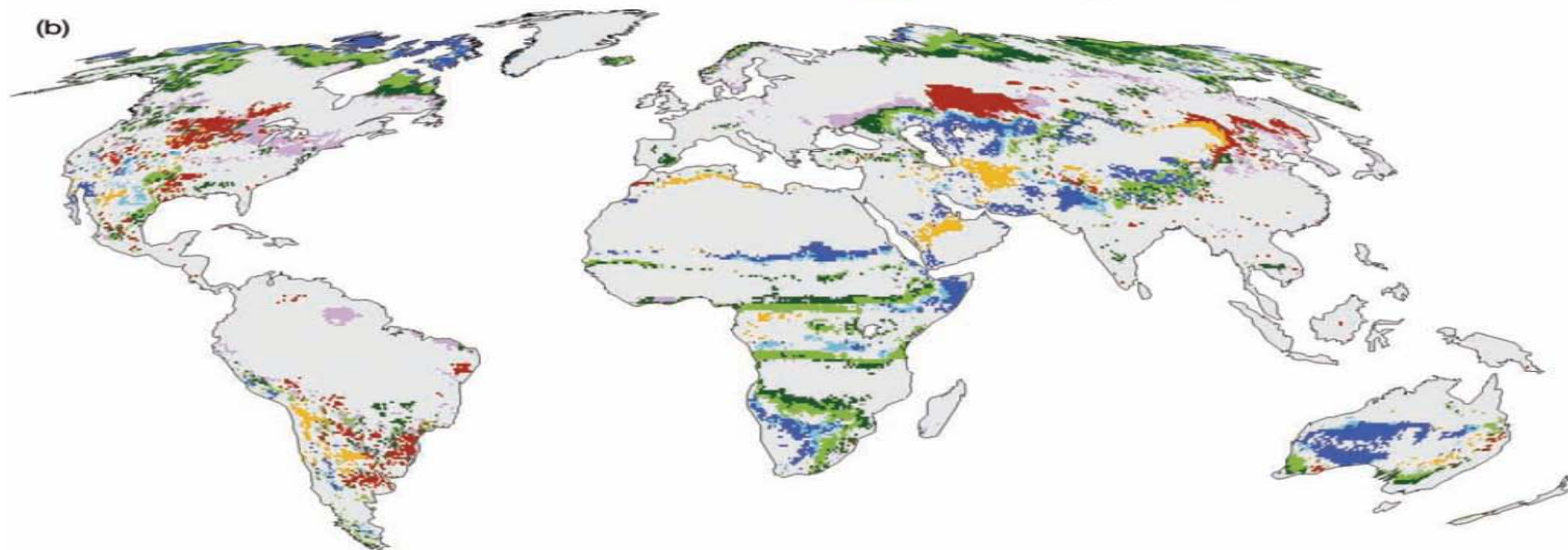
Temperature anomalies (1900-2005) and possible trends of evolution in the next century

(a)

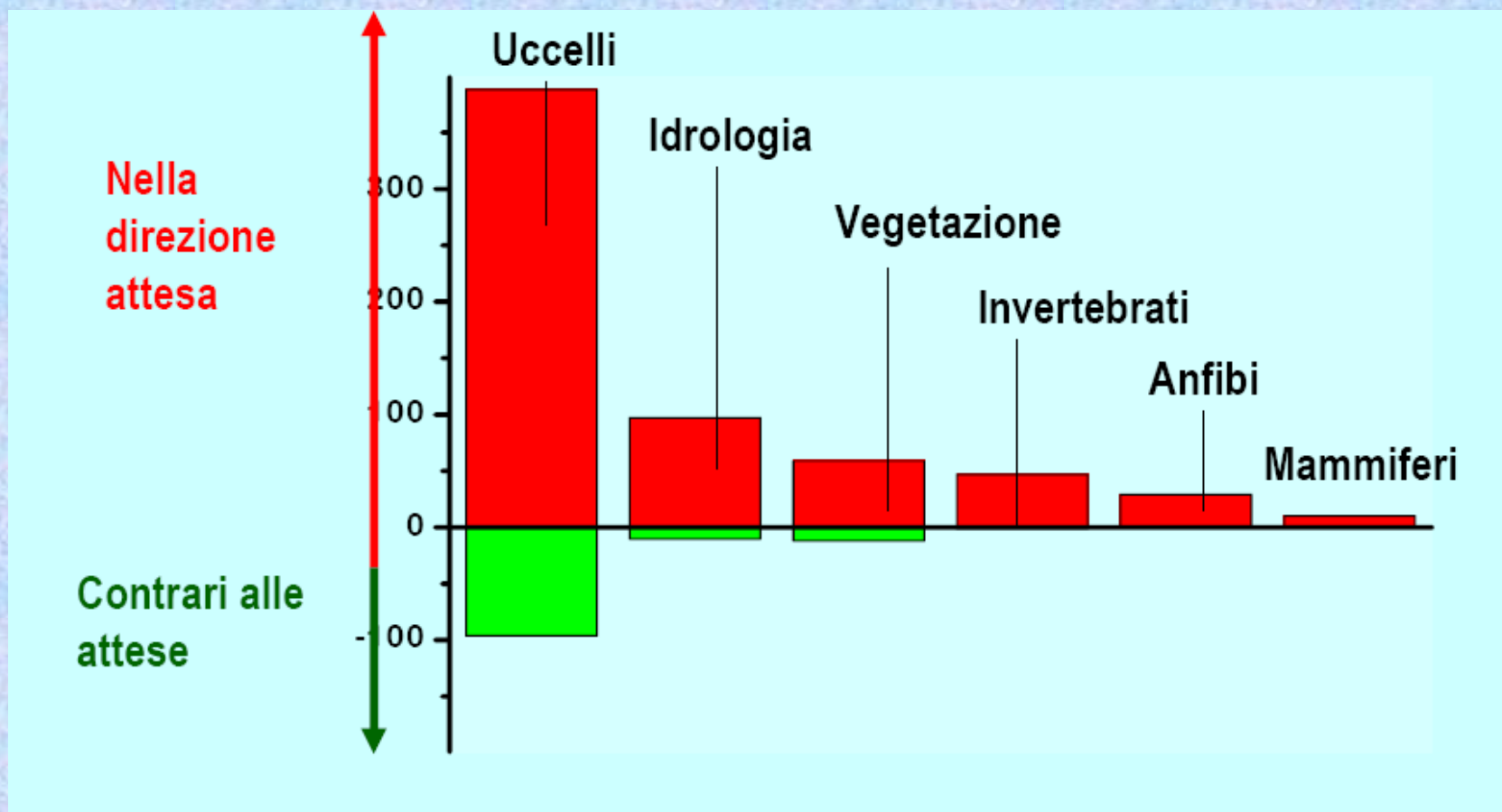


- 1 – Forest cover gain
- 2 – Shrub/woodland cover gain
- 3 – Herbaceous cover gain
- 4 – Desert amelioration
- 5 – Grass/tree cover loss
- 6 – Forest/woodland decline
- 7 – Forest type change

(b)



alterazioni nella direzione attesa dalle relazioni con la temperatura

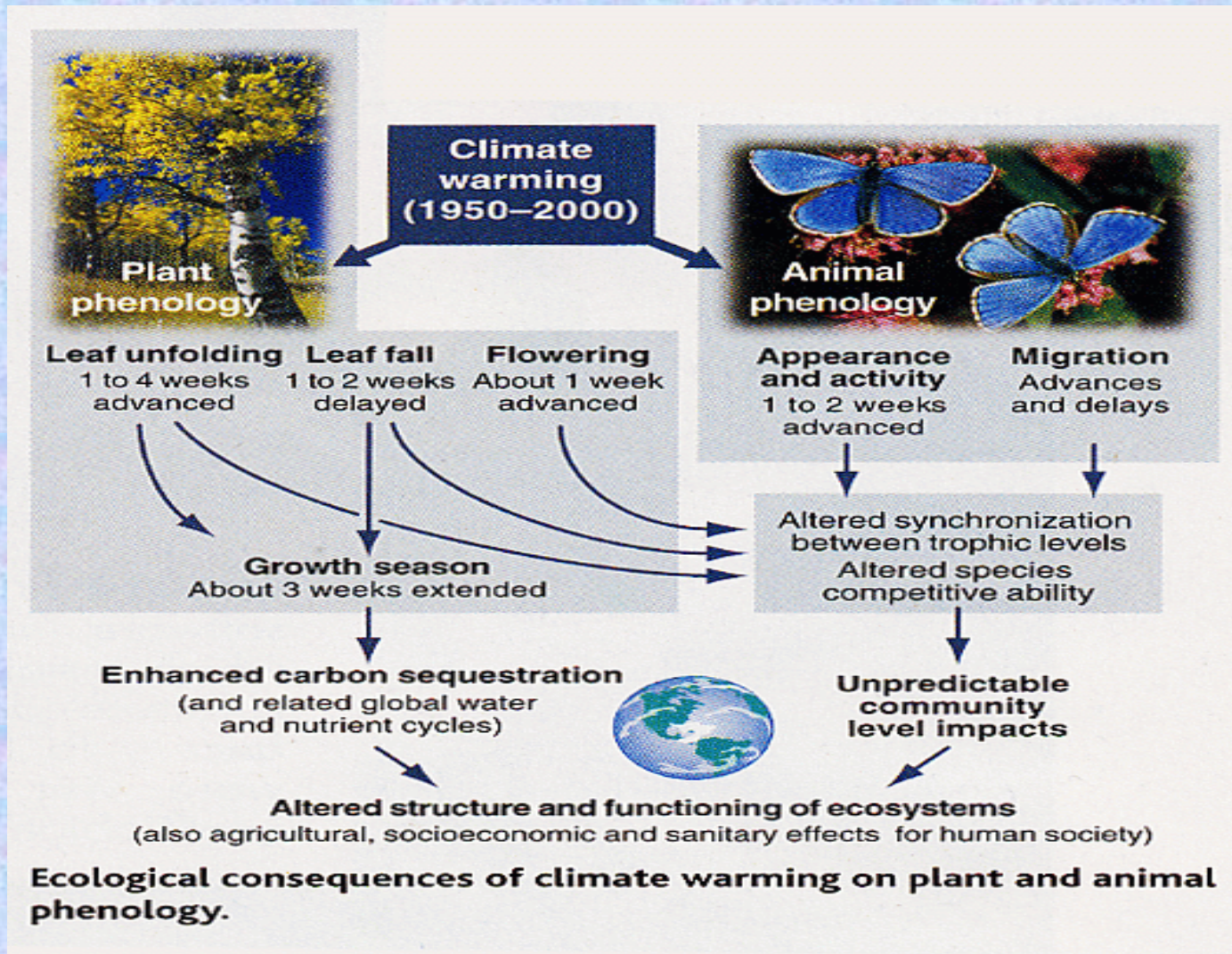


Cambiamenti biologici sistematicamente in accordo con le previsioni di cambiamento climatico

Type of Analysis	Changed as predicted (n)	Changed opposite to prediction (n)	P
Phenological N = 484 / (678)	87 %	13 %	$< .1 \times 10^{-12}$
Distributional changes: At poleward/upper range boundaries At equatorial/lower range boundaries	81 % 75 %	19 % 25 %	
Community (abundance) changes: Cold-adapted species Warm-adapted species	74 % 91 %	26 % 9%	
N = 460 / (920)	81 %	19 %	$< .1 \times 10^{-12}$
Meta-analysis Range-boundaries (n=99)	6.1 km-m/decade northward/upward shift	.013	
Phenologies (n=172)	2.3 d/decade advancement	< 0.05	

Varie specie di: vegetali, rettili, anfibi, pesci, zooplancton marino e invertebrati, mammiferi, uccelli
(Parmesan & Yohe, *Nature* 2003)

PHENOLOGICAL CHANGES



The State *of the* Birds

2010 Report On
Climate Change



State of the Birds 2010 Report on Climate Change

Sterpazzolina – migratore transahariano



Gruccione - migratore transahariano

Le specie migratorie che non si sono adattate ai cambiamenti anticipando la migrazione:

- risultano in forte declino;
- soffrono di minor apporto energetico: arrivando "*tardi*" usufruiscono in minor misura della disponibilità di risorse
- minor impatto sui migratori locali rispetto alle specie di lungo raggio



Beccofrusone – migratore intrapaleartico



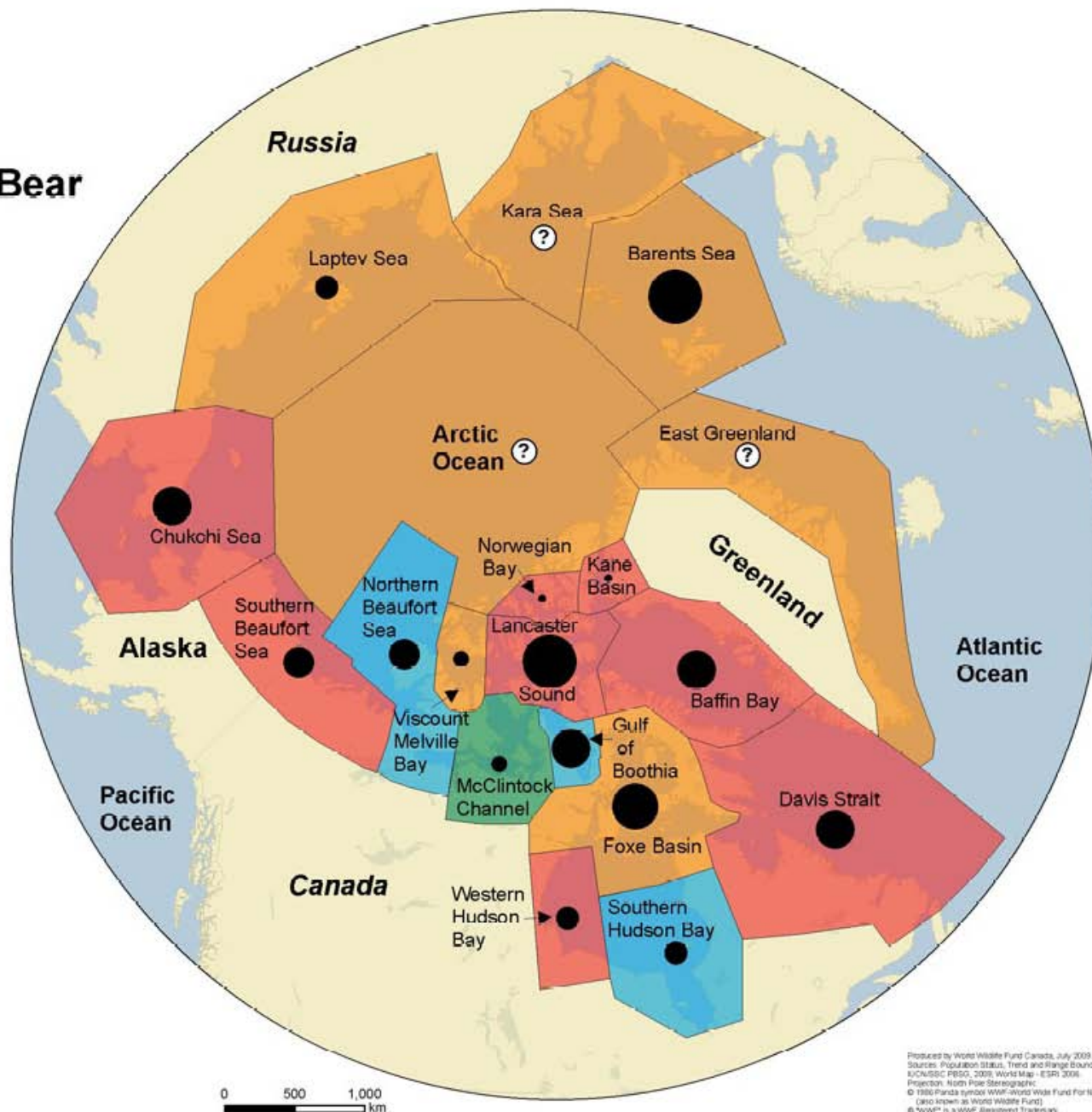
Status of the Polar Bear

Subpopulation Size (Number of Bears)

- <200
- 200-500
- 500-1000
- 1000-1500
- 1500-2000
- 2000-2500
- 2500-3000
- ⊙ Unknown

Population Trend

- Orange Data deficient
- Red Declining
- Green Increasing
- Blue Stable



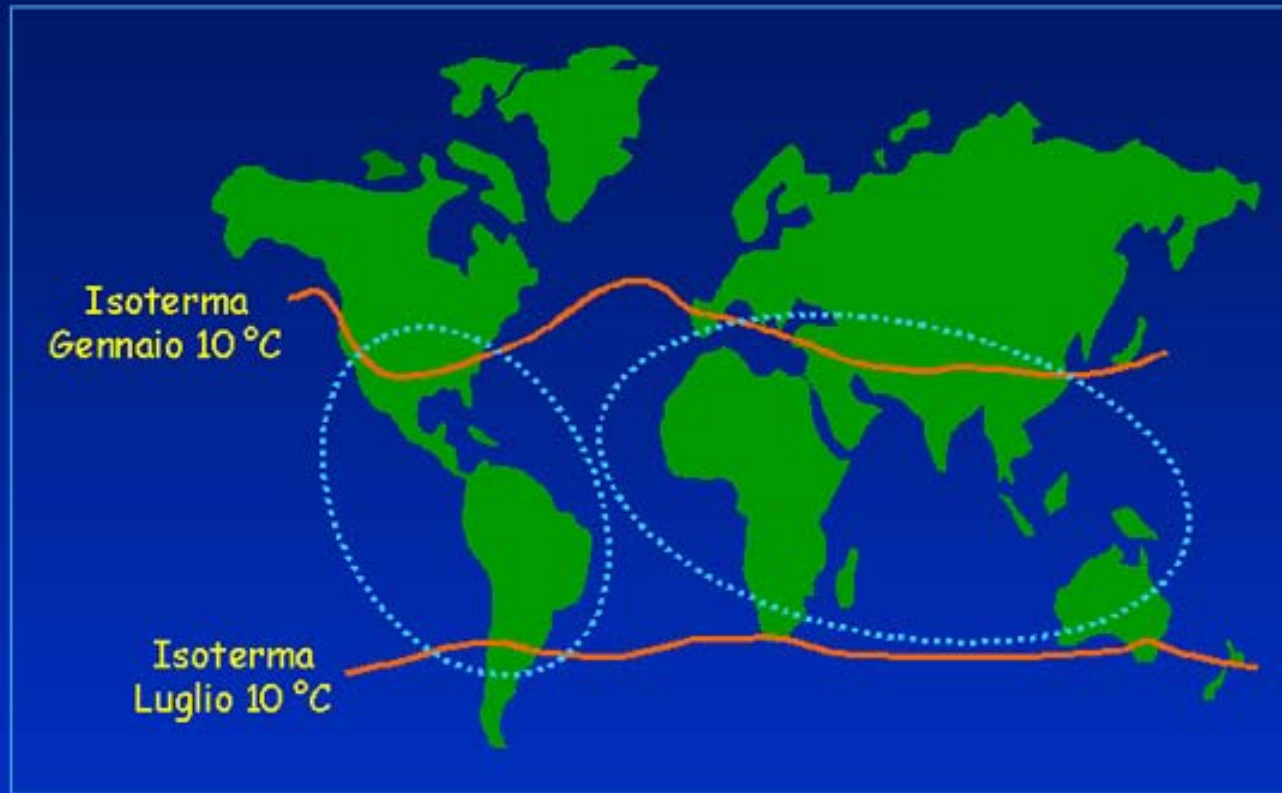
Oggi la stima della popolazione di orso polare (*Ursus maritimus*) è di 20,000 - 25,000 individui.

A Ovest della baia di Hudson (Canada), dove la rottura dei ghiacci anticipa di 3 settimane rispetto agli anni '70, il numero è sceso da 1,200 individui del 1987 a 950 nel 2004.

Nel 2005, l'IUCN *Polar Bear Specialist Group* rimuove la specie dalla *Red List* e la include nella *Least Concern to Vulnerable* per la previsione di declino della popolazione di oltre il 30% nei prossimi 35 - 50 anni.

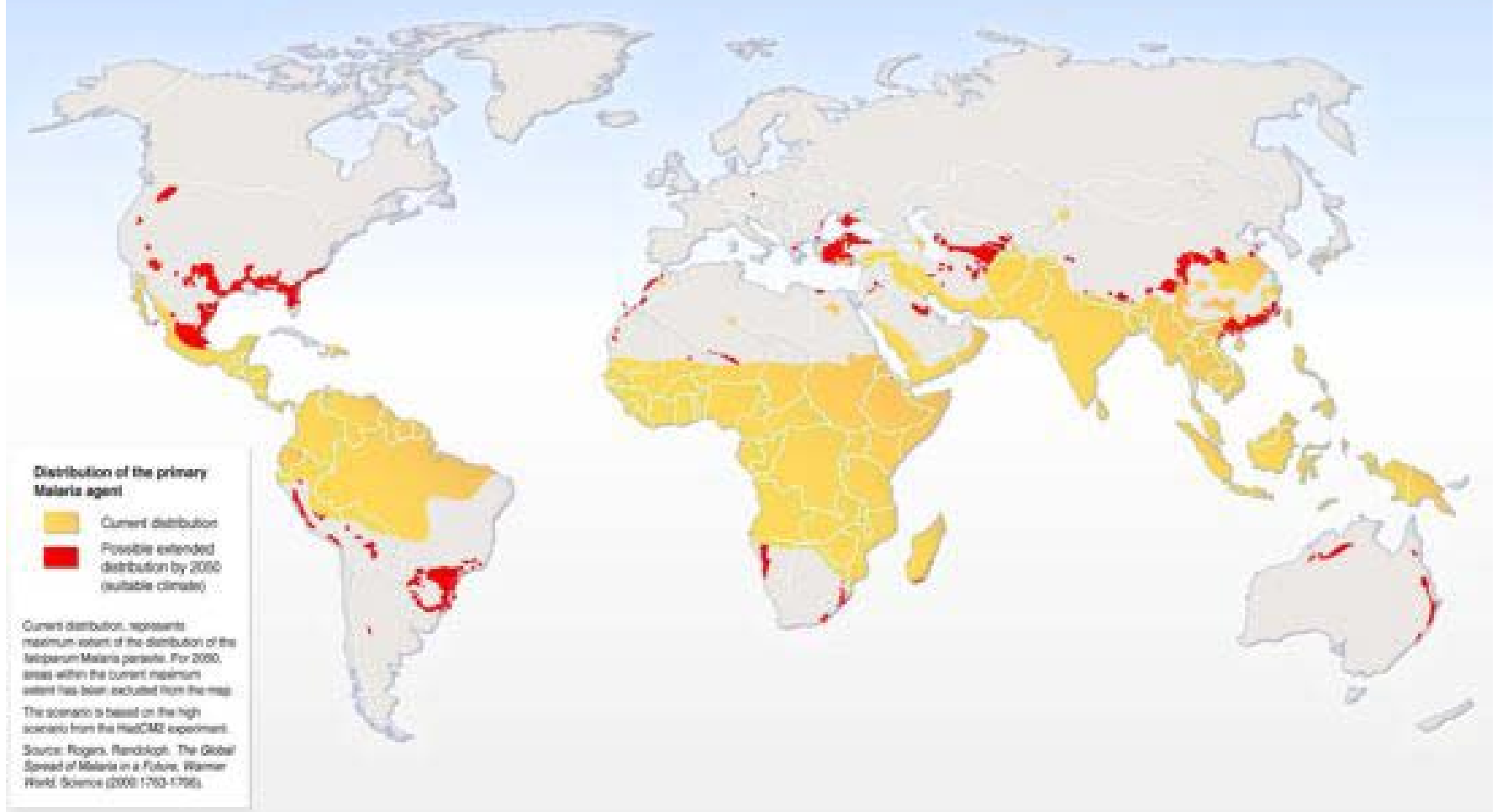
Se l'estensione della banchisa diminuisce secondo gli attuali scenari, l'orso bianco rischia l'estinzione in caso di incremento della T di 2.8 C rispetto al periodo preindustriale.





Aree di distribuzione di *Aedes aegypti* (dittero vettore di febbre gialla) e isoterme del mese invernale più freddo in Emisfero Nord e Sud.

Climate Change and Malaria



Distribuzione attuale

Previsione al 2050

“The Atlantic way” :

At the dawn of Pliocene (5 Ma) the strait of Gibraltar re-opened and the sea was repopulated by species of Atlantic origin.

“The Indo-Pacific way”

In 1869 the Suez Canal opening a connexion between Mediterranean and Indo Pacific biota (separated since Miocene - 10Ma)

two main routes of invasion...
the Mediterranean is a converging point of fauna



Recent atlantic immigration (last 50 years) is characterised by subtropical and tropical species

Lessepsian migration represent the most important biogeographic phenomenon witnessed in the contemporary oceans (Por, , 1989).

62% Atlantic species
29% endemic species
5% Indo-pacific species
Cosmopolite species

First signals since '70s

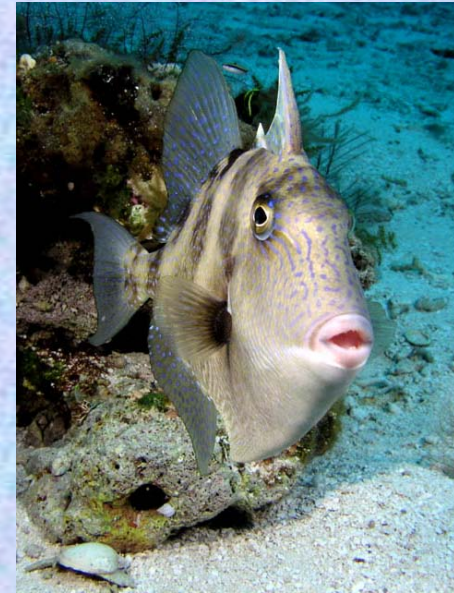
- **Northward extension of native thermophilic species**
- **Invasion of non indigenous tropical species**

Meridionalization

*spreading in the Northern
areas of thermophilic species
and increasing in abundance*



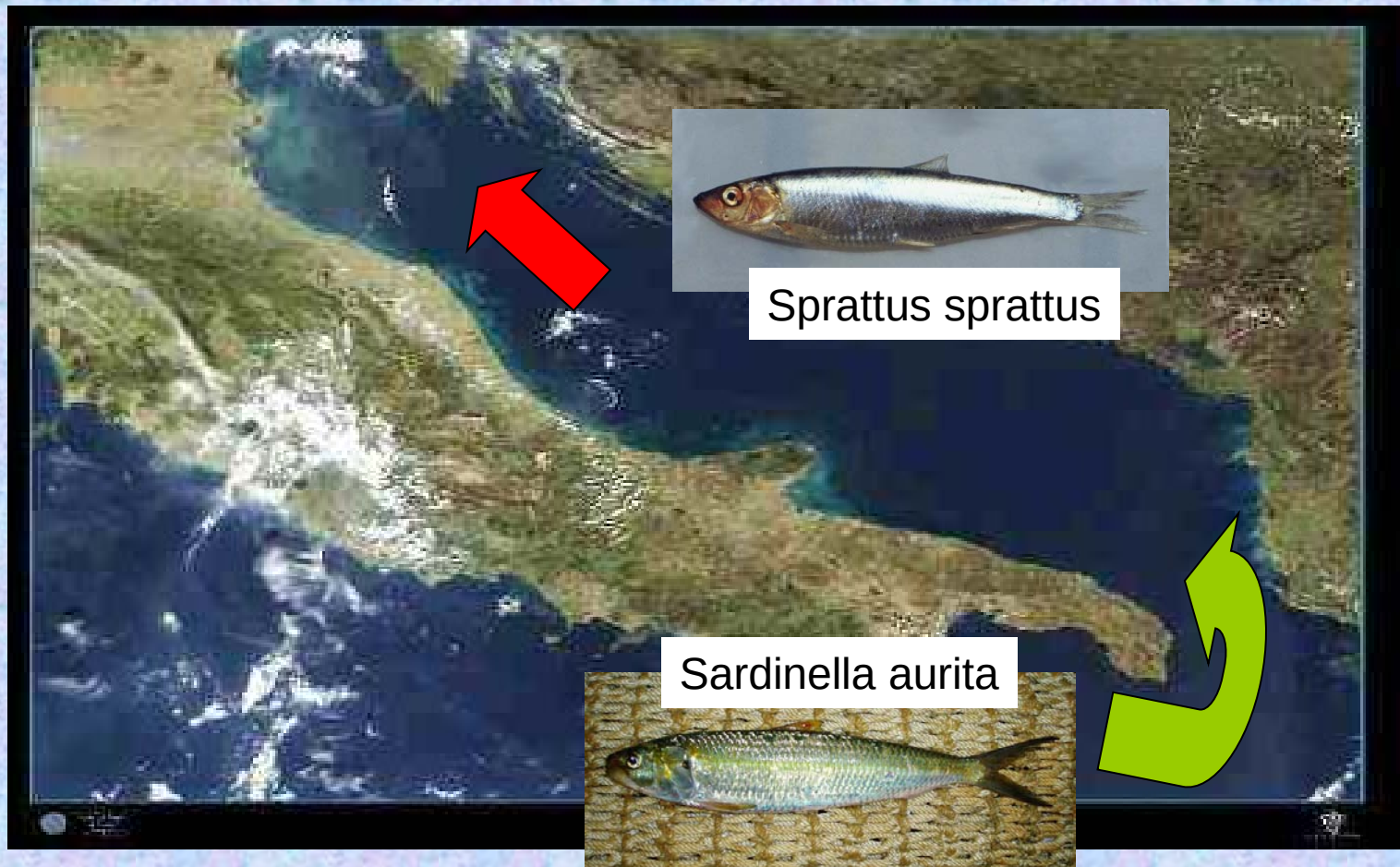
Sparisoma cretense



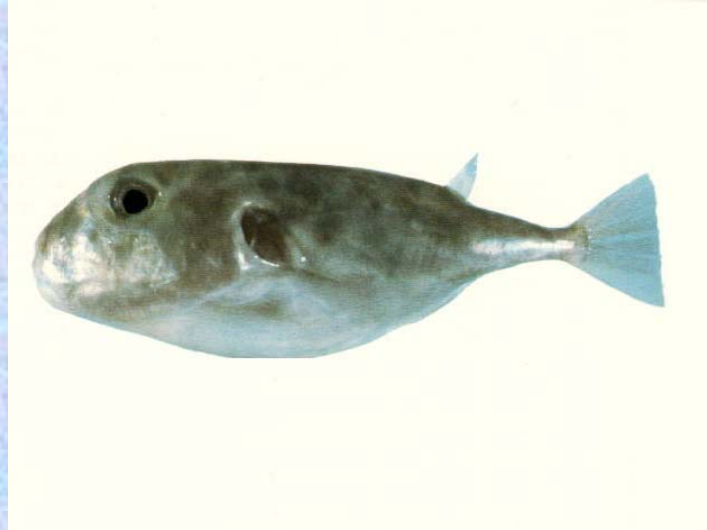
Balistes capriscus



*Northward retraction of
native cold-water affinity
species*



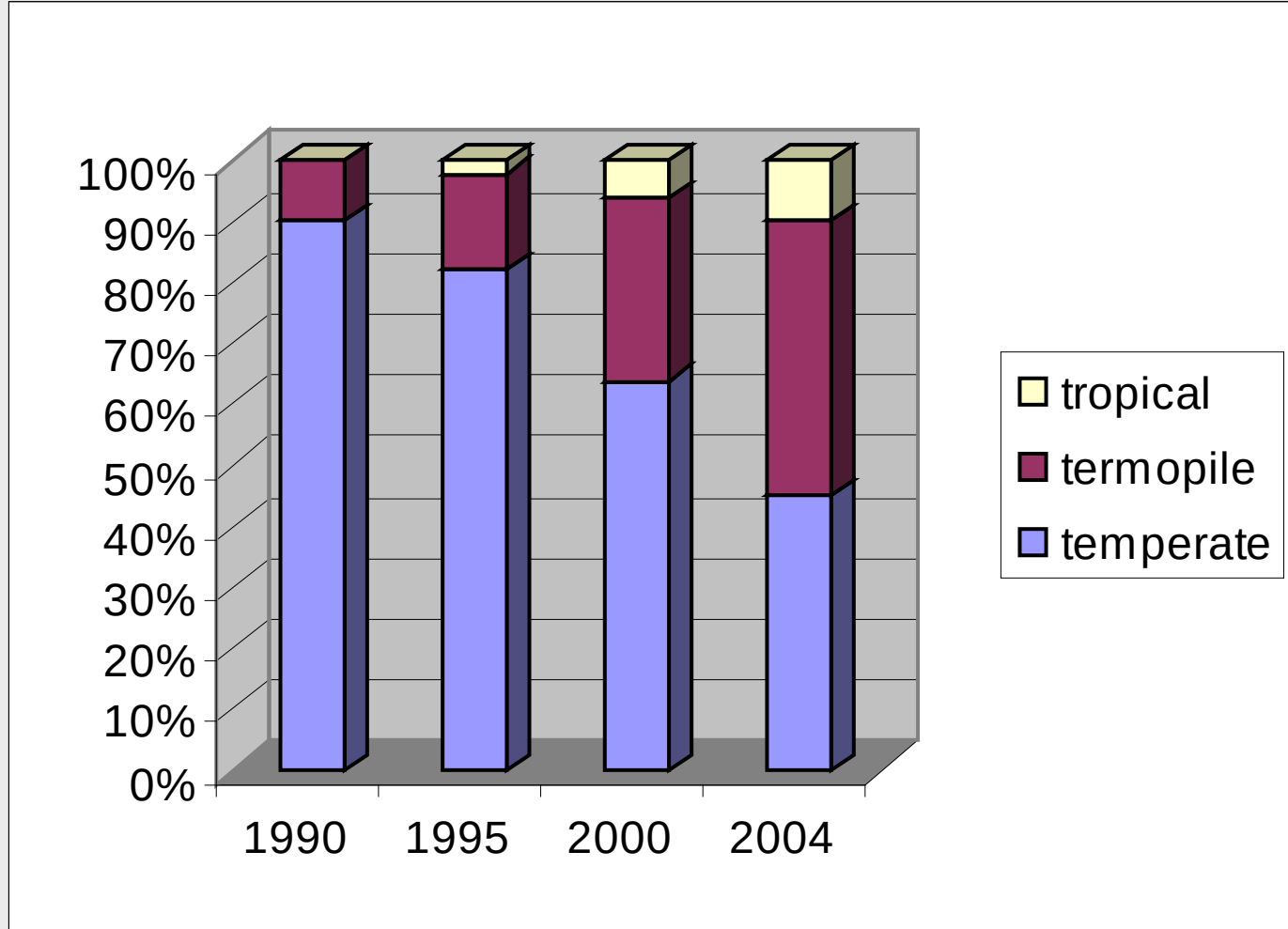
Tropicalization
increasing of
invasion by
alloctonous
thermophilic
species and
spreading of
distribution area



Sphoeroides pachygaster



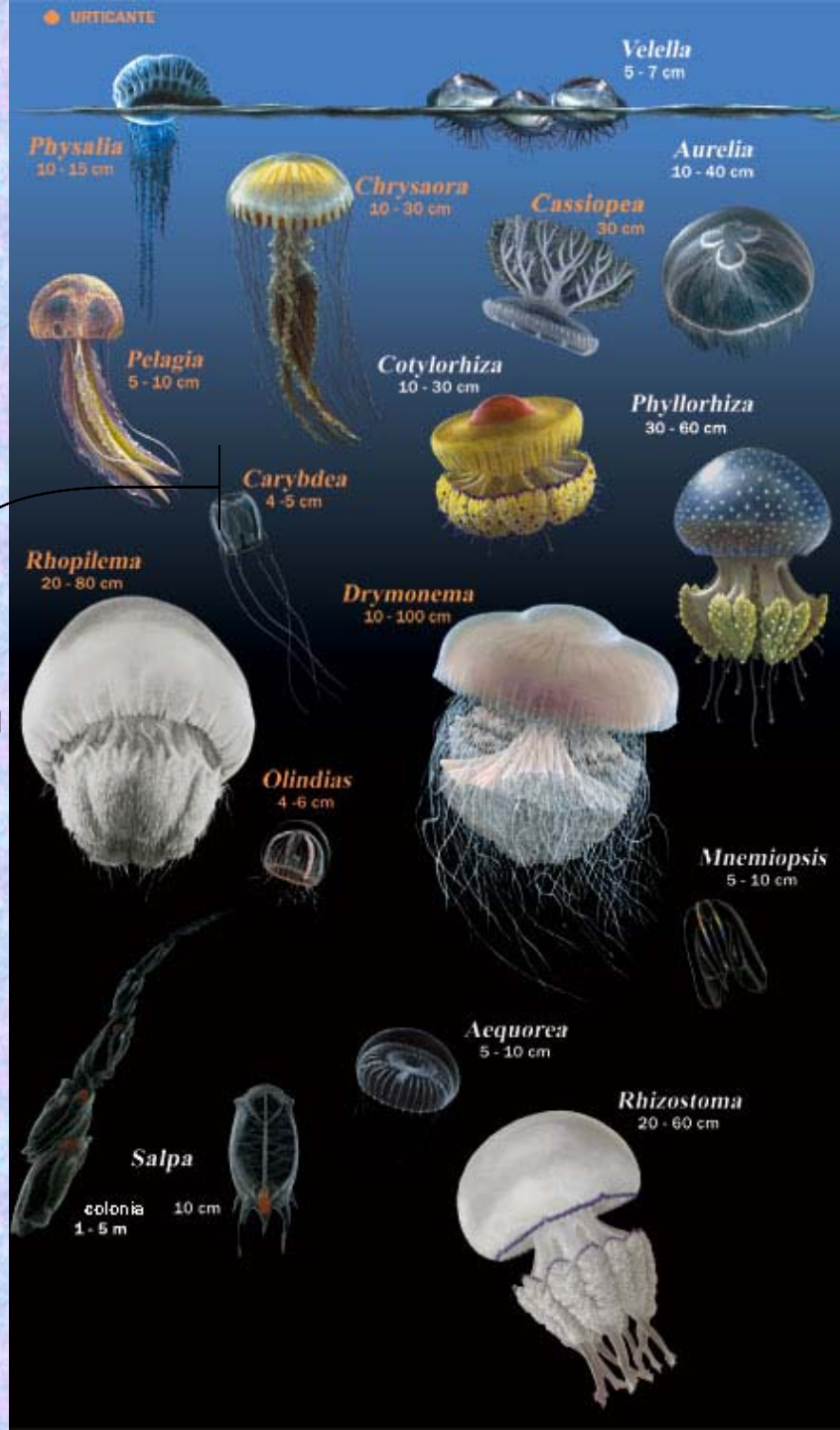
Sphyraena chrysotaenia



Pelagic species recorded in fisheries activity from South Tyrrhenian Sea (ISPRA, 2006)

Shift from fish to jellyfish

The removal of large fish (overfishing) is opening ecological space to jellyfish



jellyfish invasion

Tropical species:

Phyllorhiza punctata

Rhopilema nomadica

demographic explosions

Il Nord Adriatico



Lampuga (*Coryphaena hippurus*)

Tropical species



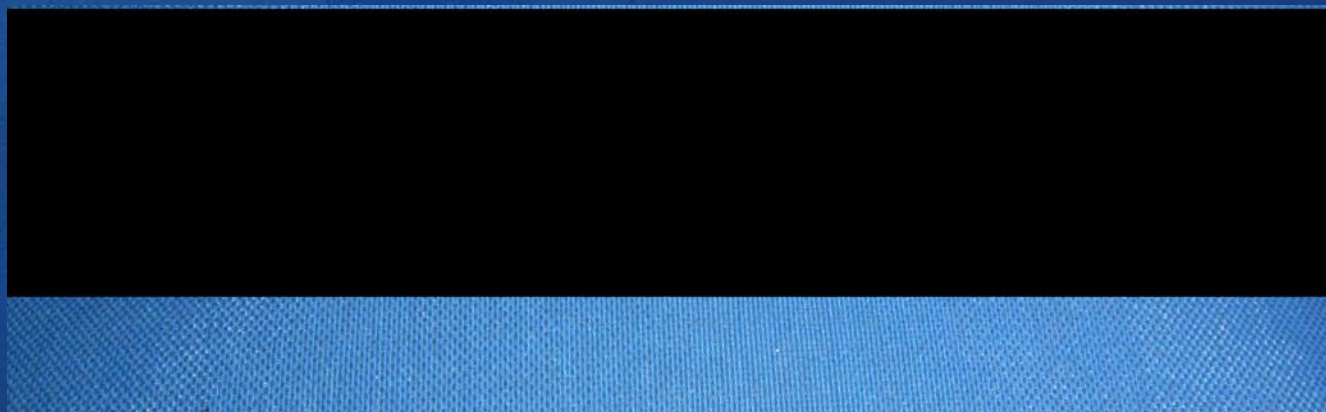
Riccato et al., 2009

Pesce serra (*Pomatomus saltatrix*)

Tropical species

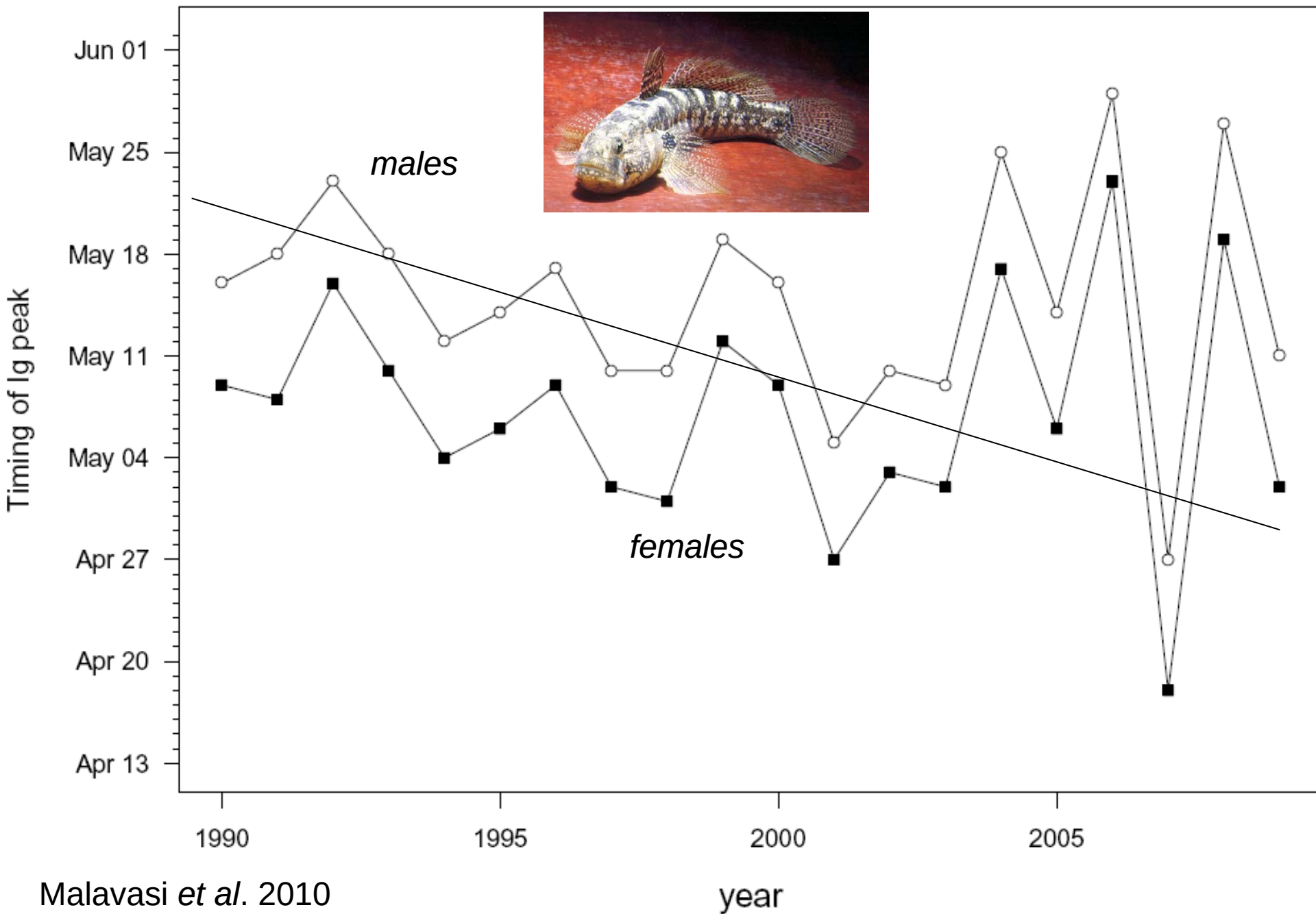


Barracuda (*Sphyraena viridensis*)

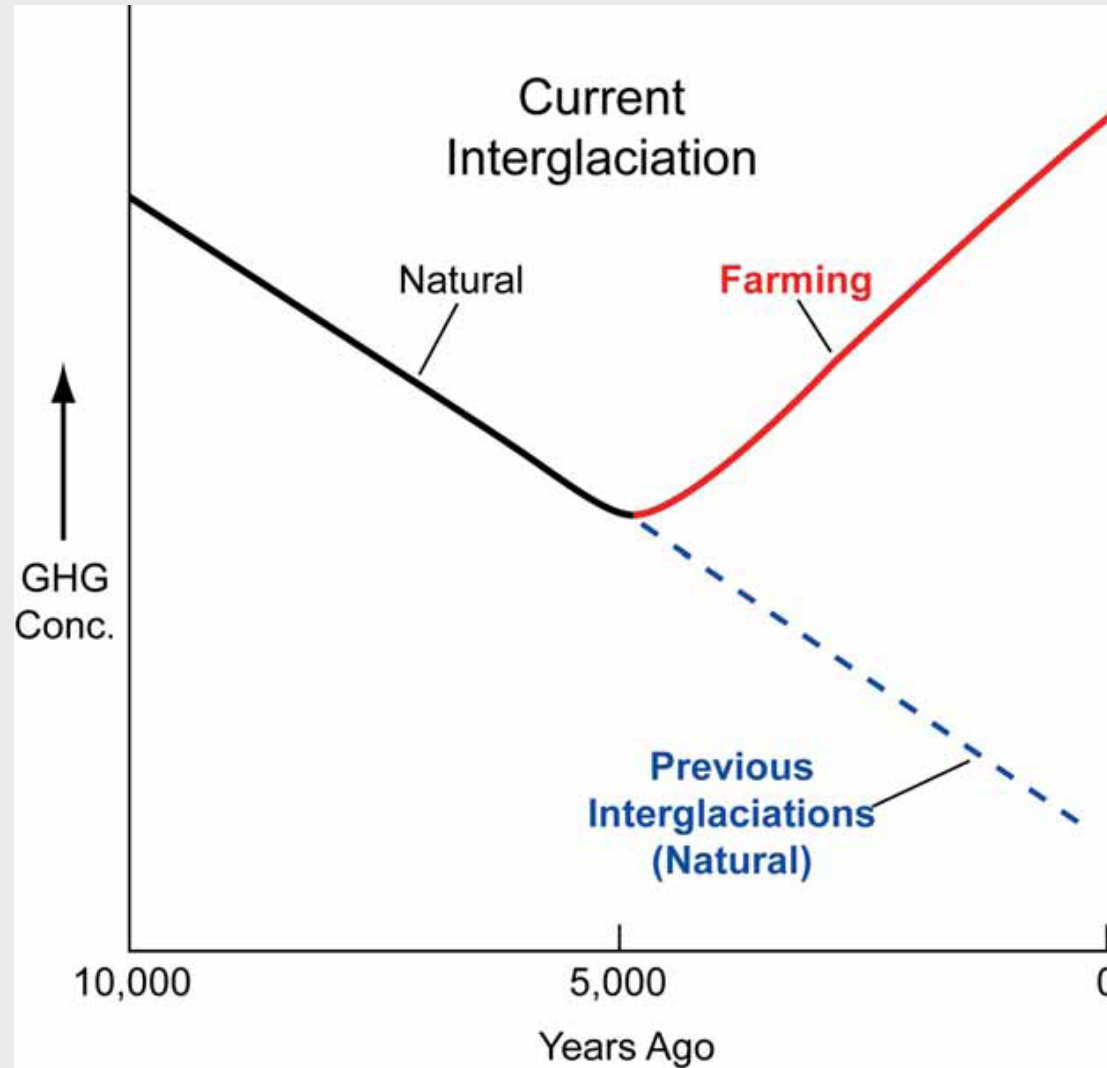


Fiorin et al., 2009

Peak of maturity in grass goby; (ig = gonadosomatic Index)

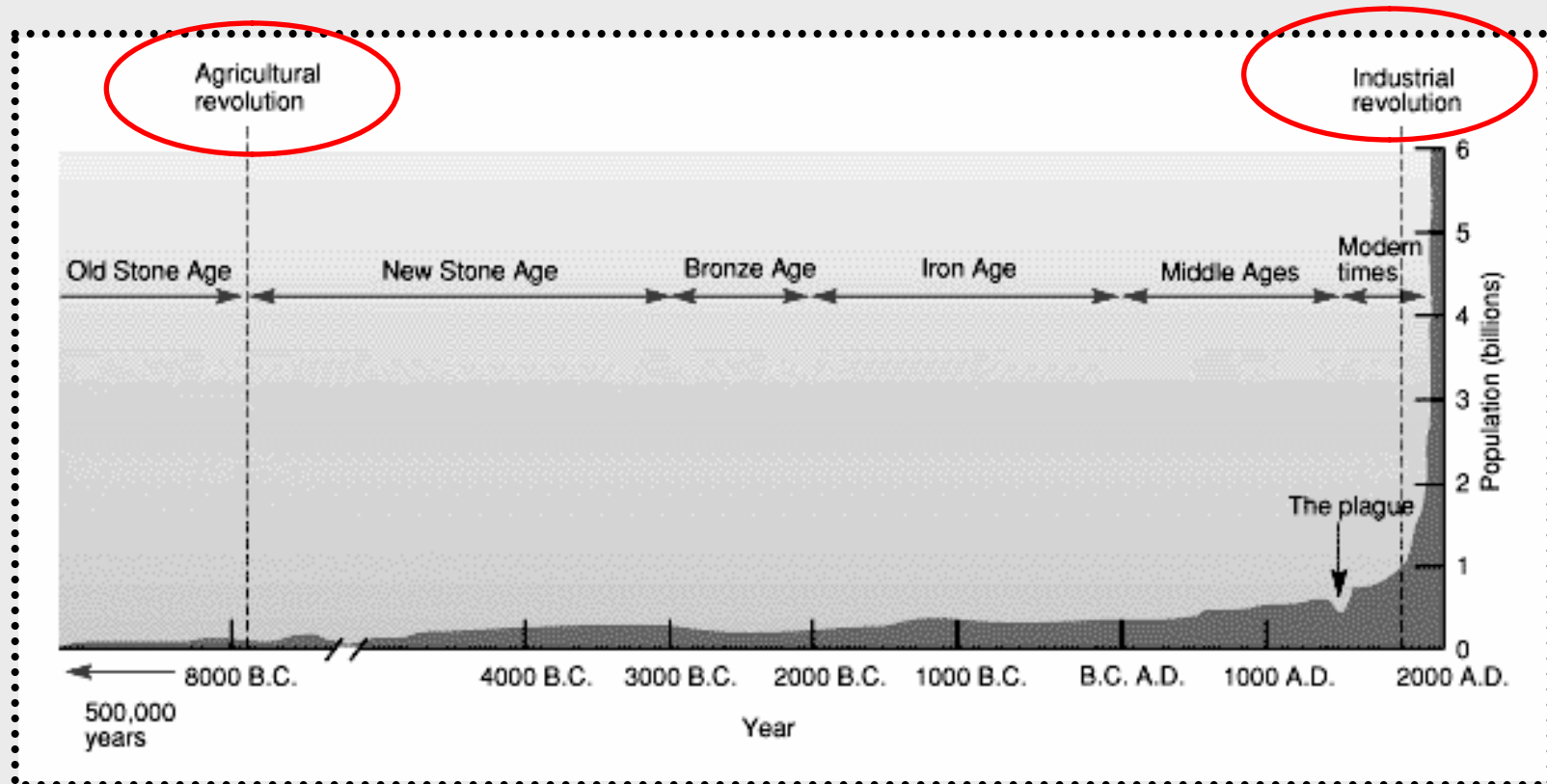


THE EARLY ANTHROPOCENE HYPOTHESIS (Ruddiman, 2003)



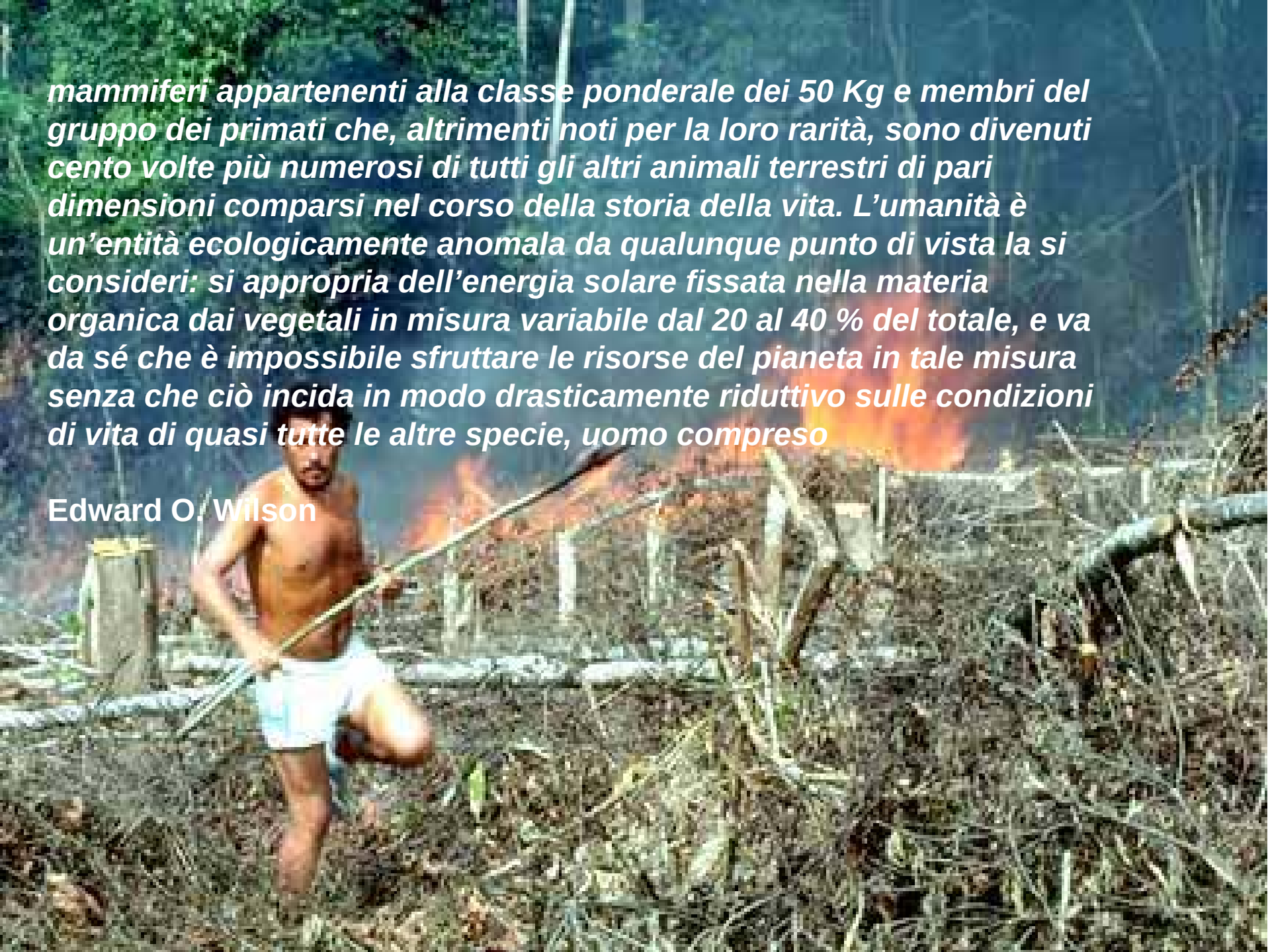
WELCOME TO THE ANTHROPOCENE !

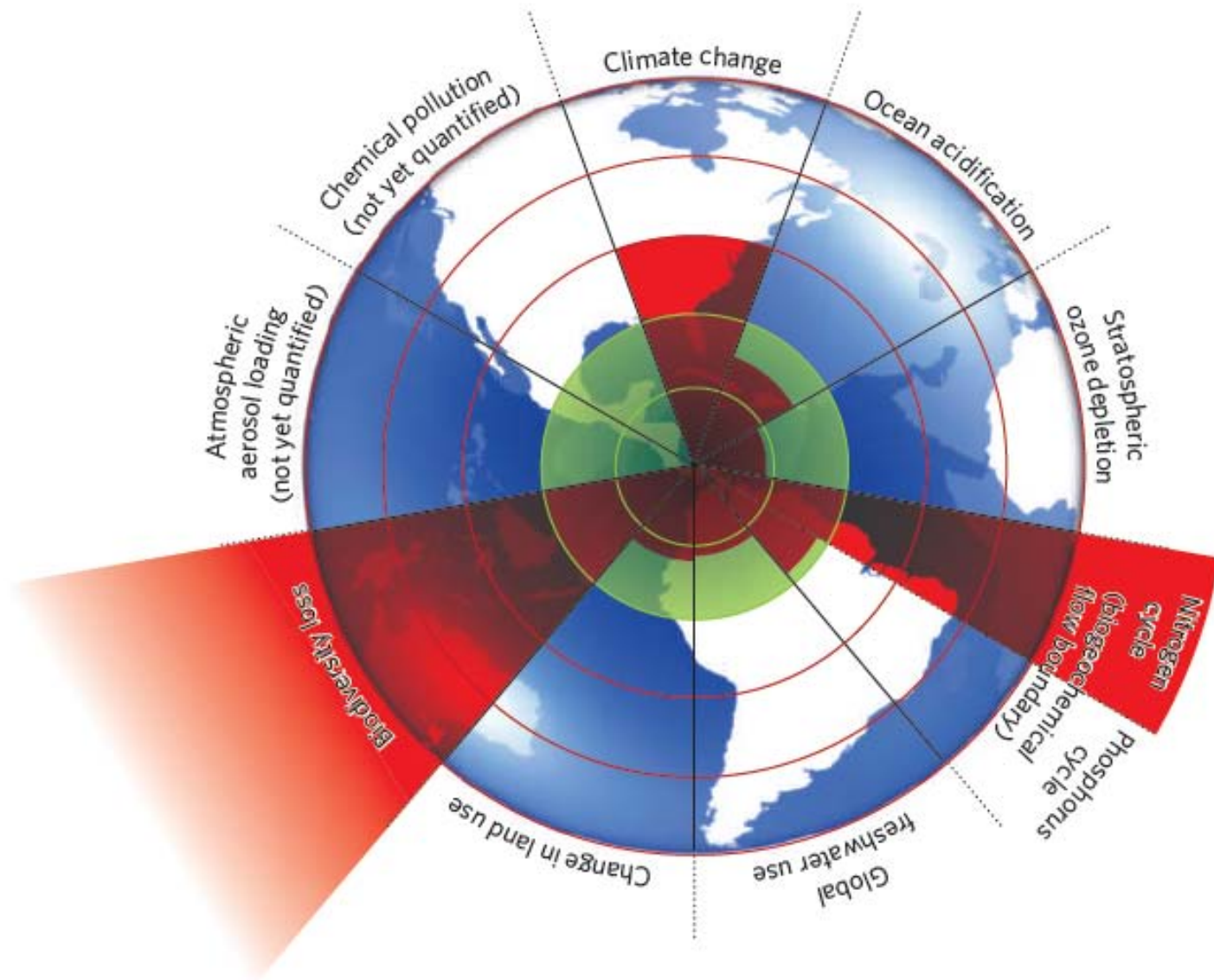
Human Population History



mammiferi appartenenti alla classe ponderale dei 50 Kg e membri del gruppo dei primati che, altrimenti noti per la loro rarità, sono divenuti cento volte più numerosi di tutti gli altri animali terrestri di pari dimensioni comparsi nel corso della storia della vita. L'umanità è un'entità ecologicamente anomala da qualunque punto di vista la si consideri: si appropria dell'energia solare fissata nella materia organica dai vegetali in misura variabile dal 20 al 40 % del totale, e va da sé che è impossibile sfruttare le risorse del pianeta in tale misura senza che ciò incida in modo drasticamente riduttivo sulle condizioni di vita di quasi tutte le altre specie, uomo compreso

Edward O. Wilson





PLANETARY BOUNDARIES

Earth-system process	Parameters	Proposed boundary	Current status	Pre-industrial value
Climate change	(i) Atmospheric carbon dioxide concentration (parts per million by volume)	350	387	280
	(ii) Change in radiative forcing (watts per metre squared)	1	1.5	0
Rate of biodiversity loss	Extinction rate (number of species per million species per year)	10	>100	0.1-1
Nitrogen cycle (part of a boundary with the phosphorus cycle)	Amount of N ₂ removed from the atmosphere for human use (millions of tonnes per year)	35	121	0
Phosphorus cycle (part of a boundary with the nitrogen cycle)	Quantity of P flowing into the oceans (millions of tonnes per year)	11	8.5-9.5	~1
Stratospheric ozone depletion	Concentration of ozone (Dobson unit)	276	283	290
Ocean acidification	Global mean saturation state of aragonite in surface sea water	2.75	2.90	3.44
Global freshwater use	Consumption of freshwater by humans (km ³ per year)	4,000	2,600	415
Change in land use	Percentage of global land cover converted to cropland	15	11.7	Low
Atmospheric aerosol loading	Overall particulate concentration in the atmosphere, on a regional basis	To be determined		
Chemical pollution	For example, amount emitted to, or concentration of persistent organic pollutants, plastics, endocrine disrupters, heavy metals and nuclear waste in, the global environment, or the effects on ecosystem and functioning of Earth system thereof	To be determined		

A polar bear is walking across a large, melting ice floe in the Arctic. The bear is white with a black nose and is moving towards the left. The ice is white and blue, with some water visible around the edges. The background shows more ice floes and a clear blue sky.

“ A scale geologiche, il nostro pianeta è in grado di prendersi buona cura di se stesso e può lasciare che il tempo cancelli l'impatto di qualsiasi abuso umano.”

S.J.GOULD

