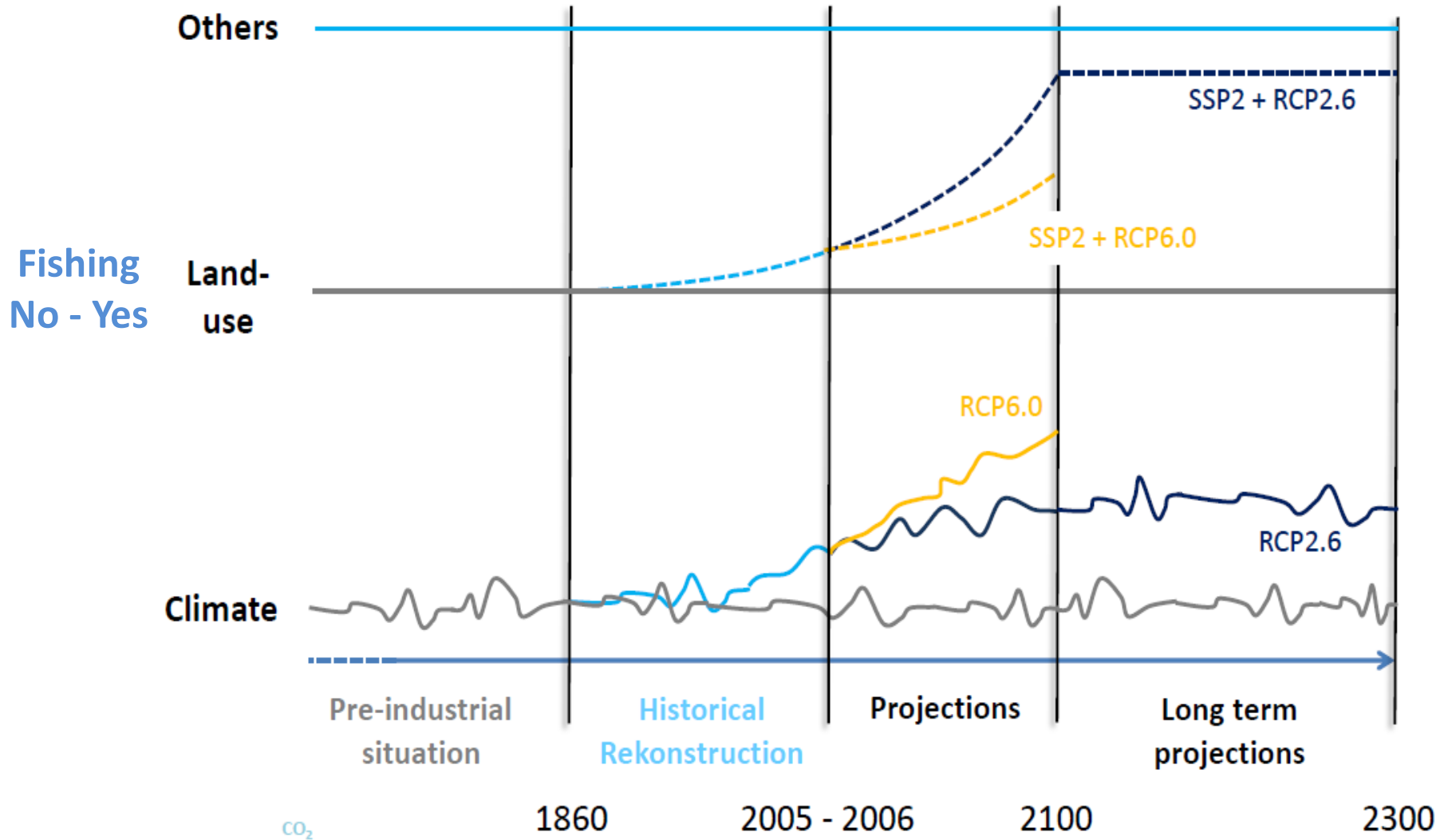


Pre-industrial control and 1.5 °C warming

FISH-MIP sector

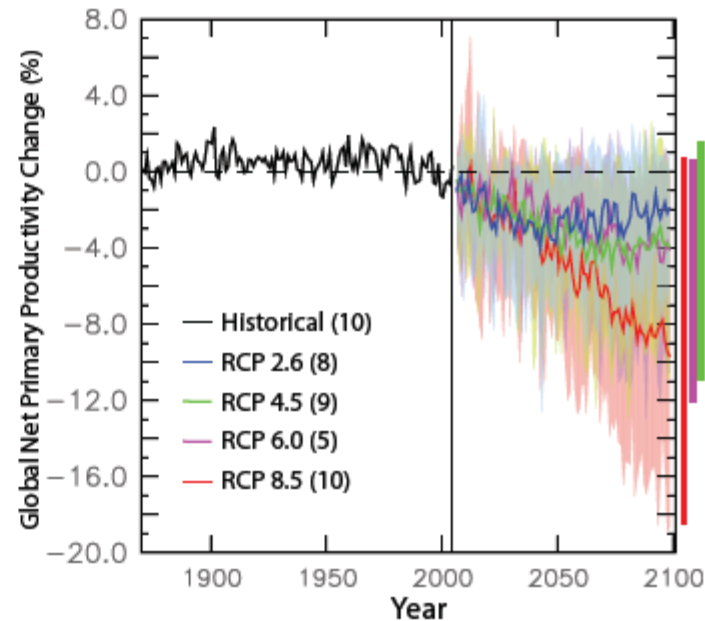
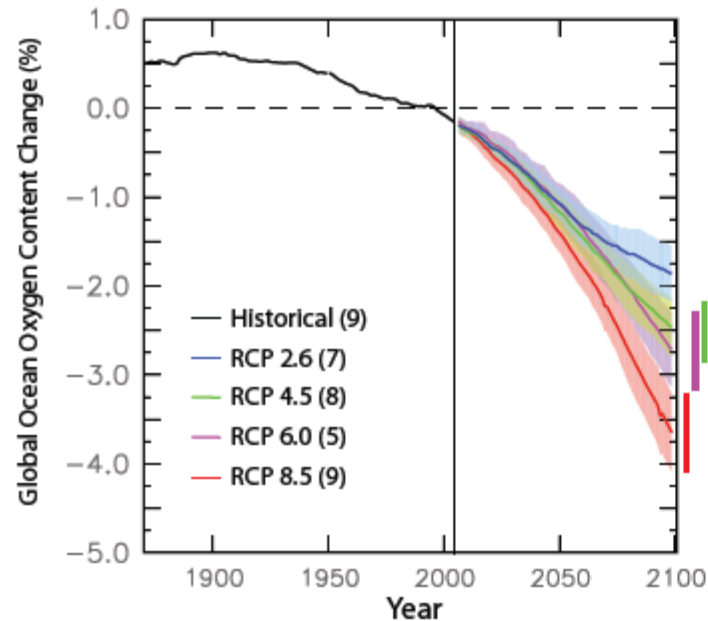
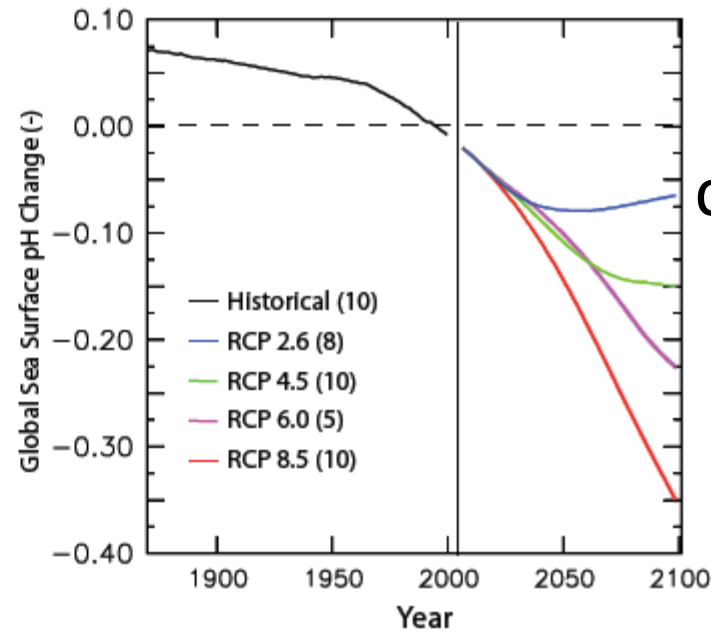
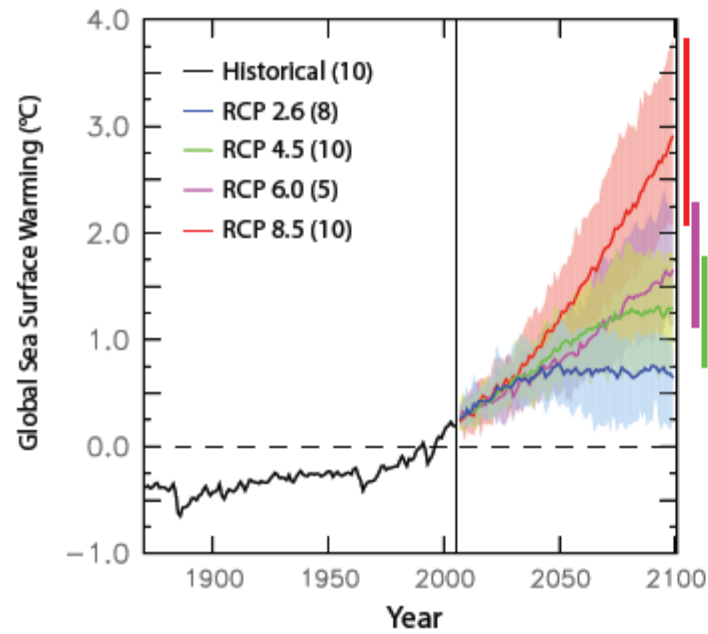
Heike Lotze

idea



Long-term climate change

CMIP5 ensemble



Bopp et al. 2013,
Biogeosciences

Long-term fishing change

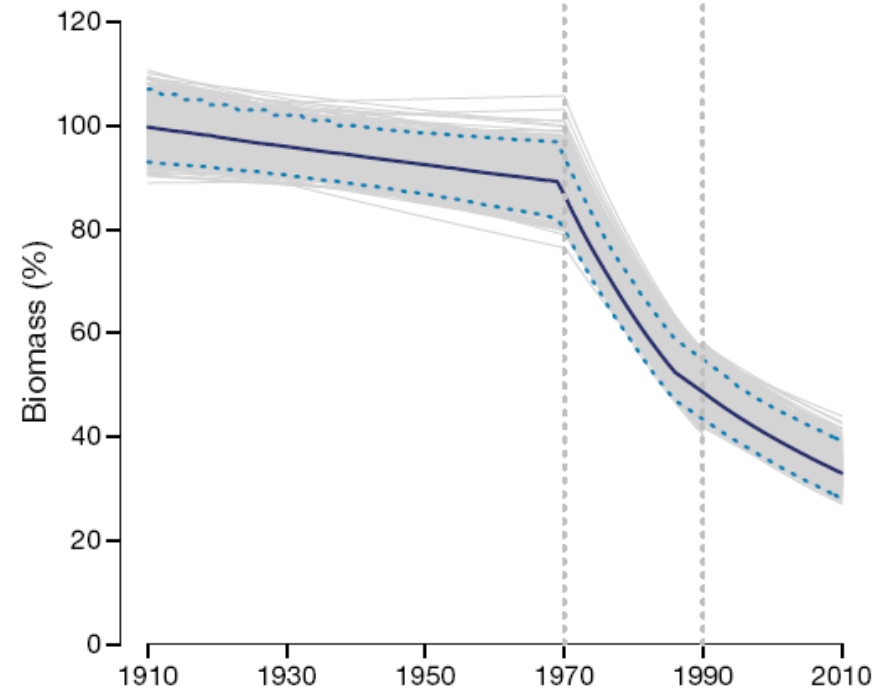
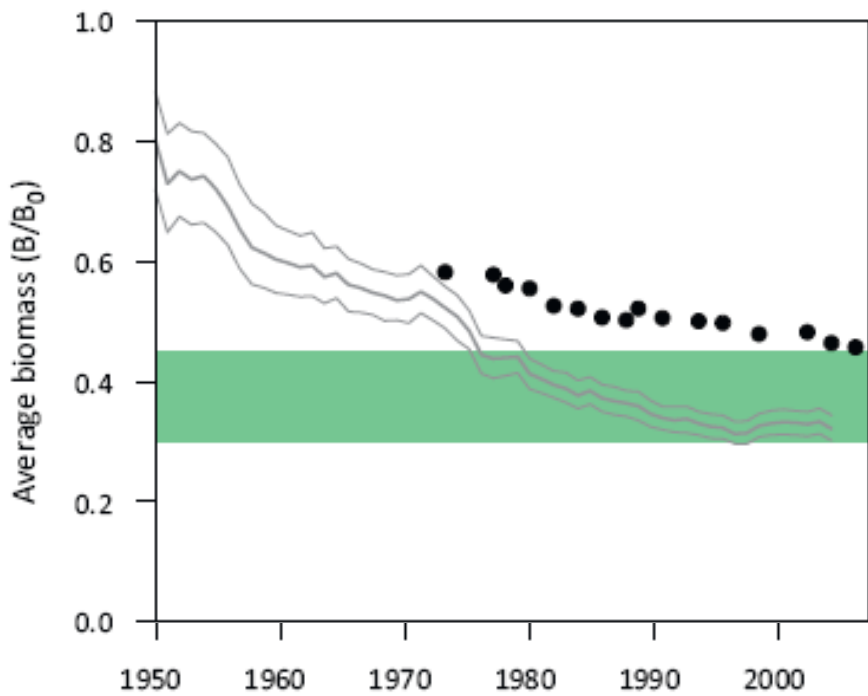
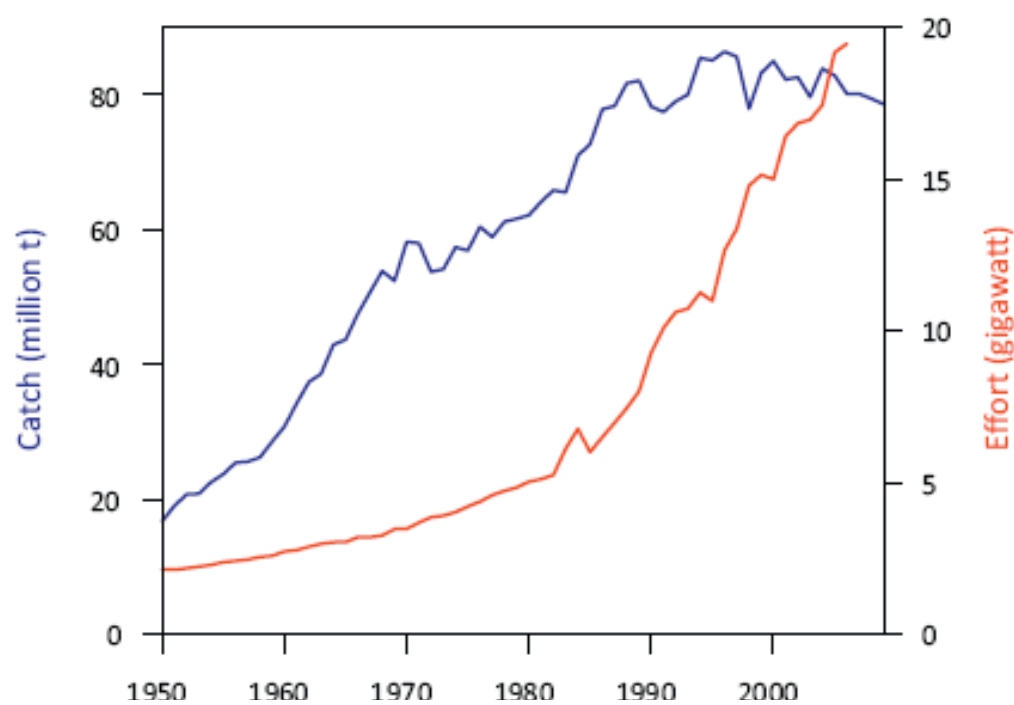


Fig. 6. Global biomass trends for predatory fish during 1910 to 2010 as predicted based on 200 ecosystem models and 1000 times random resampling of 30% of data points. The lines indicate median values and 95% confidence intervals

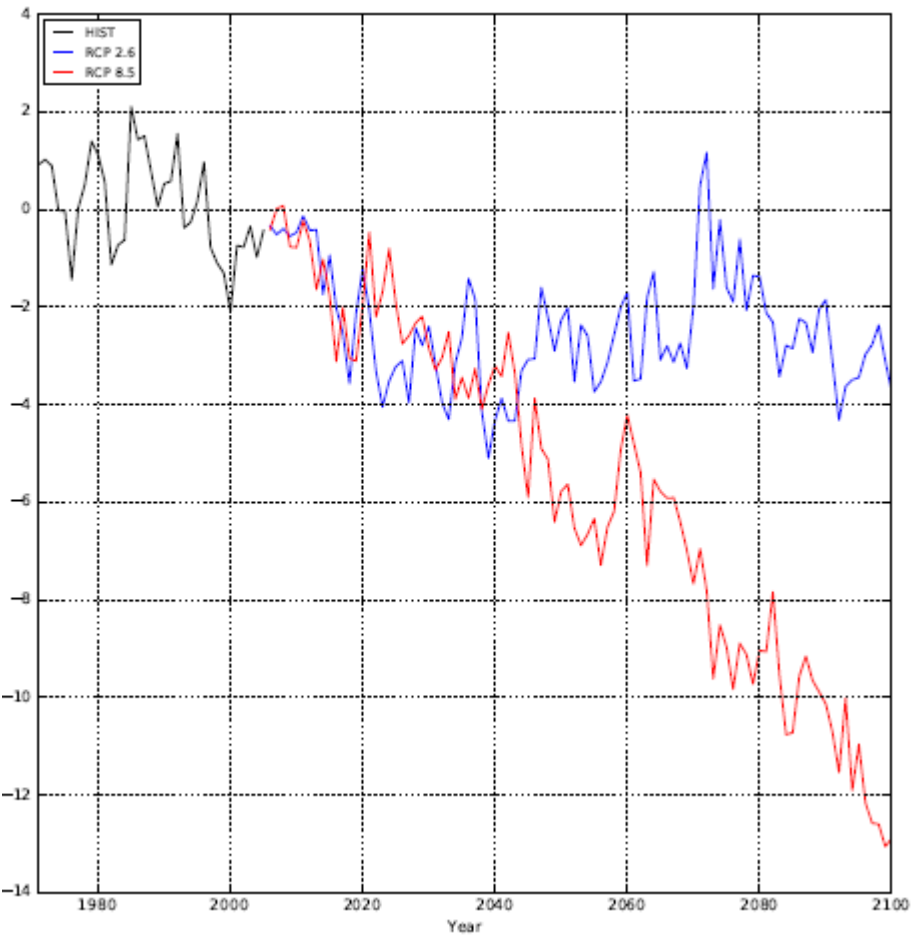
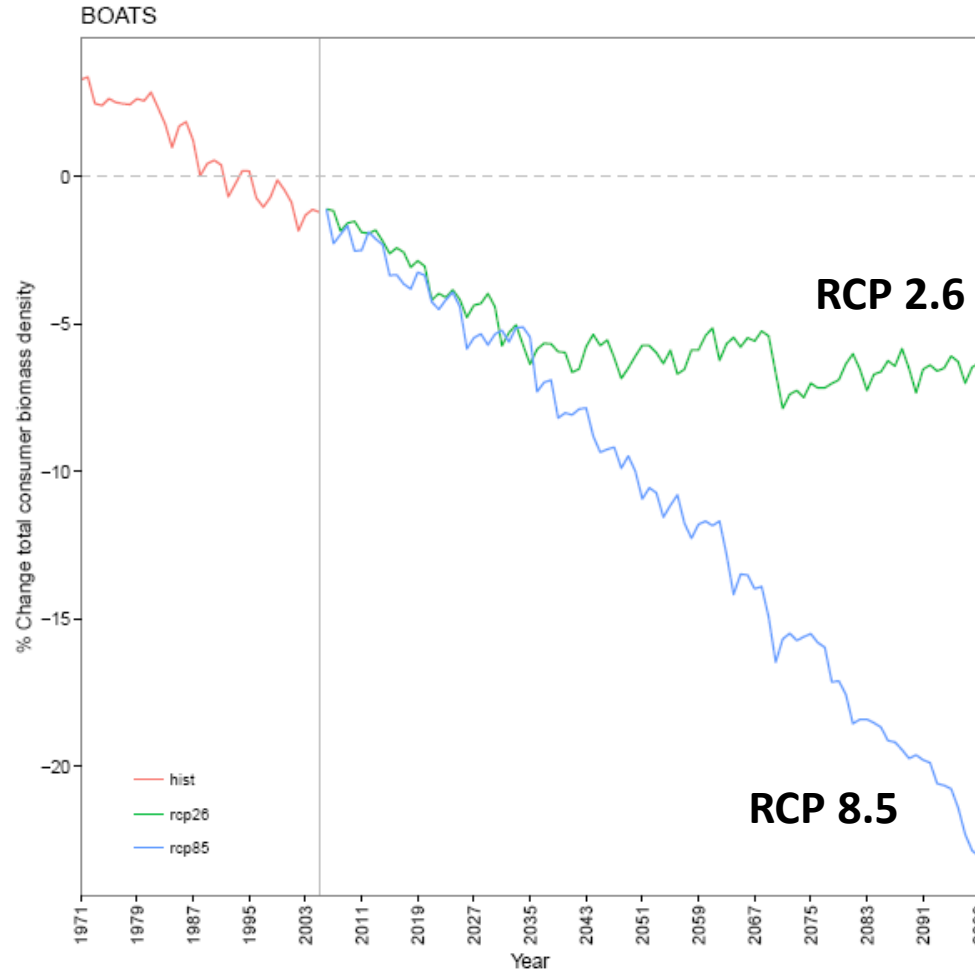
Worm & Branch
2012, *TREE*

Christensen et al.
2014, *MEPS*

Consumer abundance – no fishing

BOATS

APECOSM



Prospects for pre-industrial control runs

- Climate:
 - SST and NPP don't change much before 1950s
 - Extending to 1860 or earlier may not produce different results
 - Availability for monthly 3D resolved data:
 - IPSL CM5A LR
 - GFDL ESM2M?
- Historical Fishing:
 - Global data before 1950 not available
 - Much lower levels than after 1950s
 - Possible hindcast to 1860

Prospects for long-term change to 2300

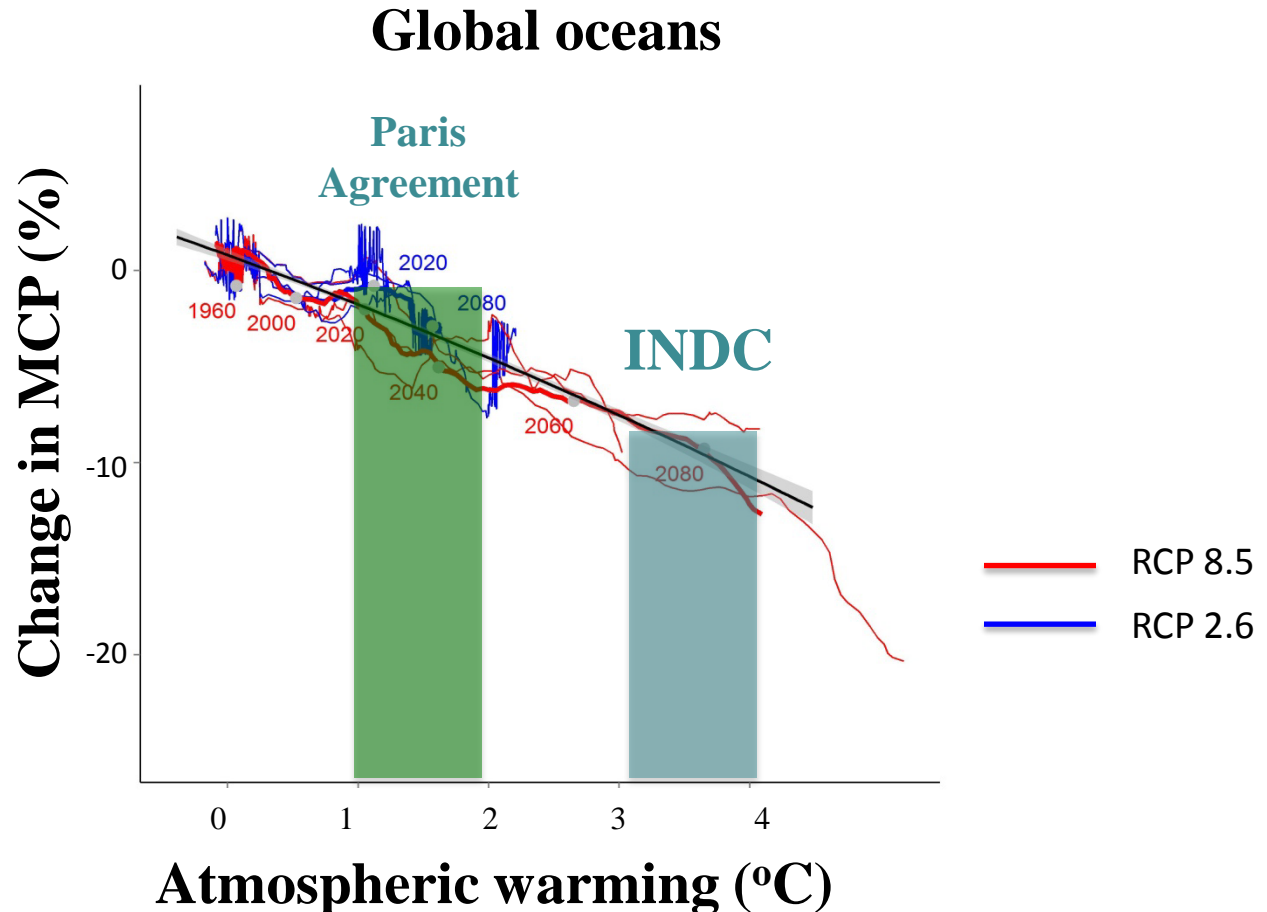
- Climate

- RCP 2.6: stabilization of trends in 21st ct
 - May not change much beyond 2100
- RCP 6.0 & 8.5: further decline
- Data availability for 3D monthly resolved:
 - IPSL CM5A LR
 - GFDL ESM2M?

- Fishing to 2100

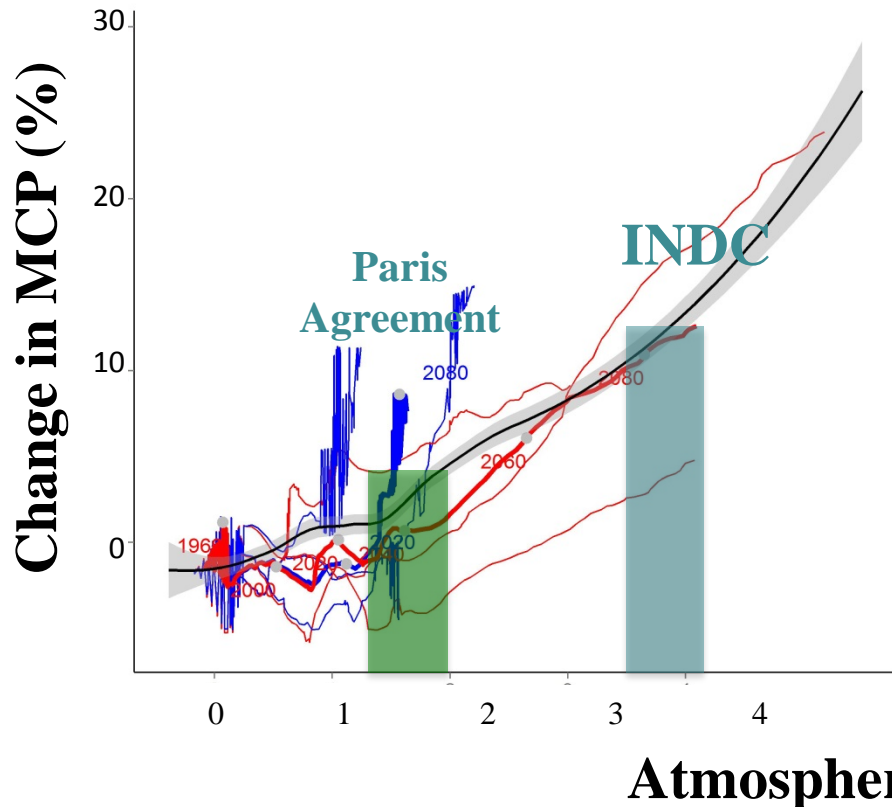
- Fishing (constant at 2005) vs. no fishing
- Fishing forecast: maybe increasing at 2-5% yr⁻¹?

Differences in Maximum Catch Potential (MCP) between global warming targets projected by DBEM

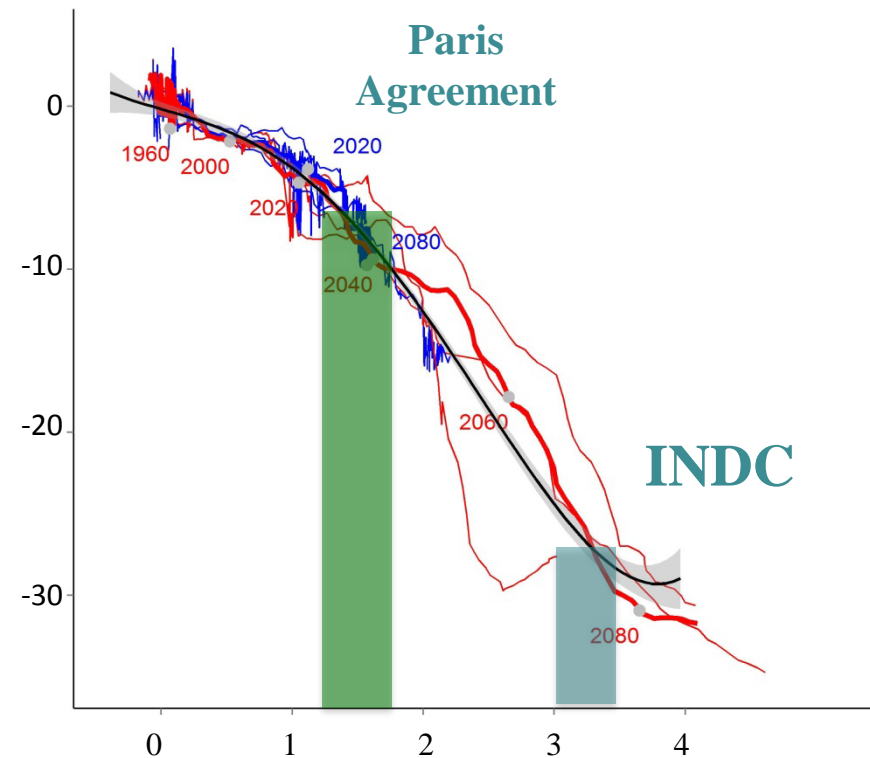


Differences in Maximum Catch Potential (MCP) between global warming targets projected by DBEM

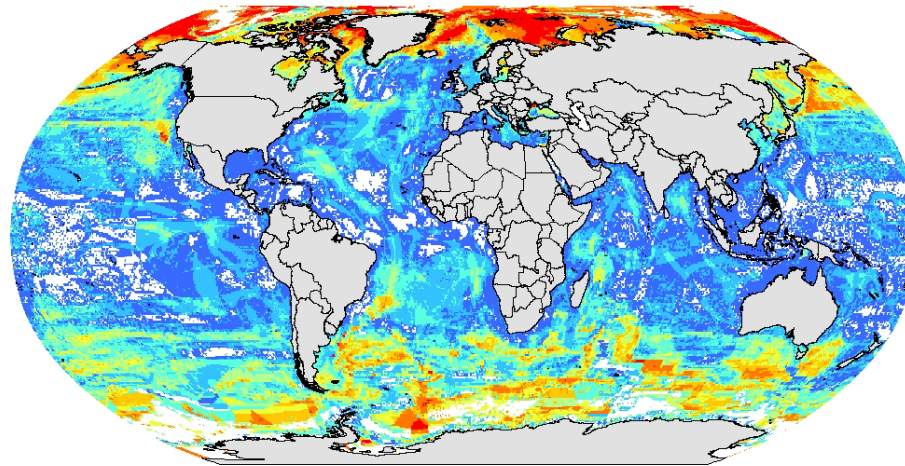
Pacific Arctic



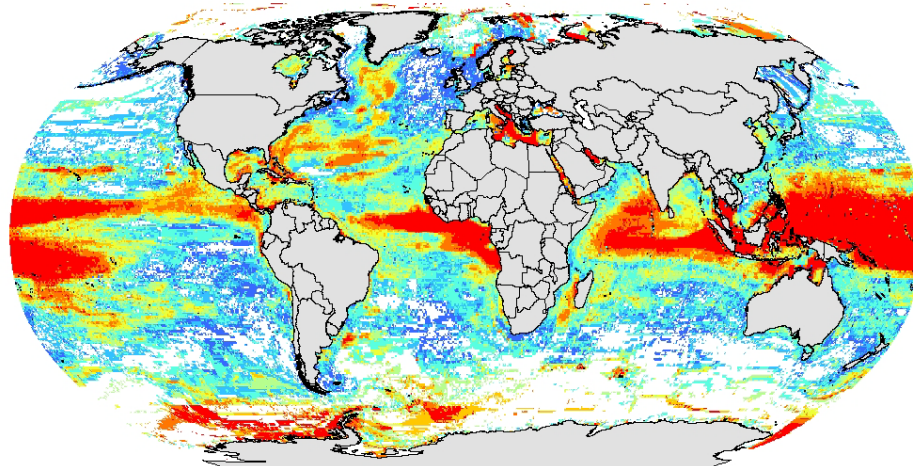
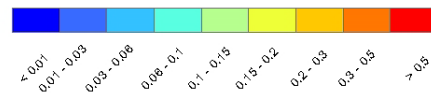
Indo-Pacific



Species invasion and local extinction



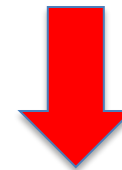
Rate of species invasion



Rate of local extinction



- Range shifts lead to species invasion and local extinction;
- 1000 species;
- 2050s relative to 2000s, RCP 8.5



Cheung *et al.* (2009);
Jones and Cheung (2015)

Proposed simulations

6.9. Fisheries and Marine Ecosystems

	GCMs	Climate	Fishing	Other settings (sens-scenario)	# runs
no climate change	GCM 1-2	pre-industrial control (pic)	Unfished (zero effort/mortality)		2
pure climate change	GCM 1-2	hist+RCP2.6 (hist, rcp2p6) hist+RCP6.0 (hist, rcp6p0)	Unfished (zero effort/mortality) Fished (time varying until 2005, then constant)		8
pure climate change	GCM 1-2	extended RCP2.6 (rcp2p6)	Unfished (zero effort/mortality) Fished (constant 2005)		4
Total number of runs					10