

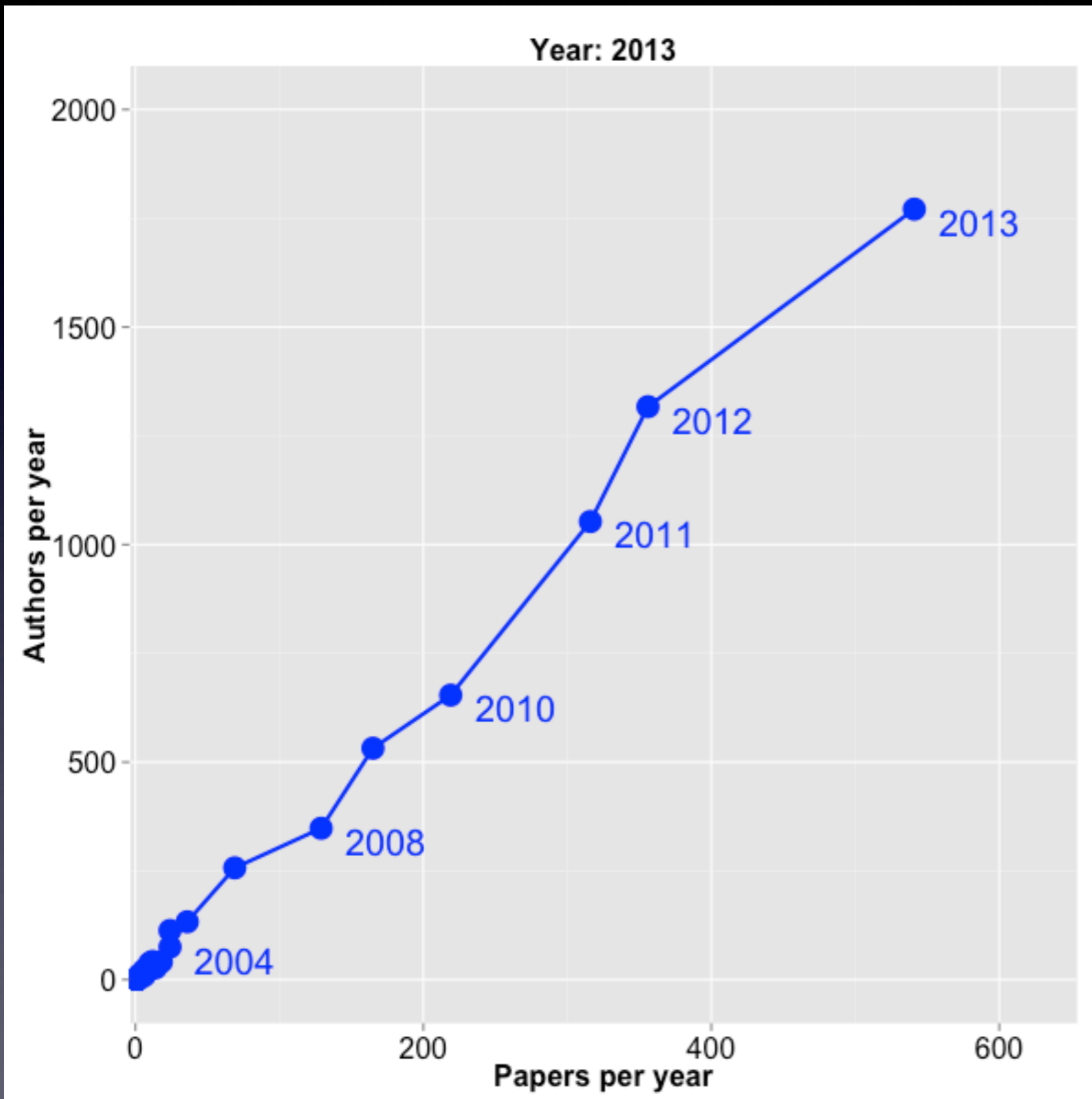
Lessons learned from ocean acidification research

Jean-Pierre Gattuso

Laboratoire d'Océanographie de Villefranche
CNRS-Université Pierre et Marie Curie-Paris 6



Bibliometric information



Papers:

- 561 in 2013
- 50% in past 3 years
- +39% y^{-1} since 2000 vs +5% y^{-1} in WoS

Authors:

- 1804 in 2013

IPCC AR5 WG II (Impacts, Adaptation and Vulnerability)

308

AUTHORS

70

COUNTRIES

50492

REVIEW COMMENTS

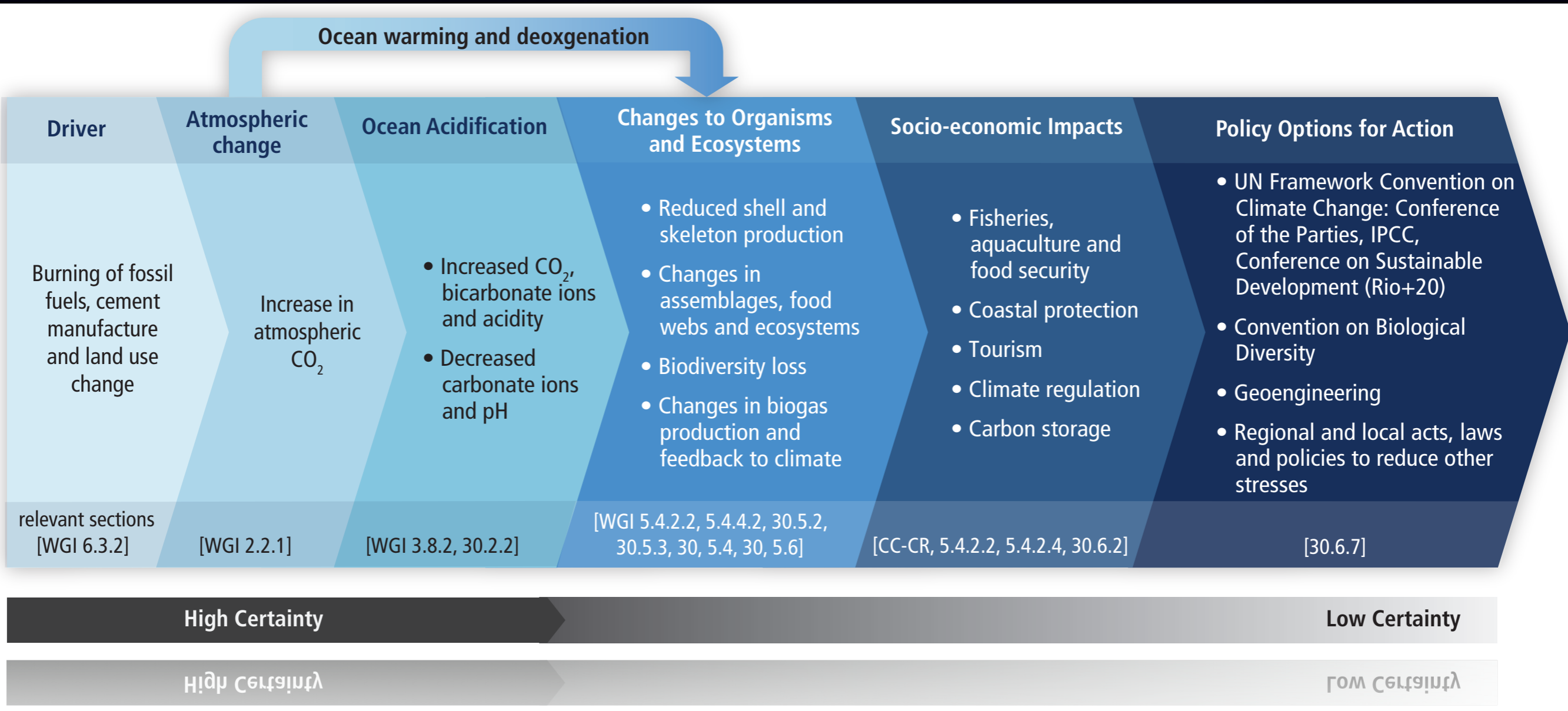


- AR4: Coastal ocean only
- AR5: Coastal ocean plus two ocean chapters!
- Ocean acidification key new element (C05, C06, C30, CC-OA TS, SPM)

OA

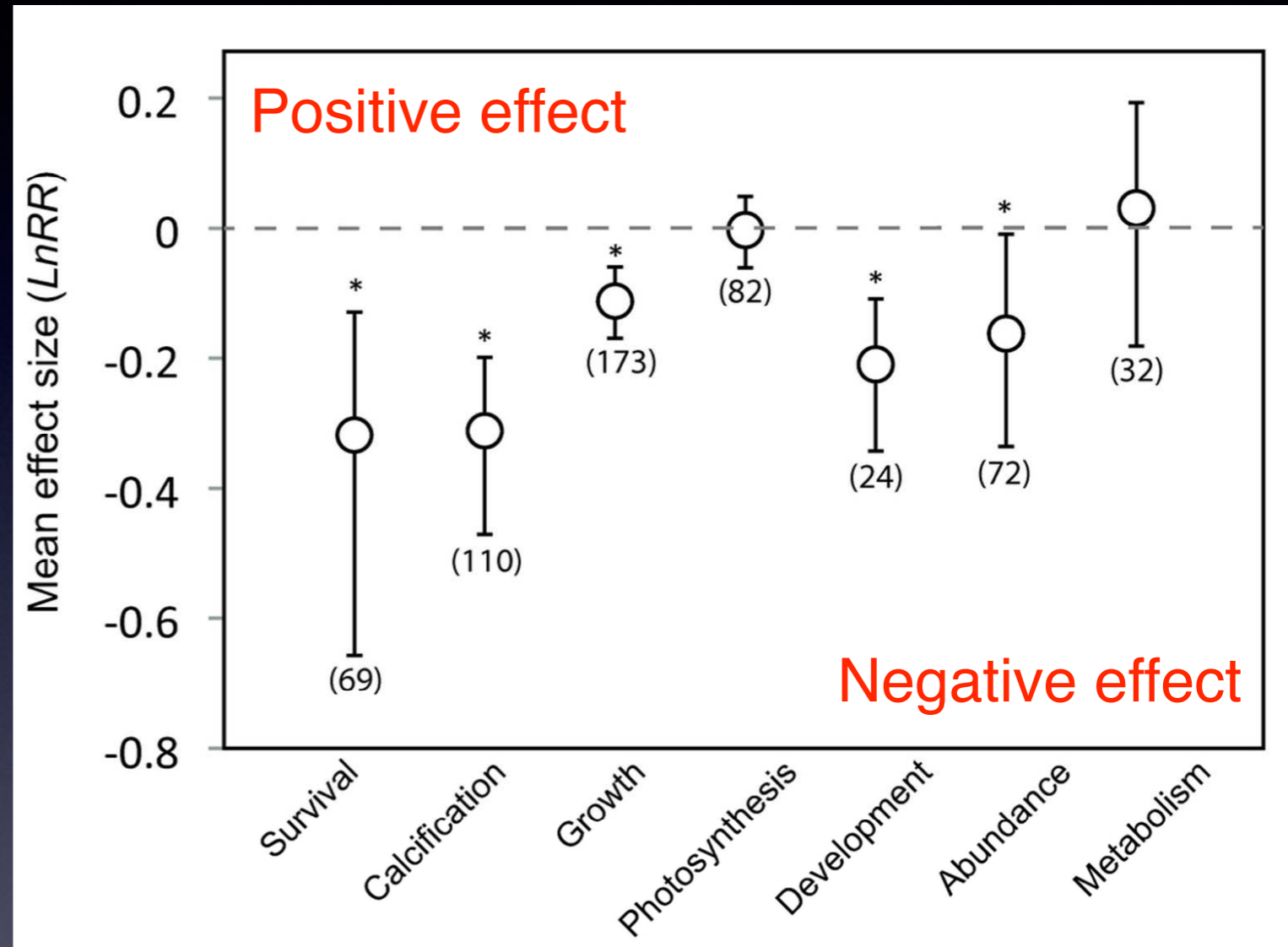
Ocean Acidification

Jean-Pierre Gattuso (France), Peter Brewer (USA), Ove Hoegh-Guldberg (Australia), Joan A. Kleypas (USA), Hans-Otto Pörtner (Germany), Daniela Schmidt (UK)

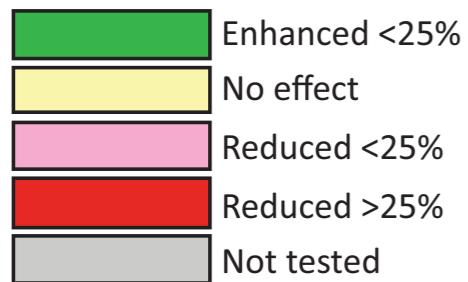


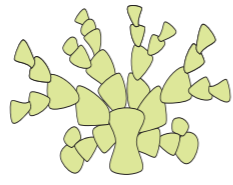
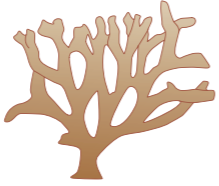

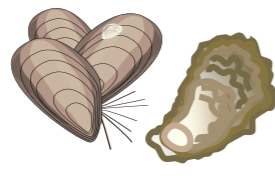
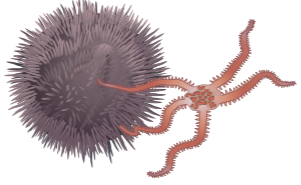
Meta-analysis: Kroeker et al. (2013)

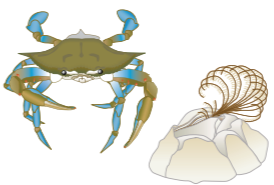
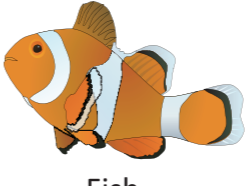


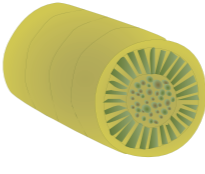
- Significant negative effect on:
 - survival
 - calcification
 - growth
 - development
 - abundance



Meta-analysis: Kroeeker et al. (2013)



Taxa	Response	Mean Effect
 Calcifying algae	Survival	Not tested
	Calcification	Not tested
	Growth	Not tested
	Photosynthesis	-28%
	Abundance	-80%
 Corals	Survival	Not tested
	Calcification	-32%
	Growth	-23%
	Photosynthesis	Not tested
	Abundance	-47%
 Coccolithophores	Survival	Not tested
	Calcification	-9%
	Growth	Not tested
	Photosynthesis	Not tested
	Abundance	Not tested
 Molluscs	Survival	-34%
	Calcification	-40%
	Growth	-17%
	<i>Development</i>	-25%
	Abundance	Not tested
 Echinoderms	Survival	Not tested
	Calcification	Not tested
	Growth	-10%
	<i>Development</i>	-11%
	Abundance	Not tested

 Crustaceans	Survival	Not tested
	Calcification	Not tested
	Growth	Not tested
	<i>Development</i>	Not tested
	Abundance	Not tested
 Fish	Survival	Not tested
	Calcification	Not tested
	Growth	Not tested
	<i>Development</i>	Not tested
	Abundance	Not tested
 Fleshy algae	Survival	Not tested
	Calcification	Not tested
	Growth	+22%
	Photosynthesis	Not tested
	Abundance	Not tested
 Seagrasses	Survival	Not tested
	Calcification	Not tested
	Growth	Not tested
	Photosynthesis	Not tested
	Abundance	Not tested
 Diatoms	Survival	Not tested
	Calcification	Not tested
	Growth	+12%
	Photosynthesis	Not tested
	Abundance	Not tested

Take home messages

- **Chemical effects:** very high confidence
- **Biological and ecological effects:** high to low confidence
- **Biogeochemistry, society and the economy:** medium to low confidence

What is the way
forward?

Time to reflect: successes

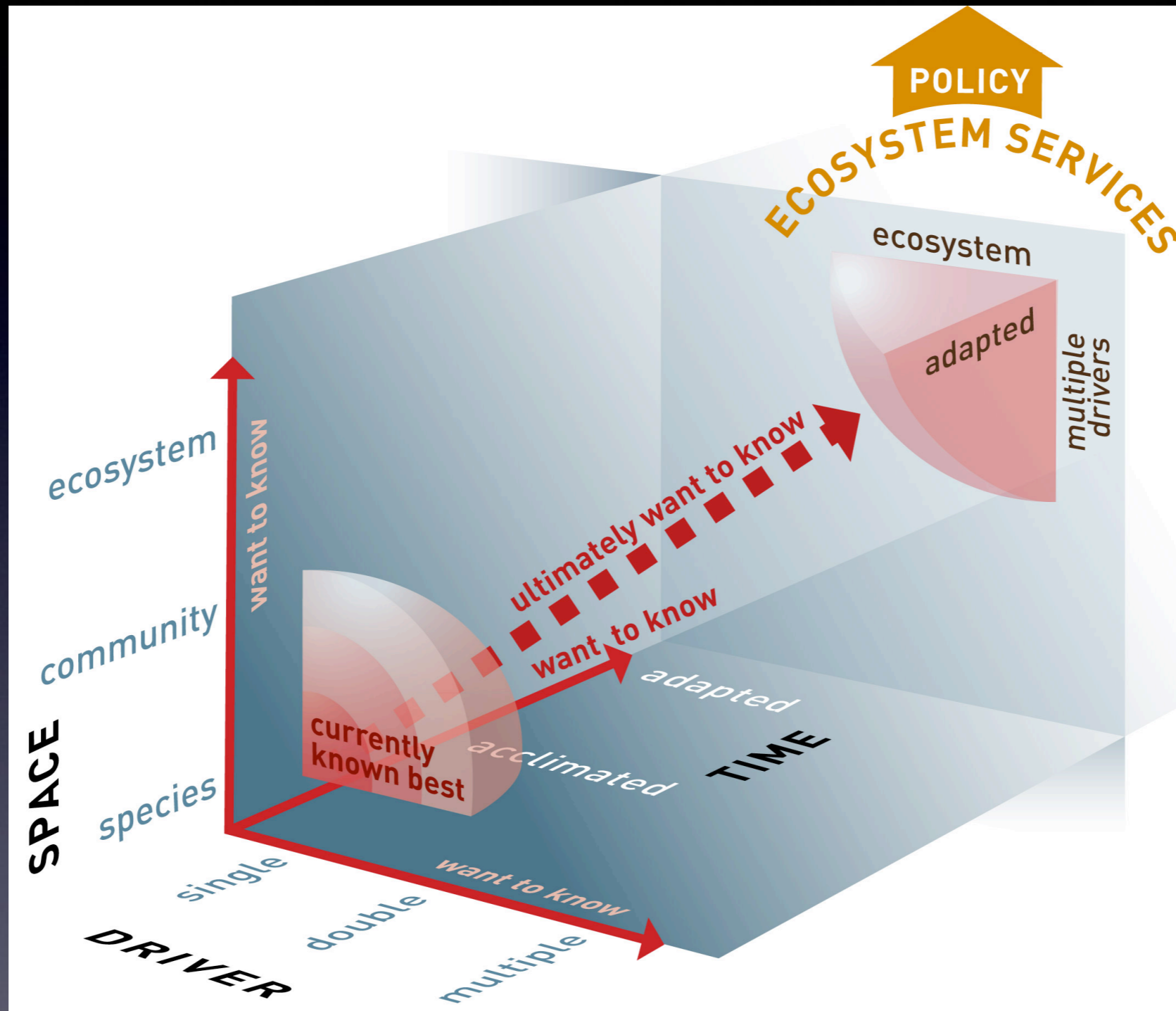
Time to reflect: successes

- Close collaboration within and between national and international projects
- Early community-driven agreement on best practices in ocean acidification research and data reporting
- Concerted communication spear-headed by a Reference User Group
- International coordination (EPOCA then OA-ICC)
- Large number of high profile reports, targeting the science community, the general public as well as stakeholders and decision makers
- Growing recognition at intergovernmental level (US State Department's "Our Ocean Conference")

Time to reflect: limitations

- Mostly on **individual species**: competitive and trophic interactions poorly studied
- **Lab studies**, few responses of communities (even less *in situ*)
- **Single driver** (80% of perturbation experiments) although interactive (additive, synergistic or antagonistic) effects not predictable from single driver
- **Short-term**: selection of standing genetic variation or via novel mutations poorly constrained

Way forward



Riebesell & Gattuso (2015)

Thank you!

