

**CLIMATE CHANGE**  
**Ocean Impacts and Projections**  
 ...a sectoral analysis by IPCC AR5 WGII  
 just launched, available via: [ipcc.ch](http://ipcc.ch)

H.O. Pörtner, D.M. Karl, P.W. Boyd, W.W.L. Cheung, S.E. Lluch-Cota, Y. Nojiri, D.N. Schmidt, and P.O. Zavalov

WGII CH. 6, Ocean Systems,  
 ocean products in TS and SPM, CC-Boxes, SYR

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## Large-scale climate-related issues in the global ocean

Oceans play a major role in climate regulation **globally**:

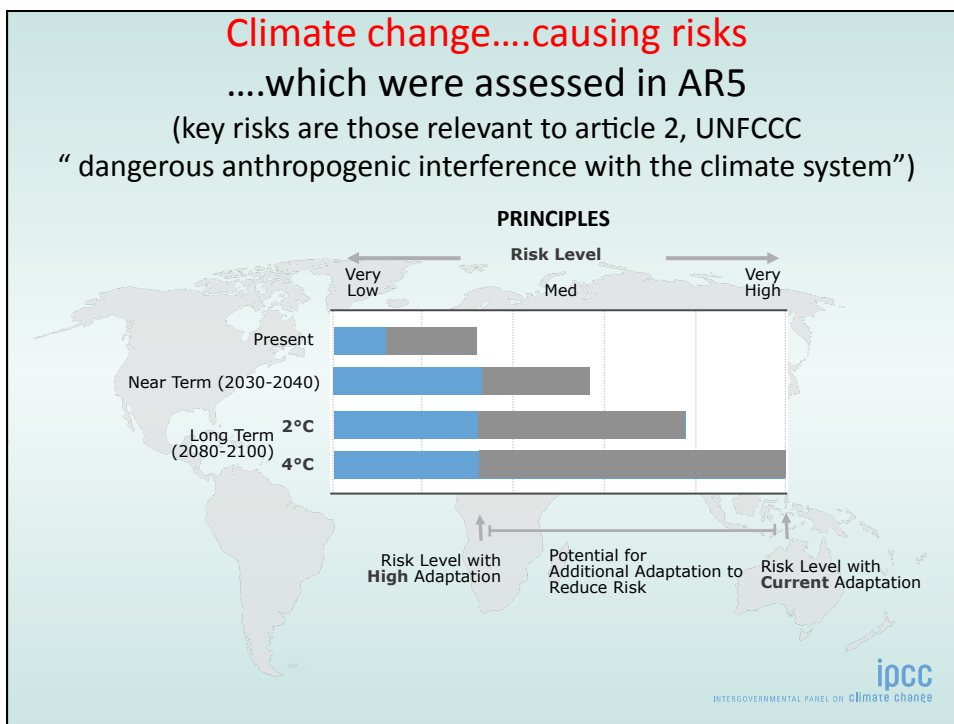
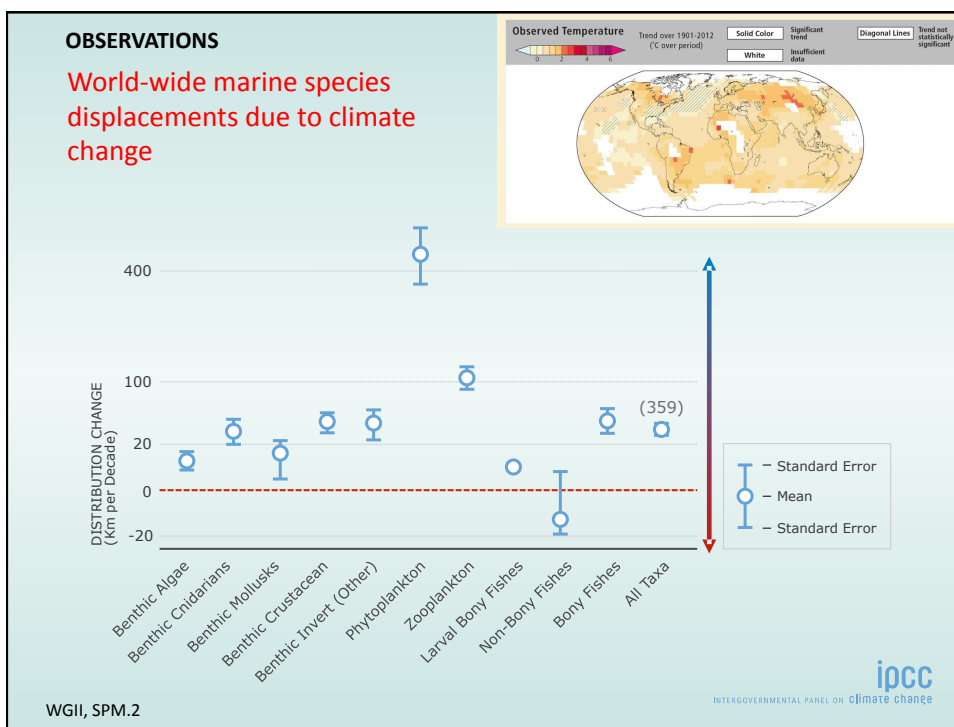
- absorb >90% of the heat accumulating in the atmosphere  
 → ocean warming, hypoxia
- absorb 25% of man-made CO<sub>2</sub> → ocean acidification
- accumulate excess water from melting ice sheets → sea level rise
- redistribution of nutrients → productivity shifts

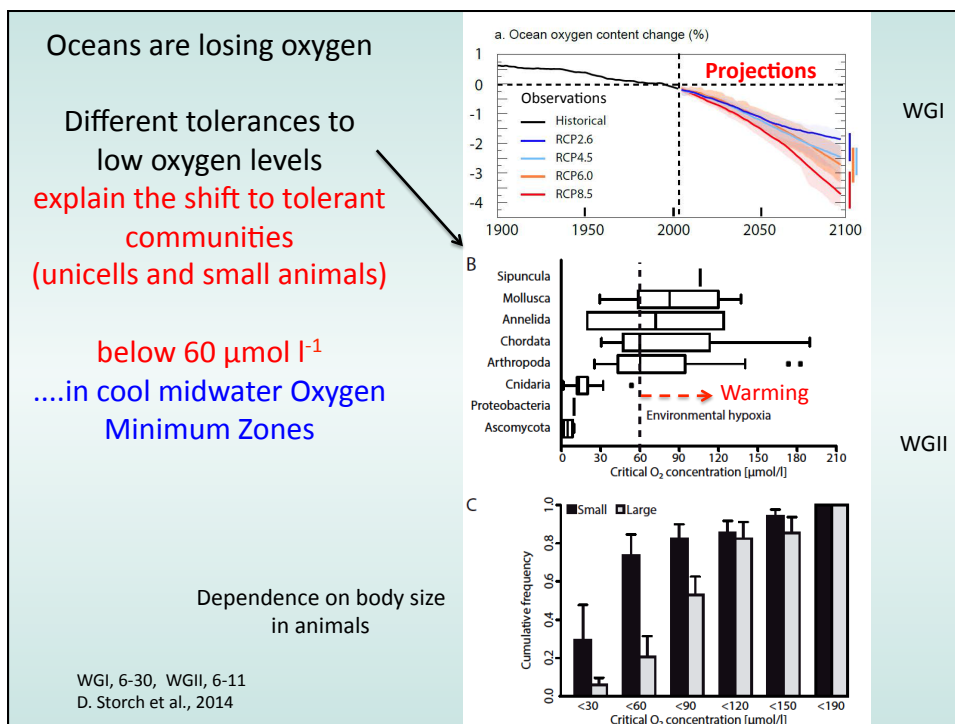
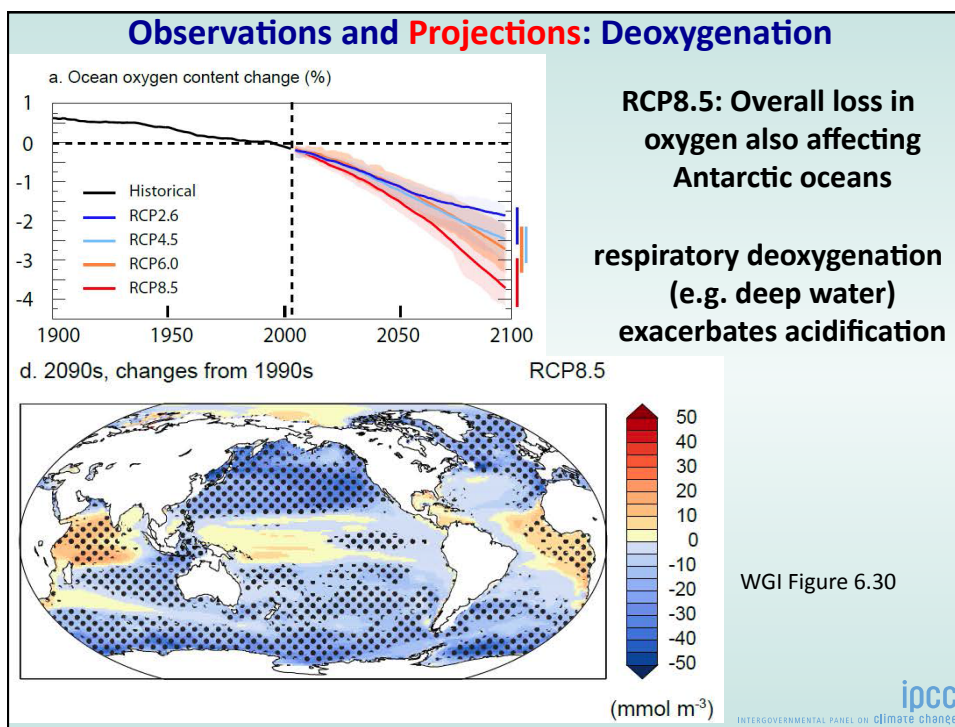
Human activities also influence ocean conditions **locally**:

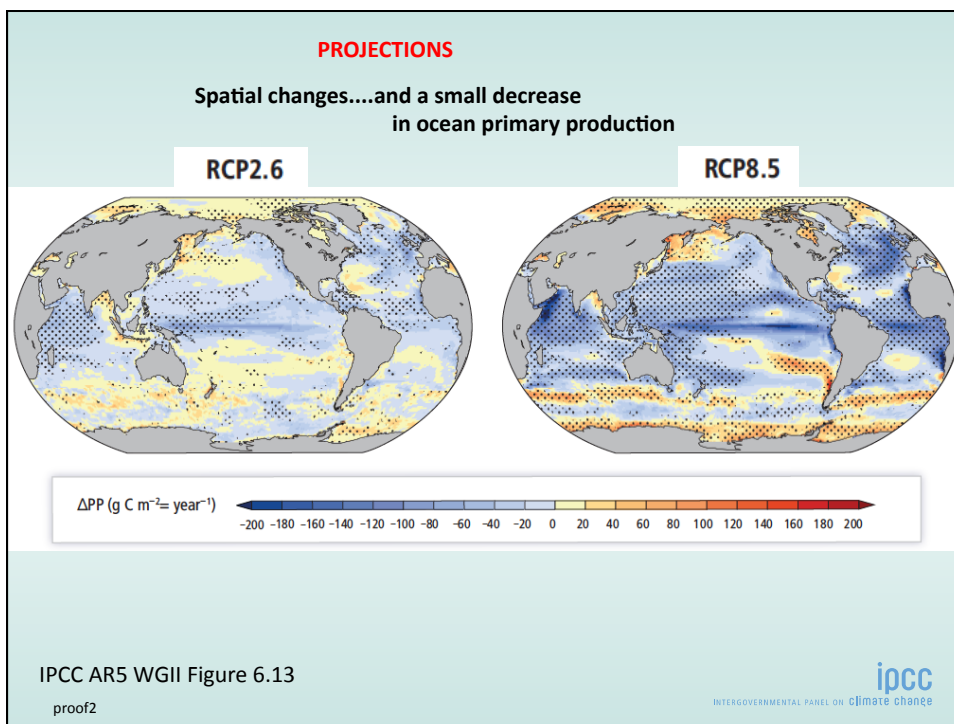
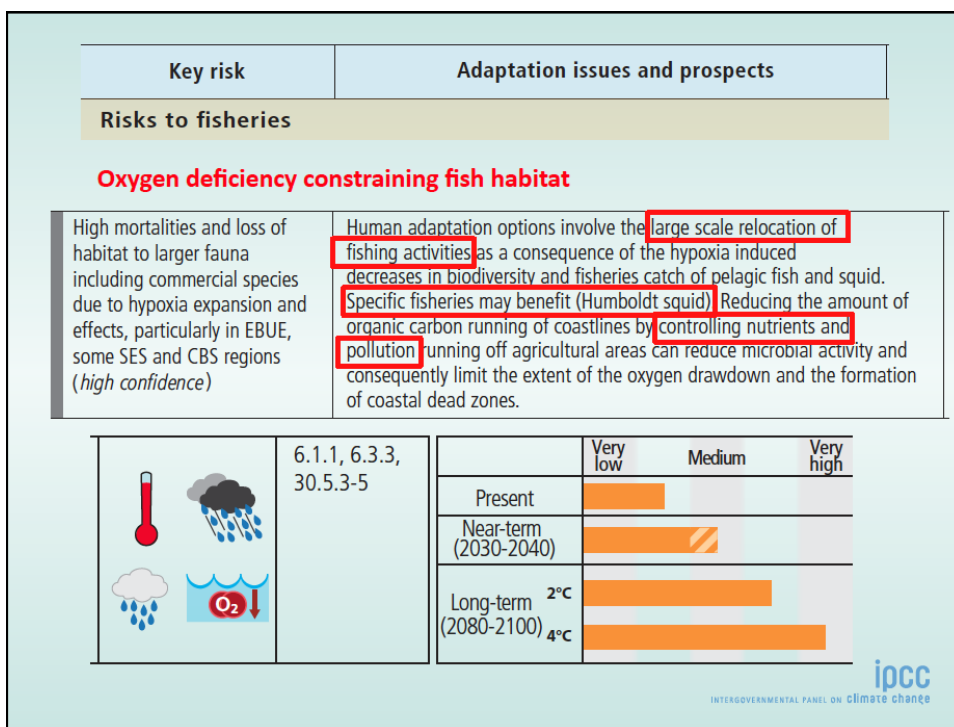
- overfishing, pollution, eutrophication etc.

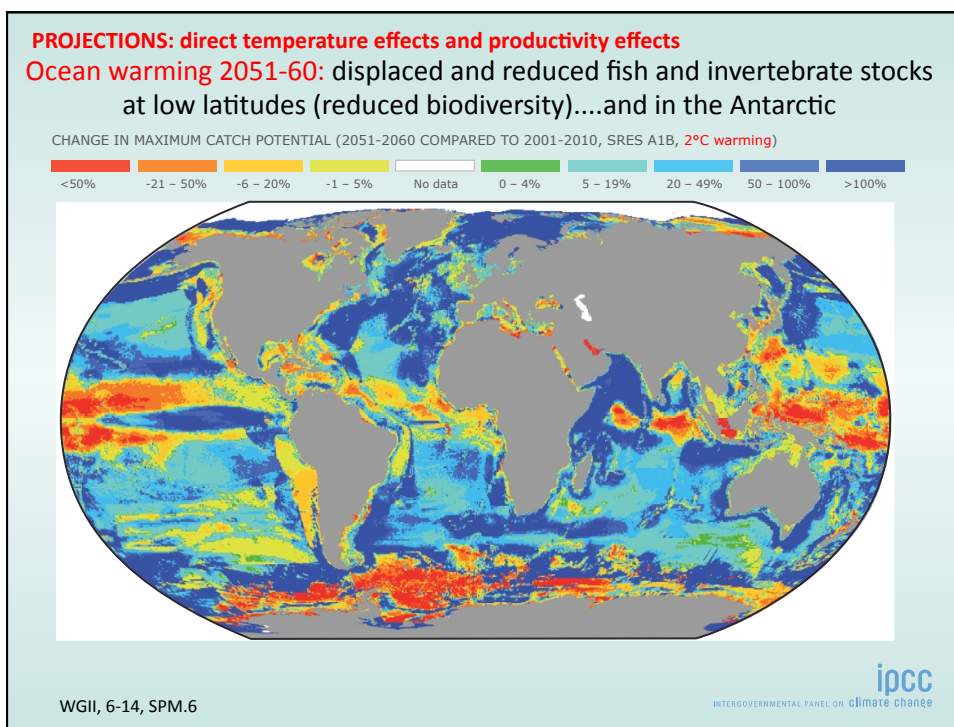
### **DETECTION AND ATTRIBUTION**

**...with temperature presently being the predominant driver of ongoing global changes, effects of ocean acidification and hypoxia reported in some areas**

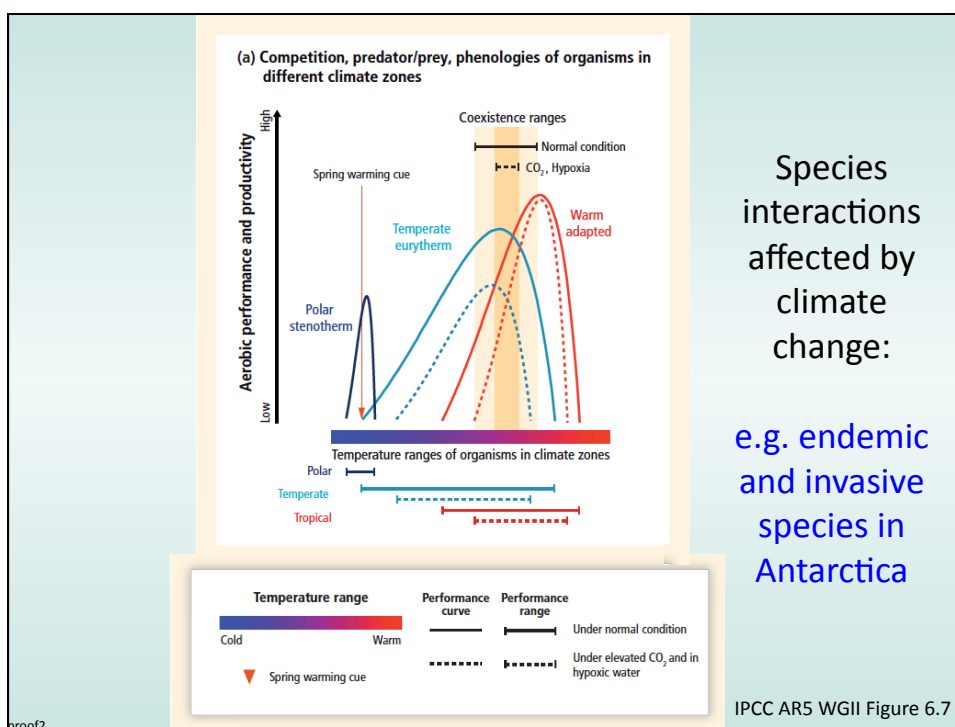
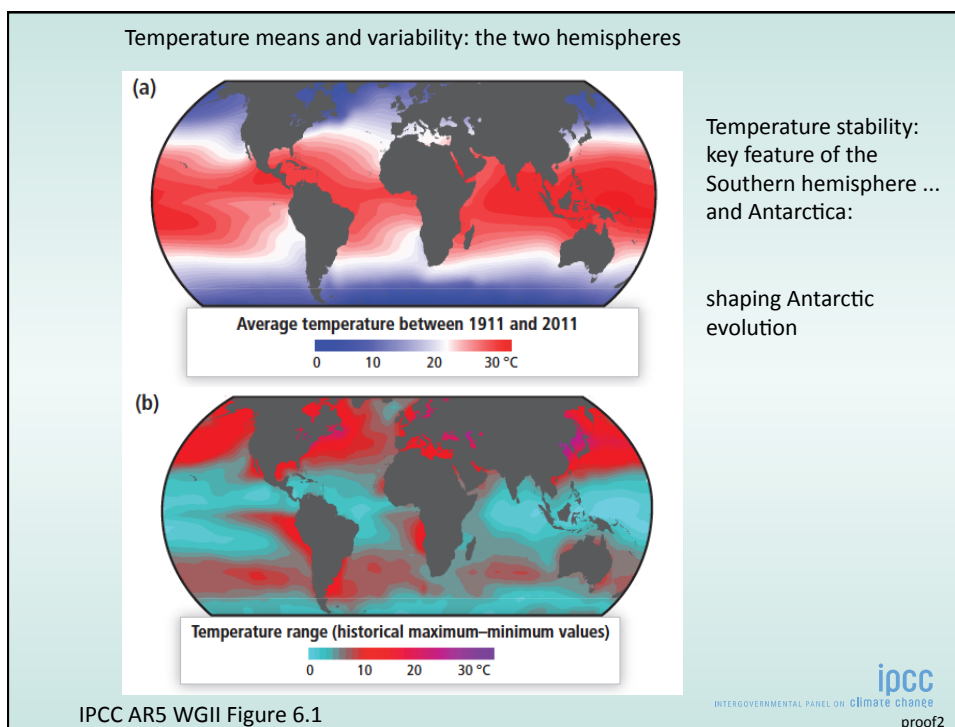


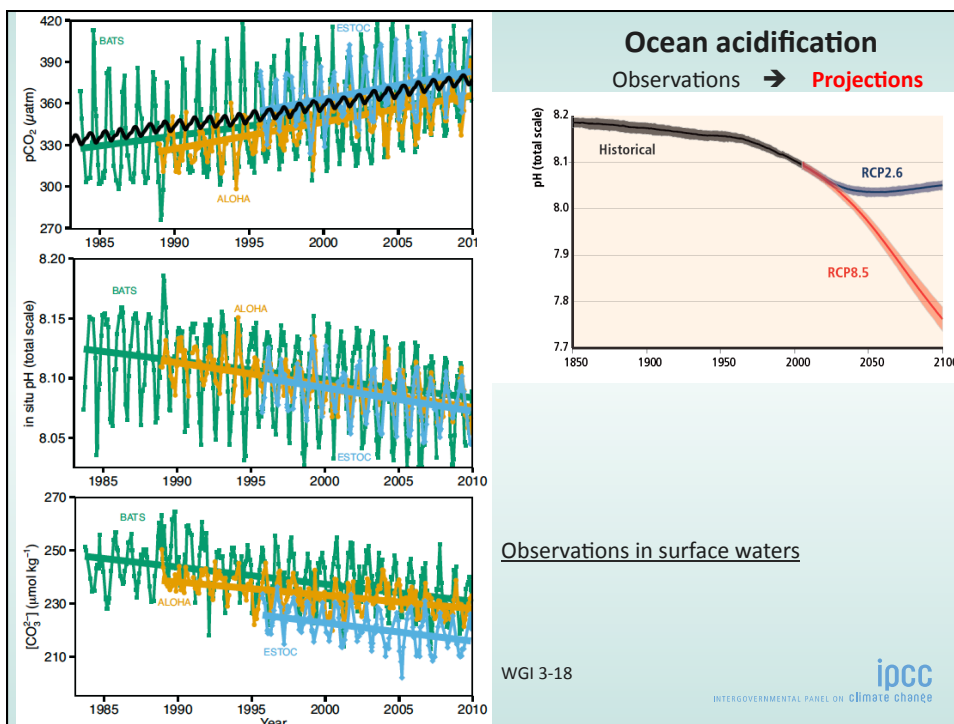
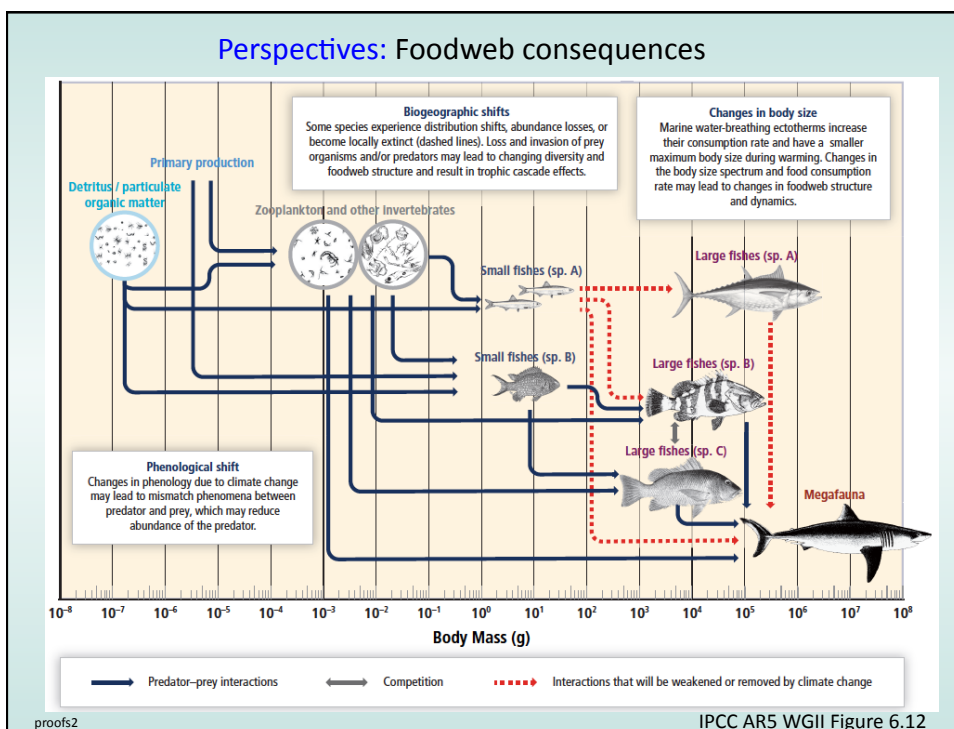


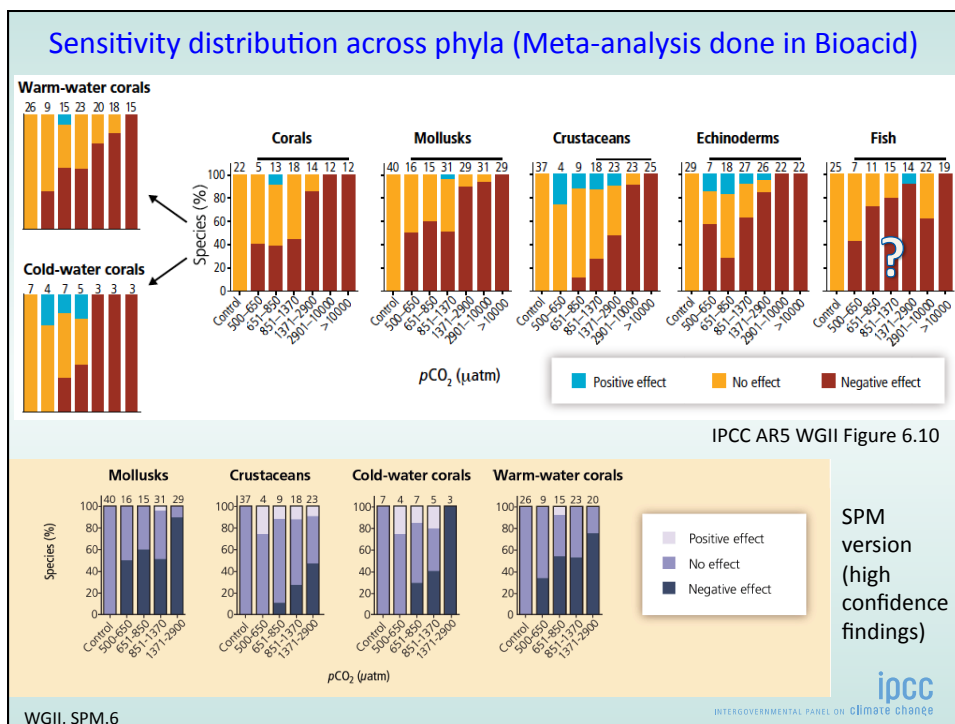
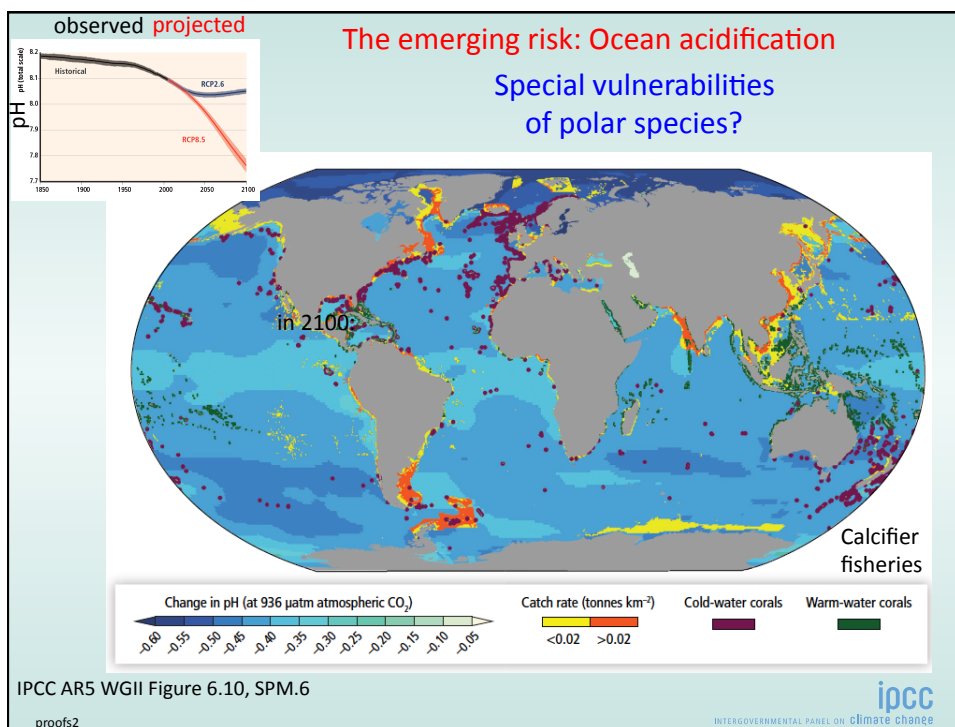





Key risk	Adaptation issues and prospects																			
<b>Risks to fisheries</b>																				
<b>Temperature driven stock displacement</b>																				
Reduced livelihoods and increased poverty (medium confidence)	Human adaptation options involve the <b>large scale relocation of industrial fishing activities</b> following the regional decreases (low latitude) versus increases (high latitude) in catch potential and shifts in biodiversity. <b>Artisanal local fisheries are extremely limited in their adaptation options</b> by available financial resources and technical capacities, except for their potential shift to other target species.																			
	6.4.1-2, 30.6.2, 30.6.5, Table 30-3																			
	<table border="1"> <thead> <tr> <th></th> <th>Very low</th> <th>Medium</th> <th>Very high</th> </tr> </thead> <tbody> <tr> <td>Present</td> <td colspan="3">[Progress bar showing medium risk]</td> </tr> <tr> <td>Near-term (2030-2040)</td> <td colspan="3">[Progress bar showing medium risk]</td> </tr> <tr> <td rowspan="2">Long-term (2080-2100)</td> <td>2°C</td> <td colspan="2">[Progress bar showing medium risk]</td> </tr> <tr> <td>4°C</td> <td colspan="2">[Progress bar showing high risk]</td> </tr> </tbody> </table>		Very low	Medium	Very high	Present	[Progress bar showing medium risk]			Near-term (2030-2040)	[Progress bar showing medium risk]			Long-term (2080-2100)	2°C	[Progress bar showing medium risk]		4°C	[Progress bar showing high risk]	
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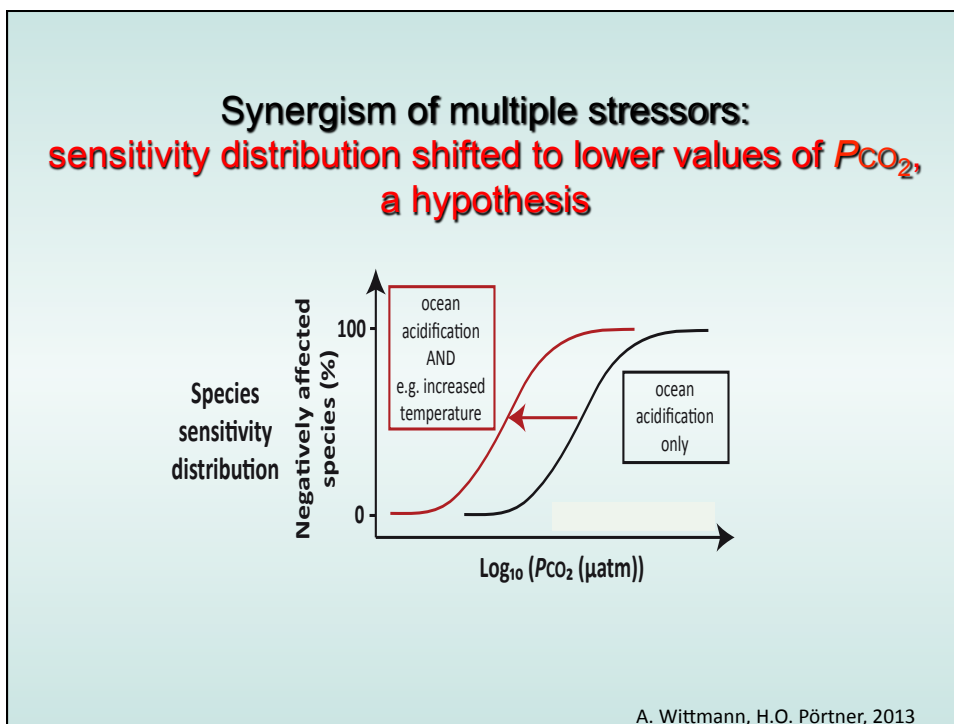




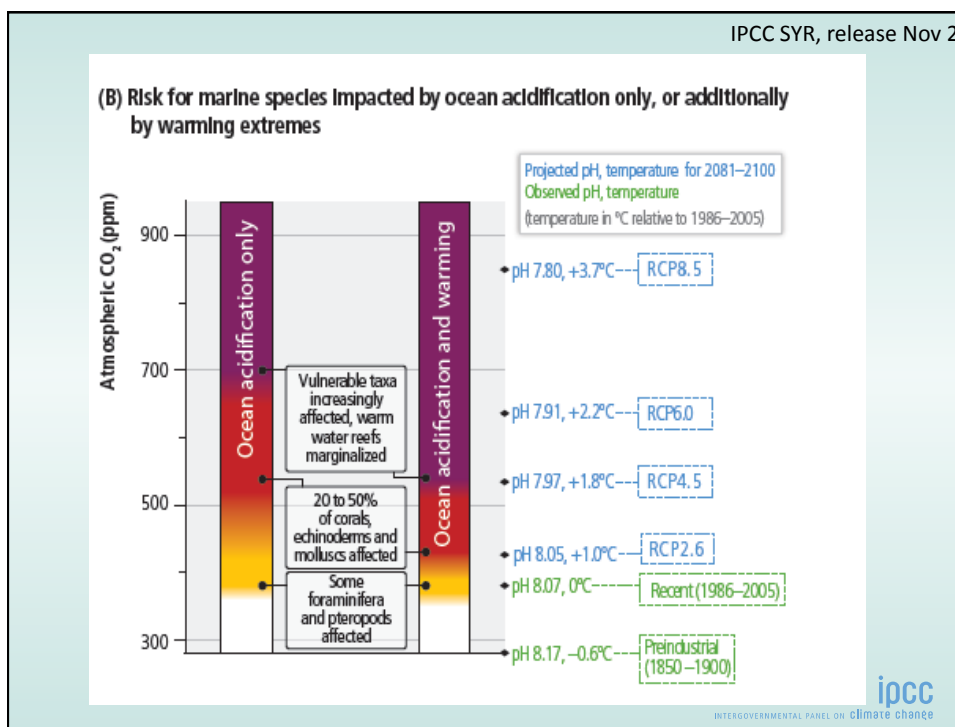


Key risk	Adaptation issues and prospects																			
<b>Risks to fisheries</b>																				
<b>Ocean acidification affecting fisheries and ecosystem engineers (corals)</b>																				
<p>Ocean acidification: Reduced growth and survival of commercially valuable shellfish and other calcifiers, e.g., reef building corals, calcareous red algae (<i>high confidence</i>)</p>	<p>Evidence for differential resistance and evolutionary adaptation of some species exists but is likely to be limited at higher CO<sub>2</sub> concentrations and temperatures reached; adaptation options include the shift to exploiting more resilient species or the protection of habitats with low natural CO<sub>2</sub> levels, as well as the reduction of other stresses mainly pollution and limiting pressures from tourism and fishing.</p>																			
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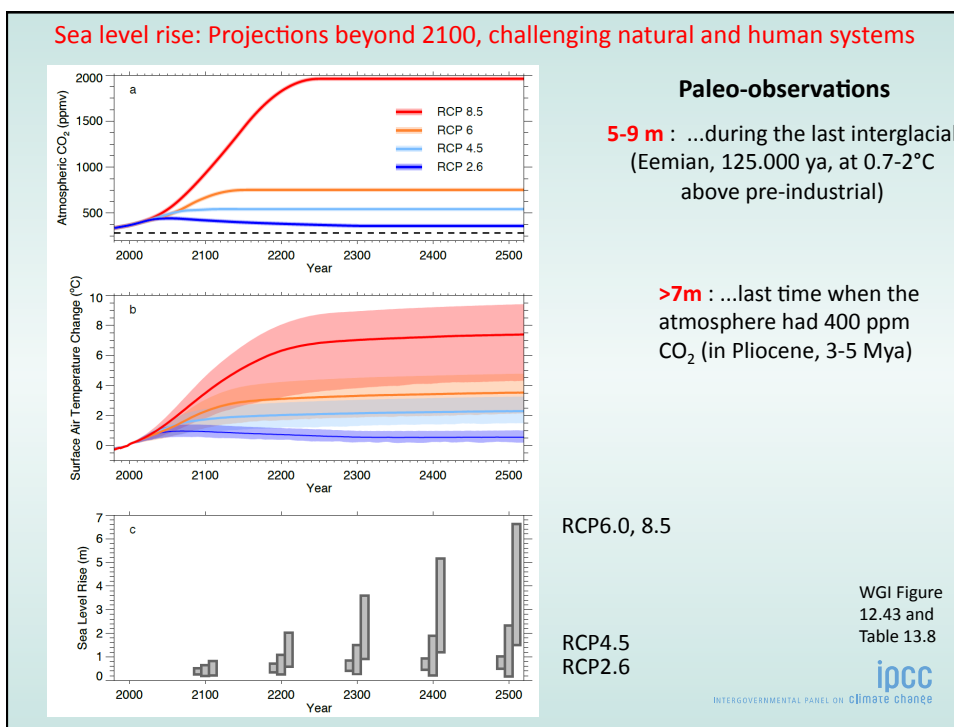


A. Wittmann, H.O. Pörtner, 2013



**... in animals strongest impacts are expected where warming, acidification and hypoxia come together,**

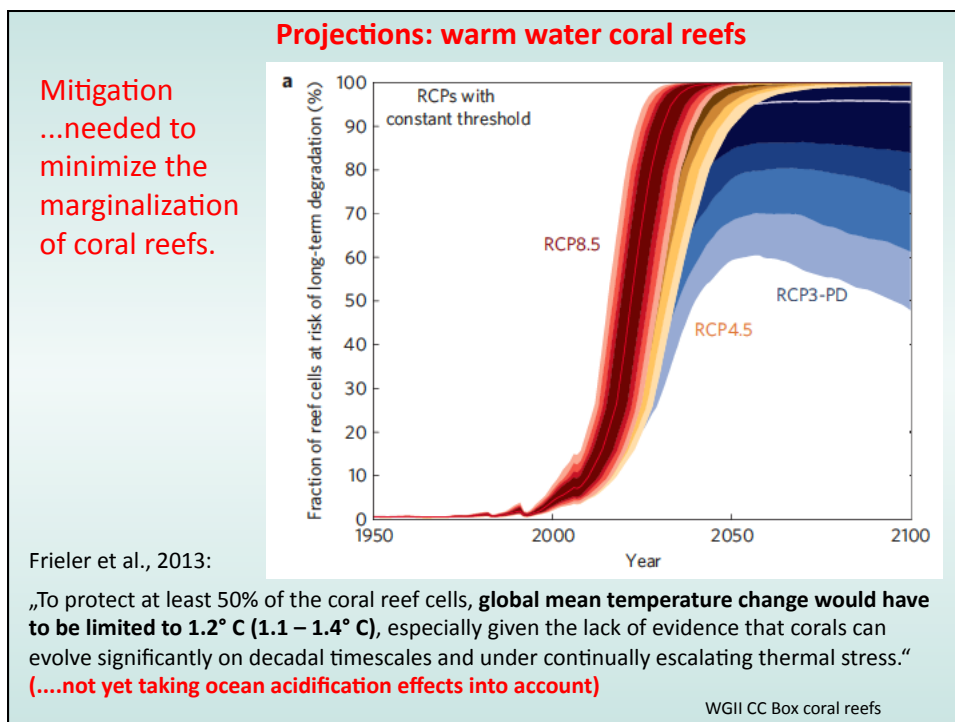
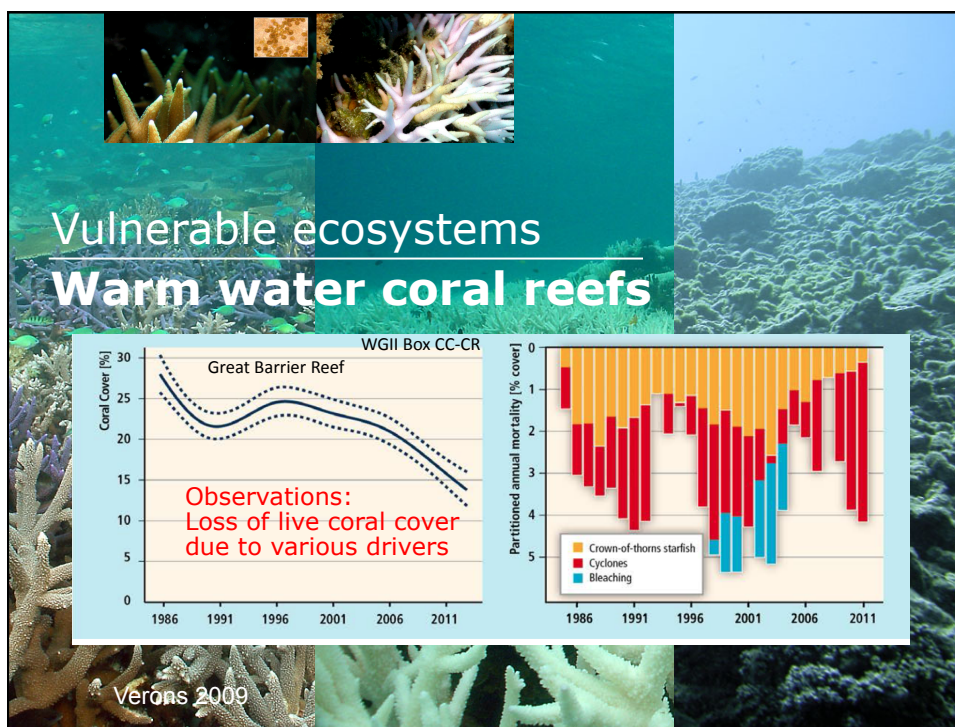
**...indicating that assessments based on individual drivers are conservative.**

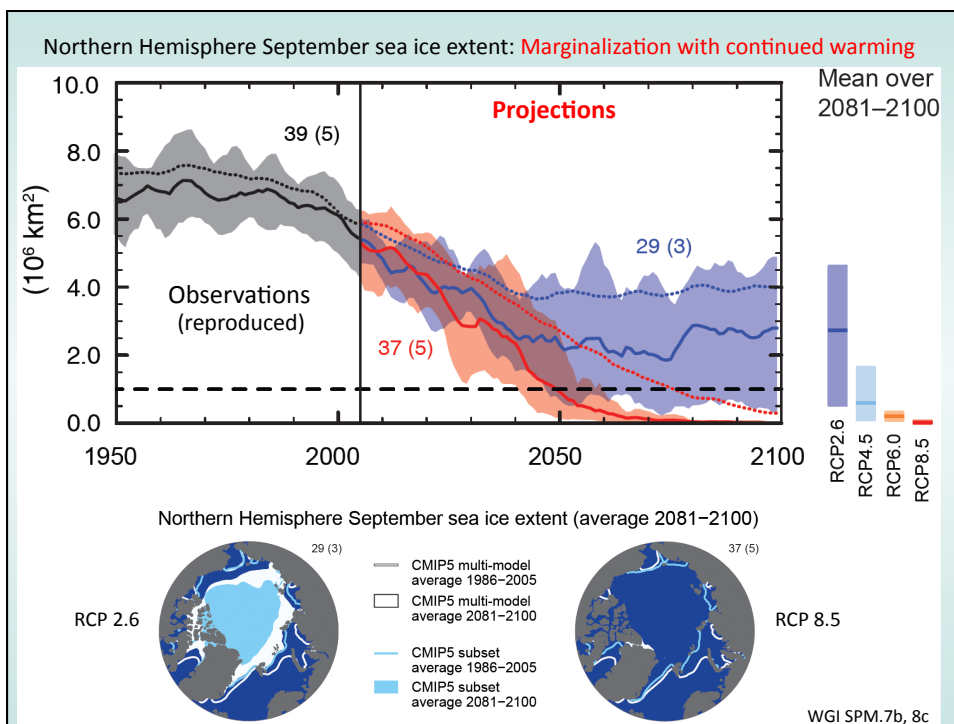


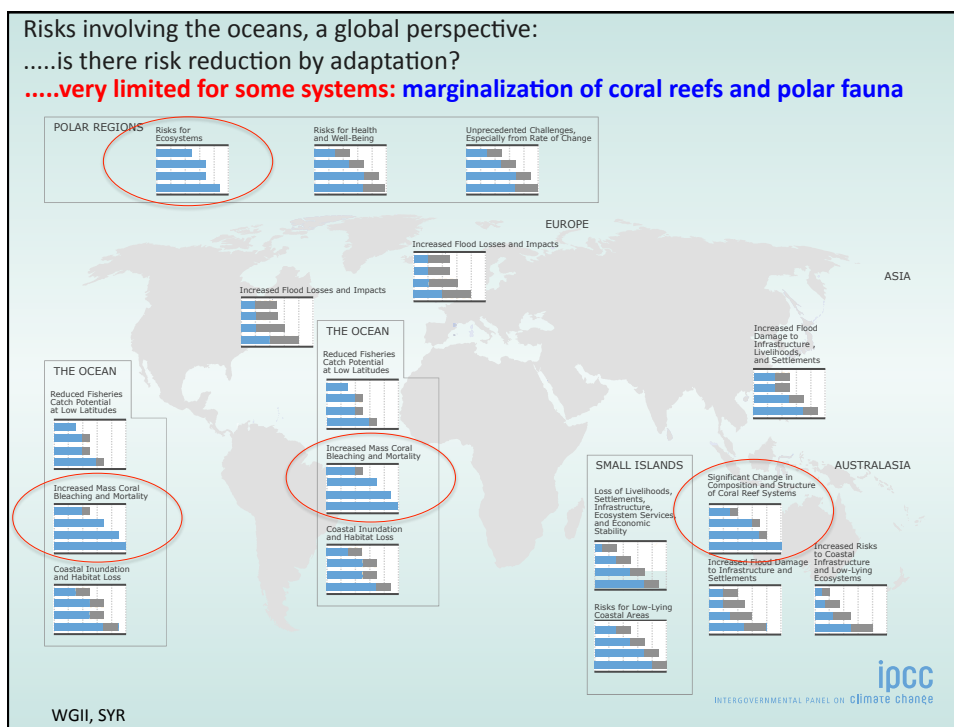
### Small island risks

Key risk	Adaptation issues & prospects																			
<b>Storm surges, swells, sea level rise</b>																				
<p>The interaction of <b>rising global mean sea level</b> in the 21st century with high-water-level events will threaten low-lying coastal areas (<i>high confidence</i>)</p> <p>[29.4, Table 29-1; WGI AR5 13.5, Table 13.5]</p>	<ul style="list-style-type: none"> <li>• <b>High ratio of coastal area to land mass</b> will make adaptation a significant financial and resource challenge for islands.</li> <li>• <b>Adaptation options include maintenance and restoration of coastal landforms and ecosystems, improved management of soils and freshwater resources</b> and appropriate building codes and settlement patterns.</li> </ul>																			
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## How to convey these messages to the policy makers?

You can contribute, ahead of COP21, Paris:

join the science conference in Paris July 7-10, 2015:

<http://www.commonfuture-paris2015.org/>

Submission of session proposals is possible until mid November.

## Thank you!

Pörtner, H.-O., D.M. Karl, P.W. Boyd, W.W.L. Cheung, S.E. Lluch-Cota, Y. Nojiri, D.N. Schmidt, and P.O. Zavialov, 2014: **Ocean systems**. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 411-484.

Hoegh-Guldberg, O., R. Cai, E.S. Poloczanska, P.G. Brewer, S. Sundby, K. Hilmi, V.J. Fabry, and S. Jung, 2014: **The Ocean**. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1655-1731.



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