



Global Meta-analysis of Marine Climate Change Impacts

Climate Adaptation

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Climate Adaptation



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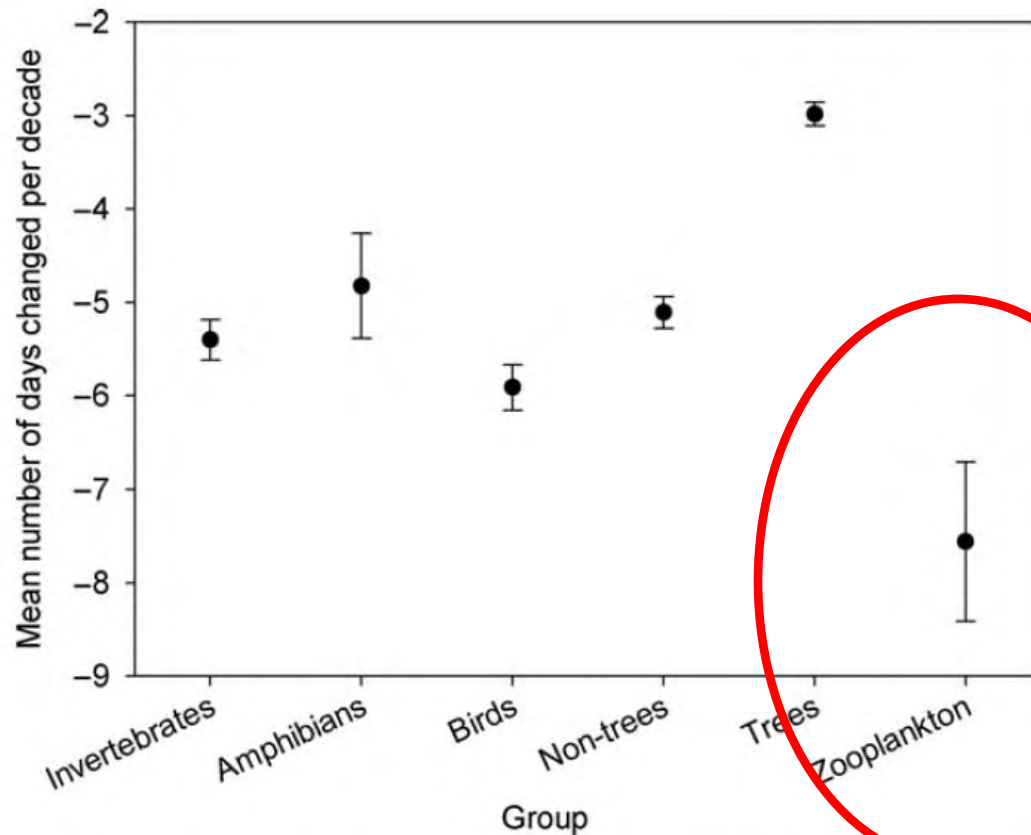
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Attribution in Climate Change Ecology

- **Detection** of change: demonstration that a system has changed, in a statistical sense, without providing a reason for that change
- **Attribution**: determining the cause of observed change, in a statistical sense, in the system
 - Single step to external forcings
 - Multi-step to external forcings
 - Associative pattern attribution to external forcings (scale mismatch biology and climate)
- **Confidence in attribution** is increased when there is a firm understanding of the processes underlying the causal link, e.g. from studies of responses to climate variability, experimental studies, modelling exercises and palaeo-studies

Phenological responses to climate change

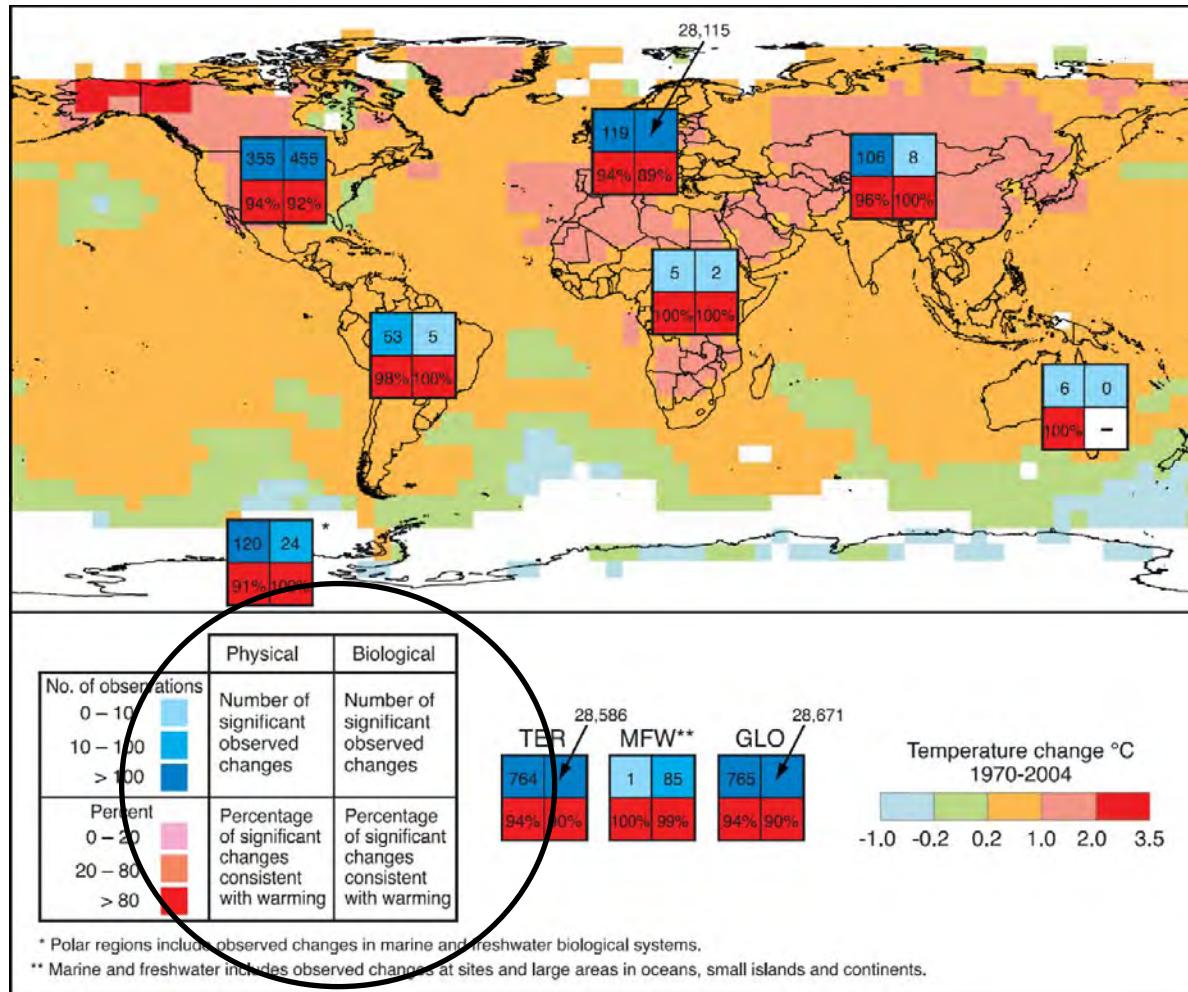


143 studies
 1468 species
 81% of species that changed where consistent with climate change

- 10 yrs + of data
- Trait of at least one species changed over time
- Temporal change in temp or strong association between species trait and temperature

Root et al 2003 Nature; Richardson 2006 ICES J Mar Sci

IPCC 4th Assessment, 2007 (also see Rosenzweig et al 2008 Nature)



Terrestrial

764	28586
94%	90%

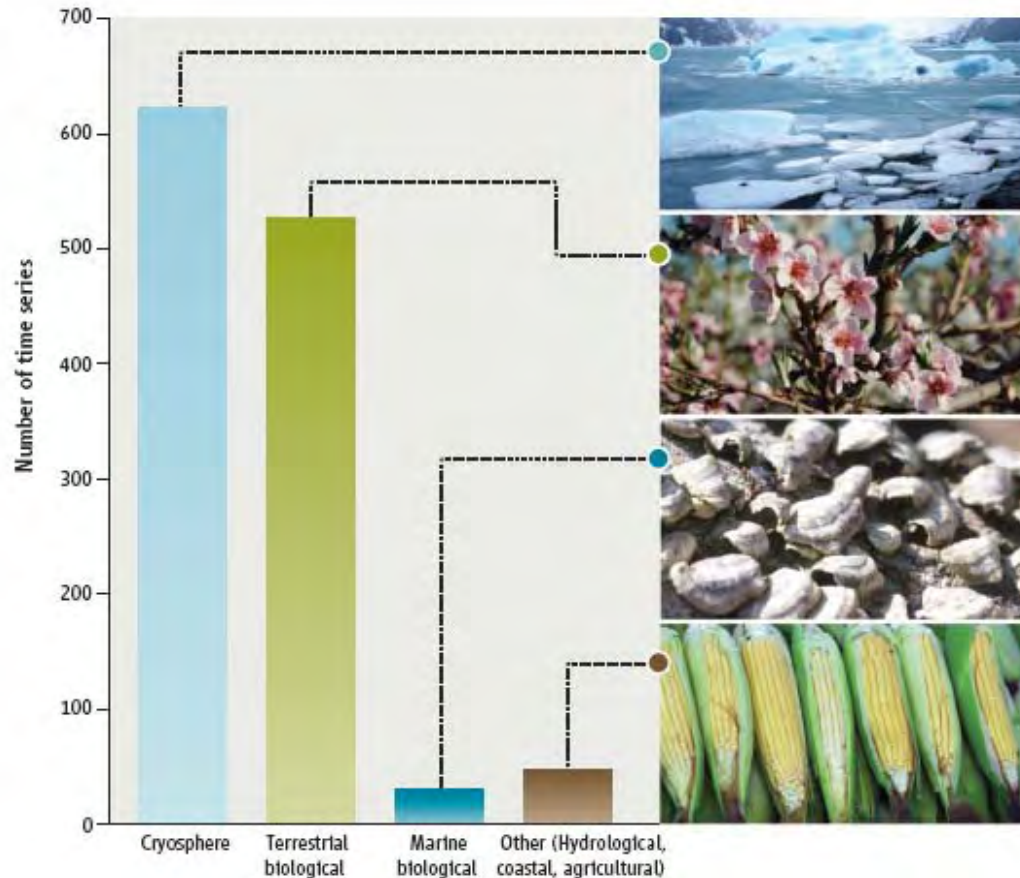
Marine and Freshwater

1	85
100%	99%

Figure SM-1.4. Changes in physical and biological systems and surface temperature used in chapter synthesis assessment in Section 1.4.

At the global scale TER = Terrestrial; MFW = Marine and Freshwater, and GLO = Global.

Richardson and Poloczanska 2008 Science



- IPCC criteria: 20 years data minimum, end 1990 or later
- Few marine specialists

NCEAS WG: Towards an Understanding of Marine Biological Impacts of Climate Change, Sept 2009 – Aug 2011

- **What are the similarities and differences in types and rates of responses between marine and terrestrial systems?**
- **Which marine species, taxonomic groups and systems are most sensitive?**
- **What are the similarities and differences in the types and rates of responses in tropical, temperate and polar seas?**
- **Are species and habitats under multiple human stresses more vulnerable to climate change?**
- **Can we attribute change in marine ecosystems to climate change?**

Climate Change Ecology



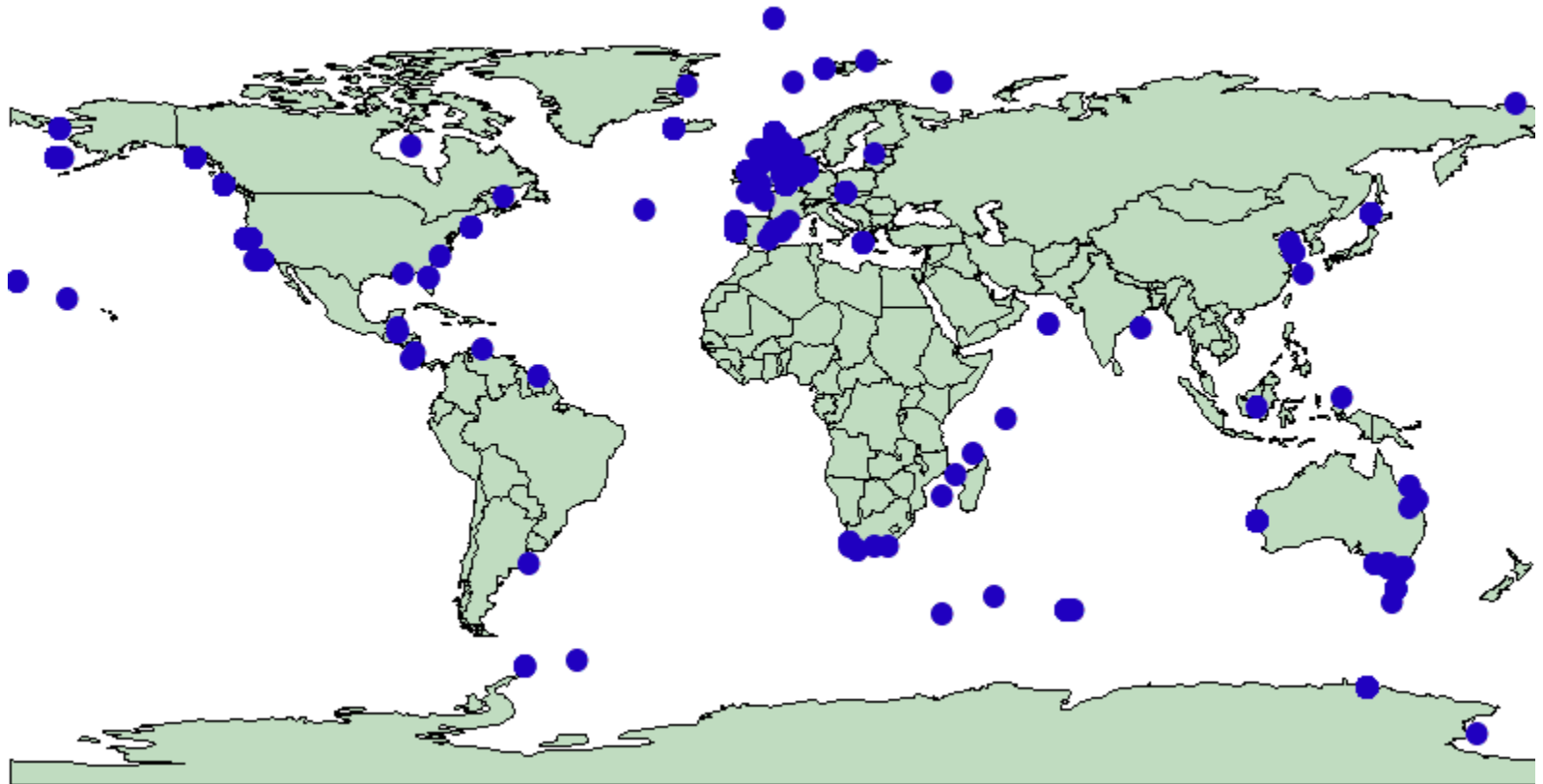
- Need for a priori **expectations** for rigorous analysis
- Predictions from ecological theory and models, experiments, climate variability responses and palaeo-records
- Identification of the likely processes that link climate change and ecology
- Appropriate time series analysis, applied by 55% in NCEAS database
- Consider synergistic effects eg fishing and climate change
- Reporting results

NCEAS marine impacts database

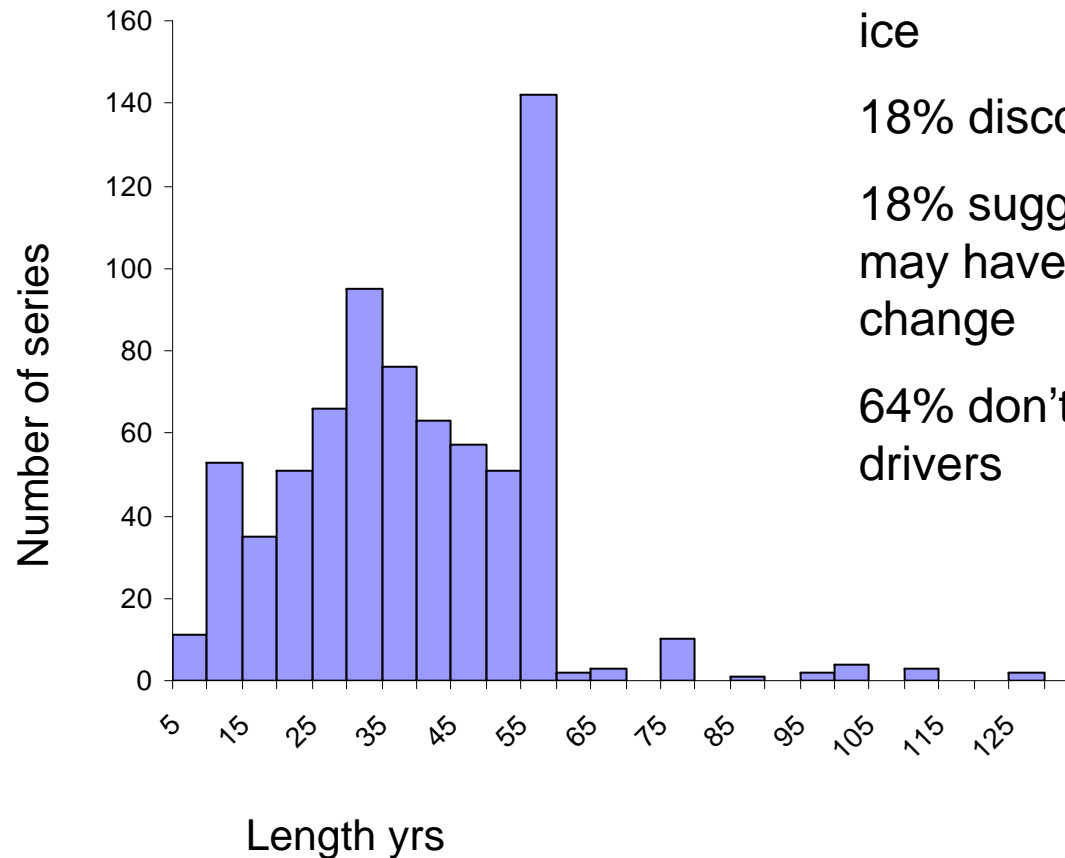
- Studies from peer-reviewed journals and grey literature where the **authors** have inferred a change is consistent with climate change
- Information collected for weighting:
 - size of study (species, years, area),
 - statistical tests applied (or not) to change in climate variable and biological observation,
 - temporal autocorrelation considered
 - Alternative explanations considered

Marine Impacts Database: Locations

124 papers, 964 observations



Marine Impacts Database: Time Span of Data Series



Climate drivers: SST or sea ice

18% discount other drivers

18% suggest other drivers may have contributed to change

64% don't consider other drivers

Call for help!

- Please submit pdfs or word documents of relevant papers and reports; data after 1960
- Database will be made publically available through the NCEAS website

To: Elvira.poloczanska@csiro.au

- **Your name**
- **Your email**
- **url for document (if appropriate)**
- **Short summary in English (if not in English)**
- **The document!**