Before the Decision-making Committee
appointed by the
Environmental Protection Authority

IN THE MATTER OF the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012

AND An application by Beach Energy Resources NZ (Holdings) Ltd for a marine discharge consent to discharge trace amounts of harmful substances from deck drains of a Mobile Offshore Drilling Unit as offshore processing drainage

Lyndon DeVantier, PhD

Oppose.

Cumulative Effects: Reductionism or holism?

Cumulative effects of O&G mining applications under the EEZ-CS Act have all been deemed by industry consultants and EPA to be ‘low or negligible’, taking a reductionist view.

In the present case, sig. infrastructure must be put in place, and serviced, before the ‘trace amounts’ of harmful substances that this hearing is deliberating over will be produced. In a holistic, rather than reductionist, view, placement and operation of that infrastructure are all cumulative effects of the application, with attendant risks, not just the discharge itself, irrespective of ‘notification’ status.

Deepwater Horizon photos courtesy Wikipedia

Cumulative Effects

Assessments for notified (and non-notified) applications under the EEZ-CS Act should focus on the overall impact, including synergisms, of adding that application to those already occurring, and predicted to occur in coming decades.

This is consistent with Sections 6, 28, 33 and 59 of the EEZ-CS Act, which provide broad discretion to the DMC, and also consistent with the Precautionary Principle.

"The challenges for humanity to sustainably live on the planet are becoming increasingly complex, creating a general need for more holistic approaches and systems-level thinking." Hodgson EE, Halpern BS and Essington TE (2019) Moving Beyond Silos in Cumulative Effects Assessment. Front. Ecol. Evol. 7:211. doi: 10.3389/fevo.2019.00211

EEZ-CS Act ‘cumulative effects’

6 Meaning of effect

(1) In this Act, unless the context otherwise requires, *effect* includes—

(a) any positive or adverse effect; and

(b) any temporary or permanent effect; and

(c) any past, present, or **future** effect; and

(d) any cumulative effect that arises **over time or in combination** with other effects; and

(e) any potential effect of high probability; and

(f) any potential effect of low probability that has a **high potential** impact.

(2) Subsection (1)(a) to (d) apply regardless of the scale, intensity, duration, or frequency of the effect.

EEZ-CS Act ‘cumulative effects’

33 Matters to be considered …

(3) The Minister must take into account—

(a) any effects on the environment or existing interests of allowing an activity with or without a marine consent, including—

(i) **cumulative effects**; and …

(i) the **effects of activities that are not regulated under this Act**; and

(ii) …

(d) the importance of **protecting the biological diversity and integrity of marine species, ecosystems, and processes**;

(e) the importance of **protecting rare and vulnerable ecosystems and the habitats of threatened species**; and

(f) New Zealand’s international obligations; and

(i) the nature and effect of other marine management regimes; …

UN Convention on Biological Diversity

Article 8 requires the following of Parties, including New Zealand (which signed and ratified the Convention in 1992 and 1993):

- Article 8(d) Promote the protection of ecosystems, natural habitats and the **maintenance of viable populations of species in natural surroundings**;
- Article 8(f) Rehabilitate and restore degraded ecosystems and **promote the recovery of threatened species**,…

Why is this relevant?

Threatened cetaceans from NZ waters

Species	IUCN Red List / NZ (if different)	Species	IUCN Red List / NZ (if different)
Antarctic Minke Whale	DD (NT)	Risso's Dolphin	LC
Common Minke Whale	LC	Short-finned Pilot Whale	DD
Southern Right Whale	LC **(NV) *****	Long-finned Pilot Whale	DD (NT)
Bryde's Whale	DD **(NC) ***	Spectacled Porpoise	DD
Sei Whale	**En**	False Killer Whale	DD (NT)
Humpback Whale	LC	Killer Whale	**DD (NC) ***
Fin Whale	**En**	Pygmy Sperm Whale	DD (NT)
Blue Whale	**En**	Southern Bottlenose Whale	**LC (DD)**
Pygmy Blue Whale (subspecies)	**En**	Hector's Beaked Whale	DD
Hector's Dolphin	**En (NE) ****	Shepherd's Beaked Whale	DD
Maui's Dolphin (subspecies)	**En (NC) ***	Cuvier's Beaked Whale	**LC (DD)**
Dusky Dolphin	DD	Ginkgo Toothed Beaked Whale	DD
Pan Tropical spotted Dolphin	LC	Gray's Beaked Whale	DD (NT)
Indo-Pacific Bottlenose Dolphin	DD	Arnoux's Beaked Whale	DD
Common Bottlenose Dolphin	**LC (NE) ****	Andrew's Beaked Whale	DD
Striped Dolphin	LC	Strap-toothed Whale	DD
Southern Right Whale Dolphin	**DD (NT)**	**Sperm Whale**	**Vu (NT)**

DD: Data Deficient; LC: Least Concern; Vu: Vulnerable; En: Endangered.

- **6 spp. Endangered**
- **1 sp. Vulnerable**
- **18 spp. Data Deficient**

*** 3 spp. Nationally Critical (NC)**

**** 2 spp. Nat. Endangered (NE)**

***** 1 sp. Nat. Vulnerable (NV)**

NT – Not Threatened

▲ This undated photo provided by the Institute for Marine Mammal Studies shows lesions on a dolphin at a shoreline. At least 279 dolphins have stranded across much of the US Gulf Coast since February. Photograph: Moby Solangi/AP

At least 279 dolphins have become stranded across much of the US Gulf Coast since the start of February, triple the usual number, and about 98% of them have died, scientists from the National Oceanic and Atmospheric Administration (Noaa) said.

Scientists will investigate whether lingering effects from the 2010 BP oil spill and more immediate effects from low salinity because of freshwater flowing from high rivers and a Louisiana spillway contributed to the deaths, said Teri Rowles, coordinator for Noaa fisheries' marine mammal health and stranding response program.

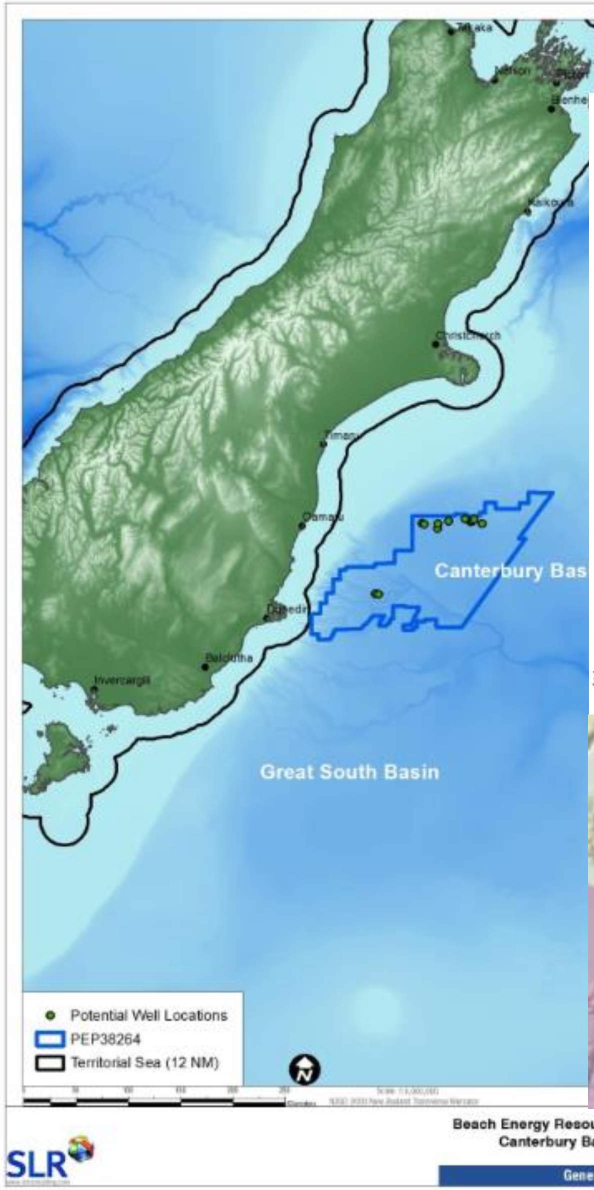
Spill risks (EEZ-CS Act Sections 6 and 33)

BP spill effects included problems with lungs and adrenal glands, which produce stress-related hormones; blood abnormalities; and general poor condition, …. the spill contributed to the Gulf of Mexico's largest and longest dolphin die-off.

https://www.theguardian.com/environment/2019/jun/15/dolphins-stranded-deaths-gulf-coast (Accessed 15 June 2019)

Hector's and Maui dolphin Marine Mammal Sanctuary & Te Rohe o Te Whanau Puha/Kaikoura Whale Sanctuary proposals

Figure 1 General location map



From: https://www.epa.govt.nz/assets/FileAPI/proposal/EEZ100019/Applicants-proposal-documents-Application-documents/Impact_Assessment_Marine_Discharge_Consent_-_Deck_Drainage_EEZ100019.pdf

Brodie (1960)

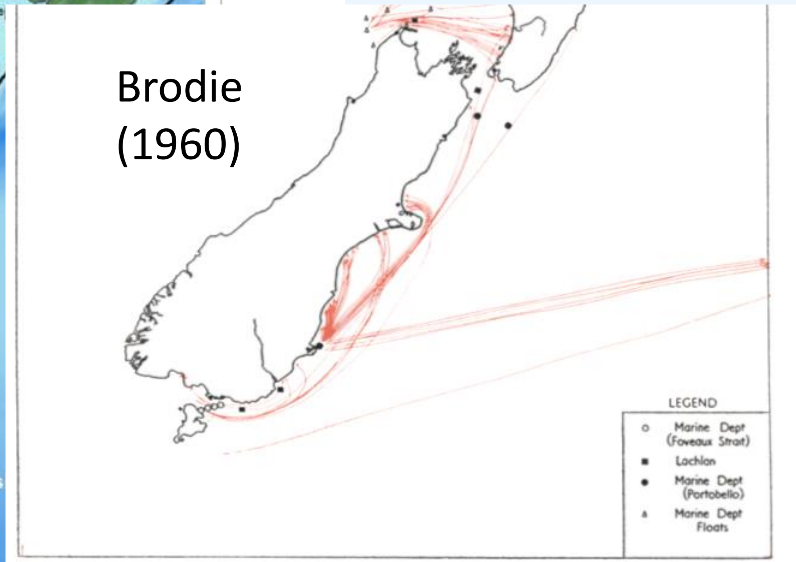
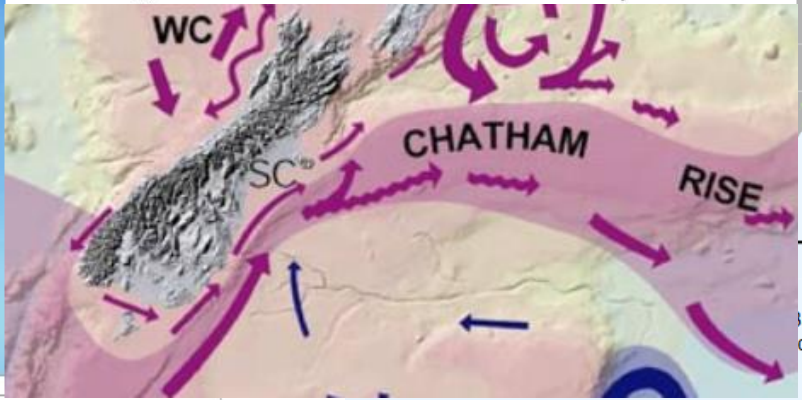
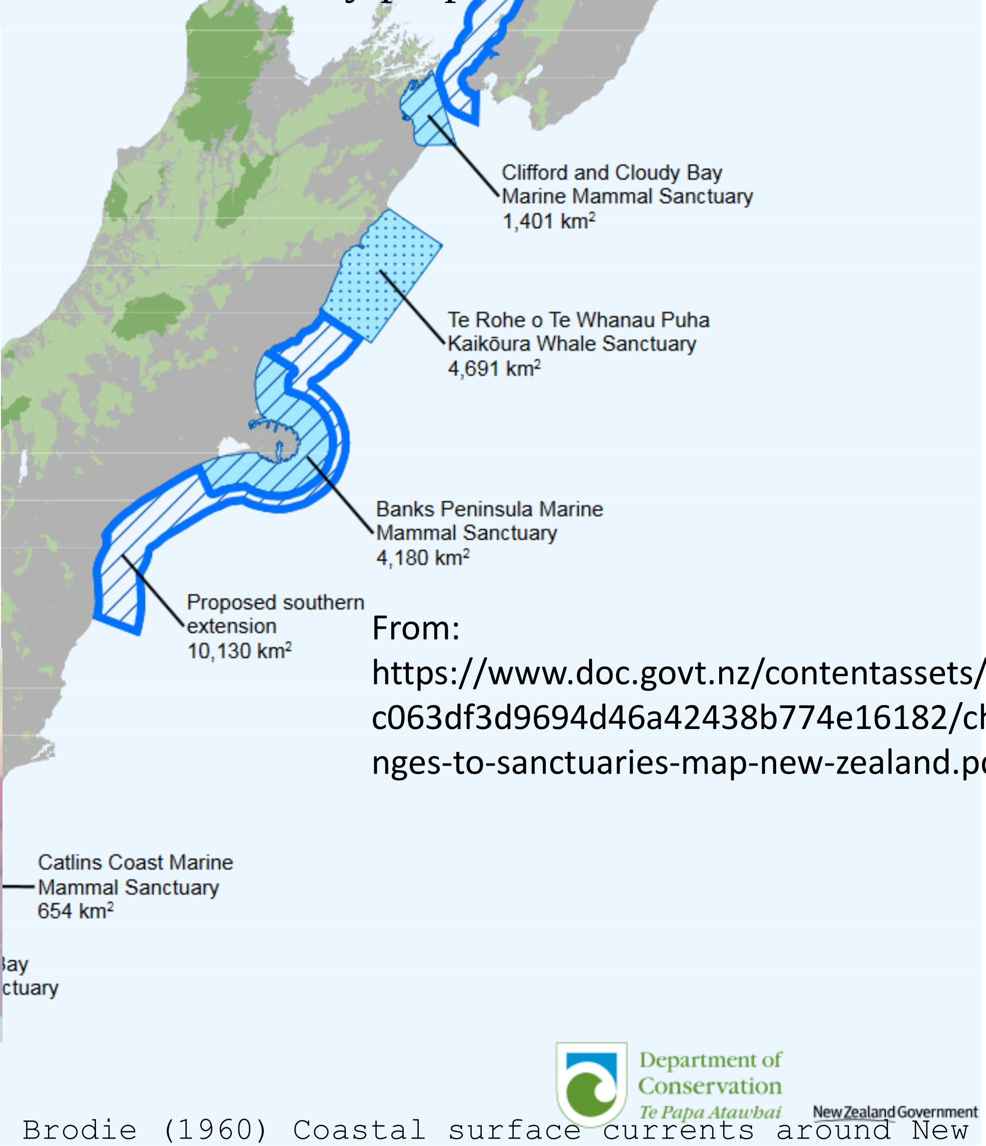


FIG. 5—Tracks of drift bottles and floats released in New Zealand coastal waters 1918–1952. Approximate shortest tracks betwen release and recovery are shown.





From: https://www.doc.govt.nz/contentassets/8c063df3d9694d46a42438b774e16182/changes-to-sanctuaries-map-new-zealand.pdf

J. W. Brodie (1960) Coastal surface currents around New Zealand, *New Zealand Journal of Geology and Geophysics* 3:2, 235-252, DOI:10.1080/00288306.1960.10423596 AND https://teara.govt.nz/en/map/5912/ocean-currents-around-new-zealand

Threatened NZ sea and shore-birds

Nationally Critical

Most severely threatened, facing an immediate high risk of extinction:

- Antipodean wandering albatross/toroa
- Black-billed gull/tarāpuka
- Chatham Island oystercatcher/tōrea tai
- Chatham Island shag
- Chatham Island tāiko
- Gibson's wandering albatross/toroa
- Kermadec white-faced storm petrel
- New Zealand fairy tern/tara iti
- Pacific white tern
- Pitt Island shag
- Salvin's albatross/toroa
- Shore plover/tuturuatu
- South Georgian diving petrel
- Southern New Zealand dotterel/tūturiwhatu
- White heron/kōtuku

Source: https://www.doc.govt.nz/nature/conservation-status/threatened-birds/

Nationally Endangered

Facing high risk of extinction in the short term:

- Black-fronted tern/tarapirohe
- Kermadec petrel "Summer"
- King shag
- Masked (blue-faced) booby
- Reef heron/matuku moana
- White-bellied storm petrel

Nationally Vulnerable

Facing a risk of extinction in the medium term:

- Auckland Island shag
- Banded dotterel/tūturiwhatu
- Black petrel/tāiko
- Campbell Island mollymawk
- Caspian tern/taranui
- Chatham petrel/ranguru
- Eastern rockhopper penguin
- Fiordland crested penguin/tawaki
- Flesh-footed shearwater/toanui
- Foveaux shag
- Grey-headed mollymawk
- Hutton's shearwater
- New Zealand storm petrel

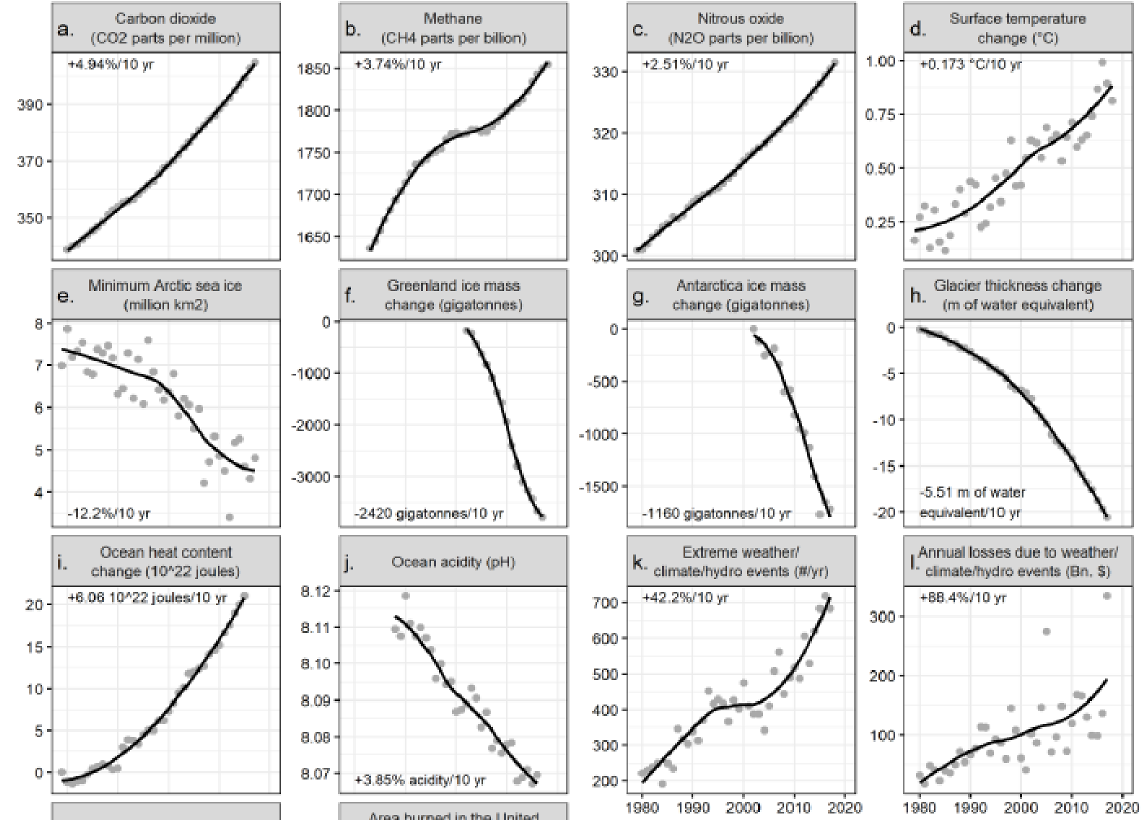
The Future: A ‘Perfect Storm’ of cumulative effects

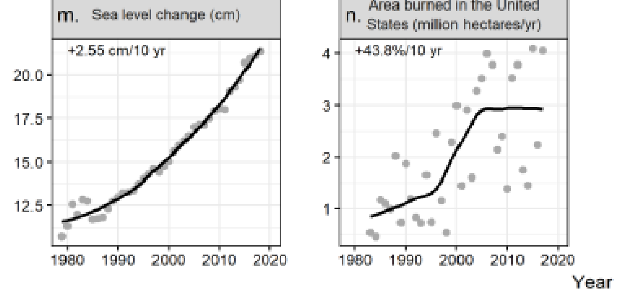
The physical, chemical and biological oceanography of earth’s oceans are changing, not just from local industrialization, but also from disruption to ocean physico-chemistry. Rising sea temperature, storms, ocean acidification, deoxygenation and associated impacts on productivity and food webs will all increase in coming decades.

Sir Peter Gluckman (2013): *“For New Zealand, the resulting impact of changes in wind patterns, precipitation, and the chemistry of our oceans can be expected to be at least as significant as the changes in temperature itself.”*

‘Cumulative effects’ under Sections 6, 28, 33 and 59 of EEZ Act

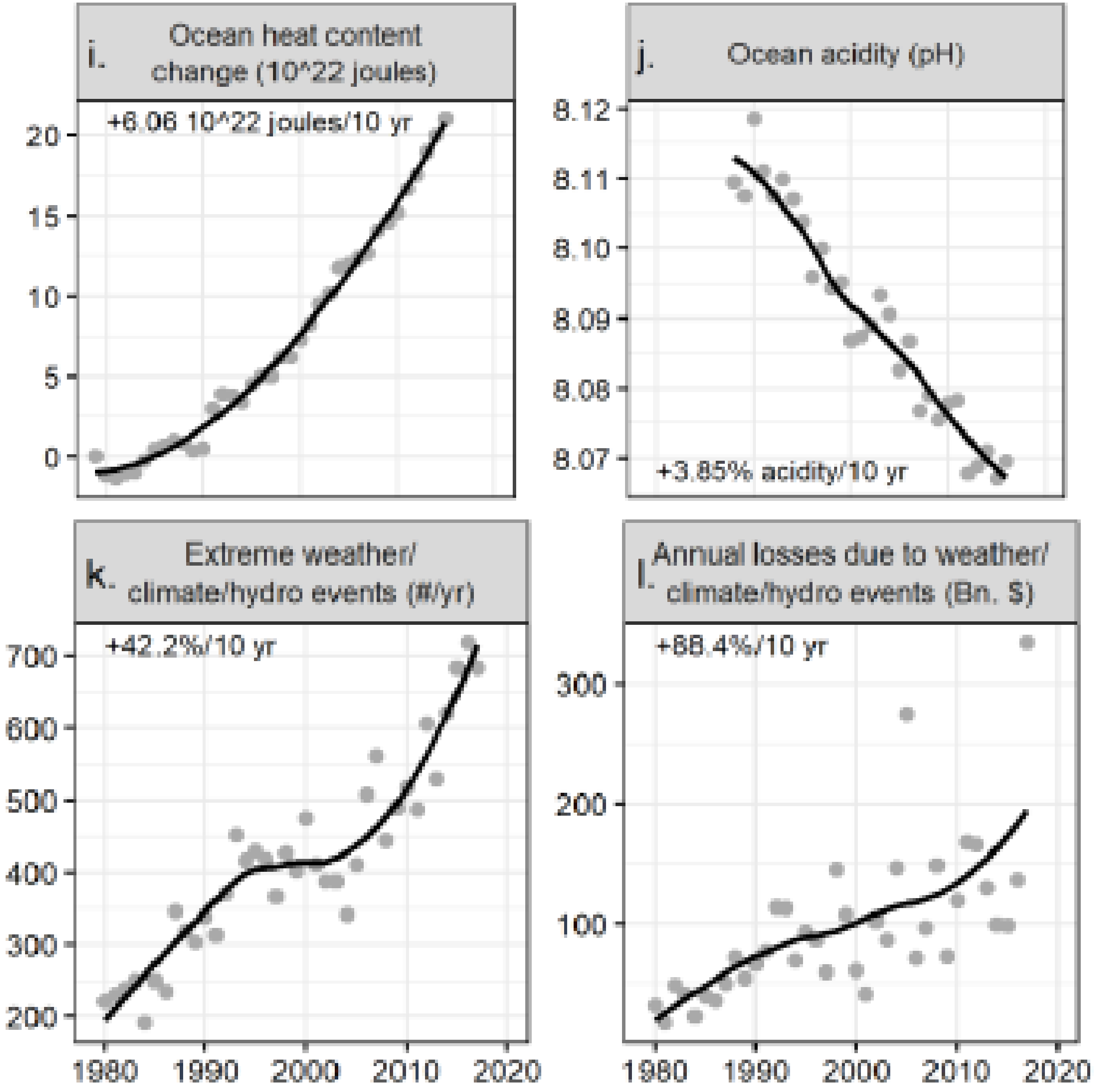
Eg. see: Babcock et al. (2019) Severe Continental-Scale Impacts of Climate Change Are Happening Now: Extreme Climate Events Impact Marine Habitat Forming Communities Along 45% of Australia’s Coast. *Front. Mar. Sci.* https://doi.org/10.3389/fmars.2019.00411

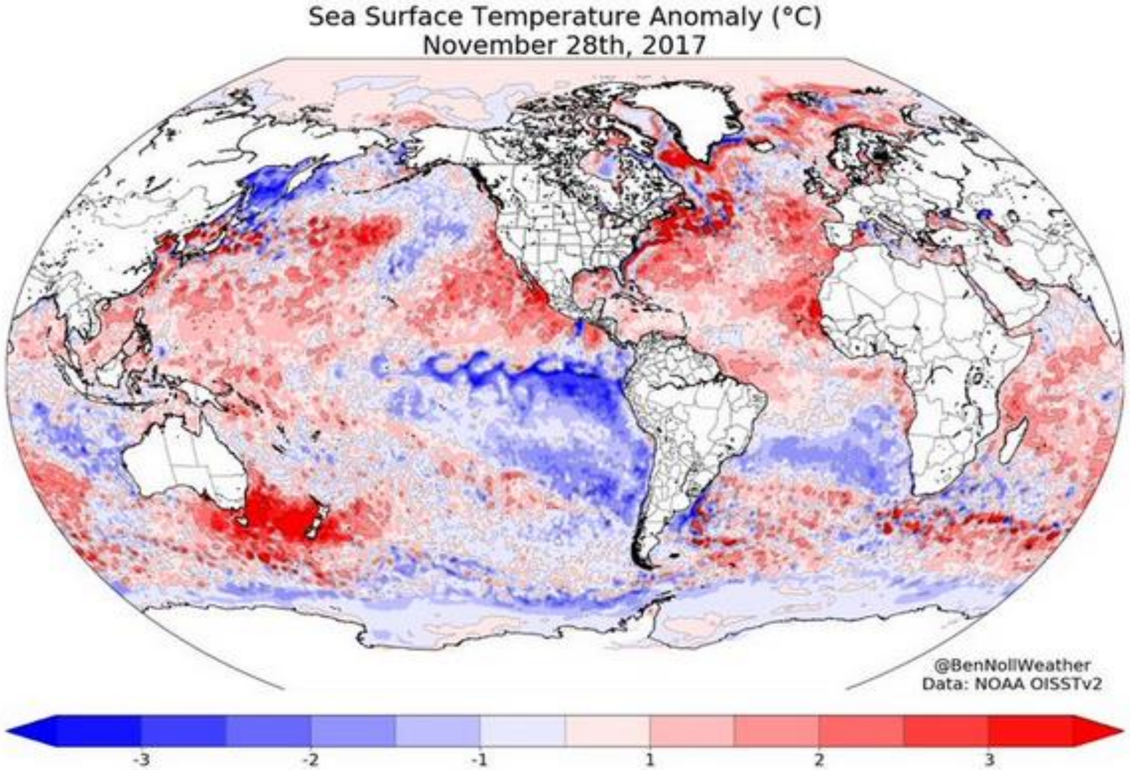




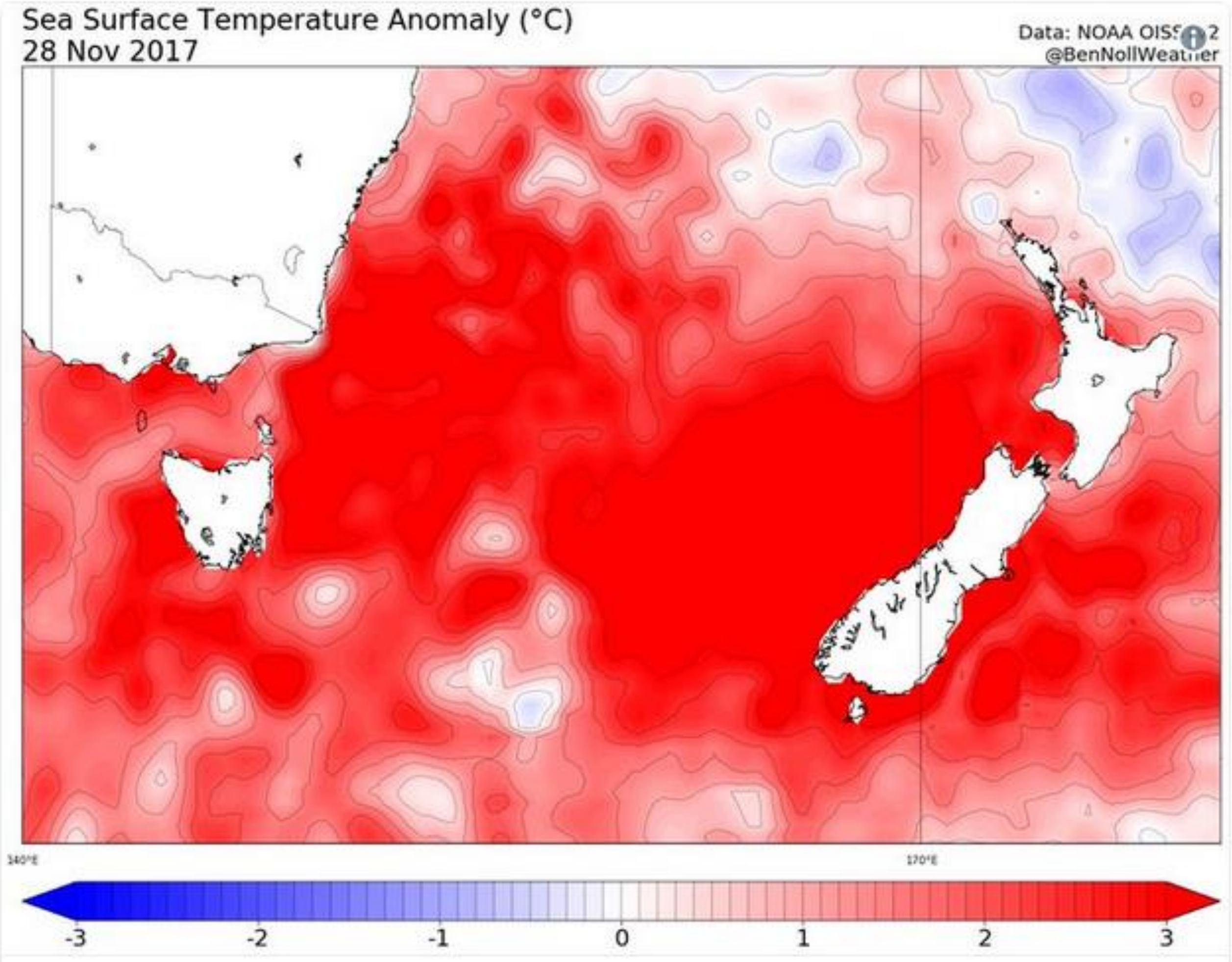
Ripple et al. (2019) **World Scientists' Warning of a Climate Emergency.** *Bioscience.* doi.org/10.1093/biosci/biz088

Figure 2. Climatic response time series from 1979 to the present. Rates shown in panels are the decadal change rates for the entire ranges of the time series. These rates are in percentage terms, except for the interval variables (d, f, g, h, i, m), where additive changes are reported instead. For ocean acidity (pH), the percentage rate is based on the change in hydrogen ion activity, a_{H^+} (where lower pH values represent greater acidity). Annual data are shown using gray points. Black lines are local regression smooth trend lines. Sources and additional details about each variable are provided in supplemental file S2.

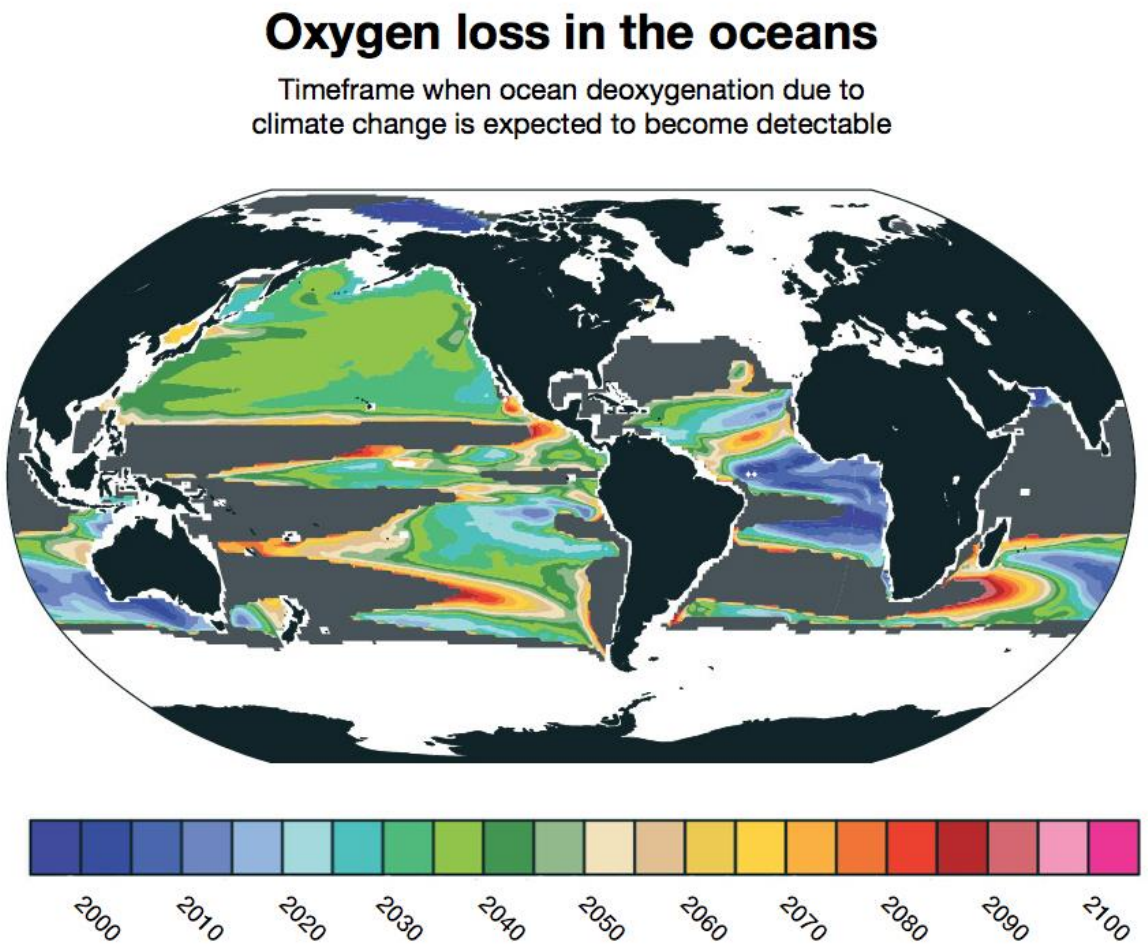




NZ EEZ temperature 'snapshot' 28th Nov. 2017



Record-breaking sea temps have cascading effects on food webs (eg. 'drastic reduction in krill biomass'). Johnson et al. (2011) Climate change cascades: Shifts in oceanography, species' ranges and subtidal marine community dynamics in eastern Tasmania. JEMBE doi:10.1016/j.jembe.2011.02.032



Oceans already showing Oxygen loss – direct ‘cumulative effect’ on ecosystems and indirect effect on threatened species via trophic cascades.

High-precision O_2 measurements dating to 1991 suggest that ocean warming is at the high end of previous estimates.

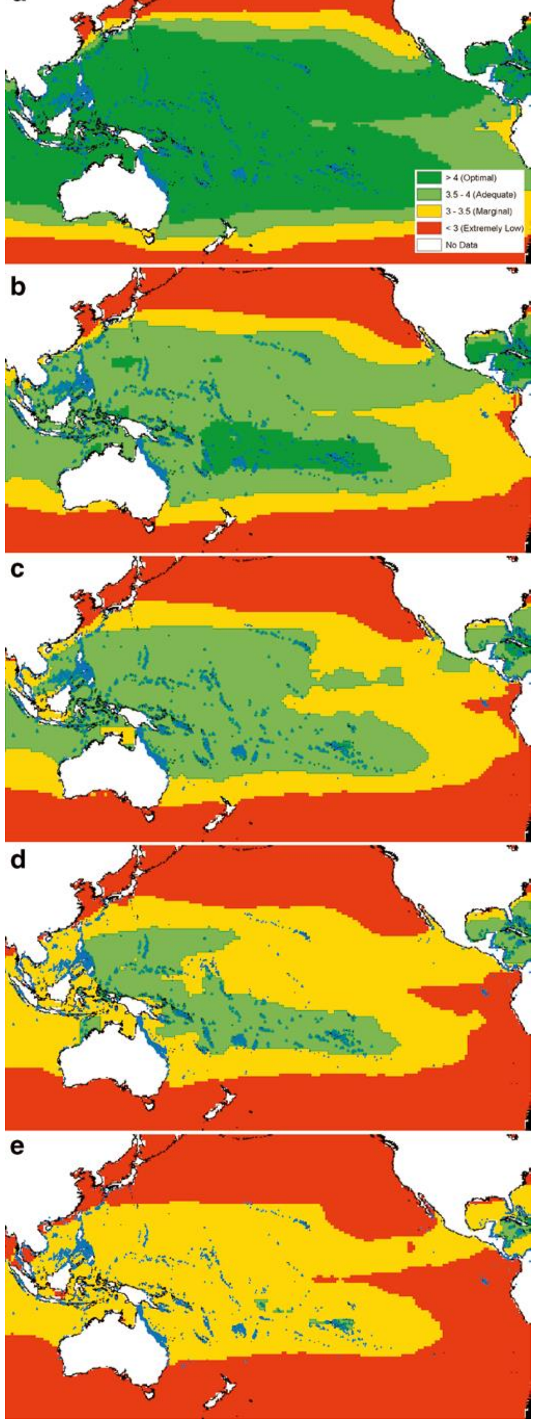
Deoxygenation is already detectable - will likely become widespread by 2040.

Long et al. (2016) Finding forced trends in oceanic oxygen. *Global Biogeochemical Cycles* 30: 381-397.
Ito et al. (2017) Upper Ocean O2 trends: 1958-2015. *Geophysical Research Letters* DOI: 10.1002/2017GL073613
Resplandy et al. (2018) Quantification of ocean heat uptake from changes in atmospheric O2 and CO2 composition. *Nature* 563: 105-107
Clarkson et al. (2018) Uranium isotope evidence for two episodes of deoxygenation during Oceanic Anoxic Event 2. *PNAS* 115: 2918-2923
Bartlett et al. (2018) Abrupt global-ocean anoxia during the Late Ordovician–early Silurian detected using uranium isotopes of marine carbonates. *PNAS* 115: 5896-5901

Ocean acidification

- rapidly changing the carbonate system of the oceans. Past mass extinction events have been linked to ocean acidification, and the current rate of change in seawater chemistry is unprecedented. Evidence suggests that these changes will have significant consequences for marine taxa, particularly those that build skeletons, shells, and tests of biogenic calcium carbonate.

High latitude reefs become extremely marginal (W_{arag} <3.0) by 2069 (Fig. 2e).



Aragonite saturation state

a. Calculated pre-industrial (1870) values; pCO_2=280 ppmv.

b. Projected values, 2000–2009; pCO_2=375 ppmv.

c. Projected values, 2020–2029; pCO_2=415 ppmv.

d. Projected values, 2040–2049; pCO_2= 465 ppmv.

e. Projected values, 2060–2069; pCO_2=517 ppmv.

Sources: Guinotte et al. 2003. *Coral Reefs* 22: 551-58; Guinotte & Fabri 2008. Ann. N.Y. Acad. Sci. 1134: 320–342 (2008).C©2008 New York Academy of Sciences. doi: 10.1196/annals.1439.01

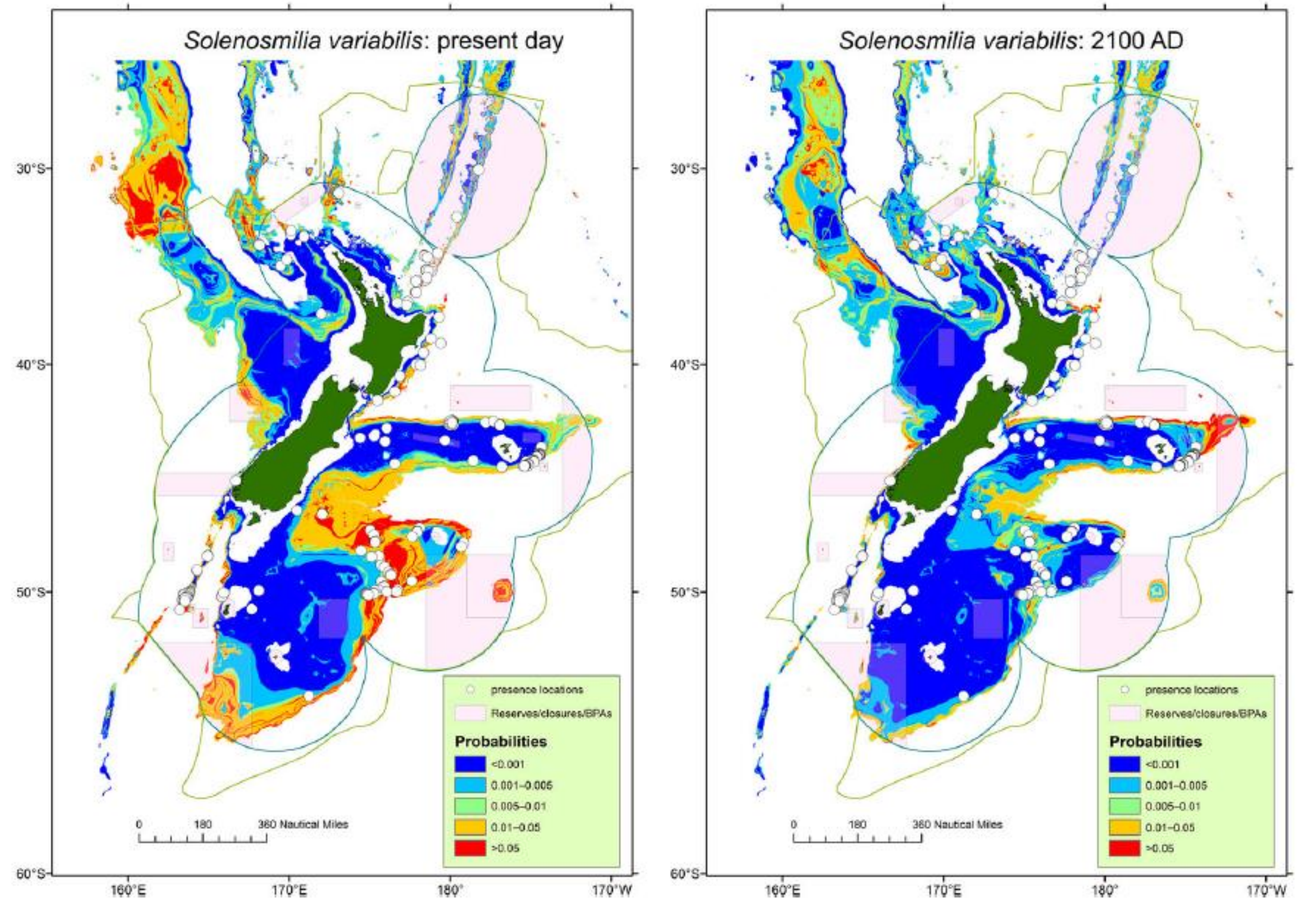


Figure 6. Habitat suitability maps for *S. variabilis* based upon present-day distribution from bottom tow data (left panel), and projected future distribution derived using an ESM (right panel, Anderson et al. 2016).

Law et al. (2017): ‘From a broad survey of New Zealand cold-water coral species and carbonate saturation, Tracey et al. (2013) identified a strong dependency of coral distribution on ΩA and ΩC. …. A general decline in suitable habitat was identified for *S. variabilis* in most regions by 2100 …’

Law et al. (2017) Ocean acidification in New Zealand waters: trends and impacts, New Zealand Journal of Marine and Freshwater Research. http://dx.doi.org/10.1080/00288330.2017.1374983

It’s not just corals, it’s across food web. BUT sig. data gaps

Table 3. Qualitative assessment of a) the vulnerability, and b) the current state of knowledge of different aspects of OA research for the major biotic groups in New Zealand waters, based upon publications cited in the respective sections in the text and detailed in Supplementary Table 1. Vulnerability is classified on a Low to High scale, with “?” indicating where vulnerability is currently unknown. Current knowledge is also classified on a Low to High scale, and based upon the number and results of published studies (see key), with “-“ indicating that no studies have been carried out. Ongoing New Zealand studies are indicated by “+”, with those in the CARIM project indicated by “*”.

From: Law et al. (2017)

	Heterotrophs	Primary Producers		Primary and Secondary Consumers						Tertiary Consumers	Higher Trophic
	Bacteria	Phytoplankton	Macroalgae	Bryozoa	Sponges	Cold Water Corals	Crustacea	Molluscs	Echinoderms	Fish	Cetaceans, pinnepids, seabirds
a) Vulnerability to OA in NZ waters	**Low**	**Low-Med**	**Low-Med**	**?**	**?**	**Medium**	**?**	**Med-High**	**Med-High**	**?**	**?**
b) Current knowledge in NZ waters											
Established Response to OA	Medium*+	Medium*	Med-High	-	Low	Low-Med	-	Medium*	Medium+	Low-Med*	-
Mechanistic understanding of response	Low-Med	Low-Med	Medium	-	Low	Low	-	Low-Med*	Low-Med+	Low	-
Indirect/Ecosystem interaction	Medium*+	Low-Med*	Medium*	Low	Low	Low	-	Low	Low-Med	-	-
Interaction with other stressors	Low-Med*+	Med-High*	Medium	Low	Low	Low	-	Medium	Medium+	-	-
Socio-economic/Ecosystem services	Low	Low-Med	Low-Med	Low	-	Low	-	Medium	Low-Med		-
Adaptive capacity	-	-	-	-	-	-	-	-	Low	-	-

Low	single study low confidence	Low-Med	1-2 studies low-medium confidence
Medium	2-3 studies medium confidence	Med-High	4+ studies medium-high confidence

Cumulative Effects – negligible?

This all begs the obvious question:

How many ‘minor or negligible effects’ does it take to make a moderate or major impact?

Or:

How many industrial activities can be squeezed into NZ coastal zone and EEZ with ‘minor or negligible effect’ in a rapidly changing oceanographic regime?

‘Having cakes and eating them’ comes to mind.