

Indicators, Expert Surveys, and the LEO Network

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Taking Stock:



Climate Change Impacts and Vulnerabilities in Canada's Pacific Marine Ecosystems

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Rev Fish Biol Fisheries (2014) 24:519–559
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RESEARCH PAPER

Effects of climate change on Canada's Pacific marine ecosystems: a summary of scientific knowledge

Thomas A. Okey · Hussein M. Alidina ·
Veronica Lo · Sabine Jessen

Ocean & Coastal Management 106 (2015) 35–48



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Mapping ecological vulnerability to recent climate change in Canada's Pacific marine ecosystems



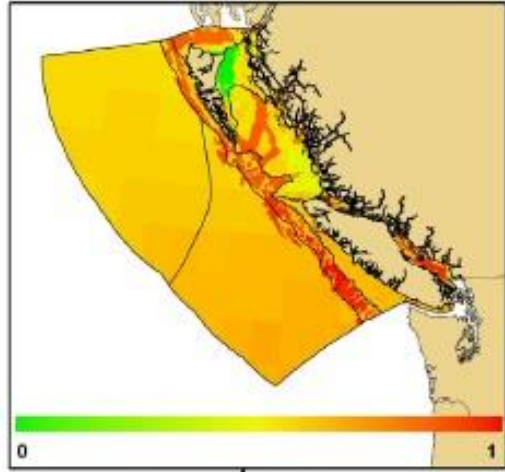
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^a School of Environmental Studies, University of Victoria, PO Box 1700, STN CSC, Victoria, BC V8W 2Y2, Canada

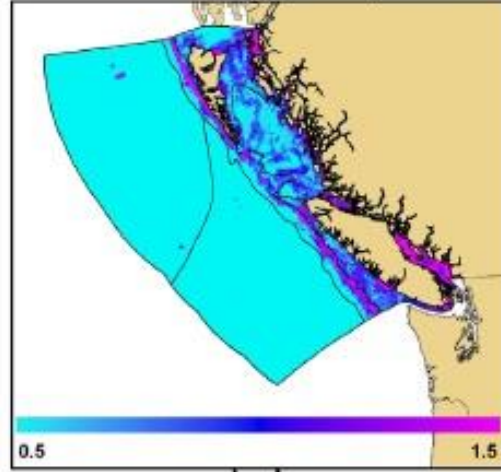
^b Ocean Integrity Research, C-70 Pilot Street, Victoria, BC V8V 2A4, Canada

^c WWF-Canada, 409 Granville Street, Suite 1588, Vancouver, BC V6C 1T2, Canada

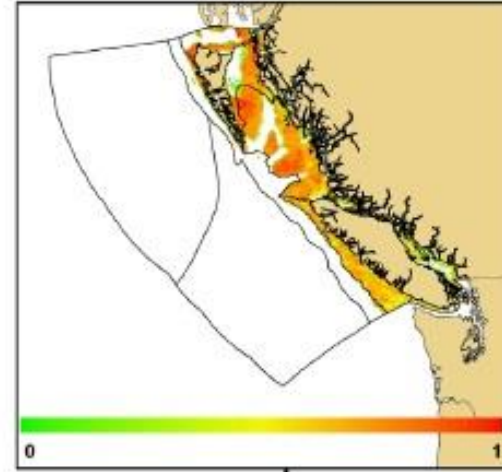
Potential Impact of
Acidification on Habitats



0.5 + Cumulative Human Impacts



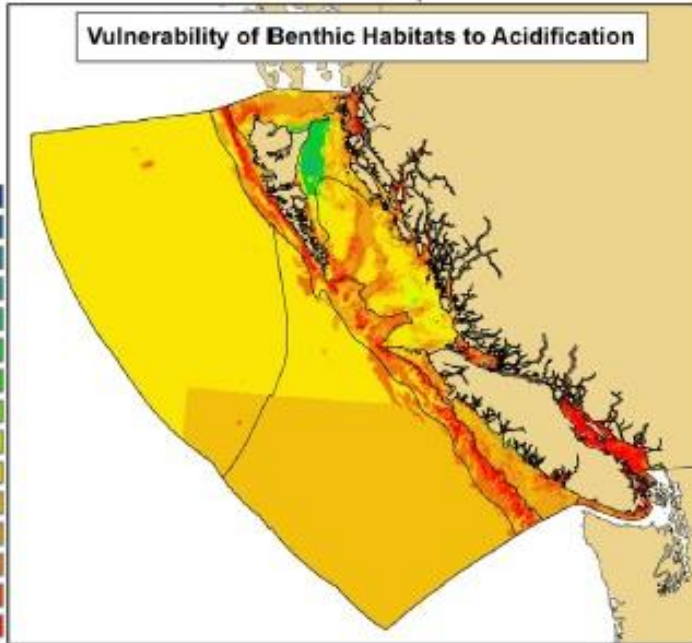
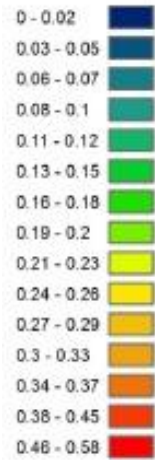
Potential Impact of Temperature
Change on Habitats



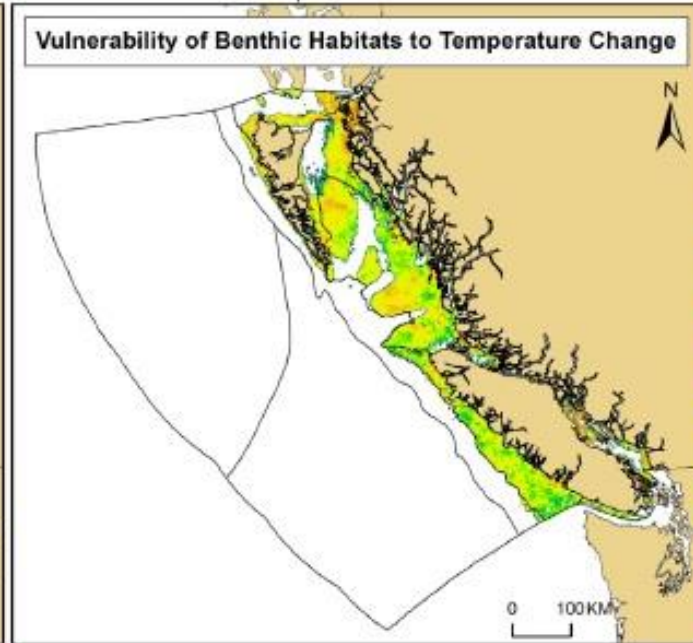
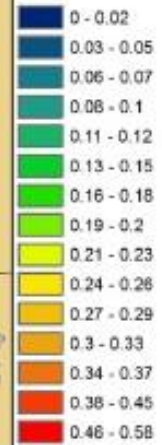
MULTIPLY

MULTIPLY

Vulnerability of Benthic Habitats to Acidification

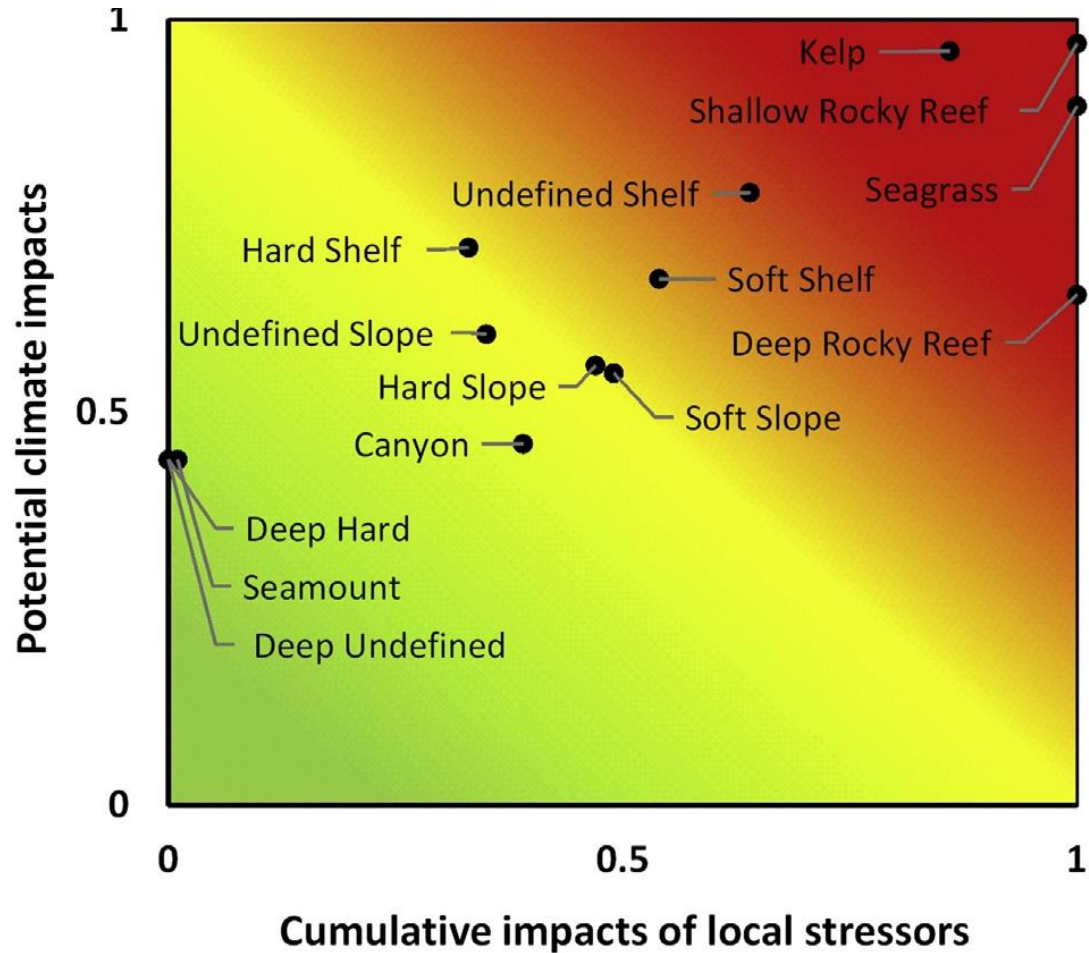


Vulnerability of Benthic Habitats to Temperature Change

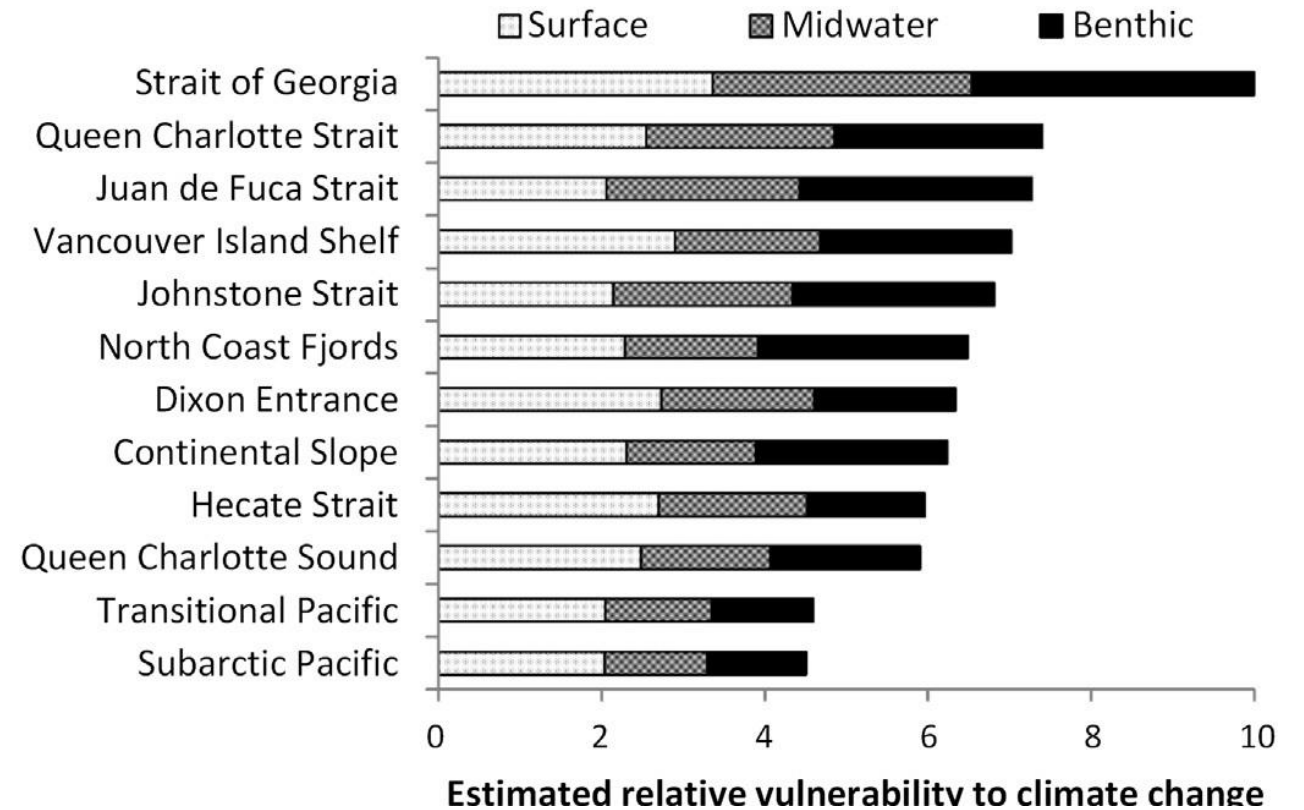


Vulnerability to Climate Change

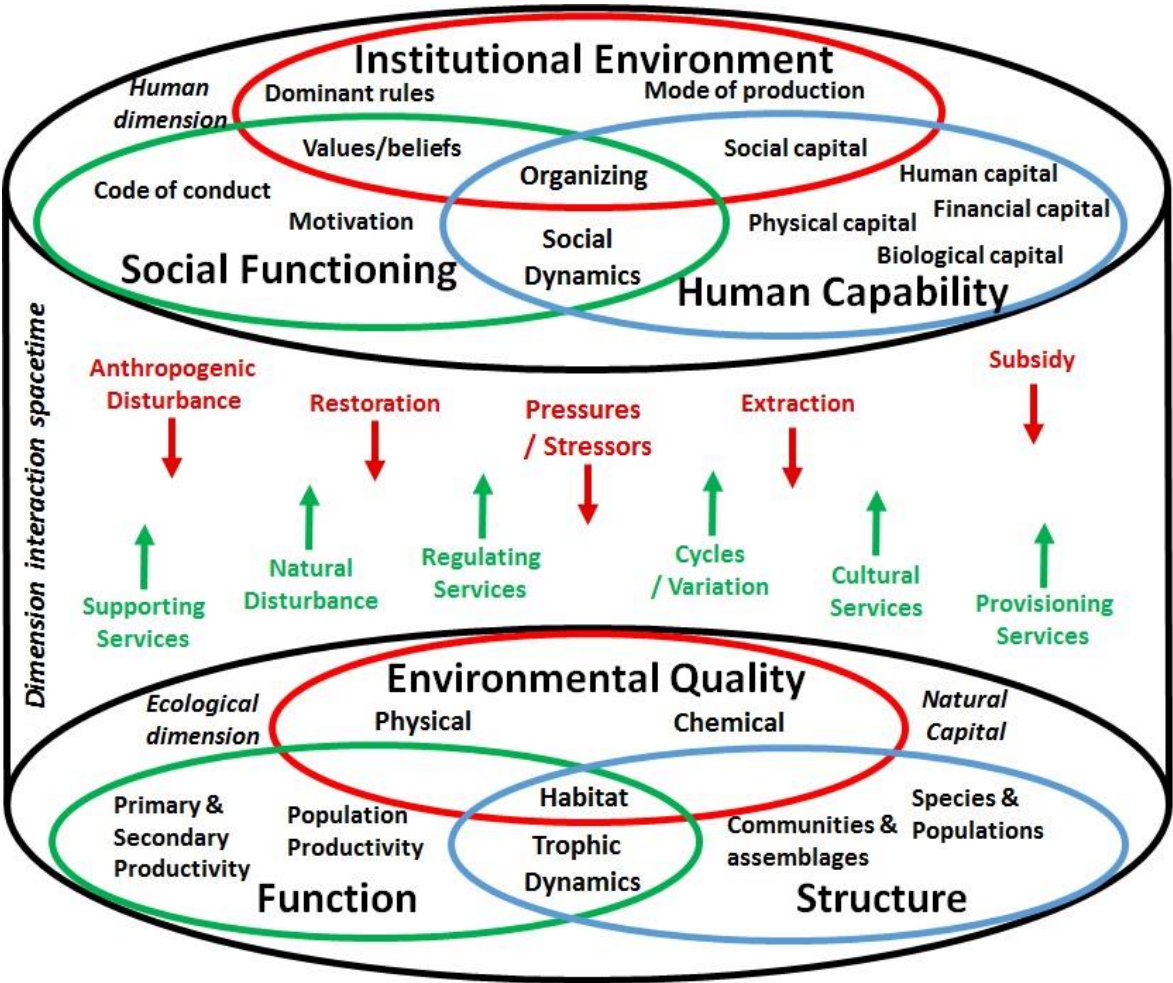
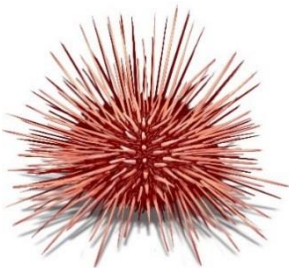
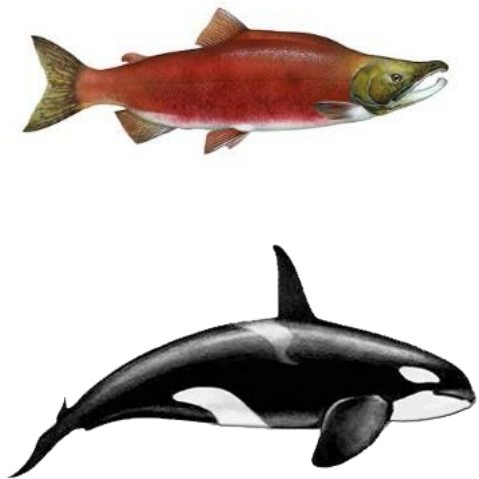
Habitats



Ecosections



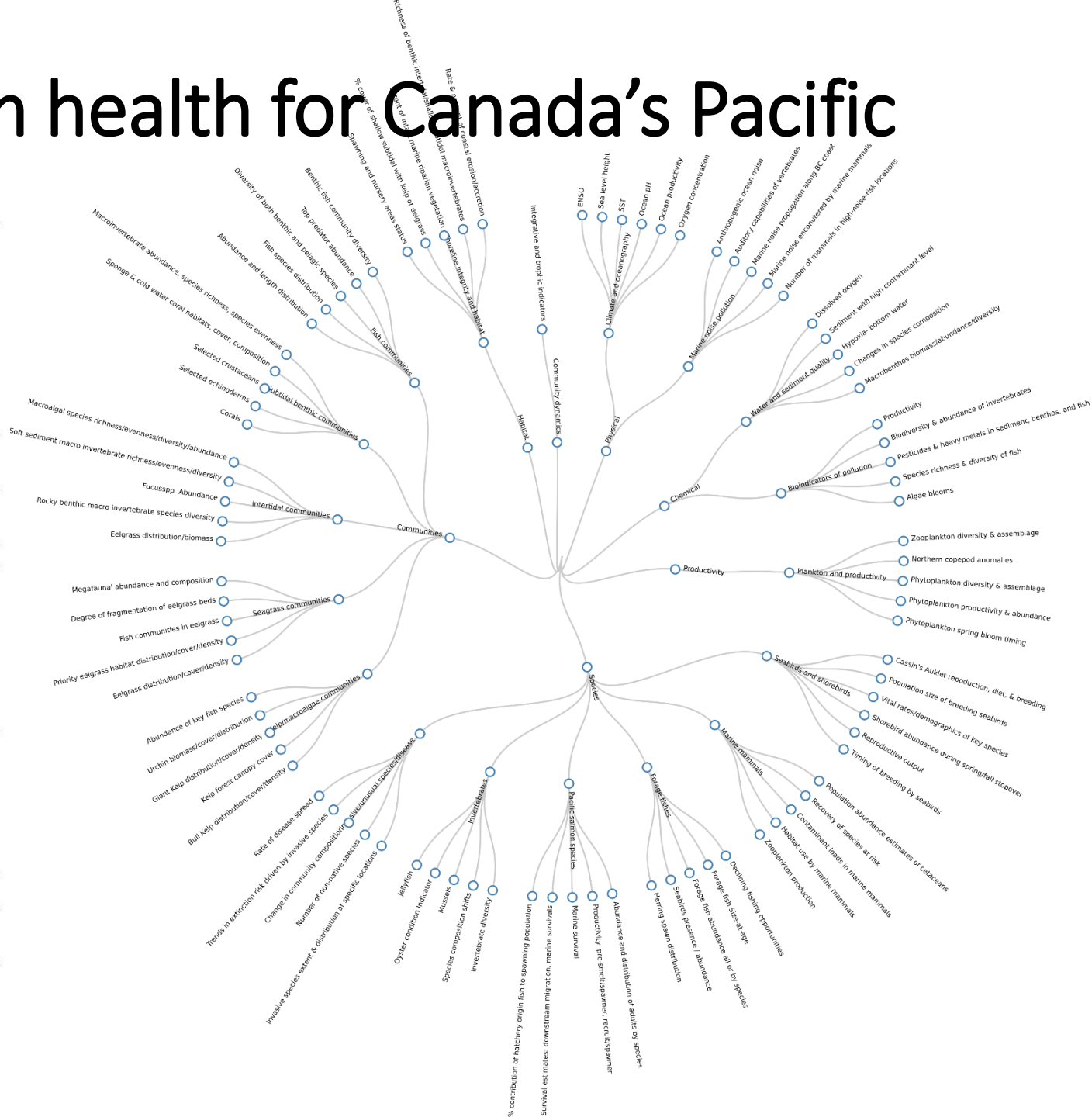
Identifying Indicators using the Drum of Health



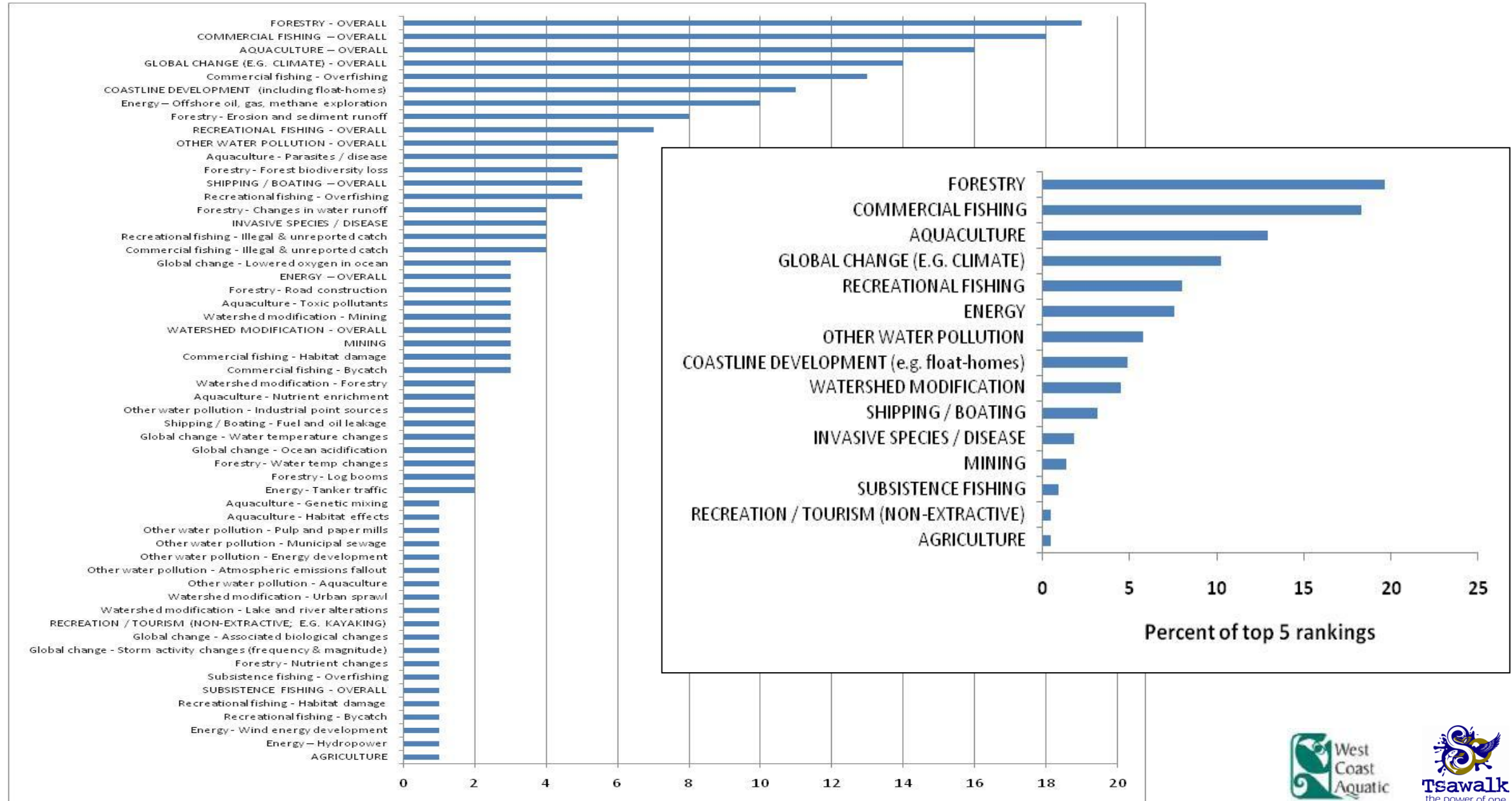
Modified from the ESSIM Framework

Indicators of ecosystem health for Canada's Pacific

Element	Feature	Aspect			Comm. dynamics
		Env. quality	Structure	Functions	
Physical	1. Climate and oceanography	Y		Y	
	2. Marine noise pollution	Y		Y	
Chemical	3. Water and sediment quality	Y		Y	
	4. <u>Bioindicators</u> of pollution	Y	Y	Y	Y
Productivity	5. Plankton and productivity		Y	Y	Y
Species / Populations / Population Productivity	6. Seabirds and shorebirds		Y	Y	Y
	7. Marine mammals		Y	Y	Y
	8. Forage fishes		Y	Y	Y
	9. Pacific salmon species		Y	Y	Y
	10. Invertebrates		Y	Y	Y
Communities / Assemblages	11. Invasive / unusual species / disease	Y	Y	Y	Y
	12. Kelp / <u>macroalgae</u> communities	Y	Y	Y	Y
	13. Seagrass communities	Y	Y	Y	Y
	14. Intertidal communities	Y	Y	Y	Y
	15. Subtidal benthic communities	Y	Y	Y	Y
	16. Fish communities		Y	Y	Y
Habitat	17. Shoreline integrity and habitat	Y		Y	
Community dynamics	Integrative and trophic indicators		Y	Y	Y



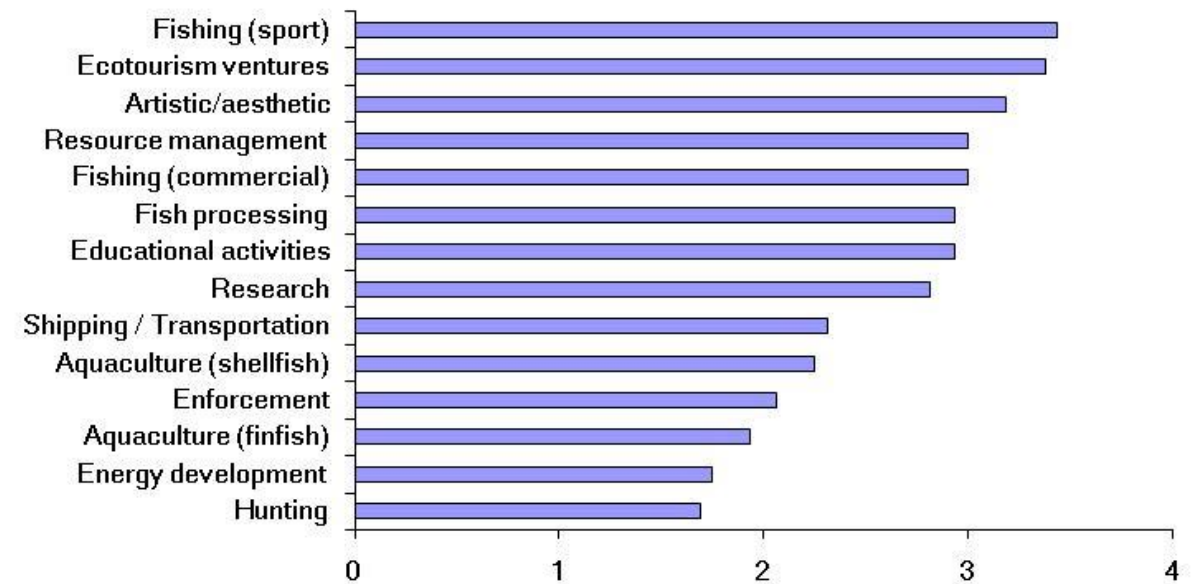
Expert knowledge: Frequency of marine stressors ranked as top five



Prioritizing management strategies




Perceived value of income-related activities



The Local Environmental Observer (LEO) Network

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Mountain Lion in Interior Alaska

Jul 01, 2008


search observations




River Watch
Mar 31, 2016
Anchorage, Alaska, USA



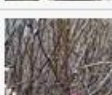
Beaver (*Castor canadensis*) activity near community
Mar 30, 2016
Chignik Lake, Alaska, United States




March Rainbow
Mar 29, 2016
Anchorage, Alaska, USA



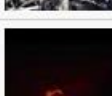
Chickadee (*Poecile atricapillus*) with Elongated Bill
Mar 29, 2016
Anchorage, Alaska, USA




Salmonberry (*Rubus spectabilis*) bloomers
Mar 29, 2016
Nanwalek, Alaska, USA




Dead Birds on Spit Beach
Mar 28, 2016
Sand Point, Alaska, United States




Volcano Spewing Ash and Lava
Mar 28, 2016



First mosquito (*Culicidae*) of spring
Mar 25, 2016
Palmer, Alaska, United States




Dandelions (*Taraxacum*) in Bloom
Mar 25, 2016



ALASKA NATIVE
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