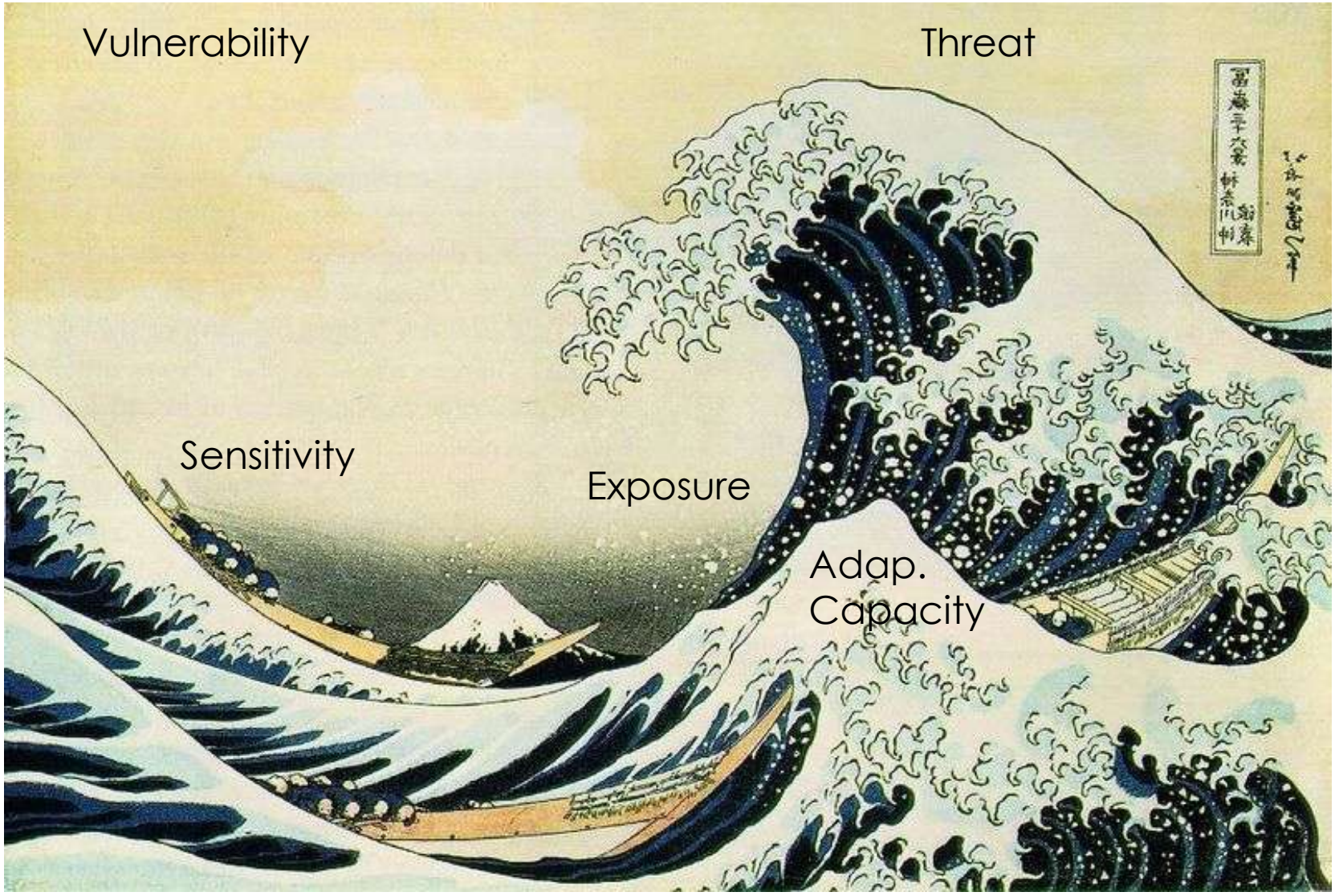
Vulnerability to CC in Chilean Aquaculture and Fisheries: results and findings

Exequiel González Poblete
School of Marine Sciences
Pontificia Universidad Catolica de Valparaiso
exequiel.gonzalez@ucv.cl

Context and content

- National strategy on Climate change
  - Adaptive capacity to CC effects/impacts
  - To analyze options to mitigate Chile's green house effect emissions
  - To create and promote adaptive capacities to CC
- Undersecretariat for Fisheries and Aquaculture (USFA) and FAO
  - Evaluating CC potential impacts and vulnerability of Fisheries and Aquaculture (Quiñones et al. 2011, González et al. 2011)
  - Proposal for a methodological approach and action plan to cope with impacts of CC on the Chilean fisheries and aquaculture (Cubillos et al., 2012).
  - The Ministry of the Environment
  - USFA-FAO, PIF (draft PPG)

Approach to undertanding vulnerability



Source: L. Cubillos et al. (2011) based on Hokusai (1830)

Aquaculture vulnerability to CC

Method and Data: Allison et al. 2009

- Exposure (-)
- Sensitivity (-)
- Adaptive Capacity (+)

Potential Impact (-)

Vulnerability

$$V = E + S - AC$$

- Scenarios (IPCC 2000): A2 current trends, B2 optimistic trends
- Data:
  - T°, Salinity, wind, Sea water level (U. of Chile)
  - Aquaculture relative importance to national sector economy and exports
  - Worldwide relative importance of national economy
  - Life expentancy, Education, Governance

Results

$$V = \frac{1}{3}E + \frac{1}{3}S + \frac{1}{3}(1 - AC)$$

			Tipo de Acuicultura				
Escenarios	**Factores**	**Peso**	**Gracilaria**	**Salmónidos**	**Chorito**	**Ostión Norte**	**Nacional**
A2	Exposición	1/3	0.325	0.295	0.299	0.453	0.298
	Sensibilidad	1/3	0.002	0.140	0.006	0.002	0.150
	Capacidad Adaptación	1/3	0.672				
	Vulnerabilidad		**0.218**	**0.254**	**0.211**	**0.261**	**0.258**
B2	Exposición	1/3	0.221	0.202	0.202	0.345	0.204
	Sensibilidad	1/3	0.002	0.140	0.006	0.002	0.150
	Capacidad Adaptación	1/3	0.672				
	Vulnerabilidad		**0.184**	**0.223**	**0.179**	**0.225**	**0.227**

Source: Gonzalez et al. (2011)

Fisheries Vulnerability to CC

Adaptive capacity Jack Mackerel Fisheries

- Based on the 1997-2002 Chilean Jack Mackerel fisheries crisis:
  - Assessment of socio-economic characteristics of workers in the processing sector (fishmeal and fishfood), large scale fleet crews and crews from the artisanal anchovy and common sardine fishing fleet
  - Assessment of adaptive social responses to the crisis from: government and parliament, industry owners, processing plan workers, large scale fishing fleet crew and artisanal fishing fleet crew.
- There is a relevant adaptive capacity to changes in biomass levels in the pelagic central-south fishery of Chile.
- Adaptive capacity to CC is directly related to fisheries sustainable management efforts, normally in those with clear signs of overexploitation.

Proposal on Methods estimate fisheries vulnerability to CC

- Based on a Socio-Ecological-Economic System (SEES)
- Considers the component elements of Vulnerability through:

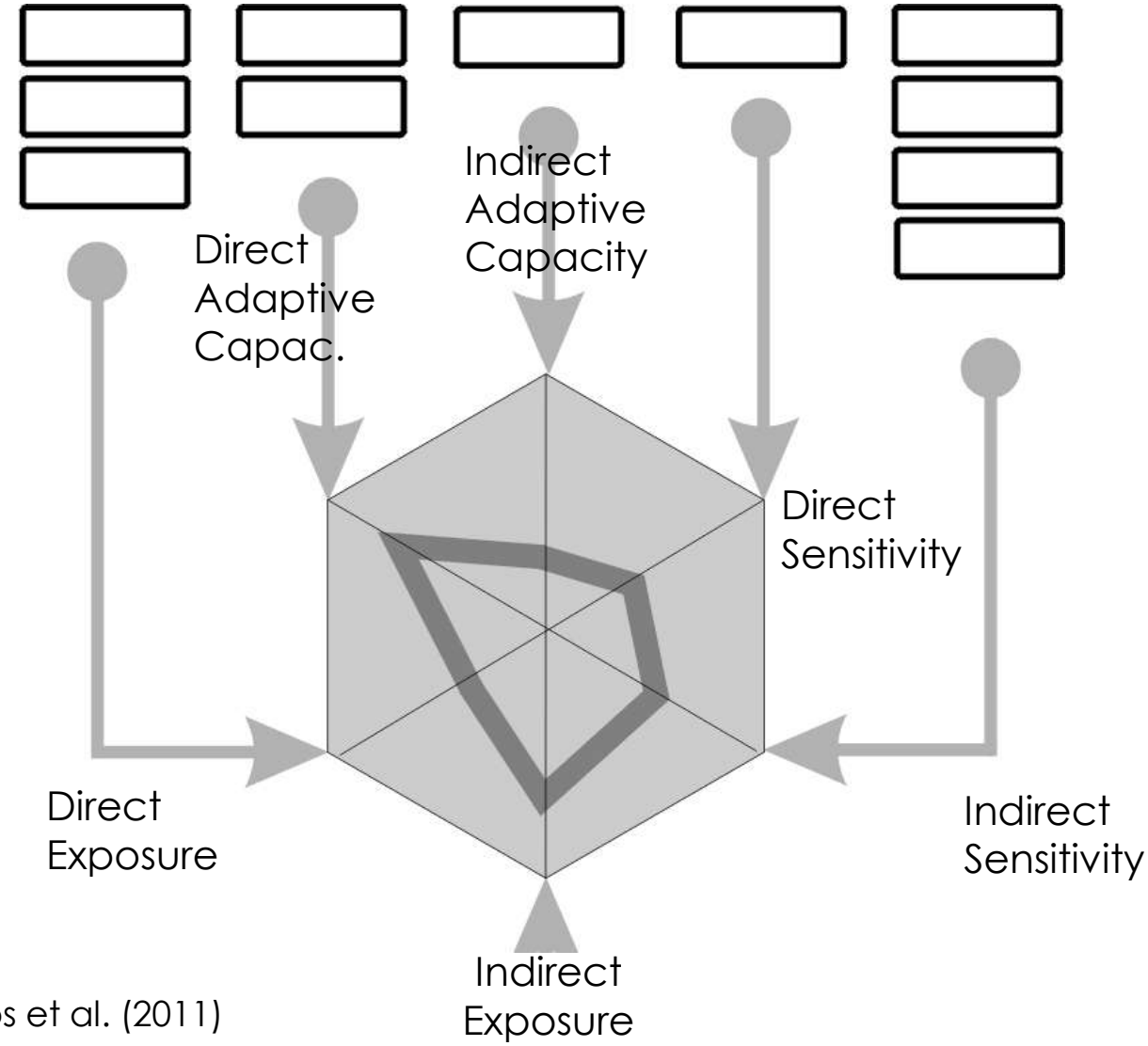
  direct and indirect effects
- Considers vulnerability has effects on five dimensions of the SEES:

  ecological, socio-economic, technological, institutional and ethical
- Considers a quali-quantitative and discrete scale of impacts:

  Null (0), Low (1), Medium (2) and High (3)

Source: L. Cubillos et al. (2011)

Proposal continued..



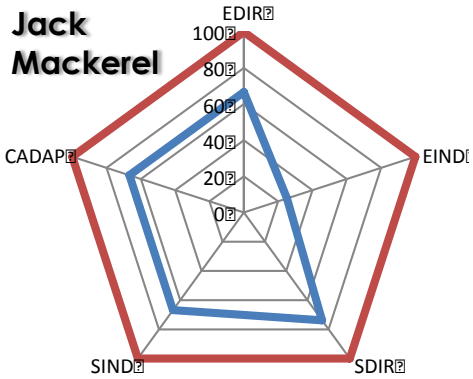
Source: L. Cubillos et al. (2011)

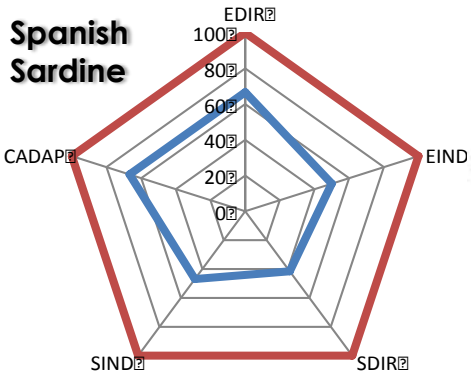
Proposal continued...

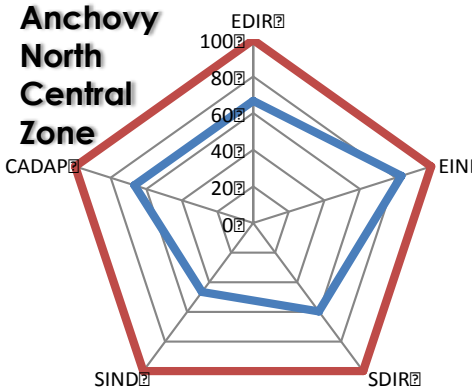
Components	Dimensions	Attributes	Jack Macherel	Spanish Sardine	Anchovy Northern Zone	Anchovy North-Central Zone	Anchovy South-Central Zone	Common Sardine	Swordfish	High	Low
Direct Exposure	Ecological	Wind	2	1	3	3	3	3	3	3	0
	Ecological	SWL	0	1	1	1	1	1	0	3	0
	Ecological	T°	1	0	2	2	2	1	3	3	0
	Ecological	Acidification	0	1	1	1	1	1	0	3	0
	Ecological	UV light	0	0	1	1	1	1	0	3	0
Indirect Exposure	Ecological	ENSO	2	2	3	3	2	2	3	3	0
	Ecological	Upwelling	0	1	3	3	2	2	1	3	0
	Ecological	Prim. Product.	1	2	3	4	5	6	1	3	0
	Ecological	O_2 min	0	1	3	2	1	1	0	3	0
	Ecological	Zooplankton	2	2	2	2	2	1	0	3	0
Direct Sensitivty	Ecological	Status	3	3	2	1	1	0	2	3	0
	Ecological	Potential Catch	2	2	2	2	1	1	3	3	0
	Socio-economic	Employment	3	2	2	2	2	2	1	3	0
	Socio-economic	Access	2	1	2	2	2	2	3	3	0
	Socio-economic	Catch Value	2	1	1	1	1	1	1	3	0
	Socio-economic	Revenues	2	0	2	2	3	3	3	3	0
Indirect Sensitivity	Socio-economic	CamDistribution	0	2	1	1	2	2	3	3	0
	Socio-economic	Market	1	1	1	1	1	1	2	3	0
	Socio-economic	Processing Infrast.	2	1	2	2	2	2	0	3	0
	Ecological	Pesca Inc	3	1	2	1	1	1	3	3	0
	Socio-economic	Capture Costs	2	2	2	2	2	2	1	3	0
	Socio-economic	Processing Costs	2	2	1	1	1	1	1	3	0
Adaptive Capacity	Socio-economic	Management Quality	2	2	2	2	2	2	1	3	0
	Socio-economic	Crew education	1	1	1	1	1	1	1	3	0
	Socio-economic	Quality of Life	2	2	2	2	2	2	2	3	0
	Technological	Infrastructure	3	3	3	3	3	3	2	3	0
	Technological	Connectivity	3	3	3	3	3	3	2	3	0
	Ethical	Illegal harvest	1	0	2	1	1	1	1	3	0
	Institutional	Enforcement	2	2	2	2	2	2	2	3	0
	Institutional	Monitoring	2	2	2	2	2	2	1	3	0
	Institutional	Certification	2	2	2	2	2	2	1	3	0
	Institutional	Industrial Fleet	3	2	2	2	2	2	1	3	0
	Technological	Selectivity	2	1	1	1	1	1	2	3	0

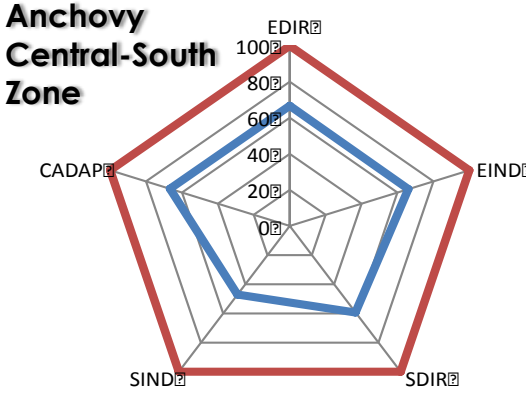
Source: L. Cubillos et al. (2011)

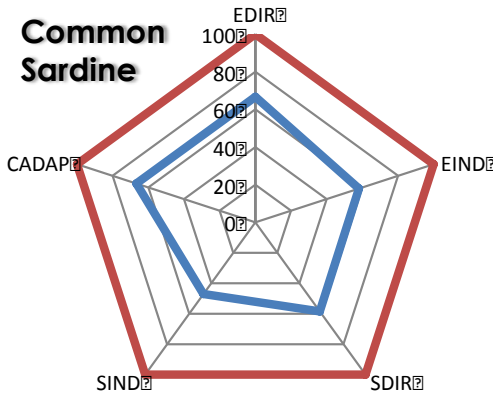
Proposal continued....

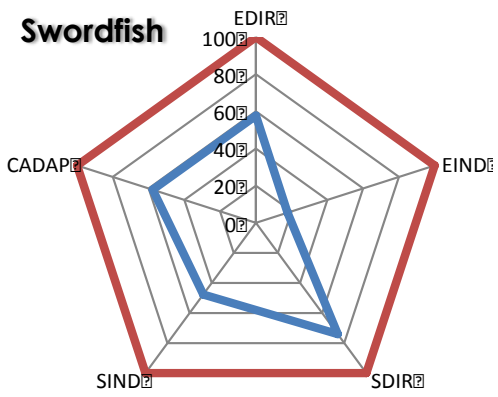








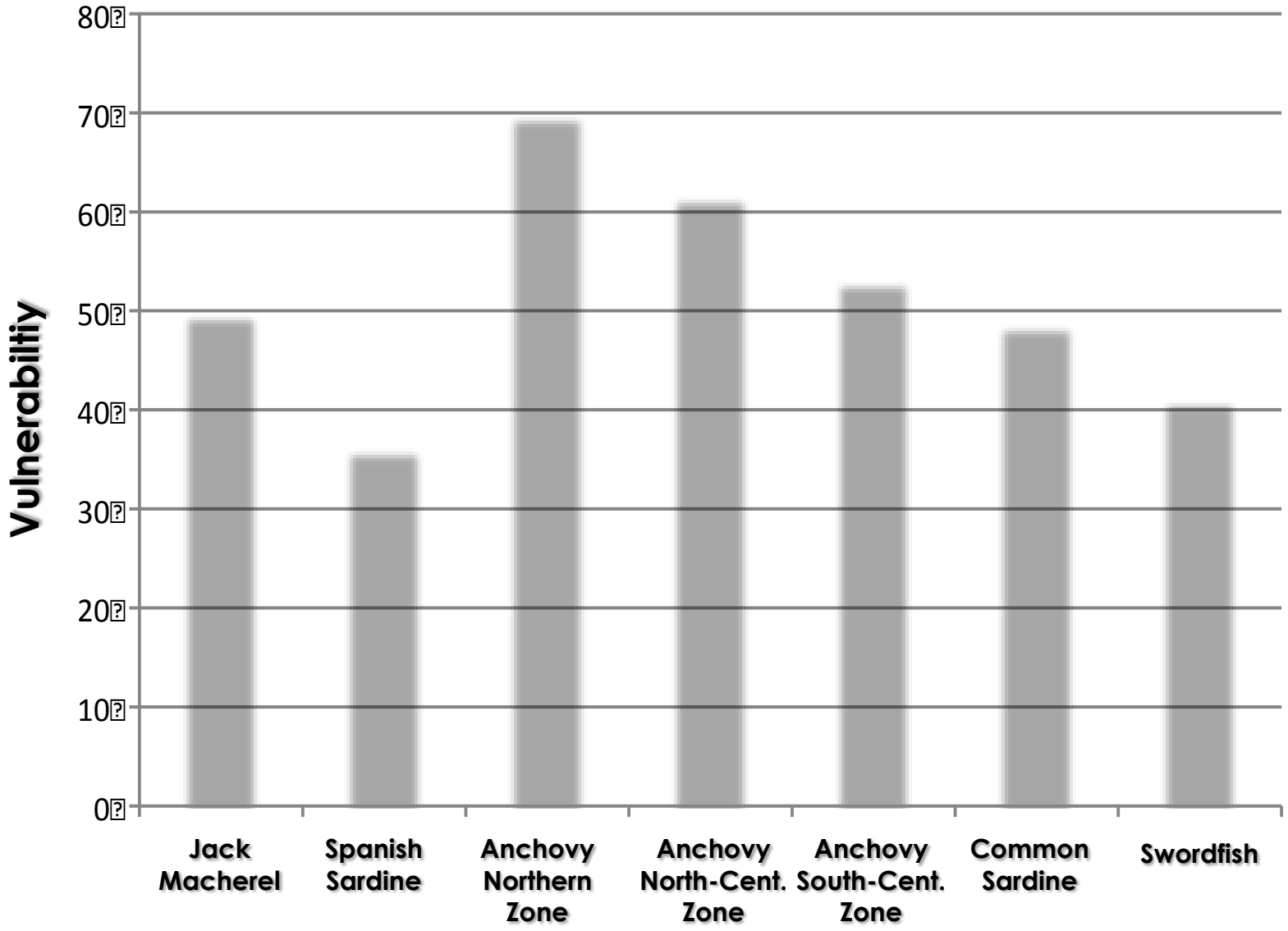




Direct Exposure (EDIR), Indirect Exposure (EIND), Direct Sensitivity (SDIR), Indirect Sensitivity (SIND), Adaptive Capacity (CADAP)

Source: L. Cubillos et al. (2011)

Proposal continued.....

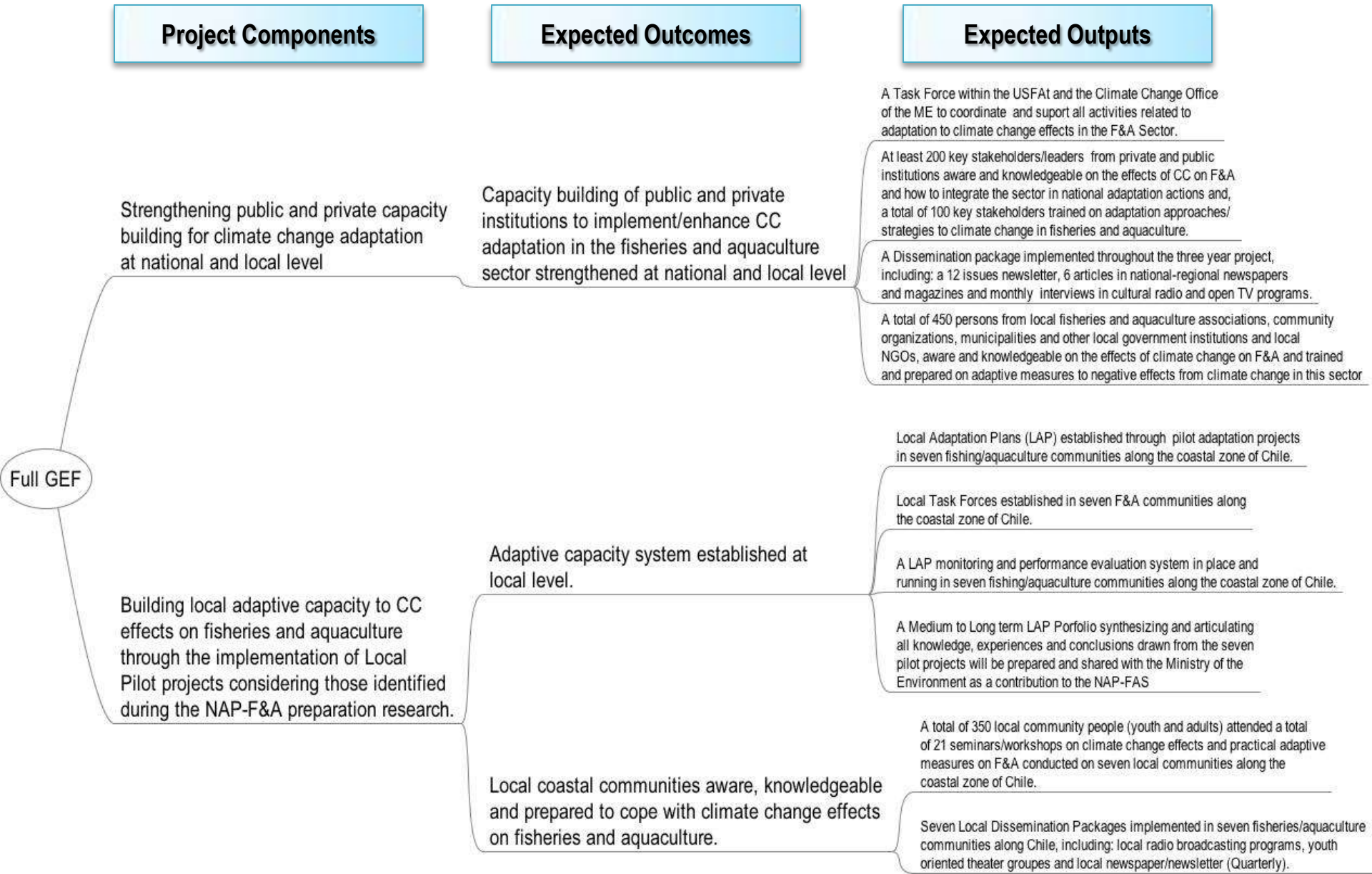


Source: L. Cubillos et al. (2011)

Strenghtening Adaptive Capacity F&A

Steps towards AC

Steps towards AC (future)



Lessons learnt

- Problem perception / threats:
  - Scarce knowledge on the CC process among F&A stakeholders in Chile.
  - Stakeholder prioritize on short-term concrete events (i.e. Contingency)
  - Difficult to establish the urgency/importance of AC to CC
- Even though there is an CC Office in the ME, there are insufficient capacities to “install” the CC issue among the most vulnerable sectors.

Lessons learnt continued...

- In spite of recent efforts to incorporate and integrate the CC variable in F&A Management, it is essencial to strenghten the public institutions capable to implement Adaptation Plans, specially at local level.
  - Ad hoc formal institution required: identifiable, permanent, visible, sufficient human and financial resources
  - To integrate CC variable in sectoral policies, regulations, research and monitoring.

Lessons learnt continued...

- Importance of time, spacial and social scales
- Recognize the relevancy and value of past stakeholderexperience in adaptation processes:
  - National: Jack mackerel and common hake fisheries, ISA virus
  - local: migration/relocation of main resources, overexploitation Chilean Abalone (loco) and soft clam (macha).
- A good approach to induce more knowledge and comprehention on CC and its effects is to rescue traditional and historic comunity knowledge, analyze it, sistematize it and present it back at the community from a CC perspective.
- The relevance and value to effectively and efficiently transfer scientific/acdemic knowledge and information to the local communities.

Lessons learnt continued…

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Gracias.....