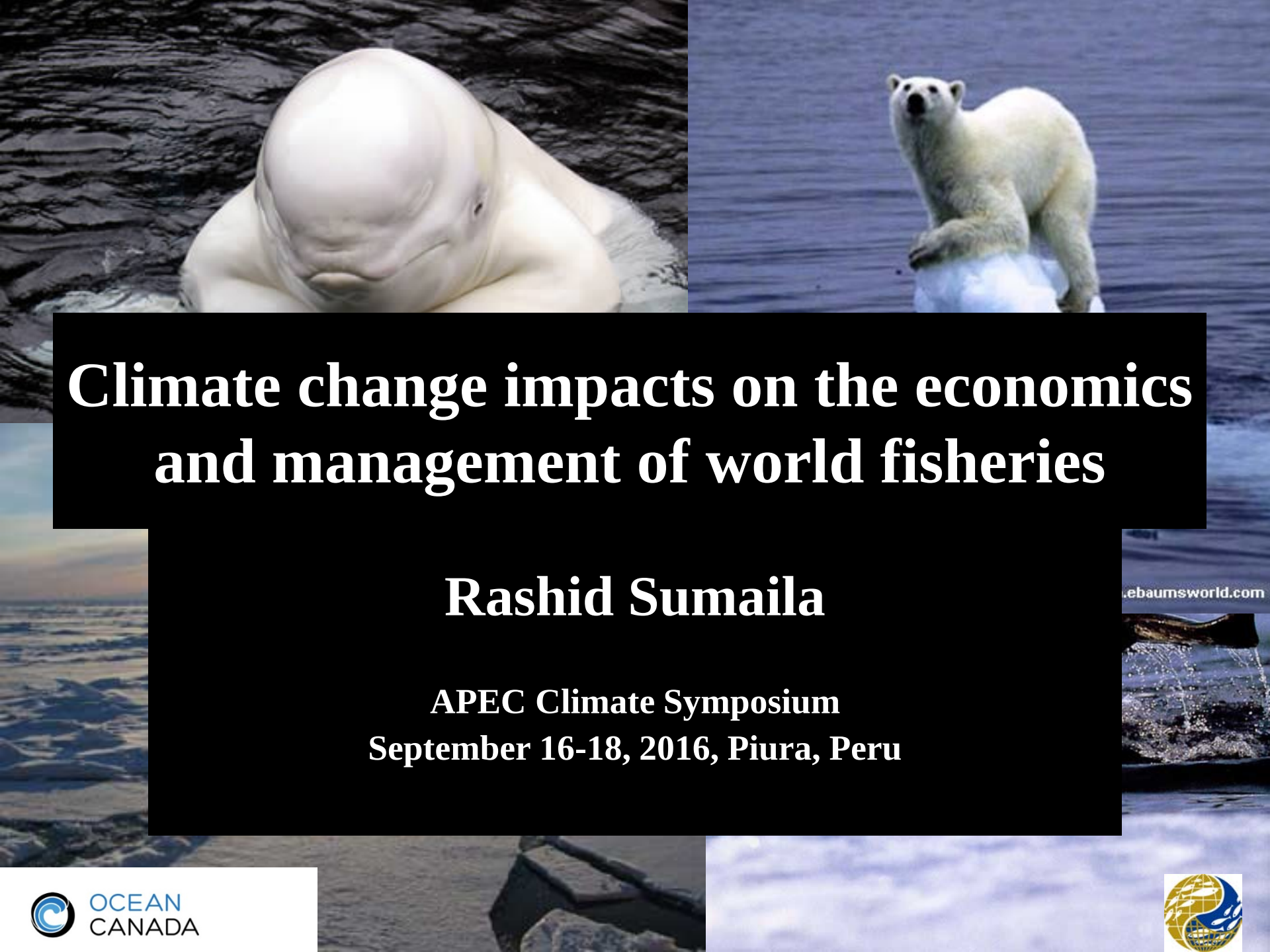


Climate change impacts on the economics and management of world fisheries

Rashid Sumaila

APEC Climate Symposium
September 16-18, 2016, Piura, Peru

OCEAN CANADA

How important are fisheries to us?

- Food and nutritional security;
- Economic security;
- Social service & security;
- Recreational values;
- Cultural and spiritual values;
- Ecosystem function and service.

Climate change impact on marine resources

Physical change in the ocean

- ↑ Sea temperature;
- ↑ acidification;
- Δ ocean current pattern;
- Δ salinity;
- retreat of sea ice;
- ↑ coastal hypoxic & oxygen min. zone;
- ↑ sea level.

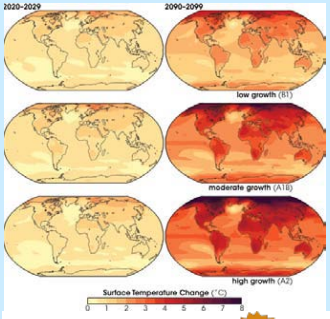
Biological / ecological change in the ocean

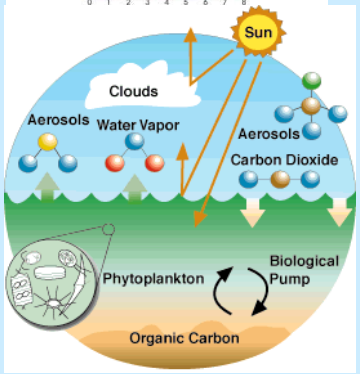
INDIVIDUAL
- Physiology;
- Growth; &
- Body size.

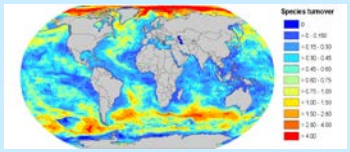
POPULATION
- Distribution;
- Abundance; &
- Recruitment.

COMMUNITY
- Species composition;
- Invasion/extinction.

ECOSYSTEM
- Productivity; &
- Species interaction.







Climate change biophysical impacts

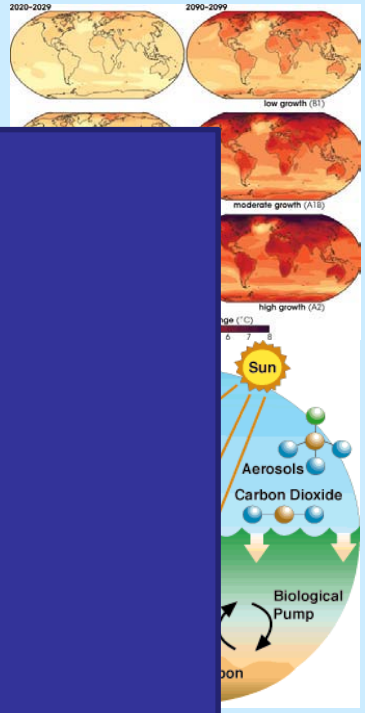
Physical change in

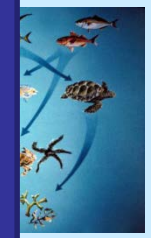
Biological / ecological

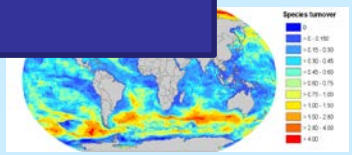
1) the productivity;

2) distribution

of fish biomass in the global ocean.







Cheung *et al.* (2010); Hoegh-Guldberg and Bruno (2010); Brander (2010)

Climate change impacts on economics & management

- It will result in changes in the following:
  - Catches;
  - Food security;
  - Catch (landed) values;
  - Cost of fishing;
  - Profits to fishing companies;
  - Income to fishers;
  - The distribution of benefits to different countries, regions and groups.

Sumaila *et al*. (2011) *Nature Climate Change*

Two contrasting scenarios

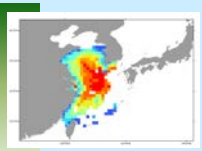
- The current high emissions trajectory (Representative Concentration Pathway 8.5, RCP8.5); and
- A reduced emissions scenario (RCP2.6) consistent with the Copenhagen Accord of keeping the global atmospheric temperature increase below 2°C in the 21st century.

Model Structure

Global climate change projections

Dynamic Bioclimate Envelope Model (DBEM)

Predicted future species distribution



Species composition in each EEZ

Catch potential & landings (t)

Gear type composition

Ex-vessel price of each species ($/tonne)

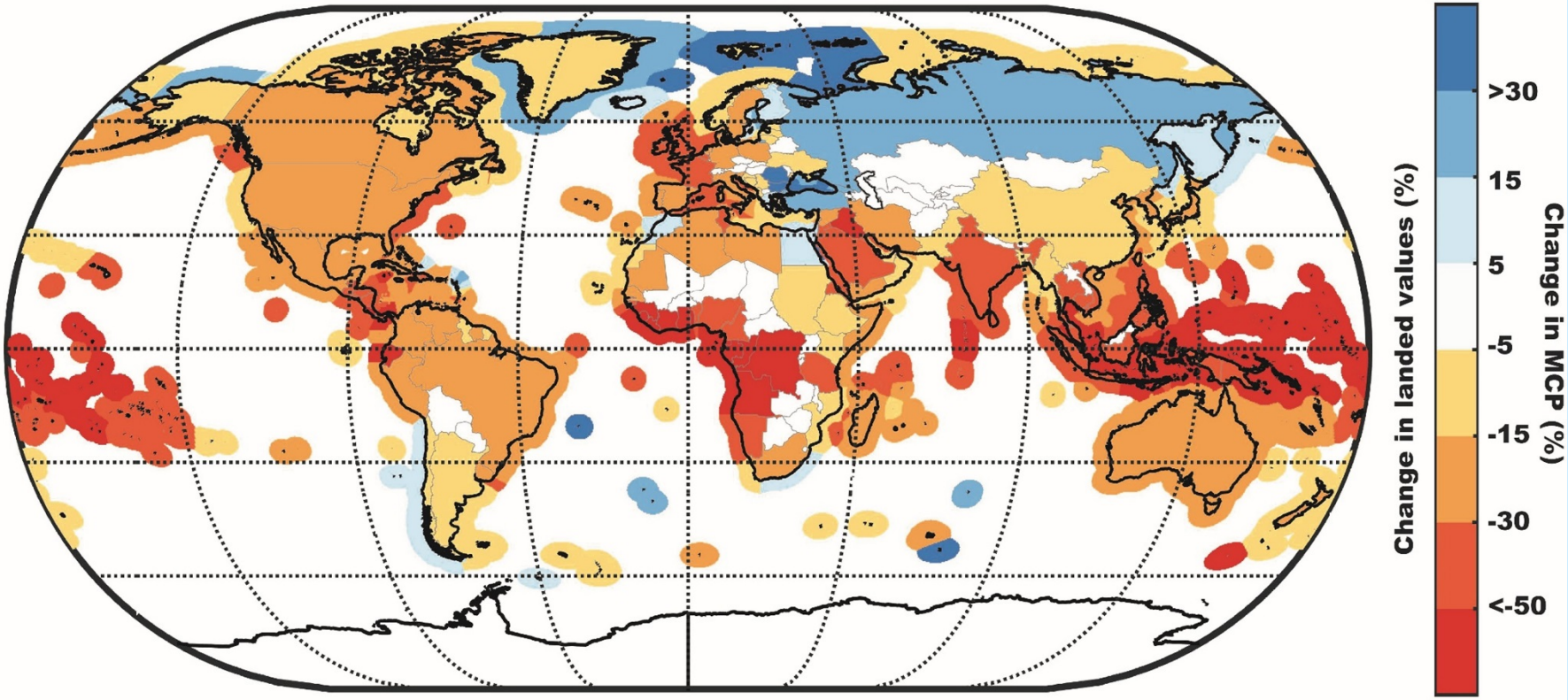
Unit variable cost ($/tonne)

Total variable fishing cost ($)

Landed Values ($)

Economic rents in each EEZ

Change in catch and revenue potential in the 2050s relative to current status under RCP 8.5 scenario



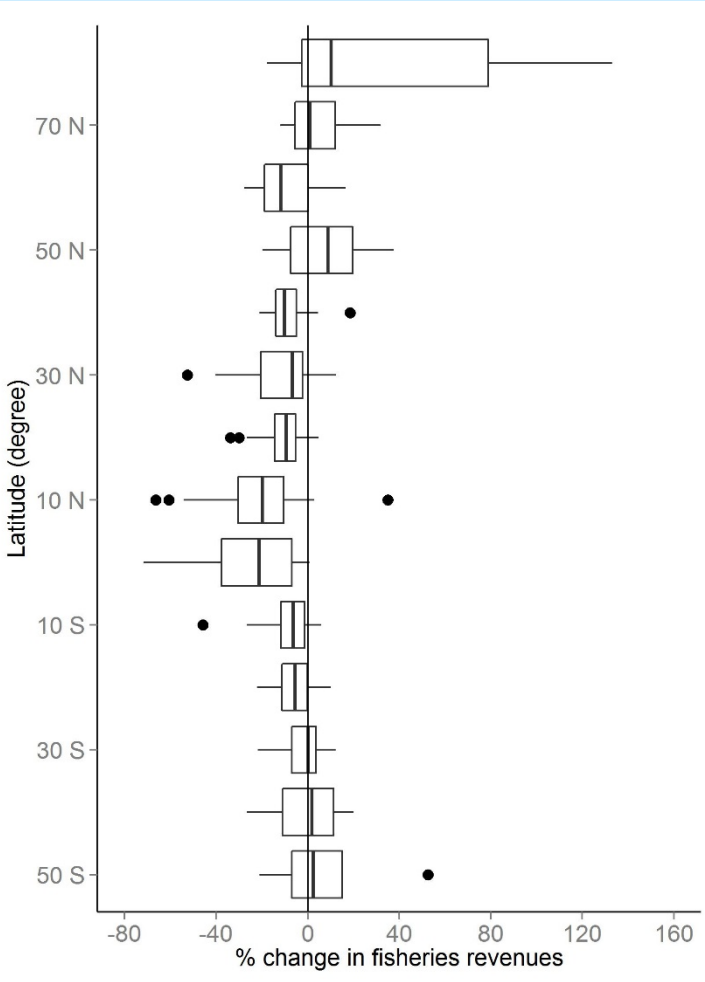
The map is created using MATLAB R2012b, http://www.mathworks.com

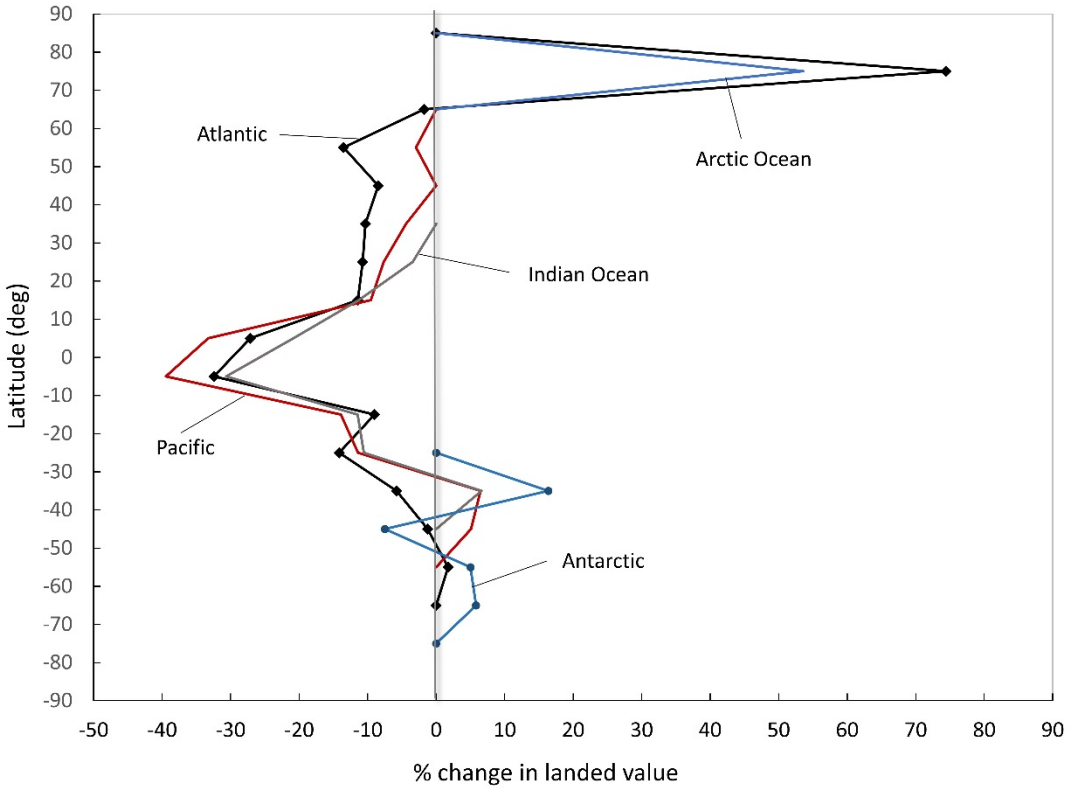
	Mean	Standard deviation
% change in MCP	-7.71	4.36
% change in MRP	-10.37	4.20

% change in revenues is 35% more than % change in MCP

Lam, Cheung, Reygondeau, Sumaila (2016) *Scientific Reports*

Latitudinal and regional patterns of impact on fisheries revenues



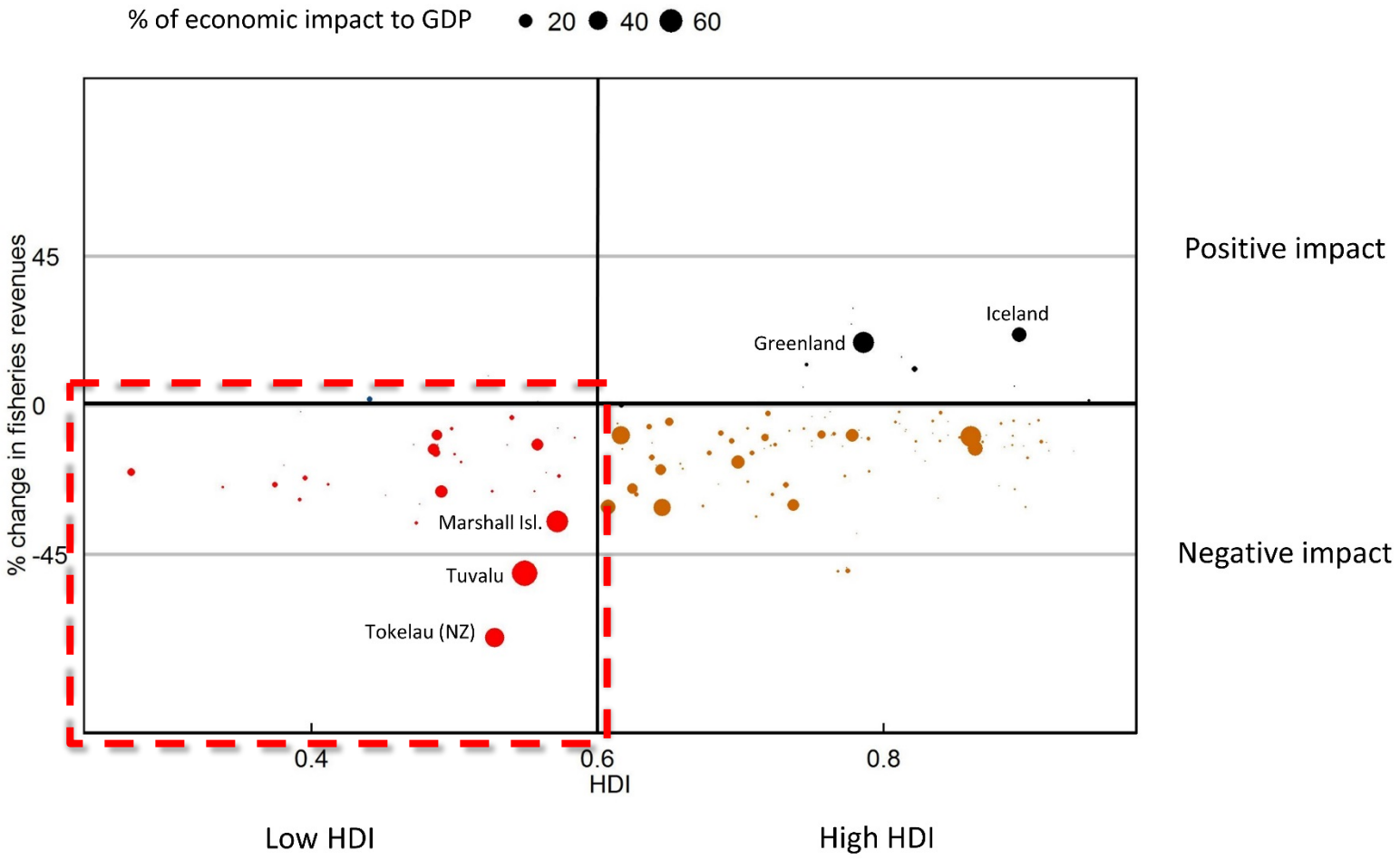


Latitudinal pattern

Change at different ocean basins

Lam, Cheung, Reygondeau, Sumaila. (2016) *Scientific Reports*

Are the impacts equally important in different countries?



Lam, Cheung, Reygondeau, Sumaila (2016) *Scientific Reports*

Impact of climate change on household budgets of British Columbians

- Objective:
  - Investigate how climate change would likely affect BC's staple seafood prices.

Sumaila and Lam (2015)

A bit on methods

- Defining BC's staple seafood species;
- Determining how much fish is consumed by British Columbians in a year;
- Identifying the sources of fish consumed in BC?
- Developing models and running them under two climate change scenarios.

Sumaila and Lam (2015)

Some key results

- 7 of B.C.’s 10 staple species will likely decline in supply;
- Sockeye salmon shows the highest potential decrease in supply at 21%;
- Resulting in an estimated 70% increase in price per pound of sockeye salmon by 2050.

Sumaila and Lam (2015)

Some key results

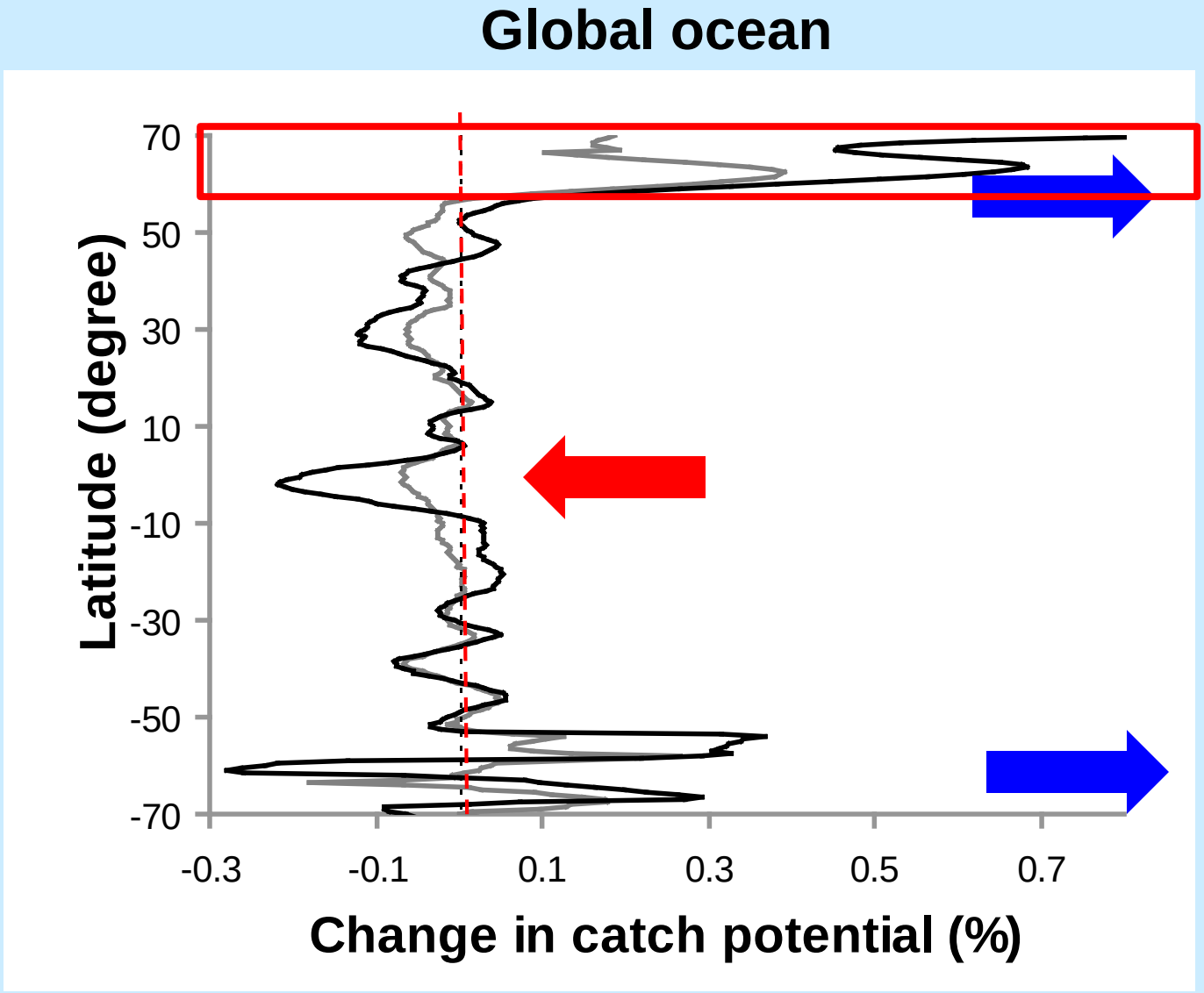
- We could also see 15% & 10% declines in sablefish and chum supplies, respectively.
- A net increase in cost to British Columbians for our 10 staple seafood species is ~ $110 million a year (2015 dollars).

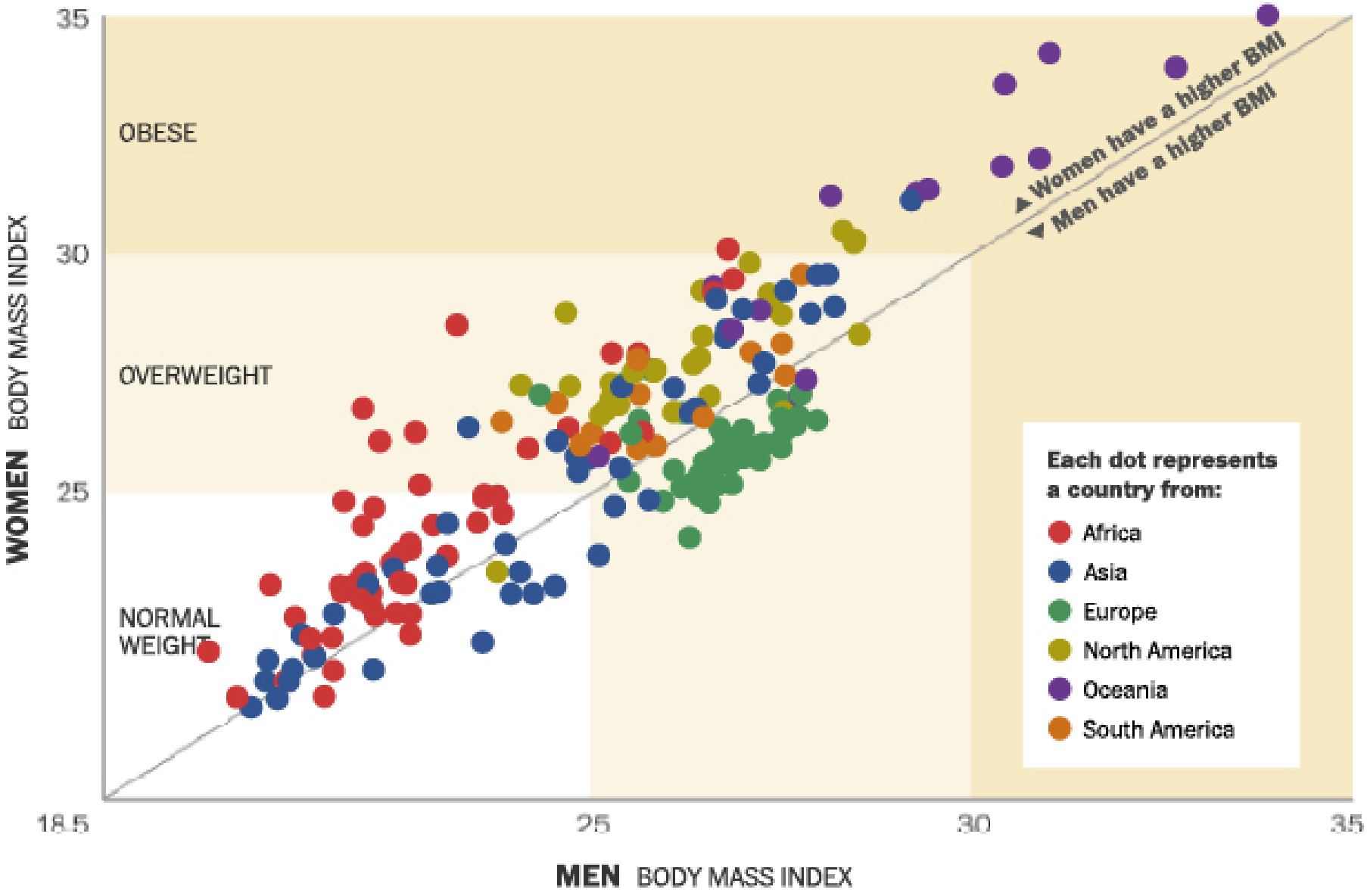
Sumaila and Lam (2015)

Food security implications

Fish as a source of relatively healthier animal protein.

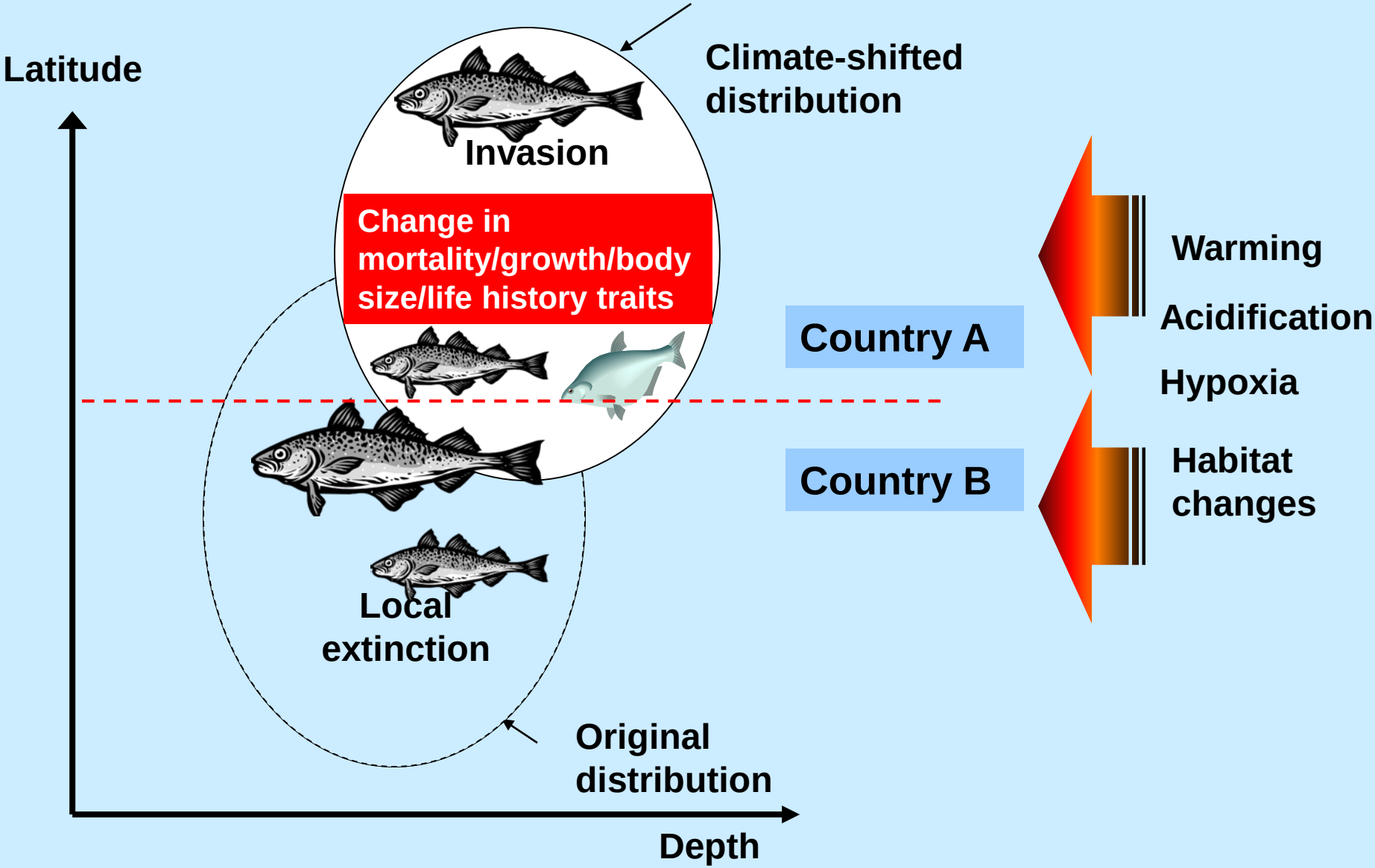
Latitudinal average changes in potential catch





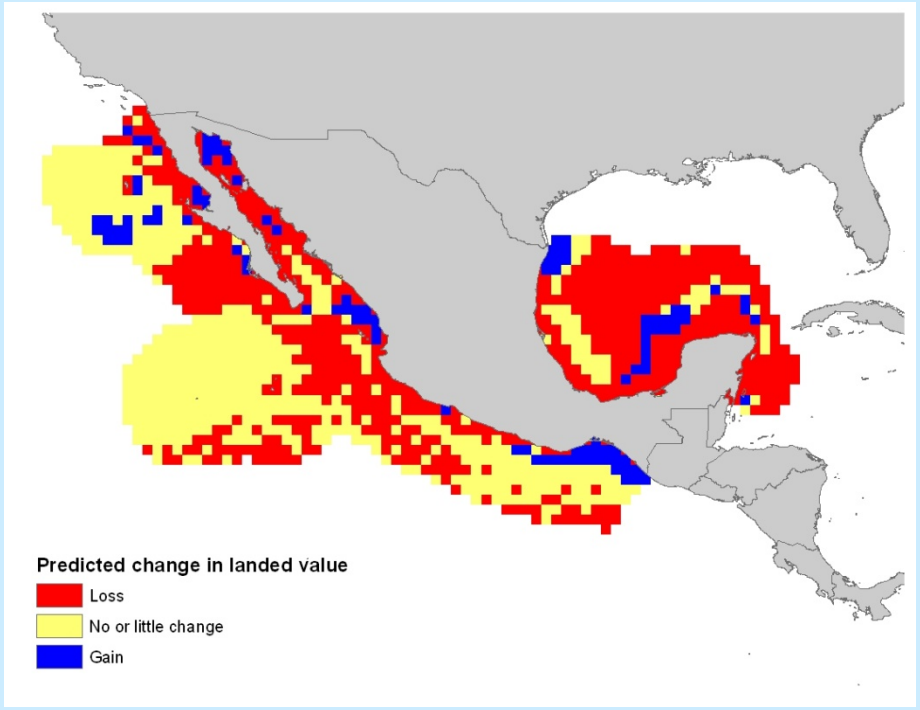
Source: Washington Post

Management implication of climate change and ocean acidification

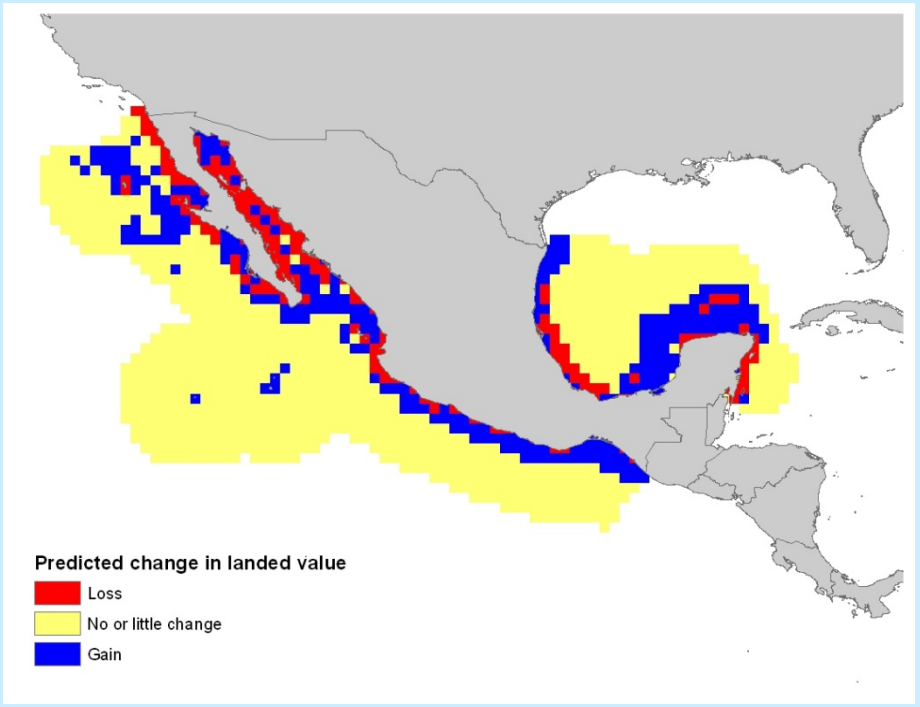


Example: Change in landed values in Mexican EEZ

SEVERE climate change scenario



MILD climate change scenario



Sumaila, Lam & Cheung (2015)

Implications for resource sharing/allocations

England | Northern Ireland | Scotland | Wales | UK Politics | Education | Magazine

24 August 2010 Last updated at 11:56 GMT

Why is Britain braced for a mackerel war?

By Andrew McFarlane
BBC News Magazine

Mackerel stocks had recovered well during the past decad

Britain is said to be bracing itself for a re-run of Iceland - except this time the fish being fought Yet, until recently, few were interested in a fish unclean.

WORLD NEWS

Fishery

Mackerel war could hurt Iceland's EU bid

27/08/10 17:19 CET

EUbusiness

Go to topic | Go to country

Members | Community | Events | Press | Forum | Jobs | Publications | Links

You are here: Home → Breaking news → EU warns Iceland, Faroes over 'mackerel war'

NEWS
ANALYSIS
AGENDA
GUIDES
LEGISLATION
TEXTS
RSS FEEDS
NEWS TICKER

EU LAW
LAW FIRMS
COMPANIES
FUNDING
PROJECTS
TENDERS

EU warns Iceland, Faroes over 'mackerel war'

25 August 2010, 20:50 CET

— filed under: Iceland, fish, environment, Headline1, Faroes

(*BRUSSELS*) - Iceland and the Faroe Islands are overfishing mackerel way above a level deemed safe for the survival of the fish, the European Union's executive arm said Wednesday.

Fishing boat

Iceland's fishing policies, notably its refusal to share its cod fishing waters, has been identified as a thorny issue to resolve with the EU in the North Atlantic island's bid to join the 27-nation club.

Oliver Drewes, the European Commission's spokesman for maritime affairs, said the dispute over mackerel would be discussed with Iceland and the Faroe Islands at a technical meeting in September.

"They are overfishing more than which is justifiable on the basis of scientific evidence," Drewes said at a news briefing.

Next | Previous | Highlight all | Match case

rom www.eubusiness.com...

t world news

EU response to Hungarian sludge danger

11/10 19:42 CET

Greek policeman jailed for murder of teenager

11/10 19:42 CET

US grenade may have killed British aid worker

11/10 19:42 CET

Potential solutions

- Governments;
- Non-governmental organizations;
- Businesses;
- Individuals.

UBC

SEA AROUND US PROJECT

OCEAN CANADA

Fisheries Economics Research Unit