UNDERSTANDING AND MANAGING ENVIRONMENTAL AND ECONOMIC PRESSURES

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'Understanding and <u>managing</u> the economic contributions of the ocean and coasts is crucial for human welfare."

Will we <u>manage</u> the economic contributions of the ocean by 2100?

What would that imply?



THE BLUE ECONOMY AND ITS CONTRIBUTIONS

CURRENT (2010) VALUATION OF THE OCEAN ECONOMY

\$1.5 TRILLION (OECD) PROJECTED TO TRIPLE BY 2050

WATER AND WASTEWATER

CURRENT EMPLOYMENT

\$0.5 TRILLION (OECD)

FISH & AQUA	38M
TOURISM	54M
SHIPS & PORTS	4M
OIL, GAS, MIN	4M

Food resources Fisheries Aquaculture



Oil, gas and other energy resources



National Geographic

Mineral resources



Water resources (desalinization)

Kleinfelder

Other biological resources Biodiversity (drug molecules, etc.)





THE BLUE ECONOMY AND ITS VALUE



THE VALUE OF THE OCEANS RESOURCES IS GREATER THAN THE LARGEST SOVEREIGN WEALTH FUNDS

Hoegh-Guldberg, O. et al. 2015

INHERENT TENSIONS: SIZE OF BLUE ECONOMY VERSUS IMPACT OF OCEANS ON ECONOMY



THE BLUE ECONOMY AND ITS TRADITIONAL PRESSURES





Ports Port of Rotterdam

Land Use/ Real Estate Manhattan Beach, Calif.



Overfishing

Only 11% of fisheries not overfished or fished to capacity

THE BLUE ECONOMY AND ITS NEWER PRESSURES



Desalinization

Marafiq Plant in Al Jubail, Saudi Arabia



Aquaculture

Tilapi aquaculture

BLUE ECONOMY MANAGEMENT AND ITS TRADITIONAL GOALS







Maintaining Open Coastal Spaces Carlsbad, Calif. Maintaining Water Quality Orange County, Calif.

Minimizing Ecosystem Impacts *Mississippi River Dead Zone*

WHAT'S NEXT?



R/V Roger Revelle in Lighthouse Channel, Palau

SUSTAINABLE G ALS



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INHERENT TENSIONS: BLUE GROWTH OR USE OF OCEAN RESOURCES VS SUSTAINABILITY



NEW CHALLENGE: MANAGING FOR SUSTAINABILITY AND ADAPTATION



Cabo Pulmo National Park, Mexico , Photo : Octavio Aburto



AND NOW... CLIMATE CHANGE



Sea Level Rise \rightarrow Infrastructure Pressure

Simulated Sea Level Rise in Miami. Source: Climate Central.



Ocean Acidification \rightarrow Ecosystem Changes

Oyster culture impacted by ocean acidification in Oregon (US)

SUSTAINABILITY OF MARINE PROTECTED AREAS



Sustainability Tool for Ecosystems

Tres Maria Archipelago off Mexico. Photo: Octavio Aburto.



Sea Level Rise Now Becoming a Challenge

Florida Everglades – Saltwater Intrusion





Focus was Environmental Impact

No ballast water discharge



Most Extreme: 55" Sea Level Rise + 100-year Storm Surge

Now Taking Climate Change Into Consideration

Port of Long Beach – Climate Adaptation and Coastal Resiliency Plan

OCEAN POLICIES MUST CONSIDER NOT JUST ENVIRONMENTAL IMPACT BUT HOW THIS WILL EVOLVE WITH CHANGING CLIMATE

GETTING POLICY RIGHT: USING THE BEST SCIENCE AVAILABLE



Sea level trends (2008-2017)



Source: University of Hawaii Sea Level Center

USE MEASUREMENTS THAT ALLOW EFFECTIVE MANAGEMENT





Average biomass increased inside and outside of MPAs, among both targeted (left) and non-targeted species (right), at northern Channel Islands 10 years after implementation. The greatest increases have been seen for targeted species inside MPAs. Source: PISCO.

INHERENT TENSIONS: WHAT CAN WE ACTUALLY MANAGE



THE FUTURE OCEAN: WILL WE MANAGE THE OCEAN ECONOMY FOR SUSTAINABILITY BY 2100?

WHAT DO WE MEAN BY "OCEAN" ECONOMY?



WHAT DO WE MEAN BY "OCEAN" ECONOMY?

WE PROBABLY AT LEAST MEAN MANAGING THE RESOURCES AND USES OF THE OCEAN THAT WE WANT TO RETAIN

WHAT DO WE MEAN BY "OCEAN" ECONOMY?

BUT WHAT ABOUT MANAGING THE CHARACTERISTICS OF OCEAN WE WANT TO BE PRESENT TO SUSTAIN THAT ECONOMY?

- SEA LEVEL
- LEVEL OF ACIDITY
- AMOUNT OF OXYGEN
- **TEMPERATURE**



TO MANAGE: BE IN CHARGE OF (A COMPANY, ESTABLISHMENT, OR UNDERTAKING); ADMINISTER; RUN

BUT WE GENERALLY TALK ABOUT MANAGING HUMAN BEHAVIOR AFFECTING THE OCEAN RATHER THAN MANAGING THE OCEAN ITSELF

WE HAVE HISTORICALLY TRIED TO MANAGE THE AMOUNT AND THE LOCATION OF ACTIVITY TO PRESERVE AN AGREED-UPON INVENTORY OF RESOURCES

- AMOUNT/LOCATION OF FISHING/AQUACULTURE
- LOCATION OF ENERGY EXTRACTION
- LOCATION OF MINERAL EXTRACTION
- LOCATION OF DESALINIZATION

BUT WE HAVE ALSO TRIED TO MANAGE A CHARACTERISTIC OF THE OCEAN – ITS BIODIVERSITY – BY SETTING ASIDE RESERVES (A FORM OF RESTRICTING EXTRACTION AS WELL AS SETTING LOCATION)

- MARINE RESERVES/PROTECTED AREAS (MPAS)
- BIODIVERSITY BEYOND NATIONAL JURISDICTION (BBNJ)

WE HAVE ALSO EMBARKED ON MANAGING A CHARACTERISTIC OF CLIMATE – THE TROPOSPHERIC TEMPERATURE, WHICH COULD BE A FORERUNNER OF MANAGING OCEAN CHARACTERISTICS

WILL MANAGING CLIMATE CHARACTER GIVE US THE AUDACITY (OR TEMERITY) TO TRY TO MANAGE OCEAN CHARACTERISTICS?

WHO DO WE MEAN BY "WE"?



WHO DO WE MEAN BY "WE"?

AT WHAT LEVEL OF ORGANIZATION WOULD WE HAVE TO WORK TO MANAGE THE OCEAN

- LOCAL GOVERNMENT
- NATIONAL GOVERNMENT
- INTERNATIONAL GOVERNMENT
- PROBABLY ALL THREE

WHO DO WE MEAN BY "WE"?

IS INTERNATIONAL MANAGEMENT OF THE OCEAN REALISTIC?

EXAMPLES OF INTERNATIONAL MANAGEMENT THAT HAVE WORKED:

- MONTREAL PROTOCOL GRADE: A ?
- LONDON DUMPING CONVENTION GRADE: C- ?

WHAT MIGHT BE FULLY MANAGED BY 2100?

FISHERIESAQUACULTURE

WHAT MIGHT BE PARTIALLY MANAGED BY 2100?

- OIL, GAS AND OTHER ENERGY RESOURCES
- OTHER BIOLOGICAL RESOURCES –
 BIODIVERSITY
- SHIPPING
 - LANES
 - **DUMPING**
 - EMISSIONS

WHAT WILL WE BE STRUGGLING TO MANAGE IN 2100?

- MINERAL RESOURCES
- CO2-RELATED CHARACTERISTICS OF THE
 OCEAN
 - ACIDITY
 - DEOXYGENATION
 - **TEMPERATURE**

LARGE, DENSE DATA SETS CAN RADICALLY TRANSFORM OUR UNDERSTANDING OF THE MOST BASIC COMPONENTS OF THE OCEAN AND MAKE MANAGEMENT POSSIBLE



CHANGING WAYS OF OBSERVING THE OCEAN AND USING THE DATA

- NEW AND SOMETIMES VERY INEXPENSIVE --TOOLS FOR DATA COLLECTION, ANALYSIS AND VISUALIZATION
- MONUMENTAL GROWTH IN DATA
- INTERNET OF THINGS (IOT)
- ARTIFICIAL INTELLIGENCE (AI) AND MACHINE LEARNING
- GROWTH OF COLLABORATIONS FOR OPEN DATA COLLECTION

