Impacts of climatic and ecological variations on human user groups and implications for marine ecosystem-based management in Northern Peru

Stefan Königstein

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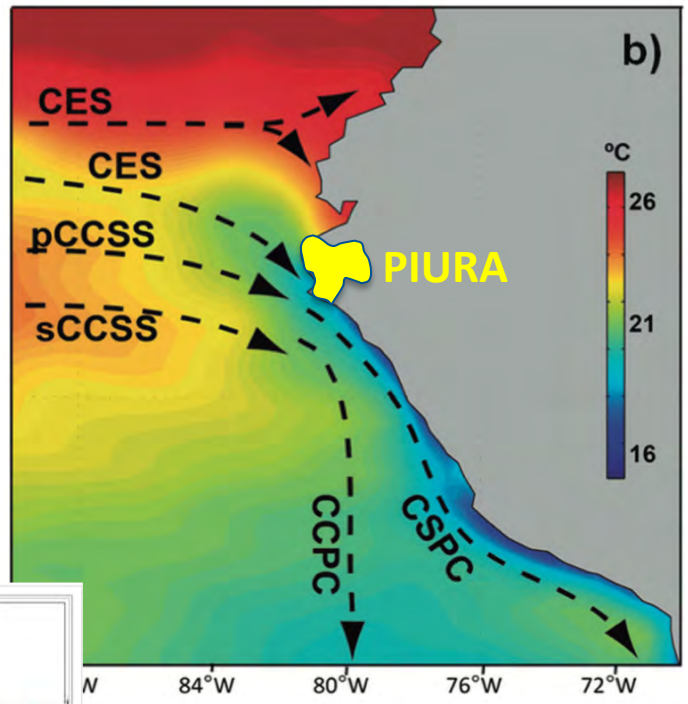
Sustainability
Research Center
Universität Bremen

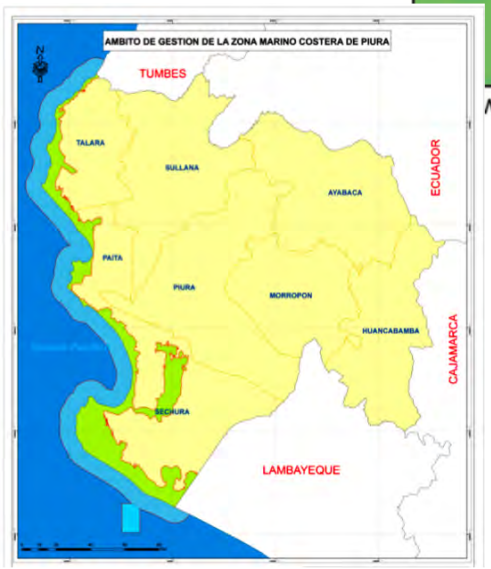
Introduction

- The Piura region is a 'transitional area' between Peruvian upwelling system and equatorial waters
- ➢ strong oceanographic gradient, variability driven by El Niño Southern Oscillation (ENSO)

- Integrated coastal zone management (ICZM) process in Piura started 2003 (first in Peru)



Guevara-Carrasco & Bertrand 2017



GoRe Piura

Piura Región
GOBIERNO REGIONAL PIURA

Introduction

Aims of scoping study:

Identify

- marine resources/services and user groups,
- users‘ concerns and perceptions about the marine system,
- impacts of climatic and environmental variability,
- potential shifts under climate change

Methods:

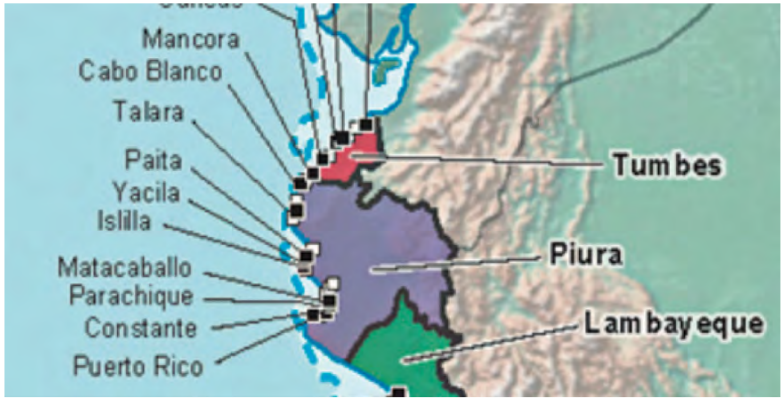
- Personal interviews with marine stakeholders in Piura October-November 2017
- Analysis of the ICZM process in Piura up to 2017 (workshop protocols and reports) and participation in ‘Comités de Bahias‘ Nov/Dec 2017

Users & interactions

Fisheries

- Small-scale and artisanal fisheries extremely important for provision of livelihoods in coastal communities

- Paita: most important fishing port, fishmeal production and export
- Sechura Bay and along the North coast
- Local fisheries associations / gremios de pescadores

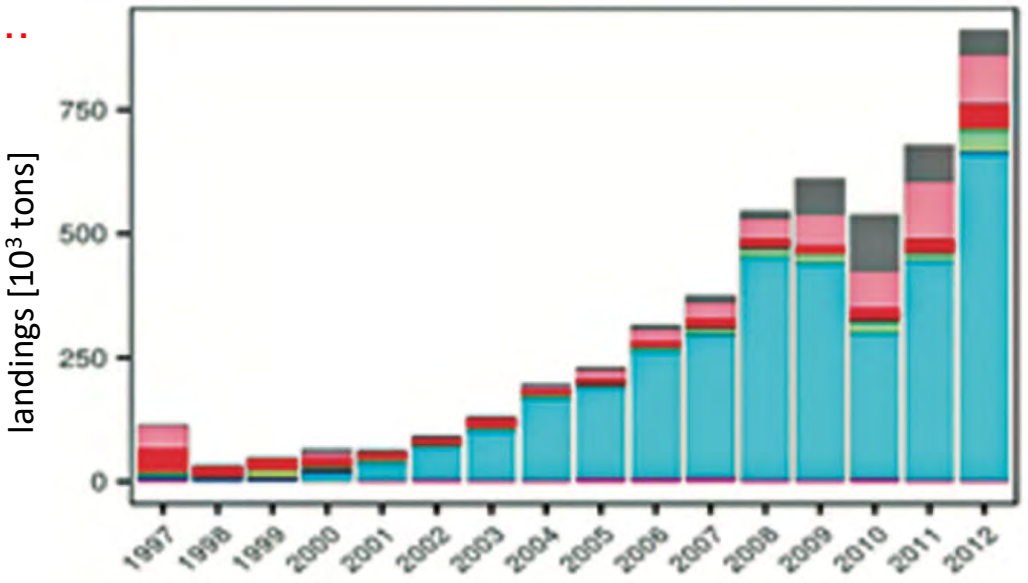


Guevara-Carrasco & Bertrand 2017

Fisheries (2)

- Strongly increasing landings in Piura in last 15 years

- Species:
  - Humboldt squid
  - Peruvian anchoveta
  - Scallops
  - Mahi-mahi (dolphinfish)
  - Tuna, bonito, chub mackerel…



Guevara-Carrasco & Bertrand 2017

Aquaculture

- Sechura has become the latin american center of scallop aquaculture (bottom and hanging culture) => export
- Shrimp farming further east (Tumbes)

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Coastal and marine tourism

- Beach tourism, national and international: Máncora and North coast, Colán,…
- Surf tourism
- Sports fishing (catch-and-release)
- Whale and turtle watching tours

Coastal and marine tourism (2)

- Some communities in the North actively pursue a transformation from fisheries to ecotourism: turtle tours, sports fishing, whale watching…
- … a path to more sustainable use of marine resources for coastal communities?

- Target species mostly migratory, highly variable and transboundary (unclear management/protection)

Fossil resources

- Offshore oil and gas drilling close to coast (in 5nm artesanal fisheries zone)
- Non-metalic mining (bentonite clay, limestone, marble) in coastal zones: runoffs into sea
- Licensed by national government to international companies

- Fear of pollution leads to conflicts with local communities and fisheries associations

Lobitos: Pobladores bloquearon carreteras por más horas en protesta contra empresa Sapet

2 diciembre, 2017

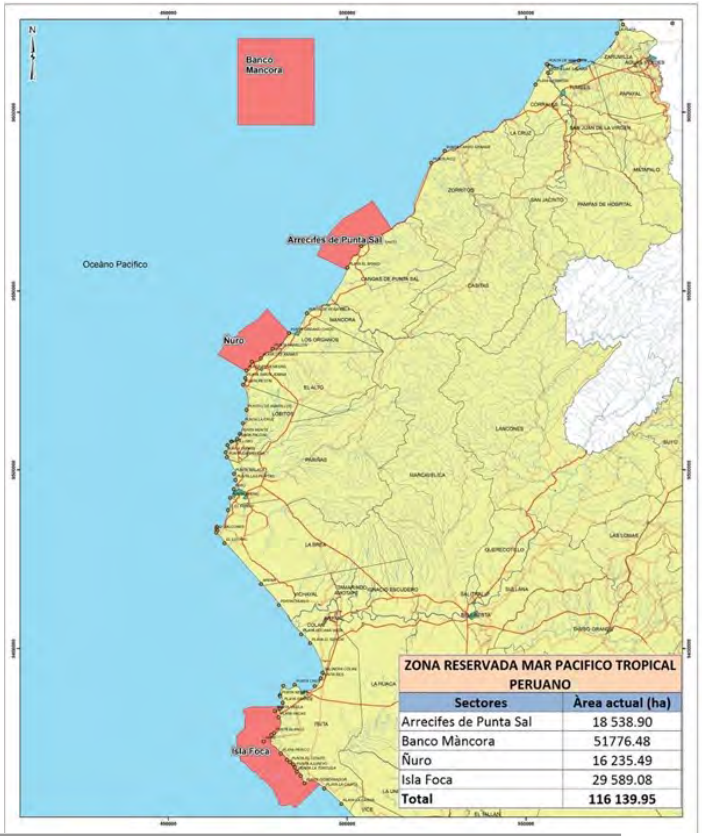
Moradores exigen a empresa Sapet, obras en el distrito. FOTO: EL REGIONAL

Conservation

- High species diversity due to transitional area (mixing of tropical and upwelling communities)
- Near-coast islands: 32 bird species (endemic to Peru: Humboldt penguin, Red-legged cormorant…), sea lion colonies

- Endemic benthic invertebrates
- New marine reserve „Mar Pacífico Tropical“ decided in 2017, establishment pending
- Marine reserve actively supported by artisanal fishers’ associations in the North

Fotografía: Yury Hooker



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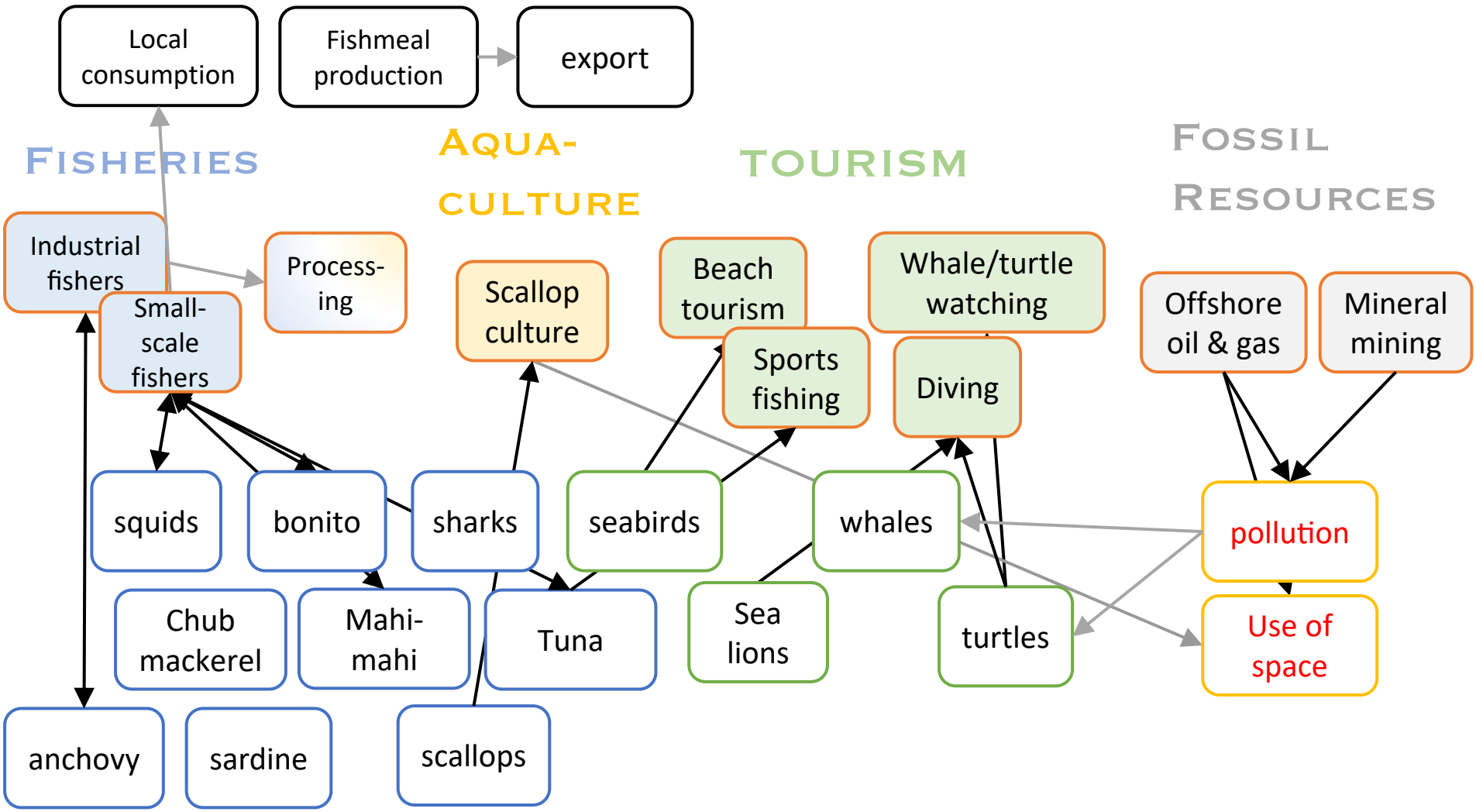
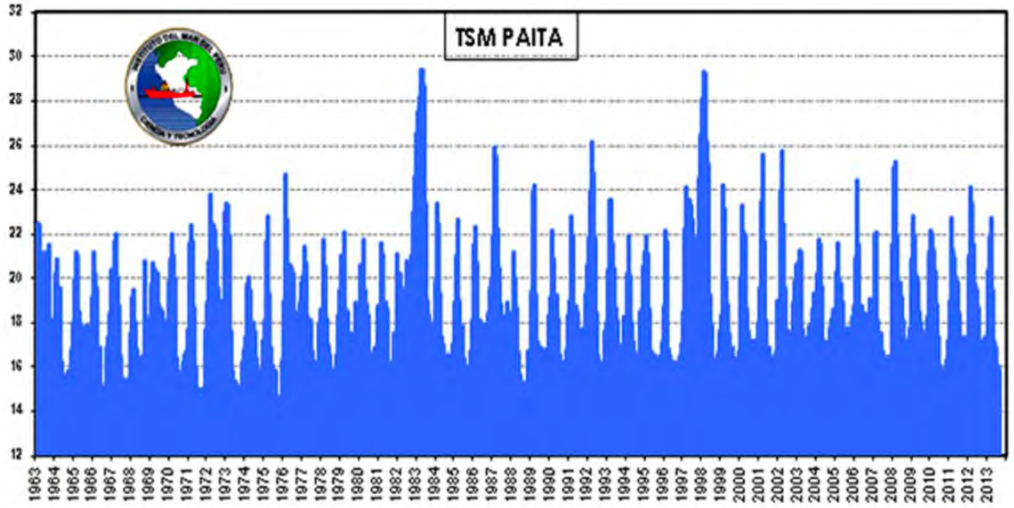
Societal actors and uses of marine ecosystem



ENSO and climate change impacts

Climatic variability and change

- Marked seasonal variability and ENSO variations
- Coastal El Niño (e.g. 2017): heavy impacts on infrastructure in Piura
- Current climate models project warming by 3-4°C until 2100 and the equatorial front moving south



IMARPE Callao

ENSO impacts on user groups

Fisheries:

climate-related distributional shifts of target species during EN

- e.g. Peruvian anchoveta, Pacific sardine, Humboldt squid and demersal fish reduced / moving to cooler/deeper waters
- Increases in decapod shrimps, mahi-mahi, tunas (Yellowfin, Bigeye)

Aquaculture:

- During normal El Niño: Warm waters increase growth and production in scallops (*A. purpuratus*)
- Coastal El Niño 2017: Mass mortality of scallops

ENSO impacts on user groups

Tourism:

- infrastructure damage and pollution of marine waters during strong EN events,
- mass mortality events in top-level predators such as sea lions and seabirds
- Turbid waters make diving impossible
- Immigration of typical tropical fish species after El Niño events

- Turtles and whales avoiding coastal waters during coastal El Niño events.

- Erosion or accretion of beaches and sandbanks

Stakeholder adaptation options to ENSO

- Fishers switch gear and target fish species (limited)
  - productivity not comparable
- Seafood processors can adapt to different products and buy raw products from different regions – still suffer losses (50% reduction in export in EN 1998)
- economic diversification, temporary employment in other sectors (e.g. transport and restaurants)

- Aquaculture: move to other localities (limiting: protected waters and the supply of scallop seed from nearby hatcheries)

- migration to other localities…

Challenges for Management

Challenges for management

- Reduction of pollution by
  - urban trash / plastic and wastewater
  - runoff from fishmeal and fish processing factories
  - disposal of engine oil from boats

- Improve fisheries licensing and control
  - Misdeclarations (anchovy for human consumption), double licensing
  - Destructive fishing practices (bottom trawling), contamination from boats, bycatch reduction
  - Overfishing / illegal entrance by industrial fleets into coastal zone,
  - Provision of environmental and climatic information to fishers
  - catch and by-catch of sharks, turtles and dolphins

Challenges for management (2)

- Mass mortality events of sea lions and seabirds, dead whale strandings: Food / pollution (noise) / fishermen??
- Mitigate conflicts for space and infrastructure through investment (e.g. jetties) and continue ICZM and increase participation
- Knowledge gaps: ecosystem shifts under climate change?

Climate change impacts: stakeholder concerns

- More frequent or stronger El Niño impacts
- Ecological shifts (more tropical/EN community, changes in productivity and movements of fish stocks to the south / deeper / offshore
- oxygen deficiency (benthic)
- decreased primary productivity

- Terrestrial impacts (water scarcity, soil erosion…)

Climate change impacts

- Sea level rise:
  - Erosion of beaches and river mouths
  - Floodings damage coastal infrastructure
  - Loss of wetlands and mangroves
- Salinization of ground water and agricultural zones
- Potentially increasing conflicts among user groups?

Projected +1m until 2100
(GoRe Piura)

(Initial) conclusions / open questions

- The transition zone off the Piura coast has the highest biodiversity in Peru and higher productivity than tropical waters
- Overall impacts of EN and climate change on marine user groups are clearly negative
- Ecotourism as an adaptation option for coastal communities?

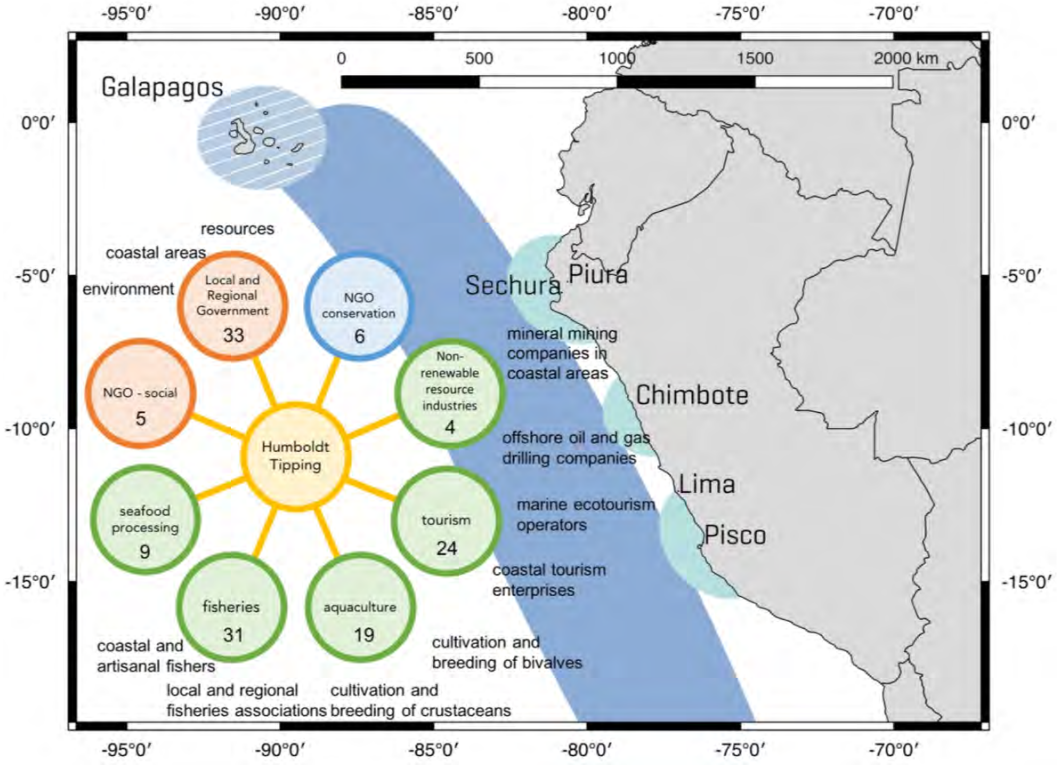
- Societally relevant knowledge gaps in climate and ecological projections

- Is societal adaptive capacity to cc increased by ENSO variability?
- Adaptation strategies: How to prepare for climate change and improve incorporation of environmental fluctuations in ecosystem-based management of marine areas in the Piura region?

Upcoming (hopefully)

‚Humboldt-Tipping' project (2019-2021):

- End-to-end modeling (pelagic system)
- Trophic models for bay systems
- Stakeholder engagement and Social-Ecological System case studies in Piura/Sechura, Pisco/Paracas, Chimbote
- Governance analyses



Thank you!

contributors

ICZM GoRe Piura	Emiko Aritomi Guerrero, Ronald Ruiz Chapiliquen
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➢ *contact: koenigstein@uni-bremen.de*

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Universität Bremen