

# Celebrate Halloween with **FUTURE!**



Session 6: The FUTURE of PICES: Next Steps in Understanding,  
Forecasting and Communicating Climate Impacts on North Pacific  
Marine Ecosystems

Wednesday, October 31<sup>st</sup>, 9:00 am  
Oshidori+Kujaku





Chocolate & caramel

My favorite!

Raisin sand cookie

Chocolate

Waters

Chocolate

Chocolate

Chocolate

おまめ



# COMMUNITY INPUT TO **FUTURE**

Wednesday, October 31<sup>st</sup>, 9:00 am – 12:50 pm / Oshidori + Kujaku

## **S6: FUTURE Topic Session**

**The FUTURE of PICES: Next steps in understanding, forecasting and communicating climate impacts on North Pacific marine ecosystems**

### **Convenors:**

Sukyung Kang (Korea) *corresponding*, Steven Bograd (USA)

‘Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems’ (FUTURE) is the flagship integrative Scientific Program undertaken by the member nations and affiliates of PICES. Since its inception in 2009, FUTURE has contributed to guiding PICES science to understand how marine ecosystems in the North Pacific respond to climate change and human activities, to forecast ecosystem status based on a contemporary understanding of how nature functions, and to communicate new insights to its members, governments, stakeholders and the public. FUTURE is scheduled to conclude in 2019, so this is a good time to reflect on its accomplishments, to identify remaining gaps in fulfilling its research objectives, and to contemplate new directions for PICES science. In this session, we will conduct a FUTURE ‘Mini-Symposium’ to update the PICES community on FUTURE progress and to coordinate activities amongst the PICES Expert Groups. Each Expert Group will provide a brief review of their past, current and planned activities as they relate to the FUTURE Science Program, which will be followed by a plenary discussion on the future path of PICES science in the coming years.



Time	Contents	Speakers
0900-0905	Opening by conveners	Sukyung Kang
0905-1030	FUTURE SSC presentation	Steven Bograd
	WG-35	Peter Chandler
	WG-36	Xiujuan Shan
	WG-37	Toru Kobari
	WG-38	Annalisa Bracco
1030-1050	Break	
1050-1150	WG40	Antonietta Capotondi
	WG41	Dan Lew
	S-CC	Jim Christian
	How PICES fits into the UN decade of the ocean	Robin Brown
	A new integrated approaches to investigate climate impacts on fish stocks	Shin-ichi Ito
1150-1250	Discussion on the future path of PICES science in the coming years	ALL OF US

# FUTURE Science Program

**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty  
and **R**esponses of North Pacific Marine **E**cosystems





# SESSION OBJECTIVES

1. Remind ourselves of **FUTURE** objectives and structure
2. Updates on Working Group activities related to **FUTURE** and other **FUTURE** related topics
3. Open discussion about **FUTURE** and Beyond!

**FUTURE**  
Science Program





# PICES **FUTURE** IMPLEMENTATION

1. To increase understanding of climatic and anthropogenic impacts and consequences on marine ecosystems, with continued leadership at the frontiers of marine science.
2. To develop activities that include the interpretation, clarity of presentation, peer review, dissemination, and evaluation of ecosystem products (e.g., status reports, outlooks, forecasts) and establish a process for engaging interested institutions and other recipients.

See **FUTURE** Implementation Plan:

[http://www.pices.int/members/scientific\\_programs/FUTURE/FUTURE-SSC](http://www.pices.int/members/scientific_programs/FUTURE/FUTURE-SSC)



# PICES **FUTURE** RESEARCH THEMES

1. What determines an ecosystem's intrinsic resilience and vulnerability to natural and anthropogenic forcing?

See FUTURE Science Plan:

[http://www.pices.int/members/scientific\\_programs/FUTURE/FUTURE\\_final\\_2008.pdf](http://www.pices.int/members/scientific_programs/FUTURE/FUTURE_final_2008.pdf)





# PICES **FUTURE** RESEARCH THEMES

1. What determines an ecosystem's intrinsic resilience and vulnerability to natural and anthropogenic forcing?
2. How do ecosystems respond to natural and anthropogenic forcing, and how might they change in the future?

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# PICES **FUTURE** RESEARCH THEMES

1. What determines an ecosystem's intrinsic resilience and vulnerability to natural and anthropogenic forcing?
2. How do ecosystems respond to natural and anthropogenic forcing, and how might they change in the future?
3. How do human activities affect coastal ecosystems and how are societies affected by changes in these ecosystems?

See FUTURE Science Plan:

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# FUTURE RESEARCH THEMES

## 1. What determines an ecosystem's intrinsic resilience and vulnerability to natural and anthropogenic forcing?

- What are the important **physical, chemical and biological processes** that underlie the structure and function of ecosystems?
- How might changing physical, chemical and biological processes cause alterations to **ecosystem structure and function**?
- How do changes in ecosystem structure affect the relationships between ecosystem components?
- How might changes in ecosystem structure and function affect an ecosystem's **resilience or vulnerability to natural and anthropogenic forcing**?
- What **thresholds, buffers and amplifiers** are associated with maintaining ecosystem resilience?
- What do the answers to the above sub-questions imply about the ability to **predict future states of ecosystems** and how they might respond to natural and anthropogenic forcing?



# FUTURE RESEARCH THEMES

## 2. How do ecosystems respond to natural and anthropogenic forcing, and how might they change in the future?

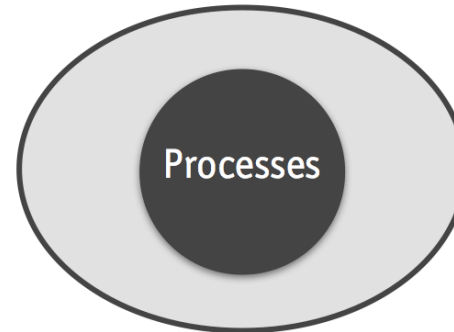
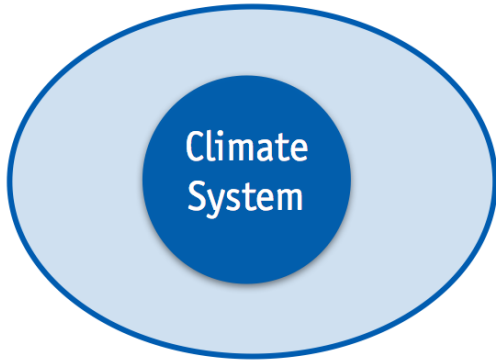
- How has the important physical, chemical and biological processes changed, how are they changing, and how might they change as a result of **climate change and human activities**?
- What factors might be mediating changes in the **physical, chemical and biological processes**?
- How does physical forcing, including climate variability and climate change, affect the processes underlying ecosystem structure and function?
- How do **human uses of marine resources** affect the processes underlying ecosystem structure and function?
- How are human uses of marine resources affected by changes in ecosystem structure and function?
- How can understanding of these ecosystem processes and relationships, as addressed in the preceding sub-questions, be used to **forecast ecosystem response**?
- What are the consequences of projected climate changes for the ecosystems and their **goods and services**?



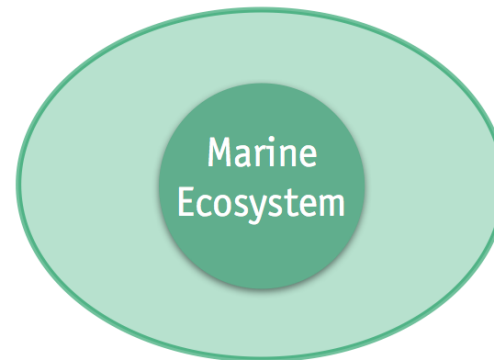
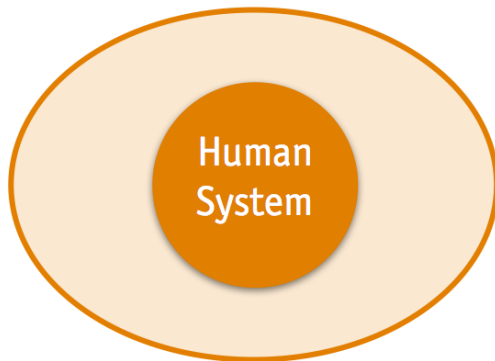
# FUTURE RESEARCH THEMES

## 3. How do human activities affect coastal ecosystems and how are societies affected by changes in these ecosystems?

- What are the dominant **anthropogenic pressures in coastal marine ecosystems** and how are they changing?
- How are these anthropogenic pressures and climate forcings, including sea level rise, affecting nearshore and coastal ecosystems and their interactions with offshore and terrestrial systems?
- How do multiple anthropogenic stressors interact to alter the structure and function of the systems, and what are the **cumulative effects**?
- What will be the consequences of projected coastal ecosystem changes and what is the **predictability and uncertainty** of forecasted changes?
- How can we effectively use our understanding of coastal ecosystem processes and mechanisms to identify the nature and causes of ecosystem changes and to **develop strategies for sustainable use**?

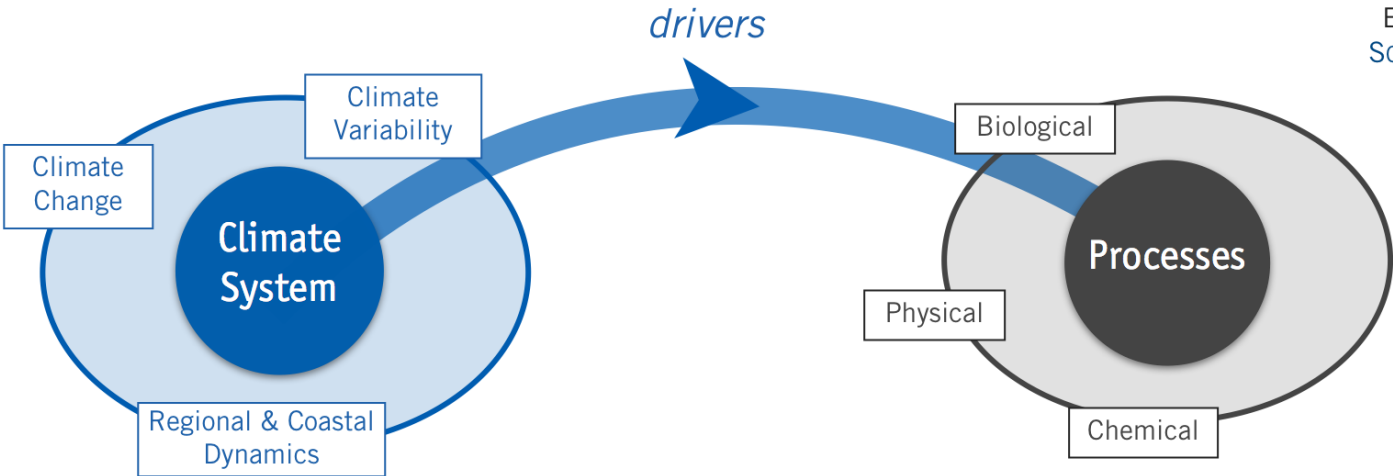


*dimensions of FUTURE Science Plan ...*

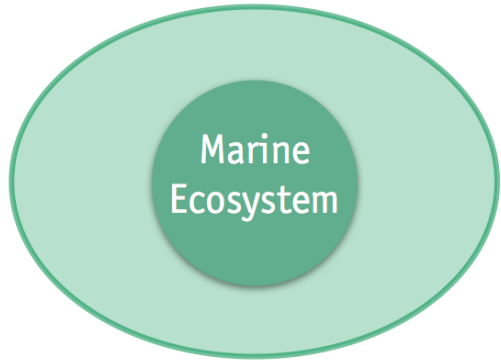
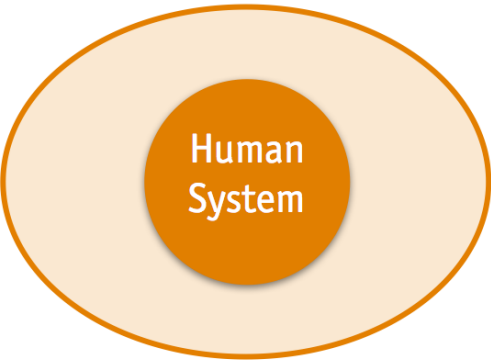


**GOAL**

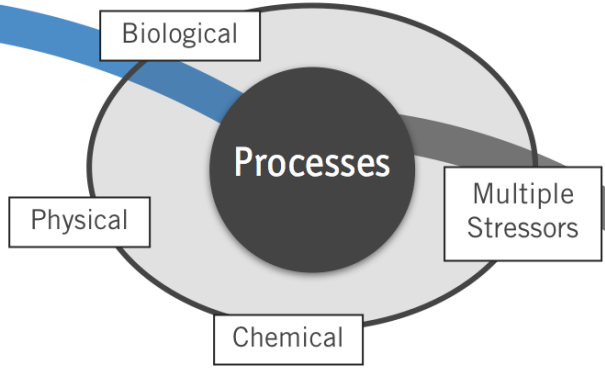
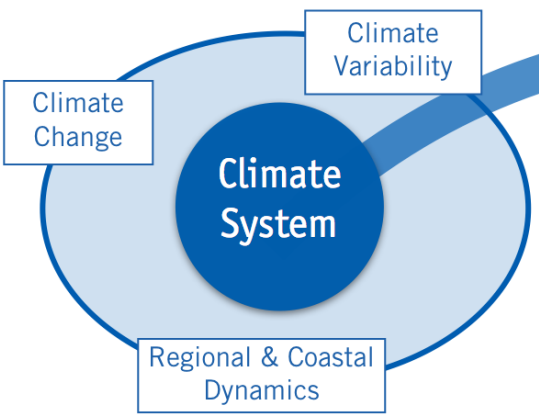
understand the PREDICTABILITY & SUSTAINABILITY of  
**Social-Ecological-Environmental Systems**



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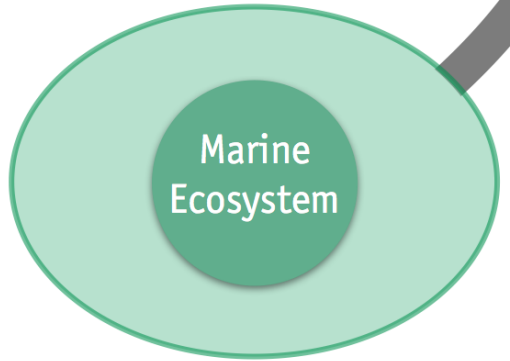
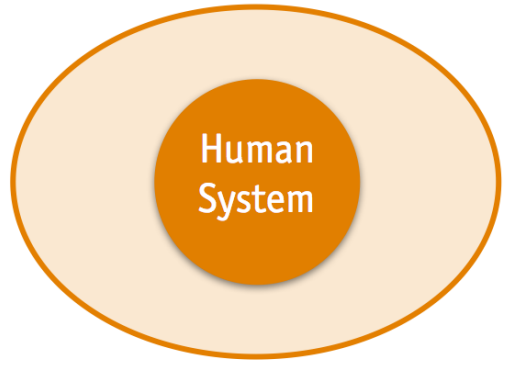


*drivers*



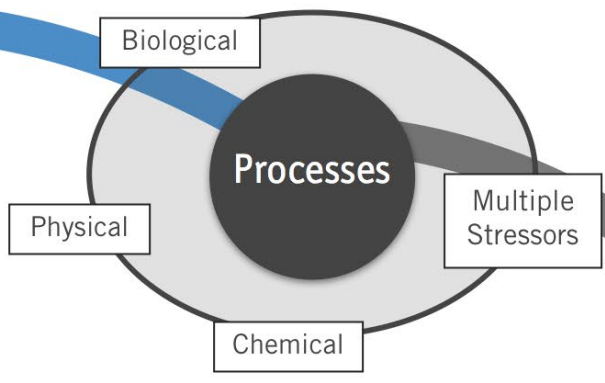
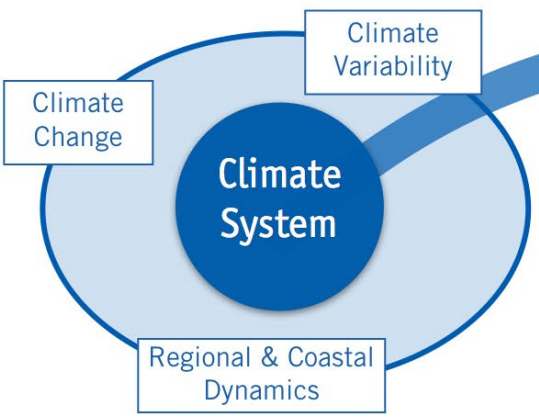
*identify, assess  
sensitivity &  
predict*

Cumulative Effects



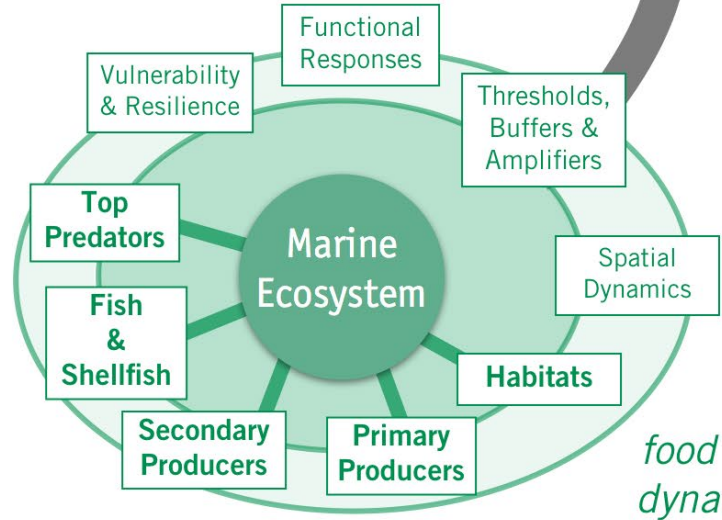
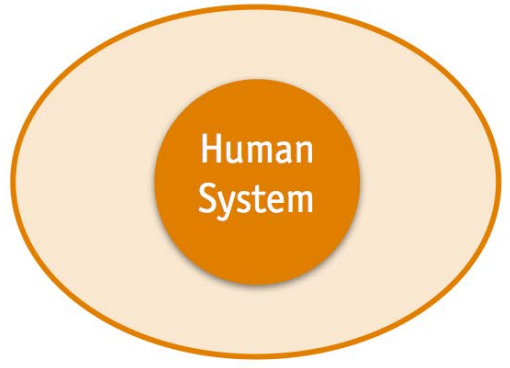


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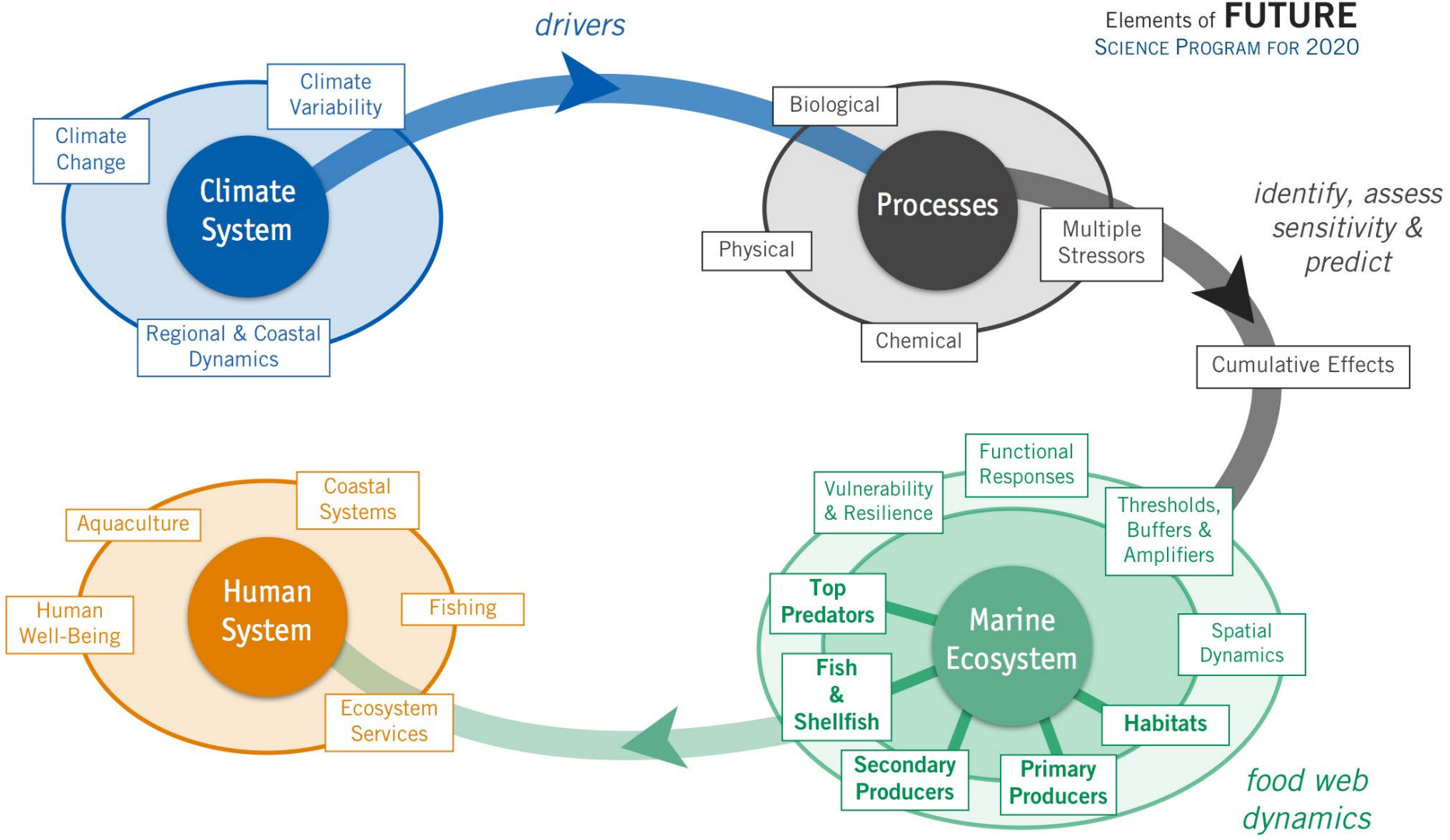


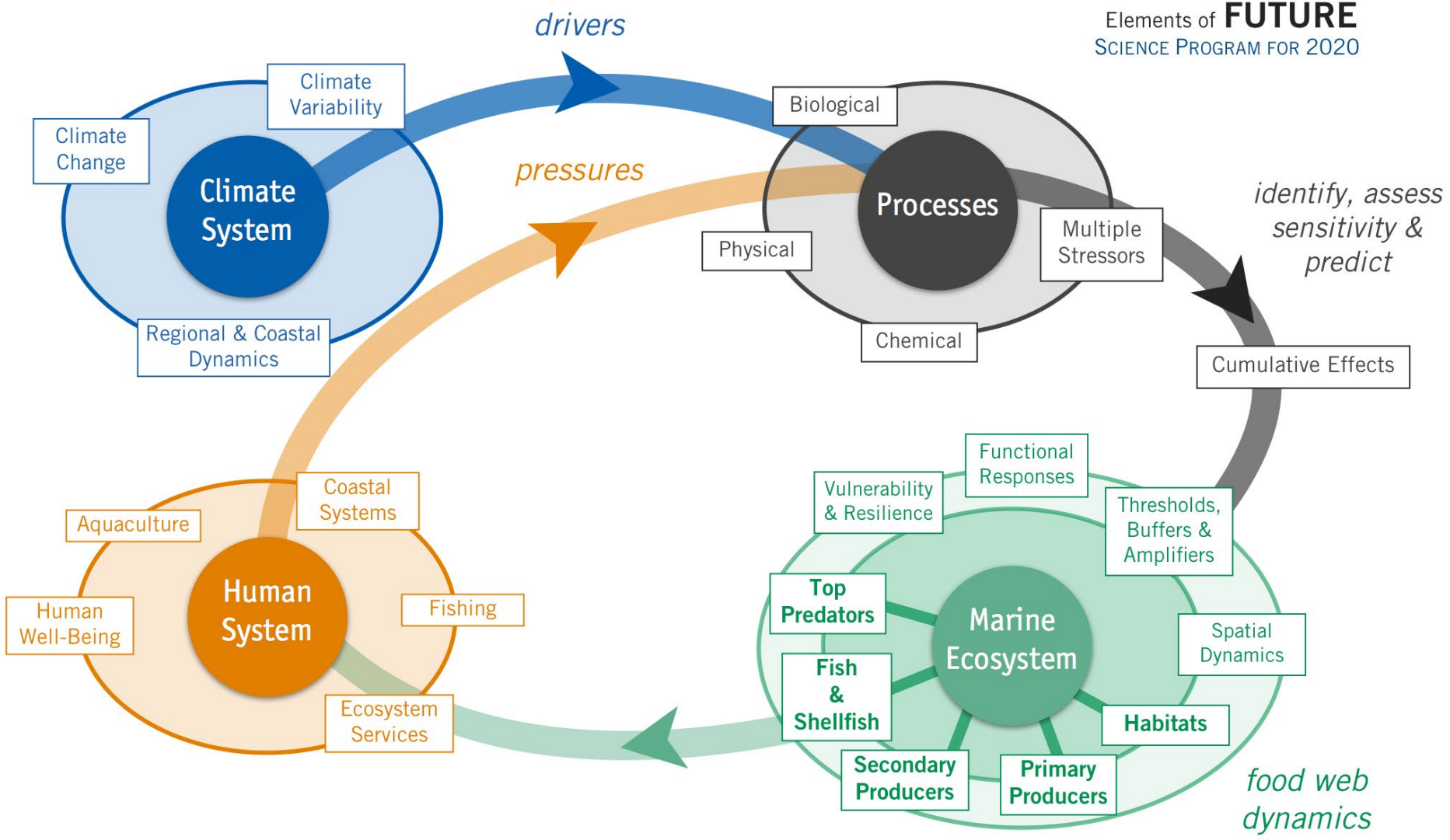
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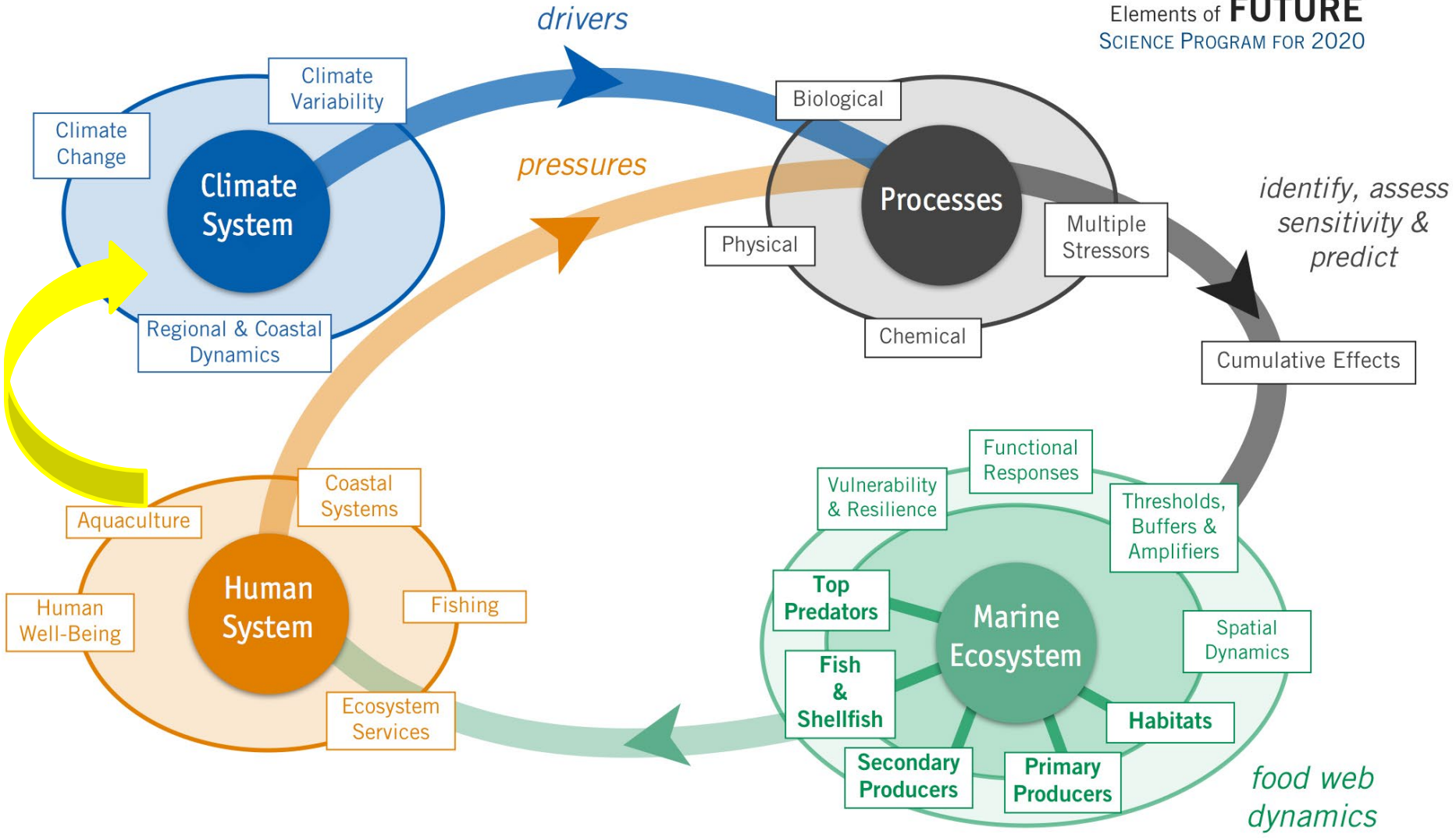
Cumulative Effects

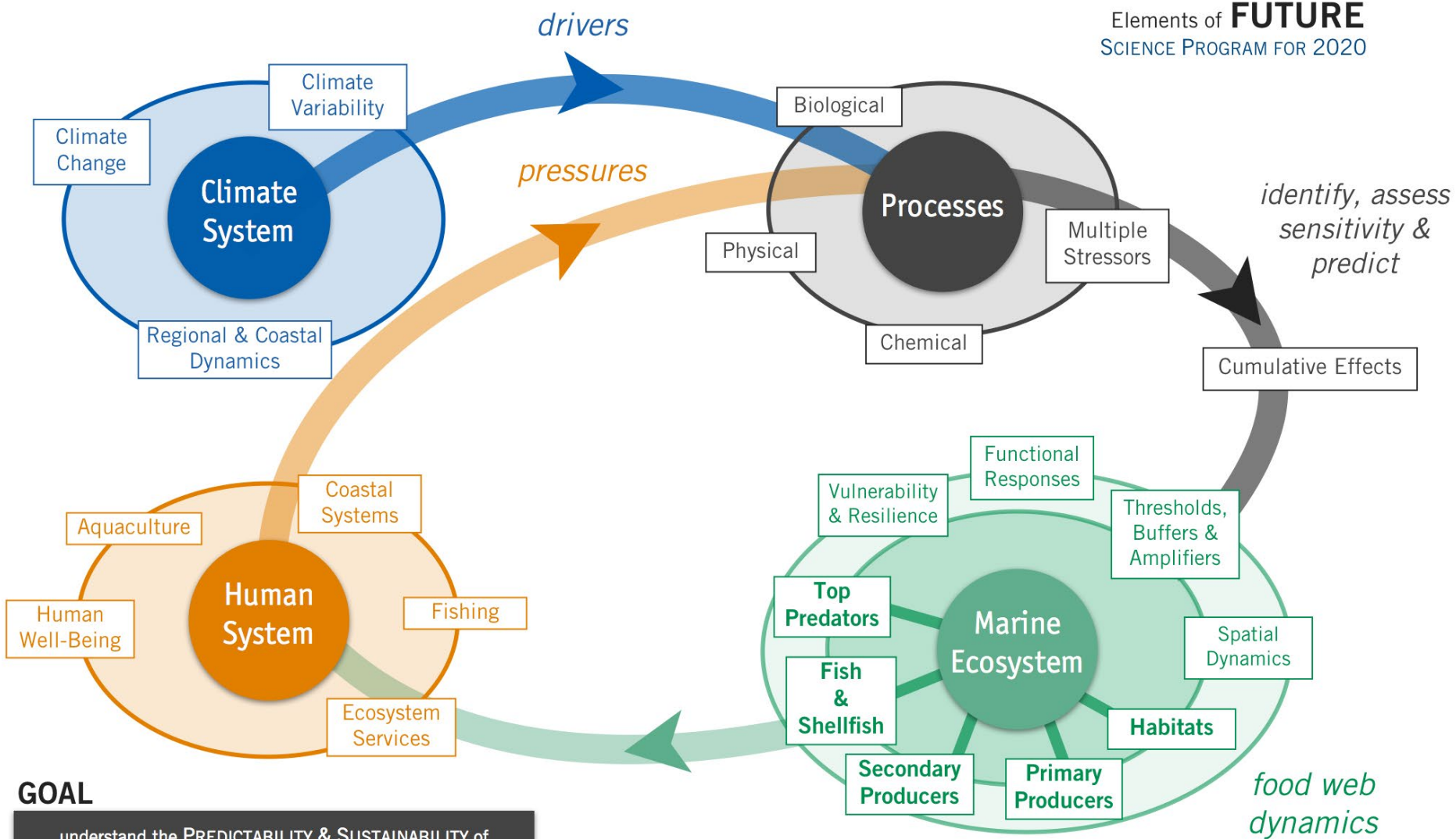


*food web  
dynamics*



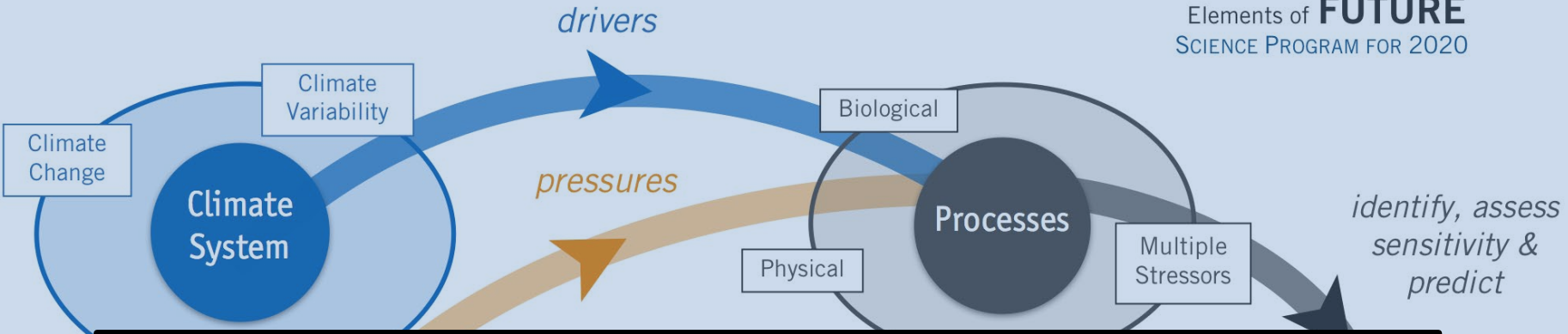




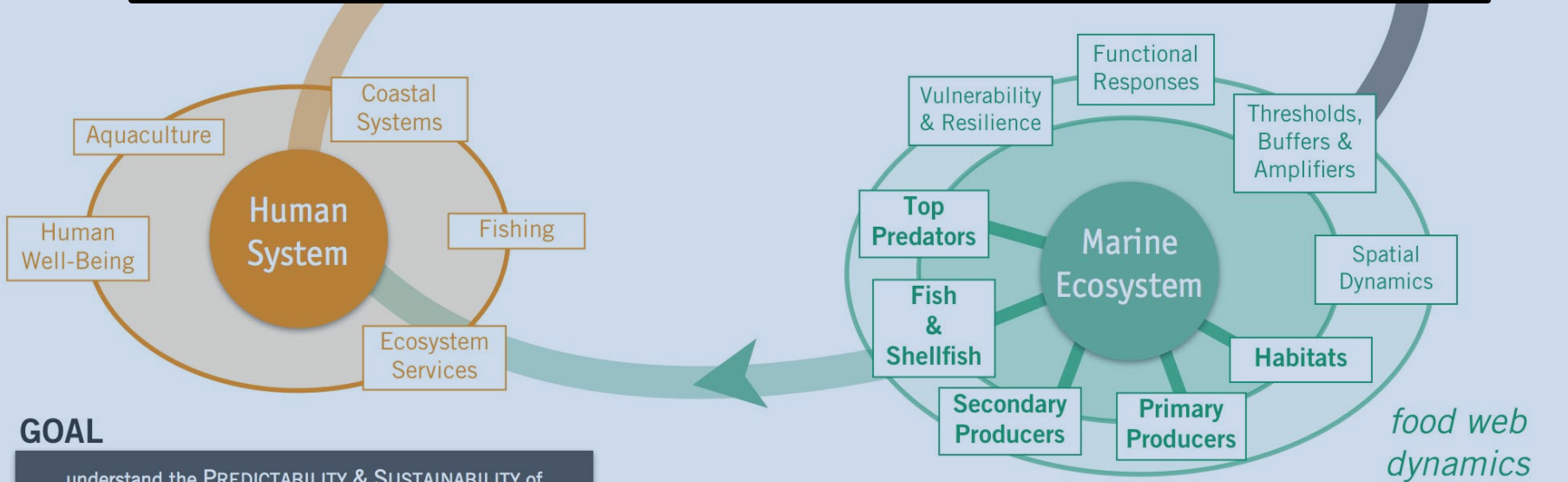


**GOAL**

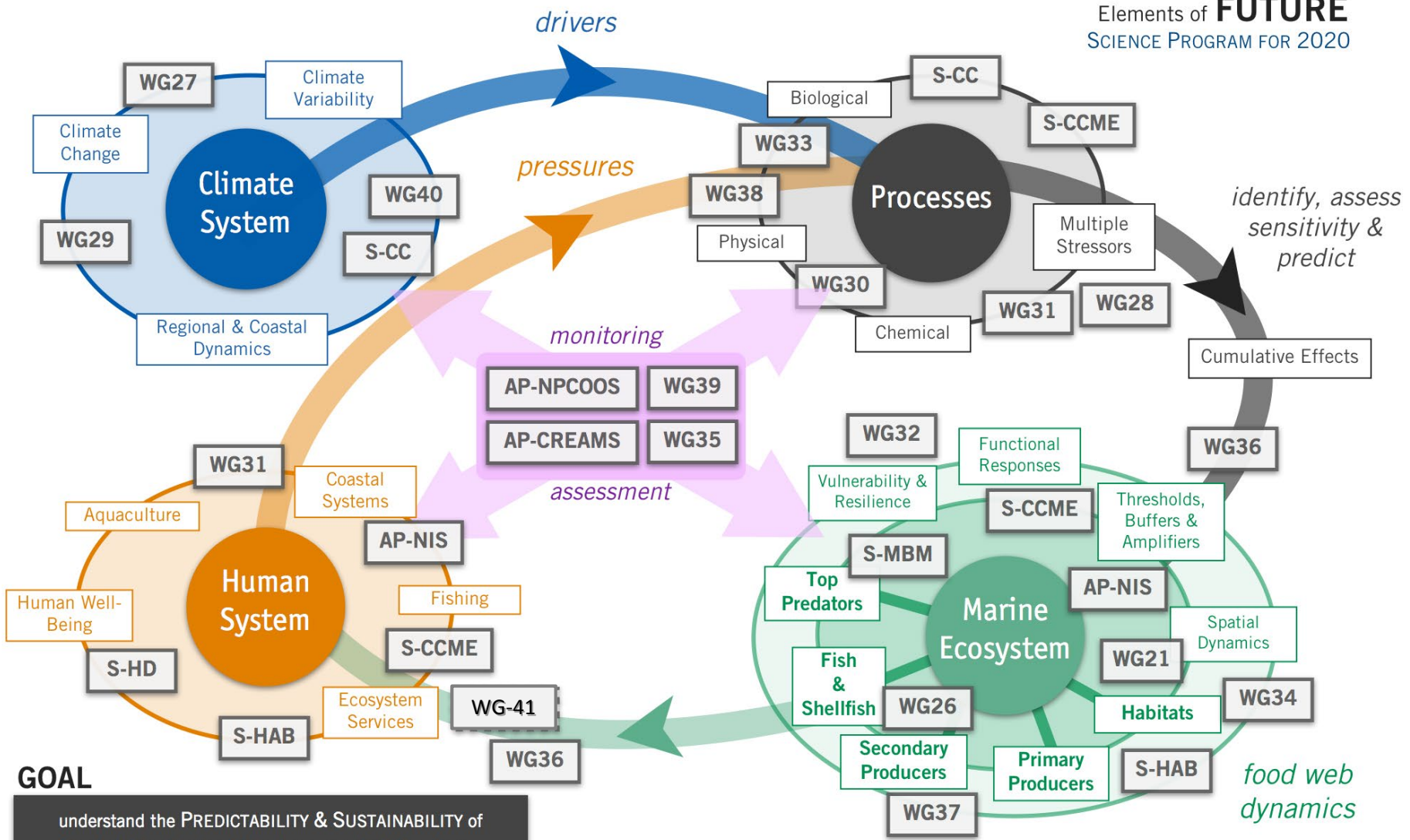
understand the **PREDICTABILITY & SUSTAINABILITY** of **Social-Ecological-Environmental Systems**



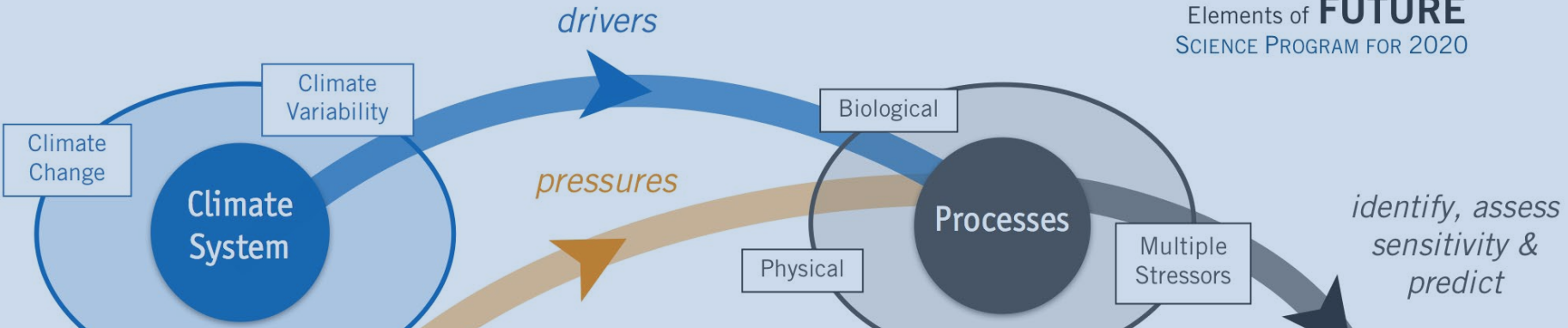
# How does PICES fit within this framework?



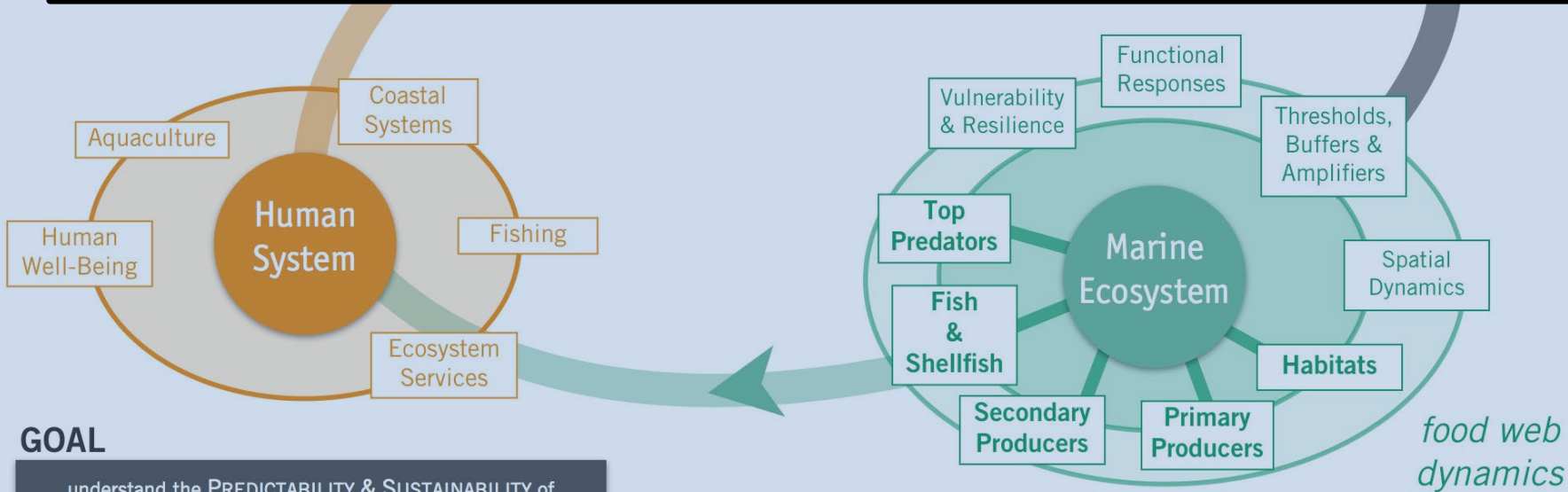
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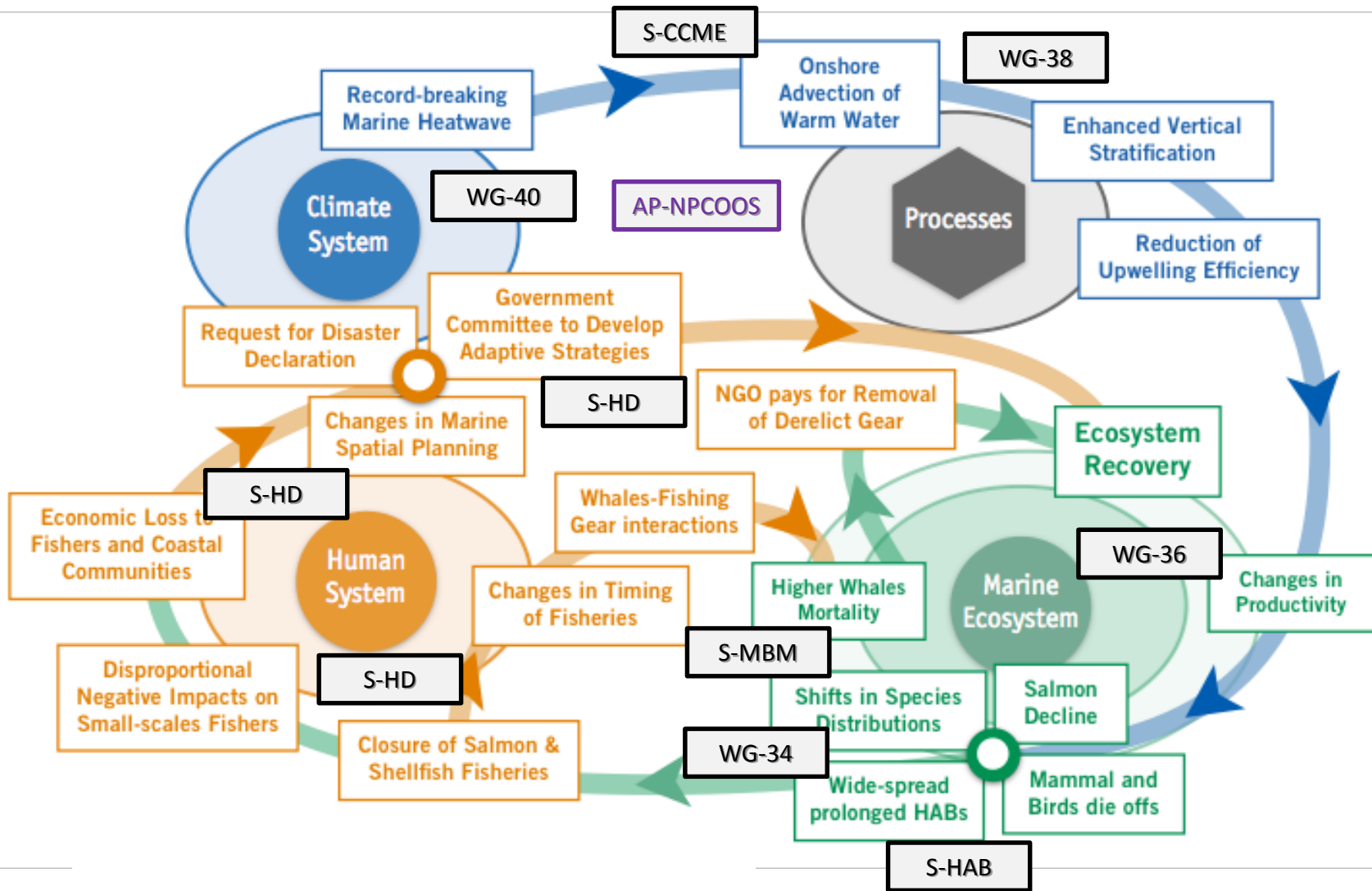
# How does PICES/FUTURE apply this framework?



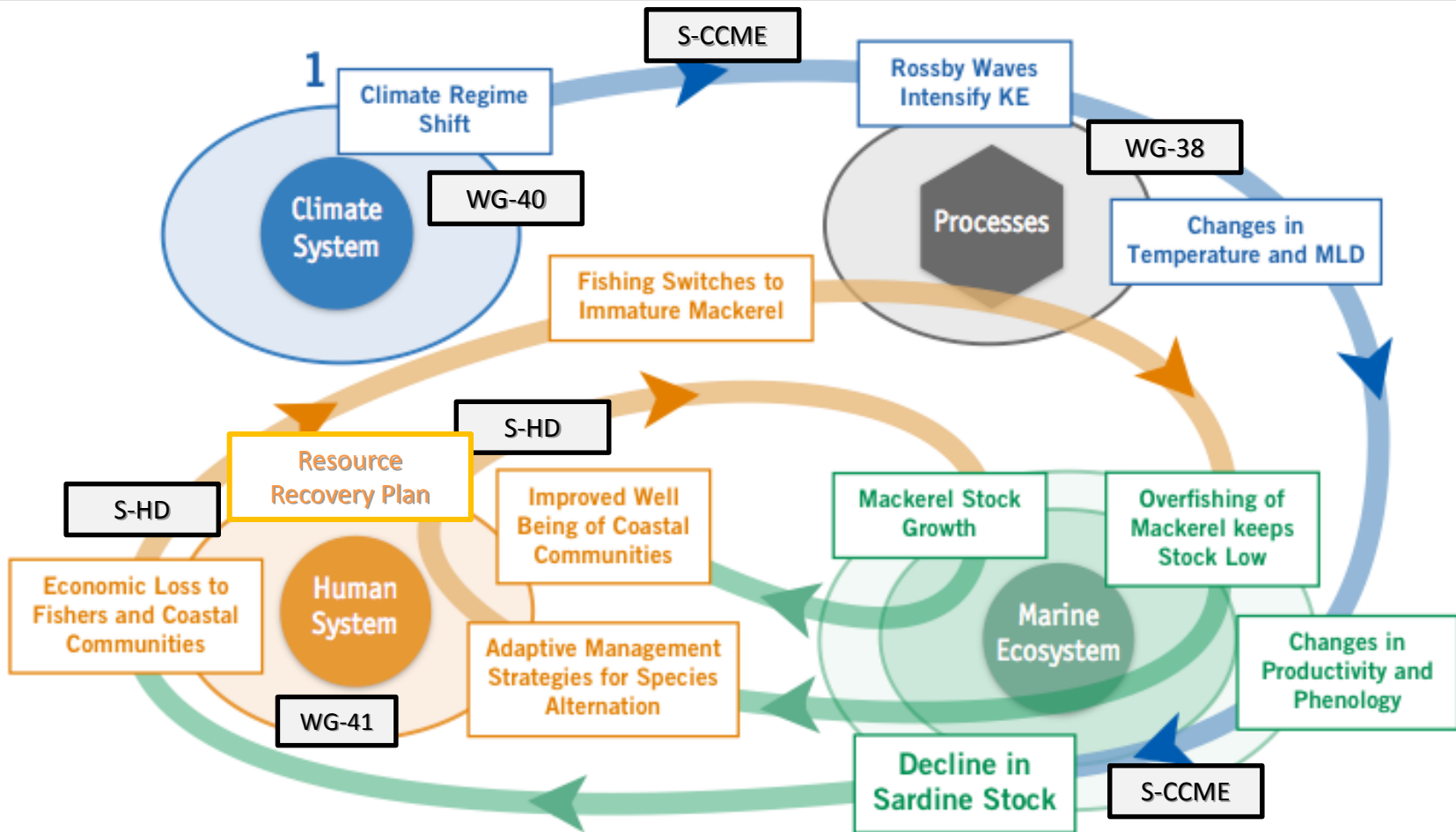
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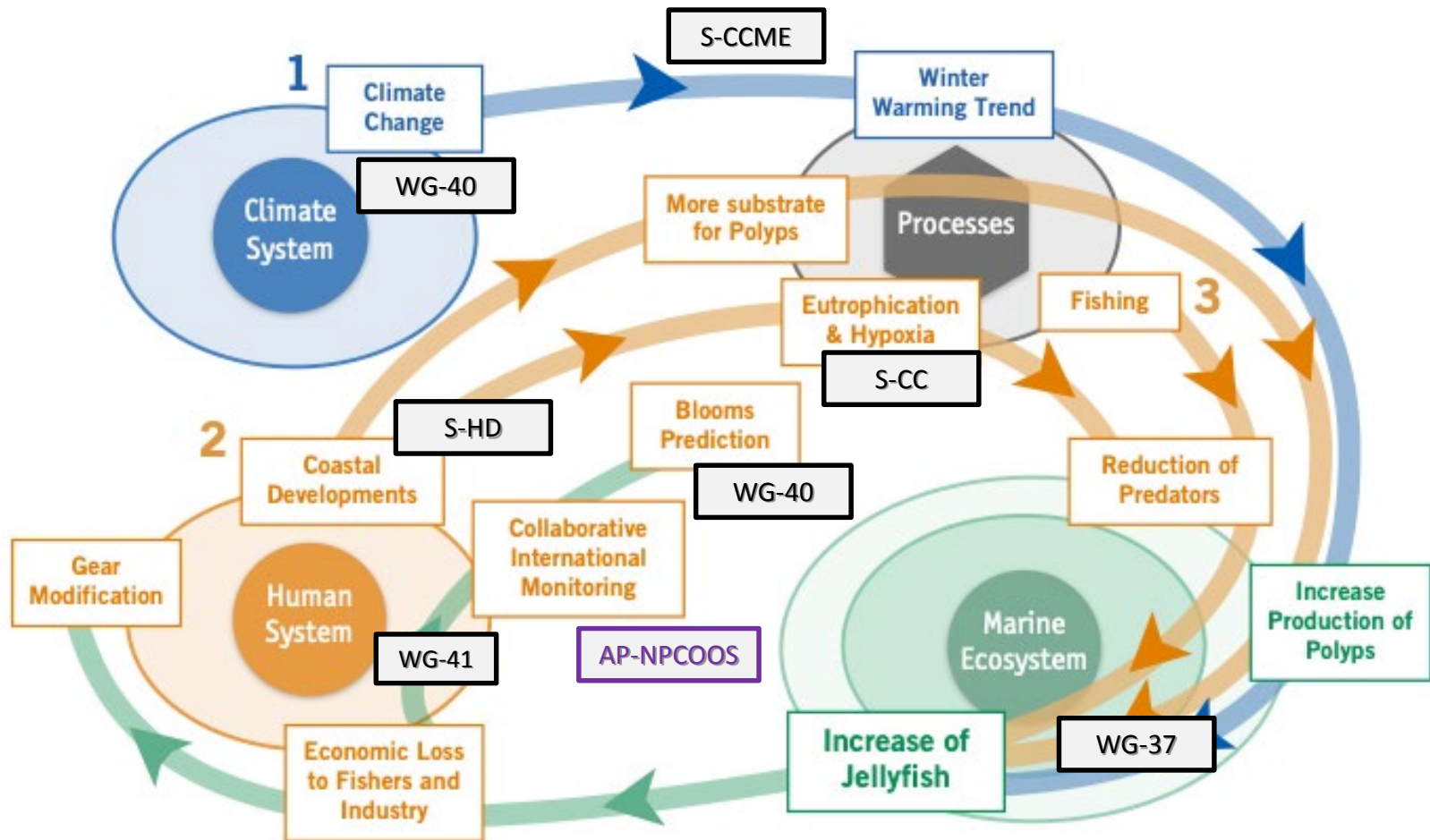
# Case Study: Northeast Pacific Marine Heat Wave, 2014-16



# Case Study: Species Alternation in the Western Pacific



# Case Study: Jellyfish Blooms in the Western Pacific







## COMMUNITY INPUT TO **FUTURE**

1. Are there better ways for FUTURE to achieve its objectives?
  - Improved communication within PICES community
  - Steering Committee liaisons for Expert Groups
  - Collaborative work between Expert Groups
2. What other case studies should PICES implement?
3. Are issues related to coastal societies and ecosystems being adequately addressed?



## COMMUNITY INPUT TO THE **FUTURE**

1. What are the emerging issues (scientific, technological) that PICES should address?
2. What process should PICES undertake to implement a new integrative Science Program?
3. What type of Science Program(s) should PICES implement?
4. How can PICES contribute to the UN Decade of the Ocean (2021-2030)

