A Regional Action Plan (RAP) for Climate Science in the Gulf of Alaska

Alaska Fisheries Science Center

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NPFMC

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Guidance Document from Headquarters

NOAA Fisheries Climate Science Strategy

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**Alaska Regional Action Plan
for the Southeastern Bering Sea**
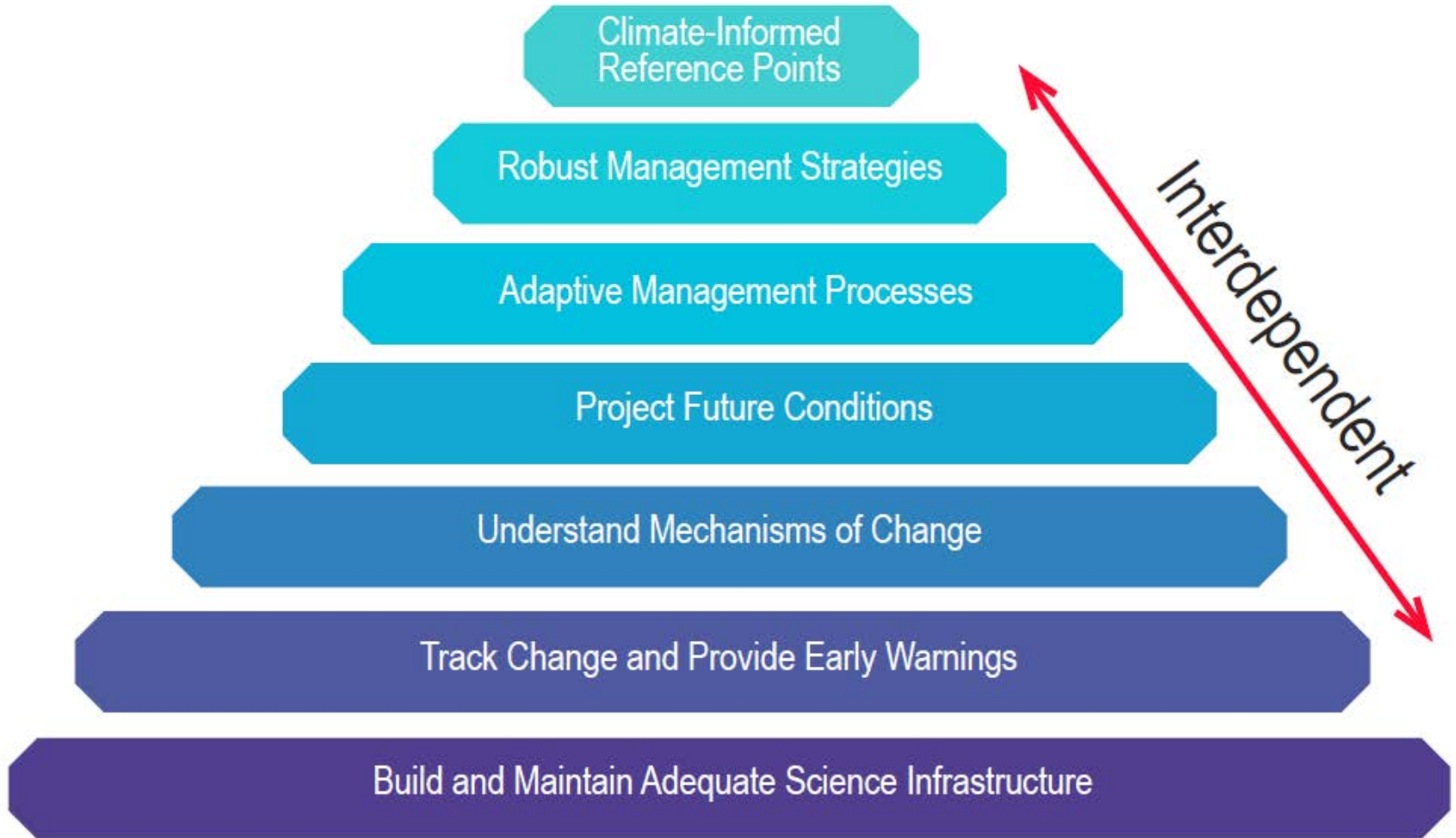
NOAA FISHERIES CLIMATE SCIENCE STRATEGY

Bering Sea plan
published Sept 2016

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Potential stressors by LME

	Arctic	EBS	AI	GOA
Fishing	✕	🟢	🔵	🟢
Population	🔵	🔵	🔵	🔵
Oil/Mineral	🟢	🔵	🔵	🟢
Climate change	🟢	🟢	🔵	🟢
Tourism	✕	🔵	🔵	🟢
Shipping	🔵	🔵	🟢	🔵
Aquaculture	✕	✕	✕	🔵
Forestry	✕	✕	✕	🔵

Climate Science Strategy Objectives

Climate-Informed Reference Points

Robust Management Strategies

Adaptive Management Processes

Project Future Conditions

Understand Mechanisms of Change

Track Change and Provide Early Warnings

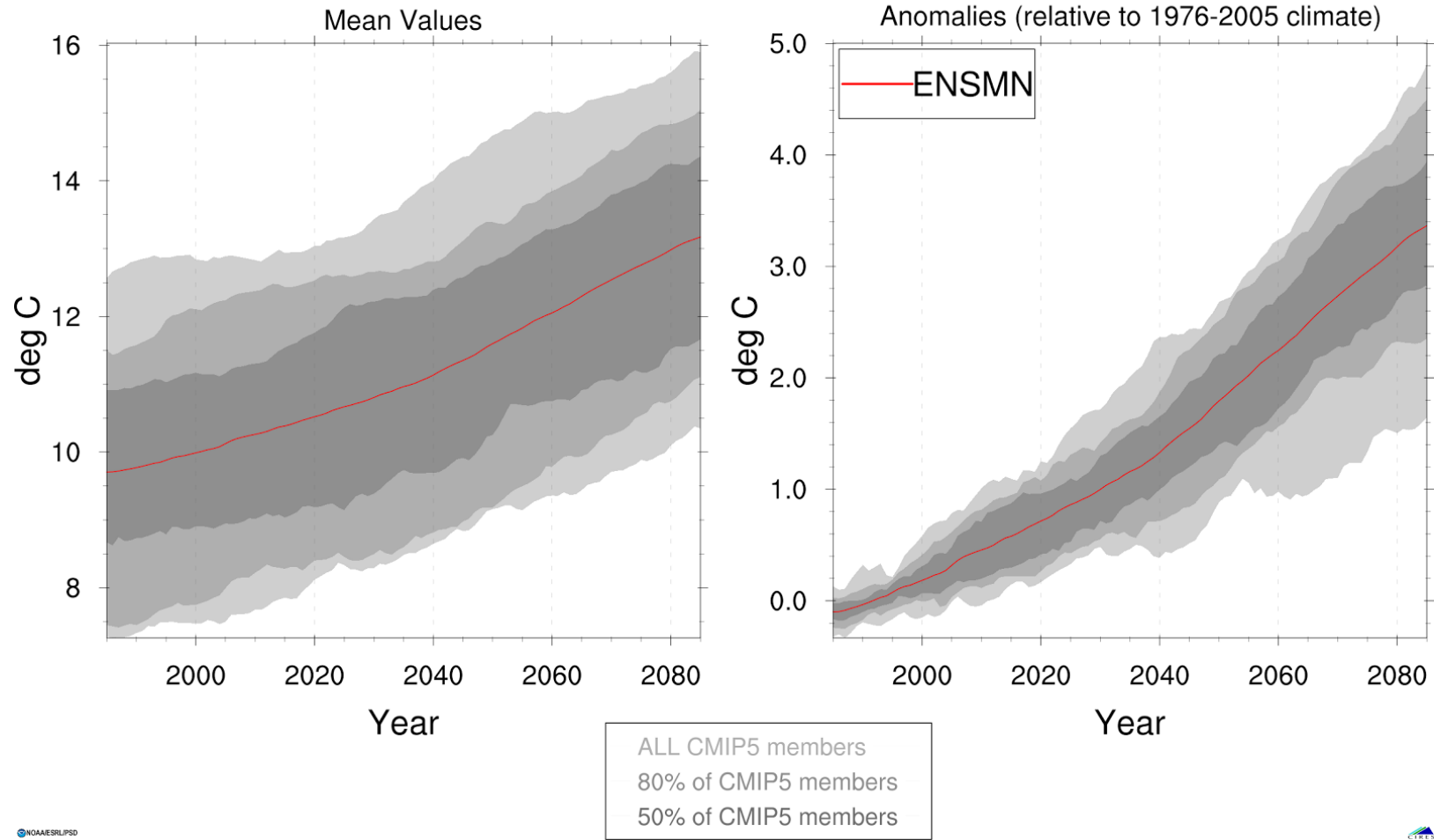Build and Maintain Adequate Science Infrastructure

Interdependent

Projected changes in climate in the GOA

- Ocean warming

- Ocean acidification

- Oxygen limitation

- Changes in freshwater runoff

- Changes in ocean circulation and stratification
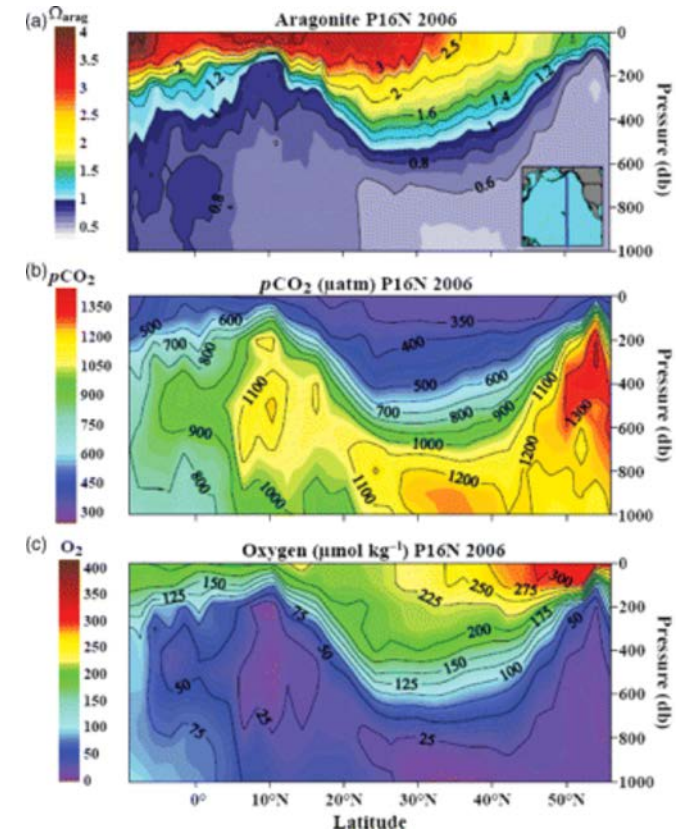
ANN tos for Gulf of Alaska with 20 year running mean (20thC + rcp85)

Projected increases in sea surface temperature for the Gulf of Alaska (left) and future temperatures relative to historic means (right).

Potential impacts on marine biota

- Direct: temperature and metabolism, ocean acidification and shelf formation

- Indirect: changes in prey, changes in predation

- Responses by individuals: growth, maturation, phenology, behavior, migration.

- Population responses: favorable or unfavorable recruitment, changes in productivity.

- Ecosystem responses: sudden or gradual ecosystem reorganization, species invasions.

AFSC's climate science strategy for the GOA: four main areas of activity

- Long-term monitoring

- Process studies

- Risk assessment

- Modeling climate impacts and management scenarios
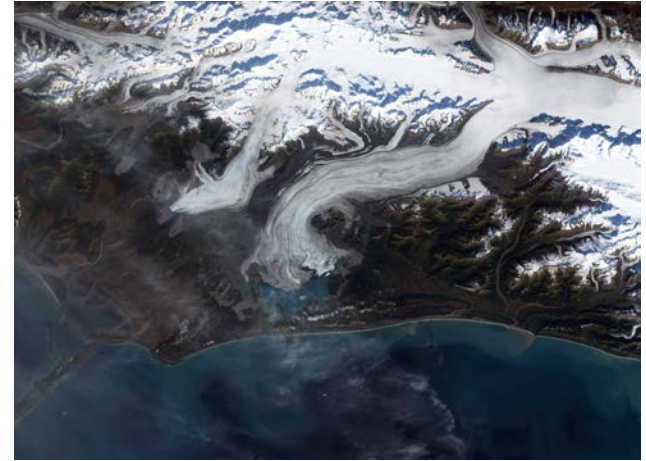
Long-term monitoring

- **Comprehensive set of assessment surveys for long-term monitoring.** AFSC conducts multispecies groundfish surveys, mid-water acoustic surveys, longline surveys, ichthyoplankton surveys, juvenile fish surveys, ecosystem process surveys, and marine mammal surveys.

- **Gulf of Alaska Ecosystem Considerations.** The AFSC Ecosystem Considerations report is produced annually to summarize information about the Alaska marine.

- **Community vulnerability indicators and snapshots.** Economic and social conditions in Gulf of Alaska fishing communities are tracked by updating susceptibility and exposure indices for the community vulnerability analysis, and by collecting and reporting the information in the community snapshots.

Process studies

- **Recruitment Processes Alliance.** This ongoing, multi-faceted research program attempts to understand recruitment variability, focusing on mechanisms that mediate growth and survival of egg, larval and juvenile stages of focal Gulf of Alaska fish species.

- **Ocean acidification research.** This project will involve a series of laboratory experiments to describe the effect of ocean acidification on the growth and development of walleye pollock and northern rock sole.

- **Spatial response of northeast Pacific groundfish to anomalous warming in 2015.** This project examines the role of extreme environmental conditions on the spatial distribution patterns of northeast Pacific groundfish throughout their range in an anomalously warm year (2015),

Risk Assessment

- **Climate vulnerability analysis for the Gulf of Alaska.** This project will qualitatively assess species vulnerabilities to climate change and provide guidance on research prioritization. This project will rely on standard NOAA Fisheries approach that has been used in the eastern Bering Sea and elsewhere.

NOAA FISHERIES

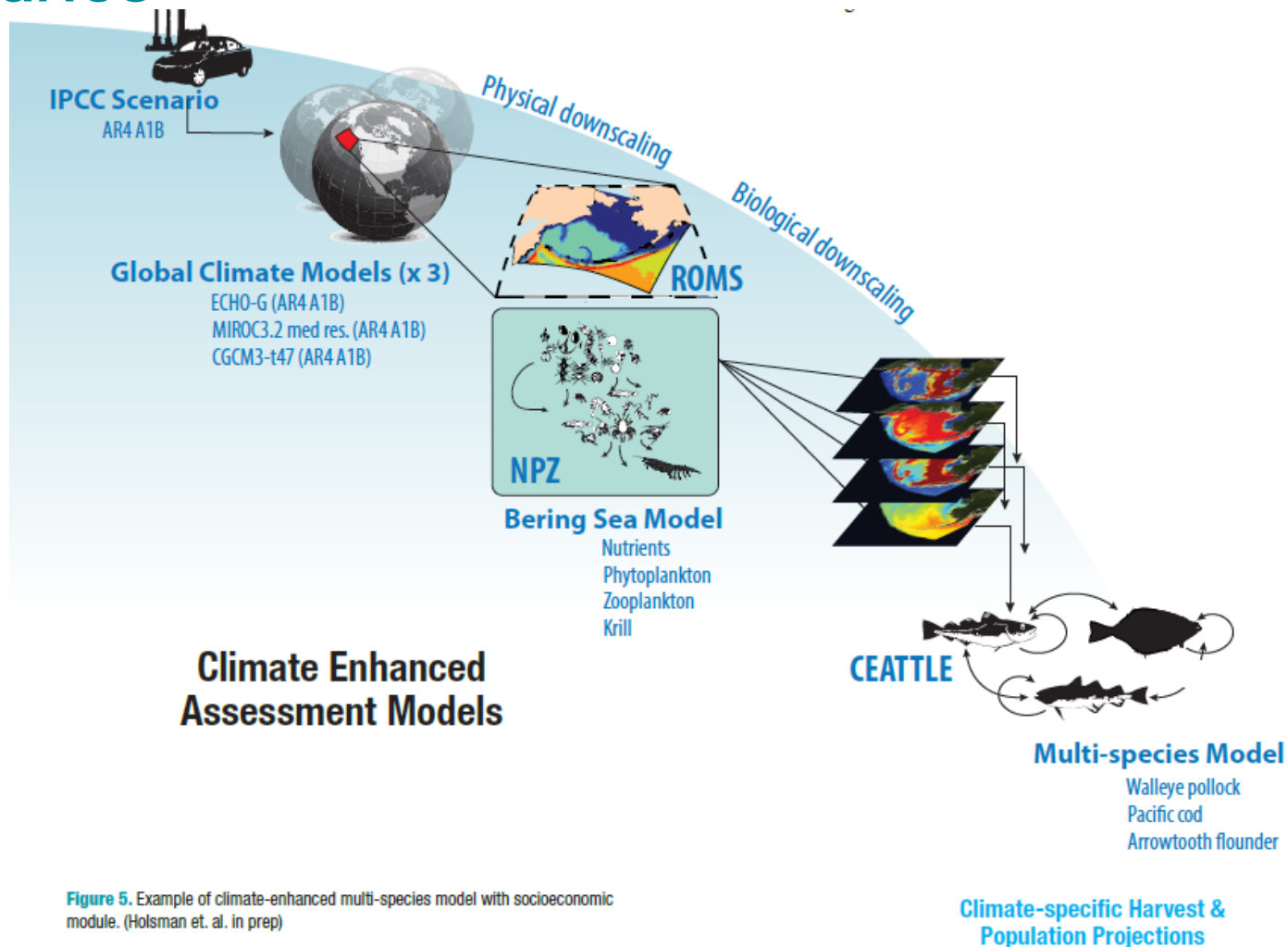# Modeling climate impacts and management scenarios

Figure 5. Example of climate-enhanced multi-species model with socioeconomic module. (Holsman et. al. in prep)

Modeling climate impacts and management scenarios

- **CEATTLE multispecies model.** This project will apply the CEATTLE multispecies model to characterize interactions between walleye pollock, Pacific cod, arrowtooth flounder and halibut in the Gulf of Alaska. This project will evaluate future fisheries productivity and climate-specific reference points under a variety of climate projections and harvest strategies.

- **Computable general equilibrium (CGE) regional economic models for southwest Alaska.** This project develops computable general equilibrium models for six borough and census areas in southwest Alaska to evaluate impacts of climate change at the local scale.

RAP Table of Projects

NCSS objectives addressed	Action name	Funding scenario	Time frame	Action description	Division/ Partners
Long-term monitoring					
6, 7	Bottom trawl survey	Level	Ongoing	Multi-species bottom trawl surveys are conducted to monitor trends in abundance and distribution of demersal component of the ecosystem, including fish and invertebrates.	RACE
1, 2, 3, 4	Single species MSEs for sablefish and several rockfish	Increase		Link recruitment and other biological processes to environment variables. Project future population trends, distribution and movement patterns.	ABL, REFM
...	...	...	...	...	...