American Samoa Reef Dependent Reef Piscivores

Climate Change Vulnerability Assessment Summary

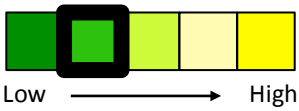
An Important Note About this Document: *This document represents an initial evaluation of vulnerability for commercial piscivores based on workshop input and existing information. The aim of this document is to expand understanding of species vulnerability to changing climate conditions, and to provide a foundation for developing appropriate adaptation responses.*

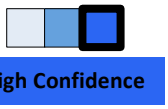
Species Description

There are over 69 different species of reef fish and invertebrates species/assemblages consumed and sold in American Samoa. Of those targeted, reef-dependent piscivores include jacks (*Carangidae* sp.), snappers *(Lutjanidae* sp.), groupers (*Serranidae* sp.), and emperor fish (*Lethrinidae* sp.).[1] Continued overfishing and declines in coral reef habitat will negatively impact reef fish populations, which are valuable to commercial, recreational, and subsistence fishermen.[2] Many reef-dependent fish that use coral reefs for spawning, foraging, protection, and feeding will likely experience population declines as corals degrade due to increased sea temperature, ocean acidifcation, and invasive species.[3]

Species Vulnerability

Low-Moderate Vulnerability

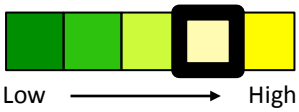


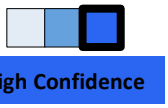


The relative vulnerability of reef-dependent piscivores was evaluated by workshop participants to be low to moderate due to moderate to high sensitivity to climatic and non-climatic stressors including ocean acidification and increased sea surface temperatures impacting reef habitat and biological processes, such as growth and reproduction. Reef-dependent piscivores also are impacted by high fishing pressure and nutrient loading/pollution but have high adaptive capacity with increased management of both habitat and species assemblages.

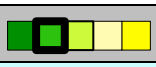
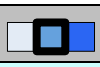
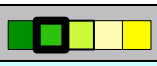
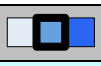
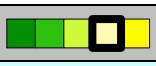
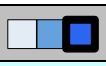
Sensitivity

Moderate-High Sensitivity





Reef-dependent piscivores are moderately to highly sensitive to several climate drivers such as ocean acidification, sea surface temperature, changes in currents, mixing, and stratification, and increased coastal erosion from extreme events. Non-climatic stressors including harvesting and coastal habitat and water quality degradation from dredging, land use changes, and nutrient loading are also issues of concern.

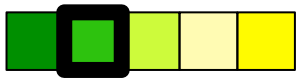
SENSITIVITY FACTORS AND IMPACTS*	
CLIMATE STRESSORS	Moderate sensitivity  Moderate confidence 
FACTOR	**IMPACT**
Ocean acidification/ pH	• Decline to coral habitat health and ability of coral to recover from bleaching events.[4] • Ocean acidification can impact reproductive processes possibly impacting fish eggs and larvae.
Sea surface temperature	• Increased bleaching events impacting habitat. • Range shifts due to increased sea temperature.[5] • Physiological and development impacts.[5] • Impact biological processes such as growth and reproduction.
Coastal erosion/Sea level rise	• Impacts to nursery grounds (seagrass and mangroves) for certain species.[3]
DISTURBANCE REGIMES	Low-moderate sensitivity  Moderate confidence 
FACTOR	**IMPACT**
El Niño patterns/ Disease/ Currents/ mixing/ stratification	• Loss of primary production due to weakening upwelling and decreased production. • Ocean circulation patterns may also disturb the ecological connectivity of coral reef populations.[4]
DEPENDENCIES	Low-moderate sensitivity  Moderate confidence 
FACTOR	**IMPACT**
Habitat Prey/forage dependency Generalist or specialist	• Moderate dependcy to habitat, prey and most species in assemblage considered generalists
NON-CLIMATE STRESSORS	Moderate-high sensitivity  High confidence 
FACTOR	**IMPACT**
Harvest	Broadly distributed, mostly for commercial and recreational fishing
Dredging	Localized dredging impacts; habitat destruction

* Factors presented are those ranked highest by workshop experts.

SENSITIVITY FACTORS AND IMPACTS*	
Land use change Roads/ armoring	Increased sedimentation from construction, farming and deforestation.

Exposure†

Low-Moderate Exposure

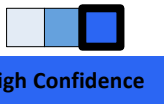


Reef-dependent piscivores will experience low to moderate future climatic exposure in the next 20 years from low dissolved oxygen impacting nearshore water quality, and increased sedimentation and erosion due to tropical storms and sea level rise.

PROJECTED CLIMATE AND CLIMATE-DRIVEN CHANGES‡	
CLIMATE STRESSOR	**PROJECTED CHANGES**
Dissolved oxygen	• Lower dissolved oxygen levels due to increased sea surface temperatures and nutrient loading from precipitation and extreme events
Coastal erosion & runoff/ Tropical storms	• Extreme rainfall projections are highly variable based on land form, ENSO/PDO patterns, and other factors. • Potential reduction in cyclone activity but increased storm intensity over the next 70 years. ○ Increased erosion, sedimentation, and nutrient loading due to sea level rise, and changes in precipitation.

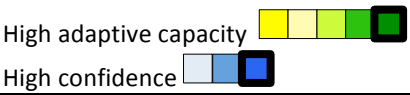
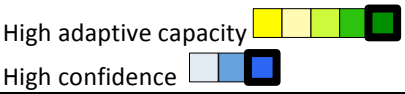
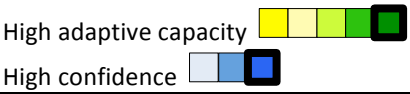
Adaptive Capacity§

High Adaptive Capacity



If managed properly, commercial piscivores could have high adaptive capacity in American Samoa through marine protected areas with enforcement, protection of nursery and spawning grounds, and reduction of sedimentation and pollution impacting reef habitats.

† Relevant references for regional climate projections can be found in the Climate Impacts Summary Table.
‡ Factors presented are those ranked highest by workshop experts, scoring 3 or above.
§ Please note that the color scheme for adaptive capacity has been inverted, as those factors receiving a rank of "High" enhance adaptive capacity while those factors receiving a rank of "Low" undermine adaptive capacity.

ADAPTIVE CAPACITY FACTORS AND CHARACTERISTIC	
FACTOR	**SPECIES CHARACTERISTICS**
Extent, status, & dispersal ability  High adaptive capacity High confidence	• Potential broad dispersal ability. • Transboundary species with high ability to disperse if proper habitat is found.
Intraspecific/life history diversity  High adaptive capacity High confidence	High diversity and plasticity.
Resistance  High adaptive capacity High confidence	High resistance to impacts and stressors.
Management potential  Moderate-high adaptive capacity High confidence	• Low management potential when used a traditional subsistence. • High cultural significance • Management efforts in reducing pollution loads, sedimentation, protection of nursery habitats, and regulating land-use practices in construction of green sea walls. • Marine protected areas with enforcement.

Literature Cited

[1] Levine, A., and S. Allen. 2009. American Samoa as a fishing community. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-PIFSC-19, 74 p.

[2] Gregg, R.M., A. Score, D. Pietri, and L. Hansen. 2016. The State of Climate Adaptation in U.S. Marine Fisheries Management. EcoAdapt, Bainbridge Island, WA.

[3] Leong, J.-A., J.J. Marra, M.L. Finucane, T. Giambelluca, M. Merrifield, S.E. Miller, J. Polovina, E. Shea, M. Burkett, J. Campbell, P. Lefale, F. Lipschultz, L. Loope, D. Spooner, and B. Wang. 2014. Ch. 23: Hawai'i and U.S. Affiliated Pacific Islands. Climate Change Impacts in the United States: The Third National Climate Assessment, J.M. Melillo, T.C. Richmond, and G.W. Yohe, Eds., U.S. Global Change Research Program, 537-556.

[4] Keener, V.W., J.J. Marra, M.L. Finucane, D. Spooner, and M.H. Smith (Eds.). 2012. Climate Change and Pacific Islands: Indicators and Impacts. Report for The 2012 Pacific Islands Regional Climate Assessment. Island Press, Washington, D.C.

[5] Guidry, M.W., and F.T. Mackenzie. 2011. Future Climate Change, Sea-Level Rise, and Ocean Acidification: Implications for Hawai'i and Western Pacific Fisheries Management. University of Hawai'i Sea Grant College Program.