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Pacific Conservation Biology

Supplementary Material

Resilience of a giant clam subsistence fishery in Kiribati to climate change

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Case study rubric

Note: the below information was a pilot research project and was incorporated into the Climate-Resilient Fisheries Planning Tool, a product of the Science for Nature and People Partnership (SNAPP) working group on Climate-Resilient Fisheries.

For the pilot research project, case study authors were provided with the following instructions and questions:

Directions: Based on the information and evaluation of the fishery system provided in the preceding modules, please provide your assessment of capacities (and conversely, limitations) that will affect its ability to be resilient to the impacts of climate change. This assessment should reflect current capacities in the system. Questions are open-ended and responses should be in the form of short narrative statements. The "questions to consider" are intended to prompt thinking about potentially relevant topics, but are not meant to constrain responses to only those topics.

For each question:
1. Use the yellow cells to record your response & information quality [not shown here].
2. Indicate 'Don't know' or 'Not relevant' in the appropriate columns as needed. (Then select Option E or Option NA in the 'information quality' column.)
3. Record any additional information in the gray cells.

Information quality scoring: For each question, please use the 'information quality' column to indicate the quality of the answer provided by using the following metrics:
A - The answer provided is based on adequate and reliable data/information
B - The answer provided is based on limited data/information and expert judgment
C - The answer provided is based solely on expert judgment, and I am fairly confident that the answer provided reflects the true state of the system
D - The answer provided is based solely on expert judgment, but I am not confident that if the answer provided reflects the true state of the system
E - No data. I do not have sufficient information available to answer this question and no basis for providing an expert opinion.
NA - Not relevant in this system

Resilience attributes (Section 4):
For each resilience attribute, indicate the degree to which this attribute is present within the fishery system (Column G) and evaluate the information quality associated with that score (Column K). For each attribute, a mechanism for how it influences resilience is proposed in Column L. In Column M, please indicate whether the mechanism works as described in the fishery system being studied. If 'yes', additional notes can be provided in Column O. If 'no', please explain why not or indicate an alternative mechanism relevant to this fishery case in column N. If the respondent doesn't have sufficient information to score an attribute, indicate 'don't know' (Column I). Then select option E in Column K and 'NA' in Column M. If the attribute is not relevant to the fishery system, indicate 'not relevant' (Column J). Then select option F in Column K and 'NA' in Column M. For each subset of resilience attributes, provide a brief description of those features and how they exist and are being maintained in the system.

Section 1 - Key Case Identifiers		
Sub-section	**Question ID**	**Question**
1.1.	1.1.1.	Name of fishery system
1.2.	1.2.1.	What species are fished? (If multi-species, please list all) *
1.3.	1.3.1.	Where does the fishery occur geographically? (LAT; LON) *
1.4. Spatial	1.4.1.	At what spatial scale are you considering the system? (km2) *
	1.4.2.	What are the lat/lon bounding coordinate of the system. *
1.5. Temporal	1.5.1.	At what temporal scale are you considering this system? (over how many past years)
	1.5.2.	At what temporal scale are you considering this system? (over how many future years)?
1.6.	1.6.1.	What is the scale of the fishery? A. Large-scale B. Small-scale C. Mixed
1.7.	1.7.1.	Who are the actors within the fishery system? A. Fishers B. Traders/dealers C. Processors D. Local community E. Scientists F. Resource Managers G. Others (please specify):
	1.7.2.	Of the actors listed above, which do you know enough about to consider in this case study? A. Fishers B. Traders/dealers C. Processors D. Local community E. Scientists F. Resource Managers G. Others (please specify):

Section 2 - Contextual Description		
Sub-section	**Question ID**	**Question**
2.1.1.	2.1.1.1.	What is the physical context within which the fishery takes place? Check all that apply: A. Intertidal (e.g. beach, mangrove) B. Estuary C. Coastal/nearshore (e.g. lagoon, fjord, coral reef, archipelago) D. Shelf E. Deep sea (e.g. canyon) F. Other (*please specify*):
2.1.2.	2.1.2.1.	Which of the following contribute to primary productivity? A. Upwelling B. Fluvial inputs/plumes C. Sea ice D. Vegetated habitats (e.g. salt marsh, mangroves, seagrasses, kelp forests) E. Coral reefs F. Other (*please specify*):
2.1.3. Species	2.1.3.1.	What is/are the focal species of the fishery? *Please describe*:
2.1.3. Species	2.1.3.2.	What are the recent population trends (at a time scale relevant to focal species lifespan)? (For a multispecies fishery, please generally describe types of population trends for groups of species in the "describe" column.) A. Increasing B. Stable C. Declining D. Threatened or vulnerable E. Insufficient data
2.1.4. Habitat	2.1.4.1.	What is the key habitat that supports species in this fishery? *Please describe:*
2.1.4. Habitat	2.1.4.2	What is the general status of the key habitat used by species in this fishery? (select one) A. Favorable B. Inadequate to unfavorable C. Unfavorable D. Collapsed E. Data deficient
2.1.4. Habitat	2.1.4.3.	Trend in key habitats: A. Improving B. Stable C. Deteriorating D. Data deficient
2.1.5. Stressors	2.1.5.1.	Is overfishing currently occuring on the stock/stocks in this fishery? (For a multispecies fishery, please *describe* which stocks (or groups of stocks) are overfished in the "describe" column. A. Yes - substantially B. Yes - moderately

		C. Yes - minimally D. No E. Data deficient
2.2.1. Social	2.2.1.1.	Are cultural, traditional, and historic practices observable? A. Yes, *please describe:* B. No
2.2.1. Social	2.2.1.2.	How dependent are harvesters on the fishery for food or nutrition compared to their dependence on other food options? Please indicate the general range if there is a high degree of variability among participants. A. High B. Moderate C. Low D. NA
2.2.1. Social	2.2.1.3.	How dependent are the communities on the fishery for food or nutrition compared to their dependence on other food options? Please indicate the general range if there is a high degree of variability among participants. A. High B. Moderate C. Low D. NA
2.2.1. Social	2.2.1.4.	Are any groups particularly dependent on this fishery for food or nutrition? A. Indigenous B. Women C. Rural D. Other (*please specify*):
2.2.2. Political governance quality	2.2.2.1.	What is the average of the following indicator in the World Bank's Governance Indicators, each scored [-2.5,2.5] ? Government Effectiveness
2.2.2. Political governance quality	2.2.2.2.	What is the average of the following indicator in the World Bank's Governance Indicators, each scored [-2.5,2.5] ? Regulatory Quality
2.2.2. Political governance quality	2.2.2.3.	What is the average of the following indicator in the World Bank's Governance Indicators, each scored [-2.5,2.5] ? Rule of Law
2.2.2. Political governance quality	2.2.2.4.	What is the average of the following indicator in the World Bank's Governance Indicators, each scored [-2.5,2.5] ? Control of Corruption
2.2.2. Political governance responsiveness	2.2.2.5.	What is the average of the following indicator in the World Bank's Governance Indicators, each scored [-2.5,2.5] ? Voice and Accountability
2.2.2. Political governance responsiveness	2.2.2.6.	What is the average of the following indicator in the World Bank's Governance Indicators, each scored [-2.5,2.5] ? Political Stability
2.2.3 Economic	2.2.3.1.	Which income category does(do) the harvesting country(ies) belong to (see definition by World Bank here)? A. High

		B. Upper-middle C. Lower-middle D. Low
2.2.3 Economic	2.2.3.2.	What kind of sectors operate in the fishery? A. Small operators B. Large operators C. Recreational D. Artisanal E. Indigenous F. Other (*please specify*):
2.2.3 Economic	2.2.3.3.	What is the current landed volume? *Please describe and indicate year represented:*
2.2.3 Economic	2.2.3.4.	What is the current landed value? *Please describe and indicate year represented:*
2.2.3 Economic	2.2.3.5.	What are the trends in landings over the past 10 years? (For a multispecies fishery, this response should represent the fishery as a whole, not individual stocks.) A. Increasing B. Declining C. Stable D. Variable with no clear trend E. Data deficient
2.2.3 Economic	2.2.3.6.	Approximately how many vessels participate? *Please describe and estimate of number or order of magnitude: tens, hundreds, thousands:*
2.2.3 Economic	2.2.3.7.	How dependent are harvesters on the fishery for jobs and income compared to their other livelihood options? Please indicate the general range if there is a high degree of variability among participants. A. High B. Moderate C. Low D. NA
2.2.3 Economic	2.2.3.8.	How dependent are shoreside businesses on the fishery for jobs and income compared to their other livelihood options? Please indicate the general range if there is a high degree of variability among participants. A. High B. Moderate C. Low D. NA
2.2.3 Economic	2.2.3.9.	How dependent are dealer/processors on the fishery for jobs and income compared to their other livelihood options? Please indicate the general range if there is a high degree of variability among participants. A. High B. Moderate C. Low D. NA
2.2.3 Economic	2.2.3.10.	How dependent is the community on the fishery for economic benefits compared to its other sources of revenue?

		A. High B. Moderate C. Low D. NA
2.2.3 Economic	2.2.3.11.	What is the primary purpose for utilization of the species harvested? A. Fresh consumption B. Processed (value-added) products (including both domestic and export-oriented) C. Export product D. Other (*please specify)*:
2.3.1.	2.3.1.1.	Within which jurisdiction(s) is the fishery contained? A. One domestic regional jurisdiction B. Multiple domestic regional jurisdictions C. One coastal state D. Multiple coastal states E. Areas Beyond National Jurisdiction (ABNJ) F. Other (*please specify*):
2.3.2.	2.3.2.1.	What laws, policies and practices exist concerning the fishery and are they upheld? (If you know them, or can easily look up, please list name of the statute and year in 'notes' column) A. International Treaty B. National C. Regional (State, Province, Prefecture, etc.) D. Municipal/Local E. Community (Including formal and informal rules and practices. implemented by local cooperatives, sectors, and other organizations) F. Other (*please specify*):
2.3.3.	2.3.3.1.	What is the nature of governance arrangements? A. Top-down B. Community-based (e.g. LMMA, TURF) C. Co-management D. Traditional/customary (e.g. ICCA) E. Other (*please specify*):
2.3.4.	2.3.4.1.	Who is involved in governance? A. Multinational fishery management body B. National government agencies C. Regional (State, Province, Prefecture, etc.) government agencies D. Municipal/local government agencies E. Individual harvesters or harvester associations F. Dealers, processors or their associations G. Shoreside businesses H. Environmental NGOs I. Community organizations J. Other (*please specify*):
2.3.5.	2.3.5.1.	Do Financial Resources confer or limit the capacity to effectively participate in the governance system? *Please describe; note whether your selection pertain to particular groups selected above* A. Confers

		B. Limits C. Neither confers or limits D. Both confers and limits
2.3.5.	2.3.5.2.	Do Human Resources confer or limit the capacity to effectively participate in the governance system? Please describe; note whether your selection pertain to particular groups selected above A. Confers B. Limits C. Neither confers or limits D. Both confers and limits
2.3.5.	2.3.5.3.	Do Social Factors (trust, social networks) confer or limit the capacity to effectively participate in the governance system? Please describe; note whether your selection pertain to particular groups selected above A. Confers B. Limits C. Neither confers or limits D. Both confers and limits
2.3.5.	2.3.5.4.	Does Scientific Competency confer or limit the capacity to effectively participate in the governance system? Please describe; note whether your selection pertain to particular groups selected above A. Confers B. Limits C. Neither confers or limits D. Both confers and limits
2.3.5.	2.3.5.5.	Do Other factors (please specify) confer or limit the capacity to effectively participate in the governance system? Please describe; note whether your selection pertain to particular groups selected above A. Confers B. Limits C. Neither confers or limits D. Both confers and limits
2.3.6.	2.3.6.1.	Is power in the governance system related to religion, gender, ethnic origin, political party, language, race or sexual orientation? A. Yes, *please describe*: B. No
2.3.7.	2.3.7.1.	Do power relations cause tension within the fishery? A. Yes, *please describe*: B. No
2.4.1.	2.4.1.1.	Does a management plan exist for this fishery? A. Yes, *please describe*: B. No
2.4.2.	2.4.2.1	Who is involved in the management process? A. Multinational fishery management body B. National government agencies C. Regional government agencies (State, Province, Prefecture, etc.) D. Municipal/local government agencies E. Individual harvesters or harvester associations

		F. Dealers, processors or their associations G. Shoreside businesses H. Environmental NGOs I. Community organizations J. Other (*please specify*):
2.4.3.	2.4.3.0.	Who plays the following roles in the fishery management process? Each may include multiple actors (2.4.3.1 - 2.4.3.5). (*Please write response in 'describe' column.*)
2.4.3.	2.4.3.1.	Determining access and harvest rights
2.4.3.	2.4.3.2.	Determining harvest procedures and rules
2.4.3.	2.4.3.3.	Enforcing rules
2.4.3.	2.4.3.4.	Monitoring fishery activity (e.g., catch)
2.4.3.	2.4.3.5.	Providing scientific information
2.4.3.	2.4.3.6.	Please add any other roles important to fisheries management in your case and indicate which actors play that role.
2.4.4.	2.4.4.1.	What are the tools used to control catch? (please check all that apply) A. None specific to this fishery B. Total allowable catch limit C. Individual catch limit D. Total allowable effort limit E. Individual effort limit F. Size limits G. Spatial restrictions on fishing H. Temporal restrictions on fishing I. Gear restrictions J. Species restrictions K. Other (*please specify*):
2.4.5.	2.4.5.1.	What measures are taken to conserve habitats? A. None specific to this fishery B. Gear restrictions C. Season closure D. Year-round no-take zones E. Seasonal no-take zones F. Other (*please specify*):
2.4.6.	2.4.6.1.	Are management enforced, and if so, how? A. Not routinely enforced B. Fines and penalty fees C. Revocation of access and harvest rights D. Social ostracism E. Other (*please specify*):
2.4.7.	2.4.7.1.	What fishery dependent data are collected to support management? A. Landed volume B. Discard volume C. Landed value D. Size E. Other (*please specify*):

2.4.7.	2.4.7.2.	Who collects and reports the fishery dependent data? A. National government agencies B. Regional (State, Province, Prefecture, etc.) government agencies C. Municipal/local government agencies D. Individual harvesters or harvester associations E. Dealers, processors or their associations F. Environmental NGOs G. Community organizations H. Other (*please specify*):
2.4.7.	2.4.7.3.	Are fishery-independent data (e.g., trawl survey) collected to support management? A. Yes B. No
2.4.7.	2.4.7.4.	Who collects fishery-independent data? A. National government agencies B. Regional (State, Province, Prefecture, etc.) government agencies C. Municipal/local government agencies D. Individual harvesters or harvester associations E. Dealers, processors or their associations F. Environmental NGOs G. Community organizations H. Universities and/or other scientific organizations I. Other (*please specify*):
2.4.7.	2.4.7.5.	How often are fishery-independent data collected? A. Seasonal (2 ~ 4 times a year) B. Annual C. Every 2 ~ 5 years D. Undermined frequency E. Other (*please specify*):
2.4.7.	2.4.7.6.	Are environmental data collected to support management? A. No B. Yes, in situ samples C. Yes, from buoys D. Yes, from remote sensing E. Yes, other (*please specify*):
2.4.7.	2.4.7.7.	Who collects and manages environmental data? A. National government agencies B. Municipal/local government agencies C. Individual harvesters or harvester associations D. Dealers, processors or their associations E. Environmental NGOs F. Community Regional (State, Province, Prefectures, etc.) G. Universities and/or other scientific organizations H. Other (*please specify*):
2.4.8.	2.4.8.1.	What are the general types of information sources used to manage the fishery? A. Local knowledge B. Scientific observation

		C. Stock assessment process D. Other (*please specify*):
2.4.9.	2.4.9.1.	How is stock size tracked? *Please describe.*
2.4.9.	2.4.9.2.	If stock assessments are in place, what types are used and who conducts them? *Please describe.*
2.4.9.	2.4.9.3.	If stock assessments are not in place, are data synthesized in any manner to track stock size trends or status? If so, who conducts the synthesis? *Please describe.*
2.5.1.	2.5.1.1.	Has the system experienced any major shocks in the last 20 years (detrimental or beneficial)? A. No shocks B. Environmental shocks (e.g. coral bleaching event, marine heatwave, king tide flooding or sea level rise, predator or invasive species outbreaks, disease events, typhoon/hurricane/cyclones, earthquake/tsunami, volcano, pollution, oil spills, nuclear disaster) C. Governance/management shocks (e.g. change in political/ruling party, change in fishery management structure, change in management approach) D. Socio-economic shocks (e.g. military conflicts, public health crises, recessions, major supply chain disruptions) E. Other (*please specify*):
2.5.2.	2.5.2.1.	Please identify the most important shocks (of any type) experienced in the system that have shaped its current structure, status, and capacities. *Describe briefly.*
2.5.3.	2.5.3.1.	What were the major impacts on natural (e.g., biological, oceanographic, coastal landscapes, habitat), human (e.g., economic, social, governmental), and coupled systems caused by the shock or shocks mentioned above? *If multiple shocks occurred, please describe and be specific about which shocks caused which effects to the fishery or stock(s).*
2.5.4.	2.5.4.1.	What actions were taken to alleviate such impacts, and who took (or contributed to) these actions? *If multiple shocks occurred, please describe and be specific about which actions are associated with which shock.*
2.5.5.	2.5.5.1.	Subsequently what happened to the natural, human, or coupled system? A. Full recovery to the pre-shock state B. Recovering towards the pre-shock state C. Transformed to a different state but still providing valuable services D. Transformed to different state but losing a majority of services E. System still responding, outcome not yet known
2.5.6.	2.5.6.1.	What kind of changes do we observe in the natural, human, or coupled systems if we compare pre-shock state to post-shock state? *Describe briefly.*
2.5.7.	2.5.7.1.	Did experiences during this shock lead to changes that will enhance resilience to future shocks? *Please describe.*
2.6.1.	2.6.1.1.	What types of climate change projections are available for the system? A. Global climate models only B. Downscaled regional projects C. Other (*please specify*):

2.6.2.	2.6.2.1.	What time frame is most relevant to this case study, for which projections are available within your consideration? A. Projections to 2050 B. Projections to 2100 C. Interdecadal variability D. Interannual variability E. Other (*please specify*):
2.6.3.	2.6.3.1.	What are the key limitations of available climate projections in the context of this case study? *Please describe.*
2.6.4.	2.6.4.1.	Which of the following climate disturbances are projected to alter the future of the fishery and surrounding ecosystem? A. Ocean warming B. Ocean acidification C. Frequency and/or severity of coral bleaching D. Frequency and/or severity of marine heatwaves E. Frequency and/or severity of extreme El Nino-Southern Oscillation events F. Frequency and/or severity of large storm events G. Ocean cooling H. Loss of sea ice I. Sea level rise J. Increase or decrease in upwelling K. Changes in ocean current patterns L. Other (*please specify*):
2.6.5.	2.6.5.1.	How is climate change expected to affect physical conditions (e.g. water chemistry, habitat availability or quality, primary productivity) in the system? *Describe briefly*.
2.6.6.	2.6.6.1.	How is climate change expected to affect the species that are the focus of this fishery case (e.g. abundance, distribution, phenology)? *Describe briefly*.
2.6.7.	2.6.7.1.	How is climate change expected to affect fishing opportunities and the fishery (e.g. yield, variability, effort)? *Describe briefly*.
2.6.8.	2.6.8.1.	How is climate change expected to affect social and economic conditions of individuals and communities (e.g. overall profit, profit distribution, trade mechanisms, societal effects (e.g. markets, migration, labor, consumption), harvest safety, infrastructure, or other livelihood opportunities)? *Describe briefly*.
2.6.9.	2.6.9.1.	Will climate change and fishing interact in ways that could create negative or positive feedback loops for the natural, human, or coupled system? If so, how would these dimensions interact and in what direction? *Describe briefly*.
2.6.10.	2.6.10.1.	Are there any perverse incentives created by climate change? *Describe briefly*.

Section 3 - Climate-Resilient Actions			
Topic	**Sub-section**	**Question ID**	**Question**
General resilience	3.1.1.	3.1.1.1.	What types of measures have been adopted to foster general resilience in the ecological dimension of the fishery system?
General resilience		3.1.1.2	What types of measures have been adopted to foster general resilience in the social dimension of the fishery system?
General resilience		3.1.1.3	What types of measures have been adopted to foster general resilience in the economic dimension of the fishery system?
General resilience		3.1.1.4	What types of measures have been adopted to foster general resilience in governance and management of the fishery system?
Specific resilience short-term	3.2.1.	3.2.1.1.	What actions have been taken to support climate resilience in response to short-term uncertainties and shocks that occur unexpectedly (e.g., heatwave, disease event, storms)? Consider the ecological, social, economic, governance and management dimensions of the system.
Specific resilience short-term		3.2.1.2.	Were these measures designed to “resist”, “recover” from, or “adapt” to climate effects?
Specific resilience short-term		3.2.1.3.	How were these measures put in place? (What features of and mechanisms in the system enabled them to be enacted?)
Specific resilience short-term		3.2.1.4.	Were there any specific resilience attributes present in the system that enabled or prompted these action(s)?
Specific resilience long-term	3.2.2.	3.2.2.1.	What actions have been taken to support long-term climate resilience to plan and prepare for expected future changes (e.g., planning/preparedness, conservation measures, rights/entitlements, adaptive institutional or management processes)?
Specific resilience long-term		3.2.2.2.	Were these measures designed to “resist”, “recover” from, or “adapt” to climate effects?
Specific resilience long-term		3.2.2.3.	How were these measures put in place? (What features of and mechanisms in the system enabled them to be enacted?)
Specific resilience long-term		3.2.2.4.	Were there any specific resilience attributes present in the system that enabled or prompted these action(s)?
Climate resilience actions	3.2.3.	3.2.3.1.	Are short- or long-term climate resilience actions directed mainly towards one dimension of the system (e.g., ecological, social, economic, governance), or will they preferentially benefit one dimension of the system? How?
Climate resilience actions	3.3.1.	3.3.1.1.	Are there any clear steps that should be taken, but are not currently in place, to enhance climate resilience in the fishery? What types of benefits would be expected from these actions?

Section 4 - Resilience Attributes					
Dimensions	**New Domain**	**Question ID**	**Resilience attribute**	**Definition**	**Options**
Ecological	Assets		Population abundance	The abundance or biomass of a species present in a defined geographic range.	1 - Very low abundance (Critical) 2 - Low abundance (Overfished) 3 - Moderate abundance 4 - High abundance
Ecological	Assets	4.1.3.5	Age structure	The age distribution of individuals within a population.	1 - Highly disturbed (e.g age-truncated, skewed) 2 - Moderately disturbed 3 - Mildly disturbed 4 - Undisturbed/in-tact
Ecological	Assets	4.1.3.3	Genetic diversity	The diversity or variability of genetic traits within a population.	1 - No diversity 2 - Limited diversity 3 - Moderate diversity 4 - High diversity
Ecological	Assets	4.1.3.2	Species diversity	The diversity of species within a community.	1 - No diversity 2 - Limited diversity 3 - Moderate diversity 4 - High diversity
Ecological	Assets	*Please describe the role of **ecological assets** in the fishery case you are examining. If this is a critical domain, please indicate details of how its associated attributes exist and are maintained in the system (i.e., how it has been operationalized).*			(Please use yellow cell to describe)

Ecological	Flexibility	4.1.2.5	Adult mobility	The mobility of a population's mature adults.	1 - Movement is completely restricted 2 - Movement is somewhat restricted 3 - Movement is minimally restricted 4 - Movement is unrestricted
Ecological	Flexibility	4.1.2.4	Larval dispersal	The degree to which eggs or larvae spread from a spawning site to a settlement location (benthic species) or until yolk sac re-adsorption (pelagic species).	1 - No capacity 2 - Weak capacity 3 - Moderate capacity 4 - Strong capacity
Ecological	Flexibility	4.1.1.1	Environmental niche breadth	The degree and extent to which a species can tolerate or acclimate to changes in environmental conditions.	1 - No capacity 2 - Weak capacity 3 - Moderate capacity 4 - Strong capacity
Ecological	Flexibility		Dietary flexibility	The range of prey items that a population can exploit or the diversity of feeding strategies available.	1 - No diversity 2 - Limited diversity 3 - Moderate diversity 4 - High diversity
Ecological	Flexibility	4.1.3.1	Habitat diversity	The range of suitable, adjacent, and available habitats that a population can exploit.	1 - No diversity 2 - Limited diversity 3 - Moderate diversity 4 - High diversity
Ecological	Flexibility	4.1.1.2	Plasticity	The capacity for one genotype to yield more than one phenotype in response to environmental cues.	1 - No capacity 2 - Weak capacity 3 - Moderate capacity 4 - Strong capacity

Ecological	Flexibility	4.1.1.3	Evolutionary potential	The capacity of a population to evolve in response to environmental change.	1 - No capacity 2 - Weak capacity 3 - Moderate capacity 4 - Strong capacity
Ecological	Flexibility	*Please describe the role of **ecological flexibility** in the fishery case you are examining. If this is a critical domain, please indicate details of how its associated attributes exist and are maintained in the system (i.e., how it has been operationalized).*			(Please use yellow cell to describe)
Ecological	Organization	4.1.2.2	Ecosystem connectivity	The degree to which an ecosystem facilitates the structural and physical connection among suitable, adjacent, and/or available ecosystem functions and components.	1 - Fully disconnected 2 - Weakly connected 3 - Moderately connected 4 - Strongly connected
Ecological	Organization	4.1.2.3	Population modularity	Modularity, the opposite of connectivity, refers to the compartmentalization of populations in space and time.	1 - Fully connected 2 - Weakly modular 3 - Moderately modular 4 - Strongly modular
Ecological	Organization	*Please describe the role of **ecological organization** in the fishery case you are examining. If this is a critical domain, please indicate details of how its associated attributes exist and are maintained in the system (i.e., how it has been operationalized).*			(Please use yellow cell to describe)
Socio-economic	Assets	4.2.3.2	Wealth and reserves	The aggregate value of assets available to individuals, organizations, and communities that contribute to human well-being.	1 - Fully connected 2 - Weakly modular 3 - Moderately modular 4 - Strongly modular
Socio-economic	Assets	4.2.1.2	Economic diversity	The variety of income earning activities that an individual, household, or community can partake in.	1 - Highly concentrated (no diversity) 2 - More concentrated than distributed

					3 - More distributed than concentrated 4 - Highly distributed
Socio-economic	Assets	4.2.1.1	Social diversity	The variety of social characteristics that shape the preferences, attitudes, values, and norms in a particular population.	1 - No diversity 2 - Limited diversity 3 - Moderate diversity 4 - High diversity
Socio-economic	Assets	*Please describe the role of **socio-economic assets** in the fishery case you are examining. If this is a critical domain, please indicate details of how its associated attributes exist and are maintained in the system (i.e., how it has been operationalized).*			(Please use yellow cell to describe)
Socio-economic	Flexibility		Flexible and agile infrastructure	The ability of built structures and facilities to provide needed services under a wide range of conditions and to quickly respond to predictable and unpredictable changes.	1 - No flexibility 2 - Limited flexibility 3 - Moderate flexibility 4 - High flexibility
Socio-economic	Flexibility	4.2.2.1	Mobility	An individual's and/or community's ability to move freely and easily, either temporarily or permanently.	1 - No mobility 2 - Limited mobility 3 - Moderate mobility 4 - High mobility
Socio-economic	Flexibility	4.2.2.3	Economic opportunity	Physical (e.g., transportation network) and non-physical (e.g., social relations) means and processes that enable individuals and communities to benefit from new or alternative income-earning or subsistence activities.	1 - Not accessible 2 - Limited accessibility 3 - Moderate accessibility 4 - High accessibility
Socio-economic	Flexibility	4.2.5.1	Resilience mindset	The degree to which individuals accept "resilience thinking" from a perspective that recognizes characteristics of complexity, uncertainty, nonlinearity, thresholds, feedbacks, irreversibility, and multi-scale and multi-level interactions in a changing world.	1 - No capacity 2 - Limited capacity 3 - Moderate capacity 4 - High capacity

Socio-economic	Flexibility	4.2.2.5	Place attachment	The extent to which individuals and communities feel tied to the geographical location in which they live and operate, affecting their response to risk, including willingness to move homes, fishing grounds, or processing location in the face of adverse conditions.	1 - No attachment 2 - Limited attachment 3 - Moderate attachment 4 - High attachment
Socio-economic	Flexibility	*Please describe the role of **socio-economic flexibility** in the fishery case you are examining. If this is a critical domain, please indicate details of how its associated attributes exist and are maintained in the system (i.e., how it has been operationalized).*			(Please use yellow cell to describe)
Socio-economic	Organization	4.2.2.2	Social capital	The strength of networks of relationships among people and organizations who live and work in a particular community.	1 - No social capital 2 - Limited social capital 3 - Moderate social capital 4 - High social capital
Socio-economic	Organization	4.2.4.3	Technology transfer	The level and capacity of individuals and communities to develop and acquire new technologies and methods as well as the ease with which these technologies and methods are transferred between and among actors in the system.	1 - No capacity 2 - Limited capacity 3 - Moderate capacity 4 - High capacity
Socio-economic	Organization	4.2.3.1	Modular infrastructure	The degree of compartmentalization within and across built structures and facilities and the ease with which diffusion can proceed.	1 - No ability 2 - Limited ability 3 - Moderate ability 4 - High ability
Socio-economic	Organization	*Please describe the role of **socio-economic organization** in the fishery case you are examining. If this is a critical domain, please indicate details of how its associated attributes exist and are maintained in the system (i.e., how it has been operationalized).*			(Please use yellow cell to describe)
Socio-economic	Learning	4.2.1.3	Knowledge diversity	The variety of types and origins of knowledge that are available to individuals and members of the community.	1 - No diversity 2 - Limited diversity 3 - Moderate diversity 4 - High diversity

Socio-economic	Learning	4.2.4.1	Knowledge access	The ability of individuals and communities to obtain and derive benefit from existing knowledge about the system.	1 - Not accessible 2 - Limited accessibility 3 - Moderate accessibility 4 - High accessibility
Socio-economic	Learning	4.2.4.2	Learning capacity	The degree to which individuals and communities are able to perceive risk, learn from experience, synthesize information, and grow their own knowledge.	1 - No capacity 2 - Limited capacity 3 - Moderate capacity 4 - High capacity
Socio-economic	Learning	*Please describe the role of **learning** in the socio-economic dimension of the fishery case you are examining. If this is a critical domain, please indicate details of how its associated attributes exist and are maintained in the system (i.e., how it has been operationalized).*			(Please use yellow cell to describe)
Socio-economic	Agency	4.2.2.4	Agency	The capacity of individuals and communities to negotiate, make decisions, and act on their own free will.	1 - No capacity 2 - Limited capacity 3 - Moderate capacity 4 - High capacity
Socio-economic	Agency	*Please describe the role of **social and economic agency** in the fishery case you are examining. If this is a critical domain, please indicate details of how its associated attributes exist and are maintained in the system (i.e., how it has been operationalized).*			(Please use yellow cell to describe)
Governance	Flexibility	4.3.3.2	Responsive	The sensitivity, readiness, speed, and accuracy with which a governance system handles, resolves, and follows up on a management-relevant change to meet stakeholders' needs (Sheng, 2009).	1 - Not responsive 2 - Limited 3 - Moderately responsive 4 - Highly responsive
Governance	Flexibility	*Please describe the role of **governance flexibility** in the fishery case you are examining. If this is a critical domain, please indicate details of how its associated attributes exist and are maintained in the system (i.e., how it has been operationalized).*			(Please use yellow cell to describe)
Governance	Organization	4.3.2.1	Participatory	The degree to which an institution empowers participants to influence and	1 - Not participatory

				share control in processes of public decision-making, ranging from intermittent consultation opportunities to ongoing self-mobilization (Coghlan & Brydon-Miller, 2014; Leite & Pita, 2016).	2 - Limited participation 3 - Moderate participation 4 - High participation
Governance	Organization	4.3.1.3	Equitable and inclusive	The degree to which the governance system is fair in the distribution of benefits and burdens (risks), participatory in rule and decision-making for relevant actors, and engaged and inclusive of marginalized and disadvantaged groups (Bennett et al., 2020).	1 - Not equitable 2 - Limited equitability 3 - Moderate equitability 4 - High equitability
Governance	Organization	4.3.1.1	Accountable	The degree to which decisions and decision makers can be held culpable to both the individuals and communities that they govern as well as to higher-level mandates, commitments, goals, and objectives they serve (Battista et al., 2019; Lebel et al., 2006; Ostrom, 1990).	1 - No accountability 2 - Limited accountability 3 - Moderate accountability 4 - High accountability
Governance	Organization	4.3.2.2	Transparent	The openness and accessibility of timely information, decision-making rules and procedures, and outcomes to members of the public or stakeholders affected by management actions (Clark et al., 2015; Davis & Hanich, 2020).	1 - Not transparent 2 - Limited transparency 3 - Moderate transparency 4 - High transparency
Governance	Organization	4.3.1.2	Effective and efficient	The degree to which the governance system produces outcomes that achieve societal and/or fishery objectives while efficiently using available resources.	1 - Not effective or efficient 2 - Limited effectiveness or efficiency 3 - Moderate effectiveness or efficiency 4 - High effectiveness or efficiency
Governance	Organization	4.3.2.3	Polycentric	The degree to which multiple bodies at different levels of the governance system overlap and interact to make and enforce	1 - Not polycentric 2 - Limited

				rules within a specific policy arena or location (Ostrom, 2005; Folke et al., 2005).	3 - Moderately polycentric 4 - Highly polycentric
Governance	Organization	4.3.2.4	Cross-scale integration	The degree to which actors and/or organizations acknowledge, work with, and attempt to understand the relevance and transition of scale and the interlinkages between various other organizations, institutions, and management structures.	1 - No integration 2 - Limited integration 3 - Moderate integration 4 - High integration
Governance	Organization	*Please describe the role of **governance organization** in the fishery case you are examining. If this is a critical domain, please indicate details of how its associated attributes exist and are maintained in the system (i.e., how it has been operationalized).*			(Please use yellow cell to describe)
Governance	Learning	4.3.3.1	Adaptive	The capacity to implement a structured, iterative process of continual innovation, testing, learning, and adjustment that facilitates robust, flexible decision-making and action in the face of uncertainty and complexity.	1 - Not adaptive 2 - Limited 3 - Moderately adaptive 4 - Highly adaptive
Governance	Learning	*Please describe the role of **governance learning** in the fishery case you are examining. If this is a critical domain, please indicate details of how its associated attributes exist and are maintained in the system (i.e., how it has been operationalized).*			(Please use yellow cell to describe)
Governance	Agency	4.3.4.2	Leadership and initiative	A system that legitimizes and supports the development of leaders who are guided by collective interests, who mobilize and direct responses to disruptions (Kerner & Thomas 2014, pp 682), and who take responsibility and act when necessary (Bodin & Crona, 2008; Gutierrez et al., 2011, Crona et al., 2017).	1 - No leadership 2 - Limited leadership 3 - Moderate leadership 4 - Strong leadership
Governance	Agency	*Please describe the role of **agency** in governance of the fishery case you are examining. If this is a critical domain, please indicate details of how its associated attributes exist and are maintained in the system (i.e., how it has been operationalized).*			(Please use yellow cell to describe)

Section 5 - Capacity of Systems to Improve Climate resilience		
Question ID	**Question**	**Questions to Consider**
5.1.	Is the scientific system able to document and forecast climate-related changes in the fishery?	Do data collection systems document changes at appropriate scales (spatial and temporal)? How have these been received and used? Are future projections available for the fishery? How have these been received and used?
5.2.	Is the harvesting system itself adaptive to climate change?	Do participants know about and anticipate climate-driven changes as they make decisions? Are participants adjusting operations or tactics to respond to change or prepare for future changes?
5.3.	Is the social dimension of the fishery system adaptive in the face of climate change?	Do people consider ongoing and future change in the fishery system as they make decisions? Are there opportunities to learn and innovate to respond as changes occur? Are there resources available to support desired changes?
5.4.	Is the economic dimension of the fishery system adaptive in the face of climate change?	Are markets adapting to climate-driven changes in species availability? Does the fishery have influence in the market such that market-driven solutions could support climate adaptation? Are economic incentives or penalties being used to influence responses to climate change? Are there economic resources (e.g., loans, insurances) available to assist adaptation to climate change?
5.5.	Are the governance dimensions of the fishery system set up to anticipate responses needed for climate trends or events?	Is it highly centralized, or is there a balance between the central and local authorities? Are there powerful vested interests that resist change, or powerful actors that innovate and promote change?
5.6.	Are the management dimensions of the fishery system capable of designing and implementing measures for additional resilience, and doing so in a timely fashion?	Are there policies in place that either facilitate or limit responses to change? In what ways is management adjusting tactics to respond to change or prepare for future changes?