Name of the case study	Utqiaġvik and Nuiqsut, Alaska - Emerging salmon subsistence fishery – USA (Transformation)	
What about this case makes it interesting? How does this case contribute to understanding of resilience and/or regime shifts in the Arctic?	Utqiaġvik and Nuiqsut are two communities from the North slope of Alaska facing climate and socio-economic challenges. Fishing has historically been, and currently is, an essential subsistence for the communities that enhances cooperation, sharing and crucial for their food system. Climate change is changing the distribution patterns, shifting the species in the area, and impacting local resource harvest in the area. Along with environmental impacts, dramatic social and economic changes are recognized. Oil and gas development on fishing practices and traditional ways of life and wellbeing. Yet, the warming Arctic is providing potential opportunities for northern range expansion by salmon. The increase in salmon population, not expected in the area, had brought new opportunities for subsistence fisheries. Local communities have started to catch more salmon and develop new knowledge around the species. Despite salmon is not culturally attached to the community, currently, a new salmon-community relation is emerging. Fishers in both communities are developing new knowledge of salmon and increasing their use of salmon as a subsistence resource. Many Elders and fishers do not prefer pink salmon over whitefish, but fish that are caught tend not to be wasted. Catching fish, including salmon, to share is a crucial element for many subsistence fishers in both Utqiaġvik and Nuiqsut. Fish are commonly distributed to family, neighbours, Elders, and the wider community. Overall, salmon are currently a relatively unimportant subsistence resource in Utqiaġvik and Nuiqsut.	
Contributors	Carla Lanyon, Stockholm Resilience Centre Juan Rocha, Stockholm Resilience Centre	**Key references: Cite in the text using (1), (2), (3) etc. and provide a reference list at the bottom of the template.** (1) Carothers, C., T. L. Sformo, S. Cotton, J. C. George, and P. A. H. Westley. 2019. Pacific Salmon in the Rapidly Changing Arctic. Arctic 72(3):273–288.
Reviewed by (Name and affiliation)	*	

Category	**Resilience/ Adaptability**		**Loss of resilience**			**Transformation**		
						X		
Case study details:	**Country**	**Place**	**Scale – space**	**Scale – time**		**Sector(s)**		**Other (e.g. disturbance)**
	USA	Utqiaġvik and Nuiqsut, Alaska	Utqiaġvik: 55.63 km Nuiqsut: 23.02 km	1940-2019		Subsistence fisheries		
Drivers (mark with X in appropriate boxes)	**Climate**	**Geopolitical**	**Mineral/ oil extraction & infrastructure**	**Tourism**	**Shipping**	**Biological invasion**	**Rapid demographic change**	**Other:** ***state here***
	x		X					

	Biophysical	Social
1. Basic description of coupled social-ecological system in focus (What are the key components and stake holders) If possible draw a systems diagram or conceptual map of the case – this can be a series of diagrams to capture different periods in the case and the drivers/ actors/ events that characterize the period.	**a) What types of ecosystem(s) and other major biophysical features are present?** **b) How are the case boundaries defined in terms of ecosystems or biophysical characteristics?** Utqiagvik: Important fishing locations for Utqiaġvik residents range from coastal areas near Wainwright to Teshepuk Lake and inland to the headwaters of the Chipp River	**c) Who are the key groups of people in this case?** Utqiaġvik has a diverse community and has a relatively large population of approximately 4300 people. Approximately 61% of Utqiaġvik residents identify as Alaska Native or American Indian (primarily Iñupiat) and 17% as white, 87% of Nuiqsut residents identify as Alaska Native or American Indian (primarily Iñupiat), 10% as white, 0.3% as black. **d) What kinds of livelihoods are important in the system?** **Utqiaġvik** There are over 20 fish species harvested in the Utqiaġvik region. The primary species harvested by local residents include broad whitefish (Coregonus nasus), Arctic cisco (C. autumnalis), least cisco (C. sardinella), Arctic grayling (Thymallus arcticus), burbot (Lota lota), lake trout (Salvelinus namaycush) and Dolly Varden (Salvelinus malma). Various species of Pacific salmon are utilized as subsistence resources in Utqiaġvik. -24% of households in Utqiaġvik harvested salmon and 69% of households used salmon (although these estimates included local harvest, as well as harvests elsewhere in Alaska). **Nuiqst** Fish are an important subsistence resource for the community, typically ranking as third in total harvest after bowhead whale (Balaena mysticetus) and caribou (Rangifer tarandus). Nuiqsut fishermen use set nets as their primary mode of catching fish and also jig with hook and line for species such as burbot.

		e) What institutions are key to this case? **f) How are the case's boundaries socially defined, and how do these social boundaries relate to biophysical boundaries?** Utqiaġvik is located on the coast of the Chukchi Sea, approximately 16 km south of Point Barrow, the northernmost point of the United States. Utqiaġvik is the administrative and economic hub of the North Slope region. Nuiqsut is a small village of about 434 residents located approximately 56 km from the Beaufort Sea coast (243 km from Utqiaġvik), and situated on the west bank of the Nechelik (Nigliq) Channel of the Colville River.

2. Timeline Draw a timeline of *key* events/ developments to the case. Points to include: Make clear the period of time over which the change is being considered. Provide a brief description of event/ actors, and ecological impacts. Mark particularly significant events with *. Consider both biophysical and social dimensions. Additional points that can be considered: Is it possible to identify periods of change from one type of system to another, transformations? Identify disturbances or events that	1950´s: Increase of the temperature in the Arctic between 2˚ and 3˚C during summer and 4˚C in winter 1852: Salmon harvesting near Utqiaġvik was recorded during the summer.

challenged, built, or reduced resilience or adaptive capacity in the system.		
3. Disturbances What are the key disturbances in the system (present and past)	**a) Have there been major biophysical disturbances that are relevant for the case?**	**b) Have there been major social disturbances that are relevant for the case?**
4. Drivers of change Clarify what impacts these drivers have on the SES and if these are direct or indirect	**a) What are the key biophysical drivers of change?** Increase of temperature Habitat loss and destruction	**b) What are the key social drivers of change?** Decrease of other fishes due to the development of oil and gas industries Salmon are relatively less important than other more common local fishes. Therefore, there is less local knowledge of these species.
5. Sources of adaptive capacity: What factors allow(ed) the system to adapt to disturbances in the past and present? Give a brief assessment of recent or ongoing changes (+/-/0 = increasing/ reducing/ not affecting adaptive capacity)	**a) Within the ecosystem?** (+) Warming Arctic is providing potential opportunities for northern range expansion by salmon (-) Decrease of traditional species white fishes	**b) Within society (e.g. people, social capital, management, institutions, infrastructure):** (+) Fishers learn about salmon and have tailored their gear toward catching species that their families and sharing networks prefer. (+) The community is learning how to cook and use the salmon. Salmon is prepared and eaten in many ways, including dried, baked, boiled, fried, grilled, and smoked.

		(+/-) Salmon preference is varied; some view salmon as a nuisance species, but many others enjoy catching, sharing, and eating salmon. (+)Salmon are part of the array of subsistence foods utilized by the Iñupiat and other residents (+) Portfolio diversification. (+) Sharing networks, which include local family members, friends, neighbours, business associates, and those who live outside the North Slope (+/-) Elders and fishers demonstrated a deeper understanding of morphology, run timing, harvest techniques, and a tighter cultural connection to whitefish and other fish species. Knowledge of the salmon species is increasing, but there is still misidentification of salmon species, even among expert fishers. (0) Salmon catches are significant, however, to a few Utqiaġvik fishermen who primarily harvest salmon
The next two sections break down the information in Section I. While it is not necessary to fill these sections, if you have additional information pertinent to specific rows below feel free to enter the material.		
II.1-8 SES, resilience and adaptive		

capacity		
	Biophysical	**Social**
II.1. Where do we find change and resilience in the face of change?	**a) Within nature** Environmental change is perceived to be dramatic, increasing, and impacting local resource harvest.	**b) Within society** The number of households harvesting salmon has increased in the last few decades, as has the reported harvest of salmon. There is a shift in traditional livelihoods. Catch salmon have also change the techniques of cooking, processing, and conserve food.
II.2. What are the system's key components?	**a) Key Ecological components (e.g. lakes, coastal zones, caribou)** Five species of Pacific salmon have been observed in the Alaskan and Canadian Arctic, though only pink salmon (O. gorbuscha) and chum salmon (O. keta) have been documented. The primary species harvested by residents include broad whitefish (Coregonus nasus), Arctic cisco (C. autumnalis), least cisco (C. sardinella), Arctic grayling (Thymallus arcticus), burbot (Lota lota), lake trout (Salvelinus namaycush) and Dolly Varden (Salvelinus malma). Various species of Pacific salmon are utilized as subsistence resources in Utqiaġvik Lakes, river, coastal areas	**b) Actors in society (e.g. individuals, groups, public or private organizations)? How are people organized – by geography, livelihood, family, etc.?** Iñupiaq Arctic residents who continue to live traditional hunting and fishing lifestyles deeply connected to lands and waters are among the most experts about their local environments and changes over time. Elers, fishers, bolwhwale status
II.3. What are the key linkages? E.g. ecosystem	**a) From nature to society (e.g. ecosystem services)** Food Cultural	**b) From society to nature – modifying nature, extracting resources (e.g. hunting, mining, water pollution)** Fishing

services, resource extraction. These linkages should exist. If there are not mutual links between social and ecological components the case is not a social-ecological system.		Harvesting Mining
II.4. What are key interactions?	**a) What are the key ecological interactions within the case?** Warmer air and sea temperatures contribute to a variety of physical changes, including b permafrost thawing, a reduction in summertime sea ice extent, decreasing sea ice thickness and loss of multiyear sea ice, glacial retreat, increased precipitation, reduced snow cover, increased riverine runoff, and increased organic carbon inputs to the Arctic Ocean from river systems. These environmental changes have pronounced effects on biological communities, with significant trends of temperate species shifting northward. **b) What are the most important biophysical tele-connections to distant systems?** Climate change	**c) What collaborations, conflicts, or other key linkages exist between actors?** Sharing networks: Sharing goes far beyond giving food. Harvesting local resources is generally a cooperative activity; people share equipment, money for gas, time, and knowledge. Fishing cooperation: Family members and friends are needed to set nets, pick fish from gill nets, process and distribute the catch. **d) Between local actors and distant actors?** Local leader's concerns about the potential effects commercial fishing would have on subsistence activities for the same resources in this region. Most fishermen we interviewed stated that they did not want the commercialization of new fisheries to influence their lifestyle or to affect their important subsistence fisheries.

II.5. Culture	**a) How is the relationship between society and nature viewed?** The Iñupiat have been sustainably stewarding their lands and waters for millennia based on these complex knowledge systems. **b) What meanings are attributed to nature and to interactions with nature?** Fishing has historically been a vital subsistence mainstay for the Iñupiat of the North Slope region.	**c) What are key cultural features of relevance for the case?** Fish is part of the modern diet, and fishing is viewed as a vitally important subsistence activity that fosters family and community learning, cooperation, and sharing. Traditional knowledge and monitoring system **What are key cultural practices and beliefs related to nature?** Despite the shift in species, cultural practices remain—a relationship based on reciprocity and respect, where nobody can waste any food. Culturally valuable fish like broad whitefish are linked to status, but salmon are not coveted in Utqiaġvik and Nuiqsut the same way as whitefish species. Whether this will change should salmon abundance increase markedly or if cultural preferences change remains to be seen
II.6. Disturbance What are important types of stress & shock	**a) Describe important biophysical or ecological shocks and stresses (e.g. floods, storms, etc).**	**b) Describe important social shock and stresses (e.g. austerity policies, changes in government policy, introduction of new technologies, etc.)** Technology introduction: some locals are experimenting with electric dryers and smokers Concern about commercialization, protecting traditional hunting and fishing livelihoods from fisheries commercialization.

II.7. What are key slow variables Changes that occur over decadal or longer time scales	**a) What types of ecological processes (e.g. loss of permafrost, shifts in species composition) are driving important long-term changes in ecological structures and processes?** Shifts in species composition, colonization of salmon in the area, and decreased other species known as white fish.	**b) What types of slow social processes (e.g. aging, population growth, loss of language) are driving important changes in social institutions and behaviours?** Land-use change/ colonization Integration of new knowledge about salmon
II.8. Relationships with ecological regime shifts	**a) Are ecological regime shifts driving further ecological change or pressure?** **b) Are external or internal ecological dynamics potentially or actually producing ecological regime shift(s)?**	**c) Can social stresses or major changes be attributed to ecological regime shifts?** Land-use change **d) Are there specific social practices that might be contributing to ecological regime shifts?** Fishing traditional species as white fish have decreased the abundance in the area.
II.8 Regime shifts	**If a regime shift exists and is important to this case describe it below.** Please indicate whether the regime dynamics are well-established, contested, or speculative.	
II.8.a. Detailed description of alternate regime shifts A case study can contain more than one type of regime shift	**Briefly describe the structure of each regime. What does each regime look like?** **What are differences in ecosystem structure and function? (e.g. permafrost loss, vegetation change)?** **How do the properties and behaviours of regimes differ?** **e.g. collapse of subsistence food sources, fundamental change in types of livelihoods, change in governance institutions, new actors with significant political power who transform decision making)**	

II.8.b. Feedback mechanisms within the system that maintain each regime	**Ecological feedback mechanisms**	**Social feedback mechanisms**
II.8.c. What key changes drive regime shifts? Describe how these changes alter the state of the system or feedback processes.	a) **Drivers of ecological regime shifts (either social or ecological)**. **b) How do these changes alter biophysical feedback processes?**	c) **Drivers of social regime shifts (either social or ecological)**. **d) How do these changes alter the social feedback processes?**
II.8.d. Ecosystem services substantially impacted by regime shift	**a) Changes in ecological processes that produce ecosystem services**	**b) Changes in demand for ecosystem services (market and non-market)** **c) Changes in the institutional context of ecosystem services e.g. changes in access and changes in how ecosystem services are valued as expressed by rules and regulations.**
II.8.e. What is (+/-) impacted by changes in ecosystem services directly or indirectly	**a) Impacts from regime shift on ecological components**	**b) Impacts from regime shift on social actors**
II.8.f. Potential cascading effects	**Describe, if any, the likelihood of potential ecological cascading effects to other SES**	**Describe, if any, the likelihood of potential social cascading effects to other SES**
II.8.g. Where do actors intervene to alter regime shift dynamics	**Ecological oriented interventions**	**Socially oriented interventions**

and who can do the intervening? This can be listed here or marked with (*) in the table above		

REFERENCES/ SOURCES CITED:	
(1)	Carothers, C., T. L. Sformo, S. Cotton, J. C. George, and P. A. H. Westley. 2019. Pacific Salmon in the Rapidly Changing Arctic. Arctic 72(3):273–288.
(2)	
(3)	
(6)	

GLOSSARY OF TERMS IN THE TEMPLATE

Actor	We use this term generally to look for individuals, groups, organisations, and so on that structure actions and/ or are stakeholders.
Adaptive capacity	Is the capacity of actors in the system to manage resilience in order to stay within a desired state during periods of change. This is related to the diversity in the system behind the provision of a function.
Disturbance	This refers to any disturbance to the system, regardless of scale, duration, intensity and frequency. See shock and stress.
Driver	Actor or process that directly or indirectly affects change in a social-ecological system. External means that the system in question (the scale being looked at) is unable to affect the driver in question – there is no feedback from the system to the driver.
Ecosystem services	The goods and services humans derive from ecosystems. These include: provisioning, regulating, cultural ecosystem services respectively.

Feedbacks	A change within a system that occurs in response to a driver, and that loops back to control the system. A feedback can help to maintain stability in a system (negative or balancing feedback), or it can speed up processes and change within the system (positive or enhancing feedback). Feedback processes play a very important role in determining system thresholds and in maintaining system resilience.
Institution	Here we refer to the humanly devised constraints that shape human interactions, such as rules, norms and laws. These can be formal or informal. Note that we are not referring here to institutions as organisations.
Regime shift	For complex systems, a substantial and enduring reorganization of the system, where the internal dynamics and the extent of feedbacks undergo change.
Resilience	This is a property, in this context of social-ecological systems. It relates to the capacity of a system to cope with disturbances and recover in such a way that they maintain their core function and identity. It also relates to the capacity to learn from and adapt to changing conditions, and when necessary, transform.
Shock	A sudden, unexpected disturbance. This kind of disturbance is often punctual, and has important impacts on large parts of the system.
Slow variable	When analysing complex system is often useful separating “fast” and “slow” variables. Fast variables often represent the primary concern of ecosystem users, for instance game or crop production. Slow variables shape the behaviour of fast ones but change slowly with respect to the overall dynamics of the system. Examples of slow variables might include permafrost thawing for a social-ecological system of Arctic hunters where the fast variable is game, or soil organic matter for an agricultural system where the fast variable is crop production.
Stress	This is a disturbance that has long persistence and often low intensity in impact.
Social-ecological system	This is an interwoven system of human societies and ecosystems. This concept emphasises that humans are part of nature and that these components function in interdependent ways. In the template identifying these interactions between the components aims to identify the processes and actors/ components that interact and particularly the feedbacks between the human-related components and the ecosystems/ biophysical components.
Stakeholder	See “actor”
Systems Diagram	This is using a diagram to illustrate the configuration of a system. This is done by defining its structure, function, and feedbacks. For a case there may be more than one diagram if the system changes in character (actors, processes, drivers, disturbances, feedbacks etc.) over time.
Timeline	The goal with the timeline is to capture important events – both punctual and over longer periods of time, identifying the causes of these events and the actors/ processes involved. This should be done chronologically and distinguishing events.