Name of the case study	Aklavik - Human-whale relation in environmental and social changes - Canada (Loss of Resilience)	
What about this case makes it interesting? How does this case contribute to understanding of resilience and/or regime shifts in the Arctic?	Aklavik is a settlement in the Northwest Territory, inhabited mainly by Inuvialuit people. Hunting is their main activity and a key element of their cultural identity. Inuvialuit people builds their social structure and traditional values from traditional practice. Currently, the reproduction of these practices has decreased, risking knowledge and collaborative practices related to hunting and personal values such as patience, respect, among others. A combination of environmental and social factors is related to this change in the livelihoods of the communities. Climate change has impacted sea ice dynamics in the area, climatic stability, increased waves, storms, and coastal erosion. These changes have affected hunting, increasing travel risk, and decreasing access to hunt places. Social factors are risking the traditional hunts reproduction. On the one hand, the aging of the leaders and the master of whaling affects the transmission of knowledge. On the other hand, the integration of Western values, technology, time in formal education and wage labour has influenced the lack of interest of the younger generations to participate in traditional practices. In addition, the low cost of non-traditional foods has contributed to the demotivation to practice whaling. However, communities still identify as hunters and recognize the cultural importance of protecting this practice to adapt	
Templated completed by: *Main contributor	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) Worden, E., T. Pearce, M. Gruben, D. Ross, C. Kowana, and L. Loseto. 2020. Social-ecological changes and implications for understanding the declining beluga whale (Delphinapterus leucas) harvest in Aklavik, NT. *Arctic Science* 6. (2) Aklavik Hunters and Trappers Committee, Aklavik Community Corporation, the Wildlife Management Advisory Council (NWT), the Fisheries Joint Management Committee and the Joint Secretariat. 2016. Aklavik Inuvialuit Community Conservation Plan: A Plan for the Conservation and Management of Natural Resources and Lands within

		the Inuvialuit Settlement Region in the Vicinity of Aklavik, Northwest Territories. Inuvik, N.W.T., Canada. 195 pp. (3) Waugh, D., T. Pearce, S. Ostertag, V. Pokiak, P. Collings, and L. Loseto. 2018. Inuvialuit Traditional Ecological Knowledge of Beluga Whale (Delphinapterus leucas) Under Changing Climatic Conditions in Tuktoyaktuk, NT. *Arctic Science*. **(*) Mainly all the information comes from (1). Otherwise, is explicit cited**

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)**	
	NT, Canada	Aklavik			1975-2017	Hunting		
Drivers (mark with X in appropriate boxes)	**Climate**	**Geopolitical**	**Mineral/ oil extraction & infrastructure**	**Tourism**	**Shipping**	**Biological invasion**	**Rapid demographic change**	**Other:**
	X						X	

	Biophysical:	Social:
1. Basic description of coupled social-ecological system in focus **(**What are the key components and stake	a) What types of ecosystem(s) and other major biophysical features are present? Caribou, fish, Coregonus nasus (Pallas, 1776), Stenodus leucichthys (Güldenstädt, 1772), Coregonus autumnalis (Pallas, 1776), Lota lota (Linnaeus, 1758)) beluga whales,	c) Who are the key groups of people in this case? The hamlet of Aklavik in the Northwest Territories is a community of 600 people. The more significant percentage of the populations are Inuvialuit and Gwich'in heritage, along with some Métis and non-Indigenous individuals. The

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.	moose, and muskox are common species that are harvested for subsistence food b) How are the case boundaries defined in terms of ecosystems or biophysical characteristics? The boundaries are defined by the coastline of Mack Mackenzie Estuary and the rivers associated.	settlement is in the Peel River, one of the main channels of the Mackenzie River system. Aklavik is a modernized community The services provided are: Northern Store, Aklavik Stantons, Canada Post, Hamlet administration offices, which contracts water, sewage, and garbage services. The R.C.M.P. have a station here. Aklavik Indian Band Office, Aklavik Community Corporation with the Hunter's and Trapper's Committee, Housing office, Airport Terminal, Moose Kerr School and a nursing station (2). d) What kinds of livelihoods are important in the system? - 60% of community members participate in hunting, fishing, and country foods. -Hunters follow a seasonal schedule, trapping for fur, ice fishing and hunting muskox during the cold winter months, and fishing, hunting wildlife like caribou, moose, and beluga whale during the warmer summer months. e) What institutions are key to this case? Aklavik Hunters and Trappers Committee Aklavik Community Corporation, the Wildlife Management Advisory Council (NWT) Beaufort Sea Beluga Management Plan

		f) How are the case's boundaries socially defined, and how do these social boundaries relate to biophysical boundaries? The boundaries are represented by the different hunts spot along the coastline in the Mackenzie Estuary of Beaufort Sea. There are three established camps are Niaqunnaq (West Whitefish), Tapqaq (Shingle Point) and Aqparuatchiaq (Running River), and Aklavick as the main settlement.

2. Timeline Draw a timeline of *key* events/ developments to the case. Define the time period (decades – centuries) over which change is considered, Provide a brief description of event/ actors, and ecological impacts Is it possible to identify periods of change from one type of system to another, transformations? Identify disturbances or events that challenged, built, or reduced resilience or adaptive capacity in the system. Consider both biophysical and social dimensions. Mark particularly significant events with *.	In the first half of the 20th century, Aklavik became an administrative settlement and a trade space. 1950s: Infrastructure was threatened by floods among the limited space to an on growing settlements government replaced the service in a higher area called Inuvik. However, local people still live in Aklavik. 1973: Hunter-based beluga monitoring program. 1980s: Change in the station available to set summer camps due to flooding. 1984 Inuvalit final agreement: The IFA established several new management bodies to help ensure that the land and its living resources are conserved for the benefit of the Inuvialuit. 1993: Design of Aklavik Inuvialuit Community conservation. This figure is a community-based organization created by Aklavik Hunters and Trappers Committee, Aklavik Community Corporation, and Aklavik Elders Committee. The organization established the management area for beluga whales. The trapping of muskrats, fox, and other furbearers created employment in the area, however, because of the activities of the anti-fur lobby and animal rights groups, this opportunity has been significantly reduced. Furs are still very important for community use (2).

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? Less predictable weather, more frequent and intense storm events, permafrost thaw, changes in temperature and precipitation, coastal erosion, and flooding have made travel more complex, and decreased the space to set hunting camps. Rapid permafrost thaw and lower water levels have affected traditional pathways, requiring hunters to take less known and more dangerous detours that often require more travel time. Coastal erosion and flooding decrease the option space for camp.	b) Have there been major social disturbances that are relevant for the case? The loss of traditional whaling camps such as these play a central role in Aklavik's diminished beluga whale harvest in recent decades. Loss of traditional knowledge in young e people. They don't have the necessary skills to participate in the beluga harvest. Change in the values of hunting beluga and the social-cultural reproduction behind. Access to technology. Southern technology and modern transportation prioritize efficiency and instant gratification instead of promote patience which are key to hunt whales.
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? The increase in temperature has changed the sea ice dynamics and seascape. The timing of solid ice´s formation has become unpredictable, comes late, and lasts for a shorter	b) What are the key social drivers of change? - Aging Of the populations. Elders have a key role in hunting; they guide the trip and transmit knowledge to the rest of the hunters. There has been a decrease in the Elders

	period.	population, impacting the hunting practices. - Westernization of the society: young generation is less connected with the land and shifts spending more time in formal education, wage labour, and spend time on social media.
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 on-going changes (+/-/0 = increasing/ reducing/ not affecting adaptive capacity)	a) Within the ecosystem? (+) Diversity of species available during the year. During winter, fish is available. In summer whales and terrestrial animals. (-) Change in the movement patterns and abundance of beluga whales. (-) Decrease of areas available to hunt whales during summer, due to floods and decrease of sea ice	b) Within society (e.g. people, social capital, management, institutions, infrastructure): (-) Loss of traditional knowledge due to lack of participation of young people in whale hunting and a decrease of elders, the main teacher of the community, and space to reproduce the local knowledge. (+) Hunting strategies change by season and adapt according to the environment variables. For instance, they hunt whales in deeper water than before. (-) Adaptive strategies are more expensive due to the investment in equipment and gas to move across the sea. (-) The shift in the value of hunting and the traditional values transmitted. (+) Community-based monitoring of the Eastern Beaufort Sea beluga whale population.

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: Climate is changing, making travel to the coast more difficult and dangerous and compromising land access to establish summer camps. Intense extreme weather events during summers, such as storms and strong winds, have affected the summer camps used to harvest whales. The changes in the ocean and weather conditions have also affected beluga movements and distribution. Resilience: Community hunts according to the season, harvesting different species throughout the year.	b) Within society: Change: Beluga harvest has decreased since the 90's risking disappearing due to a combination of factors. Changes in the environment have reduced the option space for hunter´s summer camp to harvest whales and make hunting more challenging and expensive. Elder's death, who have local knowledge, the integration of southern culture that has shifted the interest among young people has decreased traditional hunting practice. Western modernization and education have changed the values and interests of the younger generations of the community. The low participation of young people in whaling has meant a loss of knowledge and skills in younger hunters. It has also meant a decrease in the development of cultural and cooperative activities, such as shared food networks. Less hunt has also caused a change in their food system. The low price of other food sources and the Western values installed in the youth guide their preference towards non-traditional foods. Resilience: Community still values traditional hunting and wants to transmit the knowledge to younger generations. This knowledge has been used to monitor belugas populations among the territory and set quotas for sustainable management. The community still has a deep connection with nature and acknowledges the change in the climate.

II.2. What are the system's key components?	a) Key Ecological components (e.g. lakes, coastal zones, caribou) Caribou, fish (Salvelinus alpinus (Linnaeus, 1758), Coregonus nasus (Pallas, 1776), Stenodus leucichthys (Güldenstädt, 1772), Coregonus autumnalis (Pallas, 1776), Lota lota (Linnaeus, 1758)) beluga whales, moose, and muskox are common species that are harvested for subsistence food. Beaufort Sea coastline, estuaries used as coastal camps areas. Rivers, channels, lakes, and creeks.	b) Actors in society (e.g. individuals, groups, public or private organizations)? How are people organised – by geography, livelihood, family, etc.? Elders are the foundation of Inuit society. They embody the culture and knowledge, allowing the community to adapt in the past. They are the teachers and leaders of the community, keeping the community together. The 60% of community practice hunting and fishing. Young people are most related to formal education and wage labour.
II.3. What are the key linkages? E.g. ecosystem 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.	a) From nature to society (e.g. ecosystem services) -Primary production -Traditional and cultural livelihoods	b) From society to nature – modifying nature, extracting resources (e.g. hunting, mining, water pollution) Hunting Fishing
II.4. What are key interactions?	a) What are the key ecological interactions within the case? Longer periods of open water in Beaufort Sea have increased the cyclogenesis due to more waves and warmer	c) What collaborations, conflicts, or other key linkages exist between actors? Collaborative practices between Hunters: Beluga are

	temperatures. Rapid permafrost and lower water levels change the river and channel composition. Decreased permafrost and increased strong winds have eroded the coastline. Among this, the loosened earth has been washed into the ocean. b) What are the most important biophysical tele-connections to distant systems? No mention in the case. However, the main driver, is the increase of temperature due to climate change	harvested and prepared through team efforts. The meat is distributed to the hunters and more vulnerable families of the community. Community-based monitoring of the Eastern Beaufort Sea beluga whale population: This program has been a success for several years. Hunters have a key role in the effective co-management of oceans and their resources. Elders and young hunters among the summer camps: The connection between the young and nature is changing; therefore, their behaviour around hunt whaling. In the past, the summer camps were a peaceful and quiet space to hunt. According to some middle and Elder's hunters, nowadays people go almost as a holiday to the camps generating a lot of noise that scare whales far away from the camp. This attitude may lead to a major conflict between the hunters who are trying to keep traditions. d) Between local actors and distant actors? No mention in the case. From the research, we can estimate that due to the decrease of summer camps in other communities, in the long term, maybe communities from different places could compete for the use of islands for hunting camps.
II.5. Culture	a) How is the relationship between society and nature viewed? Being on the land is tied to Inuvialuit well-being and is integral to calming, healing, and rejuvenating the spirit.	c) What are key cultural features of relevance for the case? The community presents them as hunters. They relate hunting with autonomy and sovereignty. Hunt is a crucial element for a community, building a network, transmitting knowledge,

	Harvesters acknowledged that things are changing and admitted the future was uncertain. However, it is undeniable that the connection to the land still exists very strongly and will continue into future generations. b) What meanings are attributed to nature and to interactions with nature? Inuvialuit relate to wildlife through their traditional practices and cosmovision. Their subsistence livelihoods and community wellbeing rely on wildlife.	value, culture, and social structure. Fishing is only used as a second source to have the income to invest in better equipment to hunt. d) What are key cultural practices and beliefs related to nature? Hunting is the primary basis for the food supply and the old tradition of 'meat gifts`. Any hunter who catches a whale or other animal should share the meat with the community, especially families with sick or old or mental states members.
II.6. Disturbance What are important types of stress & shock	a) Describe important biophysical or ecological shocks and stresses (e.g. floods, storms, etc). Floods in different locations have forced the community to have just one summer camp, affecting the reproduction of their knowledge.	b) Describe important social shock and stresses (e.g. austerity policies, changes in government policy, introduction of new technologies, etc) -Introduction of new technologies: There is concern from elders that the introduction of fast technologies (e.g, smartphones, GPS) and modes of transportation (high powered motorboats and rifles) shift the values of youth. -Influence of western societies. Southern culture makes young generations move away from their traditional values and activities.
II.7. What are key slow variables Changes that occur over decadal or longer	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?	b) What types of slow social processes (e.g. aging, population growth, loss of language) are driving important changes in social institutions and behaviours?

time scales	Loss of permafrost is changing the rivers and channels dynamics. Change in sea dynamics and wind are affecting the patterns and abundance of belugas whales. Earlier ice-break and delayed formation in the fall has affected Beluga´s migration behave.(3)	Elders' aging and death affect the transmission of knowledge and the whale's harvesting. Shift in values and interest of young people: Southern culture, the introduction of technology, may shift the traditional values of patience, humility, gratification to a more efficient way of thinking.
II.8. Relationships with ecological regime shifts	a) Are ecological regime shifts driving further ecological change or pressure? The change of ice conditions and weather, among the change in permafrost and the floods in certain areas have changed whales practices. No further information in the case b) Are external or internal ecological dynamics potentially or actually producing ecological regime shift(s)? No further information in the case	c) Can social stresses or major changes be attributed to ecological regime shifts? Climate conditions have decreased the option to reproduce whale hunting during summer. Currently, the community only has one spot to set up a camp. In the past they have several spots. The unpredictable weather enables hunters to use their traditional knowledge and make the activity even more dangerous. Among this change in the environment has decreased hunters' confidence, increased the uncertainty of success and the cost of hunting. d) Are there specific social practices that might be contributing to ecological regime shifts Yes, the harvesting of species in a climate change context.
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	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)? .	

A case study can contain more than one type of regime shift	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 and who can do the intervening? This can be listed here or marked with (*) in the table above	Ecological oriented interventions	Socially oriented interventions

REFERENCES/ SOURCES CITED:

(1)	Worden, E., T. Pearce, M. Gruben, D. Ross, C. Kowana, and L. Loseto. 2020. Social-ecological changes and implications for understanding the declining beluga whale (Delphinapterus leucas) harvest in Aklavik, NT. *Arctic Science* 6.
(2)	Aklavik Hunters and Trappers Committee, Aklavik Community Corporation, the Wildlife Management Advisory Council (NWT), the Fisheries Joint Management Committee and the Joint Secretariat. 2016. Aklavik Inuvialuit Community Conservation Plan: A Plan for the Conservation and Management of Natural Resources and Lands within the Inuvialuit Settlement Region in the Vicinity of Aklavik, Northwest Territories. Inuvik, N.W.T., Canada. 195 pp.
(3)	Waugh, D., T. Pearce, S. Ostertag, V. Pokiak, P. Collings, and L. Loseto. 2018. Inuvialuit Traditional Ecological Knowledge of Beluga Whale (Delphinapterus leucas) Under Changing Climatic Conditions in Tuktoyaktuk, NT. *Arctic Science*.

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.