

WP1: What are the implications of climate change for biodiversity and the welfare of Greenland's traditional hunters and fishers?



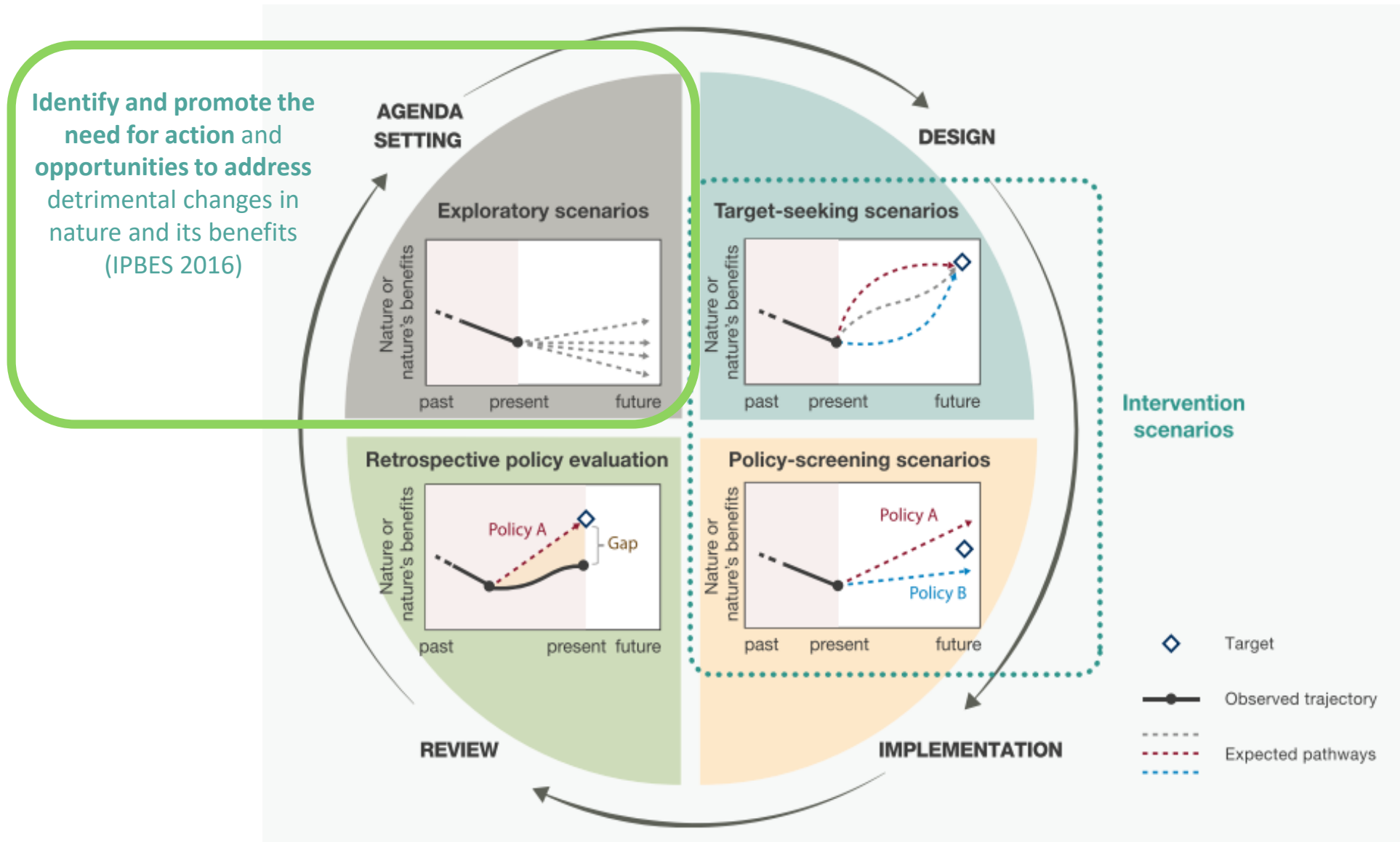
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The well-being of coastal communities and the management of human activities in the Arctic region depend on reliable information and insight into what is likely to happen next.

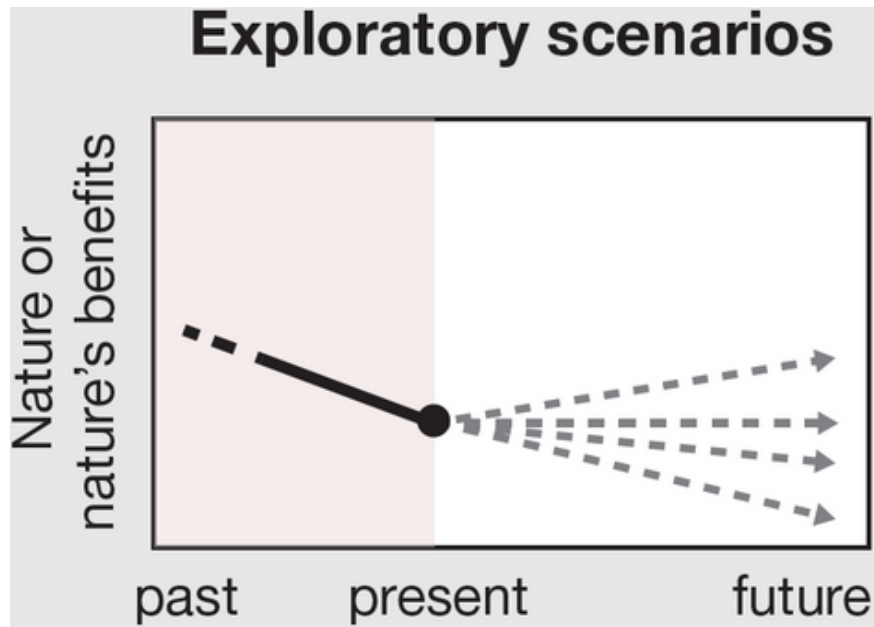


Scenario types



Source: IPBES 2016

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Exploratory scenarios

- Exploratory scenarios (also 'descriptive scenarios') describe a **range of plausible futures** according to **known processes of change or as extrapolations of past trends** (IPCC, 2001, IPBES 2016).
- They contribute significantly to **high-level problem identification** and **agenda-setting**, especially where policy responses have yet to be formulated or the nature of the problem remains unclear
- They typically have both **strong qualitative and quantitative components** and are often combined with participatory approaches involving local and regional stakeholders.

1) **Predict wildlife population trends**

2) **Predict welfare consequences with altered access to species**

Predict wildlife population trends - Method I

1. Literature review:

- Information from **129 publications and reports** for mammals, birds (Black-legged kittiwake), and fish (in progress) on past and current **abundances, current status, and assumed future trends**.

→ developed **written forecasts** for relevant species (until 2030, 2050)

- Potential **trends of population abundance and distribution** of sub-populations
- Potential development of **physiological conditions**
- Potential **behavioral changes** that can affect hunting
(e.g. Human-wildlife conflicts with “land locked” polar bears increased (Wiig et al. 2008), Bowhead whales stay longer in open waters with a reduction of sea ice concentration (Matthews et al. 2020))
- Potential **interactions between native and new species**
(~ 700,000 tons of fish and >1,500,000 tons of krill consumed annually by arriving boreal cetacean species in South East Greenland (Heide-Jørgensen et al. 2022))

Problems:

- Poor data for many species (e.g. seals) or sub-populations or stocks, and opposing pieces of information
- tends to be heavily influenced by existing data (Dubrovsky et al., 2011).

→ Usually used as an additional method (Mallampalli et al 2015)



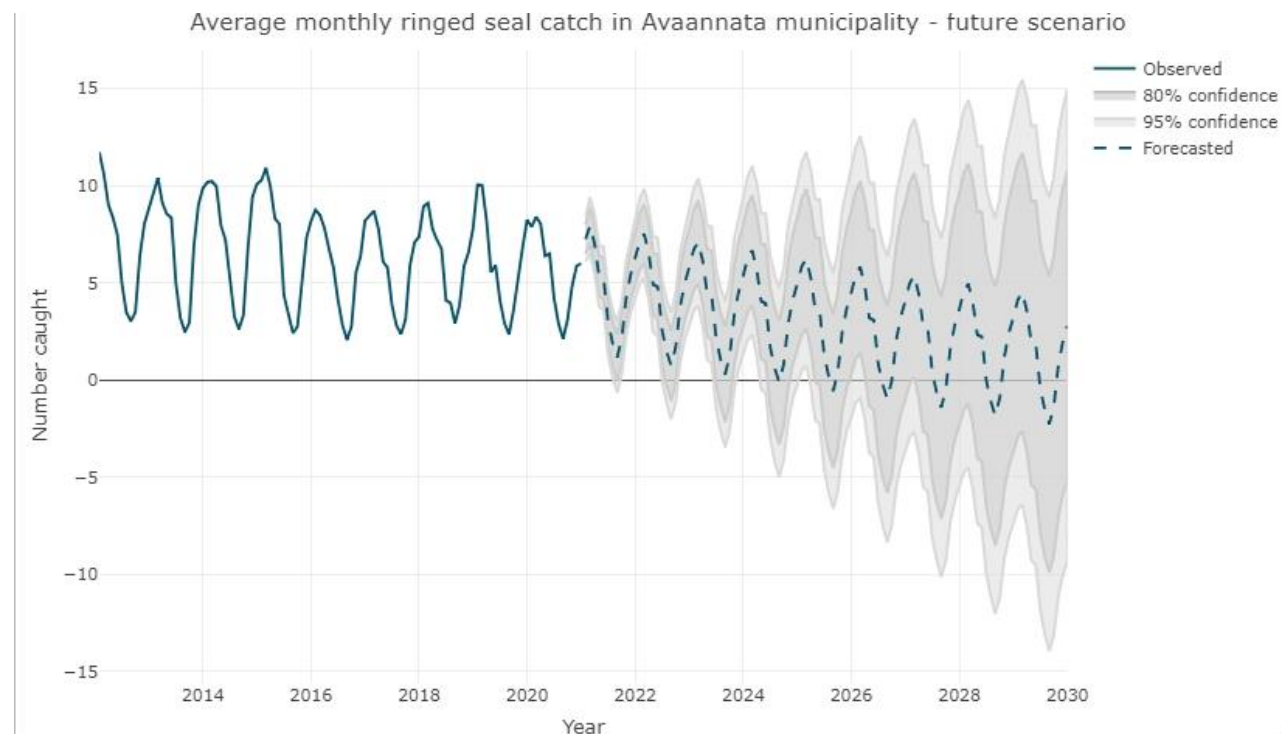
Predict wildlife population trends - Method II

2. Modelling approach:

→ Develop forecasts by **extrapolating current trends for each population** used by hunters and fishers in Greenland using catch per unit effort data

Why catch data?

- Lack of data on population abundances and trends
- Catch per unit effort (here simply number of hunting licenses) reflects access incorporating both climate change and quota impacts as well as the costs of hunting and fishing



Large CI

Validate through experts opinions – incl. local stakeholders

Importantly our objective is not to make predictions but develop plausible future scenarios and explore the welfare implications of those scenarios - if they were to come to pas

SARIMA models/ forecast package

Predict wildlife population trends - Method III

2. Expert-based scenarios :

- use of **expert opinion, knowledge or judgment** to inform the various aspects of constructing scenarios.
- **Expert**: an individual who has **expertise or experience** within a particular dimension through **training, study or involvement in practice** (Raymond et al., 2010)
- includes **scientists and local or indigenous knowledge holders** (Kuhnert et al., 2010)
- are used extensively to guide conservation planning, particularly when data are scarce (Iglecia et al., 2012).

Two types of experts:

1) Scientists → Scientific input

2) Local hunters and small-scale fishers:

- Better knowledge as only a few populations are monitored by scientists.
- Indigenous and local observations and interpretations of ecological phenomena at a much finer scale have considerable temporal depth and highlight elements that may be marginal or even new to scientists (IPBES 2016)

Experts ≠ stakeholders

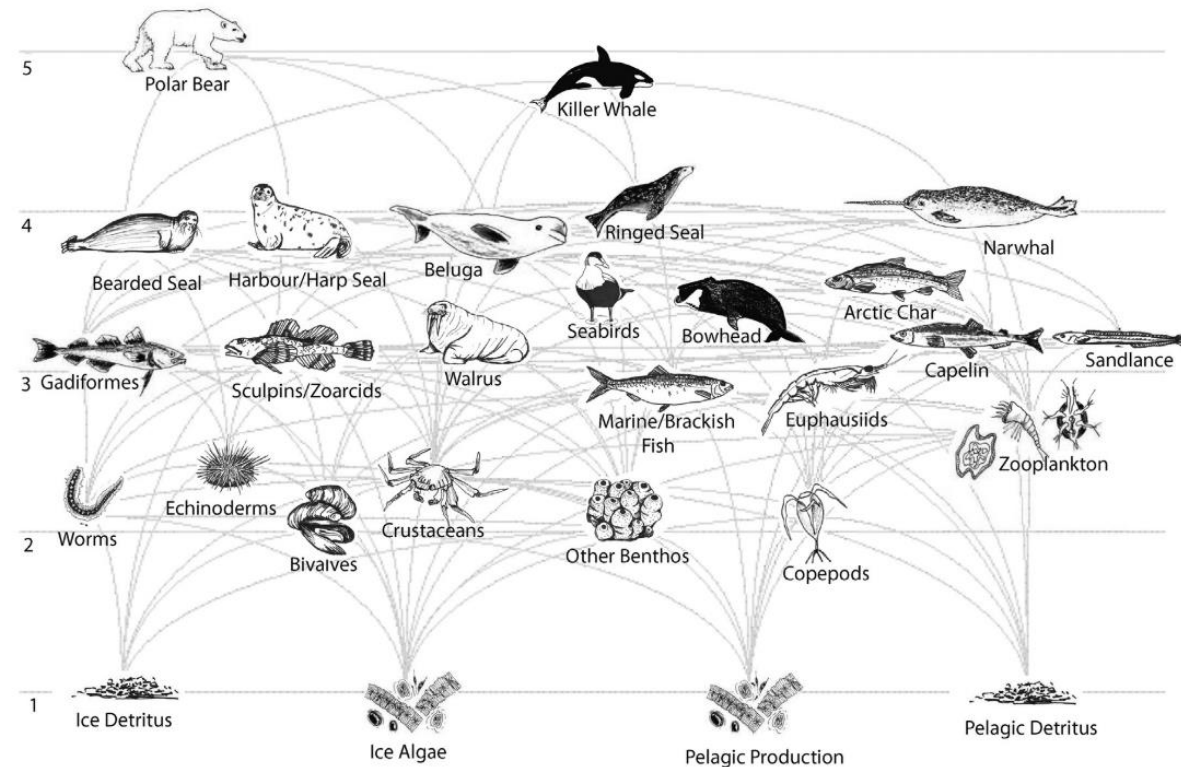
However, experts can also be stakeholders with interests

- Techniques, such as the Delphi technique can reduce uncertainties associated with expert-based elicitations.

Predict wildlife population trends - Method III

2. Expert-based scenarios: Scientists

- **1-3 experts/species** by the number of publications and first authorship
- Most are based at the **Greenland Institute of Natural Resources**
- **Questionnaires, face-to-face** interviews (including Zoom)
- **Presentation of our developed forecasts** based on literature and catch data



C. Hoover et al. / Ecological Modelling 264 (2013) 130– 142

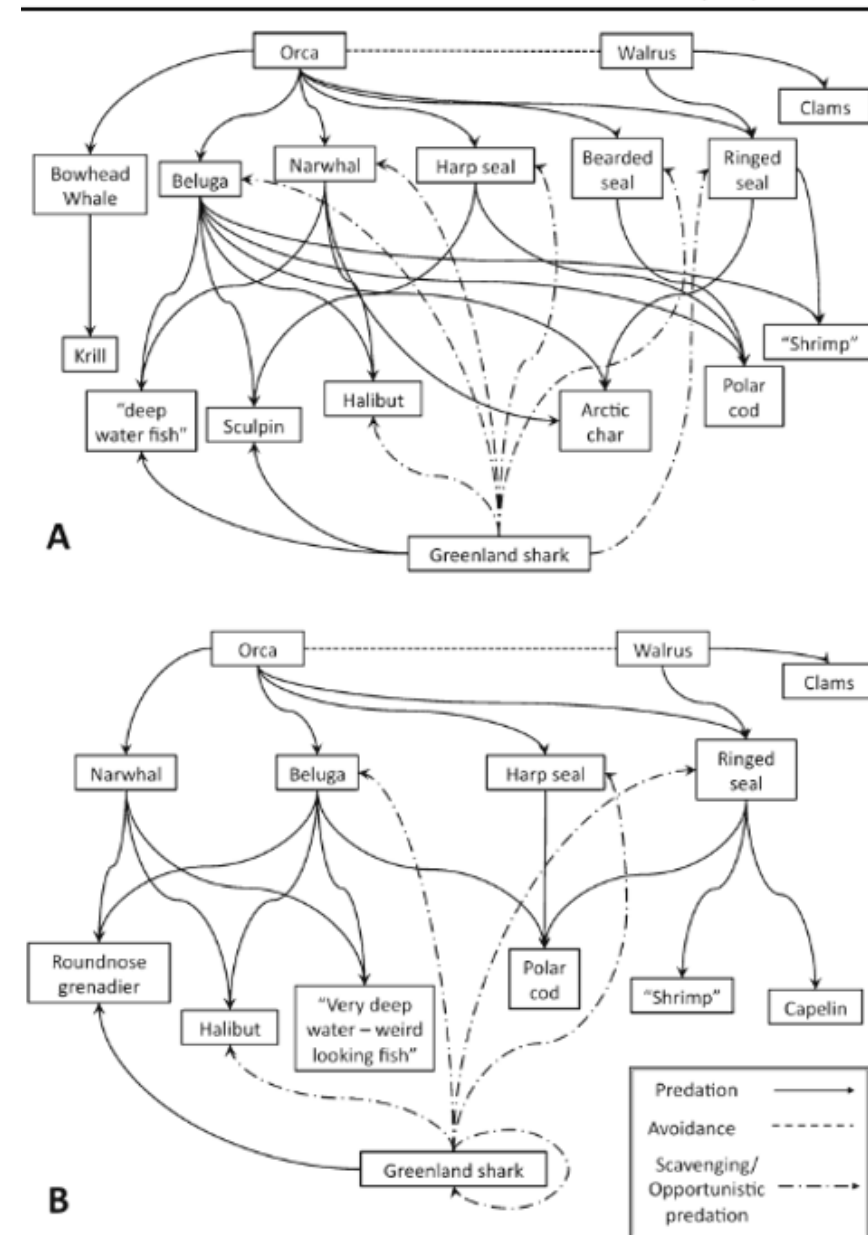
- Narrowing down the large confidence intervals to a **proportional change of abundance** and identifying **different potential trajectories**
- Identify **relevant interactions between native species and new species** and the effect on the ecosystem,
e.g. new apex predators like killer whales (likely kill >1000 narwhal during the open-water season in the eastern Canadian Arctic (Lefort et al. 2020))
- Develop **scenarios based on literature, catch data, and scientific input**

Predict wildlife population trends - Method III

2. Expert-based scenarios: Local hunters and small scale fishers

- **Local workshops:** → A participatory approach is ideal when local and indigenous expertise can supplement scientific knowledge (IPBES 206)
 - Experts: Head of **user organisations incl. hunters** and the **small-scale fishers** in the different districts
 - **Presentation of scenarios based** on literature, catch data, and scientific input
- Narrowing down the large confidence intervals to **a proportional change of abundance** and identifying different potential trajectories
- Identify **interactions between native species and new species** that we have to consider in our scenarios
- Develop **scenarios based on literature research, catch data, scientific input, and local and indigenous knowledge**
- Different perceptions between scientists and local hunters and fishers might be translated into different scenarios

Hum Ecol (2012) 40:405–414

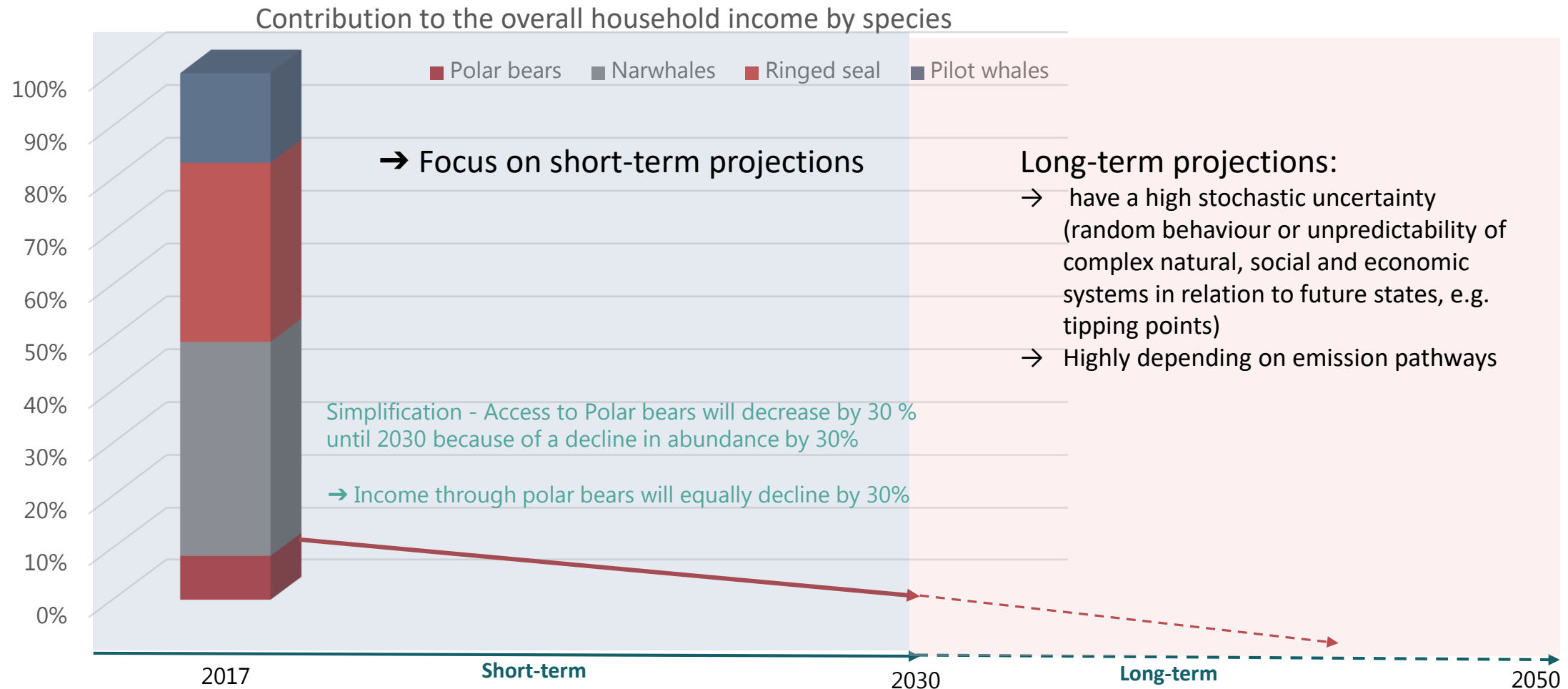


Ecosystem drawn by Greenlandic hunters (Idrobo & Berkes 2012)

Predict welfare consequences with altered access to species

→ Develop scenarios on **changes in household welfare** based on the scenarios for each species


- 1) Determine to what extent **cash and subsistence income from individual species** contribute to hunting households' total annual income using the data from Greenland Statistics
- 2) Projecting effect of **changes in species access on household income**



Predict welfare consequences with altered access to species

$$\text{Household welfare} = I_{\text{polar bears}}^{-30\%} + I_{\text{seals}}^{+10\%} + I_{\text{halibut}} + I_{\text{pensions}} + I_{\text{tourism}}^{?} + I_{\text{mining}}^{?} + \dots I_{\text{region}} + \text{hunter type} \dots$$

Potential adaption strategies ?



- **Participatory approach** with stakeholders to **identify additional socio-economic changes and potential adaptation strategies** that may affect the future prosperity

Predict welfare consequences with altered access to species - Workshop

A participatory approach to scenario development:

- ideal when **dialogue among local stakeholders is key to successful assessment** outcomes as well as when **local and indigenous expertise** can supplement scientific knowledge
- provide a platform for **views to be aired, perspectives broadened, and a greater understanding of the policy issue** under consideration.
- Involving a larger group of stakeholders through workshops or other formal meetings to share ideas and ultimately **develop scenarios based on their collective knowledge.**

Second workshop in NUUK

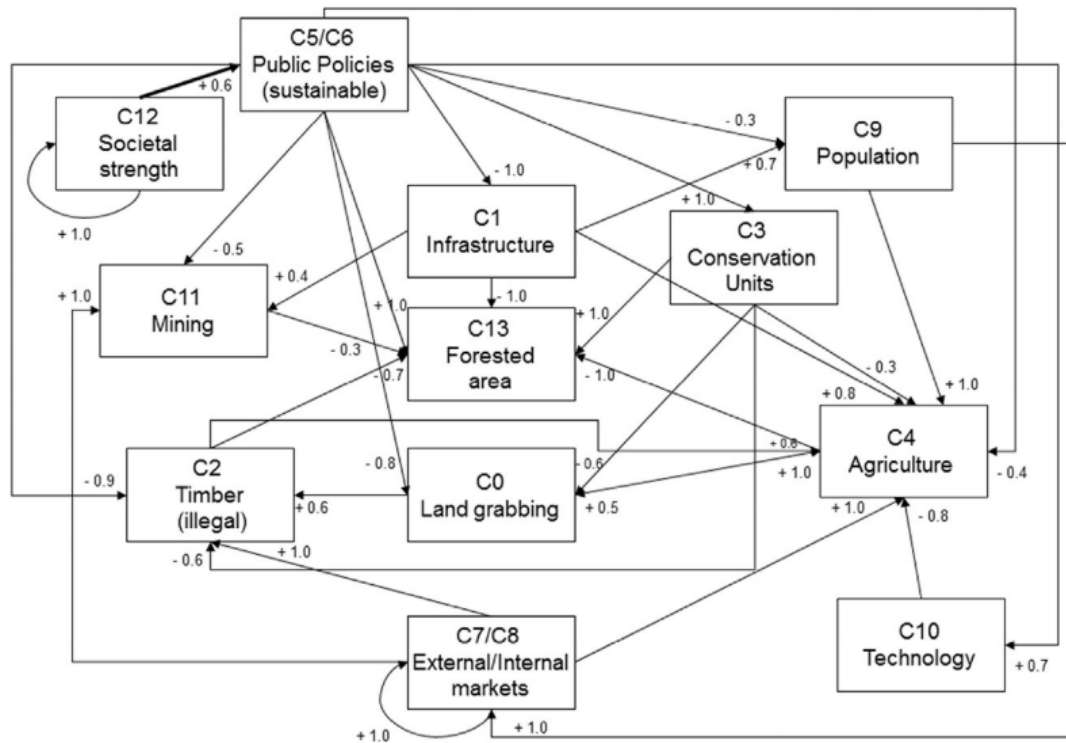
- Stakeholders (local **hunters and small-scale fishers**)
- Starting point: **presenting our scenarios** on household welfare
 - create a common baseline
 - back-casting scenarios are generally broader in scope and participants are generally more engaged and than in forecasting scenarios (Voinov et al. 2010)



Predict welfare consequences with altered access to species - Scenario building

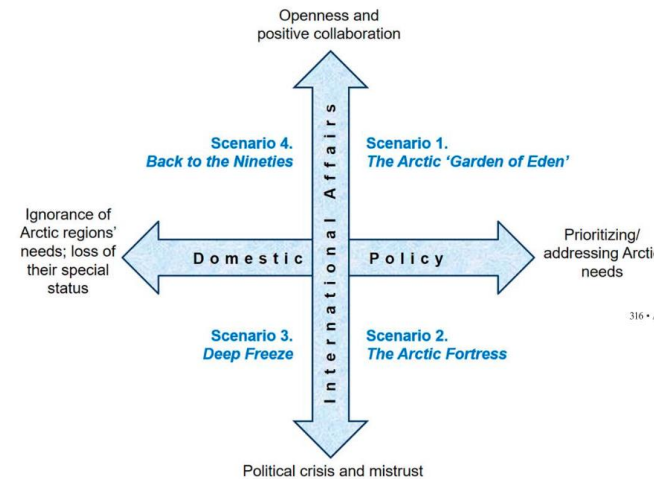
More quantitative approach:

- **Fuzzy Cognitive Maps** - mapping **feedback loops** representing the **strength of a causal relationship** between system variables (Kosko (1986))
- **Translation tool** between **qualitative** and **quantitative** scenarios
- Can be **simulated** the after strength of causal relationships are identified, but relationships are semi-quantified providing only a **semi-quantitative output**

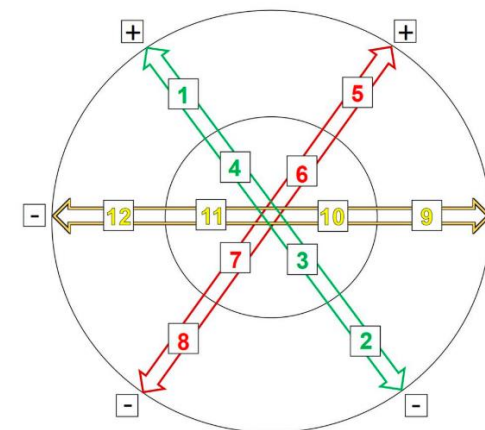


Qualitative or narrative scenarios

- e.g., **Circular-axial technique** by Petrov, et. al 2020, 12 thematic scenarios were synthesized and combined into four integrated scenarios
- Allows for **more creativity** and **broader scenarios**
 - Participants create their **own narratives of possible/desirable futures**
 - A **better understanding** of different trajectories



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Arrows present the external driving forces:
 yellow arrow – technological development
 green arrow – international affairs
 red arrow – global resources markets

What methods you would use for the workshops

- 1) to get proportional changes in wildlife population trends?
- 2) to understand socio-economic changes (qualitative vs. quantitative)?
- 3) How do you deal with opposing pieces of information (e.g. scientists, local/ indigenous knowledge)?

.....Or any other practical advice that may help

Thank you so much!!!

