

Research protocol COAT – study design

INTRODUCTION

The purpose of COAT is to **identify change** (i.e. trends) in terrestrial arctic ecosystems beyond the realm of natural variability in these ecosystems. To do this, COAT employs long-term monitoring of food webs. To **identify the causes of changes**, COAT simultaneously monitors in particular climate and management actions. For an overview of COAT and background, please visit www.coat.no and see the Science Plan for COAT.

Food webs are complex entities and simplifications are needed. The two food webs ([low-arctic Varanger](#) and [high-arctic Svalbard](#)) are divided in [food web modules](#) – 5 for Svalbard and 6 for Varanger. Each of the food web modules includes a subsets of strongly linked species (or functional groups/species assemblages) that have high climate sensitivity and key functions. Key functions can be either ecological and/or societal. Each module is named by one of its primary monitoring targets - often the one with the highest management relevance.

COAT employs an adaptive approach where new knowledge, methods and stakeholder needs are incorporated into the research. Therefore, this protocol describes the current monitoring design and methods, but is subjected to annual changes.

STATE VARIABLES AND DATA SETS

Conceptual models are the baseline of COATs approach. For each food web module, a conceptual model specifies the biotic links between **monitoring targets** (species or species assemblages) and expected impacts of climate change and management actions (**Figure 1**). These conceptual models define **what** shall be monitored (monitoring targets) and **how** state variables characterizing the targets shall be monitored and analyzed. The conceptual models thus define the monitoring design used to acquire data and the structure of the statistical models. Each of the conceptual models/food web modules are linked to other models/modules as they may include common monitoring targets.

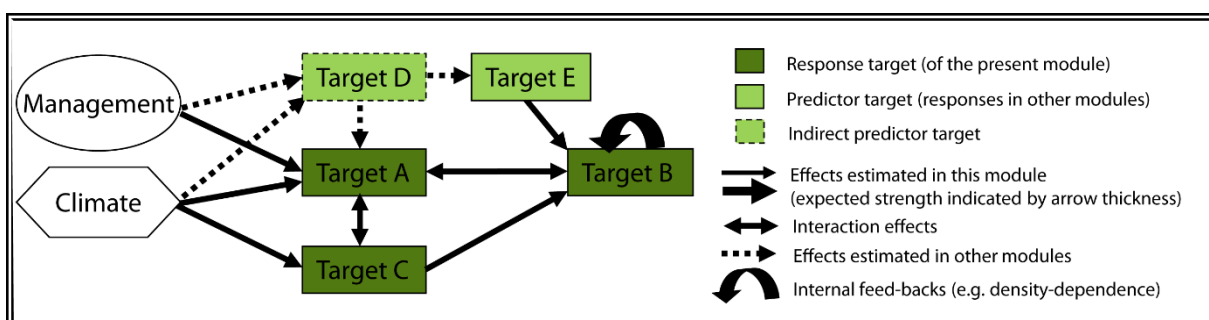


Figure 1: The principle structure of COAT’s conceptual models that outline impact pathways of climate change and management actions on strongly linked species and species assemblages (Targets) in a food web module.

The state of each monitoring target is measured by quantifying the related **state variables**. Chapter 2.9. in the COAT Science plan gives a complete overview of these and reasons behind their inclusion to the monitoring design. In this protocol, we describe the collection of **data sets**. A given data set can provide data for calculating one or several state variables. For each data set, we describe which

state variables it is used for. Data sets and state variables are stored in the COAT data portal where data older than two years is publicly available.

This protocol describes study designs and data collection methods (both field and other). Guiding principles and general description of COAT study designs are given in the section “Hierarchical monitoring design”. More detailed descriptions of region-specific study designs are given in the other parts of the COAT study design protocol. Dataset-specific measurement methods are described in separate protocols.

HIERARCHICAL MONITORING DESIGN

COAT uses a hierarchical monitoring design, with three main monitoring types. **Intensive monitoring** targets variables with rapid response to climate change and/or large temporal variability. Sampling at these sites happens monthly/seasonally. **Extensive monitoring** targets variables with slower response. Sampling happens at 5-year intervals, and some variables are remote-sensed. **Regional monitoring** targets variables that have to be sampled at a larger spatial scale or have an inherent design that cannot be accomplished by site-based monitoring (for example hunting statistics, forest regeneration after moth outbreaks).

Note that this protocol only describes the monitoring designs for which datasets are currently included in the COAT data portal.

Table 1: Definition of study design terminology used in COAT. The table describes spatial variables with names, definitions and examples. Additional levels of study design (such as plot, sub-plot) or groups (such as spatially grouped sites, plots that belong to same treatment group) are explained separately for the datasets/measurement protocols where this is relevant.

| Variable name | Definition | Explanation, examples and notes |
|-------------------|--|---|
| Region | Svalbard or Varanger | Svalbard or Varanger. Note that some datasets include data sampled in northern Norway, outside Varanger peninsula in (region being defined as Troms or Finnmark). |
| Sub-region | Kongsfjord or Nordenskiöldland on Svalbard, Rakkonjarga or Varjjatnjarga at Varanger | Used on Svalbard to split datasets between Kongsfjord and Nordenskiöld-land regions, at Varanger to split between eastern and western reindeer management districts. |
| Locality | from km to 10s of km | Localities nested within regions; for example river valleys or watershed areas (e.g. Adventdalen, Komagdalen), or shore flats (e.g. Sarsøyra). |
| Section | some km (1 to 5) | Sections nested within localities; for example parts of river valleys, large scale transects, or landscape blocks containing specific landscape elements. These can also be units characterizing some biotic/abiotic aspects of grouped sites within location, e.g. rich/poor or north/south or inner/outer part of a large valley. |
| Site | ca 15*15m til 50*50m | For example single sites (e.g. points where ptarmigans are counted on Svalbard), sites where several plots are grouped (for e.g. vegetation analyses or pellet counts), or units defined by animals area use (territories, dens). |