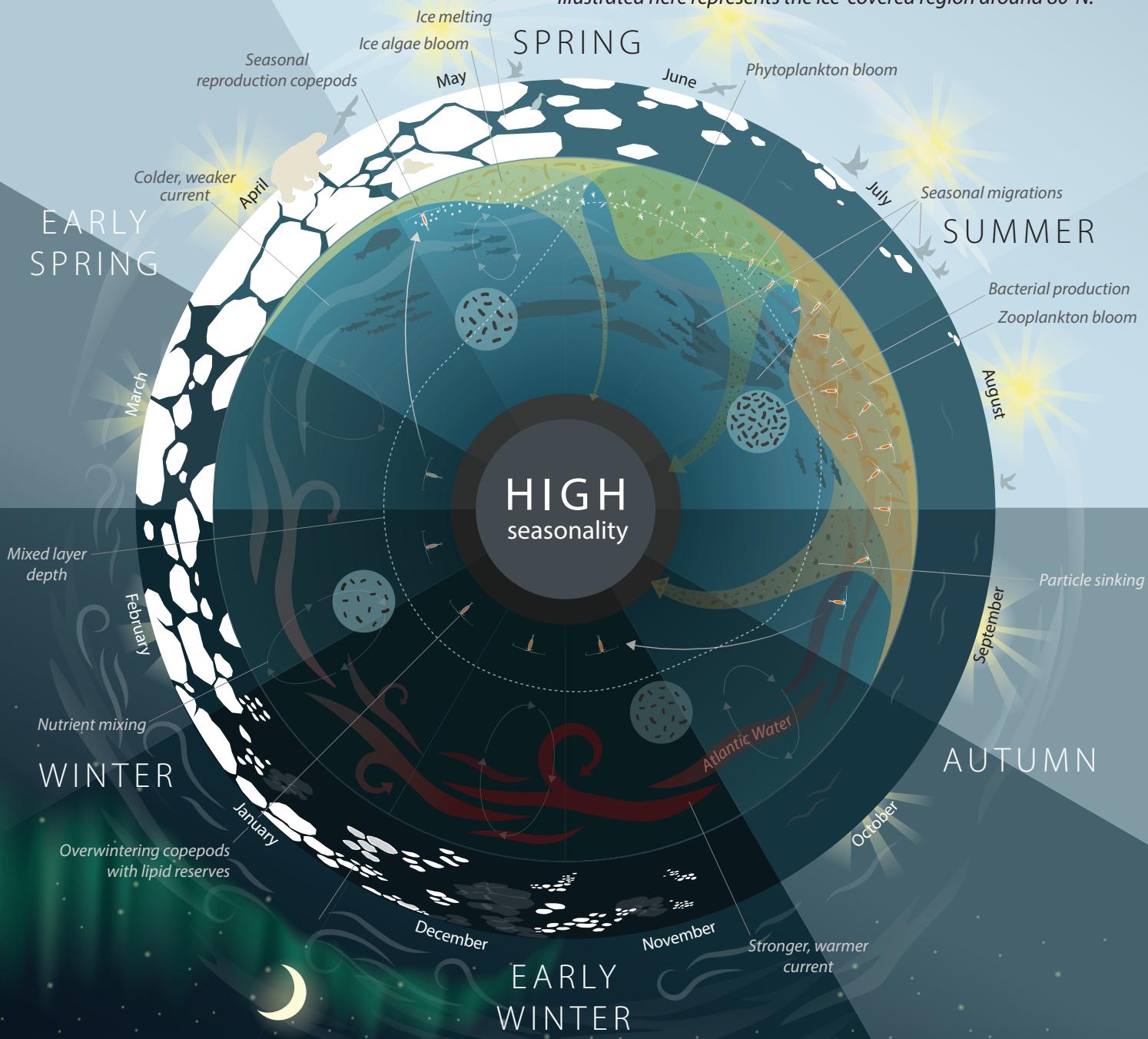




Seasonality

Seasonal variability in light and temperature is much more extreme in the northern Barents Sea than in temperate seas, and affects air-ocean interactions, sea ice cycles, and light-dependent biological processes. The Nansen Legacy used field campaigns, autonomous vehicles, remote sensing, and models to study the range of this variability. The seasonality illustrated here represents the ice-covered region around 80°N.



Seasonal environment

Fall and winter ocean mixing resupplies surface waters with nutrients. Ice cover can last from around December, extending well beyond the Polar Night into spring or early summer under Midnight Sun. Ice melt reduces alkalinity and surface salinity, the latter leading to stratification.

Bloom phenology

Sea ice decrease and returning light kickstart an algal spring bloom, starting in sea ice (as early as March) and later in nutrient-rich surface waters (April-June). As a result, nutrients are depleted within weeks, limiting summer phytoplankton growth. Seasonal shifts in bacteria, phytoplankton and zooplankton composition follow.

Fate of the bloom

Bacterial activity is at its annual peak after the spring bloom, recycling nutrients and organic material via the microbial loop. The productive spring bloom delivers a pulse of fresh food to the seafloor days to weeks later. Ice algae tend to settle to the seafloor earlier than phytoplankton and are less affected by bacterial degradation processes.

Life cycles

Life cycles of ice biota and plankton are adapted to the seasonal environmental variability. Grazing copepods emerge from depths and migratory whales, birds and fish arrive from the south to feed on fatty zooplankton or fish. Some leave before the Polar Night, but biological activity in the dark period is not as low as once thought.

Benthic communities

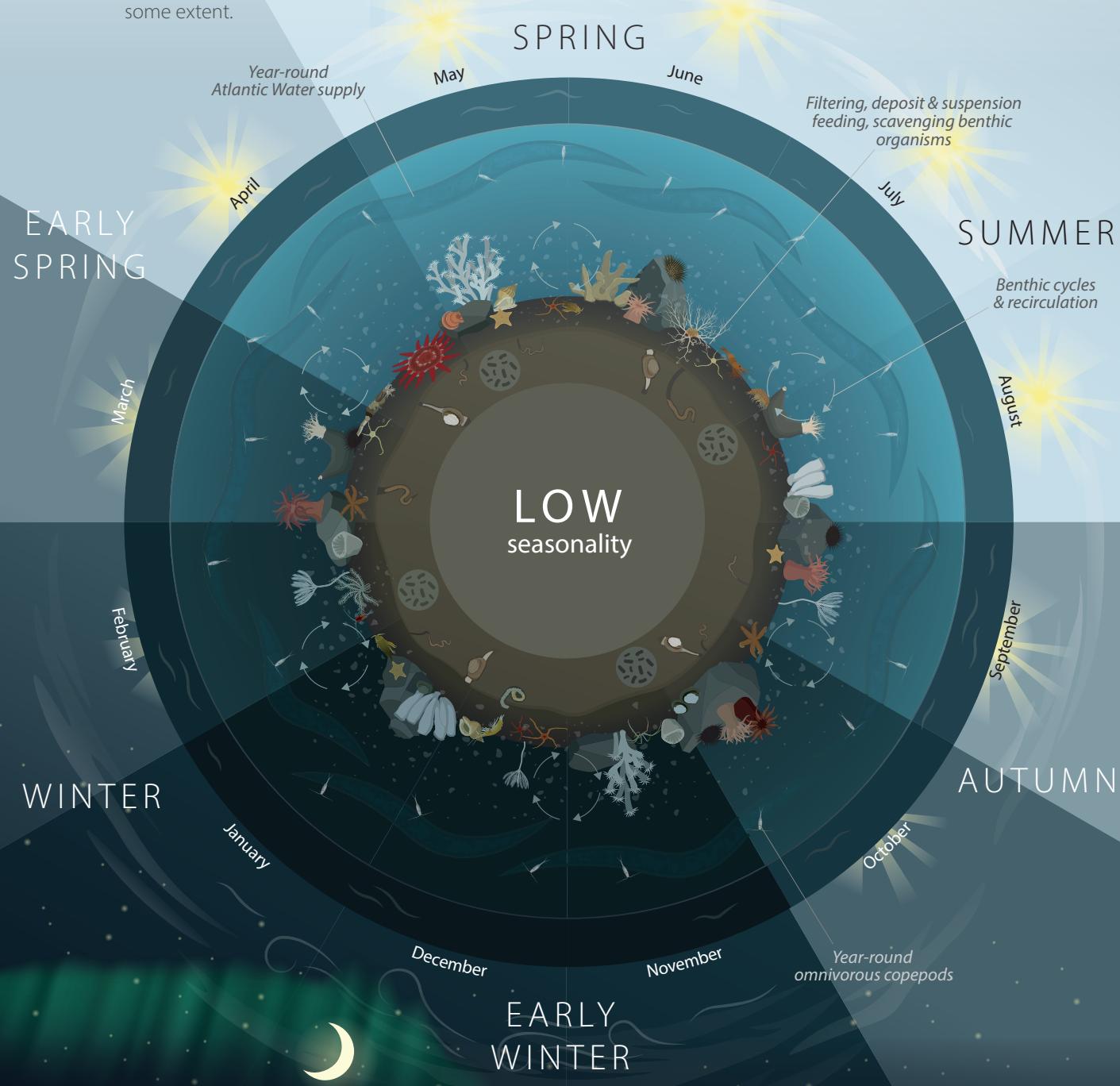
At the seafloor, community composition, biomass, sediment carbon inventories, and food web structure are much less seasonally variable than in the pelagic and ice-associated systems of the Barents Sea. The long-life spans of benthic dwellers dampen direct links to surface seasonality and processes to some extent.

Non-seasonal pelagic life cycles

Unlike zooplankton that primarily feeding on phytoplankton and are seasonally dormant, other abundant copepods consume a wide range of particles and can reproduce year-round. While they lack seasonal fat reserves, they provide a stable food source for their consumers.

Atlantic inflow: a year-round engine

The Atlantic Water inflow supplies heat, nutrients, phytoplankton and zooplankton year-round across much of the Barents Sea. Though stronger in autumn and winter, this inflow sustains higher productivity compared to most other Arctic regions.



RECOMMENDATIONS

Knowledge of key ocean variables and ecosystem components in the Barents Sea is essential for sustainable management and conservation. However, results and inferences from monitoring depend on the season when measurements are taken, as many ecological and physical processes vary throughout the year. A monitoring and management strategy must therefore be closely aligned with the seasonality of the ecosystem component in question; and it must consider that phenology of events is changing under climate change.