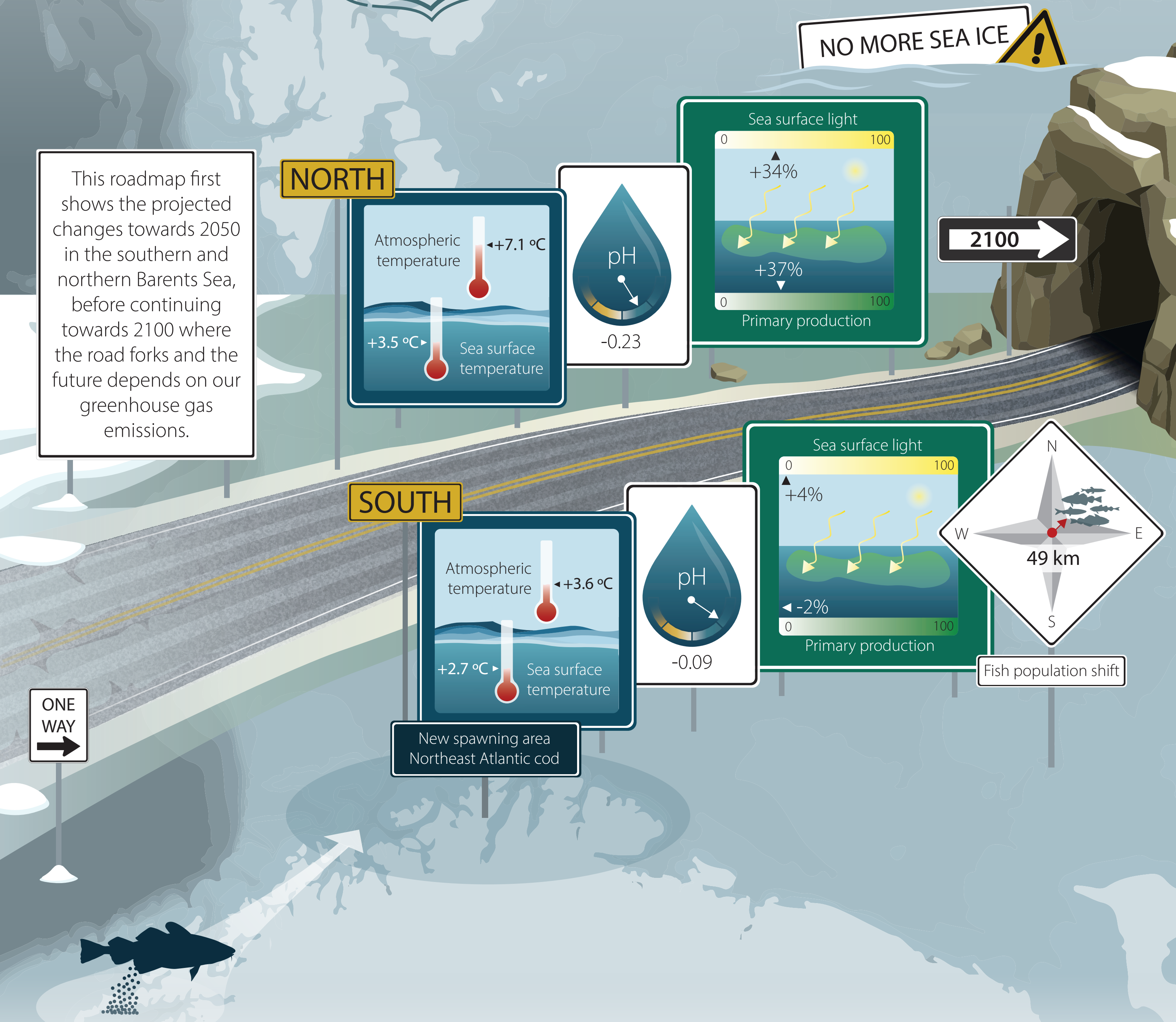
The future Barents Sea

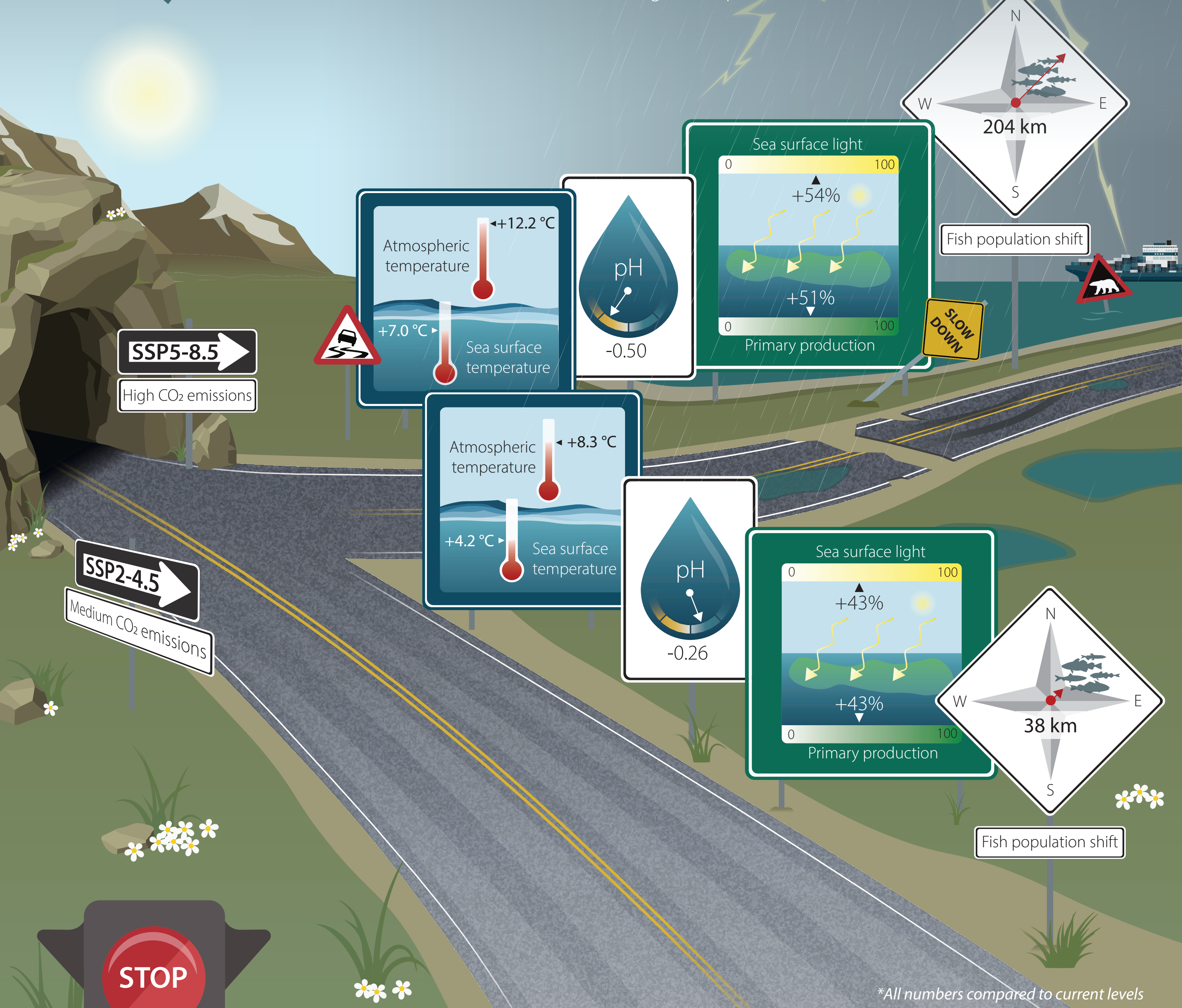
Ecosystem research is valuable not only in how it can reveal historical trends and current functioning, but also how it can inform ecosystem-based management and adaptation strategies for the future. A variety of models can project how physical drivers, biogeochemical parameters, and ecosystem processes will develop expected increases in human activities in the Barents Sea. Increases in human activities expected to be observed in the Barents Sea can also be evaluated in terms of their potential impacts on key ecosystem parameters.



Despite considerable variability, state-of-the-art climate (CMIP6) and ecosystem models project large changes, particularly in the northern Barents Sea by 2050. The entire Barents Sea is expected to be ice-free throughout the year and the increase in temperature and light levels in the northern Barents Sea will result in a one-month earlier spring bloom and a 37% higher primary production. There will be minimal change in timing or levels of primary production in the southern region. pH will decrease by 0.1 and 0.2 in the Southern and Northern regions, respectively. Fish populations will experience a nearly 50-km shift in distribution to the northeast and spawning of the Northeast Atlantic cod stocks will take place further north along the Norwegian coast. A key element of these findings is that different emission scenarios have little impact on projections towards 2050.

ROUTE year 2100

After 2050, the severity of climate change in the Barents Sea scales directly with future emissions. In the northern Barents Sea, medium CO_2 emissions lead to a 4.2 °C warming of the surface ocean and an 8.3 °C increase in air temperature at the end of the century. However, under high CO_2 emissions, the ocean and air temperature escalate to a rise of 7.0 °C and 12.2 °C respectively. Primary production increases by 51% and pH decreases by 0.5 units as well, reaching undersaturation with respect to aragonite by 2100. Warming and loss of ice will reduce polar cod stocks substantially. Under high CO_2 emissions scenarios more than a 90% reduction is expected, whereas it is less under medium CO_2 emissions levels. Fish populations continue to shift to the northeast, but the shift is greater under high CO_2 emissions. Increases in ship traffic in the region by 2100 will lead to higher contaminant levels and risk for introductions of non-indigenous species*.



All numbers compared to current levels

RECOMMENDATIONS

Changes in greenhouse gas emissions have little impact on projected changes for 2050 since the inertia within the system has already determined the near-future. Thus, management strategies need to shift to a focus on adaptation to the new ecosystem state. We do have a chance to limit changes by 2100 if we rapidly reduce global CO_2 emissions. The 'new normal' projected here presents challenges for coastal management as fisheries stocks and spawning sites shift to the north and east. Unanticipated and unquantified changes in e.g. establishment of non-native species and risk for higher contaminant loads due to increased human activities present other challenges that should be integrated into management and monitoring plans.

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