

## The Swedish [SMHI's](#) oceanographic researchers: "Offshore wind farms have a large-scale impact on the sea"

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Ocean currents, salinity, and temperature – both at the sea surface and at the seabed – are some of the parameters affected by offshore wind power. Additionally, the sea is influenced far beyond the actual wind farm when the wind turbines are operational. These are the initial results of a model study currently conducted by SMHI's oceanographic researchers on behalf of the Swedish Agency for Marine and Water Management. **The final results will be presented in spring 2024 and will be part of the basis for the Swedish marine plans.**



### **Offshore wind power affects the sea. SMHI's oceanographic researchers investigate how.**

SMHI's research contributes, among other things, to the ongoing energy transition to create a sustainable society today and in the future. Understanding how wind power can affect the marine environment is one example.



**Lars Arneborg, head of oceanographic research at SMHI:**

"Our initial model results show that offshore wind farms have a large-scale impact on the sea, and the effects extend far beyond the outer boundaries of the parks," says Lars Arneborg, head of oceanographic research at SMHI, who continues:

*"The wind behind the wind farms decreases, and we observe that this affects currents and stratification in the sea's surface layers. This, in turn, affects nutrients and algal blooms in the surface layer, which then has consequences for the entire marine ecosystem and oxygen conditions in deep waters."*

**Impact both above and below the sea surface**

In Sweden, the environmental effects of offshore wind power have so far been seen mostly as a local impact near the wind parks, especially during the construction phase. However, when the wind turbines are in operation, there are effects that extend beyond the wind farms.

The impact on the wind also has effects below the sea surface. The rotors extract energy from the wind – the very reason wind turbines are built – and depending on the weather conditions, winds decrease by up to 5–15 percent as far as 30 kilometers behind an offshore wind farm. Studies show that surface water then accumulates on one side of the area with reduced winds, while deep water wells up on the other side, affecting currents in an even larger area.

The foundations of wind power also affect the sea because they slow down ocean currents and create turbulence that mixes different water layers.

If the influx of salt- and oxygen-rich water into the Baltic Sea changes, for example, as a result of offshore wind farms in the Baltic Sea's estuary area, it would have consequences for the entire Baltic Sea environment. Changes in inflows or increased

mixing of inflowing water can affect the strength and depth of the permanent salt stratification in the central Baltic Sea, where oxygen deficiency and vertical transport of nutrients are crucial factors for marine life.

## **More studies on the effects are needed**

The changes shown by the initial model results may be considered small compared to natural variations, but this is only for already existing wind power. When more offshore wind power is built in the future, the cumulative effects of all wind parks will add up.

"It remains to be seen how significant the total effect of a large-scale wind power expansion will be, and whether this can have a significant impact on factors such as oxygen deficiency, algal blooms, and ecosystems in the Baltic Sea. Before such an expansion of wind power occurs in the Baltic Sea and its estuary area, the effects of planned wind power need to be investigated, not only for Swedish waters but for the entire area," says Lars Arneborg.

## **Basis for the new Swedish marine plans**

The results of this initial study will be presented in spring 2024 and will serve as a basis for the Swedish marine plans, guiding authorities, municipalities, and regions in investigations related to activities at sea. The study is carried out on behalf of the Swedish Agency for Marine and Water Management. The impact of wind power on plants and animals in the sea has not been investigated in this project.

<https://www.smhi.se/forskning/forskningsnyheter/smhis-oceanografiska-forskare-vindkraftsparker-till-havs-har-en-storskalig-paverkan-pa-havet-1.202627#:~:text=I%20Sverige%20har%20miljöeffekter%20av,ger%20även%20effekter%20under%20havsytan.>