Potential Impacts of Offshore Renewable Wind Energy Development on Marine Environment over the US Northeast

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Offshore renewable wind energy is one of the major blue economy development plans in the US Northeast. Funded by the Bureau of Ocean Energy Management (BOEM) and NOAA Scallop Research Set-Aside (RSA) Programs, we have developed a wind turbine-resolving (up to ~1 m) coupled physical and scallop-IBM model for Sothern England Shelf (SNE), with a computational domain covering the regions of the shelf off Massachusetts, Rhode Island, Block Island Sound, and Long-Island Sound. Using this model system, we have examined the impact of the offshore wind turbine generators (WTGs) deployment in a lease area on the dispersal and settlement of scallop larvae in the region. The results show that local WTGs in a small area can produce small-scale eddies and thus enhance turbulent mixing within and around the turbine area. The circulation change around the WTGs areas tends to increase the offshore water transport, resulting in upwelling from the deep water to the shelf. The comparison between the cases with and without WTGs suggests that the wind farm development in the region could considerably change the larval abundance in SNE. Critical impacts are mainly from the separation scale of individual WTGs, even though their layouts did show some level influences on the larval dispersion. Both satellite-derived SST and models show that the northeast U.S. shelf experienced climate change-induced warming. A downscaled coupled atmosphere (WRF)-ocean (FVCOM) model has been developed with an aim to examine the accumulative impact of the regional wind farm development on scallop recruitments over the US Northeast shelf under a warming climate condition.