

Development of the Potential Vulnerability Index for the Arctic Marine Ecosystems

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While recent changes in the Arctic marine environment, as represented by the drastic decrease of sea ice, may increase socio-economic opportunities, such as natural resource exploitation and utilization of the northern-route for intercontinental shipping, they may also cause a degradation of the present marine ecosystems and their ecological services; directly or indirectly. Therefore, assessment of the potential impacts of these environmental changes on marine ecosystem is desired for both deliberate socio-economic development and conservation of the Arctic oceans. Using Planetary Boundaries as thresholds for proposed processes regulating the stability and resilience of the Earth system, and assuming that larger environmental change increase the potential impacts on the marine ecosystems, we developed the Potential Vulnerability Index (PVI) of the Arctic marine ecosystems. The PVI is based on statistical analysis that identifies geographical regions where (1) the large variance of the selected Planetary Boundaries components is found (larger exposure to environmental forcing), (2) a response of marine ecosystems to the environmental forcing is larger (larger sensitivity), and (3) an adaptive capacity of the ecosystems is smaller (smaller resiliency). Our results highlight regions in the Arctic oceans where the potential vulnerability is large and may require further attention. Our work is expected to contribute to ecosystem management.

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