

IMPACTS OF SEA-LEVEL RISE ON EUROPEAN COASTAL WATERS WITH RESTRICTED EXCHANGE

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AIMS

This study aimed to estimate any impacts by *climate change-induced sea-level rise* in coastal areas of restricted exchange (embayments, lagoons and sealochs) in Scotland and Norway using *Geographic Information System (GIS)*. Ecological, physical and economic features of these areas were studied. Furthermore, the area of loss due to sea level rise was calculated and the predicted affected habitats determined.

Embayments are numerical scarce but scattered along the Scottish coastline. They are restricted to the ocean by narrow inlets, are generally shallow and often dominated by tidal regimes, that determine their ecology.

Coastal lagoons are numerous but spatially relatively small, very shallow (<10 m) basins with a barrier at their inlet which can lead to temporary enclosure. The density of lagoons is the highest at the Scottish islands including Orkney.

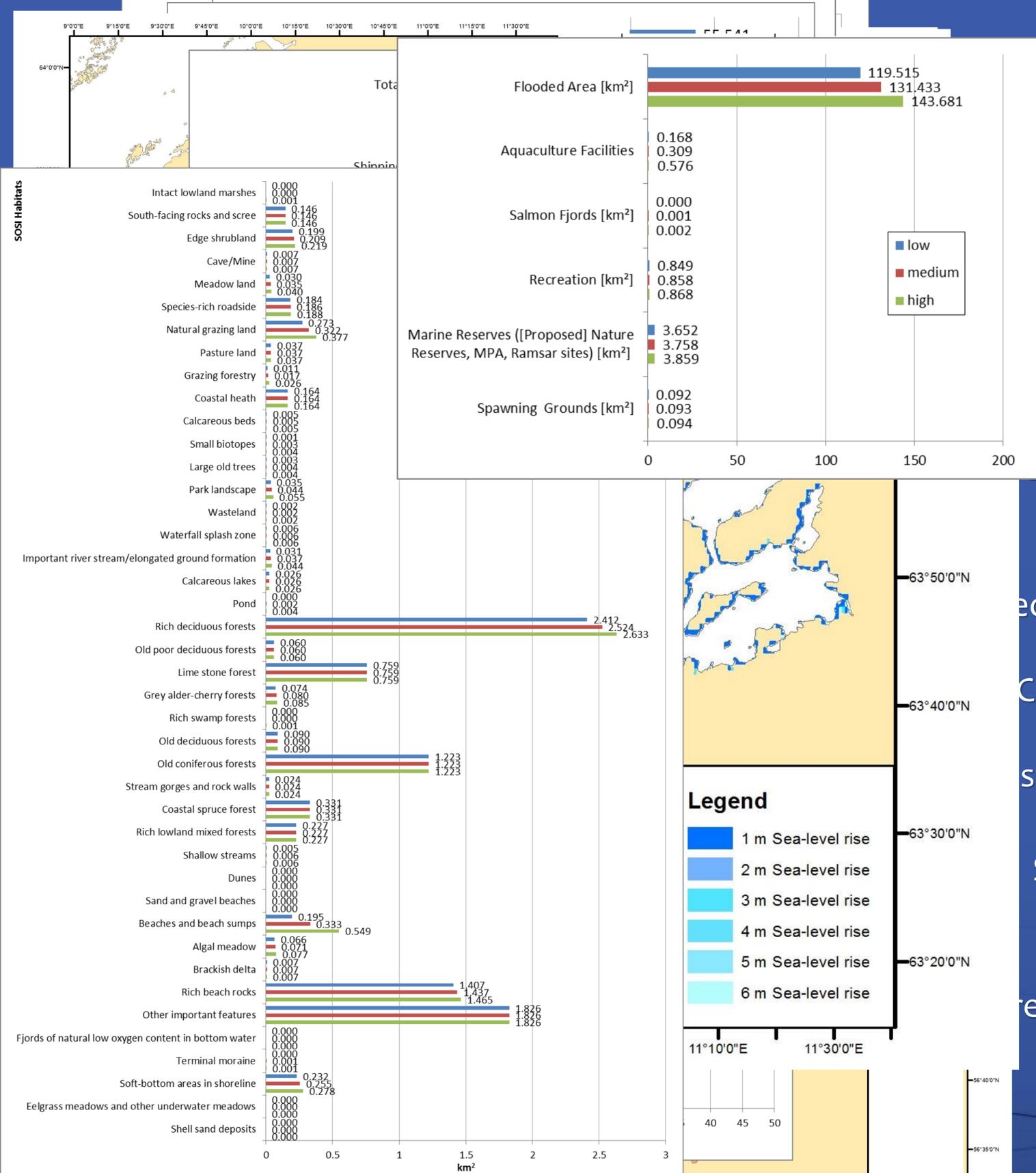
Fjords/Sealochs are predominant on the west coast of Scotland, the Shetland Islands and along the Norwegian coast with glacially formed deep basins and sills at their mouth. They often have a saline gradient due to associated rivers.

USED FUTURE PREDICTIONS OF SEA-LEVEL RISE

Predictions for	low emission	medium emission	high emission
Edinburgh, Scotland	23.4 cm	30.5 cm	39.2 cm
Trondheim, Norway	22 cm	42 cm	77 cm



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Scenarios for the Trondheim Fjord

The main objective of this study is to assess the potential impacts of sea level rise on the Trondheim Fjord system. The study area includes the fjord system, the surrounding land, and the sea. The study is based on a combination of field data, remote sensing, and modeling. The study is divided into two main parts: a description of the current state of the fjord system and a prediction of the future state of the fjord system under different sea level rise scenarios. The current state of the fjord system is described in terms of its physical characteristics, its biological characteristics, and its socio-economic characteristics. The future state of the fjord system is predicted using a combination of field data, remote sensing, and modeling. The predicted future state of the fjord system is described in terms of its physical characteristics, its biological characteristics, and its socio-economic characteristics. The predicted future state of the fjord system is compared to the current state of the fjord system to assess the potential impacts of sea level rise on the fjord system. The predicted future state of the fjord system is also compared to other fjord systems to assess the relative impacts of sea level rise on the fjord system. The predicted future state of the fjord system is also compared to other fjord systems to assess the relative impacts of sea level rise on the fjord system.

The predicted sea level rise will likely affect the Trondheim Fjord system in several ways. First, the predicted sea level rise will likely affect the physical characteristics of the fjord system. The predicted sea level rise will likely cause the fjord system to become shallower and wider. This will likely affect the hydrodynamics of the fjord system, which in turn will likely affect the biological characteristics of the fjord system. Second, the predicted sea level rise will likely affect the biological characteristics of the fjord system. The predicted sea level rise will likely cause the loss of some of the most important habitats in the fjord system, such as spawning grounds and nursery grounds. This will likely affect the population of several important fish species, such as cod, herring, and salmon. Third, the predicted sea level rise will likely affect the socio-economic characteristics of the fjord system. The predicted sea level rise will likely cause the loss of some of the most important economic activities in the fjord system, such as aquaculture and tourism. This will likely affect the livelihoods of many people who depend on the fjord system for their livelihoods.

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The economic and ecological features and habitats which are predicted to be affected in the flooded areas at the Trondheim Fjord system are shown in the map. The map shows the flooded areas at the fjord mouth and the surrounding land. The flooded areas are shown in yellow and orange. The surrounding land is shown in green. The map also shows the location of the fjord system and the surrounding land. The map is a map of the Trondheim Fjord system and the surrounding land. The map shows the flooded areas at the fjord mouth and the surrounding land. The flooded areas are shown in yellow and orange. The surrounding land is shown in green. The map also shows the location of the fjord system and the surrounding land. The map is a map of the Trondheim Fjord system and the surrounding land. The map shows the flooded areas at the fjord mouth and the surrounding land. The flooded areas are shown in yellow and orange. The surrounding land is shown in green. The map also shows the location of the fjord system and the surrounding land.

Conclusion

The area which is predicted to be flooded includes intertidal habitats which will likely no longer be free of saline water at low tide. This can be crucial at places like Montrose Basin, tide influenced lagoons in the Orkney Islands and shallow areas around sealochs and fjords.

Additional stresses will result from the increased depth of some basins which has influences on light irradiation and therefore the seabed flora.

In the basins with a saline gradient like Montrose Basin and the fjords/sealochs with their associated rivers, the increased salinity is predicted to affect the biodiversity.



As most of the coastal waters and the shore profile evolved by sea-level changes thousands of years ago, the natural movement of the coastal waters landwards by sediment shifts would be expected. For example, the lagoons in Orkney are very shallow, any sedimentation might lead to a filling whereas at other places new lagoons could evolve by barrier development.

Nevertheless, this natural movement will be restricted by pre-existing structures associated with urban development. Additional threats like promoted erosion of land and beaches should be considered for preservation measurements which should be applied soon to avoid higher costs by the rising sea-level.