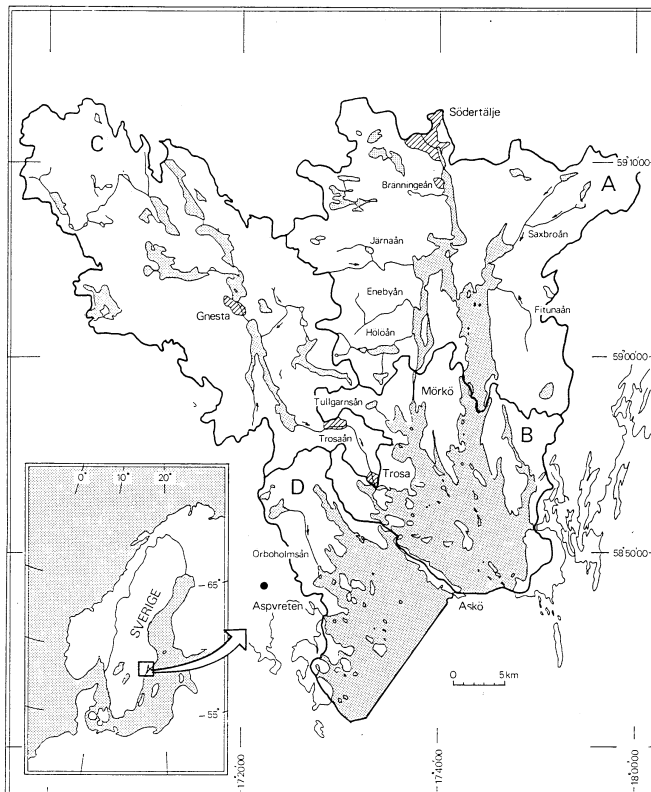


## WT 7.4 HIMMERFJÄRDEN

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**2. Himmerfjärden, Swedish Baltic coast with catchment (A+B+C) and reference area (D).**

### 3. Characteristics

<i>Marine System</i>	A coastal bay system of 232 km <sup>2</sup> , mean about depth 17 m, atidal, Salinity 4-7, slightly lower than adjacent Baltic. Ice-covered most winters, summer water temperature ca. 20°C. Located 60 km S of Stockholm, Sweden.
<i>Watershed</i>	Area 1286 km <sup>2</sup> , with 8% lakes, 20% agricultural land, 65% forest, 3% built area. Mean water input 8 m <sup>3</sup> s <sup>-1</sup> from 9 brooks and streams, 7 m <sup>3</sup> s <sup>-1</sup> from Lake Mälaren through Södertälje, 2 m <sup>3</sup> s <sup>-1</sup> diffuse runoff, 1.5 m <sup>3</sup> s <sup>-1</sup> treated sewage, 4 m <sup>3</sup> s <sup>-1</sup> rain.
<i>Human Activities</i>	<b>Waste effluents:</b> Sewage from <b>Urban</b> area, emissions from <b>industrial</b> activity (e.g. lorry and pharmaceutical factories), run-off from agriculture. <b>Shipping:</b> to Södertälje and further through Lake Mälaren. <b>Recreation:</b> boating, swimming, fishing. <b>Fisheries:</b> Some commercial fishing. <b>Agriculture, Forestry.</b>
<i>Impact Responses</i>	<b>Nutrient loading:</b> has caused increased turbidity, loss of submerged aquatic vegetation, deep water oxygen deficiency, cyanobacterial blooms, biodiversity loss. <b>Baltic overfishing:</b> has caused trophic web change, biodiversity loss. <b>Industrial effluents:</b> Chemical stress on organisms suspected

### 4. Policy

<i>Policy issues</i>	1) Difference in interpretation of Urban Waste Water Directive between Sweden and EU, 2) Need for legislation that allows an Adaptive Management approach to minimize coastal eutrophication, 3) Implementation of advance nutrient reduction to minimize coastal and open sea eutrophication, 4) Implementation of the Water Framework Directive in the Swedish Coastal Zone.
<i>Policy changes</i>	1974 Greatly increased discharge of treated sewage, 1984 experimentally increased phosphorus load during one year, 1997 introduction of enhanced nitrogen removal

	(c.85%) in Sewage treatment plant, 1997-2005 temporary use of an Adaptive Management approach for running the sewage treatment plant, from 2004 implementation of the Water Framework Directive. Permanent permission for adaptive sewage management will be sought in 2008, when a long-term discharge permit for the Himmerfjärden sewage treatment plant will be decided.
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### 5. Stakeholders and Institutional Governance

<i>Major organisations</i>	Southwestern Stockholm Region Water and Sewage Works, Inc., Himmerfjärden Nature Conservation Society, Svealand Coastal Water Conservation Association.
<i>Other leading organisations</i>	Södermanland and Stockholm County Administrative Boards, Swedish Northern Baltic Water District, Swedish Environment Protection Agency. <b>Industries:</b> Astra Zenca Inc., Scania

### 6. Partner Collaboration

<i>SPICOSA Partner Collaborations.</i>	Partners: Enveco Environmental Economics Consultancy, Contact person Dr. Tore Söderqvist, <a href="mailto:tore@enveco.se">tore@enveco.se</a> (environmental economics)
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### 7. Systems Studies

<i>Long time series</i>	From 1975 with sampling frequency 22-25/yr at 4-10, station, sampling every 5 m surface to bottom, variables: NH <sub>4</sub> , NO <sub>2</sub> /NO <sub>3</sub> , PO <sub>4</sub> , TP TN, Si, oxygen, salinity, temperature, chlorophyll a, phyto- and zooplankton (a few stations), phytoplankton primary production, yearly surveys of soft bottom macrofauna (1972-1997 every yr, thereafter every 3 <sup>rd</sup> yr), water exchange estimates from a sophisticated oceanographic model. For remote sensing AVHRR archive from 1982. Use of VSF (volume scattering function data from sea-truthing in 2001/2002) to relate to AVHRR reflectance data. Meteorological data, land run-off and discharges from Lake Mälaren (water, nutrients) and local sewage treatment plants and industries, as well atmospheric deposition of nutrients available since 1975.
<i>Research Projects</i>	<b>Earlier:</b> A series of projects 1988-1996: Major project 1997-2003: SUCOZOMA (Sustainable Coastal Zone management) to develop methodologies to use adaptive management to minimize coastal eutrophication. 1997-2002: RESE (Remote sensing for the environment - Methods for detection of changes in aquatic ecosystems and monitoring of algal blooms). 2000-2003: OAERRE (Oceanographic Applications to Eutrophication in Regions of Restricted Exchange, EU Framework V project). <b>Ongoing:</b> Test of ecosystem responses to full scale nutrient load experiments using changes in the discharge from the sewage plant. Remote sensing project (2007-2010) funded by ESA to gather unique combined bio-optical and biogeochemical data on transects from coastal to open Baltic Sea waters (Himmerfjärden to Landsort Deep). <b>Future:</b> Full scale ecosystem experiments will continue at least to 2007 and likely beyond. Substantial funds are available from the STP and other sources to sustain additional research, e.g. the Swedish EPA and FORMAS presently support analysis of zooplankton samples to obtain long-term (from 1978) data series. A project to study enhancement of water quality through large-scale release of predatory fish (pikeperch) is being planned. Remote sensing: AUTOVAL (2007-2009): developing automated systems for sea-truthing of ocean colour data, FP6 proposal under IST5. Field campaigns to improve interpretation of satellite data of the Baltic coastal zone.