Name of indicator	3.8 Zooplankton diversity
Type of Indicator	State indicator
Author(s)	Laura Uusitalo and Maiju Lehtiniemi
Description of the indicator	The indicator aims to describe the species diversity of zooplankton in the Baltic Sea by applying Shannon's diversity index (Shannon 1948). The index was calculated from routine zooplankton monitoring data for each year (1979-2008) and sub-basin around Finland (Gulf of Finland, Bothnian Sea, Bothnian Bay) including the MARMONI study area 4FIN-EST in the Gulf of Finland. Within the framework of the MARMONI project, we tested the usability of this diversity index as a biodiversity indicator. At present, the index is not ready to be utilized as an indicator. To obtain a species diversity index which could be used as a simple biodiversity indicator, further studies are needed to determine how species diversity is related to ecological processes and pressures.
Relationship of the indicator to marine biodiversity	The Shannon index provides information about the rarity and commonness of species in a community. The ability to quantify diversity in this way would be an important tool to describe zooplankton community structure. The index was tested with natural zooplankton community data from routine monitoring, collected from the northern Baltic Sea, including also the MARMONI 4FIN-EST area. The aim of the testing was to see how well the index relates to ecological processes and pressures. However, the results from our testing showed no relationship between Shannon index values, changes in the long-term data, and pressures. We conclude that the tested method, Shannon's diversity index, cannot be taken into use as a zooplankton biodiversity indicator at the moment.
Relevance of the indicator to different policy instruments	Marine Strategy Framework Directive (MSFD) descriptor 1 Biodiversity, 1.6 Habitat condition, 1.6.1. Condition of the typical species and communities. HELCOM Baltic Sea Action Plan
Relevance to commission decision criteria and indicator	1.6. Habitat condition 1.6.1. Condition of the typical species and communities
Method(s) for obtaining indicator values	The indicator is based on zooplankton data obtained from routine zooplankton sampling (e.g. HELCOM COMBINE; HELCOM 1988). Individual numbers of species are counted using a microscope and biomass can then be estimated based on length measurements of individuals or by using species and stages specific pre-established weight values. The indicator value is attained by calculating Shannon's diversity index on zooplankton species abundance data. It is important that the zooplankton species composition in the samples is analysed to the highest taxonomic resolution possible (preferably to species(sub-species) level).
Documentation of relationship between indicator and pressure	Taxonomic diversity, as computed by Shannon's index, constitutes of two components: the number of species present in the system, and the evenness of those species. Hence, the biodiversity of zooplankton is expected to decrease in two cases: a) If the number of species decreases, e.g. due to deteriorating environmental conditions so that the most sensitive species do not survive. b) If the evenness of the species decreases, i.e. some species increase in abundance. This can be caused by introduction on invasive species, or if environmental conditions favour some species so that their abundance strongly increases.
Geographical relevance of indicator	4. Baltic Sea wide
How Reference Conditions (target values/thresholds) for the indicator were obtained?	Trend based targets could be used with the target: no decline in zooplankton biodiversity over time. Long-term data were used in an attempt to obtain reference conditions and target values/thresholds. Trends in index values were tested using the Mann-Kendall nonparametric trend test. Based on this data and due to gaps in the current scientific knowledge it was not possible to obtain reference conditions and target values or thresholds.
Method for determining GES	Based on testing performed using long-term data we conclude that currently a target level for this index cannot be defined.
References	HELCOM (1988) Guidelines for the Baltic monitoring programme for the third stage. Part D. Biological determinants. Baltic Sea Environment Proceedings 27D: 1-161. Shannon, C.E. 1948. A mathematical theory of communication. – The Bell System Technical Journal 27:379–423, 623–656.