Case study reports for testing the HELCOM indicator based biodiversity assessment tool BEAT
-Supplementary Material for Chapter 5. of BSEP No.116B

This supplementary document includes material used in the HELCOM Biodiversity Assessment Tool (BEAT) calculations summarized in chapter 5 of BSEP 116B (Biodiversity in the Baltic Sea -An integrated thematic assessment on biodiversity and nature conservation in the Baltic Sea)

Refer to as: HELCOM (2009) Case study reports for testing the HELCOM indicator based biodiversity assessment tool BEAT-Supplementary Material for Chapter 5. of BSEP No.116B. www.helcom.fi

Table of Contents

1. Fish community indicators at area Kvädöfjärden Inner, archipelago of the Swedish east coast, Baltic proper.

Authors

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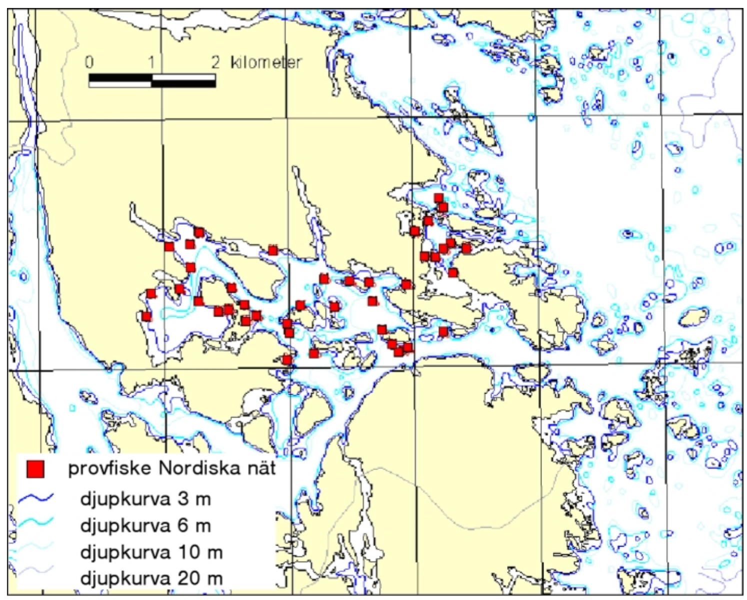
Introduction

Monitoring of the coastal fish community in Kvädöfjärden began in 1962. The current data set ranges from 1989 to 2007,which is after the regime shift in the Baltic Sea (Casini *et al*. 2008). This area is used for assessment of coastal fish stocks under Coordination Organ for Baltic Reference Areas and represents a region with a limited impact of local discharge.

Study site

Kvädöfjärden belongs to the continuous archipelago of the Swedish east coast. The bedrock consists of granite, which is frequently exposed in the outer areas. In sheltered areas, soft bottom dominates, while rocky and stony bottoms are random in exposed areas. The inner area inhabits sheltered bays, while parts of the outer area are exposed to the open sea. In the inner area, deep furrows, with depths down to 30 meter, exist.

The mean water temperature in August during the sampling period has been relatively constant between 17 and 20 ºC, and peaked at 22,4 ºC in 1994. Using the historical data set, the temperature has increased steadily from 1962 and on wards. The Secchi depth has been below 3.5 m during the sampling period, but has decreased in recent years from about 3 m in the beginning of the period to approximately 2 m in 2007. During a period of 40-years the secchi depth has decreased from around 7 to 3.3 m and salinity varies from 6 to 8 PSU.



▲Map of study site

Kvädöfjärden belongs to the continuous archipelago of the Swedish east coast (N 58 01,00, E 16 46,50: WGS 84)

Data

Fishing is performed annually in August at fixed stations. Fishing is repeated three nights at each station (since 2007, 1989-2006 six nights per station). The gillnets are set between 14.00 and 16.00 and lifted the next day between 07.00 and 10.00. The data used here has been collected by a set of bottom set gill nets which are 1.8 m (6 feet) deep and made of spun green nylon. A net consists of a 60 m long stretched net bundle which is attached to a 27 m net-rope (35 cm between floats, buoyancy 6 g/m) and a 33 m lower net-rope (weight 2.2 kg/100 m). A set of nets is composed of four nets with mesh sizes 17, 21.5, 25 and 30 mm. Yarn thickness is no. 110/2 for all mesh sizes, according to the Tex-system (e.g., 110/ 2 means 2 filaments each weighing 110 g per 10 000 m).

Average values of the five first years (1989-1993) have been used as reference values, and average values of the last five years (2003-2007) are used to reflect the present situation. The accepetable deviation was calculated for each variable separately on the basis of power estimates in Appelberg et al (2005) using the standard devation of the reference period.

The water temperature data has been collected by temperature loggers, and data on the secchi-depth has been collected during the fishing efforts in August.

Application of tool no. 1

Table I: Interim application of tool no. 1. See HELCOM (2006): Development of tools for assessment of eutrophication in the Baltic Sea (BSEP No. 104) for details.
Available via http://helcom.navigo.fi/stc/files/Publications/Proceedings/bsep104.pdf

Assessment criteria (categories and indicators)		Baseline (RefCon)	Acceptable deviation (%)	Status	Score (+/-)	
Category I	Natural marine landscapes					
	Water temperature (August)	18.3		19.2	+	
	Secchi depth	2.8		3.5		-
	Sum for Category I (one out – all out)					-
Category II	Thriving and balanced communities					
	Total fish biomass (WPUE)	7.0		5.1	+	
	Total number of species	9.2		11.4	+	
	Slope of size spectrum	-5.3		-3.9	+	
	Shannon-Wiener Diversity Index	1.5		1.7	+	
	Sum for Category II (one out – all out)				+	
Category III	Viable polulations of species					
	Biomass Perch (*Perca fluviatilis*)	1.7		1.7	+	
	Biomass Roach (*Rutilus rutilus*)	2.9		1.3	+	
	Sum for Category III (one out – all out)				+	
	Overall classsification				+	

Application of tool no. 2

<u>Temperature and secchi depth</u>
These two variables are both of importance for structuring the fish communities. Inceased temperature might give a shift to a dominance by warm-water species, and decreased secchi depth is commonly a result of eutrophication.

<u>Total fish biomass</u>
Total fish biomass is expressed as weight per unit effort (WPUE, kg), and calculated from the number of caught fish per length group in the length distribution. The measure is used as an index of the size of the standing stock. Increased biomass indicates increased nutritional conditions and production potential, whereas decreased biomass indicates the opposite. Fishing pressure may also affect the total biomass.

<u>Slope of size spectrum</u>
This variable indicate the relation between small and large fish in the community and is calculated from the number of caught fish per length group in the length distribution. An increase in the slope of the size spectrum indicates a shift towards larger individuals.

<u>Shannon-Wiener Diversity Index</u>
Calculations of this index are based on the biomass proportion of each species, and reflects the species richness and equitability of the community. Increasing values indicate increasing diversity, caused by a high number of species with even proportion in the catch. Decreasing values indicate low diversity with few dominating species and a community with a small number of species.

<u>Biomass of perch and roach</u>
Perch and roach are two key species that usually dominate the fish community in coastal areas. Changes in the biomass of these two species are therefore good indicators of changes in system.

Table II: Interim application of tool no. 2. A spread sheet for these calculations can be downloaded via HELCOM's web site. 'Root' could be HD, BSAP, HELCOM recommendation(s), national law, etc. 'Degr.' is + or ÷ indicating a numerically possitive or negative response to a pressure. G/M = acceptable deviation.

Cat.	Indicator	Root	Degr.	RefCon	Status	EQR_I	G/M	Int_stat	EQR_cat	QE_sta	Status
Natural landscapes											
	Water temperature (August)		+	18.2	19.2	0.95	0.15			HIGH	
	Secchi depth		-	2.7	1.8	0.67	0.25			MODERATE	
									0.81	GOOD	
Thriving and stable communities											
	Total fish biomass (WPUE)		-	7.0	5.1	0.73	0.5			HIGH	
	Total number of species		-	9.2	11.4	1.24	0.2			HIGH	
	Slope of size spectrum		-	-5.3	-3.9	0.75	0.2			MODERATE	
	Shannon-Wiener Diversity Index		-	1.5	1.7	1.12	0.15			HIGH	
									0.96	HIGH	
Species											
	Biomass Perch (*Perca fluviatilis*)		-	1.7	1.7	0.98	0.5			HIGH	
	Biomass Roach (*Rutilus rutilus*)		+	2.9	1.3	2.2	0.5			HIGH	
									1.6	HIGH	
FINAL ASSESSMENT											GOOD

Discussion and conclusions

During the sampling period there has been a steady decrease in secchi depth a slight increase in temperature, indicating a transition to more eutrophic conditions. Despite that total fish biomass has decreased over the sampling period there is no significant trend. The total number of species has increased, but there is no change in species diversity. As indicated by the increase in the slope of the size spectrum, there has been a shift in the community towards larger individuals. The biomass of perch has not changed whereas there has been a decrease in the biomass of roach over the sampling period.
To sum up, there are both indications for (decreased secchi depth) and against (decreased biomass of roach) a transition towards more eutrophic conditions. The decrease in roach might, however, be the result of a shift in the cyprinid community, since common bream has incresed over the sampling period.

Reference

Appelberg M *et al.* Statistical power in coastal fish monitoring with passive gears – effects of smapling strategy. ICES CM2005/Z:03.

Casini M *et al.* 2008. Multi-level trophic cascades in a heavily exploited open marine ecosystem. Proc. Roy. Lond. B-series. 275:1793-1801.

Annexes

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BEAT

A tool for biodiversity assessment and confidence rating

Station/water body: Kvädöfjärden inner

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3			100%				
Add new indicator ...				1 2 3		1 2 3		1 2 3							
											100%				xx

Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Fish community (biomass WPUE)	7,00		-	1 2 3	50%	1 2 3	5,10	1 2 3	0,729	25%				
Fish community (number of species)	9,20		-	1 2 3	20%	1 2 3	11,40	1 2 3	1,000	25%				
Fish community (Slope of size spectrum)	-5,30		-	1 2 3	20%	1 2 3	-3,90	1 2 3	0,736	25%				
Fish community (Shannon-Wiener Diversity Index)	1,50		-	1 2 3	15%	1 2 3	1,70	1 2 3	1,000	25%				
Add new indicator ...				1 2 3		1 2 3		1 2 3						
										100%	0,866	HIGH		33%

Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Perch (Perca fluviatilis) biomass	1,70		-	1 2 3	50%	1 2 3	1,70	1 2 3	1,000	50%				
Roach (Rutilus rutilus) biomass	2,90		+	1 2 3	50%	1 2 3	1,30	1 2 3	1,000	50%				
Add new indicator ...				1 2 3		1 2 3		1 2 3						
										100%	1,000	HIGH		33%

Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Water Temperature (August)	18,20		+	1 2 3	15%	1 2 3	19,20	1 2 3	0,948	50%				
Water clarity (Secchi depth)	2,70		-	1 2 3	25%	1 2 3	1,80	1 2 3	0,667	50%				
Add new indicator ...				1 2 3		1 2 3		1 2 3						
										100%	0,807	MODERATE		33%
														100%

IMPORT data from XML

EXPORT data to XML

Final biodiversity status: **MODERATE**

Final confidence rating:

version 20081010

2. The national case study of Sweden: the Askö-Landsort area.

Authors
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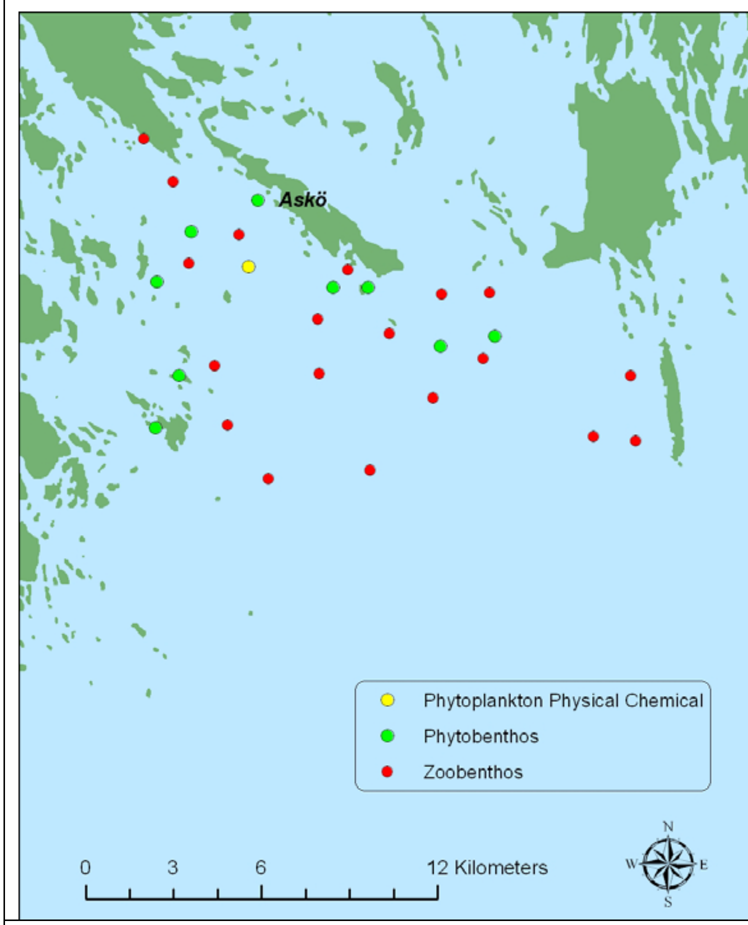
Introduction

The Askö-Landsort area in the northern Baltic proper (~90 km south from Stockholm) is a well investigated area due to the presence of a university field station on the island of Askö. It is also, for larger parts, protected as a Baltic Sea Protected Area (no 56), nature reserve and a part of the Natura 2000 network due to its high values. National monitoring of zoobenthos, phytobenthos, phytoplankton and physical-chemical parameters have taken place in the area for many years (regular monitoring since beginning of 1980-ies). The area has been choosen due to the presence of data from several different assessable (with quantitative reference levels) factors.

Study site

The area is regarded as being unaffected by local discharges and acts as a national reference area reflecting the state of a coastal area influenced mainly by conditions in the open sea.



▲Map of study site
Coordinates for stations are given in Annex.

Data

Data originates from national monitoring programmes and represent mean values of yearly calculations during the period 2000 – 2006 (in some cases 2007). Data have been filtered and indicies calculated according to priciples given in a regulation on status assessment according to the Water Framework Directive with a guidance document from the Swedish EPA (to be published in december 2007 on www.naturvardsverket.se).

Calculations for zoobenthos and phytobenthos are done by the author of this study, phytoplankton and physical-chemical calculations are done by SMHI and the University of Stockholm, Department of systems ecology.

Acceptable deviations have been calculated from reference values and good-moderate-boundaries (GM) published in the regulation mentioned above. Noticeable are that the principles for derivation of the GM-boundaries have been slightly different between the different quality factors. For zoobenthos no reliable data for derivation of a reference situation was found, instead a statistical method for determination of when a waterbody differs from a set of data from areas devoid of local pollution and other disturbances have been used. This level has been used as GM. As reference value the maximum index value in each type have been used. For phytobenthos the boundaries and the reference conditions have been set by expert judgement. Physical-chemical reference conditions are based on historical data and modelcalculations. Descriptions in detail on how reference conditions and boundaries where set are found in background documents published on http://www.vattenportalen.se/ovp_bibliotek_bedomningsgrunder.htm (in swedish with english summaries only).

Zoobenthos index BQI is calculated from the abundance based proportion of different classes of disturbance sensitivity of taxa found in a sample. This value is adjusted for no of taxa, slightly increased if more then 9 and slightly decreased if less than 9 taxa, and greatly reduced if less than 20 individuals in one 0,1 m^2 sample.

Phytobenthos index is calculated from then mean value of a classification of the maximum depth distribution of 5 macroalgal species.

Application of tool no. 1

Table I: Interim application of tool no. 1. See HELCOM (2006): Development of tools for assessment of eutrophication in the Baltic Sea (BSEP No. 104) for details.
Available via http://helcom.navigo.fi/stc/files/Publications/Proceedings/bsep104.pdf

Assessment criteria (categories and indicators)		Baseline (RefCon)	Acceptable deviation (%)	Status	Score (+/-)	
Category I	Natural marine landscapes					
	No indicators					
	Sum for Category I (one out – all out)					
Category II	Thriving and balanced communities					
	Benthic Quality Index	14	71%	5,3	+	
	Index based on depth distribution of 5 macroalgal species	1	40%	0,92	+	
	Sum for Category II (one out – all out)					
Category III	Viable polulations of species					
	No indicators					
	Sum for Category III (one out – all out)					
	Overall classsification				+	

Application of tool no. 2

Table II: Interim application of tool no. 2. A spread sheet for these calculations can be downloaded via HELCOM's web site. 'Root' could be HD, BSAP, HELCOM recommendation(s), national law, etc. 'Degr.' is + or ÷ indicating a numerically possitive or negative response to a pressure. G/M = acceptable deviation.

Cat.	Indicator	Root	Degr.	RefCon	Status	EQR_I	G/M	Int_stat	EQR_cat	QE_sta	Status
Natural landscapes											
	No indicators										
Thriving and stable communities											
	Benthic Quality Index	WFD	-	14	5,3	0,38	71%	Good			
	Index based on depth distribution of 5 macroalgal species	WFD	-	1	0,92	0,92	40%	High			
									* 0,65	Good	
Species											
	No indicators										
Supporting features											
	Phytoplankton biovolume summer	WFD	+	0,18	0,35	0,51	44%	Good			
	Chlorophyll a summer	WFD	+	1,2	2,08	0,57	33%	Mod			
	Secchi disc transparency summer	WFD	-	10	6,0	0,60	30%	Mod			
	Total nitrogen winter	WFD	+	17	21,5	0,79	15%	Mod			
	Total phosporus winter	WFD	+	0,40	0,97	0,41	39%	Poor			
	Total nitrogen summer	WFD	+	15	21,3	0,70	21%	Mod			
	Total phosporus summer	WFD	+	0,30	0,57	0,53	27%	Mod			
	DIN winter	WFD	+	2,5	4,8	0,52	34%	Mod			
	DIP winter	WFD	+	0,25	0,76	0,33	34%	Poor			
									* 0,55	Mod	
FINAL ASSESSMENT											Mod

* Different indicators have different national EQR-boundaries, hence some sort of normalisation must occur before calcultion of category EQR. I'm not aware of how a normalisation like that should be done. Presented here are category EQR according to principles in BEAT_Examples Excel file.

Discussion and conclusions

The indicators presented are the only national indicators developed where we have reference conditions and acceptable deviations given. In the future more indicators will be developed.

The values gíven are only based on data from national monitoring. Status assessment done by the water authorities will include regional and local monitoring data if present. Data given here are only provided as an example and do not constitute an official view of the status of this area.

In our regulation on assessment according to WFD principles for combining EQR-values from different factors in a quality element and also principles for combining status from different qulity elements are given. These principles do not agree with the principles given in the BEAT_example Excel file. Hence national assessment might differ from BEAT assessment.

Reference

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Annexes

Positions for Phytobenthos (decimal degrees WGS 84):

Id	*Name*	*Latitude*	*Longitude*
10	Gålklubben	58,81108	17,58348
19	Lacka V	58,75141	17,55902
13	Vrångskär	58,82031	17,62309
18	Örskär	58,76725	17,57405
23	Gråskär	58,79296	17,66575
24	Svarten	58,77394	17,72804
25	Sundsbådan	58,77658	17,76032
22	Isskären	58,79261	17,68673
9	Kockelhällen	58,79611	17,56228

Postions for zoobenthos (decimal degrees WGS 84)

Id	*Name*	*Latitude*	*Longitude*	*Depth*
6001	Käftudden	58,82667	17,57333	40
6004	Asenskallen	58,77833	17,69833	44,5
6009	Österbådarna	58,75167	17,60167	18
6010	Furholmarna	58,84	17,55667	21
6011	Trutklubben	58,735	17,625	28
6012	S Gråskär	58,78333	17,65667	22
6013	V Österholmarna	58,77	17,595	9
6014	Oxeltanden	58,80167	17,58167	11
6015	NV Nygrund	58,76667	17,65667	21,5
6016	V Landsort	58,74333	17,84167	27
6017	S Sundbådarna	58,77	17,75333	27
6018	N Gråskär	58,79833	17,675	21,5
6019	S Nygrund	58,73667	17,685	40,5
6020	Y Hållfjärden	58,81	17,61167	37
6021	Ö Galten	58,76333	17,84	52,5
6022	Lillberget	58,745	17,81667	47
6023	Spelman	58,75834	17,72333	36
6024	V Västra Röko	58,79	17,75833	33
6025	Skvallran	58,79	17,73	37,5

Position for physical chemical (decimal degree WGS 84)

Id	*Latitude*	*Longitude*
B1	58,8	17,61667

BEAT

A tool for biodiversity assessment and confidence rating

Station/water body: Askö-Landsort area (SWE)

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3			100%				
Add new indicator ...				1 2 3		1 2 3		1 2 3							
											100%				xx

Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Zoobenthos (Benthic Quality Index)	14,00		-	1 2 3	50%	1 2 3	5,30	1 2 3	0,379		25%				
Macroalgae (depth distribution index, 5 macroalgal	1,00		-	1 2 3	40%	1 2 3	0,92	1 2 3	0,920		25%				
Phytoplankton (biovolume summer)	0,18		+	1 2 3	44%	1 2 3	0,35	1 2 3	0,514		25%				
Phytoplankton (Chlorophyll a summer)	1,20		+	1 2 3	33%	1 2 3	2,08	1 2 3	0,577		25%				
Add new indicator ...				1 2 3		1 2 3		1 2 3							
											100%	0,597	MODERATE		50%

Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3			100%				
Add new indicator ...				1 2 3		1 2 3		1 2 3							
											100%				xx

Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Water clarity (Secchi disc summer)	10,00		-	1 2 3	30%	1 2 3	6,00	1 2 3	0,600		14%				
Nutrients (Total nitrogen winter)	17,00		+	1 2 3	15%	1 2 3	21,50	1 2 3	0,791		14%				
Nutrients (Total phosporus winter)	0,40		+	1 2 3	39%	1 2 3	0,97	1 2 3	0,412		14%				
Nutrients (Total nitrogen summer)	15,00		+	1 2 3	21%	1 2 3	21,30	1 2 3	0,704		14%				
Nutrients (Total phosporus summer)	0,30		+	1 2 3	27%	1 2 3	0,57	1 2 3	0,526		14%				
Nutrients (DIN winter)	2,50		+	1 2 3	34%	1 2 3	4,80	1 2 3	0,521		14%				
Nutrients (DIP winter)	0,25		+	1 2 3	34%	1 2 3	0,76	1 2 3	0,329		16%				
Add new indicator ...				1 2 3		1 2 3		1 2 3							
											100%	0,550	BAD		50%
															100%

IMPORT data from XML

EXPORT data to XML

Final biodiversity status: BAD

Final confidence rating:

version 20081010

3. Fish community indicators at area Forsmark Inner, archipelago of the Swedish east coast, Bothnian Bay.

Authors

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Corresponding author

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Introduction

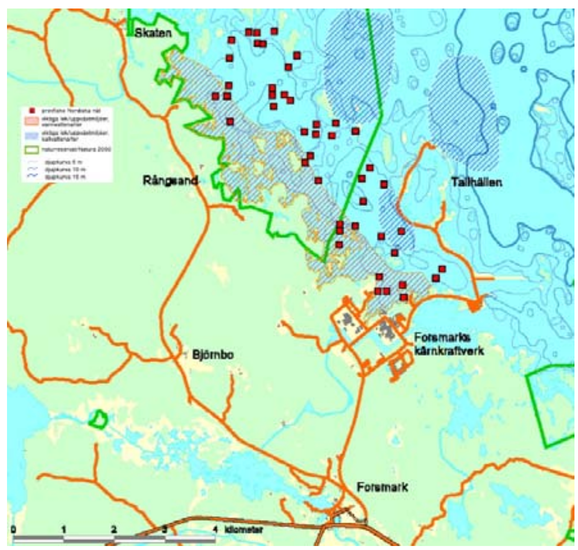
Monitoring of the coastal fish community in Forsmark began in 1975. The current data set ranges from 1989 to 2007,which is after the regime shift in the Baltic Sea (Casini *et al*. 2008). This area is used as in the recipient control programme of the nuclear power plant of Forsmark, and as such it receives process water from three aggregates of Forsmark nuclear power plant, approximately ten degrees warmer than the surrounding water. The outlet of the nuclear power plant sewage treatment works is situated south of the intake channel, why the area only to a limited extent is affected directly by fertilizing substances.

Study site

Forsmark is at the northernmost outpost of the continuous archipelago of the Swedish east coast. The area is situated along an almost unexploited coastline, stretching from Skaten in the north to Forsmark nuclear power plant in the south. The coastal area is characterized by a sloping pine forest on moraine deposits and in the water there are frequent reefs, rocks and islets. The surface water in the north half of the area has a moderate rate of exchange (5-10 days), while the surface water in the south half has a slow rate of exchange (10-20 days).

The mean water temperature in August during the sampling period has been relatively constant between 17 and 20 ºC, and peaked at 21,8 ºC in 1994. The secchi depth has been below 4.5 m during the sampling period, and has been relatively constant with a minimum of about 2 m in 2001. Salinity varies from 3 to 4 PSU, and nutirent concentrations are very

Please insert map here.



▲Map of study site

Forsmark is at the northernmost outpost of the continuous archipelago of the Swedish east coast (N 60 26,03, E 18 09,73: WGS 84)

Data

Fishing is performed annually in August at fixed stations. Fishing is repeated three nights at each station (since 2007, 1989-2006 six nights per station). The gillnets are set between 14.00 and 16.00 and lifted the next day between 07.00 and 10.00. The data used here has been collected by Coastal survey nets, 35m long, 3m deep and composed of five 7m long panels with mesh sizes 17, 21, 25, 33 and 50mm knot to knot.

Average values of the five first years (1989-1993) have been used as reference values, and average values of the last five years (2003-2007) are used to reflect the present situation. The accepetable deviation was calculated for each variable separately on the basis of power estimates in Appelberg et al (2005) using the standard devation of the reference period.

The water temperature data has been collected by temperature loggers, and data on the secchi-depth has been collected during the fishing efforts in August.

Application of tool no. 1

Table I: Interim application of tool no. 1. See HELCOM (2006): Development of tools for assessment of eutrophication in the Baltic Sea (BSEP No. 104) for details.
Available via http://helcom.navigo.fi/stc/files/Publications/Proceedings/bsep104.pdf

Assessment criteria (categories and indicators)		Baseline (RefCon)	Acceptable deviation (%)	Status	Score (+/-)	
Category I	Natural marine landscapes					
	Water temperature (August)	17.5		18.8	+	
	Secchi depth	2.8		3.5	+	
	Sum for Category I (one out – all out)				+	
Category II	Thriving and balanced communities					
	Total fish biomass (WPUE)	4.5		6.2	+	
	Total number of species	9		8.6	+	
	Slope of size spectrum	-3.6		-2.9	+	
	Shannon-Wiener Diversity Index	1.6		1.5	+	
	Sum for Category II (one out – all out)				+	
Category III	Viable polulations of species					
	Biomass Perch (*Perca fluviatilis*)	2.6		4.6	+	
	Biomass Roach (*Rutilus rutilus*)	4.1		2.2	+	
	Sum for Category III (one out – all out)				+	
	Overall classsification				+	

Application of tool no. 2

<u>Temperature and secchi depth</u>
These two variables are both of importance for structuring the fish communities. Inceased temperature might give a shift to a dominance by warm-water species, and decreased secchi depth is commonly a result of eutrophication.

<u>Total fish biomass</u>
Total fish biomass is expressed as weight per unit effort (WPUE, kg), and calculated from the number of caught fish per length group in the length distribution. The measure is used as an index of the size of the standing stock. Increased biomass indicates increased nutritional conditions and production potential, whereas decreased biomass indicates the opposite. Fishing pressure may also affect the total biomass.

<u>Slope of size spectrum</u>
This variable indicate the relation between small and large fish in the community and is calculated from the number of caught fish per length group in the length distribution. An increase in the slope of the size spectrum indicates a shift towards larger individuals.

<u>Shannon-Wiener Diversity Index</u>
Calculations of this index are based on the biomass proportion of each species, and reflects the species richness and equitability of the community. Increasing values indicate increasing diversity, caused by a high number of species with even proportion in the catch. Decreasing values indicate low diversity with few dominating species and a community with a small number of species.

<u>Biomass of perch and roach</u>
Perch and roach are two key species that usually dominate the fish community in coastal areas. Changes in the biomass of these two species are therefore good indicators of changes in system.

Table II: Interim application of tool no. 2. A spread sheet for these calculations can be downloaded via HELCOM's web site. 'Root' could be HD, BSAP, HELCOM recommendation(s), national law, etc. 'Degr.' is + or ÷ indicating a numerically possitive or negative response to a pressure. G/M = acceptable deviation.

Cat.	Indicator	Root	Degr.	RefCon	Status	EQR_I	G/M	Int_stat	EQR_cat	QE_sta	Status
Natural landscapes											
	Water temperature (August)		+	17.5	18.8	0.93	0.15			HIGH	
	Secchi depth		-	2.8	3.5	1.2	0.5			HIGH	
									1.1	HIGH	
Thriving and stable communities											
	Total fish biomass (WPUE)		-	4.5	6.2	1.4	0.25			HIGH	
	Total number of species		-	9	8.6	0.96	0.15			HIGH	
	Slope of size spectrum		-	-3.6	-2.9	0.83	0.15			MODERATE	
	Shannon-Wiener Diversity Index		-	1.6	1.5	0.91	0.15			HIGH	
									1.0	HIGH	
Species											
	Biomass Perch (*Perca fluviatilis*)		-	2.6	4.6	1.8	0.5			HIGH	
	Biomass Roach (*Rutilus rutilus*)		+	4.1	2.2	2.2	0.5			HIGH	
									2.0	HIGH	
FINAL ASSESSMENT											HIGH

Discussion and conclusions

The temperature and secchi depth has been relatively constant during the sampling period. Moreover, total fish biomass, number of species and species diversity has also remained constant. There has, however, been a shift in the community towards larger individuals as indicated by an increase in the slope of the size spectrum. Regarding the two key-species perch and roach, it has been an increase in perch biomass and a decrease in roach. As for Kvädöfjärden the decline in roach biomass is accompained by an increase in common bream biomass, suggesting a shift in the cyprinid community over the smapling period.

Reference

Appelberg M *et al.* Statistical power in coastal fish monitoring with passive gears – effects of smapling strategy. ICES CM2005/Z:03.

Casini M *et al.* 2008. Multi-level trophic cascades in a heavily exploited open marine ecosystem. Proc. Roy. Lond. B-series. 275:1793-1801.

Annexes

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BEAT

A tool for biodiversity assessment and confidence rating

Station/water body:	Forsmark inner

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3			100%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%				xx

Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Fish community (biomass WPUE)	4,50		-	1 2 3	25%	1 2 3	6,20	1 2 3	1,000	25%				
Fish community (number of species)	9,00		-	1 2 3	15%	1 2 3	8,60	1 2 3	0,956	25%				
Fish community (Slope of size spectrum)	-3,60		-	1 2 3	15%	1 2 3	-2,90	1 2 3	0,806	25%				
Fish community (Shannon-Wiener Diversity Index)	1,60		-	1 2 3	15%	1 2 3	1,50	1 2 3	0,938	25%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%	0,925	HIGH		33%

Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Perch (Perca fluviatilis) biomass	2,60		-	1 2 3	50%	1 2 3	4,60	1 2 3	1,000	50%				
Roach (Rutilus rutilus) biomass	4,10		+	1 2 3	50%	1 2 3	2,20	1 2 3	1,000	50%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%	1,000	HIGH		33%

Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Water Temperature (August)	17,50		+	1 2 3	15%	1 2 3	18,80	1 2 3	0,931	50%				
Water clarity (Secchi depth)	2,80		-	1 2 3	25%	1 2 3	3,50	1 2 3	1,000	50%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%	0,965	HIGH		33%
														100%

IMPORT data from XML

EXPORT data to XML

Final biodiversity status: HIGH

Final confidence rating:

version 20081010

4. Fish community indicators at area Holmön Inner, Northern Quark, Bothnian Bay.

Authors

Jens Olsson, Kerstin Söderberg & Magnus Appelberg

Corresponding author

Jens Olsson, Swedish Board of Fisheries, Dept. of Research and Development, Institute of Coastal Research, Box 109, SE-742 22 Öregrund, Sweden (Jens.Olsson@fiskeriverket.se)

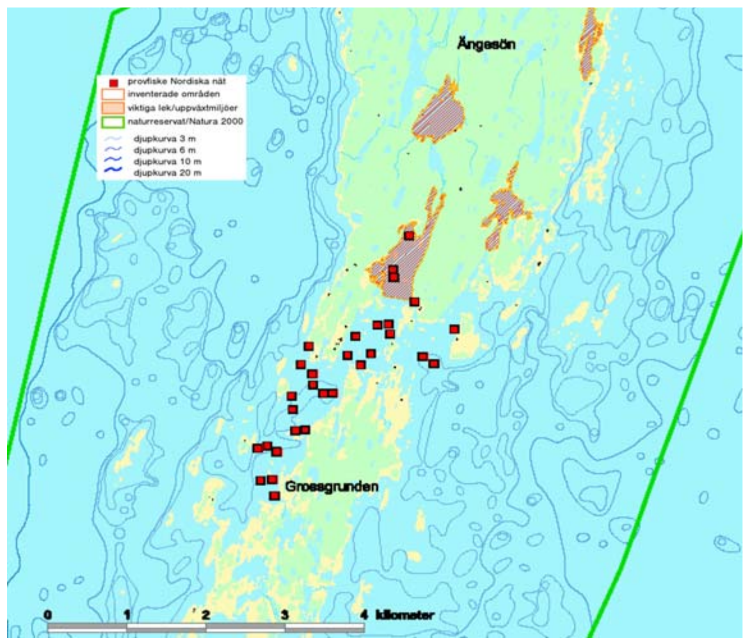
Introduction

Monitoring of the coastal fish community at Holmön was initiated in 1989. This area is used for assessment of coastal fish stocks under Coordination Organ for Baltic Reference Areas and represents a region with a limited impact of local discharge.

Study site

Holmörna is located in the Northern Quark about 7 km off shore from the Swedish coast. The Northern Quark forms a 10-20 meter shallow sill between Bothnian bay and Bothnian Sea. The bedrock consists of granite and is relatively plain. Moraine deposits and ridge cover large areas and create a rocky landscape with low but dense height and depth differences. A more than 40 meter deep abyss separates Holmöarna from the Swedish mainland. The monitoring area is shallow, seldom reaching a depth of 10 meter. The salinity is between 3-4 PSU.

Please insert map here.



▲Map of study site

Holmöarna is situated in the Northern Quark, Bothninan Bay (N 63 40,89, E 20 52,52)

Data

Fishing is performed annually in August at fixed stations. Fishing is repeated three nights at each station (since 2007, 1989-2006 six nights per station). The gillnets are set between 14.00 and 16.00 and lifted the next day between 07.00 and 10.00. The data used here has been collected by Coastal survey nets, 35m long, 3m deep and composed of five 7m long panels with mesh sizes 17, 21, 25, 33 and 50mm knot to knot.

In the BEAT-model average values of the five first years (1989-1993) have been used as reference values, and average values of the last five years (2003-2007) are used to reflect the present situation. The accepetable deviation was calculated for each indicator separately on the basis of power estimates in Appelberg *et al*. (2005), using the standard devation of the reference period.

The water temperature data has been collected by temperature loggers, and data on the secchi-depth has been collected during the fishing efforts in August.

Application of tool no. 1

Table I: Interim application of tool no. 1. See HELCOM (2006): Development of tools for assessment of eutrophication in the Baltic Sea (BSEP No. 104) for details.
Available via http://helcom.navigo.fi/stc/files/Publications/Proceedings/bsep104.pdf

Assessment criteria (categories and indicators)		Baseline (RefCon)	Acceptable deviation (%)	Status	Score (+/-)	
Category I	Natural marine landscapes					
	Water temperature (August)	15.9	15	18.1	+	
	Secchi depth	4.9	25	5.0	+	
	Sum for Category I (one out – all out)				+	
Category II	Thriving and balanced communities					
	Total fish biomass (WPUE)	13.5	50	15.3	+	
	Total number of species	6.4	20	6.4	+	
	Slope of size spectrum	-7.7	50	-8.6	+	
	Shannon-Wiener Diversity Index	0.69	50	0.73	+	
	Sum for Category II (one out – all out)				+	
Category III	Viable polulations of species					
	Biomass Perch (*Perca fluviatilis*)	10.3	50	9.6	+	
	Biomass Roach (*Rutilus rutilus*)	2.8	50	5.4	-	
					-	
	Sum for Category III (one out – all out)				+	
	Overall classsification				+	

Application of tool no. 2

Temperature and secchi depth
These two variables are both of importance for structuring the fish communities. Increased temperature might give a shift to a dominance by warm-water species, and decreased secchi depth is commonly a result of eutrophication.

Total fish biomass
Total fish biomass is expressed as weight per unit effort (WPUE, kg), and calculated from the number of caught fish per length group in the length distribution. The measure is used as an index of the size of the standing stock. Increased biomass indicates increased nutritional conditions and production potential, whereas decreased biomass indicates the opposite. Fishing pressure may also affect the total biomass.

Slope of size spectrum
This variable indicate the relation between small and large fish in the community and is calculated from the number of caught fish per length group in the length distribution. An increase in the slope of the size spectrum indicates a shift towards larger individuals.

Shannon-Wiener Diversity Index
Calculations of this index are based on the biomass proportion of each species, and reflects the species richness and equitability of the community. Increasing values indicate increasing diversity, caused by a high number of species with even proportion in the catch. Decreasing values indicate low diversity with few dominating species and a community with a small number of species.

Biomass of perch and roach
Perch and roach are two key species that usually dominate the fish community in coastal areas. Changes in the biomass of these two species are therefore good indicators of changes in a system.

Table II: Interim application of tool no. 2. A spread sheet for these calculations can be downloaded via HELCOM's web site. 'Root' could be HD, BSAP, HELCOM recommendation(s), national law, etc. 'Degr.' is + or ÷ indicating a numerically possitive or negative response to a pressure. G/M = acceptable deviation.

Cat.	Indicator	Root	Degr.	RefCon	Status	EQR_I	G/M	Int_stat	EQR_cat	QE_sta	Status
Natural landscapes											
	Water temperature (August)		+	15.9	18.1	0.88	0.15			GOOD	
	Secchi depth		-	4.9	5.0	1.0	0.25			HIGH	
									0.95	HIGH	
Thriving and stable communities											
	Total fish biomass (WPUE)		-	13.5	15.3	1.1	0.5			HIGH	
	Total number of species		-	6.4	6.4	1.0	0.2			HIGH	
	Slope of size spectrum		-	-7.7	-8.6	1.1	0.5			HIGH	
	Shannon-Wiener Diversity Index		-	0.69	0.73	1.1	0.5			HIGH	
									1.1	HIGH	
Species											
	Biomass Perch (*Perca fluviatilis*)		-	10.3	9.6	0.93	0.5			HIGH	
	Biomass Roach (*Rutilus rutilus*)		+	2.8	5.4	0.51	0.5			POOR	
									0.72	GOOD	
FINAL ASSESSMENT											GOOD

Discussion and conclusions

During the sampling period the mean water temperature has increased slightly (not statistically significant), but there has been no change in secchi depth. Except for roach biomass, there are no trends in any of the other biological indicators. Roach biomass show strong interannual fluctuations but have increased significantly during the monitoring period. Despite that increasing roach density usually signals a shift towards more eutrophic conditions, it could also be an effect of the slight temperature increase during the last years.

In conclusions the overall status of Holmöarna Inner monitoring area are good, suggesting good health of the coastal fish community.

Reference

Appelberg M *et al.* Statistical power in coastal fish monitoring with passive gears – effects of smapling strategy. ICES CM2005/Z:03.

Annexes

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BEAT

A tool for biodiversity assessment and confidence rating

Station/water body:	Holmoarna														
Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3			100%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%				xx
Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Fish community (Total fish biomass WPUE)	13,50		-	1 2 3	50%	1 2 3	15,30	1 2 3	1,000		25%				
Fish community (Number of species)	6,40		-	1 2 3	20%	1 2 3	6,40	1 2 3	1,000		25%				
Fish community (slope of size spectrum)	-7,70		-	1 2 3	50%	1 2 3	-8,60	1 2 3	1,000		25%				
Fish community (Shannon -Wiener index)	0,69		-	1 2 3	50%	1 2 3	0,73	1 2 3	1,000		25%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	1,000	HIGH		33%
Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Perch (Perca fluviatilis) biomass	10,30		-	1 2 3	50%	1 2 3	9,60	1 2 3	0,932		50%				
Roach (Rutilus rutilus) biomass	2,80		+	1 2 3	50%	1 2 3	5,40	1 2 3	0,519		50%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,725	GOOD		33%
Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Water Temperature (August)	15,90		+	1 2 3	15%	1 2 3	18,10	1 2 3	0,878		50%				
Water clarity (Secchi depth)	4,90		-	1 2 3	25%	1 2 3	5,00	1 2 3	1,000		50%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,939	HIGH		33%
															100%

IMPORT data from XML

EXPORT data to XML

Final biodiversity status: GOOD

Final confidence rating:

version 20081010

5. The national case study of Finland: the Archipelago Sea

Authors

Jan Ekebom, Pasi Laihonen, Henna Piekäinen

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Introduction

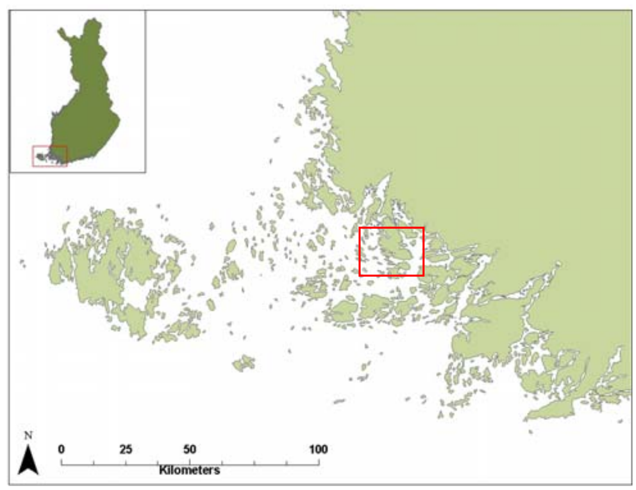
The aquatic component of the Finnish national environmental monitoring system is traditionally based on chemical and physical parametres. Biological components have been introduced only recently and systematic marine biological monitoring data is scarce. Among biology-related parametres, best time series data exists on primary production and chlorophyll-a. Benthic animals have been under continuous monitoring since the 1990's. Earlier data exists in distinct data bases, but they have not been incorporated into the national environmental monitoring data base.

We chose the Archipelago Sea as study site of the Finnish national case study mainly because biological data other than what is included in the national environmental monitoring system could be expected to be available. Still, time series data that would serve the purposes of this case study proved difficult to find.

Study site

The Archipelago Sea together with the adjoining Aland islands comprises an area of 15 000 km^2 between Finland and Sweden. 25% of this area is land covered with around 40 000 islands and skerries. The length of the shoreline in this area is about 20 000 km.

The study site is situated in the inner Archipelago close to the southwestern coast of Finland. The coastal area has been under influence of industrial, municipal and agricultural waste waters since the 1950's, but signs of eutrofication were not observed on the exact sampling site until at the beginning of the 1990's.



▲Map of study site
The study area is situated in the eastern part of the Archipelago Sea

Data

Category I

Coverage of common reed
- based on data collected from aerial photographs by Mr. Tapio Suominen (M.Sc. thesis, University of Turku)
- data covers the years 1961 and 1995
- 1961 used as background value
- municipality of Rymättylä
- hectars/shoreline km

Category II

Pair number of nesting sea birds
- based on annual censuses from 1982 to 2006 by Dr. Mikael von Numers, Åbo Akademi University
- twenty small islands in Velkua-Kustavi municipalities
- sea birds (*Larus ridibundus* excluded) including waders
- 1982 used as background value

Chironomidae biomass
- the Finnish national environmental monitoring system
- municipality of Rymättylä
- based on samples in 1991 and 2000
- 1991 used as background value
- wet weight (g/m^2)

Category III

No. of *Chironomus plumosus*
- the Finnish national environmental monitoring system
- municipality of Rymättylä
- based on samples in 1991 and 2000
- 1991 used as background value
- individuals/m^2

Application of tool no. 1

Table I: Interim application of tool no. 1. See HELCOM (2006): Development of tools for assessment of eutrophication in the Baltic Sea (BSEP No. 104) for details.
Available via http://helcom.navigo.fi/stc/files/Publications/Proceedings/bsep104.pdf

Assessment criteria (categories and indicators)		Baseline (RefCon)	Acceptable deviation (%)	Status	Score (+/-)	
Category I	Natural marine landscapes					
	Indicator 1 Coverage of common reed	0,11	0,5	0,67	+	
	Sum for Category I (one out – all out)					
Category II	Thriving and balanced communities					
	Indicator 2 Pair number of nesting sea birds	223	0,5	373	+	
	Indicator 3 Chironomidae biomass	0,22	0,5	0,11	+	
	Sum for Category II (one out – all out)					
Category III	Viable polulations of species					
	Indicator 4 No. of Chironomus plumosus	221	0,5	334	+	
	Sum for Category III (one out – all out)					
	Overall classsification					

Application of tool no. 2

Table II: Interim application of tool no. 2. A spread sheet for these calculations can be downloaded via HELCOM's web site. 'Root' could be HD, BSAP, HELCOM recommendation(s), national law, etc. 'Degr.' is + or ÷ indicating a numerically possitive or negative response to a pressure. G/M = acceptable deviation.

Cat.	Indicator	Root	Degr.	RefCon	Status	EQR_I	G/M	Int_stat	EQR_cat	QE_sta	Status
Natural landscapes											
	Indicator 1 Coverage of common reed		+	0,11	0.67	0,164	0,5	BAD			
									0,164	BAD	
Thriving and stable communities											
	Indicator 2 Pair number of nesting sea birds		+	223	373	0,598	0,5	MODERATE			
	Indicator 3 Chironomidae biomass	National law	+	0,22	0,11	2,000	0,5	HIGH			
									1,299	HIGH	
Species											
	Indicator 4 No. of Chironomus plumosus	National law	+	221	334	0,662	0,5	MODERATE			
									0,662	MODERATE	
Supporting features											
	Indicator 5 Chlorophyll a	National law	+	1,7	5,3	0,321	0,5	BAD			
	Indicator 6 Turbidity	National law	+	1,5	1,4	1,071	0,5	HIGH			
	Indicator 7 Primary production	National law	+	57	85	0,671	0,5	GOOD			
	Indicator 8 Visibility	National law	-	3,7	4,7	1,270	0,25	HIGH			
									0,833	HIGH	
FINAL ASSESSMENT											BAD

Discussion and conclusions

The results given by different parametres were somewhat contradictory. This could be caused by the small number of indicators available due to lack of proper data. Applicability of some indicators could also be questioned, e.g. the biomass of *Chironomidae* has decreased while the number of *Chironomus plumosus* has increased at the same time. Both parametres have been traditionally regarded as good indicators of eutrophication. Supporting features also gave contradictory results, since the parametres indicating transparency of water show improvement of water quality whereas the biological parametres from the same samples show increase in eutrophication. The result of the final assessment is also surprising, most of the QE_sta –values given by the indicators would have suggested otherwise.

Reference

Suominen, T. (1998): Järviruokokasvustojen muutokset Saaristomerellä. M.Sc. –thesis, Dept. of Geography, University of Turku (in Finnish).

Annexes

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BEAT

A tool for biodiversity assessment and confidence rating

Station/water body: Archipelago Sea, inner parts (FIN) + EUTRO PRO Turm 220 (FIN)

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
Reed (Phragmites australis) coverage	0,11	ha/km	+	1 2 3	50%	1 2 3	0,67	1 2 3	0,164	50 %	100%				
Add new indicator ...				1 2 3		1 2 3		1 2 3							
											100%	0,164	BAD	38 %	33%

Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Bird community (Pair number of nesting sea birds)	223,00	pairs	-	1 2 3	50%	1 2 3	373,00	1 2 3	1,000	50 %	20%				
Zoobenthos (Chironomidae biomass)	0,22	g/m2	+	1 2 3	50%	1 2 3	0,11	1 2 3	1,000	50 %	20%				
Zoobenthos (No. of Chironomus plumosus)	221,00		+	1 2 3	50%	1 2 3	334,00	1 2 3	0,662		20%				
Phytoplankton (Chlorophyll a)	1,70		+	1 2 3	50%	1 2 3	5,30	1 2 3	0,321		20%				
Phytoplankton (Primary production)	1,50		+	1 2 3	50%	1 2 3	85,00	1 2 3	0,018		20%				
Add new indicator ...				1 2 3		1 2 3		1 2 3							
											100%	0,600	MODERATE		33%

Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3		50 %	100%				
Add new indicator ...				1 2 3		1 2 3		1 2 3							
											100%			38 %	xx

Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Water clarity (Turbidity)	1,50	?	+	1 2 3	50%	1 2 3	1,40	1 2 3	1,000	50 %	50%				
Water transparency (Secchi depth)	5,70	?	-	1 2 3	25%	1 2 3	1,80	1 2 3	0,316	50 %	50%				
Add new indicator ...				1 2 3		1 2 3		1 2 3							
											100%	0,658	MODERATE	50 %	33%
															100%

IMPORT data from XML

EXPORT data to XML

version 20081010

41,67 %

Final biodiversity status: BAD

Final confidence rating: Class III

6. Fish community indicators at area Finbo, northwestern Åland

Authors

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Introduction

Coastal fish monitoring began in 1976. Comparable long-term data is available since 1991. The area is used for assessment of coastal fish stocks and as reference area to the recipient control programme of the nuclear power plant of Forsmark.

Study site

Finbo monitoring area is located in the north western part of Åland. The archipelago is sheltered from south and opens gradually towards north. The depths seldom exceed 20 m. The shores are mainly cliffs and rocks, but sandy shores are common in creeks. The bottoms are sand mixed with clay, gravel and mud.

The mean water temperature during May – October is between 13 and 14 ºC. The temperature has increased lately and a peak of 16.8 ºC was noted in 2006. Salinity varies from 6.2 to 5.8 PSU. Transparency, recorded as Secchi depth, is mostly below 5 m, but has during the last years been lower than 5 m. The nutrient content in the surface water is on a moderate level. Phosphorus content during May – September was 13 – 15 µg/l in 2006 and nitrogen was between 250 - 300µg/l. There were no obvious changes of the nutrient content during the last 15 years (data from Husö biological station).

No suitable map available for the moment.

▲Map of study site

The Finbo area is located in the northwestern part of Åland (N60 15,00; E19 35,00: WGS 84)

Data

Fishing is performed annually in August at fixed stations at 2 – 5m water depths. Fishing is repeated six nights at each station. The gillnets are set between 14.00 and 16.00 and lifted the next day between 07.00 and 10.00. The data used here has been collected by Coastal survey nets, 35m long, 3m deep and composed of five 7m long panels with mesh sizes 17, 21, 25, 33 and 50mm knot to knot. The data collected by this method originates from year 1991, and since 2002(?) a new sampling method has been introduced, allthough the old method has still been in use during the recent years. Average values of the five first years (1991-1995) have been used here as reference values and average values of the latest five years (2002-2006) are used to reflect the present situation.

The water temperature data has been collected by temperature loggers, and Husö biological station has provided the salinity values. Transparency data (Secchi-depth) has been collected during the fishing efforts in August.

Application of tool no. 1

Table I: Interim application of tool no. 1. See HELCOM (2006): Development of tools for assessment of eutrophication in the Baltic Sea (BSEP No. 104) for details. Available via http://helcom.navigo.fi/stc/files/Publications/Proceedings/bsep104.pdf						
Assessment criteria (categories and indicators)		**Baseline (RefCon)**	**Acceptable deviation (%)**	**Status**	**Score (+/-)**	
Category I	Natural marine landscapes					
	Water temperature (May-October)	13,6	0,2	15,2		-
	Salinity	6,0	0,15	5,8	+	
	Transparency	5,1	0,2	4,2		-
	Sum for Category I (one out – all out)					
Category II	Thriving and balanced communities					
	Shannon-Wiener diversity index	1,2	0,2	0,9	+	
	Total biomass	3,7	0,5	6,6	+	
	Trophic level	4,0	0,15	4,1	+	
	Sum for Category II (one out – all out)					
Category III	Viable polulations of species					
	Perch	2,5	0,5	4,9		-
	Roach	2,4	0,5	9,4		-
	Sander	0,5	0,5	1,4		-
	Sum for Category III (one out – all out)					
	Overall classsification					

Application of tool no. 2

Total biomass

Total biomass is used as an index of the size of the standing stock. Increased biomass indicates increased nutritional conditions and production potential, whereas decreased biomass indicates the opposite. Fishing pressure may also affect the total biomass. Total biomass, expressed as weight per unit effort (WPUE, kg), is estimated from actual biomass figures or calculated from number of caught fish per length group in the length distribution

Species diversity

Shannon Wiener index reflects the species richness and equitability of the community. Increasing values indicate increasing diversity, caused by a high number of species with even proportion in the catch. Decreasing values indicate low diversity with few dominating species and a community with a small number of species. Calculations are based on the biomass proportion of each species.

Trophic level of catch

Average trophic level of a fish community reflects both size structure and food web composition. Decreasing values indicate that the proportion of species at higher trophic levels, e.g., piscivorous fish, decreases and that the fish community is largely composed of plankton- and benthos-feeding species. The average trophic level also reflects environmental and anthropogenic pressures such as fishery. The trophic level of coastal fish communities was calculated based on the annual weight per unit effort (WPUE) for each species and area, adjusted by species-specific values for trophic level according to Fishbase (2004).

CPUEs (as biomass) of perch, roach and sander.

The two former species are the most abundant species among the catches in the monitoring area. High catches of perch indicate healthy conditions, while roach and sander generally benefit from eutrophic and warm conditions. However, sander is a valuable target species for fisheries.

Table II: Interim application of tool no. 2. A spread sheet for these calculations can be downloaded via HELCOM's web site. 'Root' could be HD, BSAP, HELCOM recommendation(s), national law, etc. 'Degr.' is + or ÷ indicating a numerically possitive or negative response to a pressure. G/M = acceptable deviation.											
Cat.	**Indicator**	**Root**	**Degr.**	**RefCon**	**Status**	**EQR_I**	**G/M**	**Int_stat**	**EQR_cat**	**QE_sta**	**Status**
Natural landscapes											
	Water temperature		+	13,6	15,2		0,2				
Thriving and stable communities											
	Shannon-Wiener diversity		-	1,2	0,9		0,2				
	Total biomass		+	3,7	6,6		0,5				
	Trophic level		-	4,0	4,1		0,15				
Species											
	Perch		-	2,5	4,9		0,5				
	Roach		+	2,4	9,4		0,5				
	Sander		-	0,5	1,4		0,5				
Supporting features											
	Salinity		-	6,0	5,8		0,15				
	Transparency		-	5,1	4,2		0,2				
FINAL ASSESSMENT											

Discussion and conclusions

The use of CPUE of sander here as an indicators is a little problematic, as it is not easy to judge whether the values should decrease or increase. Here the increases in the CPUE of perch and sander has been treated as positive changes but the opposite could also be justifiable.

Generally, both the indicators derived from fish catches and the indicators based on environmental measurements show that there has been slight changes towards more eutrophic, warmer and less saline conditions in the Finbo monitoring area. The most conspicuous change has been the increase in roach catches during the monitoring period. As a result, roach has been clearly the dominating species in the cathes of recent years.

Reference

-

Annexes

-

BEAT

A tool for biodiversity assessment and confidence rating

Station/water body:	Finbo (FIN)

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3			100%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%				xx

Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Fish community (Shannon-Wiener Index)	1,20		-	1 2 3	20%	1 2 3	0,90	1 2 3	0,750		33%				
Fish community (total biomass)	3,70		+	1 2 3	50%	1 2 3	6,60	1 2 3	0,561		33%				
Fish community (trophic level)	4,00		-	1 2 3	15%	1 2 3	4,10	1 2 3	1,000		34%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,773	MODERATE		33%

Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Perch (Perca fluviatilis, biomass)	2,50		-	1 2 3	50%	1 2 3	4,90	1 2 3	1,000		33%				
Roach (Rutilus rutilus, biomass)	2,40		+	1 2 3	50%	1 2 3	9,40	1 2 3	0,255		33%				
Zander (Stizostedion lucioperca, biomass)	0,50		-	1 2 3	50%	1 2 3	1,40	1 2 3	1,000		34%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,754	HIGH		33%

Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Salinity	6,00		-	1 2 3	15%	1 2 3	5,80	1 2 3	0,967		33%				
Water Transparency	5,10		-	1 2 3	20%	1 2 3	4,20	1 2 3	0,824		33%				
Water Temperature	13,60		+	1 2 3	20%	1 2 3	15,20	1 2 3	0,895		34%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,895	HIGH		33%
															100%

IMPORT data from XML

EXPORT data to XML

Final biodiversity status: MODERATE

Final confidence rating:

version 20081010

7. The Brackish Parts of the Neva estuary

Authors

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Introduction

Eastern Gulf of Finland is a complicated natural system, which biodiversity suffered from diverse anthropogenic impacts: high nutrient and contaminant loads, high fisheries, dredging and creation of new lands, high ship traffic. The boundary of the region coincides with the boundary of the Neva Estuary and consists of two natural sub-systems: upper freshwater Neva Bay and lower brackish water part of the estuary.

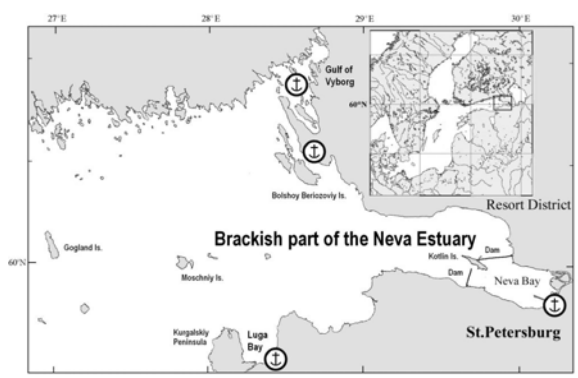
The Neva River is among the most important sources of pollution for the Gulf of Finland, because it provides about 60-80 per cent of the nutrient loads to the Gulf (Kondratyev et al. 1997, Pitkänen et al. 1997). Considerable part of pollution comes from St. Petersburg, which is one of the largest megapolises in the world with 4.5 millions of citizens and well developed industry. This leads to intensive eutrophication of the eastern Gulf of Finland (Golubkov et al., 2003a, 2003b). The coastal zone of the estuary has been intensively used for recreation (especially in the Resort District of St. Petersburg situated along the northern coast of the Gulf), sport and commercial fishery, and different industries, including a nuclear power station, and shipping. Intensity of ship traffic has increased greatly during the last decade. There is almost fivefold increase in oil transportation in the eastern Gulf of Finland since 1987. Two large oil terminals were constructed in its north-western part and cargo port in the Luga Bay in early 2000's (see map).
High anthropogenic impact comes from intensive dredging activity connecting with creations of new building lots and passenger terminal in the Neva Delta. Considerable amounts of bottom sediments and sand drag from the bottom in the eastern part of the Neva Bay, part of them suspends in the water decreasing its transparency and pass to the western part of the bay and even in the lower brackish part of the Neva Estuary.

Environmental quality and biological diversity existing in the Eastern Gulf of Finland in the first half of 20^{th} centaury has been chosen as reference conditions.

Study site

Salinity in the lower brackish part of the Neva Estuary (Fig. 1) ranges from 1.5-3 ‰ in the eastern part to 3-8 ‰ in the western part, depth from 12 – 14 m at the east to 40 – 50 m at the west. Several large bays are located in this part of the estuary, e.g., Luga Bay at the south and the Gulf of Vyborg at the north, with desalinated water in their inner parts. There are a lot of islands in different parts of the estuary. The largest ones are Kotlin Island, which is located at the boundary between Neva Bay and the lower brackish part of the Neva Estuary, Beryozovyye islands at the north, Moschniy Island and Gogland Island in the middle-western part the estuary.

The study area includes the Russian waters west of the Neva Bay Dam (see map) .



▲Map of study site

The study area is situated in the eastern part of the Gulf of Finland. ... coordinates to be added …

Data

Category I

% of Phaeophyta and Rhodophyta species endangered
Gobi, 1874, 1877; Rozanova, Golubeva, 1921; Derjugin, 1947 Belavskaya, 1987; Korelyjkova, 1997; Golubkov et al., 2003b, Kovalchuk, 2007, Zhakova, 2007
Red Data Book of Nature of the Leningrad Region 2000

Category II

% of the total biomass constituted by Crustacean glacial relicts
Historical extent: Skorikov, 1910, Derjugin, 1947
Present extent:Maximov, 2003 Maximov, 2007 Orlova et al., 2006

% of alien species in zoobenthic biomass
Historical extent: Skorikov, 1910, Derjugin, 1947
Present extent:Maximov, 2003 Maximov, 2007 Orlova et al., 2006

Total catch of fish
Historical extent: Kudersky, 1996
Present extent: Kudersky et al, 2007

Indicator 5 % of bird species endangered
Historical & Present extent: Malchevskiy, Pukinskiy, 1983;Khrabriy, 1984; Noskov, 2002, Khrabriy, 2007
Red Data Book of Nature of the Leningrad Region 2002

Category III

Indicator 6 Population of ringed seal Phoca hispida
Verevkin, Sagitov, 2004 Rezvov, 1975; Tormosov, 1977 Tormosov, Esipenko, 1990

Application of tool no. 1

Table I: Interim application of tool no. 1. See HELCOM (2006): Development of tools for assessment of eutrophication in the Baltic Sea (BSEP No. 104) for details.
Available via http://helcom.navigo.fi/stc/files/Publications/Proceedings/bsep104.pdf

Assessment criteria (categories and indicators)		Baseline (RefCon)	Acceptable deviation (%)	Status	Score (+/-)	
Category I	Natural marine landscapes					
	Indicator 1 % of Phaeophyta and Rhodophyta species endangered	0	0,5	30%		
	Sum for Category I (one out – all out)					
Category II	Thriving and balanced communities					
	Indicator 2 % of the total biomass constituted by Crustacean glacial relicts	80-90	0,5	10-20		
	Indicator 3 % of alien species in zoobenthic biomass	0	0,5	50-96		
	Indicator 4: Total catch of fish	25000-30000 ton yr-1		3000 ton yr-1		
	Indicator 5 % of bird species endangered	0	0,5	11%		
	Sum for Category II (one out – all out)					
Category III	Viable polulations of species					
	Indicator 6 Population of ringed seal Phoca hispida	5000	0,5	300		
	Sum for Category III (one out – all out)					
	Overall classsification					

Application of tool no. 2

Table II: Interim application of tool no. 2. A spread sheet for these calculations can be downloaded via HELCOM's web site. 'Root' could be HD, BSAP, HELCOM recommendation(s), national law, etc. 'Degr.' is + or ÷ indicating a numerically possitive or negative response to a pressure. G/M = acceptable deviation.												
Cat.	Indicator	Root	Degr.	RefCon	Status	EQR_I	G/M	Int_stat	EQR_cat	QE_sta	Status
Natural landscapes											
Thriving and stable communities											
Species											
Supporting features											
FINAL ASSESSMENT											

Discussion and conclusions

Please write a short discussion and outline main conclusions

The main losses of biodiversity include disappearance of more than 90 % of seal populations, fivefold decrease of commercial fish catch, and replacement of native dominant zoobenthic species by aliens in coastal and open waters. Good status may be considered only for marine birds due to a relatively good situation with protected areas in this part of the gulf, which mostly directed to conservation of bird biodiversity.

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Please add references.

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Annexes

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BEAT

A tool for biodiversity assessment and confidence rating

Station/water body: Neva Bay (Brackish water outer parts) (RUS)

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3			100%				
Add new indicator ...				1 2 3		1 2 3		1 2 3							
											100%				xx

Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Zoobenthos (% of the total biomass Crustacean gla	85,00	% biomass	-	1 2 3	50%	1 2 3	15,00	1 2 3	0,176	33%				
Zoobenthos (% of alien species in biomass)	0,00	%biomass	+	1 2 3	50%	1 2 3	73,00	1 2 3	0,000	33%				
Fish community (Total catch)	27500,00	tn/yr	-	1 2 3	50%	1 2 3	3000,00	1 2 3	0,109	34%				
Add new indicator ...				1 2 3		1 2 3		1 2 3						
										100%	0,095	BAD		50%

Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Ringed seal (Phoca hispida)	5000,00	individuals	-	1 2 3	50%	1 2 3	300,00	1 2 3	0,060	33%				
Bird species (% of bird species endangered)	1,00	%species	+	1 2 3	50%	1 2 3	11,00	1 2 3	0,091	33%				
Macrophyte species (% of Phaeophyta and Rhodo	1,00	%species	+	1 2 3	50%	1 2 3	30,00	1 2 3	0,033	34%				
Add new indicator ...				1 2 3		1 2 3		1 2 3						
										100%	0,061	BAD		50%

Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Indicator 8				1 2 3		1 2 3		1 2 3		100%				
Add new indicator ...				1 2 3		1 2 3		1 2 3						
										100%				xx
														100%

IMPORT data from XML

EXPORT data to XML

Final biodiversity status: **BAD**

Final confidence rating:

version 20081010

8. Neva Bay: the upper freshwater part of the Neva Estuary

Authors

Sergey Golubkov

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Introduction

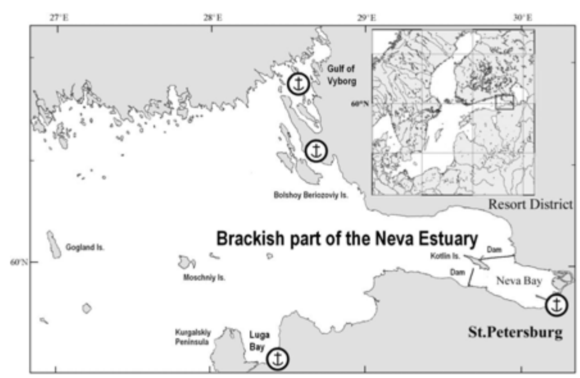
Eastern Gulf of Finland is a complicated natural system, which biodiversity suffered from diverse anthropogenic impacts: high nutrient and contaminant loads, high fisheries, dredging and creation of new lands, high ship traffic. The boundary of the region coincides with the boundary of the Neva Estuary and consists of two natural sub-systems: upper freshwater Neva Bay and lower brackish water part of the estuary.

The Neva River is among the most important sources of pollution for the Gulf of Finland, because it provides about 60-80 per cent of the nutrient loads to the Gulf (Kondratyev et al. 1997, Pitkänen et al. 1997). Considerable part of pollution comes from St. Petersburg, which is one of the largest megapolises in the world with 4.5 millions of citizens and well developed industry. This leads to intensive eutrophication of the eastern Gulf of Finland (Golubkov et al., 2003a, 2003b). The coastal zone of the estuary has been intensively used for recreation (especially in the Resort District of St. Petersburg situated along the northern coast of the Gulf), sport and commercial fishery, and different industries, including a nuclear power station, and shipping. Intensity of ship traffic has increased greatly during the last decade. There is almost fivefold increase in oil transportation in the eastern Gulf of Finland since 1987. Two large oil terminals were constructed in its north-western part and cargo port in the Luga Bay in early 2000's (see map).
High anthropogenic impact comes from intensive dredging activity connecting with creations of new building lots and passenger terminal in the Neva Delta. Considerable amounts of bottom sediments and sand drag from the bottom in the eastern part of the Neva Bay, part of them suspends in the water decreasing its transparency and pass to the western part of the bay and even in the lower brackish part of the Neva Estuary.

Environmental quality and biological diversity existing in the Eastern Gulf of Finland in the first half of 20th centaury has been chosen as reference conditions.

Study site

Surface area of the Neva Bay (Fig. 1) is about 400 km^2, salinity – 0.07-0.02 ‰, with the exception of short-term intrusions of brackish water from the lower part of the estuary during surge events when brackish waters from the lower part of the Neva Estuary come to the Neva Bay and mix there with fresh waters; the depth of the bay is 3.5 – 4 m. In the middle of 1980's Neva Bay had been separated from lower part of the estuary by a storm-surge barrier (Dam), which is still under construction. The storm-surge barrier has several water leaking gates in its northern part and a broad ship gate in the southern part.
The study area includes waters inside the Neva Bay Dam (see map) .



▲Map of study site
The study area is situated in the eastern part of the Gulf of Finland.

Data

Category I

Indicator 1 Distribution of submerged vascular plants and macroalgae beds (% area)
Historical extent: Gobi, 1874, 1877; Rozanova, Golubeva, 1921; Derjugin, 1947
Present extent: e.g., Belavskaya, 1987; Korelyjkova, 1997; Golubkov et al., 2003, Zhakova, 2007

Category II

Indicator 2 Occurrence of crustacean glacial relicts (% samples)
Historical extent: Skorikov, 1910 Derjugin, 1947
Present extent: Maximov, 2004

Indicator 3 Occurrence of mollusks Pisidiidae (% samples)
Historical extent: Skorikov, 1910 Derjugin, 1947
Present extent: Maximov, 2004

Indicator 4 Portion of alien species in zoobenthic biomass in shallow coastal zone (%)
Historical extent: Skorikov, 1910 Derjugin, 1947
Present extent: Maximov, 2004 Orlova et al., 2006

Indicator 5 Total catch of fish spawning in the Neva Bay (ton yr-1)
Historical extent: Kudersky, 1996
Present extent: Kudersky et al, 2007

Indicator 6 Area of bay used by migratory birds, nesting sites of waterfowl and coastal birds (%)
Historical & Present extent: Malchevskiy, Pukinskiy, 1983;Khrabriy, 1984; Noskov, 2002, Khrabriy, 2007

Category III

No indicators

Application of tool no. 1

Table I: Interim application of tool no. 1. See HELCOM (2006): Development of tools for assessment of eutrophication in the Baltic Sea (BSEP No. 104) for details.
Available via http://helcom.navigo.fi/stc/files/Publications/Proceedings/bsep104.pdf

Assessment criteria (categories and indicators)		Baseline (RefCon)	Acceptable deviation (%)	Status	Score (+/-)	
Category I	Natural marine landscapes					
	Indicator 1 Distribution of submerged vascular plants and macroalgae beds (% area)	100	0,5	10-20		-
	Sum for Category I (one out – all out)					-
Category II	Thriving and balanced communities					
	Indicator 2 Occurrence of crustacean glacial relicts (% samples)	100	0,5	1		-
	Indicator 3 Occurrence of mollusks Pisidiidae (% samples)	100	0,5	100	+	
	Indicator 4 Portion of alien species in zoobenthic biomass in shallow coastal zone (%)	0	0,5	45		-
	Indicator 5 Total catch of fish spawning in the Neva Bay (ton yr-1)	6000-8000 ton yr-1	0,5	500 ton yr-1		
	Indicator 6 Area of bay used by migratory birds, nesting sites of waterfowl and coastal birds (%)	100	0,5	60-70		
	Sum for Category II (one out – all out)					-
Category III	Viable populations of species					
	Sum for Category III (one out – all out)					
	Overall classsification					

Application of tool no. 2

Table II: Interim application of tool no. 2. A spread sheet for these calculations can be downloaded via HELCOM's web site. 'Root' could be HD, BSAP, HELCOM recommendation(s), national law, etc. 'Degr.' is + or ÷ indicating a numerically possitive or negative response to a pressure. G/M = acceptable deviation.

Cat.	Indicator	Root	Degr.	RefCon	Status	EQR_I	G/M	Int_stat	EQR_cat	QE_sta	Status
Natural landscapes											
	Indicator 1 Distribution of submerged vascular plants and macroalgae beds (% area)										
Thriving and stable communities											
	Indicator 2 Occurrence of crustacean glacial relicts (% samples)										
	Indicator 3 Occurrence of mollusks Pisidiidae (% samples)										
	Indicator 4 Portion of alien species in zoobenthic biomass in shallow coastal zone (%)										
	Indicator 5 Total catch of fish spawning in the Neva Bay (ton yr-1)										
	Indicator 6 Area of bay used by migratory birds, nesting sites of waterfowl and coastal birds (%)										
Species											
Supporting features											
FINAL ASSESSMENT											

Discussion and conclusions

Please write a short discussion and outline main conclusions

The main losses of biodiversity include disappearance of more than 75 % of submerged vascular plant meadows and disappearance of main spawning areas of fish in the eastern part of the bay. Alien species contribute up to 45 % of total biomass of zoobenthos in shallow littoral. At present, protected areas, which may promote to biodiversity conservation in this part of the eastern Gulf of Finland, are absent.

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Annexes

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BEAT

A tool for biodiversity assessment and confidence rating

Station/water body: Neva Estuary (freshwater inner parts) (RUS)

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
Macrophytes (% of total area submerged vascular	100,00	% area	-	1 2 3	50%	1 2 3	15,00	1 2 3	0,150		50%				
Birds (% of bay area used by migratory birds and a	100,00	%area	-	1 2 3	50%	1 2 3	65,00	1 2 3	0,650		50%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,400	MODERATE		50%

Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Zoobenthos (Occurrence of crustacean glacial relic	100,00	% samples	-	1 2 3	50%	1 2 3	1,00	1 2 3	0,010	25%				
Zoobenthos (% of species alien in shallow coastal	0,00	% biomass	+	1 2 3	50%	1 2 3	45,00	1 2 3	0,000	25%				
Fish (Total catch, fish spawning in the Neva Bay)	7000,00	tn/yr	-	1 2 3	50%	1 2 3	500,00	1 2 3	0,071	50%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%	0,038	BAD		50%

Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Indicator 6				1 2 3		1 2 3		1 2 3		100%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%				xx

Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Indicator 7				1 2 3		1 2 3		1 2 3		100%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%				xx
														100%

IMPORT data from XML

EXPORT data to XML

Final biodiversity status: **BAD**

Final confidence rating:

version 20081010

9. Estonian case study: Gulf of Riga

Authors

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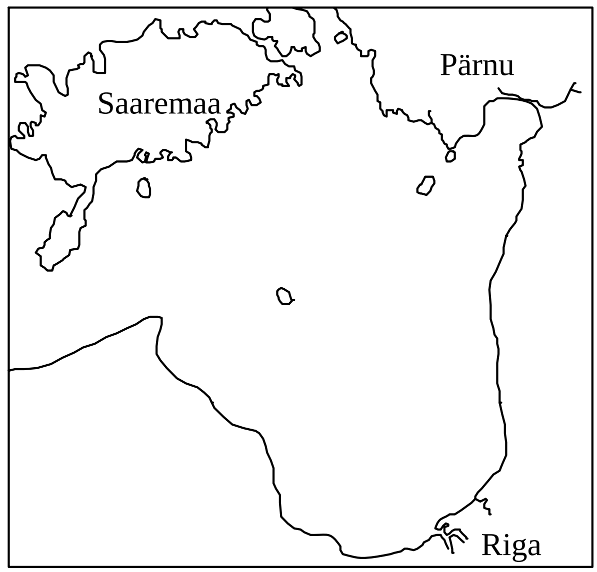
Introduction

The Gulf of Riga is one of the best-studied sub-basins in the Baltic Sea. The purpose of the current exercise is to assess the status of the (northern part) of Gulf of Riga based on selected biotic and abiotic parametres by using the BEAT approach. The available data allowed us to select parametres for each of the provided category: landscapes, communities, species and supporting features. The following organism groups/abiotic parametres were used: Secchi depth, essential nutrients, Chl a, bottom vegetation, benthic invertebrates and fish.

Study site

The Gulf of Riga (area 16,330 km^2, volume 424 km^3, drainage area 134,000 km^2) is situated in the NE part of the Baltic Sea. Its shallow depth (mean 26, max >60 m) results in complete vertical mixing during the winter. Mean annual salinity varies from 5.4 to 6.1 ‰. The Gulf is one of the most eutrophicated areas in the Baltic Sea. Of the land-based incoming nutrients, nearly all phosphorus and 25% of nitrogen is exported into the Baltic Proper (HELCOM, 1996). Chlorophyll *a* concentrations are highest in spring (14–18 mg m^{-3}) and notably lower in summer and autumn (<7 mg m^{-3}). In spring, diatoms and dinoflagellates dominate the phytoplankton whereas blooms of cyanobacteria occur in summer. The basin also supports high fish production and currently accounts for about 4% of the total fish landings in the Baltic Sea (HELCOM, 1996). The most abundant fish are herring (*Clupea harengus membras*), sticklebacks (*Gasterosteus aculeatus* and *Pungitius pungitius*), smelt (*Osmerus eperlanus*) and currently also sprat (*Sprattus sprattus*).



Map of study site

Data

The data originate both from dedicated investigations and routine marine monitoring surveys.

For the current exercise the data from running environmental monitoring programme was used. For the environmental variables the data from the period 2001-2006 was applied. The refernce conditions were set using information available from different modelling excercises. Current situation for benthic invertebrates and SAV was estimated from the data collected in 2005/2006. Reference conditions for bethic invertebrates and SAV are based on historical data. (Martin 1999, 2000) Fish catch data used within the current work represent joint Estonian and Latvian national official annual catch statistics from commercial fisheries during 1972-2005 (Saat and Ojaveer, 2005). The Gulf of Riga herring catch was taken from ICES WGBFAS report (ICES, 2007). Fish community studies were performed during the 1970s-1990s by experimental trawling method (Ojaveer 1997).

It is important to mention that most of the datasets originate from times when human impact to the marine ecosystem was already substantial both in terms of eutrophication and fisheries activities. However, these originate from two basic regimes of the Baltic Sea representing by this way response of the ecosystem components to the environmental variability induced both by climate and human impact.

Application of tool no. 1

In most cases, the deviation was set to 0.5.

Table I: Interim application of tool no. 1. See HELCOM (2006): Development of tools for assessment of eutrophication in the Baltic Sea (BSEP No. 104) for details.
Available via http://helcom.navigo.fi/stc/files/Publications/Proceedings/bsep104.pdf

Assessment criteria (categories and indicators)		Baseline (RefCon)	Acceptable deviation (%)	Status	Score (+/-)	
Category I	Natural marine landscapes					
	coverage of Furcellaria community, km2	200	50	168		
	Sum for Category I (one out – all out)					
Category II	Thriving and balanced communities					
	Fucus belt depth	5	50	2.1		
	Mean number of demersal fish	2.5	50	5		
	Proprtion of perennial algae in the community	80	50	62		
	Number of functions in zoobenthic communities	4.84	50	4.08		
	Sum for Category II (one out – all out)					
Category III	Viable populations of species					
	Smelt catch (t)	2200	50	400		
	Cod catch (t)	8000	50	0		
	Sprat catch (t)	500	50	5000		
	Eelpout catch (t)	14000	50	17		
	Flounder catch (t)	400	50	90		
	Herring catch (t)	30000	50	32000		
	Sum for Category III (one out – all out)					
	Overall classsification					

Application of tool no. 2

Table II: Interim application of tool no. 2. A spread sheet for these calculations can be downloaded via HELCOM's web site. 'Root' could be HD, BSAP, HELCOM recommendation(s), national law, etc. 'Degr.' is + or ÷ indicating a numerically possitive or negative response to a pressure. G/M = acceptable deviation.

Cat.	Indicator	Root	Degr.	RefCon	Status	EQR_I	G/M	Int_stat	EQR_cat	QE_sta	Status
Natural landscapes											
	coverage of Furcellaria community, km2		-	200	168	0.840	0.5	HIGH			
									0.840	HIGH	
Thriving and stable communities											
	Fucus belt depth		-	5	2.1	0.420	0.5	MOD			
	Mean number of demersal fish		+	2.5	5	0.500	0.5	POOR			
	Proprtion of perennial algae in the community		-	80	62	0.775	0.5	HIGH			
	Number of functions in zoobenthic communities		-	4.84	4.08	0.843	0.5	HIGH			
									0.634	GOOD	
Species											
	Smelt catch (t)		-	2200	400	0.182	0.5	POOR			
	Cod catch (t)		-	8000	0	0.00	0.5	BAD			
	Sprat catch (t)		+	500	5000	0.100	0.5	BAD			
	Eelpout catch (t)		-	14000	17	0.001	0.5	BAD			
	Flounder catch (t)		-	400	90	0.225	0.5	POOR			
	Herring catch (t)		+	30000	32000	0.938	0.5	HIGH			
									0.241	POOR	
Supporting features											
	Phytoplankton chlorophyll a		+	1.8	3.9	0.462	0.5	POOR			
	Secchi		-	3.9	2.1	0.538	0.25	BAD			
	N-tot		+	9	27.44	0.328	0.5	BAD			
	PO4		+	0.25	0.65	0.385	0.5	POOR			
									0.426	POOR	
FINAL ASSESSMENT											POOR

Discussion and conclusions

By different evaluated categories, the status of the Gulf of Riga varies from high to poor with the summary evaluation 'poor'. This is mainly because both species and supporting features categories obtained 'poor' rankings. While benthic vegetation and bethic invertebrates are performing relatively well, all measured abiotic parametres (PO4, N-tot, Secchi depth) and also Chl a concentration indicate that the system is in the 'poor' state. Similarily, the upper trophic levels (fish community and landings of selected most important commercial fish) show impoverishment of the system. This is driven both by internal factors of the Gulf of Riga (eutrophication, pollution and fisheries have caused declines in eelpout and smelt catches) but also external factors (less saline water intrusions in to the Baltic Sea that has caused shrinkage of the distribution area of the eastern baltic cod population). The latter has caused increase of the number of fish present in the open Gulf of Riga (no cod→higher number of forage fish species) which points to worsening of the situation. In conclusion, the truly open Gulf component (fish and the water column parameters) reveal 'poor' state of the system whereas more coastal areas of the basin are in much better condition – 'high/good'.

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Annexes

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BEAT

A tool for biodiversity assessment and confidence rating

Station/water body: Gulf of Riga, northern parts (EST)

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
Macrophytes (Coverage of Furcellaria community k	200,00	km2	-	1 2 3	50%	1 2 3	168,00	1 2 3	0,840		100%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,840	HIGH		25%

Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Macrophytes (Fucus belt depth m)	5,00	m	-	1 2 3	50%	1 2 3	2,10	1 2 3	0,420	20%				
Fish communities (Demersal fish species mean nu	2,50	N species	+	1 2 3	50%	1 2 3	5,00	1 2 3	0,500	20%				
Macrophytes (% perennial species)	80,00	% total	-	1 2 3	50%	1 2 3	62,00	1 2 3	0,775	20%				
Zoobenthos (N functional groups)	4,84	N func.gr.	-	1 2 3	50%	1 2 3	4,08	1 2 3	0,843	20%				
Phytoplankton (chlorophyll a)	1,80		+	1 2 3	50%	1 2 3	3,90	1 2 3	0,462	20%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%	0,600	GOOD		25%

Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Smelt (Osmerus eperlanus) catch	2200,00	t	-	1 2 3	50%	1 2 3	400,00	1 2 3	0,182	17%				
Cod (Gadus morhua) catch	8000,00	t	-	1 2 3	50%	1 2 3	0,00	1 2 3	0,000	17%				
Sprat (Sprattus sprattus) catch	500,00	t	+	1 2 3	50%	1 2 3	5000,00	1 2 3	0,100	17%				
Eelpout (Zoarces viviparus) catch	14000,00	t	-	1 2 3	50%	1 2 3	17,00	1 2 3	0,001	17%				
Flounder (Platichthys flesus) catch	400,00	t	-	1 2 3	50%	1 2 3	90,00	1 2 3	0,225	17%				
Herring (Harengus membras) catch	30000,00	t	+	1 2 3	50%	1 2 3	32000,00	1 2 3	0,938	15%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%	0,227	POOR		25%

Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Water clarity (Secchi depth)	3,90	m	-	1 2 3	25%	1 2 3	2,10	1 2 3	0,538	33%				
Nutrients (Ntot)	9,00		+	1 2 3	50%	1 2 3	27,44	1 2 3	0,328	33%				
Nutrients (PO4)	0,25		+	1 2 3	50%	1 2 3	0,65	1 2 3	0,385	34%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%	0,417	BAD		25%
														100%

IMPORT data from XML

EXPORT data to XML

Final biodiversity status: **BAD**

Final confidence rating:

version 20081010

10. Estonian case study: Pärnu Bay

Authors

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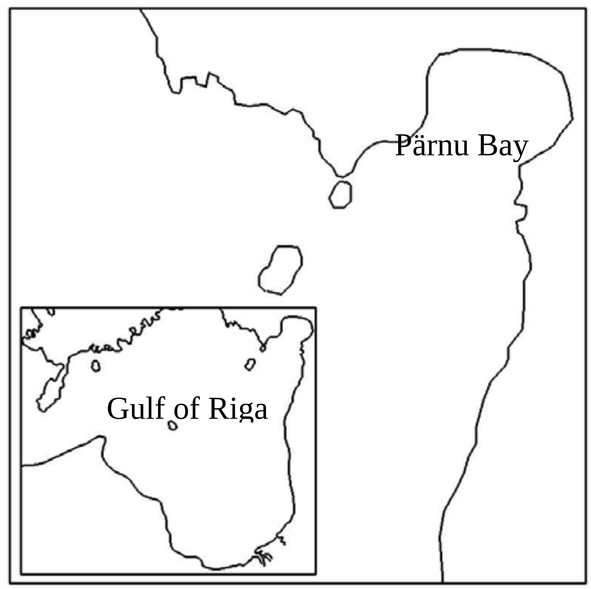
Introduction

Surrounded largely by land, Pärnu Bay is an important source for livelyhood and under substantial impact of local coastal communities. The purpose of the current exercise is to assess the status of Pärnu Bay on selected biotic and abiotic parametres by using the BEAT approach. The available data allowed us to select parametres for three provided categories: communities, species and supporting features. The following organism groups/abiotic parametres were used: Secchi depth, Chl a, macroalgae, zooplankton and commercial fish.

Study site

Pärnu Bay is a relatively enclosed and very shallow (maximum depth 10 m) sea area in the northeastern Gulf of Riga covering approximately 700 km^2. The bay is directly influenced by effluents from Pärnu town via Pärnu River where wastewater treatment plants have been in operation since the first half of the 1990s. Fisheris and tourism, togehter with maritime traffic visiting the Port of Pärnu are the main sources of antrophogenic impact to the marine ecosystem. The bay is fully covered with ice in winter (average icecover up to 90 days/year). In summer, the average water temperature may reach 18 C. The salinity of the bay fluctuates from 0 to 5‰. With high content of humic substances in the water coming from Pärnu river, the transparency of sea water is usually very low. Pärnu Bay is the most productive area in the Gulf of Riga by acting as essential spawning and larval and young fish retention area for several commercial fish species. Freshwater and euryhaline organisms dominate the fauna of the bay.



Map of study site

Data

The data originate both from dedicated investigations and routine marine monitoring surveys

Data for water quality and abiotic features is oriniating from extensive monitoring programme carried out in the Pärnu Bay already from 1960ies. So the reference conditions are set basing on historical values as well as modelk estimations.

Data on bottom vegetation is coming from the monitoring programme carried out in the Bay staring from 1995. The refence conditions for SAV parameters were set using historical values (Martin 1999, 2000).

Zooplankton weekly collected dataset for June-September for years 1970-2006 was made available for the current study. Since the 1990s, these date include both national monitoring and research data and have been used in several publications ant/project reports (e.g., Ojaveer et al. 2004, Anon., 2005).

Fish catch data used within the current work represent Estonian official annual catch statistics from commercial fisheries during 1972-2006. For several recent years, recreational fishery represent substantial catch amounts for a few species (especially perch). However, as these catch amounts are unrecorded and therefore not available, these were not taken into account.

Both datasets originate from times when human impact to the marine ecosystem was already significant both in terms of eutrophication and fisheries activities. Therefore, baselines for the period prior to the substantial eutrophication and industrial fisheries cannot be set.

Application of tool no. 1

For majority of cases, the deviation was set to 0.5.

Table I: Interim application of tool no. 1. See HELCOM (2006): Development of tools for assessment of eutrophication in the Baltic Sea (BSEP No. 104) for details.
Available via http://helcom.navigo.fi/stc/files/Publications/Proceedings/bsep104.pdf

Assessment criteria (categories and indicators)		Baseline (RefCon)	Acceptable deviation (%)	Status	Score (+/-)	
Category I	Natural marine landscapes					
	Indicator 1					
	Indicator 2					
	Indicator 3					
	Sum for Category I (one out – all out)					
Category II	Thriving and balanced communities					
	Depth of macroalgae	5	50	1.8		
	Proprtion of perennial algae in the community	60	50	38		
	Sum for Category II (one out – all out)					
Category III	Viable populations of species					
	Bream catch	10	50	70		
	Perch catch	1200	50	580		
	Pikeperch catch	150	50	50		
	Whitefish catch	15	50	2		
	Copepod nauplii abundance	30000	50	36000		
	Bosmina coregoni maritima, abundance	20000	50	5000		
	Limnocalanus grimaldii, abundance	200	50	0		
	Sum for Category III (one out – all out)					
	Overall classsification					

Application of tool no. 2

Table II: Interim application of tool no. 2. A spread sheet for these calculations can be downloaded via HELCOM's web site. 'Root' could be HD, BSAP, HELCOM recommendation(s), national law, etc. 'Degr.' is + or ÷ indicating a numerically possitive or negative response to a pressure. G/M = acceptable deviation.

Cat.	Indicator	Root	Degr.	RefCon	Status	EQR_I	G/M	Int_stat	EQR_cat	QE_sta	Status
Natural landscapes											
	none										
Thriving and stable communities											
	Depth of macroalgae		-	5	1.8	0.360	0.5	MOD			
	Proprtion of perennial algae in the community		-	60	38	0.633	0.5	GOOD			
									0.497	MOD	
Species											
	Bream catch		+	10	70	0.143	0.5	BAD			
	Perch catch		-	1200	580	0.483	0.5	MOD			
	Pikeperch catch		-	150	50	0.133	0.5	POOR			
	Whitefish catch		-	15	2	0.133	0.5	MOD			
	Copepod nauplii abundance		+	30000	36000	0.833	0.5	HIGH			
	Bosmina coregoni maritima, abundance		-	20000	5000	0.250	0.5	POOR			
	Limnocalanus grimaldii, abundance		-	200	0	0.000	0.5	BAD			
									0.311	POOR	
Supporting features											
	Phytoplankton chlorophyll a		+	3.1	6	0.517	0.5	POOR			
	Secchi depth		-	3.9	2.2	0.564	0.25	POOR			
									0.540	POOR	
FINAL ASSESSMENT											POOR

Discussion and conclusions

By different evaluated categories, the status of Pärnu Bay varies from 'moderate' to' poor' with the summary evaluation 'poor'. This is mainly because both species and supporting features categories obtained 'poor' rankings. While benthic vegetation-related indicators show better condition of Pärnu Bay, there are several fish and zooplankton taxa that have declined. These prefer either cooler and more cleaner water (e.g., copepod Limnocalanus grimaldii, whitefish Coregonus lavaretus) or are subject of excessive fishing effort (especially percids). Along with several recent consecutive warm summers, cyprinids (e.g., bream Abramis brama) which tolerate higher eutrohication level and even gain profit from it, are doing well. Similarly, productivity of major zooplankton taxa (copepods Eurytemora affinis and Acartia spp.), expressed as the annual mean abundance of their nauplii, is high. The reason why Bosmina coregoni maritima has declined recently is only partly understood. However, their decline contributres to impoversihment of zooplankton community. Both two analysed pelagic indicators – Chl a and Secchi dept – point to' poor' status of the bay.

Reference

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Annexes -

BEAT

A tool for biodiversity assessment and confidence rating

Station/water body: Parnu Bay (EST)

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3			100%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%				xx

Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Macrophytes (depth distribution)	5,00		-	1 2 3	50%	1 2 3	1,80	1 2 3	0,360	17%				
Macrophytes (Proportion of perennial algae in mac	60,00		+	1 2 3	50%	1 2 3	38,00	1 2 3	1,000	17%				
Zooplankton (Copepod nauplii abundance)	30000,00		+	1 2 3	50%	1 2 3	36000,00	1 2 3	0,833	17%				
Zooplankton (Bosmina coregoni maritima abundan	20000,00		-	1 2 3	50%	1 2 3	5000,00	1 2 3	0,250	17%				
Zooplankton (Limnocalanus grimaldii abundance)	200,00		-	1 2 3	50%	1 2 3	0,00	1 2 3	0,000	17%				
Phytoplankton (chlorophyll a)	3,10		+	1 2 3	50%	1 2 3	6,00	1 2 3	0,517	15%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%	0,493	MODERATE		33%

Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Bream (Abramis brama) catch	10,00		+	1 2 3	50%	1 2 3	70,00	1 2 3	0,143	25%				
Perch (Perca fluviatilis) catch	1200,00		-	1 2 3	50%	1 2 3	580,00	1 2 3	0,483	25%				
Pikeperch (Stizostedion lucioperca) catch	150,00		-	1 2 3	50%	1 2 3	50,00	1 2 3	0,333	25%				
Whitefish (Cregonus lavaretus) catch	15,00		-	1 2 3	50%	1 2 3	2,00	1 2 3	0,133	25%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%	0,273	POOR		33%

Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Water clarity (Secchi depth)	3,90	m	-	1 2 3	25%	1 2 3	2,20	1 2 3	0,564	100%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%	0,564	POOR		33%
														100%

IMPORT data from XML

EXPORT data to XML

Final biodiversity status: **POOR**

Final confidence rating:

version 20081010

11. The first Latvian case study ever for HELCOM BIO at the southern part of the Gulf of Riga

Authors

Contributions from Andris Andrushaitis, Aivars Yurkovskis, Vadims Jermakovs, Ingrida Purina, Baiba Kalveka, Dagnija Fedorovicha, Anda Ikauniece

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Introduction

Being in front of the fact that stony coastal areas with the highest biodiversity are still in the state of data analysis there was only one choice left for the case study – the transitional waters of the Gulf of Riga as the best studied region in Latvian marine waters. Latvian legislation has the typology included according to WFD already since 2004 still the official values of parameters for quality classes are missing. However, the abovementioned authors have contributed to EU project CHARM in the sense of reference conditions thus the figures below are considered as reliable.

Study site

The study site is reduced to a station (119) with the highest sampling frequency in the Gulf of Riga. It is situated at the south-eastern part of the Gulf, 44 m deep. The location is about 25 km from the coast where the freshwater inflow is quite impressive. Therefore spring flood as a reduced salinity in the surface layer is observed also there. The water layer is homogeneous from autumn till spring and stratified with thermocline only, during warm part of the year. Inflows from the Baltic Sea as more saline water are observed during winter. Mud is the sediment type of the station. Oxic conditions near the bottom become less favourable during summer and early autumn due to the stable thermocline and lack of advection.

▲Map of study site

Could be found at /www.lhei.lv/en/dati-licis.php

Data

All the data used for characterization of the current status are collected as monitoring or related research project data by the same institute. Methods, if changed, have been intercalibrated to continue the comparability of the data. Measurements have been performed at one sampling station having the best temporal coverage. The current status is described using data of 2004. The data of later years have not been processed. Reference conditions for phytoplankton and macrozoobenthos have been derived from published values about 1930s till 1950s. Water transparency and oxygen concentration are from early 1960s.

Biotic index and biotic coefficient used for macrozoobenthos data are allowing to assess the species composition and abundance within a single indicator, also describing the health of community (Borja et al., 2000; Borja et al., 2003).

Application of tool no. 1

The acceptable deviation was assumed to cover the limit needed for “good” status according to WFD and draft values created for quality classes in this area.

The principles are reasonable and tool is effective. To get the values of appropriate indicators could be the headache.

Table I: Interim application of tool no. 1. See HELCOM (2006): Development of tools for assessment of eutrophication in the Baltic Sea (BSEP No. 104) for details.
Available via http://helcom.navigo.fi/stc/files/Publications/Proceedings/bsep104.pdf

Assessment criteria (categories and indicators)		Baseline (RefCon)	Acceptable deviation (%)	Status	Score (+/-)	
Category I	Natural marine landscapes					
	Water transparency, Secchi depth, m	4	25	2,8	-	
	Oxygen concentration, summer, below thermocline, ml/l	6	15	5,36	+	
	Sum for Category I (one out – all out)					-
Category II	Thriving and balanced communities					
	Share of diatoms in total spring phytoplankton, %	60	25	90	-	
	Share of cyanobacteria in total summer phytoplankton, %	60	25	50	+	
	Sum for Category II (one out – all out)					-
Category III	Viable polulations of species					
	Macrozoobenthos biotic index	1	50	1.5	+	
	Macrozoobenthos biotic coefficient	2	50	2	+	
	Sum for Category III (one out – all out)					+
	Overall classsification					-

Application of tool no. 2

Table II: Interim application of tool no. 2. A spread sheet for these calculations can be downloaded via HELCOM's web site. 'Root' could be HD, BSAP, HELCOM recommendation(s), national law, etc. 'Degr.' is + or ÷ indicating a numerically possitive or negative response to a pressure. G/M = acceptable deviation.

Cat.	Indicator	Root	Degr.	RefCon	Status	EQR_I	G/M	Int_stat	EQR_cat	QE_sta	Status
Natural landscapes											
	Water transparency, Secchi depth		-	4	2,8	0,700	0,25	moderat e			
	Oxygen concentration, summer, below thermocline		-	6	5,36	0,893	0,15	good			
									0,797	moderat e	
Thriving and stable communities											
	Share of diatoms in total spring phytoplankton, %		+	60	90	0,667	0,25	poor			
	Share of cyanobacteria in total summer phytoplankton, %		-	60	50	0,833	0,25	good			
									0,750	moderat e	
Species											
	Macrozoobenthos biotic index		+	1	1,5	0,667	0,5	moderat e			
	Macrozoobenthos biotic coefficient		+	2	2	1,000	0,5	high			
									0,833	high	
Supporting features											
	none										
FINAL ASSESSMENT											modera te

Discussion and conclusions

In order to produce more biodiversity and conservation success oriented assessment definitely more specific indicators should be used. Keeping in mind the natural Baltic Sea gradients and variability, the final outcome for year 2004 in the southern Gulf of Riga may not necessarily mean ecosystem under unfavourable impact with a certain loss of biodiversity. To draw more conclusions, this exercise should be repeated with either data from other years or different indicators.

Reference

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Annexes -

BEAT

A tool for biodiversity assessment and confidence rating

Station/water body: Gulf of Riga, south-eastern parts (LAT)

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3			100%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%				xx

Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Phytoplankton (% diatoms of total, spring)	60,00		+	1 2 3	25%	1 2 3	90,00	1 2 3	0,667	25%				
Phytoplankton (% cyanobacteria of total, summer)	60,00		-	1 2 3	25%	1 2 3	50,00	1 2 3	0,833	25%				
Zoobenthos (biotic index)	1,00		+	1 2 3	50%	1 2 3	1,50	1 2 3	0,667	25%				
Zoobenthos (biotic coefficient)	2,00		+	1 2 3	50%	1 2 3	2,00	1 2 3	1,000	25%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%	0,792	GOOD		50%

Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3		100%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%				xx

Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Water clarity (Secchi depth)	4,00		-	1 2 3	25%	1 2 3	2,80	1 2 3	0,700	50%				
Oxygen (summer, below thermocline)	6,00		-	1 2 3	15%	1 2 3	5,36	1 2 3	0,893	50%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%	0,797	MODERATE		50%
														100%

IMPORT data from XML

EXPORT data to XML

Final biodiversity status: **MODERATE**

Final confidence rating:

version 20081010

BEAT

A tool for biodiversity assessment and confidence rating

Station/water body:	Curonian Lagoon (LIT)

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
none				1 2 3		1 2 3		1 2 3			100%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%				xx

Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Macrophytes (Max depth of Potamogeton, northern	3,00	m	-	1 2 3	25%	1 2 3	0,90	1 2 3	0,300	17%				
Macrophytes (max depth of Potamogeton, central p	3,00	m	-	1 2 3	25%	1 2 3	0,80	1 2 3	0,267	17%				
Zoobenthos (number of species, northern parts)	20,00	N species	-	1 2 3	25%	1 2 3	9,00	1 2 3	0,450	17%				
Zoobenthos (number of species, central parts)	18,00	N species	-	1 2 3	25%	1 2 3	7,00	1 2 3	0,389	17%				
Phytoplankton (biomass, central parts)	5,00		+	1 2 3	50%	1 2 3	91,81	1 2 3	0,054	16%				
Phytoplankton (biomass, northern parts)	3,00		+	1 2 3	50%	1 2 3	95,44	1 2 3	0,031	16%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%	0,253	BAD		50%

Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
none				1 2 3		1 2 3		1 2 3		100%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%				xx

Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Nutrients (TN summer mean, central parts)	470,00		+	1 2 3	50%	1 2 3	1190,00	1 2 3	0,395	25%				
Nutrients (TN summer mean, northern parts)	550,00		+	1 2 3	50%	1 2 3	1173,00	1 2 3	0,469	25%				
Nutrients (TP summer mean, central parts)	30,00		+	1 2 3	50%	1 2 3	122,00	1 2 3	0,246	25%				
Nutrients (TP summer mean, northern parts)	35,00		+	1 2 3	50%	1 2 3	104,00	1 2 3	0,337	25%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%	0,362	BAD		50%
														100%

IMPORT data from XML

EXPORT data to XML

Final biodiversity status: **BAD**

Final confidence rating:

version 20081010

13. Puck Bay

Authors
Eugeniusz Andrulewicz, Jan Marcin Węsławski

Consultant
Katarzyna Roszkowska,

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Eugeniusz Andrulewicz

Introduction

Puck Bay has been selected as an illustrative example for the assessment of biological diversity for HELCOM BEAT exercise because this bay reflects well complicated ecosystem of the Baltic Sea and the effects of pressure from anthropogenic sources. Mismanagement of human activities are the main causes of biological degradation of biodiversity of the Puck Bay.

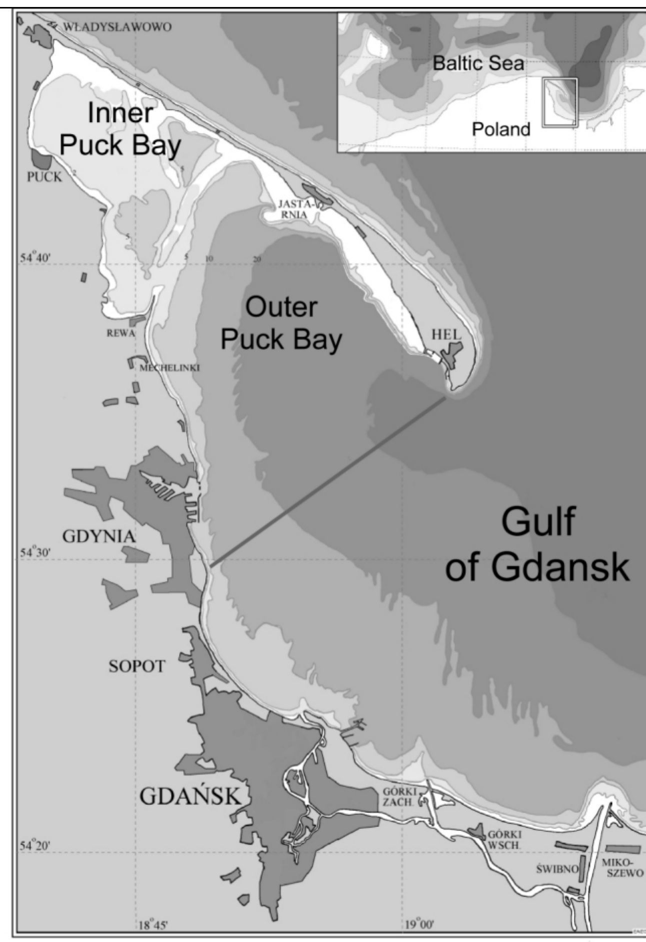
The present biodiversity status of the natural ecosystem units of the Puck Bay is assessed versus historical reference period (1950s).

Study site

Puck Bay is the westernmost part of the Gulf of Gdansk, separated from the open sea by the Hel Peninsula, a long scythe-shaped spit. Puck Bay surface area is about 360 km^2, volume about 5,6 km^3, max depth about 55 m. The Bay is divided by a sand ridge (Seagall's Shoal) for two parts: the Outer Puck Bay and the Inner Puck Bay (also called Puck Lagoon). Puck Lagoon has about 100 km^2, volume about 0.3 km^3, and max. depth 8 m.). Salinity ranges from below 1 PSU close to river mouths up to 7 PSU in the Outer Puck Bay. Therefore freshwater, brackish (and some marine) species occur there together.

The Hel Peninsula is narrow, in some places not wider than 150 meters and about 60 km long. Sandy dunes of various shapes and heights appear almost along the whole of its extension, which is one of important tourist attractions.

Puck Bay is under strong anthropogenic pressure, mainly, due to municipal wastewater discharges, intensive fishery, agricultural run-off, coastal defence and seasonal tourism. This Bay, although at present seriously degraded, it is still the most diverse area in the Polish Baltic coast.



▲Map of the Study site
Westernmost part of the Gulf of Gdansk - Puck Bay

Data

Puck Bay has been one of the most intensively studied area, however, similarly to the Baltic Sea, its biological diversity has never been fully assessed. Some historical data about Puck Bay are available from the beginning of the twentieth century (Lakowitz 1907 and 1929, Demel 1927a and 1927b), and from before and after the World War II (Bursa *et al*. 1939 1947, Demel 1935,Wojtusiak *et al.* 1950). There also are some recent publications (Andrulewicz & Witek 2002, Ciszewski *et al.* 1991, 1992a and 1992b, Kruk-Dowgiałło 1991, 1996, 1998; Kruk-Dowgiałło & Dubrawski 1998; Jażdżewski 1970, 1987, Korzeniewski 1993, Kotwicki 1997, Meissner 1990, Osowiecki 1998 and 2000; Pliński 1982; Pliński & Wiktor 1987; Pliński & Florczyk 1990; Skora 1993, Warzocha and Gostkowska 1996, Węsławski 2005). Summing-up, there is an impressive amount of scientific documentation about Puck Bay, as compare to other Baltic regions, therefore Puck Bay is a good choice for the assessment of biological diversity status.

Regarding reference conditions for the Puck Bay, the authors are of the opinion that status of biological diversity existing in the time period before World War II (or soon after it, up to 1950s) is adequate for the Puck Bay as the reference period. This is the most recent pre-industrial period, and a period before the advent of agriculture supported by artificial fertilizers, pesticides and herbicides. This proposal is supported by other important arguments, such as still "living human memories" of a diverse and productive Puck Bay and a wide body of knowledge already available about this marine area. This assessment is to large extent is also based on "expert judgement", mostly in cases of lack of sufficient data or observations (ref. birds, alien species).

<u>Phytobenthos</u>. Up to 1950s, algae and vascular plants in the Puck Bay, have occurred together and composed underwater meadows that covered almost completely the bottom of its shallow and sheltered parts. The vascular plants included *Zostera marina, Potamogeton pectinatus* and *P. filiformis, Myriophyllum spicatum, Ranunculus baudotii,* and *Zannichellia palustris.* The algae included mostly *Chara baltica, Fucus vsiculosus, Furcellaria lumbricalis* and some more rare algae such as *Tolypella nidific* and *Delesseria sanguinea.* The depths limit was reaching 25 m.

Changes in the phytobenthos have been recorded since the mid 1970s, especially in the Inner Puck Bay. These have included following:

- disappearance of the algae *Fucus vesiculosus* and *Furcellaria lumbricalis* that dominated until the late 1960s
- decreasing size of bottom areas overgrown by *Zostera marina* and *Potamogeton spp*. and declines in their biomass;
- this changes were followed by domination of one group of vegetation, filamentous brown algae *Pilayella littoralis* and *Ectocarpus siliculosus*

The phtobentos meadows that grew on the sandy bottom and that were so common in the shallow parts of the Puck Bay still in the 1960s are now practically extinct. Additionally, the vertical range of occurrence of bottom vegetation in the Gulf of Gdańsk declined significantly - from a depth of 25 m (Lakowitz 1907) to 6 m (Kruk-Dowgiałło 1998).

<u>Macrozoobenthos</u>. The benthic fauna of the Gulf of Gdansk is relatively well documented and published in different scientific documents (as cited above). The first negative changes were observed here in the 1960s and were related to the restructuring of the macrophyte composition in the Bay (Osowiecki 2000).

It is reasonable to assume that continuous process of eutrophication is the primary factor responsible for changes in macrozoobenthos in the Puck Bay. Sediments that were overloaded with organic matter underwent a structural transformation that prompted adaptive changes in the composition of the benthic fauna. They have been replaced by sandy-silt and silt sediments, which create more favourable conditions for the development of deposit feeders that tolerate greater degrees of environmental pollution. The quantitative and qualitative changes that have occurred in the macrozoobenthos during the last decades are significant, but definitely not as spectacular as those that have occurred in the phytobenthos.

<u>Alien species</u>: non-indigenous species appearing in the Puck Bay in 20th century include such species as: *Neogobius melanostomus*, *Mnemiopsis leidyi*, *Boccardia redeki, Cercopagis pengoi, Eriocheir sinensis,* and number of gammarid species (e.g. *Gammarus tigrinus*). Most of these introductions are probably related to ballast water exchange and were likely introduced via ballast water, ballast sediments or hull fouling. Others are result of semi-natural migration of brackishwater species from Pontocaspian basin or marine water exchange with North Sea. An impressive example of invasion is Round Goby *Neogobius melanostomus,* which appeared in the Puck Bay in the 1990s and within a few years succeeded in colonizing this region.

<u>Ichthyofauna</u>: the fish occurring in the Puck Bay include marine, freshwater and diadromous species of commercial importance such as *Platichthys flesus*, *Clupea haregus*, *Salmo salar*, *Anquilla anquilla*, *Stizostedion liciopercas* and *Perca fluviatilis*, and also a number (about 50) of non-commercial fish species. This includes some protected species such as the small goby and sand goby, as well as pest fish such as *Gasterosteus aculeatus* and *Neogobius melatostomus*. Puck Bay provides spawning grounds for many commercial and non-commercial fish species, feeding sites for young stages of commercial fish and habitats

for many small species.

In the first half of the 1960s *Anquilla anquilla* and *Esox lucius* dominated catches in the inner Puck Bay. In the 1970s, *Rutilus rutilus* began to occur on a massive scale (Ciszewski et al. 1992a; Skóra 1993a). Due to the destruction of the natural spawning sites and feeding grounds of freshwater fish and overfishing, the current commercial significance of roach and perch is minimal. Eutrophication and pollution in the inner Puck Bay has resulted in the following:

- the decreased size of underwater meadows has caused diminishing and/or disappearance of spawning grounds of fish species like pike, roach, perch;
- limitations of occurrence of the unique species *Nerophis ophidion*, *Syngnathus typhle*, *Spinachia spinachia* and *Coryphoterus flavescens*;
- the expansion of species from the stickleback and goby families. The biomass of the three-spine stickleback currently stands at nearly 99% of the overall fish biomass in the Puck Bay (Skora 1993).
- Expanding the area of occurrence of the new species such as round goby *Neogobius melanostomus*
- Serious limitations of local populations of *Coregonus lavaretus* and *Vimba vimba*
- Deterioration of quality of spawning grounds due to eutrophication (in coastal areas due to filamentous brown algae development, in the Puck Bay.

Avifauna - Changes in avifauna communities are more probably related to natural dynamics than in other marine components. Some marine birds communities though, showed decrease in the Puck Bay due to the anthropogenic pressure and loss of suitable habitats. These are e.g. knot C*alidris alpina* on the other hand black cormorant an heron populations are on the continuous increase since last years.
Mammals: oss of seals in the Gulf of Gdansk that happened before 1950-ties, is most probably related to climatic changes (lack of favorable ice conditions) and anthropogenic pressure (hunting before the world War II) and lack of suitable habitats (islands) where they could reproduce without being disturbed by man.

Status of Baltic Sea Protected Areas: in spite of serious degradation of its natural amenities, Puck Bay is still one of the most diverse and valuable area and therefore worth protection. Already in 1978, the Gdansk Voivodship has declared the inner part of this Bay (Puck Lagoon) as protected area. In 1993, Puck Lagoon, together with waters around Redlowo Cliff (Redlowo Nature Reserve) were included in HELCOM BSPAs list. Finally, it was officially nominated as BSPA in 2006. Currently, Puck Bay is also Natura 2000 site protected under Habitat's and Bird's Directives..

Application of tool no. 1

Table I: Interim application of tool no. 1. See HELCOM (2006): Development of tools for assessment of

eutrophication in the Baltic Sea (BSEP No. 104) for details.
Available via http://helcom.navigo.fi/stc/files/Publications/Proceedings/bsep104.pdf

Assessment criteria (categories and indicators)		Baseline (RefCon)	Acceptable deviation (%)	Status	Score (+/-)
Category I	**Natural marine landscapes**				
	Indicator				
	Sum for Category I (one out – all out)				
Category II	**Thriving and balanced communities**				
	Indicator				
	Sum for Category II (one out – all out)				
Category III	**Viable polulations of species**				
	Indicator				
	Sum for Category III (one out – all out)				
	Overall classsification				

Application of tool no. 2

Table II: Interim application of tool no. 2. A spread sheet for these calculations can be downloaded via HELCOM's web site. 'Root' could be HD, BSAP, HELCOM recommendation(s), national law, etc. 'Degr.' is + or ÷ indicating a numerically possitive or negative response to a pressure. G/M = acceptable deviation.

Cat.	Indicator	Root	Degr.	RefCon	Status	EQR_I	G/M	Int_stat	EQR_cat	QE_sta	Status
Natural landscapes											
	Indicator 1: BSPA										
	Percentage of the coast in the natural state	HELCOM Rec. 15/1	–	95 %	50 %	0.52	50 %				poor
	Percentage of the coast free of coastal defence measures	HELCOM Rec. 15/...	–	100 %	25 %	0.25	50 %				bad
	Percentage of BSPA area from total area	HEL COM BSPA	–	100 %	30 %	0.30	50 %				poor
Thriving and stable communities											
	Indicator 4: Phytobenthos										
	Depth distribution of phytobenthos	WFD		25 m	6 m	0.24				bad	
	Phytobenthos area coverage	WFD		50 %	5 %	0.10				bad	
	Eelgrass depth limit	WFD		15 m	5 m	0.33	15 %			bad	
	Eelgrass coverage	WFD		50 %	2,5 %	0.05	50 %			bad	
	No. of read algae species	WFD		15	6	0.4	25 %			bad	
	Indicator 5: Zoobenthos										

Benthic quality index	WFD		?	?		50 %			poor	
Indicator 6: Alien species	ICES SGEH					20 %				
% of alien species in macrozoobenthos	ICES SGEH					20 %			poor	
Rate of new introductions	ICES SGEH					10 %			poor	
Species										
Indicator 7: Fish	WFD								bad	
Fish community structure	WFD					50 %			bad	
Total catch of fish	WFD		30 tons	1 tonnes	0.03	50 %			bad	
Eel catches	WFD		15 tons	0.5 tonnes	0.003	50 %			bad	
Pike catches	WFD		5 tons	0.001	0.0002	50 %			bad	
Indicator 8: Birds										
% of edandangered bird species	HEL COM								moderate	
Indicator 9: Mammals										
Population of ringed seal *Phoca hispidia*	ASCO BANS					50 %			bad	
Supporting features										
Indicator 10										
Indicator 11										
Indicator 12										
FINAL ASSESSMENT										Bad

Discussion and conclusions

The Puck Bay biodiversity status has been assessed as „bad“, as compare to the reference period from 1950’s. More than 75% of the underwater meadows have disappeared including some loss of species, e.g. *Fucus vesiculosus* and *Furcellaria lumbicalis.* Diminished depth range of vascular plants (from 25 to 6 m). Fish landings have diminished by more than 75% including local loss of several fish species.

However, in spite of serious degradation of biodiversity, the Puck Bay is still the most valuable part of the Gulf of Gdansk and therefore some selected sites has been designed as HELCOM BSPAs, Biodiversity Flag Areas and/or NATURA 2000 areas.

To improve biological diversity of the Puck Bay anthropogenic pressure should be reduced, particularly nutrient and contaminant loads, overexploitation of fish, coastal defence measures and seasonal tourist activities. In some cases reintroduction of lost species should be undertaken, particularly reintroduction of vascular plants and macroalgae (e.g. *Zostera marina, Fucus vesiculosus, Furcellaria lumbricalis*); restoring spawning grounds and reintroducing selected commercial fish species is necessary. Coastal defense measures along protected areas should be restricted (or stopped) to allow to preserve natural coastal dynamics. Marine areas along the Redlowo/Orlowo cliff should be adopted by Polish authorities as BSPA (as it has been declared by Poland in 1995, HELCOM Rec. 15/5).

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Annexes

Water Framework Directive	High	Good	Mode-rate	Poor	Bad
Biodiversity status:	5	4	3	2	1

Expressions of ecological status /biodiversity status according to WFD

BEAT

A tool for biodiversity assessment and confidence rating

Station/water body:	Puck Bay (PL)														
Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
Coastline (% of coast without buildings or construct	95,00	% coastline	-	1 2 3	50%	1 2 3	50,00	1 2 3	0,526		20%				
Coastline (% of coast free of coastal defence)	100,00	% coastline	-	1 2 3	50%	1 2 3	25,00	1 2 3	0,250		20%				
Protected areas (% of area protected as BSPA)	100,00	% total area	-	1 2 3	50%	1 2 3	30,00	1 2 3	0,300		20%				
Macrophytes (algae areal coverage)	50,00	% total area	-	1 2 3	50%	1 2 3	5,00	1 2 3	0,100		20%				
Macrophytes (Eelgrass coverage)	50,00	% total area	-	1 2 3	50%	1 2 3	2,50	1 2 3	0,050		20%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,245	POOR		33%
Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Macrophytes (algae depth distribution)	25,00	m	-	1 2 3	15%	1 2 3	6,00	1 2 3	0,240		25%				
Macrophytes (Eelgrass depth limit)	15,00	m	-	1 2 3	15%	1 2 3	5,00	1 2 3	0,333		25%				
Macrophytes (number of red algae species)	15,00	N species	-	1 2 3	25%	1 2 3	6,00	1 2 3	0,400		25%				
Fish (total catch)	30000,00	kg	-	1 2 3	50%	1 2 3	1000,00	1 2 3	0,033		25%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,252	BAD		33%
Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Eel (Anguilla anguilla) catch	15000,00	kg	-	1 2 3	50%	1 2 3	500,00	1 2 3	0,033		33%				
Pike (Esox lucius) catch	5000,00	kg	-	1 2 3	50%	1 2 3	1,00	1 2 3	0,000		67%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,011	BAD		33%
Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Indicator 12				1 2 3		1 2 3		1 2 3			xx				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%				xx
															100%

IMPORT data from XML

EXPORT data to XML

Final biodiversity status: **BAD**

Final confidence rating:

version 20081010

14. Fehmarn Belt

Authors
Rolf Karez, Thorkild Petenati, Hans-Christian Reimers, Joachim Voss

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Introduction

In Germany, during the last years reference conditions and classification tools have been developed for coastal waters to meet the needs of the EU Water Framework Directive (WFD). At the same time, the coastal montoring on ecological elements (Phytoplankton, Macrophytes, Macrozoobenthos) was revised and intensified in coastal near areas. Baseline studies for the marine monitoring of the Habitat Directive are still under way, reference and assessment systems are in preparation.Thus, this BIO assessment is based mainly on the knowledge gained by the WFD work.

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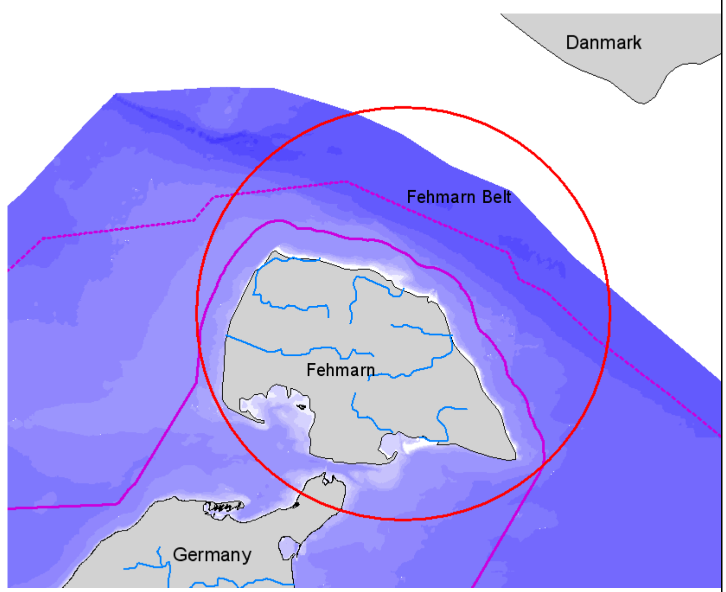
Study site

This water body is situated off thewestern, northern and eastern coasts of the island of Fehmarn at the Fehmarn Beltand has a size of 68,7 km². It belongs to the national type B3"Mesohaline, fully mixed, open coastal waters". The depth maximum is 15 m and the mixing of water is good. In the western part, coarse sand is mixed with stones, gravel and clay, in the northern part sand dominates and in the eastern parts hard substrata.The coast of this water body is (on a " Baltic scale"…) exposed to moderately exposed.

The dominant anthropogenic pressure is nutrient load and partly loss of suitable substrata due to stone fishing in the 50s and 60s.



▲Map of study site

Centre of water body: 54,5236 N; 11,1786 E

Data for seegras, macroalgaeand nutrients (N=9) are derived from the test monitoring in 2007 to fine-tune the WFD assessment tools. Macrozoobenthos data (2001-2007) are from 17 samples and calculated with the classification tool MarBIT. Chlorophyll data are summer means (May-Sept. 2006-07, 5 samples).

Application of tool no. 1

Table I: Interim application of tool no. 1. See HELCOM (2006): Development of tools for assessment of eutrophication in the Baltic Sea (BSEP No. 104) for details.
Available via http://helcom.navigo.fi/stc/files/Publications/Proceedings/bsep104.pdf

Assessment criteria (categories and indicators)		Baseline (RefCon)	Acceptable deviation (%)	Status	Score (+/-)
Category I	Natural marine landscapes				
	Indicator				
	Sum for Category I (one out – all out)				
Category II	Thriving and balanced communities				
	Indicator				
	Sum for Category II (one out – all out)				
Category III	Viable polulations of species				
	Indicator				
	Sum for Category III (one out – all out)				
	Overall classsification				

Application of tool no. 2

Table II: Interim application of tool no. 2. A spread sheet for these calculations can be downloaded via HELCOM's web site. 'Root' could be HD, BSAP, HELCOM recommendation(s), national law, etc. 'Degr.' is + or ÷ indicating a numerically possitive or negative response to a pressure. G/M = acceptable deviation.

Cat.	Indicator	Root	Degr.	RefCon	Status	EQR_I	G/M	Int_stat	EQR_cat	QE_sta	Status
Natural landscapes											
	Indicator 1										
	Indicator 2										
	Indicator 3										
Thriving and stable communities											
	max depth of dense Zostera marina	WFD	-	>=8 m	4,8 m		>= 7 m (12,5%)				
	opportunists in Zostera beds	WFD	+	<= 1%	1 %		<= 10% (Not allowed as 50%+)				
	Fucus max depth	WFD	-	>=8 m	5,4 m		>= 7 m (12,5 %)				
	Fucus cover	WFD	-	>= 75 %	19 %		>= 50% (33%)				
	opportunists on hard substratum	WFD	+	<= 1%	10 %		<= 10% (Not allowed as				

							50%+)				
	occurrence of important perennial species (max number = ref)	WFD	-	>=9 of 10 spec.	8 spec.		>= 7 spec (22%)				
	biomass of Furcellaria	WFD	-	>= 30 %	26 %		>= 20% (33%)				
Species											
	Macrozoobenthos	WFD	-	1,00	0,566		40%				
	Indicator 8										
	Indicator 9										
Supporting features											
	hard substratum cover	WFD	-	>= 30%	15%		<= 20% (33%)				
	Total nitrogen	WFD	+	0,13 – 0,17	0,3		>50%				
	Total phosphorus	WFD	+	0,012 – 0,019	0,026		>50%				
	Chlorophyll a	WFD	+	1,2	1,8		58% (not allowed 50%+)				
FINAL ASSESSMENT											

XX: High status can just be given as “more than” or “less than”. Since we do not know how you prefer to calculate AcDev from that, we give for angiosperm/macroalge the border between G/M, but not deviation percentages!!!

Discussion and conclusions

Macrophyte metrics spread from moderate to very good, the current integrated classification is moderate for this biological quality element, since the moderate assessed metrics dominate. The EQR for macrozoobenthos shows moderate ecological quality, whereas the condition of phytoplankton (Chl-a) is good .

Reference

Schories et al. 2006+Fürhaupter et al. 2008 (both reports (in German) developed the German system for outer Baltic coastal waters. Thorsten Berg (Meyer, Berg & Fürhaupter, 2007) developed the MarBIT classification system.

Annexes

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BEAT

A tool for biodiversity assessment and confidence rating

Station/water body:	Fehmarn Belt

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
Hard substratum (% coverage)	30,00		-	1 2 3	20%	1 2 3	15,00	1 2 3	0,500		50%				
Macrophytes (Fucus cover % of area)	80,00	%	-	1 2 3	33%	1 2 3	19,00	1 2 3	0,238		50%				
Add new indicator ...				1 2 3		1 2 3		1 2 3							
											100%	0,369	BAD		33%

Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Macrophytes (max depth of dense Zostera marina)	9,40	m	-	1 2 3	15%	1 2 3	4,80	1 2 3	0,511	12%				
Macrophytes (opportunist species in Zostera beds)	1,00	%	+	1 2 3	50%	1 2 3	1,00	1 2 3	1,000	12%				
Macrophytes (Fucus max depth)	9,40	m	-	1 2 3	15%	1 2 3	5,40	1 2 3	0,574	12%				
Macrophytes (Opportunist algae on hard surface)	1,00	%	+	1 2 3	50%	1 2 3	10,00	1 2 3	0,100	12%				
Macrophytes (N key perennial species)	10,00	N species	-	1 2 3	22%	1 2 3	8,00	1 2 3	0,800	12%				
Macrophytes (Furcellaria biomass)	40,00	%	-	1 2 3	33%	1 2 3	26,00	1 2 3	0,650	12%				
Zoobenthos (index)	1,00		-	1 2 3	40%	1 2 3	0,57	1 2 3	0,566	12%				
Phytoplankton (Chlorophyll a)	1,20		+	1 2 3	50%	1 2 3	1,80	1 2 3	0,667	16%				
Add new indicator ...				1 2 3		1 2 3		1 2 3						
										100%	0,611	MODERATE		33%

Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3		100%				
Add new indicator ...				1 2 3		1 2 3		1 2 3						
										100%				xx

Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Nutrients (TN)	0,15		+	1 2 3	50%	1 2 3	0,30	1 2 3	0,500	25%				
Nutrients (TP)	0,16	x10	+	1 2 3	50%	1 2 3	0,26	1 2 3	0,596	25%				
Add new indicator ...				1 2 3		1 2 3		1 2 3						
										100%	0,274	MODERATE		33%
														100%

IMPORT data from XML

EXPORT data to XML

Final biodiversity status: **BAD**

Final confidence rating:

version 20081010

15. Neustadt Bay (Lübeck Bight)

Authors

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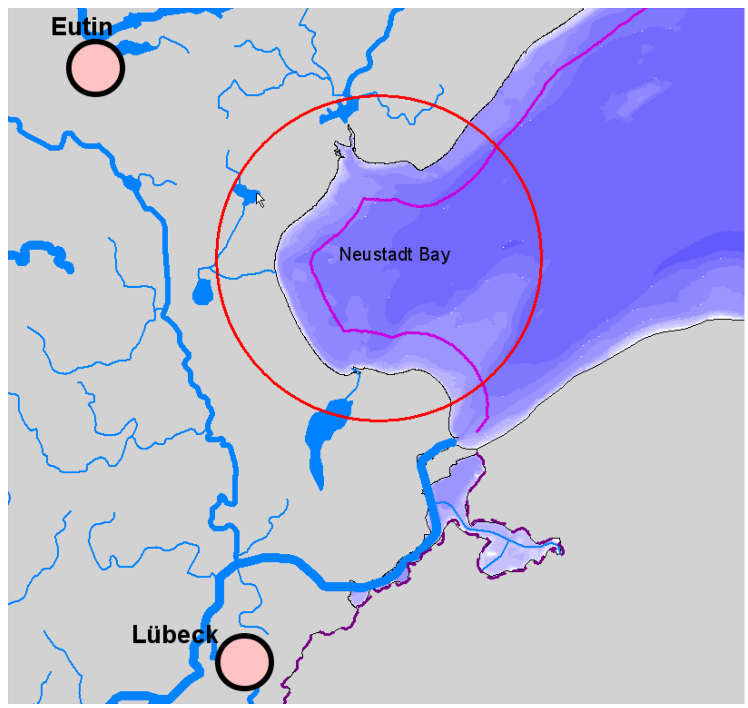
Introduction

In Germany, during the last years reference conditions and classification tools have been developed for coastal waters to meet the needs of the EU Water Framework Directive (WFD). At the same time, the coastal montoring on ecological elements (Phytoplankton, Macrophytes, Macrozoobenthos) was revised and intensified in coastal near areas. Baseline studies for the marine monitoring of the Habitat Directive are still under way, reference and assessment systems are in preparation. Thus, this BIO assessment is based mainly on the knowledge gained by the WFD work.

Study site

This water body is situated at the southwestern part of Lübeck Bight and has a size of 45,6 km². It belongs to the national type B3"Mesohaline, fully mixed, open coastal waters". The depth maximum is 15 m and the mixing of water is good. The water body is dominated by sandy and gravel areas, but there are several sites with natural hard substrata (boulders, clay). There are exposed as well as sheltered sites in this water body.

The dominant anthropogenic pressure is nutrient load and partly loss of suitable substrata due to stone fishing in the 50s and 60s. One major nutrient source is the Trave River, the biggest river of Schleswig-Holstein flowing into the Baltic. The annual load (2000-2006) is about 1392 t of Nitrogen and 35 t of Phosphate. Regular summer hypoxia in the adjacent deeper and stratified parts of Neustadt Bay effects occasionally the bottom invertebrates during upwelling events.



▲Map of study site

Centre of water body: 54,0047 N; 10,8325 E

Data

Data for seegras and macroalgae and nutrients (N=9) are derived from the test monitoring in 2007 to fine-tune the WFD assessment tools. Macrozoobenthos data (2001-2007) are from 54 samples and calculated with the classification tool MarBIT. Chlorophyll data are summer means (May-Sept. 2006-07, 6 samples).

Application of tool no. 1

Table I: Interim application of tool no. 1. See HELCOM (2006): Development of tools for assessment of eutrophication in the Baltic Sea (BSEP No. 104) for details.
Available via http://helcom.navigo.fi/stc/files/Publications/Proceedings/bsep104.pdf

Assessment criteria (categories and indicators)		Baseline (RefCon)	Acceptable deviation (%)	Status	Score (+/-)	
Category I	Natural marine landscapes					
	Indicator					
	Sum for Category I (one out – all out)					
Category II	Thriving and balanced communities					
	Indicator					
	Sum for Category II (one out – all out)					
Category III	Viable polulations of species					
	Indicator					
	Sum for Category III (one out – all out)					
	Overall classsification					

Application of tool no. 2

Table II: Interim application of tool no. 2. A spread sheet for these calculations can be downloaded via HELCOM's web site. 'Root' could be HD, BSAP, HELCOM recommendation(s), national law, etc. 'Degr.' is + or ÷ indicating a numerically possitive or negative response to a pressure. G/M = acceptable deviation.

Cat.	Indicator	Root	Degr.	RefCon	Status	EQR_I	G/M	Int_stat	EQR_cat		QE_sta	Statu
Natural landscapes												
	none											
Thriving and stable communities												
	max depth of dense Zostera marina	WFD	-	>=8 m	4,2 m		>= 7 m (12,5%)					
	opportunists in Zostera beds	WFD	+	<= 1%	15 %		<= 10% (50%+)					
	Fucus max depth	WFD	-	>=8 m	0 m		>= 7 m (12,5%)					
	Fucus cover	WFD	-	>= 75 %	0 %		>= 50% (33%)					
	opportunists on hard substratum	WFD	+	<= 1%	100 %		<= 10% (50%+)					
	occurrence of important perennial species (max number = ref)	WFD	-	>=9 of 10 spec.	2 spec.		>= 7 spec (22%)					
	biomass of Furcellaria	WFD	-	>= 30 %	1 %		>= 20% (33%)					
Species												
	Macrozoobenthos	WFD	-	1,00	0,548		40%					
	Indicator 8											
	Indicator 9											
Supporting features												
	hard substratum cover	WFD	-	>= 30%	20%		<= 20% (33%)					
	Total nitrogen	WFD	+	0,13 – 0,17	0,33		>50%					
	Total phosphorus	WFD	+	0,012 – 0,019	0,027		>50%					
	Chlorophyll a	WFD	+	1,2	2,1		58% (50%+)					
FINAL ASSESSMENT												

XX: High status can just be given as “more than” or “less than”. Since we do not know how you prefer to calculate AcDev from that, we give for angiosperm/macroalge the border between G/M, but not deviation percentages!!!

Discussion and conclusions

Macrophyte metrics spread from bad to moderate, the current integrated classification is poor for this biological quality element. The EQR for macrozoobenthos and phytoplankton (Chl-a) shows moderate ecological quality.

Reference

Schories et al. 2006+Fürhaupter et al. 2008 (both reports (in German) developed the German system for outer Baltic coastal waters. Thorsten Berg (Meyer, Berg & Fürhaupter, 2007) developed the MarBIT classification system.

Annexes

-

BEAT

A tool for biodiversity assessment and confidence rating

Station/water body: Lubeck Bight

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
Macrophytes (Fucus cover)	80,00	%	-	1 2 3	33%	1 2 3	0,00	1 2 3	0,000		50%				
Hard substratum (% coverage)	30,00		-	1 2 3	33%	1 2 3	20,00	1 2 3	0,667		50%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,333	BAD		33%
Communities	**RefCon**	**Unit**	**Resp.**	**RefCon_score**	**AcDev**	**AcDev_score**	**Status**	**Status_score**	**EQR**		**Weight**	**QE_EQR**	**QE status**	**QE_Conf**	**Weight**
Macrophytes (max depth dense Zostera marine)	9,40	m	-	1 2 3	15%	1 2 3	4,20	1 2 3	0,447		13%				
Macrophytes (opportunists in Zostera beds)	1,00	%	+	1 2 3	50%	1 2 3	15,00	1 2 3	0,067		13%				
Macrophytes (Fucus max depth)	9,40	m	-	1 2 3	15%	1 2 3	0,00	1 2 3	0,000		13%				
Macrophytes (opportunist algae on hard substrates	1,00	%	+	1 2 3	50%	1 2 3	100,00	1 2 3	0,010		13%				
Macrophytes (occurrence of key perennial species)	10,00	N species	-	1 2 3	22%	1 2 3	3,00	1 2 3	0,300		13%				
Macrophytes (Furcellaria biomass of total)	40,00	%	-	1 2 3	33%	1 2 3	1,00	1 2 3	0,025		13%				
Zoobenthos (MarBIT index)	1,00		-	1 2 3	40%	1 2 3	0,55	1 2 3	0,548		13%				
Phytoplankton (Chlorophyll a)	1,20		+	1 2 3	50%	1 2 3	2,10	1 2 3	0,571		9%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,233	BAD		33%
Species	**RefCon**	**Unit**	**Resp.**	**RefCon_score**	**AcDev**	**AcDev_score**	**Status**	**Status_score**	**EQR**		**Weight**	**QE_EQR**	**QE status**	**QE_Conf**	**Weight**
No indicators				1 2 3		1 2 3		1 2 3			100%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%				xx
Supporting Indicators	**RefCon**	**Unit**	**Resp.**	**RefCon_score**	**AcDev**	**AcDev_score**	**Status**	**Status_score**	**EQR**		**Weight**	**QE_EQR**	**QE status**	**QE_Conf**	**Weight**
Nutrients (TN)	0,15		+	1 2 3	50%	1 2 3	0,33	1 2 3	0,455		50%				
Nutrients (TP)	0,16	x10	+	1 2 3	50%	1 2 3	0,27	1 2 3	0,593		50%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,524	POOR		33%
															100%

IMPORT data from XML

EXPORT data to XML

version 20081010

Final biodiversity status: BAD

Final confidence rating:

16. Bülk (Southwestern Kiel Bight)

Authors

Rolf Karez, Thorkild Petenati, Hans-Christian Reimers, Joachim Voss

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Introduction

In Germany, during the last years reference conditions and classification tools have been developed for coastal waters to meet the needs of the EU Water Framework Directive (WFD). At the same time, the coastal montoring on ecological elements (Phytoplankton, Macrophytes, Macrozoobenthos) was revised and intensified in coastal near areas. Baseline studies for the marine monitoring of the Habitat Directive are still under way, reference and assessment systems are in preparation.Thus, this BIO assessment is based mainly on the knowledge gained by the WFD work.

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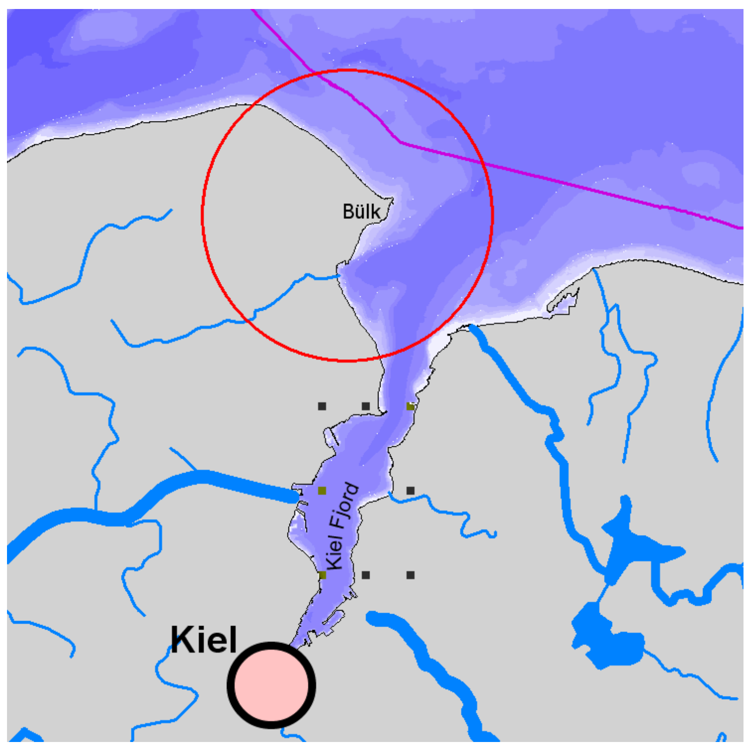
Study site

This water body is situated at the northwestern part of outer Kiel Fjord and has a size of 14,5 km². It belongs to the national type B3"Mesohaline, fully mixed, open coastal waters". The depth maximum is 15 m and the mixing of water is good. The water body is dominated by sandy and gravel areas, but there are several sites with natural hard substrata (boulders, clay). There are moderately exposed to sheltered sites in this water body.

The dominant anthropogenic pressure is nutrient load and partly loss of suitable substrata due to stone fishing in the 50s and 60s. One major nutrient source is inner Kiel Fjord, where the second biggest river of Schleswig-Holstein flows into the Baltic. The annual load (2000-2006) is about 408 t of Nitrogen and 20 t of Phosphate. At Bülk is the modernised Kiel sewage treatment plant with N and P elimination.



▲Map of study site
Centre of water body: 54,4485 N; 10,2003 E

Data

Data for seagras and macroalgae and nutrients (N=19) are derived from the test monitoring in 2007 to fine-tune the WFD assessment tools. Macrozoobenthos data (2001-2007) are from 23 samples and calculated with the classification tool MarBIT. Chlorophyll data are summer means (May-Sept. 2000-07, 42 samples).

Application of tool no. 1

Table I: Interim application of tool no. 1. See HELCOM (2006): Development of tools for assessment of eutrophication in the Baltic Sea (BSEP No. 104) for details.
Available via http://helcom.navigo.fi/stc/files/Publications/Proceedings/bsep104.pdf

Assessment criteria (categories and indicators)		Baseline (RefCon)	Acceptable deviation (%)	Status	Score (+/-)	
Category I	Natural marine landscapes					
	Indicator 1					
	Sum for Category I (one out – all out)					
Category II	Thriving and balanced communities					
	Indicator 4					
	Sum for Category II (one out – all out)					
Category III	Viable polulations of species					
	Indicator 7					
	Sum for Category III (one out – all out)					
	Overall classsification					

Application of tool no. 2

Table II: Interim application of tool no. 2. A spread sheet for these calculations can be downloaded via HELCOM's web site. 'Root' could be HD, BSAP, HELCOM recommendation(s), national law, etc. 'Degr.' is + or ÷ indicating a numerically possitive or negative response to a pressure. G/M = acceptable deviation.

Cat.	Indicator	Root	Degr.	RefCon	Status	EQR_I	G/M	Int_stat	EQR_cat	QE_sta	Status
Natural landscapes											
	none										
Thriving and stable communities											
	max depth of dense Zostera marina	WFD	-	>=8 m	4,0 m		>= 7 m (12,5%)				
	opportunists in Zostera beds	WFD	+	<= 1%	0 %		<= 10% (50%+)				
	Fucus max depth	WFD	-	>=8 m	3,6 m		>= 7 m (12,5%)				
	Fucus cover	WFD	-	>= 75 %	86 %		>= 50% (33%)				
	opportunists on hard substratum	WFD	+	<= 1%	2 %		<= 10% (50%+)				
	occurrence of important perennial species (max number = ref)	WFD	-	>=9 of 10 spec.	6 spec.		>= 7 spec (22%)				
	biomass of Furcellaria	WFD	-	>= 30 %	1 %		>= 20% (33%)				
Species											
	Macrozoobenthos	WFD	-	1,00	0,710		40%				
	Indicator 8										
	Indicator 9										
Supporting features											
	hard substratum cover	WFD	-	>= 30%	< 15%		<= 20% (33%)				
	Chlorophyll a	WFD	+	1,2	2,4		58% (50%+)				
	Total nitrogen	WFD	+	0,13 – 0,17	0,28		>50%				
	Total phosphorus	WFD	+	0,012 – 0,019	0,024		>50%				
FINAL ASSESSMENT											

XX: High status can just be given as “more than” or “less than”. Since we do not know how you prefer to calculate AcDev from that, we give for angiosperm/macroalge the border between G/M, but not deviation percentages!!!

Discussion and conclusions

Macrophyte metrics spread from poor to very good, the current integrated classification is poor for this biological quality element. The EQR for macrozoobenthos shows good ecological quality, whereas the condition of phytoplankton (Chl-a)is moderate .

Reference

Schories et al. 2006+Fürhaupter et al. 2008 (both reports (in German) developed the German system for outer Baltic coastal waters. Thorsten Berg (Meyer, Berg & Fürhaupter, 2007) developed the MarBIT classification system.

Annexes

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BEAT

A tool for biodiversity assessment and confidence rating

Station/water body: Bülk (outer Kiel Fjord)

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
Macrophytes (Fucus cover)	80,00	%	-	1 2 3	33%	1 2 3	86,00	1 2 3	1,000		50%				
Hard substratum (cover)	30,00		-	1 2 3	33%	1 2 3	15,00	1 2 3	0,500		50%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,750	GOOD		33%

Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Macrophytes (max depth dense Zostera marina)	9,40	m	-	1 2 3	15%	1 2 3	4,00	1 2 3	0,426	13%				
Macrophytes (opportunists in Zostera beds)	1,00	%	+	1 2 3	50%	1 2 3	1,00	1 2 3	1,000	13%				
Macrophytes (Fucus max depth)	9,40	m	-	1 2 3	15%	1 2 3	3,60	1 2 3	0,383	13%				
Macrophytes (opportunists on hard substrates)	1,00	%	+	1 2 3	50%	1 2 3	2,00	1 2 3	0,500	13%				
Macrophytes (occurrence of key perennial species)	10,00	N species	-	1 2 3	22%	1 2 3	6,00	1 2 3	0,600	13%				
Macrophytes (Furcellaria biomass of total)	40,00	%	-	1 2 3	15%	1 2 3	1,00	1 2 3	0,025	13%				
Phytoplankton (Chlorophyll a)	1,20		+	1 2 3	50%	1 2 3	2,40	1 2 3	0,500	13%				
Zoobenthos (MarBIT index)	1,00		-	1 2 3	40%	1 2 3	0,71	1 2 3	0,710	9%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%	0,510	BAD		33%

Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3		100%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%				xx

Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Nutrients (TN)	0,15		+	1 2 3	50%	1 2 3	0,28	1 2 3	0,536	50%				
Nutrients (TP)	0,16	x10	+	1 2 3	50%	1 2 3	0,24	1 2 3	0,667	50%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%	0,601	MODERATE		33%
														100%

IMPORT data from XML

EXPORT data to XML

Final biodiversity status: **BAD**

Final confidence rating:

version 20081010

17. *Gelting Bight (outer Flensburg Fjord, northwestern Kiel Bight)*

Authors

Rolf Karez, Thorkild Petenati, Hans-Christian Reimers, Joachim Voss

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Introduction

In Germany, during the last years reference conditions and classification tools have been developed for coastal waters to meet the needs of the EU Water Framework Directive (WFD). At the same time, the coastal montoring on ecological elements (Phytoplankton, Macrophytes, Macrozoobenthos) was revised and intensified in coastal near areas. Baseline studies for the marine monitoring of the Habitat Directive are still under way, reference and assessment systems are in preparation.Thus, this BIO assessment is based mainly on the knowledge gained by the WFD work.

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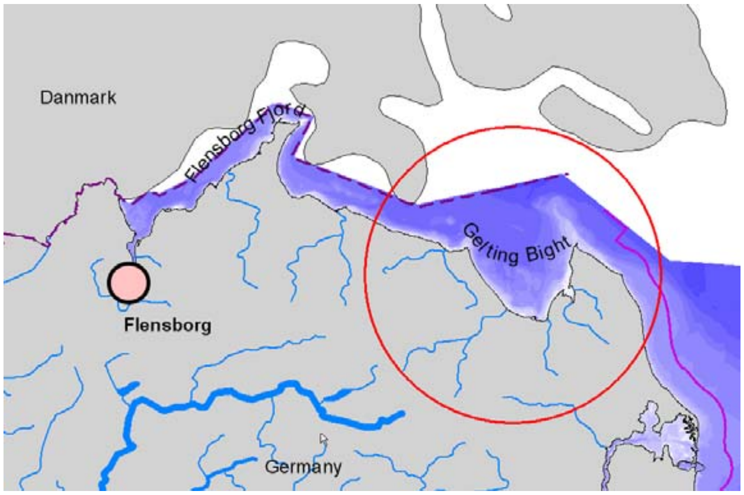
Study site

This water body is situated at the northwestern part of Kiel Bight and the outer part of Flenburg Fjord and has a size of 43,7 km². It belongs to the national type B3"Mesohaline, fully mixed, open coastal waters". The depth maximum is 15 m and the mixing of water is good. The waterbody Gelting Bight is characterized by sandy bottoms partly with high proportions of mud, grave and stones. Hard substrata such as stones are rare. The waterbody is moderately exposed, inner parts are sheltered.

The dominant anthropogenic pressure is nutrient load and partly loss of suitable substrata due to stone fishing in the 50s and 60s.



▲Map of study site

Centre of water body: 54,7940 N; 9,7996 E

Data

Data for seegras, macroalgae and nutrients (N=10) are derived from the test monitoring in 2007 to fine-tune the WFD assessment tools. Macrozoobenthos data (2001-2007) are from 80 samples and calculated with the classification tool MarBIT. Chlorophyll data are summer means (May-Sept. 2000-07, 34 samples).

Application of tool no. 1

Table I: Interim application of tool no. 1. See HELCOM (2006): Development of tools for assessment of eutrophication in the Baltic Sea (BSEP No. 104) for details.
Available via http://helcom.navigo.fi/stc/files/Publications/Proceedings/bsep104.pdf

Assessment criteria (categories and indicators)		Baseline (RefCon)	Acceptable deviation (%)	Status	Score (+/-)	
Category I	Natural marine landscapes					
	Indicator					
	Sum for Category I (one out – all out)					
Category II	Thriving and balanced communities					
	Indicator					
	Sum for Category II (one out – all out)					
Category III	Viable polulations of species					
	Indicator					
	Sum for Category III (one out – all out)					
	Overall classsification					

Application of tool no. 2

Please apply tool no. 2 by using the data described above.Please comment the principles and the tool.

Table II: Interim application of tool no. 2. A spread sheet for these calculations can be downloaded via HELCOM's web site. 'Root' could be HD, BSAP, HELCOM recommendation(s), national law, etc. 'Degr.' is + or ÷ indicating a numerically possitive or negative response to a pressure. G/M = acceptable deviation.

Cat.	Indicator	Root	Degr.	RefCon	Status	EQR_I	G/M	Int_stat	EQR_cat	QE_sta	Status
Natural landscapes											
	none										
Thriving and stable communities											
	max depth of dense Zostera marina	WFD	-	>=8 m	4,6 m		>= 7 m (12,5%)				
	opportunists in Zostera beds	WFD	+	<= 1%	16 %		<= 10% (Not allowed as 50%+)				
	Fucus max depth	WFD	-	>=8 m	0 m		>= 7 m (12,5%)				
	Fucus cover	WFD	-	>= 75 %	0 %		>= 50% (33%)				
	opportunists on hard substratum	WFD	+	<= 1%	11 %		<= 10% (Not allowed as 50%+)				
	occurrence of important perennial species (max number = ref)	WFD	-	>=9 of 10 spec.	4 spec.		>= 7 spec (22%)				
	biomass of Furcellaria	WFD	-	>= 30 %	1 %		>= 20% (33%)				
Species											
	Macrozoobenthos	WFD	-	1,00	0,606		40%				
Supporting features											
	hard substratum cover	WFD	-	>= 30%	< 15%		<= 20% (33%)				
	Total nitrogen	WFD	+	0,13 – 0,17	0,28		>50%				
	Total phosphorus	WFD	+	0,012 – 0,019	0,028		>50%				
	Chlorophyll a	WFD	+	1,2	2,5		58% (Not allowed as 50%+)				
FINAL ASSESSMENT											

XX: High status can just be given as “more than” or “less than”. Since we do not know how you prefer to calculate AcDev from that, we give for angiosperm/macroalge the border between G/M, but not deviation percentages!!!

Discussion and conclusions

Macrophyte metrics spread from bad to good, the current integrated classification is moderate for this biological quality element. The EQR for macrozoobenthos shows good ecological quality, whereas the condition of phytoplankton (Chl-a)is moderate .

Reference

Schories et al. 2006+Fürhaupter et al. 2008 (both reports in German that developed the German system for outer Baltic coastal waters. Thorsten Berg (Meyer, Berg & Fürhaupter, 2007) developed the MarBIT classification system.

Annexes

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BEAT

A tool for biodiversity assessment and confidence rating

Station/water body: Geltinger Bight

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
Hard substratum (cover)	30,00		-	1 2 3	33%	1 2 3	15,00	1 2 3	0,500		50%				
Macrophytes (Fucus cover)	80,00	%	-	1 2 3	33%	1 2 3	0,00	1 2 3	0,000		50%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,250	BAD		33%

Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Macrophytes (dense Zostera marine max depth)	9,40	m	-	1 2 3	15%	1 2 3	4,60	1 2 3	0,489	13%				
Macrophytes (opportunists in Zostera beds)	1,00	%	+	1 2 3	50%	1 2 3	16,00	1 2 3	0,063	13%				
Macrophytes (Fucus max depth)	9,40	m	-	1 2 3	15%	1 2 3	0,00	1 2 3	0,000	13%				
Macrophytes (opportunists on hard substrates)	1,00	%	+	1 2 3	50%	1 2 3	17,00	1 2 3	0,059	13%				
Macrophytes (occurrence of key perennial species)	10,00	N species	-	1 2 3	22%	1 2 3	6,00	1 2 3	0,600	13%				
Macrophytes (Furcellaria biomass of total)	40,00	%	-	1 2 3	33%	1 2 3	1,00	1 2 3	0,025	13%				
Phytoplankton (Chlorophyll a)	1,20		+	1 2 3	50%	1 2 3	2,50	1 2 3	0,480	13%				
Zoobenthos (MarBIT index)	1,00		-	1 2 3	40%	1 2 3	0,61	1 2 3	0,606	9%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%	0,278	BAD		33%

Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3		100%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%				xx

Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Weight	QE_EQR	QE status	QE_Conf	Weight
Nutrients (TN)	0,15		+	1 2 3	50%	1 2 3	0,28	1 2 3	0,536	50%				
Nutrients (TP)	0,16	x10	+	1 2 3	50%	1 2 3	0,28	1 2 3	0,571	50%				
Add new indicator …				1 2 3		1 2 3		1 2 3						
										100%	0,554	MODERATE		33%
														100%

IMPORT data from XML

EXPORT data to XML

Final biodiversity status: **BAD**

Final confidence rating:

version 20081010

BEAT

A tool for biodiversity assessment and confidence rating

Station/water body: Odense Fjord, inner and outer parts

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
Macrophytes (Eelgrass coverage, whole system)	26,48	km2	-	1 **2** 3	50%	1 2 **3**	1,25	1 **2** 3	0,047	33 %	50%				
Wetlands (perimeter, whole system)	21,31	km2	-	1 **2** 3	50%	1 2 **3**	3,87	1 **2** 3	0,182	33 %	50%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,114	POOR	33 %	33%

Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Phytoplankton (Primary production, outer parts)	117,00		+	**1** 2 3	50%	1 **2** 3	226,00	**1** 2 3	0,518	83 %	20%				
Macrophytes (algae biomass, inner parts)	9,00		+	**1** 2 3	50%	1 **2** 3	42,00	**1** 2 3	0,214	83 %	20%				
Macrophytes (Eelgrass depth limit, outer parts)	6,00		-	1 2 3	25%	1 2 3	2,50	1 2 3	0,417		20%				
Phytoplankton (Chlorophyll-a, inner parts)	1,70		+	1 2 3	25%	1 2 3	4,20	1 2 3	0,405		20%				
Phytoplankton (Chlorophyll-a, outer parts)	3,10		+	1 2 3	25%	1 2 3	5,70	1 2 3	0,544		20%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,419	BAD		33%

Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 **2** 3		**1** 2 3		**1** 2 3		83 %	100%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%			63 %	xx

Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Nutrients (DIN annual, outer parts)	7,90		+	**1** 2 3	50%	1 **2** 3	31,40	**1** 2 3	0,252	83 %	14%				
Nutrients (TP annual, outer parts)	0,31		+	**1** 2 3	50%	1 **2** 3	1,51	**1** 2 3	0,205	83 %	14%				
Nutrients (DIP annual, outer parts)	0,32		+	**1** 2 3	50%	1 **2** 3	0,77	**1** 2 3	0,416	83 %	14%				
Nutrients (DIN annual, inner parts)	24,30		+	**1** 2 3	50%	1 **2** 3	85,00	**1** 2 3	0,286	83 %	14%				
Nutrients (TP annual, inner parts)	0,81		+	**1** 2 3	50%	1 **2** 3	3,31	**1** 2 3	0,245	83 %	14%				
Nutrients (DIP annual, inner parts)	0,32		+	**1** 2 3	50%	1 **2** 3	1,78	**1** 2 3	0,180	83 %	14%				
Nutrients (TN annual, inner parts)	47,50		+	**1** 2 3	50%	1 **2** 3	126,00	**1** 2 3	0,377	83 %	16%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,282	BAD	83 %	33%
															100%

IMPORT data from XML

EXPORT data to XML

Final biodiversity status: **BAD**

59,72 % Final confidence rating: **Class II**

version 20081010

BEAT

A tool for biodiversity assessment and confidence rating

Station/water body:	Limfjorden

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3			100%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%				xx

Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Zoobenthos (Biomass, filter feeders, Løgstør)	40,20	gC/m2	+	1 2 3	50%	1 2 3	191,60	1 2 3	0,210	67 %	5%				
Zoobenthos (Biomass, detrivores, Løgstør)	26,90	gC/m2	-	1 2 3	25%	1 2 3	6,80	1 2 3	0,253	67 %	5%				
Zoobenthos (Biomass, filter feeders, Thisted)	19,50	gC/m2	+	1 2 3	50%	1 2 3	52,80	1 2 3	0,369	67 %	5%				
Zoobenthos (Biomass, detrivores, Thisted)	18,30	gC/m2	-	1 2 3	25%	1 2 3	5,50	1 2 3	0,301	67 %	5%				
Zoobenthos (Benthic fauna, DKI, Løgstør)	1,00		-	1 2 3	50%	1 2 3	0,34	1 2 3	0,341	83 %	23%				
Zoobenthos (Biomass, filter feeders, southern parts	12,40	gC/m2	+	1 2 3	50%	1 2 3	47,80	1 2 3	0,259	67 %	5%				
Zoobenthos (Biomass, detrivores, southern parts)	22,50	gC/m2	+	1 2 3	50%	1 2 3	48,90	1 2 3	0,460	67 %	5%				
Zoobenthos (Benthic fauna, DKI, southern parts)	1,00		-	1 2 3	33%	1 2 3	0,31	1 2 3	0,310	83 %	22%				
Zoobenthos (Biomass, filter feeders, Nissum)	5,80	gC/m2	+	1 2 3	50%	1 2 3	17,70	1 2 3	0,328	67 %	5%				
Zoobenthos (Biomass, detrivores, Nissum)	53,40	gC/m2	-	1 2 3	25%	1 2 3	12,70	1 2 3	0,238	67 %	5%				
Zoobenthos (Biomass, filter feeders, Kaas)	9,90	gC/m2	+	1 2 3	50%	1 2 3	34,00	1 2 3	0,291	67 %	5%				
Zoobenthos (Biomass, detrivores, Kaas)	23,60	gC/m2	-	1 2 3	25%	1 2 3	8,10	1 2 3	0,343	67 %	10%				
Macrophytes (Eelgrass depth limit, Eastern parts)	5,60	m	-	1 2 3	25%	1 2 3	1,80	1 2 3	0,321		0%				
Macrophytes (Eelgrass depth limit, Central parts)	5,60	m	-	1 2 3	25%	1 2 3	1,90	1 2 3	0,339		0%				
Macrophytes (Eelgrass depth limit, Southern parts	5,60	m	-	1 2 3	25%	1 2 3	3,10	1 2 3	0,554		0%				
Macrophytes (Eelgrass depth limit, western parts)	5,60	m	-	1 2 3	25%	1 2 3	2,60	1 2 3	0,464		0%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,316	BAD		50%

Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3		67 %	100%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%			50 %	xx

Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Water clarity (Secchi depth, Central parts)	5,20	m	-	1 2 3	25%	1 2 3	3,70	1 2 3	0,712	67 %	25%				
Water clarity (Secchi depth, southern parts)	5,20	m	-	1 2 3	25%	1 2 3	3,10	1 2 3	0,596	67 %	25%				
Nutrients (TN annual mean, southern parts)	23,00	umol/l	+	1 2 3	50%	1 2 3	57,20	1 2 3	0,402	67 %	25%				
Nutrients (TN annual mean), western parts	30,00	umol/l	+	1 2 3	50%	1 2 3	33,70	1 2 3	0,890	67 %	25%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,650	MODERATE	67 %	50%
															100%

IMPORT data from XML

EXPORT data to XML

version 20081010

58,33 %

Final biodiversity status: **BAD**

Final confidence rating: **Class II**

BEAT

A tool for biodiversity assessment and confidence rating

Station/water body: Randers Fjord, inner and outer parts

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3			100%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%				xx

Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Macrophytes (Eelgrass depth limit, outer parts)	6,60	m	-	1 2 3	25%	1 2 3	1,70	1 2 3	0,258	83 %	100%				
Zoobenthos (Macroalgae species richness, i.p.)	15,00	n	-	1 2 3	50%	1 2 3	3,00	1 2 3	0,200	67 %	0%				
Macrophytes (algae species richness, o.p.)	12,00	n	-	1 2 3	50%	1 2 3	7,00	1 2 3	0,583	67 %	0%				
Zoobenthos (species richness, i.p.)	16,00	n	+	1 2 3	50%	1 2 3	24,00	1 2 3	0,667	67 %	0%				
Zoobenthos (species richness, o.p.)	94,00	n	-	1 2 3	50%	1 2 3	46,00	1 2 3	0,489	67 %	0%				
Phytoplankton (Chlorophyll-a summer mean, inner	9,00		+	1 2 3	50%	1 2 3	13,00	1 2 3	0,692	67 %	0%				
Phytoplankton (Chlorophyll-a summer mean, outer	3,00		+	1 2 3	50%	1 2 3	6,94	1 2 3	0,432	67 %	0%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,258	BAD	83 %	50%

Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3		67 %	100%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%			50 %	xx

Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Nutrients (TN (summer mean, inner parts)	42,89		+	1 2 3	50%	1 2 3	128,57	1 2 3	0,334	67 %	10%				
Nutrients (TN summer mean, outer parts)	14,29		+	1 2 3	50%	1 2 3	71,43	1 2 3	0,200	67 %	10%				
Nutrients (TP summer mean, inner parts)	1,29		+	1 2 3	50%	1 2 3	2,90	1 2 3	0,445	67 %	10%				
Nutrients (TP summer mean, outer parts)	0,97		+	1 2 3	50%	1 2 3	1,95	1 2 3	0,497	67 %	40%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,297	POOR	47 %	50%
															100%

IMPORT data from XML

EXPORT data to XML

Final biodiversity status: **BAD**

60,00 %

Final confidence rating: **Class II**

version 20081010

BEAT

A tool for biodiversity assessment and confidence rating

Station/water body:	Isefjorden & Roskilde Fjord

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3			100%				
Add new indicator ...				1 2 3		1 2 3		1 2 3							
											100%				xx

Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Zoobenthos (biomass, Isefjorden)	14,00	g/m2	+	1 2 3	25%	1 2 3	489,00	1 2 3	0,029	67 %	25%				
Zoobenthos (DKI index, Roskilde Fjord)	1,00	-	-	1 2 3	23%	1 2 3	0,41	1 2 3	0,412	83 %	25%				
Macrophytes (Eelgrass depth limit, Isefjorden)	4,70	m	-	1 2 3	25%	1 2 3	4,20	1 2 3	0,894	67 %	25%				
Macrophytes (Eelgrass depth limit, Roskilde Fjord)	4,50	m	-	1 2 3	25%	1 2 3	2,90	1 2 3	0,644	67 %	25%				
Add new indicator ...				1 2 3		1 2 3		1 2 3							
											100%	0,495	BAD	71 %	50%

Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3		67 %	100%				
Add new indicator ...				1 2 3		1 2 3		1 2 3							
											100%			50 %	xx

Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Nutrients (TN annual, Roskilde Fjord)	50,00	uM	+	1 2 3	15%	1 2 3	65,50	1 2 3	0,763	67 %	100%				
Add new indicator ...				1 2 3		1 2 3		1 2 3							
											100%	0,763	BAD	50 %	50%
															100%

IMPORT data from XML

Final biodiversity status: **BAD**

EXPORT data to XML

version 20081010

56,94 %

Final confidence rating: **Class II**

BEAT

A tool for biodiversity assessment and confidence rating

Station/water body: The Sound

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
Macrophytes (Eelgrass bed area)	705,00	km2	-	1 2 3	50%	1 2 3	162,00	1 2 3	0,230	100 %	100%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,230	POOR	75 %	33%
Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Zoobenthos (DKI Index)	1,00	NA	-	1 2 3	37%	1 2 3	0,72	1 2 3	0,720		25%				
Macrophytes (Eelgrass, depth limit)	7,70	m	-	1 2 3	25%	1 2 3	6,00	1 2 3	0,779		25%				
Phytoplankton (Chlorophyll a, summer mean)	1,70		+	1 2 3	50%	1 2 3	3,70	1 2 3	0,459	83 %	25%				
Phytoplankton (Primary Production)	160,00		+	1 2 3	50%	1 2 3	280,00	1 2 3	0,571	83 %	25%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,633	MODERATE		33%
Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
No indicators				1 2 3		1 2 3		1 2 3		100 %	100%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%			75 %	xx
Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR		Weight	QE_EQR	QE status	QE_Conf	Weight
Water clarity (Secchi depth)	11,30		-	1 2 3	25%	1 2 3	8,50	1 2 3	0,752	83 %	100%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,752	GOOD	63 %	33%
															100%

IMPORT data from XML

EXPORT data to XML

Final biodiversity status: **POOR**

70,83 %

Final confidence rating: **Class II**

version 20081010

BEAT

A tool for biodiversity assessment and confidence rating

Station/water body:	Baltic Proper

Landscapes	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
Anoxic seabed area (Savchuk et al 2008)	18,50	10000 km3	+	1 2 3	50%	1 2 3	44,40	1 2 3	0,417		50%				
Rivers with wild salmon production [Ranke et al (ed	22,00	N rivers	-	1 2 3	50%	1 2 3	9,00	1 2 3	0,409		50%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,413	MODERATE		25%

Communities	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
Threatened and declining biotopes and habitats (H	0,00	N biotopes	+	1 2 3	15%	1 2 3	12,00	1 2 3	0,000		17%				
Zoobenthos (average number of taxa, Eastern Got	5,30	N taxa	-	1 2 3	39%	1 2 3	0,62	1 2 3	0,117	83 %	17%				
Zoobenthos (average number of taxa, Bornholm Se	12,40	N taxa	-	1 2 3	40%	1 2 3	2,96	1 2 3	0,239	67 %	17%				
Zoobenthos (average number of taxa, Northern Ba	4,70	N taxa	-	1 2 3	33%	1 2 3	0,00	1 2 3	0,000	100 %	17%				
Zoobenthos (BIF gamma diversity, Arkona Sea)	18,33	N taxa	-	1 2 3	31%	1 2 3	14,00	1 2 3	0,764	83 %	16%				
Zoobenthos (average number of taxa, E Gotland ba	8,00	Ntaxa	-	1 2 3	40%	1 2 3	1,83	1 2 3	0,229		16%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,219	BAD		25%

Species	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
White tailed eagle (population size, entire Baltic)	200,00	Individuals	-	1 2 3	50%	1 2 3	2250,00	1 2 3	1,000		17%				
Established Alien Species 1950- (Baltic Alien Spec	6,00	liated species	+	1 2 3	15%	1 2 3	14,00	1 2 3	0,429		17%				
Eastern Baltic Cod SSB (RefCon=ICES long term a	270,00	1000tonnes	-	1 2 3	15%	1 2 3	160,00	1 2 3	0,593		17%				
Threatened and decling species (HELCOM BSEP 1	0,00	N species	+	1 2 3	15%	1 2 3	50,00	1 2 3	0,000		33%				
Common Seal (intrinsic rate of increase, Kalmarsu	0,12		-	1 2 3	25%	1 2 3	0,80	1 2 3	1,000		16%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,504	BAD		25%

Supporting Indicators	RefCon	Unit	Resp.	RefCon_score	AcDev	AcDev_score	Status	Status_score	EQR	Ind_Conf	Weight	QE_EQR	QE status	QE_Conf	Weight
Secchi depth BSAP	9,30	m	-	1 2 3	25%	1 2 3	6,30	1 2 3	0,677		100%				
Add new indicator …				1 2 3		1 2 3		1 2 3							
											100%	0,677	MODERATE		25%
															100%

IMPORT data from XML

EXPORT data to XML

Final biodiversity status: BAD

Final confidence rating:

version 20081010