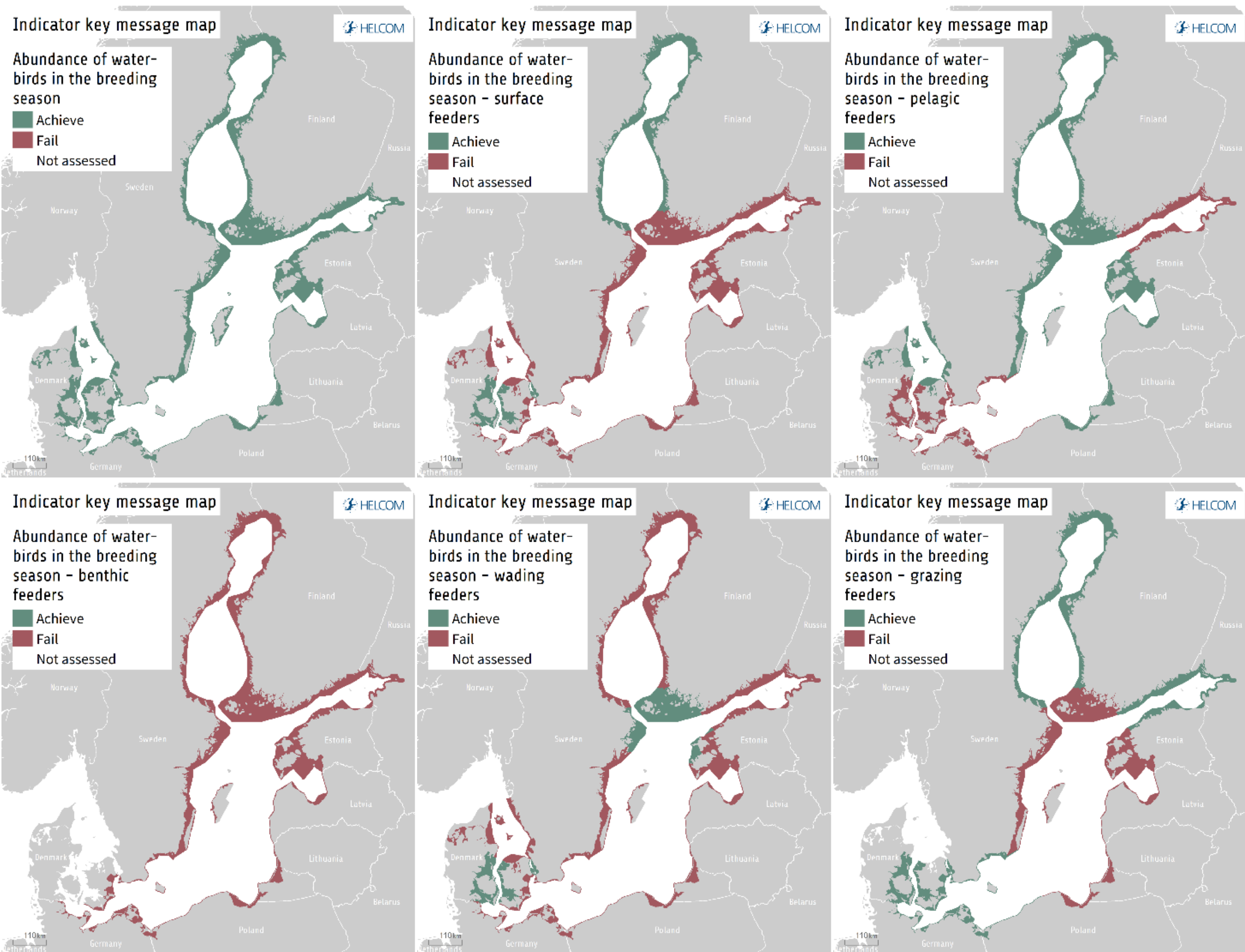
HELCOM core indicator report

July 2018

Abundance of waterbirds in the breeding season

Key Message

This core indicator evaluates the status of the bird species breeding in the Baltic Sea area by assessing fluctuations in abundance. As a rule, good status is achieved when the abundance of 75% of the considered species making up a species group do not decline by more than 30% (20% in species laying only one egg per year) compared to a baseline during the reference period 1991-2000.



Key message figure 1. Status of the indicator 'abundance of waterbirds in the breeding season'. The current assessment is presented for coastal areas. The assessment is for the entire Baltic Sea – including all species currently assessed (top left, Scale 1 HELCOM assessment units, defined in the [HELCOM Monitoring and Assessment Strategy Attachment 4](#)) and for seven sudivisions of the Baltic Sea (see Assessment unit figure 1). Results for the species groups are based on the trends of individual species: surface feeders (top middle), pelagic feeders (top right), benthic feeders (bottom left), wading feeders (bottom middle) and grazing feeders (bottom right). NOTE: due to the size of figures within the composite image details in some coastal areas are better visualised via the HELCOM Map and Data Service (MADS). Click here to access interactive maps at the HELCOM Map and Data Service: [Abundance of waterbirds in the breeding season](#), [surface feeders](#), [pelagic feeders](#), [benthic feeders](#), [wading feeders](#), [grazing feeders](#).

The indicator performs status evaluations by aggregating annual single species index values for all waterbird species and on the basis of aggregated indices for five species groups (wading feeders, surface feeders, pelagic feeders, benthic feeders, grazing feeders).

The assessment is only carried out for coastal areas (not offshore). Since harmonized offshore monitoring could not be conducted for this assessment period and several species show strong declines in the whole offshore area (Skov et al. 2011), an overall assessment of birds is not possible and the data and results are based only on land based observations.

On the scale of the entire Baltic Sea the evaluation for the assessment period 2011-2016 showed a good status for all waterbird species when considered together, but diverging results for the species groups. While surface feeders, pelagic feeders, benthic feeders and grazing feeders achieved the threshold value indicating a good status, wading feeders failed to achieve the threshold value and do not indicate good status.

On a finer spatial scale, the status for breeding waterbirds was assessed in seven subdivisions of the Baltic Sea (see Assessment units figure 1). The results define a different perspective and diverging evaluations bwteen the spatial subdivisions.

The confidence of the indicator evaluation is estimated to be **intermediate**.

The core indicator is applicable in the waters of all the countries bordering the Baltic Sea. However, the current evaluation does not include data from Russia and Lithuania.

Relevance of the core indicator

Waterbirds are an integral part of the Baltic marine ecosystem. They are important predators, often at a high level in the marine food web. The indicator follows temporal change in the abundance of key waterbird species, which responds to numerous pressures, many of them owing to human activities. Thus, the indicator gives a more general view on the state of marine birds in the Baltic Sea and reflects the cumulative impact of pressures.

Policy relevance of the core indicator

	BSAP Segment and Objectives	MSFD Descriptors and Criteria
Primary link	Biodiversity • Viable populations of species. • Thriving and balanced communities of plants and animals.	D1 Biodiversity D1C2 The population abundance of the species is not adversely affected due to anthropogenic pressures, such that its long-term viability is ensured.
Secondary link	Eutrophication • Natural Distribution and occurrence of plants and animals.	D1 Biodiversity D1C3 The population demographic characteristics of the species are indicative of a healthy population which is not adversely affected due to anthropogenic pressures D1C4 The species distributional rangeand where relevant, pattern is in line with prevailing physiographic, geographic and climatic conditions. D4 Food-web D4C1 The diversity of the trophic guild is not adversely affected due to anthropogenic pressures D4C2 The balance of total abundance between the trophic guilds is not adversely affected due to anthropogenic pressures D4C4 Productivity of the trophic guild is not adversely affected due to anthropogenic pressures.
Other relevant legislation: EU Birds Directive (migrating species Article 4 (2); barnacle goose, pied avocet, Mediterranean gull, Caspian tern, sandwich tern, common tern, Arctic tern, little tern listed in Annex I); Birds Directive Article 12 report, parameter "Population trend"; Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA).		

Cite this indicator

HELCOM (2018). Abundance of waterbirds in the breeding season. HELCOM core indicator report. Online. [Date Viewed], [Web link].

ISSN 2343-2543

Download full indicator report

Abundance of waterbirds in the breeding season HELCOM core indicator 2018 (pdf)

Results and Confidence

This indicator is based on the main parameter 'abundance of breeding waterbirds' and also takes into account the supporting parameter 'breeding success'. The abundance parameter follows the OSPAR Ecological Quality Objective (EcoQO) procedure for the status of seabirds in the North Sea (ICES 2008, 2013, OSPAR/HELCOM/ICES 2016), whereas the breeding success parameter is being developed separately.

Abundance – Whole Baltic Sea scale

The abundance component of the indicator is based on counts of breeding pairs, nests or individuals belonging to a breeding population. After testing the indicator concept for selected breeding waterbirds in the Baltic earlier (Herrmann et al. 2013), the indicator has now been applied to a broader spectrum of waterbird species.

The analysis, spanning the reference period (1991-2000) and the assessment period (2011-2016), is based on data of 30 waterbird species, of which one (barnacle goose) could only be analysed on the spatial level of Baltic Sea subdivisions (i.e. not at the scale 1 whole Baltic Sea level).

In 24 of the 29 species assessments for the entire Baltic Sea, the geometric mean of index values in the assessment period (2011-2016) deviated less than 30% (species laying two eggs per year) or 20% (species laying one egg per year) downwards from the modern baseline defined as the average index values in the reference period 1991-2000. These 24 species are estimated to be in a good status. However, five species deviated more than 30% downwards from the baseline, which indicates that they are not in a good status..

The status assessments for the species groups give diverging results. Breeding waterbirds of four species groups achieved the threshold value of 75% of species deviating less than 30%:

- surface feeders: 9 out of 10 (90%) species' index values deviate less than 30% ,
- pelagic feeders: 7 out of 7 (100%) species' index values deviate less than 30% (including razorbill and common guillemot deviating less than 20%),
- benthic feeders: 3 out of 4 (75%) species' index values deviate less than 30% and
- grazing feeders: 2 out of 2 (100%) species' index values deviate less than 30%.

In contrast, one species group failed to achieve the threshold value of 75% of species deviating less than 30%:

- wading feeders: 3 out of 6 (50%) species' index values deviate less than 30%.

Index values of the species included in the assessment are listed in Results table 1 and can be used for national MSFD reporting for those HELCOM Contracting Parties that are also EU Member States.

Species failing to achieve the threshold level (deviate more than 30%) in the years 2011-2016 were the velvet scoter, great black-backed gull, pied avocet, turnstone and dunlin.

Species that increased so much that their average index value for 2011-2016 exceeds 130% of the baseline level, which according to the indicator concept are reported as a signal for possible imbalance in the environment, were to a large extant fish-eating species: the great crested grebe, common guillemot, black guillemot, sandwich tern, common tern and Arctic tern.

Results table 1 presents trends calculated for the whole period (1991-2016), with details listed in Results table 2 as information to support the interpretation of the status results in a more long-term perspective.

Though still indicating good status, three species are significantly declining (common eider, goosander and common gull). All species not achieving good status in the indicator status evaluation also show significantly declining trends, most strongly in dunlin and great black-backed gull. Out of the 29 species assessed, 11 show significant positive trends, eight significant negative trends, while nine species appear to be stable, and for one species the result is uncertain.

Graphs showing index values are provided in Results figure 1.

The method of analysis applied did not give results for barnacle goose at the whole Baltic Sea scale as its TRIM model was not possible to estimate.

The abundance parameter evaluates data from regular monitoring activities of the coastal countries, but also includes data from some other sources and surveys. If a wider scope would be aimed for, the indicator could be updated using more data from additional sites and stemming from various mapping activities outside regular monitoring programmes. Such a filling of gaps in the regular monitoring with additional data sources could improve the confidence and coverage of the indicator evaluation in the future.

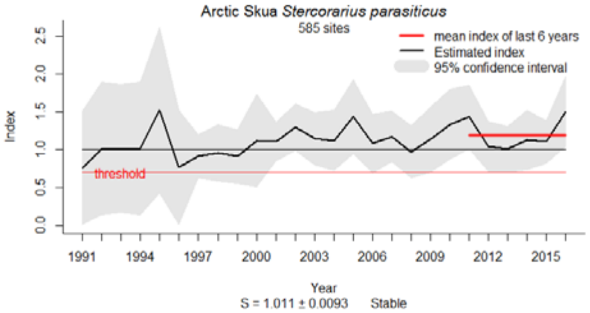
Results table 1. Evaluation of the status of breeding waterbirds in the entire Baltic Sea for the period 2011-2016. Index values (single years and mean) are scaled to the average of the reference period (1991-2000, index value set to 1). Good status is shown by green colour, if in individual species the threshold level of 0.7 (0.8 in species laying only one egg per year: razorbill, common guillemot) is met for the geometric mean 2011-2016 and for species groups if at least 75% of the species are in good status. If the index value exceeds 1.3 indicating a large abundance increase the status is still considered good but indicated in orange. Red colour means that the species or the species groups is not in good status. Trends for the period 1991-2016 are shown as ↑ (moderate increase), → (stable), ↓ (moderate decline) and ↓↓ (strong decline), with * when p<0.05 and ** when p<0.01 (?: uncertain; for details see Results table 2).

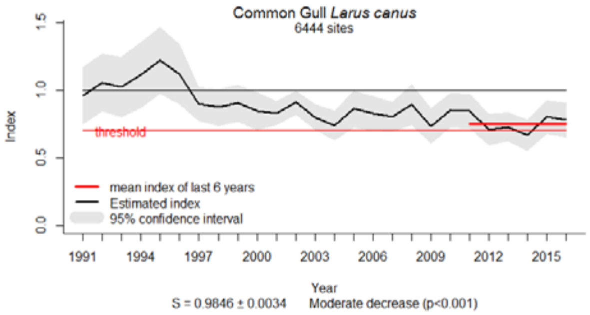
group	species	number of sites	index values 2011	2012	2013	2014	2015	2016	mean 2011-2016	good status?	trend 1991-2016
surface feeders	Arctic skua	585	1.434	1.046	1.007	1.124	1.102	1.504	**1.188**	yes	→
	common gull	6444	0.845	0.707	0.727	0.666	0.800	0.781	**0.752**	yes	↓**
	great black-backed gull	3202	0.311	0.316	0.517	0.369	0.291	0.223	**0.327**	no	↓↓*
	herring gull	2837	0.963	0.944	0.988	0.894	0.871	1.036	**0.948**	yes	→
	lesser black-backed gull	1138	1.033	1.220	1.176	0.718	0.876	0.910	**0.973**	yes	→
	little tern	313	0.900	0.882	0.963	1.138	1.027	0.830	**0.951**	yes	→
	Caspian tern	270	1.176	1.031	1.225	1.173	1.381	1.099	**1.176**	yes	→
	sandwich tern	142	1.453	1.372	1.361	1.563	1.404	1.533	**1.445**	yes	↑*
	common tern	2568	3.726	2.335	2.585	2.633	3.311	3.152	**2.919**	yes	↑*
	Arctic tern	4149	2.029	1.612	1.586	2.184	1.868	2.179	**1.894**	yes	↑**
pelagic feeders	goosander	5013	0.897	0.799	0.845	0.820	1.002	0.802	**0.858**	yes	↓*
	red-breasted merganser	3655	1.033	1.220	1.176	0.718	0.876	0.910	**0.973**	yes	→
	great crested grebe	1215	2.486	2.751	3.142	4.701	2.180	2.003	**2.759**	yes	↑**
	great cormorant	528	0.829	0.904	0.863	1.041	1.115	1.156	**0.977**	yes	→
	razorbill	222	1.315	1.080	1.188	1.281	1.130	0.914	**1.143**	yes	↑*
	common guillemot	43	1.573	1.812	1.321	1.580	1.369	3.187	**1.721**	yes	↑*
	black guillemot	828	2.509	2.061	1.973	1.911	1.858	2.125	**2.063**	yes	↑**
benthic feeders	tufted duck	3151	1.173	1.167	1.193	1.449	1.200	1.128	**1.214**	yes	↑*
	greater scaup	73	1.011	1.012	1.173	1.167	1.193	1.449	**1.159**	yes	?
	common eider	4628	1.033	1.220	1.176	0.718	0.876	0.910	**0.973**	yes	↓↓**
	velvet scoter	2021	0.605	0.504	0.507	0.513	0.529	0.475	**0.521**	no	↓**
wading feeders	common shelduck	470	1.214	0.964	1.143	0.963	0.943	0.805	**0.996**	yes	→
	Eurasian oystercatcher	2753	1.255	1.246	1.286	1.323	1.304	1.290	**1.284**	yes	↑**
	pied avocet	407	0.873	0.615	0.549	0.550	0.546	0.659	**0.623**	no	↓**
	ringed plover	687	1.068	0.904	1.013	1.165	0.984	1.046	**1.027**	yes	→
	turnstone	1117	0.459	0.322	0.377	0.374	0.331	0.415	**0.377**	no	↓**
	dunlin	113	0.353	0.380	0.420	0.019	0.078	0.140	**0.151**	no	↓↓**
grazing feeders	mute swan	3318	0.999	1.330	1.461	1.269	1.105	1.032	**1.188**	yes	↓**
	greylag goose	2127	1.210	1.497	1.162	1.238	1.204	1.045	**1.219**	yes	↑**

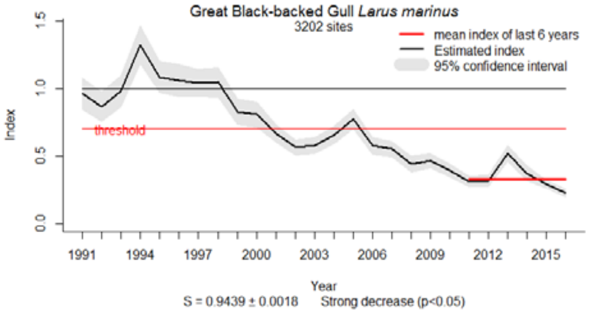
Results table 2. Trends observed in breeding waterbirds in the entire Baltic Sea 1991-2016. Trend slopes and standard errors result from TRIM analyses.

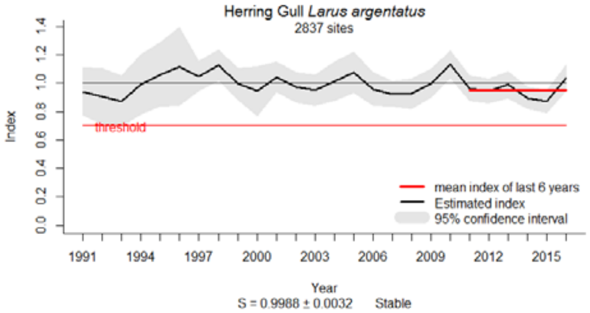
group	species	number of sites	trend slope	S.E.	p	status
surface feeders	Arctic skua	585	1.0110	0.0093		stable
	common gull	6444	0.9846	0.0034	<0.01	moderate decline
	great black-backed gull	3202	0.9439	0.0018	<0.05	strong decline
	herring gull	2837	0.9988	0.0032		stable
	lesser black-backed gull	1138	1.0028	0.0113		stable
	little tern	313	0.9954	0.0036		stable
	Caspian tern	270	1.0099	0.0074		stable
	sandwich tern	142	1.0160	0.0071	<0.05	moderate increase
	common tern	2568	1.0614	0.0263	<0.05	moderate increase
	Arctic tern	4149	1.0338	0.0057	<0.01	moderate increase
pelagic feeders	goosander	5013	0.9939	0.0021	<0.05	moderate decline
	red-breasted merganser	3655	1.0085	0.0048		stable
	great crested grebe	1215	1.0576	0.0070	<0.01	moderate increase
	great cormorant	528	1.0019	0.0035		stable
	razorbill	222	1.0085	0.0037	<0.05	moderate increase
	common guillemot	43	1.0359	0.0127	<0.05	moderate increase
	black guillemot	828	1.0432	0.0094	<0.01	moderate increase
benthic feeders	tufted duck	3151	1.0072	0.0029	<0.05	moderate increase
	greater scaup	73	0.9617	0.0440		uncertain
	common eider	4628	0.9285	0.0026	<0.01	strong decline
	velvet scoter	2021	0.9630	0.0031	<0.01	moderate decline
wading feeders	common shelduck	470	0.9976	0.0027		stable
	Eurasian oystercatcher	2753	1.0148	0.0030	<0.01	moderate increase
	pied avocet	407	0.9790	0.0031	<0.01	moderate decline
	ringed plover	687	1.0019	0.0100		stable
	turnstone	1117	0.9452	0.0031	<0.01	moderate decline
	dunlin	113	0.9072	0.0077	<0.01	strong decline
grazing feeders	mute swan	3318	1.0124	0.0017	<0.01	moderate decline
	greylag goose	2127	1.0124	0.0026	<0.01	moderate increase

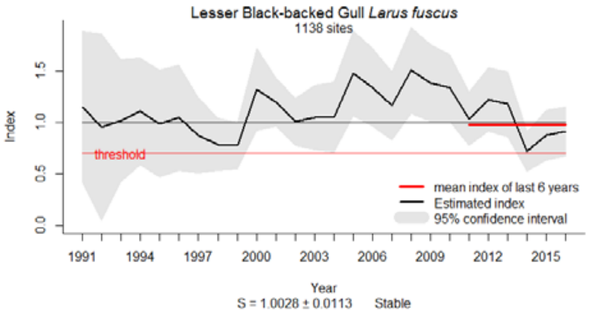
Surface feeders

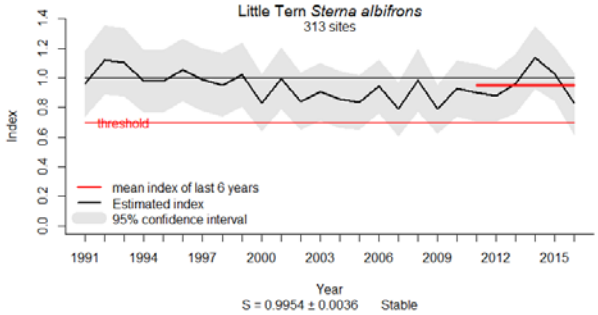


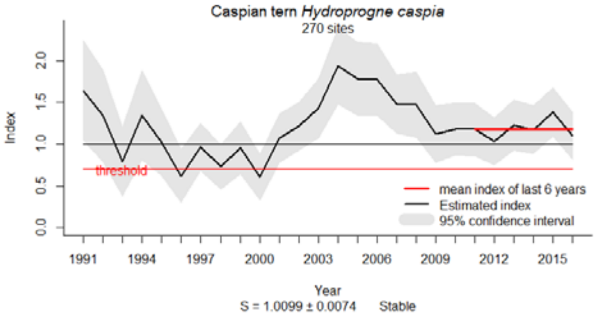


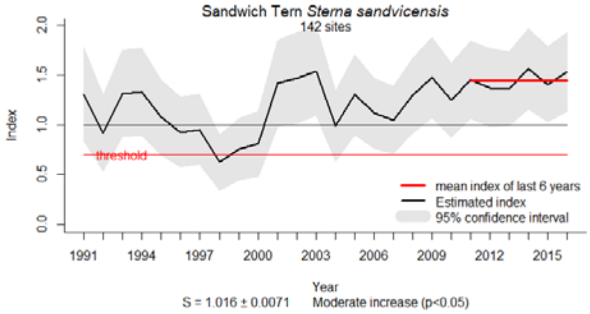


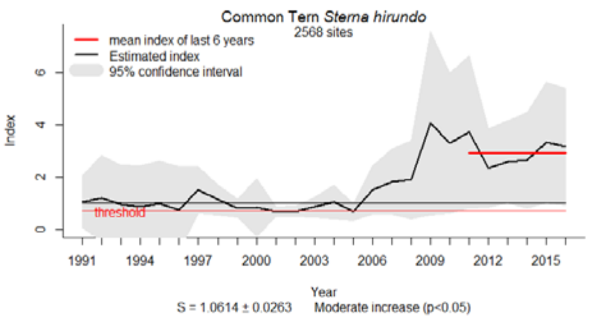


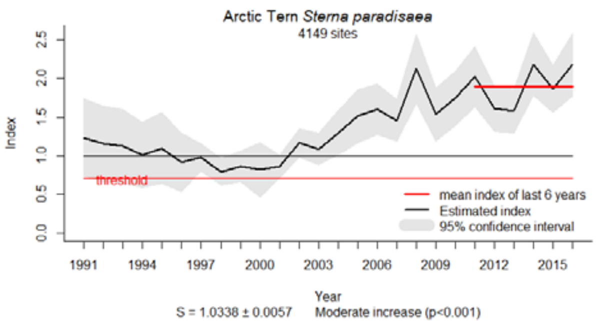




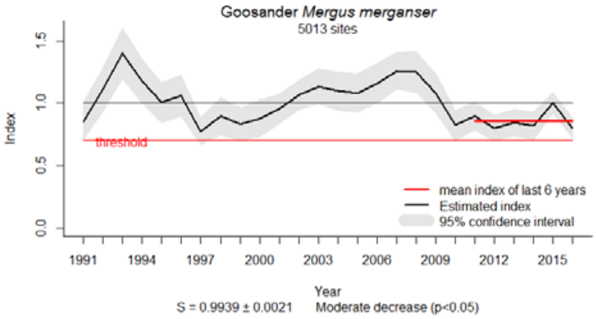


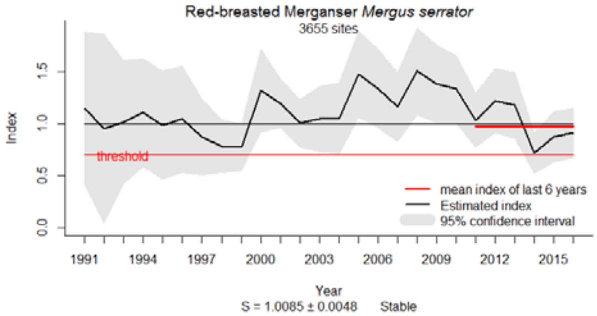


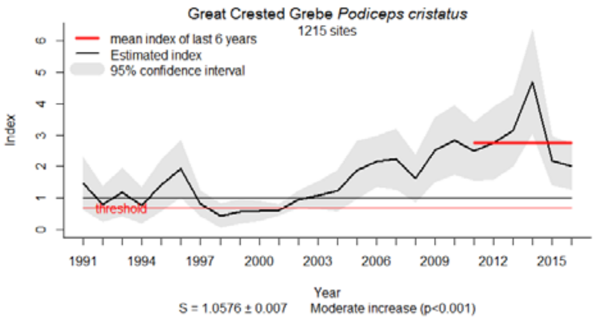


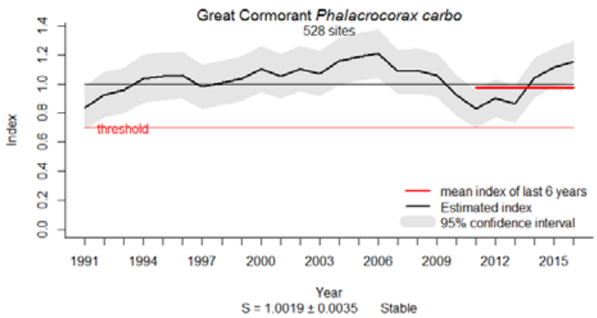


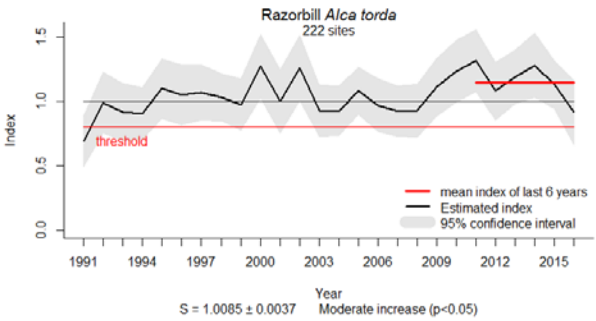
Pelagic feeders

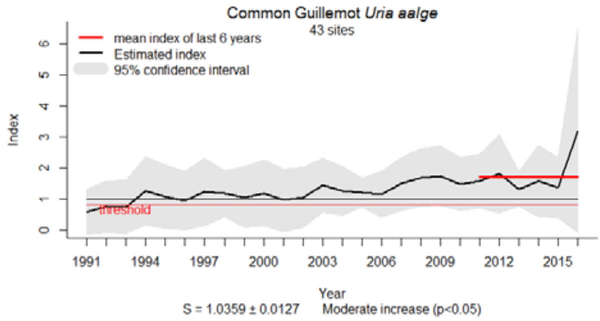


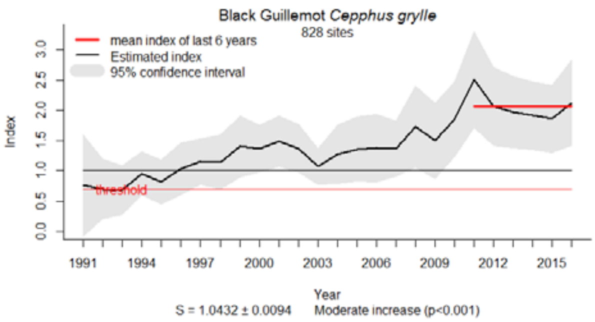




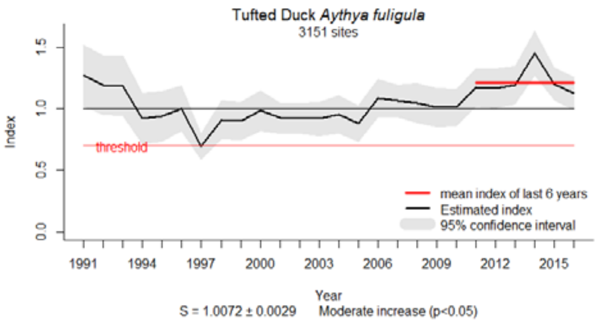


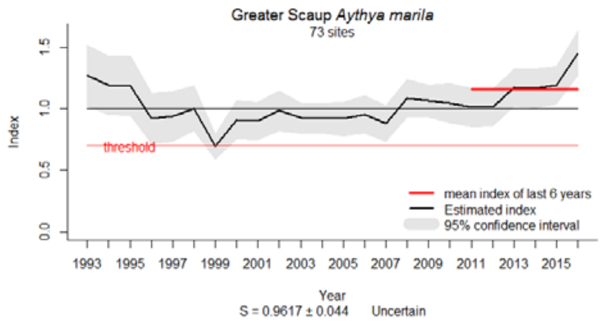


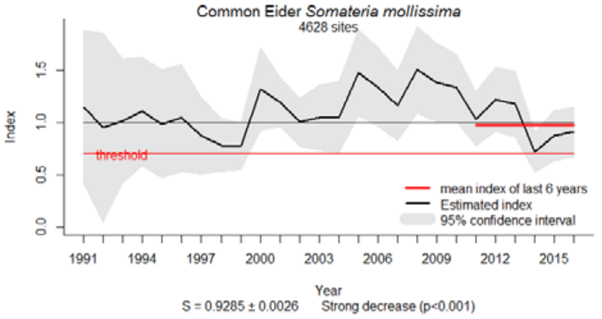


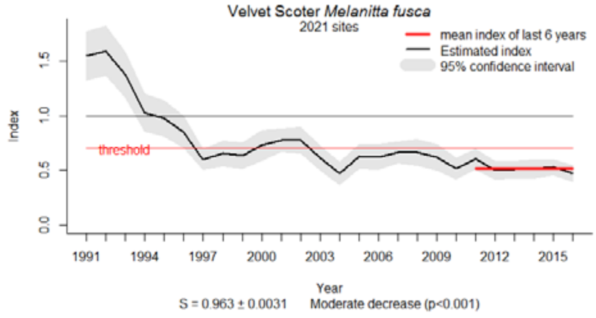


Benthic feeders

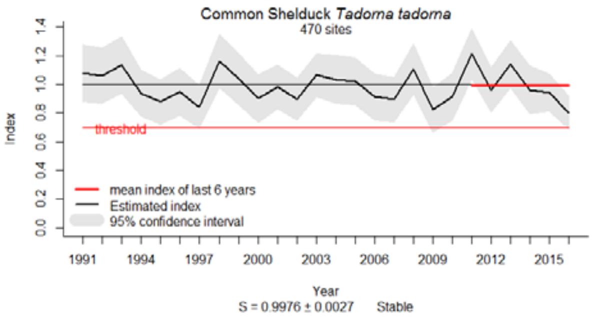


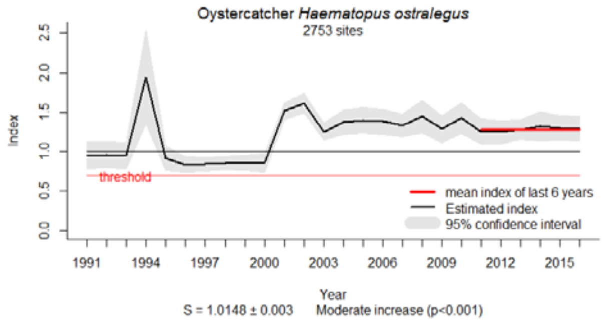


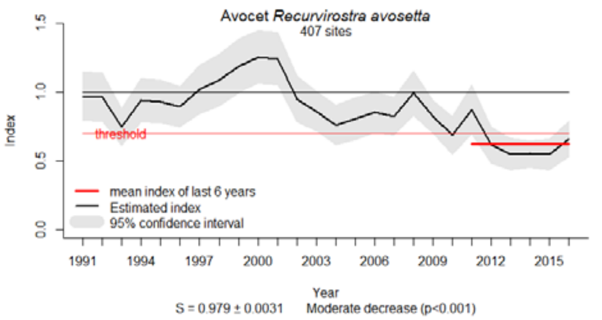


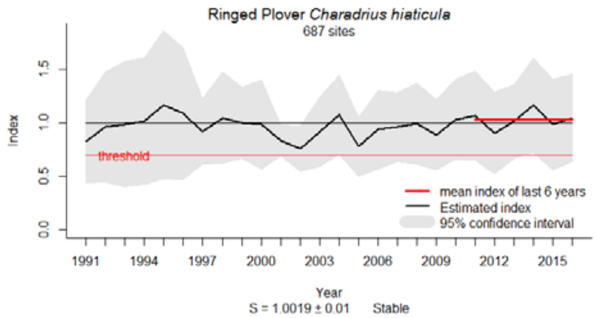


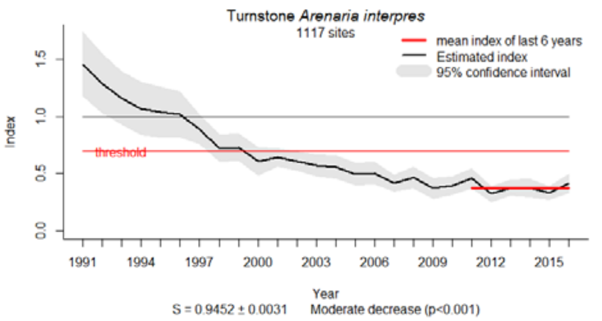
Wading feeders

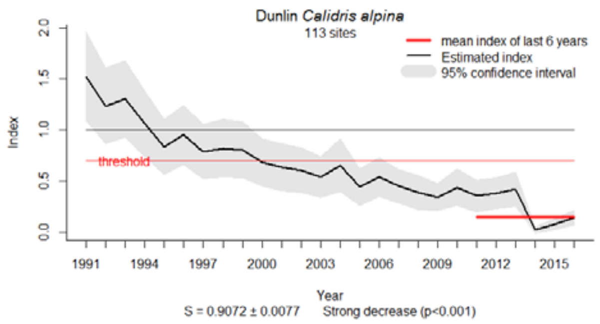




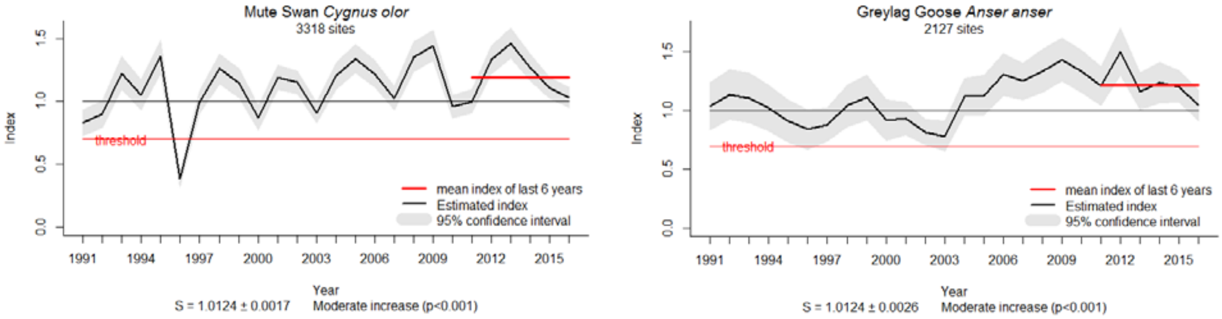








Grazing feeders



Results figure 1. Index graphs showing annual index values for breeding waterbirds in the entire Baltic (black line) and 95% confidence intervals (grey shading) resulting from TRIM analyses after rescaling the annual indices to reference level where average of index values 1991-2000 is 1 (thin black line). Further shown are thresholds for good status (70% of baseline, 80% of baseline in species laying only one egg per year, thin red line) and the average index values 2011-2016 (geometric mean) used for the evaluation (red line). In addition, trend slopes and s.e. as well as the status of the species are given below the graphs.

Abundance – Baltic Sea sub-divisions

The status of breeding waterbirds was also analysed on a smaller regional spatial scale, i.e. based on aggregations of sub-basins to form seven subdivisions (based on HELCOM assessment unit level 2, see Assessment Protocol). As not all species are breeding in each of these subdivisions, the number of species assessed per subdivision is smaller than for the entire Baltic Sea. The analyses followed the same protocol as for the entire Baltic Sea assessment.

Kattegat

In the Kattegat, only 50% of the 14 waterbird species assessed passed the threshold value and therefore the breeding waterbirds did not achieve a good status in the period 2011-2016 (Results table 3). The same holds true for surface feeders (good status in 3 out of 7 species, 43%) and wading feeders (all 3 species not in good status), whereas a good status was observed in pelagic feeders (4 out of 4 species above threshold). Owing to lacking data the status of benthic feeders and grazing feeders could not be assessed.

Results table 3. Evaluation of the status of breeding waterbirds in the Kattegat for the period 2011-2016. Index values (single years and mean) are scaled to the average of the reference period (1991-2000, index value set to 1). For explanation see Results table 1.

group	species	number of sites	index values 2011	2012	2013	2014	2015	2016	mean 2011-2016	good status?	trend 1991-2015
surface feeders	common gull	281	0.344	0.182	0.305	0.219	0.162	0.121	**0.209**	no	↓↓**
	herring gull	283	1.929	1.755	1.819	2.139	1.475	2.293	**1.883**	yes	↑**
	lesser black-backed gull	150	0.669	0.794	0.529	0.459	0.390	0.599	**0.558**	no	↓*
	little tern	66	1.034	0.963	0.806	1.049	1.205	1.056	**1.011**	yes	→
	sandwich tern	30	1.746	1.802	1.662	1.710	1.733	2.103	**1.787**	yes	↑*
	common tern	243	0.392	0.285	0.562	0.636	0.457	0.371	**0.435**	no	↓**
	Arctic tern	120	0.730	0.466	0.698	0.539	0.392	0.534	**0.547**	no	↓**
pelagic feeders	great cormorant	154	0.912	1.021	0.929	1.104	1.143	1.062	**1.025**	yes	↑*
	razorbill	1	0.950	0.860	0.932	1.004	1.093	1.183	**0.998**	yes	→
	common guillemot	1	4.098	4.590	5.738	7.213	9.016	11.148	**6.540**	yes	↑↑*
	black guillemot	61	2.030	1.396	1.600	1.757	1.782	2.132	**1.765**	yes	↑**
wading feeders	pied avocet	125	0.513	0.479	0.460	0.358	0.407	0.501	**0.450**	no	↓**
	ringed plover	74	0.295	0.314	0.621	0.659	0.698	0.916	**0.538**	no	?
	dunlin	43	0.499	0.551	0.582	0.010	0.031	0.171	**0.144**	no	↓↓*

Out of the seven species not in good status, six showed significant declines over the period 1991-2016, most strongly observed for the common gull and dunlin (trend for ringed plover uncertain, Results table 4). Species in good status were either stable or increasing, with the steepest increase observed in common guillemot. The trends of individual species are depicted in Results figure 2 (Annex 1).

Results table 4. Trends observed for breeding waterbirds in the Kattegat 1991-2016. Trend slopes and standard errors result from TRIM analyses.

group	species	number of sites	trend slope	S.E.	p	status
surface feeders	common gull	281	0.9192	0.0047	<0.01	strong decline
	herring gull	283	1.0386	0.0035	<0.01	moderate increase
	lesser black-backed gull	150	0.9766	0.0075	<0.05	moderate decline
	little tern	66	1.0023	0.0099		stable
	sandwich tern	30	1.0293	0.0086	<0.05	moderate increase
	common tern	243	0.9536	0.0058	<0.01	moderate decline
	Arctic tern	120	0.9746	0.0049	<0.01	moderate decline
pelagic feeders	great cormorant	154	1.0255	0.0087	<0.05	moderate increase
	razorbill	1	1.0040	0.0128		stable
	common guillemot	1	1.1034	0.0190	<0.05	strong increase
	black guillemot	61	1.0293	0.0032	<0.01	moderate increase
wading feeders	pied avocet	125	0.9715	0.0065	<0.01	moderate decline
	ringed plover	74	0.9612	0.0290		uncertain
	dunlin	43	0.9057	0.0213	<0.05	strong decline

Belt Group

In the Belt Group (Great Belt, The Sound), only two species (great cormorant, Arctic tern) did not reach the threshold level, thus with a pass rate of 83% the breeding waterbirds showed an overall good status (Results table 5). With pass rates of 88% (surface feeders) and 100% (wading feeders, grazing feeders), good status was found for these three species groups, whereas pelagic feeders failed (1 out of 2 species in good status, 50%) and benthic feeders could not be assessed due to a lack of data.

Results table 5. Evaluation of the status of breeding waterbirds in the Belt Group for the period 2011-2016. Index values (single years and mean) are scaled to the average of the reference period (1991-2000, index value set to 1). For explanation see Results table 1.

group	species	number of sites	index values 2011	2012	2013	2014	2015	2016	mean 2011-2016	good status?	trend 1991-2015
surface feeders	common gull	216	0.745	0.684	1.074	0.401	0.875	0.766	**0.727**	yes	↓*
	herring gull	200	0.894	1.001	0.974	0.573	1.049	1.018	**0.901**	yes	→
	lesser black-backed gull	80	1.087	1.235	0.679	0.801	0.537	0.669	**0.800**	yes	→
	little tern	96	0.851	0.701	1.319	1.354	1.117	0.709	**0.972**	yes	→
	Caspian tern	7	4.333	4.333	4.333	2.667	5.000	2.333	**3.692**	yes	?
	sandwich tern	29	2.369	2.020	1.938	2.396	1.739	1.856	**2.038**	yes	↑*
	common tern	96	1.859	1.257	1.725	2.361	2.126	3.364	**2.020**	yes	↑**
	Arctic tern	213	0.455	0.431	0.414	0.461	0.503	0.634	**0.478**	no	↓**
pelagic f.	great cormorant	64	0.540	0.558	0.491	0.643	0.613	0.563	**0.566**	no	↓**
	black guillemot	15	1.412	1.392	1.060	1.114	1.417	1.491	**1.303**	yes	→
wading f.	pied avocet	176	1.350	0.738	0.597	0.602	0.640	0.680	**0.733**	yes	↓*
grazing f.	barnacle goose	10	23.3	43.6	99.9	203.4	275.4	251.5	**106.1**	yes	↑↑**

Negative trends (1991-2016) were not only observed in the two species in bad status, but also in common gull and pied avocet, of which the index values still reflect good status. A very steep increase was experienced by barnacle goose (Results table 6). The trends of individual species are depicted in Results figure 3 (Annex 1).

Results table 6. Trends observed in breeding waterbirds in the Belt Group 1991-2016. Trend slopes and standard errors result from TRIM analyses.

group	species	number of sites	trend slope	S.E.	p	status
surface feeders	common gull	216	0.9882	0.0040	<0.05	moderate decline
	herring gull	200	0.9998	0.0041		stable
	lesser black-backed gull	80	0.9931	0.0083		stable
	little tern	96	0.9908	0.0074		stable
	Caspian tern	7	1.0619	0.0408		uncertain
	sandwich tern	29	1.0427	0.0176	<0.05	moderate increase
	common tern	96	1.0369	0.0088	<0.01	moderate increase
	Arctic tern	213	0.9622	0.0046	<0.01	moderate decline
pelagic f.	great cormorant	64	0.9701	0.0055	<0.01	moderate decline
	black guillemot	15	1.0145	0.0077		stable
wading f.	pied avocet	176	0.9847	0.0043	<0.05	moderate decline
grazing f.	barnacle goose	10	1.3696	0.0901	<0.01	strong increase

Bornholm Group

In the Bornholm Group (Kiel Bay, Bay of Mecklenburg, Arkona Basin, Bornholm Basin), half of the 24 species assessed did not reach the threshold level, and therefore breeding waterbirds did not achieve good status (Results table 7). On the level of species groups, only the grazing feeders attained good status, with both of the two species assessed passing the threshold. Much lower pass rates reveal bad status of surface feeders (44%, 9 species), pelagic feeders (50%, 6 species), benthic feeders (50%, 2 species) and wading feeders (40%, 5 species).

Results table 7. Evaluation of the status of breeding waterbirds in the Bornholm Group for the period 2011-2016. Index values (single years and mean) are scaled to the average of the reference period (1991-2000, index value set to 1). For explanation see Results table 1.

group	species	number of sites	index values 2011	2012	2013	2014	2015	2016	mean 2011-2016	good status?	trend 1991-2015
surface feeders	common gull	230	0.488	0.448	0.528	0.387	0.354	0.363	**0.423**	no	↓**
	great black-backed gull	150	1.069	1.627	2.025	1.661	2.098	1.759	**1.669**	yes	↑*
	herring gull	239	0.944	1.003	1.168	1.116	1.180	1.193	**1.097**	yes	→
	lesser black-backed gull	58	1.829	3.805	4.896	4.366	6.513	7.494	**4.401**	yes	↑↑*
	little tern	64	0.863	0.938	0.719	1.081	1.006	0.726	**0.878**	yes	→
	Caspian tern	25	0.174	0.108	0.138	0.072	0.228	0.084	**0.124**	no	↓*
	sandwich tern	40	0.614	0.604	0.392	0.598	0.405	0.374	**0.486**	no	?
	common tern	152	0.742	0.662	0.698	0.665	0.685	0.693	**0.690**	no	↓**
	Arctic tern	109	0.183	0.217	0.176	0.437	0.453	0.607	**0.307**	no	↓**
pelagic feeders	goosander	58	2.317	2.414	1.541	1.390	2.694	1.347	**1.875**	yes	↑*
	red-breasted merganser	108	0.527	0.590	0.535	0.451	0.506	0.531	**0.522**	no	↓**
	great crested grebe	28	2.202	2.225	1.933	1.393	1.663	1.506	**1.791**	yes	↑*
	great cormorant	77	0.849	1.078	0.965	1.170	1.376	1.663	**1.154**	yes	→
	razorbill	6	2.038	1.038	0.579	0.324	0.251	0.102	**0.465**	no	?
	common guillemot	3	2.127	0.529	0.143	0.039	0.025	0.003	**0.088**	no	?
benthic feeders	tufted duck	70	0.744	0.493	0.564	0.764	0.851	0.341	**0.598**	no	↓*
	common eider	89	0.804	0.967	1.114	1.582	2.843	2.309	**1.442**	yes	↑*
wading feeders	common shelduck	134	1.353	0.951	1.100	0.975	0.943	0.933	**1.033**	yes	→
	Eurasian oystercatcher	164	0.802	0.722	0.686	0.680	0.695	0.734	**0.719**	yes	↓**
	pied avocet	79	0.751	0.621	0.561	0.783	0.583	0.807	**0.677**	no	↓*
	ringed plover	61	0.769	0.603	0.685	0.691	0.708	0.752	**0.699**	no	↓**
	dunlin	28	0.164	0.082	0.117	0.070	0.094	0.059	**0.092**	no	↓↓**
grazing feeders	mute swan	154	0.654	0.802	1.219	0.628	0.675	0.653	**0.749**	yes	↓*
	greylag goose	111	1.738	2.043	1.842	2.402	2.667	2.045	**2.100**	yes	↑**

Out of 12 species in bad status, nine showed significant declines (most steeply in dunlin), while the trend remained uncertain in three species (Results table 8). Most of the other species were stable or increased, but mute swan and Eurasian oytercatcher declined significantly despite their good status based on index values. The steepest increase was observed in lesser black-backed gull. The trends of individual species are depicted in Results figure 4 (Annex 1).

Results table 8. Trends observed in breeding waterbirds in the Bornholm Group 1991-2016. Trend slopes and standard errors result from TRIM analyses.

group	species	number of sites	trend slope	S.E.	p	status
surface feeders	common gull	230	0.9550	0.0033	<0.01	moderate decline
	great black-backed gull	150	1.0548	0.0177	<0.05	moderate increase
	herring gull	239	1.0055	0.0031		stable
	lesser black-backed gull	58	1.0952	0.0175	<0.05	strong increase
	little tern	64	0.9921	0.0064		stable
	Caspian tern	25	0.9037	0.0291	<0.05	moderate decline
	sandwich tern	40	0.9652	0.0175		uncertain
	common tern	152	0.9772	0.0052	<0.01	moderate decline
	Arctic tern	109	0.9407	0.0068	<0.01	moderate decline
pelagic feeders	goosander	58	1.0647	0.0179	<0.05	moderate increase
	red-breasted merganser	108	0.9635	0.0045	<0.01	moderate decline
	great crested grebe	28	1.0368	0.0121	<0.05	moderate increase
	great cormorant	77	1.0108	0.0067		stable
	razorbill	6	0.9744	0.0464		uncertain
	common guillemot	3	0.9035	0.3290		uncertain
benthic feeders	tufted duck	70	0.9745	0.0113	<0.05	moderate decline
	common eider	89	1.0185	0.0090	<0.05	moderate increase
wading feeders	common shelduck	134	1.0003	0.0045		stable
	Eurasian oystercatcher	164	0.9820	0.0033	<0.01	moderate decline
	pied avocet	79	0.9805	0.0060	<0.05	moderate decline
	ringed plover	61	0.9799	0.0041	<0.01	moderate decline
	dunlin	28	0.8806	0.0117	<0.01	strong decline
graz. f.	mute swan	154	0.9893	0.0035	<0.05	moderate decline
	greylag goose	111	1.0447	0.0079	<0.01	moderate increase

Gotland Group

In the Gotland Group (Gdansk Basin, Eastern Gotland Basin, Western Gotland Basin, Gulf of Riga), 16 out of 27 species (63%) passed the threshold level, but the limit of 75% of species necessary for an overall good status of breeding waterbirds was not met (Results table 9). The only species group in good status are the pelagic feeders with 6 out of 7 species (86%) in good status. This goal was not reached by surface feeders (63%, 8 species), benthic feeders (33%, 3 species), wading feeders (33%, 6 species) and grazing feeders (67%, 3 species).

Results table 9. Evaluation of the status of breeding waterbirds in the Gotland Group for the period 2011-2016. Index values (single years and mean) are scaled to the average of the reference period (1991-2000, index value set to 1). For explanation see Results table 1.

group	species	number of sites	2011	2012	2013	2014	2015	2016	mean 2011-2016	good status?	trend 1991-2015
surface feeders	common gull	820	1.113	1.284	1.018	1.093	1.086	0.770	**1.049**	yes	→
	great black-backed gull	717	0.282	0.305	0.342	0.358	0.241	0.164	**0.273**	no	↓↓**
	herring gull	553	0.409	0.466	0.382	0.355	0.280	0.257	**0.351**	no	↓↓*
	lesser black-backed gull	117	0.122	0.302	0.321	0.064	0.080	0.126	**0.141**	no	↓↓*
	little tern	68	1.166	1.235	1.710	1.364	0.967	1.131	**1.242**	yes	→
	Caspian tern	98	1.207	0.983	1.486	1.290	1.420	0.861	**1.186**	yes	→
	common tern	284	4.151	2.741	3.851	3.317	3.544	2.496	**3.298**	yes	↑**
	Arctic tern	672	2.526	2.420	2.750	3.676	2.469	2.120	**2.620**	yes	↑**
pelagic feeders	goosander	674	0.769	0.878	1.095	0.896	0.895	0.646	**0.852**	yes	↓*
	red-breasted merganser	369	1.697	1.382	1.277	1.533	1.217	0.899	**1.309**	yes	↑**
	great crested grebe	294	2.763	2.508	3.751	5.833	2.158	2.544	**3.067**	yes	↑**
	great cormorant	119	1.780	1.688	1.982	2.071	2.365	2.546	**2.050**	yes	↑**
	razorbill	61	2.663	2.481	2.467	2.777	2.502	1.874	**2.442**	yes	↑**
	common guillemot	13	1.222	3.074	1.301	1.812	2.266	7.485	**2.306**	yes	↑**
	black guillemot	53	0.366	0.248	0.187	0.178	0.435	0.396	**0.284**	no	↓*
benthic feeders	tufted duck	429	1.295	1.362	1.467	1.950	1.387	1.265	**1.438**	yes	↑**
	common eider	872	0.192	0.179	0.189	0.115	0.089	0.076	**0.131**	no	↓↓**
	velvet scoter	253	0.526	0.761	0.520	0.543	0.553	0.236	**0.495**	no	↓**
wading feeders	common shelduck	182	0.866	0.765	0.801	0.590	0.298	0.164	**0.498**	no	↓**
	Eurasian oystercatcher	707	0.973	1.080	1.109	1.015	0.803	0.847	**0.964**	yes	→
	pied avocet	23	0.170	0.268	0.804	0.769	0.827	0.876	**0.523**	no	↓*
	ringed plover	233	1.362	1.258	1.511	1.701	1.040	0.984	**1.285**	yes	↑**
	turnstone	165	0.343	0.263	0.363	0.343	0.207	0.385	**0.310**	no	↓↓*
	dunlin	15	0.057	0.057	0.057	0.115	0.517	0.057	**0.093**	no	↓*
grazing feeders	mute swan	933	1.645	2.185	1.931	2.110	1.737	1.499	**1.834**	yes	↑**
	barnacle goose	59	0.414	0.259	0.261	0.346	0.298	0.340	**0.315**	no	↓**
	greylag goose	453	1.077	1.329	0.957	0.821	0.565	0.566	**0.843**	yes	↓**

All species not in a good status showed significant negative trends (Results table 10). Five of them (great black-backed gull, herring gull, lesser black-backed gull, common eider, turnstone) were even declining steeply. On the other hand, most of the species in good status were stable or increased, with the exception of greylag goose and goosander, which declined significantly. The trends of individual species are depicted in Results figure 5 (Annex 1).

Results table 10. Trends observed in breeding waterbirds in the Gotland Group 1991-2016. Trend slopes and standard errors result from TRIM analyses.

group	species	number of sites	trend slope	S.E.	p	status
surface feeders	common gull	820	1.0011	0.0025		stable
	great black-backed gull	717	0.9352	0.0021	<0.01	strong decline
	herring gull	553	0.9439	0.0026	<0.05	strong decline
	lesser black-backed gull	117	0.9014	0.0136	<0.05	strong decline
	little tern	68	1.0154	0.0111		stable
	Caspian tern	98	1.0076	0.0090		stable
	common tern	284	1.0628	0.0061	<0.01	moderate increase
	Arctic tern	672	1.0503	0.0042	<0.01	moderate increase
pelagic feeders	goosander	674	0.9889	0.0044	<0.05	moderate decline
	red-breasted merganser	369	1.0159	0.0031	<0.01	moderate increase
	great crested grebe	294	1.0697	0.0100	<0.01	moderate increase
	great cormorant	119	1.0531	0.0129	<0.01	moderate increase
	razorbill	61	1.0597	0.0051	<0.01	moderate increase
	common guillemot	13	1.0500	0.0128	<0.01	moderate increase
	black guillemot	53	0.9348	0.0202	<0.05	moderate decline
benthic feeders	tufted duck	429	1.0173	0.0036	<0.01	moderate increase
	common eider	872	0.8963	0.0031	<0.01	strong decline
	velvet scoter	253	0.9639	0.0045	<0.01	moderate decline
wading feeders	common shelduck	182	0.9620	0.0054	<0.01	moderate decline
	Eurasian oystercatcher	707	0.9979	0.0019		stable
	pied avocet	23	0.9596	0.0167	<0.05	moderate decline
	ringed plover	233	1.0166	0.0036	<0.01	moderate increase
	turnstone	165	0.9374	0.0051	<0.05	strong decline
	dunlin	15	0.9116	0.0274	<0.05	strong decline
grazing feeders	mute swan	933	1.0360	0.0023	<0.01	moderate increase
	barnacle goose	59	0.9453	0.0100	<0.01	moderate decline
	greylag goose	453	0,9888	0,0029	<0.01	moderate decline

Åland Group

In the Åland Group (Northern Baltic Proper, Åland Sea), 16 out of 23 species (70%) were in a good status in the assessment period (2011-2016), thus breeding waterbirds failed to achieve an overall good status (Results table 11). With an 80% pass rate each, pelagic feeders (5 species) and wading feeders (5 species) were indicated to be in good status. This was only narrowly missed for surface feeders (71%, 7 species) and grazing feeders (67%, 3 species), whereas benthic feeders failed the threshold more clearly (33%, 3 species).

Results table 11. Evaluation of the status of breeding waterbirds in the Åland Group for the period 2011-2016. Index values (single years and mean) are scaled to the average of the reference period (1991-2000, index value set to 1). For explanation see Results table 1.

			index values								
group	species	number of sites	2011	2012	2013	2014	2015	2016	mean 2011-2016	good status?	trend 1991-2015
surface feeders	common gull	1748	0.720	0.610	0.699	0.890	1.071	0.859	**0.795**	yes	→
	great black-backed gull	880	0.343	0.190	0.316	0.257	0.268	0.218	**0.260**	no	↓**
	herring gull	491	0.291	0.178	0.227	0.187	0.229	0.127	**0.200**	no	↓↓**
	lesser black-backed gull	281	0.824	0.844	1.014	0.784	0.903	0.782	**0.855**	yes	→
	Caspian tern	55	38.739	31.261	32.252	25.856	28.649	22.973	**29.541**	yes	↑↑**
	common tern	298	1.459	3.503	3.662	1.940	3.614	4.004	**2.841**	yes	↑**
	Arctic tern	728	3.546	1.583	2.530	4.626	2.729	3.262	**2.892**	yes	↑**
pelagic feeders	goosander	1765	0.740	0.692	0.899	0.774	0.728	0.596	**0.732**	yes	↓*
	red-breasted merganser	534	0.863	0.678	0.873	0.961	0.492	0.617	**0.728**	yes	→
	razorbill	93	0.772	0.653	0.650	0.935	0.781	1.132	**0.804**	yes	↓*
	common guillemot	14	1.225	1.131	1.075	1.565	1.264	0.843	**1.164**	yes	→
	black guillemot	171	0.656	0.812	0.790	0.717	0.839	0.321	**0.658**	no	→
benthic feeders	tufted duck	706	0.766	0.667	1.370	1.316	1.388	1.337	**1.094**	yes	→
	common eider	2264	0.245	0.248	0.212	0.178	0.160	0.053	**0.164**	no	↓↓**
	velvet scoter	263	0.325	0.278	0.370	0.362	0.428	0.626	**0.385**	no	↓**
wading feeders	common shelduck	56	0.358	0.373	0.604	1.006	1.721	0.864	**0.703**	yes	?
	Eurasian oystercatcher	992	1.036	0.891	1.232	1.149	1.193	1.104	**1.095**	yes	↑*
	pied avocet	4	20.769	25.983	1.709	1.282	0.427	3.248	**3.435**	yes	?
	ringed plover	93	2.055	1.059	2.527	1.727	2.327	2.095	**1.895**	yes	↑*
	turnstone	211	0.347	0.128	0.087	0.349	0.479	0.387	**0.251**	no	↓**
grazing feeders	mute swan	1281	1.623	2.004	2.293	2.336	1.825	1.919	**1.984**	yes	↑**
	barnacle goose	94	1.038	0.843	1.386	1.485	1.435	1.448	**1.246**	yes	?
	greylag goose	611	0.218	0.330	0.515	0.662	0.411	0.505	**0.415**	no	↓**

Out of the seven species in bad status, trend analysis revealed stability for black guillemot, but all the other species were significantly declining from 1991 to 2016 (steep declines in common eider and herring gull, Results table 12). While a steep increase was observed in Caspian tern and others were increasing moderately, significant declines were noticed in goosander and razorbill despite of being in good status in the assessment period (2011-2016). The trends of individual species are depicted in Results figure 6 (Annex 1).

Results table 12. Trends observed in breeding waterbirds in the Åland Group 1991-2016. Trend slopes and standard errors result from TRIM analyses.

group	species	number of sites	trend slope	S.E.	p	status
surface feeders	common gull	1748	0.9912	0.0049		stable
	great black-backed gull	880	0.9406	0.0064	<0.01	moderate decline
	herring gull	491	0.9236	0.0058	<0.01	strong decline
	lesser black-backed gull	281	0.9948	0.0060		stable
	Caspian tern	55	1.2317	0.0379	<0.01	strong increase
	common tern	298	1.0525	0.0134	<0.01	moderate increase
	Arctic tern	728	1.0572	0.0092	<0.01	moderate increase
pelagic feeders	goosander	1765	0.9880	0.0039	<0.05	moderate decline
	red-breasted merganser	534	0.9841	0.0087		stable
	razorbill	93	0.9874	0.0056	<0.05	moderate decline
	common guillemot	14	1.0151	0.0089		stable
	black guillemot	171	0.9846	0.0118		stable
benthic feeders	tufted duck	706	0.9925	0.0103		stable
	common eider	2264	0.9132	0.0051	<0.01	strong decline
	velvet scoter	263	0.9477	0.0094	<0.01	moderate decline
wading feeders	common shelduck	56	1.0221	0.0337		uncertain
	Eurasian oystercatcher	992	1.0085	0.0034	<0.05	moderate increase
	pied avocet	4	1.1187	0.0796	<0.01	uncertain
	ringed plover	93	1.0462	0.0151	<0.05	moderate increase
	turnstone	211	0.9382	0.0132	<0.01	moderate decline
grazing feeders	mute swan	1281	1.0492	0.0058	<0.01	moderate increase
	barnacle goose	94	1.0340	0.0235		uncertain
	greylag goose	611	0.9670	0.0076	<0.01	moderate decline

Gulf of Finland

Only 11 out of 21 species (52%) achieved the threshold level, therefore breeding waterbirds did not achieve an overall good status in the Gulf of Finland in the years 2011-2016 (Results table 13). The only species group in good status was grazing feeders (all 3 species passing threshold). All the other groups did not reach the threshold of 75% of species in good status: surface feeders (17%, 6 species), pelagic feeders (67%, 6 species), benthic feeders (33%, 3 species) and wading feeders (67%, 3 species).

Results table 13. Evaluation of the status of breeding waterbirds in the Gulf of Finland for the period 2011-2016. Index values (single years and mean) are scaled to the average of the reference period (1991-2000, index value set to 1). For explanation see Results table 1.

group	species	number of sites	index values 2011	2012	2013	2014	2015	2016	mean 2011-2016	good status?	trend 1991-2015
surface feeders	common gull	19	0.887	0.918	0.929	0.276	0.165	0.616	**0.526**	no	↓*
	great black-backed gull	22	0.220	0.261	0.567	0.212	0.184	0.273	**0.265**	no	↓**
	herring gull	24	0.462	0.468	0.693	0.383	0.287	0.329	**0.419**	no	↓**
	lesser black-backed gull	10	0.802	0.743	0.687	0.156	0.092	0.136	**0.304**	no	↓*
	common tern	13	1.591	0.191	0.826	1.223	0.742	1.176	**0.803**	yes	?
	Arctic tern	14	0.711	0.493	0.707	0.583	0.484	0.800	**0.618**	no	→
pelagic feeders	goosander	9	0.240	0.480	0.395	0.206	0.103	0.034	**0.179**	no	↓↓*
	red-breasted merganser	11	0.622	0.838	0.622	1.459	0.243	0.432	**0.606**	no	?
	great crested grebe	4	2.727	7.273	4.545	2.273	1.364	0.455	**2.242**	yes	?
	great cormorant	8	19.169	21.246	24.004	30.957	36.430	40.006	**27.590**	yes	↑*
	razorbill	4	3.333	5.333	2.667	2.000	4.000	7.333	**3.750**	yes	?
	black guillemot	5	2.417	2.275	2.064	1.774	1.497	1.345	**1.853**	yes	↑*
benthic feeders	tufted duck	17	0.358	0.672	0.870	0.617	0.776	0.421	**0.590**	no	↓*
	common eider	24	0.863	0.993	1.295	0.521	0.890	1.122	**0.912**	yes	↓*
	velvet scoter	14	0.658	0.438	1.288	0.384	0.274	0.822	**0.564**	no	?
wading feeders	Eurasian oystercatcher	21	1.165	1.333	1.333	0.851	0.661	0.761	**0.980**	yes	→
	ringed plover	11	1.576	1.467	1.359	3.750	2.011	1.196	**1.746**	yes	↑*
	turnstone	6	0.394	0.287	0.358	0.376	0.412	0.502	**0.383**	no	↓**
grazing feeders	mute swan	24	0.928	1.657	2.021	2.099	1.743	1.396	**1.585**	yes	↑*
	barnacle goose	7	17.052	17.596	17.029	16.576	15.896	16.236	**16.721**	yes	↑↑*
	greylag goose	11	0.609	1.826	1.826	0.348	0.174	1.043	**0.710**	yes	?

Out of 10 species in bad status, seven were significantly decling (steeply in the case of goosander), one showed stability and for two the trends remained uncertain (Results table 14). The species in good status mostly increased or the trend remained uncertain, but Eurasian ostercatcher was stable and common eider even declined (Table 14). The steepest increase was noticed for barnacle goose. The trends of individual species are depicted in Results figure 7 (Annex 1).

Results table 14. Trends observed in breeding waterbirds in the Gulf of Finland 1991-2016. Trend slopes and standard errors result from TRIM analyses.

group	species	number of sites	trend slope	S.E.	p	status
surface feeders	common gull	19	0.9664	0.0124	<0.05	moderate decline
	great black-backed gull	22	0.9419	0.0080	<0.01	moderate decline
	herring gull	24	0.9610	0.0065	<0.01	moderate decline
	lesser black-backed gull	10	0.9311	0.0246	<0.05	moderate decline
	common tern	13	1.0044	0.0222	<0.05	uncertain
	Arctic tern	14	0.9791	0.0126	<0.01	stable
pelagic feeders	goosander	9	0.9181	0.0144	<0.05	strong decline
	red-breasted merganser	11	0.9759	0.0132		uncertain
	great crested grebe	4	1.0568	0.0579	<0.01	uncertain
	great cormorant	8	1.2824	0.1355	<0.05	moderate increase
	razorbill	4	1.0742	0.0738		uncertain
	black guillemot	5	1.0298	0.0082	<0.05	moderate increase
benthic feeders	tufted duck	17	0.9671	0.0105	<0.05	moderate decline
	common eider	24	0.9874	0.0058	<0.05	moderate decline
	velvet scoter	14	0.9815	0.0157		uncertain
wading feeders	Eurasian oystercatcher	21	1.0001	0.0095		stable
	ringed plover	11	1.0327	0.0108	<0.05	moderate increase
	turnstone	6	0.9490	0.0098	<0.01	moderate decline
grazing feeders	mute swan	24	1.0336	0.0139	<0.05	moderate increase
	barnacle goose	7	1.1937	0.0475	<0.05	strong increase
	greylag goose	11	1.0176	0.0218		uncertain

Bothnian Group

In the Bothnian Group (Bothnian Sea, The Quark, Bothnian Bay), only 3 out of 19 species failed to pass the threshold level. As 84% of the breeding waterbird species were in good status, an overall good status was determined (Results table 15). While all species (100%) and therefore the respective species groups were in good status in surfaces feeders (7 species), pelagic feeders (2 species) and grazing feeders (3 species), this was not the case in benthic feeders (67%, 3 species) and wading feeders (50%, 4 species).

Results table 15. Evaluation of the status of breeding waterbirds in the Bothnian Group for the period 2011-2016. Index values (single years and mean) are scaled to the average of the reference period (1991-2000, index value set to 1). For explanation see Results table 1.

group	species	number of sites	index values							good status?	trend 1991-2015
			2011	2012	2013	2014	2015	2016	mean 2011-2016		
surface feeders	Arctic skua	285	1.564	1.224	1.178	1.083	1.196	1.873	**1.327**	yes	→
	common gull	3130	1.329	1.067	0.852	1.020	1.157	1.341	**1.114**	yes	↑*
	great black-backed gull	1243	0.751	0.707	0.707	0.660	0.707	0.673	**0.700**	yes	→
	herring gull	1047	1.647	1.415	1.452	1.015	1.222	1.511	**1.360**	yes	↑*
	lesser black-backed gull	442	2.255	2.433	2.770	1.419	2.015	1.707	**2.050**	yes	↑*
	common tern	1482	7.499	3.894	3.754	4.605	5.990	5.705	**5.083**	yes	↑*
	Arctic tern	2293	2.284	1.942	1.513	1.940	2.222	2.952	**2.099**	yes	↑**
pelagic feeders	red-breasted merganser	2529	1.473	1.259	1.122	1.042	1.209	1.164	**1.204**	yes	→
	black guillemot	523	3.254	2.837	2.424	2.675	2.445	2.952	**2.749**	yes	↑**
benthic feeders	tufted duck	1927	3.772	3.369	2.420	2.643	3.290	3.368	**3.108**	yes	↑**
	common eider	1244	0.736	0.648	0.524	0.446	0.651	0.495	**0.574**	no	→
	velvet scoter	1478	2.282	1.671	1.570	1.764	1.571	1.681	**1.742**	yes	↑*
wading feeders	common shelduck	20	0.368	0.588	0.221	0.221	0.221	0.221	**0.283**	no	?
	Eurasian oystercatcher	693	1.910	1.570	1.480	1.476	1.353	1.771	**1.582**	yes	↑*
	ringed plover	215	1.380	1.070	1.147	1.149	0.874	1.043	**1.100**	yes	?
	turnstone	729	0.432	0.295	0.341	0.323	0.302	0.376	**0.342**	no	↓**
grazing feeders	mute swan	815	1.176	1.190	1.140	1.231	1.214	1.739	**1.267**	yes	→
	barnacle goose	169	17.102	15.451	11.593	17.812	20.096	16.795	**16.250**	yes	↑↑**
	greylag goose	873	2.168	2.265	2.053	1.547	1.925	0.850	**1.716**	yes	↑*

Turnstone was the only species declining in the period 1991-2016, whereas most others were increasing (most steeply the barnacle goose, Results table 16). For some species, the trend analyses indicated stable population sizes, including the common eider, which did not reach good status. The trends of individual species are depicted in Results figure 8 (Annex 1).

Results table 16. Trends observed in breeding waterbirds in the Bothnian Group 1991-2016. Trend slopes and standard errors result from TRIM analyses.

group	species	number of sites	trend slope	S.E.	p	status
surface feeders	Arctic skua	285	1.0126	0.0144		stable
	common gull	3130	1.0058	0.0028	<0.05	moderate increase
	great black-backed gull	1243	0.9865	0.0149		stable
	herring gull	1047	1.0393	0.0165	<0.05	moderate increase
	lesser black-backed gull	442	1.0524	0.0156	<0.05	moderate increase
	common tern	1482	1.1211	0.0419	<0.05	moderate increase
	Arctic tern	2293	1.0414	0.0061	<0.01	moderate increase
pelagic feeders	red-breasted merganser	2529	1.0079	0.0053		stable
	black guillemot	523	1.0642	0.0072	<0.01	moderate increase
benthic feeders	tufted duck	1927	1.0848	0.0203	<0.01	moderate increase
	common eider	1244	0.9894	0.0173		stable
	velvet scoter	1478	1.0256	0.0070	<0.05	moderate increase
wading feeders	common shelduck	20	0.9412	0.0384		uncertain
	Eurasian oystercatcher	693	1.0250	0.0080	<0.05	moderate increase
	ringed plover	215	1.0140	0.0303		uncertain
	turnstone	729	0.9389	0.0094	<0.01	moderate decline
grazing feeders	mute swan	815	1.0083	0.0155		stable
	barnacle goose	169	1.1628	0.0249	<0.01	strong increase
	greylag goose	873	1.0509	0.0196	<0.05	moderate increase

It is obvious from the results of both the whole Baltic Sea and in the seven subdivisions that the welfare of waterbird species varies considerably between and within species groups. Therefore, it is difficult to derive simple conclusions from the indicator results. It is known from a number of case studies that the development of population sizes are subject to a large variety of impacting factors. JWGBIRD has explored impacts on breeding waterbirds at the Baltic Sea coast and found that direct influence from human activities is relatively scarce, with tourism and leisure being the pressure affecting the largest number of species (OSPAR/HELCOM/ICES 2018). More importance was assigned to more natural drivers, as many breeding species are influenced by predation, habitat change and prey availability. However, even the natural drivers are not independent from anthropogenic pressures. For example, fishing has considerable impact on the composition of the Baltic fish fauna, and the removal of competitive large fish has promoted piscivorous waterbirds, as expressed by positive trends in this indicator. Declining waterbird populations often suffer from predation of eggs and chicks, which is partly caused by introduced predators such as American mink and raccoon dog (HELCOM 2013). On the other hand, the strong increase of an indigenous predator, the white-tailed sea eagle, has negative impacts on the breeding population of common eiders (and probably other waterbirds) through the removal of indviduals and the failure of broods (Ekroos et al. 2012). As many species are influenced by several natural and anthropogenic drivers, indicator results have to be examined carefully in order to draw appropriate conclusions and implement suitable management measures.

Breeding success

The status evaluation based on the breeding success parameter of the indicator is poorly developed. No current results can yet be presented. There are no operational country-wide monitoring scheme which could currently supply data for the evaluation, although productivity is observed in several case studies (Herrmann et al. 2013). Therefore, this part of the indicator has been regarded as only providing qualitative support to the status evaluation based on the abundance of breeding waterbirds parameter. If monitoring schemes covering a number of waterbird species are available, it could be relevant to construct the breeding success parameter as an independent indicator with its own threshold value comparable to the operational indicator in the OSPAR region (ICG-COBAM MSFD Indicator B-3 'Breeding success/failure of marine birds', OSPAR 2017b).

Breeding success can directly show the suitability of prevailing environmental conditions for the reproduction of waterbirds. Whereas the bird abundance parameter alone may react slowly to changes in the environment owing to the high longevity of the individuals of the population, breeding success reflects short-term changes much better and could potentially act as an “early warning system”. For example, decreased food availability would directly translate into breeding failure as soon as a certain threshold is no longer met. As long as marine food is taken for chick provisioning, the marine ecosystem can thus be evaluated by the reproductive output in relation to reference values. However, breeding failure is often connected to predation. As this mainly involves terrestrial mammals, a breeding success indicator reflects the conditions in the coastal landscape as well. Therefore, evaluations based on measurements of breeding success have to include careful considerations about the reasons responsible for breeding failure. As the drivers behind changes in population sizes are often either unknown or very complex, monitoring of reproduction would potentially improve our understanding very much.

Confidence of the indicator status evaluation

The overall confidence of the indicator is currently **intermediate**.

Regarding the temporal coverage, the confidence is high because data from all years of the assessment period (2011-2016) are included. However, not all species are monitored in each country annually. Commonly found intervals are three or six years (as adaptation to Natura 2000 reporting cycles, see European Commission 1992, 2010) or even ten years. This results in many missing data for part of the years in the dataset. Although TRIM is designed to handle this by imputing the missing data, the analysis needs a substantial amount of yearly “real” data to calculate reliable imputed values. Missing counts for particular sites are estimated (´imputed´) from changes in all other sites. If there are too few of these “other sites” with “real” data, the obtained estimates for focal sites are strongly influenced by site-specific processes at the sites providing the real data.

The spatial representability is estimated to be intermediate, because this evaluation is lacking information from two Contracting Parties of HELCOM (Lithuania, Russia) and contains only fragmentary information from Latvia. Therefore, the current analyses are based on unevenly distributed sites around the Baltic Sea.

The accuracy of the estimate is high, because the results clearly show whether or not the threshold values are met. The reference period (1991-2000) used to define the modern baseline for the indicator is arbitrarily chosen to reflect as early abundance data as possible. The modern baseline does not reflect pristine conditions. In order to enhance the confidence in the overall threshold values, future work to explore the abundance of the baseline period in relation to pristine conditions could be undertaken.

Methodological confidence can be regarded as intermediate. Though there are no HELCOM guidelines for monitoring breeding bird abundance, the methods applied in breeding bird surveys can be expected to meet international agreed standards and to result in data qualities according to at least local standards.

Thresholds and Status evaluation

The status is evaluated by examining the proportion of breeding waterbird species for which the abundance deviates more than 30% (20% in species laying only one egg per year) downwards from the abundance in the modern baseline defined by a reference period. This approach can be used for status evaluations i) as a multi-species assessment or ii) for species of waterbirds separately, the latter is used in MSFD assessments according to the COM Decision (EU) 2017/848 about criteria and methodological standards on Good Environmental Status. In the multi-species assessment, the threshold value is achieved when 75% of the species deviate less than 30%/20% downwards from the baseline.

This threshold concept follows the concept of the OSPAR Indicator 'Marine bird abundance' (ICES 2013, OSPAR 2017a). Upward deviations (>30% above abundance at the baseline) are not considered to reflect a failure to achieve the threshold value indicating good status, however they are reported as possible indications of imbalance in the ecosystem. The applicability of this method in the Baltic Sea has been shown in preceeding versions of this indicator (Herrmann et al. 2013, HELCOM 2017). Good status is possible to achieve also for species identified as being threatened in the Baltic Sea (HELCOM 2013), when the species maintained its population size on a low level or even increased while still being under pressure from anthropogenic influence.

The multi-species assessment can be conducted using all species without any weighting, but then the results are biased with regard to the numbers of species in the species groups. More meaningful results are obtained when species groups form the basis of the assessment. ICES (2015) has defined terminology and composition of functional species groups, which are defined mainly by the way of foraging (see Thresholds table 1). OSPAR/HELCOM/ICES (2016) have identified bird species suitable for supporting the breeding waterbird abundance indicator. Thus, this indicator provides five evaluations when applied to

- wading feeders (six species: common shelduck, Eurasian oystercatcher, pied avocet, ringed plover, turnstone, dunlin),
- surface feeders (ten species: Arctic skua, common gull, herring gull, great black-backed gull, lesser black-backed gull, little tern, Caspian tern, sandwich tern, common tern, Arctic tern),
- pelagic feeders (seven species: great crested grebe, great cormorant, goosander, red-breasted merganser, razorbill, common guillemot, black guillemot),
- benthic feeders (four species: greater scaup, tufted duck, common eider, velvet scoter) and
- grazing feeders (three species: mute swan, barnacle goose, greylag goose).

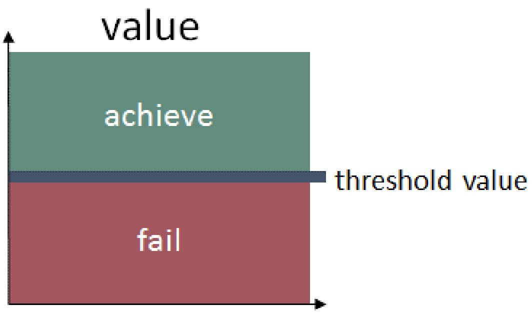
It has to be noted that some species apply more than one foraging mode (OSPAR/HELCOM/ICES 2016). Of the species selected for this indicator, this holds true for some gulls (which are also wading feeders), mallard and pintail (which are also wading feeders), Eurasian teal (which is also grazing feeder) and great cormorant and Eurasian coot (which are also benthic feeders).

Given the composition of the species groups, the five evaluations are based on a different number of species per group. For example, in surface feeders, eight out of ten species would need to be above the threshold, while in benthic feeders all three species would have to be above the threshold level, because two out of three species would mean that only 67% of the species do not deviate from the baseline too much (but 75% is required).

The selection of species assessed in the indicator was related only to breeding occurrence in Baltic marine habitats and data availability, but independent of threat status.

Thresholds table 1: Species groups of waterbirds as defined by ICES (2015).

Species group	Typical feeding behaviour	Typical food types	Additional guidance
Wading feeders	Walk/wade in shallow waters	Invertebrates (molluscs, polychaetes, etc.)	
Surface feeders	Feed within the surface layer (within 1–2 m of the surface)	Small fish, zooplankton and other invertebrates	"Surface layer" defined in relation to normal diving depth of plunge-divers (except gannets)
Pelagic feeders	Feed at a broad depth range in the water column	Pelagic and demersal fish and invertebrates (e.g. squid, zooplankton)	Include only spp. that usually dive by actively swimming underwater; but including gannets. Includes species feeding on benthic fish (e.g. flatfish).
Benthic feeders	Feed on the seafloor	Invertebrates (e.g. molluscs, echinoderms)	
Grazing feeders	Grazing in intertidal areas and in shallow waters	Plants (e.g. eelgrass, saltmarsh plants), algae	Geese, swans and dabbling ducks, coot



Thresholds figure 1. Schematic representation of the threshold value. Determination of acceptable deviation from baseline (condition during the reference period), where the threshold is achieved if 75% of the considered populations are not more than 30% below the baseline level (20% in species laying only one egg per year). Upward deviations (>30% above abundance at the baseline) are not considered to reflect a failure to achieve the threshold, but rather indicate possible imbalance in the ecosystem. No threshold value has currently been developed for the included parameter 'breeding success'.

Owing to both natural and anthropogenic influences, breeding bird numbers have fluctuated over the past decades. Therefore, it is difficult to define 'natural' population sizes or pristine conditions, which could serve as reference levels. For practical reasons, a preliminary modern baseline is set based on a reference period as the average abundance during the starting period of data compilation (1991-2000), but future work on the indicator may find more appropriate solutions by setting species-specific reference periods for defining the baseline against which the status is assessed, which reflect the pressures affecting the populations.

Although generally giving more up-to-date information on the situation of bird populations, the parameter breeding success (i.e. the annual reproductive output) cannot be evaluated at present. This is mainly due to the lack of monitoring programmes. If monitoring of breeding success can be implemented in the Baltic Sea region in future, an evaluation method could be developed by either looking at colony failures similar to the OSPAR indicator 'Breeding success/failure of marine bird species', developed by ICG-COBAM (ICES 2013, OSPAR 2017b) or relying on more precise measurements of offspring per breeding pair as currently prepared for the OSPAR indicator by the OSPAR/HELCOM/ICES Joint Working Group on Marine Birds (OSPAR/HELCOM/ICES 2018).

Assessment Protocol

The assessment is based on the numbers of breeding pairs of selected waterbird species, counted in breeding colonies or in monitoring plots. Site level raw data are used for each species to calculate the annual indices and trends. The national monitoring programmes provide the breeding bird monitoring data. Each site level data for each species consists of site code, coordinates of the site, year of survey, recorded abundance and the units in which the abundance is expressed (mostly pairs). There is a separate entry for each year the site was visited. Each site is assigned a code indicating to which country and assessment unit it belongs.

To calculate the yearly indices and trends, the TRIM framework and "rtrim" package for the R statistical software is used. Models explaining the observed abundance by site effects and year effects while accounting for serial correlation and overdispersion in the data are built for each species. The method is based on loglinear Poisson regression and is able to impute the missing observations (ter Braak et al. 1994, van Strien et al. 2001, 2004). For more details of the procedure, see also http://www.ebcc.info/trim.html and https://www.cbs.nl/en-gb/society/nature-and-environment/indices-and-trends--trim--/ . The method produces yearly indices and linear trend estimates (the slope of the regression line through the logarithm of the indices). The year 1991 or the start year of the time series (if later) is used as the point of reference (when the index is 1), but the results are then scaled to a reference period (i.e. the average index values from 1991-2000 are scaled to 1).

The multiplicative overall slope estimate in TRIM is converted into one of the following categories. The category depends on the overall slope as well as its 95% confidence interval (= slope +/- 1.96 times the standard error of the slope) (Pannekoek & van Strien 2001):

- Strong increase - increase significantly more than 5% per year (5% meaning a doubling in abundance within 15 years). Criterion: lower limit of confidence interval >1.05.
- Moderate increase - significant increase, but not significantly more than 5% per year. Criterion: 1.00< lower limit of confidence interval <1.05.
- Stable - no significant increase or decline, and it is certain that trends are less than 5% per year. Criterion: confidence interval encloses 1.00 but lower limit >0.95 and upper limit <1.05.
- Moderate decline - significant decline, but not significantly more than 5% per year. Criterion: 0.95< upper limit of confidence interval <1.00.
- Steep decline - decline significantly more than 5% per year (5% meaning a halving in abundance within 15 years). Criterion: upper limit of confidence interval <0.95.

All analyses are conducted on the level of species. Though in some species diverging trends are observed in different parts of the Baltic Sea, those differences are owing to two subspecies only in lesser black-backed gull and black guillemot. Lesser black-backed gull is represented by *Larus fuscus intermedius* in Kattegat, Belt Group and Bornhom Group, but by *L. f. fuscus* in Gotland Group, Åland Group, Gulf of Finland and Bothnian Group. Black guillemots breeding in Kattegat and Belt Group belong to the subspecies *Cepphus grylle arcticus*, those from further east in the Baltic Sea to *C. g. grylle*.

For the parameter breeding success of Baltic waterbirds, no assessment protocol currently exists.

Further development of the indicator

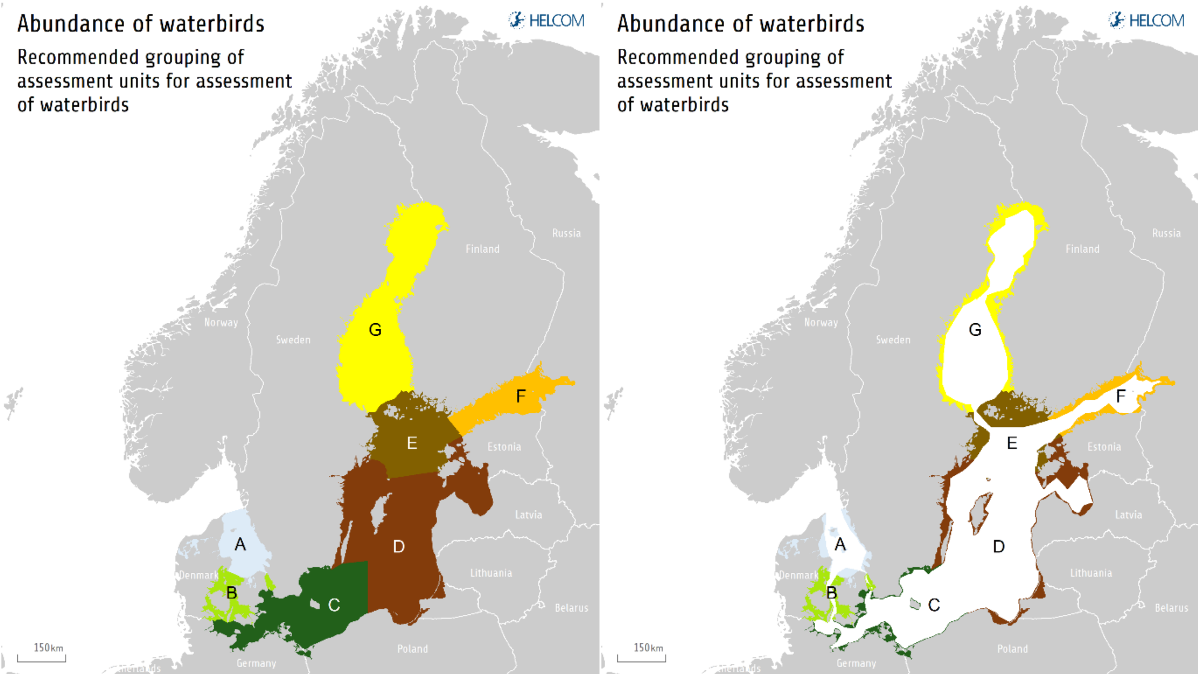
The indicator is in a state allowing evaluation of the status of breeding waterbirds in the entire Baltic based on population sizes. Development is needed to include breeding success as an additional criterion to assess the status of breeding waterbirds. The assessment of population sizes would gain from the establishment of species-specific reference periods, which would allow to compare recent population sizes to pristine conditions.

Assessment units

The assessment units are defined in the HELCOM Monitoring and Assessment Strategy Annex 4.

The assessment was conducted at two spatial scales, the entire Baltic Sea (HELCOM assessment unit scale 1) and seven subdivisions of the Baltic Sea, which were defined as aggregations of up to four of the 17 sub-basins (HELCOM assessment unit scale 2) following recommendation by OSPAR/HELCOM/ICES (2017, 2018) (Assessment units figure 1). Several waterbird species (terns in particular) are known to switch between breeding colonies from year to year, possibly even at distances involving switches between sub-basins, leading to the estimate that HELCOM assessment unit scale 2 is not an appropriate scale. Further, the use of the seven subdivisions shall make it easier to localize problems and to implement necessary regional or local measures to improve the status. These smaller scale assessments are better suited to reflect the conditions of a given part of the Baltic Sea rather than downscaling the results from the entire Baltic Sea to everywhere. In addition, subdivision assessments serve better the national reporting according to Article 8 of MSFD, because there is much less influence from other parts of the Baltic on the national assessments. The seven subdivisions are defined as follows:

- A: Kattegat (Kattegat),
- B: Belt Group (Great Belt, The Sound),
- C: Bornholm Group (Kiel Bay, Bay of Mecklenburg, Arkona Basin, Bornholm Basin),
- D: Gotland Group (Gdansk Basin, Eastern Gotland Basin, Western Gotland Basin, Gulf of Riga),
- E: Åland Group (Northern Baltic Proper, Åland Sea),
- F: Gulf of Finland (Gulf of Finland),
- G: Bothnian Group (Bothnian Sea, The Quark, Bothnian Bay).



Assessment units figure 1. Grouping of 17 sub-basins (HELCOM assessment unit scale 2) to seven subdivisions as spatial units for breeding waterbird abundance evaluations as recommended by OSPAR/HELCOM/ICES (2018). The left figure shows the entire subdivision coloured, and the right figure shows the coastal areas, as used in the current assessment, coloured by the seven subdivisions.

Relevance of the Indicator

Biodiversity assessment

The status of biodiversity is assessed using several core indicators. Each indicator focuses on one important aspect of the complex issue. In addition to providing an indicator-based evaluation of the abundance of waterbirds in the breeding season, this indicator contributes to the overall biodiversity assessment along with the other biodiversity core indicators.

Policy relevance

The indicator on abundance of waterbirds in the breeding season addresses the Baltic Sea Action Plan (BSAP) Biodiversity and nature conservation segment's ecological objectives 'Thriving and balanced communities of plants and animals' and 'Viable populations of species' as well as the eutrophication segment's ecological objective 'Natural distribution and occurrence of plants and animals'.

The core indicator is relevant to the following action of the 2013 HELCOM Ministerial Declaration:

- 4 (B). WE DECIDE to protect seabirds in the Baltic Sea, taking into consideration migratory species and need for co-operation with other regions through conventions and institutions such as the Agreement on Conservation of African Eurasian Migratory Waterbirds (AEWA) under the Convention on Migratory Species (CMS), and particularly in the North Sea (OSPAR) and Arctic (Arctic Council) areas.

The core indicator also addresses the following qualitative descriptors of the MSFD for determining good environmental status (European Commission 2008):

Descriptor 1: 'Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions';

Descriptor 4: 'All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity'.

and the following criteria of the Commission Decision (European Commission 2017):

- Criterion D1C2 (population abundance)
- Criterion D1C3 (population demographic characteristics)
- Criterion D1C4 (species distribution)
- Criterion D4C1 (diversity of trophic guild)
- Criterion D4C2 (balance of total abundance between trophic guilds)
- Criterion D4C4 (productivity of trophic guild)

The EU Birds Directive (a) lists in Annex 1 barnacle goose, pied avocet, dunlin (Baltic subspecies *Calidris alpina schinzii*), Caspian tern, sandwich tern, common tern, Arctic tern and little tern as subject of special conservation measures and (b) generally covers all migratory species and they have to be reported (European Commission 2010). Thus, all species included in the concept of the indicator are also covered by the EU Birds Directive, which requires conservation of habitats in a way that allows birds to breed, moult, stage during migration and spend the winter.

Furthermore, the Baltic Sea is located in the agreement area of the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA). Contracting Parties (all HELCOM member countries except Poland and Russia) are obliged to undertake measures warranting the conservation of migratory waterbirds and their habitats.

The goals of the BSAP, EU MSFD, AEWA and EU Birds Directive are largely overlapping and the data needed for the indicator are roughly the same as needed for reporting within the framework of the EU Birds Directive.

In order to protect migrating birds in the Baltic Sea region, HELCOM has adopted the Recommendation 34/E-1 'Safeguarding important bird habitats and migration routes in the Baltic Sea from negative effects of wind and wave energy production at sea'. Since some species included in the concept of the indicator are vulnerable to habitat loss caused by wind farms and access to feeding areas of breeding birds may be blocked by wind farms, while others are prone to collisions (e.g. Masden et al. 2010, Furness et al. 2013, Bradbury et al. 2014), the indicator is linked to the intentions of the recommendation.

Role of waterbirds in the ecosystem

Waterbirds are an integral part of the Baltic marine ecosystem. They are predators of fish and macroinvertebrates, scavengers of carcasses and fishery discards and herbivores of littoral vegetation. They can be assigned to functional species groups, meaning that different prey types are taken from different compartments of the marine environment. Most species are specialized in certain species and/or size classes of prey. As they cannot survive without a sufficient food supply, changes in the number of waterbirds reflect conditions in the food web of the Baltic Sea. A high number of breeding waterbirds may not automatically indicate a good environmental status, because for instance piscivorous species benefit from a high availability of small fish, which in turn may points to a disorder of the food web owing to overfishing of large fish species.

As they are predators at or close to the top of the food web, waterbirds accumulate contaminants and their numbers, and even more their breeding success, may indicate the degree of contamination. Moreover, several waterbird species are predated by white-tailed sea eagles, transferring the loads of contaminants to a higher level in the food web.

Some waterbird species are not only breeding, but also wintering in the Baltic Sea region. For several reasons, those species are potentially included in the concepts of both the breeding and wintering waterbird abundance indicators. The intention of the indicators is to support the assessment of environmental status of marine areas rather than the state of bird populations per se. This is most obvious in species that have differing distribution patterns between breeding and wintering seasons (e.g. alcids). In general, the explanatory power of the indicator is constrained by factors acting on the waterbirds in the non-breeding season, either in the Baltic Sea or in staging and wintering areas along the flyways to southern Europe and Africa or even Australia and Antarctica, depending on the migration routes of the respective species.

Human pressures linked to the indicator

	General	MSFD Annex III, Table 2a
Strong link	The most important human threats to breeding waterbirds are predation by indigenous and non-indigenous mammals, contamination by hazardous substances, prey depletion and habitat loss.	Biological pressures: - input or spread of non-indigenous species - disturbance of species (e.g. where they breed, rest and feed) due to human presence. - extraction of, or mortalityx/injury to, wid species (by commercial and recreational fishing and other activities). Physical pressures: - physical disturbance to seabed (temporary or reversible). - physical loss (due to permanent change of seabed substrate or morphology and to extraction of seabed substrate). Pressures by substances, litter and energy - input of nutrients – diffuse sources, point sources, atmospheric deposition - input of organic matter – diffuce sources and point sources. - input of other substances (e.g. synthetic substances, non-synthetic substances, radionuclides) – diffuse sources, point sources, atmospheric deposition, acute events.
Weak link	Numbers of breeding waterbirds are additionally influenced by pressures acting primarily in the non-breeding season.	in addition to those mentioned above: Pressures by substances, litter and energy: - input of litter (solid waste matter, including micro-sized litter). - input of anthropogenic sound (impulsive, continuous). - input of other forms of energy (including electromagnetic fields, light and heat).

The abundance of breeding waterbirds in the Baltic Sea is strongly influenced by a variety of human activities, both directly and indirectly. The effects are cumulative, because pressures exist in the breeding season, during migration and in winter.

In general, waterbirds strongly respond to food availability. Therefore, human activities influencing the food supply of waterbirds are reflected in bird numbers. For fish-eating birds, direct human pressure is posed by the extraction of fish, while physical damage of the seafloor directly affects benthic feeders. On the other hand, overfishing of large predatory fish species increases the abundance of smaller species and thereby improves the food supply for birds. Indirect effects can also occur via human induced eutrophication: in the oligotrophic end of the eutrophication status, the bird populations are limited by the availability of food sources, whereas towards eutrophic conditions plant and zoobenthos biomass increases, which first benefits waterbird populations, but in the extreme end will cause a decrease in food availability.

As their reproduction takes place on land, even waterbirds that live at sea during all other times are prone to predation by non-indigenous mammals such as American mink and raccoon dog, which have been introduced by humans and therefore have to be treated as a human pressure. While many breeding colonies are well protected nowadays, some breeding sites are still under pressure from direct human disturbance, for example from tourism and recreational boating, but also from habitat loss due to changes in land use and agriculture..

Bird losses from drowning in fishing gear, hunting and plumage oiling as well as habitat loss from offshore wind farming, aggregate extraction and shipping are pressures mostly acting in the non-breeding season. At least in those species that both breed and spend the winter in the Baltic Sea, also these human pressures affect the numbers of breeding birds – not only by the elimination of birds from the population, but also in terms of carry-over effects by reducing body condition with effects on survival and reproductive success. Negative impacts on body condition are also obtained year-round from the accumulation of contaminants ingested via the food web.

Monitoring Requirements

Monitoring methodology

Monitoring of breeding waterbirds in the Contracting Parties of HELCOM is described on a general level in the **HELCOM Monitoring Manual** in the **sub-programme: Marine breeding birds abundance and distribution.**

Specific monitoring guidelines for breeding waterbirds are planned to be included into the Monitoring Manual.

The indicator on breeding waterbirds is primarily based on counts of breeding pairs or nests along the shorelines of the Baltic Sea, i.e. is restricted to coastal landscape (including islands). Many species only breed in nature reserves or other protected sites, which have been monitored using constant methods for decades. In many sites, breeding birds are counted annually, and gaps can be filled by a TRIM analysis.

Breeding success is usually measured as the number of fledged chicks per breeding pair. Methods to observe the reproductive output differ between species. For instance, in Great Cormorants it is possible to count the nearly-fledged juveniles in the nests, whereas in gulls and terns reliable data are available only when movements of the non-fledged offspring are restricted by fencing or when mark-recapture methods are applied.

Current monitoring

The monitoring activities relevant to the indicator that are currently carried out by HELCOM Contracting Parties are described in the **HELCOM Monitoring Manual** in the **monitoring concepts table**.

Sub-programme: Marine breeding birds abundance and distribution

Monitoring Concepts table

There are some differing characteristics in the countries' monitoring programmes, e.g. the species covered and the temporal scaling. Surveys are in most cases conducted annually, but every three or six years (as an adaptation to Natura 2000 reporting cycles, see European Commission 1992, 2010) or even every ten years (e.g. common eider in Denmark) in some cases. Some new monitoring schemes, such as the 2015 spring monitoring scheme in Sweden, will be implemented in the near future, however recent overviews of monitoring of breeding waterbirds are still valid, e.g. the BALSAM metadatabase or the project's interim report (HELCOM 2014).

Description of optimal monitoring

For abundance of breeding birds, the currently operational national monitoring schemes are only partly sufficient to supply the necessary data for the indicator. There are still gaps regarding spatial coverage (lack of monitoring schemes in Russia and Latvia) and coverage of species (not all monitoring schemes include all the species dealt with in the indicator), and an optimal monitoring would have to close these gaps. The monitoring methods applied could benefit from international standardization, however, need to take into consideration the varying environmental conditions and species composition of the different regions of the

Baltic Sea. As not all species can be monitored in every country, depending on the assessment unit level chosen, it would be wise to coordinate national monitoring schemes in a way that allows for coverage of as many species as possible. For rare species, and those showing higher degrees of inter-annual relocation, coordinated Baltic-wide surveys should be aspired for in order to minimize the effects of data gaps and low site fidelity.

Breeding success is currently not monitored sufficiently to allow for any status evaluation. In order to improve the confidence of the indicator evaluation, breeding success should be included in monitoring activities at least for the key species in the main breeding colonies throughout the Baltic Sea region.

Data and updating

Access and use

The data and resulting data products (tables, figures and maps) available on the indicator web page can be used freely given that the source is cited. The indicator should be cited as following:

HELCOM (2018) Abundance of waterbirds in the breeding season. HELCOM core indicator report. Online. [Date Viewed], [Web link].

ISSN 2343-2543

Metadata

Result: Abundance of waterbirds in the breeding season

Data: Abundance of waterbirds in the breeding season

Result: Abundance of waterbirds in the breeding season - surface

Result: Abundance of waterbirds in the breeding season - pelagic

Result: Abundance of waterbirds in the breeding season - benthic

Result: Abundance of waterbirds in the breeding season – grazing

Result: Abundance of waterbirds in the breeding season - wading

Following a data call in May 2017, breeding bird data of 30 species for the years 1991-2016 were supplied by authorities from Contracting Parties of HELCOM, except Russia and Lithuania. Breeding bird abundance was reported in numbers of breeding pairs, but Swedish data referred to numbers of males and individuals. The use of different units did not cause problems, because calculations are done on the basis of population indices rather than on population sizes. Data sets consisted of site code, year, species and abundance. Data were supplied for a total of 11164 sites, but each species had different numbers of sites used in the analysis.

Contributors and references

Contributors

Volker Dierschke, Ainars Auninš, Fredrik Haas, Leif Nilsson, Owen Rowe

Other recognized contributors: Markus Ahola, Antti Below, Thomas Bregnballe, Julia Bublichenko, Tomasz Chodkiewicz, Mindaugas Dagys, Gennady Grishanov, Christof Herrmann, Gitte Høj Jensen, Joni Kaitaranta, Jan Kieckbusch, Jana Kotzerka, Antti Lappalainen, Łukasz Ławicki, Meelis Leivits, Leho Luigujoe, Nele Markones, Wlodzimierz Meissner, Ian Mitchell, Ib Krag Petersen, Antra Stipniece.

Archive

This version of the HELCOM core indicator report was published in July 2018:

Abundance of waterbirds in the breeding season HELCOM core indicator 2018 (pdf)

Older versions of the report:

HOLAS II component - Core indicator report – web-based version July 2017 (pdf)

2013 Core indicator Report

References

Bradbury, G., Trinder, M., Furness, B., Banks, A.N., Caldow, R.W.G., Hume, D. (2014) Mapping seabird sensitivity to offshore wind farms. PLOS ONE 9 (9): e106366.

Brenning, U., Nehls, H.W. (2013) Vogelinsel Langenwerder – 100 Jahre Naturschutz. (In German). Ornithol. Rundbr. Meckl.Vorpomm. 47 (Suppl. 2): 1-296.

Ekroos, J., Fox, A.D., Christensen, T.K., Petersen, I.K., Kilpi, M., Jónsson, J.E., Green, M., Laursen, K., Cervencl, A., de Boer, P., Nilsson, L., Meissner, W., Garthe, S., Öst, M. (2012) Declines amongst breeding Eider *Somateria mollissima* numbers in the Baltic/Wadden Sea flyway. Ornis Fennica 89: 81-90.

European Commission (1992) Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Off. J. Eur. Communities L 206: 7-50.

European Commission (2008) Directive 2008/56/EC of the European Parliament and the Council establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive). Off. J. Eur. Union L 164: 19-40.

European Commission (2010) Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds. Off. J. Eur. Union L20: 7-25.

European Commission (2017) Commission Decision of (EU) 2017/848 of 17 May 2017 laying down criteria and methodological standards on good environmental status of marine waters and specifications and standardized methods for monitoring and assessment, and repealing Decision 2010/477/EU. May 2017.

Furness, R.W., Wade, H.M., Masden, E.A. (2013) Assessing vulnerability of marine bird populations to offshore wind farms. J. Environ. Manage. 119: 56-66.

HELCOM (2013) Red List of Baltic Sea species in danger of becoming extinct. Baltic Sea Environ, Proc. No. 140.

HELCOM (2014) First Interim Report of the Baltic Sea Pilot Project: Testing New Concepts for Integrated Environmental Monitoring of the Baltic Sea (BALSAM): Information Collected During Cataloguing of Environmental Monitoring in the Baltic Sea. Available at: http://portal.helcom.fi/meetings/BALSAM%202-2014-110/MeetingDocuments/BALSAM%20Interim%20report%20May%202014_final.pdf

HELCOM (2017) Abundance of waterbirds in the breeding season. HELCOM core indicator report. Online. http://helcom.fi/Core%20Indicators/Abundance%20of%20waterbirds%20in%20breeding%20season_HELCOM%20core%20indicator%20-%20HOLAS%20II%20component.pdf

Herrmann, C., Rintala, J., Lehikoinen, A., Petersen, I.K., Hario, M., Kadin, N., Korpinen, S. (2013) Abundance of waterbirds in the breeding season. HELCOM Core Indicator Report.

ICES (2008) Report of the Workshop on Seabird Ecological Quality Indicator (WKSEQUIN), 8-9 March 2008, Lisbon, Portugal. Available at: http://www.ices.dk/reports/lrc/2008/WKSEQUIN/WKSEQUIN2008.pdf

ICES (2013) Report on the Joint ICES/OSPAR Expert Group on Seabirds (WGBIRD), 22-25 Oct 2013, Copenhagen, Denmark. Available at: http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2013/WGBIRD/wgbird_2013.pdf

ICES (2015) Report on the Joint ICES/OSPAR Working Group on Seabirds (JWGBIRD), 17-21 November 2014, Copenhagen, Denmark. Available at: http://ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2014/JWGBIRD/JWGBIRD_2014.pdf

Masden, E.A., Haydon, D.T., Fox, A.D., Furness, R.W. (2010) Barriers to movement: Modelling energetic costs of avoiding marine wind farms among breeding seabirds. Mar. Poll. Bull. 60: 1085-1091.

OSPAR (2017a) Marine bird abundance. In: Intermediate Assessment 2017. Available at: https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/biodiversity-status/marine-birds/bird-abundance/

OSPAR (2017b) Marine Breeding Success / Failure. In: Intermediate Assessment 2017. Available at: https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/biodiversity-status/marine-birds/marine-bird-breeding-success-failure/

OSPAR/HELCOM/ICES (2016) Report of the Joint OSPAR/HELCOM/ICES Working Group on Seabirds (JWGBIRD), 9-13 November 2015, Copenhagen, Denmark. Available at: http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2015/JWGBIRD/JWGBIRD_2015.pdf

OSPAR/HELCOM/ICES (2017) Report of the OSPAR/HELCOM/ICES Working Group on Marine Birds (JWGBIRD), 10-14 October 2016, Thetford, U.K. Available at: http://ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2016/JWGBIRD/ExSumm_JWGBIRD_2016.pdf

OSPAR/HELCOM/ICES (2018) Report of the OSPAR/HELCOM/ICES Working Group on Marine Birds (JWGBIRD), 6-10 November 2017, Riga, Latvia. In prep.

Österblom, H., Casini, M., Olsson, O., Bignert, A. (2006) Fish, seabirds and trophic cascades in the Baltic Sea. Mar. Ecol. Prog. Ser. 323: 233-238.

Pannekoek, J., van Strien, A.J. (2001) TRIM 3 manual (TRends and Indices for Monitoring data). Research paper no. 0102. Statistics Netherlands.

Soldaat, L.L., Pannekoek, J., Verweij, R.J.T., van Turnhout, C., van Strien., A.J. (submitted) A Monte Carlo method to account for sampling error in multi-species indicators.

ter Braak C, van Strien A, Meijer R, Verstrael T (1994) Analysis of Monitoring Data With Many Missing Values: Which Method? In: Hagemeijer EJM, Verstrael TJ (eds) Bird numbers 1992 distribution monitoring and ecological aspects. Proceedings of the 12th International Conference of IBCC and EOAC. pp 663–673

van Strien, A.J., Pannekoek, J., Gibbons, D. (2001) Indexing European bird population trends using results of national monitoring schemes: a trial of a new method. Bird Study 48: 200-213.

van Strien, A., Pannekoek, J., Hagemeijer, W., Verstrael, T. (2004) A logline Poisson regression method to analyse bird monitoring data. Bird Census News 13: 33-39.

Additional relevant publications

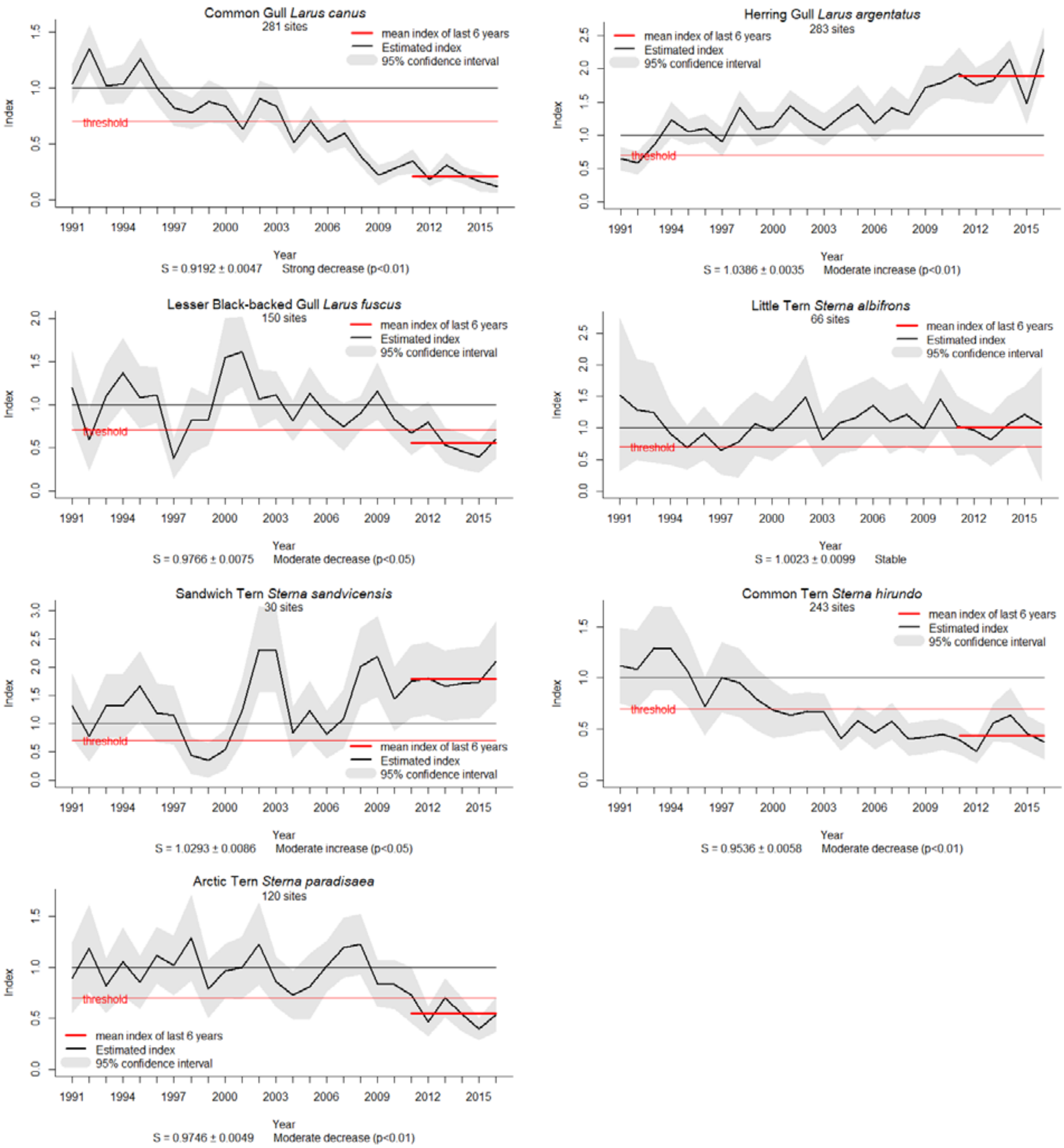
Martin, G., Fammler, H., Veidemane, K., Wijkmark, N., Aunins, A., Hällfors, H., Lappalainen, A. (2015) The MARMONI approach to marine biodiversity indicators. Vol. 1: Development of indicators for assessing the state of marine biodiversity in the Baltic Sea within the LIFE MARMON I project. Vol. 2: List of indicators for assessing marine biodiversity in the Baltic Sea developed by the LIFE MARMONI project. Estonian Marine Institute Report Series No 16. http://marmoni.balticseaportal.net/wp/.

HELCOM core indicator report
ISSN 2343-2543

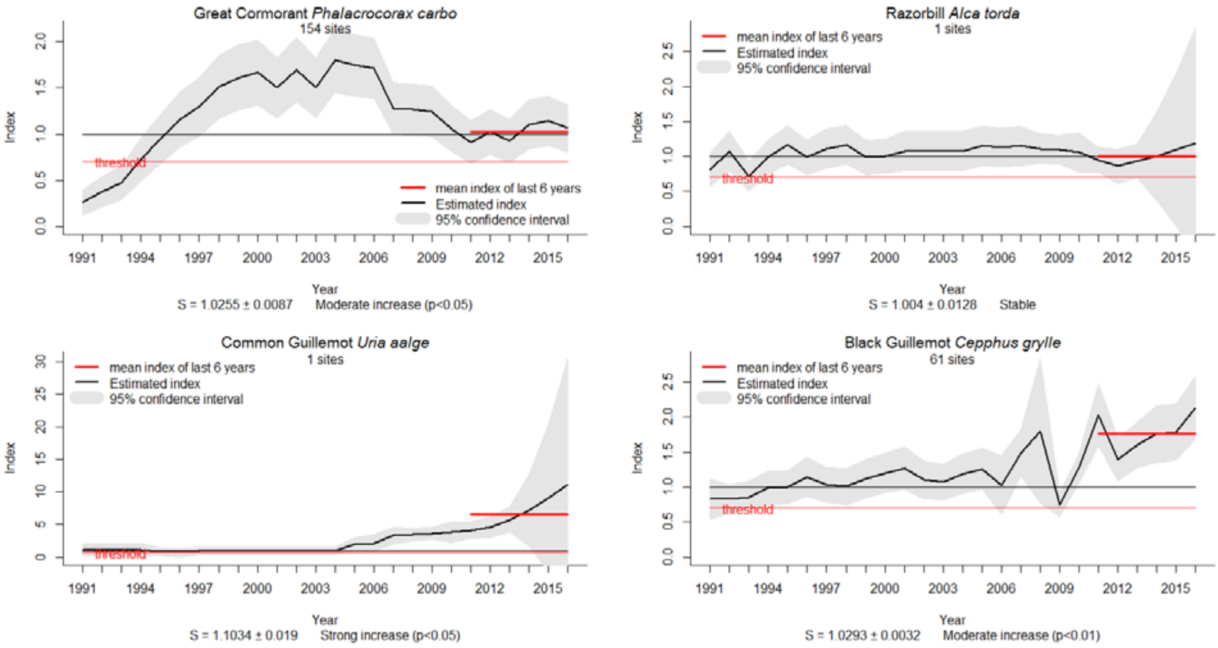
Annex 1

Results figure 2: Index graphs showing annual index values for breeding waterbirds in the **Kattegat** (black line) and 95% confidence intervals (grey shading) resulting from TRIM analyses after rescaling the annual indices to reference level where average of index values 1991-2000 is 1 (thin black line). Further shown are thresholds for good status (70% of baseline, 80% of baseline in species laying only one egg per year, thin red line) and the average index values 2011-2016 (geometric mean) used for the evaluation (red line). In addition, trend slopes and s.e. as well as the status of the species are given below the graphs.

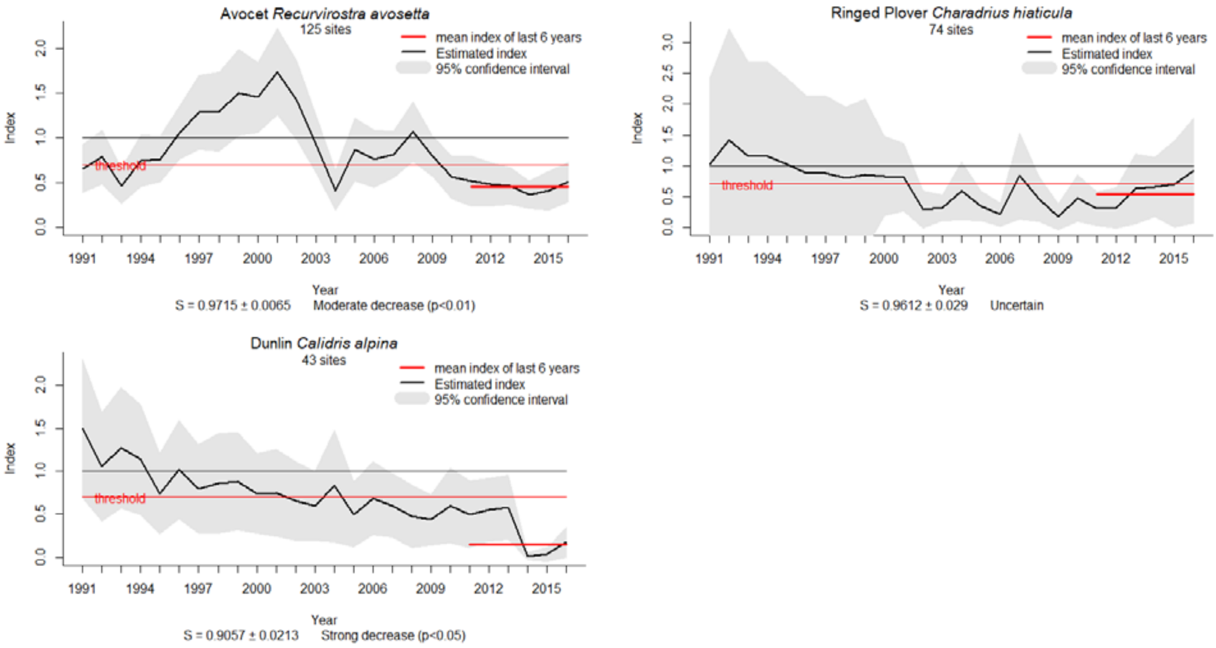
Surface feeders



Pelagic feeders

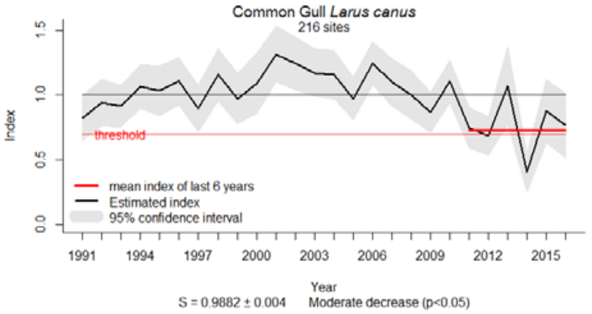


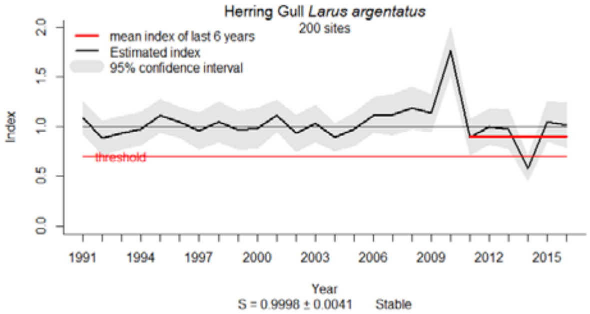
Wading feeders

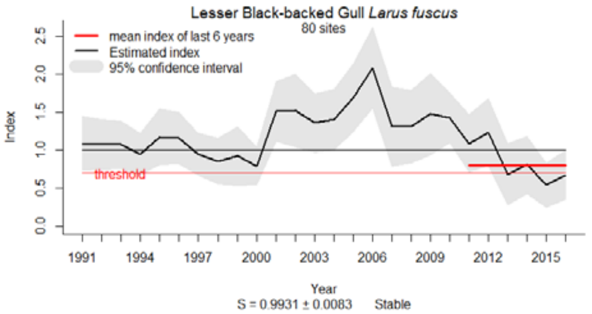


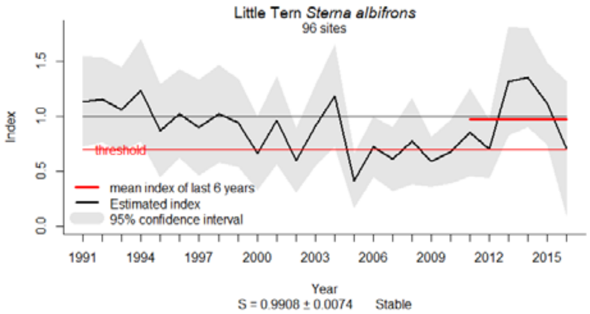
Results figure 3: Index graphs showing annual index values for breeding waterbirds in the **Belt Group** (Great Belt, The Sound; black line) and 95% confidence intervals (grey shading) resulting from TRIM analyses after rescaling the annual indices to reference level where average of index values 1991-2000 is 1 (thin black line). Further shown are thresholds for good status (70% of baseline, thin red line) and the average index values 2011-2016 (geometric mean) used for the evaluation (red line). In addition, trend slopes and s.e. as well as the status of the species are given below the graphs.

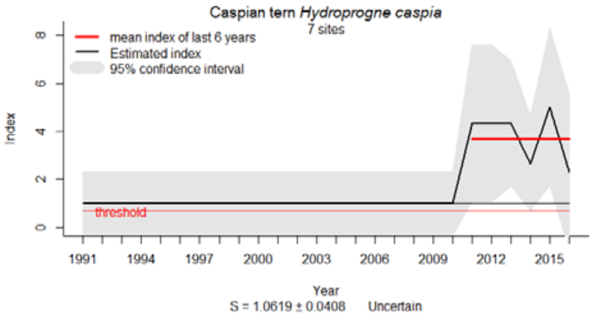
Surface feeders

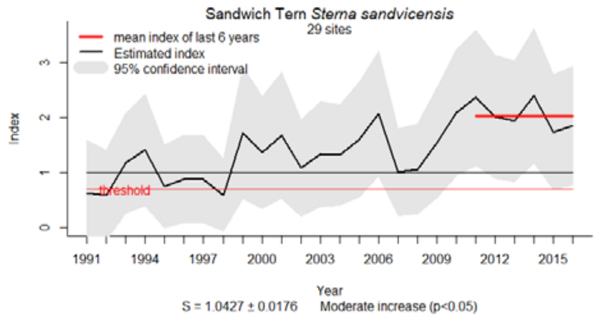


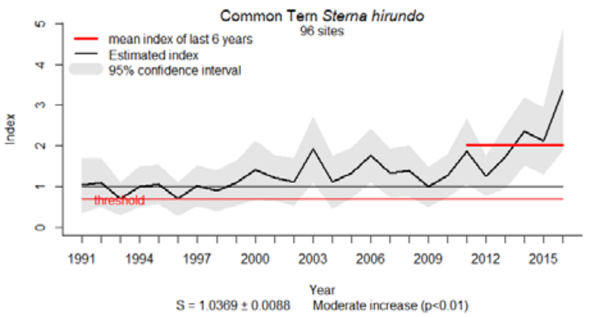


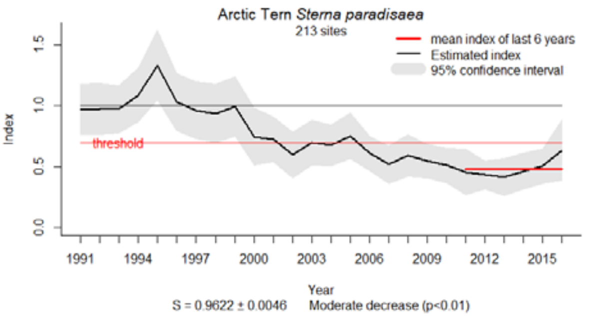




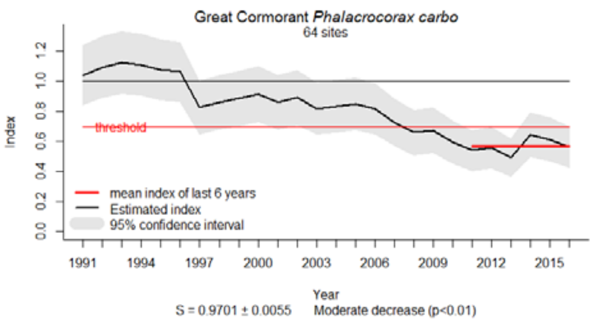


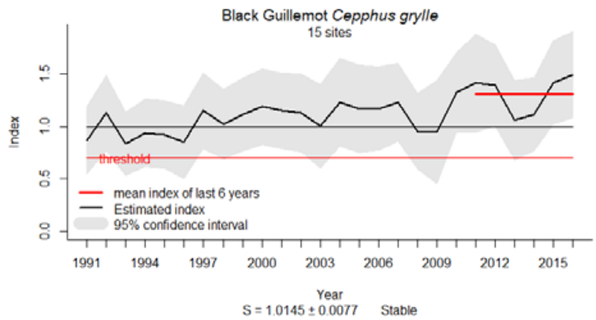




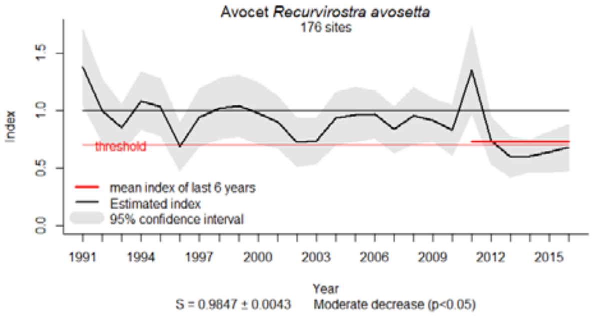


Pelagic feeders

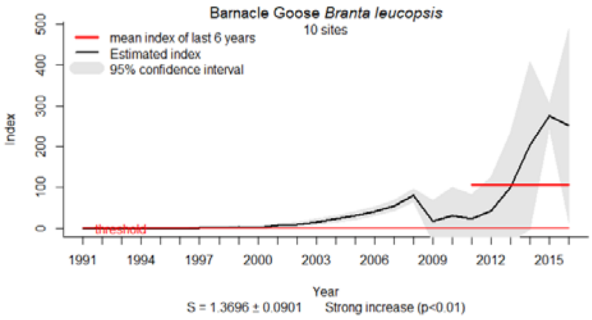




Wading feeders

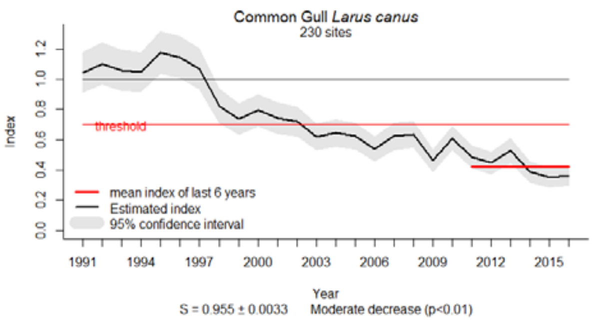


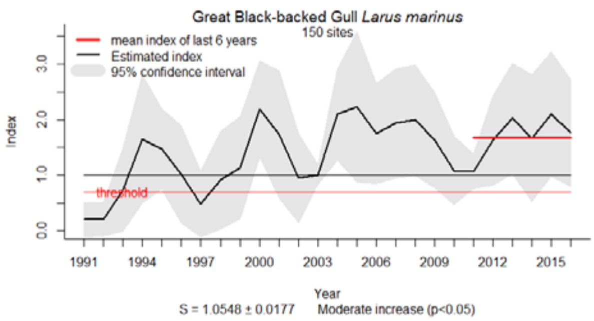
Grazing feeders

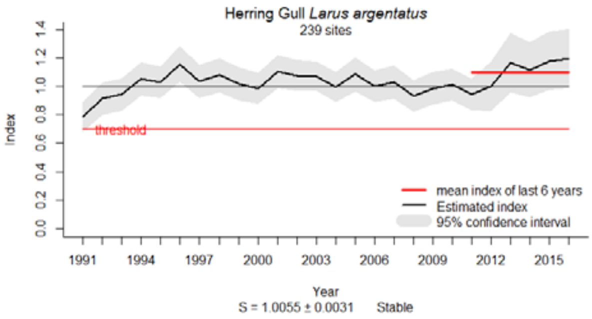


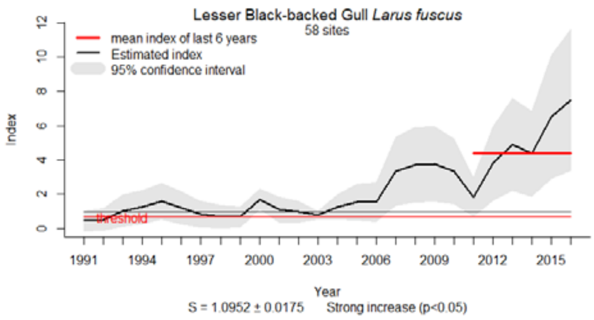
Results figure 4: Index graphs showing annual index values for breeding waterbirds in the **Bornholm Group** (Kiel Bay, Bay of Mecklenburg, Arkona Basin, Bornholm Basin; black line) and 95% confidence intervals (grey shading) resulting from TRIM analyses after rescaling the annual indices to reference level where average of index values 1991-2000 is 1 (thin black line). Further shown are thresholds for good status (70% of baseline, 80% of baseline in species laying only one egg per year, thin red line) and the average index values 2011-2016 (geometric mean) used for the evaluation (red line). In addition, trend slopes and s.e. as well as the status of the species are given below the graphs.

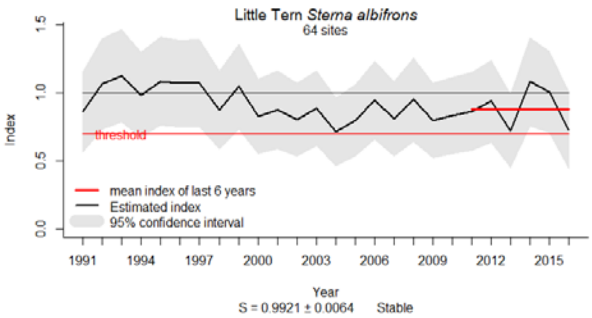
Surface feeders

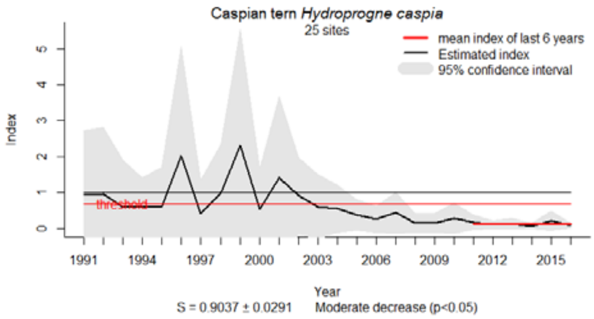


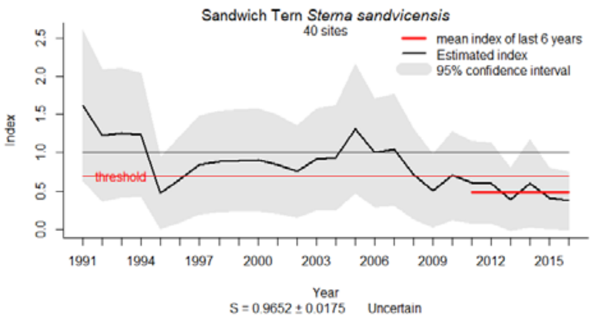


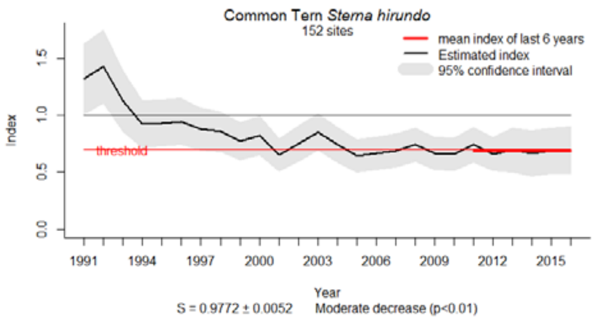


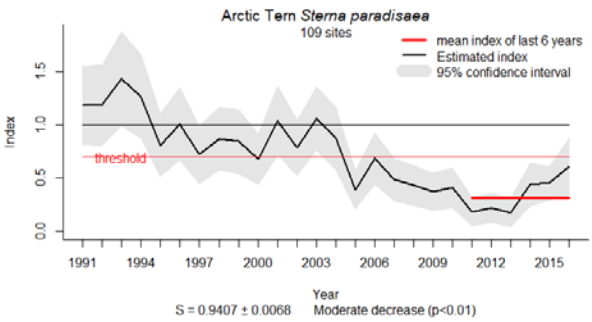




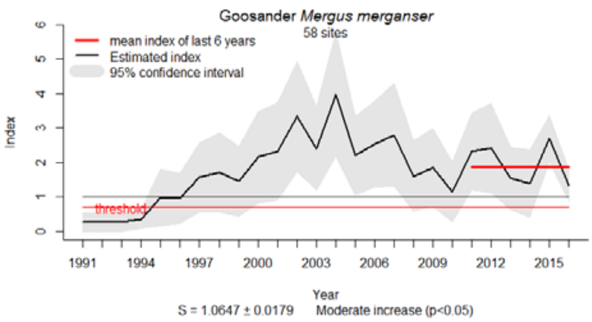


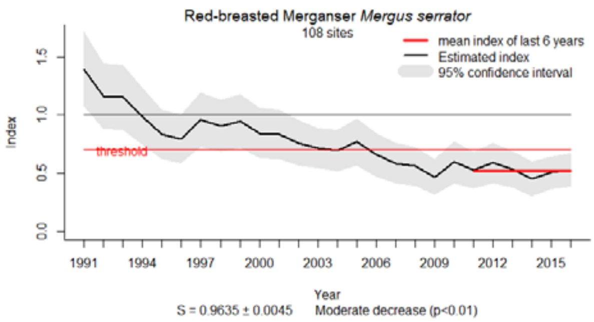


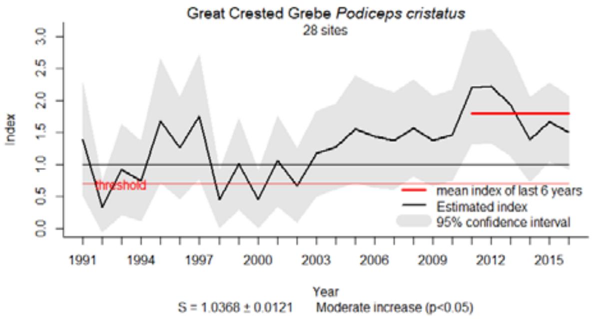


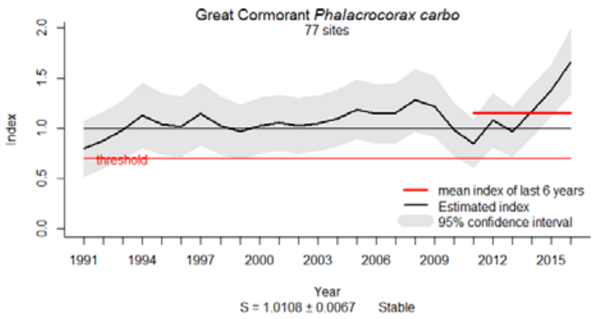


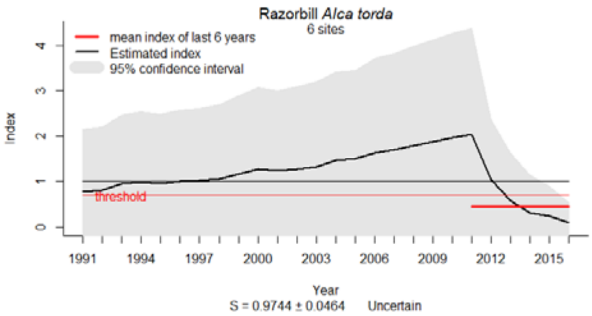
Pelagic feeders

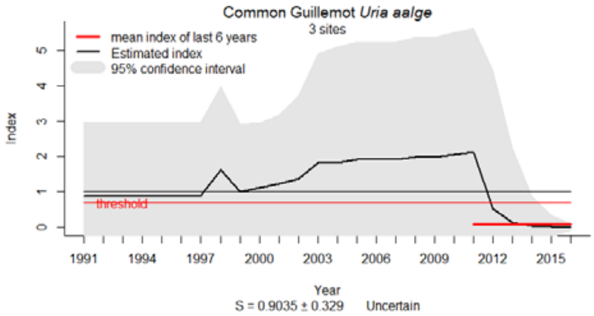




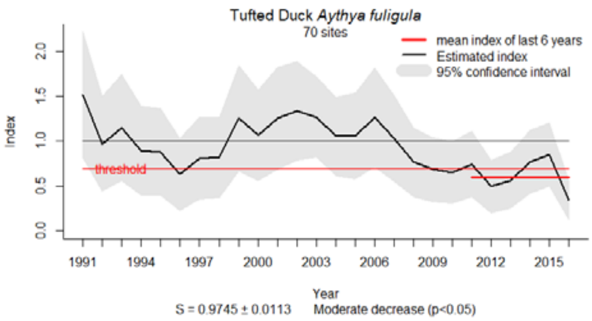


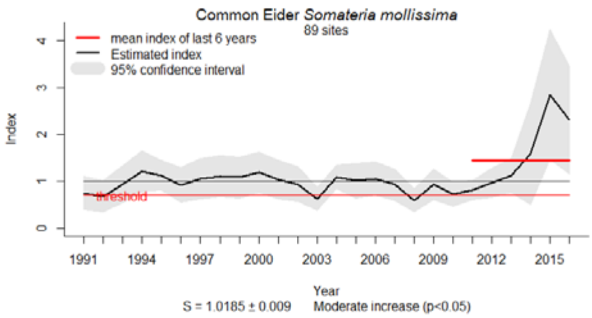




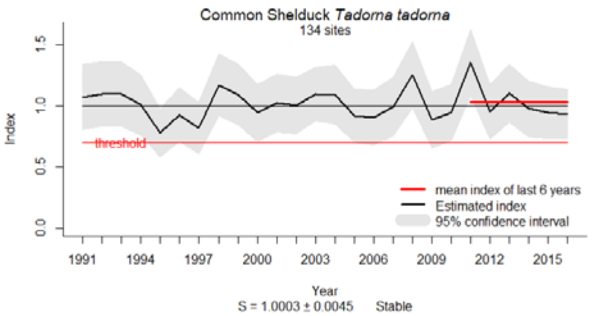


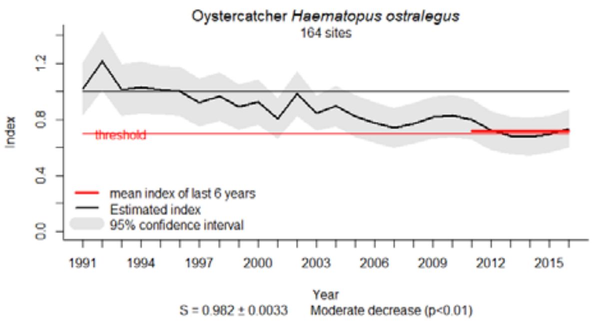
Benthic feeders

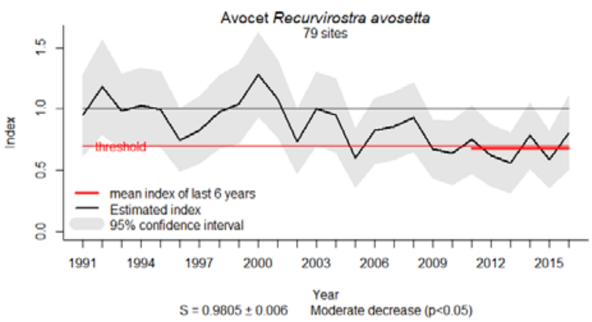


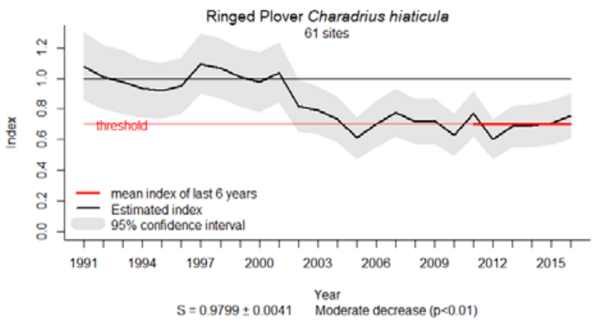


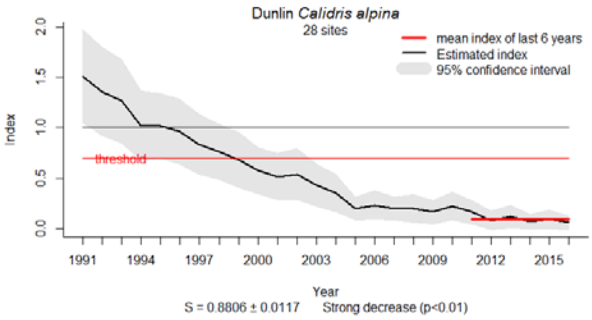
Wading feeders



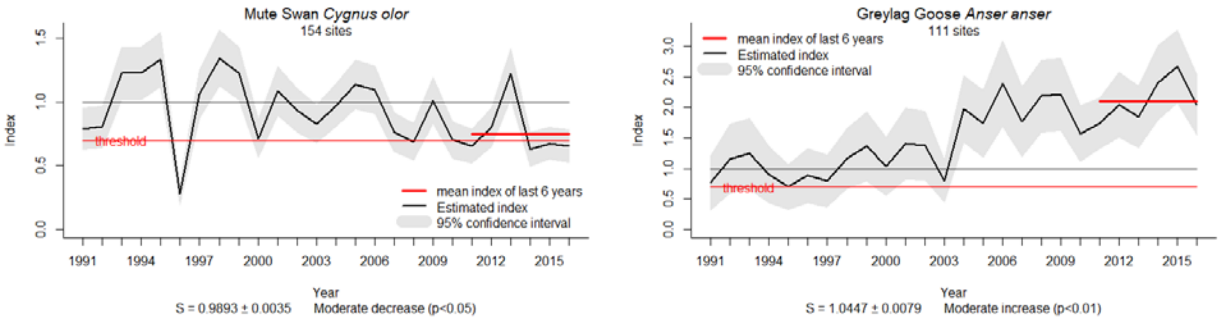






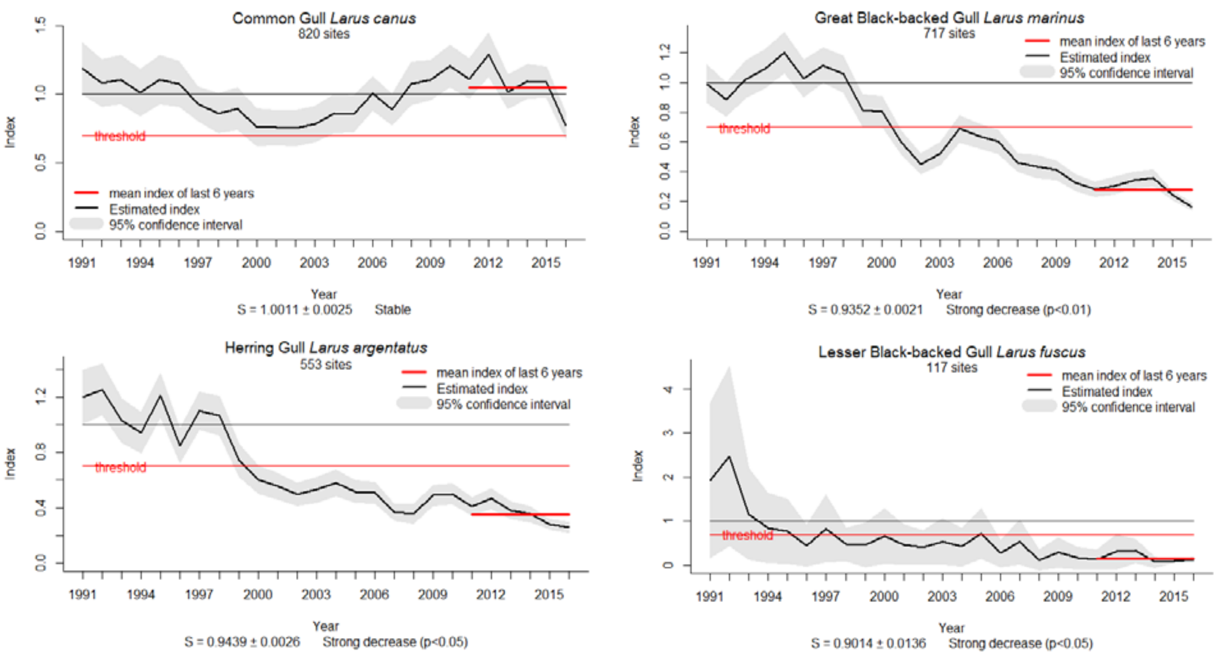


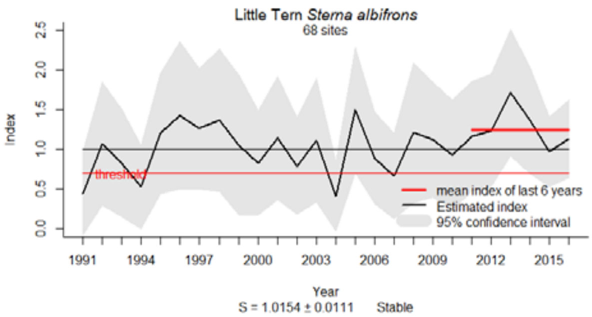
Grazing feeders

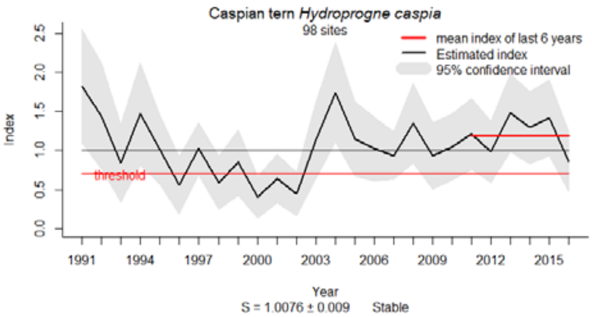


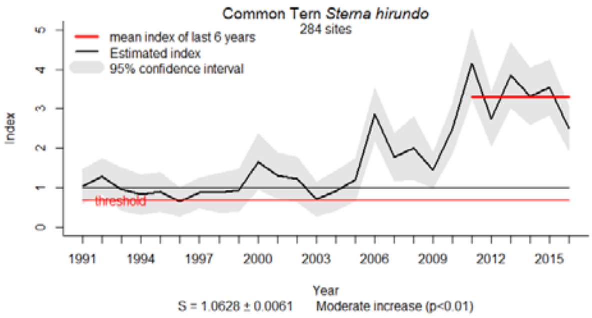
Results figure 5: Index graphs showing annual index values for breeding waterbirds in the **Gotland Group** (Gdansk Basin, Eastern Gotland Basin, Western Gotland Basin, Gulf of Riga; black line) and 95% confidence intervals (grey shading) resulting from TRIM analyses after rescaling the annual indices to reference level where average of index values 1991-2000 is 1 (thin black line). Further shown are thresholds for good status (70% of baseline, 80% of baseline in species laying only one egg per year, thin red line) and the average index values 2011-2016 (geometric mean) used for the evaluation (red line). In addition, trend slopes and s.e. as well as the status of the species are given below the graphs.

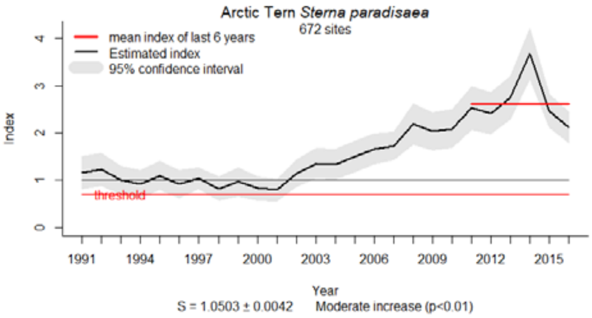
Surface feeders



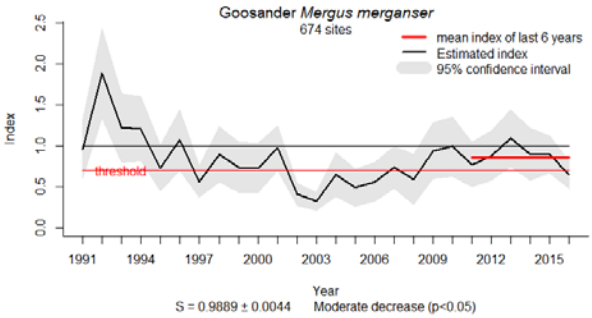


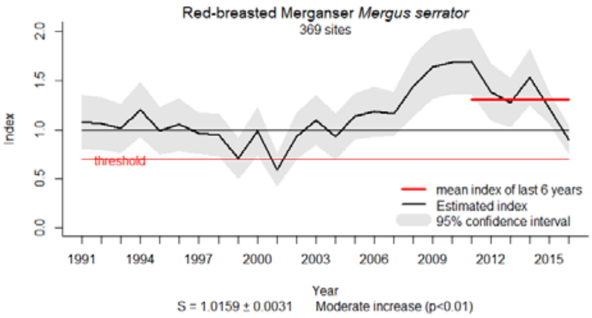


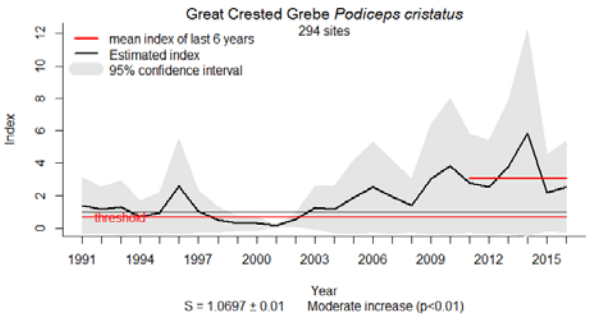


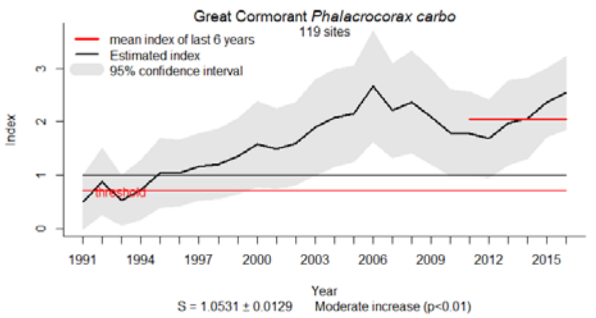


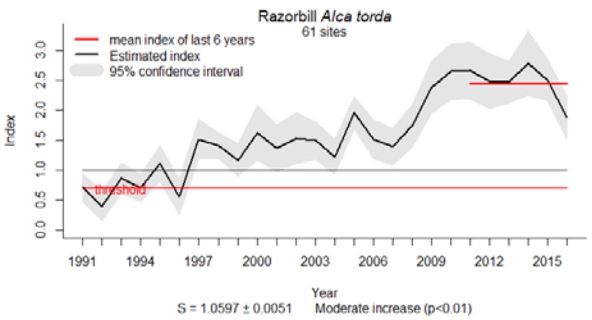
Pelagic feeders

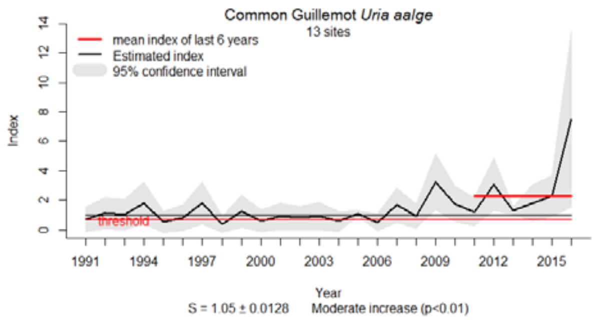


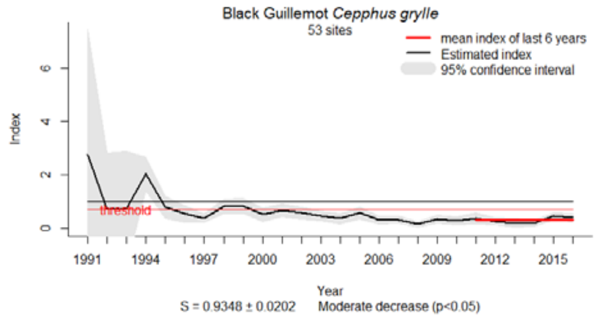




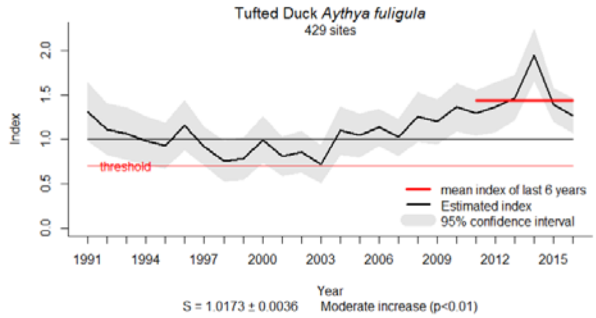


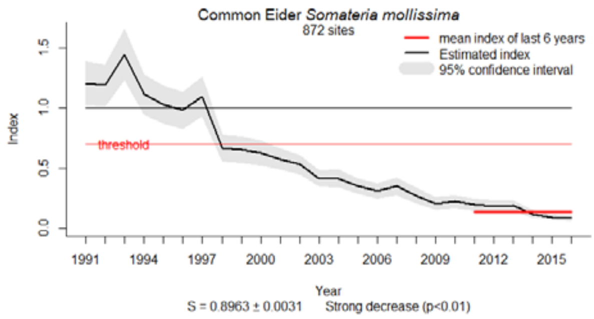


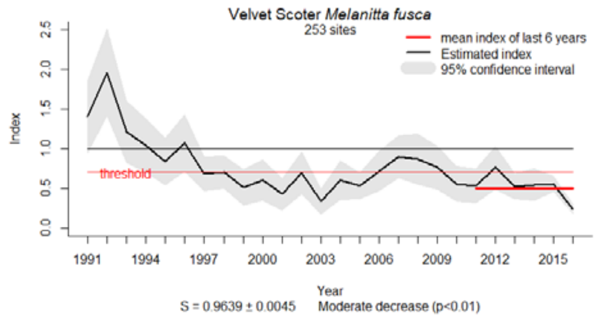




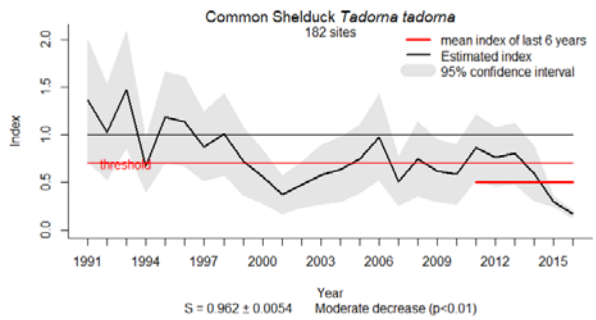
Benthic feeders

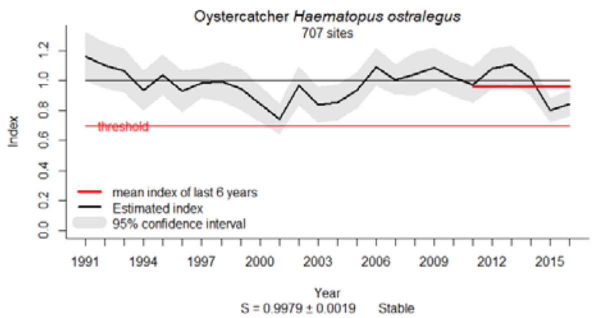


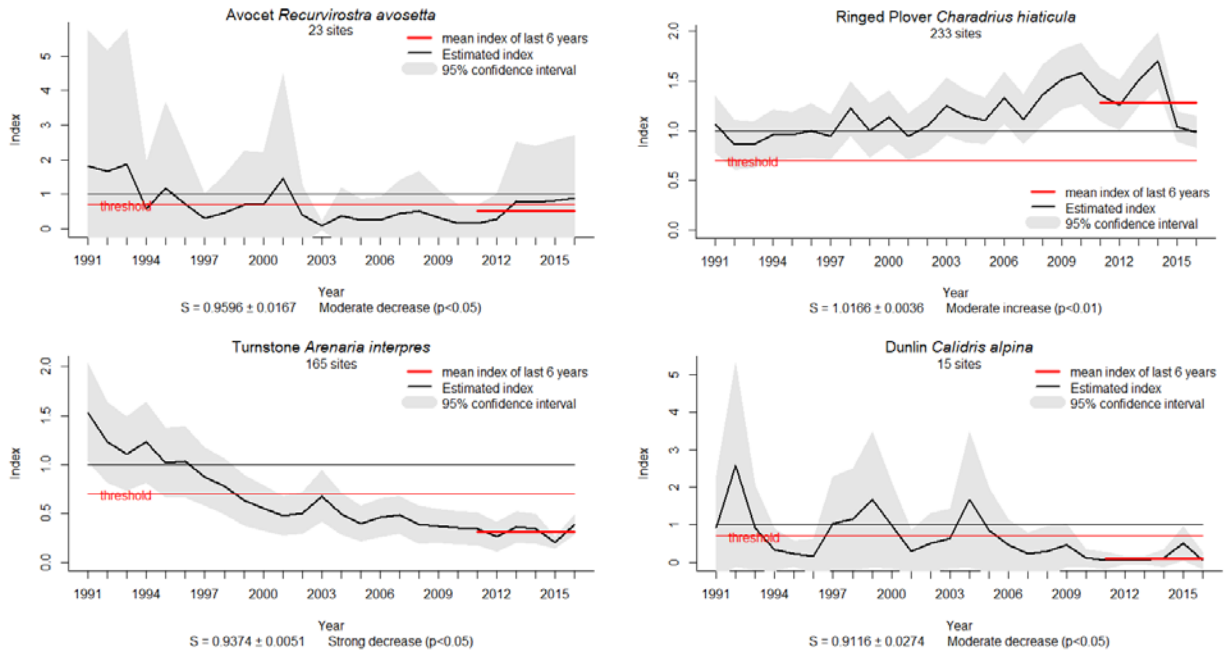




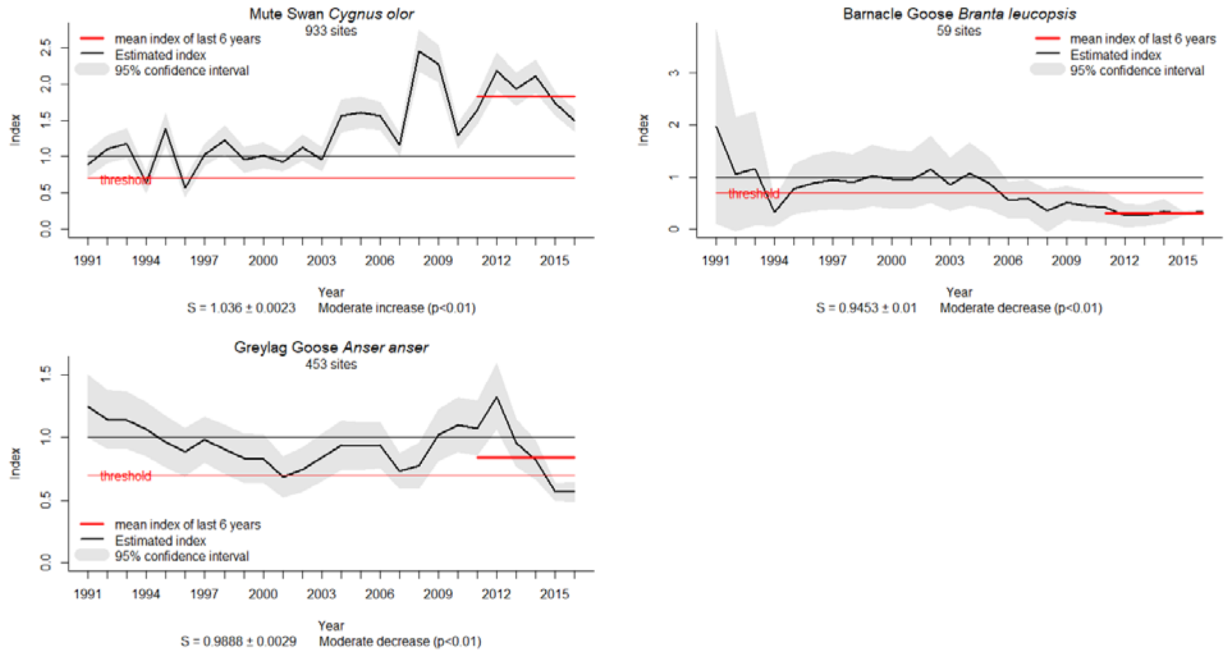
Wading feeders





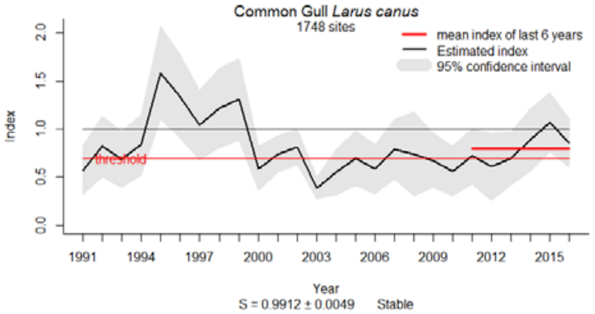


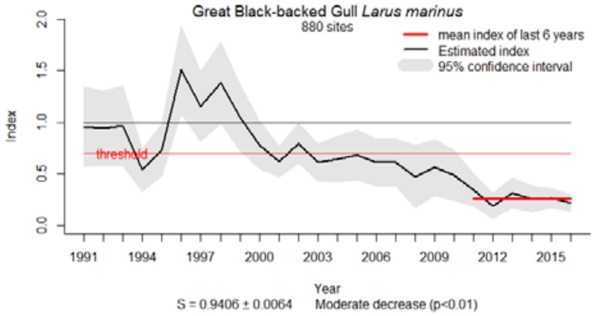
Grazing feeders

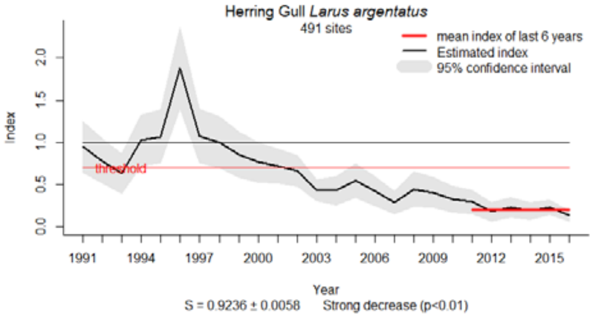


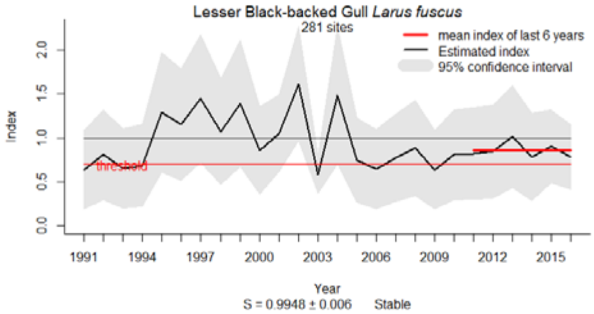
Results figure 6: Index graphs showing annual index values for breeding waterbirds in the **Åland Group** (Northern Baltic Prober, Åland Sea; black line) and 95% confidence intervals (grey shading) resulting from TRIM analyses after rescaling the annual indices to reference level where average of index values 1991-2000 is 1 (thin black line). Further shown are thresholds for good status (70% of baseline, 80% of baseline in species laying only one egg per year, thin red line) and the average index values 2011-2016 (geometric mean) used for the evaluation (red line). In addition, trend slopes and s.e. as well as the status of the species are given below the graphs.

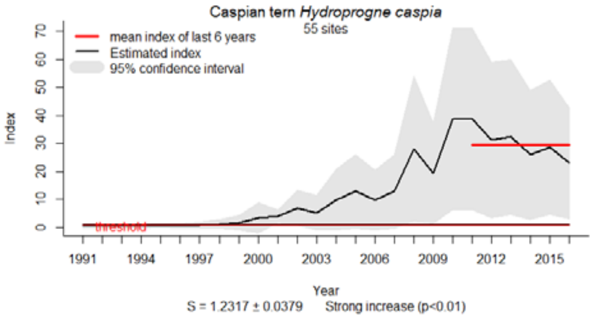
Surface feeders

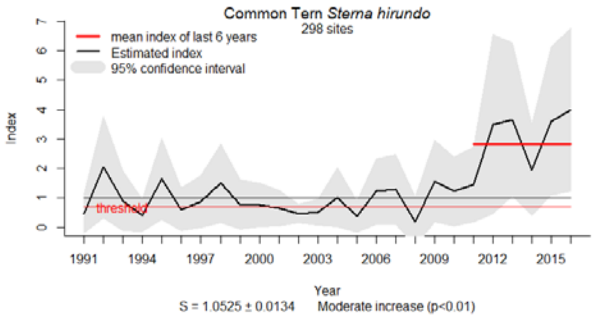


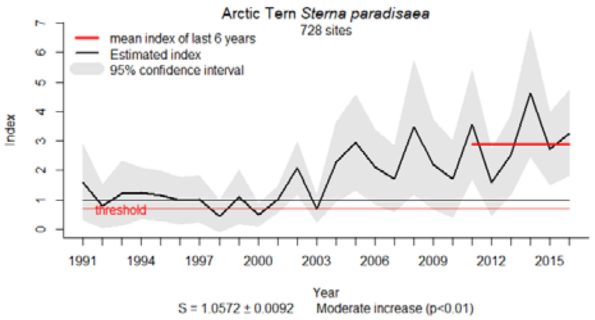




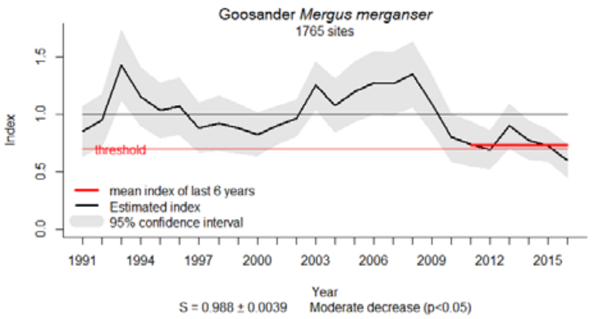


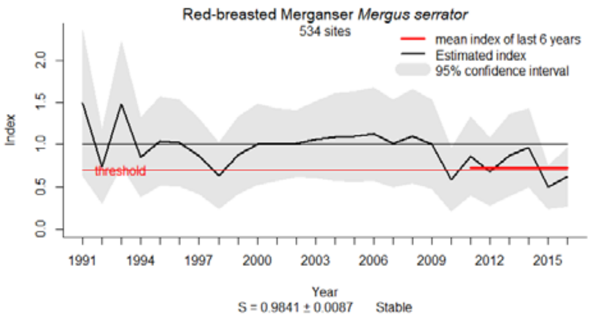


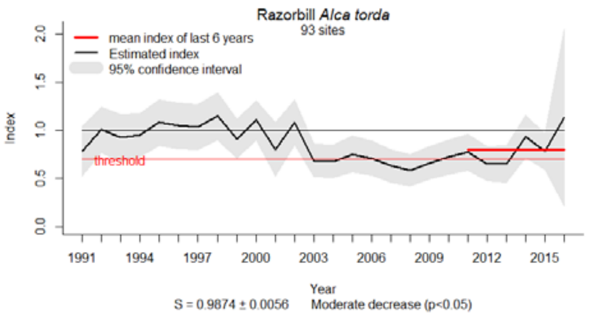


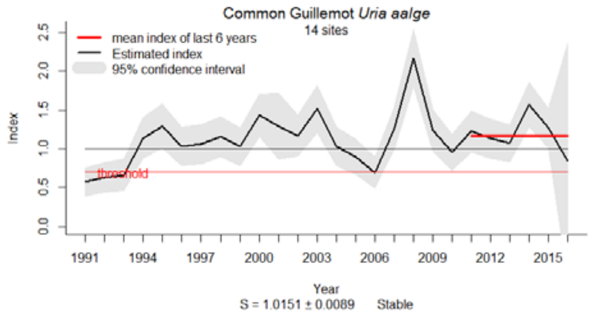


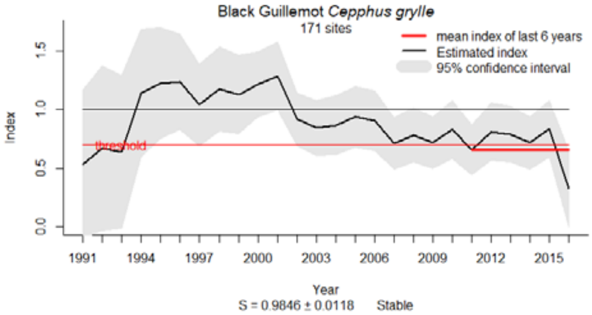
Pelagic feeders



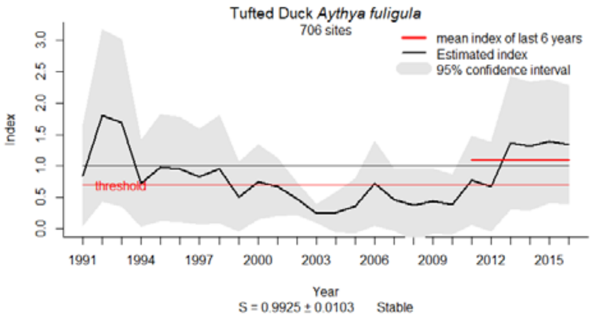


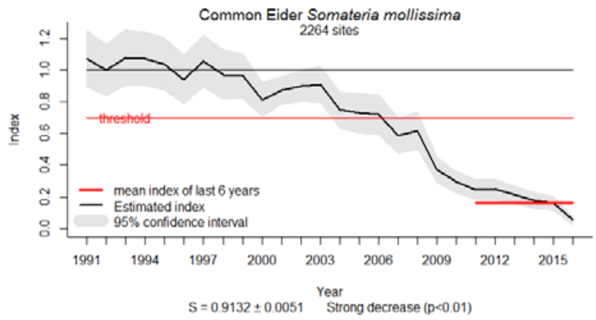


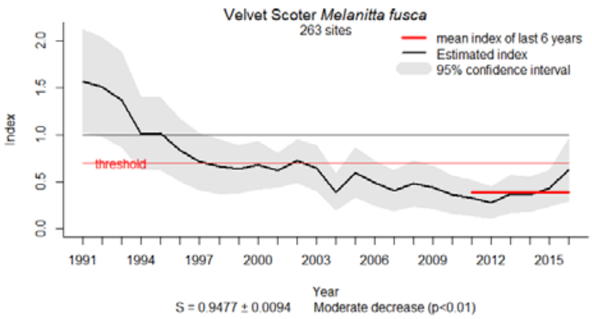




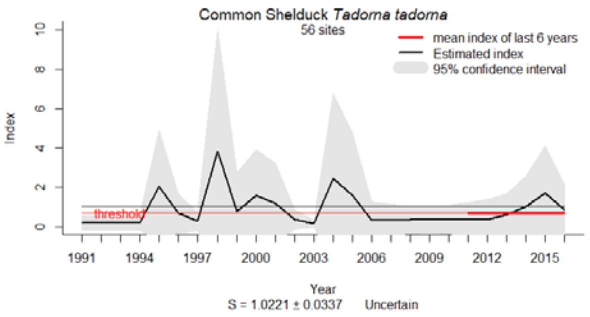
Benthic feeders

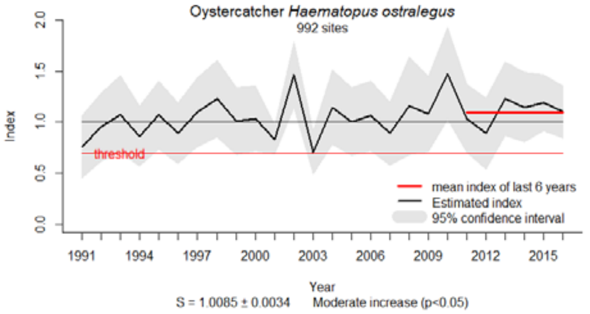


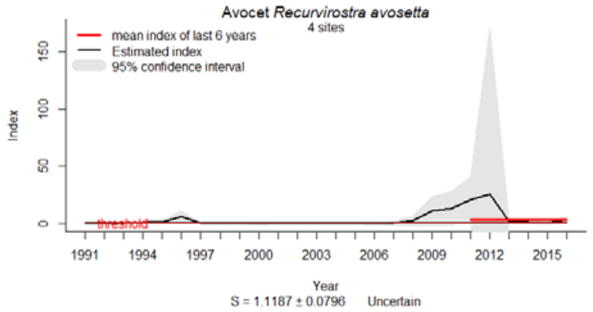


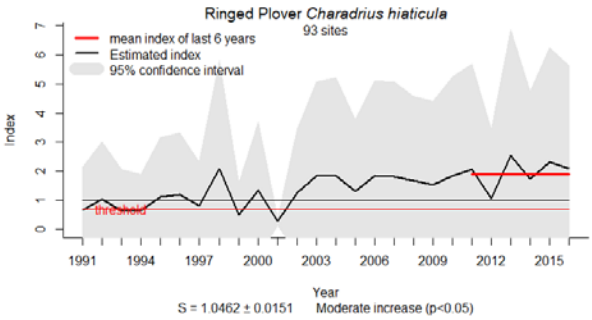


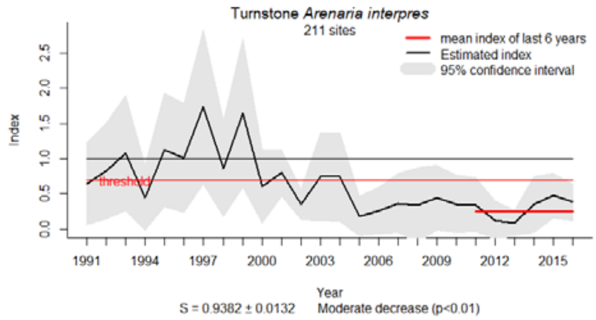
Wading feeders



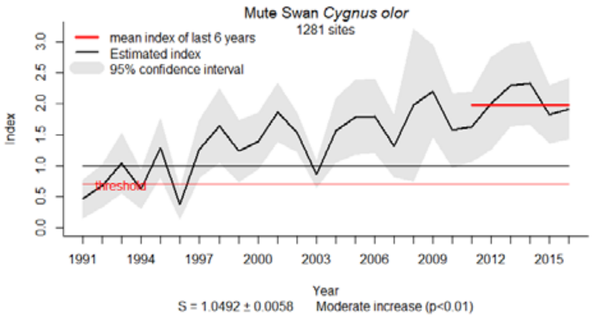


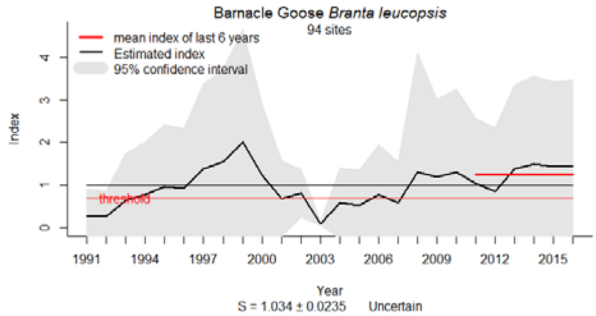


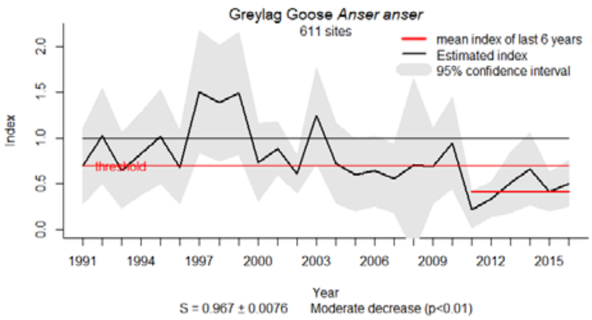




Grazing feeders

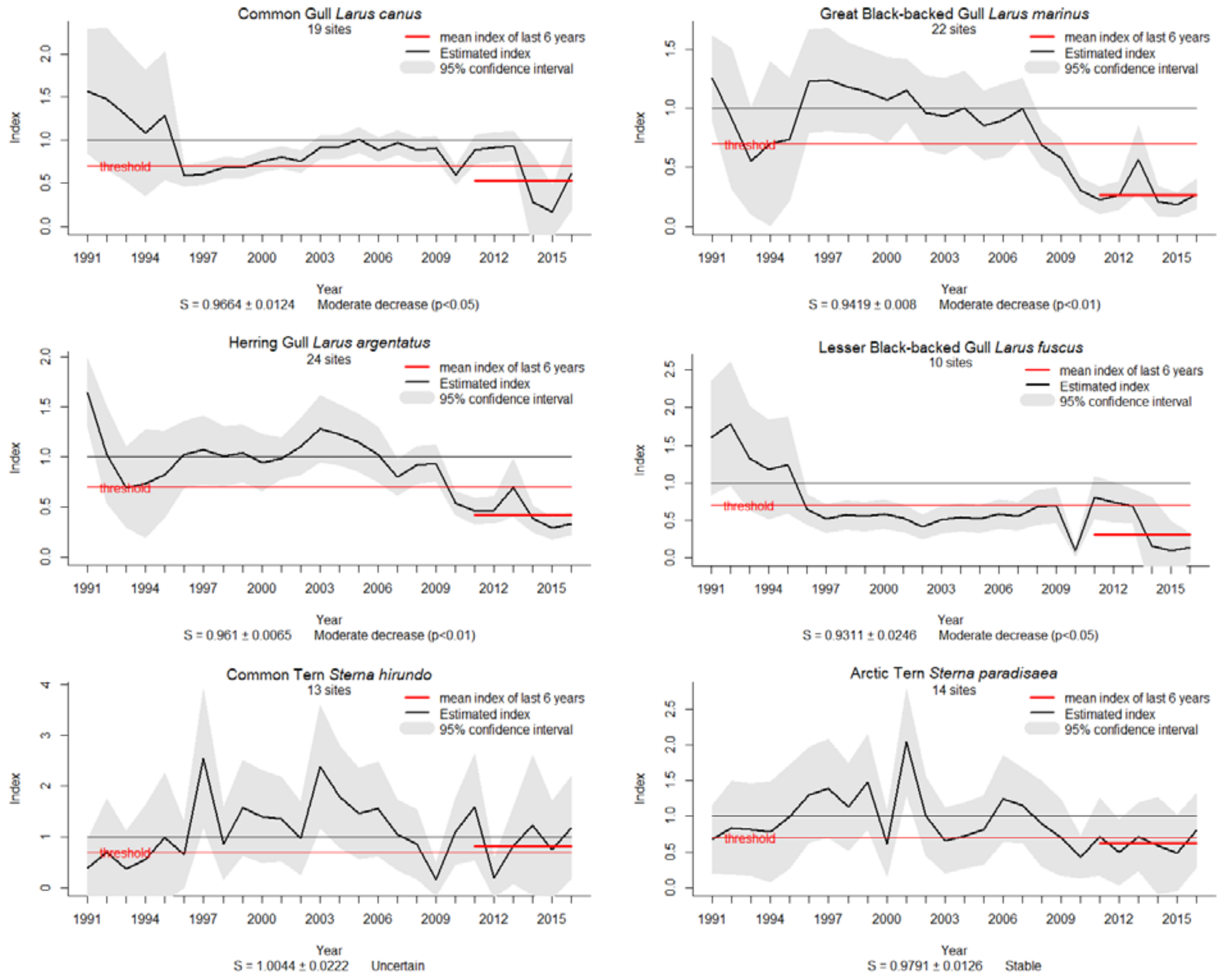




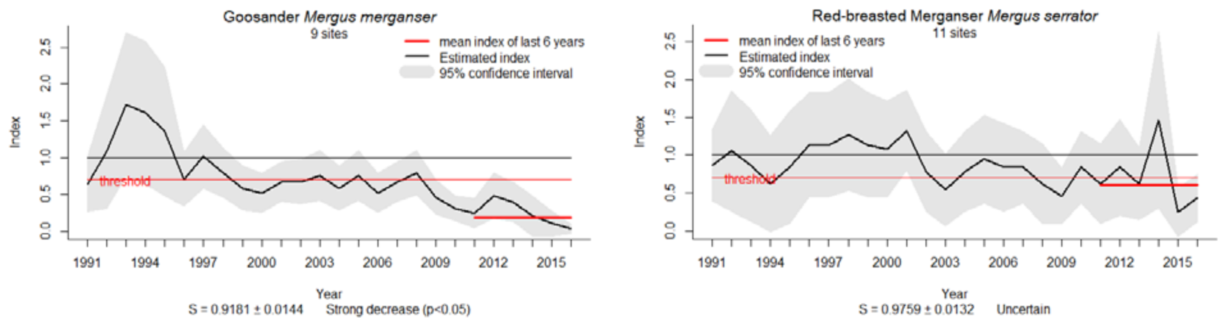


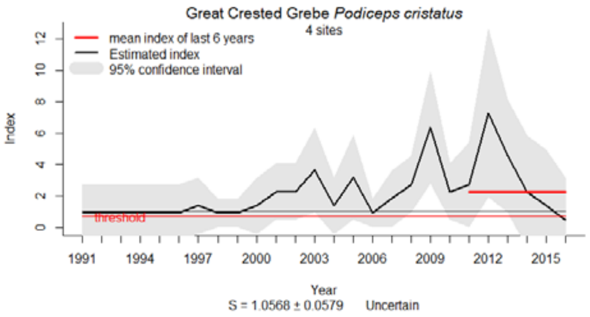
Results figure 7: Index graphs showing annual index values for breeding waterbirds in the **Gulf of Finland** (black line) and 95% confidence intervals (grey shading) resulting from TRIM analyses after rescaling the annual indices to reference level where average of index values 1991-2000 is 1 (thin black line). Further shown are thresholds for good status (70% of baseline, 80% of baseline in species laying only one egg per year, thin red line) and the average index values 2011-2016 (geometric mean) used for the evaluation (red line). In addition, trend slopes and s.e. as well as the status of the species are given below the graphs.

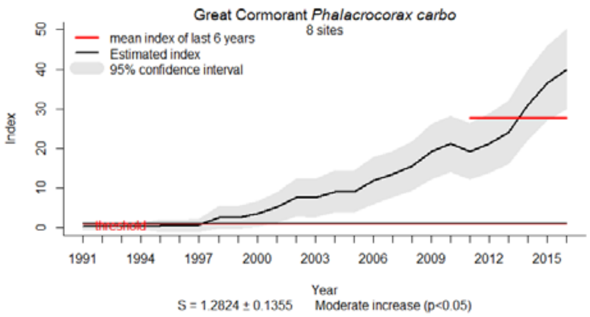
Surface feeders

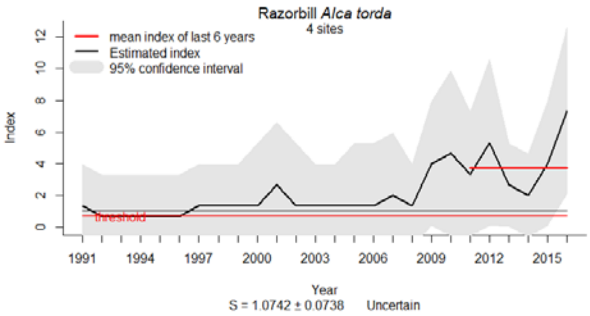


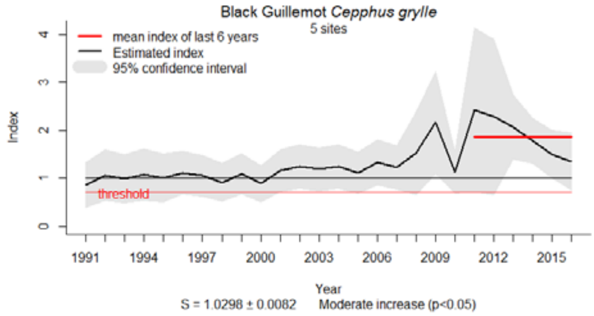
Pelagic feeders



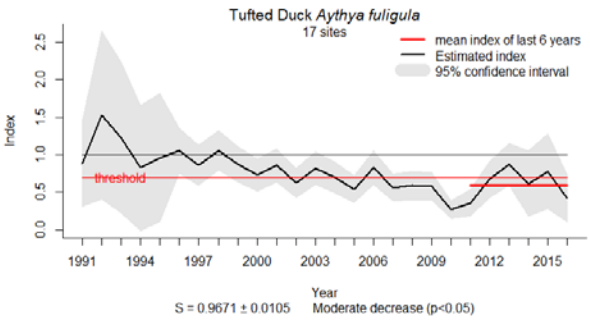


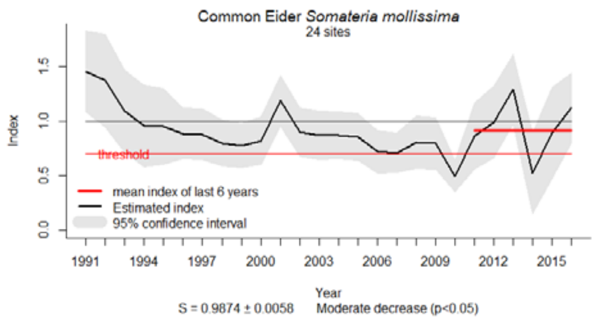


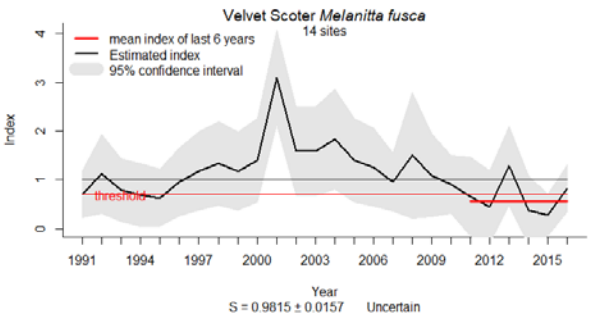




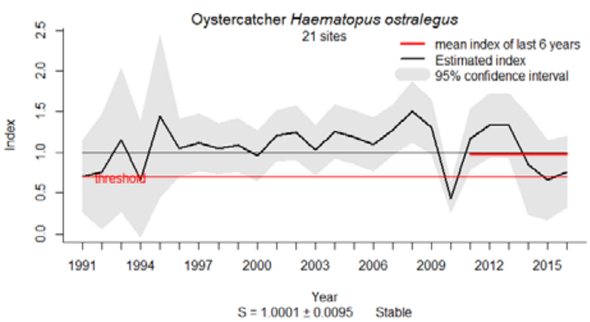
Benthic feeders

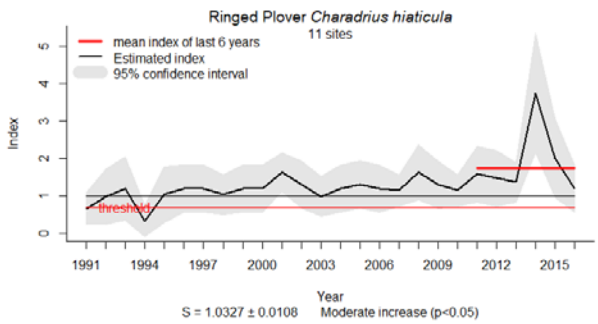


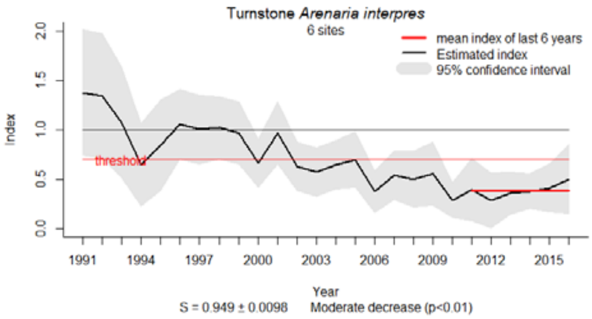




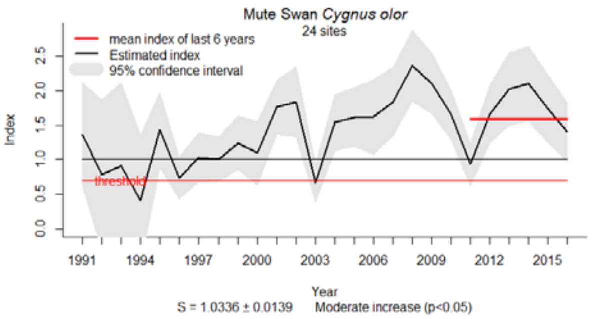
Wading feeders

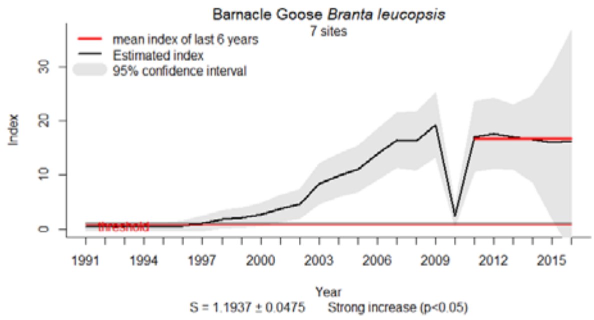


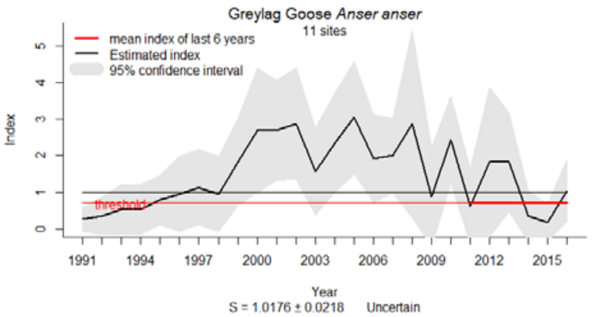




Grazing feeders

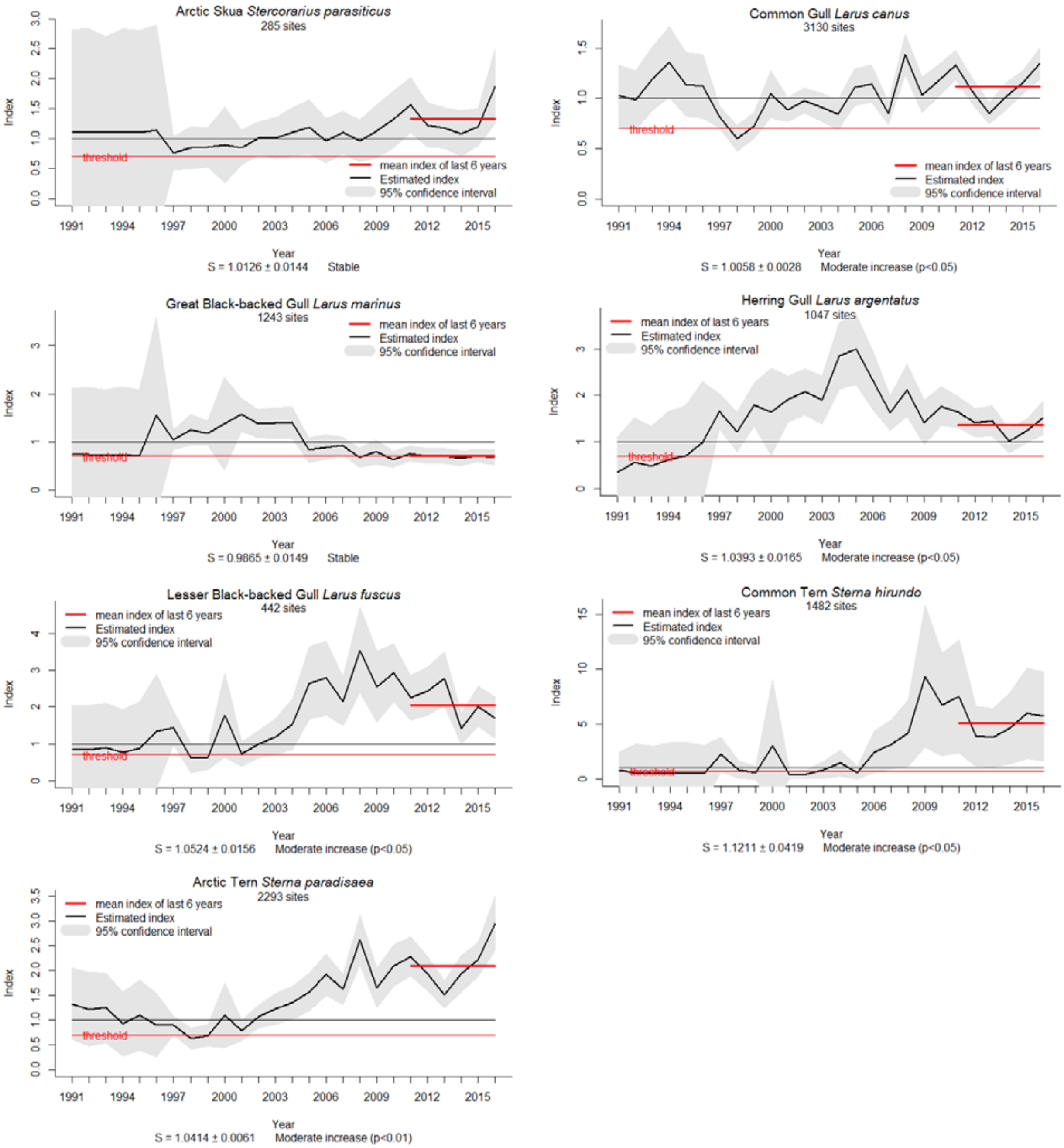




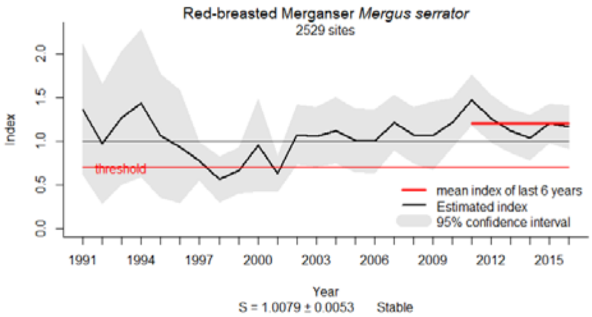


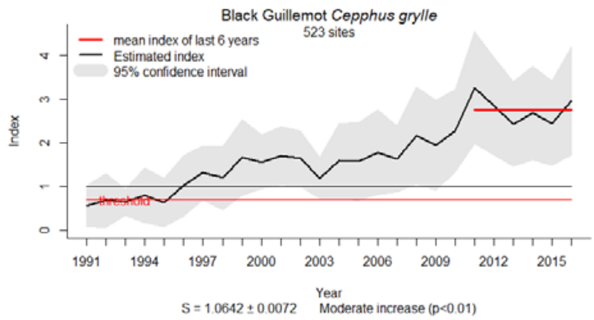
Results figure 8: Index graphs showing annual index values for breeding waterbirds in the **Bothnian Group** (Bothnian Sea, The Quark, Bothnian Bay; black line) and 95% confidence intervals (grey shading) resulting from TRIM analyses after rescaling the annual indices to reference level where average of index values 1991-2000 is 1 (thin black line). Further shown are thresholds for good status (70% of baseline, thin red line) and the average index values 2011-2016 (geometric mean) used for the evaluation (red line). In addition, trend slopes and s.e. as well as the status of the species are given below the graphs.

Surface feeders

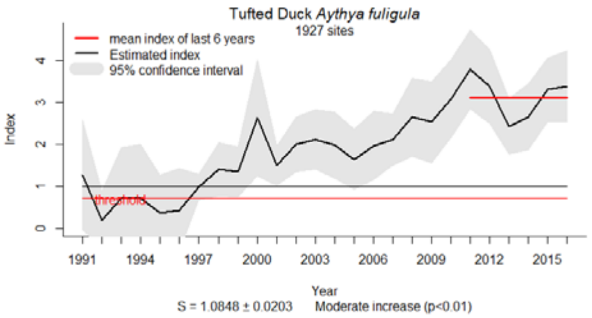


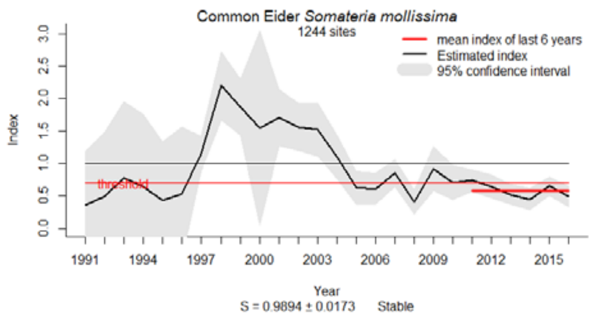
Pelagic feeders

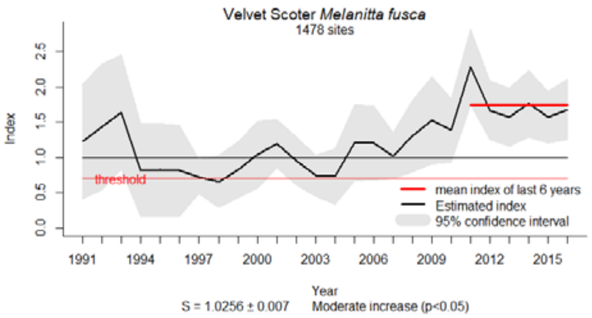




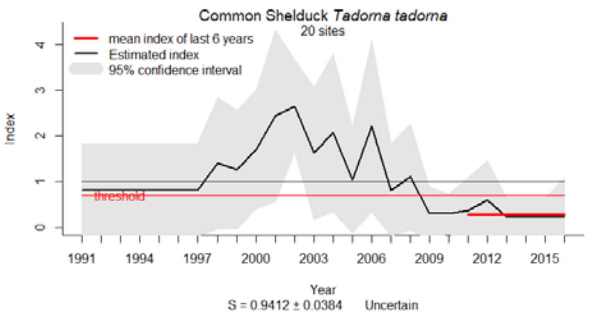
Benthic feeders

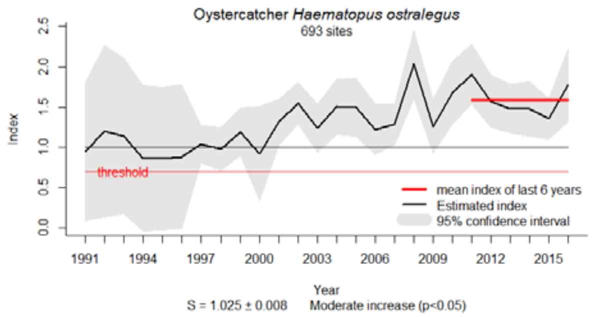


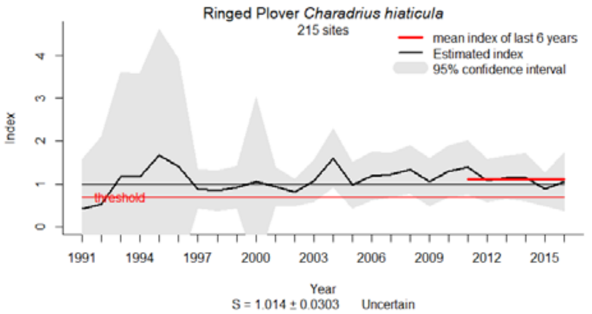


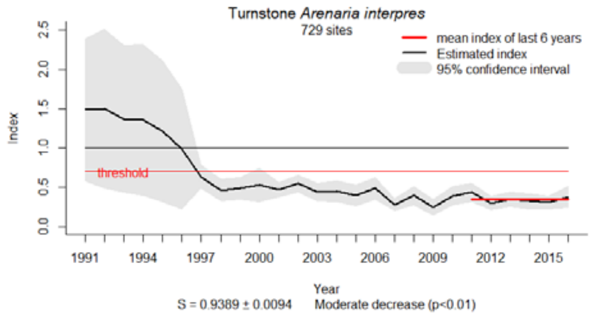


Wading feeders

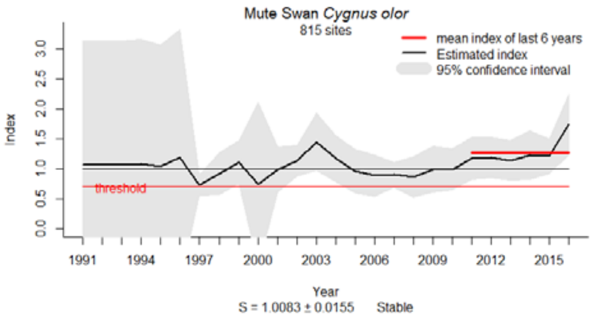


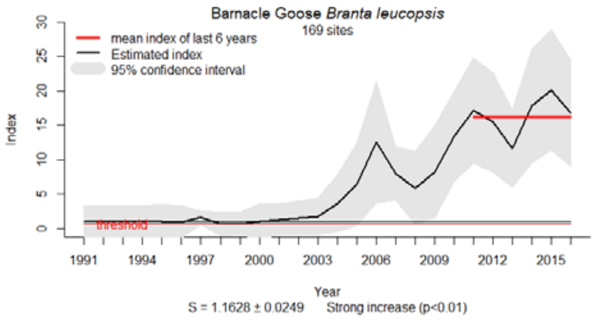


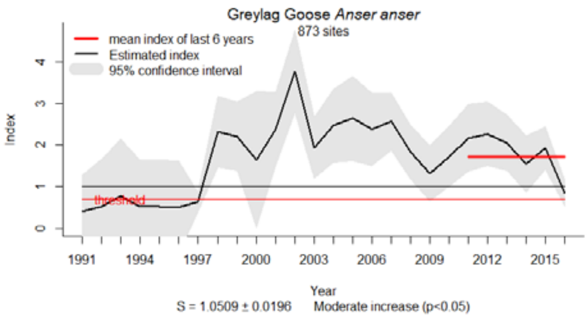




Grazing feeders


Mute Swan Cygnus olor
815 sites
mean index of last 6 years
Estimated index
95% confidence interval
threshold
Index
Year
1991 1994 1997 2000 2003 2006 2009 2012 2015
S = 1.0083 ± 0.0155 Stable


Barnacle Goose Branta leucopsis
169 sites
mean index of last 6 years
Estimated index
95% confidence interval
threshold
Index
Year
1991 1994 1997 2000 2003 2006 2009 2012 2015
S = 1.1628 ± 0.0249 Strong increase (p<0.01)


Greylag Goose Anser anser
873 sites
mean index of last 6 years
Estimated index
95% confidence interval
threshold
Index
Year
1991 1994 1997 2000 2003 2006 2009 2012 2015
S = 1.0509 ± 0.0196 Moderate increase (p<0.05)