HELCOM core indicator report
July 2018

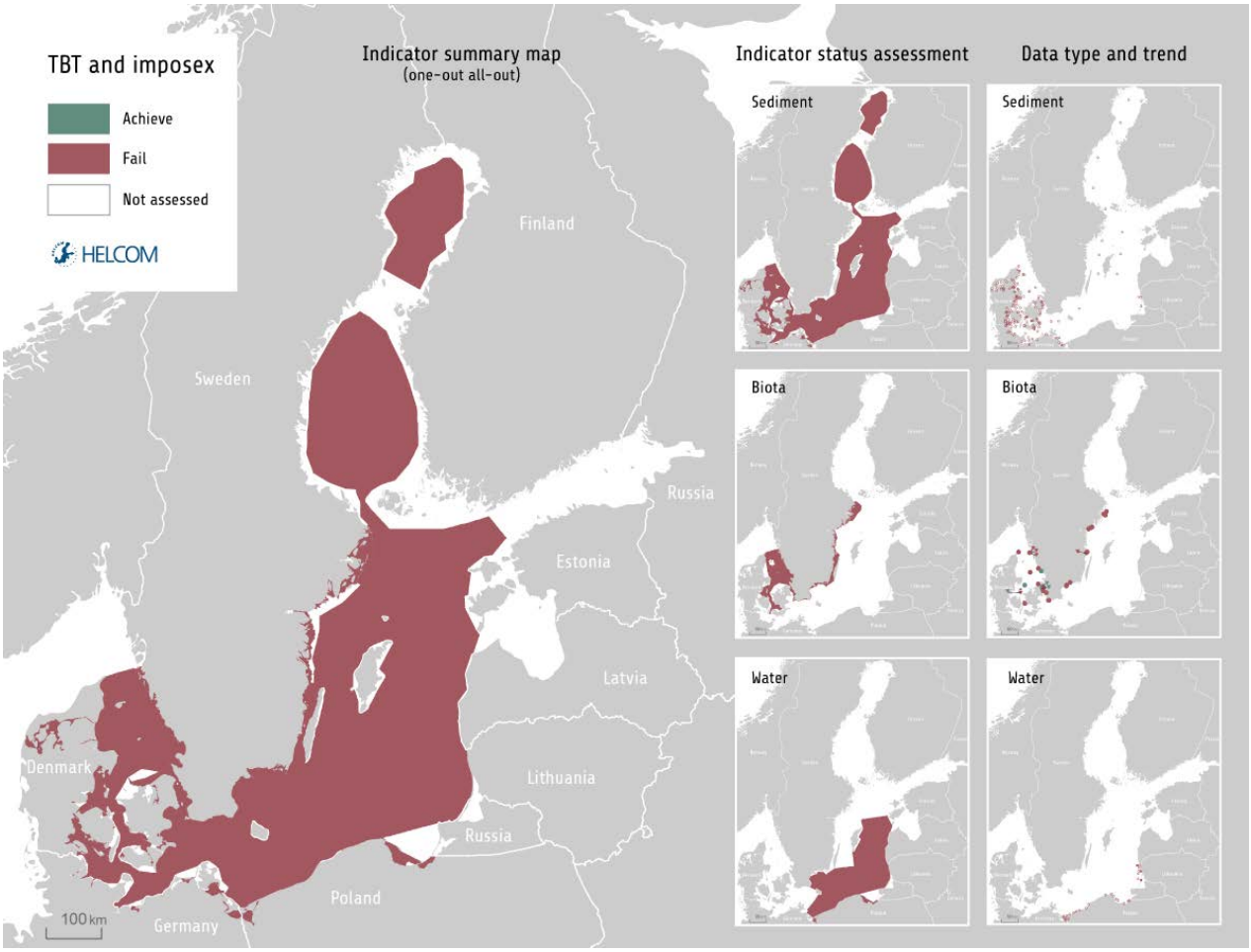
Tributyltin (TBT) and imposex

Key Message

The threshold values for sediment and imposex in this core indicator are not yet commonly agreed.

The threshold values are included as test threshold values for the purposes of the 2018 'State of the Baltic Sea' report, and the results are to be considered as intermediate.

This core indicator evaluates the status of the marine environment based on concentrations of tributyltin (TBT) and its breakdown products dibutyltin (DBT) and monobutyltin (MBT) in the Baltic Sea.



Key message figure 1. Status assessment results based on evaluation of the TBT concentrations in sediment and water, and biological effects in biota - marine gastropods (VDS). One-Out-All-Out (OOAO) method (main figure), in sediment (upper insert), in biota (middle insert), and in water (lower insert). The assessment is carried out using Scale 4 HELCOM assessment units (defined in the HELCOM Monitoring and Assessment Strategy Annex 4). **Click here to access interactive maps at the HELCOM Map and Data Service: TBT and imposex.**

Monitoring is carried out in water, biota (marine gastropods) and sediments. Imposex effects of TBT on marine gastropods are used as another source of data on TBT, as a sensitive biological effect caused by organotin. Good status is achieved when the concentrations of TBT are below the threshold value. The indicator presents a status evaluation using all data available until 2016 to evaluate the assessment period 2011 - 2016. Some stations (data series) in the Kattegat, The Sound and the Great Belt achieve the good status (see results and confidence section) but only for imposex, and all sediments and water assessments fail their respective thresholds; for water mainly due to pre-2015 detection limits above the AA-EQS. When considering all available data using the One-Out-All-Out method the sediment status (fail status) in the southern Kattegat override the achieve imposex status (Key message figure 1).

Data on TBT induced effects of imposex (as Vas deference Sequence – VDS) biological effects in marine gastropods are available from Denmark and Sweden (see Results and confidence section). Data was extracted from the HELCOM COMBINE database for TBT in sediment and water. Sediment data was available from Denmark, Sweden, Germany and Lithuania, water data was available from Lithuania and Poland.

The confidence of the indicator evaluation is **high in the Kattegat and Belt Sea/The sound area** since the data on TBT concentrations in bivalves, sediments and imposex in marine gastropods is spatially adequate and time series are available for several stations. In the **rest of the Baltic Sea, confidence is low** due to very limited data availability.

All significant trends are downwards, as would be expected since the main source of TBT is in antifouling paints which have been banned, but sediments still represent a potential source of TBT in harbours and shipping lanes, which can be re-suspended during storms.

The indicator is applicable in the waters of all countries bordering the Baltic Sea.

Relevance of the core indicator

Organotin, and in particular TBT, has been shown to be very toxic to marine life, resulting in changes in oyster shells and interfering with the marine gastropods female reproductive organ, an effect known as imposex, causing sterility in some sensitive species. TBT is bioaccumulated by marine organisms causing harmful effects that mainly depend on the level of its final concentration in the tissues. Mussels are not able to degrade TBT by de-butylation, as fish and some marine gastropods are. Levels can be high in top-predators (Strand *et al*, 2005; Law *et al*, 2012). That is why the concentrations of TBT, especially those of importance to ecosystem or human health, have to be monitored. EQS values have been set for water AA-EQS at 0.2 ng/l and MAC-EQS at 1.5 ng/l, but the detection limit of analytical methods is up to 1 ng/l.

TBT and triphenyltin (TPT) were introduced in antifouling paints in the 1960s, but soon after, effects on growth and shell formation were found in French oyster grounds, and shortly after, also the effect on marine gastropods reproductive system was discovered. This led to a ban on use of these paints on pleasure boats, and eventually followed up by a total ban on TBT in antifouling paints (782/2003/EC (EC, 2003)) effective from 2008 (OSPAR, 2014).

Some concern over TBT in fish for human consumption exists, EFSA set a group TDI of 0.25 µg/kg for TBT, DBT, TPT and dioktyltin (DOT) (EFSA, 2004), noting that also pesticides, plastic additives and food contact substances can contain organotin, an integrated risk assessment is therefore needed to take into account all of these sources. Based on the fish intake and concentration levels in fish, it was not expected TDI in general to be exceeded, except perhaps for consumption of fish caught in harbour areas or other very polluted sites.

Policy relevance of the core indicator

	BSAP segment and objectives	MSFD Descriptor and criteria
Primary link	Hazardous substances • Concentration of hazardous substances close to natural levels. • Healthy wildlife.	D8 Concentrations of contaminants D8C1 Within coastal and territorial and beyond territorial waters, the concentration of contaminants do not exceed the threshold values.
Secondary link	Hazardous substances • Fish safe to eat.	D9 Contaminants in fish and seafood D9C1 The level of contaminants in edible tissues (muscle, liver, roe, flesh or other soft parts, as appropriate) of seafood (including fish, crustaceans, molluscs, echinoderms, seaweed and other marine plants) caught or harvested in the wild (excluding fin-fish from mariculture) does not exceed the threshold values.
Other relevant legislation: For some Contracting Parties also Water Framework Directive Tributyltin is listed as no. 30 on the priority substances list in directive 2013/39/EU.		

Cite this indicator

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Tributyltin TBT and imposex HELCOM core indicator 2018 (pdf)

Results and Confidence

The threshold values for sediment and imposex in this core indicator are not yet commonly agreed.

The threshold values are included as test threshold values for the purposes of the 2018 'State of the Baltic Sea' report, and the results are to be considered as intermediate.

The data presented in the core indicator report were collected in the HELCOM COMBINE data base, a compilation of data from the monitoring activities reported by all Baltic Sea countries. The report presents information on the current levels of TBT concentrations in selected marine matrices: seawater, biota (mussels, marine gastropods) and sediments. Fish data have not been used, as currently no thresholds have been defined for TBT in this matrix.

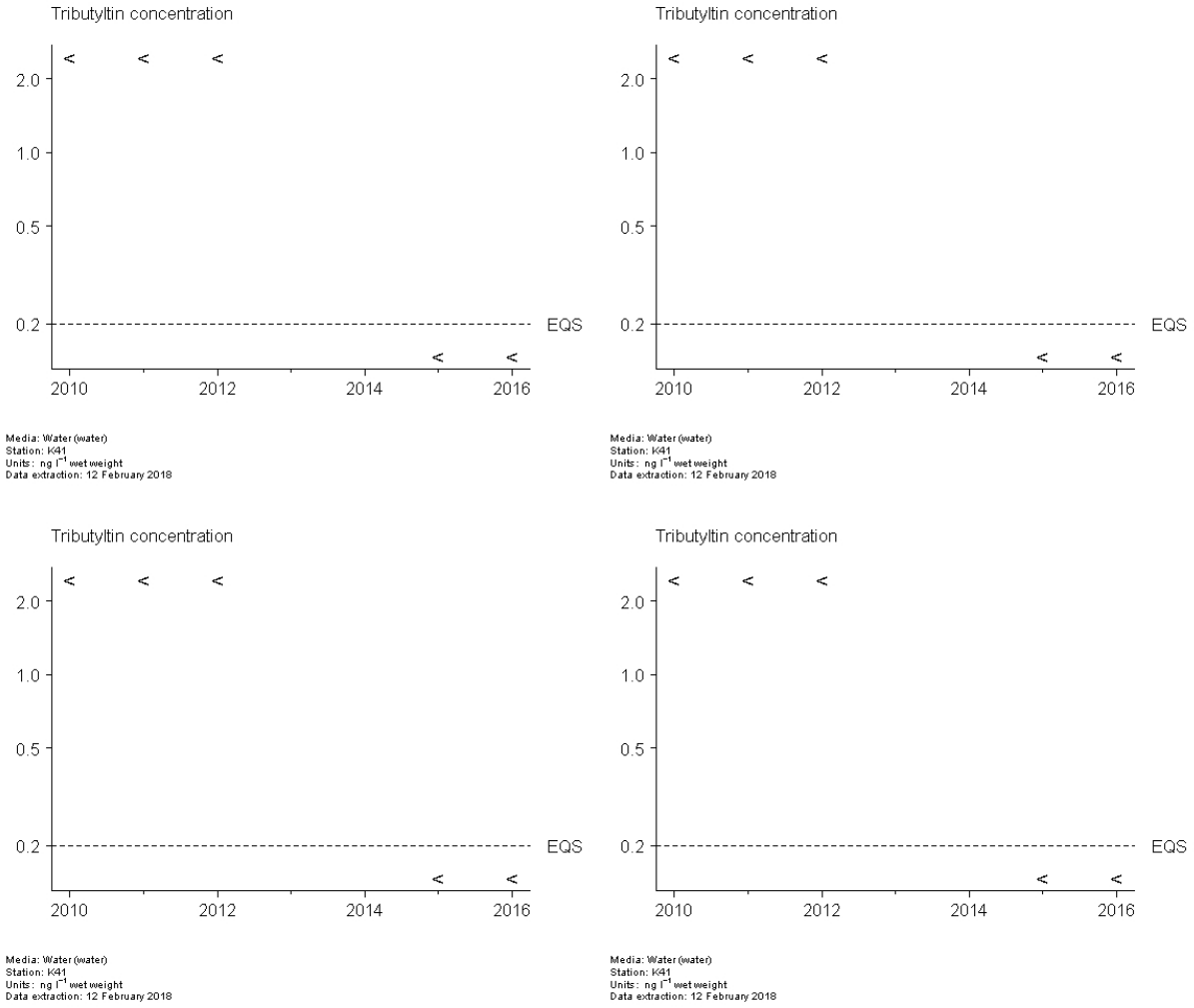
Seawater

The agreed secondary threshold value for TBT in water is the EQS value (AA-EQS) of 0.2 ng/l. This is in conflict with the HELCOM COMBINE monitoring program, where the preferred matrix is biota and sediment. As a result, very little data is available for TBT in water.

TBT concentrations in the water phase have been measured by Poland (2011–2016) and Lithuania (2010–2016) (figure 1). Only 6% of these values were above the maximum annual Environmental Quality Standards (MAC-EQS) of 1.5 ng/l. Most samples were above the average annual concentration EQS (AA-EQS) of 0.2 ng/l, which was below the quantification limits in Lithuania until 2015, and the lowest value measured in Poland. The AA-EQS is considered to be high. For example, compared to the OSPAR (Oslo-Paris Convention for the Protection of the Marine Environment of the North-East Atlantic) Environmental Assessment Criteria (EACs) in seawater (0.01-0.1 ng/l). The 2004 revision of OSPAR EACs suggested using the AA-EQS as the lower and MAC-EQS as the upper EAC value. Hence, the AA-EQS is considered to be the relevant threshold value, not MAC-EQS that would normally be used for spot samples (Results figure1). With a quantification limit (QL) around 0.06-1 ng/l, even the newest, best method with QL at 0.06 ng/l is at 30% of the AA-EQS, which is the minimum performance criteria for methods of analysis used in the Water Framework Directive set by the European Commission (2009). Unfortunately, the minimum requirement was only achieved in 2015 for Lithuanian samples where the newest analytical method was used.

Some Lithuanian stations have been monitored in the period 2010 to 2016 (Results figure 2), but most results were at or below the detection limit, so no further interpretation of the results is possible.

Results figure 1. Station based assessment of TBT in seawater are measured by Poland and Lithuania (left) and assessment unit status assessment (right). The detection limit of stations is just above the AA-EQS of 0.2 ng/l for Poland and Lithuania until 2015. Since 2015 a new method with detection limit of 0.06 have been used in Lithuanian samples, and all results have been below this limit, and therefore below the EQS (see figure 2). **Click here to access interactive maps at the HELCOM Map and Data Service: TBT and imposex.**



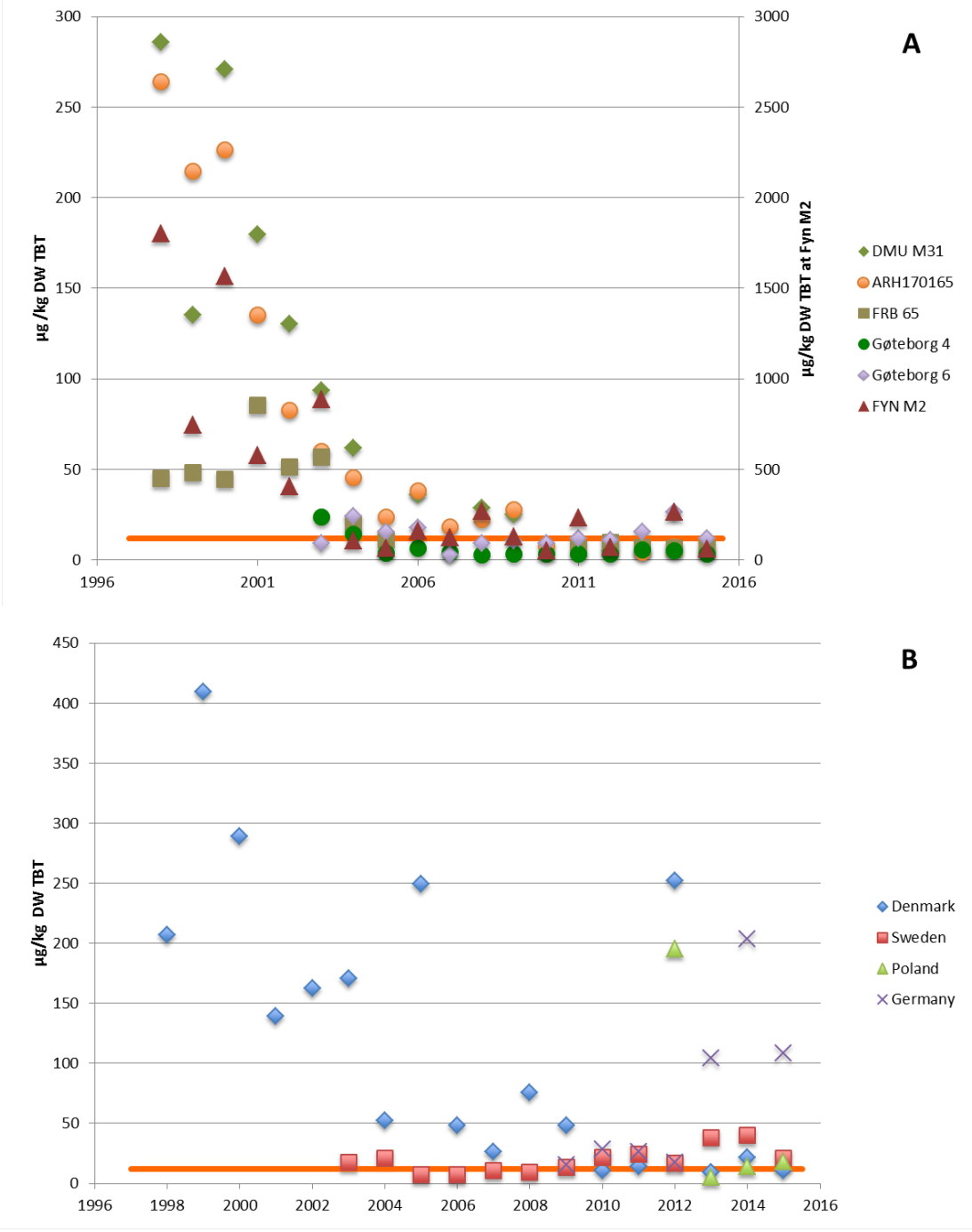
Results figure 2. Selected stations from Lithuania (top) and Poland (bottom). Notice the Lithuanian detection was reduced for from higher than the MAC-EQS of 1.5 ng/l to less than the AA-EQS of 0.2 in 2015. Polish results from Szczenski Bay and Gdansk Basin all showed similar results and typically below detection limits, which in some cases was above the AA-EQS. The outcome is indicated as failing the threshold (red) in Results figure 1 due to the detection limits being above the AA-EQS in some of the results.

Mussel – intermediate results based on test threshold value

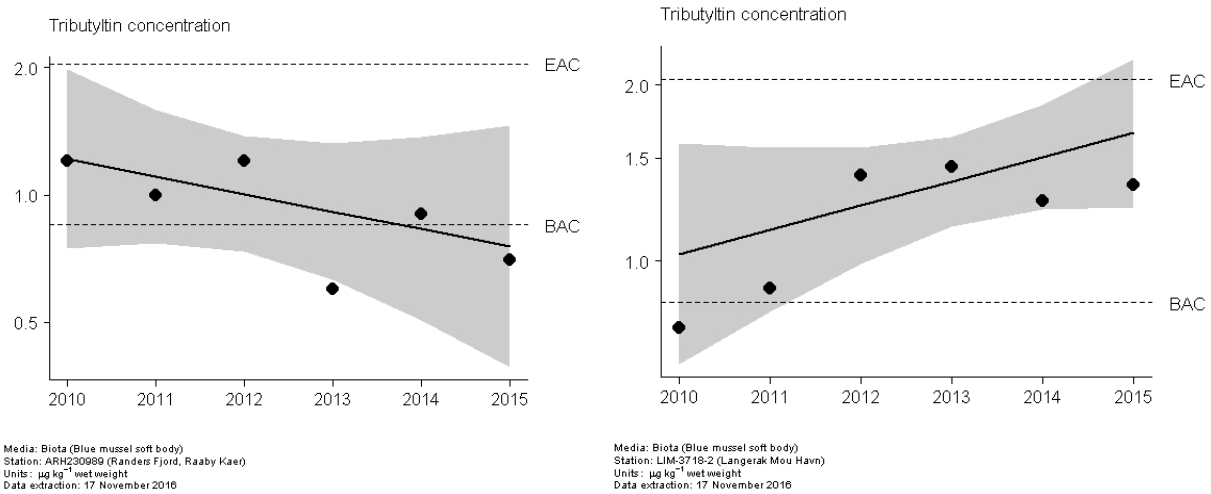
The soft body of mussels was selected as a secondary matrix for TBT status assessment. Data were extracted from the HELCOM COMBINE database. There is no data in northern part of the Baltic Sea, while in the western part the coverage of sampling stations is very dense (Results figure 4).

For the stations in the HELCOM COMBINE database, the average of each of the four countries reporting (Denmark, Germany, Poland and Sweden) are shown in Results figure 3 (upper). The levels in Germany are influenced by some stations with very high concentrations in 2013-15, probably harbour areas. The Danish stations in The Sound (DMU M31), Odense Fjord (FYN M2, 10x higher - levels on secondary axis scale), and Bay of Århus (close to harbour, ARH 170165) have a clear tendency of decreasing concentrations from 1998 to 2005, and then concentrations seems to level out at these stations.

Time trend analysis has been performed by OSPAR at some stations in the Kattegat area (according to the same principles as in the HELCOM assessment but with different threshold values) but no significant trends were detected (Result figure 4).



Results figure 3. Time trends for mussels at HELCOM stations. A – Selected stations from Denmark and Sweden with long time trends (Notice FYN M2 on the secondary axis is a factor of 10 higher than other stations). B – Average for all results of each country, indicating data availability and levels – notice that it is not the same stations analysed each year in all countries. Note that stations vary from year to year. Orange line marks the threshold value of 12 µg/kg DW.

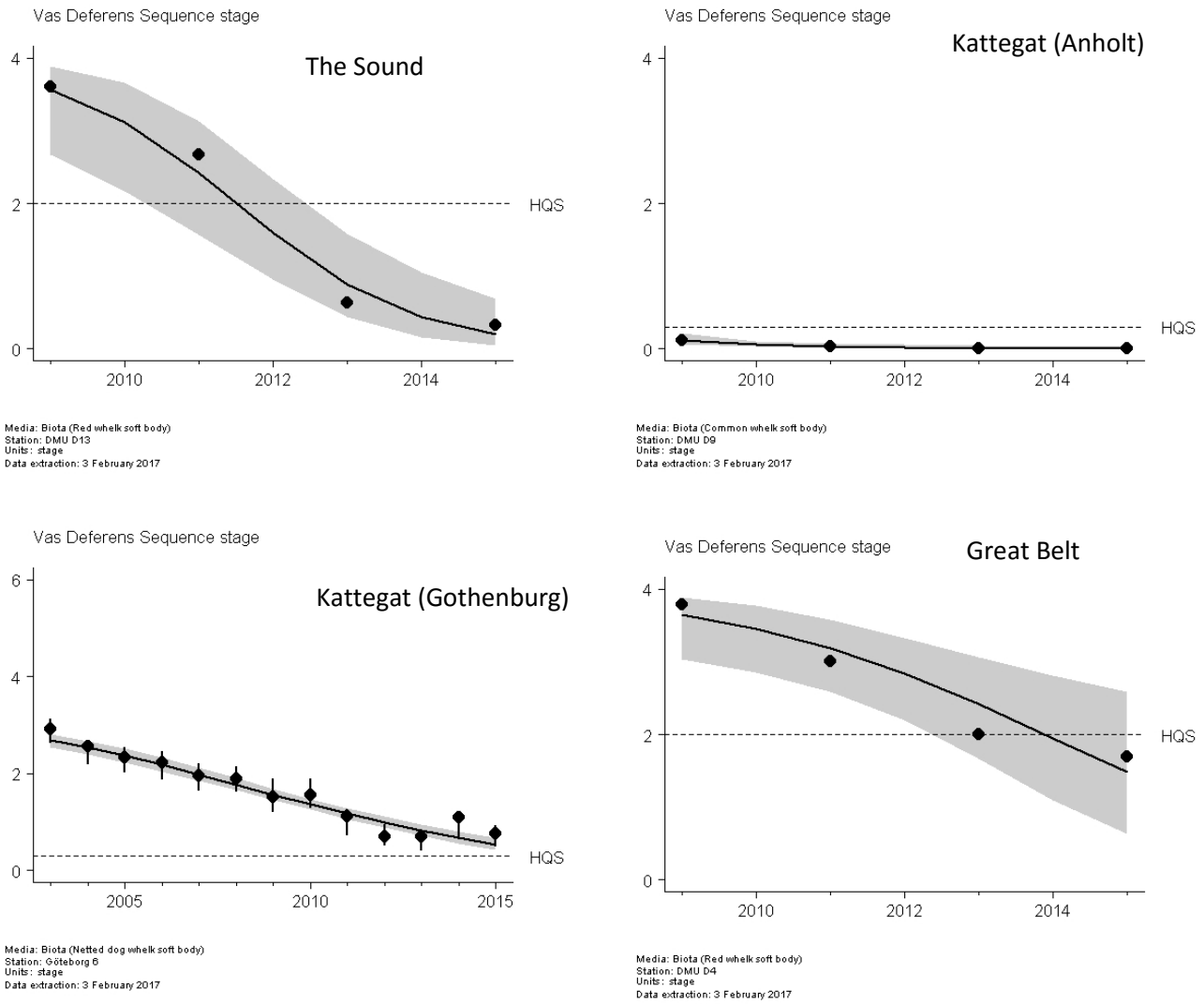


Results figure 4. Examples from OSPAR assessment in the Kattegat area, notice the limits and thresholds used are not the same as those used in the HELCOM assessment, and the measurements are per wet weight. Neither of the trends is significant.

Marine Gastropods – intermediate results based on test threshold value

The biological effect on marine gastropods reproductive organs, known as imposex, has been classified after the Vas deference Sequence (VDS), and due to the different sensitivity, good status is achieved at the threshold value of VDSI 2 for the sensitive species dog whelk (*Nucella lapillus)* and red whelk (*Neptunea antiqua)*. Most other less sensitive species are set at good status for a threshold value of VDSI 0.3, with exception of the laver spire shell (*Peringa ulvea)* for which good status threshold value is set at only VDSI 0.1. The stations assessed are shown in Results figure 5. Examples of time trends are shown in Results figure 6.

Results figure 5. Map presenting status based on imposex effect in (biota) marine gastropods (VDSI) at each sampling station. Green colour represents achieving the threshold value (good status) and red colour represents failing the threshold value (not good status). Filled large circles represent results based on five or more years, full evaluation (see Assessment protocol), small filled circles represent results based on three-four years and empty circles represent results based on <3 years, initial status assessment. Triangles indicating trends (downward) at Gothenburg (transekt, 3 stations), Blankaholm Kaj in the Western Gotland Basin and the Great Belt. **Click here to access interactive maps at the HELCOM Map and Data Service: TBT and imposex.**



Results figure 6. Long-term trends of VDS stage in gastropods at chosen stations (HQS – target level, grey colour- confidence level 95% range (see Assessment protocol)).

The VDSI is measured at 41 stations, with 17 stations representing six or more years of monitoring data, of which 8 showed defined downward trends (Results figure 5). No upward trends were found and 11 stations achieve good status. The levels of TBT are decreasing in the area of Gothenburg, the Great Belt and The Sound, all areas with heavy ship traffic. This is in agreement with the findings in the North Sea area, where 48% of the imposex stations showed decreasing trends (https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/pressures-human-activities/contaminants/imposex-gastropods/). The species available in the North Sea area are generally more sensitive to TBT (due to salinity restriction for the sensitive species) than most of the species found in the Baltic Sea area, and many of the time trends include data dating back to before the international ban on TBT in antifouling paints.

The biological effects therefore support the observations of TBT in mussels and water, generally indicating a reduction in contamination levels. But even so, most stations are still not at good status. As most stations are time trend stations, the biological effects measurements generally have a high confidence rating.

Sediment – intermediate results based on test threshold value

Danish, Swedish, German and Lithuanian results were available for the sediment assessment for the period 2011-2016 (Results figure 7), but no time trends are available, as sediments are not analyzed for time trends with only up to 3 results per station being available (one site). Hence, data are treated as initial status assessment for sediments. Of the 178 stations investigated, only two mean values from the Great Belt were found to be below the QS for sediment (1.6 µg/kg), and all assessed stations failed the threshold.

The average organic carbon content is around 2%, and less than 10% of the stations are above 5% organic carbon, which increases the measured concentrations during the normalization procedure.

TBT is only slowly degraded to DBT, MBT and finally tin, especially in anoxic sediments, so the sediment concentration is expected to be above the QS many years ahead, but to eventually follow the decreasing pattern seen in imposex and biota. As the stations are only based on 1-3 data points, only a low confidence rating can be given to the data.

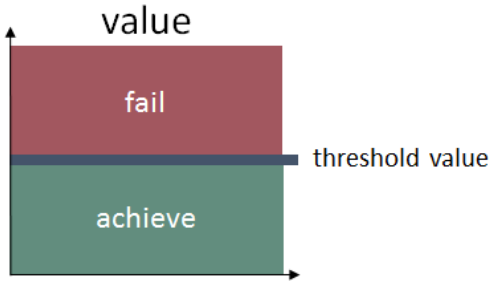
Results figure 7. Map presenting station based assessment of TBT in sediment (left) and assessment unit assessment (right). Green colour (none shown) represents achieved threshold value (good status) and red colour represents failed threshold value (not good status). Small filled circles represent results based on three-four years and empty circles represent results based on <3 years, initial status assessment (see Assessment protocol). **Click here to access interactive maps at the HELCOM Map and Data Service: TBT and imposex.**

Thresholds and Status evaluation

The threshold values for sediment and imposex in this core indicator are not yet commonly agreed.

The threshold values are included as test threshold values for the purposes of the 2018 'State of the Baltic Sea' report, and the results are to be considered as intermediate.

Good Status is achieved if the concentrations of TBT are below the specified threshold values (Thresholds figure 1).



Thresholds figure 1. Good status is achieved if the concentrations of TBT are below the threshold values listed in Good environmental status table 1.

The good status threshold for TBT are based on Environmental Quality Standards (EQS) for water and biota (Good environmental status table 1) which have been defined at EU level for substances included in the priority list under the Water Framework Directive, WFD (European Commission 2000, 2013).

The threshold value is applicable if concentrations are measured in the appropriate matrix. For historical reasons, the countries around the Baltic Sea have differing monitoring strategies. As a pragmatic approach, a threshold value is defined for primary matrix (sediment). However, if suitable monitoring data is not available in a region the secondary threshold value can be used for the evaluation of alternative matrixes (biota, water) (Thresholds table 1). Under the WFD, Member States may establish other values than EQS for alternative matrixes if specific criteria are met (see Art 3.3. in European Commission 2008a, revised in European Commission 2013).

Thresholds table 1. Threshold value for TBT and imposex (EQS – Environmental Quality Standard, AA- Annual Average Concentration, QS – Quality Standard, BAC = Background assessment criteria). Note that the threshold values for sediment (*), biota (*) and imposex (*) are not yet commonly agreed and included as test threshold value.

	Threshold values					
	Primary			Secondary		
	Matrix	Concentration	References	Matrix	Concentration	References
TBT	Sediment*	1.6 µg /kg dw sediment (5% TOC)	$QS_{sediment}$[1]	Water	0.2 ng/l water	EQS water[2]
				Mussel*	12 µg/kg dw mussel	EAC[3]
Imposex VDSI* (ISI for *Littorina littorea*)	Gastropods	*Peringia ulvae*: 0.1 *Nucella lapillus*: 2.0 *Neptunea antiqua:* 2.0 *Hinia reticulata:* 0.3 *Buccinum undatum:* 0.3 *Littorina littorea:* <0.3	Gercken & Sordyl 2009; Magnusson et al. 2016; OSPAR (2010a) EcoQO			

[1] Threshold derived from Swedish legislation (HVMFS 2013:19, https://www.havochvatten.se/download/18.1d58828a15f50337fd41fcd5/1508942603512/2013-19-keu-20170101.pdf) and incorporated into HELCOM processes during CORSET II (https://portal.helcom.fi/meetings/CORESET%20II%202015%20HZ%20BE-220/MeetingDocuments/Outcome%20of%20CORESET%20II%202015%20HZBE%20-%20BALSAM%20WP2.pdf).

[2] European Commission (2013) Directive 2013/39/EU of the European Parliament and of the Council of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy. Off. J. Eur. Union L 226: 1-17.

[3] OSPAR 2010b

Assessment Protocol

The threshold values for sediment and imposex in this core indicator are not yet commonly agreed.

The threshold values are included as test threshold values for the purposes of the 2018 'State of the Baltic Sea' report, and the results are to be considered as intermediate.

To evaluate contamination status of Baltic Sea, the ratio of concentration of TBT in the biotic and abiotic elements of marine environment to the specified concentration (threshold) levels are used. Data are extracted from the HELCOM COMBINE database as specified in the extraction table to ensure that the values are from the appropriate measurement matrices (Assessment protocol table 1).

All available data on TBT concentrations in seawater, molluscs and sediments from 2011 to 2016 (longer historic assessments used in trend assessment where available), reported by HELCOM Contracting Parties to the HELCOM COMBINE database, were used to assess the state of the Baltic Sea environment for this assessment period (2011-2016). Also imposex in marine gastropods, as VDS, was used.

Assessment protocol Table 1. Overview table of the parameters, matrices, basis and supporting parameters selected for extraction from the COMBINE database to evaluate the core indicators.

Parameters (PARAM) / Parameter groups (PARGROUP) (see also http://vocab.ices.dk/)	Primary matrix	Species	Matrix	Basis	Supporting parameters and information	Secondary matrix	Species	Matrix	Basis	Supporting parameters and information
PARAM = TBTIN, TBSN+	SED			5% CORG	Surface water layer (1-5.5 m)	Biota	Molluscs (*Mytilus edulis, Macoma baltica*)	SB	D	Dry weight
						Water	filtered and Unfiltered	WT	W	
PARAM = VDSI, ISI	Biota	*Peringia ulvae; Nucella lapillus; Neptunea antiqua; Hinia reticulate; Buccinum undatum: Littorina littorea*	Reproductive organs	W						

SED – sediment; WT – water; MU – muscle; SB – soft body; LI – liver; W – wet weight; D- dry weight

A two-way approach was used to determine the representative concentrations of the individual TBT and imposex in the individual matrices. In the case of stations where long-term data series exist, the agreed script (MIME Script) was used. This method allows determination of the upper value of the 95% confidence level, which is regarded as a representative concentration. In the case of stations where data are from 1-2 years only, the average values were calculated and these values were defined as initial status assessment station data. The lower confidence of these data was taken into account during assessment process.

The detail description of MIME Script method could be found:

for biota http://dome.ices.dk/helcomhz2017/help_methods_biota_imposex.html

for sediment http://dome.ices.dk/helcomhz2017/help_methods_sediment_organo-metals.html

All initial data is handled in a highly precautionary manner to further ensure that the risk of false positives is minimalised. For all initial data the 95% confidence limit on the mean concentration, based on the uncertainty seen in longer time series throughout the HELCOM area, is used. Applying a precautionary approach, the 90% quantile (psi value, Ψ) of the uncertainty estimates in the longer time series from the entire HELCOM region are used. The same approach is used for time series with three or more years of data, but which are dominated by less-than values (i.e. no parametric model can be fitted). The mean concentration in the last monitoring year (meanLY) is obtained by: restricting the time series to the period 2011-2016 (the last six monitoring years), calculating the median log concentration in each year (treating 'less-than' values as if they were above the limit of detection), calculating the mean of the median log concentrations, and then back-transforming (by exponentiating) to the concentration scale. The upper one-sided 95% confidence limit (clLY) is then given by: exp (meanLY + qnorm (0.95) * Ψ / sqrt(n)), where n is the number of years with data in the period 2011-2016 (HELCOM 2018).

Assessment units

The assessment of the present environmental status in respect of TBT content has been carried out in all assessment units at level 4.

The core indicator evaluates the status with regard to concentrations of TBT using HELCOM assessment unit scale 4 (division of the Baltic Sea into 17 sub-basins and further division into coastal and offshore areas). The assessment units are defined in the HELCOM Monitoring and Assessment Strategy Annex 4.

Relevance of the Indicator

The threshold values for sediment and imposex in this core indicator are not yet commonly agreed.

The threshold values are included as test threshold values for the purposes of the 2018 'State of the Baltic Sea' report, and the results are to be considered as intermediate.

Hazardous substances assessment

The status of the Baltic Sea marine environment in terms of contamination by hazardous substances 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 status of the Baltic Sea in terms of concentrations of TBT in the marine environment, this indicator along with the other hazardous substances core indicators contributes to the overall assessment of hazardous substances, though this indicator is currently not included in the integrated assessment of hazardous substances.

Policy relevance

The core indicator on TBT concentrations and imposex addresses the Baltic Sea Action Plan's (BSAP) hazardous substances segment's ecological objectives 'Concentrations of hazardous substances close to natural levels' and 'All fish safe to eat'. The natural level of TBT is zero. TBT is included in the HELCOM list of substances or substance groups of specific concern to the Baltic Sea.

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

- Descriptor 8: 'Concentrations of contaminants are at levels not giving rise to pollution effects' and
- Descriptor 9: 'Contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant standards'

and the following criteria of the Commission Decision (European Commission 2010):

- D8C1 (concentration of contaminants)
- D9C1 (levels, number and frequency of contaminants).

TBT and its compounds are included in the EU WFD (in water). Part of the EU food directives set limits in a range of fish species, shellfish and other seafood. In the OSPAR Coordinated Environmental Monitoring Programme (CEMP), TBT and imposex are to be measured on a mandatory basis in sediment and marine gastropod (OSPAR 2010).

Article 3 of the EU directive on environmental quality standards states that also long-term temporal trends should be assessed for substances that accumulate in sediment and/or biota (European Commission 2008a).

Role of TBT in the ecosystem

Since 1960, the tri-substituted OTC (TBT and TPT) has been used extensively as biocide in antifouling paints for boats. It was very efficient and considered to have a low toxicity to mammals. The use has been restricted in many countries, starting in France 1982, because of the recognised adverse effects of these compounds on the aquatic ecosystem. The European Union, Regulation 782/2003/EC (EC, 2003c) requires TBT free anti-fouling systems to be used from 1 July 2003, and removal of TBT containing paints from 2008.

The uses of TBT and TPT, their persistence, their tendency to bioaccumulate through the food chain (in particular fish and seafood), their high toxicity to aquatic organisms even at levels below 1 ng/l in water, and their complex toxicity profile in experimental animals cause concerns about risks to humans and non-human organisms. Apart from the discovery that organotins were causing deformation and reproductive failure for oysters in France in the 1970s, and at the same time discovery of the imposex effect of masculinisation of female gastropods was later followed by observation of masculinisation of fish (Shimasaki et al., 2003), suggesting that these compounds are strong endocrine disruptors (WHO-IPCS, 1999a,b).

Human pressures linked to the indicator

	General	MSFD Annex III, Table 2a
Strong link		Substances, litter and energy - Input of other substances (e.g. synthetic substances, non-synthetic substances, radionuclides) – diffuse sources, point sources, atmospheric deposition, acute events
Weak link		

After the ban on TBT in antifouling paints, few uses of organotins as pesticides (mainly phenyltins) are still legal. The major source is now its release from impacted sediments in harbour areas and shipping routes (dredging) and illegal use of TBT-containing antifouling paints. Studies in Sweden have also shown that the supply of TBT via contaminated port areas and the management of boats on land are of great importance for continued distribution to the marine environment. High concentrations have been found in stormwater drainage systems (up to 40 000 ng/l in water and up to 285 000 μg/kg TS in the sludge) and in dirt samples (up to 39000 μg/kg TS) sampled close to harbour areas (Bengtsson & Wernersson, 2012).

Monitoring Requirements

The threshold values for sediment and imposex in this core indicator are not yet commonly agreed.

The threshold values are included as test threshold values for the purposes of the 2018 'State of the Baltic Sea' report, and the results are to be considered as intermediate.

Monitoring methodology

HELCOM common monitoring of relevance to the indicator is described on a general level in the **HELCOM Monitoring Manual** in the **programme topic: Concentrations of contaminants and Biological effects of contaminants (imposex)** [still under development]

Quality assurance in the form of international workshops and proficiency testing has been organized annually by QUASIMEME starting from development exercises in 1998, with two rounds each year for water, sediment and biota.

Current monitoring

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

Sub-programme: Contaminants in biota

Monitoring Concept Table [DK only listed in COMBINE program from 2015 in mussels]

Sub-programme: Contaminants in water

Monitoring Concept Table

Sub-programme: Contaminants in sediment

Monitoring Concept Table

Concentrations of TBT and imposex are monitored regularly in few countries, mainly in the more saline parts of the Baltic Sea. Monitoring is performed in sediment (Denmark, Sweden, Germany, Lithuania), mussels and fish liver (several contracting partners but no threshold for fish livers) and Water (Germany, Lithuania and Poland). Imposex is reported by Denmark and Sweden.

The number of sediment and biota monitoring stations per sub-basin is indicated in Monitoring Figure 1.

Description of optimal monitoring

TBT concentrations are spatially highly varying in the Baltic Sea. Therefore, a dense network of monitoring stations is needed to have reliable overviews of the state of the environment. The monitoring should contain both mussels and marine gastropods. Current levels are close to detection limits in pristine areas away from ship routes and harbours with historic contaminations.

Sediment monitoring can complement the assessment. Sediment represents longer timespans than biota (typically years vs. months), and is available in all places, whereas especially local species are not always available for spatial surveys. Time-trends from dated sediment cores in undisturbed (anoxic) areas can be a valuable source of information on the development in concentrations from before monitoring was started and even back to pre-industrialized times.

Water monitoring is generally at levels close to or below the current quantification levels, and can only be recommended with quantification levels around 0.05 ng/l or preferably better.

Monitoring of TBT is relevant in the entire sea area.

Data and updating

The threshold values for sediment and imposex in this core indicator are not yet commonly agreed.

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Access and use

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

HELCOM (2018) Tributyltin TBT and imposex. HELCOM core indicator report. Online. [Date Viewed], [Web link].

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Metadata

Result: TBT and imposex

Data: TBT and imposex sediment data

Data: TBT and imposex biota data

Data: TBT and imposex water data

The indicator is based on data held in the HELCOM COMBINE database hosted at the International Council for the Exploration of the Seas (ICES).

Contributors and references

The threshold values for sediment and imposex in this core indicator are not yet commonly agreed.

The threshold values are included as test threshold values for the purposes of the 2018 'State of the Baltic Sea' report, and the results are to be considered as intermediate.

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Archive

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Tributyltin TBT and imposex HELCOM core indicator 2018 (pdf)

Earlier versions of the core indicator report:

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

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