OSPAR COMMISSION

Levels and trends in marine contaminants and their biological effects – CEMP Assessment report 2017

Monitoring and Assessment Series

2018

OSPAR Convention

The Convention for the Protection of the Marine Environment of the North-East Atlantic (the "OSPAR Convention") was opened for signature at the Ministerial Meeting of the former Oslo and Paris Commissions in Paris on 22 September 1992. The Convention entered into force on 25 March 1998. The Contracting Parties are Belgium, Denmark, the European Union, Finland, France, Germany, Iceland, Ireland, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom of Great Britain and Northern Ireland.

Convention OSPAR

La Convention pour la protection du milieu marin de l'Atlantique du Nord-Est, dite Convention OSPAR, a été ouverte à la signature à la réunion ministérielle des anciennes Commissions d'Oslo et de Paris, à Paris le 22 septembre 1992. La Convention est entrée en vigueur le 25 mars 1998. Les parties contractantes sont : l'Allemagne, la Belgique, le Danemark, l'Espagne, la Finlande, la France, l'Irlande, l'Islande, le Luxembourg, la Norvège, les Pays-Bas, le Portugal, le Royaume-Uni de Grande Bretagne et d'Irlande du Nord, la Suède, la Suisse et l'Union européenne.

Acknowledgement

This report has been prepared by the Working Group on Monitoring and on Trends and Effects of Substances in the Marine Environment (MIME), led by Dr Rob Fryer. Special thanks to Dr Rob Fryer, UK, for his hard work in producing this report.

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The 2017-18 MIME roll-over (http://dome.ices.dk/osparmime2017/main.html)

The 2017-18 MIME roll-over assessed 8203 time series (of three years or more) in biota, of which 5597 were assessed for trends and 7806 for status, and 4562 time series in sediment, of which 3258 were assessed for trends and 4016 for status. A breakdown of trends and status by region and determinand is given in Tables 1-4. The assessment methodology is described in the help files that accompany the assessment.

Organo-bromine concentrations have been assessed for status for the first time. Canadian Federal Environmental Quality Guidelines (FEQGs) were used as EAC equivalents for biota and sediment. Background Assessment Concentrations (BACs) were developed for BDE47 in biota and sediment and trialled. More work is required to develop BACs for other organo-bromines, and the BACs for BDE47 might need to be revised as part of that process. The development of the BACs and the use of the FEQGs are described at http://dome.ices.dk/osparmime2017/help_ac_development_organo-bromines.html.

Time series of contaminant concentrations in water were assessed for the first time. To keep things simple, attention was restricted to concentrations of CD, PB and NI in filtered samples, and BAP, TBTIN and PFOS in unfiltered samples. The fitted mean concentration in the final year was compared to the Annual Average Environmental Quality Standard (AA-EQS) for 'other surface waters'. There were 94 time series (of three years or more), of which 50 were assessed for trends and all of which were assessed for status.

The regional assessments that underpinned the contaminant and imposex components of the 2017 Intermediate Assessment have been updated.

Heat maps showing the estimated (a) time to reach the Background Concentration (BC) and (b) current distance from the BC will be produced for metals and PAHs (i.e. the naturally occurring substances) in biota and sediment. These will be made available in the CEMP tool as separate html documents.

Considerations for the assessment of mercury in biota

The MIME assessments are based on the OSPAR BAC and EU food criteria. Within the Water Framework Directive, EC (2000), an EQS has been established at 20 µg kg^{-1} WW (EC 2008, EC 2013), but this has not been used in the MIME assessments. During 2015 and 2016, MIME investigated the use of the EQS in relation to the assessment strategy (OSPAR, 2016), and the possible ways to implement the EU Guidance Document 32 on biota monitoring (EU, 2014).

The main concern in using the EQS value is that the level of the EQS is very close to the BAC, i.e. even at what OSPAR considers background levels, an effect of mercury can be expected. In the 2013 revision of the biota EQSs, it was further stated that the EQS is applicable to whole fish. This leads to incompatibility with the available data in the OSPAR CEMP program, where mercury traditionally have been measured in fish muscle, the organ usually applied for food safety limits. In the Guideline 32 (EU, 2014), it was further specified that the fish used for monitoring should be from a specific trophic level, in the case of the North Sea this was set to trophic level 4 to be relevant for the top predators that the EQS_{biota} was developed to protect.

There are a number of uncertainties in both the derivation of the EQS and for species, which are not at trophic level (TL) 4, the adjustment via bioconcentration and/or biomagnification factors used. In all 455

time-series were investigated, 324 of which were shellfish, mainly blue mussels (272 time-series). For each species a correction was made to normalise for dry weight, the trophic level was adjusted to TL 4 taking into account a mercury trophic magnification factor (TMF) of 4.

When performing the calculation on OSPAR's dataset for time trends using the mean last year, only one station in the UK (flounder) passed the EQS_{biota} criteria of the 455 time series tested. Using the standard upper limit for last year, no stations out of 354 available passed. In comparison, using the normal OSPAR criteria of BAC and EC food limits, only 2 stations were in "bad" status, and three species was undetermined, the remaining 450 were either at background (113 stations) or "green" (337 stations). Even using the EQS value directly, without adjusting for trophic level, results "fail" for a significant number of time-series. The "background concentration" for mercury was at the same level as the EQS (18 vs. 20 µg kg^{-1} for mussels), and below the background for fish.

It was the conclusion of the MIME group that derivation of a standalone EQS_{biota} for mussels could not be recommended, as many birds and mammals forage at higher trophic levels than TL2 for mussels, and in a more general sense, the approach of EQS is not readily extendable to the marine environment. The use of generic TMF and TL values are inherently uncertain, and TMF and TL data should be measured in the specific ecosystems.

The use of mercury in the countries around the North Sea has been greatly reduced since the OSPAR Convention entered into force, and globally based interventions against mercury are needed to reduce the levels of mercury under the current technical guidance document based approach. The MIME group also found that future assessments should be made without normalisation to TL 4.

Table 1: Summary of trends in contaminants and biological effects in biota

	Region I			Region II			Region III			Region IV		
	total	down	up	total	down	up	total	down	up	total	down	up
Metals												
CD	19	6	1	162	38	25	82	32	6	54	17	4
HG	18	2	0	174	27	17	69	10	5	54	11	1
PB	18	5	0	161	46	12	79	12	7	54	15	1
CU	16	9	0	152	26	8	79	14	3	52	2	4
ZN	20	6	2	155	36	10	79	16	1	52	11	0
PAHs (parent)												
NAP	3	2	0	49	11	3	13	1	1	10	0	1
PA	4	1	0	77	13	2	35	5	4	39	3	1
ANT	2	0	0	36	7	0	11	0	1	24	9	1
DBT				11	5	0						
FLU	4	2	0	78	13	4	35	5	3	39	12	0
PYR	4	2	0	81	18	1	33	7	1	39	14	0
BAA	4	3	0	48	12	4	17	7	1	37	8	0
CHR	4	2	0	58	18	1	19	8	0	38	14	0
BAP	3	3	0	29	7	0	10	5	0	34	4	1
BGHIP	4	4	0	34	12	0	15	6	0	24	6	0
ICDP	3	3	0	26	9	0	11	1	0	23	6	0
CBs												
CB28	4	4	0	67	33	1	51	18	1	22	8	0
CB52	12	5	0	92	39	0	54	24	1	35	14	0
CB101	15	9	0	129	60	2	59	24	0	44	24	0
CB105	14	11	0	81	51	3	32	6	0	38	15	0
CB118	18	14	0	133	70	1	70	25	2	43	17	4
CB126				1	0	0						
CB138	18	14	1	125	72	0	65	23	1	39	25	0
CB153	18	12	1	144	73	1	71	21	2	44	29	0
CB156	7	4	0	46	24	0	24	1	0	23	10	0
CB169				2	0	0						
CB180	10	4	0	96	45	1	53	8	2	37	22	0
Organobromines												
BDE28	1	0	0	14	5	0	14	2	0			
BDE47	2	1	0	31	23	0	33	16	1	21	5	1
BDE99	1	0	0	20	10	0	26	15	1	21	9	1
BD100	1	0	0	28	6	1	30	13	0	20	7	1
BD153				11	2	2	17	5	0	6	0	0
BD154	1	0	0	10	5	1	20	6	2	13	3	0
Pesticides												
DDEPP	18	11	0	65	21	1	30	1	3	31	8	0
HCB	18	6	0	55	17	1	27	4	2	5	0	0
HCHA	14	11	0	22	14	0	27	7	1	17	2	0

	Region I			Region II			Region III			Region IV		
HCHG	10	5	0	48	36	0	27	10	0	30	11	0
Dioxins, furans and PFCs												
TCDD				11	3	1						
CDF2T				10	2	0						
PFOS	1	0	0	4	4	0						
Organometals												
DBTIN				19	12	0						
MBTIN				11	4	0						
TBTIN	2	2	0	29	22	0				1	0	0
TPTIN				3	1	0						
Biological effects												
EROD				37	8	1	30	14	0			
PYR1OH				28	2	3	15	0	2			
PA1OH				4	2	0						
BAP3OH				3	1	0						
ACHE				1	0	0						
ALAD				3	0	0						
GST				1	1	0						
SFG										17	4	0
VDS	2	2	0	88	60	0	27	9	0	9	8	0
INTS				3	0	0						

Table 2: Summary of trends in contaminants in sediment

	Region II			Region III			Region IV		
	total	down	up	total	down	up	total	down	up
Metals									
CD	61	17	0	19	2	3	29	2	1
HG	65	26	0	25	7	0	29	7	1
PB	71	16	5	25	7	2	29	3	1
AS	57	4	3	26	0	4	29	0	3
CR	67	2	4	26	5	1	29	6	0
CU	69	16	3	26	7	0	29	0	3
NI	70	4	4	26	4	1	29	0	1
ZN	67	8	1	26	8	1	29	10	0
PAHs (parent)									
NAP	50	3	1	24	6	0	0	0	0
PA	74	15	1	28	2	1	29	6	0
ANT	64	10	5	25	3	1	29	7	2
DBT	14	1	1	14	5	0	0	0	0
FLU	73	13	3	27	3	2	29	7	0
PYR	74	14	3	28	5	2	29	9	0
BAA	68	10	1	25	4	2	29	7	0
CHR	72	13	2	25	3	4	29	7	0
BAP	69	16	2	26	4	1	29	10	0
BGHIP	69	19	3	27	6	0	29	3	0
ICDP	69	15	2	27	4	0	29	14	0
PAHs (alkylated)									
NAPC1	10	1	1	4	0	0			
NAPC2	25	0	2	19	3	0			
NAPC3	26	0	2	19	4	0			
PAC1	16	3	1	15	2	1			
PAC2	16	2	2	15	4	0			
PAC3	14	1	2	14	2	1			
DBTC1	15	1	2	14	2	2			
DBTC2	15	1	0	14	4	0			
DBTC3	15	1	3	14	3	1			
CBs									
CB28	42	11	1	15	5	1	19	0	0
CB52	35	16	1	16	6	1	26	5	4
CB101	48	15	2	17	8	1	20	0	0
CB105	12	4	0	7	0	1	22	0	1
CB118	49	21	1	18	4	2	21	0	1
CB138	50	21	1	18	5	0	24	0	0
CB153	54	17	2	18	3	2	27	0	0
CB156	2	0	0	5	0	0	24	0	1
CB180	43	17	1	14	2	1	23	0	0

	Region II			Region III			Region IV
Organobromines							
BDE28				2	0	0	
BDE47	5	0	0	9	2	0	
BDE66				3	2	0	
BDE99				1	1	0	
BD100				6	1	0	
BD153				2	0	0	
BD154				5	0	0	
BD183				2	1	0	
Organometals							
DBTIN	27	13	0				
MBTIN	28	7	0				
TBTIN	25	17	0				

Table 3: Summary of status of contaminants and biological effects in biota: B = blue, G = green, O = orange (above BAC, but no EAC or equivalent), R = red

	Region I				Region II				Region III				Region IV			
	B	G	O	R	B	G	O	R	B	G	O	R	B	G	O	R
Metals																
CD	2	18	0	2	60	127	0	7	37	58	0	1	46	11	0	3
HG	14	7	0	0	21	181	0	0	12	82	0	0	14	46	0	0
PB	14	8	0	2	41	146	0	10	25	63	0	6	20	38	0	2
CU	9	0	6	0	20	0	114	0	14	0	58	0	7	0	50	0
ZN	3	0	14	0	0	0	134	0	1	0	71	0	0	0	57	0
PAHs (parent)																
NAP	0	5	0	0	0	81	0	11	0	26	0	7	0	18	0	0
PA	1	4	0	0	5	100	0	2	1	52	0	0	5	37	0	0
ANT	0	5	0	0	0	77	0	2	0	43	0	1	0	32	0	0
FLU	2	3	0	2	4	89	0	9	3	45	0	3	9	31	0	2
PYR	2	1	0	2	5	82	0	16	1	41	0	8	5	36	0	1
BAA	0	3	0	2	4	70	0	6	1	29	0	2	5	35	0	2
CHR	2	0	3	0	14	0	90	0	9	0	39	0	9	0	33	0
BAP	0	5	0	0	3	63	0	0	3	28	0	1	3	38	0	0
BGHIP	1	4	0	0	0	69	0	0	1	29	0	3	4	36	0	0
ICDP	0	0	5	0	4	0	58	0	3	0	25	0	7	0	33	0
CBs																
CB28	13	8	0	1	37	101	0	23	28	36	0	16	32	10	0	0
CB52	13	8	0	1	17	127	0	13	23	46	0	11	15	30	0	2
CB101	13	8	0	2	7	136	0	30	13	55	0	13	3	37	0	7
CB105	13	0	6	0	28	0	73	0	24	0	22	0	21	0	24	0
CB118	13	4	0	6	5	50	0	120	7	26	0	55	0	18	0	29
CB138	7	15	0	1	0	146	0	16	2	75	0	6	0	42	0	3
CB153	5	18	0	0	0	176	0	3	0	90	0	0	0	46	0	1
CB156	13	0	5	0	41	0	55	0	28	0	16	0	27	0	16	0
CB180	13	7	0	1	36	114	0	2	20	53	0	2	17	29	0	0
Organobromines																
BDE28	0	3	0	0	0	35	0	0	0	50	0	0	0	21	0	0
BDE47	0	7	0	0	0	53	0	0	0	54	0	0	0	23	0	0
BDE99	0	6	0	0	0	49	0	0	0	45	0	5	0	23	0	0
BD100	0	4	0	1	0	38	0	12	0	37	0	15	0	23	0	0
BD153	0	2	0	0	0	39	0	0	0	40	0	2	0	23	0	0
BD154	0	2	0	0	0	28	0	1	0	47	0	4	0	23	0	0
Pesticides																
DDEPP	11	0	8	0	0	0	107	0	0	0	51	0	0	0	44	0
HCB	13	0	6	0	20	0	59	0	28	0	17	0	17	0	7	0
HCHA	13	0	0	0	36	0	28	0	30	0	3	0	21	0	20	0
HCHG	13	4	0	0	48	24	0	14	30	0	0	5	34	8	0	2
Organometals																
TBTIN	0	2	0	0	1	6	0	33	0	2	0	1	0	0	0	9

Biological effects																
EROD					29	0	14	0	20	0	10	0				
PYR1OH					2	17	14	0	0	13	0	0				
PA1OH					1	0	3	0								
SFG													1	11	0	11
VDS	2	0	0	0	20	42	0	28	0	14	0	13	3	3	0	36

Table 4: Summary of status of contaminants in sediment: B = blue, G = green, O = orange (above BAC, but no EAC or equivalent), R = red

	Region II				Region III				Region IV			
	B	G	O	R	B	G	O	R	B	G	O	R
Metals												
CD	19	61	0	8	19	6	0	2	3	25	0	1
HG	12	15	0	60	9	9	0	8	0	8	0	21
PB	15	5	0	70	9	5	0	12	1	1	0	27
AS	26	0	47	0	20	0	7	0	0	0	0	29
CR	0	20	0	70	0	5	0	22	0	7	0	22
CU	46	17	0	27	15	3	0	9	0	2	0	27
NI	36	0	54	0	6	0	21	0	0	2	0	27
ZN	18	9	0	62	10	6	0	11	0	10	0	19
PAHs (parent)												
NAP	12	46	0	10	2	26	0	5	0	0	0	0
PA	16	62	0	10	3	19	0	11	13	12	0	4
ANT	12	64	0	12	6	21	0	6	8	19	0	2
DBT	0	17	0	0	0	15	0	0	0	0	0	0
FLU	14	71	0	3	5	24	0	4	12	15	0	2
PYR	13	71	0	4	4	25	0	4	10	19	0	0
BAA	15	63	0	5	3	22	0	7	12	15	0	2
CHR	10	75	0	2	3	24	0	4	13	16	0	0
BAP	23	56	0	4	4	24	0	4	13	16	0	0
BGHIP	48	0	35	0	5	0	27	0	11	0	18	0
ICDP	55	0	28	0	9	0	23	0	13	0	16	0
CBs												
CB28	6	59	0	6	5	22	0	2	0	26	0	2
CB52	1	62	0	5	1	25	0	1	0	25	0	2
CB101	0	66	0	6	2	25	0	1	0	18	0	8
CB118	4	26	0	43	1	9	0	19	0	9	0	18
CB138	5	66	0	2	1	26	0	2	0	23	0	6
CB153	5	68	0	0	1	27	0	0	0	29	0	0
CB180	4	69	0	0	2	26	0	0	0	25	0	4
Organobromines												
BDE28	0	13	0	0	0	13	0	0	0	7	0	0
BDE47	0	38	0	1	0	17	0	0	10	19	0	0
BDE66	0	14	0	0	0	14	0	0	0	29	0	0
BDE99	0	12	0	0	0	11	0	1	0	0	0	1
BD100	0	29	0	10	0	9	0	7	0	27	0	2
BD153	0	14	0	6	0	14	0	1	0	15	0	0
BD154	0	25	0	0	0	14	0	0	0	15	0	0
BD183	0	21	0	0	0	13	0	0	0	15	0	0
BD209	0	29	0	0	0	13	0	0	0	16	0	0

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