Contribution to the OSPARs QSR23 (OSPAR's Quality Status Report 2023) in relation to the biological effects of chemical contamination

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Data sheet

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Category: Communication report

Title: Contribution to the OSPARs QSR23 (OSPAR's Quality Status Report 2023) in relation to the biological effects of chemical contamination.

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1 Background

In December 2021, the Danish Ministry of Environment requested DCE to select, compile, format and submit data on chemical and biological effect measurements from the NOVANA monitoring program for OSPAR's Quality Status Report 2023.

The OSPAR area of the North-East Atlantic receives the chemical pressure of approximately 140,000 hazardous substances, and therefore an integrated approach on the biological effects of chemical contaminants has been developed for monitoring, which forms the basis for the descriptor 8 (contaminants and effects) of the MSFD and contributes to the assessment of chemical exposure in the marine environment. The thresholds of effects (EAC: Environment Assessment Criteria) and the baseline levels (BAC: Background Assessment Criteria) were produced from monitoring data collected within the OSPAR region. The field monitoring data and expertise shared by the contracting parties over the past ten years are illustrated by different short and long-term case studies carried out under the voluntary OSPAR monitoring program (PRE-CEMP) for application in different national coastal and offshore areas.

2 Data for OSPAR's Quality Status Report 2023

The selected NOVANA data are compiled and submitted using an excel file containing algorithms for integration of chemical and biological measurements according to respective assessment criteria (AC). The used excel format for data submission were developed specifically for this project by the French Research Institute for Exploitation of the Sea (IFREMER), France.

The data on chemical and biological effect measurements and respective ACs submitted for the following stations (NOVANA Station Code): Kalvebodløbet (ROSsortløb), Roskilde Fjord (DMU2R), Randers Fjord (ARH230066), Langerak (NORMSS11), Frederiksværk (FRB65).

The data sets represent the year 2013, since the amount of data available is highest and covers more stations than during other years.

These data have previously been used during the reporting of NOVANA results for 2013 and, hence, were a subject of standard quality assurance and quality control procedures that are in place under the Marine Topic Center, Aarhus University (Høgslund et al., 2019), and further reported to ICES and used in OSPAR and HELCOM assessments.

Types of data compiled and submitted and included in the excel file are shown in the Table 1.

Currently, the draft of the report for OSPAR non-indicator 'other assessments' for OSPAR's Quality Status Report 2023 is being developed by IFREMER, France. The template for the draft report is in Annex 1.

Table 1. Types of data on biological and chemical measurements submitted to QSR23 Report. The data are derived from NOVANA monitoring databases for the year 2013. The data cover "Exposure" and "Effects" biological measurements in fish, mussels and marine gastropods as well as chemical measurements of contaminants in fish and mussels as environmental matrix.

	Determinands	Units	Matrix	Species on which the threshold have been determined	Species actually sampled without specific threshold	Sex
EXPOSURE	**Biomarker of exposure**					
	EROD S9	pmol/min/mgprot	Fish	Viviparous eelpout (Zoarces viviparus), liver	Viviparous eelpout (Zoarces viviparus), liver	F
	OH Pyren equivalents fluorescence SFS	µg/ml	Fish	Viviparous eelpout (Zoarces viviparus), bile	Viviparous eelpout (Zoarces viviparus), bile	F
	NRR LMS	min	Mussel	Mytilus edulis	Mytilus haemolymph	M/F
EFFECTS	**Biomarker of effect**					
	Imposex	VDSI	Gastropod	Hinia reticulata		
	Imposex	VDSI	Gastropod	Buccinum undatum		
	% Total abnormal fry	% prevalence	Fish	Viviparous eelpout (Zoarces viviparus), brood	Viviparous eelpout (Zoarces viviparus), brood	
	% Malformed fry	% prevalence	Fish	Viviparous eelpout (Zoarces viviparus), brood	Viviparous eelpout (Zoarces viviparus), brood	
CONTAMINANTS	**Contaminants**					
	Hg	µg_kg_ww	Fish	Viviparous eelpout (Zoarces viviparus)	Viviparous eelpout (Zoarces viviparus), muscle	
	TBT	µg Sn/kg ww	Fish	Viviparous eelpout (Zoarces viviparus)	Viviparous eelpout (Zoarces viviparus), liver	
	CB118	µg_kg lw per 5% lipid	Fish	Viviparous eelpout (Zoarces viviparus)	Viviparous eelpout (Zoarces viviparus), muscle	
	sumBDE6	µg_kg per 5% lipid	Fish	Viviparous eelpout (Zoarces viviparus)	Viviparous eelpout (Zoarces viviparus), muscle	
	PFOS	µg_kg_ww	Fish	Viviparous eelpout (Zoarces viviparus)	Viviparous eelpout (Zoarces viviparus), liver	
	TPhT	µg_kg_ww	Fish	Viviparous eelpout (Zoarces viviparus)	Viviparous eelpout (Zoarces viviparus), liver	
	WHO-TEQ 1998 total, excl. LOQ	ng_kg_lw per 5% lipid	Fish	Viviparous eelpout (Zoarces viviparus)	Viviparous eelpout (Zoarces viviparus), muscle	
	Hg	µg_kg_ww	Mussel	Mytilus		
	TBT	µg Sn/kg ww	Mussel	Mytilus		
	Benzo[a]pyrene	µg_kg_ww	Mussel	Mytilus		
	WHO-TEQ 1998 total, ekskl. LOQ	µg_kg_lw	Mussel	Mytilus		

3 References

Høgslund, S., Hansen, J. L. S., Bruhn, A., Krause-Jensen, D., Carstensen, J., Jakobsen, H. H., Markager, S., Hansen, J. W., Dahl, K., Galatius, A., Tougaard, J., Sveegaard, S., Anker Kyhn, L., Feld, L., & Larsen, M. (2019). *Beskrivelse af metoder til maglig kvalitetssikring af dataemner i NOVANA-rapportering for marine områder. Version: 1.*

ANNEX "Draft outline for OSPAR's Quality Status Report 2023 (Integrated biological effects and chemical contaminants approach: a case study)".

The draft outline for OSPAR's Quality Status Report 2023, "Template for OSPAR non-indicator 'other assessments' for OSPAR's Quality Status Report 2023", was developed by IFREMER, France.

Template for OSPAR non-indicator 'other assessments' for OSPAR's Quality Status Report 2023

Please complete the below table for all OSPAR non-indicator 'other assessments' to allow the Secretariat to prepare cover pages for the report in the agreed QSR 2023 style.

Title of report or assessment	Integrated biological effects and chemical contaminants approach: a case study
Contracting Party or Organisation Name (please also submit any organisation logo that you wish to be used as a png.)	WGBEC/ICES and MIME/OSPAR
Contributors to be credited (please list any individuals that you would like to be credited for this report in order)	Thierry Burgeot (MIME biological effects coordinator, Ifremer, France) Aourell Mauffret (MIME Vice-chair, Ifremer, France), Steven Brooks (WGBEC Co-chairman, NIVA, Norway), Juan Bellas Bereijo, (WGBEC Co-chairman, IOE, Spain), Joachim Sturve (Gothenburg University, Sweden), John Bignell (Cefas, United Kingdom) Jörn Scharsack (Thünen Institute, Germany) Kris Coorman (Ilvo, Belgium) Koen Parmentier (RIBNS ,Belgium) Marta Assuncao (Cefas, United Kingdom) Michelle Giltrap (Technological University Dublin, Ireland) Halldor Palmar Halldorsson (Reykjavik University, Iceland) Hermann Dreki Guls (Reykjavik University, Iceland) Zhanna Tairova (Aarhus University, Denmark) Concepcion Martinez-Gomez (IOE, Spain) Ketil Hylland (University of Oslo, Norway, and Institute for Marine Research, Norway)
Contents (please provide the contents page for your report)	**Contents** **I- Introduction** (Thierry Burgeot *et al*.) **II- Biological effects of chemical contaminants on a broad geographical scale** (Thierry Burgeot et al.,)

	III- Chemical stress scenarios in coastal areas III-1 Biological effects and chemical contamination in relation to different anthropic pressures: Case study in the Bay of Seine (France) (Aourell Mauffret et al.,) III-2 Biomarkers of contaminant effects in fish and mussels from the North Sea: case study at St Andrews Bay and Firth of Forth in Scotland. (Hannah Anderson) *III-3 Insert:* Trybutyltin: The story of a hidden bottom-up killer of the *Crangon crangon* population (Kris Coorman et al.,) **IV- Long-term series to confirm the biological effects of chemical contaminants in coastal and offshore areas** IV-1) Fish monitoring from a Swedish reference site (Joachim Sturve and Lars Förlin) IV-2) Biological effects in cod from the Oslofjord (Steven Brooks et al.,) IV-3) Assessment of spatial and temporal data on diseases of the common dab (*Limanda limanda*) in the OSPAR Region using the FDI approach (Jörn P. Scharsack *et al*.,) *IV-4) Insert*: Development of methods to evaluate trends of liver neoplasms in the common dab (*Limanda limanda*) flatfish: a UK case study (John Bignell et al.,)
Executive Summary (500 words max)	The OSPAR area of the North-East Atlantic receives the chemical pressure of approximately 140,000 hazardous substances. In a context of global change, the *in situ* assessment of the biological effects of chemical contaminants has made significant methodological progress of standardisation over the past decade, following a consensual methodology. An integrated approach on the biological effects of chemical contaminants has been developed for monitoring. Three structuring methodological criteria were applied: 1) Common reference methods; 2) Quality assurance and; 3) Chemical and biological effect thresholds. The thresholds of effects (EAC: Environment Assessment Criteria) and the baseline levels (BAC: Background Assessment Criteria) are unique in ecotoxicology. They were produced from monitoring data collected within the OSPAR region and they differ from chemical risk assessment methods. They underline a pioneering monitoring expertise in comparison with terrestrial or continental water matrices. The field monitoring expertise shared by the contracting parties over the last ten years is illustrated by different case studies carried out under the voluntary

	OSPAR monitoring programme (PRE-CEMP) for application on a broad geographical scale, in different national coastal and offshore areas, in the short and long term studies. These various methodological developments adopted by different contracting countries are applied to sites often annually with low or very high contamination, but following a combination of biomarkers and chemical contaminants from a core list. Biological effects and chemical contaminants were measured on some sentinel species that were selected according to their local distribution (cod, herring, sole, eelpout, whiting, saithe) or on a broad geographic scale (mussel, flounder, dab, gastropod). The results demonstrate an assessment of the spatiotemporal health status of different sentinel organisms exposed in their natural habitats to different chemical pressures. This OSPAR monitoring approach forms the basis of both the descriptor 8 (contaminants and effects) of the MSFD and it contributes to the assessment of chemical exposome in the marine environment, a real challenge for the next ten years.
Executive Summary French	La zone OSPAR de l'Atlantique Nord-Est reçoit la pression chimique d'environ 140 000 substances dangereuses. Dans un contexte sensible de changement global, l'évaluation consensuelle des effets biologiques des contaminants chimiques *in situ* a progressé de manière significative ces dix dernières années. Une approche intégrée des effets biologiques des contaminants chimiques a été développée pour la surveillance. Trois critères méthodologiques ont été appliqués: Méthodes de référence communes, 2) Assurance qualité et 3) Seuils chimiques et d'effets biologiques. Les seuils d'effets (EAC: Environment Assessment Criteria) et seuils de base (BAC: Background Assessment criteria) sont uniques en écotoxicologie . Ils ont été produits à partir de données de surveillance à l'échelle de la zone OSPAR et ils se distinguent des méthodes d'évaluation de risque chimique. L'expertise de surveillance partagée par les pays contractants est illustrée suivant différents cas d'études menés sur une large échelle géographique, dans des zones locales et offshore, à court et long terme. Les développements méthodologiques optées par les différents pays contractants sont ainsi restitués sur des sites peu ou très contaminés, suivant une combinaison de biomarqueurs et contaminants chimiques issus d'une liste ciblée. Les effets biologiques et les contaminants chimiques mesurés sur certaines espèces sentinelles ont été sélectionnées suivant leur distribution locale (cabillaud, hareng, blennie , merlan, lieu noir) ou bien sur une large échelle géographique (moule, flet, limande, gastéropodes). Les résultats démontrent une évaluation de l'état santé spatiotemporel

	de différents organismes sentinelles exposés à différentes pressions chimiques et dans leurs habitats naturels. Cette approche de surveillance OSPAR constitue à la fois la base du descripteur 8 (contaminants et effets) de la DCSMM et elle contribue à l'évaluation de l'exposome chimique dans le milieu marin, un véritable défi pour les dix prochaines années.