

1.6.6.3 OSPAR request to support the development of common and candidate OSPAR biodiversity indicators for benthic habitats: pressure maps

Advice summary

ICES has collated Vessel Monitoring System (VMS) and logbook data received, but submissions were not received from all those holding the required data.

ICES evaluated the fishing pressure abrasion maps and found that over 90% of activity by vessels over 10 m (overall length) was represented, but notes that data from vessels under 10 m (30% of fleets in terms of numbers of vessels, although not necessarily of activity) are not included in this calculation or in the maps.

ICES provides fishing abrasion pressure maps (and the underlying data) for 2009–2013, but advises that assumptions have been made in developing these maps and provides a set of caveats that must be taken into account when interpreting the both maps and the underlying data.

Request

ICES is requested to support on-going OSPAR indicators work on benthic habitats, in support of the requirements under the MSFD.

a) Using mobile bottom contacting gear data, produce fishing abrasion pressure maps (2009–2013) using the BH3 approach as a follow-up of the OSPAR request to ICES (Request 5/2014). Fishing abrasion pressure maps should be analysed by gear distribution, and type, in the OSPAR maritime area and be based on the methodology propose on the physical damage indicator (BH3). Specifically ICES is requested to:

- i) collate relevant national VMS and logbook data;*
- ii) estimate the proportions of total fisheries represented by the data;*
- iii) using methods developed in Request 5/2014, where possible, collect other non-VMS data to cover other types of fisheries (e.g. fishing boats < 12m length);*
- iv) prepare maps for the OSPAR maritime area (including ABNJ) on the spatial and temporal intensity of fishing using mobile bottom contacting gears (BH3 approach);*
(Any analysis relating to main threats and development of abrasion maps should not be applied to the Portuguese continental shelf)

Elaboration on the advice

- i) VMS and logbook data were requested from all OSPAR Contracting Parties, Russia, and from the North-East Atlantic Fisheries Commission (NEAFC). Data were received from twelve of these sources; however, only data from nine Contracting Parties were complete and could be used in developing this advice.
- ii) The proportion of total fisheries represented by the fishing abrasion pressure outputs was calculated by proxy using landings weight. The results (Table 1.6.6.3.1) show that the data capture over 91.2% of the total fisheries for all mobile bottom-contacting gear. Dredge gear was noted as an exception with only 48.8% represented by the VMS data, which will be the result of significant effort by smaller vessels fishing for species such as scallops, mussels, and cockles.

Table 1.6.6.3.1 Proportion of total fisheries of nine OSPAR Contracting Parties represented by vessels fitted with a VMS unit. The proportion is calculated using landings weight from logbook data as a proxy. It should be noted that from 2012, VMS was mandatory for vessels over 12 m overall length, whereas before the start of 2012 it was only mandatory for vessels

over 15 m overall length. Total mobile bottom-contacting gear is a weighted average (by landed weight of catch) of each gear type.

Gear group	Abrasion pressure	2009	2010	2011	2012	2013	Average
Beam trawls	Surface/Subsurface	96.2%	97.0%	97.2%	99.2%	99.0%	97.7%
Dredges	Surface/Subsurface	39.6%	45.5%	44.5%	60.5%	54.0%	48.8%
Otter trawls	Surface/Subsurface	94.2%	93.6%	95.6%	96.9%	98.0%	95.7%
Demersal seines	Surface	89.6%	90.5%	97.9%	100.0%	100.0%	95.6%
<i>Total mobile bottom-contacting gear</i>		<i>88.4%</i>	<i>89.1%</i>	<i>90.7%</i>	<i>93.6%</i>	<i>94.3%</i>	<i>91.2%</i>

It should be noted that logbook data are only required from vessels over 10 m. The proportions above therefore do not necessarily represent proportions of the total fisheries, but rather proportions by those vessels that complete logbook data either with (>12 m) or without (10–12 m) VMS units. The EU Fleet Register for the OSPAR Contracting Parties shows that 29.2% of fishing vessels using bottom contact gear are not captured by the logbook data presented above (Table 1.6.6.3.2). Note that some of these fleets fish in waters outside the OSPAR area; OSPAR Contracting Parties that are not part of the EU are not included here.

Table 1.6.6.3.2 Proportion of vessels by overall length. Based on data extracted from the EU Fleet Register (11/08/2015) for the following OSPAR Contracting Parties: Belgium, Denmark, Germany, France, Ireland, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

	Vessel length class			
	< 10 m	10–12 m	12–15 m	>15 m
Vessels using mobile bottom-contacting gears	29%	12%	10%	49%

The activity of vessels < 10 m will mainly occur in inshore, coastal waters. It is unlikely that assessments of fishing abrasion pressure further offshore will be affected. The proportion of vessels < 10 m varies between OSPAR Contracting Party fleets and the proportion of time spent fishing varies also, both by country and by vessel length. The size of nets, and therefore of the towed area is related also to the size of the vessel – smaller vessels generally tow smaller nets.

- iii) ICES has not collected other information than VMS and logbook data. ICES reviewed approaches for integrating logbook and VMS data in mapping fishing abrasion pressure but does not recommend any approach due to unvalidated assumptions and spatial resolution issues. ICES considered using other data types. Ship-borne Automatic Identification System (AIS) data offer limited benefits over VMS data as only fishing vessels >15 metres are required to carry this system. Sales note landings data may be a better proxy of the fleet (especially for vessels < 10 m) in assessing the proportion of fishing effort covered by VMS.
- iv) ICES produced fishing abrasion pressure maps (ICES, 2015a) using the data provided by nine OSPAR Contracting Parties. Separate maps were produced for surface abrasion and subsurface abrasion. Two sets of maps (Annex 1) have been created: one covering the whole OSPAR maritime area and another covering the North Sea and Celtic Seas (OSPAR Regions II and III), as the data in these regions are most complete. Several assumptions have been made in developing these maps; therefore the caveats listed in the section “Basis of the advice” must be taken into account when interpreting the maps and any further products using the underlying data.

Suggestions

Only data from nine out of sixteen potential sources could be used in developing this advice. ICES suggests that OSPAR encourages a full response from those that either did not submit data (Faroe Islands, Greenland, Iceland, and Russia), provided incomplete data (Portugal), or provided data in an unsuitable format (Spain and NEAFC).

ICES notes that efforts to map the fishing effort of vessels < 12 m overall length is challenging. Two approaches could be tested in future: i) logbook data by ICES rectangle for vessels of 10–12 m overall length could be mapped (not possible this year for resource reasons); ii) if future data calls were expanded to include data from the register of buyers and sellers (includes sales landing notes for vessels < 10 m), the mapping of home/landing ports of these vessels would give an indication of the main areas in which these vessels are fishing. Note that this would not lead to improved fishing abrasion maps.

ICES has provided maps of the spatial and temporal intensity of fishing activities on an annual basis. It would be possible to provide these maps on a different temporal basis, but guidance is needed from OSPAR on this issue.

Basis of the advice

Background

OSPAR is developing Benthic Habitat Indicator 3 (BH3): Physical damage of predominant and special habitats. This work requires knowledge of fishing abrasion pressure across the OSPAR maritime area.

Results and conclusions

i) Collate relevant national VMS and logbook data

Data were submitted by twelve out of sixteen OSPAR Contracting Parties and others, but only nine data submissions could be used in full as part of this advice. Data submitted by Portugal only constituted a partial submission. Data were submitted by Spain, but summarized by ICES rectangle, which did not meet the requirements of the request. Data were submitted by NEAFC but gear codes were often missing and there was duplication with data submitted individually (for OSPAR Contracting Parties and others whose vessels operated in the NEAFC regulatory area) which could not be resolved. In areas for which data were not submitted and where fleets operate, the fishing abrasion pressure maps will be incomplete.

ii) Estimating the proportions of total fisheries represented by the data

The proportion of total fisheries by vessels fitted with VMS units, based on the landing weight data from logbooks, was calculated and presented in Table 1.6.6.3.1. The logbook approach, as a proxy for fishing effort, was deemed the best possible solution to meet the requirements of the OSPAR request at this stage. Vessels under 10 m overall length are not captured by logbook data.

iii) Collect other non-VMS data to cover other types of fisheries (e.g. fishing vessels under 12 m overall length)

ICES (2015b) examined whether logbook data from 10–12 m vessels could be used in conjunction with VMS data for larger vessels to create more comprehensive maps of fishing abrasion pressure. In summary, fishing days recorded in logbooks per ICES rectangle by vessels of 10–12 m overall length were converted to hours (a 24-hour fishing day was adopted to demonstrate the methodology) and the swept area ratio was applied at that stage as normal. Results were integrated with the VMS-derived fishing abrasion pressure data.

Although this was the best approach that could be achieved at this stage using available data, the results are not appropriate for management use at this stage because:

- The assumption that 24 hours of fishing takes place on a fishing day is unlikely for smaller vessels;
- The results presented by ICES rectangle exceed the scale at which assessment will take place.

AIS data have significant limitations that inhibit their use in formulating advice. The main limitations are that AIS is only mandatory for fishing vessels over 15 m overall length, data availability is limited where receiver stations are present, AIS transmitter units can be turned off, and where vessels under 15 m carry an AIS unit, the proportion of the fleet represented is unknown.

Methods developed in the UK to map the distribution and intensity of inshore fishing activity were noted (Breen *et al.*, 2015), but it is not known whether similar aerial and patrol vessel fishing vessel surveillance data are available in other inshore areas in the OSPAR maritime area.

Systems to monitor the location of small, coastal fishing vessels have been developed in France and the UK. These systems may be able to contribute to improved fishing abrasion pressure maps in future, especially if they are adopted widely.

Based on a review of the latest technological advances and developments, there are currently no suitable alternatives to collect data for fishing vessels under 12 m overall length.

Prepare fishing abrasion pressure maps for the OSPAR maritime area

The maps presented in Annex I (Figures 1.6.6.3.1–1.6.6.3.4) appear to show that surface and subsurface abrasion is highest in shelf sea areas such as the North and Celtic Seas. Low levels of abrasion are observed in OSPAR Region I. In areas where data are relatively complete, surface abrasion was observed to be highest in the Skagerrak, Eastern English Channel, Northwest Irish Sea, and along the French Atlantic Coast. Subsurface abrasion was highest across the southern North Sea, the eastern English Channel, and along the Dutch and German coastline.

Methods

Collate relevant national VMS and logbook data

Data were requested from OSPAR Contracting Parties and others through a call for aggregated VMS and logbook data. Not all of those contacted responded in full to the data call (Table 1.6.6.3.3) and thus the outputs provided are limited.

Table 1.6.6.3.3 OSPAR Contracting Parties and others to whom ICES data call was submitted and their response.

Belgium	✓	The Netherlands	✓
Denmark	✓	Norway	✓
Faroe Islands	✗	Portugal	✗ – partial submission
France	✓	Russia	✗
Germany	✓	Spain	✗ – incorrect data format
Greenland	✗	Sweden	✓
Iceland	✗	United Kingdom	✓
Ireland	✓	NEAFC	✗ – unsuitable data format

✓: Suitable data submission

✗: Unsuitable data submission

✗: No data submitted

Estimating the proportions of total fisheries represented by the data

In the absence of any quantitative effort data, this request was partially addressed by assuming that the weight of fish landed was approximately proportionate to fishing effort. The weight of fish landed by vessels >15 m (or >12 m after 2012) using mobile bottom-contacting gear was compared, using logbook data, to the total weight of fish landings by all vessels with that gear. This assumes that the weight of fish landed is in proportion to effort (and therefore possibly abrasion pressure). ICES does not know how valid this assumption is. The proportion of landings by non-VMS and VMS vessels was calculated and presented by gear types per year.

Prepare fishing abrasion pressure maps for the OSPAR maritime area

The same methodology as used in the ICES response to OSPAR Request 5/2014 (ICES, 2014) was applied to develop fishing abrasion pressure maps (ICES, 2015). 'Swept area' is generally considered to be an estimate of the area of seabed in contact with the fishing gear and is a function of gear width, vessel speed, and fishing effort. The gear considered as mobile bottom contacting are listed in Annex II. The swept area ratio is calculated as the swept area divided by the cell area, and the values indicate the number of times the entire grid cell area was swept (but distribution of effort may not be evenly spread). The swept area ratio is calculated for surface and subsurface abrasion separately. Different gear types interact with the seabed in different ways and thus exert different levels of abrasive pressure, both in terms of the area of substrate affected and the penetration depth. Surface abrasion is defined as the damage to seabed surface features, subsurface abrasion as the penetration and/or disturbance of the substrate below the surface of the seabed.

Users of the data should note the following caveats:

- a) Vessels are only obliged to allocate landings for any 24 hr period to a single ICES rectangle, irrespective of the number of rectangles in which they may have been active over that period. As some countries may have restricted their data submission to only include VMS pings from those rectangles for which there are associated landings values, it is likely that effort and intensity will be underestimated in certain areas. Due to the lack of a standardized audit of pre-submission extraction routines, the extent of this issue was difficult to determine.
- b) The outputs can only reflect the data submitted. Iceland, Greenland, the Faroe Islands, and Russia did not submit data; Spain submitted data by ICES rectangle which did not answer the request; and Portugal only provided a partial submission. Data submitted by NEAFC were not used due to the lack of gear codes associated with the VMS pings and duplication with other individual submissions. Therefore, the maps are incomplete for any areas where vessels from these countries operate and also within the NEAFC regulatory area.
- c) The fishing abrasion pressure maps provided cover the period 2009–2013. It should be noted that for the period 2009–2011 VMS was mandatory in EU waters only for fishing vessels >15 m (some vessels < 15 m adopted VMS voluntarily prior to 2012). From the 1st of January 2012, VMS became mandatory in EU waters for fishing vessels >12 m, but in some countries the implementation was delayed and some vessels were still not using VMS in 2013. In Norwegian waters, fishing vessels >24 m have been required to carry VMS since 1st of January 2005; this was expanded to all Norwegian fishing vessels >15 m since 1st of January 2010. Within the NEAFC regulatory area, currently only fishing vessels >20 m between perpendiculars or 24 m overall length are required to be equipped with a VMS unit.
- d) Data for fishing vessels < 12 m are not captured by these maps. These are expected to occur mainly in coastal, nearshore waters and are therefore unlikely to significantly alter the results in the majority of the OSPAR maritime area. The methods for identifying fishing activity from the VMS data varied between countries; therefore there may be some country-specific biases. Additionally, activities other than active towing of gear may have been incorrectly identified as fishing activity. This would have the effect of increasing the apparent fishing intensity near ports and in areas used for passage.
- e) The fishing abrasion pressure methodology is based on very broad assumptions in terms of the area affected by abrasion. A single speed and gear width was applied across each gear category in most cases, which can lead to both underestimates and overestimates in actual surface and subsurface abrasion.
- f) Any results in Portuguese waters have been excluded from the maps presented and data provided, in line with the footnote to the OSPAR request: *Any analysis relating to main threats and development of abrasion maps should not be applied to the Portuguese continental shelf.*

Sources and references

Breen, P., Vanstaen, K., and Clark, R. W. E. 2015. Mapping inshore fishing activity using aerial, land, and vessel-based sighting information. *ICES Journal of Marine Science*, 72: 467–479.

ICES. 2014. OSPAR request on mapping of bottom fishing intensity using VMS data. *In* Report of the ICES Advisory Committee, 2014. ICES Advice 2014, Book 1, Section 1.6.6.5. 11 pp.

ICES. 2015a. Fishing abrasion pressure maps for mobile bottom-contacting gears. Available as ESRI Raster data at: http://ices.dk/sites/pub/Publication%20Reports/Data%20outputs/OSPAR_mapping_bottom_fishing_intensity_data_outputs_2015.zip.

ICES. 2015b. Second Interim Report of the Working Group on Spatial Fisheries Data (WGSFD), 8–12 June 2015, ICES Headquarters, Copenhagen, Denmark. ICES CM 2014/SSGSUE:05. 150 pp.

Annex I

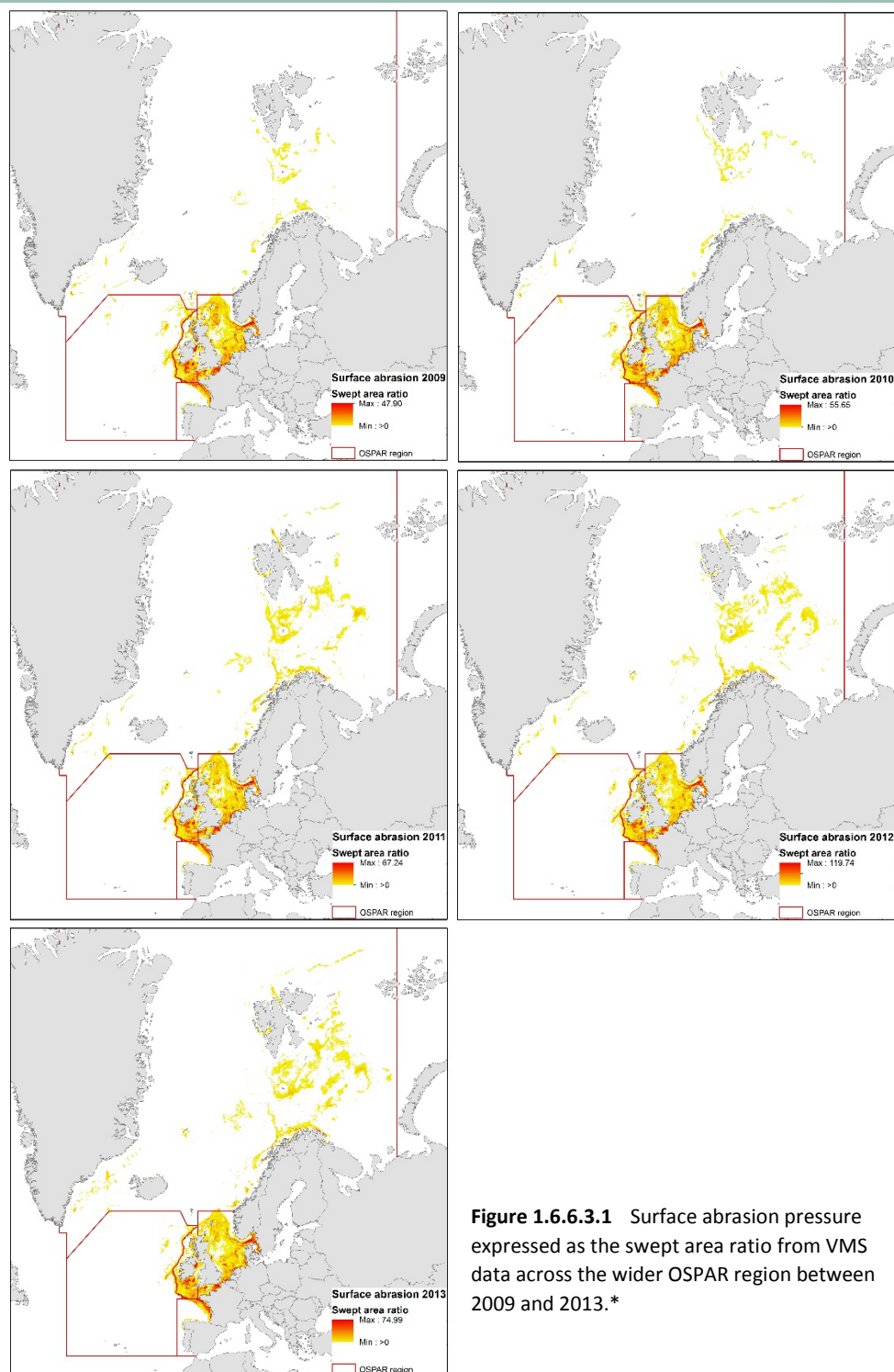


Figure 1.6.6.3.1 Surface abrasion pressure expressed as the swept area ratio from VMS data across the wider OSPAR region between 2009 and 2013.*

*Version 2: Figure updated

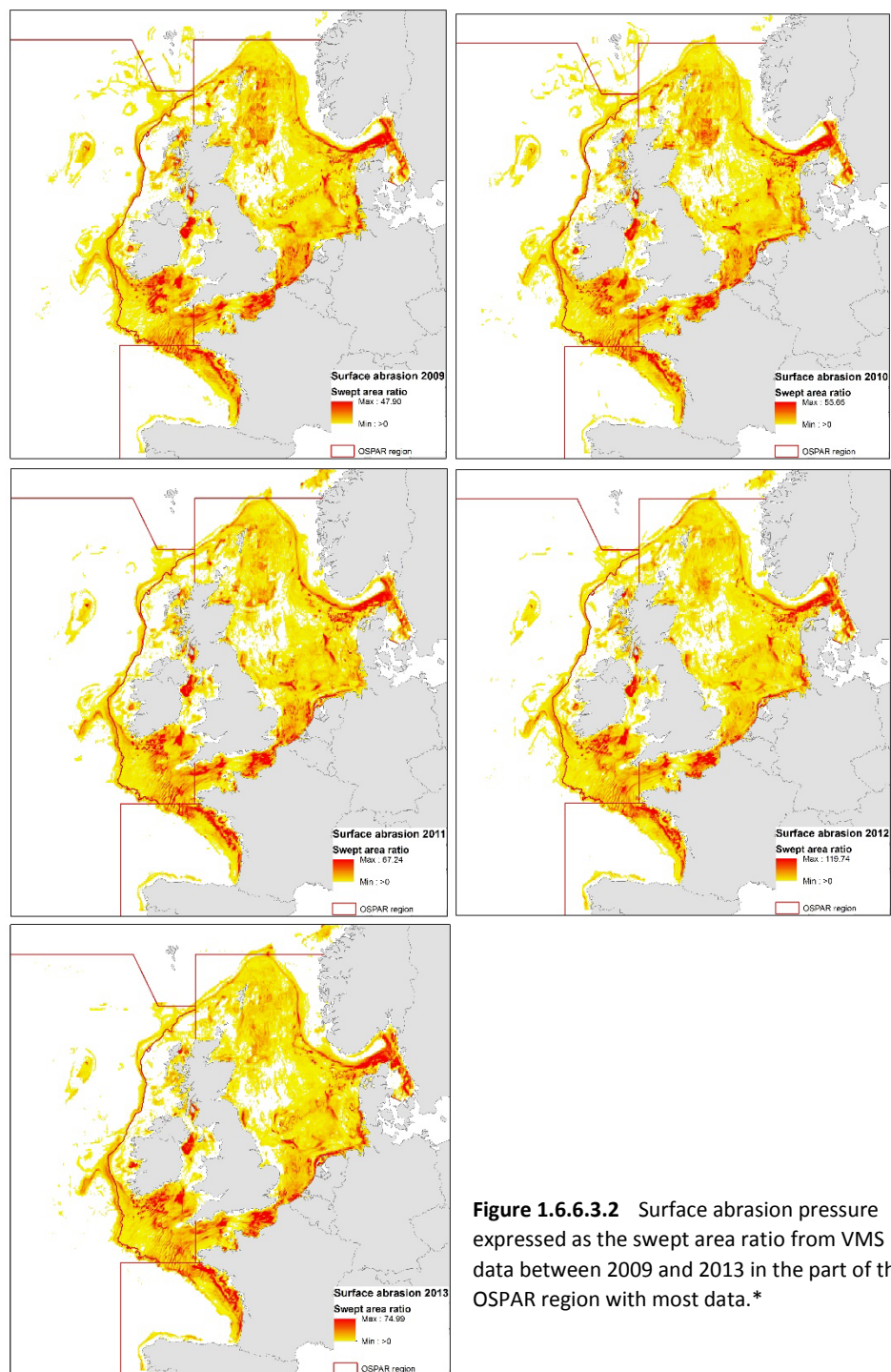


Figure 1.6.6.3.2 Surface abrasion pressure expressed as the swept area ratio from VMS data between 2009 and 2013 in the part of the OSPAR region with most data.*

*Version 2: Figure updated

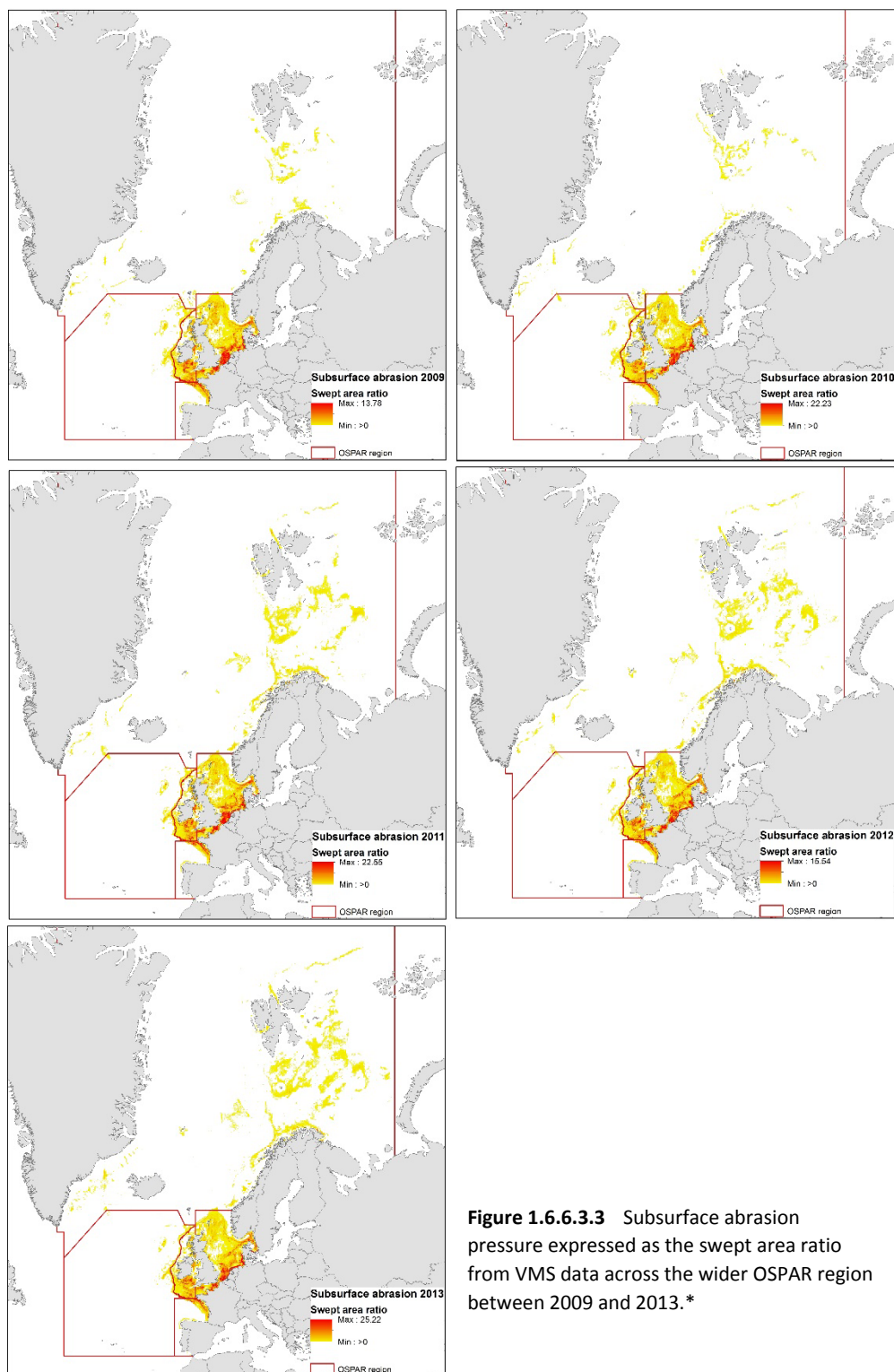


Figure 1.6.6.3.3 Subsurface abrasion pressure expressed as the swept area ratio from VMS data across the wider OSPAR region between 2009 and 2013. *

*Version 2: Figure updated

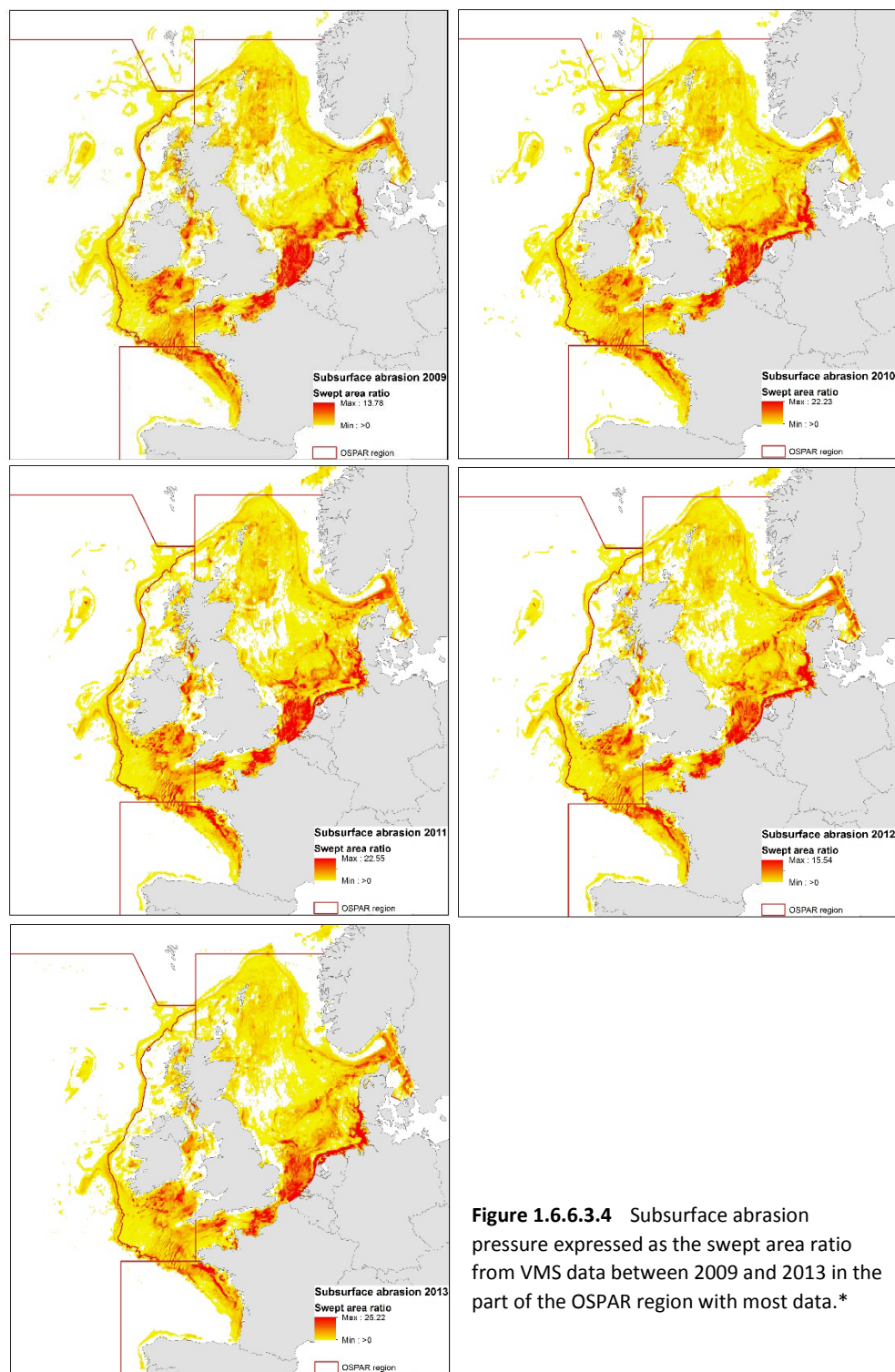


Figure 1.6.6.3.4 Subsurface abrasion pressure expressed as the swept area ratio from VMS data between 2009 and 2013 in the part of the OSPAR region with most data.*

*Version 2: Figure updated

Annex II

Gear codes included in mobile bottom-contacting gears:

Beam trawls (TBB)***Demersal seines***

- Danish seines (SDN)
- Pair seines (SPR)
- Scottish seines (SSC)

Dredges

- boat dredges (DRB)
- hand dredges (DRH)
- mechanized dredge (HMD)

Otter trawls

- otter trawls (not specified) (OT)
- otter bottom trawls (OTB)
- otter twin trawls (OTT)
- pair trawls (PTB)
- *Nephrops* trawls (TBN)
- bottom trawls (not specified) (TB)
- shrimp bottom trawls (TBS)