ECOREGION General advice
SUBJECT OSPAR request on implementation of MSFD for marine mammals

Advice summary

ICES advises on a number of aspects of the common implementation by OSPAR of the Marine Strategy Framework Directive (MSFD).

ICES advises that "assessment unit" is a more appropriate term than "management unit" for subdivisions of the range of marine mammals under consideration by OSPAR. In OSPAR regions II, III, and IV, ICES advises that harbour seals be treated within 17 units and grey seals be treated within two units. ICES also advises on assessment units for the five cetacean species being considered by OSPAR under MSFD.

ICES provides general advice on the need to understand the statistical power of monitoring programmes before targets are set under MSFD in relation to that monitoring. It is not advisable to set targets that demand a higher statistical precision than can be met within a feasible monitoring programme. This requires that the statistical power of a monitoring programme needs to be analysed prior to set targets.

ICES notes that several of the indicators proposed by OSPAR are compound indicators (e.g. indicators that cover more than one species), which do not include specific rules defining how the indicator should operate. ICES recommends breaking the compound indicators down to species level, before setting rules for their use. ICES also suggests the simplification of the indicators of cetacean abundance. ICES advice is based on these simplified indicators.

ICES advises that distributional range is a difficult concept to set MSFD targets for in relation to seals and cetaceans with the exception of inshore assessment units of bottlenose dolphins. The number of regular sites for grey seal pupping and harbour seal moulting would be suitable for target setting in relation to the distribution of these species.

ICES advises also that the current technique for monitoring grey seal abundance is to survey pup numbers and therefore there is duplication in the currently suggested grey seal targets. ICES advises on technical aspects of target setting for the abundance of the two seal species and notes that further harmonization of monitoring methods will be required, as well as an upgrade on current data storage.

The decadal frequency of current surveys of cetaceans that range over wide areas mean that it is very difficult to detect, with any statistical certainty, any change in abundance on a reasonable time scale (a six-year time scale is implied in some EU legislation). This implies that survey frequency needs to be increased – the (societal) choice of statistical power has implications for survey frequency. ICES also notes that IUCN uses a three-generational approach to the detection of changes in population abundance and recommends that OSPAR might switch to such an approach in setting targets. ICES makes suggestions for the wording of targets using this approach.

ICES has provided advice to the European Commission under EU Regulation 812/2004 on setting targets for limits on bycatch using an approach known as the Catch Limit Algorithm. Key choices need to be made at the societal/policy level for this advice to be further developed and ICES has offered to help organize a workshop to consider these choices.

ICES has provided a summary of existing monitoring schemes but cannot provide a full overview of future monitoring needs until societal and policy decisions have been taken in relation to targets and their statistical precision. ICES has not, on this occasion, been able to provide overviews of the monitoring of marine mammal bycatch.

Request

ICES is requested to:

a. Advise on appropriate management units (MUs) for grey and harbour seals in the OSPAR Maritime area;

b. Provide technical and scientific advice on options for ways of setting targets for the OSPAR common MSFD Indicators for marine mammals and where possible, provide examples of the application of these options. The advice should consider the suitability of various options for relevant marine mammal species/ MUs/ indicators. In considering target setting options, also consider the consequences that this may have for the monitoring programme (including spatial and temporal implications). Consideration should be given to precision in target setting and monitoring. (Note that ICES are not asked to take any societal/ policy choices, but if necessary should identify the need for such choices and their potential implications);

c. *Provide an overview of existing monitoring per OSPAR common MSFD indicator and marine mammal species, including the description of current monitoring frequency (and whether this is likely to be sufficient to meet the assessment requirement);*
d. *Provide an overview of possible future monitoring requirements and methodology per OSPAR common MSFD indicator and marine mammal species.*

The request is to cover OSPAR regions II, III and IV.
The existing indicator technical specifications developed by COBAM should form the basis of this work. (OSPAR 6/2014)

ICES advice

OSPAR request a) *Advise on appropriate management units (MUs) for grey and harbour seals in the OSPAR Maritime area*

Assessment units for seals and cetaceans in OSPAR regions II, III, and IV

There are some ambiguities between research scientists and managers on the actual definition and use of the term "management unit" or MU. For clarification purposes, ICES advises using the term "assessment unit" instead of "management unit" for marine mammal species included in MSFD indicator assessments. The designation "assessment unit" is also used for marine mammals by HELCOM. For completeness, ICES describes recommended assessment units for both seals and cetaceans in the following section.

Proposed harbour seal assessment units

Harbour seals tend to undertake relatively short excursions from their favoured haul-out sites, often less than 50 km (although they may range over much larger distances) and there is little evidence of extensive seasonal migrations.

Since ICES reviewed the geographical EcoQO subunits for harbour seals (*Phoca vitulina*) in the North Sea in 2009, two genetic studies have been undertaken. These studies proposed a northern Skagerrak and a southern Skagerrak assessment unit, thus splitting the Skagerrak and Oslo fjord EcoQO sub-unit into two; the assessment units defined for harbour seals in Scotland were supported. Although some broader genetic clustering was apparent, the structuring based on haul-out sites and associated local foraging areas is likely to be as important in the management of these populations as the maintenance of their genetic diversity.

Harbour seals in French waters of the North Sea and Channel should be assessed as a separate assessment units. Telemetry work undertaken in the three main colonies suggests that harbour seals are very coastal, staying within 100 km of their haul-out site.

There has been no genetic analysis of populations on the coast of Ireland. ICES proposes interim regional assessment units for Southwest, West, and North and Northeast Ireland. This division would capture the main national regional population centres, which are comparatively isolated from one another.

The proposed assessment units are shown in Figure 1.6.6.1.1. It should be noted that the proposed harbour seal assessment units in the North Sea are broadly similar to the previously defined EcoQO sub-units.

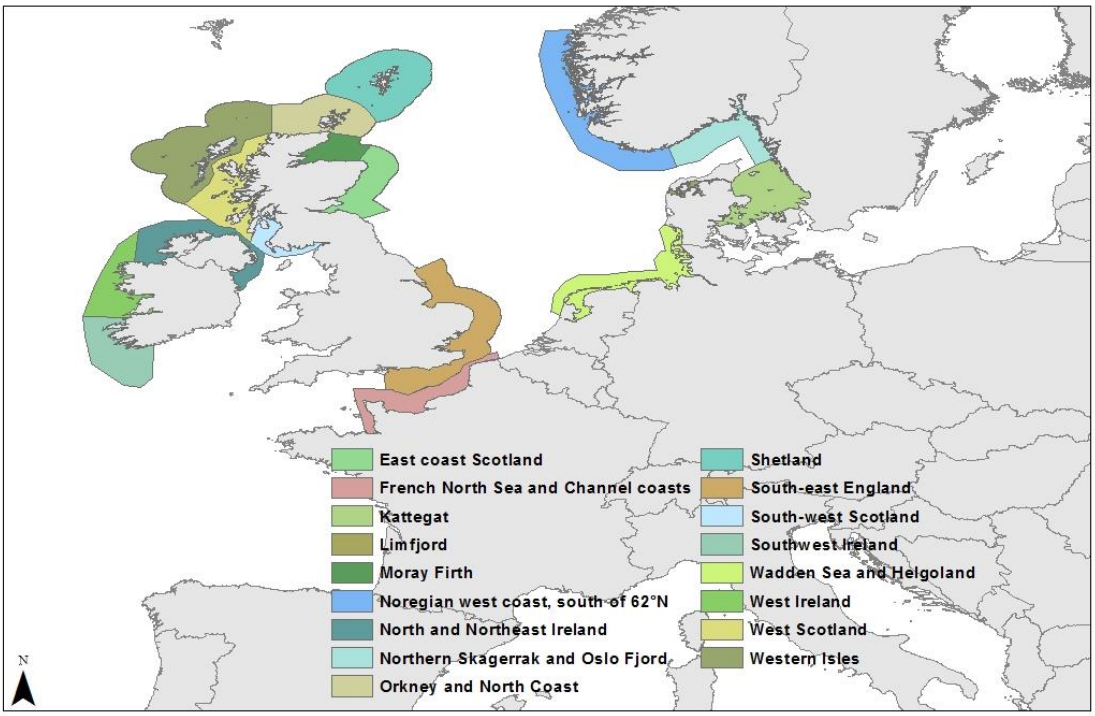

Figure 1.6.6.1.1 Proposed harbour seal assessment units for OSPAR MSFD indicator assessments.

Proposed grey seal assessment units

Two grey seal (*Halichoerus grypus*) assessment units are proposed within OSPAR regions II, III, and IV: (1) North Sea (Region II) and (2) western Britain, Ireland, and western France (Region III and part of Region IV).

Grey seals range widely at sea and may visit multiple distant haul-out sites. Studies using flipper tags have indicated that young seals disperse widely in the first few months of life. For example, pups marked in the UK were recaptured or recovered along the North Sea coasts of Norway, France, and the Netherlands, mostly during their first year of life. Individual mature seals of both sexes are usually faithful to particular breeding sites, and may return to within 10–100 m of individual breeding locations.

Proposed harbour porpoise assessment units

ICES advises the following assessment units for harbour porpoise (*Phocoena phocoena*) delineated by ICES subarea/division boundaries (except in one case; see Figure 1.6.6.1.2):

1) North Sea: ICES Subarea IV, Division VIId, and part of Division IIIa (Skagerrak);
2) Kattegat and Belt Seas: Part of ICES Division IIIa (Kattegat) and Baltic Areas 22 and 23;
3) Western Scotland and Northern Ireland: ICES Division VIa and Subdivision VIb_2;
4) Celtic Sea and Irish seas: ICES Subarea VII with the exception of Division VIId (note that there are very few harbour porpoises in the deeper parts of OSPAR regions III and IV);
5) Iberian Peninsula: ICES Divisions VIIIc and IXa.

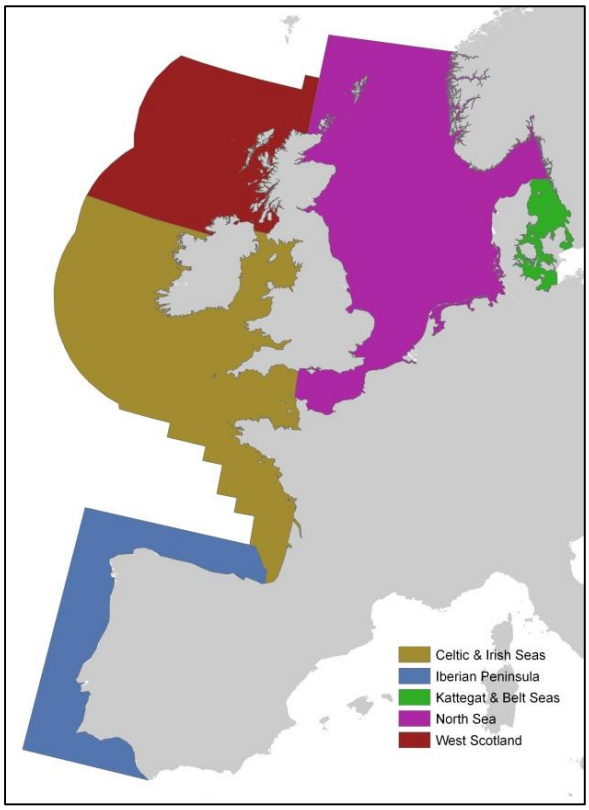

Figure 1.6.6.1.2 Proposed harbour porpoise assessment units for OSPAR MSFD indicator assessments.

Proposed bottlenose dolphin assessment units

ICES advises the following assessment units for bottlenose dolphins (*Tursiops truncatus*) (Figure 1.6.6.1.3).

a) West coast of Scotland; b) East coast of Scotland; c) Cardigan Bay; d) West coast of Ireland; e) Southwest England; f) Normandy/Brittany; g) North coast of Spain; h) Southern Galician Rias (Spain); i) Coast of Portugal; j) Gulf of Cadiz. This is not a comprehensive list of coastal groups as there are further groups of coastal bottlenose dolphins; however, their relationships with other groups are at present uncertain. Should further research reveal either changes in boundaries to the above units or additions to them, OSPAR could amend the list of assessment units at a later date. Bottlenose dolphins also occur in offshore waters, but their distribution overlaps with OSPAR Region V. Should OSPAR choose to include this region in the implementation of the part of MSFD, an assessment unit could be added to cover these dolphins.

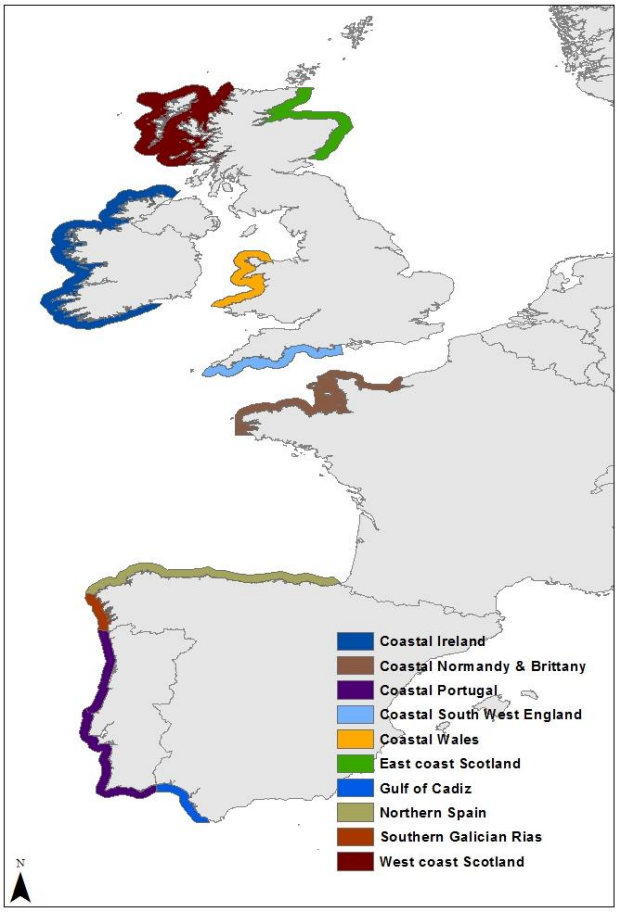

Figure 1.6.6.1.3 Proposed bottlenose dolphin assessment units for OSPAR MSFD indicator assessments.

Proposed common dolphin assessment units

ICES advises a single assessment unit for OSPAR regions II, III, and IV as only one population of short-beaked common dolphin (*Delphinus delphis*) exists in the Northeast Atlantic, ranging from waters off Scotland to Portugal.

Proposed white-beaked dolphin assessment units

ICES advises a single assessment unit for OSPAR regions II and III for white-beaked dolphin (*Lagenorhynchus albirostris*). The species does not occur in Region IV.

Proposed minke whale assessment units

ICES advises a single assessment unit for minke whale (*Balaenoptera acutorostrata*) for OSPAR regions II, III, and IV.

OSPAR request b) *Provide technical and scientific advice on options for ways of setting targets for the OSPAR common MSFD Indicators for marine mammals and where possible, provide examples of the application of these options. The advice should consider the suitability of various options for relevant marine mammal species/ MUs/ indicators. In considering target setting options, also consider the consequences that this may have for the monitoring programme (including spatial and temporal implications). Consideration should be given to precision in target setting and monitoring. (Note that ICES are not asked to take any societal/ policy choices, but if necessary should identify the need for such choices and their potential implications)*

Options for ways of setting targets

OSPAR has proposed six indicators for marine mammals (Table 1.6.6.1.1) and has produced an advice manual that includes a categorization of approaches to target setting (Table 1.6.6.1.2).

Table 1.6.6.1.1 Proposed OSPAR common MSFD indicators for marine mammals (OSPAR, 2012).

Code	Indicator	Category
M-1	Distributional range and pattern of grey and harbour seal breeding and haul-out sites, respectively.	Core
M-2	Distributional range and pattern of cetaceans species regularly present	Core
M-3	Abundance of grey and harbour seal at breeding and haul-out sites, respectively.	Core
M-4	Abundance at the relevant temporal scale of cetacean species regularly present.	Core
M-5	Grey seal pup production	Core
M-6	Numbers of individuals within species being bycaught in relation to population.	Core

Table 1.6.6.1.2 OSPAR methods for setting targets and baselines.

Methods for setting targets:	
Method 1. Directional or trend-based targets	
	i) direction and rate of change; ii) direction of change only.
Method 2. Targets set at a baseline.	
Method 3. Target set as a deviation from a baseline.	
Baselines may be described through three possible methods:	
Method A (reference state/negligible impacts)	
	Baselines can be set as a state in which the anthropogenic influences on species and habitats are considered to be negligible.
Method B (past state)	
	Baselines can be set as a state in the past, based on a time-series data set for a specific species or habitat, selecting the period in the dataset which is considered to reflect least impacted conditions.
Method C (current state)	
	The date of introduction of an environmental directive or policy can be used as the baseline state. As this may represent an already deteriorated state of biodiversity, the associated target typically includes an expression of no further deterioration from this state.

The choice of method for setting targets is to an extent dependent on the quality of information currently available and what can or cannot be understood through monitoring and studies. The soundness and feasibility of targets will be influenced by the quality of the indicator on which they are based. If the indicator is poor then it would be likely that the related target(s) is not suitable, but the reverse does not necessarily hold true.

One of the key properties of an indicator and its associated monitoring programme is the statistical power to detect change based on logistically feasible monitoring. Monitoring schemes should be designed to detect changes beyond the normal range of natural variability. Targets should be set in relation to the statistical power to determine whether or not it can be met. Therefore, prior to target setting, a power analysis should be undertaken on all proposed MSFD monitoring programmes to identify the power of existing and future monitoring activities to detect rates of change/trends.

ICES notes that many of the current OSPAR indicators are compound or combined indicators covering more than one species. For example *M-1 Distributional range and pattern of grey and harbour seal breeding and haul-out sites, respectively*, is a compound indicator that includes two species. If these two species behave differently then it is not easy to use a single metric and to set a single target on that metric. If a single target is set (e.g. in this case, seal distributional range should not decline), rules would need to be established to determine whether a target has been met if, for (this) example, the range of one species increases while the other declines. This complexity does not seem necessary, nor easy to resolve scientifically. ICES has therefore divided these compound indicators to their constituent parts in the following analysis.

M-1a Distributional range and pattern of grey seal breeding sites

The assessment units describe the distributional range of pupping (breeding) sites for this species and thus distributional range is not a particularly useful quality of grey seals for target setting. Within each assessment unit there exist a number of breeding sites; these may be viewed as the pattern within the distributional range. Targets for the number of breeding sites could be set using any of methods 1 to 3. In order to avoid the need to monitor and detect all breeding sites that hold small numbers or are ephemeral, ICES recommends considering a target that includes only colonies holding above, e.g. 2% of the seal population of the assessment unit. Method B or Method C could be used to set baselines within each

assessment unit if required. The monitoring of the location of breeding sites is built into abundance monitoring programmes.

M-1b Distributional range and pattern of harbour seal haul-out sites

The assessment units describe the distributional range of moult (haul-out) sites of this species and thus this is not a particularly useful quality of harbour seals for target setting. Within each assessment unit (Figure 1), there exist a number of haul-out sites; these may be viewed as the pattern within the distributional range. Targets for the number of haul-out sites could be set using any of methods 1 to 3. In order to avoid the need to monitor and detect all haul-out sites that hold small numbers or are ephemeral, ICES recommends considering a target that includes only sites holding above, e.g. 2% of the seal population of the assessment unit. Method B or Method C could be used to set baselines within each assessment unit if required. The monitoring of location of haul-out sites is built into abundance monitoring programmes.

M-2 Distributional range and pattern of cetacean species regularly present

With one exception, the populations of cetacean species present in OSPAR regions II, III, and IV are wide-ranging and have ranges that extend beyond these regions. Range boundaries within the OSPAR regions could only be established roughly and it is difficult to determine exact position at the low density edges of the range. ICES, thus, does not advise establishing targets for the range of cetaceans, with one exception. Equally the pattern of distribution within the range appears to be variable in these highly mobile species and at present baselines would be very difficult to establish with any confidence and therefore it is difficult to establish scientifically valid targets.

M-2a Distributional range and pattern of inshore bottlenose dolphin populations

The exception to the wide-ranging nature of most cetacean species is the bottlenose dolphin when present as 'resident' inshore populations. The proposed management units for the inshore populations of bottlenose dolphin (Figure 3) essentially encompass the relatively discrete range of each resident group. Some of these groups are monitored photographically every year and it would be easier to detect range changes of these groups. Methods 1 to 3 could be used, perhaps based on a percentage growth or shrinkage of the length of coastline occupied. Considerable and consistent monitoring effort would be required at the edges of the coastal range to detect change reliably – and it should be noted that this effort would be in addition to the monitoring required to meet the requirements for inshore bottlenose dolphins under indicator M-4 (see below). Methods B or C could be used to establish a baseline.

M-3a Abundance of grey seal at breeding sites/M-5 Grey seal pup production

The calculation of grey seal abundance for the vast majority of the European range of the species is based upon counts of pups at pupping (breeding) sites scaled up to populations. Indicator M-3a therefore has a great overlap with Indicator M-5 and ICES does not advise the setting of independent targets for both. ICES advises that OSPAR consider combining these indicators.

Targets could be set using any of methods 1 to 3. The now discontinued relevant OSPAR EcoQO was set based on rate of change only (a potential further subdivision of Method 1). At present, the abundance of grey seals in all proposed assessment units is stable or increasing; this would need to be considered if methods 2 or 3 were to be chosen. Targets should be set for each assessment unit separately.

The OSPAR methods to set baselines are difficult to apply for species with an increasing population; there is no indication of when a "least impacted" state might have occurred (methods A or B) or of the current state (Method C) being an "already deteriorated" state. It might be possible to set the baseline as the current rate of population increase, but since such increases cannot continue for ever, this baseline would become redundant at some point in time. For the North Sea assessment unit, the population in 1984 (the year that current UK monitoring activities were instigated) may be suitable as the baseline. At this time, the vast majority of grey seals in the North Sea were breeding along the UK coastline, and abundance levels in other North Sea countries were at their lowest, relative to current estimates. Grey seals disappeared from the eastern North Sea around 1500 AD, and breeding did not occur again until the end of the 1970s. There has been a consistent rise in UK grey seal pup production estimates in the North Sea since 1984.

OSPAR ICG–COBAM have proposed a target for grey seal pup production as "*No statistically significant long-term average decline of ≥10% at each management unit*". Detecting a ≥10% decline in grey seal pup production within each assessment unit may not be realistically achievable. Power analyses were conducted by ICES to investigate the rate of decline in grey seal relative abundance that could be detected by the biennial grey seal pup surveys in the UK. These surveys generate estimates of total pup production with a CV of about 0.1. The probability of making a Type-I error was set at alpha = 0.05. The probability of making a Type-II error was set at beta = 0.20; equivalent to a power of 80%. Table 1.6.6.1.3 shows the minimum detectable rate of decline per year for biennial surveys over periods of 6 and 12 years (one

and two MSFD reporting periods). A lower annual rate of decline of 3% was detectable over a longer time period (12 years) with a larger number of surveys.

Table 1.6.6.1.3 Minimum detectable rate of decline per year for biennial surveys over periods of 6 and 12 years.

Survey interval (yrs)	Monitoring period (yrs)	Number of surveys	CV of pup production	Minimum annual rate of decline detectable
2	6	4	0.1	10%
2	12	7	0.1	3%

Additionally, it is essential that targets for both indicators are time-bound, in other words "long-term" requires better definition. ICES notes that the now discontinued OSPAR EcoQO addressed this issue "*taking into account natural population dynamics and trends, there should be no decline in pup production of grey seals of ≥10% as represented in a five-year running mean or point estimates (separated by up to five years) within any of nine sub-units of the North Sea".* This EcoQO text could be used by adapting it to reflect the ICES advice on grey seal assessment units (see above).

If ICES advice on the assessment units for this species is followed, it is likely that further harmonization of monitoring methods between Member States on the coasts of each assessment unit will be required. An upgrade in the existing ICES database on seals will also be needed, should OSPAR continue to use it.

M-3b Abundance of harbour seal at haul-out sites

Targets for abundance of harbour seals at moult (haul-out) sites could be set using any of methods 1 to 3. The now discontinued relevant OSPAR EcoQO was set based on rate of change only. The abundance of harbour seals within many assessment units is declining (for unknown reasons), baselines could be set using methods B or C. Data exist since the mid-1980s for most assessment units.

OSPAR ICG–COBAM have proposed a target for harbour seal abundance as "*Maintain populations in a healthy state, with no decrease in population size with regard to the baseline (beyond natural variability) and restore populations, where deteriorated due to anthropogenic influences, to a healthy state"* using Method 1 ii. The baseline (*a healthy state*) is presumed to have been set using Method C. A problem with this target is understanding the limits of *natural variability*. It is difficult to know whether the current decline in the abundance of harbour seals within many assessment units is natural or caused by *anthropogenic influences*. Equally the target of restoring populations is challenging if the causes of the declines (deterioration) are not understood. ICES considers that this target also needs to be time bound and notes that the now discontinued OSPAR EcoQO addressed this issue: "*taking into account natural population dynamics and trends, there should be no decline in harbour seal population size (as measured by numbers hauled out) of ≥10% as represented in a five-year running mean or point estimates (separated by up to five years) within any of eleven sub-units of the North Sea*". This EcoQO text could be adapted to reflect the ICES advice on harbour seal assessment units (see above).

A power analysis has been undertaken to identify the effectiveness of an existing monitoring scheme for Wadden Sea harbour seal abundance. This showed that the current monitoring programme of two replicate counts every August had sufficient power (80%) to detect a minimal trend of 2.2% per annum in 10 years and 6% per annum in 6 years. This level of power is below that suggested by the guidelines for the now discontinued OSPAR EcoQOs. If those guidelines were to be met, monitoring would need to be increased to at least four simultaneous counts in August throughout the entire Wadden Sea. OSPAR will need to bear in mind this ability to detect change when deciding on its target.

M-4 Abundance at the relevant temporal scale of cetacean species regularly present

The meaning of "at the relevant temporal scale" in this indicator description is unclear to ICES. It is obvious that temporal scale needs to be accounted for in designing monitoring programmes, both in terms of power to detect change and in seasonality (some cetacean species are present only in some seasons, and all are easier to survey in calmer (summer) conditions). ICES therefore suggests that "at the relevant temporal scale" be removed from the wording of this common indicator. The indicator does not refer to assessment units for cetacean species. ICES considers that some cetacean species should be evaluated within assessment units rather than at the species level.

OSPAR ICG–COBAM have proposed a target for cetacean abundance "*Maintain populations in a healthy state, with no decrease in population size with regard to the baseline (beyond natural variability) and restore populations, where deteriorated due to anthropogenic influences, to a healthy state*". An index of relative abundance could be used to determine whether this target was being met or not, but absolute abundance is more useful in determining baselines and assessing the impacts of human activities.

Within the OSPAR area, among those species chosen to represent those "regularly present", there is at present no quantitative evidence of *deterioration due to anthropogenic influences*. There is evidence that some inshore bottlenose

dolphin populations have disappeared, and there have been reductions in the range/abundance of harbour porpoise in the English Channel in the more distant past. However, it is not possible to set quantitative baselines prior to relatively recent wide-area quantitative surveys. At this stage the inclusion within the target of this clause on restoration seems unnecessary. Management policies should ensure that this remains the case, but should deterioration due to anthropogenic influences occur in the future, a quantitative "recovery" target could then be set.

The nature and variability of the distribution of most cetacean species and the logistic difficulties of surveying these wide-ranging marine mammals cause the estimates of absolute abundance that have been obtained for many populations to have little precision and therefore low power to detect trends in the short to medium term. Higher power can be obtained for smaller coastal/resident populations that are surveyed more frequently.

Power analyses were conducted for a number of cetacean species based upon the results of two wide area surveys (Table 1.6.6.1.4). These analyses indicate that surveys every decade (as currently conducted) would have very low power to detect trends and certainly could not detect, e.g. a 1% annual decline over a six-year period as might be required by the EU Habitats Directive. ICES considers that a more appropriate time interval to measure change would be a generational scale such as that used by IUCN. If wide-area surveys for cetacean species are increased in frequency to once every three years, it would be possible to detect changes of about 30% over three generations for most species. Targets using OSPAR methods 2 and 3 are therefore suggested for each relevant species below. If practical or financial considerations mean that wide-area surveys cannot be conducted at three-year intervals, then an adjustment in the power to detect change is needed, with the consequential change in magnitude of decrease that could be reliably detected. Power analysis is still required on data used to assess the abundance of inshore/resident groups of bottlenose dolphins, but it is likely that a much more sensitive indicator could be set.

Table 1.6.6.1.4 Precision (CV) of estimates of abundance and power (%) to detect a 30% decline in three generations (based on Taylor *et al.*, 2007 for all species and an additional calculation for a European harbour porpoise generation time of 7.5 years), obtained from existing large-scale, decadal distance-sampling surveys using ships and aircraft. Power is shown for the two significance levels of 0.05 and 0.2. For harbour porpoise, two sets of power analyses have been undertaken using each of the generation times suggested for the species. These differences arise because Taylor *et al.* (2007) considered the maximum age of reproducing females to be between 24 and 27 years. In European waters, whilst a maximum life expectancy of 24 years has been recorded, a maximum age of 12 years is considered more normal, with the average age of a reproductive female considered to be 7.5 years (Pierce, unpub. data).

Monitoring activity	Species (generation time in years)	CV of measured estimate of abundance	Power (%) to detect trends in abundance with a survey every ten years		Power (%) to detect trends in abundance with a survey every five years		Power (%) to detect trends in abundance with a survey every three years	
			$\alpha = 0.05$	$\alpha = 0.2$	$\alpha = 0.05$	$\alpha = 0.2$	$\alpha = 0.05$	$\alpha = 0.2$
SCANS (ships and aircraft)	Harbour porpoise (11.9)	0.14	20	57	50	81	69	91
	Harbour porpoise (7.5 European)	0.14	11	42	28	66	50	81
	White-beaked dolphin (18.1)	0.3	12	36	20	46	30	58
	Minke whale (22.1)	0.24	18	47	35	64	51	77
SCANS-II (ships and aircraft)	Harbour porpoise (11.9)	0.20	13	42	28	59	57	72
	Harbour porpoise (7.5 European)	0.20	8	32	17	47	28	59
	Short-beaked common dolphin (14.8)	0.23	14	41	30	54	38	68
	White-beaked dolphin (18.1)	0.30	12	36	20	46	30	58
	Minke whale (22.1)	0.35	11	34	18	43	28	55

M-4a Abundance [at the relevant temporal scale] of harbour porpoise

Harbour porpoises are widely distributed in the shelf seas of OSPAR regions II, III, and IV, with little interaction known with adjacent regions – though further investigation is needed of northwards interactions to Region 1 along the coast of Norway. In addition, the OSPAR boundary in the Kattegat runs across the population distribution in that area. Sweden and Denmark will need to work together, with HELCOM involved, to set agreed targets and consequent monitoring and assessment schemes in this assessment unit. A suitable target (using OSPAR methods 2 and 3) might therefore be: *For each assessment unit, maintain harbour porpoise population size at or above baseline levels, with no decrease of ≥30% over a three generation period (36 or 22.5 years*[1]).

The baseline would need to be set using Method C as no quantitative information exists on the past state or on a state with negligible impacts. The suggested baseline levels are provided in Table 1.6.6.1.5.

[1]For harbour porpoise, there are two different generation time estimates. Taylor *et al* (2007) considered the maximum age of reproducing females to be between 24 and 27 years. In European waters, whilst a maximum life expectancy of 24 years has been recorded, a maximum age of 12 years is considered more normal, with the average age of a reproductive females considered to be 7.5 years (Pierce unpub. data).

M-4b Abundance [at the relevant temporal scale] of inshore bottlenose dolphin

Resident populations of bottlenose dolphins occur in inshore parts of OSPAR regions II, III, and IV. There are interactions between some of the suggested assessment units, and also between these assessment units and populations further offshore. Though it is not believed that these interactions are large scale, further research would be wise to ensure this understanding is correct. A suitable target (using OSPAR methods 2 and 3) might therefore be: *For each assessment unit, maintain inshore bottlenose dolphin population sizes at or above baseline levels, with no decrease of ≥30% over any ten-year period.*

The baseline would need to be set using Method C as no quantitative information exists on the past state or on a state with negligible impacts. The suggested baseline levels are provided in Table 1.6.6.1.5.

M-4c Abundance [at the relevant temporal scale] of offshore bottlenose dolphin

The bottlenose dolphins in offshore parts of OSPAR regions III and IV are likely to be part of a population with a much wider distribution that extends into Region V. ICES advises not setting a target for a subset of this wider distribution. Should OSPAR wish to set a target for this wider distribution by including (parts of) Region V, a suitable target (using a combination of OSPAR methods 2 and 3) might be: *Maintain the offshore NE Atlantic bottlenose dolphin population size at or above the baseline level, with no decrease of ≥30% over a three-generation period (63 years).*

This target would require monitoring over a relatively large area (including deeper Atlantic waters) at more regular intervals (three to five years) than the decadal survey intervals used previously. If surveys cannot occur at this spatial scale, OSPAR may then wish to consider not setting a target.

The baseline level for bottlenose dolphins in the Northeast Atlantic has yet to be calculated.

M-4d Abundance [at the relevant temporal scale] of white-beaked dolphin

The white-beaked dolphin population in OSPAR regions II and III is relatively discrete, and a suitable target for this population (using a combination of OSPAR methods 2 and 3) might be: *Maintain the white-beaked dolphin population size at or above the baseline levels, with no decrease of ≥30% over a three-generation period (54 years).*

The baseline would need to be set using Method C as no information exists on the past state or on a state with negligible impacts. The 95% confidence intervals for this baseline are 9107 and 27 743 around a best estimate of approximately 16 000 animals (Table 1.6.6.1.5).

M-4e Abundance [at the relevant temporal scale] of minke whale

The minke whale population in OSPAR regions II and III appears to be relatively discrete (although some further investigation would be advisable), and a suitable target for this population (using a combination of OSPAR methods 2

and 3) might be: *Maintain the minke whale population size at or above the baseline levels, with no decrease of ≥30% over a three-generation period (66 years)*. Minke whales have been hunted in OSPAR Region III in the past and are still hunted in adjacent waters to the EU, but it is not known whether the current population size is depleted or not.

The baseline would need to be set using Method C as no information exists on the past state or on a state with negligible impacts. The 95% confidence intervals for this baseline are 13 772–38 958 around a best estimate of approximately 23 200 animals (Table 1.6.6.1.5).

M-4f Abundance [at the relevant temporal scale] of common dolphin

The common dolphins in OSPAR regions II, III, and IV are part of a wider Northeast Atlantic assessment unit. ICES advises not setting a target for a subset of this unit. Should OSPAR wish to set a target for this unit by including (parts of) Region V, a suitable target (using a combination of OSPAR methods 2 and 3) might be: *Maintain the Northeast Atlantic common dolphin population size at or above the baseline level, with no decrease of ≥30% over a three-generation period (44 years).*

This target would require monitoring over a relatively large area (including deeper Atlantic waters) at more regular intervals (three to five years) than the decadal survey intervals used previously. If surveys cannot occur at this spatial scale, OSPAR may then wish to consider not setting a target. The baseline level for common dolphins in the Northeast Atlantic has yet to be calculated.

Table 1.6.6.1.5 Baselines proposed for cetacean species regularly present.

Species	Assessment units	Year	Abundance estimate	CV	SE	95% CI
Harbour porpoise	Kattegat and Belt seas	1994	27 923	0.46		11 831–65 901
	North Sea	1994	273 918	0.15		204 478–366 939
	West Scotland and Northern Ireland	2005	21 4621	0.42		9 740–47 289
	Celtic Sea and Western Ireland	2005	106 382	0.32		57 689–196 176
	Iberian Peninsula	2005	4 398	0.92		948–20 410
Bottlenose dolphin	East coast of Scotland	1990–1993	129		± 15	110–174
	West coast of Scotland	2006–2007	45			33–66
	Cardigan Bay	2001–2007	397	0.23		362–414
	West Coast Ireland	2014	ca. 190			
	SW England	2009–2013	ca. 140			
	Brittany and Normandy[1]	2000	ca. 160			
	Northern Spain[2]	2003–2011	10 687	0.26		4 094–18 132
	Southern Galician Rias (NW Spain)	2000–2010	> 255			
	Coastal Portugal	2010	3 051	0.78		294–31 666
	Gulf of Cadiz	2009–2010	397	0.17		300–562
	Offshore[3]	2005/2007	11 923	0.21		7 935–17 915
White-beaked dolphin	Britain and Ireland	2005	15 895	0.29		9 107–27 743
Minke whale	European North Atlantic	2005/2007	23 163	0.27		13 772–38 958
Common dolphin	European North Atlantic	2005/2007	174 485	0.26		105 694–288 048
Striped dolphin	European North Atlantic	2007	61 364	0.93		12 323–305 568

[1] This estimate is a combination of that for individuals in the archipelago of Molene (Brittany) and those in the Normandy region (western part of the Cotentin peninsula).
[2] Estimate for the Northern Spain AU includes animals from the Bay of Biscay.
[3] Estimate currently excludes animals from the Bay of Biscay.

M-6 Numbers of individuals within species being bycaught in relation to population

ICES advised the European Commission in 2009 that "a Catch Limit Algorithm approach is the most appropriate method to set limits on the bycatch of harbour porpoises or common dolphins. In order to use this (or any other) approach, specific conservation objectives must first be specified. In both cases improved information on bycatch and the biology of the species would improve the procedure." The conservation objectives must also set the level of detection accuracy. The conservation objectives are a policy/societal choice and are needed before ICES can advance this approach further. ICES based this advice on a broad review of other options (i.e. percentage of abundance, Potential Biological Removal, IWC's Revised Management Procedure for whaling).

ICES is continuing to advise fisheries authorities on bycatch monitoring and will be able to help develop targets in this area in future as soon as political decisions are provided on objectives.

OSPAR request c) *Provide an overview of existing monitoring per OSPAR common MSFD indicator and marine mammal species, including the description of current monitoring frequency (and whether this is likely to be sufficient to meet the assessment requirement)*

ICES provides a summary tabulation of current national monitoring programmes for seals and cetaceans below.

Table 1.6.6.1.6 Current and known plans for monitoring harbour seals during the moult.

Country	MSFD assessment unit	Monitoring method	Comments
United Kingdom	Shetland	Single aerial survey, approximately every five years.	
	Orkney and North Coast	Single aerial survey, approximately every five years.	
	Moray Firth	Repeat annual aerial survey	
	East coast Scotland	Single aerial survey, approximately every five years. Single annual aerial survey in Firth of Tay.	
	Southeast England	Repeat annual aerial survey.	
	Southwest Scotland	Single aerial survey, approximately every five years.	
	West Scotland	Single aerial survey, approximately every five years.	
	Western Isles	Single aerial survey, approximately every five years.	
Netherlands/ Germany/ Denmark	Wadden Sea, Dutch Delta and Helgoland	Wadden Sea and Dutch Delta: Repeat annual aerial survey.	Monitoring also undertaken during pupping.
Germany		Helgoland: Daily land counts.	
Denmark	Limfjord	Repeat annual aerial survey.	
Norway/Sweden	Northern Skagerrak and Oslo Fjord	Annual aerial survey.	
Denmark/Sweden	Kattegat	Repeat annual aerial survey. Breeding only monitored in Denmark.	Monitoring also undertaken during pupping.
Denmark/Germany	Belt seas	Repeat annual aerial survey. Breeding only monitored in Denmark.	Monitoring also undertaken during pupping.
Norway	West coast, south of 62°N	Aerial survey, every five years.	
France	French North Sea and Channel coasts	Baie du Mont Saint Michel – aerial surveys, 18 per year + 15 census (boat and land).	Monitoring also undertaken during pupping.
		Baie de Somme and adjacent haul-outs – land census every ten days (January–June). Daily from June to September.	
		Baie des Veys – monthly land and aerial surveys.	
Ireland/United Kingdom	North and Northeast Ireland	Single aerial survey, approximately every five years in Northern Ireland.	No formal monitoring programme in place yet for Irish section but is currently under consideration.
Ireland	South and southeast Ireland		No formal monitoring programme in place yet but is currently under consideration.
	West Ireland		

Table 1.6.6.1.7 Current and known plans for monitoring grey seals during pupping.

Country	MSFD assessment unit: Main breeding area monitored	Monitoring method	Comments
United Kingdom	North Sea: Shetland, Scotland	Annual ground count since 2004.	Difficult area to monitor.
	North Sea: Orkney, Scotland	Annual aerial survey until 2010, biennial thereafter.	
	North Sea: Fast Castle, Isle of May and adjacent colonies, Scotland	Annual aerial survey until 2010, biennial thereafter.	
	North Sea: Moray Firth, east Scotland	Annual aerial survey until 2010, biennial thereafter.	
	North Sea: Farne Islands, East England	Annual ground count.	
	North Sea: Donna Nook and Norfolk colonies, Southeast England	Annual ground count.	
Netherlands	North Sea: Wadden Sea	Aerial survey.	Moult counts are also undertaken as pup counts are considered unreliable and not appropriate to population estimates.
Netherlands	North Sea: Delta	Monthly aerial survey.	
Germany	North Sea: Schleswig–Holstein, Wadden Sea	Aerial survey conducted five times per year from November to April/May; annual boat and land survey also.	Moult counts are also undertaken as pup counts are considered unreliable and not appropriate to population estimates.
	North Sea: Helgoland	Annual ground count.	
Denmark	North Sea: Limfjord	Repeated annual aerial survey.	Summer counts undertaken during monitoring of harbour seal moult.
	North Sea: Kattegat	Annual aerial survey.	North Sea grey seals also occur in this area; as their moult coincides with the breeding of Baltic grey seals, this season is also covered, although seals from the two assessment units cannot be distinguished.
Norway	North Sea: Rogaland	Ground count, every five years at least.	
France	North Sea: Archipelago of Sept Îles and adjacent haul-outs	Regular (monthly) census and photo identification.	Pup counts are not appropriate to population estimates (low numbers).
	North Sea: Archipelago of Molene and adjacent haul-outs		
	North Sea: Baie de Somme and adjacent haul-outs		
United Kingdom	Celtic Sea: West Scotland	Annual aerial survey until 2010, biennial thereafter.	
	Celtic Sea: Western Isles, Scotland		
	Celtic Sea: Welsh coasts and Southwest England	Ground counts in caves or from cliff tops.	Pup counts in caves is difficult to undertake.
Ireland	Celtic Sea: Sturrall (near Glen Head) to Maghera in southwest Co. Donegal	Aerial surveys on rotational basis, each surveyed once in the last four years.	No formal monitoring programme in place yet but is currently under consideration.
	Celtic Sea: the Inishkea Island group off northwest Co. Mayo		
	Celtic Sea: Inishshark, Inishgort and associated islands off northwest Co. Galway		

Country	MSFD assessment unit: Main breeding area monitored	Monitoring method	Comments
	Celtic Sea: Islands around Slyne Head, Co. Galway		
	Celtic Sea: the Blasket Islands, Co. Kerry		
	Celtic Sea: the Saltee Islands, Co. Wexford		
	Celtic Sea: Lambay Island and Ireland's Eye, Co. Dublin		

Current and known plans for monitoring of cetaceans

Individual, uncoordinated national (or small area) monitoring (or individual surveys) of parts of the assessment unit are being undertaken, for other purposes than MSFD implementation. These are not suitable for assessing change at the scale of the assessment unit. Such monitoring and surveying is not a suitable replacement for properly designed large-scale population surveys.

Table 1.6.6.1.8 Current and known plans for monitoring cetaceans.

Country	MSFD assessment unit	Monitoring method	Comments
Harbour porpoise	North Sea	Large-scale aerial and ship-based surveys (SCANS and SCANS II) every decade.	SCANS III planned for 2016.
	West Scotland and Northern Ireland	SCANS II (2005) was the only large-scale survey conducted in area.	SCANS III planned for 2016.
	Irish Sea	SCANS II (2005) was the only large-scale survey conducted in area.	SCANS III planned for 2016.
	Celtic Sea and Western Ireland	Large-scale aerial and ship-based surveys (SCANS and SCANS II) every decade.	SCANS III planned for 2016.
	Iberian Peninsula	SCANS II (2005) was the only large-scale survey conducted in area.	SCANS III planned for 2016.
	Kattegat and Belt seas	Large-scale aerial and ship-based surveys (SCANS and SCANS II) every decade.	SCANS III planned for 2016.
Common dolphin	European North Atlantic	Decadal SCANS II and CODA large-scale population survey.	SCANS III planned for 2016.
Minke whale	European North Atlantic	Decadal SCANS II and CODA large-scale population survey.	SCANS III planned for 2016.
Striped dolphin	European North Atlantic	Decadal SCANS II and CODA large-scale population survey.	SCANS III planned for 2016.
White-beaked dolphin	Britain and Ireland	Large-scale aerial and ship-based surveys (SCANS and SCANS II) every decade.	SCANS III planned for 2016.
Bottlenose dolphin	East coast Scotland	Annual photo-identification and line transect studies.	
	West coast Scotland	*Ad hoc* photo-ID surveys to date. Annual localized line transect surveys inside the Hebrides.	
	Cardigan Bay	Annual photo-identification and line transect studies focused on localized areas.	
	West coast Ireland	Photo-ID surveys and some line transect surveys in recent years.	
	Southwest England	Photo-ID surveys and some line transect surveys in recent years.	
	Brittany and Normandy	Photo-ID surveys and some line transect surveys in recent years.	
	Northern Spain	Decadal SCANS II large-scale population survey.	SCANS III planned for 2016.

Country	MSFD assessment unit	Monitoring method	Comments
	Southern Galician Rias (Northwest Spain)	Photo-ID surveys and dedicated surveys without standardized survey design.	
	Coastal Portugal	Decadal SCANS II large-scale population survey. Annual aerial surveys in recent years (to 50 nm).	SCANS III planned for 2016.
	Gulf of Cadiz	Decadal SCANS II large-scale population survey. Photo ID surveys.	SCANS III planned for 2016.
	Oceanic waters	Decadal SCANS II and CODA large-scale population survey.	SCANS III planned for 2016.

OSPAR request d) *Provide an overview of possible future monitoring requirements and methodology per OSPAR common MSFD indicator and marine mammal species*

The full nature of monitoring schemes cannot be defined until societal/policy decisions are taken as (in particular) the precision required has a great effect on the number of surveys. An indication of the surveys required (and the coordination needed) is provided below. In general:

- Power analysis should be used to assess the effectiveness of the existing survey schemes. Schemes may need to be adjusted to meet the needs for statistical power.
- Replicate surveys increase the statistical power when analysing temporal trends.
- Annual surveys can more accurately detect smaller changes than less frequent surveys.
- The area surveyed should be consistent between years.
- The timing of surveys should be consistent.
- Environmental and other covariates (e.g. state of tide, time of day, weather and disturbance) may need to be considered when designing surveys and should be recorded as they may be needed when evaluating results.
- Any revisions of survey methods and design should take care to ensure, as far as possible, comparability with earlier surveys.
- Coordination and compatibility between entities undertaking monitoring within assessment units is essential.

Harbour seal

M1 + M3 – Abundance estimates should be based on estimates at haul-out sites during the moult period. The number of moult sites can be assessed at the same time as the abundance surveys. During this period the greatest and most consistent numbers of seals are found ashore. The peak counts of three surveys should be used (when available), as onshore seal numbers represent a minimum number (index) of harbour seals in a population. If a correction factor is applied this needs to be consistent within an assessment unit. Replicate surveys should be performed periodically over an extended period to assess changes in phenology (changes in the peak of the moulting season) that may change the correction factor. Aerial surveys are recommended rather than land-based counts for larger sites. Survey design should be reviewed and where necessary updated at regular intervals, particularly to account for changes in species range, epizootics, or other significant events.

Grey seal

M1 + **M3 (+ M5)** – Abundance estimates should be based on pup counts during the time that pups are ashore. Due to variance in timing of pupping of grey seals by site, surveying should match the timing of peak numbers of pups. Aerial surveys are recommended rather than land-based counts for most sites, with the exception of those not visible from above (e.g. caves). Survey designs should be reviewed and where necessary updated at regular intervals, particularly to account for changes in species range, epizootics, or other significant events.

Wide-ranging cetacean species (harbour porpoise, bottlenose dolphin, white-beaked dolphin, common dolphin, minke whale)

M4 – Monitoring of these cetaceans need line transect surveys at the scale of the assessment units. Uncoordinated local (national) surveys are in general of little use in monitoring and assessment at MSFD level. ICES advises that OSPAR Contracting Parties should consider re-dedicating the resources being used for current (annual) surveys to contributing towards coordination of international wide-area surveys at a greater frequency than the current decadal approach (SCANS). Monitoring efforts will need to be increased so as to provide six-year estimates for MSFD reporting. This will also have the benefit of improving power and accuracy. Even greater improvement in power and accuracy can be obtained by increasing survey frequency further. The choice of accuracy is a policy and societal choice.

Inshore bottlenose dolphin

M2 + M4 – Inshore bottlenose dolphin will require more detailed photo identification surveys, sometimes coupled with line transect surveys. The choice of survey method will often depend on local factors within each assessment unit. Surveys should be designed to measure range at the same time (close attention needs to be paid to the edges of the range). Monitoring efforts ensure accurate and timely estimates so as to provide six-year estimates for MSFD reporting. In some assessment units several organizations are involved in bottlenose dolphin monitoring. Monitoring should be rationalized and coordinated in these assessment units to optimize the use of resources and provide reliable results for MSFD.

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