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NEOM Regional Baseline & Monitoring Program

**Marine Monitoring Standards**

Amec Foster Wheeler Energy and Partners Engineering Company – February 2021

Report for

NEOM

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# Introduction

## Preamble

Amec Foster Wheeler Energy and Partners Engineering Company (hereafter referred to as “Wood”) is pleased to provide this technical methodology to NEOM. This technical methodology outlines the proposed approach to the conduct marine monitoring programs, including detailed information of the equipment to be used, references to international standards and best practices and a description of the deliverables.

Large-scale construction activities are planned for the various NEOM development areas. It is therefore important to establish an accurate environmental baseline prior to these works, part of which will be a series of Marine Environmental Baseline Surveys (MEBS). These surveys will help to identify key environmental sensitivities, and, in conjunction with future monitoring, provide early warning of any adverse environmental impact.

This document sets out relevant technical standards and a brief overview of procedures for sampling of seawater, marine sediments and biota as well as spatially continuous surveying of habitats and fauna. This will ensure that the MEBS and future monitoring are undertaken in a consistent manner and to a level that meets or exceeds international best practice.

## Projects Background

Located in the northwest of Saudi Arabia on the Red Sea and Gulf of Aqaba coasts, NEOM spreads over an area of 26,500 km2 covering a wide variety of activities and receptors. Limited information is currently available to characterize the marine environment in the region although it is known that these northern Red Sea waters are species rich and represent valuable and sensitive habitats. It is therefore necessary to collect primary data to support permit application for future developments and allow monitoring of effects over time.

As part of the NEOM Regional Baseline & Monitoring Program a series of marine surveys and monitoring campaigns are being undertaken. This Standard is to ensure that any future surveys for different NEOM developments are undertaken in a consistent manner and to a level that meets or exceeds international best practice.

This document has been developed to describe in detail the methods these surveys will adopt, including:

* **Reference Standards** to ensure the proposed approach is robust and based on internationally accepted guidance;
* **Monitoring Equipment** specification including details of use and maintenance;.
* **Survey and Monitoring Methods** to provide a detailed description of the plan to deliver surveys; and
* **Baseline Reporting** structure describing how data collected will be processed and presented to form the baseline for future EIAs.

# Reference Standards

## Best Practice and Guidelines

Best practice in conducting MEBS is derived from a variety of national and international standards and guidance, as well as published scientific literature. This covers aspects of sample/data collection, sample storage/handling, sample analysis, and the presentation and analysis of the data. Many of these standards inform one another, thus best practice draws from numerous recognised sources including national agencies e.g. the UK Join Nature Conservation Committee (JNCC), US Environment Protection Agency (EPA), Australian Institute for Marine Science (AIMS), multilateral bodes such as International Finance Corporation (IFC) or international organisations such as the European Commission and OSPAR (Oslo and Paris Commission) and ICES (International Council for the Exploration of the Sea)[[1]](#footnote-2) and PERSGA[[2]](#footnote-3). The latter is compiled from a variety international best practice and for the majority of the tasks required for the MEBS will therefore be the default approach.

Where additional activities not covered in the PERSGA guidance are required, other standard approaches will be used. Additional detail is given in relation the specific activities below.

## Consents and approvals

NEOM will ultimately operate under its own regulatory regime and protocols, as yet to be fully developed. In the interim, consents and approvals will be obtained as required in line with KSA’s laws and its commitments to multilateral agreements, notably the 1992 Regional Convention for the Conservation of the Red Sea and Gulf of Aden (the Jeddah Convention).

In addition, consistent with the equator principles, the MEBS will comply with international guidelines and best practice in relation to data and reporting, in particular IFC Guidelines.

# Monitoring Equipment

The operation, calibration and servicing of monitoring equipment will be undertaken in accordance with manufacturers’ guidance, or best practice, where no guidance is given. Calibration and maintenance records, including details and actions taken to resolve equipment failures shall be recorded and retained for inspection. These records shall also contain any supporting information in the event of data gaps caused through fault resolution.

Instruments and sampling equipment will be physically inspected prior to deployment, and data reviewed on a daily basis, to identify potential faults. Real time digital data collected in the field (e.g. from sondes) shall be backed up once downloaded from the instrument.

Precise equipment specifications are not included in most standards, but published guidance includes suggestions for suitable equipment. A standard representative set of survey equipment for MEBS is set out below.

Table . Standard Equipment for Conducting MEBS

| Activity | Equipment | Comment |
| --- | --- | --- |
| Water sampling | Niskin bottle | 1.7 l and 5l are the most commonly used |
| Water profiling | Multi parameter sonde | YSI EXO2 multi-parameter sonde commonly used |
| Phytoplankton | Bongo net  Flowmeters  Lugol’s solution (preservative) |  |
| Zooplankton | Bongo net  Fixative (4% formaldehyde or Lugol’s solution)  Preservative (Lugol’s solution) | The small size of the organisms allows for effective fixation with formaldehyde alternatives, |
| Sediment sampling:  Physico-chemical parameters | 0.045m2 Van Veen grab  0.1 m2 Van Veen or Day grab  Box Corer sampler | Choice of grab will vary depending on ground conditions, required sample size and vessel. |
| Sediment sampling:  Infauna | 0.045 - 0.1 m2 Van Veen or Day grab  Box Corer  0.5 mm mesh sieve/sieving table  Auto sieve  Fixative (4% formaldehyde or alternative)  Ethanol (preservative) | Depending on substrate type  Formaldehyde alternatives may be used, but it is the most reliable fixative and recommended by most standard methodologies. |
| Underwater Video | Diver-operated hand-held or head-mounted cameras (SCUBA) YSI EXO2 multi-parameter sonde  USV/AUV  ROV  Drop-down static video  BRUV/RUV | STR ‘SeaSpyder; Underwater video system  STR ‘SeaSpyder Nano’ Underwater video system  GoPro Hero4 HD action cameras + LED lamps |
| Fish and Epibenthos | Beam trawl (2m)  Diver-operated hand-held or head-mounted cameras (SCUBA)  ROV  BRUV/RUV | Beam trawl (2m designed to CEFAS specifications with a 5mm cod end mesh) |
| Habitat /Biotope Mapping (inc. Corals and Seagrass) | Transect Lines and Quadrats  Diver-operated hand-held or head-mounted cameras (SCUBA)  BRUV/RUV  Sidescan sonar  Multibeam echosounder  RoxAnn | Requires ground-truthing with video. Can be supplemented with remote sensing data |
| Marine Megafauna and Birds | High powered binoculars (marine spec)  High powered telescopes (coastal watching spec)  Range finders  Compass  Clinometer  Acoustic sensors | Coastal and offshore surveys |
| Aerial Surveys | Fixed wing aircraft where possible  High resolution digital cameras (fixed)  Marine spec binoculars Clinometer  High quality portable digital audio recorder | Flying at high altitudes to avoid disturbances.  Mid powered binoculars or wider field of view, high powered binoculars to assist accurate identification.  Audio recorder to include high quality microphone. A headset may be appropriate in some situations, especially with high ambient background noise e.g. a helicopter cabin. |

# Survey and Monitoring Methods

## Water sampling

Water samples will be acquired from pre-determined depths (surface, mid-column, or bottom) using either a 1.7L or 5L Niskin water sampler. After collection, the samples will then be placed inside a cool-box or refrigerator in efforts to prevent degradation and exposure to sunlight penetration prior to laboratory consignment.

## Water Profiling

Water profiles may be acquired in conjunction with the water sample operations using a multi-parameter probe/sonde. Any sonde(s) in use will have been manufacturer calibrated within 12 months of the survey and sensors prone to drift will be checked (and if necessary recalibrated) at least twice weekly.

The physical seawater parameters to be measured include:

* Depth;
* Temperature (ºC);
* Salinity;
* Dissolved Oxygen (DO);
* pH;
* Electrical conductivity (SPC); and
* Turbidity (NTU).

## Plankton Trawls

Standard phytoplankton samples are taken by vertical trawl through the water column, drawn from mid-column to the water surface. A 50 µm bongo net is typically deployed twice to account for patchiness in the distribution of organisms. The starting depth of the tow is recorded to allow calculation of the water volume sampled. The samples are transferred into opaque containers and fixed with 2% Lugol’s solution for subsequent analysis, as recommended by the UK Marine Biological Association (MBA) and others. The time of day for sample collection should be standardised to allow for vertical migration patterns.

Zooplankton samples can be collected by either vertical or horizontal trawls. The samples are typically collected in a 120-200 μm mesh net. For horizontal trawls, a flow-meter is attached to calculate volume of water sampled. As with phytoplankton, the time of day for sample collection should be standardised to allow for vertical migration patterns. Upon recovery, the samples are put into opaque containers and fixed in 10% formal saline (4% formaldehyde) solution or Lugol’s solution. While many older standard methods suggest formalin, Lugol’s solution is equally effective and much less hazardous/toxic.

Plankton surveys conducted in spring will include meroplanktonic stages of benthos and fish, and may thus yield additional information compared to samples collected at other times.

## Sediment Quality and Infauna (Grabs)

Sediment samples will be acquired using either a 0.1m2 Van Veen or Day grab, or box corer if conditions require. Subsamples will be taken into appropriately washed containers and placed into cold storage (nominally at 4°C ± 2°) as per US EPA guidance, prior to analysis. Samples may be frozen, though those subsamples required for PSA should not be to avoid altering the fine sediment structure through the formation of ice crystals.

Replicate sediment samples will be acquired for infaunal analysis, according to best practice guidance e.g. that published by JNCC[[3]](#footnote-4) and CEFAS[[4]](#footnote-5) in the UK (PERSGA guidance does not cover subtidal grab sampling). The undisturbed sample will be photographed, prior to sieving through a 0.5 mm mesh. The retained material will be fixed in 4% formalin solution, prior to being transferred to ethanol preservative for storage and transportation to the laboratory. Formaldehyde alternatives may be used, though most are less effective and some require further sample processing. Ethanol may distort the tissues of soft-bodied animals making identification more difficult. Commercial preparations such as NOTOXhisto are affected by the presence of matrix material, meaning it works better on picked samples. DESS[[5]](#footnote-6) is also a possible alternative, but formaldehyde remains the most practical fixative for benthic samples and is the one recommended by most standard methodologies.

Deck logs will be kept of all samples, detailing the sample name / number, fix number / geographical location, sediment type, sediment colouration (Munsell chart), layering and depth / volume of sample. Samples will undergo rigorous QA / QC checks with all samples retained photographed.

Other than actually constructing a curve and extrapolating it to estimate total number of species, there’s not much to say. It would also require all individuals to be identified to functional species level, which with infauna from areas where there is a paucity of historical data is a very big ask and would take a dedicated team of taxonomists a significant time to undertake. It would probably also require the input form international taxonomic experts e.g. BMNH or Smithsonian, depending on where the expertise currently resides. I’ve used this approach before in the Gulf, and it works, but its time consuming and expensive.

## Fish and Epibenthos

The rocky shores of the PERSGA region are highly dynamic and range between flat terraces and vertical cliffs. These hard substrate habitats tend to support a high diversity of fish and epibenthic species and communities are variable due to the range of exposures and other environmental conditions.

A variety of techniques are used to establish baseline data for fish and epibenthos. These include include scientific beam trawls (2m designed to CEFAS specifications with a 5mm cod end mesh), subtidal video surveys and still photography to collect data of benthic communities and images of the seabed, netting and trawling surveys, commercial fishing observational surveys and questionnaires and intertidal surveys to undertake biotope mapping. Also, SCUBA diving surveys to undertake in situ recording and still and video photography and Baited or Unbaited Remote Underwater Video (BRUV/RUV) recordings.

For beam trawls the towing speed should be around 1.5 knots over the ground, the duration or length or the tow is normally either 500m or 10 minutes. A field log book and trawl sample log will be maintained and this should be retained for 4 years from the end of the survey, unless otherwise stated by the client.

Following the ReefCheck methodology, fish are surveyed by SCUBA diving along four replicate 20m long x 5m wide belt transects (100m2) centred on transects at two depth ranges (7-12 or 2-6m) within each survey site. Further details on the ReefCheck method, identification guides and photographs of target species are provided at www.reefcheck.org.

BRUV is a system that attracts fish into the field of view of a remotely controlled camera to record [fish diversity](https://en.wikipedia.org/wiki/Fish_diversity), [abundance](https://en.wikipedia.org/wiki/Abundance_(ecology)) and [behaviour](https://en.wikipedia.org/wiki/Ethology). Video is captured in the region surrounding a baited canister, which is lowered to the bottom from a surface vessel, or less commonly by a [submersible](https://en.wikipedia.org/wiki/Submersible) or [remotely operated underwater vehicle](https://en.wikipedia.org/wiki/Remotely_operated_underwater_vehicle). The video can be transmitted directly to the surface by cable, or recorded for later analysis. Baited cameras are highly effective at attracting [scavengers](https://en.wikipedia.org/wiki/Scavenger) and subsequent [predators](https://en.wikipedia.org/wiki/Predation), and are a non-invasive method of generating relative [abundance](https://en.wikipedia.org/wiki/Abundance_(ecology)) indices for a number of marine species.

Where SCUBA diving is employed, strict safety and QA protocols are required. UK HSE (2014) Approved Code of Practice and Guidance for Scientific and Archaeological diving projects and Diving at Work Regulations 1997 provide an internationally recognised benchmark for such activities.

## Coral and Seagrass Communities

Grab sampling is not suitable for coral or seagrass areas, which require direct non-destructive observation.

Coral surveys will follow the methods originally set out by AIMS, by English et al. (1997)[[6]](#footnote-7) and recommended by PERSGA. Along each of five 50 m transect line, 0.5 m x 0.5 m photoquadrats will be taken at regular intervals (approximately 2 m intervals). The frames will be analysed using Coral Point Count with Excel extensions (CPCe) and will be based on a stratified-random overlay of a minimum of 20 points per frame to provide coral and other benthic cover data. The analysis will result in 2,500 data points per station depth, with the data output summarising the percentage cover of individual live hard coral genera, the percentage of live and dead corals (recently dead, partially dead, long-dead) plus a number of other indicator categories including coral bleaching, turf and macroalgae, coralline algae, and substrate groups (sand, rock, rubble etc.). Sedimentation and coral damage will be included as indicators of anthropogenic impacts, alongside coral diseases, *Drupella* snail and *Acanthaster* starfish predation, as well as other indicators as set out by the IUCN for reef resilience studies (Obura & Grimsditch, 2009)[[7]](#footnote-8).

Fish assemblages will additionally be monitored using non-destructive video techniques. While both BRUV and RUV systems can be used, unbaited RUV has some advantages in that it introduces less bias in the data, as it does not disproportionately attract predators and scavenging species. As per PERGSA guidance, a minimum of three or more rigs will be deployed at each site for one hour.

Similar approaches are used for seagrass areas, using the transect based method set out by SeagrassWatch[[8]](#footnote-9) and recommended by PERGSA, using photoquadrats along three 50 m transects.

Where SCUBA diving is employed, strict safety and QA protocols are required. UK HSE (2014) Approved Code of Practice and Guidance for Scientific and Archaeological diving projects and Diving at Work Regulations 1997 provide an internationally recognised benchmark for such activities.

## Large-scale Habitat Mapping

Habitat mapping will be achieved through a variety of spatially continuous data acquisition methods, ground-truthed using high resolution video and photography.

Spatially continuous techniques use boat mounted or towed hydro-acoustic apparatus (multibeam echo sounder and sidescan sonar) to map large areas according to seabed reflectivity and bathymetry. Multispectral satellite imagery can also be used for coastal and shallow water areas (satellite imagery starts to degrade at around -15 m and is not useable beyond -25 m).

Once the mosaic of habitats is mapped identified, ground-truthing is achieved using photographic and video observation using either towed or drop-down rigs. A stratified programme of ground truthing ensures that direct observations are made of each habitat type, while minimising the number of locations. This prevents the possibility of patch habitat being missed when using a regular grid with wide spacing.

Ecological information for each habitat identified will be presented in the reports in a hierarchical manner. This is the standard approach used by e.g. the UK Joint Nature Conservation Committee ‘Marine Habitat Classification for Great Britain and Ireland’ (JNCC, 2004); photographs of each habitat type will also be presented.

A key role for habitat mapping is to inform sampling site selection. Sampling sites need to be representative of the area in which they are situated, thus an understanding of the heterogeneity/homogeneity of the wider area is required to ensure all habitat types are adequately sampled. Sample points must be spread out over the extent of the habitat studied to ensure an adequate consideration of spatial variation, as well as being representative of the whole monitoring area; all characteristic habitat structures and substrates must be sampled[[9]](#footnote-10). Habitat mapping allows for the development of such a “stratified” sampling design and also allows for the selection of representative control sites that should be included against which to measure potential future anthropogenic impacts. This is particularly important of a BACI (Before/ After/ Control/ Impact programme is required.

## Marine Megafauna and Birds

The Red Sea harbours diverse megafauna comprising migratory and resident birds, marine mammals, large migratory fish (whale sharks and manta rays) and marine reptiles. Many of these species are listed by IUCN as being either threatened or endangered; therefore baseline data on these animals are an important component of MEBS, particularly when noisy construction works are expected.

Due to the seasonality of migrant species, surveys should be conducted at least twice per year to account for different species with different breeding seasons; the precise timing of such surveys should be determined after a desktop review of the likely species to be encountered. A combination of ground level and aerial surveys can be used; the suitability of different techniques varies by species and time of year.

### Ground Level Observations

Ground level observations will be carried out both from vessels (all species) and onshore (for birds and turtles). Observers will have a good knowledge of both the local and regional coastal waters and migratory patterns.

### Shipboard Observations

Shipboard observations will be made during all survey cruises by suitably qualified and experienced observers. All sightings shall be logged, along with details/descriptions of the behavioural patterns being displayed during sighting. The observation log sheets shall then be included within the report and mapped accordingly within a GIS, noting the estimated distance of the observer to the subject.

Best practice marine mammal surveys from boats require a team of 3 observers, and a boat steaming at 3 knots on a planned route. It should be noted that this slow speed may not always be practical if “piggybacking” on another survey activity.

A sound recorder may be used to allow the observer to record notes while scanning; otherwise an additional team member can be designated to transcribe observations in real time if preferred.

### Land Based Observations

Land based observations of birds will use vantage point counts, flush counts and walk-through counts to estimate to estimate breeding seabird numbers and nest densities as set out in PERSGA guidance. The suitability of these methods depends upon the species, season and terrain. Each colony/site may need a different combination of methods.

* Vantage point surveys will comprise timed counts from a fixed location, with numbers of individuals, occupied nest and vacant nests being recorded. The estimated size of the survey area, substrate composition (e.g. percentage sand and rock, vegetation cover, vegetation height) and evidence of human activities, including huts, fishing camps and boats within 2 km of coast will be noted at each site.
* Flush counts entail the observer approaching the colony just close enough for birds to take flight, at which point the flying birds of each species are counted. This will be repeated 3-5 times per site and the mean calculated. Flush counts will not be used in isolation but paired with walkthrough or transect/quadrat counts of nests and clutch sizes.
* For smaller colonies, walkthroughs may be used. Following a flush count, two observers will walk through the colony on parallel tracks to count nests and clutches. For very high density colonies, quadrats will be used to estimate nest and clutch numbers, with quadrats at 5 m intervals.

### Sea Turtle Nesting Beaches

To identify the suitable sea turtle nesting beaches within the NEOM Project Area, beaches on the islands and the mainland coast will be monitored during nesting season. The intensity of nesting attempts and species present will be estimated based on the pattern, number and distribution of nesting tracks. Coordinates of each nesting track will be obtained from geotagged photographs. GIS maps with locations of turtle nesting tracks will be developed. This follows the Level 1 Nesting Beach Survey method set out be PERSGA.

### Aerial Surveys

While PERSGA states that aerial observations may be conducted from fixed wing aircraft or helicopters, the latter is not recommended, as it is well documented due to the degree of noise and disturbance they cause. A review commissioned by the Collaborative Offshore Wind Research Into the Environment (COWRIE) is considered to represent best practice in Europe. This review recommends that twin-engine, high wing reconnaissance aircraft, should be used as they can fly at an appropriate speed, have sufficient range and endurance for offshore work and ensure the best all round visibility for observers[[10]](#footnote-11). It is nonetheless acknowledged that such may not always be available and helicopters might need to be used instead.

Aerial count surveys require a minimum of two surveyors with previous experience in conducting these types of surveys, as they must be familiar with and able to accurately record the species found within the area. In some circumstances the use of camera drones is a suitable alternative, as they are relatively quiet and unobtrusive.

* Surveys are conducted at 30–90 m above sea level and as slowly as possible (roughly 160 kph);
* Several overpasses of some bird colonies or cetacean pods may be required to cover the range of species;
* Overflight of small islands will be restricted to 5 minutes overhead or less;
* Summer nesting bird surveys should be in the early morning, or late afternoon, to minimise heat stress on eggs and chicks. During winter, a longer part of the day may be used; and
* During aerial surveys, a photographic record will be maintained, in addition to real-time voice records, giving information on species, number, behaviour, transect band and time.

The most practical method for recording observations is to use a good quality hands-free sound recorder that allows the observer to record notes without interruption observation. An integrated microphone is commonly present on such devices, though a headset may be preferred if the level of ambient noise is high, as in a helicopter cabin. The selection of recording device should be made accordingly.

# Baseline reporting

## Analysis

Organisms will be identified to functional species level (i.e. if the precise species cannot be determined, it is given a unique designation to which all similar individuals are assigned). This may require additional taxonomic expertise from international centres of excellence for specific faunal groups. This level of consistency is required to allow the construction of species accumulation curves and estimation of the total number of species in the community.

Typically, ecological data will be subject to univariate, distributional and multivariate analyses.

* Univariate analyses will include total number of individuals, total number of species, diversity (Shannon-Wiener Index H’), dominance (Simpson Index C), species richness (Margalef’s d) and evenness (Pielou’s J’). In general, such measures tend to be highly correlated and therefore there is limited value in calculating more indices, as they will show similar trends in the data.
* Diversity profiles can be visualised by plotting k-dominance distribution curves. These are useful for the future analysis of possible anthropogenic impacts that might disproportionately affect only part of the community.
* Univariate and distributional analyses are useful as community-wide indicators, but are not based on the identity of species. Accordingly, species dependent multivariate analysis of community structure is also required. Non-parametric multi-dimensional scaling (MDS) ordination, employing the Bray-Curtis similarity measure is a commonly used analytical technique. Dendrograms of similarity can then be constructed to show how the biota at different stations group together, allowing for distribution of different benthic assemblages and communities to be mapped.

## Reporting

The purpose of the baseline reporting is to document the ambient physico-chemical and biotic environment of the project area prior to the start of construction works. It is therefore important that it be comprehensive, and statistically rigorous, in order to form the basis of future monitoring programmes to determine any anthropogenic impact and to help design appropriate mitigation as required. The report will provide interpreted analysis of the data that is accessible to project decision makers going forward, but it is also important that the raw data be preserved in a format that will allow easy incorporation of supplementary data and re-analysis in future if desired.

Given that this will also form part of the baseline of future formal environmental assessments, IFC[[11]](#footnote-12), [[12]](#footnote-13) and EU[[13]](#footnote-14) guidance on baseline reporting will be followed.



1. OSPAR Commission (2013) JAMP Guidelines for Monitoring of Contaminants in Seawater [↑](#footnote-ref-2)
2. PERSGA/GEF (2019) Standard Survey Methods for Key Habitats and Key Species in the Red Sea and Gulf of Aden, 2nd Edition. PERSGA Technical Series No. 19, PERSGA, Jeddah. [↑](#footnote-ref-3)
3. Noble-James, T., Jesus, A. & McBreen, F (2017) Monitoring guidance for marine benthic habitats Joint Nature Conservation Committee Report No: 598 July 2017 (Revised June 2018) [↑](#footnote-ref-4)
4. CEFAS (2004) Sampling and analysis of the macrobenthic infauna from soft sediments. Centre for Environment, Fisheries and Aquaculture Studies Standard Operating Procedure 1381 [↑](#footnote-ref-5)
5. A solution of dimethyl sulphoxide, disodium EDTA, and saturated NaCl [↑](#footnote-ref-6)
6. English, S., Wilkinson, C. and Baker, V. (1997) Survey manual for tropical marine resources, 2nd edition, Australian Institute of Marine Science, Townsville, 390pp [↑](#footnote-ref-7)
7. Obura, David & Grimsditch, Gabriel. (2009). Coral Reefs, Climate Change and Resilience An Agenda for Action from the IUCN World Conservation Congress in Barcelona, Spain. [↑](#footnote-ref-8)
8. McKenzie L.J., Campbell S.J. & Order C.A. (2001) Seagrass- Watch Manual for Mapping & Monitoring Seagrass Resources by Community (citizen) volunteers (QFS, NFC, Cairns). 100p [↑](#footnote-ref-9)
9. OSPAR (2012) JAMP Eutrophication Monitoring Guidelines: Benthos. OSPAR Commission Agreement 2012-12 [↑](#footnote-ref-10)
10. Camphuysen, C. J., Fox, A. D., Leopold, M. F. and Petersen, I. K. (2004). Towards standardised seabirds at sea census techniques in connection with environmental impact assessments for offshore wind farms in the U.K. A Comparison of Ship and Aerial Sampling Methods for Marine Birds, and Their Applicability to Offshore Wind Farm Assessments. Koninklijk Nederlands Instituut voor Onderzoek der Zee Report commissioned by COWRIE. [↑](#footnote-ref-11)
11. International Finance Corporation (2012) Guidance Note 1 Assessment and Management of Environmental and Social Risks and Impacts [↑](#footnote-ref-12)
12. International Finance Corporation (2019) Guidance Note 6 Biodiversity Conservation and Sustainable Management of Living Natural Resources [↑](#footnote-ref-13)
13. European Commission (2017) Guidance on the preparation of the Environmental Impact Assessment Report

    (Directive 2011/92/EU as amended by 2014/52/EU) [↑](#footnote-ref-14)