Deployment Planning

Survey design should carefully consider:

- **Environmental conditions**: deployment methodology and cetacean detections will depend on weather conditions, water depth, seabed sediment type, tidal currents, wave heights, and human activities such as fisheries and boating.

- **Redundancy**: SAM devices can fail or be lost, so device redundancy should be incorporated into survey design.

Standard metrics for monitoring cetaceans are currently based around Detection Positive Minutes, 10 Minutes, Hours, or Days (DPM, DP10M, DPH & DPD), which should be effort corrected. ‘Detection Positive time units’ is the number of time units (e.g. minutes in an hour, or 10 minutes in a month as in the figure above) in which dolphins or porpoises were detected. Time unit should be selected such that the temporal autocorrelation is sufficiently low. Waiting time (time since last acoustic encounter) is used for monitoring impacts of impulsive noise impacts such as pile driving.

For further information on environmental monitoring for wave energy developments visit the SOWFIA website: [www.sowfia.eu](http://www.sowfia.eu).

**Metrics**

Wave Hub dolphin DP10M
Since all cetaceans (whales, dolphins and porpoises) are protected by national, EU and/or international legislation, consideration should be given to the potential effects that wave energy converters (WECs) may have on these species.

Cetaceans may be impacted by WECs in a number of positive or negative ways such as:

- **Collision/entanglement**: WECs may have underwater moving parts with which collision may occur, and are likely to have cables and mooring lines in which animals may get entangled.
- **Displacement and habitat loss**: may occur due to potential noise disturbance during installation and operation or other associated human activities.
- **Electromagnetic Fields (EMF)**: WEC power cables produce EMF which may interfere with some cetacean species navigation.
- **Local increase of fish numbers**: due to exclusion zones and/or fish aggregation effect.

Cetacean monitoring at WEC sites can be divided into two different stages: (i) pre-consent monitoring as part of the Environmental Impact Assessment (EIA); or (ii) post-consent impact monitoring to check the assumptions of the EIA and the effectiveness of any mitigation measures.

Post-consent monitoring to evaluate the impact of WEC installation and operation on cetaceans can be carried out using either:

- **BACI (Before-After-Control-Impact)** which requires careful selection of an appropriate ‘control’ or ‘reference’ site, or
- **BAGI (Before-After-Gradient-Impact)** where monitoring is carried out at increasing distances from the impact site.

Both methods require baseline data of at least 1 year & preferably 2-3 years over all seasons to allow impacts to be detected against background temporal variation. After the first year of data collection, the methodology should be evaluated to ensure there is sufficient statistical power to detect impact.

Static Acoustic Monitoring (SAM) devices can be used for cetacean monitoring and take one of two formats:

- **Click detectors** (e.g. CPODs, Chelonia Ltd.) – able to detect high and broadband echolocation clicks of porpoises and dolphins but unable to distinguish among dolphin species.
- **Broadband recorders** (e.g. SM2s, Wildlife Acoustics) – combined with click detectors may be able to identify dolphin species.

SAM devices can be deployed using one of two methods:

- **Surface-buoy moorings**: where the position of devices can be identified & retrieved using surface markers.
- **Acoustic-release moorings**: used to moor devices in areas of strong tidal currents, harsh sea states or high fish trawling activity.