ISPRA
Istituto Superiore per la Protezione
e la Ricerca Ambientale

# FIXED LINE TRANSECT USING FERRIES AS PLATFORM OF OBSERVATION

# MONITORING PROTOCOL

**Allegato tecnico I della**
**CONVENZIONE PER LO SVOLGIMENTO DI ATTIVITA' DI**
**'FIXED LINE TRANSECT USING FERRIES AS PLATFORM OF OBSERVATION FOR MONITORING MEGA AND MACRO MARINE FAUNA AND MAIN THREATS'**

**Technical Annex I for the**
**AGREEMENT**
**'FIXED LINE TRANSECT USING FERRIES AS PLATFORM OF OBSERVATION FOR MONITORING MEGA AND MACRO MARINE FAUNA AND MAIN THREATS'**

## Introduction: potential of the fixed line transect method using ferries as platform of observation for monitoring cetacean population

All cetacean species, whether resident or migratory, within the Mediterranean basin are protected by a national and international legislative framework. Threats can have immediate impacts on individuals as well as longer-term impacts on cetacean population size or distribution and on population dynamics. To manage potential threats to cetacean populations, the legislative framework (e.g. Habitat and Marine Strategy Framework Directives) requires the initial evaluation and the monitoring of cetacean populations to assess their conservation status, the effect of potential threats and to plan effective conservation measures. Population monitoring is therefore a key pillar to early detection of any significant change that require a definition or re-definition of conservation efforts. An understanding of the cause of significant changes is also needed and can be obtained in part by relating the distribution and abundance of the species to environmental and/or anthropogenic factors.

To meet the needs of management objectives, monitoring programmes are required to be cost effective and feasible to carry out at regular intervals over a long period[1.] To ensure that any observed changes reflect an actual change in the population, consideration must be given to possible bias due to methodology, such as changes in methods, experience of observers, equipment used, changes in the surveyed area, changes in the time of year surveyed or adequacy of the sampled survey area. Spatial heterogeneity, for example, can influence results if the position of the survey transects or the surveyed areas change over time. In particular, if the surveyed areas do not include the entire range of the population, caution must be taken in comparing data on distribution or abundance of species which have an extended range, are not homogenously distributed, are highly mobile or undergo temporal variation in distribution[2]. Comparison of data on rare or elusive species can be biased by a low spatial or temporal resolution of the surveys, which make the results susceptible to influence by causality. Major issues affecting whether monitoring programmes will meet the requirements of the legislative framework are, in synthesis, costs (which also affect the repeatability and spatial extent of the surveys), the detectability of species and consistency of the survey method.

Although several studies are conducted on cetaceans in the Mediterranean basin, it is difficult to infer useful data for conservation purposes, mainly because of a lack in consistency in methods between the different research programs. The cost of research has been one of the main problems in the development of monitoring programs capable of surveying cetacean populations over time. Donovan (2005) suggests a combination of large-scale surveys to be taken at a regular but longer interval (e.g. 10 years) in combination with more regular, cheaper, smaller scale surveys. This is in line with what is suggested by Evans and Hammond (2004) who recommend a complementary use of different approaches to provide a more complete picture of the status and distribution of a particular cetacean species. Consistency within each approach is needed to compare two or more estimates of absolute or relative abundance in order to avoid variation due to changes in methodology rather than changes in species abundance.

To monitor changes in population size for many conservation purposes, it may not be necessary to have absolute population estimates, especially if the species is highly mobile and distributed heterogeneously spatially and/or temporally. Instead, changes in population size can be inferred from trends in an index that is itself related to abundance, such methods are used in many other taxa to measure population trends (Battersby and Greenwood, 2004[3]; Vorisek et al., 2008[4]).

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1 Donovan, 2005. Cetaceans: can we manage to conserve them The role of long term monitoring. Long term Monitoring: why, whot, where, when and how? Ed. John Solbé.

2 Evans P.G.H. and Hammond P.S., 2004. Monitoring cetaceans in European waters. Mammal Rev. 34(1):131-156.

3 Battersby JE, Greewood JJD (2004). Monitoring terrestrial mammals in the UK: Past, present and future, using lessons from the bird world. Mammal Review 34, 3–29.

4 Vorisek P., Klvanova A., Wotton S., Gregory R.D. (editors), 2008. A best practice guide for wild bird monitoring schemes. JAVA Trebon.

Fixed transect monitoring, especially if designed with multiple transects monitored with consistent methodology, can be used to provide information on changes in cetacean population status for research and conservation policy through indices of abundance. Fixed Transect can be monitored on a regular bases by ferries, allowing extensive data collection at low cost. The placement of the ferry routes is not determined by the distribution of cetaceans, so the two are effectively independent (and important factor for systematic data collection). Fixed Transect Surveys allow investigation of temporal aspects of population status (not biased by spatial variations in coverage) including temporal aspects of habitat use (i.e. migrations). By sampling the same transect repeatedly, indeed, the potentially confounding effects of spatial heterogeneity on any variations in cetacean occurrence can be accounted for much easier than if different areas were sampled on each survey, making it easier to identify temporal relationships. In addition, the method allows the investigation of seasonal occurrence and whether (and how) this changes over time. In particular, the use of sampling fixed transects: (1) enables extensive seasonal/year-round survey effort over a large spatial scale at low cost, (2) makes it possible to repetitively survey offshore areas difficult to reach using standard research vessels, (3) increases the precision of annual abundance estimates due to monthly repeat sampling, (4) increases statistical power to quickly detect long-term trends due to a time-series of annual data, (5) reduces bias due to spatial heterogeneity by repeatedly sampling the same transect, and, as the physiographic variables are fixed, allows the investigation of relationships between cetacean occurrence and temporal environmental or anthropogenic variables (e.g. SST, Chl, maritime traffic); (6) allows for collection of associated oceanographic or anthropogenic parameters (e.g. maritime traffic, marine litter) as well as data on other taxa (e.g. seabirds, sea turtle, other macro-fauna), (7) enhances the opportunity to detect rare species/rare events, (8) provides an indication of important areas and seasons of concentration for specified species, (9) provides significant opportunity to enhance networking among scientific organizations and collaboration with other organizations such as the ferry companies (10) has the potential for building significant communication actions for involving the general public in the work of cetacean researchers.

Main constrains in the use of ferries as research platform refer to data that cannot be collected in passing mode without approaching the animals, such as high quality photos for photoID analysis, behavioural data, tissue sampling etc. Other kind of constrains, commonly described for the use of platform of opportunity, could be easily overcome setting in advance an appropriate and well defined surveys method with a research question specifically tailored to the limitations of the specific vessel. The use of platform of opportunity  to conduct systematic cetacean research is indeed recently increasing providing a valuable alternative for scientific data collection (see Hupman et al. 2014[5], for a review) and, if conducted under a scientific protocol, is considered equivalent to data collected from dedicated research vessels for modelling cetacean habitat (Redfern et al., 2006[6]). If the temporal and spatial coverage of the fixed transects is enough to represent the habitat variability, the use of species distribution modelling (SDM) approaches also allows the results to be applied to a wider area to investigate how the distribution of cetaceans varies temporally and spatially across the whole region.

Fixed Line Transect (FLT) method, using ferries as research platforms, has been used in the Atlantic since 2001 by the Atlantic Research Coalition (Kiszka et al. 2007[7], MacLeod et al. 2009[8], Brereton et

5 Hupman, K., Visser, I. N., Martinez, E., & Stockin, K. A. (2014). Using platforms of opportunity to determine the occurrence and group characteristics of orca (Orcinus orca) in the Hauraki Gulf, New Zealand. New Zealand Journal of Marine and Freshwater Research, (ahead-of-print), 1-18.

6 Redfern, J. V., Ferguson, M. C., Becker, E. A., Hyrenbach, K. D., Good, C. P., Barlow, J., ... & Werner, F. E. (2006). Techniques for cetacean–habitat modeling.

7 Kiszka J, MacLeod K, van Canneyt O, Walker D, Ridoux V (2007) Distribution, encounter rates, and habitat characteristics of toothed cetaceans in the Bay of Biscay and adjacent waters from platform-of-opportunity data. ICES Journal of Marine Science 64, 1033–1043.

8 MacLeod C.D., BreretonT. , Martin C. (2009) Changes in the occurrence of common dolphins, striped dolphins and harbor porpoises in the English Channel and Bay of Biscay. Journal of the Marine Biological Association of the United Kingdom, 89(5), 1059–1065

al. 2011[9]), in the Mediterranean since 1989 (Marini et al. 1997[10]; Monestiez et al. 2006[11]; Cottè et al. 2009[12]) and in other parts of the world (i.e. Viddi et al., 2010[13], Correia et al., 2014[14]). The method has also been used by Joint Nature Conservation Committee (JNCC) to respond to the requirements of the Habitats Directive (Brereton et al., 2011[8]).
Within the FLT, at date analysis were performed for delivering large scale cetaceans distribution and trends, long term comparison on cetacean presence and habitat use and for studying the relationship between cetaceans and environmental parameters (Arcangeli et al., 2012[15];Arcangeli et al., 2014[16]) and for modeling prediction on species' suitable habitat (e.g. potential feeding habitat for fin whale, Druon et al., 2014[17]; changes in suitable habitat for *Ziphius cavirostris*, Arcangeli et al., 2015[18]).
Within the programme, specific protocols were established for multidisciplinary monitoring of macro fauna (e.g. sea turtle, sea birds etc) and two of the main potential threats (i.e. maritime traffic, marine macro litter), allowing to contribute to the requirement of the legislative framework and to the understanding of the marine ecosystem complexity (Arcangeli et al., 2014[19]). First analyses delivered information on the relationship between cetaceans and potential anthropogenic pressure such as maritime traffic (Crosti et al. 2011[20]; Campana et al., 2015[21]) and marine macro litter (Arcangeli et al., 2015, 2019, 2020[22]).

## Methodological characteristics of the Fixed Line transect network in Mediterranean Sea

These surveys involve systematic monitoring of cetaceans along fixed routes (sampling transects) which are repeatedly surveyed, with a predetermined range of platform types and speeds. Meteorological conditions are recorded and experienced and dedicated Cetacean Observers are used. Survey temporal resolution is weekly/twice a month. Data can be analysed on a spatial basis, using as statistical unit the grid-cell of appropriate resolution or using each transect as the statistical unit; correlation and autocorrelation analyses are performed between using data for the analysis.

**Assumptions**: detectability of species doesn't change through time and space (preliminary analysis are undertaken to avoid possible bias due to type of platform, speed, experience of the observer, meteorological conditions and distance). For the FLT network we investigated different possible sources of bias (Table 1).

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10 Marini L., Consiglio C., Angradi A. M., Catalano B., Sanna A., Valentini T., Finoia M. G. and Villetti G. (1997) Distribution, abundance and seasonality of cetaceans sighted during scheduled ferry crossings in the central Tyrrhenian Sea: 1989-1992. Italian Journal of Zoology, 63, 381-388.

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13 Viddi F.A., Hucke-Gaete R., Torres-Florez J., Riveiro S., 2010. Spatial and seasonal variability in cetacean distribution in the fjords of northern Patagonia, Chile. International Council for the Exploration of the Sea. Oxford Journal.

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16 Arcangeli A., Orasi A., Carcassi S., Crosti C. (2014). Exploring thermal and trophic preference of Balaenoptera physalus in the Central Tyrrhenian Sea: a new summer feeding ground? Mar Biol 161:427–436.

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19 Arcangeli A., Aissi M., Aragno P., Atzori F., Azzolin M., Baccetti N., Campana I., Castelli A., Cerri F., Cinti F., Crosti R., David L., Di Meglio N., Frau F., Lippi S., Luperini S., Maffucci F., Marini L., Moulins A., Paraboschi M., Pellegrino G., Ruvolo A., Tepsich P., Tringali M. (2014). Cetacean, marine birds, sea turtle, marine traffic and floated marine litter: potential of a synioptic multi-disciplinary data collection in the western mediterranean marine region. Biol.Mar.Med. 21 (1): 366-368.

20 Crosti R., Arcangeli, A., Moulins, A., Tepsich, P., Tringali, M. (2011) Cetacean and maritime traffic in deep sea waters. A relation to avoid? Biol. Mar. Mediterr., 18(1): 178-179.

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Table 1

| Possible bias | Correction |
|---|---|
| Density gradient | Transect design perpendicular to any density gradient (e.g. migration of fin whale) for most of the transects |
| Meteorological condition | Change with sea state : effort only under Beaufort scale ≤3 (could be considered ≤2 for *Ziphius cavirostris* and ≤4 for *Balaenoptera physalus* ) |
| Speed, type of ferries | No change in sighting rates within the same type of ferries : Ferry Type I (12-15m deck height); Ferry Type II (20-22m) and Ferry Type III (25m) |
| Experience of observers | We detected a 50% of difference in sighting rates between experienced and un-experienced observers: only appropriately experienced and trained observers are used in the programme. |
| Distance | Detection probability changes with distance between species (estimate of effective strip width is undertaken for single species/type of ferry) but it is constant between time and space. |
| Distance estimate | Preliminary training for the observers to estimate distance using fixed point at a known distance to calculate personal error in the use of different method to measure distance. |
| Recount of animals | Angle of observation 130° ahead each side; analysis of correlation between outbound and return between two consecutive runs. |
| Species and group identification | Can change with the experience of the observers: only experienced observers are used in the program and photo taken to confirm species identification and group size. |
| Responsive movement of species | Limited by the range of speed of the vessels and the angle of observation |
| Typing and transcription errors | Use of dedicated application; validation by an independent expert after data collection. |

## Advantages of the method

- Sustainable, long-term monitoring program
- Consistency over space and time
- Repeatability
- Correlation with environmental parameters and pressures
- Possibility to detect rare species/rare events
- Large geographic scale
- Possibility to monitor large high sea areas (where data are scarce)
- Repetiveness all year round (also in seasons when data are scarce)
- Simple standard protocol, easily replicable in different areas
- Multidisciplinary data collection
- Facilitate collaborations among different organizations (research institutions, ferry companies, institutions with different missions..)
- Potential for increasing awareness on sea life conservation
- Cost-effectiveness

# Protocol for data collection

Only dedicated and expert observers (DO) are used in the study to avoid bias due to differences in detectability. There is not a comprehensive method to evaluate the experience of the observers as it depends by a mix of personal characteristics, previews experiences, number of surveys already done, specifically on ferries, and number of different species and in different conditions already sighted. So, the experience of the observer in training is established by the senior, who has the responsibility to decide the stage of the experience of the specific observer. There are at least three stages for the observers: senior, experienced, in training.

Cetacean Dedicated Observers are located on the two side of the command deck of ferries and collect data on cetacean presence continuously from both side. DOs rotate side each 1-2 hours. DOs collect data on cetacean presence in "passing mode" (continuous search effort, with schools or animals not being approached) following the distance sampling protocol.

Each CO focus primarily on a 130° arc ahead of the ship and continuously scan the area by naked eye with occasional scan binoculars. The back of the route is scanned only occasionally to avoid risk of re-counting of sightings.

Height on the horizon and exposure of the commander deck of the observation platform as well as observer expertise can affect the detection capability along the transect. Consequently to be able to properly compare the different routes it is important to compute the "effective strip width" through the distance sampling detection function so to be able to calculate the density values along the transect (for each species). Consequently in the survey sheet it is important always to quote the name of the ferry/ship and firstly the name of the more experienced observer of the team. Transect width must be compute for each platform/more expert observer/species.

## Effort data:

All data concerning ferry track (position, speed and heading) are recorded by a dedicated GPS all along the ferry route. GPS resolution should be set as the best possible resolution according to GPS memory capacity and trip duration. In case of problems with the personal GPS, coordinates of marked points along the transect are recorded at least each 20 minutes and each time the routes is changed. All data can be collected by mean of electronic dedicated applications assuring that all data within the "meteo - sight – maritime traffic – other species data collection sheets" are collected.

Table 2 GPS positions to be recorded

| | | |
|---|---|---|
| **BEG** | Beginning of effort | Beginning of the survey |
| **STOP** | Beginning "off effort" | Pause during survey |
| **START** | Start "effort" | During survey |
| **END** | End effort | At the end of survey |
| **WP** | Way Point | Positions along track |
| **METEO** | Change of meteo conditions | |
| **Sight** | Sighting | Position of sightings |
| **OS** | Other species sighting | Position of sightings |
| **NAV** | Naval traffic | Position of systematic scan samplings in absence of cetacean sightings |

## Metadata and data on meteorological conditions

At the beginning of the effort all data regarding date, transect number, name of the ship, names of the observers are recorded. Data on meteorological conditions are collected in the 'meteo data sheet' (on the data collection file Annex I) at the beginning of the "on effort" period; at the end; and each time a change occurs. Data on meteorological condition is recorded by one of the DOs for both side of the command deck. On the same data-sheet are eventually recorded the off-effort period, change side of the DOs and changes on the effort conditions. Meteo condition is indicated as Beaufort scale, taking in consideration both the wind speed and the sea state condition. Data are collected under all weather condition even if only data collected in good weather conditions (Beaufort $\leq$ 3) are used for the analysis. The definition of the Beaufort scale is done through descriptive observation of the sea and range of wind speed when available (both described in the data collection sheet).
Survey data and sighting data are recorded through datasheet or through software device and/or specific applications, assuring that all the data required in the data collection sheets are provided.

## Sightings data

During sightings data are collected on the "sight data collection sheet" (Meteo; Sighting; Naval traffic; Other species; Annex II). For each sighting, species, number of individuals, presence of juveniles, behavior and vessel presence are recorded. Sightings are reported recording the time of sighting by one of the DO, avoiding the risk of recording twice the same sighting (if eventually sighted from both size of the observation points). A sighting done by a crew member or an in training observer or people other than DO is recorded only if confirmed by a DO.
Binoculars and photos are used to confirm sightings and assess species and group size. Not identified species are registered using "US" followed by the indication "large whale species"(L), "medium cetacean species" (M), "small dolphin species" (S) (see Annex VI for more detail).
Coordinates of sightings are marked in the personal GPS and reported in the data sheet (see Annex VIII for more detail on the GPS settings). Data on radial distance and angle between the detected group and the track line are recorded by graduated binocular, or using a personal measuring stick and a goniometer.

## Mixed species

If mixed species are sighted in a single group are recorded as a single sighting and all species are recorded. If multiple groups of same species are simultaneously recorded over a large area, they will be recorded as single sighting if they are assessed to be "sub-groups" (according to the definition of group).

## Collision

Particular focus is given for recording possible event of collision or near collision in order to contribute to the comprehension and the definition of mitigation measure for ship strike. Case of collision or near-collision are clearly reported with details of the dynamic of the event. Is considered "Near collision event" when the animal is sighted in front of the ship at a minimum distance of 50 mt in front of the bow and 25 mt on the side, with animals not showing evident approaching behavior (e.g. bow riding in front of the ship) but being instead not aware of the boat approaching. The behavior of the animals is an indicator DOs is required to warn ferry's crew about cetacean presence in order to avoid ship strikes.

## Maritime traffic

Potential relationship between maritime traffic and cetacean presence is investigated: systematic scan samplings of the horizon, in concurrence with cetacean sightings, are undertaken in order to quantify the number of vessels (sailing boats, fishing boat, ferries, cargo etc), detectable from the observation platform (in the same area scanned by naked eye). In absence of cetaceans, scans are undertaken randomly at a minimum distance of 45 minutes or 10 NM. An alarm clock should be set in order to avoid collecting data in concurrence with the sight of a ship that "remember" us that is time to do it. Always keep at least 15 min interval between a sight and a random scan (if the sight is done soon after the random data, delete the random data). Vessels are divided in X<5m (S); 5m<X<20m (M); X>20m (L). Number of vessels, hour and GPS position is registered for each scan. Ship and maritime traffic data, if possible, will be also gathered from the ship's AIS system.

## Other species

Potential multi taxa relationship is investigated. Even though priority is given to cetaceans surveys, data on other marine macro-fauna is also collected each time it occurs in order to be used for presence only analysis. Potential macro-fauna data collected regards the species listed in table 3. In order of maintaining a consistent effort focused on cetaceans, only two species of sea birds were selected for opportunistic data collection (Levantine shearwater and Scopoli's Shearwater), choose in consideration of the role for conservation purposes. Sea turtles are considered of major priority for data collection: the opportunistic data collection is strongly recommended in all the routes. Systematic data collection on sea turtles (as well as Jellyfish, Ocean sunfish and Devil fish) is required only during the application of the Marine litter protocol (see Protocol for marine macro litter data collection). For species usually observed in big groups (eg Tuna and velella) as it is not possible to count individuals, groups are categorized into small ( <10 individuas) medium (10-100)-big (>100). Data on jellyfish, also outside the standard protocol (litter and mega fauna protocol) are reported to prof. Ferdinando Boero (Univ. Salento/CoNISMa/CNR-ISMAR).

Table 3 List of potential other species of marine mega fauna to be recorded.

| ##Other Species names## | Eng name | It name |
|---|---|---|
| *Caretta caretta* | Loggerhead sea turtle | Tartaruga marina |
| *Mola Mola* | Ocean Sunfish | Pesce luna |
| *Mobula mobular* | Devil fish | Manta |
| *Xiphias glaudius* | Swordfish | Pesce spada |
| *Thunnus ssp* | Tuna | Tonno |
| *Fam. Istiophoridae* | Marlins | Marlin, pesce vela |
| Shark | Shark | Squalo |
| Jellyfish | Meduse | Jellyfish |
| *Puffinus yelkouan* | Yelkouan Sh ( or Levantine shearwater) | Berta minore |

| | | |
|---|---|---|
| *Calonectris diomedea* | Scopoli's Shearwater | Berta maggiore |
| *Other* | | |

## Data storage

Each team is responsible for storing data for each ferry trip and to prepare shape files (.shp) to be shared with partners of the network at least seasonally. Data could be shared as excel or .shp file, including all the information and under the format indicate in annex IX.

## Preliminary basic data analysis

Effort data is analyzed as time (hour) spent and/or distance travelled (Nautical Mile or Km) in observation (on effort) in good weather condition (Beaufort≤3).
Beaufort scale is assessed by means of visual observation and range of wind speed. Measure of effort in distance travelled is generally preferred for coherence with spatial analysis.
Abundance is calculate through index of abundance or Encounter Rate, ER (= SPUE, sight per Unit of Effort) using as statistical unit: 1) the single transect, after testing for independency of the dataset (e.g. Spearman coefficient; especially if the outbound and return are undertaken in the same day or within a week); 2) the cell unit at adequate resolution used for the spatial analysis. ER is measured as number of sightings per space travelled (Nautical Mile or Km) spent in observation (on effort) in good weather condition. Differences on ERs are compared with non-parametric tests (box-plots and Kruskal-Wallis and/or Mann-Withney between pair; Kolmogorov-Smirnov if one of more medians are nulls). Only ERs computed using data from the same type of Ferry can be directly compared, otherwise preliminary analysis to test for differences on sightability must be performed (e.g. through Distance or GAM analysis) and/or all data shall be standardized according to the most restrictive category (type I). To reduce variability within the data, density could be used instead ER: this means compute strip width and use square kilometers rather than km.
Geographical data are analyzed with a GIS program using WGS84 as Datum. Sightings and effort (on effort track) data are stored as .shp files (points for sightings and polyline for the on effort track). Spatial analyses are performed after testing for independency of the dataset.
Number of ships gained from scans in presence of cetacean sightings (presence dataset) and in absence of cetacean sightings (absence dataset) are compared with non-parametric statistical tests (Kolmogorov-Smirnov or Mann-Withney, assessing the probability (p) of the two distribution frequency or the two medians to be equal).

## Biodiversity indicator

Basing on collected data (particularly the parameters Presence of the species; Species composition (%) and Species Per Unit Of Effort) is assessed the possibility to implement a biodiversity indicator on Cetacean species consistency in the Italian sea territory (Ligurian Sea; Central Tyrrheanian Sea; Southern Tyrrheanian Sea; Adriatic Sea). This indicator is useful to complete the biodiversity set of indicators included in the chapter "Biosphere" of the ISPRA "Yearbook of environmental data". The implementation of the indicator conforms to the specification of the Indicator Factsheet adopted for the Yearbook.

## Schedule

During autumn (October-November-December), winter (January-February-March) and spring (April –May), surveys are generally performed four times per month (two trips outbound and return) while during late spring and summer (June-July-August-September) surveys are generally performed twice a week (one trip outbound and return each week). The number of surveys could vary for each ferry track, according to ferry-company schedule and general logistic organizations, assuring at least one survey per month. Minimum requirement is five survey for each season (with at least one each months). This will allow comparisons among seasons or routes.
The trip schedule of the season (at least three months) must be mailed to ferry companies through ISPRA at the latest 15 days before the first trip of the season.

Data collected are mailed to ISPRA by the end of the month following surveys' season (i.e. by the end of October for data collected during summer season) and/or upload in the shared drive.
Beginning of each calendar year, all data of the Ferry Monitoring Network are stored by ISPRA in the "FLT Network stanza di lavoro" with access to all partners.

## *Annex I Data collection sheet: meteo condition*

### Data collection sheet: Meteo

**COD_Transect N.** **Date** **Ship name** **Observers**

| COD GPS | Time | Effort | Sea state | Wind direction | Rain | Visibility | Cloud cover | Lat | Long | Route | Speed | Other | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BEG=beginning off effort STOP=start of off effort START=start effort; END=end effort; | | | Mist, Fine, Drizzle | (optimus, good, mean, scarce) | % | Y | X | | | (es. predator fishing, fishing ship, naval traffic..) | **Sea state** | **Wind (KN)** | **Description** |
| | | | | | | | | | | | | | 0 | 0 | Calm (glassy) |
| | | | | | | | | | | | | | 1 | 1-3 | Calm (rippled) |
| | | | | | | | | | | | | | 2 | 4-6 | Smooth (wavelets) |
| | | | | | | | | | | | | | 3 | 7-10 | Slight |
| | | | | | | | | | | | | | 4 | 11-16 | Moderate |
| | | | | | | | | | | | | | 5 | 17-21 | Rough |
| | | | | | | | | | | | | | 6 | 22-27 | Very rough |
| | | | | | | | | | | | | | 7 | 28-33 | High |
| | | | | | | | | | | | | | 8 | 34-40 | Very high |
| | | | | | | | | | | | | | 9 | 41-47 | Phenomenal |
| | | | | | | | | | | | | | 10 | 48-55 | Storm |

| **Other:** | **! Remember the Naval traffic sheet!** |
|---|---|

## *Annex II Data collection sheet: sightings*

# Data collection sheet: Sightings

**COD Transect N.** **Date** **Ship name** **Observers**

| N/COD GPS | Time | Ship position | | Side | Obs | Species | N° Tot | | | N° Juv | Distance | Angle | Direction of swim | Responce to ship | | | Behaviour | Ph | Collision or Near collision | Ships (see sheet) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Lat (Y) | Long (X) | | | | Min | Max | Best | | | (0-180°) | (0-360°) | Apr | Esc | Indif | | | | |
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**Behaviour**

| Behaviour | Superficial | Speed | Progress | Direction | Group association |
|---|---|---|---|---|---|
| Travel | Half Leap | Slow | Straigth | Same | (i.e. 2+2; 2+2+1) |
| Rest | Full Leap | Normal | Irregular | Different | |
| Play | Dorsal Fin | Fast | None | Circle | **Type** |
| Feeding Wild | Surfing | Porpoising | Zig-zag | | Males |
| Feeding Net | Blow | Floating | | | Fem/juv |
| Mating | Breach | | | | Mother/calves |
| Unknown | Spyhopp | | | | |

**Unidentified Species (US):**

- **L** LARGE "whale" species
  - **DD** Distinct Dorsa
  - **ID** Indistint Dorsal
- **M** MEDIUM "cetacean" species
  - **LF** Large Fin
  - **SF** Small Fin
- **S** SMALL patterned "dolphin" species

## *Annex III Data collection sheet: naval traffic*

### Data collection sheet: Naval Traffic

**COD Transect N.** **Date** **Ship name** **Observers**

| | | | | < 2 NM | | | | | > 2 NM | | | | | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cetacean Presence/Absence | Time | Ship position | | Small | Medium | | | Big | Small | Medium | | | Big | |
| | | Lat (Y) | Long (X) | < 5m | 5m < X < 20m | | | > 20m | < 5m | 5m < X < 20m | | | > 20m | |
| | | | | | Motor | Sail | Fishing | | | Motor | Sailing | Fishing | | |
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## *Annex IV Data collection sheet: sightings other species*

# Data collection sheet: Sightings other species

**COD Transect N.** **Date** **Observers** **Ship name**

| COD GPS | Time | Ship position | | Side | Obs | Species | N° Tot | | | N° Juv | Distance | Angle | Direction of swim | Responce to ship | | | Behaviour | Ph | Collision or Near collision |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Lat (Y) | Long (X) | | | | Min | Max | Best | | | (0-180°) | (0-360°) | Apr | Esc | Indif | | | |
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## *Annex V: unidentified species classification*

### Unidentified Species classification (US)

**LARGE** "whale" species (**L**)

- Distinct Dorsal (**DD**)
  - Fin whale (*Balaenoptera physalus*)
  - *Minke whale* (*Balaenoptera acutorostrata*)
  - *Sei whale (Balaenoptera borealis)*
  - *Northern bottlenose whale (Hyperoodon ampullatus)*

- Indistinct Dorsal (**ID**)
  - Sperm whale (*Physeter macrocephalus*)
  - *Humpback whale (Megaptera novaeangliae)*
  - *Northern right whale* (*Eubalaena glacialis*)

**MEDIUM** "cetacean" species (**M**)

- Large dorsal fin (**LF**)
  - Bottlenose dolphin (*Tursiops truncatus*)
  - Risso's dolphin (*Grampus griseus*)
  - Long-finned pilot whale (*Globicephala melas*)
  - *Killer whale* (*Orcinus orca*)
  - *False killer whale* (*Pseudorca crassidens*)

- Small dorsal fin (**SF**)
  - Cuvier's beaked whale (*Ziphius cavirostris*)
  - *Sowerby's beaked whale (Mesoplodon bidens)*
  - *Blainville's beaked whale (Mesoplodon densirostris)*
  - *Gervais' beaked whale (Mesoplodon europaeus)*
  - *Indopacific humpback dolphin (Sousa chinensis)*

**SMALL** patterned "dolphin" species (**S**)

- common dolphin (*Delphinus delphis*)
- striped dolphin (*Stenella coeruleoalba*)
- *rough-toothed dolphin (Steno bredanensis)*
- *dwarf sperm whale (Kogia simus)*
- *harbour porpoise (Phocoena phocoena)*

## *Annex VI: general behaviour classification*

| | Behaviour | Superficial | Speed | Progress | Directio n | Group association |
|---|---|---|---|---|---|---|
| **Behaviour** | Travel | Half Leap | Slow | Straigth | Same | (i.e. 2+2; 2+2+1) |
| | Rest | Full Leap | Normal | Irregular | Different | |
| | Play | Dorsal Fin | Fast | None | Circle | **Type** |
| | Feeding Wild | Surfing | Porpoisin g | Zig-zag | | Males |
| | Feeding Net | Blow | Floating | | | Fem/juv |
| | Mating | Breach | | | | Mother/calves |
| | Unknown | Spyhopp | | | | |

## *Annex VII: unidentified species classification*

### Other species (OS)

| | | Eng name | It name |
|---|---|---|---|
| ☐ | *Caretta caretta* | Loggerhead sea turtle | Caretta |
| ☐ | *Mola mola* | Ocean Sunfish | Pesce luna |
| ☐ | *Mobula mobular* | Devil fish | Manta |
| ☐ | *Xiphias glaudius* | Swordfish | Pesce spada |
| ☐ | Thunnus ssp | Tuna | Tonno |
| ☐ | Fam. Istiophoridae | Marlins | Marlin, pesce vela |
| ☐ | Shark | Shark | Squalo |
| ☐ | Jellyfish | Meduse | Jellyfish |
| ☐ | *Puffinus yelkouan* | Yelkouan Sh (or Levantine shearwater) | Berta minore |
| ☐ | *Calonectris diomedea* | Scopoli's Shearwater | Berta maggiore |
| ☐ | Other | | |

### IDENTIFICATION BIRDS:

**Scopoli's Shearwater**
*(Berta maggiore)*

Similar in size to a yellow-legged gull, brown upper parts and white under parts, yellow bill. Direct and powerful flight, low over water, slow beats alternated to long glides. In windy conditions almost no beats and may raise high on water with body rotated 90° degrees respect to sea surface. Floating groups similar to small ducks and to other shearwaters (see under yelkouan shearwater). It can be mistaken with immature yellow-legged gulls.

*Dimensioni confrontabili a quelle di un gabbiano reale, parti superiori brune e inferiori bianche, stria biancastra sul groppone alla base della coda, becco giallo. Volo rettilineo, di norma con battute lente alternate a lunghe planate, col vento si può innalzare di molto sulle onde e mantiene le ali immobili anche per lunghi periodi. Per gli stormi posati vedi berta minore. Può essere scambiata con immaturi di gabbiano reale.*

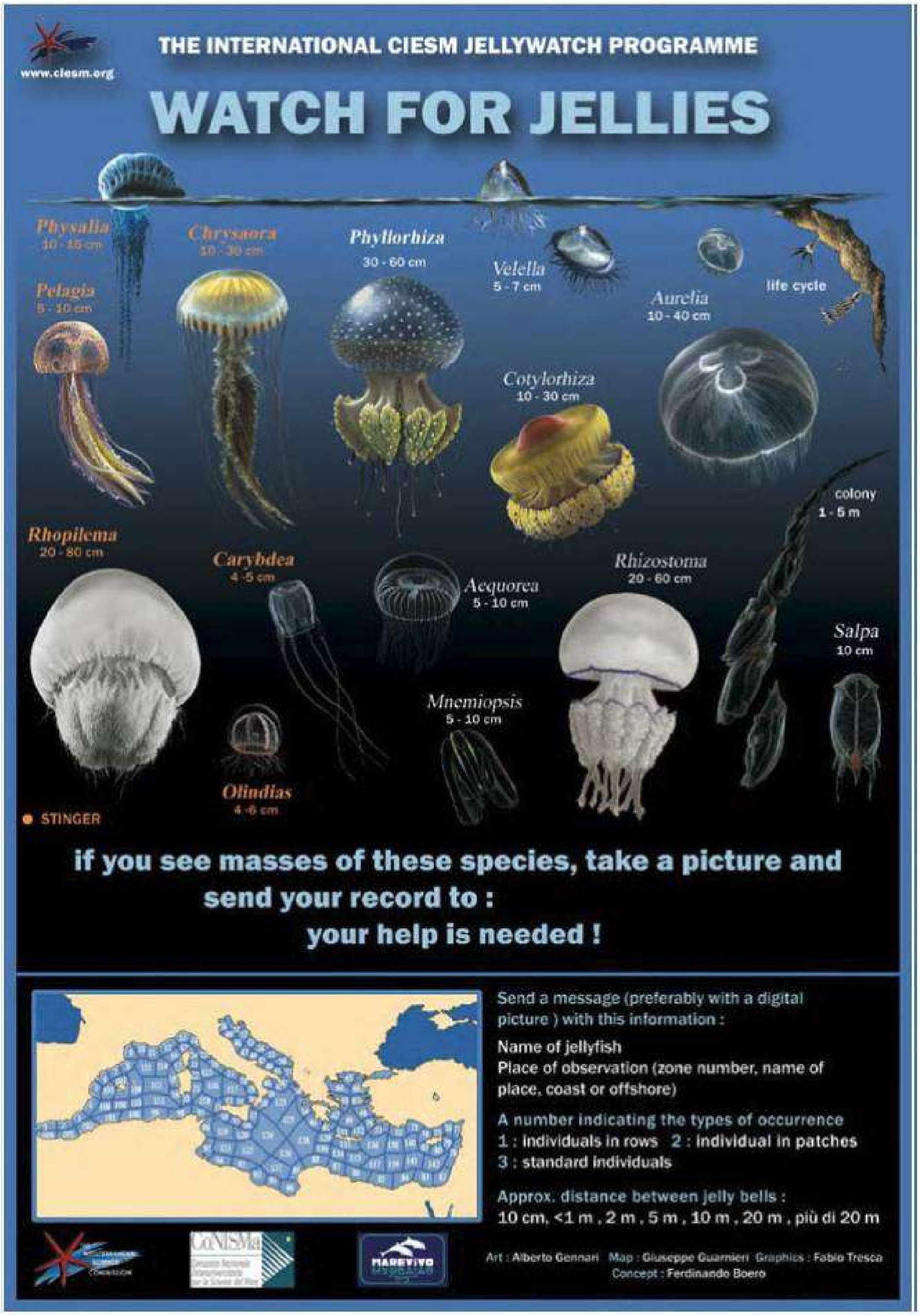
**Yelkouan Shearwater**
*(Berta minore)*

Similar in size to a pigeon, sharp contrast between almost black upper parts and white under parts, black bill, feet projecting out of the tail profile. Direct and rapid flight, low over water, fast beats alternated to glides with rigid wings. In windy conditions glides are longer and may raise higher on water. Floating groups similar to small ducks and to other shearwaters (check bill colour and size difference with yellow-legged gulls - if present).

*Dimensioni confrontabili con quelle di un colombo, marcato contrasto fra le parti superori quasi nere e le inferiori bianche, becco nero, piedi sporgenti oltre la coda. Volo dritto e rapido, basso sull'acqua, alterna veloci battute a planate anche prolungate in condizioni di vento teso. Solo con vento forte si innalza periodicamente di alcuni metri sulle onde. In stormi posati, visti a distanza, ricordano piccole anatre e sono difficilmente distinguibili dalle berte maggiori (occorre notare il colore del becco e quello delle parti superiori, nonché la differenza dimensionale con eventuali gabbiani posati nei pressi).*

## IDENTIFICATION JELLYFISH:

refer to Boero, F. (2013). *Review of jellyfish blooms in the Mediterranean and Black Sea*. Food and Agriculture Organization of the United Nations. Rome




| | | |
|---|---|---|
| Contact person for sea turtle identification | Sandra Hochscheid, SZN Anton Dohrn | sandra.hochscheid@szn.it |
| Contact person for shark identification | Fabrizio Serena | fabrizio.serena@arpat.toscana.it |
| Contact person for Jellyfish | Ferdinando Boero | boero@unisalento.it |

## ***Annex VIII:*** GPS SETTINGS

1. Set the GPS for
   a. automatically take the track at the maximum resolution
   b. automatically save the track daily (!be careful as sometime, depending on the GPS, when saving the track, some models simplify the track and save already a polyline, thus loosing the original data!)
2. Control that the clock of the GPS is properly setted
3. Have the second pair of battery ready and always charged
4. Use the following code for the points marked on the GPS:

| ***Cod*** | ***Meaning*** | **When** |
|---|---|---|
| ***BEG*** | ***Beginning of effort*** | Beginning of the effort + data |
| ***STOP*** | ***Beginning "off effort"*** | Pause during survey |
| ***START*** | ***Start "effort"*** | End of the break (beginning of on effort after a break) |
| ***END*** | ***End effort*** | End of observations/survey |
| ***WP*** | ***Way Point*** | Positions along track: every 20 min if the personal GPS is not working for automatically recording the track |
| ***METEO*** | ***Change of meteo conditions*** | Each point along the transect with information on the changes occurred in meteo condition |
| ***SIGHT*** | ***Sighting*** | Sighting point followed by the progressive number of the sighting , then the first letters of the species and the numbers of the animals within the group. |
| ***OS*** | ***Other species sighting*** | During cetacean surveys (only presence) |
| ***NAV*** | ***Naval traffic*** | Position of systematic scan samplings in absence of cetacean sightings |

- Use the coordinate as: gradus° decimus of primus' with at least 3 numbers after the comma (i.e. 41° 32,557' N ). DATUM WGS84.
- Write ALL the data requested in the data sheet each time a change on meteo conditions occurs.
- Always use the measuring stick (or the scaled binocular) and the emigoniometer for the data on distance and angle of the sighting
- Take always a cetacean and jellyfish recognition sheet /book on board.

## *Annex IX:*

| ID_transect | O/R | ROUTE | N transect | DAY | SHIP name | ROUTE NUM | MEAN SPEED KNOTS | Observer 1 | Observer 2 | Observer 3 | Observer 4 | Cetaceans survey | Naval survey | Other species_presence only | Litter/other species_systematic | Segment | Km on effort | Tot hours on effort | CetSight TOT | *B.physalus* | *G.griseus* | *P.macrocephalus* | *S.coeruleoalba* | *T.truncatus* | *Z.cavirostris* | *G.melas* | *D.delphis* | *S.bredanensis* | *B.acutorostrata* | N.I.b | N.I.m | N.I.s | Other (e.g. for mixed species) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| ID_transect | Effort | Source | lat | lon | ns1:time2 | Date | Time-2 | Time effective | COD effort | Code points | Seastate | Speed | Wind Direction | Rain | Visibility | % cloud cover | Other | SightN | Ship side | Observer | *Species* | *Species (best)* | N min | N max | N best | N°of juv. | Distance | Angle | Swim direction | behaviour response to ship | Sup behaviour | other | Photo | Colision | Near collision | Traffic in presence / absence | <2NM x<5m | <2NM 5m<X<20m Motor | <2NM 5m<X<20m Sailing | <2NM 5m<X<20m Fishing | <2NM x>20m | >2NM x<5m | >2NM 5m<X<20m Motor | >2NM 5m<X<20m Sailing | >2NM 5m<X<20m Fishing | >2NM x>20m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|