PROTOCOLS FOR CCAHD FIELD SURVEYS

VERSION: MAY 2023

TABLE OF CONTENTS

BACKROUND AND CONTEXT

These protocols have been developed by the Consortium for the Conservation of the Atlantic Humpback Dolphin (CCAHD) for surveys to be conducted in the range of *Sousa teuszii*. By providing standardized methods that can be used and adapted as funding and logistics allow, it is hoped that results from surveys throughout the region can be more easily compared and used to gain an understanding of relative abundance, habitat use, and where possible, absolute abundance in different parts of the species' range. These protocols are also designed to include an element of capacity building for participating scientists who may be new to cetacean survey methodology. The protocols have been implemented and refined during surveys in the Delta Saloum in Senegal and the waters of north-western Guinea during 2021 and 2022, and are intended to be adapted for use in other survey locations. As such, users can add their own maps, and adapt text and equipment lists etc. to suit their own survey locations and conditions. Sections highlighted in yellow are intended to be adapted for each survey site.

These protocols are written in a brief and accessible style so that they can be easily translated and used to train teams in the field and serve as a reference for trainees when they set up their own surveys in new locations. These written protocols will be accompanied by power-point presentations that will be shared with trainee participants before vessel surveys begin. These presentations (available in French and English) will include more background, context and rationale for the protocols, as well as more detailed information on cetacean biology, ecology and species identification.

For more extensive background on survey objectives and priorities identified by the CCAHD for field surveys, capacity building, and passive acoustic monitoring, please see the CCAHD Short- and medium- term priorities report, and especially the annexes with the detailed reports from Working Groups 3 (field surveys) and Working Group 8 (Acoustic surveys). This field survey is also designed to address some of the objectives of Working Group 2 (outreach and capacity building), and Working Group 10 (coastal development).

OBJECTIVES:

The main Objectives during surveys will include:

Vessel surveys:

- Documenting distribution and relative abundance of *Sousa teuszii* (*S.t.*) by recording survey effort and tracks.
- Establishing or augmenting the photo identification catalogue for *S.t.* by photographing the dorsal fins of individual dolphins encountered. As it grows over time, after multiple sampling surveys, the catalogue will be used to generate absolute abundance estimates, and, where possible, to understand dolphins' movements, range, residency patterns and social structure within the study area.
- Capacity building for range-state scientists to gain hands-on experience in cetacean survey methodology.
- Collection of data to allow modelling of *S.t.* habitat preferences through recording of salinity, turbidity, depth and temperature at regular intervals during survey transects as well as at the location of each *S.t.* observation.
- Recording and mapping of other wildlife observations, including dolphins, manatees, turtles, fish, etc.
- Recording observations of human activity that may impact the dolphins or their habitat, including fishing activity, aquaculture, vessel traffic, mangrove clearing, etc.

SURVEY DESIGN: PLANNED TRANSECTS

Survey transects should be designed with the aim of obtaining even survey coverage of the targeted study area (e.g. Buckland et al., 2001), while striking a balance with practical considerations of vessel range and logistics of accommodation etc. Ideally transects should be designed so that they would allow estimation of abundance using standard line-transect methodology (as adapted for coastal, estuarine and riverine habitats) (e.g. Thomas et al., 2007; Dawson et al., 2008; Minton et al., 2011; Minton et al., 2013; Williams et al., 2017). However, for the first surveys conducted in each study area, training objectives will focus on simpler protocols that will allow scientists to master documentation of relative abundance and collection of environmental and photo-identification data before adding the more robust survey protocols required for absolute abundance estimation using the software DISTANCE.

Survey tracks should be planned well in advance of the planned fieldwork, and use all available maps and resources available to plan transects that: 1) use available information on confirmed AHD sightings or suitable AHD habitat to guide the selection of the survey area; 2) cover the area of interest as systematically as possible; and 3) are practical and feasible in relation to the distance that can be covered by the available vessel each day in the number of days available (which may be determined by the available budget for boat rental, fuel, accommodation etc.). The actual survey design will also inevitably be dictated by local geography and topography.

In the Delta Saloum in Senegal, for example, survey tracks have been designed to replicate the survey effort from the study conducted by Weir (2016). The survey, which was conducted over a period of roughly 3 weeks, covered most of the main inland mangrove channels of the Delta Saloum, as well as the nearshore coastal habitats surrounding the Delta. Google Earth imagery, which shows mangrove channels and sandbanks more accurately than most of the basic shapefiles available for GIS systems, was used to determine which channels are likely to be navigable. Channels were considered narrow enough that observers would be able to detect animals anywhere in the channel by navigating the mid-line of the channel. Waypoints were placed at the start-and endpoints of the channels to be navigated, as well as every 'junction' where channels crossed. Waypoints for the coastal transect follow a 'zig-zag' or 'sawtooth' pattern extending roughly 5km offshore, within the 20m contour line. During the course of the survey, the team works systematically through all the transects, plotting each day's tracks and sightings on Google Earth or a GIS system, and planning the next day's itinerary (detailing the sequence of waypoints to be followed).

Figure 1: Example of transects designed for *Sousa teuszii* surveys in Senegal.

By contrast, for the Guinea survey in June 2022, a total of 23 transects were planned, with a total length of 284.75 km, in addition to haphazard (non-systematic) surveys in inner channels. In this region, very shallow waters extend relatively far from shore, extending the suitable AHD habitat further offshore. Transects were designed to obtain even survey coverage of this area, while taking into account possibly changing morphology of the area (sand-banks and islands), and the range of the vessel from planned accommodation/survey bases. The planned transects are based on an assumption that roughly 7 hours per day will be spent on transects, and that transect speed while on effort will typically be 12-20 km/h (this may depend on the vessel used, the local sea conditions and distances to be covered), with some possible 'transit at speed' to and from the start or end of transect legs that are further from the accommodation/vessel mooring point. In general, teams should plan on surveying a maximum distance of 70-100 km per day, with total distance covered in a day reduced in proportion to the number of dolphin observations that are made, when time is spent with dolphin groups to collect photo-identification and habitat data.

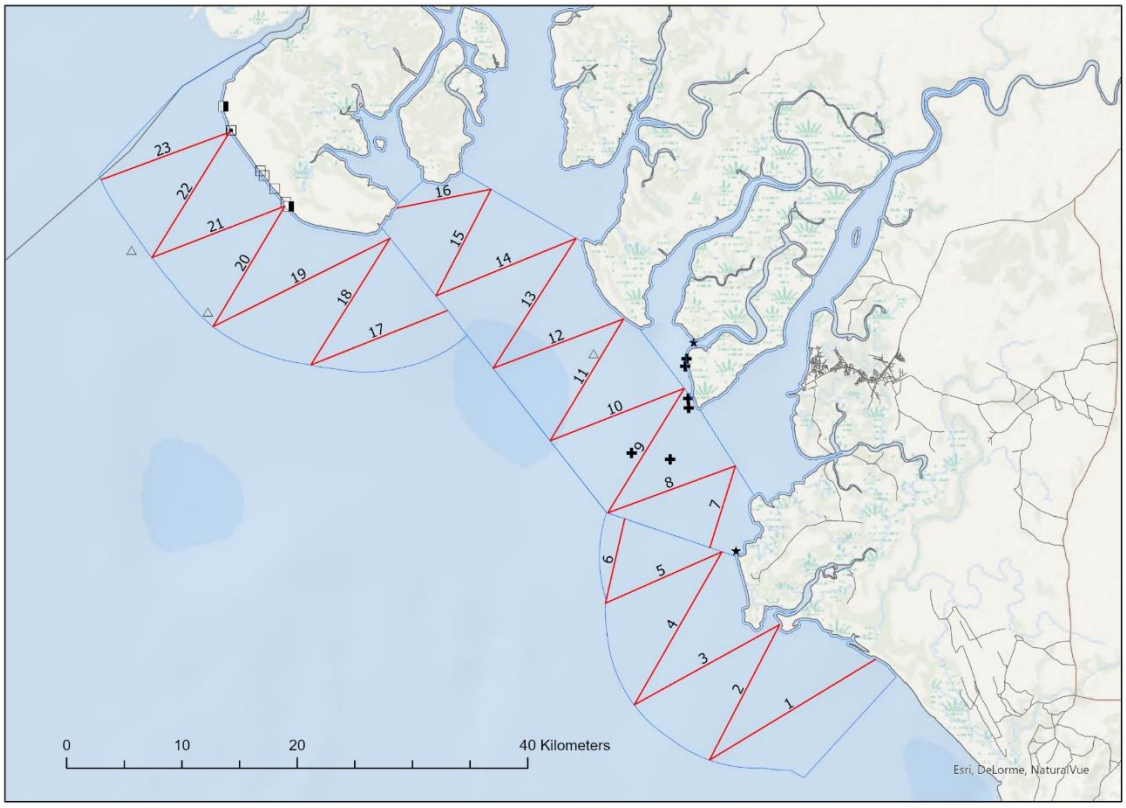


Figure 2: Example of transects designed for *Sousa teuszii* surveys in Guinea

In areas such as Gabon and Congo, where AHD habitats comprise open exposed coastline, dolphins typically occur in waters of less than 20 m, and in some areas this constrains animals to a relatively narrow band extending approximately 2 km from shore. Trying to sample this area in an unbiased way (for instance by designing transects) tends to lead to very low encounter rates and thus attempting to generate an estimate of abundance using distance sampling is impractical, and likely to necessitate considerable effort. It is thus preferable to survey 'transects' that run parallel to (and follow) the shape of the coast, with one transect at approximately 300-500m from shore and a second at 1-1.5km from shore. This is often considered undesirable in standard line-transect surveys, but makes sense in the case of AHD in such habitats. These transects are surveyed as a 'round-trip,' with the boat surveying one of the transects on the outbound journey and the other surveyed on the return journey. However, the order in which they are surveyed should account for tides, other subsurface hazards, swell direction and glare. Surveying in this way ensures that effort is focused on habitats that are likely to be utilised by the dolphins, and once dolphins are encountered, the team can switch to photo-ID and other focused data collection activities. As with other survey types, effort on open coastlines needs to strike a balance with practical considerations of vessel range, anchorages and other logistics. There are several hazards associated with surveys on open coastlines that also need to be factored into survey planning, especially in areas that are exposed to swell or significant wave action. Having a skipper and/or crew that are familiar with the particular stretch of coast to be surveyed is a good idea (this applies to all types of study areas). Many inshore areas have submerged hazards that can damage boats and put survey teams in danger. The dolphins frequently occur within waters that are very close to shore, and approaches with a boat need consider the risks associated with waves and swell direction. In many regions the calmest time of day is typically the morning, so it may be more practical to bring the boat in closer to shore on the outbound leg when waves are smaller and then to increase the distance from shore on the return leg when waves are larger.

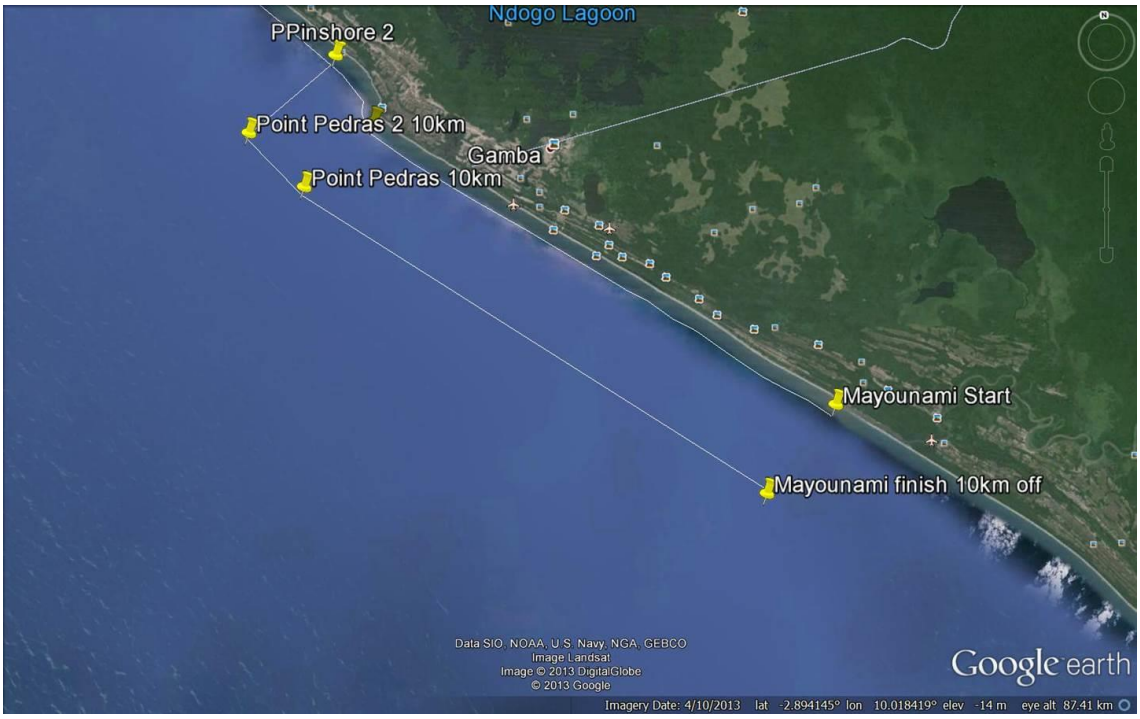


Figure 3: Example of transects designed for *Sousa teuszii* surveys in Gabon. Note that the offshore return leg is further offshore than would be expected for S. teuszii habitat, because survey objectives included documenting humpback whales and offshore oil installations located approximately 10km from the coast.

DAILY PROTOCOL – TIMINGS AND CHECKLISTS

DAILY SCHEDULE

Timing: Generally, it tends to be calmer during mornings with wind speeds increasing in the afternoon around 2-3pm. As such, it is best to start early and ensure that as much survey effort can be achieved as possible during the first part of the day. The boat should leave early (e.g. at 7:00) each morning. As such, the survey team should be ready with equipment packed and prepared by 6:50 each morning. The route for the day must be communicated to the boat driver and other team members the day before to allow accurate planning for fuel and permissions if required.

Surveys can continue until approximately 1 hour before sunset (e.g. 5pm) each day as long as weather conditions permit in order to maximise the opportunity of having mobilized a team and secured a vessel.

Upon return to accommodation/base survey teams will allocate tasks of data download and entry (see section DATA DOWNLOAD AND ENTRY) and equipment cleaning and preparation for the following day.

SAFETY PROTOCOL

This Section should include:

- text on particular dangers/safety issues in the survey area, including COVID 19 precautions or other relevant/topical issues
- telephone numbers for rescue services, and numbers and locations for the nearest hospitals.
- "float plan" - details of a journey management system, by which someone who will remain on land is informed of the planned survey track for the day, and agrees to notify emergency services if the crew does not return and check in at an agreed hour at the end of the day. This can be enhanced by a GPS tracker on the boat that can be transmitted to, and followed by a designated person on land.
- Boats used should adhere to good safety standards, including hull integrity and reliable and well-serviced engine(s), and should be able to travel up to 100km per day. Ideally, they should be 5.5 – 10m in length and able to accommodate a minimum of 5-6 people and substantial equipment. Longer vessels could also be used if maneuverability is not compromised. As much as possible, boats should have shallow draft, suitable for navigating in waters as shallow as 1.5-2m. They should have a good viewing platform/deck for a minimum of 2-3 observers who should have an unobstructed 180 degree view in front of the vessel (up to 90 degrees port and starboard). Searching for this inconspicuous species from inside a wheelhouse or cabin, for example, will greatly reduce chances of observations. The deck should include stable flat surfaces for researchers to stand while photographing animals. Ideally, the boat should have a canopy to provide some protection from the sun during long hours at sea.
- Safety equipment should include personal flotation devices life jackets, first aid kit, tool kit, communication devices (mobile phone and/or radio, depending on how reliable mobile phone signals are in the survey area), several litres of spare water, spare cash or other means to pay for emergency transport of personnel, towing of vessel, or emergency repairs, and, if possible, flares or other devices used to attract attention in an emergency. Ideally, an SOS emergency transmitter should also be onboard. Ideally, mobile phones should be placed in waterproof casings.
- Life jackets should be worn while on the boat, by everyone on board regardless of swimming ability.

- Participants should prepare for strong sun for 8 hours a day and wear hats, clothing to cover arms and legs, sunglasses and sunscreen.
- The weather should be constantly reassessed, and surveys should be terminated in case of thunderstorms or deteriorating/rough water conditions.

EQUIPMENT CHECKLIST: PRE-DEPARTURE (TO BE ADAPTED FOR EACH SPECIFIC PROJECT)

- CCAHD BLACK PELICAN CASE: Contains two photo-ID cameras – 1. CANON EOS 5D Mark IV with 100-400mm zoom lens and 2. CANON EOS 90D with 70-300mm zoom lens – as well as OSMO Action underwater camera with extension stick. Spare batteries and memory cards are also there.
- CCAHD BLACK PELICAN CASE: Contains two GPS units Garmin GPSMap 78sc, binoculars, depth sounder, clipboard with datasheets, backup refractometer, and spare AA and 9V batteries.
- YSI METER CASE: Contains the YSI instrument.

PRE-DEPARTURE CHECK LIST (To be adapted for each specific project – and to be read out each morning before boarding)			
Equipment item	**Purpose**	**Accessories**	**Checklist for start of day**
Handheld Garmin GPSMap 78SC	For boat driver to navigate transects	Spare AA batteries (x4)	Ensure that the unit was properly downloaded the previous evening before ensuring the following: • Track log empty (set to fill, not wrap) • Trip log reset to zero (read the manual if uncertain how to do this) • Critical waypoints available (home/base, start and end points of transects, key navigation marks, for transect start and end points) • Batteries charged or changed
Handheld Garmin GPSMap 78SC	For data collector to note time, waypoints of observations and effort etc.	Spare AA batteries (x4)	Ensure that the unit was properly downloaded the previous evening before ensuring the following: • Track log empty (set to fill, not wrap) • Trip log reset to zero (read the manual if uncertain how to do this) • Critical waypoints available (home/base, start and end points of transects, key navigation marks, for transect start and end points) • Batteries charged or changed
Canon EOS 5D Mark IV and 100-400 mm zoom lens	For principal photographer to obtain photo-identification images	Spare battery, hood for lens, lens cleaning equipment, spare CF cards	• Ensure that these cards were properly downloaded before formatting • Format cards so empty with lots of memory • If more cards are available then add them to the box as well
CANON 90D with 70-300 mm zoom	For trainee scientists to practice taking photo ID images	Spare battery, hood for lens, lens cleaning equipment, spare SD cards	• Ensure that these cards were properly downloaded before formatting • Format cards so empty with lots of memory • If more cards are available then add them to the box as well
Hand held depth sounder	To measure depth at observations	Spare batteries	• Wiped clean and dry
Binoculars	To confirm sightings in the distance and/or scan horizon		• Clean lenses
Clipboard and datasheets	To record data throughout the day and consult for tracks/orientation	3 Sharpened pencils or mechanical pencils	• Effort and observation sheet (see ANNEX 1 – a minimum of 3 pages) • Marine Mammal Sighting sheets (See ANNEX 2 - 15 copies) • Water quality data sheet • Laminated map of study area and tracks • Emergency numbers

EQUIPMENT CHECKLIST: END OF DAY

END OF SURVEY DAY CHECKLIST (To be adapted for each specific project and checked before bed each evening)			
Equipment item	**Purpose**	**Accessories**	**Checklist for end of day**
Handheld Garmin GPSMap 78SC	For boat driver to navigate transects	Spare AA batteries (x4)	• Wipe down with damp cloth to remove salt spray • Check battery level and ensure waypoints for next day are uploaded.
Handheld Garmin GPSMap 78SC	For data collector to note time, waypoints of observations and effort etc.	Spare AA batteries (x4)	• Wipe down with damp cloth to remove salt spray • Check battery level and download waypoints and tracks to project laptop (see protocol below) • Review waypoints and tracks in Garmin Basecamp BEFORE deleting from unit. • Delete/clear all tracks and waypoints ready for the next day. • Copy waypoint and tracks to external hard drive.
Canon EOS 5D Mark IV and 100-400 mm zoom lens	For principal photographer to obtain photo-identification images	Spare battery, hood for lens, lens cleaning equipment, spare CF cards	• Wipe down camera with damp cloth, ensure lens is clean • Download photos to project laptop (see full protocol below) • Backup photos to external hard drive • Format CF cards so they are empty and ready for next day. • Charge batteries
CANON 90D with 70-300 mm zoom	For trainee scientists to practice taking photo ID images	Spare battery, hood for lens, lens cleaning equipment, spare SD cards	• Wipe down camera with damp cloth, ensure lens is clean • Download photos to project laptop (see full protocol below) • Backup photos to external hard drive • Format SD cards so they are empty and ready for next day. • Charge batteries
Hand held depth sounder	To measure depth at set points during transects and at every cetacean or manatee observation	Spare batteries	• Wipe clean with damp cloth and dry. • Ensure spare batteries ready for next day
Binoculars	To confirm sightings in the distance and/or scan horizon		• Wipe clean with damp cloth and dry. • Use lens cloth for lenses if needed.
Clipboard and datasheets	To record data throughout the day and consult for tracks/orientation	3 Sharpened pencils or mechanical pencils	• Enter Effort and sightings and water quality data into Excel sheets on project laptop (see full protocol below) • Load clipboard with new datasheets • Sharpen pencils

DATA COLLECTION IN THE FIELD

At the start of each day, team members will be assigned a role or primary responsibility. During training surveys, trainees will cycle through all of the roles in order to gain experience in all aspects of the survey. During survey effort, team members will rotate through observer positions and rest/data transcribing positions, depending on the number of team members available.

EFFORT, WEATHER AND GPS DATA

Minimum survey effort that can be replicated in *S.t.* surveys throughout the region should involve two observers, who actively search a 180 degree arc forward of the vessel and to 90 degrees on either side. If more observers are available, three observers can be actively engaged in search effort. Ideally, an extra team member will be 'off effort' and will be responsible for recording effort data and sightings. Team members will rotate through the different observation positions and the off effort position in order to avoid fatigue. Rotations could occur at fixed time intervals (e.g. every hour) or at the start and end of transect legs, whichever is deemed most practical. The team will be considered 'on effort' when team members are in position, actively searching, and the vessel is navigating a pre-determined transect at a fixed speed (12-20 km/h, depending on the vessel, local sea conditions and distance to be covered).

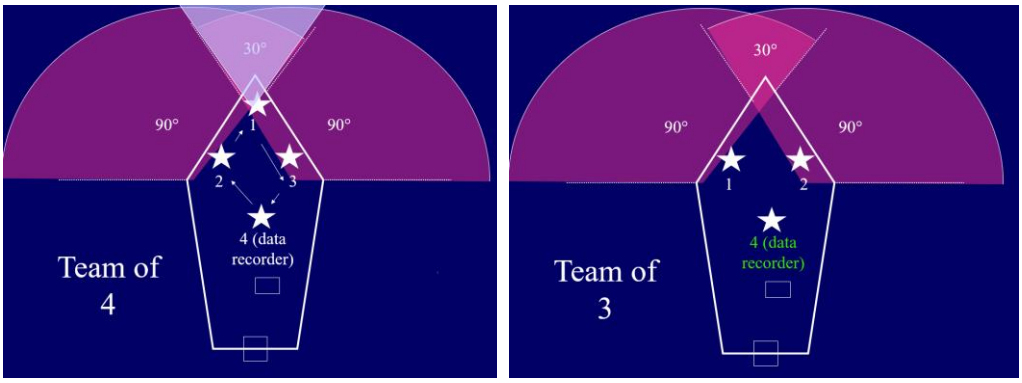


Figure 4: Positions for team members during observation/search effort.

Accurate effort data are incredibly important in scientific survey work – in any field. Put simply, effort data allows you to draw meaningful conclusions about where animals are less likely to be seen (e.g. where you have searched and not observed animals) as well as where they are more likely to be seen. Data are recorded in an effort log and will include details such as sightings, changes in survey conditions, whether the team are actively searching for animals or not, whether they are actively following animals, whether they are on a break, in transit or conducting some other experiment. Effort logs are also useful for recording other incidental pieces of information, such as sightings of non-target species or fishing boats.

The effort log (Annex 1) should be completed accurately using the same hand-held GPS to record time, waypoints, and trip odometer values. You will record every major research event/activity. What does this mean?

- At the end of the day, you should be able to reconstruct (broadly) what the boat and team were doing by referring to this sheet.

- Because this is categorical data, we try to limit the descriptions of these events to as few standardized categories as possible. These are listed at the bottom of each sheet as a reminder, but you will quickly memorize them.
- These data should always be linked to the GPS – this includes waypoints for every event recorded and all times should be synchronized to the GPS.
- Waypoints should be recorded in DECIMAL DEGREES

Effort data begins the moment the vessel leaves the dock, anchorage or slip. In most circumstances you will not immediately launch into a search for dolphins but recording the amount of time between departure and the start of survey work is very useful for logistic purposes (for instance estimation of fuel consumption/distance and transit time/distance). We have not included an event code for the departure, but the same word can suffice for both departure and return (something like dock or jetty will do).

Event Code	Description
SE	*Search start*. The moment when you begin to actively survey in a structured manner – this means that team members are actively searching for animals. It is assumed that searches are made on fixed bearings and at fixed speeds (typically 12-20km/hr), even when transects are not being searched
WP	*Waypoint of Turn.* Noted when the search bearing changes
CO	*Confirmation of Sighting*. This is recorded when a suspected or confirmed sighting has been made and the vessel has altered course to intercept it/investigate. Not all 'sightings' will be located; when this happens the vessel will typically switch back to either SE or RT mode. All sightings (whales, dolphins, turtles, rays) can be recorded under this event code.
BG	*Begin Group:* This is the point at which the vessel stops its approach to the animals and a waypoint is taken to record the closest position possible to the group. Typically this is where photo-ID efforts also begin.
EG	*End Group:* This waypoint/event denominates the moment at which the team stops working with one group of cetaceans and resumes a different activity.
BK	*Break.* Any time the vessel stops to give the team a break (lunch, drink, phone or pee stop) or if tidying up biopsies.
RT	*Return to Track.* Typically reserved for line transect work, but can be useful if returning to a fixed course following a false CO
SP	*Speed/Transit.* Not all search effort (SE) begins at the beach or the point of departure. Similarly, not all search effort ends at the dock or jetty/beach. SP is recorded when the boat is transiting, usually at higher speeds. Sightings can be recorded during SP's but may not be used in some analyses of encounter rates or relative abundance.
AC	*Acoustic station:* This denotes time spent either deploying, maintaining, or observing one of the passive acoustic monitoring devices
YSI	*Water Parameter measurements:* This indicates that the boat is drifting to take measurements of depth, temperature, salinity and turbidity.

1. Our effort and cetacean sighting sheets include other important fields (columns). These include:
    a. **Speed** – record the speed of the vessel during search effort, transit to and from start/end points, etc.
    b. **Trip** – this is to record the 'odometer' or 'trip log,' a standard feature on most modern GPS units. The trip log records the distance travelled by the GPS unit (and thus the boat) and is very useful

for generating quick sums at the end of the day and at the end of the season. Teams must reset this log at the start of each day (see the GPS section below for this routine).

c. **Sighting number** – this is recorded for **marine mammals only** and is sequential through the day, always starting at 1.

2. **Weather data** is also recorded on the effort sheet and comprises 3 fields:
   a. **Beaufort Sea State** – a standard scale of sea and weather conditions. See Annex 3.
   b. **Swell** (estimated height in metres) – this can be a little bit subjective. We typically nominate one person on board, usually the skipper, to always determine this.
   c. **Visibility** – this is a subjective scale and used to search given the air quality (hazy or clear), availability of light, rain, sea spray etc. Your ability to see the shore from the boat is a good gauge. A score of 1 is used when the visibility is very poor; a score of 5 is used when visibility is excellent, typically the sun is out.

GPS

Team members are expected to understand how a handheld GPS functions. Team leaders can provide training and manuals are provided for each unit (or can be downloaded from the internet if not). However, there are some pertinent things to learn and remember: team leaders can customize hand held GPS units to suit their purpose. You can customize the data shown on various screens and modify their formats. We typically set the units up to show the time, the bearing, the location (decimal degrees), the trip log, the speed and the battery meter. The GPS is always running on a dolphin research boat. To ensure this you must either plug it in to the 12V connector (cigarette lighter) using an appropriate adapter, or ensure that you have a good supply of batteries, typically AA. The GPS settings should include the following:

1. Tracklogs
   a. The tracklog must be downloaded at the end of each day and the tracklog must then be erased.
   b. Tracklogs should be set to record a position at least once every 10-30 seconds. Do not allow the GPS to automatically define the time interval. These units can record 10,000 points, so you are in no danger of filling the memory.
   c. Tracklogs must be set to **FILL** and not WRAP.
2. Waypoints
   a. Waypoints should be downloaded at the end of each day and then erased. If you wish to save a set of waypoints on the unit for transect navigation and safety purposes, then these should be saved as a stand-alone GPS file (gpx format) on the desktop that can then be uploaded each night once waypoints have been transferred.
   b. Each event recorded on the effort log should include a waypoint. This may seem excessive but will become second nature.
   c. All devices with a clock (cameras, videos, watches) should be synchronized to the GPS. Check this every few days to make sure things that clocks are still closely allied. This has a bearing on the quality of recorded data and how it all links.
3. You need to find and learn how to use the GPS 'Trip Log' function. This is a setting that allows the GPS to record the distance travelled since the start of the 'trip.' This can be used at the end of the day to calculate not only total distance covered, but distance on effort and sightings per unit of effort. It can also be used by skippers/pilots to assess fuel consumption and fuel needs.
4. Check the GPS often! Batteries can run out.
5. Ensure that the GPS has an unobstructed signal – putting it in a pocket usually doesn't work.

CETACEAN ENCOUNTERS

When we see a cue that indicates the presence of dolphins or manatees, we will note a "CO" on our Effort sheet, and leave our planned transect to try and approach the animals. We will use the "Cetacean Sighting Sheet" (see Annex 2) to record details of the dolphin group – including the estimated number of individuals (minimum, maximum and best estimate) and the group composition (mixed adults and calves, adults only, etc.). Sightings are numbered sequentially throughout the day, regardless of cetacean species.

On first approach to a group of dolphins you should distinguish the following (usually accomplished very quickly):

- What is the species (refer to this regional ID guide for help, and these two fact sheets to help distinguish between *Sousa teuszii* and *Tursiops truncatus*)
- How many individuals are there?
- Are they all adults or are calves and/or juveniles present?
- What is the predominant behaviour/activity?
- Are there any particular associations between individuals that stand out?
- Is there any notable human activity in the immediate vicinity? If yes, then is their behavior related to that of your group?
- Are there any other associated fish, bird or marine mammal species?

PHOTO-IDENTIFICATION

CAMERAS

We traditionally refer to the cameras as the "babies of the project" and we encourage you to maintain this idea, silly as it might seem. The data they collect (time-stamped, photo-id and biopsy confirmation images, video of key behaviours, etc.) is critical to almost everything we are trying to accomplish. They are also expensive, and need to be treated with a lot of love.

The project will use 2 Canon EOS cameras, 1) a 5D MARK IV with a 100-400mm zoom lens for primary photo-identification; and 2) a Canon EOS 90D with a 70-300mm zoom lenses for trainees. We encourage everyone to become familiar with their operation and maintenance. In particular read the "Handling Precautions" page in the manual. Cameras should stay in their pelican cases unless they are being used or cleaned. Keep them dry.

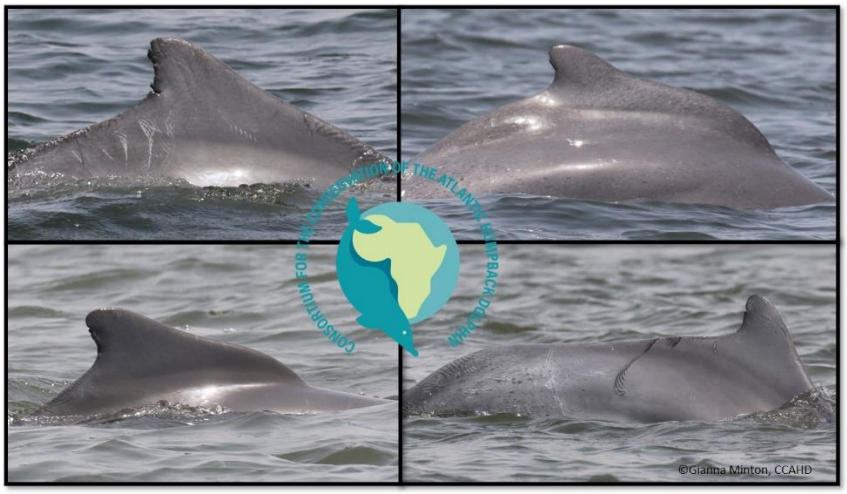
GENERAL RULES FOR PHOTO-ID

1. Be patient.
2. Watches and cameras should all reflect GPS time
3. Don't start taking images as soon as you see things. Take a minute or two to assess how many dolphins are in the group, if they are on different sides of the boat, etc.
4. Precision AND detail are essential when recording these data and are critical for future analyses.
5. The lead scientist should direct the boat driver in the best approach and maneuvering around dolphins. In many cases the driver may have a natural feeling or experience for knowing where animals are, and where the boat should be. However, boat drivers with less experience working around dolphins will need guidance during the first few surveys.

6. Talk to each other during encounters, call out the numbers of key photo frames that the data recorder can note in the sighting sheet – e.g. a mother and calf, an individual with a distinctive scar.

TAKING ID-PHOTOS OF SOUSA TEUSZII

1. Photos for identification – try to make sure that at least one 'good' photograph of each of the following is obtained for **each animal in each group**, well framed, **perpendicular to the feature**, with the feature central to the image.
    a. Left dorsal (LDF)
    b. Right dorsal (RDF)
    c. Any unusual injuries, scars, or marks on other parts of the body.



Individual humpback dolphins can be recognised by the nicks and scars on their dorsal fins, through a process called photo-identification. (*photos taken in the Saloum Delta, Senegal*)

2. Try to be selective in the images that you take, as more images will take more time to process. At the same time, take each opportunity that you can to photograph as many body parts of each individual as you can.
3. Make sure the exposure settings work and do it often – check images frequently on the review screen.
4. Blanks: A blank is a picture or a sequence of pictures of standard *objects that would not otherwise appear in your images* to separate worked groups. For example, you can take 3 images of the bow of the boat or a camera box to separate worked groups (make sure you take blanks at the beginning of each sighting). You can also take a photo of the completed sighting form at the end of each sighting, as an additional blank, which also serves as a back-up for the data on the form.

5. Keep the camera dry!

CAMERA SETTINGS FOR DOLPHIN PHOTO-ID

1. We **do not** shoot ID photos with the camera in either of the Automatic modes. Images are to be shot in either aperture or shutter priority modes. One major reason for this is that we need to capture a decent **depth-of-field**.
2. However, the lens is kept on AF – autofocus, and the stabilizer setting is kept on mode 1
3. Use the lens hood provided – this keeps the glass dry (light rain and occasional splash).
4. The UV filter (clear glass insert) should always be on the lens. The only exception is when you are using the polarizer – the reason is simple; scratching the filter is a lot less expensive than scratching the glass. You will lose nothing in image quality as long as everything is kept clean.
5. There is lots of light in Central and West Africa – even when there is lots of cloud. Generally speaking you want to keep the shutter speed up around 1000 or higher - in full sun this can be up around 3200. The camera will resolve the ideal aperture size.
6. You can improve the balance of shutter, aperture and light requirements by playing with the ISO speed – in full sun ISO 100 works well, but these cameras are also excellent at a wide range of higher ISO speeds. However, try not to go over ISO 1000 for ID shots as it starts to introduce graininess into the image.
7. Autofocus mode is typically kept in AI Servo mode.
8. The drive mode is usually set on high. However, be aware that the 5D has a decent frame rate, and that millions of images will take more time to download and process in the evening (more on this below).
9. Make sure the camera is set to dual JPEG/RAW mode.
    - RAW: 18M 5184 X 3456
    - JPEG: 4.5M 2592 X 1728
10. This will use up card space quickly, but you have at least two 128GB cards and we rarely take more than 900 images per day. However, if you are finding that you are filling the buffer too quickly (and thus unable to shoot during critical moments) or need more space for video then you can turn off the JPG function. Remember that we use these images to sell the project to donors who can ensure the continuation of fieldwork. They appreciate decent images for reports and websites etc.
11. Light conditions in Central and West Africa can be very difficult. When shooting ID-Images against the sun (images are back-lit – see below for an idea) you will need to play with the 'exposure-compensation' settings. This can be accomplished in a few ways.
    - By pushing the button with the +/- symbol and increasing by anywhere from 1/3 to 1 full stop in bright sun
    - By using shutter priority and then forcing the aperture to open wider than the camera suggests (the inverse also works)
12. The camera has a 'live-view' photography mode – don't use this on the boat as it consumes battery and lifts the mirror, exposing the sensitive CCD underneath.
13. Make sure you use the review functions to figure out how your images look – remember that they sometimes look under-exposed on this little screen because of ambient light conditions – be sure not to over-expose as a result.
14. If playing with settings try to remember to put them back onto something generic once complete – forgetting to do this can make a mess of subsequent ID photos.

WATER PARAMETER SAMPLING (TO BE ADAPTED TO LOCAL PROJECT)

Sampling of water parameters/ habitat characteristics will allow us to describe the characteristics of the environment where *S.t.* are observed, as well as the areas where they are not observed. With a large enough sample size of data associated with both presence and absence, we can start to draw some statistically significant conclusions and conduct habitat modelling to help us predict where the species may be found in areas that have not been surveyed, and also to understand how any changes to the environment that might be caused by coastal development or climate change could impact the species.

Water sampling will be conducted at set points during each transect leg and at the location of each dolphin observation using the data collection sheet in Annex 4.

The following parameters will be measured using the following tools (Adapt according to equipment available for your project):

- **SST** – Sea Surface Temperature - this is recorded by the hand-held depth sounder and the YSI unit.
- **Depth** – this is recorded using either a boat-mounted GPS/depth sounder if the survey vessel has one, or with a hand-held depth sounder at the start and end of every transect leg as well as at the location of each dolphin sighting.
- **Salinity**: is measured by a hand-held refractometer and/or a the YSI unit (if available). See this video for a demonstration of how salinity is measured with a refractometer:
- **Turbidity**: is measured using the YSI meter (if available) or a Secchi Disk. See this video for a demonstration of how a Secchi disk is used to measure turbidity.

DATA DOWNLOAD AND ENTRY

Equipment should be cleaned, batteries put on charge, and data downloaded and entered at the end of every day before team members go to bed. This can sometimes make for late evenings, but it is essential for two reasons: 1) The GPS and Camera need to be cleared and batteries changed/charged and ready for the next day's data collection, and 2) reviewing the day's data at the end of each day allows for quality control and corrections of any inconsistencies between GPS, camera and effort data when it is still fresh in everyone's mind.

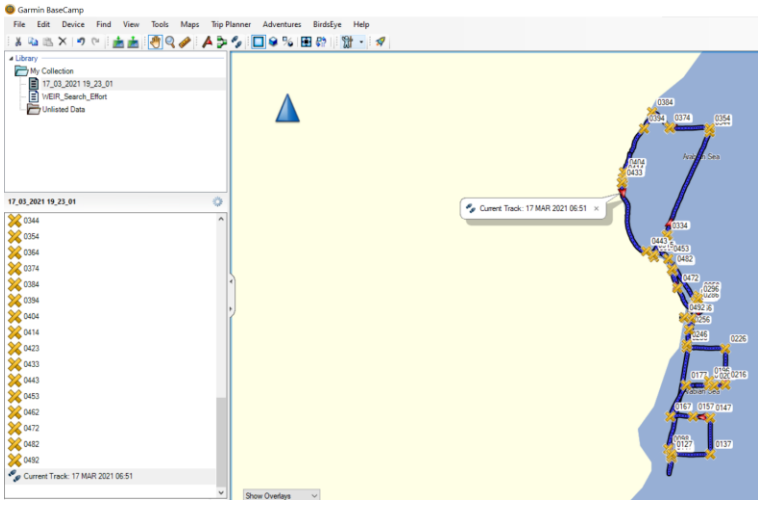
EFFORT

Transcribing the Effort datasheet into an Excel datasheet is a little tedious, but is an excellent way to perform quality control on the day's data. This is best done with a team of two people, where one person reads out the columns of data and the other types them into the standard format provided here. In the first instance, type in the numbers for waypoints associated with each event in the Effort datasheet, but leave the lat-long fields blank. We will return to these after downloading GPS tracks and waypoints (see next step).

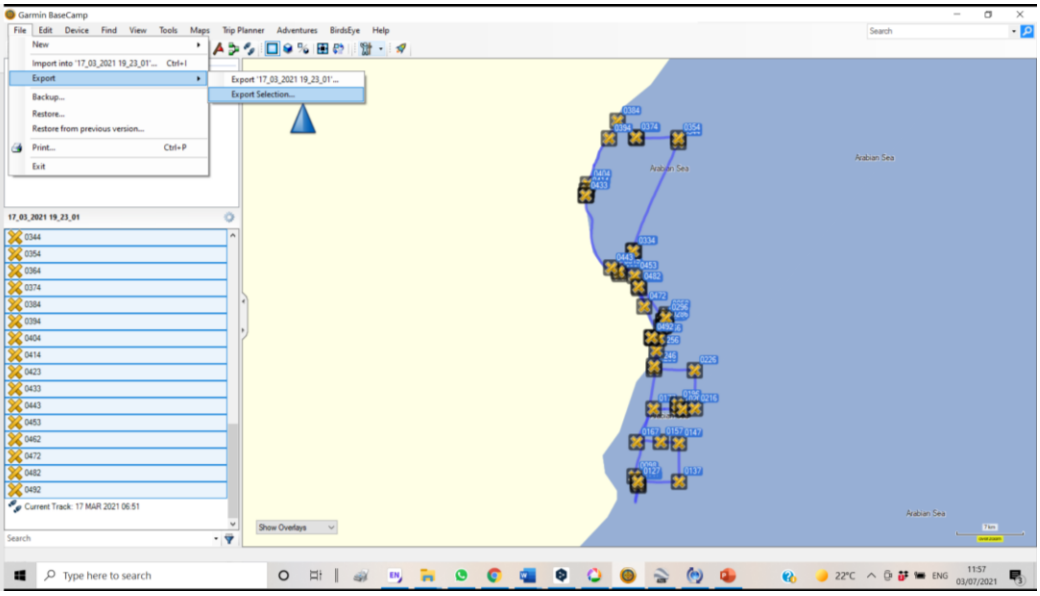
GPS TRACKS AND WAYPOINTS

Tip – this looks a lot more complicated than it is. Once you get the hang of it – it is very quick and easy!

- Open Garmin Basecamp.
- Connect GPS to laptop using correct cable. Follow instructions in Basecamp to download track and waypoints (menu item – 'Device' >> 'Receive from Device' then select tracks and waypoints). Review all track and waypoint data on the basecamp map to make sure it looks sensible and has included speed, bearing and (if appropriate for your GPS) depth data. Save the track and waypoint files as combined .gpx file using the following file naming convention and steps:
    - 20210714_GN_GPS (where 20210714 is the date, GN = Guinea (or another 2-letter survey area abbreviation).
    - You will see that the gpx file has waypoint data and track data (see screenshot below)



- Highlight all the Waypoints by clicking on the top one, pressing 'shift' and then clicking the last one. Go to the file menu in the top left corner and click 'export' in the drop-down menu, then choose the 'export selection' option:

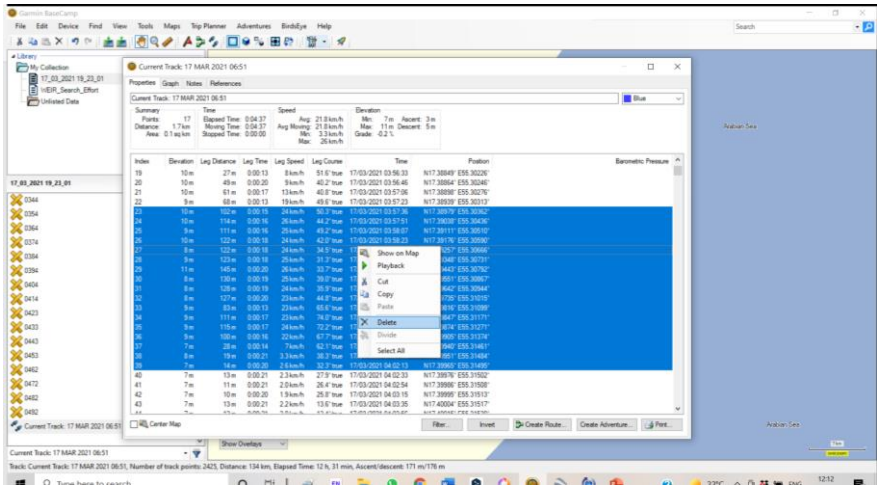


- Save the file in a CSV format so that it can be easily opened and edited in Excel and pasted into your Effort and water sampling and sightings data. Use the following naming convention: 20210714_GN_WPT.CSV
- Highlight the 'current track' file at the bottom. Follow the same steps above to export the full track as a CSV file, and name it: 20210714_GN_Fulltrack.CSV
- Double click on the current track file to reveal all the individual points of the track and associated details. You will note the time column shows the time of day for each position recorded as part of the track.
- Enter your effort data into Excel (see Effort section below). Make sure to do this before the following steps, as you may discover inconsistencies in your effort datasheet as you enter it.

VISUALISING GPS TRACKS AND WAYPOINTS

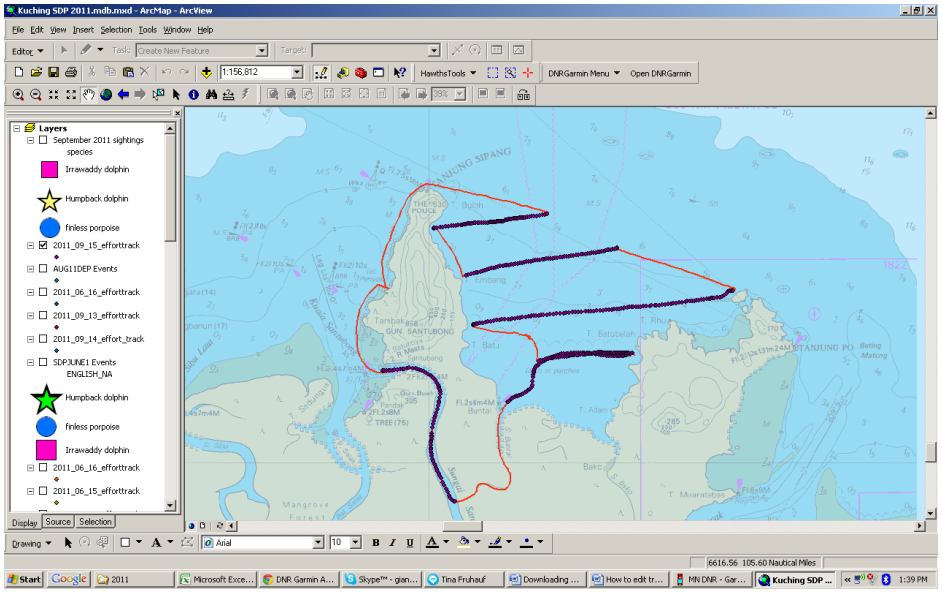
This will typically be done after the field surveys have been completed, but is useful to include here so that users can understand and visualize the difference between 'on effort' portions of track and 'off effort' portions of track. Only on-effort tracks and sightings made during official search effort will be used in calculating encounter rates and relative abundance.

- Once you have completed your effort data, return to your Garmin Basecamp track window. Expand the window by clicking and dragging on the sides and tops to make it as large as possible.
- Using the date and time data at the far right, highlight the rows of your track data from the times that you were OFF EFFORT. (Eg. Highlight all track points from the point of a CO at 10:54 to the time you resume SE at 11:20). Delete these rows by right clicking, and choosing the 'delete' X option in the dropdown menu.



- Once you have edited out all the off-effort portions of track, save your track file again as a CSV file, and also as a gpx file using the following naming convention: 20210714_GN_Efforttrack.CSV

- If you have ArcGIS, QGIS, or a similar mapping programme, you should be able to view the difference between your full track and your edited effort track by importing them both and viewing the. Below is an example from Kuching, Malaysia. In this example, ON EFFORT tracks are in purple, and OFF EFFORT are in red.

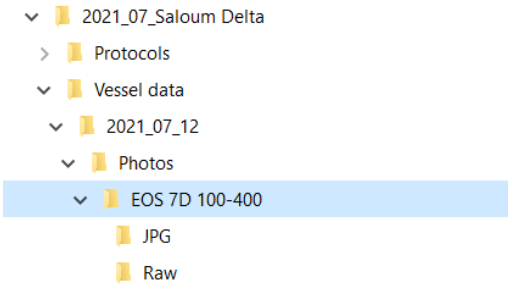


SIGHTINGS

Sightings datasheets should be transcribed into the master Excel sheet that will compile sightings throughout the survey. A template for this datasheet can be found in this Google Drive. Transcribing these data each day allows review and quality control while details are still fresh.

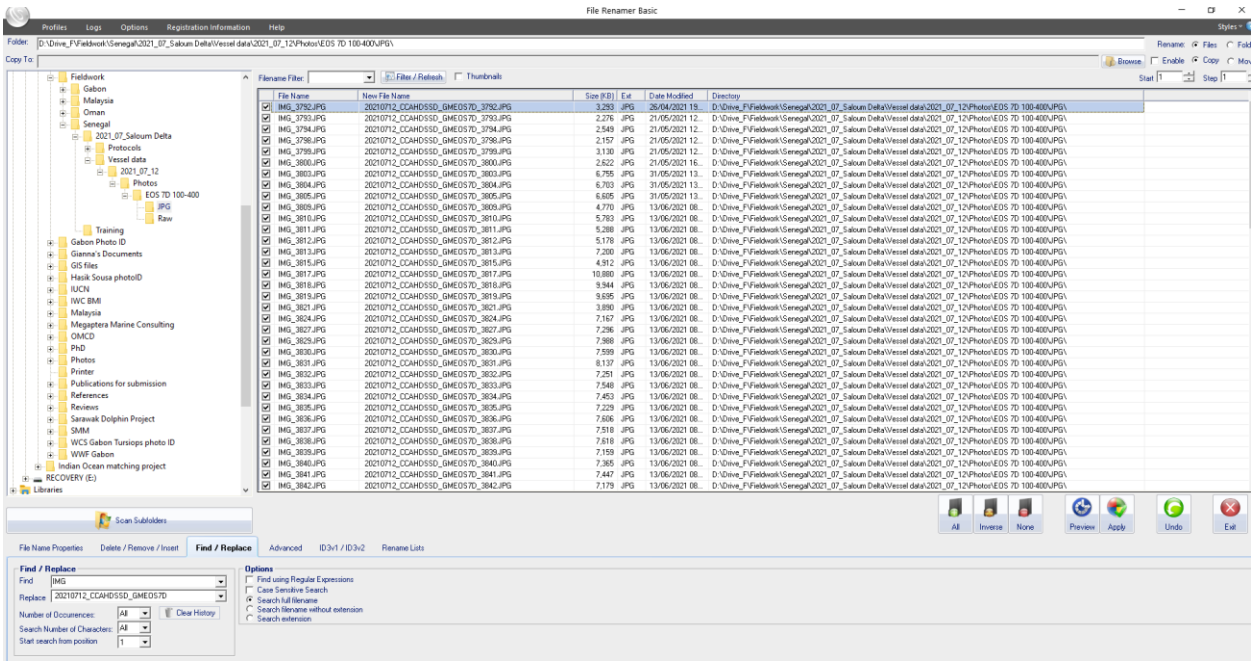
PHOTOS

Photographs should be downloaded from each camera used on the boat using a cable or card reader. They should be stored on the dedicated project laptop, and then backed up onto an external hard drive using the following folder structure and naming conventions:



Photos should be renamed in bulk, using a programme like FileRenamer so that every photo file is easily linked to the survey, survey date, camera and photographer associated with the photo:

1. Open "File Renamer". Use the left hand folder view menu bar to navigate to your newly created folder of photos for the day.
2. Highlight the group folder so that all the image files appear in the main table on the right of the screen.
3. Choose the "Find/Replace" tab at the bottom of the screen. In the "find" field, type in "IMG" or "DSC" – whatever abbreviation your camera assigns to photo file names. In the Replace section, type in the following text: 20210712_CCAHDSSD_ TGEOS5D where:
    a. 20210712 = four digits for the year and 2 for the month and day
    b. CCAHDGUI = a four-letter code for the research project (CCAHD) or tour operator and a two or three letter code for the survey area (e.g. GUI for Guinea)
    c. TGEOS5D = a two letter code for the photographer and a three letter code for the camera (in this case, Tilen Genov Canon EOS 5D).
4. Click on the blue "preview button in the middle of the screen to preview how the change would affect all your file names, and check to make sure it looks right. If it looks ok – click on "apply". The photos should all now be renamed.



5. If you have time, look through all the photos and take notes/make drawings in a designated notebook to:
    - Make sure that each group is separated by spacer photos. If not, make a "READ ME" file in the photo folder to explain where one group starts and another group ends.
    - Try and distinguish one dolphin from another and/or earmark the best right dorsal fin (RDF) and left dorsal fin (LDF) shots for various individuals. Start to give them individual designations – a combination of a number (to correspond to the sighting group number) and a letter - starting with A for the first individual and moving up sequentially through B, C. etc. for each individual in the group. Do not worry about matching left and right dorsal fins. We will assume that we cannot match these – as our database protocol will have separate matching procedures for left and right dorsal fins.

Doing this will help you to become familiar with the individuals you have seen, and recognize them if they are seen again during the survey. However, a more systematic cropping, labeling and matching process will take place after the survey to confirm matches and build a proper photo-identification catalogue. There will be a separate manual/protocol for this process.

Deleting photos from the camera to be used the next day

6. Double check that you have transferred ALL the photos into the laptop and the hard drive. Make sure that you have transferred all the photos into the appropriate folders before emptying the memory cards.

BACKING UP TO EXTERNAL HARD DRIVE

Once all the steps above have been completed, copy across the photo, effort, sightings and water data to the external hard drive, using the same folder structure created on the laptop. The external hard drive should always be left on shore at your base, it should never be brought on the boat!

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ANNEX 1: EFFORT DATASHEET – DOWNLOAD EXCEL OR PDF FORMAT HERE

CCAHD Effort Record Date____/____/____ Vessel _____ Observers Initials_____ Page:_____of_____

Survey Objective _____ Equip Details: GPS_____Camera 1_____Camera 2_____ CTD/Secchi?

Time	Activity	WPT	Transect No.	Course (deg)	Speed (km)	Trip (km)	Beaufort	Swell (m)	Vis (0-5)	Sighting No *	Sight Bearing	Distance (m)	Best Grp Size	Observer Initials	Notes

SE- Search Effort (transect) **SP**- Search at Speed **WP**-Waypoint **BK**- Break **RT**-Return Track
CO- Confirm observation **BG**-Begin group **EG**-End Group **BP**- Begin Photo **AC**- Acoustic Station **AE** Acoustic End

ANNEX 2 SIGHTING DATASHEET – DOWNLOAD THE EXCEL FORMAT HERE

Sightings/ Occurrence Data			Date								Vessel/ Platform Code				Sheet No	
Sight no. (this boat)	Species ID	Effort level	Min	Max	Best	Initial Cue	Depth	SST	Turbidity	Salinity	Behaviour	Direc of travel (N,S,E,W, Var)	Grp Comp	Associated species	Human Activity	Notes
Effort level: 1= On 2=partial 3=O **Initial Cue:** blow, breach, dorsalfin/back, body part, fluke up, acoustic, splash, birds, boats, other, undetermined																
Behaviour: fast travelling, travelling, feeeding, probable feeding, milling, resting, socialising, surface active, mixed behaviour, undetermined.																
Group composition: mother-calf, mother calf escourt, mother calf multiple escourt, competative group, pair, singleton singer, non-competative.																
Human activity: Nets, traps, fibreglass skiffs, recreational boats, fishing dhows, cargo vessel/ tankers, seismic surveys, whale watching, none, other.																

CCAHD Cetacean Sighting Recording Form

DATE	Stg #	TIME	Boat wpt (at time of stg)	Stg wpt (after approached)	DEPTH (m)	TEMP (SST)
Bearing transect	Bearing dolphin	Distance to stg (m)	Sea State	Observer		

INITIAL SIGHTING CUE

- ❑ Dorsal fin/back
- ❑ Blow
- ❑ Fluke
- ❑ Splash
- ❑ Breach
- ❑ Fishing boats
- ❑ Birds
- ❑ Other _____

NUMBER OF INDIVIDUALS

Best estimate

Maximum estimate

Minimum estimate

EFFORT LEVEL

Sighted during:

- ❑ On effort (1)
- ❑ Sub-optimal (2)
- ❑ Off effort (3)

SPECIES

Genus
Species

SIZE

Avg. (adults) _____ m

Min (calves) _____m

APPEARANCE

BEHAVIOUR

- ❑ Feeding
- ❑ Probable feeding
- ❑ Fast swimming
- ❑ Moderate swimming
- ❑ Slow swimming
- ❑ Surface active
- ❑ Traveling
- ❑ Resting
- ❑ Milling
- ❑ Mating/sexual
- ❑ Undetermined
- ❑ Other _____

GROUP COMPOSITION

- ❑ adults only
- ❑ mixed age classes
- ❑ juveniles
- ❑ unknown
- ❑ mother/calf
- ❑ single animal

---------Number of Calves

HUMAN ACTIVITY

- ❑ Nets
- ❑ Traps
- ❑ Fiberglass fishing boats
- ❑ Recreational boats
- ❑ Fishing dhows
- ❑ Cargo vessels/Tankers
- ❑ Military vessels
- ❑ Seismic survey
- ❑ Whale-watching
- ❑ None
- ❑ Other _____

DIRECTION OF TRAVEL

- ❑ N ____ Toward boat
- ❑ SE ____ Away from boat
- ❑ S ____ Across bow
- ❑ NE ____Undetermined
- ❑ E
- ❑ SE
- ❑ S
- ❑ SW
- ❑ W
- ❑ NW
- ❑ Varied
- ❑ Undetermined

NOTES

Associated Species

ID photos taken?

- ❑ Yes **Camera(s)** _____ **photographer(s)** _____
- ❑ No

ANNEX 3: BEAUFORT SEA STATE DEFINITIONS

Beaufort Level	Force Wind	Speed (Knots)	Sea Conditions (waves heights in metres)
0	Calm	<1	calm, glassy
1	Light air	1-3	calm, rippled (0-0.1)
2	Light breeze	4-6	wavelets, not breaking
3	Gentle breeze	7-10	smooth, few whitecaps (0.1-0.5)
4	Moderate breeze	11-16	slight, more whitecaps (0.5-1.25)
5	Fresh breeze	17-21	moderate, many whitecaps (1.25-2.5)
6	Strong breeze	22-27	rough, heavy spray (2.5-4.0)
7	Near gale	28-33	rough, foam forming streaks
8	Gale	34-40	very rough (4-6), foam in streaks
9	Strong gale	41-47	high, rolling sea (6-7)
10	Storm	48-55	high (7-9), heavy rolling sea
11	Violent storm	56-63	very high (9-14), low visibility, foam patches
12	Hurricane	>64	phenomenal (14+), air filled with foam

ANNEX 4: WATER PARAMETER DATASHEET – DOWNLOAD THE WORD FORMAT HERE

CCAHD CETACEAN SURVEY 20_____WATER PARAMETER DATASHEET

Date ___/ ____/____ Vessel: _____ Page ___ of ___

Remarks _____

Time (hrs)	Waypoint (GPS)	Sighting number	Depth (m)	Temperature (°C)	Specific Conductivity (ms/cm)	Salinity (ppt)	Turbidity (NTU) or depth at which Secchi disk visible			Notes
							Max	Min	Avg	