IX. MARINE MAMMAL DATA COLLECTION PROCEDURES NOAA FISHERIES' SOUTHWEST FISHERIES SCIENCE CENTER (J. Redfern)

This summary of data collection procedures on cetacean and ecosystem assessment surveys conducted by the Marine Mammal and Turtle Division at NOAA Fisheries' Southwest Fisheries Science Center is primarily taken from the following references: Kinzey et al. (2000), Gerrodette and Forcada (2005), and Barlow et al. (2001). Please see these references for additional details.

Platforms

Surveys are primarily conducted on vessels that range in size from 50-65m. Observations are made from the flying bridge, which ranges from 10 to 15m above sea level. Aerial surveys have been used to calibrate densities estimated from ship surveys in the nearshore environment.

Equipment

There are typically three pairs of pedestal-mounted, 25×150 power binoculars on the flying bridge: one on the port side, one on the starboard size, and one near the center. There are also many pairs of 7×50 power handheld binoculars available on the flying bridge. All binoculars have reticles inscribed on the eye pieces.

Azimuth rings are mounted on the pedestals of the 25×150 power binoculars and on the flying bridge in front of the data recorder/observer. They have a resolution of 1˚ increments

Data Recording

We use a program called WinCruz to record all data. This program is freely available. WinCruz records the beginning and end of effort, the observers on effort and their positions, viewing conditions (Beaufort sea state, swell height, swell direction, and wind speed), navigation information (ship course and speed), weather (rain/fog, horizontal and vertical sun angle, wind direction, and visibility), and sightings (sighting number, bearing, reticle, the observer that made the sighting, cue, sighting method (e.g., by eye or using 25×150 power or 7×50 power binoculars), and course and speed of the school). The computer running WinCruz is linked to the ship's GPS to record the time and location of every entry. WinCruz also makes an automatic location entry every 10 minutes to ensure that the ship's course is adequately captured. The wind, wave, and swell data are typically provided by the crew on the ship's bridge. WinCruz also has a mapping feature that displays the location of schools relative to the ship. The map also displays and updates the most likely location for schools, which makes it helpful for relocating schools.

Each value entered into WinCruz is tested against a range of acceptable values as a first step to ensuring data accuracy. A data checking program is also run at the end of each day by the leader of the scientific team. Any potential issues in the data are resolved at the end of each day to ensure that the observers have the best memory of the field conditions.

For each sighting, the data recorder begins a sighting form by recording the bearing to the sighting, reticle at which the sighting was made, date, time, effort status (i.e., on versus off), observer making the sighting, sighting number, and species identifications. The observer that made the sighting completes the sighting form. Sightings forms contain a drawing of each species and notes about the features that were used to identify the animals. The form should contain enough information to justify the level of identification (e.g., unidentified dolphin versus unidentified spotted dolphin versus coastal spotted dolphin). If a sighting could not be identified to species, the sighting form may contain notes about the probable identification.

Each observer also maintains a logbook. Group sizes are recorded in the logbook, as are any comments about a sighting.

Observers and Effort

Survey effort consists of two observers searching from the flying bridge of the ship using pedestal mounted 25×150 power binoculars. A third observer serves as the data recorder and searches by eye or with 7×50 power handheld binoculars. During a sighting, the data recorder/observer may use the third pair of 25×150 power binoculars, located in the center of the flying bridge, to determine species identification and estimate group size.

The ship travels at 18.52km/hour (10knots) while on effort. Observers may direct the ship to deviate up to 30˚ from the transect during effort to avoid glare or rain. The ship returns to the transect when conditions improve.

Observations are made during all daylight hours. Observers rotate through three positions: 25 × 150 power binoculars on the port side of the flying bridge, data recorder/observer in the center of the flying bridge, and 25 × 150 power binoculars on the starboard side of the flying bridge. Observers change positions every 40 minutes. The scientific team on each survey typically has six observers, which results in each person working two to three shifts that consist of 2 hours on watch followed by 2 hours of rest. One expert in marine mammal identification and survey protocols is always on duty. The leader of the scientific team is responsible for ensuring that survey protocols are followed. Finally, the scientific team may also have an independent observer. Sightings made by this observer are not shared with the three on-effort observers until the sighting is 90˚ abeam. Sightings made by the independent observer are considered off effort; these sightings can be used to estimate the number of sightings that are missed by the three on-effort observers.

While on effort, the port and starboard observers scan 180˚ forward of the ship (see figure 10). Each observer scans out to the horizon from 90˚ abeam on their side of the ship to 10˚ on the opposite side of the bow (i.e., each observer scans 100˚ in total). This scan pattern ensures that the transect is searched by both observers. Observers are instructed to scan their entire area systematically and not to focus on particular region. The data recorder/observer scans the entire 180˚ in front of the ship. However, they focus on the transect and the area from the ship out to approximately 400m (which is a blind spot for the 25×150 power binoculars).

Sightings

Only on-effort (e.g., all three observers are in their designated positions and are actively scanning for animals) sightings are used to estimate abundance. A sighting is entered into WinCruz if the school is within 0.1 reticles of the ship. The distance to sightings at or over the horizon cannot be accurately estimated. For example, the difference between 0.0 reticles and 0.1 reticles for 25x150 power binoculars on a 10m high platform is 2 miles. Consequently, distant sightings are not recorded until they come within 0.1 reticles of the ship.

We try to detect schools as far as possible from the ship because we need to determine their location before they have an opportunity to react to the ship (e.g., to approach or avoid the ship). The distance and bearing to the first animal seen are estimated by the observer that made the sighting. For many schools, a single animal may be all that is seen for several minutes. Consequently, it is not possible to accurately estimate the location of the center of a school. The data recorder/observer may estimate the distance and angle to a sighting by eye.

Sightings are only entered when an observer has seen an animal. We do not enter sighting cues, such as a splash or bird flock. If an observer sees a cue, they may study the area for 1-2 minutes, but then must return to scanning their entire area. If an independent observer or other personnel see a school that has not been detected by the three on-effort observers, they do not tell the on-effort observers until the school is past 90˚ abeam. Missed sightings are entered as off-effort sightings and are not used to estimate abundance.

Schools are not always in a single aggregation during a sighting. Subgroups may separate and merge during a single sighting. Consequently, it can be difficult to distinguish between a single sighting with multiple subgroups and separate sightings. A single sighting is considered a school of animals that is traveling together with only temporary separations of subgroups throughout the encounter. Separate sightings are schools that will likely remain apart during the time needed to identify the species and estimate group size. Our general approach is to start by entering separate sightings and then delete the second sighting, if the subgroups actually form a single sighting. Deleting the second sighting, when subgroups form a single sighting, is important because it allows the observers to make a single estimate of the number of animals in the area, rather than trying to get separate estimates of the schools initially sighted. For long diving species (such as baleen whales), it can be difficult to determine whether an individual was already sighted and recorded. If there is any doubt, we assume the individual is part of the previous sighting and adjust the group size estimate to reflect the uncertainty about whether the animal was already sighted.

When a sighted is made, the observers may stop effort and request that the ship approach the school (i.e., the survey is conducted in closing mode). We approach sightings that are made within 3nmi perpendicular to the transect (see Table 1 for angle and reticle turning criteria for two vessels that have been used by the Southwest Fisheries Science Center). Once effort has stopped, all observers focus on the sighting. They may switch to using 7x50 power binoculars as they get closer to the school. Variable speeds and courses can be used to approach the sighting. The goal is to approach close enough to a school to identify the species and to accurately estimate the number of animals in the school. The data recorder/observer typically communicates with the crew on the ship's bridge to guide the ship to the animals. New sightings may be made while approaching the school. However, they are considered off-effort and are not used in abundance estimations.

We identify species using field-observable morphological characteristics. We try to identify sightings to the species level whenever possible. Identifications are made at the level that is most certain, not the most specific. Species identification is decided by consensus among the observers. Sightings may contain more than one species. In these cases, both species are recorded in the sighting. Multiple species sightings are only used when there is evidence that more than one species is present. We do not use multiple species sightings when observers only clearly see some animals in a school. When only a portion of the animals in a school are seen clearly, the animals that are not seen clearly are assumed to belong to the identified species, unless there is evidence that another species is present.

If a sighting occurs far from the ship and on the transect, we stay on effort as we approach the school. If there is an extra person on the flying bridge, they may be assigned to track the school while the on-effort observers continue scanning their areas of responsibility. If a second on-effort sighting is made, we approach the closest sighting.

Once all activities associated with a sighting are complete, the ship continues on a course parallel to the transect, unless the ship is more than 10nmi from the transect. If the ship is more than 10nmi from the transect, the ship sets a 20˚ course back to the transect. Observers do not go back on effort until the ship is traveling at 10 knots and there is no possibility of mistaking the previous sighting for a new sighting.

Group size

Group size estimates are made by each observer independently (i.e., observers do not discuss or share their estimates). Estimates are entered in a computer at night by the leader of the scientific team, not an observer. Each observer makes three group size estimates for each sighting: best, high, and low. The high and low estimates define the range in which the observer is confident that the true group size occurs. The range will be wide for sightings in which the estimate is uncertain (schools seen at a distance or larger schools) and smaller when the estimate is more certain (schools that were approached closely and smaller schools). In rare cases, it may only be possible for an observer to provide a low estimate. For sightings with multiple species, we estimate the number of all animals present. We also estimate the percentage of each species in the school. This approach ensures that observers only have to make a single count of all animals in the area.

The method used to estimate group size varies by observer. They may directly count animals in small schools. They may also estimate the number of groups within a school that contain a specified number of individuals (e.g., counting groups of 10 individuals). Group size estimates for many observers that work on surveys conducted by the Southwest Fisheries Science Center have been calibrated against counts made from aerial photographs of dolphin schools. Estimates from new observers that have not been directly calibrated are indirectly calibrated using estimates from calibrated observers.

Group size estimation is one of the most challenging and important aspects of line-transect surveys. There are some particularly challenging situations. For example, we have found that it is particularly difficult to estimate group size for sperm whales because these animals can dive for 40-50 minutes and can occur in non-synchronously diving groups. To address these issues, we have found it necessary to make counts of sperm whale groups for 90 minutes.

References

Barlow J, Gerrodette T, Forcada J (2001) Factors affecting perpendicular sighting distances on shipboard line-transect surveys for cetaceans. Journal of Cetacean Research and Management 3:201-212

Gerrodette T, Forcada J (2005) Non-recovery of two spotted and spinner dolphin populations in the eastern tropical Pacific Ocean. Mar Ecol Prog Ser 291:1-21

Kinzey D, Olson P, Gerrodette T (2000) Marine mammal data collection procedures on research ship line-transect surveys by the Southwest Fisheries Science Center. In. Southwest Fisheries Science Center, La Jolla

McArthur II Turning Criteria

Table 2. Sightings that occur within 3nmi perpendicular to the transect are approached on cetacean and ecosystem assessment surveys conducted by the Southwest Fisheries Science Center. This turning criterion has been converted to angles and reticles for two vessels that have been used on these surveys.

Height of viewing platform above sea surface (meters)	If the bearing from the transect is less than or equal to this angle (positive to right of transect negative to left):	Then the sighting is within 3 nm of the transect if the reticle value, is greater than or equal to:
Vessel = McArthur II		
15.2	34	0.1
15.2	40	0.2
15.2	46	0.3
15.2	52	0.4
15.2	59	0.5
15.2	66	0.6
15.2	78	0.7
15.2	90	0.8
Vessel = David Star Jordan		
10.5	34	0.1
10.5	54	0.2
10.5	65	0.3
10.5	90	0.4

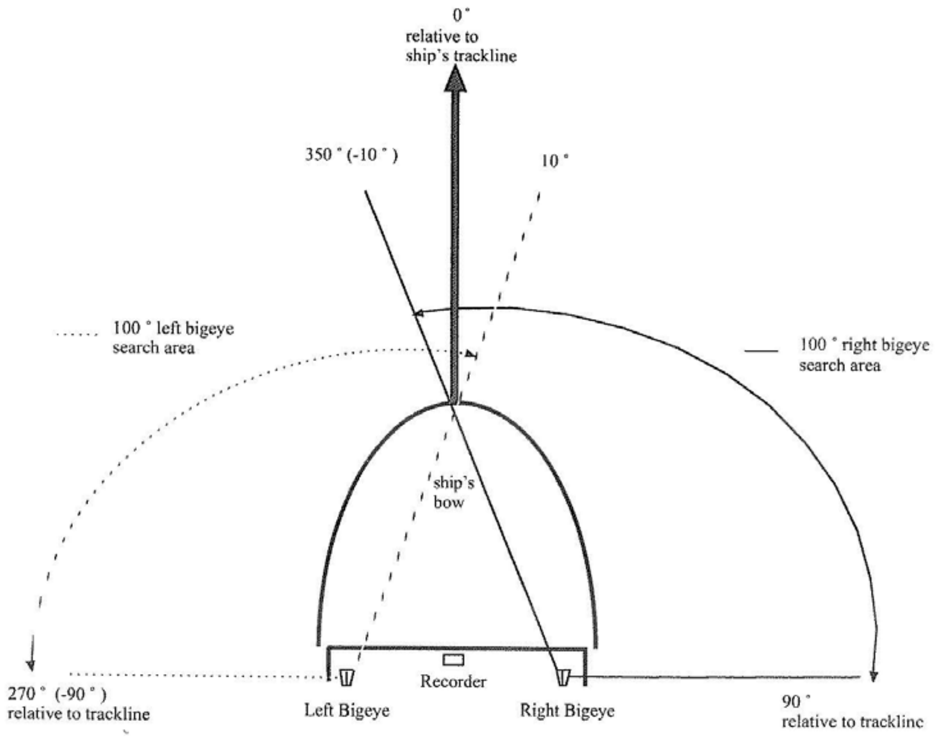

Figure 10. On-effort observers rotate through three positions: 25 × 150 power (big-eye) binoculars on the port (left) side of the flying bridge, data recorder/observer in the center of the flying bridge, and 25 × 150 power binoculars on the starboard (right) side of the flying bridge. While on effort, the port and starboard observers scan 180˚ forward of the ship. Each observer scans out to the horizon from 90˚ abeam on their side of the ship to 10˚ on the opposite side of the bow (i.e., each observer scans 100˚ in total). This figure is taken from Kinzey et al. (2000).

X. FIELD TRAINING (J.C. Salinas and J. Redfern)

The second day of the workshop included five hours of field training on board a yacht (Figure 12). On the yacht, participants had the opportunity to apply data collection protocols and use new equipment. Data collection protocols were applied using two groups of three people – one group of three surveyed from the starboard side of the yacht, while the other surveyed from the port side. While this observation configuration would not be used on actual surveys, it was used during training to ensure that all participants had an opportunity to practice the data collection protocols. Each team worked for one hour and rotated through the three observing positions (right side, data recorder, and left side) every 20 minutes. All participants had the opportunity to fill out sightings and effort logs and estimate group sizes, distance to sightings, and angle to sightings. Each participant was provided with a group size log so that they could independently estimate group size. Numerous humpback whale sightings were made during the training. The yacht approached some of the sightings to simulate conducting a survey in closing mode.

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Workshop Report

August 2015