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U.S. Navy Lookout Effectiveness Study
Marine Mammal Observer Survey Protocol

Prepared for:
U.S. Fleet Forces Command and Commander U.S. Pacific Fleet

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List of Acronyms and Abbreviations

ASWO	Anti-submarine Warfare Officer
CG	United States Navy guided missile cruiser
CMDCM	Command Master Chief
CTR	Contractor
DDG	United States Navy guided missile destroyer
DMMO	data marine mammal observer
ESA	Endangered Species Act
GPS	global positioning system
ICMP	Integrated Comprehensive Monitoring Program
LMMO	liaison marine mammal observer
LO	Lookout
MFAS	mid-frequency active sonar
MMO	marine mammal observer
MMPA	Marine Mammal Protection Act
NAVFAC	Naval Facilities Engineering Command
NMFS	National Marine Fisheries Service
OOD	Officer of the Deck
OPS	Operations Officer
POC	Point of Contact
SMMO	survey marine mammal observer
SYSCOM	Systems Command
U.S.	United States
XO	Executive Officer

SECTION 1 INTRODUCTION

In order to train and test with active sonar, the United States (U.S.) Navy has obtained Authorizations and permits from the National Marine Fisheries Service (NMFS) under the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA) for the incidental take of protected species. The Navy conducts monitoring within Navy Range Complexes and testing ranges, guided by the Integrated Comprehensive Monitoring Program (ICMP), as required under the MMPA and the ESA (Department of the Navy 2010).

The ICMP provides the overarching framework for coordination of the U.S. Navy Marine Species Monitoring Program. The ICMP outlines objectives for marine species monitoring and U.S. Navy-funded research relating to the effects of naval training and testing activities on protected marine species. The ICMP includes the following scientific objectives (Department of the Navy 2010):

1. monitor and assess the effects of Navy activities on protected marine species;
2. ensure that data collected at multiple locations is collected in a manner that allows comparison between and among different geographic locations;
3. assess the efficacy and practicality of the monitoring and mitigation techniques; and
4. add to the overall knowledge base of protected marine species and the effects of Navy activities on these species.

In accordance with the third objective, the Navy is conducting a Lookout Effectiveness Study to evaluate the effectiveness of Navy lookout and bridge watch teams at detecting protected marine species during at-sea training and testing events. To conduct the Lookout Effectiveness Study, trained marine mammal observers (MMO) embark on Navy ships to collect data that characterizes the likelihood of detecting marine species in the field from U.S. Navy guided missile destroyers (DDG) or cruisers (CG). The MMO sighting data is then compared to the sighting data collected from the ship's watch team.

SECTION 2 PLATFORMS AND CONFIGURATIONS

2.1. Search Platforms

Data collection takes place onboard either CG or DDG vessels. CGs are multi-mission surface combatants capable of supporting carrier battle groups, amphibious forces, or of operating independently and as flagships of surface action groups. CGs are 567 feet in length. DDGs are also multi-mission surface combatants, but are slightly smaller at 504 feet in length. Both ships are capable of speeds over 30 knots, and have crews of over 300 Sailors. Both of these ships are equipped with mid-frequency active sonar (MFAS) and are the ships most commonly involved in sonar exercises.

The layouts of the bridge wings on both ships are similar and are approximately 6x20 ft. Each bridge wing is equipped with a set of "big eye" binoculars, a Captain's chair, and a Pelorus. Navy personnel on the bridge that may be acting as a lookout, either on the wings or as part of the bridge team, include the Junior Officer of the Watch, Boatswain's Mate of the Watch, sky and surface lookouts, and Quartermaster of the Watch.

2.2. Marine Mammal Observer Configuration

Four MMOs are required to perform lookout effectiveness data collection:

- One MMO is positioned on each bridge wing; these MMOs are called survey MMOs (or SMMOs).
- One MMO is dedicated to recording data that the other MMOs relay (Data MMO or DMMO).
- One MMO is dedicated to liaising (liaison MMO, or LMMO) with the bridge and lookout team, and reporting their sightings to the DMMO.

The MMOs rotate positions hourly, such that no two hours are spent consecutively as SMMOs. For example, the rotation would be port SMMO → DMMO → starboard SMMO → LMMO.

2.3. Navy Lookout and Bridge Team Configuration

Lookouts are stationed in various arrangements depending on ship configuration and training exercise. Ships using low-frequency and hull-mounted MFAS sources associated with anti-submarine warfare and mine warfare activities at sea have a minimum of two Lookouts, one on each bridge wing.

Lookouts on some ships wear headsets for communication with the bridge, which makes determining when they see a surfacing species more difficult. SMMOs need to be flexible in their positioning relative to the lookouts to maximize data collection while minimizing the potential for cueing the lookout to a sighting.

SECTION 3 MARINE MAMMAL OBSERVER PROTOCOL

The goal of the survey is to set up "trials" for the bridge/lookout team, such that the MMO observes an animal before the bridge/lookout, and determines if the bridge/lookout team subsequently detects that animal or not, and at what distance. It is imperative that the MMOs do not cue the bridge or lookouts to any animals; if cueing the bridge/lookout has occurred, the sighting is no longer considered a trial for the purpose of analysis.

A sighting is a trial if:

1. The animal or group is sighted either first by the MMO or the MMO sights the animal or group at the same time as the lookout team.

2. The animal or group is between 270° and 90° relative to the ship.

A sighting is not considered a trial if:

1. The bridge/lookout sights the animal or group before the MMO.

2. The bridge/lookout sights the animal or group and the MMO does not.

3.1 Survey MMO

Survey MMOs are responsible for actively searching for animals from abeam to 5° to the opposite side of the bow (i.e., starboard SMMO surveys 355° to 90° and port SMMO surveys 270° to 5° relative to the bow of the ship). It is imperative that the MMOs do not cue the lookout or bridge team upon sighting an animal so between sightings, SMMOs should occasionally use the binoculars or camera as if they would during a sighting. All effort and environmental data recorded as well as sightings made by the SMMOs are relayed to the DMMO.

For an SMMO sighting:

1. Relay sighting to the DMMO. At the first instance of a sighting, the MMO that saw the animal will say "mark".

2. Provide the following information when prompted by the DMMO: species, bearing, sighting distance, and group size. Information (e.g., cue or behavior) should be collected afterwards if time allows. WARNING: MMOs must not hold button on headset/radio longer than necessary as it would not allow other sightings to be relayed.

3. Inform the lookout/bridge team if the animal is within or enters the shutdown zone during MFAS use (not bow-riding), or if a collision may occur, for appropriate action. The sighting is no longer considered a trial once the lookout/bridge team has been notified of the animal(s).

4. Track the animal, relaying all subsequent surfacing (for example, whale blows), as appropriate. In the case of continuously or almost-continuously available sightings (for example, large dolphin pods), record the beginning & end times of the sighting.

5. Inform the DMMO that you are no longer tracking the animal(s) once the animal(s) has either passed the beam of the ship or can no longer be tracked.

6. If the track of the animal is lost, any additional sightings that can't be confirmed as the same animal(s) previously being tracked would be a new trial.

SMMOs are also responsible for determining if a bridge/lookout sighting is a duplicate (i.e., the same animal) as one that is being tracked.

3.2 Liaison MMO

The LMMO is responsible for relaying all sightings made by the bridge and/or lookout team to the DMMO. Depending upon the configuration of the lookouts, the LMMO may be positioned either inside the pilot house, on one bridge wing, or moving between the bridge wings and the pilot house.

At the beginning of each ship watch team rotation, the lead MMO should introduce themselves to the Officer of the Deck (OOD) and let them know that for the purposes of the study, the LMMO needs to be informed when anyone observes a marine mammal. Also remind them that MMO team is only collecting scientific data and does not replace the lookouts. Therefore, the watch team should observe, report and mitigate as they would if the MMO team were not aboard.

When there is a sighting made by the lookout/bridge team, the LMMO should immediately query the lookout/bridge team to obtain, at minimum, the lookout's estimated distance, bearing, and species group (whale, dolphin, etc.) as quickly as possible. It is necessary for data analysis requirements that the LMMO collects these data in numerical units (e.g. degrees, yards); even though in most cases the lookouts/bridge team may not initially provide these numerical data. The LMMO should also obtain a reticle distance to the animal(s) in addition to reporting the distance estimated by the bridge/lookout team. When the LMMO is reporting information, it needs to be clear whether the information was provided by the bridge/lookout or whether the information is an observation from the LMMO. The sighting information described by the lookout/bridge team should have its own entry on the Sightings datasheet. Additional information such as species identification can be added in the Comments field or under a separate data entry if the animals are re-sighted by an MMO. In addition to real-time data gathering of lookout/bridge team sightings, any bridge logs of animals observed should be copied to ensure all sightings are captured. Additionally, the LMMO may be able to plug into the same communications network as the lookouts (typically sound powered phones). This would improve the ability to obtain the required contact information.

It is important to not cue the bridge/lookout team to the presence of an animal or group. This is because providing any indication of a sighting to the bridge/lookout team would eliminate the sighting as a trial. The LMMO can try to photograph the animals for species identification purposes once the bridge/lookout has sighted an animal. Alternately, if photographs can be taken discretely, taking them is recommended to help in species identification. The LMMO can frequently photograph non-marine mammals, such as birds, water, etc., such that the lookouts desensitize to camera presence.

The LMMO may also operate as an additional SMMO so long as the bridge/lookout is not cued by any sightings. If the LMMO first observes the animal(s), the initial sighting distance/bearing should be provided by the LMMO, and then tracking of the sighting should be passed to the SMMO so that the LMMO can focus on the bridge/lookout team for their observations.

LMMOs may assist the SMMOs in determining if a bridge/lookout sighting is a duplicate (i.e., the same animal) as one that is being tracked.

3.3 Data MMO

The DMMO is responsible for recording all effort and environmental data at the beginning of the shift, as well as all sightings made by the SMMOs and those relayed by the LMMO. The DMMO position is also considered a resting position; when feasible, the DMMO may sit down so long as a waypoint can be immediately recorded upon a sighting being called.

Ideally, the DMMO will be positioned in the pilot house with permission from the Officer of the Deck. This facilitates the collection of ship bearing and ship speed, which can be obtained from displays on the bridge (typically available on the bridge wing as well). The DMMO location is dependent upon bridge wing configuration and pilot house congestion.

At the first instance of a sighting, the MMO that saw the animal will say “mark”. This lets the DMMO know to take a waypoint using a Global Positioning System (GPS) unit to mark the time and location of a sighting. Any GPS devices brought on board (either dedicated devices or enabled on certain camera bodies) must not record the trackline of the vessel since a detailed record of ship movements during exercises would be sensitive information. The DMMO should then immediately note the ship bearing and speed. Next, the DMMO asks the SMMO for the bearing, distance, group size, and species of the animal. The SMMOs/lookouts can report distance in yards, meters, or reticles, but all distance measures should be converted to meters for the final datasheet. These are the most crucial pieces of information. The DMMO should then query the SMMO for the remaining data fields as the SMMO has time/ability to answer. While focused on maintaining sighting of the animal, the SMMO is not expected to remember all of the data fields on the data sheets. Therefore, it is the responsibility of the DMMO to ask the SMMOs for missing entries and ensure that all fields are filled in by the end of the sighting. It is the responsibility of the DMMO to prioritize data collection from the SMMOs when multiple SMMOs have a sighting at the same time. The DMMO should enter the time, latitude, and longitude for each sighting from the GPS onto the data sheets when there is time to do so.

SECTION 4 DATA COLLECTION AND FORMS

4.1. Effort and Environmental Data

At the beginning of each effort period and at each observer rotation, effort and environmental data are recorded. Additionally, any significant change in weather also warrants recording new data. Each field in the Effort and Environmental Data form is described in Table 1. Additional discussion is provided below the table for those fields needing better explanation. An example of a completed Effort and Environmental Data form is provided in Appendix A.

Table 1. Effort and Environmental Data Form Field Descriptions

Field	Description
WP (Waypoint)	Waypoint obtained from the GPS unit
Effort	Whether search effort is on or off
Event*	Event Options: 1. Begin effort 2. End effort 3. Observer rotation 4. Significant weather change 5. Other (for any other waypoints, changes in lookout configuration, etc.)
Time	Time (hh:mm:ss) recorded off GPS waypoint
Ship Latitude and Longitude	Latitude and longitude recorded off GPS waypoint in decimal degrees
MMO Positions (Port, Starboard, Liaison, Data)	Record the (three-letter initials) of the person at each MMO position. If one position is vacant, enter N/A for that field.
Sea State*	Beaufort sea states are provided in the text below and Table 2
Wave Height	Total (swell included) wave height.
	Light (0 – 3ft) Moderate (4 – 6ft) Heavy (>6ft)
Visibility	Visibility codes: B – Bad (<0.5km) P – Poor (0.5 – 1.5km) M – Moderate (1.5 – 10km) G – Good (10 - 15km) E – Excellent (>15km)
% Glare	Percent glare should be the total for the 180° field of view for both Port and Starboard observers. Each observer will report the % glare in their 90° quadrant.
% Cloud Cover	Percent cloud cover should be taken by each Port and Starboard observer for their 90° quadrant. The % cloud cover for the 180° field of view will be averaged upon data entry.
Sonar on/off	Indicate whether sonar was on or off during an effort period.
Explosives in use?	Yes or no.
LO config*	Identify the locations and numbers of the Navy lookouts.
Comments	Any additional comments relative to the observing session.

* indicates additional description is provided below.

4.1.1. Event

Events 1, 2, and 3 are used to record when effort starts (at the beginning of each day and after breaks), when effort is off for breaks (e.g., lunch), and at each observer rotation, respectively. Event 4 is used to record significant changes in weather. Event 5 is used to record miscellaneous points that are deemed important such as changes in sonar use, changes in lookout configuration, etc.

4.1.2. Sea State

Beaufort sea states should be used when recording data. However, be advised that the Navy has historically used a separate sea state scale, and therefore information obtained from the bridge may not be consistent with the Beaufort sea state scale, so use the Beaufort sea state and not the sea state reported by the bridge. A description of the Beaufort sea states are provided in Table 2 and Figure 1.

Table 2. Beaufort Sea State Descriptions

Beaufort Sea State	Wind speed (kts)	Wind description	Wave height (ft)	Description – Beaufort
0	<1	Calm	0	Calm; like a mirror
1	1-3	Light air	¼	Ripples with appearance of scales; no foam crests
2	4-6	Light breeze	½ – 1	Small wavelets; crests of glassy appearance, not breaking
3	7-10	Gentle breeze	2 – 3	Large wavelets; crests begin to break; scattered whitecaps
4	11-16	Moderate breeze	3 ½ – 5	Small waves, becoming longer numerous whitecaps
5	17-21	Fresh breeze	6 – 8	Moderate waves, taking longer form; many whitecaps; some spray
6	22-27	Strong breeze	9 ½ – 13	Larger waves forming; whitecaps everywhere; more spray
7	28-33	Near gale	13 ½ – 19	Sea heaps up; white foam from breaking waves begins to be blown in streaks
8	34-40	Gale	18 – 28	Moderately high waves of greater length; edges of crests begin to break into spindrift; foam is blown in well-marked streaks
9	41-47	Strong gale	23 – 32	High waves; sea begins to roll; dense streaks of foam; spray may reduce visibility
10	48-55	Storm	29 – 41	Very high waves with overhanging crests; sea takes white appearance as foam is blown in very dense streaks; rolling is heavy and visibility is reduced
11	56-63	Violent storm	39 – 46	Exceptionally high waves; sea covered with white foam patches; visibility still more reduced
12	≥ 64	Hurricane	37 – 52	Air filled with foam; sea completely which with driving spray; visibility greatly reduced


Force 0


Force 1


Force 2


Force 3


Force 4


Force 5

Figure 1. Beaufort Sea State Photographs, Sea States 0 – 7

4.1.3. Lookout Configuration

Identify the positions of the Navy lookouts, i.e. port wing, starboard wing, both wings or bridge team, being careful not to cue the lookouts that you are taking information on them. The DMMO should discreetly gather this information rather than requesting the SMMOs for updates so as to avoid potential signals that these data are being gathered.

4.2. Sighting Data

Each field in the Sighting Data form is described in Table 3. Additional discussion is provided below the table for those fields needing further explanation. An example of a completed Sightings Data form is provided in Appendix B.

Table 3. Sightings Data Form Field Descriptions

Field	Description
Sighting Number*	Sighting numbers are sequential, with each cruise beginning with sighting number 1.
Time (& Ending if continuous)	Time at sighting is to be recorded as HH:MM:SS and is obtained from the GPS unit in local time. For species that are continuously available (such as a large pod of dolphins), the start time would be the initial sighting and the end time would be once the animals pass the beam or are lost from view.
WP (Waypoint)	Waypoint obtained from the GPS unit
Animal Bearing	Animal bearing is estimated using 'the compass' on the big eyes (if calibrated correctly), the gyrocompass repeater, or observer estimate. If based on observer estimate, for ease in the field this can be written as 0 to 90° Port or Starboard (P or S) on the datasheet to account for the position of the animal(s) in the survey quadrant that it is sighted in. .
Animal Distance	Distance is estimated to the single animal or to the geometric center of a group of animals. Distance is recorded as an observer estimate (in yards, nautical miles, meters, etc.) or as a reticle distance. Each demarcation line in the Fuginon binoculars represents 1 reticle.
Species*	Species codes are determined by merging the first three letters of the genus with the first two letters of the species. For example, humpback whale would be MEGNO.
Group Size (min/max/best) & # of Calves	The minimum, maximum, and best estimate for number of animals in a group, as well as the number of calves are to be included.
Ship Latitude and Longitude	Latitude and longitude of the GPS waypoint in decimal degrees.

Ship Bearing	True bearing of the ship needs to be recorded so the true position of the animal can be calculated.
Ship speed (kts)	Ship speed provides an indication of the time available for the bridge/lookout to observe an animal before it passes the beam. To avoid classification issues, categories of ship speeds are provided: < 5 kts, 5 – 10 kts, 11 – 15 kts, 16 – 20 kts, and > 20 kts.
Relative motion*	The animal's motion with respect to the ship.
Observer	The three-letter initials of the MMO, or "BR" for the bridge or "LO" for the lookout.
Sighting cue	Indicate what the sighting cue was. For consistency, the following are provided: Blow, Body, Breach, Dorsal fin, Fluke up, Head slap, Porpoising, Pectoral fin slap, Slick, footprint, or ring, Splash, Tail slap, Seabirds/Wildlife, Other
Behavior*	Provide any relevant information on the behavior of the animal or group sighted (traveling, diving, spyhopping, etc).
End of Track*	Reason for which the animal(s) is no longer being tracked.
Mitigation	Indicate N/A if sonar is not on; N if sonar is on and no mitigation was implemented, and Y if sonar is on and the type of mitigation implemented (6 dB down, shut off, ship turned away from animal, etc.)
Trial (Y/N)	Identifies if the sighting is considered a "trial" for the effectiveness study. A sighting is a trial if: 1. The animal or group is sighted either first by the MMO or the MMO sights the animal or group simultaneously as the bridge/lookout team **and** 2. The animal is between 270° and 90° relative to the ship
Comments	All other pertinent data should be included here, such as LO configuration at the time of sighting, and ID numbers of photos taken.

* indicates additional description is provided below.

4.2.1. Sighting Number

Sighting numbers are sequential throughout a cruise; each cruise begins with sighting #1.

Upon the first sighting of an animal, the next sequential number is assigned, for example Sighting # 4.0 in the Tables 4-6 below. Additional sightings of the same animal (e.g., for each surfacing) would be given decimal numbers, such that sightings would be called 4.1, 4.2, 4.3, etc.

In cases where the surfacing of animals are continuously available (e.g. large pod of dolphins), one sighting number is recorded, which includes the start time of the initial sighting and the end time for when the animals pass the beam or is lost from view.

If the bridge or lookout team observes the animal(s) at the same time as the MMO, two entries are recorded on the data form and each entry is given the same sighting number (Table 4 and Table 7). If the bridge/lookout team observes the same animal(s) as the MMO, whether it is a surfacing series or a continuous sighting, but sees it later in time, the same sighting number is used but the later time is recorded (Table 5 and Table 8). If the bridge or lookout team observes a surfacing of the animal(s) within a series and that surfacing is not observed by the MMO, the next sequential decimal number is assigned (Table 6). If the bridge or lookout team observes an

initial surfacing of the animal(s) and that surfacing is not observed by the MMO, the next sequential sighting number is assigned (Table 9).

Table 4. Example Sighting – MMO and Lookout Simultaneous Observation During a Surfacing Series

Sighting Number	Time	WP	Observer	Trial	Comments
4.0	08:12:23	10	ABC	Y	
4.1	08:12:57	11	ABC	Y	
4.2	08:13:37	12	ABC	Y	
4.3	08:14:01	13	ABC	Y	LO observed at same time as MMO
4.3	08:14:01	13	LO	N	

Table 5. Example Sighting – Lookout Observes Same Surfacing Series, but Later in Time

Sighting Number	Time	WP	Observer	Trial	Comments
4.0	08:12:23	10	ABC	Y	
4.1	08:12:57	11	ABC	Y	
4.2	08:13:37	12	ABC	Y	
4.3	08:14:01	13	ABC	Y	
4.3	08:14:20	13	LO	N	LO observed same surfacing series as MMO, but slightly later. Same sighting number is used, but a later time is recorded.

Table 6. Example Sighting – Lookout Sighting after Initial MMO Sighting During a Surfacing Series

Sighting Number	Time	WP	Observer	Trial	Comments
4.0	08:12:23	10	ABC	Y	
4.1	08:12:57	11	ABC	Y	
4.2	08:13:37	12	ABC	Y	
4.3	08:14:01	13	LO	N	MMO missed this surfacing.
4.4	08:14:42	14	ABC	N	No longer a trial because the lookout has seen the animal

Table 7. Example of a Continuous Sighting- MMO and Lookout Simultaneous Observation

Sighting Number	Start Time	End Time	WP	Observer	Trial	Comments
1.0	08:12:23	08:14:27	1	ABC	Y	
2.0	08:25:57	08:26:38	9	ABC	Y	
2.0	08:25:57	08:26:38	9	LO	N	LO observed at same time as MMO
3.0	08:37:01	08:38:04	13	ABC	Y	

Table 8. Example of a Continuous Sighting- Lookout Observes Same Surfacing, but Later in Time

Sighting Number	Start Time	End Time	WP	Observer	Trial	Comments
1.0	08:12:23	08:14:27	1	ABC	Y	
2.0	08:25:57	08:27:38	9	ABC	Y	

2.0	08:26:42	08:27:38	10	LO	N	LO observed same group of dolphins as MMO, but slightly later. Same sighting number is used, but a later time is recorded.
3.0	08:37:01	08:38:04	13	ABC	Y	

Table 9. Example of a Continuous Sighting- Lookout Observes Initial Surfacing, but MMO Does Not

Sighting Number	Start Time	End Time	WP	Observer	Trial	Comments
1.0	08:12:23	08:14:27	1	ABC	Y	
2.0	08:25:57	08:27:38	9	LO	N	
2.1	08:26:42	08:27:38	10	ABC	N	LO observed group of dolphins before MMO. A decimal number is used for the sighting, and a later time is recorded.
3.0	08:37:01	08:38:04	13	ABC	Y	

4.2.2. Species

Species codes are determined by combining the first three letters of the genus with the first two letters of the species. For example, humpback whale would be MEGNO for ***MEG****aptera* ***NO****vaeangliae*. Table 10 provides a list of species codes; this list will be updated as necessary.

Table 10. Species Codes

Group	Species Code	Common Name	Scientific Name
Mysticetes	BALAC	Minke whale	*Balaenoptera acutorostrata*
	BALED	Bryde's whale	*Balaenoptera edeni*
	BALBO	Sei whale	*Balaenoptera borealis*
	BALMU	Blue whale	*Balaenoptera musculus*
	BALPH	Fin whale	*Balaenoptera physalus*
	BAL--	Unidentified rorqual	Balaenopteridae
	MEGNO	Humpback whale	*Megaptera novaeangliae*
	ESCRO	Gray whale	*Eschrichtius robustus*
	WHALE	Unidentified whale	
Beaked whales	ZIP--	Unidentified beaked whales	Ziphiidae
	MES--	Unidentified *Mesoplodon*	*Mesoplodon* spp.
	MESDE	Blainville's beaked whale	*Mesoplodon densirostris*
	ZIPCA	Cuvier's beaked whale	*Ziphius cavirostris*
	INDPA	Longman's beaked whale	*Indopacetus pacificus*
	BERBA	Baird's beaked whale	*Berardius bairdii*
Sperm whales	PHYMA	Sperm whale	*Physeter macrocephalus*
	KOGBR	Pygmy sperm whale	*Kogia breviceps*
	KOGSI	Dwarf sperm whale	*Kogia sima*
	KOG--	Unidentified pygmy/dwarf sperm whale	*Kogia* spp.
Blackfish	ORCOR	Killer whale	*Orcinus orca*

Group	Species Code	Common Name	Scientific Name
	PSECR	False killer whale	*Pseudorca crassidens*
	FERAT	Pygmy killer whale	*Feresa attenuata*
	PEPEL	Melon-headed whale	*Peponocephala electra*
	GLOMA	Short-finned pilot whale	*Globicephala macrorhynchus*
	BLACK	Unidentified blackfish	
Dolphins	TURTR	Bottlenose dolphin	*Tursiops truncatus*
	STEAT	Pantropical spotted dolphin	*Stenella attenuata*
	GRAGR	Risso's dolphin	*Grampus griseus*
	STELO	Spinner dolphin	*Stenella longirostris*
	STE--	Unidentified *Stenella*	*Stenella* spp.
	STECO	Striped dolphin	*Stenella coeruleoalba*
	STEBR	Rough-toothed dolphin	*Steno bredanensis*
	LAGHO	Fraser's dolphin	*Lagenodelphis hosei*
	LAGOB	Pacific white-sided dolphin	*Lagenorhynchus obliqidens*
	LISBO	Northern right whale dolphin	*Lissodelphis borealis*
	DOLPH	Unidentified dolphin	
Turtles	CHEMY	Green turtle	*Chelonia mydas*
	EREIM	Hawksbill turtle	*Eretmochelys imbricata*
	LEPKE	Kemp's ridley turtle	*Lepidochelys kempii*
	DERCO	Leatherback turtle	*Dermochelys coriacea*
	CARCA	Loggerhead turtle	*Caretta caretta*
	LEPOL	Olive ridley turtle	*Lepidochelys olivacea*
	TURTL	Unidentified turtle	
Pinnipeds	NEOSC	Hawaiian monk seal	*Neomonachus schauinslandi*
	ZALCA	California sea lion	*Zalophus californianus*
	PHOVI	Harbor seal	*Phoca vitulina*
Unidentified	CET--	Unidentified cetacean	
	LGWHA	Unidentified large whale	
	SMALL	Unidentified small cetacean	

4.2.3. Relative Motion

The relative motion is that of the animal relative to the ship.

- Opening: animal is moving away from the ship
- Closing: animal is moving toward the ship
- Parallel: animal is staying at the same distance from the ship
- None: animal is stationary

If only one surfacing is detected, and the direction of movement of the body is not discerned (eg. only a single blow is seen), enter UNK in the field.

4.2.4. Behavior

Record the initial behavior of the animal or group once sighted. Any other changes in behavior can be recorded in the comments. Examples of behavior include:

- Breaching
- Bowriding
- Feeding
- Fluking
- Flipper slapping
- Milling
- Logging
- Resting
- Traveling
- Tail slap
- Vocalizing
- Other

4.2.5. End of Track

End of Track identifies why an animal or group is no longer being observed. The end of the track is either due to the animal observed passing the beam or the animal is "lost" meaning that sufficient time has passed (species dependent) that another surfacing should have occurred, but was not observed by the MMO. If neither of those cases sufficiently explains the end of track, write a brief reason in the space provided or in the comments.

4.3. Data Storage

Copies of the sighting data sheets, entered data files, and all supplemental data (such as pictures) are submitted to U.S. Fleet Forces Command (N46) or Commander, Pacific Fleet Environmental (N465), depending on the cruise location, and NUWCDIVNPT. NUWCDIVNPT currently formats the data to send to the University of St. Andrews for analysis.

SECTION 5 BRIEFINGS AND INTERACTION WITH OFFICERS AND CREW

5.1. Initial Briefing

It is important that the Commanding Officer (CO), the officers and the crew know that you work for the U.S Navy (as a Government Service or Contractor (CTR), what you need from them and why you are on board. At the discretion of the CO, you may be asked to brief the Wardroom on the first day (or at a presail) or at the first Operations Officer (OPS) brief. A template will be provided by CPF or USFF. The senior MMO, as designated by the Fleet, should be prepared to give the brief if requested by the CO.

5.2. Use the Opportunity Aboard to Inform and Potentially Learn

5.2.1. Inform

- How important implementation of protective measures are (e.g they are legally required to train and test, they protect marine mammals)
- How important the lookouts are (e.g. they are the "front line" of marine mammal protection)
- What the Fleet/Naval Facilities Engineering Command (NAVFAC)/Systems Command (SYSCOM) Environmental programs do (e.g. we do the paperwork to get authorization for them to train and test.)

5.2.2. Learn

- If you work on the EIS, MMPA and ESA authorizations (this does not apply to the CTRs), you may have the need to know. Assuming you have SECRET clearance, at the discretion of the vessel, and if there is time you may request access to the following from your onboard Point of Contact (POC) (usually the OPS) or Anti-submarine Warfare Officer (ASWO) : SONAR to see how they observe/report marine mammal vocalizations to the bridge, see how they track, etc.; COMBAT to observe portions of the training event; NIXIE (Torpedo Countermeasures System) if it is being deployed while you are onboard. Seeing these operations in action will help your support of environmental compliance documents.

5.3. Professionalism

The MMO may be the only U.S. Navy environmental staff that most onboard the ship will ever interact with. This is especially true for the enlisted Sailors. This probably goes without saying, but you are the ambassadors for the at sea program. While what we do is very important, we are visitors aboard the ship. Please be professional at all times.

Remember that all vessel traffic can hear the MMOs radio communications while onboard. Please be sensitive to the information that is being relayed to one another. Limit personal

conversations, use professional language, and do not relay information that may be labeled as sensitive such as ship speed or sonar information.

At the beginning of the embark, the senior MMO should introduce themselves and the rest of the MMO team to the CO, Executive Officer (XO) and Command Master Chief (CMDCM) and let them know that for the purposes of the study, they need to be informed when anyone observes a marine mammal. Also remind them that the MMOs are only collecting scientific data and are not replacing the lookouts. Therefore, the lookouts should observe, report and mitigate as they would if the MMOs were not onboard.

SECTION 6 REFERENCES

Department of the Navy (2010). United States Navy Integrated Comprehensive Monitoring Program 2010 Update, 20 December 2010.

APPENDIX A COMPLETED EFFORT AND ENVIRONMENTAL DATA FORM

Example of a completed Effort and Environmental Data Form is provided on the next page.

Event : Form Example 1

Vessel Type: SSN - X

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Date: 30 February 2011

Vessel Name: USS Porthole

Location: Hawaii Range Complex

Effort and Environmental Data

WP	Effort	Event	Time	Ship Latitude and Longitude	Port MMO	Stbd MMO	Liaison MMO	Data MMO	Sea State	Sonar on/off	Explosives in use?	Visibility	Wave Height	Swell Direction	% Glare	% Cloud Cover	LO config	Comments
1	on (off)	1	07:01:23	Lat: Lon:	AMY	JUL	TAJ	RKU	3	on (off)	Y (N)	B P M (G) E	(Light) Mod Heavy	010	40	75	LOs arrived on wings at 0713	
2	on off	3	08:00:10	Lat: Lon:	TAJ	RKU	JUL	AMY	4	on (off)	Y (N)	B P M (G) E	Light (Mod) Heavy	170	0	75	1 LO on each wing	
4	on off	5	08:22:46	Lat: Lon:	TAJ	RKU	JUL	AMY	4	(on) off	Y (N)	B P M (G) E	Light (Mod) Heavy	190	0	75	1 LO on each wing	
9	on off	3	09:05:17	Lat: Lon:	JUL	AMY	RKU	TAJ	3	(on) off	Y (N)	B P (M) G E	Light (Mod) Heavy	180	0	75	1 LO on each wing	
9	on off	3	10:03:29	Lat: Lon:	RKU	TAJ	AMY	JUL	3	(on) off	Y (N)	B P (M) G E	Light (Mod) Heavy	30	0	95	1 LO on each wing	
10	on off	5	10:11:33	Lat: Lon:	RKU	TAJ	AMY	JUL	3	(on) off	Y (N)	(B) P M G E	Light (Mod) Heavy	90	0	100	1 LO on each wing	Rain squall. MMOs and LOs in pilot house observing
11	on off	5	10:46:15	Lat: Lon:	RKU	TAJ	AMY	JUL	4	on (off)	Y (N)	B P (M) G E	Light (Mod) Heavy	90	0	100	1 LO on each wing	
17	on off	3	11:01:23	Lat: Lon:	AMY	JUL	TAJ	RKU	4	on (off)	Y (N)	B P (M) G E	Light (Mod) Heavy	90	0	100	1 LO on each wing	
21	on off	2	12:06:01	Lat: Lon:						on off	Y N	B P M G E	Light Mod Heavy					Off effort for lunch. Yum!
	on off		: :	Lat: Lon:						on off	Y N	B P M G E	Light Mod Heavy					

Event: 1 – begin effort; 2 – end effort; 3 – observer rotation; 4 – weather change; 5 – waypoint (sonar change); 6 – high density area; 7 – back to normal

APPENDIX B COMPLETED SIGHTINGS DATA FORM

Example of a completed Sightings Data Form is provided on the next page.

Event: Form Example 2

Vessel Type: DDG

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Date: 20 July 2010

Vessel Name: USS Porthole

Location: SOCAL Range Complex

Sighting Number	Time (& ending time if continuous)	WP #	Animal Bearing	Animal Distance	Species	Group Size (min/max/best)	Ship Latitude and Longitude	Ship Bearing	Ship Speed (kts)	Relative Motion	Observer	Sighting cue	Behavior	End of Track	Mitiga-tion	Trial Y/N	Comments
42.0	10: 11 :45 : :	0473	10 P °	2	pinniped	1/ 2 /1 ___ calves	Lat: 33.0034 Lon: 118.9484	359 °	**<5** 5-10 11-15 16-20 >20	opening **closing** parallel none	RKU	body	travel	Lost Passed Beam ___	N	**Y** N	
42.0	10: 11 :55 : :	0473	10 S °	1000 yds	pinniped	1/ 2 /1 ___ calves	Lat: 33.0034 Lon: 118.9484	359 °	**<5** 5-10 11-15 16-20 >20	opening **closing** parallel none	LO	body		Lost Passed Beam ___	N	**Y** N	LO probably cued by MMO
42.1	10: 13 :54 : :	0473	80 S °	3	pinniped	1/ 2 /1 ___ calves	Lat: 33.00678 Lon: 118.9481	359 °	<5 **5-10** 11-15 16-20 >20	opening closing **parallel** none	RKU	fin	travel	Lost **Passed Beam** ___	6 dB down	**Y** N	Passed 90° at 10:14:59
42.1	10: 13 :54 : :	0474	80 P °	500 yds	pinniped	1/ 2 /1 ___ calves	Lat: 33.00678 Lon: 118.9481	359 °	<5 **5-10** 11-15 16-20 >20	opening closing **parallel** none	LO	splash		Lost Passed Beam ___	6 dB down	**Y** N	
	: : : :		°			/ / ___ calves	Lat: Lon:	°	<5 5-10 11-15 16-20 >20	opening closing parallel none				Lost Passed Beam ___		Y N	
43.0	14: 23 :09 14: 35:00	23	320 S °	1.5	Tursiops	3/ 6 /5 ___ calves	Lat: 32.80225 Lon: 117.6638	270 °	<5 5-10 **11-15** 16-20 >20	opening **closing** parallel none	MS	splash	bow riding	Lost **Passed Beam** ___	NA	**Y** N	Photos #4826-4986 suggest bottlenose dolphin
	: : : :		°			/ / ___ calves	Lat: Lon:	°	<5 5-10 11-15 16-20 >20	opening closing parallel none				Lost Passed Beam ___		Y N	
	: : : :		°			/ / ___ calves	Lat: Lon:	°	<5 5-10 11-15 16-20 >20	opening closing parallel none				Lost Passed Beam ___		Y N	
	: : : :		°			/ / ___ calves	Lat: Lon:	°	<5 5-10 11-15 16-20 >20	opening closing parallel none				Lost Passed Beam ___		Y N	