Prepared for
National Marine Fisheries Service
Office of Protected Resources

Prepared by
Department of the Navy

In accordance with
Biological Opinion 09 February 2007
National Defense Exemption 23 January 2007

U.S. Navy
SOUTHERN CALIFORNIA
COMPOSITE TRAINING UNIT EXERCISE 08-1
After Action Report
24 October – 14 November 2007

SUBMITTED TO
Office of Protected Resources, National Marine Fisheries Service

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Abstract
This report presents an analysis of the effectiveness of the mitigation and monitoring measures as required under the Biological Opinion on the U.S. Navy's Proposed Composite Unit Training Exercises and Joint Task Force Exercises Off Southern California From February 2007 to January 2009

AND

Discussion of the nature of effects on marine mammals, if observed, under the National Defense Exemption from the Requirements of the Marine Mammal Protection Act (MMPA) for Mid-Frequency Active Sonar

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EXECUTIVE SUMMARY

- This reports summarizes marine mammal sightings and assessment of mitigation effectiveness for the U.S. Navy's Composite Unit Training Exercise (COMPTUEX) 08-1 conducted by the USS Abraham Lincoln Carrier Strike Group (CSG) from 25 October to 14 November 2007 within the offshore waters of Southern California per the National Defense Exemption and Biological Opinion.
- Over 4,032 hours of visual survey were conducted by U.S. Navy lookouts assigned to 8 MFAS-equipped surface ships over the course of the exercise (21 days x 24 hrs/day = 504 hrs x 8 ships = 4,032). This accounts for time conducting non-MFAS events and MFAS events. Of these 4,032 hours of at-sea time, 345 hours of MFAS were reported from all sources including hull-mounted 53C, helicopter dipping sonar, and DICASS sonobuoys. These hours are reflective of MFAS use by various units including up to three MFAS-equipped ships geographically spread out over the entire exercise area and are not an indication of consecutive and continuous use.
- There were a total of 105 marine mammal sightings for an estimated 1,410 animals during COMPTUEX 08-1. The majority of animals sighted were dolphins and porpoises, with 46 dolphin sightings accounting for 1,255 animals or 89% of the total estimated number of animals.
- There were 6 sighting events for an estimated total of 107 marine mammals sighted within NDE safety zones <1,000 yards during MFAS transmissions. Two of these 6 sightings were 2 separate pods of 50 dolphins each which accounts for most of the total animals seen. In all cases, however, sonar was either secured or powered down when the marine mammals were first observed.
- For all of COMPTUEX 08-1 marine mammal sightings, there was no obvious indication or report that any animal behaved in a manner not associated with normal movement or foraging, recognizing that the level of biological information obtained is limited at this time.
- Based on visual reports of marine mammals from U.S. Navy lookouts during COMPTUEX 08-1, the U.S. Navy's COMPTUEX/JTFEX Environmental Assessment/Overseas Environmental Assessment (EA/OEA) acoustic modeling appears to very conservatively over-estimate the number of potential acoustic exposures, including those to ESA-listed species. The degree of variability and over predictive nature inherent within these acoustic impact models is based largely on the significant natural variability within the science of at-sea marine mammal surveys used to derive density estimates and other model limitations.

INTRODUCTION

This report is presented to fulfill U.S. Navy and U.S. Pacific Fleet written reporting requirements conditional to the 23 January 2007 National Defense Exemption (NDE) from the Requirements of the Marine Mammal Protection Act (MMPA) for Certain DoD Military Readiness Activities That Employ Mid-Frequency Active Sonar (MFAS) or Improved Extended Echo Ranging Sonobuoys. In addition, as these NDE mitigation measures are included in the 30 July 2007 *Biological Opinion (BO) on the U.S. Navy's Composite Unit Training Exercises (COMPTUEX) and Joint Task Force Exercises (JTFEX) Off Southern California From February 2007 to January 2009*, this report fulfills both the NDE and BO reporting requirements.

Language from COMTUEX/JTFEX BO (NMFS 2007):

5. Within 120 calendar days of completing an exercise the U.S. Navy shall provide the Chief, Endangered Species Division, Office of Protected Resources (with a copy provided to the Assistant Regional Administrator for Protected Resources in NMFS' Southwest Regional Office) with a written report that shall include the following information.

a. Summary of exercise (starting and ending date of exercise, number of ships and aircraft involved in exercise, and number of hours passive and active sonar was used during the exercise);

b. Specific mitigation measures Navy implemented during exercise;

c. Number of blue whales, fin whales, humpback whales, sei whales, sperm whales, and Guadalupe fur seals that (i) **had been detected within 200 yards of a sonobuoy and 500 and 1,000 yards of a sonar dome or during an active transmission** and (ii) the estimate of number of ESA-listed marine mammals that had been exposed to MFAS at received levels equal to or greater than 173 dB re 1 $\mu Pa^2 \cdot s$;

d. Reports of the activity or activities that blue whales, fin whales, humpback whales, sei whales, sperm whales, and Guadalupe fur seals had been observed to exhibit while they were within 200 yards of a sonobuoy and 500 and 1,000 yards of a sonar dome that was actively transmitting during exercise;

Reports of observations shall identify date, time, and visual conditions associated (if the observation is produced from a helicopter, the report should identify the speed, vector, and altitude of the airship; the sea state, and lighting conditions) with observation; and how long an observer or set of observers maintained visual contact with a marine mammal;

e. evaluation of effectiveness of those mitigation measures at avoiding exposing endangered whales to ship traffic and endangered whales and pinnipeds to MFAS. This evaluation shall identify the specific observations that support any conclusion U.S. Navy reaches about effectiveness of mitigation measures;

f. evaluation of monitoring program's ability to detect marine mammals that occur within 200 yards of a sonobuoy and 500 and 1,000 yards of a sonar dome, during an active transmission (or close enough to an exercise to be exposed to mid-frequency sonar at received levels equal to or greater than 173 dB re 1 $\mu Pa^2 \cdot s$) with specific evidence that supports any conclusions U.S. Navy reaches.

REPORT ORGANIZATION

This report contains unclassified material and provides the information and analysis for Composite Unit Training Exercise (COMPTUEX) 08-1 and is submitted in fulfillment of NDE and BO written requirements.

The report is organized by section in the following order:

Section 1- Exercise Summary: provides exercise specific information including the starting and ending dates, the number of ships and aircraft participating, and the number of hours of mid-frequency active sonar (MFAS) used from all emitters.

Section 2- Biological Observations: provides an overview of marine mammal observations and post-exercise derived remote sensing of potential oceanographic conditions.

Section 3- Mitigation Assessment: provides an estimated number of marine mammals observed during COMPTUEX 08-1 potentially affected or not affected by Anti-submarine Warfare (ASW) operations, noting the nature of any observed effects where possible. Under the BO, this analysis is focused on marine mammal observations within 1000 yards of a MFAS transmission. In addition, Section 3 assesses the effectiveness of the NDE and BO mitigation and monitoring measures required during the exercise with regard to power down and shut down zones when marine mammals are sighted within the vicinity of ships using MFAS.

Appendix A: lists the 29 NDE mitigation measures.

BACKGROUND

Composite Unit Training Exercises (COMPTUEX) are part of an Integrated Phase of the Fleet Readiness Training Plan (FRTP) and may involve either a Carrier Strike Group (CSG) or an Expeditionary Strike Group (ESG). A COMPTUEX is conducted as a series of scheduled training events that occur according to a given time schedule against an opposition force. COMPTUEX provides an opportunity for the Strike Group to become proficient in myriad required warfare skill sets. Additionally, it stresses the integration or coordination of the different warfare areas and provides realistic training on in-theater operations.

Prior to the exercise, NMFS-approved marine species awareness training was provided to exercise participants. A Letter of Instruction (LOI) reiterating the NDE mitigation measures was distributed to participants explaining procedures for reporting marine mammal sightings discussed in Section 2. The NDE measures are presented in **Appendix A**.

MFAS use by surface ships and aviation assets (dipping sonar and DICASS sonobuoys) is captured and added to sonar totals reported in this document. MFAS on Los Angeles-class (SSN) submarines is seldom used in tactical training scenarios.

SECTION 1 EXERCISE SUMMARY

EXERCISE PARTICIPANTS

COMPTUEX 08-1 was conducted from 25 October to 14 November 2007, for the USS ABRAHAM LINCOLN CSG (**Table 1 and Figure 1**). Participating units included CSG assigned ships (surface combatants, submarines, and supply ships) and MFAS-equipped opposition forces (including submarines). Eight SQS-53C MFAS-equipped surface ships were present in COMPTUEX 08-1. However, there was minimum active sonar use by non-CSG assigned platforms because of either tactical considerations for surface ships and submarines or lack of MFAS capability (supply ships). There were no SQS-56 MFAS-equipped ships participating in this exercise. Based on the ship types in COMPTUEX 08-1, there were between 6 to 10 ASW-capable helicopters with dipping sonar available for training during the exercise on any given day depending on maintenance availability. All helicopters are not used all the time in any given exercise event which is driven by tactical and training objectives. Depending upon the training scenario, there were also one or two P-3 maritime patrol aircraft participating.

Total MFAS Use

During COMPTUEX 08-1, 345 hours of MFAS time were reported from all sources including hull mounted sonar, dipping sonar, and DICASS sonobuoy. Key caveats to the derivation of this total are presented in Section 3.

MITIGATION MEASURES FOLLOWED

All 29 mitigations measures as stated in the 23 January 2007 NDE (as presented in **Appendix A**) were adhered to during COMPTUEX 08-1. Those NDE measures include specific details for personnel training, established lookout and watchstander responsibilities, mandated specific operating procedures, and described coordination and reporting requirements. Observation data from Navy lookout sightings for COMPTUEX 08-1 is described in Section 2.

Table 1. Exercise summary for COMPTUEX 08-1 conducted within Southern California from 25 October to 14 November 2007.

Participants	Event Name	Dates	MFAS Use Reported (hours)
USS Abraham Lincoln CSG	COMPTUEX 08-1	25 Oct-14 Nov 2007	345 hrs
Number of MFAS equipped surface ships:			8
Estimated number of potential ASW helicopters:			6-10 upper estimate assumes no helicopters down for maintenance; not all helicopters used at same time

Figure 1. Approximate area of reported marine mammal sightings during exercise COMPTUEX 08-1.
Note: this area only represents the area in which marine mammal sightings were reported by exercise participants and does not imply operational area.

SECTION 2 BIOLOGICAL OBSERVATIONS

Section 2 provides an overview of marine mammal observations that require reporting under the Terms and Conditions of the National Marine Fisheries Service BO (NMFS 2007).

The biological summary in this section includes counts of the total numbers of marine mammals sighted and species guilds, estimates of the number of marine mammals observed within 1000 yards during MFAS transmission, and science-based discussions on likely species present in Southern California during this time of year.

COMPTUEX 08-1 BIOLOGICAL OBSERVATIONS

There were a total of 105 marine mammal sightings for an estimated 1,410 animals during COMPTUEX 08-1. The majority of animals sighted were dolphins and porpoises, with 46 dolphin sightings accounting for 1,255 animals or 89% of the total estimated number of animals.

There were 6 sightings of animals classified as "small whales" for a total of 7 animals, 24 sightings of animals classified as "large whales" for a total of 70 animals, 22 sightings of animals classified as "whale" (not designated small whale or large whale) for a total of 38 animals, and 4 sighting of pinnipeds (seal or sea lion) for a total of 38 animals (this includes 1 sighting of 34 pinnipeds resting on buoys and floating docks while a ship was leaving San Diego Bay).

Figure 1 shows the approximate boundaries of all marine mammal sightings during COMPTUEX 08-1. described in this section were made by standard Navy surface ship and aircrew lookout reporting procedures as detailed in a formal LOI issued prior to the exercise which reiterates the NDE measures and safety zones described in **Appendix A**.

Estimated numbers of marine mammals observed within 1,000 yards of a U.S. Navy ship in Southern California offshore waters during COMPTUEX 08-1 are presented in **Table 2** which lists each individual sighting. These sightings were taken during the exercise based on visual observations from trained U.S. Navy lookouts per ship (NDE mitigations measures 6 and 7). In addition to the 56 sightings in **Table 2**, there were an additional 49 sightings of marine mammals during COMPTUEX 08-1 at ranges greater than 1,000 yards (not shown in **Table 2)** when no MFAS transmission occurred.

Table 3 provides recent marine mammal sighting data conducted quarterly from July 2004 to November 2005 (Soldevilla et al. 2006). This paper represents one data source to visualize potential marine mammal seasonal assemblages within Southern California and one of the few reports with late fall and winter survey results. For November, ESA-listed species potentially included fin whales, humpback whales, and sperm whales (Soldevilla et al. 2006). The three most abundant dolphins were common dolphins (short-beaked and long-beaked), Risso's dolphin, and bottlenose dolphins (**Table 3**). Blue whales are more migratory within Southern California having to integrate food resources over large areas (D. Croll, UCSC personal communication). Blue whales in November typically have begun to head to winter foraging and potential breeding areas further south in the Eastern Tropical Pacific. However, based on preliminary plots from blue whales with satellite tracking tags, there were potentially blue whales still present within Southern California during October and November (**Figure 2**). These particular animals were part of a set of blue whales tagged in mid-September 2008 by academic researchers and data provided to the Tagging of Pacific Predators website (http://topp.org/). The U.S. Navy has contacted these researchers to see if detailed spatial information for tagged blue whales in Southern California can be made available for comparison with lookout sighting reports during COMPTUEX 08-1. As of the submission date for this report, daily location information for these tagged blue whale between October to November 2007 was

not available, but will be forwarded to NMFS as a supplement when received (Dr. Bruce Mate, OSU, personal communication). More detailed information on marine mammal seasonal occurrence in Southern California can be found in Forney and Barlow (1998), Carretta et al. (2000), Soldevilla et al. (2006), Barlow and Forney (2007), and Oleson et al. (2007).

Based on the references discussed above, and given the time of year COMPTUEX 08-1 occurred (Oct-Nov), likely ESA species present in Southern California during the exercise include blue whales, fin whales, humpback whales, and sperm whales, although sperm whales have a much more variable abundance in the deep offshore waters off California (Barlow and Forney 2007). The majority of sperm whale sightings reported in Barlow and Forney (2007) were from waters west of the Patton Escarpment, in areas of the Southern California Operating Area (OPAREA) not used for this exercise (west of the polygon in **Figure 1**). Humpback whales when feeding in Southern California are often more commonly sighted around the northern Channel Islands outside of the COMPTUEX 08-1 exercise area. At-sea distributions of Guadalupe sea lions are poorly documented so no determination of presence or absence can be inferred.

There were two sightings of floating pinniped (seal or sea lion) carcasses during the exercise, one on 26 October, and another on 2 November. The 2 November carcass was observed entangled in rope and mortality may have been the result of non-Navy fishery interaction. Sea lion mortalities within Central and Southern California have been increasing as the result of domoic acid poisoning resulting from harmful algal blooms as documented in Van Dolah et al. 2003, Greig et al. 2005, Van Dolah et al. 2005, Brodie et al. 2006, Goldstein et al. 2008.

Oceanographic conditions, which along with potential bathymetry features can influence large and small scale marine mammal distribution, were typical to cool for Southern California in November (Hickey 1993) with sea surface temperatures (SST) measured by satellite ranging between 12-20°C (°F) (**Figure 3**). There is some data to suggest a potential for La Niña conditions which often result in cooler than normal water temperature off California. The National Weather Service, Climate Prediction Center (http://www.cpc.noaa.gov/products/analysis_monitoring/ensostuff/ensoyears.shtml) indicates a cool water period based on the Oceanic Niño Index, a metric of a three month running mean of sea surface temperature (SST) anomalies in the Pacific Ocean (**Figure 4**). There was some indication of frontal activity within the middle of the exercise area (**Figure 5**) although current satellite detection technology and in particular thermal edge detection may not be sensitive enough to predict potential marine mammal occurrence as accurately as desired (Burtenshaw et al. 2004, Etnoyer et al. 2004, Etnoyer et al. 2006). Based on reports from individual U.S. Navy ships, sea states were relatively mild with the majority of sea states between 1 and 3.

Table 2. Marine mammal sightings and actions by exercise participants for marine mammals sighted within 1000 yards of a U.S. Navy vessel during COMPTUEX 08-1.
"NR" indicates "Not Reported", "N/A" indicates "Not Applicable"

Date and Local Time	Description of Actions Taken	SEA STATE	#	Animal Type	MFAS in use ?	Sonar Secured ?
25 Oct-1220	Surface ship sights 34 "sea lions" at 100 yards resting on buoy. MFAS not in use. No action taken.	1	34	sea lion	no	no
25 Oct-2300	Surface ship sights 10 "porpoises" transiting at 40 yards. MFAS not in use. No action taken.	1	10	porpoise	no	no
26 Oct-0100	Surface ship sights 30-50 "dolphins" at 100 yards. MFAS not in use. No action taken.	1	30-50	dolphin	no	no
26 Oct-0135	Surface ship sights 8-12 "dolphins" at 1000 yards. MFAS not in use. No action taken.	1	8-12	dolphin	no	no
26 Oct-0230	Surface ship sights 5-6 "dolphins" transiting to the south at 500 yards. MFAS not in use. No action taken.	1	5-6	dolphin	no	no
26 Oct-0833	Surface ship sights 10 "porpoises" at 500 yards. MFAS not in use. No action taken.	2	10	porpoise	no	no
27 Oct-0855	Surface ship sights 1 "whale" astern of ship at 150 yards spouting and diving. MFAS not in use. No action taken.	1	1	whale	no	no
27 Oct-1212	Surface ship sights 3 "whales" at 400 yards. MFAS not in use. No action taken.	1	3	whale	no	no
27 Oct-1225	Surface ship sights 1 "large whale" diving at 500 yards. MFAS not in use. No action taken.	2	1	large whale	no	no
27 Oct-1412	Surface ship sights 10 "dolphins" feeding and swimming at 340 yards. MFAS not in use. No action taken.	1	10	dolphin	no	no
28 Oct-0750	Surface ship sights 30 "porpoises" diving at 200 yards. MFAS not in use. No action taken.	2	30	porpoise	no	no
28 Oct-0914	Surface ship sights 30 "porpoises" diving at 100 yards. MFAS not in use. No action taken.	2	30	porpoise	no	no
28 Oct-1314	Surface ship sights 1 "large whale" diving at 600 yards. MFAS not in use. No action taken.	3	1	large whale	no	no
28 Oct-1342	Surface ship sights 1 "small whale" at 40 yards. MFAS not in use. No action taken.	3	1	small whale	no	no
28 Oct-1428	Surface ship sights 14-20 "dolphins" at 200 yards. MFAS not in use. No action taken.	3	14-20	dolphin	no	no
29 Oct-1150	Surface ship sights 50 "dolphins" swimming at 20 yards. MFAS not in use. No action taken.	3	50	dolphin	no	no
29 Oct-1817	Surface ship sights 10 "porpoises" crossing ship bow. MFAS not in use. No action taken.	2	10	porpoise	no	no
30 Oct-1007	Surface ship sights 5-7 "dolphins" swimming at 200 yards. MFAS not in use. No action taken.	2	5-7	dolphin	no	no
31 Oct-0651	Surface ship sights 10 "porpoises" crossing ship bow at 200 yards. MFAS not in use. No action taken.	2	10	porpoise	no	no
31 Oct-1023	Surface ship sights 10 "dolphins" at 500 yards. MFAS not in use. No action taken.	2	10	dolphin	no	no

Date and Local Time	Description of Actions Taken	SEA STATE	#	Animal Type	MFAS in use ?	Sonar Secured ?
31 Oct-1156	Surface ship sights 14 "dolphins" at 100 yards. MFAS not in use. No action taken.	2	14	dolphin	no	no
31 Oct-0944	Surface ship sights 25 "dolphins" swimming at 800 yards. MFAS not in use. No action taken.	2	25	dolphin	no	no
31 Oct-1028	Surface ship sights 60-80 "dolphins" transiting at 400 yards. MFAS not in use. No action taken.	1	60-80	dolphin	no	no
01 Nov-1018	Surface ship visually sights 50 "porpoises" transiting at 400 yards. **MFAS in use**. **MFAS secured for 10 minutes.**	1	50	porpoise	yes	yes
01 Nov-1035	Surface ship visually sights 1 "whale" at 1000 yards. **MFAS in use. MFAS 6 dB power reduction for 10 minutes**.	2	1	whale	yes	Power down
01 Nov-1339	Surface ship visually sights 2 "whales" at 200 yards. **MFAS in use. MFAS secured.** Unit lost track of ASW training target. Unit also slowed and maneuvered to avoid animals.	2	2	whale	yes	yes
02 Nov-1415	Surface ship sights 4 "large whales" traveling at 500 yards. MFAS not in use. No action taken.	2	4	large whale	no	no
03 Nov-0835	Surface ship sights 1 "seal or sea lion" traveling at 30 yards. MFAS not in use. No action taken.	1	1	seal or sea lion	no	no
03 Nov-0915	Surface ship visually sights 50 "dolphins" at 1000 yards. **MFAS in use. MFAS secured**.	1	50	dolphin	yes	yes
03 Nov-1605	Surface ship sights 3 "large whale" traveling at 300 yards. MFAS not in use. No action taken.	1	3	large whale	no	no
03 Nov-1632	Surface ship visually sights 1 "whale" at 150 yards. **MFAS in use. MFAS secured.**	1	1	whale	yes	yes
03 Nov-1704	Surface ship sights 2 "large whales" traveling at 200 yards. MFAS not in use. No action taken.	1	2	large whale	no	no
03 Nov-1805	Surface ship sights 6 "dolphins" traveling at 15 yards. MFAS not in use. No action taken.	1	6	dolphin	no	no
03 Nov-1812	Surface ship sights 4 "large whales" traveling at 200 yards. MFAS not in use. No action taken.	1	4	large whale	no	no
04 Nov-0600	Surface ship sights 1 "seal or sea lion" swimming at 50 yards. MFAS not in use. No action taken.	1	1	seal or sea lion	no	no
04 Nov-1021	Surface ship sights 20 "dolphins" at 1000 yards. MFAS not in use. No action taken.	2	20	dolphin	no	no
04 Nov-1155	Surface ship sights 120 "dolphins" jumping at 500 yards. MFAS not in use. No action taken.	2	120	dolphin	no	no
05 Nov-1123	Surface ship sights 2 "seals or sea lions" transiting at 100 yards. MFAS not in use. No action taken.	1	2	seal or sea lion	no	no
05 Nov-1530	Surface ship sights 30 "dolphins" traveling at 200 yards. MFAS not in use. No action taken.	1	30	dolphin	no	no

Date and Local Time	Description of Actions Taken	SEA STATE	#	Animal Type	MFAS in use ?	Sonar Secured ?
06 Nov-0712	Surface ship sights 1 "dolphin" traveling at 20 yards. MFAS not in use. No action taken.	1	1	dolphin	no	no
06 Nov-0745	Surface ship sights 5 "whales" swimming at 500 yards. MFAS not in use. No action taken.	2	5	whale	no	no
06 Nov-0814	Surface ship sights 100 "dolphins" at 1000 yards. MFAS not in use. No action taken.	2	100	dolphin	no	no
07 Nov-1435	Surface ship sights 1 "large whale" traveling at 100 yards. MFAS not in use. No action taken.	2	1	large whale	no	no
07 Nov-1438	Surface ship sights 1 "whale" at 100 yards. MFAS not in use. No action taken.	1	1	whale	no	no
07 Nov-0638	Surface ship sights 1 "whale" at 50 yards. MFAS not in use. No action taken. ***Ship slows and maneuvers to avoid animal.***	2	1	whale	no	no
08 Nov-0746	Surface ship sights 1 "whale" 90 yards. MFAS not in use. No action taken.	2	1	whale	no	no
08 Nov-0852	Surface ship sights 2 "whales" traveling at 500 yards. MFAS not in use. No action taken.	2	2	whale	no	no
08 Nov-0931	Surface ship sights 100 "dolphins" traveling at 300 yards. MFAS not in use. No action taken.	2	100	dolphin	no	no
08 Nov-1326	Surface ship sights 128 "dolphins" traveling at 300 yards. MFAS not in use. No action taken.	2	128	dolphin	no	no
09 Nov-1645	Surface ship sights 20 "dolphins" traveling at 1000 yards. MFAS not in use. No action taken.	1	20	dolphin	no	no
09 Nov-1224	Surface ship sights 40 "dolphins" at 15 yards. MFAS not in use. No action taken.	1	40	dolphin	no	no
10 Nov-1215	Surface ship sights 40 "dolphins" traveling at 100 yards. MFAS not in use. No action taken.	1	40	dolphin	no	no
11 Nov-0838	Surface ship sights 35 "dolphins" traveling at 100 yards. MFAS not in use. No action taken.	3	35	dolphin	no	no
11 Nov-1350	Surface ship visually sights 3 "whales" traveling at 200 yards. **MFAS in use. MFAS secured for 3 minutes.**	3	3	whale	yes	yes
12 Nov-0806	Surface ships sights 3 "whales" swimming at 200 yards. MFAS not in use. No action taken.	2	3	whale	no	no
12 Nov-0023	Surface ship sights 6 "minke whales" swimming at 1000 yards. MFAS not in use. No action taken.	2	6	large whale	no	no

Table 3. Visual detections of cetaceans over California Cooperative Oceanic Fisheries Investigations (CalCOFI) cruises from July 2004–November 2005. Total number of individuals sighted per species for each trip (Table from: Soldevilla et al. 2006).

	Jul. 2004	Nov. 2004	Jan. 2005	Apr. 2005	Jul. 2005	Nov. 2005	Total
Blue whale	9	7	–	–	14	–	30
Fin whale	11	9	–	2	7	32	61
Gray whale	–	1	4	–	–	–	5
Humpback whale	2	22	–	17	7	7	55
Minke whale	–	–	–	1	2	1	4
Sperm whale	14	–	–	5	5	3	27
Killer whale	–	–	–	–	6	–	6
Baird's beaked whale	20	–	–	–	–	–	20
Cuvier's beaked whale	2	4	–	–	–	–	6
Unid. beaked whale	–	2	–	–	–	–	2
Unid. whale	34	25	6	7	18	6	96
Common dolphin—short-beaked	1657	1946	2421	440	2184	412	9060
Common dolphin—long-beaked	475	3729	60	1650	1084	235	7233
Common dolphin—unid. spp	843	852	29	32	3481	1621	6858
Risso's dolphin	17	102	12	26	–	235	392
Northern right whale dolphin	–	2	5	299	3	14	323
Pacific white-sided dolphin	25	183	44	157	81	2	492
Rough-toothed dolphin	–	–	–	9	–	–	9
Striped dolphin	77	–	–	–	–	–	77
Bottlenose dolphin	30	11	–	20	–	56	117
Unid. dolphin	900	2204	1220	183	207	392	5106
Dall's porpoise	2	–	21	58	–	17	98
Harbor porpoise	2	–	–	–	–	–	2
Total individuals sighted	4120	9099	3822	2906	7099	3033	30079

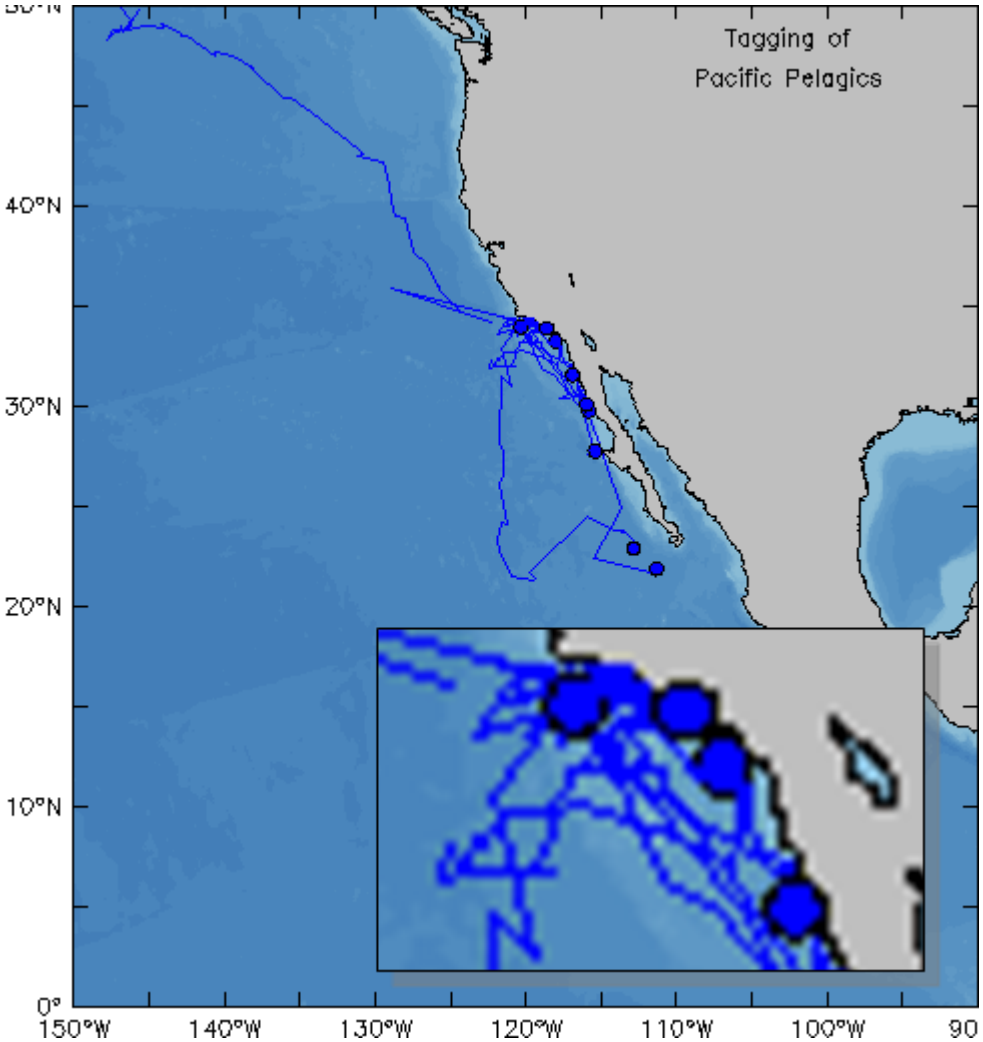
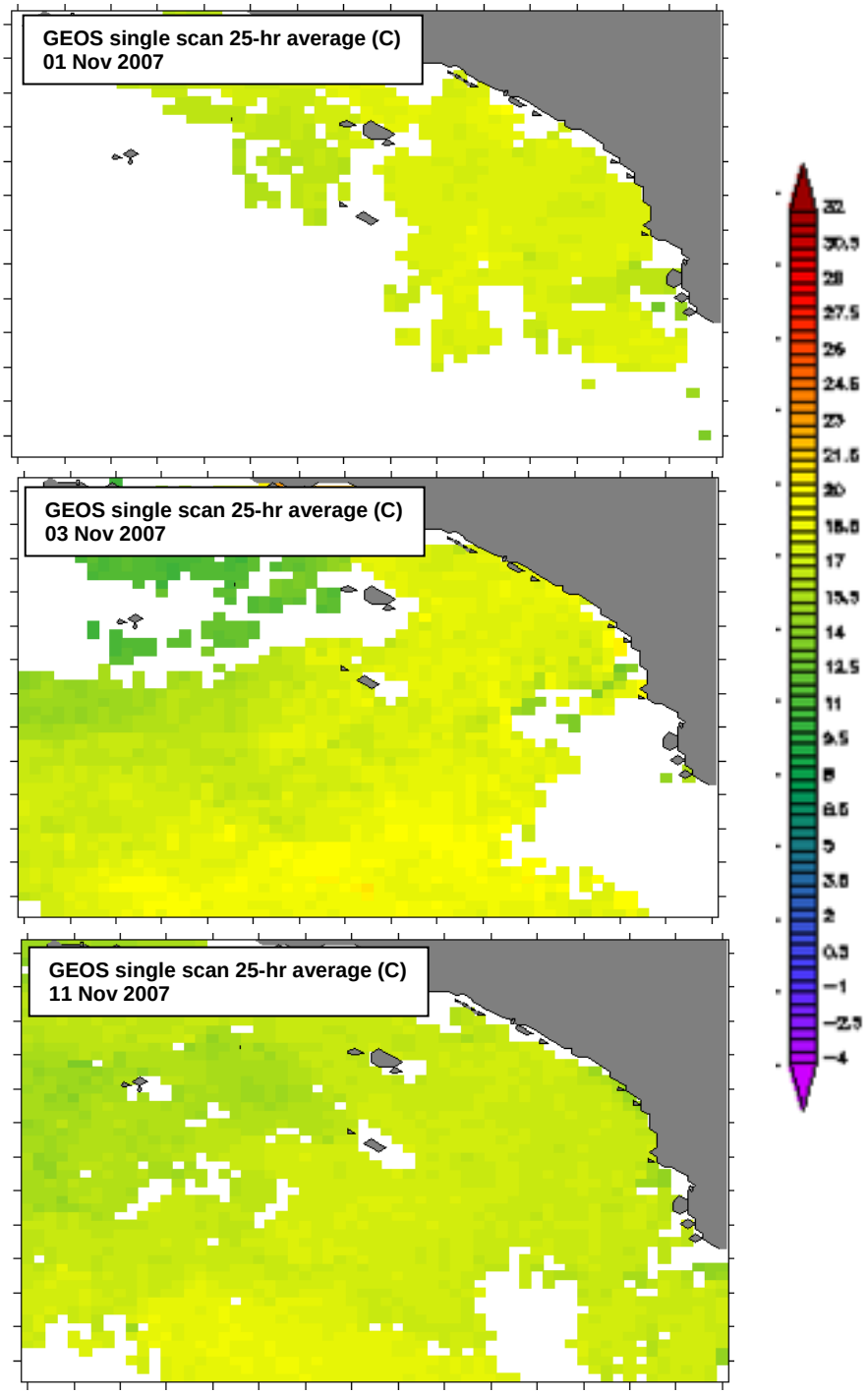


Figure 2. Location of blue whales with satellite tracking tags within Southern California waters November 2008.
Animals were tagging in mid-September 2007. Graphic shows approximate locations on 11/01/2008
(image from Tagging of Pacific Predators web site http://topp.org/)

Figure 3. Sea surface temperature (SST) for Southern California on 01, 03, and 11 November 2007.
(GOES SST 25 hour average from North Pacific Demonstration Project Ocean Watch provided online by Coastwatch and Southwest Fisheries Science Center, NMFS http://las.pfeg.noaa.gov/oceanWatch/oceanwatch.php?hab=0)



Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
1950	-1.8	-1.5	-1.4	-1.4	-1.4	-1.2	-0.9	-0.8	-0.8	-0.8	-0.9	-1.0
1951	-1.0	-0.8	-0.6					0.5	0.6	0.7	0.7	0.6
1952												
1953												
1954				-0.5	-0.7	-0.7	-0.8	-1.0	-1.1	-1.1	-1.0	-1.0
1955	-1.0	-0.9	-0.9	-1.0	-1.1	-1.0	-1.0	-1.0	-1.5	-1.8	-2.1	-1.7
1956	-1.2	-0.8	-0.7	-0.6	-0.6	-0.5	-0.7	-0.8	-0.9	-0.9	-0.9	-0.8
1957	-0.5			0.6	0.7	0.8	0.9	0.9	0.8	0.9	1.2	1.5
1958	1.6	1.5	1.1	0.7	0.5	0.5						
1959												
1960												
1961									-0.6	-0.6	-0.5	-0.5
1962	-0.5	-0.5	-0.5	-0.5	-0.4	-0.3	-0.2	-0.3	-0.4	-0.6	-0.7	-0.7
1963	-0.6						0.6	0.8	0.8	0.9	1.0	1.0
1964	0.8			-0.5	-0.7	-0.7	-0.8	-0.9	-1.0	-1.1	-1.1	-1.0
1965	-0.8	-0.5				0.6	1.0	1.2	1.4	1.5	1.6	1.5
1966	1.2	1.1	0.8	0.5								
1967										-0.5	-0.5	-0.6
1968	-0.7	-0.9	-0.8	-0.8							0.6	0.9
1969	1.0	1.0	0.9	0.7	0.6				0.6	0.7	0.7	0.6
1970	0.5						-0.6	-0.8	-0.8	-0.8	-0.9	-1.2
1971	-1.4	-1.4	-1.2	-1.0	-0.8	-0.8	-0.8	-0.8	-0.9	-0.9	-1.0	-0.9
1972	-0.7				0.5	0.8	1.1	1.3	1.5	1.8	2.0	2.1
1973	1.8	1.2	0.5		-0.5	-0.8	-1.1	-1.3	-1.4	-1.7	-1.9	-2.0
1974	-1.8	-1.6	-1.2	-1.1	-0.9	-0.7	-0.5	-0.4	-0.5	-0.7	-0.8	-0.7
1975	-0.6	-0.6	-0.7	-0.8	-1.0	-1.1	-1.3	-1.4	-1.6	-1.6	-1.7	-1.8
1976	-1.6	-1.2	-0.9	-0.7	-0.5				0.5	0.7	0.8	0.8
1977	0.6	0.5							0.5	0.7	0.8	0.8
1978	0.7											
1979												
1980												
1981												
1982					0.6	0.7	0.8	1.0	1.5	1.9	2.2	2.3
1983	2.3	2.0	1.6	1.2	1.0	0.6			-0.5	-0.8	-0.9	-0.8
1984	-0.5									-0.6	-1.0	-1.1
1985	-1.0	-0.8	-0.8	-0.8	-0.7	-0.5						
1986								0.5	0.7	0.9	1.1	1.2
1987	1.3	1.2	1.1	1.0	1.0	1.2	1.5	1.6	1.6	1.5	1.3	1.1
1988	0.8	0.5			-0.8	-1.2	-1.2	-1.1	-1.3	-1.6	-1.9	-1.9
1989	-1.7	-1.5	-1.1	-0.9	-0.6							
1990												
1991					0.6	0.8	0.9	0.9	0.8	1.0	1.4	1.7
1992	1.8	1.7	1.6	1.4	1.1	0.8						
1993			0.6	0.8	0.8	0.7	0.5					
1994				0.5	0.6	0.6	0.6	0.6	0.7	0.9	1.2	1.3
1995	1.2	0.9	0.7						-0.5	-0.6	-0.7	-0.8
1996	-0.8	-0.7	-0.5									
1997					0.9	1.4	1.7	2.0	2.3	2.4	2.5	2.5
1998	2.4	2.0	1.4	1.1			-0.8	-1.0	-1.1	-1.1	-1.3	-1.5
1999	-1.6	-1.2	-0.9	-0.7	-0.8	-0.8	-0.9	-0.9	-1.0	-1.2	-1.4	-1.6
2000	-1.6	-1.5	-1.1	-0.9	-0.7	-0.5				-0.5	-0.7	-0.7
2001	-0.7	-0.5										
2002					0.7	0.8	0.9	0.9	1.1	1.3	1.5	1.3
2003	1.1	0.8	0.6									
2004							0.7	0.8	0.9	0.9	0.9	0.8
2005	0.6	0.5										
2006									0.7	0.9	1.1	1.1
2007	0.8							-0.6	-0.8	-1.1	-1.2	-1.4
	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ

warm period scale
= 0.5 to 0.7
= 0.8 to 1.0
= >1.1
cold period scale
= -0.5 to -0.7
= -0.8 to -1.0
= > -1.1

Figure 4. Pacific Ocean warm and cold episodes by season with COMPTUEX 08-1 period circled.

Warn and cold episodes based on a threshold of +/- 0.5 C for the Oceanic Niño Index (ONI) [3 month running mean of ERSST.v2 SST anomalies in the Niño 3.4 region (5N-5S, 120o-170W)], based on the 1971-2000 base period. For historical purposes cold and warm episodes are defined when the threshold is met for minimum of 5 consecutive overlapping seasons. Data from National Weather Service, Climate Prediction Center
http://www.cpc.noaa.gov/products/analysis_monitoring/ensostuff/ensoyears.shtml

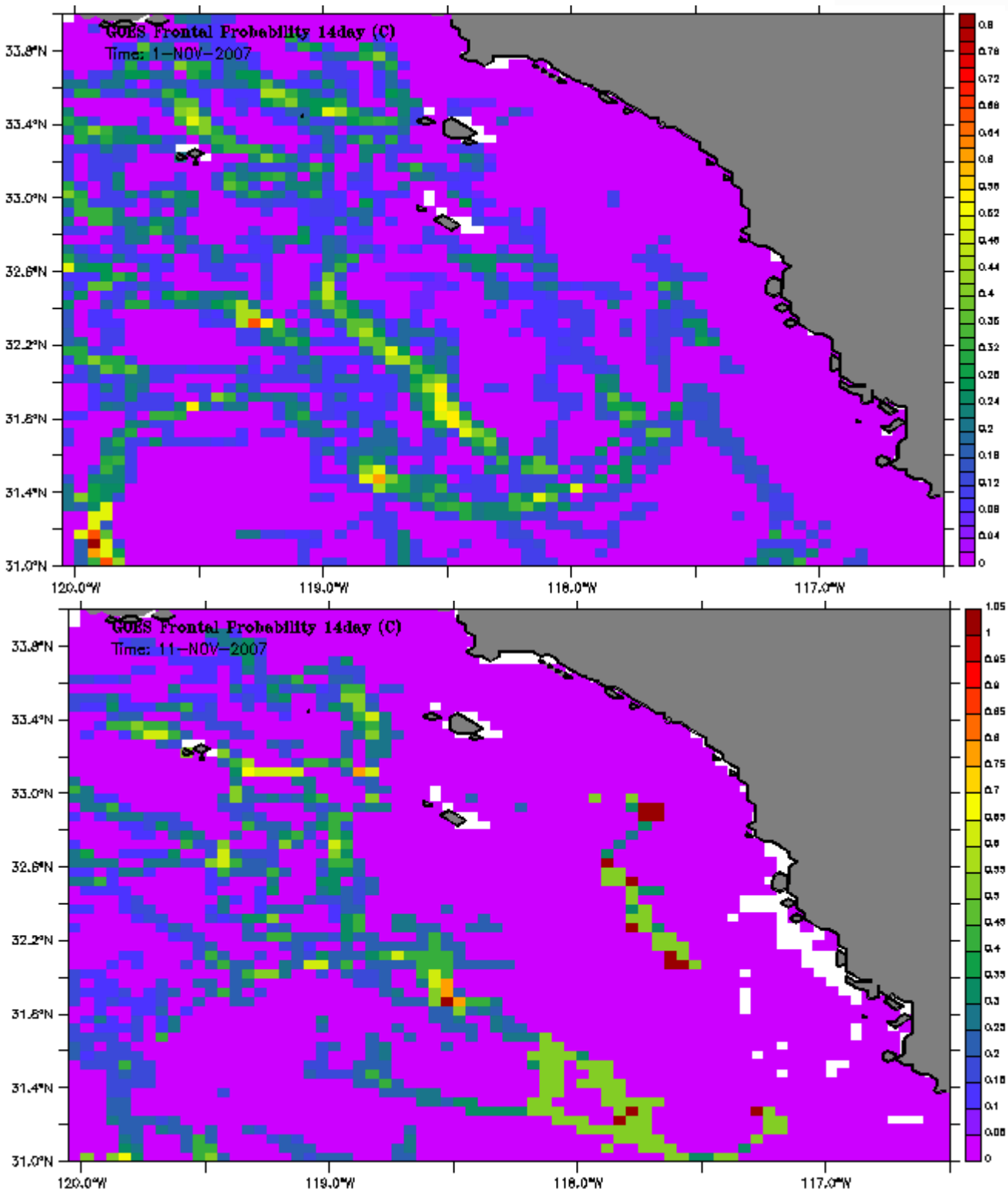


Figure 5. Southern California monthly frontal probability index for 01 and 11 Noveber 2007; medium and long term frontal activity is often associated with potentially increased biological activity as oceanographic conditions concentrate nutrients within a defined area.
(from North Pacific Demonstration Project Ocean Watch provided online by Coastwatch and Southwest Fisheries Science Center, NMFS http://las.pfeg.noaa.gov/oceanWatch/oceanwatch.php?hab=0)

SECTION 3 MITIGATION ASSESSMENT

COMPTUEX 08-1 ASSESSMENT

OVERVIEW

The NDE calls for the U.S. Navy to submit a report to NMFS that includes a discussion of the nature of any effects or lack of effects based on modeling results and marine mammal sightings. In addition, the BO Terms and Conditions require a report that evaluates the mitigation measures and details results from the U.S. Navy's exercise monitoring and reporting program. In this case, the mitigation measure under the BO are the NDE measures, therefore, the discussion is presented together in this section.

This section of the report provides an assessment of the effectiveness of the mitigation and monitoring measures. The section includes discussion of observations during MFAS transmission, limitations with passive sonar detection, mention of other effects (i.e. vessel strikes), comparison of pre-exercise acoustic model impact predictions with actual COMPTUEX 08-1 observations, and NDE and BO conclusions.

ASW proceeds slowly and requires careful development of a tactical frame of reference over time. Data is integrated from a number of sources and sensors. Once MFAS is turned off for a period of time, turning it back on later does not usually allow a commander to simply continue from the last frame of reference. Lost MFAS time not only equates to lost exercise time, but has a broader, overall impact on the tempo and development of a "tactical picture" shared among exercise participants as they train toward the goal of improving ASW skills in general.

Mitigation measures were designed to minimize interactions between marine mammals and Navy vessels involving MFAS levels that have potential to result in a Temporary Threshold Shift (TTS) and Permanent Threshold Shift (PTS) (DoN 2007). During COMPTUEX 08-1, Navy assets observed marine mammals only infrequently and encounters were brief in duration. This is due to both aviation asset and surface ship movement and animal movement. Navy ships were not tasked nor expected to maintain contact with marine mammals sighted for purposes of monitoring requirements. To do so would have unnecessarily interfered with military readiness activities and may result in concerns Navy ships were intentionally harassing marine mammals.

MFAS TRANSMISSION

As in any review of the operational aspects of U.S. Navy ASW operations using MFAS, specific source levels, numbers of sources, and frequencies of sonars used during COMPTUEX 08-1 are classified since this information provides potential adversaries with critical tactical data. The following discussion is focused on the 1) amount of time spent visually searching the ocean for marine mammals, 2) the amount of time conducting MFAS (as required to be reported under the NMFS BO), and 3) a discussion of individual events when MFAS was active and marine mammals were spotted within 1,000 yards.

1) Visual sighting effort: Visual sighting effort by ship for COMPTUEX 08-1 can be approximated given the numbers of days this major exercise occurred (21 days), the number of hours per day (24 hours), the normal standard operating procedure for all vessels to have at least 3 lookouts on watch and scanning the ocean at all times (24/7), and the presence of 8 MFAS-equipped vessels. Therefore, 4,032 hours of MFAS surface ship visual survey effort for marine mammals occurred during COMPTUEX 08-1 (21 days x 24 hrs/day = 504 hrs x 8 ships = 4,032). This accounts for time conducting non-MFAS events and MFAS events.

2) MFAS use: During COMPTUEX 08-1, 345 hours of MFAS time was reported from all sources including hull-mounted 53C, helicopter dipping sonar, and DICASS sonobuoys (**Table 1**). These hours are reflective of MFAS use by various units geographically spread out over the entire exercise area (**Figure 1**) and are not an indication of consecutive and continuous use (i.e. NOT 345 hours/24 hours per day = 14 days); A closer approximation would have to account for potential concurrent use by several units including up to eight MFAS ships and aviation units).

It should be noted that MFAS is only used for a small subset of any given exercise time frame. Total active sonar hours, as presented in this report, represent a sum of the total MFAS time from a number of individual training events during COMPTUEX 08-1. In other words, the unit using sonar records when the sonar was turned on at the beginning of a training event and reports time until the event is finished. The sonar "on period" is **not** equivalent to active sonar transmission since there may be tactical and maintenance reasons why MFAS may not be in transmit mode for the entire training event. Therefore, based on how the U.S. Navy MFAS reporting system operates and standardized reporting protocols, number of MFAS hours value does not represent actual total sonar ping hours. Furthermore, during periods when there is an active transmission, MFAS only puts active sound into the water at discrete intervals. Sonar signals are not a continuous source of acoustic energy. For example, surface ship sonar signal consists of a pulse (i.e. ping) significantly less than one to two seconds long with time between successive pings as much as 30 seconds (NMFS 2007). During typical active sonar use, the MFAS active sonar is silent for the vast majority of the time which was also the case for COMPTUEX 08-1.

Given the relatively conservative nature of the U.S. Navy sonar use reporting system (i.e. higher number of hours discussed above compared to actual time spent pinging), the 345 hours of MFAS use represents less than 10% of the total ship observation effort (345/4,032 = 8.6%).

3) MFAS Events: Tables 2 and 6 shows COMPTUEX 08-1 marine mammal sightings in relation to NDE-mandated safety zones.

There were a total of six occurrences of MFAS being turned off (i.e. secured) or powered down by surface ships based on marine mammal sightings within the NDE safety zones (<200 yards, 201-500 yards, and 501-1000 yards).

Estimated exposures can be determined based on standard generic formulas of how sound propagates in water [defined as spherical spreading where propagation loss from a source = 20log[R] with "R" being range from the source (Urick 1982)]. This estimate of potential exposure makes a very conservative assumption. This assumption is based on using the horizontal range from a visual sighting to account for an animal across all depths to which an animal travels in which it could receive the maximum potential exposure. In other words, this worst case exposure is presented independent of the animal's actual depth level since a) time and depth of current and previous dives cannot be deduced from a limited surface sighting and b) oceanographic and tactical conditions influence actual sound propagation at different depths. Given relative motion of ships and animals at sea, the time spent with any given exposure from surface ships is limited.

200 yard NDE safety zone: From **Table 5**, there were three separate events for a total of six whales (potential ESA species) observed within 200 yards during MFAS transmission. In all three cases sonar was secured. Estimated exposures calculated as described above were 191 and 189 dB re 1 μPa2•s. In one of these instances of securing the sonar, a target contact was lost, potentially adversely impacting the fidelity of the training exercise.

201-500 yards NDE safety zone: From **Table 5**, there was only 1 instance when a pod of 50 dolphins were observed at 400 yards. MFAS was secured for 10 minutes until the animals were no longer in sight as an added precaution by this particular vessel. The tactical implication of this event is under internal Navy evaluation. Estimated exposure was 183 dB re 1 μPa2•s.

501-1,000 yards NDE safety zone: From **Table 5**, there were 2 separate cases where marine mammals were observed at 1,000 yards, 1 whale (potential ESA species) observed for 10 minutes until lost from sight and 50 dolphins. MFAS was powered down 6 dB during the whale sighting and secured during the dolphin sighting. Given the relative position of the dolphins ahead of that particular vessel, the ship elected to secure sonar vice powering down. The tactical implication of this event is under internal Navy evaluation. Estimated exposure was 175 dB re 1 μPa2•s.

There were no during or post-exercise reports of any marine mammal shore strandings during COMPTUEX 08-1 that can be associated with U.S. Navy operations. Two decomposing sea lion carcasses were sighted at sea, but as described in Section 2, indications of non-Navy fishery entanglement and other ongoing sources of natural mortality within California are likely causes.

For all of COMPTUEX 08-1 marine mammal sightings, there was no obvious indication or report that any animal behaved in a manner not associated with normal movement, or foraging, recognizing that the level of biological information obtained is limited at this time.

PASSIVE SONAR

Passive sonar involves acoustic listening to underwater sounds and does not involve transmitting active sound into the water column. Passive sonar use is driven by the tactical nature of an ASW or training event, and should be assumed to be employed whenever possible. Given the nature of passive sonar technology and underwater sound propagation, localizing or determining range and absolute position of a marine mammal is generally not possible or exceedingly difficult with any single ship-based passive sonar.

Also, there is no current technology on U.S. Navy MFAS-equipped ships to easily localize marine mammals in real-time using passive detection. If passive detection were that easy in a dynamic coastal environment, then there would be no need for active sonar submarine detection because passive technology could be used instead. This is not the case, and active sonar is critical in providing range and bearing to potential underwater submarines and mines.

In addition, passive sonar may only detect marine mammals that are actually vocalizing (i.e. making underwater sound as part of communication and echolocation). Marine mammals do not always vocalize based on individual needs at a particular moment, species-level foraging and mating strategies, and other oceanographic or biological factors. Depending on oceanographic conditions and animal source levels, when marine mammal do vocalize, sounds can easily travel 1 to several 10s of kilometers (km) (0.5 nautical mile (nm) to 10s of nm) for some mid-to-low frequency animals, and 10s to 100s of km for very low frequency baleen whales (i.e. blue and fin whales). These ranges demonstrate that even if the marine mammal vocalization can be detected, it does not mean the mammal is necessarily close to a ship or bottom-mounted range hydrophone.

OTHER EVENTS

In regards to impacts not associated with MFAS such as ship strikes, the U.S. Navy has a robust required ship strike reporting program. No marine mammal ship strikes occurred during COMPTUEX 08-1. During COMPTUEX 08-1, there were three instances where U.S. Navy ships not using MFAS proactively maneuvered to avoid close encounters with marine mammals, providing evidence that these marine mammal mitigation measures are well-understood by Fleet operators and actively executed in operational practices. For COMPTUEX 08-1, these procedures are assessed to have been effective.

MODELING ESTIMATES APPLICABLE TO COMPTUEX 08-1

For the COMPTUEX/JTFEX EA/OEA (DoN 2007) an estimate of potential acoustic exposures to marine mammals was generated in support of the NEPA process. **Table 4** shows estimated marine mammal acoustic exposures from model derived calculations based on estimated marine mammal densities, operational parameters, sound transmission loss, and potential energy accumulated based strictly on pre-exercise acoustic impact modeling (DoN 2007). **Table 4** only lists possible marine mammal species generally occurring in Southern California waters based solely on *estimated* distribution and abundance, but does not take into account potential seasonal distribution. This table highlights the ESA-listed species described in the COMPTUEX/JTFEX BO (NMFS 2007) and shows estimated potential acoustic exposures derived from acoustic impact modeling (DoN 2007 COMPTUEX/JTFEX EA/OEA).

The exercise specific model estimated total potential exposures over two years of Southern California COMPTUEXs and JTFEXs. Extrapolating for a single exercise as in **Table 4** estimates 12,198 potential exposures (11,564 sub-TTS Level B, 590 TTS Level B, and 44 Level A). These estimates include an overly conservative assumption that counts exposures to Level B harassment levels as Level A exposures for beaked whale species.

Clearly, as seen from the 107 animals (100 dolphins and 7 potential ESA-listed whales) reported as being potential exposed to MFAS greater than 173 dB but less than 191 dB re 1 $\mu Pa^2 \cdot s$ during COMPTUEX 08-1, the level of actual animal density encountered within Southern California, even considering animals not detected visually, appears to have been significantly less than pre-exercise modeling assumptions. This is reflective of the conservative data used to populate acoustic effects models, the lack of scientific information on regional occurrence and distribution for many species, and the resulting broad assumptions that are typically used in the models concerning animal distribution and biology.

FINAL NDE AND BO ASSESSMENT

1) All measures promulgated in the 23 January 2007 *Mid-Frequency Active Sonar Mitigation Measures during Major Training Exercises or within Established DoD Maritime Ranges and Established Operating Areas* (NDE) section were implemented before and during COMPTUEX 08-1.

2) In addition to the above assessment of the NDE, the BO calls for a report that evaluates the effectiveness of the U.S. Navy's exercise mitigation measures. The three categories of measures (Personnel Training, Lookout and Watchstander Responsibilities, and Operating Procedures) as outlined in the NDE are effective in detecting and responding appropriately to the presence of marine mammals, when visually observed. Fleet commanders and ship watch teams continue to improve individual awareness and enhance reporting through various pre-exercise conferences, lessons learned, and these after action reports. The NDE safety zones are adhered to and vessels apply mitigation when marine mammals are first visually observed within a zone. The U.S. Navy acknowledges that this discussion does not account for potential marine mammal species not visually observed, which is a difficult determination even within the marine mammal scientific survey community. Deep diving animals if

exposed may not be exposed to significant levels for long periods, given the moving nature of ship MFAS use and even more limited pings from lower power aviation deployed MFAS systems (dipping sonar, sonobuoys). For instance, during a 1 hour dive by a beaked whale or sperm whale, a MFAS ship moving at a nominal 10 knot speed would cover about 10 nm from its original location, well beyond ranges predicted to have significant exposures. For cryptic, hard to spot species when at the surface, such as beaked whales, real-time detection is difficult given any U.S. Navy or non-Navy science tool presently available.

3) NMFS (2007) COMPTUEX/JTFEX BO Terms and Conditions require the U.S. Navy to estimate the number of ESA-listed marine mammals that may have been exposed to received energy level equal to or greater than 173 dB re 1 $\mu Pa^2 \cdot s$. A summary of this is provided for all marine mammals (potential ESA and non-ESA) above and in **Table 5**.

4) From **Table 4**, a single COMPTUEX/JTFEX would be expected to potentially expose 101 ESA-listed marine mammals from all MFAS sources based solely on pre-exercise predicted impact models, yet only 7 potential ESA-listed marine mammals were actually observed during COMPTUEX 08-1 at ranges that may have exposed them to a Sound Exposure Level (SEL) greater than 173 dB but less than 191 dB re 1 $\mu Pa^2 \cdot s$. In addition, a single COMPTUEX/JTFEX would also be expected to potentially expose 12,097 other non-ESA-listed marine mammals from all MFAS sources based solely on pre-exercise predicted impact models, yet only 100 potential marine mammals were actually observed during COMPTUEX 08-1 at ranges that may have exposed them to SEL greater than 173 dB but less than 183 dB re 1 $\mu Pa^2 \cdot s$. Clearly, acoustic impact models overestimate potential marine mammal exposures.

5) For all of COMPTUEX 08-1 marine mammal sightings, there was no obvious indication or report that any animal behaved in a manner not associated with normal movement or foraging, recognizing that the level of biological information obtained is limited at this time.

Data Limitations and Improvements

There is no information from which to assess how many, if any, animals <u>not observed</u> by Navy lookouts may or may not have been exposed to MFAS received levels greater than 173 dB re 1 $\mu Pa^2 \cdot s$.

Data collection needed to address this question will be reviewed as they become available for potential incorporation into future exercises, although this remains a problematic science issue for even non-Navy marine mammal surveys. Real-time passive sonar systems used by the U.S. Navy, and to some degree by most of the marine mammal science community, lack the ability to automatically classify detected species, although there is substantial academic research into improving this capability. Most current passive data sets rely on extensive post-collection analysis by skilled subject matter experts to conclusively establish species identification. In addition to species classification, range detection using moving passive acoustic systems on U.S. Navy ships is limited in real time at the typical 8-10 knot speeds at which many ASW training events occur. Indeed, if passive range detection of any submerged contacts (submarines, marine mammals) was more advanced and easier, then there would be less tactical reliance on active sonar systems. Also, non-vocalizing marine mammals cannot currently be detected using passive systems.

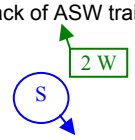
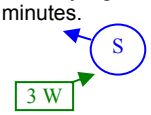
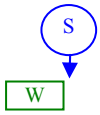
The U.S. Navy continues conducting robust and realistic exercises and developing long-term range complex monitoring plans. The goal of these plans is to integrate multiple tools, such as surveys, in an effort to generate better assessments of marine mammal occurrence and possible MFAS effects, or lack thereof. In accordance with the COMPTUEX/JTFEX BO, data collection needs to address unresolved questions regarding likely area-specific species composition and potential for alternative detection technologies may be incorporated into future exercises as the U.S. Navy's exercise monitoring program evolves.

Table 4. Total estimated annual exposures based on pre-exercise modeling for MFAS sonar from DoN 2007 based on seven exercise per year (COMPTUEX/JTFEX EA/OEA Tables 4.3-6 and 4.3-7) (*left three columns*), and estimated exposures per exercise (estimated total exposures divided by seven) (*right three columns*).

Species	DoN 2007 annual estimated exposures			Estimated single exercise exposures		
	Level B Sub TTS	Level B	Level A	Level B Sub TTS	Level B	Level A
ESA-listed						
Blue whale	325	14	0	46.4	2.0	0
Fin whale	263	10	0	37.6	1.4	0
Humpback whale	33	0	0	4.7	0	0
Sei whale	2	0	0	0.3	0	0
Sperm whale	59	4	0	8.4	0.6	0
Non-ESA listed						
Baird's beaked whale	4	0	(4)*	0.6	0	0.6
Bottlenose dolphin	516	30	0	73.7	4.3	0
Bryde's whale	2	0	0	0.3	0.0	0
Common dolphin	69,258	3,464	8	9894.0	494.9	1.14
Cuvier's beaked whale	208	10	(218)*	29.7	1.4	31.1
Dall's porpoise	142	3	0	20.3	0.4	0
Dwarf sperm whale	0	0	0	0.0	0.0	0
False killer whale	16	0	0	2.3	0.0	0
Gray whale	64	0	0	9.1	0.0	0
Killer whale	12	1	0	1.7	0.1	0
Mesoplodon spp.	0	0	0	0.0	0.0	0
Minke whale	24	2	0	3.4	0.3	0
Northern right whale dolphin	3,003	227	0	429.0	32.4	0
Pacific white-sided dolphin	1,949	101	0	278.4	14.4	0
Pantropical spotted dolphin	547	0	0	78.1	0	0
Pygmy sperm whale	859	56	0	122.7	8.0	0
Risso's dolphin	2,050	96	0	292.9	13.7	0
Rough-toothed dolphin	0	0	0	0	0	0
Short-finned pilot whale	0	0	0	0	0	0
Striped dolphin	1,554	72	0	222.0	10.3	0
Ziphiid beaked whale	49	3	(52)*	7.0	0.4	7.4
California sea lion	0	0	0	0	0	0
Northern elephant seal	0	0	0	0	0	0
Pacific harbor seal	6	0	0	0.9	0	0
			Total=	**11,564**	**590**	**44**

* ALL predicted beaked whale Level B exposures (sub-TTS and TTS) counted as Level A exposures as an overly conservative metric

Table 5. Sightings during COMPTUEX 08-1 where MFAS was on and mitigation occurred. Listed by range. (**Bold=** potential ESA species).

Assessment by Range for Surface Ship MFA sonar		
Range	**ESA species (potential) in BOLD /** or MMPA species (non-BOLD)	**Comments** Relative position of ship (S) movement and whale (W) or dolphin location (D) shown below if known. Estimated exposure based on 20Log[R] spherical spreading propagation loss where "R" is range from 235 ship MFAS (Urick 1982)
200 yards **Sonar secured** **(turned off)**	**1 whale**	03 Nov: Surface ship visually sights 1 "whale" at 150 yards. MFAS in use. MFAS secured. MAX. est. MFAS exposure: **191** dB re 1 $Pa^2 \cdot s$
	2 whales	01 Nov: Surface ship visually sights 2 "whales" at 200 yards. MFAS in use. MFAS secured. Unit lost track of ASW training target. Unit also slowed and maneuvered to avoid animals.  MAX. est. MFAS exposure: **189** dB re 1 $Pa^2 \cdot s$
	3 whales	11 Nov: Surface ship visually sights 3 "whales" traveling at 200 yards. MFAS in use. MFAS secured for 3 minutes.  MAX. est. MFAS exposure: **189** dB re 1 $Pa^2 \cdot s$
200-500 yards **Sonar reduced** **-10 dB (surface ship only)**	50 dolphins or porpoises	01 Nov: Surface ship visually sights 50 "porpoises" transiting at 400 yards. MFAS in use. MFAS secured for 10 minutes. MAX. est. MFAS exposure: **183** dB re 1 $Pa^2 \cdot s$
500- 1000 yards **Sonar reduced** **-6 dB** **(surface ship only)**	**1 whale**	01 Nov: Surface ship visually sights 1 "whale" at 1000 yards. MFAS in use. MFAS 6 dB power reduction for 10 minutes.  MAX. est. MFAS exposure: **175** dB re 1 $Pa^2 \cdot s$
	50 dolphins	03 Nov: Surface ship visually sights 50 "dolphins" at 1000 yards. MFAS in use. MFAS secured. MAX. est. MFAS exposure: **175** dB re 1 $Pa^2 \cdot s$
Assessment by Range for Helicopter MFA dipping sonar		
Range	**ESA species (potential) in BOLD /** or MMPA species (non-BOLD)	**Comments**
< 200 yards- Sonar secured (turned off)		No reports

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APPENDIX A -NDE MEASURES

NDE

NDE mitigation measures include:

I. General Maritime Protective Measures: Personnel Training:

1. All lookouts onboard platforms involved in ASW training events will review the NMFS approved Marine Species Awareness Training (MSAT) material prior to use of mid-frequency active sonar.
2. All Commanding Officers, Executive Officers, and officers standing watch on the bridge will have reviewed the MSAT material prior to a training event employing the use of MFAS.
3. Navy lookouts will undertake extensive training in order to qualify as a watchstander in accordance with the Lookout Training Handbook (NAVEDTRA 12968-B).
4. Lookout training will include on-the-job instruction under the supervision of a qualified, experienced watchstander. Following successful completion of this supervised training period, Lookouts will complete the Personal Qualification Standard program, certifying that they have demonstrated the necessary skills (such as detection and reporting of partially submerged objects). This does not preclude personnel being trained as lookouts counted as those listed in previous measures so long as supervisors monitor their progress and performance.
5. Lookouts will be trained in the most effective means to ensure quick and effective communication within the command structure in order to facilitate implementation of protective measures if marine species are spotted.

II. General Maritime Protective Measures: Lookout and Watchstander Responsibilities:

6. On the bridge of surface ships, there will always be at least three people on watch whose duties include observing the water surface around the vessel.
7. In addition to the three personnel on watch noted previously, all surface ships participating in ASW exercises will have at all times during the exercise at least two additional personnel on watch as lookouts.
8. Personnel on lookout and officers on watch on the bridge will have at least one set of binoculars available for each person to aid in the detection of marine mammals.
9. On surface vessels equipped with MFAS, pedestal mounted “Big Eye” (20x110) binoculars will be present and in good working order to assist in the detection of marine mammals in the vicinity of the vessel.
10. Personnel on lookout will employ visual search procedures employing a scanning methodology in accordance with the Lookout Training Handbook (NAVEDTRA 12968-B).
11. After sunset and prior to sunrise, lookouts will employ Night Lookouts Techniques in accordance with the Lookout Training Handbook.
12. Personnel on lookout will be responsible for reporting all objects or anomalies sighted in the water (regardless of the distance from the vessel) to the Officer of the Deck, since any object or disturbance (e.g., trash, periscope, surface disturbance, discoloration) in the water may be indicative of a threat to the vessel and its crew or indicative of a marine species that may need to be avoided as warranted.

III. Operating Procedures

13. A Letter of Instruction, Mitigation Measures Message or Environmental Annex to the Operational Order will be issued prior to the exercise to further disseminate the personnel training requirement and general marine mammal protective measures.

14. Commanding Officers will make use of marine species detection cues and information to limit interaction with marine species to the maximum extent possible consistent with safety of the ship.

15. All personnel engaged in passive acoustic sonar operation (including aircraft, surface ships, or submarines) will monitor for marine mammal vocalizations and report the detection of any marine mammal to the appropriate watch station for dissemination and appropriate action.

16. During MFAS operations, personnel will utilize all available sensor and optical systems (such as Night Vision Goggles to aid in the detection of marine mammals.

17. Navy aircraft participating in exercises at sea will conduct and maintain, when operationally feasible and safe, surveillance for marine species of concern as long as it does not violate safety constraints or interfere with the accomplishment of primary operational duties.

18. Aircraft with deployed sonobuoys will use only the passive capability of sonobuoys when marine mammals are detected within 200 yards of the sonobuoy.

19. Marine mammal detections will be immediately reported to assigned Aircraft Control Unit for further dissemination to ships in the vicinity of the marine species as appropriate where it is reasonable to conclude that the course of the ship will likely result in a closing of the distance to the detected marine mammal.

20. Safety Zones - When marine mammals are detected by any means (aircraft, shipboard lookout, or acoustically) within 1,000 yards of the sonar dome (the bow), the ship or submarine will limit active transmission levels to at least 6 dB below normal operating levels.

    (i) Ships and submarines will continue to limit maximum transmission levels by this 6 dB factor until the animal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 2,000 yards beyond the location of the last detection.

    (ii) Should a marine mammal be detected within or closing to inside 500 yards of the sonar dome, active sonar transmissions will be limited to at least 10 dB below the equipment's normal operating level. Ships and submarines will continue to limit maximum ping levels by this 10 dB factor until the animal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 2,000 yards beyond the location of the last detection.

    (iii) Should the marine mammal be detected within or closing to inside 200 yards of the sonar dome, active sonar transmissions will cease. Sonar will not resume until the animal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 2,000 yards beyond the location of the last detection.

    (iv) Special conditions applicable for dolphins and porpoises only: If, after conducting an initial maneuver to avoid close quarters with dolphins or porpoises, the Officer of the Deck concludes that dolphins or porpoises are deliberately closing to ride the vessel's bow wave, no further mitigation actions are necessary while the dolphins or porpoises continue to exhibit bow wave riding behavior.

(v) If the need for power-down should arise as detailed in "Safety Zones" above, Navy shall follow the requirements as though they were operating at 235 dB - the normal operating level (i.e., the first power-down will be to 229 dB, regardless of at what level above 235 sonar was being operated).

21. Prior to start up or restart of active sonar, operators will check that the Safety Zone radius around the sound source is clear of marine mammals.

22. Sonar levels (generally) – The ship or submarine will operate sonar at the lowest practicable level, not to exceed 235 dB, except as required to meet tactical training objectives.

23. Helicopters shall observe/survey the vicinity of an ASW exercise for 10 minutes before the first deployment of active (dipping) sonar in the water.

24. Helicopters shall not dip their sonar within 200 yards of a marine mammal and shall cease pinging if a marine mammal closes within 200 yards after pinging has begun.

25. Submarine sonar operators will review detection indicators of close-aboard marine mammals prior to the commencement of ASW operations involving active mid-frequency sonar.

26. Increased vigilance during major ASW training exercises with tactical active sonar when critical conditions are present.

Based on lessons learned from strandings in Bahamas 2000, Madeiras 2000, Canaries 2002, and Spain 2006, beaked whales are of particular concern since they have been associated with MFAS operations. Navy should avoid planning major ASW training exercises with MFAS in areas where they will encounter conditions which, in their aggregate, may contribute to a marine mammal stranding event.

The conditions to be considered during exercise planning include:

(1) Areas of at least 1000 m depth near a shoreline where there is a rapid change in bathymetry on the order of 1000-6000 meters occurring across a relatively short horizontal distance (e.g., 5 nm).

(2) Cases for which multiple ships or submarines (≥ 3) operating MFAS in the same area over extended periods of time (≥ 6 hours) in close proximity (≤ 10NM apart).

(3) An area surrounded by <u>land masses, separated by less than 35 nm and at least 10 nm in length</u>, or an <u>embayment</u>, wherein operations involving multiple ships/subs (≥ 3) employing MFAS near land may produce sound directed toward the channel or embayment that may cut off the lines of egress for marine mammals.

(4) Although not as dominant a condition as bathymetric features, the historical presence of a <u>significant surface duct</u> (i.e. a mixed layer of constant water temperature extending from the sea surface to 100 or more feet).

If the major exercise must occur in an area where the above conditions exist in their aggregate, these conditions must be fully analyzed in environmental planning documentation. Navy will increase vigilance by undertaking the following additional protective measure:

A dedicated aircraft (Navy asset or contracted aircraft) will undertake reconnaissance of the embayment or channel ahead of the exercise participants to detect marine mammals that may be in the area exposed to active sonar. Where practical, advance survey should occur within about two hours prior to MFA sonar use, and periodic surveillance should continue for the duration of the exercise. Any unusual conditions (e.g., presence of sensitive species, groups of species milling

out of habitat, any stranded animals) shall be reported to the Officer in Tactical Command (OTC), who should give consideration to delaying, suspending or altering the exercise.

All safety zone requirements described in Measure 20 apply.

The post-exercise report must include specific reference to any event conducted in areas where the above conditions exist, with exact location and time/duration of the event, and noting results of surveys conducted.

IV. Coordination and Reporting

27. Navy will coordinate with the local NMFS Stranding Coordinator for any unusual marine mammal behavior and any stranding, beached live/dead or floating marine mammals that may occur at any time during or within 24 hours after completion of mid-frequency active sonar use associated with ASW training activities.

28. Navy will submit a report to the OPR, NMFS, within 120 days of the completion of a Major Exercise. This report must contain a discussion of the nature of the effects, if observed, based on both modeled results of real-time events and sightings of marine mammals.

29. If a stranding occurs during an ASW exercise, NMFS and Navy will coordinate to determine if MFAS should be temporarily discontinued while the facts surrounding the stranding are collected.