2006 Rim of the Pacific Exercise After Action Report:

Analysis of the Effectiveness of the Mitigation and Monitoring Measures as Required Under the Marine Mammal Protection Act (MMPA) Incidental Harassment Authorization and National Defense Exemption from the Requirements of the MMPA for Mid-Frequency Active Sonar Mitigation Measures

Dated December 7, 2006

INTRODUCTION

This report is presented to fulfill the requirements conditional to the 2006 Rim of the Pacific Exercise (RIMPAC 06) Marine Mammal Protection Act (MMPA) Incidental Harassment Authorization (IHA) and the National Defense Exemption from the Requirements of the MMPA for Certain DoD Mid-Frequency Active Sonar Activities (NDE).

Pursuant to the MMPA, an IHA was sought from the National Marine Fisheries Service (NMFS), which was issued by the NMFS Division of Permits, Conservation, and Education, Office of Protected Resources for 2006 RIMPAC Exercise on 27 June 2006. On 30 June 2006, the Deputy Secretary of Defense issued the NDE, which specified that for the conduct of RIMPAC 2006, the Navy would comply with all mitigation measures set out in the IHA. The IHA required that the Navy, "Submit a report to the Division of Permits, Conservation, and Education, Office of Protected Resources, NMFS and the Pacific Islands Regional Office, NMFS, within 90 days of the completion of RIMPAC."[1] The IHA further specifies that the report contain and summarize the following information:

> (1) "An estimate of the number of marine mammals affected by the RIMPAC ASW exercises and a discussion of the nature of the effects, if observed, based on both the modeled results of real-time exercises and sightings of marine mammals";
> (2) "An assessment of the effectiveness of the mitigation and monitoring measures with recommendations on how to improve them";
> (3) "Results of the marine species monitoring (real-time monitoring from all platforms, independent aerial monitoring, shore-based monitoring at chokepoints, etc.) before, during, and after the RIMPAC exercises"; and
> (4) "As much information (unclassified and, to appropriately cleared recipients, classified "secret") as the Navy can provide including, but not limited to, where and when sonar was used (including sources not considered in take estimates, such as submarine and aircraft sonars) in relation to any measures received levels (such as sonobuoys or on PMRF range), source levels, numbers of sources, and frequencies so it can be coordinated with observed cetacean behaviors."

This report, which contains only unclassified material, provides the necessary information and analyses, and thus fulfills these requirements. The report is organized by section following the order of the requirements in the IHA.

Section 1 provides an estimated number of marine mammals affected by the RIMPAC 06 ASW events based on analysis of actual events and sightings of marine mammals, noting the nature of any observed effects where possible.

1 Given that the last day of the RIMPAC 2006 exercise was 26 July 2006, this report is due no later than 24 October 2006.

Section 2 of this report assesses the effectiveness of the mitigation and monitoring measures required during RIMPAC 2006 with regard to minimizing the use of Mid-Frequency Active Sonar (MFAS) in the vicinity of marine mammals. This section also includes an assessment of the practicality of implementation of the mitigation measures, the scientific basis behind those measures, and the impact some of the measures had on safety and the effectiveness of the required military readiness activities.

Section 3 presents the results of the marine species monitoring comprised of independent aerial reconnaissance, shore-based monitoring in the vicinity of the chokepoint events, and results from the NMFS observers embarked on the USS LINCOLN during one of the choke-point exercises. Also included in this section is a summary of the 29 marine mammal detections made by exercise participants during RIMPAC 06.

Section 4 of this report provides data on the location and hours of active MFAS used during RIMPAC 06 placed in context with observations of cetacean behaviors resulting from the aerial reconnaissance and shore-based monitoring and exercise participants.

SECTION 1: Marine Mammals Affected

The requirements stipulated in the IHA are to provide; "An estimate of the number of marine mammals affected by the RIMPAC ASW exercises and a discussion of the nature of the effects, if observed, based on both the modeled results of real-time exercises and sightings of marine mammals". To meet this requirement, Section 1 provides an estimated number of marine mammals affected by the RIMPAC 06 ASW events based on Navy's original calculations using a threshold of 190dB for sub-TTS effects, and analysis of actual events and sightings of marine mammals, noting the nature of any observed effects. It is compared to the estimated number of marine mammals affected as calculated when applying the 173dB sub-TTS threshold required by NMFS for issuance of the IHA.

The RIMPAC 2006 Supplemental Environmental Assessment predicted 532 hours of hull mounted MFAS use by exercise participants based on what had occurred in the previous RIMPAC exercise (RIMPAC 2004) and based on the present tactical ASW training requirements. In actuality, 472 hours of MFAS use from hull mounted sources occurred during RIMPAC 06 exercise.[2]

The types of ASW training conducted during RIMPAC 06 involved the use of ships, submarines, aircraft, non-explosive exercise weapons, and other training related devices. While ASW events would occur throughout the Hawaiian Islands Operating Area, most events would occur within six areas that were used for the modeling analysis since they were representative of variation in the marine mammal habitats and the bathymetric, seabed, wind speed, and sound velocity profile conditions within the entire Hawaiian Islands Operating Area (OPAREA). Figure 1 on the following page displays the areas used for modeling and the OPAREA for the RIMPAC 06 exercise.

For purposes of the impacts analysis, all likely RIMPAC 06 ASW events were modeled as occurring in these areas. In fact, the majority of MFAS use occurred in the modeled areas as predicted (see Section 4 for a more detailed discussion), but any deviation from this would have been immaterial since the modeled areas were delineated so as to encompass the variation occurring in the entire Hawaiian Islands Operating Area.

Modeling a predicted number of marine mammals affected by the RIMPAC 06 ASW events was undertaken based on acoustic thresholds derived from experimental data – 190 dB Sound Exposure Level (SEL), which Navy believed, in a worst case analysis, indicated the potential to affect 289 marine mammals (for further details see the 2006 Supplement to the 2002 Rim of the Pacific Programmatic Environmental Assessment). This number was calculated from the modeling without consideration for reductions resulting from the standard Navy protective measures mitigating exposure to MFAS or the additional measures imposed by the IHA.

2 Three days of planned MFAS use were precluded by a temporary restraining order resulting from a lawsuit.

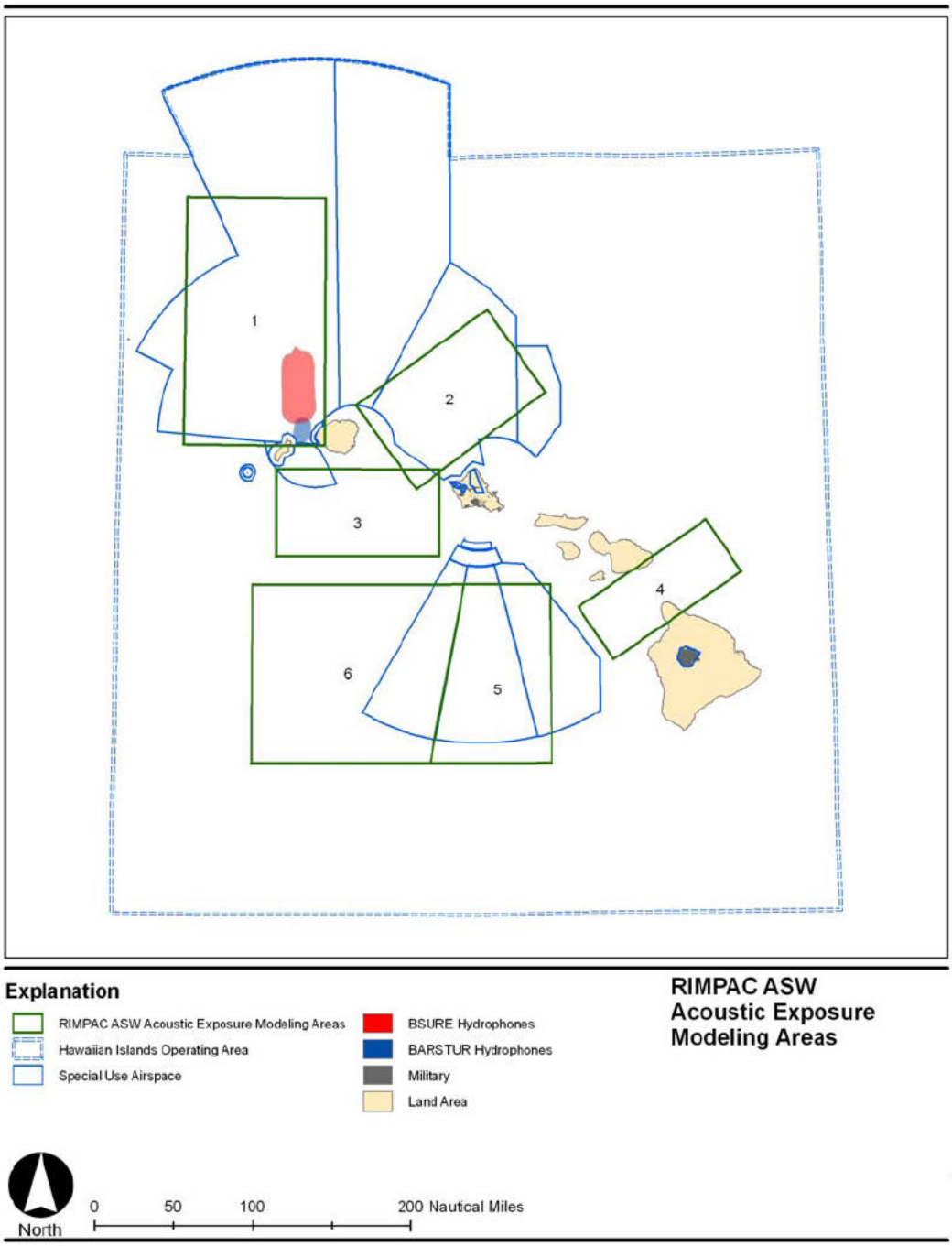

Figure 1. RIMPAC 2006 Exercise Operating Area depicting the areas used for modeling purposes in the analysis of effects on marine mammals.

Based on the reduction of MFAS hours from the modeled 532 to the actual 472 hours, the estimated potential number of marine mammals affected may be reduced to approximately 256 marine mammals (based on a ratio of marine mammal exposures exceeding the threshold to hours of MFAS operation).

Following the modeled calculation of marine mammals affected, if required to determine the actual number of marine mammals affected by the exercise as mandated by the IHA, it is necessary to take into consideration standard Navy protective measures including decreasing the source level and then shutting down MFAS when detected marine mammals are approached. This must be done since the mitigative effect of the protective measures were not factored into the modeling calculations. While there is no clear metric value that can be assigned to mitigative effect of these measures, there was a reduction in potential to impact marine mammals by their implementation.

During the exercise, there were 29 instances when marine mammals (individuals or pods) were detected by exercise participants. All detections were made by standard lookout and aircraft reporting procedures except for one case of passive acoustic detection, which is also a standard Navy practice protective measure. As a result of the protective measures in place and the high-level emphasis placed upon marine mammal protection, MFAS was shutdown by 12 exercise participants due to the detected marine mammals as detailed in Table 1.

Table 1. Details of the 29 marine mammal detections and actions by exercise participants during RIMPAC 06.

	July Date-Time (Z)	Modeled Area (Fig. 1)	Lost Hours	Description of Actions Taken
1	7/10-1738	1	0.5	Helicopter sighted "marine mammal" >30Kyds from two active ships. Two ships shutdown MFAS for 15 min until further information from reporting unit was obtained and assessed in regard to requirements. Submarines in vicinity.
2	7/10-1912	5	1.5	Surface ship sighted "marine mammal" and shutdown MFAS. Other Surface Action Group (SAG) units notified. Helicopter obtained visual on "a whale"; notified nearest ship in SAG. Second helicopter 11 nm west detected another "whale" four minutes later but contact then immediately lost on both whales. Ship in SAG obtained visual on "pod of dolphins", which then approached w/in 1000 yards so MFAS reduced sonar by 6 dB. Second pod of dolphins appeared soon thereafter and then a third "whale" appeared inside 200 yards MFAS shutdown for all three 3 SAG surface and 2 air units 30 min. MFAS resumed 30 minutes later after range opened. Submarine in vicinity. Note: 6 total marine mammal detections this event.
3	7/11-1314	2		Surface ship sighted "dolphin" at 500 yds. MFAS not active.
4	7/11-1522	2		Surface ship sighted "pod of whales" range at 300 yds. Maneuvered to open range. MFAS not active.
5	7/11-1641	2		Surface ship sighted "whale" at 200 yds. MFAS not active.
6	7/12 0215	2	0.5	Sighted "marine mammal" and shutdown MFAS opened range prior to recommencing active.

Table 1 (cont.). Details of marine mammal detections and actions by exercise participants during RIMPAC 06

	July Date-Time (Z)	Modeled Area (Fig. 1)	Lost Hours	Description of Actions Taken
7	7/12-1827	5	2.0	P-3 aircraft detected passive acoustic marine mammal traces within 4000 yards. Active tracking of submarine ceased with limitation to passive only and lost contact. Four submarines in vicinity.
8	7/14-1909	1		Ship sighted "whale" >1000 yards. MFAS remained active.
9	7/14-1923	1		Ship sighted "marine mammal" >1000 yards. MFAS remained active.
10	7/17-1625	1		Ship sighted a "dolphin". MFAS not active.
11	7/17 2248	2	0.5	P-3 aircraft sighted two "whales". Could not use active (DICASS) buoys. Submarine in vicinity.
12	7/19 0046	1	0.25	Ship sighted "2 pods of 10 pilot whales". Shutdown MFAS.
13	7/19 0320	1	0.5	Ship sighted "pod of three pilot whales" to the south bearing 040T @200 yds. Shutdown MFAS.
14	7/19 1819	2	0.25	Ship sighted "whales" 1000 yards off port beam. Shutdown MFAS.
15	7/20 0346	5	1.0	Ship sighted "pod of whales". Shutdown MFAS.
16	7/20 1612	2	0.5	Ship sighted "marine mammals". Shutdown MFAS. Submarine in vicinity.
17	7/20 2013	6		Ship sighted "dolphins" off bow. MFAS not active.
18	7/20 2128	6		P-3 aircraft sighting of 8 "whales". DICASS not available for tactical development. Submarine in immediate vicinity.
19	7/20 2300	5		Ship sighted 5 "dolphins" moving SE at 8 kts. MFAS not active Two submarines in vicinity.
20	7/21 1742	5		Ship sighted pod of approx 20 "dolphins" moving to SE. MFAS not active. Two submarines in vicinity.
21	7/22 0429	5		Ship sighted "porpoises" 1-2 miles off starboard beam. MFAS not active. Two submarines in vicinity.
22	7/23 0457	3		Ship sighted "pilot whale". MFAS not active.
23	7/23 1913	5	0.5	Ship sighted 20 "whales" heading SW and shutdown MFAS. Two submarines in the area.
24	7/25 0015	4		**NMFS** passed along report of pod of approx 400-500 melon-headed whales in channel between Maui and Hawaii. P-3 tasked to investigate but verification precluded due to cloud cover.
25	7/25 0430	5		Ship sighted "whale". MFAS not active.
		Participant Hours Lost	**8.0**	

As noted previously, instances of marine mammal detection by exercise participants with the resulting implementation of protective measures was unaccounted for by the predictive modeling assessing potential exercise effects on marine mammals. In RIMPAC 06, there were 29 marine mammal detections by exercise participants, which resulted in protective measures being implemented for approximately 70 marine mammals and eight additional "pods" of marine mammals (Table 1). Assuming that each detected (un-quantified) pod of marine mammals consisted of at least four marine mammals, then the total number of detected marine mammals for which exposure to MFAS was limited by standard Navy lookouts was approximately 100 marine mammals.

Also required for the analysis in this section was consideration of "the nature of any observed effects" resulting from MFAS use. The reports from exercise participants contained nothing that could be construed as abnormal or "observed effects" of MFAS. There were no instances where marine mammals behaved in an erratic, unusual, or anything other than a normal manner.

Details regarding sightings and behaviors resulting from the aerial reconnaissance and the shore-based observers are presented in Section 3 of this report. In short, there were no abnormal behaviors or unusual distributions of marine mammals observed during these monitoring efforts and, therefore, no observed effects resulting from MFAS use.

Of the estimated potential 256 marine mammals affected by 472 hours of MFAS use, approximately 100 were precluded from exposure to MFAS by implementation of the protective measures. Therefore, an estimate of the number of marine mammals affected by the RIMPAC ASW exercises was 156 marine mammals based on the modeled results of real-time exercises, actual events, and sightings.

NMFS believed that the 190dB SEL sub-TTS threshold was not sufficiently precautionary and required Navy to apply for its IHA using 173dB SEL. Using the 173dB threshold with the same modeling program and marine mammal density estimates as before, we arrived at in excess of 33,000 behavioral disturbances, or takes. For perspective, this is about twice the number of marine mammals estimated to inhabit the waters around Hawaii in which the exercise took place.

There were no affected marine mammals observed by exercise participants, aerial or shore based monitors, or via any other reports. Therefore, further analysis based on observed effects, as mandated by this reporting requirement, is not possible and was not attempted.

In summary, the pre-exercise estimate of marine mammals behaviorally affected in RIMPAC 06 was 289 using 190dB sub-TTS threshold and over 33,000 using 173dB. No observers, from any platform or vantage point, noted in any reports that any marine mammals were affected by sonar. Conclusions are:

- Using 173dB SEL, a discrete decibel level, to define sub-TTS threshold was overly precautionary to a significant degree.

- There was no evidence of any behavioral affects on marine mammals throughout the exercise.

SECTION 2: Mitigation And Monitoring

As required under the IHA the report must contain, "An assessment of the effectiveness of the mitigation and monitoring measures with recommendations on how to improve them". This section of the report, therefore, provides an assessment of the effectiveness of the mitigation and monitoring measures, the scientific validity behind each measure, and recommendations on how to improve them with regard to practicality of implementation, their impact on exercise safety, and their impact on the effectiveness of the military readiness training activity.

During RIMPAC 06, there were 199 anti-submarine warfare (ASW) events and 472 total hours of mid-frequency active sonar (MFAS) use. There were no reported stranding events or observations of behavioral disturbance of marine mammals linked to sonar use during the exercise. Specifically, there were three monitored choke-point exercises with observations by aerial reconnaissance and shore-based monitors before, during, and after. There was no indication from the Navy monitors or from the non-governmental civilian monitors of any effects on marine mammals. These results are consistent with the previous 19 RIMPAC exercises in which no strandings linked to sonar use.

The only mitigation measures that prevented the use of MFAS in the vicinity of marine mammals were those that the Navy already had in place (Lookouts, aircraft reporting, and "safety zones") with the exception of a modification of the Navy's safety zone (450 yds) to 1000 m, agreed to for issuance of the IHA. The result of applying these standard mitigation measures was that exercise participants lost approximately eight hours of active sonar use.

In the 12 events where MFAS was shutdown by exercise participants, a total of approximately eight hours of ongoing MFAS use ceased, thus impacting the effectiveness of those military readiness activities. Some of the interrupted events involved lost time by multiple units operating in an integrated manner with the ramification being that shutdown of MFAS by a Surface Action Group (SAG) consisting of three vessels for 30 minutes resulted in 1.5 hours lost training time. Many of these events took place when submarines were in the vicinity of exercise participants and could have possibly been detected if MFAS had been available. It is important to realize that for the remainder of the instances for which marine mammals were detected, the option to use MFAS as tactically indicated was precluded and thus impacted the effectiveness of exercise event since commanders were operating without the option of their full sensor suite (e.g., helicopters operating with the SAG). This is especially true in the case of events involving sonobuoys where the inability to command-activate DICASS may have precluded the ability to track a contact or precluded development of attack criteria. In one case during RIMPAC 06 (Table 1, #7), a P-3 aircraft lost track on a submarine actively being prosecuted resulting in a major training impact to the unit involved.

ASW proceeds slowly and requires careful development of a tactical frame of reference over time as data is integrated from a number of sources and sensors. Once MFAS is turned off for a period of time, simply turning it back on minutes later does not usually allow a Commander to simply continue from the last frame of reference. Thus, 15 minutes of lost MFAS time does not equate to only 15 minutes of lost exercise time but should be considered in the fuller context of its overall impact on the tempo and tactical development of a Common Operational Picture shared among exercise participants as they trained with the goal of interoperability and improvement of ASW skills in general.

While the Navy's standard protective measures impacted the effectiveness of the training, a subset of the additional measures imposed by the IHA had no observed increased effectiveness in the protection of mammals during this exercise, and restricted the ability to train realistically in the known diesel submarine threat environments required for warfighting readiness. This subset of mitigation measures is as follows:

- Requirements regarding "strong surface ducting conditions"
- Requirements regarding "low visibility conditions"
- Restrictions from operating MFAS within 25 km of the 200 m isobath.
- Restrictions from operating MFAS in choke-points, constricted channels or canyon-like areas.

The following requirements associated with choke-point events were monitoring efforts mandated by NMFS as a sampling strategy to determine if there was any effect on marine mammals during these transits of the channels while conducting ASW operations..

- Additional requirements when conducting choke-point operations, to include:
    - Additional Non-Navy observers
    - Extensive additional aircraft monitoring
    - Shoreline reconnaissance
    - Additional Navy lookouts

These measures arose from a precautionary concern that MFAS use in the channels could possibly have greater potential to impact marine mammals, despite no evidence suggestive of this from previous RIMPAC exercises. The cost to implement these requirements was $66,000 for RIMPAC 06.

Analysis of results from RIMPAC indicates that the types of measures already in place in the Protective Measures Assessment Protocol (PMAP) were adequate to prevent operation of MFAS in the vicinity of detected marine mammals:

- There were no indications of any effects to any marine species throughout the exercise.
- Of the 29 instances where marine mammals were detected, MFAS was shutdown for 12 units and ASW events were interrupted by implementation of standard mitigation measures by Navy watch standers or aircraft (see Table 1). Mitigation

measures agreed to for this exercise that were in addition to Navy SOP protective measures did not provide observable increased protection to marine mammals.

- Burdensome administration of the IHA's additional mitigation measures distracted exercise participants, watchstanders, and exercise commanders at the headquarters level from their primary responsibility of exercise training and safety. While personnel seemed to adequately absorb this increased workload, there were no indications from all observations that the additional mitigation measures required provided additional protection to marine mammals during this exercise.

The following protective measures were already Navy SOP (PMAP) and were also mandated as mitigation measures for RIMPAC:

1. Personnel are trained on marine mammal awareness and mitigation measures.
2. There are personnel on lookout with binoculars at all times when the vessel is moving through the water.
3. On surface ships there are always at least three people on the bridge on lookout at all times and during ASW operations at least five people on lookout.
4. Lookouts report the sighting of any marine species, disturbance to the water's surface, or object in the water to the Officer of the Deck, who is the Commanding Officer's direct representative on watch.
5. A safety zone is established around an active sonar source and sonar power is reduced when marine mammals enter this zone.
6. Submarine sonar operators review detection indicators of close-aboard marine mammals prior to the commencement of ASW operations involving MFAS.
7. Aerial surveillance for marine species occurs whenever possible and detections are reported to ships in the vicinity.
8. Helicopters using active (dipping) sonar observe and employ a safety zone.
9. Sonar is always operated at the lowest practicable level to meet tactical training objectives.

The following mitigation measures agreed to for issuance of the IHA had no observable impact on the protection of mammals in this exercise and negatively affected training. Prohibitions against operating in shallow water or in choke-points are contrary to ASW training requirements. These measures affect the ability to train realistically in the known diesel submarine threat environment and directly impact vital military readiness activity:

1. The restriction from operating MFAS within 25 km of the 200 m isobath.
2. The restriction from conducting sonar activities in constricted channels or canyon-like areas.

The following measures had no observable effect on the protection of mammals during this exercise, and could not be accurately and uniformly employed:

1. Requirements regarding "strong surface ducting conditions"
2. Requirements regarding "low visibility conditions"

To organize the assessment of each mitigation measure, they are presented below in the order and organization as presented by in the IHA.

RIMPAC 06 IHA Mitigation and Monitoring Requirements

Measures (a) and (b)
The first two mitigation measures ((a) and (b)) detail training requirements for units participating in MFAS ASW exercises. All of the requirements within these two measures are redundant with the Marine Species Awareness Training (MSAT) that Navy lookouts and bridge personnel receive as Navy SOP. MSAT was developed in coordination with marine biology experts within the Navy and provides all effective marine species detection cues and information necessary to detect marine mammals and sea turtles. This material is part of the Navy Lookout watchstander qualification system, and will soon be available as online interactive training, and can also be provided in a video format for large audience presentations.

NMFS (Pacific Islands Region) reviewed and approved MSAT to meet the purposes of these first two mitigation measures.

Measure (a)
The MMPA Permit Monitoring and Mitigation Measure (a) read as follows:

(a) All RIMPAC participants will receive the following marine mammal training/briefing during the port phase of RIMPAC:
(i) Exercise participants (CO/XO/Ops) will review the C3F Marine Mammal Brief, available OPNAV N45 video presentations, and a NOAA brief presented by C3F on marine mammal issues in the Hawaiian Islands.
(ii) NUWC will train observers on marine mammal identification observation techniques.
(iii) Third fleet will brief all participants on marine mammal mitigation requirements.
(iv) Participants will receive video training on marine mammal awareness.

Assessment: Training was already standard for all units before RIMPAC and is effective as a mitigation measure.

Operational Impact of this mitigation measure:
None. Using standardized and required training materials and procedures is more practical and effective.

Recommendation
Training personnel in marine species detection and cues to enable operators to make informed decisions regarding potential interactions with protected marine species should be retained and is standard Navy practice. This measure should be rewritten as provided in Appendix (A).

Measure (b)

The MMPA Permit Monitoring and Mitigation Measure (b) read as follows:

> *(b) Navy watchstanders, the individuals responsible for detecting marine mammals in the Navy's standard operating procedures, will participate in marine mammal observer training by a NMFS-approved instructor. Training will focus on identification cues and behaviors that will assist in the detection of marine mammals and the recognition of behaviors potentially indicative of injury or stranding. Training will also include information aiding in the avoidance of marine mammals and the safe navigation of the vessel, as well as species identification review (with a focus on beaked whales and other species most susceptible to stranding). At least one individual who has received this training will be present, and on watch, at all times during operation of tactical mid-frequency sonar, on each vessel operating mid-frequency sonar.*

Assessment: Training as a mitigation measure can be captured in one requirement as provided in Appendix (A).

Operational Impact of this mitigation measure:

None. Using standardized and required training materials and procedures is more practical and effective.

Recommendation

For Navy authorizations, adopt the training measure provided in Appendix (A), which is based on the MSAT training video.

(1) The Navy's training and qualification program meets or exceeds the expectations of this mitigation measure. Navy personnel serving as lookouts and on bridge watch are highly qualified and experienced marine observers. At all times, they are required to sight and report all objects sighted in the water (regardless of the distance from the vessel) to the Officer of the Deck, because any object (e.g., trash, periscope) or disturbance (e.g., surface disturbance, discoloration) in the water may be indicative of a threat to the vessel. Navy lookouts undergo extensive training in order to qualify. This training includes on-the-job instruction under the supervision of an experienced lookout, followed by completion of the Personal Qualification Standard program, certifying that they have demonstrated the necessary skills (such as detection and reporting of partially submerged objects). In addition to these requirements, many lookouts periodically undergo a 2-day refresher training course.

(2) The Navy includes MSAT as part of its regular training regimen for its bridge lookout personnel on ships and submarines. This training is the most appropriate material available to allow for the safe operation of Naval vessels while limiting interactions with marine mammals and has been approved by NMFS. This training addresses the lookout's role in environmental protection, laws governing the protection of marine species, Navy stewardship commitments, and general observation information to aid in avoiding interactions with marine mammals. Finally, Navy personnel are trained

in the most effective means to ensure quick and effective communication within the command structure and facilitate implementation of protective measures if marine species are spotted. Navy personnel are trained to act swiftly and decisively to ensure that information is passed to the appropriate supervisory personnel.

Measure (c)
This measure reads:

> *(c) All ships and surfaced submarines participating in the RIMPAC ASW exercises will have personnel on lookout with binoculars at all times when the vessel is moving through the water (or operating sonar). These personnel will report the sighting of any marine species, disturbance to the water's surface, or object to the Officer in Command.*

Assessment: This measure is included Navy's SOPs, but as written requires one change.

Operational Impact of this mitigation measure:
None.

Recommendation
This mitigation measure is standard Navy practice and necessary for safe navigation. Reference to surfaced submarines should be removed since surfaced submarines are never engaged in ASW or use MFAS for ASW when on the surface.

Measure (d)
This measure reads:

> *(d) All aircraft participating in RIMPAC ASW events will conduct and maintain, whenever possible, surveillance for marine species prior to and during the event. Marine mammal sightings will be immediately reported to ships in the vicinity of the event as appropriate.*

Assessment: This measure is part of Navy's SOPs.

Operational Impact of this mitigation measure:
None.

Recommendation
This mitigation measure is standard Navy practice and necessary for safe navigation.

Measure (e)
This measure reads:

> *(e) Submarine sonar operators will review detection indicators of close-aboard marine mammals prior to the commencement of ASW operations involving active mid-frequency sonar. Marine mammals detected by passive acoustic* (sic)[3]

3 The last sentence of this mitigation measure as published in both the IHA and the NDE is incomplete.

Assessment: This measure is in Navy's SOPs.

Operational Impact of this mitigation measure:
None.

Recommendation
These practices are already standard Navy procedures.

Measure (f)
This measure reads:

> (*f) Safety Zones - When marine mammals are detected by any means (aircraft, lookout, or acoustically) within 1000 m of the sonar dome (the bow), the ship or submarine will limit active transmission levels to at least 6 dB below normal operating levels. 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 seen for 30 minutes, or the vessel has transited more than 2000 m beyond the location of the sighting.*
>
> *Should a marine mammal be detected within or closing to inside 500 m 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 seen for 30 minutes, or the vessel has transited more than 1500 m beyond the location of the sighting.*
>
> *Should the marine mammal be detected within or closing to inside 200 m 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 seen for 30 minutes, or the vessel has transited more than 1200 m beyond the location of the sighting.*
>
> *If the Navy is operating sonar above 235 dB and any of the conditions necessitating a power-down arise ((f), (g), or (h)), the 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).*

Assessment: This mitigation measure is effective, and requires improvement.

Operational Impact of this mitigation measure:
During RIMPAC, marine mammals were visually detected three times by fixed-wing aircraft, three times by helicopters, and 23 times by lookouts aboard ships. Active MFAS use ceased in 12 exercise events, as the ships opened the range with the locations where the marine mammals had been detected. In three additional events, P-3 aircraft were not able to use active DICASS sonobuoys as tactics may have required. Due to this mitigation measure, a total of approximately eight hours of training time was lost.

This loss of MFAS training hours is more than a simple metric involving a loss of training time as a small percentage of the overall exercise hours since, in at least six

cases, the proximity of a submarine in the vicinity meant there was a potential submarine detection opportunity missed by the exercise participants.

Recommendation
A "safety zone" mitigation measure was already SOP and this mitigation measure should be retained. Expansion of the safety zone beyond 1000 m (or 1000 yards) is not prudent. This distance is the maximum Navy should impose on its ship commanding officers to certify "safe" for marine mammals or decrease the output of MFA sonar.

The provision regarding the reduction of transmission power if operating sonar above 235 dB is reasonable and should be added as Navy SOP.

This mitigation measure involving "safety zones" should be retained with the following revisions:

- Yards should be used vice meters because all Navy training and operations use yards as a term reference and there is no substantive difference in sound propagation between 1000 meters and 1000 yards.
- The 2000 meter, 1500 meter, and 1200 meter variable distance for when active sonar can resume is unnecessarily complex and the expanded distances without scientific merit.

Measure (g)
This measure reads:

> *(g) In strong surface ducting conditions (defined below), the Navy will enlarge the safety zones such that a 6-dB power down will occur if a marine mammal enters the zone within a 2000 m radius around the source, a 10-dB power-down will occur if an animal enters the 1000 m zone, and shut down will occur when an animal closes within 500 m of the sound source.*
>
> *A strong surface duct (half-channel at the surface) is defined as having the all the following factors: (1) A delta SVP between 0.6 to 2.0 m/s occurring within 20 fathoms of the surface with a positive gradient (upward refracting); (2) Sea conditions no greater than Sea State 3 (Beaufort Number 4); and (3) Daytime conditions with no more than 50% overcast (otherwise leading to diurnal warming). This applies only to surface ship mid-frequency active mainframe sonar.*

Assessment: This mitigation measure could not be effectively implemented or uniformly employed in RIMPAC. Additionally, there is no evidence to indicate it is effective or that it provides protection for marine mammals in addition to that provided in measure (f).

Operational Impact of this mitigation measure:
This mitigation measure could not be accurately and uniformly employed during RIMPAC. The exercise headquarters found so many variations in water conditions

across the exercise area that the determination of “strong surfacing ducting” was futile. It was problematic for the following reasons:

(1) There is so much local variation in the Pacific Fleet training areas that it would be necessary for a ship to constantly monitor the local environment to accurately comply with this measure. Measurements taken during RIMPAC indicated large variation in the presence or absence of significant surface ducts over relatively short distances in the Hawaiian operating areas.

(2) The models used in forecasting a significant surface duct used high resolution that still resulted in a generalized sea state, SVP, and cloud cover over a large operational area covered by exercise participants. Measured local variations were so different from these forecasts that the determination that "significant surface duct condition do/do not exist" was inherently inaccurate.

(3) There is no means to know if the local SVP ahead of the ship is the same as the SVP being measured. Oceanographic models are years away from being able to model the ocean's structure in four dimensions at the resolution required to accurately predict SVP changes on a detailed scale.

(4) There is no allowance for local variations from tidal flux, differential sea states (as frequently seen in channels or shear lines to the southwest of most points of land in Hawaii), and currents/eddies - all of which have a significant effect on surface ducting.

Recommendation

Because the process to determine if a significant surface duct exists across the entire exercise area could not be effectively implemented or uniformly employed, recommend this measure not be included in future authorizations.

In addition, this measure seems to have been an outgrowth of the apparent evidence that significant surface ducting may have played a role in previous incidents involving stranding of beaked whales in certain conditions. There is no evidence to suggest that significant surface ducting in and of itself causes MFA sonar’s overall effects to be increased, and it is still not known whether the presence of surface ducting was actually significant in the known beaked whale stranding incidents.

Measure (h)

This measure reads:

> *(h) In low visibility conditions (i.e., whenever the entire safety zone cannot be effectively monitored due to nighttime, high sea state, or other factors), the Navy will use additional detection measures, such as infrared (IR) or enhanced passive acoustic detection. If detection of marine mammals is not possible out to the prescribed safety zone, the Navy will power down sonar (per the safety zone criteria above) as if marine mammals are present immediately beyond the extent of detection. (For example, if detection of marine mammals is only possible out to 700 m, the Navy must implement a 6 dB power-down, as though an animal is present at 701 m, which is inside the 1000 m safety zone)*

Assessment: This mitigation measure was not necessary in RIMPAC since a condition of low visibility, as defined by the measure, was never encountered. In other words, at night lookouts were still able to monitor out to the limits of the safety zone. This mitigation measure has the potential to directly affect training and therefore the effectiveness of the military readiness activity.

Operational Impact of this mitigation measure:
This measure would preclude use of a sensor when tactically required and significantly affects the military readiness activity. Navy must be allowed to operate MFAS at night and in heavy seas using the full potential of sonar as a sensor.

There is no "enhanced passive acoustic detection" – Navy ships continuously use every passive device available, and the state of technology for detecting marine mammals passively is rudimentary at best.

Recommendation
This procedure has the potential to directly affect the military readiness activity. Recommend it not be incorporated in future authorizations or modified as to avoid impacting training realism in low visibility conditions.

Measure (i)
This measure reads:

> *(i) Helicopters shall observe/survey the vicinity of an ASW exercise for 10 minutes before deploying active (dipping) sonar in the water. 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.*

Assessment: This measure is part of Navy's SOPs.

Operational Impact of this mitigation measure:
None.

Recommendation
Continue as standard Navy protective measures.

Measure (j)
This measure reads:

> *(j) The Navy will operate sonar at the lowest practicable level, not to exceed 235 dB, except for occasional short periods of time to meet tactical training objectives.*

Assessment: This measure is part of Navy's SOPs.

Operational Impact of this mitigation measure:
None.

Recommendation
Continue as standard Navy protective measures.

Measure (k)
This measure reads:

> *(k) With the exception of three specific choke-point exercises (special measures outlined in item (m)), the Navy will not conduct sonar activities in constricted channels or canyon-like areas.*

Assessment: This mitigation measure could not be precisely implemented, significantly impacts military readiness, has no scientific basis for implementation in the Hawaiian Islands, and provided no observable protection to marine mammals during this exercise.

Operational Impact of this mitigation measure:
Restricting Navy operations in choke-points are contrary to ASW training requirements. This measure limits the ability to train realistically in the known diesel submarine threat environment and directly impacts a vital military readiness activity.

This prohibition against MFAS use in "constricted channels or canyon-like areas" could not be precisely implemented or uniformly enforced because there were no defining metrics. The terms "constricted channels or canyon-like areas" have no meaning within the Navy or in maritime communities and were not defined by the IHA. Additionally, there is no scientific basis for a determination that such vaguely defined bathymetric features tend to concentrate marine mammals and/or have a greater potential to effect marine mammals, and therefore warrant prohibitive measures.

RIMPAC 2006 completed three monitored choke-point events with observations before, during, and after the events. There was no indication of any marine mammal impacts from the Navy monitors or from the non-governmental civilian monitors who were out in small vessels off Kauai and Hawaii Island during these events.

There is no data for the Pacific indicating the need for the precautionary prohibition against choke-point exercises, "constricted channels", or "canyon-like areas". There have been 19 previous RIMPAC exercises and numerous JTFEX, USWEX and COMTUEX exercises in SOCAL and Hawaii involving choke-point exercises that have occurred over many years without an indication of effect on any marine mammals.

Recommendation
This procedure had no observable effect on the protection of mammals during this exercise. Recommend future authorizations contain better definition of bathymetric features of concern and that the features of concern are based on definitive evidence of increased risk to marine mammals.

Measure (l)

This measure reads:

> *(l) With the exception of three specific "choke-point" exercises (special measures outlined in item (m)), the Navy will not operate mid-frequency sonar within 25 km of the 200 m isobath.*

Assessment: This is no scientific basis indicating this measure is warranted in the Pacific and no basis for the specific metrics (25 km of the 200 m isobath). In addition, there are no standard US nautical charts depicting depths in meters making this a difficult measure to implement in the field. This measure significantly impacts military readiness.

Operational Impact of this mitigation measure:

During RIMPAC this measure precluded active ASW training in the littoral region, which significantly impacted realism and training effectiveness. Prohibitions against operating in littoral areas are contrary to ASW training requirements. This measure affects the ability to train realistically in the known diesel submarine threat environment and directly impacts vital military readiness activity. (Note: Any reference to isobath curves should be in fathoms vice meters. There are no approved NOAA nautical charts that provide for a 200m isobath.)

Recommendation

This procedure had no observable effect on the protection of mammals during this exercise and therefore its value is uncertain. Its effect on realistic training is, however, clear and significant. The areas prohibited by this measure are the very ones where training against quiet submarines is most important. With respect to the presence of marine mammals, there is no scientific basis for the metrics particular to the 200 m isobath nor the 25 km distance from the 200 m isobath. In addition, the lengthy history of sonar use in the Hawaiian Islands and SOCAL without any strandings or apparent effect on marine mammals argues that this measure is unnecessary. Recommend it not be included in future authorizations.

Measure (m)

This measure deals with "choke-point" events, contains various subparts, and reads:

> *(m) The Navy will conduct no more than three "choke-point" exercises. These exercises will occur in the Kaulakahi Channel (between Kauai and Niihau) and the Alenuihaha Channel (between Maui and Hawaii). These exercises fall outside of the requirements listed above in (k) and (l), i.e., to avoid canyon-like areas and to operate sonar farther than 25 km from the 200 m isobath. The additional measures required for these three choke-point exercises are as follows:*

Assessment: This measure is not a mitigation and therefore requires no assessment.

Measure (m) Part (i)

This part of measure (m) reads:

(i) The Navy will provide NMFS (Stranding Coordinator and Protected Resources, Headquarters) and the Hawaii marine patrol with information regarding the time and place for the choke-point exercises 24 hours in advance of the exercises.

Assessment: This measure is a monitoring effort vice a mitigation and does not provide additional protection to marine mammals.

Operational Impact of this mitigation measure:
Notification to NMFS did not meet the "24 hours in advance" requirement for several reasons. Since choke-point events are scheduled to occur within a range of time, such as within a 24 hour period, the exercise participants could not provide specific times for when the choke-point transit would begin. The actual transit of the channel occurred based on the on-scene Commander's read of the tactical situation as it developed over the course of many hours. To address this issue during RIMPAC 2006, and in coordination with NMFS Pacific Islands Regional Office, NMFS was kept apprised of the timeframe as it became available.

Recommendation
The coordination with stranding offices and Navy's cooperation with NMFS in the event of a stranding are established procedures and should not be confused with mitigation measures mandated for a specific exercise. In addition, the emphasis on monitoring for strandings during naval exercises has the potential to perpetuate unsubstantiated correlations of strandings as being caused by MFAS use. If a comprehensive marine mammal monitoring program is warranted, it should be pursued by NMFS through implementation of statistically based monitoring protocols and a research and sampling design that objectively assesses stranding occurrence across all potential causal factors, resulting in a baseline understanding of strandings for a given region.

Note: There is no "Hawaii marine patrol" and as a result, this component of the mitigation requirement could not be implemented.

Measure (m) Part (ii)
This part of measure (m) reads:

(ii) The Navy will have at least one dedicated Navy marine mammal observer who has received the NMFS-approved training mentioned above in (a), on board each ship and conducting observations during the operation of mid-frequency tactical sonar during the choke-point exercises. The Navy has also authorized the presence of two experienced marine mammal observers (non-Navy personnel) to embark on Navy ships for observation during the exercise.

Assessment: The first component of this measure duplicates standard Navy training requirements and is unnecessary. The "experienced marine mammal observers (non-Navy personnel)" detected no marine mammals during the time they were embarked and therefore provided no additional capability or protection to marine mammals during this exercise.

Operational Impact of this mitigation measure:
None for this exercise, however, it is usually not feasible to provide transportation, berthing, and manning for non-navy personnel aboard exercise vessels. In some cases, inclusion of these observers would result in the inability to accommodate essential Navy personnel associated with the exercise such as trainers and data collection personnel.

The requirement for a "dedicated Navy marine mammal observer" indicates a fundamental misunderstanding of Navy practices. This measure duplicates the watch standing requirements inherent in measures (a) and (b), because all lookouts have been trained to be "dedicated Navy marine mammal observers". Any marine mammals detected are reported to the OOD as required under normal procedures, regardless of whether the ship is conducting a choke point transit.

NMFS embarked two observers on 19 July to the CVN during one of the Kaulakahi choke-point events, because this served as a superb viewing platform in the approximate center of ASW operations. These observers detected no marine mammals, and therefore provided no additional value as a mitigation measure during this exercise. As discussed under measures (a) and (b), Navy spotters receive sufficient training to undertake the required tasks. Use of Navy lookouts is the most effective means to ensure quick and effective communication within the command structure and facilitate implementation of protective measures if marine species are spotted.

Recommendation
Navy lookouts have the skills and training to detect marine mammals without augmentation by additional non-navy observers onboard ships. Additional non-navy observers have the potential to adversely impact an exercise, and did not appear to improve marine mammal detection cabability during RIMPAC. Recommend this measure not be included in future authorizations.

Measure (m) Part (iii)
This part of measure (m) reads:

> *(iii) Prior to start up or restart of sonar, the Navy will ensure that a 2000 m radius around the sound source is clear of marine mammals.*

Assessment: This is unnecessary given that the safety zones established in Measure (f) already provide adequate protection.

Operational Impact of this mitigation measure:
None.

Conclusion
This measure is inconsistent with the provisions required in Measure ((f); Safety Zones). Recommend it not be included in future authorizations.

Measure (m) Part (iv)

This part of measure (m) reads:

> *(iv) The Navy will coordinate a focused monitoring effort around the choke-point exercises, to include pre-exercise monitoring (2 hours), during-exercise monitoring, and post-exercise monitoring (1-2 days). This monitoring effort will include at least one dedicated aircraft or one dedicated vessel for real-time monitoring from the pre- through post-monitoring time period, except at night. The vessel or airplane may be operated by either dedicated Navy personnel, or non-Navy scientists contracted by the Navy, who will be in regular communication with a Tactical Officer with the authority to shut-down, power-down, or delay the start-up of sonar operations. These monitors will communicate with this Officer to ensure the 2000 m safety zone is clear prior to sonar start-up, to recommend power-down and shut-down during the exercise, and to extensively search for potentially injured or stranding animals in the area and down-current of the area post-exercise.*

Assessment: This measure is relatively costly and did not result in any marine mammal sightings requiring MFAS source reduction or shutdown.

Operational Impact of this mitigation measure:

The time and money spent to provide this mitigation measure appeared to provide no additional protection to marine mammals.

Observations

The monitoring efforts consisted of shore-based observers, aerial surveys and the routine patrols of Torpedo Recovery Boats. Though these surveys spotted numerous marine mammals, none of the mammal detected were in the vicinity of exercise participants or provided protection from exercise MFAS. For marine mammals detected before the event, there was no way to determine if they were likely to move into or out of an exercise that was miles from a given observation/detection location.

The capability of sighting marine mammals from both surface and aerial platforms participating in the exercise provides excellent survey capabilities using the Navy's existing exercise assets. Six of the 29 marine mammal detections were made by Navy aerial assets participating in the RIMPAC exercise.

Given the vast distances involved, it was impossible to ensure a 2000 m safety zone was clear of every single participant by these additional monitors. The monitors could not recommend power-down or shut-down during the exercise because the focus of their efforts was so dispersed.

Although monitors did serve to extensively search for potentially injured or stranded animals in the area they were assigned to observe, none were detected and the value provided by this time consuming and expensive search is questionable.

Other comments on this measure: The provision for searching "down-current of the area post-exercise" fails to recognize that an exercise area may involve many hundreds of square miles of ocean with variable currents.

Shore-based monitors' observations: Resident groups of spinner dolphins nearshore at Kekaha, Kauai on five consecutive mornings before, during, and after two choke point exercises taking place in the Kaulakahi Channel. Three days of shore-based observation from the Kohala Coast of Hawaii Island occurred around a choke-point exercise taking place in the Alenuihaha Channel. A pod of bottlenose dolphins was observed feeding nearshore a few hours apart on the first day of observation. Over the eight days of shore-based observation, there were no unusual behaviors exhibited by these animals.

Aerial survey observations: Aerial surveys covered these same channels over six days (18 hours). This aerial survey effort was generally hampered by rough sea state conditions. Two days of aerial survey had to be cancelled due to safety requirements concerning the use of unmanned drones and weapon firing on the range at PMRF on those days. There were a total of 13 sightings of marine mammals over the six days with no unusual behavior or activity observed.

Finally, of note, the aerial surveys conducted around the time of the choke point exercises showed that "the densities of marine mammal species reported here is identical with that normally seen for the Hawaiian Islands, albeit at different times of the year." Therefore, although some 30-40 ships conducted a wide ranging exercise over more than three weeks and employed MFA sonar extensively, marine mammal densities remained stable, and observers detected no unusual behavior in the marine mammals they saw.

Recommendation

This procedure is a monitoring measure vice a mitigation measure and had no demonstrable impact on the protection of mammals during RIMPAC. Due to the experience of Navy aircrews and their sensitivity to detecting marine mammals, as well as the cost involved in contracting these services, recommend that for future authorizations, only Navy assets be considered for increased monitoring, and then only when required in the aggregations of conditions which show the most potential for risk to marine mammals.

Measure (m) Part (v)

This part of measure (m) reads:

> *(v) The Navy will further contract an experienced cetacean researcher to conduct systematic aerial reconnaissance surveys and observations before, during, and after the choke-point exercises with the intent of closely examining local populations of marine mammals during the RIMPAC exercise.*

Assessment: This measure duplicates measure (m)(iv) and provides no additional protection for marine mammals.

Operational Impact of this mitigation measure:
None. However, the money spent to provide this mitigation measure provided no observable protection to marine mammals during this exercise and cannot be resourced for routine Navy's exercises.

Conclusion
The contracted "experienced cetacean researcher" did not spot any marine mammals in the vicinity of the exercise. Recommend this measure not be included in future authorizations.

Measure (m) Part (vi) and (vii)
These parts of measure (m) reads:

> *(vi) Along the Kaulakahi Channel (between Kauai and Niihau), shoreline reconnaissance and nearshore observations will be undertaken by a team of observers located at Kekaha (the approximate mid point of the Channel). Additional observations will be made on a daily basis by range vessels while enroute from Port Allen to the range at PMRF (a distance of approximately 16 nmi) and upon their return at the end of each day's activities. Finally, surveillance of the beach shoreline and nearshore waters bounding PMRF will occur randomly around the clock a minimum four times in each 24 hour period.*
>
> *(vii) In the Alenuihaha Channel (between Maui and Hawaii), the Navy will conduct shoreline reconnaissance and nearshore observations by a team of observers rotating between Mahukona and Lapakahi before, during, and after the exercise.*

Assessment: This measure does not appear to provide additional protection for marine mammals and is unnecessary.

Operational Impact of this mitigation measure:
None. However, the personnel resources spent to provide this mitigation measure provided no demonstrable protection to marine mammals during this exercise and cannot be routinely resourced for Navy's exercises.

Conclusion
This procedure did not result in any effective mitigation during RIMPAC. Tasking personnel to observe a portion of the shoreline during a choke-point as a monitoring measure has no scientific basis (no research questions, research design, or sampling approach).
Although the shore based observers saw marine mammals and sea turtles, and these observations were reported to the RIMPAC Battle Watch as required, the observed marine species were miles from any exercise events and hours before the choke-point transits began. These observations were of no utility as a mitigation measure. Recommend this measure not be included in future authorizations.

Measure (n)
This measure reads:

> *(n) The Navy will continue to coordinate with NMFS on the "Communications and Response Protocol for Stranded Marine Mammal Events During Navy Operations in the Pacific Islands Region" that is currently under preparation by NMFS PIRO to facilitate communication during RIMPAC. The Navy will coordinate with the NMFS Stranding Coordinator for any unusual marine mammal behavior, including stranding, beached live or dead cetacean(s), floating marine mammals, or out-of-habitat/milling live cetaceans that may occur at any time during or shortly after RIMPAC activities. After RIMPAC, NMFS and the Navy (CPF) will prepare a coordinated report on the practicality and effectiveness of the protocol that will be provided to Navy/NMFS leadership.*

Assessment: This measure documents what is standard procedure.

Operational Impact of this mitigation measure:
None.

Recommendation
This requirement documents Navy's standard procedure.

SECTION 2 SUMMARY

During RIMPAC 06, there were 472 total hours of mid-frequency active sonar (MFAS) use. There were no reported observations of behavioral disturbance of marine mammals during the exercise. The Navy's previously developed and used mitigation measures from PMAP, as modified for RIMPAC 06, appeared to be effective in protecting marine mammals observed near exercise ships. Mitigation measures agreed to for issuance of the IHA that went beyond standard Navy measures had no observable effect on protection of marine mammals in this exercise, and their application unnecessarily increased the cost of the exercise or had a negative effect on the fidelity of training.

As the first major exercise for which Navy applied for an authorization under MMPA, RIMPAC '06 presented unique challenges from the perspective of regulatory requirements and public perception. We anticipate that future authorizations for exercises and operating area coverage will recognize the differences in those areas as well as how developing science will inform our understanding of the role of mitigation measures.

SECTION 3: Monitoring Results

The IHA requires this report contain, "Results of the marine species monitoring (real-time monitoring from all platforms, independent aerial monitoring, shore-based monitoring at chokepoints, etc.) before, during, and after the RIMPAC exercises". This section of the report, therefore, provides a summary of the detections of marine species from all exercise participants, the aerial reconnaissance survey, and shore-based monitoring efforts associated with the RIMPAC 06 exercise.

Figure 2. Location of marine mammals sighted by exercise participants depicted in red. Locations with multiple sightings are depicted by a single box. The line of longitude shown is 160° West and the latitude is 20° North.

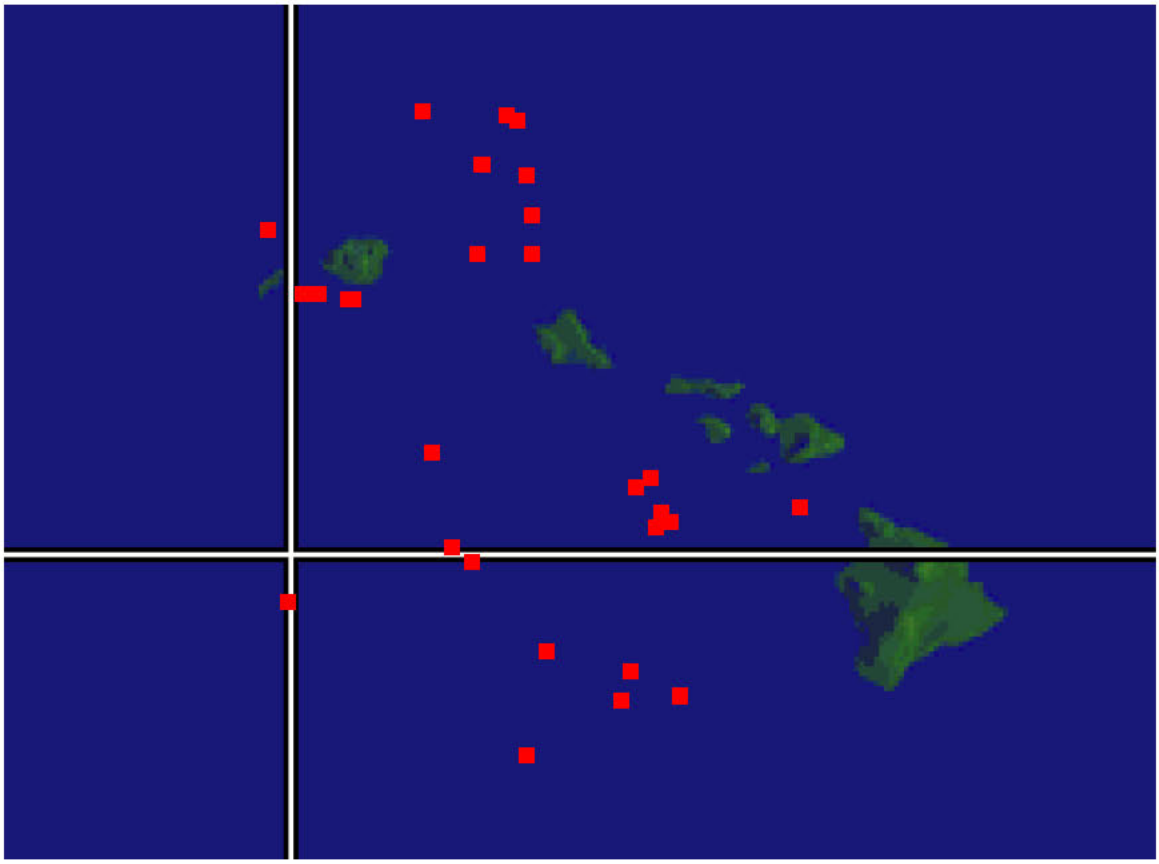

Figure 2 depicts the approximate location of marine mammals that were sighted by exercise participants. This is a skewed sample since there were no attempts made to detect marine mammals by other means in areas not being used by exercise participants. In addition to these sightings, marine species detections occurred as a result of two other

IHA mandated measures consisting of an aerial reconnaissance effort and shore-based monitors.

As noted previously, the additional monitoring requirements consisting of aerial and shipboard monitoring, and shore-based observations before, during, and after choke-point events. These monitoring efforts were required by NMFS as a sampling strategy to determine if there was any observable effect on marine mammals during ASW training events taking place in the channels between two sets of islands. These measures arose from a precautionary concern that MFAS use in the channels could possibly have greater potential to impact marine mammals, despite the lack of evidence suggestive of any problems in this regard from any of the previous 19 RIMPAC exercises. The cost to implement these monitoring requirements was approximately $66,000 for RIMPAC 06

A separate report providing details from the shore-based monitors' observations is presented in Appendix B and summarized here. These shore-based observations took place centered on two channels between the islands. The first of these monitoring efforts took place at Kekaha on Kauai. This is the approximate mid point along the Kaulakahi Channel between Kauai and Niihau, and spanned five consecutive days before, during, and after two choke point exercises taking place in that channel. Each morning of the five days, a pod of spinner dolphins were present 300-400 meters offshore. There were no unusual or abnormal behaviors observed. Sea turtles were also observed on two days.

Additional observations made on a daily basis by range vessels while enroute from Port Allen through the channel to the range at PMRF and surveillance of the beach shoreline and nearshore waters bounding PMRF did not result in any marine mammal detections.

Shore-based observation also took place on the Kohala Coast of Hawaii Island for three full days occurred around a choke-point exercise taking place in the Alenuihaha Channel between Hawaii Island and Maui. A pod of bottlenose dolphins was observed feeding during the first day of observation. There were no unusual or abnormal behaviors observed. Sea turtles were also observed on two days.

Aerial surveys covered these same channels over six days (approximately 18 hours flight time) as detailed in Appendix C. This aerial survey effort was generally hampered by rough sea state conditions. Two days of aerial survey had to be cancelled due to safety requirements concerning the use of unmanned drones and weapon firing on the range at PMRF on those days. There were a total of 13 sightings of marine mammals over the six days with no unusual behavior or activity observed.

Navy also authorized the presence of two experienced marine mammal observers (non-Navy personnel) to embark on a Navy ship for observation during a choke-point exercise. NMFS did not have any marine mammal observers available and alternatively embarked two Fisheries Program observers on 19 July to an available CVN during one of the Kaulakahi choke-point events. This ship was chosen since it served as a superb viewing platform with a large height of eye and unobstructed visibility in the approximate center of ASW operations. These observers detected no marine mammals.

In summary, there were 13 sightings of marine mammals from the air over approximately 18 hours of flight time. Shore based observation for 80 hours of effort by two people produced five sightings of a resident pod of spinner dolphins over five consecutive days on Kauai and a pod of bottlenose dolphins offshore of Hawaii Island. The results of these monitoring efforts provided no evidence of indicating there were any effects on the detected marine mammals as a result of the ASW exercises, which took place in the adjacent channels.

SECTION 4: Sonar Usage and Marine Mammals

The IHA requires that this report contain, "As much information (unclassified and, to appropriately cleared recipients, classified “secret”) as the Navy can provide including, but not limited to, where and when sonar was used (including sources not considered in take estimates, such as submarine and aircraft sonars) in relation to any measures received levels (such as sonobuoys or on PMRF range), source levels, numbers of sources, and frequencies so it can be coordinated with observed cetacean behaviors." Section 4 of the report provides information on the location and hours of active MFAS used during RIMPAC 06. The IHA also required as much data as could be provided on measured received levels, source levels, numbers of sources and frequencies so it could be coordinated with observed cetacean behaviors. Typically, there are no measurements (calibrated or otherwise) of actual sound levels made during an exercise and none were made during RIMPAC 06. Source levels, numbers of sources, and frequencies are classified since that information would provide potential adversaries with important tactical data. The observance of marine mammals by Navy assets only occurred as very brief encounters given the mitigation measures are designed to limit interaction to a minimum.

Observations of marine species and their behaviors resulting from the aerial reconnaissance and shore-based monitoring (as previously detailed in Section 3) observed no unusual behaviors for coordination with MFAS use. There were no indications from the observations that the presence of exercise participants had any affect on any marine mammals.

The requirement to report where and when sonar was used so it can be coordinated with observed cetacean behaviors can not be completed since no animals were observed doing anything unusual or behaving in any overt manner. Information presented previously in Table 1 provides a list of instances when marine mammals were detected and sonar was being used.

As noted previously, during RIMPAC 06, there were 199 anti-submarine warfare (ASW) events and 472 total hours of hull mounted MFAS. This was less than the anticipated number of hours (532) presented in the RIMPAC 2006 Supplemental Environmental Assessment as a result of a temporary restraining order (TRO) restricting the use of MFAS arising from a lawsuit (NRDC v. Winter) in effect for the first days of the exercise. During the period of this TRO, three days of scheduled MFAS training (25 events) were lost including 4 live fire events, 14 P-3 ASW events, and 7 surface ASW events.

In addition to the 472 hours of hull mounted MFAS use, there were approximately 115 hours of operations involving both passive DIFAR and active DICASS sonobuoys reported for RIMPAC 06. This quantity of operational hours does not equate to 115

hours of active sonar use since only approximately 10% of the sonobuoys expended[4] were active DICASS and they are commanded to transmit an active ping only as required by the tactical situation. In short, an individual DICASS sonobuoy, even though deployed, may never be activated during an event. In other instances, DICASS buoys are not deployed until a possible contact is identified and the need to localize the target arises. There is no standard data collection reporting that would serve as a means to determine how much actual active sonar time resulted from DICASS sonobuoy use during RIMPAC.

Finally, there were approximately 45 hours of operations involving the use of dipping sonars deployed from helicopters. Similar to the case for sonobuoys, there is no standard data collection reporting that would serve as a means to determine how much actual active sonar time resulted from this number of hours of dipping sonar operation. During RIMPAC, dipping sonars were not in a search capacity but instead used for localization or confirmation of suspected contacts. In can be estimated that in this capacity dipping sonars, which are used very briefly (2-5 pulses a few hundred msec in duration) approximately every 10 minutes, would have resulted in approximately 11-12 minutes of active sonar over a 20 day period spread across the RIMPAC exercise area.

4 There were 2,713 passive and 292 active sonobuoys expended in RMPAC 06.

Appendix (A)

PROPOSED MITIGATION MEASURES FOR MFAS DURING MAJOR ASW EXERCISES

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 MFAS use.

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 forbid 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. All surface ships participating in ASW exercises will, in addition to the three personnel on watch noted previously, 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 1,000 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 1,000 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 1,000 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) - Navy 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.

    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. Of particular concern are beaked whales, for which strandings have been associated, in theory, with MFAS operations.

    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 land masses, separated by less than 35 nm and at least 10 nm in length, or an embayment, 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) Though not as dominant a condition as bathymetric features, the historical presence of a strong surface duct (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. All safety zone power down requirements described above apply.

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 Office of Protected Resources, 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.

Appendix (B)

RIMPAC 2006
NEARSHORE MONITORING
FIELD REPORT

JULY 2006

Prepared by:
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INTRODUCTION

In support of RIMPAC 2006, nearshore monitoring for marine mammals and sea turtles was conducted during July 16-20 from Kekaha Beach, Kauai, Hawaii and July 24-26 from Mahukona and Kapa`a Beach Park, Kohala Coast, Hawaii. The locations were chosen based upon their proximity to the Kalaukahi (between Kauai and Ni`ihau) and Alanuihaha (between Hawaii and Maui) Channels. The purpose of the monitoring was to 1) provide the Navy ships with information on species in the nearshore waters, 2) provide observations of marine mammal behavior before, during and after swept-channel (choke point) exercises, and 3) to monitor the beach and nearshore waters for marine species exhibiting abnormal behavior (offshore animals nearshore, congregations of offshore animals, strandings, etc).

METHODS

Shore-based monitoring was conducted from 0700 to 1830 hours with two observers using hand-held 10x42 binoculars and un-aided eye. Monitoring schedule corresponds to one day before and after each planned swept-channel exercise, two in the Kalaukahi channel and one in the Alanuihaha Channel. All observations were conducted by one experienced Navy marine mammal observer and one field assistant.

Kekaha Beach observations were conducted essentially at sea level. The sandy beach allowed for observers to walk the length of the beach north to the PMRF, Barking Sands Boundary and south to the end of Kehaka Beach (3 miles). Walks were conducted between two and four times per day. One observer would remain on station (near the lifeguard tower) as the other walked up the beach. The horizon from sea level is a distance of approximately 5 km.

Observations were conducted from Mahukona on July 23rd from 0700 to 1200 hours, but Kapa`a Beach Park was chosen for the rest of the 2.5 days since it offered a better view of the Alanuihaha Channel. Kapa`a Beach Park is a boulder beach, and observations were conducted at approximately 7m above sea level (horizon distance approximately 5 miles). A point to the north of the beach park resulted in a consistently lower sea state close to shore than in the open channel. On two days, portions of the coastline to the north of Kapa`a Beach Park (between Upolu Point and Mo`okini Heiau) was driven using a 4x4 vehicle to check the boulder beaches for stranded or distressed animals.

Data were collected on visibility, Beaufort sea state, marine mammals observed, sea turtles observed, and Navy ships/operations observed. While at Kehaka, data were also collected on commercial tour boats that were observed interacting with resident spinner dolphins.

RESULTS

Table 1 provides daily observation information. Only two species of marine mammals were observed, spinner dolphins (*Stenella longitrostris*) and bottlenose dolphins (*Tursiops aduncus*). Both are typically nearshore species. Two species of sea turtles were observed – green (*Chelonia mydas*) and leatherback (*Dermochelys coriacea)*. All were observed exhibiting normal behaviors.

The following is provided as a summary of marine mammals and sea turtles observed during the two nearshore monitoring periods.

Kekaha:

16 July 2006: A school of approximately 100 spinner dolphins (*Stenella longirostris*) are observed approximately 300m offshore (0747 hrs). Animals are slowly heading south and are being followed by a catamaran. When first vessel leaves, a series of RHIBs and catamarans stop and follow animals, one after the other. Animals are last seen at 0826 hrs approximately 0.5 miles offshore. Behavior overall is slow travel to south, with several spins. This is largest group that was seen during the five day period.

16 July 2006: A turtle (presumed green) is seen surfacing approximately 100m offshore.

17 July 2006: A school of approximately fifteen spinner dolphins is observed heading slowly south (0830 hrs) being followed by a tour catamaran. Dolphins are last observed at 0910 hrs. Behavior overall is slow travel to south, with several aerial spins.

17 July 2006: Green sea turtle is observed approximately 4 m offshore.

18 July 2006: A small school of ten to fifteen spinner dolphins are observed approximately 0.25 miles offshore, with two tour boats (0835 hrs). Dolphins are very low in the water and would be very difficult to see without boats as "cue". Dolphins not seen after boats leave at 0845 hrs.

19 July 2006: Unidentified dolphins, cue is splash and idling tour boat, at horizon (0715 hrs.).

19 July 2006: Unidentified dolphins (presumed spinners) observed at southwestern horizon splashing, heading north (0858 hrs.).

19 July 2006: Spinner dolphins observed heading north towards Barking Sands (0922 hrs.). They continue to north out of view.

20 July 2006: Spinner dolphins observed in resting mode about 400m off southern shore of Kekaha Beach. Group size is approximately 20 animals, and they are milling at 0730 hrs. At 0745 hrs, they are traveling slowly to the north towards Barking Sands. They bowride as a boat approaches and follows them. Dolphins last seen at 0847 hrs.

Mahukona:

(0730 hrs to 1300 hrs.)

24 July 2006: Leatherback turtle (*D. coriacea)* observed approximately 300m offshore. Turtle is identified as a leatherback based upon very large carapace size (estimated 5-6 ft across) and huge rounded head. Back and head were seen simultaneously at the animal breathed. Turtle was observed at the surface for 1-2 minutes then dove (0759 hrs).

Kapa`a Beach Park:

24 July 2006: Group of approximately 20 bottlenose dolphins (*Tursiops aduncus*) are observed, first seen heading southwest (1630 hrs). A third of the group are calves. Animals travel steadily to the SW, except stopping to mill for about 3 minutes near a group of shearwaters and tuna feeding on bait fish. Dolphins contour shoreline to the south and disappear from view at 1646 hrs.

Bottlenose dolphins reappear from the south, heading west (1725 hrs). The dolphins are much more surface-active during this sighting, porpoising and leaping out of the water. At 1749 hrs, after a long dive (5 minutes), they resurface with obvious blows and change direction to the southwest and appear to be feeding along the edge of a large aggregation of shearwaters, tuna and bait fish.

25 July 2006: Small turtle (green?) observed just offshore (0858 hrs).

26 July 2006: Small green turtle observed hugging coastline and "riding" the surge (1415 hrs).

DISCUSSION AND CONCLUSIONS

All marine mammals and turtles were observed exhibiting normal behavior. No adverse behavior, strandings, or offshore species were observed.

Land based, stationary monitoring has known deficiencies. The low height of eye above water provides a limited distance to the horizon and species identification can be difficult as there is no option to approach animals. However, given the purpose of this project, the goals were achieved. This monitoring gathered adequate data on the lack of behavioral change exhibited by resident groups of spinner dolphins at Kekaha, Kauai and Kohala, Hawaii. Additionally, we were able to monitor the length of Kekaha Beach, by foot, for stranded or distressed animals. The Kohala coast presented more of a challenge as it was comprised of boulder beaches. However, a 4x4 vehicle was utilized to access areas to the North (towards the channel) from the monitoring station at Kapa`a Beach.

Additionally, anecdotal data collected on interactions between commercial tour catamarans and RHIBs might prove to be useful to regulatory agencies such as the State of Hawaii and National Oceanographic and Atmospheric Association.

TABLE 1

Date 2006	**Location**	**Time (24 hr)**	**Beaufort Sea State**	**Species**	**Observations**
7/16	Kekaha	0700	2		Begin watch. Great visibility, overcast skies
	Kekaha	0747		*S. longirostris*	Spinners with catamaran. Slowly bowriding on vessel (Aladin?). Couple of spins seen after cat leaves. Located about 300m offshore, moving south. Group size ~100.
7/16	Kekaha	0750		*S. longirostris*	Catamaran leaves dolphins
7/16	Kekaha	0755		*S. longirostris*	RHIB runs up to animals and follows them
7/16	Kekaha	0759		*S. longirostris*	RHIB leaves dolphins
7/16	Kekaha	0809		*S. longirostris*	Still heading slowly S
7/16	Kekaha	0826			Two new RHIBs with S.l., about 0.5 mile offshore
7/16	Kekaha	0850		*C. mydas*	Green turtle seen about 100m offshore
7/16	Kekaha	1230	3		Sea state change
7/16	Kekaha	1430	4		Occasional rain squalls passing over
7/16	Kekaha	1600	3		Squalls clear. Navy ship seen on horizon heading from N coast to the S
7/16	Kekaha	1655	2		Sea state change
7/16	Kekaha	1745			Complete watch
7/17	Kekaha	0700	3		Begin watch, sunny skies, good visibility
7/17	Kekaha	0745			Two helicopters and 3 Navy ships seen on horizon. Helos ahead of ships along with three small red RHIBs inshore of ships
7/17	Kekaha	0815			Three Navy ships seen N of Barking Sands and head SW

Date 2006	Location	Time (24 hr)	Beaufort Sea State	Species	Observations
					through the channel, one right after the other.
7/17	Kekaha	0830		*S. longirostris*	Spinners seen bowriding on catamaran. Cat is heading N but stops and does u-turn through spinners and follows them south for ~ 5 min.
7/17	Kekaha	0835		*S. longirostris*	Just as cat leaves dolphins, a RHIB goes through them while heading N.
7/17	Kekaha	0850	4	*S. longirostris*	Na Pali Kai III catamaran seen doing u-turn and following dolphins to S. They stay with the dolphins heading S until 0910 hrs. Few spins from dolphins. Visibility changes to moderate due to higher Beaufort.
7/17	Kekaha	1015	4		Glare, moderate visibility. Have lost sight of dolphins due to sea conditions.
7/17	Kekaha	1053	3=inshore 4=offshore		Visibility improves as wind dies down.
7/17	Kekaha	1345	4		Sea state change
7/17	Kekaha	1612	4	*C. mydas*	Turtle seen at surface about 4 m offshore.
7/17	Kekaha	1830			Complete watch
7/18	Kekaha	0700	1		Begin watch
7/18	Kekaha	0835		*S. longirostris*	Small group of spinners (~15 animals) observed ~.25 miles offshore. One RHIB and one cat stop with dolphins and proceed slowly through them.
7/18	Kekaha	0845		*S. longirostris*	Boats leave dolphins and head N
7/18	Kekaha				Catamaran seen stopping ~ 0.5 miles offshore towards N. Can't see dolphins but assume that is why they are stopping.
7/18	Kekaha	1005	3		Still sunny…
7/18	Kekaha	1700			Cruise ship comes from N, heads through channel and continues to the S over horizon

Date 2006	Location	Time (24 hr)	Beaufort Sea State	Species	Observations
7/18	Kekaha	1830			Complete watch
7/19	Kekaha	0700	1		Begin watch, swell 2-3 ft.
7/19	Kekaha	0715		Unidentified dolphin	Catamaran and two RHIBs are stopped on horizon. Appear to be slowly following marine mammals, but other than one splash, I cannot identify them to species.
7/19	Kekaha	0858		Unidentified dolphin	School of dolphins (presumed spinners) seen at SW horizon, splashing, heading N
7/19	Kekaha	0922		*S. longirostris*	Spinners seen heading N off Kekaha. Catamaran comes up to them and slowly moves through them. Group size ~20.
7/19	Kekaha	0955	3		Sea state change
7/19	Kekaha	1515			Three red RHIBs head out of Portlock heading N through channel (we are later told these are part of RIMPAC ops).
7/19	Kekaha	1530	2		Swell 1-2 ft.
7/19	Kekaha	1644			1st Navy destroyer enters channel. Second one ~1 mile behind it. Helo overhead and doing sweeps ahead of ships (and has been for about an hour over the horizon). Ships appear to be moving slowly through channel.
7/19	Kekaha	1703			Second ship leaves channel. Helo has been dipping sonar ahead of 2nd ship. 1st ship N of Lehua and over horizon.
7/19	Kekaha	1706			2nd ship passes Lehua heading N and goes over horizon.
7/19	Kekaha				3 red Navy RHIBs pass Kekaha.
7/19	Kekaha	1800			Complete watch
7/20	Kekaha	0700	1		Begin watch with great visibility, partly cloudy.
7/20	Kekaha	0715		*S. longirostris*	Spinners in resting mode about 400m offshore, off southern shore of beach. Milling

Date 2006	Location	Time (24 hr)	Beaufort Sea State	Species	Observations
					behavior, group size ~20. No boats with dolphins, the boats appear to not see them.
7/20	Kekaha	0730		*S. longirostris*	Spinners are now just N of lifeguard tower heading N.
7/20	Kekaha	0753		*S. longirostris*	Tour boat Makana stops with dolphins and they slowly bowride.
7/20	Kekaha	0800	0		Sea state change
7/20	Kekaha	0804		*S. longirostris*	Makana still slowly following spinners to the N, then S. They are really staying with them longer than most boats do, following the milling dolphins back and forth.
7/20	Kekaha	0811		*S. longirostris*	Makana leaves dolphins
7/20	Kekaha	0814		*S. longirostris*	Tour RHIB runs up on dolphins, then u-turns and follows them.
7/20	Kekaha	0820		*S. longirostris*	As RHIB leaves, catamaran "Lucky Lady" comes slowly up to them and sits with dolphins.
7/20	Kekaha	0828		*S. longirostris*	"Lucky Lady" leaves dolphins
7/20		0840		*S. longirostris*	Another cat on spinners, N of Kehaka. Does u-turns and runs through them a few times at slow speed.
7/20	Kekaha	0847	1	*S. longirostris*	Cat leaves dolphins, heads N
7/20	Kekaha	1234	2		Overcast skies, great visibility
7/20	Kekaha	1800			Complete watch. Total beach monitored with 2-3 beach walks daily is 3 miles (includes all of Kekaha Beach to Barking Sands boundary)
7/24	Mahukona	0730	2=inshore 3=offshore		Begin watch. Walked up to point north of harbor for better view of channel and Maui. Partly cloudy skies, good visibility.

Date 2006	Location	Time (24 hr)	Beaufort Sea State	Species	Observations
7/24	Mahukona	0759		*D. coriacea*	Leatherback turtle observed. Carapace was 5-6 ft across and a huge rounded head, which is seen simultaneously during surfacing. (There is a kayaker offshore of turtle which we used for a size comparison). Turtle is observed breathing at surface for about 1 minute, then dives.
7/24	Mahukona	0951	4=offshore 3=inshore		Sea state change
7/24	Kapa`a Beach Park	1330	2=inshore 4=offshore		Change monitoring station to Kapa`a Beach Park, which is just N of Mahukona towards Hawi. It offers a better view of the channel, Maui and provides a protected inshore area with better viewing conditions. Cloud cover is 90%.
7/24	Kapa`a	1630		*T. aduncus*	Group of ~ 20 bottlenose dolphins are observed heading SW, about 400m offshore. Does not appear to be mixed species, however, about 1/3 of the group are calves. Group is traveling slowly and steadily to the SW, except for stopping for about 3 minutes near a group of shearwaters and tuna feeding on bait fish. Group stayed about the same distance offshore and heads SW out of view (at 1646 hrs.)
7/24	Kapa`a	1725		*T. aduncus*	Group of ~20 bottlenose dolphins are observed again, coming from around the point where they were last seen. They are heading to the W. They are moving more quickly this time, porpoising out of the water. As they lift heads higher to prepare for a dive, several of

Date 2006	Location	Time (24 hr)	Beaufort Sea State	Species	Observations
					them flip their tails up. Reappear after five minutes with very visible blows.
7/24	Kapa`a	1749		*T. aduncus*	Ta change direction to SW and appear to be feeding. They are working the margin of a large school of tuna and shearwaters which feeding on bait fish. The dolphins behavior includes direction change, leaps out of the water, and a few tail slaps. The group is a little more spread out too, than before. They continue this behavior for about 5 minutes, then regroup and head slowly offshore to the SW out of sight.
7/24	Kapa`a	1800			Complete watch. Drive up 4x4 road towards Hawi to check coastline for any strandings or other animals that might be out of sight.
7/25	Kapa`a Beach Park	0715	2=inshore 4=offshore		Begin watch. Three Navy ships and one other unid ship are observed over horizon towards Maui, in the channel. They are heading W.
7/25	Kapa`a	0745			Ships have disappeared over W horizon
7/25	Kapa`a	0858		*C. mydas* ?	Small turtle (green?) seen just off cove, about 100m offshore.
7/25	Kapa`a	0917	3=inshore 4=offshore		Sea state change
7/25	Kapa`a	1200			Leave beach park to drive up to Upolu Point and down to Mookini Heiau and Kam I birthplace to monitor other boulder beaches closer to channel.
7/25	Kapa`a	1300			Return to Kapa`a Beach Park
7/25	Kapa`a	1400	4=inshore 5=offshore		Sea state change

Date 2006	Location	Time (24 hr)	Beaufort Sea State	Species	Observations
7/25	Kapa`a	1830			Complete watch for the day.
7/26	Kapa`a	0700	2=inshore 3/4offshore		Begin watch, excellent visibility inshore. Mostly sunny skies.
7/26	Kapa`a	1200	3=inshore 4=offshore		Sea state change
7/26	Kapa`a	1415		*C. mydas*	Small green turtle observed hugging coastline. Observed for about 30 minutes riding the surge back and forth around the rocks. Last seen at 1445 hrs. Lots of glare inshore.
7/26	Kapa`a	1630	4=inshore 5=offshore		Continues to be lots of glare, covering approximately 1/3 of viewing range.
7/26	Kapa`a	1800			Complete watch (head to airport).

Appendix C

Results of 2006 RIMPAC Surveys of Marine Mammals in Kaulakahi and Alenuihaha Channels

Final Report Submitted by:
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Marine Mammal Research Consultants, Ltd.

Date:

August 25, 2006

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Results of 2006 RIMPAC Surveys of Marine Mammals in Kaulakahi and Alenuihaha Channels

Abstract

A total of six aerial surveys of marine mammals were performed on dates corresponding with scheduled dates for "choke point" maneuvers of the "Rim of the Pacific" (RIMPAC) joint military exercises in Hawaiian waters. Three surveys were performed in the vicinity of the Kaulakahi Channel (between Kauai and Niihau) (July 16, 17 and 20) and three were performed in the Alenuihaha Channel (between Hawaii and Maui) (July 24-26). The mission of the surveys was to detect, locate and identify all marine mammal species in the target areas using methods consistent with modern distance sampling theory. Marine mammals were sighted on four of the six surveys, comprising a total of 13 groups. All sightings consisted of small to medium-sized odontocetes (toothed cetaceans), including one sighting each of bottlenose dolphins, spotted dolphins, Cuvier's beaked whale, false killer whale, unidentified beaked whale and eight sightings of unidentified delphinid species. Encounter rates of odontocete sightings (sightings/km surveyed) in this series were identical to those seen during earlier survey series (1993-03) albeit at different times of the year. No unusual observations (e.g., sightings of stranded or dead animals) were noted during the total of ca. 18 hrs of survey effort.

Background

During the summer of 2006, The United States Pacific Command hosted the joint "Rim of the Pacific Exercises" (RIMPAC) military exercises in the Hawaiian Islands. Due to concerns over possible responses of marine mammal species to sonar and other aspects of the naval operations (e.g., ICES, 2005), aerial surveys were scheduled for dates before, during and after scheduled "choke point" maneuvers. Specifically this involved the Kaulakahi Channel, between the islands of Kauai and Niihau, on July 16, 17 and 20; and the Alenuihaha Channel, between the islands of Hawaii and Maui, on July 24, 25 and 26. The mission of the surveys was to detect, locate and identify all marine mammals in these channel areas, as well as to report any unusual behavior, including sightings of stranded or dead cetaceans.

Since the month of July falls outside the normal seasonal residency of humpback whales (Jan-Apr) (Mobley 2004), the less abundant odontocete species (toothed cetaceans) were the target species in the present survey series. Shallenberger (1981) described 15 odontocete species as resident in Hawaii. Based on aerial surveys conducted between 1993-98, Mobley et al. (2000) estimated abundance for 11 odontocete species for the waters within 25 nautical miles (nmi) of the major Hawaiian Islands based on surveys conducted during Jan-Apr of 1993-98. An updated summary of aerial survey results for near-shore Hawaiian waters conducted from 1993-2003 identified a total of 15 odontocete species (Mobley, unpublished data, Appendix A). Barlow (2006) provided abundance estimates for 21 cetacean species, including 18 odontocetes, based on

shipboard transect surveys conducted in Aug-Nov 2002 in the Hawaiian Exclusive Economic Zone (EEZ).

Method

Three surveys were performed in each of the Kaulakahi (July 16, 17 and 20) and Alenuihaha (July 24, 25, 26) channels for a total of six surveys. Survey protocol was based on distance sampling methods, which is the standard accepted approach for estimating abundance of free ranging animal populations (Buckland et al. 2001).

Surveys in both regions followed pre-determined tracklines constructed to optimize area sampled within range limits of the aircraft (Figures 1 & 2). For the Kaulakahi Channel surveys, tracklines ran mostly north-south and were spaced 7.5 km apart comprising a total length of ca 556 km.[1] For the Alenuihaha surveys, tracklines ran from northeast to southwest and were spaced 15 km apart and comprised a total length of ca. 740 km. Starting longitudes in both regions were randomly chosen per distance sampling methodology (Buckland et al. 2001) so that the exact trackline configuration varied slightly for each survey.

The survey aircraft for the first survey (July 16) was a single-engine Cessna 177RG Cardinal[1]. For the remaining five surveys a twin-engine Piper PA34 Seneca was used. Both aircraft flew at a mean ground speed of 100 knots and an average altitude of 244m (800 ft). Two experienced observers made sightings of all marine mammal species, one on each side of the aircraft. Sightings were called to a data recorder who noted the species sighted, number of individuals, presence or absence of a calf, angle to the sighting (using hand-held Suunto clinometers), and any apparent reaction to the aircraft. Additionally, GPS locations and altitude were automatically recorded onto a laptop computer at 30-sec intervals, as well as manually whenever a sighting was made. Environmental data (seastate, glare and visibility) were manually recorded at the start of each transect leg and whenever conditions changed. The two data sources (manual and computer) were later merged into a single data file. Species identifications were typically made by orbiting an initial sighting until sufficient diagnostic features were discernible to permit positive identification. When the initial sighting could not be recaptured upon orbiting, the species was recorded as "unidentified."

[1] Due to PMRF Range Ops on July 16, 2006, flying in the Kaulakahi Channel region was not permitted. We therefore surveyed an adjacent region off the central and southwest coast of Kauai in order to avoid the warning area on that date.

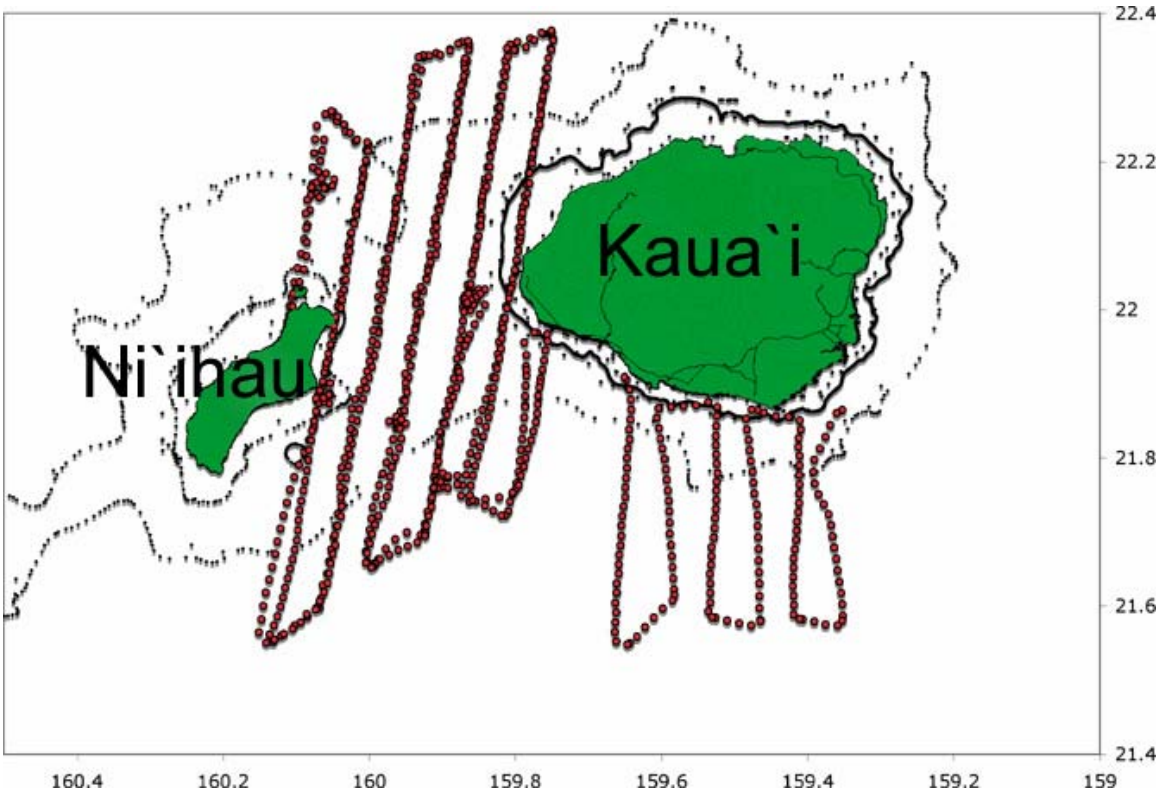

Figure 1. Survey effort for Kaulakahi Channel. GPS data (red lines) for surveys performed on July 16,17 and 20. Tracklines were 7.5 km apart and extended 13 km past the 1000 fathom contour. Total transect length was ca. 556 km. The tracklines to the south of Kauai were flown on July 16 only, when the waters of Kaulakahi Channel were closed due to scheduled operations of the Pacific Missile Range Facility (PMRF) at Barking Sands, Kauai.

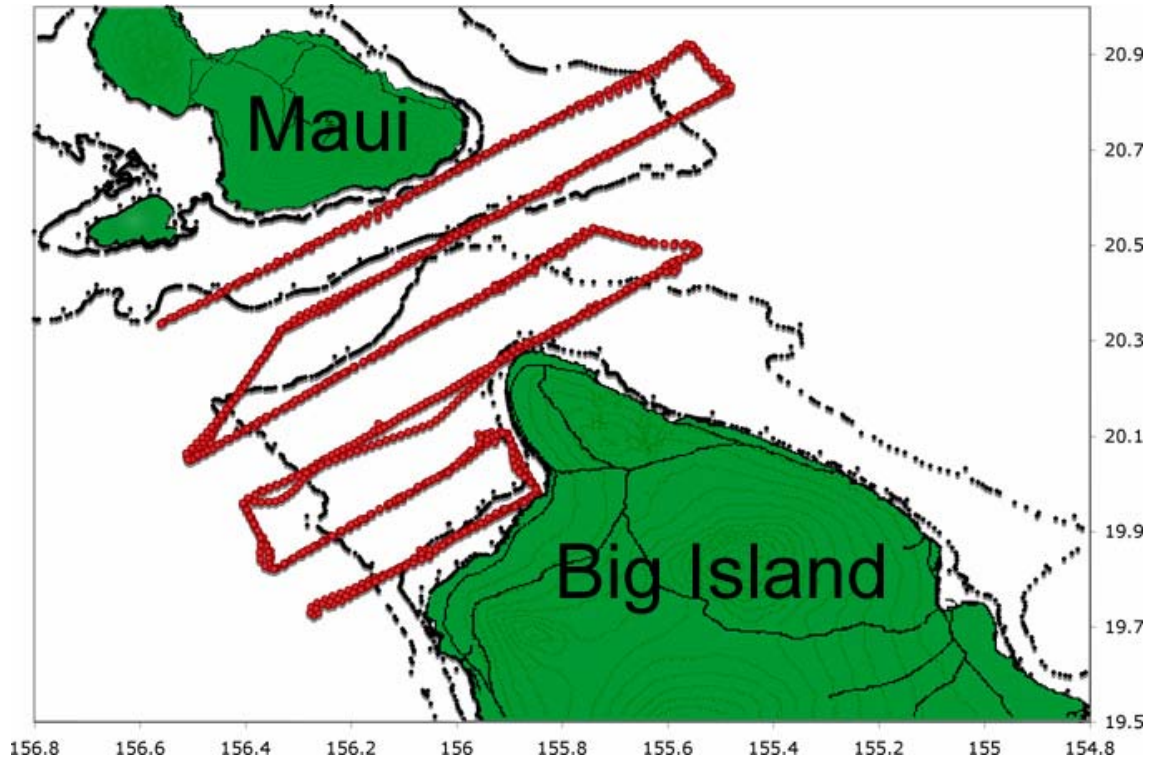

Figure 2. Survey effort for Alenuihaha Channel. GPS position data (red lines) are shown for July 24-26 surveys. Tracklines were 15 km apart and extended 13 km past the 1000 fathom limit. Total trackline distance for each survey was approximately 740 km.

Results

Overview. The six surveys comprised a total of ca. 18 hrs and ca. 3300 km of linear survey effort (Table 1). The number of sightings as well as the ability to identify species was generally hampered by poor seastate conditions that prevailed on all but one of the survey dates (July 20) (Table 1, Figure 3). Seastate is the primary factor affecting the ability to detect marine mammals (Buckland et al. 2001).

Summary of sightings. Cetacean species were detected on five of the six surveys (Table 1), including four identified species (bottlenose dolphins, spotted dolphins, false killer whales and Cuvier's beaked whale), one unidentified beaked whale species (likely *Mesoplodon densirostris*) and eight unidentified delphinid species (Table 2, Figures 4 & 5). All four of the identified species are among those typically seen in nearshore Hawaiian waters (Mobley et al. 2000; Shallenberger 1981). No unusual behavior or activity (e.g., stranded or dead animals) was observed during the six surveys.

Encounter rate comparison. One method of normalizing sightings for performing comparisons is to calculate encounter rates (groups sighted/km surveyed) (Buckland et al.

2001). In the present series a total of 13 sightings were made across ca. 3,334 km of survey effort which corresponds to an encounter rate of .0004 sightings/km. This rate is identical with the encounter rate for all odontocetes combined observed during the 1993-2003 survey series for inshore waters around the main Hawaiian Islands during the months Jan-Apr (Mobley, unpublished data, Appendix A). Therefore, the densities of marine mammal species reported here is identical with that normally seen for the Hawaiian Islands, albeit at different times of the year.

Table 1. Summary of Survey Effort and Sightings

Region	Date	No. of sightings	Survey effort (hrs)	Mean Beaufort seastate
Kaulakahi Channel	July 16	0	1.25	4.38
	July 17	2	3.96	4.06
	July 20	3	3.08	1.47
Alenuihaha Channel	July 24	1	3.28	4.36
	July 25	5	3.33	4.17
	July 26	2	3.02	4.80
	Total:	13	17.92	

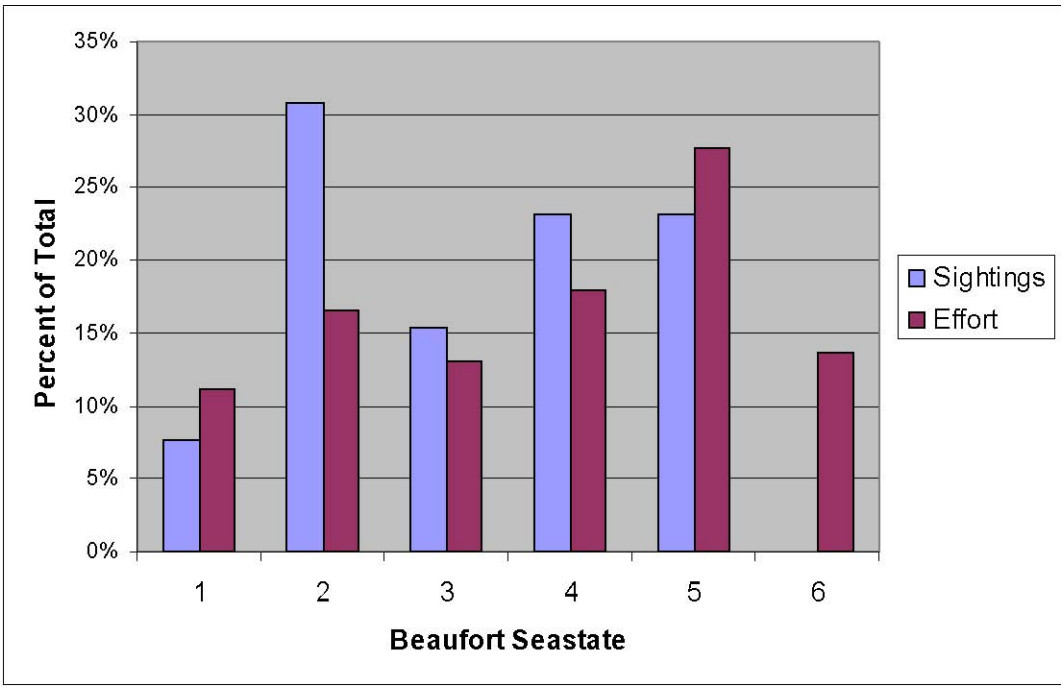

Figure 3. Summary of Beaufort Seastate Conditions. Beaufort seastate is one of the main factors affecting the ability to detect marine mammals. Normally, the ability to detect drops substantially beyond Beaufort 3. As shown, the majority of survey effort occurred in Beaufort 5, whereas the greater number of sightings occurred in Beaufort 2.

Table 2. Summary of Species Sightings by Region

Region / Species	No. groups	No. individuals
Kaulakahi Channel:		
Spotted dolphins (*Stenella attenuata*)	1	14
Unidentified delphinid species	4	21
Alenuihaha Channel:		
Bottlenose dolphin (*Tursiops truncatus*)	1	1
False killer whales (*Pseudorca crassidens*)	1	4
Cuvier's beaked whale (*Ziphius cavirostris*)	1	1
Unidentified beaked whale	1	1
Unidentified delphinid species	4	29

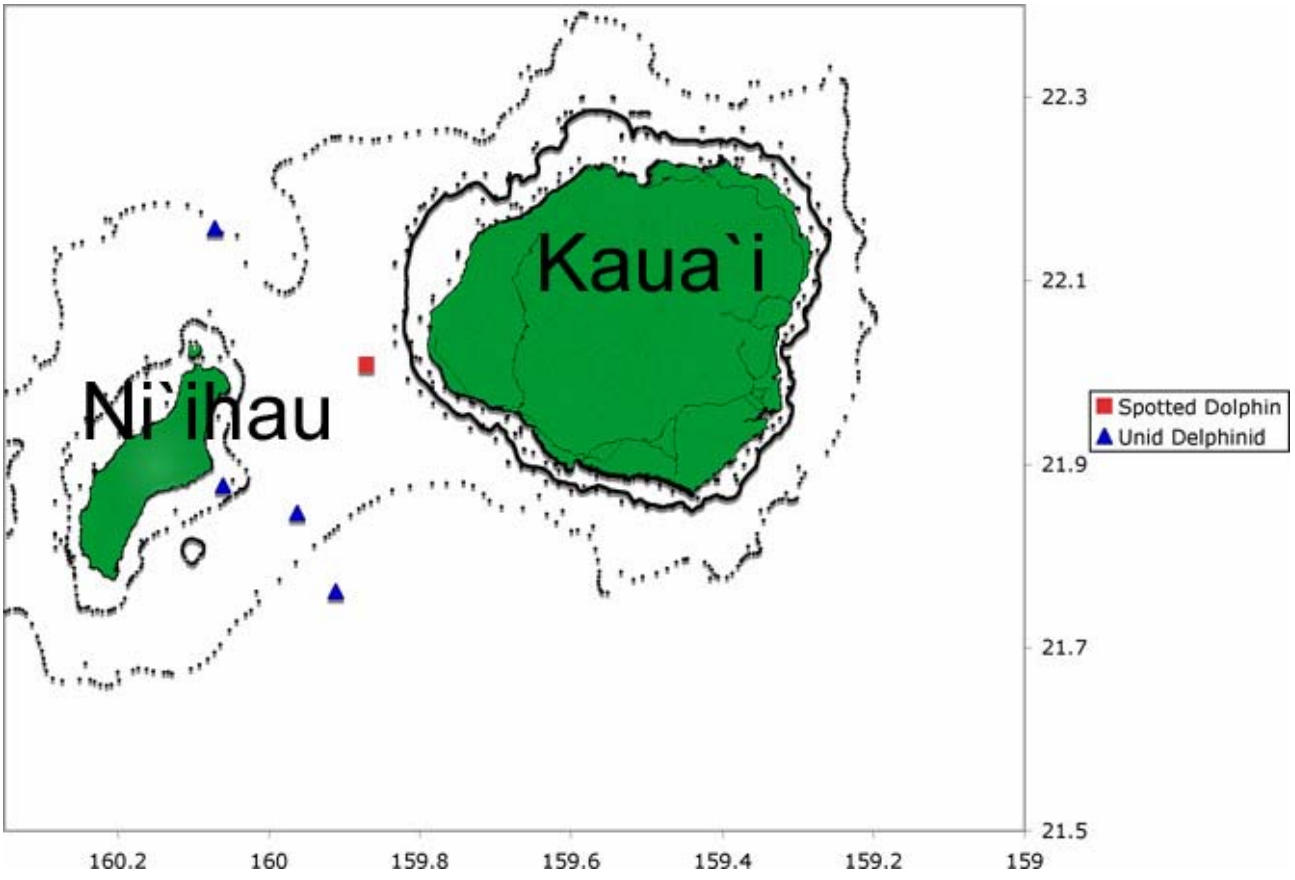

Figure 4. Kaulakahi Channel sightings. A total of five sightings occurred in the Kaulakahi Channel including one pod of spotted dolphins and four of unidentified delphinid species. Inner and outer bathymetry lines refer to 100 and 1000 fathom contours, respectively.

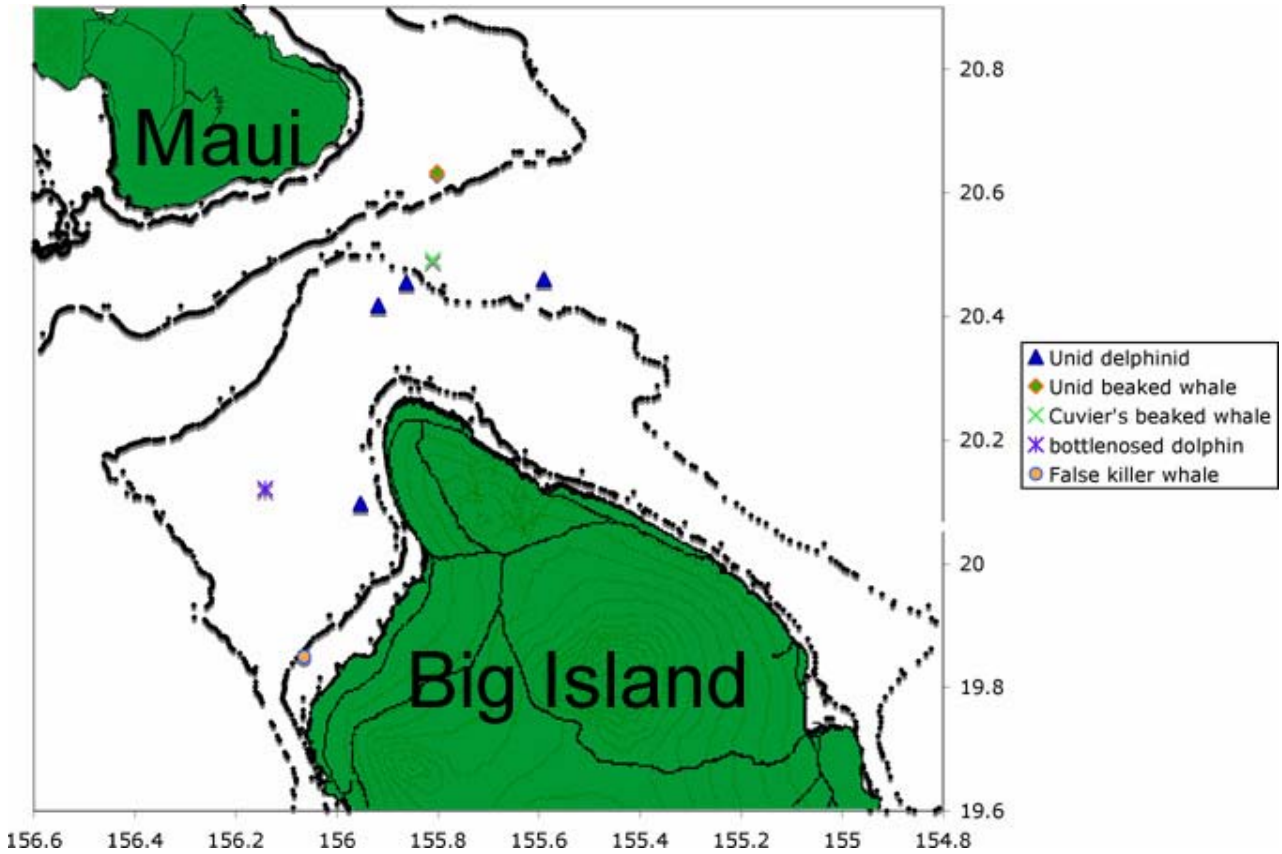

Figure 5. Alenuihaha Channel sightings. A total of 8 sightings occurred in the Alenuihaha Channel, including one pod of each of the following species: bottlenose dolphin, false killer whale, Cuvier's beaked whale and an unidentified beaked whale species (likely *Mesoplodon densirostris*). Additionally four pods of unidentified delphinids were sighted. Inner and outer bathymetry lines refer to the 100 and 1000 fathom contours, respectively.

Discussion

From the total of 13 sightings only four (31%) were positively identified to species. One sighting in the Alenuihaha Channel was identified as a beaked whale (likely Blainville's beaked whale, *M. densirostris*) but was not resighted upon orbiting, thus obviating positive species identification. The low rate of species identification was likely due to the poor seastate conditions that prevailed on all but one of the six surveys (Table 1, Figure 3) thereby making it difficult to recapture the sighting when orbiting.

The sighting of a group of four false killer whales (*Pseudorca crassidens*) was significant given recent concerns over the possible decline in their population around the Hawaiian Islands, possibly due to fisheries interactions (Baird and Gorgone 2005). In the 1993-03

aerial survey series, false killer whales were not seen after 1998 (Mobley, unpublished data), so the current sighting is the first aerial sighting since that time, though shipboard observations have been recorded (e.g., Barlow 2006).

Similarly, the sighting of a single Cuvier's beaked whale (*Ziphius cavirostris*), also in the Alenuihaha Channel, was significant given the fact that previous reports of adverse reactions to mid-range sonar primarily involved this species (ICES, 2005). It was sighted on 25July when RIMPAC activities were scheduled to occur in the channel, and was sighted mid-channel in waters deeper than 1000 fathoms (Figure 5).

As noted, the encounter rate for sightings in the present survey series (.0004 sightings/km surveyed) was identical to that recorded for odontocete species during the 1993-03 aerial survey series for the months Jan-Apr (Mobley 2004). This suggests that densities in the Kaulakahi and Alenuihaha Channels were no more or less than those normally seen throughout Hawaiian waters, albeit at different times of the year. Barlow (2006) commented on the low densities of odontocete species noted during 2002 shipboard surveys of the Hawaiian Exclusive Economic Zone (EEZ), noting them to be lower than most warm-temperate and tropical locations worldwide. He attributed this low density to the low productivity of the subtropical gyre that affects Hawaiian waters.

In conclusion, these surveys provided no evidence of impact of RIMPAC activities on resident populations of cetaceans in the Kaulakahi and Alenuihaha Channels. No differences in cetacean densities were detected, and no unusual behavior or event (e.g., unusual aggregations or near strandings) was observed. This statement should not be interpreted as evidence of no impact, merely that no such evidence was detected during these 18 hrs of surveys.

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References

Baird, R.W. and Gorgone, A.M. (2005). False killer whale dorsal fin disfigurements as a possible indicator of long-line fishery interactions in Hawaiian waters. *Pacific Science, 59*:593–601.

Barlow, J. (2006). Cetacean abundance in Hawaiian waters estimated from a summer/fall survey in 2002. *Marine Mammal Science, 22*:446-464.

Buckland, S.T., Anderson, D.R., Burnham, K.P, Laake, J.L., Borchers, D.L. and Thomas, L. (2001). *Introduction to* d*istance sampling: Estimating abundance of biological populations*. New York: Chapman and Hall.

International Council for the Exploration of the Sea (ICES) (2005), "*Report of the Ad-Hoc Group on the Impact of Sonar on Cetaceans."* 50 pp. Available at: http://socrates.uhwo.hawaii.edu/SocialSci/jmobley/ICES.pdf

Mobley, Jr., J. R. (2004). Results of marine mammal surveys on U.S. Navy underwater ranges in Hawaii and Bahamas. Final Report to Office of Naval Research, 27 pp. Available as downloadable pdf file at: http://socrates.uhwo.hawaii.edu/SocialSci/jmobley/ONRfinal.pdf

Mobley, Jr., J.R., Spitz, S.S., Forney, K.A., Grotefendt, R.A. and Forestell, P.H. (2000). Distribution and abundance of odontocete species in Hawaiian waters: Preliminary results of 1993-98 aerial surveys. Report to Southwest Fisheries Science Center, Administrative Report
LJ-00-14C. 26 pp. Available as downloadable pdf file at: http://socrates.uhwo.hawaii.edu/SocialSci/jmobley/SWFSC.pdf

Mobley, Jr., J.R., Spitz, S.S., Grotefendt, R, Forestell, P.H., Frankel, A.S. and Bauer, G.A. (2001). Abundance of humpback whales in Hawaiian waters: Results of 1993-2000 aerial surveys. Report prepared for the Hawaiian Islands Humpback Whale National Marine Sanctuary, Nov. 26, 2001.

Shallenberger, E.W. (1981). The status of Hawaiian cetaceans. Final report to the U.S. Marine Mammal Commission, Washington, DC. Report No. MMC-77/23. 79 pp.

Appendix A

1993 - 2003 Hawaiian Islands Aerial Survey Results

Species Name	No. pods	No. indiv.
Humpback whale (*Megaptera novaeangliae*)	2352	3907
Spinner dolphin (*Stenella longirostris*)	52	1825
Spotted dolphin (*Stenella attenuata*)	31	1021
Short-finned pilot whale (*Globicephala macrorhynchus*)	73	769
Melon-headed whale (*Peponocephala electra*)	6	770
Bottlenosed dolphin (*Tursiops truncatus*)	54	492
False killer whale (*Pseudorca crassidens*)	18	293
Sperm whale (*Physeter macrocephalus*)	23	106
Rough-toothed dolphin (*Steno bredanensis*)	8	90
Blainville's beaked whale (*Mesoplodon densirostris*)	9	32
Pygmy or dwarf sperm whale (*Kogia* spp.)	4	28
Striped dolphin (*Stenella coeruleoalba*)	1	20
Pygmy killer whale (*Feresa attenuata*)	2	16
Cuvier's beaked whale (*Ziphius cavirostris*)	7	13
Risso's dolphin (*Grampus griseus*)	1	8
Killer whale (*Orcinus orca*)	1	4
Fin whale (*Balaenoptera physalus*)	1	3
Unid. Dolphin	96	452
Unid. Stenella spp.	11	196
Unid. Whale	28	39
Unid. beaked whale	9	23
Unid. Cetacean	14	27
Totals:	2801	10134