

Final Report

Analysis of Monk Seal Behavior Relative to Navy Activities (U)

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14. ABSTRACT NOAA Fisheries' Hawaiian Monk Seal Research Program (HMSRP) and U.S. Navy Pacific Fleet Environmental initiated a collaborative research effort to investigate potential impacts of naval activities in the HRC. To accomplish this goal, positional data was collected by 13 global positioning system (GPS) telemetry tags deployed over a 2-year period (2010–2011) on 11 individual Hawaiian monk seals, for a total of 38,232 hours (1,593 days). By using geo-spatial data bases, it was determined that four of the eight seals were exposed to a total of 14.48 hours (less than 1 day) of mid frequency sonar activity while the seal was within 36 km of a hull mounted sonar ship. Independently, the tag data were analyzed by HMSRP to identify specific dates where seal behaviors differed from "normal" for each individual. The time periods determined by HMSRP to be outside the "normal" range were compared to those time periods when a monk seal was in the vicinity of a hull mounted sonar ship while it was transmitting. The available data suggest there were no significant impacts from MFAS on the Hawaiian monk seals tagged in HRC during the 2010–2011 time period, as no outlier days occurred on the day of active transmissions.					
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Section 1 – Introduction

In 2010, NOAA Fisheries’ Hawaiian Monk Seal Research Program (HMSRP) and U.S. Navy Pacific Fleet Environmental initiated a collaborative research effort to investigate potential impacts of naval activities in the Hawaii Range Complex (HRC). To accomplish this goal, positional data was collected by 13 global position system (GPS) telemetry tags deployed over a 2 year period (2010-2011) on 11 individual Hawaiian monk seals. For each tag deployment, the seal tracks were analyzed with respect to their location relative to tactical platforms operating in HRC during that time period. If it was determined that the ship and the seal were within 36 km of each other, the data were queried to determine if there was any concurrent hull mounted mid-frequency sonar activity. Independently, the tag data were analyzed by HMSRP to identify specific dates where seal behaviors differed dramatically from “normal” for each individual. These “outlier” dates were compared to those time periods when a monk seal was in the vicinity of a hull mounted sonar ship while it was transmitting, to determine if there was any correlation between the seal’s abnormal behavior and concurrent mid-frequency active sonar activity.

Section 2 – Methods

Positional data obtained from the Monk seal tag data (latitude, longitude and time) while it was on the surface was input into a geo-spatial data base to determine 1) if there were any tactical platform within specified range bins (described below) and 2) if there was any sonar activity during those times the animal was in the range bin. Time periods (if any) for overlap were compared to the outlier data provided by HMSRP.

The range bins used were derived from the Hawaii Range Complex Final EIS/OEIS (DoN, 2008) table 4.1.2.4.9.7-1. This table provides an estimate of received level from a tactical sonar operating in the Hawaii Range Complex. For each of the 13 monk seal tracks analyzed, it was determined the amount of time the monk seal was within the range bin (defined in table 1). For those time periods the animal was in that range bin, time periods (if any) were determined for concurrent hull mounted sonar activity. For those times when there was a sonar transmitting, the outlier data was queried to see if there were any time periods when there was any correlation between times of sonar transmissions and an identified change in behavior as defined in 6 categories: dive, haulout, surface and trip duration, trip distance and island movements.

Table 1. Representative received level at the animal in HRC. (U)

Received level (SPL)	Distance at which level occurs in HRC
>140 dB to <150dB	15-36 km
>150db to <160dB	5-15 km
>160dB to <170dB	2-5 km
>170dB	<2 km

Section 3-Results

Table 2 shows the cumulative number of hours of ship presence (if any) in each of the range bins defined in table 1, during some portion of the tag attachment. The data base was then queried for the time periods of hull mounted sonar transmission while in the designated range bin.

Data summary – 2010

There were 7 monk seals tagged for a total of 805 days (19,320 hours) in 2010. During this time period, 5 of the 7 tagged seals were within 36 km of a hull mounted sonar ship during some portion of their tagging period. There was a total of 1080 hours 45 minutes when a seal was in 15-36 km of a hull mounted sonar ship (not necessarily transmitting). When the seal was in this range bin, there were a total of 13 hours 38 minutes hrs of concurrent mid-frequency active sonar activity. There was 192 hours 25 minutes when a seal was in the 5-15 km range bin of a sonar capable ship, with 30 minutes of concurrent sonar activity. There was 24 hours 5 minutes when a seal was in the 2-5 km range bin of a sonar capable ship, with no concurrent sonar activity. There was only 1 instance of a monk seal (RI11 2010) at a range of less than 2 km from tactical ship, however there was no concurrent active transmissions during that time period. These data have been combined in table 2 with the 2-5 km range bin, indicating that there was no concurrent sonar transmission in 2010 for a seal within 5 km of a tactical platform.

Data summary - 2011

There were 6 monk seals tagged for a total of 788 days (18,912 hours) in 2011. During this time period, 3 of the 6 tagged seals were within 36 km of a hull mounted sonar ship during some portion of their tagging period. There was a total of 155 hours 40 minutes hours when a seal was within 15-36 km of an sonar capable ship, with 15 minutes of concurrent sonar activity. There was 20 hours 55 minutes when a seal was in the 5-15 km range bin of a sonar capable ship, with no concurrent sonar activity. There was no time a seal was 5 km or less of a sonar capable ship.

Table 3 summarizes the outlier data (in days) calculated by HMSRP per monk seal for each of the 6 categories shown in the table. In the 2 year period, 4 monk seals (denoted by an asterisk in the table) were within one of the range bins while there was concurrent sonar activity. Three occurrences (out of 7 monk seals) were in 2010, one occurrence (out of 6 monk seals) occurred in 2011. For those time periods of concurrent sonar activity, the dates of the outlier activity were compared to the date/time of the mid frequency active sonar transmissions. The total number of outlier days is shown for each tagged monk seal tagged. For the 4 monk seals that were within one of the range bins during active sonar transmissions, the number of days shown denote that there was an overlap of an outlier date with the day of or the day after mid frequency active sonar transmissions.

RI11 2010 - There was a single outlier day (same date) in each of 2 categories (haul out duration and island movements) that occurred the day after sonar transmissions. For the remaining 4 categories, there was no overlap of any outlier days that occurred on the day of or the day after mid frequency sonar transmissions.

RO18 2010 -There was one outlier day in a single category (surface duration) that occurred the day after sonar transmissions. For the remaining 5 categories, there were no overlap of any outlier days that occurred the day of or the day after mid frequency sonar transmissions.

RR70 2010 - There were no outlier days that occurred the day of or the day after mid frequency sonar transmissions.

RO18 2011 - There was one outlier day in a single category (trip duration) that occurred the day after sonar transmissions. For the remaining 5 categories, there were no overlap of any outlier days that occurred the day of or the day after mid frequency sonar transmissions.

Section 4 Discussion

In the 2 year period, 2010-2011, 13 monk seals were tagged in the Hawaii Range Complex for a total of 38,232 hours (1593 days). By using geo-spatial data bases, it was determined that 8 of these 13 seals were within 36 km of a hull mounted sonar ship for a total of 1473 hours 50 minutes (approximately 62 days) or 3.85% of the total tagged time. Considering concurrent active sonar activity during the 2 year period, 4 of the 8 seals were exposed to a total of 14.48 hours (less than 1 day) or 1.0% of concurrent sonar activity while the seal was within 36 km of a mid-frequency sonar ship. One seal was exposed to mid-frequency sonar transmissions for 30 minutes within the 5-15 km range bin, receiving a maximum receive level of 160dB (using the HRC receive level estimates shown in table 1). The majority of the time, the 4 seals were exposed to mid-frequency sonar transmissions while in the 15-36 km range bin, receiving a maximum receive level of 150dB (using the HRC receive level estimates shown in table 1).

When considering the outlier data shown in table 3, none of the outlier days occurred on the same day of mid-frequency sonar transmissions for the 4 seals that were exposed to mid-frequency sonar transmissions. For the 3 seals that an outlier day occurred the day after a period of active sonar transmission, only 1 seal exhibited outlier behavior in 2 categories (haulout duration and island movements), while the remaining 2 seals exhibited outlier behavior in 1 category each (surface duration and trip duration). For the remaining seal, there were no outlier days that occurred the day of or the day after sonar transmissions. When considering the number of total outlier days per category, and that there were no outlier days on the day of active transmissions (only the day after time periods of active transmissions), the available data suggest there were no significant impacts from mid-frequency active sonar on the Hawaiian monk seals tagged in HRC during the 2010-2011 time period.

Section 5 – Acknowledgements

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Section 6 – Literature Cited

DoN (Department of the Navy) 2008. Hawaii Range Complex Final Environmental Impact Statement/Overseas Environmental Impact Statement (May 2008).

Table 2. Amount of time each monk seal is within defined range bins and corresponding amount of time there was active sonar activity.

Seal ID	Tag attachment dates	Range Bin 15-36 km		Range Bin 5-15 km		Range Bin less than 5 km	
		# hrs:min seal in proximity of ship	# hrs:min concurrent MF sonar activity	# hrs:min seal in proximity of ship	# hrs:min concurrent MF sonar activity	# hrs:min seal in proximity of ship	# hrs:min concurrent MF sonar activity
2010							
R4DI 2010	2-23 Feb 2010	0	0	0	0	0	0
RO12 2010	1 Mar - 20 Aug 2010	167:30	0	39:00	0	0	0
RE70 2010	27 Mar - 10 May 2010	0	0	0	0	0	0
RI11 2010	27 Mar - 27 Sep 2010	35:50	5:12 ¹	3:05	0	1:15	0
RO18 2010	9 June - 8 Dec 2010	27:55	8:16 ²	2:15	0:30 ¹	0:20	0
RR70 2010	29 June - 31 Aug 2010	122:25	0:35 ¹	17:40	0	10:00	0
R4DF 2010	9 July - 25 Nov 2010	727:05	0	130:25	0	12:30	0
2011							
RB24 2011	26 Jan - 13 July 2011	0:15	0	0	0	0	0
R018 2011	18 Feb - 12 June 2011	62:40	0:15 ¹	20:55	0	0	0
RB02 2011	1 Jun - 5 Oct 2011	0	0	0	0	0	0
R4DI 2011	15 Jun - 31 Oct 2011	0	0	0	0	0	0
RW02 2011	13 July - 6 Oct 2011	0	0	0	0	0	0
T21M	15 Jul - 13 Dec 2011	92:45	0	0	0	0	0
¹ One ship was transmitting within this time period ² Three ships were transmitting within this time period, value is total time of transmissions							

Table 3. Summary of outlier data provided by HMSRP showing number of overlap days when there was sonar activity and an outlier date. No overlap days occurred on the same day of sonar activity, the overlap days indicated occurred the day *after* sonar activity.

		# outlier (overlap days/total outlier days)						
		# days tag on	dive duration	haulout duration	surface duration	trip distance	trip duration	island movements
2010								
1	R4DI 2010	15	0/15	0/13	0/15	0/0	0/0	0/0
2	RO12 2010	173	0/3	0/7	0/9	0/29	0/6	0/9
3	RE70 2010	45	0/2	0/2	0/4	0/2	0/6	0/1
4	RI 11 2010*	185	0/5	1/15	0/10	0/19	0/9	1/18
5	RO18 2010*	183	0/5	0/1	1/10	0/24	0/3	0/22
6	RR70 2010*	64	0/6	0/9	0/2	0/1	0/2	0/4
7	R4DF 2010	140	0/2	0/4	0/2	0/18	0/2	0/7
2011								
1	RB24 2011	169	0/5	0/2	0/5	0/41	0/8	0/9
2	RO18 2011*	115	0/1	0/10	0/5	0/10	1/19	0/16
3	RB02 2011	127	0/5	0/36	0/1	0/3	0/14	0/5
4	R4DI 2011	139	0/135	0/135	0/130	0/18	0/3	0/5
5	RW02 2011	86	0/9	0/84	0/7	0/1	0/3	0/0
6	T21M	152	0/1	0/149	0/2	0/16	0/8	0/5
		* denotes when there were time periods of sonar activity during tag attachment						