

## Addendum

# U.S. Marine Corps Application for Proposed Rulemaking for Training Exercises at Brant Island Bombing Target and Piney Island Bombing Range, USMC Cherry Point Range Complex, NC

July 2014

PROPOSED CHANGE TO MUNITIONS BT-9

Proposed Ordnance	Net Explosive Weight in Pounds (lbs)	Proposed Number of Rounds
Small arms excluding .50 cal (7.62 mm)	N/A, inert	525,610
.50 cal	N/A, inert	568,515
Large arms – live (30 mm)	0.1019	3,432
Large arms – live (40 mm)	0.1199	10,420
Large arms – inert (20, 25, 30, and 40 mm)	N/A	120,405
Rockets – live (2.75- inch)	4.8	220
Rockets – live (5-inch)	15.0	68
Rockets – inert (2.75-inch rocket, 2.75-inch illumination, 2.75-inch white phosphorus, 2.75-inch red phosphorus; 5-inch rocket, 5-inch illumination, 5-inch white phosphorus, 5-inch red phosphorus )	N/A	844
Grenades – live (G911)	0.5	144
Bombs – inert (BDU-45 practice bomb, MK-76 practice bomb, MK-82 practice bomb, MK-83 practice bomb)	0.083800 - 0.1676 signal cartridge only	4,460
Pyrotechnics – inert (chaff, LUU-2, self-protection flares)	N/A	4,496

Cherry Point Annual Ordnance Usage for BT-9

Take Based on Previous Criteria
Take Based on Navy Criteria
Criteria Unchanged - No Delta

Ordnance Type	Behavioral and TTS Take Estimates			PTS			Slight Lung Injury		Injury	Mortality	
	177 & 182 dB SEL	167 & 172 dB SEL	23 psi	205 dB SEL	187 dB SEL	45.9 psi	BND @ 12.2 kg	BND @ 14 kg	104 psi	BND @ 12.2 kg	BND @ 14 kg
30 mm Large Arms - Summer	2.35	15.43	3.13	0.05	1.94	0.96	0.03	0.03	0.21	0.00	0.00
30 mm Large Arms - Winter	2.11	12.17	3.13	0.06	1.69	0.96	0.03	0.03	0.21	0.00	0.00

Annual Total	Behavioral and TTS Take Estimates			PTS			Slight Lung Injury		Injury	Mortality	
	177 & 182 dB SEL	167 & 172 dB SEL	23 psi	205 dB SEL	187 dB SEL	45.9 psi	BND @ 12.2 kg	BND @ 14 kg	104 psi	BND @ 12.2 kg	BND @ 14 kg
Annual Total	4.46	<b>27.60</b>	6.26	0.11	<b>3.64</b>	1.92	0.06	0.06	0.41	0.00	0.00

Increase in annual take using Navy criteria

Revised Using Navy Explosive Thresholds

Threshold: Behavioral and TTS (SEL)				Total Energy (dB) at 167 dB - 15 dB (151.9)					Total Energy at 172 dB - 15 dB (156.9)					Cumulative Impact Area (Behavior)	Modeled Animals Exposed per Burst	Cumulative Impact Area (TTS)	Modeled Animals Exposed per Burst	Ordnance Usage Level	Results by Threshold (Behavior)	Results by Threshold (TTS)	Annual Results by Threshold (Behavior)	Annual Results by Threshold (TTS)
Ordnance	BND Density (km <sup>2</sup> )	Area Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth									
30 mm Summer	0.183	0.000001	30	422,546.98	1,018,207.00	1,554,528.20	1,961,038.20	2,413,033.40	261,127.97	634,522.52	941,033.72	1,212,002.70	1,466,819.20	570769.53	0.104451	903101.22	0.16527	1716	5.97	9.45	10.41	17.18
30 mm Winter	0.183	0.000001	30	377,768.26	906,547.33	1,372,623.10	1,522,617.30	1,633,869.80	235,397.64	567,284.22	830,913.80	989,064.72	1,070,176.60	424117.76	0.077614	738567.40	0.13516	1716	4.44	7.73		

For energy metrics all rounds are used for estimating exposures.

Correct : Subtracting # of bursts from the SELcum threshold of 167 and 172 dB to derive the received level that accounts for number of bursts.

Threshold: TTS at 23 psi (22.9)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per burst	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
30 mm Summer	0.183	0.000001	30	8169.502	11656.287	11656.287	11656.287	11656.287	10958.93	0.002005	1716	3.44	6.88
30 mm Winter	0.183	0.000001	30	8203.7864	11656.287	11656.287	11656.287	11656.287	10965.79	0.002007	1716	3.44	

Threshold: PTS at 187 - 15 dB SEL (Total Energy at 171.9)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
30 mm Summer	0.183	0.000001	30	54601.132	138392.04	200225.29	248444.26	287275.99	185787.74	0.033999	1716	1.94	3.64
30 mm Winter	0.183	0.000001	30	50667.161	126315.02	180494.22	218456.13	233452.18	161876.94	0.029623	1716	1.69	

Threshold: PTS at 45.9 psi (45.5)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
30 mm Summer	0.183	0.000001	30	3124.8761	3416.4379	3416.4379	3401.9706	3387.5631	3349.46	0.000613	1716	1.05	2.11
30 mm Winter	0.183	0.000001	30	3246.7282	3416.4379	3416.4379	3401.9706	3387.5631	3373.83	0.000617	1716	1.06	

Revised Using Navy Explosive Thresholds

Threshold: Slight Lung Injury (14 kg and postive impulse)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
30 mm Summer	0.183	0.000001	30	75.250752	127.91965	107.58222	82.430569	52.279527	89.09	0.000016	1716	0.028	0.06
30 mm Winter	0.183	0.000001	30	75.250752	127.91965	107.58222	82.430569	52.279527	89.09	0.000016	1716	0.028	
			Pa-s	96.54	100.99	105.25	109.35	113.3					
			psi-ms	14.00	14.66	15.36	15.90	16.46					

Threshold: Injury (104 psi)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
30 mm Summer	0.183	0.000001	30	736.39863	736.39863	729.66577	719.67063	703.28599	725.08	0.000133	1716	0.228	0.46
30 mm Winter	0.183	0.000001	30	736.39863	736.39863	729.66577	719.67063	703.28599	725.08	0.000133	1716	0.228	

Threshold: Mortality (14 kg)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
30 mm Summer	0.183	0.000001	30	0	0	0	0	0	0.00	0.000000	1716	0	0.000
30 mm Winter	0.183	0.000001	30	0	0	0	0	0	0.00	0.000000	1716	0	
			Pa-s	225.67	236.07	246.04	255.62	264.85					
			psi-ms	32.96	34.52	35.74	37.44	38.76					

Previous Explosive Thresholds

Threshold: Behavioral and TTS (SEL)				Peak OTO Energy (dB) at 177 dB - 15 dB (162.12)					Peak OTO Energy at 182 dB -15 dB (167.15)					Cumulative Impact Area (Behavior)	Modeled Animals Exposed per Burst	Cumulative Impact Area (TTS)	Modeled Animals Exposed per Burst	Ordnance Usage Level	Seasonal Estimate (Behavior)	Seasonal Estimate (TTS)	Annual Results by Threshold (Behavior)	Annual Results by Threshold (TTS)
Ordnance	BND Density (km <sup>2</sup> )	Area Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth									
30 mm Summer	0.183	0.000001	30	65,549.74	168,199.36	256,829.72	336,335.64	410,451.89	37,099.65	96,443.99	147,281.49	192,885.30	236,376.44	105455.90	0.019298	142017.37	0.025989	1,560	1.00	1.35	1.89	2.58
30 mm Winter	0.183	0.000001	30	60,074.83	154,802.22	235,397.64	303,196.93	354,974.75	34,424.84	89,499.61	136,679.56	176,787.66	207,844.48	92642.05	0.016953	129047.23	0.023616	1,560	0.88	1.23		

Correct: Subtracting # of bursts from the SELcum threshold of 177 and 182 dB to derive the received level that accounts for number of bursts.

Threshold: TTS at 23 psi (22.9 psi)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isopleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
30 mm Summer	0.183	0.000001	30	8,169.50	11,656.29	11,656.29	11,656.29	11,656.29	10,958.93	0.002005	1,560	3.13	6.26
30 mm Winter	0.183	0.000001	30	8,203.79	11,656.29	11,656.29	11,656.29	11,656.29	10,965.79	0.002007	1,560	3.13	

Threshold: PTS at 205 dB SEL - 15 dB SEL (Total Energy at 190.04 dB)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isopleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
30 mm Summer	0.183	0.000001	30	3,534.36	5,391.67	5,670.85	6,708.51	7,234.67	5,708.01	0.001045	1,560	0.0543	0.115
30 mm Winter	0.183	0.000001	30	3,519.41	5,914.36	6,624.58	7,639.86	8,135.36	6,366.71	0.001165	1,560	0.0606	

Threshold: PTS at 45.9 psi (45.5 psi)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isopleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
30 mm Summer	0.183	0.000001	30	3,124.88	3,416.44	3,416.44	3,401.97	3,387.56	3,349.46	0.000613	1,560	0.96	1.919
30 mm Winter	0.183	0.000001	30	3,246.73	3,416.44	3,416.44	3,401.97	3,387.56	3,373.83	0.000617	1,560	0.96	

Cherry Point Annual Ordnance Usage for BT-9

Take Based on Previous Criteria
Take Based on Navy Criteria
Criteria Unchanged - No Delta

Ordnance Type	Behavioral and TTS Take Estimates			PTS			Slight Lung Injury		Injury	Mortality	
	177 & 182 dB SEL	167 & 172 dB SEL	23 psi	205 dB SEL	187 dB SEL	45.9 psi	BND @ 12.2 kg	BND @ 14 kg	104 psi	BND @ 12.2 kg	BND @ 14 kg
40 mm Large Arms - Summer	18.93	136.97	10.49	0.13	12.49	1.69	0.15	0.12	0.71	0.00	0.00
40 mm Large Arms - Winter	17.30	112.23	10.49	0.16	11.30	1.71	0.15	0.12	0.71	0.00	0.00

Annual Total	Behavioral and TTS Take Estimates			PTS			Slight Lung Injury		Injury	Mortality	
	177 & 182 dB SEL	167 & 172 dB SEL	23 psi	205 dB SEL	187 dB SEL	45.9 psi	BND @ 12.2 kg	BND @ 14 kg	104 psi	BND @ 12.2 kg	BND @ 14 kg
Annual Total	36.22	<b>249.20</b>	20.98	0.30	<b>23.78</b>	3.40	0.31	0.25	1.42	0.00	0.00

Increase in annual take using Navy criteria

Revised Using Navy Explosive Thresholds

Threshold: Behavioral and TTS (SEL)				Total Energy (dB) at 167 dB - 7dB (159.82)					Total Energy at 172 dB - 7 dB (164.78)					Cumulative Impact Area (Behavior)	Modeled Animals Exposed per Burst	Cumulative Impact Area (TTS)	Modeled Animals Exposed per Burst	Ordnance Usage Level	Results by Threshold (Behavior)	Results by Threshold (TTS)	Annual Results by Threshold (Behavior)	Annual Results by Threshold (TTS)
Ordnance	BND Density (km <sup>2</sup> )	Area Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth									
40 mm Summer	0.183	0.000001	5	207,844.48	507,170.06	749,056.32	964,750.38	1,162,753.30	126,315.02	313,429.82	461,012.63	588,865.66	698,049.12	280780.46	0.051383	437534.45	0.08007	5210	53.54	83.43	95.37	153.84
40 mm Winter	0.183	0.000001	5	188,142.01	455,310.28	661,399.76	810,487.00	827,473.93	115,291.32	282,547.47	410,451.89	513,521.79	524,285.26	219343.05	0.040140	369219.55	0.06757	5210	41.83	70.40		

For energy metrics all rounds are used for estimating exposures.

Correct : Subtracting # of bursts from the SELcum threshold of 167 and 172 dB to derive the received level that accounts for number of bursts.

Threshold: TTS at 23 psi (22.9)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per burst	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
40 mm Summer	0.183	0.000001	5	8554.5674	12992.652	12992.652	12992.652	12992.652	12105.04	0.002215	5210	11.54	23.08
40 mm Winter	0.183	0.000001	5	8554.5674	12992.652	12992.652	12992.652	12992.652	12105.04	0.002215	5210	11.54	

Threshold: PTS at 187 - 7 dB SEL (Total Energy at 179.87)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
40 mm Summer	0.183	0.000001	5	22242.074	54149.379	73023.505	85859.859	92138.765	65482.72	0.011983	5210	12.49	23.78
40 mm Winter	0.183	0.000001	5	21070.317	50247.91	67483.289	77716.468	79676.955	59238.99	0.010841	5210	11.30	

Threshold: PTS at 45.9 psi (45.5)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
40 mm Summer	0.183	0.000001	5	3302.3621	3814.4468	3814.4468	3798.3319	3782.2837	3702.37	0.000678	5210	3.53	7.09
40 mm Winter	0.183	0.000001	5	3445.5533	3814.4468	3814.4468	3798.3319	3782.2837	3731.01	0.000683	5210	3.56	



Revised Using Navy Explosive Thresholds

Threshold: Slight Lung Injury (14 kg and postive impulse)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
40 mm Summer	0.183	0.000001	5	96.354458	174.45251	156.25078	127.91965	94.191527	129.83	0.000024	5210	0.124	0.25
40 mm Winter	0.183	0.000001	5	96.354458	174.45251	156.25078	127.91965	94.191527	129.83	0.000024	5210	0.124	
			Pa-s	96.54	100.99	105.25	109.35	113.3					
			psi-ms	14.00	14.66	15.36	15.90	16.46					

Threshold: Injury (104 psi)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
40 mm Summer	0.183	0.000001	5	829.204	829.204	825.44642	814.26675	795.94037	818.81	0.000150	5210	0.781	1.56
40 mm Winter	0.183	0.000001	5	829.204	829.204	825.44642	814.26675	795.94037	818.81	0.000150	5210	0.781	

Threshold: Mortality (14 kg)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
40 mm Summer	0.183	0.000001	5	0	0	0	0	0	0.00	0.000000	5210	0	0.000
40 mm Winter	0.183	0.000001	5	0	0	0	0	0	0.00	0.000000	5210	0	
			Pa-s	225.67	236.07	246.04	255.62	264.85					
			psi-ms	32.96	34.52	35.74	37.44	38.76					

Previous Explosive Thresholds

Threshold: Behavioral and TTS (SEL)				Peak OTO Energy (dB) at 177 dB - 7 dB (169.89)					Peak OTO Energy at 182 dB -7 dB (174.81)					Cumulative Impact Area (Behavior)	Modeled Animals Exposed per Burst	Cumulative Impact Area (TTS)	Modeled Animals Exposed per Burst	Ordnance Usage Level	Seasonal Estimate (Behavior)	Seasonal Estimate (TTS)	Annual Results by Threshold (Behavior)	Annual Results by Threshold (TTS)
Ordnance	BND Density (km <sup>2</sup> )	Area Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth									
40 mm Summer	0.183	0.000001	5	28,313.20	73,938.88	113,392.87	149,126.72	181,244.81	14,602.49	38,036.56	58,353.30	75,804.17	87,660.86	54311.82	0.009939	54891.48	0.010045	4,736	9.41	9.51	17.92	18.30
40 mm Winter	0.183	0.000001	5	26,380.06	68,899.17	105,666.81	137,248.02	160,693.60	13,659.76	36,185.76	55,285.83	70,637.46	77,716.47	49080.48	0.008982	50697.06	0.009278	4,736	8.51	8.79		

Correct: Subtracting # of bursts from the SELcum threshold of 177 and 182 dB to derive the received level that accounts for number of bursts.

Threshold: TTS at 23 psi (22.9 psi)

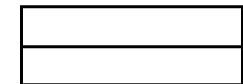
Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isopleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
40 mm Summer	0.183	0.000001	5	8,554.57	12,992.65	12,992.65	12,992.65	12,992.65	12,105.04	0.002215	4,736	10.49	20.98
40 mm Winter	0.183	0.000001	5	8,554.57	12,992.65	12,992.65	12,992.65	12,992.65	12,105.04	0.002215	4,736	10.49	

Threshold: PTS at 205 dB SEL - 7 dB SEL (Total Energy at 197.9 dB)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isopleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
40 mm Summer	0.183	0.000001	5	567.47	788.72	840.57	848.23	848.23	778.64	0.000142	4,736	0.1350	0.299
40 mm Winter	0.183	0.000001	5	623.35	1,020.04	1,043.06	1,020.04	1,015.49	944.40	0.000173	4,736	0.1637	

Threshold: PTS at 45.9 psi (45.5 psi)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isopleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
40 mm Summer	0.183	0.000001	5	3,302.36	3,814.45	3,814.45	3,798.33	3,782.28	3,702.37	0.000678	2500	1.69	3.401
40 mm Winter	0.183	0.000001	5	3,445.55	3,814.45	3,814.45	3,798.33	3,782.28	3,731.01	0.000683	2500	1.71	



Previous Explosive Thresholds

Threshold: Slight Lung Injury (12.2 kg and positive impulse)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isopleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
40 mm Summer	0.183	0.000001	5	96.35446	197.479	209.17	199.78	182.99	177.15	0.000032	4,736	0.1535	0.307
40 mm Winter	0.183	0.000001	5	96.35446	197.479	209.17	199.78	182.99	177.15	0.000032	4,736	0.1535	
			psi-ms	13.3	13.9	14.6	15.1	15.7					

Threshold: Injury 104 psi (103.59)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isopleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
40 mm Summer	0.183	0.000001	5	829.20	829.20	825.45	814.27	795.94	818.81	0.000150	4,736	0.710	1.419
40 mm Winter	0.183	0.000001	5	829.20	829.20	825.45	814.27	795.94	818.81	0.000150	4,736	0.710	

Threshold: Mortality (12.2 kg)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isopleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
40 mm Summer	0.183	0.000001	5	0.00	0.00	0.00	0.00	0.00	0.00	0.000000	4,736	0.00	0.000
40 mm Winter	0.183	0.000001	5	0.00	0.00	0.00	0.00	0.00	0.00	0.000000	4,736	0.00	

Cherry Point Annual Ordnance Usage for BT-9

Take Based on Previous Criteria
Take Based on Navy Criteria
Criteria Unchanged - No Delta

Ordnance Type	Behavioral and TTS Take Estimates			PTS			Slight Lung Injury		Injury	Mortality	
	177 & 182 dB SEL	167 & 172 dB SEL	23 psi	205 dB SEL	187 dB SEL	45.9 psi	BND @ 12.2 kg	BND @ 14 kg	104 psi	BND @ 12.2 kg	BND @ 14 kg
2.75" Rocket - Summer	3.43	14.11	1.27	0.09	1.81	0.52	0.07	0.08	0.14	0.02	0.03
2.75" Rocket - Winter	3.10	11.06	1.18	0.10	1.56	0.52	0.07	0.08	0.14	0.02	0.03

Annual Total	Behavioral and TTS Take Estimates			PTS			Slight Lung Injury		Injury	Mortality	
	177 & 182 dB SEL	167 & 172 dB SEL	23 psi	205 dB SEL	187 dB SEL	45.9 psi	BND @ 12.2 kg	BND @ 14 kg	104 psi	BND @ 12.2 kg	BND @ 14 kg
Annual Total	6.53	<b>25.17</b>	2.45	0.20	<b>3.37</b>	1.04	0.14	0.15	0.29	0.05	0.06

Increase in annual take using Navy criteria

Revised Using Navy Explosive Thresholds

Threshold: Behavioral and TTS (SEL)				Total Energy (dB) at 167 dB - 5 dB (162.1)					Total Energy at 172 dB - 5 dB (167.1)					Cumulative Impact Area (Behavior)	Modeled Animals Exposed per Burst	Cumulative Impact Area (TTS)	Modeled Animals Exposed per Burst	Ordnance Usage Level	Results by Threshold (Behavior)	Results by Threshold (TTS)	Annual Results by Threshold (Behavior)	Annual Results by Threshold (TTS)
Ordnance	BND Density (km <sup>2</sup> )	Area Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth									
2.75" Rocket Summer	0.183	0.000001	3	569,642.56	1,407,294.60	2,211,802.70	2,860,475.10	3,461,834.20	346,247.11	858,952.51	1,311,474.50	1,724,477.60	2,139,531.10	826073.27	0.151171	1276136.56	0.23353	110	5.54	8.56	9.82	15.35
2.75" Rocket Winter	0.183	0.000001	3	507,170.06	1,237,482.70	1,897,106.10	2,148,503.30	2,453,484.90	312,132.07	761,589.85	1,148,372.50	1,355,646.80	1,479,039.30	637393.31	0.116643	1011356.10	0.18508	110	4.28	6.79		

For energy metrics all rounds are used for estimating exposures.

Correct : Subtracting # of bursts from the SELcum threshold of 167 and 172 dB to derive the received level that accounts for number of bursts.

Threshold: TTS at 23 psi (22.9)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per burst	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
2.75" Rocket Summer	0.183	0.000001	3	19630.33	52597.434	79346.809	102215.29	122697.77	75297.53	0.013779	110	1.52	2.93
2.75" Rocket Winter	0.183	0.000001	3	19306.014	50667.161	75177.245	95250.291	111063.67	70292.88	0.012864	110	1.41	

Threshold: PTS at 187 - 5 dB SEL (Total Energy at 182 )

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
2.75" Rocket Summer	0.183	0.000001	3	75177.245	192885.3	286086.49	363922.33	431403.89	269895.05	0.049391	110	1.81	3.37
2.75" Rocket Winter	0.183	0.000001	3	69762.909	175326.42	255766.26	318675.03	344813.51	232868.83	0.042615	110	1.56	

Threshold: PTS at 45.9 psi (45.5)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
2.75" Rocket Summer	0.183	0.000001	3	9070.76	22995.2	34139.775	43266.858	45479.052	30990.33	0.005671	110	0.62	1.24
2.75" Rocket Winter	0.183	0.000001	3	9146.9795	22995.2	33998.129	42553.595	45479.052	30834.59	0.005643	110	0.62	

Revised Using Navy Explosive Thresholds

Threshold: Slight Lung Injury (14 kg and postive impulse)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
2.75" Rocket Summer	0.183	0.000001	3	700.04965	2691.9816	4151.1889	5324.0234	6299.0865	3833.27	0.000701	110	0.077	0.15
2.75" Rocket Winter	0.183	0.000001	3	739.78607	2785.4625	4151.1889	5324.0234	6299.0865	3859.91	0.000706	110	0.078	
			Pa-s	96.54	100.99	105.25	109.35	113.3					
			psi-ms	14.00	14.66	15.36	15.90	16.46					

Threshold: Injury (104 psi)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
2.75" Rocket Summer	0.183	0.000001	3	3192.0097	7639.8581	10544.313	10544.313	10500.34	8484.17	0.001553	110	0.171	0.34
2.75" Rocket Winter	0.183	0.000001	3	3330.5272	8067.4978	10544.313	10544.313	10500.34	8597.40	0.001573	110	0.173	

Threshold: Mortality (14 kg)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
2.75" Rocket Summer	0.183	0.000001	3	285.9099	1071.3274	1577.9087	1926.1448	2201.2349	1412.51	0.000258	110	0.028433728	0.057
2.75" Rocket Winter	0.183	0.000001	3	315.79556	1071.3274	1577.9087	1926.1448	2201.2349	1418.48	0.000260	110	0.028554048	
			Pa-s	225.6	236	246	255.6	264.8					
			psi-ms	32.70	34.20	35.60	37.00	38.40					

Previous Explosive Thresholds

Threshold: Behavioral and TTS (SEL)				Peak OTO Energy (dB) at 177 dB					Peak OTO Energy at 182 dB					Cumulative Impact Area (Behavior)	Modeled Animals Exposed per Burst	Cumulative Impact Area (TTS)	Modeled Animals Exposed per Burst	Ordnance Usage Level	Seasonal Estimate (Behavior)	Seasonal Estimate (TTS)	Annual Results by Threshold (Behavior)	Annual Results by Threshold (TTS)
Ordnance	BND Density (km <sup>2</sup> )	Area Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth									
2.75" Rocket Summer	0.183	0.000001	1	51,945.99	135,549.69	209,576.61	279,052.21	341,964.08	29,638.69	78,364.55	121,683.41	162,706.78	198,570.42	85424.95	0.015633	118192.77	0.021629	92	1.44	1.99	2.72	3.81
2.75" Rocket Winter	0.183	0.000001	1	47,804.15	125,791.81	195,301.58	253,652.52	298,206.43	27,500.66	73,327.37	114,338.16	149,746.92	175,326.42	76103.39	0.013927	108047.91	0.019773	92	1.28	1.82		

Correct: Subtracting # of bursts from the SELcum threshold of 177 and 182 dB to derive the received level that accounts for number of bursts.

Threshold: TTS at 23 psi (22.9 psi)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isoleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
2.75" Rocket Summer	0.183	0.000001	1	19,630.33	52,597.43	79,346.81	102,215.29	122,697.77	75,297.53	0.013779	92	1.27	2.45
2.75" Rocket Winter	0.183	0.000001	1	19,306.01	50,667.16	75,177.25	95,250.29	111,063.67	70,292.88	0.012864	92	1.18	

Threshold: PTS at 205 dB SEL (Total Energy at 204.9 dB)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isoleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
2.75" Rocket Summer	0.183	0.000001	1	2,439.88	4,422.73	5,647.05	7,114.33	8,342.36	5,593.27	0.001024	92	0.0942	0.199
2.75" Rocket Winter	0.183	0.000001	1	2,503.34	4,935.33	6,486.98	8,033.78	9,185.33	6,228.95	0.001140	92	0.1049	

Threshold: PTS at 45.9 psi (45.5 psi)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isoleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
2.75" Rocket Summer	0.183	0.000001	1	9,070.76	22,995.20	34,139.78	43,266.86	45,479.05	30,990.33	0.005671	92	0.52	1.041
2.75" Rocket Winter	0.183	0.000001	1	9,146.98	22,995.20	33,998.13	42,553.60	45,479.05	30,834.59	0.005643	92	0.52	

Previous Explosive Thresholds

**Threshold: Slight Lung Injury (12.2 kg and positive impulse)**

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isopleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
2.75" Rocket Summer	0.183	0.000001	1	733.02522	2,797.367	4,367.06	5,599.75	6,624.58	4,024.36	0.000736	92	0.0678	0.136
2.75" Rocket Winter	0.183	0.000001	1	774.44459	2,931.631	4,367.06	5,599.75	6,624.58	4,059.49	0.000743	92	0.0683	
			psi-ms	13.3	13.9	14.6	15.1	15.7					

**Threshold: Injury 104 psi (103.59)**

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isopleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
2.75" Rocket Summer	0.183	0.000001	1	3,192.01	7,639.86	10,544.31	10,544.31	10,500.34	8,484.17	0.001553	92	0.143	0.288
2.75" Rocket Winter	0.183	0.000001	1	3,330.53	8,067.50	10,544.31	10,544.31	10,500.34	8,597.40	0.001573	92	0.145	

**Threshold: Mortality (12.2 kg)**

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isopleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
2.75" Rocket Summer	0.183	0.000001	1	298.21	1100.30	1626.71	2019.73	2278.16	1464.62	0.000268	92	0.02	0.049
2.75" Rocket Winter	0.183	0.000001	1	325.73	1100.30	1626.71	2019.73	2278.16	1470.13	0.000269	92	0.02	
			psi-ms	32.2	33.7	34.9	36.1	37.8					



Cherry Point Annual Ordnance Usage for BT-9

Take Based on Previous Criteria
Take Based on Navy Criteria
Criteria Unchanged - No Delta

Ordnance Type	Behavioral and TTS Take Estimates			PTS			Slight Lung Injury		Injury	Mortality	
	177 & 182 dB SEL	167 & 172 dB SEL	23 psi	205 dB SEL	187 dB SEL	45.9 psi	BND @ 12.2 kg	BND @ 14 kg	104 psi	BND @ 12.2 kg	BND @ 14 kg
5.0" Rocket - Summer	1.58	6.78	0.53	0.07	0.86	0.24	0.03	0.04	0.08	0.01	0.02
5.0" Rocket - Winter	1.41	5.20	0.49	0.07	0.73	0.23	0.03	0.04	0.08	0.01	0.02

Annual Total	Behavioral and TTS Take Estimates			PTS			Slight Lung Injury		Injury	Mortality	
	177 & 182 dB SEL	167 & 172 dB SEL	23 psi	205 dB SEL	187 dB SEL	45.9 psi	BND @ 12.2 kg	BND @ 14 kg	104 psi	BND @ 12.2 kg	BND @ 14 kg
Annual Total	2.99	<b>11.98</b>	1.03	0.14	<b>1.59</b>	0.46	0.07	0.08	0.16	0.03	0.03

Increase in annual take using Navy criteria

Revised Using Navy Explosive Thresholds

Threshold: Behavioral and TTS (SEL)				Total Energy (dB) at 167 dB - 5 dB (162.1)					Total Energy at 172 dB - 5 dB (167.1)					Cumulative Impact Area (Behavior)	Modeled Animals Exposed per Burst	Cumulative Impact Area (TTS)	Modeled Animals Exposed per Burst	Ordnance Usage Level	Results by Threshold (Behavior)	Results by Threshold (TTS)	Annual Results by Threshold (Behavior)	Annual Results by Threshold (TTS)
Ordnance	BND Density (km <sup>2</sup> )	Area Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth									
5.0" Rocket Summer	0.183	0.000001	3	827,552.47	2,175,406.70	3,390,774.10	4,725,168.40	5,219,787.50	505,070.32	1,268,668.10	1,985,673.80	2,546,811.00	3,280,881.50	1350316.89	0.247108	1917420.94	0.35089	34	2.80	3.98	4.77	7.21
5.0" Rocket Winter	0.183	0.000001	3	742,867.12	1,858,164.70	2,896,293.80	3,293,733.80	3,745,712.10	455,310.28	1,143,697.10	1,760,617.30	2,087,015.40	2,353,794.80	947267.33	0.173350	1560086.98	0.28550	34	1.96	3.24		

Correct : Subtracting # of bursts from the SELcum threshold of 167 and 172 dB to derive the received level that accounts for number of bursts.

Threshold: TTS at 23 psi (22.9)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per burst	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
5.0" Rocket Summer	0.183	0.000001	3	24991.071	69762.909	106547.74	139545.58	171725.94	102514.65	0.018760	34	0.64	1.23
5.0" Rocket Winter	0.183	0.000001	3	24476.474	66647.747	100115.53	128429.66	153522.63	94638.41	0.017319	34	0.59	

Threshold: PTS at 187 - 5 dB SEL (Total Energy at 182)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
5.0" Rocket Summer	0.183	0.000001	3	112923.16	289669.83	434998.42	564935.64	666910.29	413887.47	0.075741	34	0.86	1.59
5.0" Rocket Winter	0.183	0.000001	3	103926.73	261127.97	384089.89	482538.99	522114.67	350759.65	0.064189	34	0.73	

Threshold: PTS at 45.9 psi (45.5)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
5.0" Rocket Summer	0.183	0.000001	3	11656.287	31026.056	47408.551	62104.477	74865.725	45412.22	0.008310	34	0.28	0.55
5.0" Rocket Winter	0.183	0.000001	3	11705.065	30514.219	46241.261	59577.853	70053.217	43618.32	0.007982	34	0.27	

Revised Using Navy Explosive Thresholds

Threshold: Slight Lung Injury (14 kg and postive impulse)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
5.0" Rocket Summer	0.183	0.000001	3	932.57806	3640.8065	6624.5777	8882.955	10722.04	6160.59	0.001127	34	0.038	0.08
5.0" Rocket Winter	0.183	0.000001	3	971.03913	3814.4468	6822.0656	8882.955	10722.04	6242.51	0.001142	34	0.039	
			Pa-s	96.54	100.99	105.25	109.35	113.3					
			psi-ms	14.00	14.66	15.36	15.90	16.46					

Threshold: Injury (104 psi)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
5.0" Rocket Summer	0.183	0.000001	3	4385.538	11086.465	16547.968	21246.5	22615.513	15176.40	0.002777	34	0.094	0.19
5.0" Rocket Winter	0.183	0.000001	3	4517.0591	11415.41	17108.967	21783.906	22615.513	15488.17	0.002834	34	0.096	

Threshold: Mortality (14 kg)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
5.0" Rocket Summer	0.183	0.000001	3	423.05334	1713.7411	2857.6372	3625.4104	4293.9052	2582.75	0.000473	34	0.016069867	0.032
5.0" Rocket Winter	0.183	0.000001	3	450.84423	1813.0428	2857.6372	3625.4104	4293.9052	2608.17	0.000477	34	0.016228021	
			Pa-s	225.6	236	246	255.6	264.8					
			psi-ms	32.70	34.20	35.60	37.00	38.40					

Previous Explosive Thresholds

Threshold: Behavioral and TTS (SEL)				Peak OTO Energy (dB) at 177 dB					Peak OTO Energy at 182 dB					Cumulative Impact Area (Behavior)	Modeled Animals Exposed per Burst	Cumulative Impact Area (TTS)	Modeled Animals Exposed per Burst	Ordnance Usage Level	Seasonal Estimate (Behavior)	Seasonal Estimate (TTS)	Annual Results by Threshold (Behavior)	Annual Results by Threshold (TTS)
Ordnance	BND Density (km <sup>2</sup> )	Area Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth									
5.0" Rocket Summer	0.183	0.000001	1	77,716.47	202,733.48	313,429.82	413,871.87	505,070.32	46,241.26	121,179.38	188,142.01	250,514.61	306,994.53	119950.03	0.021951	182614.36	0.033418	29	0.626	0.952	1.18	1.82
5.0" Rocket Winter	0.183	0.000001	1	71,820.59	187,362.88	289,669.83	373,095.40	433,197.43	42,553.60	112,923.16	175,326.42	228,658.57	268,823.66	105372.14	0.019283	165657.08	0.030315	29	0.550	0.864		

Threshold: TTS at 23 psi (22.9 psi)													
Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isoleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
5.0" Rocket Summer	0.183	0.000001	1	24,991.07	69,762.91	106,547.74	139,545.58	171,725.94	102,514.65	0.018760	29	0.53	1.03
5.0" Rocket Winter	0.183	0.000001	1	24,476.47	66,647.75	100,115.53	128,429.66	153,522.63	94,638.41	0.017319	29	0.49	

Threshold: PTS at 205 dB SEL (Total Energy at 204.9 dB)													
Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isoleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
5.0" Rocket Summer	0.183	0.000001	1	5,437.24	11,086.47	13,716.86	15,938.70	18,595.68	12,954.99	0.002371	29	0.0676	0.138
5.0" Rocket Winter	0.183	0.000001	1	5,391.67	11,367.83	14,602.49	17,180.41	19,386.59	13,585.80	0.002486	29	0.0709	

Threshold: PTS at 45.9 psi (45.5 psi)													
Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isoleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
5.0" Rocket Summer	0.183	0.000001	1	11,656.29	31,026.06	47,408.55	62,104.48	74,865.73	45,412.22	0.008310	29	0.24	0.464
5.0" Rocket Winter	0.183	0.000001	1	11,705.07	30,514.22	46,241.26	59,577.85	70,053.22	43,618.32	0.007982	29	0.23	

Previous Explosive Thresholds

**Threshold: Slight Lung Injury (12.2 kg and positive impulse)**

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isoleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
5.0" Rocket Summer	0.183	0.000001	1	979.78278	3,830.629	6,995.97	9,340.32	11,226.27	6,474.59	0.001185	29	0.0338	0.068
5.0" Rocket Winter	0.183	0.000001	1	1,010.96320	4,013.131	7,234.67	9,340.32	11,226.27	6,565.07	0.001201	29	0.0342	
			psi-ms	13.3	13.9	14.6	15.1	15.7					

**Threshold: Injury 104 psi (103.59)**

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isoleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
5.0" Rocket Summer	0.183	0.000001	1	4,385.54	11,086.47	16,547.97	21,246.50	22,615.51	15,176.40	0.002777	29	0.079	0.160
5.0" Rocket Winter	0.183	0.000001	1	4,517.06	11,415.41	17,108.97	21,783.91	22,615.51	15,488.17	0.002834	29	0.081	

**Threshold: Mortality (12.2 kg)**

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isoleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
5.0" Rocket Summer	0.183	0.000001	1	427.23	1736.18	2894.40	3718.75	4348.66	2,625.05	0.000480	29	0.01	0.028
5.0" Rocket Winter	0.183	0.000001	1	455.25	1828.80	2894.40	3718.75	4348.66	2,649.17	0.000485	29	0.01	
			psi-ms	32.2	33.7	34.9	36.1	37.8					

Cherry Point Annual Ordnance Usage for BT-9

Take Based on Previous Criteria
Take Based on Navy Criteria
Criteria Unchanged - No Delta

Ordnance Type	Behavioral and TTS Take Estimates			PTS			Slight Lung Injury		Injury	Mortality	
	177 & 182 dB SEL	167 & 172 dB SEL	23 psi	205 dB SEL	187 dB SEL	45.9 psi	BND @ 12.2 kg	BND @ 14 kg	104 psi	BND @ 12.2 kg	BND @ 14 kg
G911 - Summer	1.08	4.14	0.38	0.01	0.45	0.12	0.01	0.01	0.03	0.00	0.00
G911 - Winter	1.00	3.37	0.37	0.01	0.40	0.12	0.01	0.01	0.03	0.00	0.00

Annual Total	Behavioral and TTS Take Estimates			PTS			Slight Lung Injury		Injury	Mortality	
	177 & 182 dB SEL	167 & 172 dB SEL	23 psi	205 dB SEL	187 dB SEL	45.9 psi	BND @ 12.2 kg	BND @ 14 kg	104 psi	BND @ 12.2 kg	BND @ 14 kg
Annual Total	2.08	<b>7.51</b>	0.75	0.02	<b>0.85</b>	0.24	0.03	0.02	0.06	0.00	0.00

Increase in annual take using Navy criteria

Revised Using Navy Explosive Thresholds

Threshold: Behavioral and TTS (SEL)				Total Energy (dB) at 167 dB - 5 dB (162.1)					Total Energy at 172 dB - 5 dB (167.1)					Cumulative Impact Area (Behavior)	Modeled Animals Exposed per Burst	Cumulative Impact Area (TTS)	Modeled Animals Exposed per Burst	Ordnance Usage Level	Results by Threshold (Behavior)	Results by Threshold (TTS)	Annual Results by Threshold (Behavior)	Annual Results by Threshold (TTS)
Ordnance	BND Density (km <sup>2</sup> )	Area Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth									
5.0" Rocket Summer	0.183	0.000001	3	267,710.55	655,934.75	976,831.90	1,268,589.50	1,541,684.40	162,706.78	403,696.47	596,240.38	771,127.41	925,547.38	370286.54	0.067762	571863.68	0.10465	72	1.63	2.51	2.91	4.60
5.0" Rocket Winter	0.183	0.000001	3	241,331.80	586,427.74	866,108.78	1,026,689.90	1,120,142.20	148,509.09	362,415.56	530,851.31	642,468.96	689,415.32	293408.04	0.053694	474732.05	0.08688	72	1.29	2.09		

Correct : Subtracting # of bursts from the SELcum threshold of 167 and 172 dB to derive the received level that accounts for number of bursts.

Threshold: TTS at 23 psi (22.9)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per burst	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
5.0" Rocket Summer	0.183	0.000001	3						0.00	0.000000	72	0.00	0.00
5.0" Rocket Winter	0.183	0.000001	3						0.00	0.000000	72	0.00	

Threshold: PTS at 187 - 5 dB SEL (Total Energy at 182)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
5.0" Rocket Summer	0.183	0.000001	3	31155.348	79018.03	111063.67	134988.26	154161.1	102077.28	0.018680	72	0.45	0.85
5.0" Rocket Winter	0.183	0.000001	3	29271.172	72720.901	101370.16	121179.38	130579.69	91024.26	0.016657	72	0.40	

Threshold: PTS at 45.9 psi (45.5)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
5.0" Rocket Summer	0.183	0.000001	3	5126.0503	10028.486	9986.6486	9986.6486	9986.6486	9022.90	0.001651	72	0.12	0.24
5.0" Rocket Winter	0.183	0.000001	3	5257.2095	10028.486	9986.6486	9986.6486	9986.6486	9049.13	0.001656	72	0.12	

Revised Using Navy Explosive Thresholds

Threshold: Slight Lung Injury (14 kg and positive impulse)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
5.0" Rocket Summer	0.183	0.000001	3	334.20538	817.97786	1066.5675	1191.6926	1218.3128	925.75	0.000169	72	0.012	0.02
5.0" Rocket Winter	0.183	0.000001	3	339.37375	817.97786	1066.5675	1191.6926	1218.3128	926.78	0.000170	72	0.012	
			Pa-s	96.54	100.99	105.25	109.35	113.3					
			psi-ms	14.00	14.66	15.36	15.90	16.46					

Threshold: Injury (104 psi)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
5.0" Rocket Summer	0.183	0.000001	3	1648.0642	2278.1574	2268.4019	2258.6868	2239.3771	2138.54	0.000391	72	0.028	0.06
5.0" Rocket Winter	0.183	0.000001	3	1728.6719	2278.1574	2268.4019	2258.6868	2239.3771	2154.66	0.000394	72	0.028	

Threshold: Mortality (14 kg and positive impulse)

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed per Det Cluster	Ordnance Usage Level	Results by Threshold	Annual Results by Threshold
5.0" Rocket Summer	0.183	0.000001	3	71.470393	177.62046	189.57948	160.17898	125.36635	144.84	0.000027	72	0.001908453	0.004
5.0" Rocket Winter	0.183	0.000001	3	71.470393	177.62046	189.57948	167.21214	125.36635	144.84	0.000027	72	0.001908453	
			Pa-s	225.6	236	246	255.6	264.8					
			psi-ms	32.70	34.20	35.60	37.00	38.40					



**Previous Explosive Thresholds**

Threshold: Behavioral and TTS (SEL)				Peak OTO Energy (dB) at 177 dB					Peak OTO Energy at 182 dB					Cumulative Impact Area (Behavior)	Modeled Animals Exposed per Burst	Cumulative Impact Area (TTS)
Ordnance	BND Density (km <sup>2</sup> )	Area Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth			
G911 Summer	0.183	0.000001	1	20,895.59	55,285.83	85,149.85	113,392.87	136,679.56	10,456.55	28,078.63	43,447.03	54,374.79	44,049.90	46199.36	0.008454	36081.38
G911 Winter	0.183	0.000001	1	19,548.75	51,945.99	80,675.65	105,229.08	121,683.41	9,986.65	26,711.37	41,333.51	50,247.91	25,836.95	44993.30	0.008234	30823.28

Threshold: TTS at 23 psi (22.9 psi)													
Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isopleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
G911 Summer	0.183	0.000001	1	11,952.01	29,149.68	33,857.07	33,857.07	33,857.07	28,534.58	0.005222	72	0.38	0.75
G911 Winter	0.183	0.000001	1	11,952.01	28,668.72	33,857.07	33,857.07	33,857.07	28,438.39	0.005204	72	0.37	

Threshold: PTS at 205 dB SEL (Total Energy at 204.9 dB)													
Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isopleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
G911 Summer	0.183	0.000001	1	371.77	578.28	623.35	638.06	659.18	574.13	0.000105	72	0.0076	0.017
G911 Winter	0.183	0.000001	1	459.70	750.03	817.98	814.27	814.27	731.25	0.000134	72	0.0096	

Threshold: PTS at 45.9 psi (45.5 psi)													
Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isopleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
G911 Summer	0.183	0.000001	1	5,126.05	10,028.49	9,986.65	9,986.65	9,986.65	9,022.90	0.001651	72	0.12	0.238
G911 Winter	0.183	0.000001	1	5,257.21	10,028.49	9,986.65	9,986.65	9,986.65	9,049.13	0.001656	72	0.12	

**Previous Explosive Thresholds**

**Threshold: Slight Lung Injury (12.2 kg and positive impulse)**

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isopleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
G911 Summer	0.183	0.000001	1	355.27042	887.479	1,170.79	1,290.17	1,336.35	1,008.01	0.000184	72	0.0133	0.027
G911 Winter	0.183	0.000001	1	360.70256	887.479	1,170.79	1,290.17	1,336.35	1,009.10	0.000185	72	0.0133	
			psi-ms	13.3	13.9	14.6	15.1	15.7					

**Threshold: Injury 104 psi (103.59)**

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isopleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
G911 Summer	0.183	0.000001	1	1,648.06	2,278.16	2,268.40	2,258.69	2,239.38	2,138.54	0.000391	72	0.028	0.057
G911 Winter	0.183	0.000001	1	1,728.67	2,278.16	2,268.40	2,258.69	2,239.38	2,154.66	0.000394	72	0.028	

**Threshold: Mortality (12.2 kg and positive impulse)**

Ordnance	BND Density (km <sup>2</sup> )	Density Conversion Factor	Burst Size	Impact Area for 0.5 m Depth	Impact Area for 1.5 m Depth	Impact Area for 2.5 m Depth	Impact Area for 3.5 m Depth	Impact Area for 4.5 m Depth	Cumulative Impact Area	Modeled Animals Exposed at Isopleths	Ordnance Usage Level	Seasonal Estimate (by rounds)	Annual Estimate
G911 Summer	0.183	0.000001	1	73.98	182.99	196.34	173.41	131.37	151.62	0.000028	72	0.002	0.004
G911 Winter	0.183	0.000001	1	73.980164	182.98878	196.33627	173.40525	131.37386	151.62	0.000028	72	0.002	
			psi-ms	32.2	33.7	34.9	36.1	37.8					