

12-31-2011

Limnological Assistance for Lake Mead National Recreation Area: Quarterly Report, Period Ending December 31, 2011

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Date: December 31, 2011

To: Kent Turner, Program Manager – Water Sciences
National Park Service - Government Technical Representative
[REDACTED]

From: Dr. Margaret N. Rees [REDACTED]
Executive Director, Public Lands Institute

Re: Year 2, Quarter 4 Report:
Task Agreement # J8360100020

Enclosed please find the Quarterly Report for the project titled: "Limnological Assistance for Lake Mead National Recreation Area."

This report reflects activities commenced during the fourth quarter of the second year of this project, ending 12/31/2011 with product delivery as described within the report.

If you have any questions after reviewing this report, please do not hesitate to call me at (702) 895-3890.



QUARTERLY REPORT
University of Nevada, Las Vegas
Period Ending December 31, 2011

Cooperative Agreement Number H8360090007
Task Agreement Number J8360100020

Limnological Assistance for Lake Mead National Recreation Area

Executive Summary

Project 1

- Technical assistance with the implementation of the *Interagency Monitoring Action Plan (I-MAP) for Quagga Mussels* is ongoing; remaining analyses are underway with report delivery re-scheduled for 05/2012.
- Data have been delivered for *Veliger abundance and settlement at different depths of Lake Mead* with report delivery re-scheduled for 05/2012.
- ***Growth of adult quagga mussels within Las Vegas Wash/Las Vegas Bay***
- The Interagency Quagga Mussel Meeting was held on 11/17/2011; the next meeting is scheduled for 02/16/2011.

Project 2

- Appendix 7, an addition to the *Long-term Limnological and Aquatic Resource Monitoring and Research Plan for Lakes Mead and Mohave*, has been revised with additional content added.
- All available deliverables from NPS project partners have been collected for a close-out report to SNPLMA on all Water 2025 Conservation Initiative-funded projects (Rounds 4, 5, and 7); the report narrative was finalized and project files were linked to an organizer spreadsheet within an external hard drive and delivered.
- The updated interagency quagga mussel needs statement was distributed to members of the Interagency Quagga Mussel Meeting group and finalized.
- The project group contributed to the NPS-funded U.S. Geological Survey Circular Report on the science of Lakes Mead and Mohave.
- The Interagency Monitoring and Research Coordination Meetings was also held on 11/17/11; the next meeting is scheduled for 01/18/2012. A planning meeting for a new iteration of this meeting group is scheduled for 01/24/2012.

Project 1 Technical Assistance Related to Quagga Mussels

C.1(a) Provide technical assistance in the implementation of the Interagency Management Action Plan (I-MAP)

Data and findings (shown below) were presented by UNLV at the Quarterly Interagency Quagga Mussel Meeting on 11/17/2011 and delivered to K. Turner on 11/28/2012. The final report by D. Wong with assistance from J. Miller, which will combine the results of tasks C.1(a) and (b) has

been re-scheduled, for delivery in May 2012 following review by K. Turner (ATR). The report will include the following sections: Part I – Quagga Mussel Monitoring: Adults and Juveniles; Part II Quagga Mussel Monitoring: Veligers and Associated Zooplankton (to include analysis of data from Bureau of Reclamation and the research project described in C.1 (a) below); Summary – Key Findings and Recommendations; References; and Acknowledgements. The final report will be included in the project compendium.

Data and Findings

The first comprehensive I-MAP started in fall 2009 and concluded in fall 2010. 152 samples were collected from different basins of Lake Mead with intensive sampling in the Boulder Basin (Table C1a1). The data are not normally distributed (Shapiro-Wilk Test, $W = 0.53$, $P < 0.0001$). The mean density is 4,613 mussels per square meter with maximum and minimum values as 76,500 and 0 mussels/m². The distribution of mussels at different depths of Lake Mead is illustrated in Figure C1a1.

Table C1a1. I-MAP samples and adult/juvenile mussel density collected from Fall 2009 to Fall 2010.

Substrate	Basin	Location	Date	Depth (ft)	Mussels/m ²
Soft	Boulder	Callville Bay CR 351.7	12/15/2009	8.9	1,538
Soft	Boulder	Callville Bay CR 351.7	12/15/2009	49.4	846
Soft	Boulder	Callville Bay CR 351.7	12/15/2009	101.0	38
Soft	Boulder	Callville Bay CR 351.7	12/15/2009	149.0	5,135
Soft	Boulder	Callville Bay CR 351.7	12/15/2009	206.0	2,135
Soft	Boulder	Callville Bay CR 351.7	12/15/2009	245.0	1,500
Soft	Boulder	Callville Bay CR 351.7	12/15/2009	299.0	19
Soft	Boulder	Callville Bay CR 351.7	12/15/2009	357.0	192
Soft	Boulder	Callville Bay CR 351.7	3/17/2010	7.2	115
Soft	Boulder	Callville Bay CR 351.7	3/18/2010	59.5	1,231
Soft	Boulder	Callville Bay CR 351.7	3/19/2010	111.0	4,673
Soft	Boulder	Callville Bay CR 351.7	3/20/2010	155.0	769
Soft	Boulder	Callville Bay CR 351.7	3/21/2010	225.0	6,827
Soft	Boulder	Callville Bay CR 351.7	3/22/2010	256.0	16,192
Soft	Boulder	Callville Bay CR 351.7	3/23/2010	307.0	3,077
Soft	Boulder	Callville Bay CR 351.7	6/2/2010	10.0	2,173
Soft	Boulder	Callville Bay CR 351.7	6/3/2010	53.6	1,750
Soft	Boulder	Callville Bay CR 351.7	6/4/2010	102.8	4,769
Soft	Boulder	Callville Bay CR 351.7	6/5/2010	149.5	2,481
Soft	Boulder	Callville Bay CR 351.7	6/6/2010	225.3	3,385
Soft	Boulder	Callville Bay CR 351.7	6/7/2010	282.0	1,558
Soft	Boulder	Callville Bay CR 351.7	6/8/2010	300.0	2,173
Soft	Boulder	Callville Bay CR 351.7	6/9/2010	363.1	596
Soft	Boulder	Callville Bay CR 351.7	9/11/2010	45.0	1,442
Soft	Boulder	Callville Bay CR 351.7	9/11/2010	92.4	2,481
Soft	Boulder	Callville Bay CR 351.7	9/11/2010	256.2	3,327
Soft	Boulder	Callville Bay CR 351.7	9/11/2010	304.9	269

Soft	Boulder	Callville Bay CR 351.7	9/11/2010	354.8	1,904
Soft	Boulder	Callville Bay CR 351.7	9/15/2010	26.8	192
Soft	Boulder	Callville Bay CR 351.7	9/15/2010	138.0	115
Soft	Boulder	Callville Bay CR 351.7	9/15/2010	199.0	58
Soft	Gregg	Gregg Basin	11/30/2009	64.1	3,981
Soft	Gregg	Gregg Basin	11/30/2009	107.4	2,538
Soft	Gregg	Gregg Basin	11/30/2009	200.5	77
Soft	Gregg	Gregg Basin	12/27/2010	60.0	12,654
Soft	Gregg	Gregg Basin	12/27/2010	126.0	6,423
Soft	Gregg	Gregg Basin	12/27/2010	192.0	96
Soft	Boulder	LVB 3.5	9/23/2009	32.4	58
Soft	Boulder	LVB 3.5	9/23/2009	35.0	212
Soft	Boulder	LVB 3.5	9/23/2009	36.0	308
Soft	Boulder	LVB 3.5	9/23/2009	44.6	38
Soft	Boulder	LVB 3.5	9/23/2009	45.4	58
Soft	Boulder	LVB 3.5	9/23/2009	46.1	0
Soft	Boulder	LVB 3.5	5/26/2010	35.7	0
Soft	Boulder	LVB 3.5	5/26/2010	35.9	154
Soft	Boulder	LVB 3.5	5/26/2010	38.8	0
Soft	Boulder	LVB 3.5	9/1/2010	25.7	3,500
Soft	Boulder	LVB 3.5	9/1/2010	29.5	19
Soft	Boulder	LVB 7-3 D	10/21/2009	22.0	135
Soft	Boulder	LVB 7-3 D	10/21/2009	31.7	0
Soft	Boulder	LVB 7-3 D	10/21/2009	80.5	1,808
Soft	Boulder	LVB 7-3 D	10/21/2009	189.2	1,596
Soft	Boulder	LVB 7-3 D	3/10/2010	21.0	1,635
Soft	Boulder	LVB 7-3 D	3/10/2010	30.0	288
Soft	Boulder	LVB 7-3 D	3/10/2010	78.0	5,904
Soft	Boulder	LVB 7-3 D	3/10/2010	90.9	5,192
Soft	Boulder	LVB 7-3 D	3/10/2010	201.8	769
Soft	Boulder	LVB 7-3 D	3/10/2010	179.5	7,442
Soft	Boulder	LVB 7-3 D	3/10/2010	285.7	500
Soft	Boulder	LVB 7-3 D	3/10/2010	275.0	269
Soft	Boulder	LVB 7-3 D	5/25/2010	38.4	3,962
Soft	Boulder	LVB 7-3 D	5/25/2010	71.7	23,308
Soft	Boulder	LVB 7-3 D	5/25/2010	176.7	846
Soft	Boulder	LVB 7-3 D	5/25/2010	181.2	58
Soft	Boulder	LVB 7-3 D	5/25/2010	278.1	4,115
Soft	Boulder	LVB 7-3 D	9/4/2010	11.9	1,558
Soft	Boulder	LVB 7-3 D	9/4/2010	47.0	1,327
Soft	Boulder	LVB 7-3 D	9/4/2010	78.8	2,538
Soft	Boulder	LVB 7-3 D	9/4/2010	178.5	3,154
Soft	Boulder	LVB 7-3 D	9/4/2010	189.0	19

Soft	Boulder	LVB 7-3 D	9/4/2010	268.9	2,077
Soft	Overton	Overton Arm	12/16/2006	19.3	38
Soft	Overton	Overton Arm	12/16/2006	47.4	385
Soft	Overton	Overton Arm	12/16/2006	96.3	135
Soft	Overton	Overton Arm	12/15/2010	15.8	0
Soft	Overton	Overton Arm	12/15/2010	37.4	115
Soft	Overton	Overton Arm	12/15/2010	63.3	0
Soft	Overton	Overton Arm	12/15/2010	72.4	38
Soft	Overton	Overton Arm	12/19/2010	86.9	192
Soft	Boulder	Sentinel Island CR 346.4	12/1/2009	360.0	192
Soft	Boulder	Sentinel Island CR 346.4	12/1/2009	369.0	2,038
Soft	Boulder	Sentinel Island CR 346.4	2/24/2010	122.0	76,500
Soft	Boulder	Sentinel Island CR 346.4	2/24/2010	360.0	1,769
Soft	Boulder	Sentinel Island CR 346.4	2/24/2010	370.0	1,462
Soft	Boulder	Sentinel Island CR 346.4	5/27/2010	141.0	1,558
Soft	Boulder	Sentinel Island CR 346.4	5/27/2010	373.0	2,058
Soft	Boulder	Sentinel Island CR 346.4	5/27/2010	382.0	38
Soft	Boulder	Sentinel Island CR 346.4	9/8/2010	367.8	24,096
Soft	Boulder	Sentinel Island CR 346.4	9/8/2010	370.9	827
Soft	Boulder	Sentinel Island CR 346.4	9/15/2010	157.0	13,596
Soft	Virgin	Temple Bar	11/30/2009	61.9	2,750
Soft	Virgin	Temple Bar	11/30/2009	106.3	2,346
Soft	Virgin	Temple Bar	11/30/2009	201.3	173
Soft	Virgin	Temple Bar	11/30/2009	252.0	596
Soft	Virgin	Temple Bar	12/7/2010	100.0	2,288
Soft	Virgin	Temple Bar	12/7/2010	200.0	38
Soft	Virgin	Temple Bar	12/7/2010	250.0	519
Soft	Virgin	Virgin Basin	12/16/2009	47.3	2,404
Soft	Virgin	Virgin Basin	12/16/2009	152.0	442
Soft	Virgin	Virgin Basin	12/16/2009	247.0	19
Soft	Virgin	Virgin Basin	12/16/2009	298.0	308
Soft	Virgin	Virgin Basin	12/8/2009	158.0	3,308
Soft	Virgin	Virgin Basin	12/8/2009	237.0	1,519
Soft	Virgin	Virgin Basin	12/8/2009	285.0	154
Hard	Boulder	Black Island	10/29/2009	10.0	2,539
Hard	Boulder	Black Island	10/29/2009	15.0	1,172
Hard	Boulder	Black Island	10/29/2009	20.0	5,589
Hard	Boulder	Black Island	10/29/2009	40.0	2,565
Hard	Boulder	Black Island	10/29/2009	60.0	4,039
Hard	Boulder	Black Island	10/29/2009	80.0	12,192
Hard	Boulder	Black Island	2/22/2010	10.0	6,864
Hard	Boulder	Black Island	2/22/2010	20.0	8,640
Hard	Boulder	Black Island	2/22/2010	40.0	11,472

Hard	Boulder	Black Island	2/22/2010	60.0	9,120
Hard	Boulder	Black Island	2/22/2010	80.0	4,672
Hard	Boulder	Black Island	2/26/2010	10.0	5,264
Hard	Boulder	Black Island	2/26/2010	20.0	17,334
Hard	Boulder	Black Island	2/26/2010	40.0	4,432
Hard	Boulder	Black Island	2/26/2010	60.0	9,774
Hard	Boulder	Black Island	2/26/2010	80.0	4,288
Hard	Boulder	Black Island	8/31/2010	20.0	8,816
Hard	Boulder	Black Island	8/31/2010	40.0	4,816
Hard	Boulder	Black Island	8/31/2010	60.0	9,856
Hard	Boulder	Black Island	8/31/2010	80.0	9,248
Hard	Boulder	Black Island	8/31/2010	10.0	13,744
Hard	Boulder	Sentinel Island	11/18/2009	20.0	7,376
Hard	Boulder	Sentinel Island	11/18/2009	40.0	15,603
Hard	Boulder	Sentinel Island	11/18/2009	60.0	8,128
Hard	Boulder	Sentinel Island	11/18/2009	80.0	10,144
Hard	Boulder	Sentinel Island	11/18/2009	100.0	10,864
Hard	Boulder	Sentinel Island	2/23/2010	10.0	6,432
Hard	Boulder	Sentinel Island	2/23/2010	20.0	11,472
Hard	Boulder	Sentinel Island	2/23/2010	40.0	20,576
Hard	Boulder	Sentinel Island	2/23/2010	60.0	5,456
Hard	Boulder	Sentinel Island	2/23/2010	80.0	3,248
Hard	Boulder	Sentinel Island	2/23/2010	100.0	1,264
Hard	Boulder	Sentinel Island	5/25/2010	10.0	11,296
Hard	Boulder	Sentinel Island	5/25/2010	20.0	5,056
Hard	Boulder	Sentinel Island	5/25/2010	40.0	6,208
Hard	Boulder	Sentinel Island	5/25/2010	60.0	2,928
Hard	Boulder	Sentinel Island	5/25/2010	80.0	2,480
Hard	Boulder	Sentinel Island	5/25/2010	100.0	4,320
Hard	Boulder	Sentinel Island	9/1/2010	40.0	8,809
Hard	Boulder	Sentinel Island	9/1/2010	60.0	9,884
Hard	Boulder	Sentinel Island	9/1/2010	80.0	1,472
Hard	Boulder	Sentinel Island	9/1/2010	100.0	2,887
Hard	Boulder	Boulder Island	12/30/2009	10.0	18,192
Hard	Boulder	Boulder Island	12/30/2009	20.0	13,904
Hard	Boulder	Boulder Island	12/30/2009	40.0	13,664
Hard	Boulder	Boulder Island	12/30/2009	60.0	17,216
Hard	Boulder	Boulder Island	12/30/2009	80.0	2,880
Hard	Boulder	Boulder Island	2/23/2010	10.0	9,536

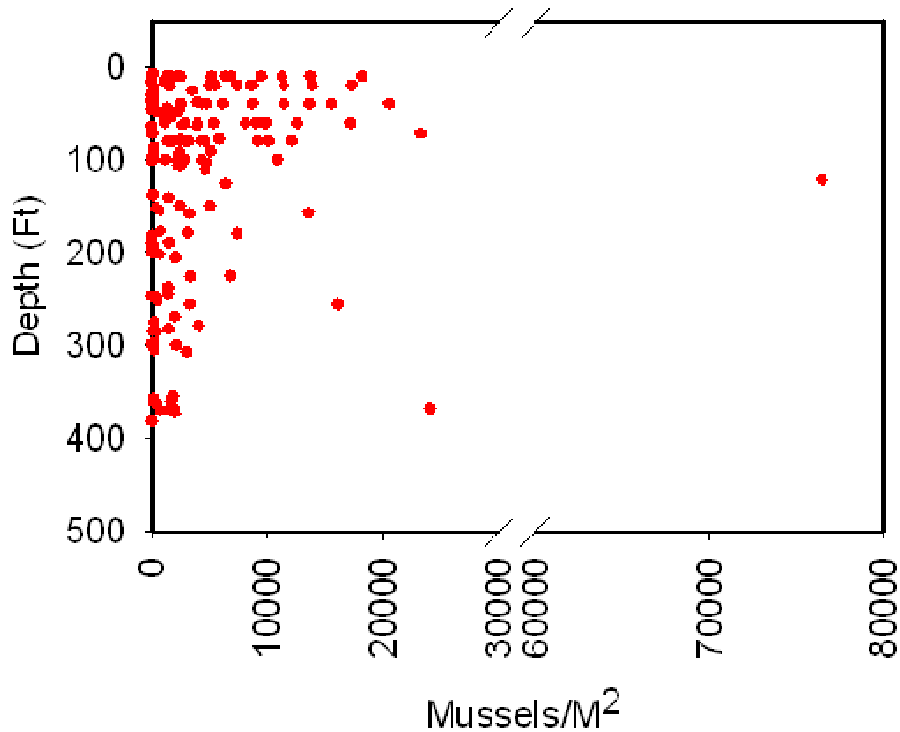


Figure C1a1. Density of quagga mussels at different depths of Lake Mead.

Table C1a2. Mussel density (mussels per square meter) summary

Statistics	Total abundance	Hard Substrate	Soft Sediment
Mean	4,613	8,078	3,014
Median	2,231	7,752	1,279
Inter Quatile Range (IQR)	5,365	6,660	2,361
Maximum	76,500	20,576	76,500
Min	0	1,172	0

Veliger monitoring funded through this task agreement is described below [Task C.1(b)], all other I-MAP veliger monitoring is conducted by other NPS partners.

C.1(b) Research Project: Veliger abundance and settlement at different depths of Lake Mead

As described in previous reports, all veliger sampling and substrate collection was completed by Sean Comeau. A Master’s of Public Health thesis resulted (see below), which was made available online during the previous quarter. Data from this work (shown below) have been delivered to K. Turner (11/28/2012) and will be included in the final report to be delivered in May 2012 and in the project compendium (as described above).

Thesis: Comeau, Sean Robin “Colonization and decontamination of quagga mussels in the western United States: Monitoring veligers in Lake Mead and field testing the effects of hot-water spray as a means of watercraft decontamination.” MPH thesis, University of Nevada, Las Vegas, 2011. Available for download at: <http://search.proquest.com/docview/873812299>

With assistance from NPS, S. Comeau collected veliger samples on a weekly basis at depths of 5, 10, 20, 30, 40, 50, and 60 m in Lake Mead, NV, from 06/30/2010 until 06/16/2011. There were two peaks of total veliger abundance once on 08/18/2010 (41 veligers/L) and on 09/01/2010 (38 veligers/L). The highest number of total veligers was found at the sampling depth at 20 m from 06/30/2010 until 03/19/2011, and again from 06/09/2011 to 06/16/2011. During this period, the total abundance of veligers was highest at a depth of 10 m. Dynamics of different developmental stages of quagga mussels at different depths of the lake were also quantified during this annual survey in Lake Mead. More detailed information on the results is provided below:

Table C1b1. Sampling Volume Calculated per Tow at Specific Depths.

Collection Net Diameter = 0.20 m	Depth (m)						
	5	10	20	30	40	50	60
How many tows	7	4	2	1	1	1	1
Volume after 1 tow (L)	157	314	628	942	1257	1571	1885
Total Volume (L) after tows*	1099	1256	1256	942	1257	1571	1885
* Rinsing volume is not counted							

Results

Quagga mussel veligers were found to be present in the water column of Lake Mead consistently from 06/30/2010 to 06/16/2011. The concentration and abundance was found to vary throughout the year-long period and there was also a noticeable variation in abundance between the different measured depths. The largest peaks present for this period was found to be on 08/18/2010 and 09/01/2010 which had a calculated abundance of 40.7 veligers/L and 38.1 veligers/L, respectively. It is interesting to note that a majority of the veligers were found to be present at depths between 10 m and 30 m for a majority of the yearlong survey. There was a switch from this noticeable pattern in mid-March when a majority of the total veligers began to be found between depths of 0 m and 10 m. In early June, the majority of total veligers resumed being found between depths of depths between 10 m and 30 m. From the data collected, there was an increase of veliger abundance from July until mid-September 2010 which was followed by a gradual decrease until March 2011 (Figure C1b1).

There was a relatively low abundance of total veligers seen at depths of 5 m (peak at 3.9 veligers/L) and 10 m (peak at 4.8 veligers/L) from June 2010 until March 2011, and veligers at these depths were also seen to decrease in abundance throughout the period of the study (Figure C1b 2). Then in mid-March, there was a significant increase in the amount of veligers found between these depths with peaks of 16.2 veligers/L and 8.4 veligers/L at depths of 5 m and 10 m,

respectively on 05/25/2011. There was little veliger abundance at 30 m in depth, and virtually no abundance at depths of 40, 50, and 60 m.

It was found that the highest abundance of pediveligers occurred during the month of August 2010 (>10 pediveligers/L), and the lowest was found to be during October 2010 (<2 pediveligers/L) (Figure C1b 6). For depths of 5 m and 10 m, the highest abundance was found to be between the months of March and June 2011. The average abundance of each stage at different depths did fluctuate during the course of this study as seen in Figures 3, 4, 5, and 6.

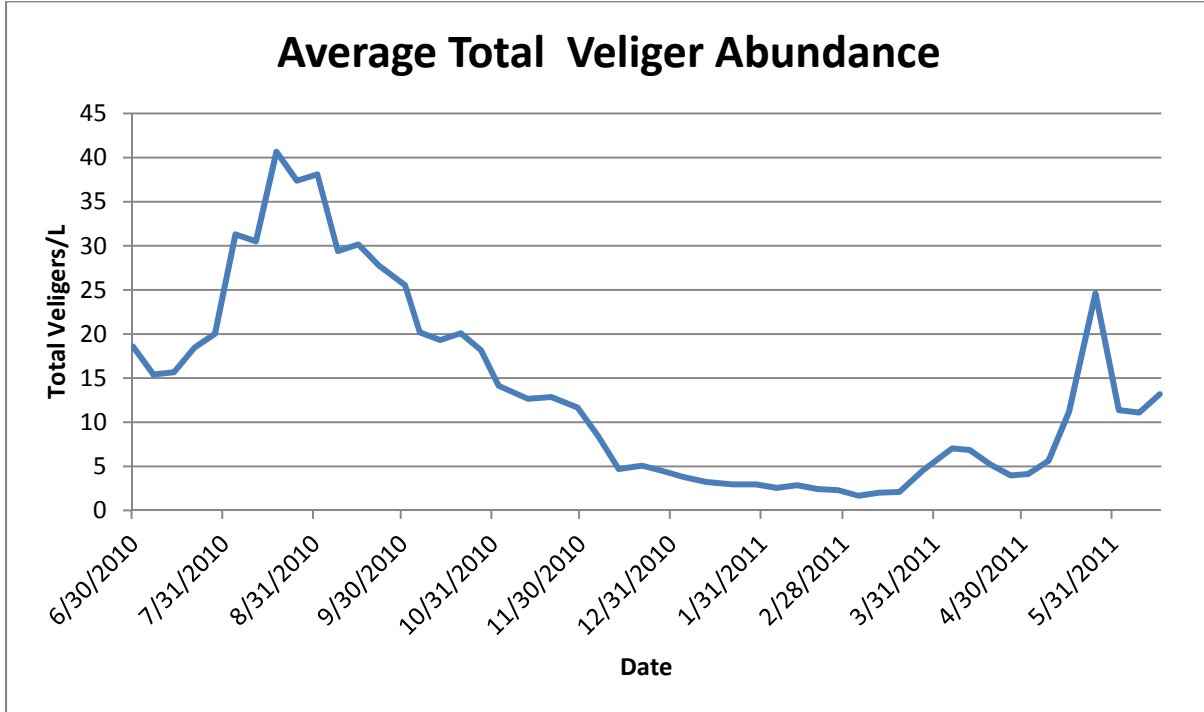


Figure C1b1. Total Veliger Abundance per L. Averages were taken weekly from 6/30/2010 to 6/16/2011.

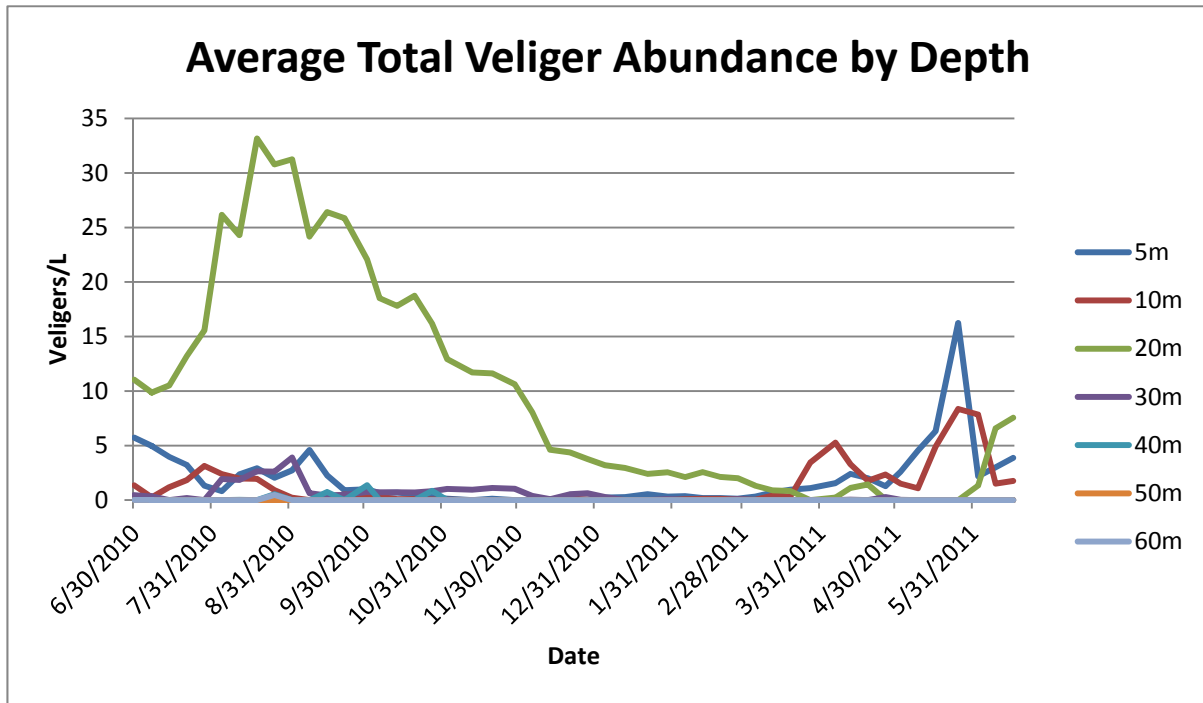


Figure C1b2. Total Veliger Abundance per L calculated by depth. Averages were taken weekly from 6/30/2010 to 6/16/2011.

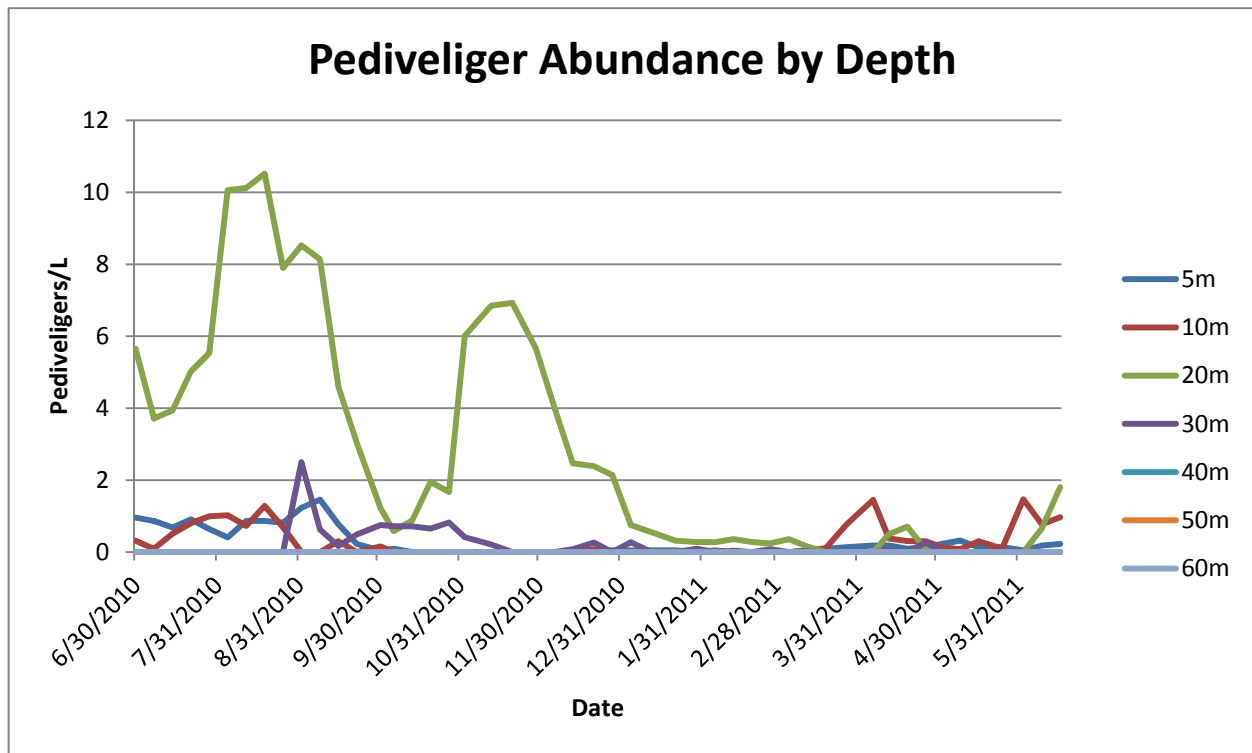


Figure C1b3. Average Pediveliger Abundance per L calculated by depth. Averages were taken weekly from 6/30/2010 to 6/16/2011.

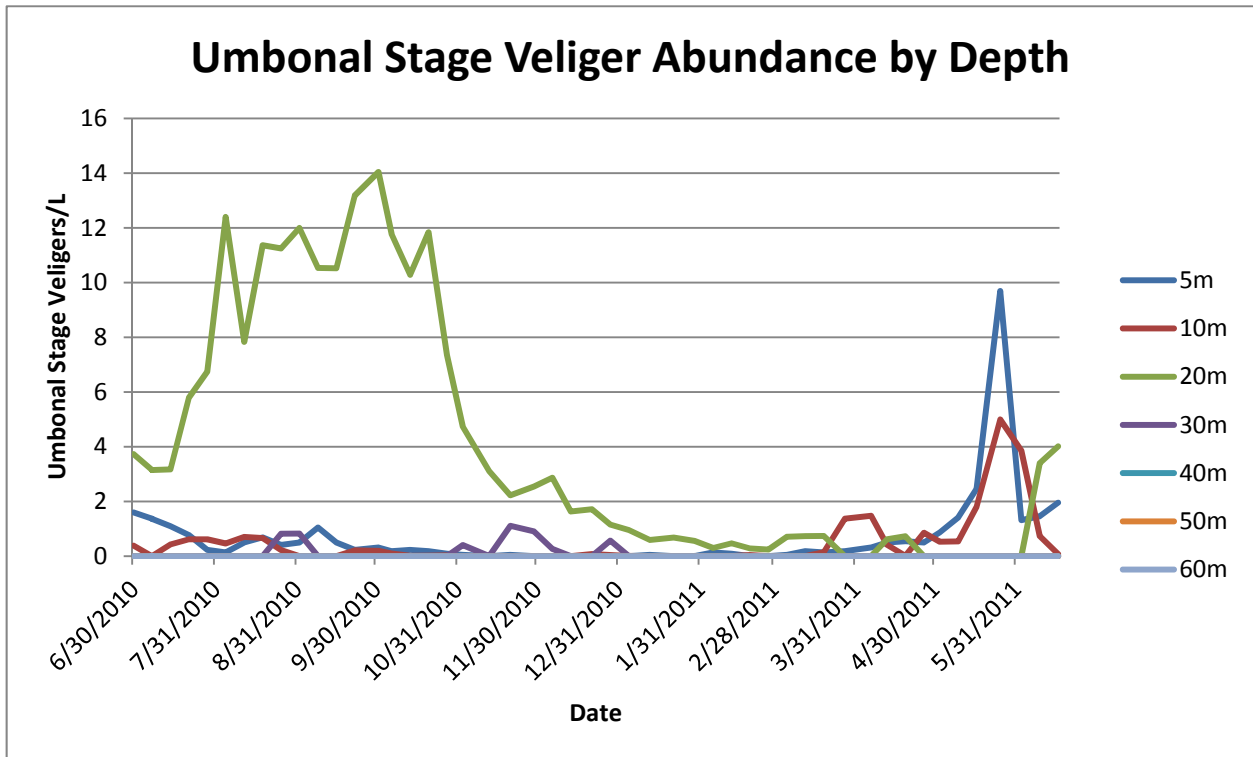


Figure C1b4. Average Umbonal Stage Veliger Abundance per L calculated by depth. Averages were taken weekly from 6/30/2010 to 6/16/2011.

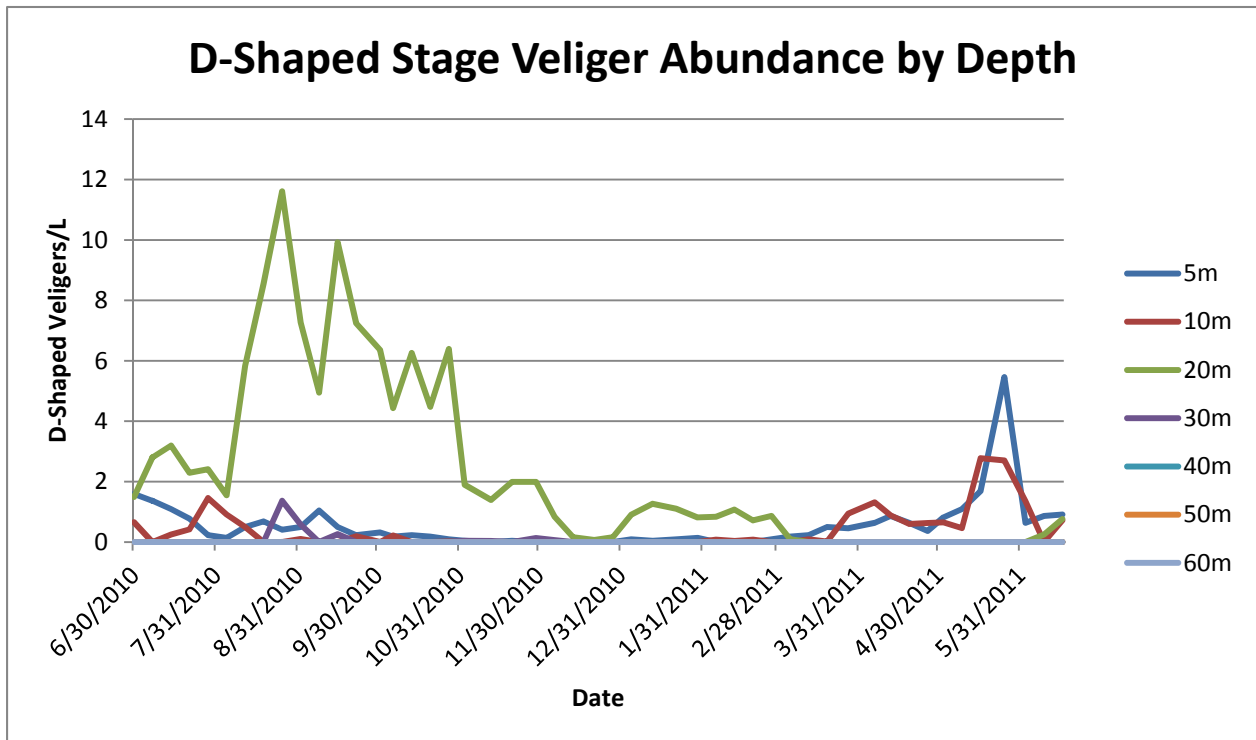


Figure C1b5. Average D-Shaped Stage Veliger Abundance per L calculated by depth. Averages were taken weekly from 6/30/2010 to 6/16/2011.

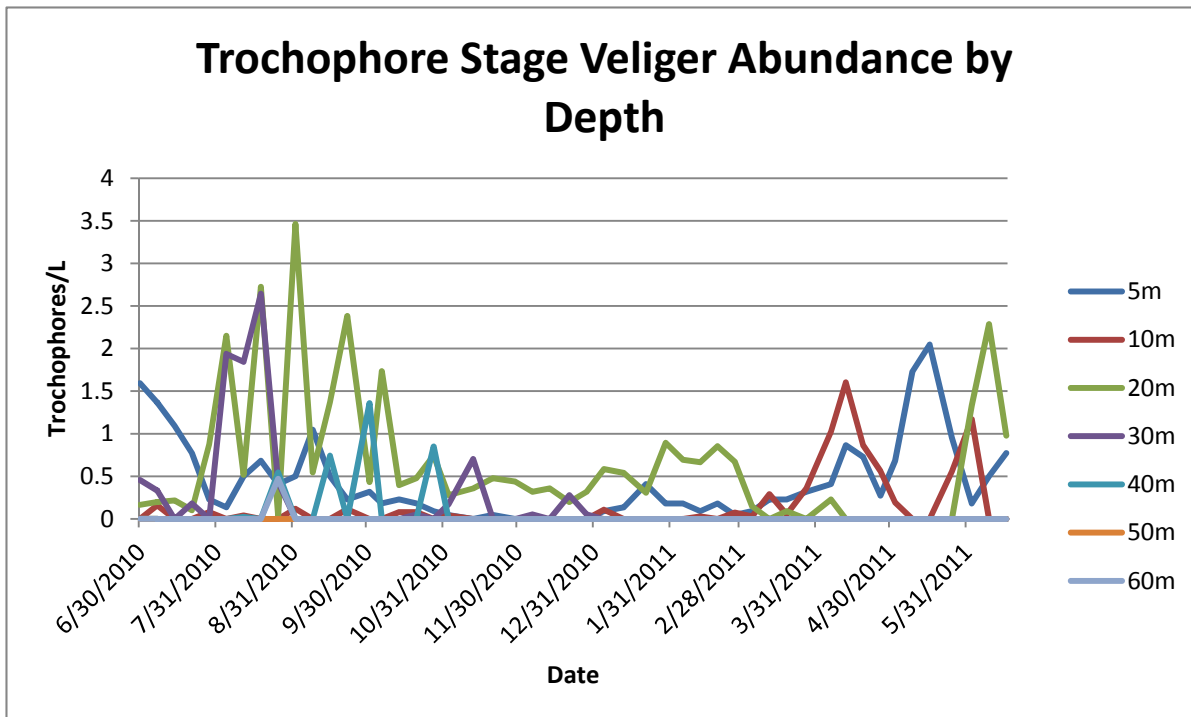


Figure C1b6. Average Trochophore Stage Veliger Abundance per L calculated by depth. Averages were taken weekly from 6/30/2010 to 6/16/2011.

C.1(c) Research Project: Growth of adult quagga mussels within Las Vegas Wash/Las Vegas Bay

This research project was conducted by S. Rainville as master’s thesis work. Sampling for this project was in April 2011 and the results for multiple locations are listed below (Table C1c1).

Table C1c1. Density of adult quagga mussels along Las Vegas Bay.

Coordinates	Depth	Density (mussels/m ²)
N: 36° 07' 05.3" / W: 114° 50' 32.8"	26.4'	77
N: 36° 06' 50.0" / W: 114° 49' 39.5"	80.4'	1,096
N: 36° 06' 21.2" / W: 114° 49' 15.3"	34.4'	250
N: 36° 06' 43.0" / W: 114° 49' 10.8"	97.5'	200,000*
N: 36° 06' 03.9" / W: 114° 48' 23.2"	193.5'	1,712
N: 36° 06' 37.4" / W: 114° 48' 04.8"	65'	4,981
N: 36° 06' 41.2" / W: 114° 47' 16.1"	62.9'	1,462
N: 36° 05' 34.1" / W: 114° 47' 06.9"	219.8'	5,558
N: 36° 05' 11.3" / W: 114° 47' 25"	120'	19,346

*Density was only estimated based on portion of the sample

In Las Vegas Bay, there is no noticeable trend from inner to outer basin. The mean value is 26,053 mussels/m² in Las Vegas Bay. However, because the data are not normally distributed, a median is more appropriate to represent this area and the median density is 1,712 mussels/m². A more comprehensive analysis on the distribution of quagga mussels in Las Vegas Bay and how mussels are potentially affected by environmental variables such as temperature, oxygen, nutrients, sediment composition along Las Vegas Bay will be carried out by S. Rainville as his master thesis (Master of Public Health). This thesis is anticipated to be available in late 2012.

C.1(d) Facilitation of Interagency Quagga Mussel Meetings

The quarterly Interagency Quagga Mussel Meeting took place on 11/17/2011. The meeting was facilitated by S. Gerstenberger and documented by J. Miller. Agendas were distributed prior to the meeting and CDs containing the 8/25/2012 PowerPoint files were provided. Two agency updates were presented along with a topic presentation and I-MAP update. Extensive meeting notes are taken, presented to speakers for approval, and distributed following each meeting. Related activities included updating the list-serve developed for this group with new members and sending out informational e-mails at the request of members.

The previously described draft Interagency Quagga Mussel Monitoring and Research Needs Summary prepared by J. Miller and K. Turner was presented and underwent review at the Interagency Quagga Mussel Meeting on 08/25/2011. The revised document was then distributed at the 11/17/2011 Interagency Quagga Mussel Meeting; no additional changes were requested at that forum, and therefore is considered final for inclusion in the project compendium.

Project 2 Technical Assistance Related to Ecological Monitoring of Lakes Mead and Mohave

C.2(a) Additions to the Ecological Monitoring Plan for Lakes Mead and Mohave

As reported previously, the original objective of this task was to acquire existing, current protocols relevant to the *Long-term Limnological and Aquatic Resource Monitoring and Research Plan for Lakes Mead and Mohave*. Discussions among the project group, K. Turner, and members of the Interagency Monitoring and Research Coordination Meeting (referred to as “Interagency Water 2025 Meetings”) resulted in the decision to create, instead, a protocol finders guide as Appendix 7 to the plan referenced above. Key citations (which include unpublished reports held at authoring agencies) were identified and included for every plan category. “Water 2025” team members were invited to provide recommendations for citations in all categories. During quarter 3 (year 2), draft Appendix 7 was reviewed by Southern Nevada Water Authority staff; comments related to Category 1 Water Quality and Limnology provided by Peggy Roefer and Todd Tietjen have been incorporated. Three staff members within the U.S. Bureau of Reclamation were interviewed regarding protocols relevant, specifically to Category 6: Riparian Resources. So far, no documented protocols have been submitted by the agency for Category 6; however, searches continue. No additional changes to this document were requested this quarter; therefore, its delivery has been made to K. Turner and is considered final for inclusion in the project compendium.

C.2(b) Implementation of the Ecological Monitoring Plan for Lakes Mead and Mohave

This task, which has relied on data from agency partners, has been completed with all available submission and is considered final for inclusion in the project compendium.

This task also overlaps with *C.2(e)*, below in close-out report organization for submission to the Southern Nevada Public Land Management Act (SNPLMA) of deliverables from all projects funded through implementation of Lake Mead NRA's Water 2025 SNPLMA Conservation Initiatives (Meeting the Challenge of Water 2025 Initiative: Balancing Water Quality, Community Needs & Water-Based Recreation for Lake Mead and Lake Mohave). The deliverables collected represent the monitoring data and key findings of partner organizations. The first installment of deliverables was to be those funded through Rounds 4, 5, and 7. As described previously, J. Miller reviewed the applicable task agreements between NPS and its partners, and prepared an Excel spreadsheet organizer for project deliverables. She has been in communication with all project leads and has either downloaded from partner web pages or requested electronic copies of deliverable products. This task has required numerous communications with project leads as task components have changed in title, completion date, or other aspect. J. Miller assisted K. Turner in the development of a final report for submission to the spreadsheet will be completed early in the upcoming quarter. This quarter (q4, year 2) has the narrative portion of the report has been completed and the accompanying Excel spreadsheet organizing all project files and web links submitted were delivered to the ATR on two 4GB external flash drives. These materials will also be included in the project compendium.

C.2(c) Coordination of Web Organization and Content for Lake Mead NRA Limnology

No additional effort was required on this task this quarter. It should be noted, however, that the National NPS content management system appeared to have reverted some text from these pages to previously uploaded versions (which did not include all revisions requested and integrated after the first posting). The system changes also altered font color and style. These unforeseen reversions were outside the control of the project team and the Visual Arts Office at Lake Mead NRA. If time allows in the remainder of the project, this issue will be investigated further and J. Miller will assist in documenting where pages need to be re-updated.

C.2(d) Facilitation of Interagency Monitoring and Research Coordination Meetings

The Interagency Monitoring and Research Coordination Meeting (referred to as "Interagency Water 2025 Meetings") took place on 11/17/2011. The major topics of discussion were the future of the group; review of tasks *C.2(b)* and *(e)* of this task agreement; and development of a circular report synthesizing the state of science knowledge of various limnological and ecological resources within Lakes Mead and Mohave, which will be carried out by the U.S. Geological Survey with input from various NPS Lake Mead NRA partners. The next meeting is scheduled to take place in January.

C.2(e) Technical Assistance to Lake Mead NRA with other Monitoring Programs

As reported previously, the major aspect of this task has been defined as assistance to Lake Mead NRA in close-out report organization for submission to the Southern Nevada Public Land Management Act (SNPLMA) of deliverables from all projects funded through implementation of Lake Mead NRA's Water 2025 SNPLMA Conservation Initiatives (Meeting the Challenge of

Water 2025 Initiative: Balancing Water Quality, Community Needs & Water-Based Recreation for Lake Mead and Lake Mohave). As described previously [and as discussed above in **C.2(b)**], J. Miller reviewed the applicable task agreements between NPS and its partners, and prepared an Excel spreadsheet organizer for project deliverables. She has been in communication with all project leads and has either downloaded from partner web pages or requested electronic copies of deliverable products. This task has required numerous communications with project leads as task components have changed in title, completion date, or other aspect. This quarter (q4, year 2) has the narrative portion of the report has been completed and the accompanying Excel spreadsheet organizing all project files and web links submitted were delivered to the ATR on two 4GB external flash drives. These materials will also be included in the project compendium.

Other Tasks:

- An NPS-funded U.S. Geological Survey (USGS) Circular Report on the science of Lake Mead and Mohave is currently under development. The following sections were co-authored and are undergoing revisions by the project team as part of this task:

Chapter 4: Wildlife and Biological Resources

Chapter 5: Threats and Stressors to the Health of the Lake Mead Aquatic Ecosystem

Inset Box: Lake Mead Water Circulation and Hydrology

Inset Box: How You Can Help

- The project team continues to provide planning input and assistance for the 2012 Lake Mead Science Symposium scheduled for next quarter (March 5 and 6, 2012). J. Miller devoted time to coordinating and organizing presentations for each session, and assisting session chairs in inviting suggested additional speakers to fill sessions. The following presentations are tentatively planned from the project team representing work done through this task agreement:
 - Veliger Abundance & Dynamics in Lake Mead 2009–2010.
 - Sizes of Newly Settled Quagga Mussels Attached to Different Substrates in Lake Mead (Nevada-Arizona).
 - Interagency Monitoring Action Plan (I-MAP): Adult & Juvenile Quagga Mussels in Lake Mead from Fall 2009 to 2010.

Submitted by:



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12/31/2011

Date