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2015-16 Eurasian Mussel Surveys

Lake Berryessa (Solano Project)

September 10, 2016

To: Chris Lee, Principal Water Resources Specialist
Solano County Water Agency

Subject: **2016-17 Eurasian Mussel Surveys - Lake Berryessa (Solano Project)**

SUMMARY

The survey program for Eurasian Mussels in the Solano Project which includes Lake Berryessa, the Putah South Canal and associated reservoirs was initiated in 2005. All surveys to date have been negative for Eurasian Mussel adults, veligers and shells. The following information outlines the types of surveys for Quagga, Zebra, and Golden mussels that are conducted on a regular basis in Lake Berryessa and other segments of the Solano Project. Current protocols are employed. In most cases we exceed the protocol requirements. All surveys are conducted and documented by a professional aquatic biologist. For additional information, please see: **Solano Project: Early Detection & Education Plan for Eurasian Mussels.**

TARGET SPECIES - EURASIAN MUSSELS

The following are target species that were photographed after being exposed during low water periods at infested reservoirs. The images are important for the recognition of the target species during shoreline surveys.

Golden Mussels: Have never been found in the U.S. They have infested many waterways in South America. Some researchers are concerned they will invade the U.S.

Zebra Mussel Shells: Dead mussels on a rock at San Justo Reservoir.

Quagga Mussel Shells: Dead Quagga mussels on the Lake Mead shoreline.

Quagga Mussel Shells: Sun-bleached Quagga Mussel shells on a Lake Mead shoreline boulder.

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ROUTINE VISUAL SURVEYS FOR EURASIAN MUSSELS

Capell Launch Ramp during low water conditions on 8/29/2016.

VISUAL SURVEYS - Shoreline:

Protocol for shoreline: Sites near marinas, popular fishing areas, and areas subject to windblown debris are checked on a monthly basis when lake water levels continue to drop. Surveys are completed by an aquatic biologist that is experienced with all life stages of Eurasian Mussels. At least one-half mile of lake shoreline is surveyed and photographed. All existing structure such as boulders, anchor bases, old docks, once submerged tree trunks, etc., are examined closely for the presence of adult mussels. This type of survey is only effective during periods of low water.


Pleasure Cove Marina: Drought conditions allow complete survey of areas that were submerged or difficult to survey.

VISUAL SURVEYS - Marinas:

Protocol for marinas: Various docks at every marinas are surveyed from the banks and docks at least once per month. Casual visual surveys are conducted while slowly walking the docks en route to check adult colonization devices and/or plankton collection. The following marinas and launch ramps are surveyed monthly:

1. Markley Cove
2. Pleasure Cove Marina
3. Capell Public Launch Ramp
4. Spanish Flats temporary launch ramp
5. Steele Park
6. Management Cove
7. Putah Creek Resort launch
8. East Side Access
9. Various Fishing Access Sites


Pleasure Cover Marina: Site checked on a monthly basis during low water conditions. Image 10/15/2015


Spanish Flat: Site of former marina. Image: 11/8/2015

Submerged Marina Anchors:

The sites of former Lake Berryessa marinas are rich with infrastructure that are ideal for the settlement of adult mussels. As water levels continue to drop, additional infrastructure is exposed. All low water visual surveys for adult Eurasian Mussels have been negative.

ROUTINE VISUAL SURVEYS FOR EURASIAN MUSSELS

Hydrolift at Markley Cove Marina

Watercraft & Marinas:

Marinas are rich with materials and structures that are perfect for mussel colonization and easy visual surveys. Hydrolifts are commonly used for visual surveys. We never get on or touch the watercraft or hydrolifts.

Markly Cove Marina: Bank across channel from marina

Watercraft Entrance & Exit Areas:

Areas used for watercraft to enter and exit marinas are considered high risk for mussel settlement. This narrow section has the Markley Marina on the west side and a lengthy section of rip rap on the east section. On a busy day, more than 100 watercraft move past through this section.

Capell Cove: When submerged this area is a popular area for bass anglers and is checked when possible for Eurasian Mussels. Image: September 2016

Popular Fishing Sites:

Areas used by anglers are visually inspected on a regular basis. Sites used by bass anglers, such as this one that is adjacent to the Capell Launch Ramp, are ideal for mussel settlement. Note the angling lures that are hanging from the trees.

ROUTINE COLONIZATION SURVEYS FOR ADULT EURASIAN MUSSELS - DEVICES

Assortment of materials used for detection of adult Eurasian Mussels. "Colonization Trees" are hung from various docks in Lake Berryessa.

Adult Colonization Devices:

Protocol: Colonization trees are hung from a variety of docks at Lake Berryessa marinas. Materials used are selected based on scientific studies that show surfaces preferred by Eurasian mussels. Materials show on left are hung at Markley Cove Marina, Dock C, Slip number 11. Device is checked monthly for sub-adult and /or adult mussels.

Materials hung from the USBR Management docks before cleaning and reinstalled.

MONTICELLO DAM SURVEYS:

Glory Hole at Monticello Dam. Image taken 2014

Lake Berryessa Glory Hole & Monticello Dam:
The lake side face of Monticello Dam and the Glory Hole are inspected visually at least twice per year for adult mussels.

Monticello Dam. Downstream face of dam.

Monticello Dam - Putah Creek:
The Putah Creek side of dam is surveyed on an annual basis. The rip rap is surveyed on a monthly basis for adult mussels. Plankton is usually collected at the same time and examined with a cross-polarized microscope.

Putah South Canal: The boulder collected from Putah South Canal prior to canal cleaning held several groups of organisms including snails and snail egg masses.

Putah South Canal: Mussel Surveys
The Putah South Canal is surveyed at various sites on a monthly basis. The first one-half mile of the canal is visually surveyed (on foot) annually depending upon cleaning schedule and access to the canal.

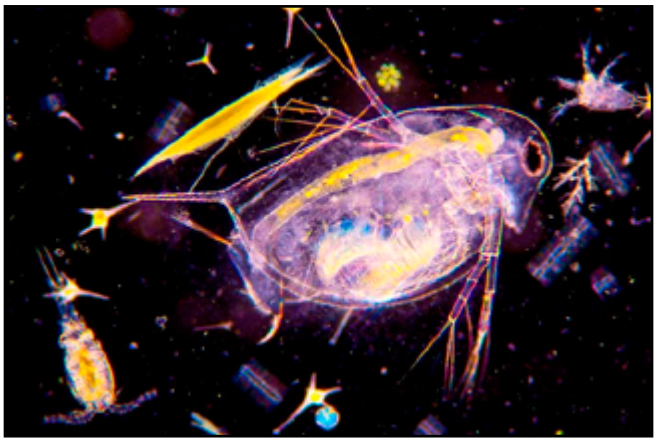
ROUTINE PLANKTON COLLECTION & MICROSCOPIC EXAMINATION:

EPA approved Plankton Net.

EPA Approved Plankton Nets & Protocols:

Protocol(s): Nets used for plankton collection are EPA approved size and mesh. Plankton tows exceed state protocol by filtering at least 5000 Liters. Collections are preserved immediately using standard CDFW protocol.

Plankton collections are taken from Marina docks and launch ramps rather than from a vessel in the middle of the reservoir. Mussel infestations in other waterways have typically been discovered at launch ramps and docks. This process is more efficient because we don't need access to a boat, have better control of plankton collections, and it facilitates discussions with marina staff and watercraft owners.



Lake Berryessa Plankton. Dark field microscopic image of Daphnia, This is an example of images in the Plankton Photo Library.

Plankton Examination:

Plankton samples are examined within 12 hours of collection by a qualified biologist using a cross-polarized microscope. Specimens are compared to images in a photo library of plankton species previously collected in Lake Berryessa.

Report sent via e-mail on September 12, 2016

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SURVEY SITES - EURASIAN MUSSELS - SOLANO PROJECT									
			GPS					SURVEYS	
CODE	SITE	SUBSITE	N	W	Primary Target	METHOD	FREQ.	Date	Pos / Neg
17J	Lake Berryessa	Putah Creek Resort	38.66588	122.27397	mussels	visual	monthly		Negative
17J	Lake Berryessa	Putah Creek Resort	38.66588	122.27397	mussels	plankton	monthly		Negative
17I	Lake Berryessa	Monticello Resort	38.59697	122.26483	mussels	visual	biannual		Negative
17I	Lake Berryessa	Monticello Resort	38.59697	122.26483	mussels	plankton	biannual		Negative
17L	Lake Berryessa	Spanish Flats	38.51836	122.21185	mussels	visual	biannual		Negative
17L	Lake Berryessa	Spanish Flats	38.51836	122.21185	mussels	plankton	biannual		Negative
17D	Lake Berryessa	Lake Berryessa Resort	38.57992	122.24755	mussels	plankton	biannual		Negative
17D	Lake Berryessa	Lake Berryessa Resort	38.57992	122.24755	mussels	visual	biannual		Negative
17G	Lake Berryessa	Management Cove	38.55003	122.22951	mussels	plankton	monthly		Negative
17G	Lake Berryessa	Management Cove	38.55003	122.22951	mussels	visual	monthly		Negative
17G	Lake Berryessa	Management Cove	38.55003	122.22951	mussels	Plates	monthly		Negative
17F	Lake Berryessa	Steele Park	38.49942	122.2019	mussels	plankton	monthly		Negative
17F	Lake Berryessa	Steele Park	38.49942	122.2019	mussels	visual	monthly		Negative
17A	Lake Berryessa	Capell Cove	38.50861	122.22017	mussels	plankton	monthly		Negative
17A	Lake Berryessa	Capell Cove	38.50861	122.22017	mussels	visual	monthly		Negative
17A	Lake Berryessa	Capell Cove	38.50861	122.22017	mussels	banks	monthly		Negative
17E	Lake Berryessa	Pleasure Cove	38.50690	122.16414	mussels	plankton	monthly		Negative
17E	Lake Berryessa	Pleasure Cove	38.50690	122.16414	mussels	visual	monthly		Negative
17E	Lake Berryessa	Pleasure Cove	38.50690	122.16414	mussels	Plates	monthly		Negative
17B	Lake Berryessa	Markley Cove	38.49783	122.12374	mussels	plankton	monthly		Negative
17B	Lake Berryessa	Markley Cove	38.49783	122.12374	mussels	visual	monthly		Negative
17B	Lake Berryessa	Markley Cove	38.49783	122.12374	mussels	Plates	monthly		Negative
17MO	Lake Berryessa	Monticello Dam	38.51295	122.10689	mussels	plankton	biannual		Negative
17MO	Lake Berryessa	Monticello Dam	38.51295	122.10689	mussels	plates	biannual		Negative
17	Lake Berryessa	Other			mussels				Negative
22T	Putah Creek	Monticello Dam	38.51326	122.10161	Mussels	plankton	monthly		Negative
22T	Putah Creek	Monticello Dam	38.51326	122.10161	Mussels / NZMS	visual	monthly		NZMS Positive
22T	Putah Creek	Montcello Dam	38.51326	122.10161	Mussels / NZMS	Plates	monthly		NZMS Positive

22T	Putah Creek	Monticello Dam	38.51326	122.10161	mussels	banks	monthly		NZMS Positive
22P	Putah Creek	Cold Creek	38.51263	122.09735	NZMS / Didymo	collection	bmonthly		NZMS Positive
22L	Putah Creek	Fishing Access 3	38.51661	122.05857	NZMS / Didymo	collection	monthly		NZMS Positive
22H	Putah Creek	Fishing Access 5	38.51008	122.04801	NZMS / Didymo	collection	monthly		NZMS Positive
22H	Putah Creek	Fishing Access 5	same	same	NZMS / Didymo	collection	monthly		NZMS Positive
	Putah Creek	Lake Solano	38.49337	122.02629	NZMS / Didymo/ Mussels	collection	monthly		NZMS Positive
	Putah Creek	Putah Diversion Dam	38.49385	122.00437	NZMS / Mussels	collection	monthly		NZMS Positive
	Putah Creek	Putah Diversion Dam	same	same	NZMS / Mussels	collection	monthly		NZMS Positive
	Putah Creek	Putah Diversion Dam	same	same	NZMS / Mussels	collection	monthly		NZMS Positive
	Lower Putah Creek	Pickerel Weir	38.49321	122.00193	NZMS	collection	monthly		NZMS Positive
	Lower Putah Creek	Morales	38.50005	121.99462	NZMS	collection	biannual		NZMS Positive
	Lower Putah Creek	Dry Creek	38.51443	121.97337	NZMS	collection	biannual		NZMS Positive
	Lower Putah Creek	Design Channel	38.51619	121.97039	NZMS	collection	monthly		NZMS Positive
	Lower Putah Creek	Neil Property	38.52455	121.95516	NZMS	collection	biannual		NZMS Positive
	Lower Putah Creek	River Park	38.52347	121.95825	NZMS	collection	monthly		NZMS Positive
	Lower Putah Creek	I-505	38.52621	121.95141	NZMS	collection	monthly		NZMS Positive
	Lower Putah Creek	Yolo Housing	38.5333	121.94046	NZMS	collection	biannual		NZMS Positive
	Lower Putah Creek	Hasbrook	38.52992	121.92645	NZMS	collection	biannual		NZMS Positive
	Lower Putah Creek	Russell Ranch	38.52831	121.82166	NZMS	collection	biannual		NZMS Positive
	Lower Putah Creek	Pedrick Road	38.52709	121.80318	NZMS	collection	monthly		NZMS Positive
	Lower Putah Creek	UCD Reserve - Fire Pit	38.52313	121.78545	NZMS	collection	biannual		NZMS Positive
	Lower Putah Creek	Mace Blvd.	38.51912	121.69348	NZMS	collection	monthly		Negative
	Lower Putah Creek	Los Rios Farm	38.51375	121.6203	NZMS	collection	biannual		Negative
	Other				NZMS	collection			Negative
	Putah South Canal	Mile 0.18 (Parshall Flume)	38.49288	122.00125	Mussels / NZMS	Visual / traps	monthly		NZMS Positive
	Putah South Canal	Mile 1.01 (Holmes Road)	38.49356	121.98719	Mussels / NZMS	Visual / traps	bimonthly		NZMS Positive
	Putah South Canal	Mile 1.50 (University Bridge)	38.49571	121.97412	Mussels / NZMS	Visual / traps	bimonthly		NZMS Positive
	Putah South Canal	Mile 1.99 (Wintu Way Bridge)	38.49576	121.96933	Mussels / NZMS	Visual / traps	monthly		NZMS Positive
	Putah South Canal	Mile 2.42 (Campos)	38.49332	121.96118	Mussels / NZMS	Visual / traps	bimonthly		NZMS Positive
	Putah South Canal	Mile 3.23 (Hines Nursery)	38.47005	121.94388	Mussels / NZMS	Visual / traps	bimonthly		NZMS Positive
	Putah South Canal	Mile 3.76 (Dry Arroyo)	38.46619	121.94282	Mussels / NZMS	Visual / traps	monthly		NZMS Positive

	Putah South Canal	Mile 4.50 (Hines 2)	38.46076	121.94245	Mussels / NZMS	Visual / traps	bimonthly		NZMS Positive
	Putah South Canal	Mile 5.25 (Entry Ramp)	38.45676	121.94238	Mussels / NZMS	Visual / traps	bimonthly		NZMS Positive
	Putah South Canal	Mile 5.62 (Weyand Canal)	38.45358	121.93983	Mussels / NZMS	Visual / traps	monthly		NZMS Positive
	Putah South Canal	Mile 6.18 (Sweeny Check)	38.44767	121.94332	Mussels / NZMS	Visual / traps	monthly		NZMS Positive
	Putah South Canal	Mile 6.94 (Udell Road)	38.43501	121.9524	Mussels / NZMS	Visual / traps	bimonthly		NZMS Positive
	Putah South Canal	Mile 7.55 (Paddon Road)	38.42641	121.95321	Mussels / NZMS	Visual / traps	bimonthly		NZMS Positive
	Putah South Canal	Mile 7.77 (Robinson Road)	38.42367	121.95591	Mussels / NZMS	Visual / traps	monthly		NZMS Positive
	Putah South Canal	Mile 8.31 (Midway Road)	38.41722	121.95912	Mussels / NZMS	Visual / traps	bimonthly		NZMS Positive
	Putah South Canal	Mile 9.46 (Aldridge Road)	38.40075	121.96149	Mussels / NZMS	Visual / traps	bimonthly		NZMS Positive
	Putah South Canal	Mile 9.92 (Vaca Valley Prkwy)	38.39688	121.96279	Mussels / NZMS	Visual / traps	monthly		NZMS Positive
	Putah South Canal	Mile 13.0 (Elmira - Vacaville)	38.34635	121.95757	Mussels / NZMS	Visual / traps	bimonthly		NZMS Positive
	Putah South Canal	Mile 16.10 (Peabody Rd - Vacaville)	38.32269	121.95887	Mussels / NZMS	Visual / traps	monthly		NZMS Positive
	Putah South Canal	Mile 17.90 (Cement Hill Outlet)	38.28755	121.99515	Mussels / NZMS	Visual / traps	bimonthly		NZMS Positive
	Putah South Canal	Mile 18.81 (Cement Plant)	38.27797	121.99466	Mussels / NZMS	Visual / traps	bimonthly		NZMS Positive
	Putah South Canal	Mile 21 (North Texas - Fairfield)	38.28766	122.03411	Mussels / NZMS	Visual / traps	monthly		NZMS Positive
	Putah South Canal	Mile 22.75 (Trevino Rd - Fairfield)	38.27735	122.06659	Mussels / NZMS	Visual / traps	bimonthly		NZMS Positive
	Putah South Canal	Mile 24.25 (Rancho Solano)	38.27416	122.08047	Mussels / NZMS	Visual / traps	bimonthly		NZMS Positive
	Putah South Canal	Mile 25.81 (Mankas Corner)	38.27944	122.10393	Mussels / NZMS	Visual / traps	monthly		NZMS Positive
	Putah South Canal	Mile 27.67 (Meredith Road)	38.26599	122.13031	Mussels / NZMS	Visual / traps	bimonthly		Negative
	Putah South Canal	Mile 30	38.24454	122.12446	Mussels / NZMS	Visual / traps	bimonthly		Negative
	Putah South Canal	Mile 32	38.24151	122.1277	Mussels / NZMS	Visual / traps	bimonthly		Negative
	Terminal Reservoir	Intake	38.22196	122.15999	Mussels / NZMS	plankton	monthly		Negative
	Terminal Reservoir	Floatsom Site	38.21942	122.15838	Mussels / NZMS	visual	monthly		Negative
	Terminal Reservoir	Outtake	38.21883	122.15925	Mussels / NZMS	plankton	monthly		Negative
	Terminal Reservoir	Entire Reservoir	38.22049	122.15987	Mussels / NZMS	plates	monthly		Negative
	Green Valley Creek	Reservoir Road	38.22719	122.15221	Mussels / NZMS	Visual / collection	quarterly		Negative
	Suisun Creek	PSC Management Road	38.27455	122.12291	Mussels / NZMS	Visual/Collection	quarterly		Negative
	Sweeny Creek	Hartley Road	38.44747	122.94332	Mussels / NZMS	Visual/Collection	quarterly		Negative