

FY99 Investigational Report :
Health Evaluation of Adult Carp (*Cyprinus carpio*) and Largemouth Bass (*Micropterus salmoides*) from Mason Valley Wildlife Management Area, NV.



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Summary: No significant viral or bacterial pathogen infections were detected in carp or bass sampled from 4 sites. A helminth parasite infection was observed in 48% of the bass and occurred at all 4 sample sites. The condition factors (Wt./ Length³) for both carp and bass were lowest in Hinkson Slough. Histological examination of kidney, liver, and spleen showed a common occurrence of multifocal, endogenous pigment deposits within apoptotic macrophages. The primary component of the pigment was lipofuscin which is often referred to as "age pigment" and forms when cellular lipids and phospholipids are oxidized into an insoluble, intracellular material. While not deemed a significant lesion, the presence of lipofuscin deposits would suggest that many of these fish were under some level of oxidative stress (water quality, diet). Bass from Hinkson slough had the greatest prevalence and severity of lipofuscin deposit. Low water levels may have reduced the fitness of Hinkson Slough fish.

Introduction:

On August 18 – 19, 1999, the California - Nevada Fish Health Center (FHC) assisted the USFWS Reno Field Office in a comparative study examining the general health of adult common carp (*Cyprinus carpio*) and largemouth bass (*Micropterus salmoides*). The FHC performed three functions for the study: 1) organosomatic analysis and tissue sampling during field collection; 2) microbiological assays, and 3) histological evaluation of select tissues. This work was performed with partial funding from the USFWS Wildfish Health Survey program.

Methods

Adult common carp (*Cyprinus carpio*) and largemouth bass (*Micropterus salmoides*) were captured by use of a beach seine, gill net, or electroshocking boat. Fish were collected from four water sources at five general sites (Table 1).

Table 1. Sample site data for common carp (*Cyprinus carpio*) and largemouth bass (*Micropterus salmoides*) sampled at Mason Valley Wildlife Management Area, NV (GPS coordinates: 119.1102° W, 39.1093° N).

Date	Site	Water Source	No. carp	No. bass
18AUG99	Hinkson Slough (HS)	Fish hatchery effluent	10	10
18AUG99	Cinnamon Pond (CP)	Treated municipal effluent	10	6
19AUG99	Miller's Marsh (MM)	Power plant effluent	0	2
19AUG99	Perk Slough (PS)	Walker River	10	0
19AUG99	Widgeon Pond (WP)	Walker River	0	3

The fish were held alive in an in-situ livebox for 1 - 3 hours prior to necropsy. Bass captured in Widgeon Pond were in a gill net for up to 24 hours prior to necropsy. Each fish was overdosed in MS222, rapidly examined for external abnormalities (gill, eye, skin), weighed, measured for total and fork length, and bled from the caudal peduncle into a heparinized plasma separator tube (Microtainer brand). Plasma protein was measured using a refractometer (Model 10400A TS Meter from Reichert-Jung). The peritoneal cavity was open and internal organs were examined for gross abnormalities. The following samples were collected from each fish:

- A sterile loop was inserted into the kidney and used to inoculate a brain heart infusion agar plate.
- Kidney for *R. salmoninarum* antigen ELISA and viral assay on both Fathead minnow (FHM) and CHSE214 cell lines (five fish pooled samples cultured for 15 days at 15 °C).
- Histological samples of kidney, liver, and spleen fixed in Davidson's fixative for 24 hours and transferred to 70 % ethanol. These tissues were processed for 5 µm paraffin sections and stained with hematoxylin & eosin. A subset of sections from each sample group was stained with Perl's Iron stain for both brightfield and fluorescent microscopy (360 nm filter).

Results

Carp Morphological Data – Total length of carp from the 3 sites ranged from 290-760 mm (Table 2). Variation in length between sites was not compared due to inconsistent sample methods. Mean condition factor in Hinkson Slough was lower than the other sites ($P=0.003$, one way ANOVA). Lower condition factors were likely related to the low water levels in Hinkson Slough. All of the bass sampled in Perk Slough were observed to have lesions and/or scale loss. It is unknown if this was due to the sample method (gill net) or some other factor.

Carp Pathogen Data – No significant bacterial or viral pathogens were isolated from carp at any of these sites. No internal parasites were observed by gross observation.

Table 2. Morphological data of carp reported as mean \pm S.E.M. including Condition factor ($Wt \{gram\} / Total \ Length^3 \{mm\} \times 10^5$).

	Hinkson slough	Cinnamon Pond	Perk Slough
Total Carp	9	10	10
Female	6	6	3
Male	3	4	7
Total Length (mm)	428 \pm 38	389 \pm 20	341 \pm 4
Weight (g)	1123 \pm 408	812 \pm 109	531 \pm 27
Condition Factor (combined)	1.16 \pm 0.04	1.31 \pm 0.04	1.33 \pm 0.02
Female	1.12 \pm 0.05	1.35 \pm .0.06	1.32 \pm 0.05
Male	1.24 \pm 0.05	1.26 \pm 0.03	1.34 \pm 0.02

Table 3. Blood data from carp reported as mean \pm S.E.M. including hematocrit (% erythrocyte vol.), leukocrit (% white blood cell vol.) and plasma total protein (g/dL). Number of fish at each site as given in Table 2 unless otherwise noted.

	Hinkson Slough	Cinnamon Pond	Perk Slough
Hematocrit (%)	37 \pm 2	37 \pm 2	40 \pm 2
Leukocrit (%)	0.74 \pm 0.10 n = 7	0.80 \pm 0.08 n = 8	0.47 \pm 0.02 n = 4
Plasma Protein* (combined)	3.4 \pm 0.2	4.4 \pm 0.2	3.8 \pm 0.2
Female	3.5 \pm 0.3	4.8 \pm 0.3	3.9 \pm 0.1
Male	3.3 \pm 0.1 n = 9	3.8 \pm 0.1	3.7 \pm 0.2

* measured by refractometer and considered to be higher than actual values

Bass Morphological Data – Total length from the 4 sites ranged from 110-370 mm (Table 4). Variation in length between sites was not compared due to inconsistent sample methods. Most of the bass caught were immature, and sex could not be determined in the field. Mean condition factor in Hinkson Slough was lower than both Cinnamon and Widgeon ponds (P=0.001, one way ANOVA). Lower condition factors were likely related to the low water levels in Hinkson Slough.

Bass Pathogen Data – No significant bacterial or viral pathogens were isolated from fish at any of these sites. A helminth parasite was observed by gross observation in bass at 3 of the 4 sample sites.

Table 4. Morphological data of bass reported as mean \pm S.E.M. including Condition factor (Wt {gram}/ Total Length³ {mm} x 10⁵).

	Hinkson Slough	Cinnamon Pond	Millers Marsh	Widgeon Pond
Total Bass	10	6	2	3
Female	2	1	0	2
Male	1	1	0	1
Immature	7	4	2	0
Total Length (mm)	281 \pm 17	160 \pm 22	124 \pm 14	331 \pm 15
Weight (g)	302 \pm 18	89 \pm 40	25 \pm 4.5	674 \pm 44
Condition Factor	1.20 \pm 0.05	1.54 \pm 0.14	1.30 \pm 0.20	1.88 \pm 0.14

Table 5. Blood data from bass reported as mean \pm S.E.M. including hematocrit (% erythrocyte vol.) and plasma total protein (g/dL). Number of fish at each site as given in Table 4 unless otherwise noted.

	Hinkson slough	Cinnamon Pond	Millers Marsh	Widgeon Pond
Hematocrit (%)	38 \pm 2 n = 9	43 \pm 2	40 \pm 1	38 \pm 1
Plasma Protein**	5.4 \pm 0.4	6.0 \pm 0.2 n = 5	6.5 n = 1	6.4 \pm 0.8 n = 2

** measured by refractometer and considered to be higher than actual values

Histological Data - No significant lesions were observed in the spleen, kidney, or liver sections from either carp or bass at any sample site (Tables 6 & 7). An encysted helminth was seen in the kidney, liver, and spleen of bass from all 4 sites (Fig. 1). These worms had been also observed on the viscera during necropsy. While quite numerous in some fish (> 10 cysts), no significant lesion was associated with the parasites. Bass from Widgeon Pond had the heaviest infections. It was not possible to identify the worms from the histological slides and no whole specimens were collected at necropsy. Several features are suggestive of either an Acanthocephalan ("thorny-head" worm) or possibly a *Gnathostoma* spp. Both of these helminths are visceral parasites of freshwater fish (*Gnathostoma* spp will use fish as a paratenic host). Some of the features observed in the cross-sections include: spiny cuticle (Fig 2), no definitive digestive or reproductive tracts (one worm seen with muscular pharynx), polymyarian muscle fiber arrangement, and lacunar spaces within the body cavity. No oral or attachment structures were observed in any of the bass parasites.

Brown pigments (BP) were observed in all 3 tissues from both fish species. These endogenous pigments were identified as either lipofuscin by its autofluorescence (excitation at 360 nm with max. emission at 430 nm, Shimusaki et al 1989) or hemosiderin by its iron staining reaction (Perl's iron stain, Humason 1972). Lipofuscin is often referred to as "age pigment" and forms when cellular lipids and phospholipids are oxidized into an insoluble, intracellular pigment. Often, phagocytes will accumulate this material in their cytoplasm and form aggregates of lipofuscin-filled cells. These aggregates form discrete brown foci in the tissues. Hemosiderin is typically concentrated in the reticuloendothelial cells of the spleen and kidney as they "recycle" iron from degraded erythrocytes.

The focal brown pigment deposits in the kidney and spleen were entirely composed of lipofuscin in both species. Hemosiderin was only observed in the liver where it represented approximately 20 % of the liver's brown pigments (remainder being lipofuscin). The number of fish with brown pigments in the examined organs varied between sites. Bass from Hinkson Slough had both the highest prevalence and severity rating (mean of a 0,1,2,3 ratings: data not shown) of splenic lipofuscin deposits of all the sample groups. While not deemed a significant lesion, the presence of lipofuscin deposits would suggest that many of these fish were under some level of oxidative stress (water quality, diet).



Figure 1. Encysted helminth in Bass Kidney

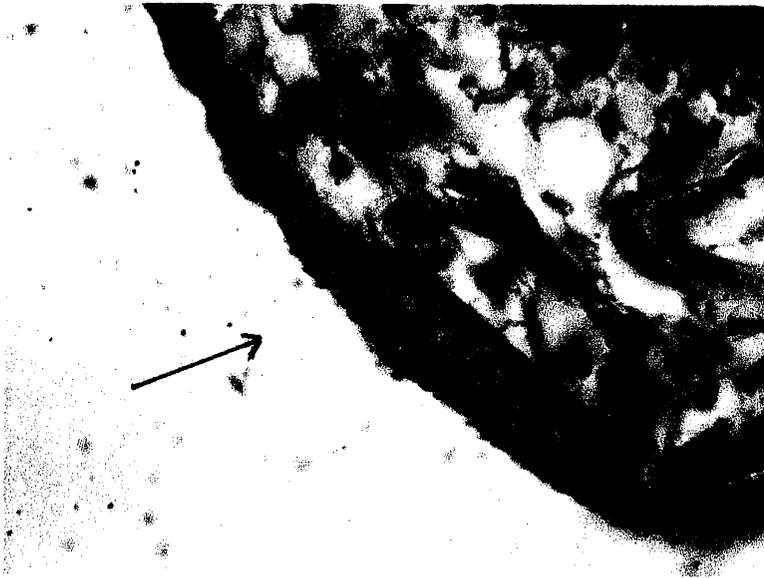


Figure 2. Higher magnification showing spiny cuticle. (150X)

Table 6. Histological examination of carp tissues. Data reported as number of positive / total tissues examined for brown pigments (BP, scored 0,1,2,3), calcium oxalate crystals within degenerative kidney tubules (CaOx Kidney), and cross sections of a similar helminth found within either the kidney,liver, and / or spleen of a given fish (Helminth KLS).

	Hinkson Slough	Cinnamon Pond	Perk Slough
BP > 1 Kidney	7 / 10	7 / 10	3 / 10
BP > 1 Liver	1 / 10	1 / 9	0 / 10
BP > 1 Spleen	2 / 8	2 / 9	1 / 10
CaOx Kidney	2 / 10	0 / 9	1 / 10
Helminth (KLS)	0 / 10	0 / 10	0 / 10

Table 7 Histological examination of bass tissues. Data reported as number of positive / total tissues examined for brown pigments (BP, scored 0,1,2,3), calcium oxalate crystals within degenerative kidney tubules (CaOx Kidney), and cross sections of a similar helminth found within either the kidney,liver, and / or spleen of a given fish (Helminth KLS).

	Hinkson Slough	Cinnamon Pond	Millers Marsh	Widgeon Pond
BP > 1 Kidney	3 / 6	NS	NS	1 / 2
BP > 1 Liver	6 / 9	0 / 6	0 / 2	1 / 3
BP > 1 Spleen	7 / 10	0 / 3	0 / 2	2 / 3
CaOx Kidney	0 / 6	NS	NS	0 / 2
Helminth (KLS)	4 / 10	2 / 6	2 / 2	3 / 3

NS = no section of that particular tissue

References:

Humason, G.L. 1979. Animal tissue techniques. 4th ed., W.H. Freeman and Co. , San Francisco, pg 470.

Shimasaki, H. , R. Maeba, and N. Ueta. 1989. Lipid peroxidation and storage of fluorescent products by macrophages In-Vitro as a model of ceroid - like pigment formation., pp 323 - 332, *In: Lipofuscin and ceroid pigments: Advances in experimental medicine and biology* Vol 266, ed EA Porta, Plenum Press, New York.

Appendix:

REPORT: 99-152 B
 SITE: Mason Valley - Hinkson Slough
 STOCK: Largemouth Bass
 SAMPLE DATE: 18-Aug-99
 DATA ENTRY DAT: 11/22/99

UNIT: _____
 LOT: _____
 TEMP & TIME: _____
 DC: _____
 INVESTIG: JF, KN

REMARKS: Fish Hatchery Effluent
 Pond being drained, low water conditions
 BC smeared up side of tube on all samples. Could not measure.
 Beach Seine

FISH	TL (mm)	FL (mm)	WT(g)	SKIN	EYE	GILL	Sex	Pia Pro	HEMOR ORGAN	WOLF STEREOSCOPE RBC	Tlmm	3X BC	UNIT/mm	KTL	KFL	HCT	LCT
1	350	345	653	0	0	0	F	6.8	Nem-heavy	14	33			1.52	1.59	42.42%	
2	280	280	285	0	0	0	U	4.9	Nem-heavy	21	51			1.30	1.30	41.18%	
3	250	245	190	0	0	0	U	6.2	Nem-heavy					1.22	1.29		
4	292	280	244	1	0	0	U	4.5	Nem-heavy	15	42			0.98	1.11	35.71%	
5	291	277	315	1	0	0	U	8	Nem-heavy	25	60			1.28	1.48	41.67%	
6	255	242	192	1	0	0	U	5	Nem-heavy	25	65			1.16	1.35	38.46%	
7	370	367	619	1	0	0	M	5	Nem-heavy	25	65			1.22	1.25	38.46%	
8	300	285	287	1	0	0	F	4.75	Nem-heavy	30	70			1.06	1.24	42.86%	
9	236	229	175	0	0	0	U	4	Nem-heavy	22	57			1.30	1.46	38.60%	
10	185	167	62	2	0	0	U	5	Nem-heavy	8	30			0.98	1.33	26.67%	
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MEAN	TL (mm)	FL (mm)	WT(g)	SKIN	EYE	GILL	Sex	Pia Pro	HEMOR ORGAN	WOLF STEREOSCOPE RBC	Tlmm	3X BC	UNIT/mm	KTL	KFL	HCT	LCT
MEAN	281.1	271.7	302.20	60.0%	0.0%	10.0%		5.42						1.202	1.341	38.45%	#DIV/0!
STDS	53.7	56.9	190.35	% abn	% abn	% abn		1.21						0.166	0.138	4.99%	#DIV/0!
SEM	17.0	18.0	60.20					0.38						0.053	0.044	1.66%	#DIV/0!
CV	19.11%	20.96%	62.99%					22.43%						13.82%	10.27%	12.98%	#DIV/0!
MAX	370	367	653	1.0	0.0	0.0	0.0	5.0						1.523	1.590	42.86%	0.00%
MIN	185	167	62	0	0	0	0	4						0.979	1.112	26.67%	0.00%
NO.	10	10	10	10	10	10	0	10						10	10	9	0

REPORT: 99-152 C
 SITE: Mason Valley - Cinnamon Pond
 STOCK: Carp
 SAMPLE DATE: 08/18/99
 DATA ENTRY DATE: 11/22/99

UNIT: _____
 LOT: _____
 TEMP & TIME: _____
 DO: _____
 INVESTIG: JF, KN

REMARKS:
 Treated municipal effluent
 Electrofished

FISH	TL (mm)	FL (mm)	WT(g)	SKIN	EYE	GILL	Sex	Pia Pro	HEMOR ORGAN	WOLF STEREOSCOPE			UNIT/mm	KTL	KFL	HCT	LCT
										RBC	Tlmm	3X BC					
1	400	360	814	0	1	0	F	4.75		20	48	8	0.24	1.27	1.74	41.67%	0.50%
2	380	345	822	0	0	0	F	5		5	20			1.50	2.00	25.00%	
3	460	410	1335	0	0	0	F	5		12	34	9	0.27	1.37	1.94	35.29%	0.79%
4	305	275	350	0	0	0	M	3.5		22	53	15	0.45	1.27	1.73	41.51%	0.85%
5	355	330	675	0	0	0	F	4.4		21	57			1.51	1.88	36.84%	
6	470	410	1260	1	0	0	M	3.8		64	57	13	0.39	1.21	1.83	43.75%	0.61%
7	365	325	600	0	0	0	F	3.8		12	33	8	0.24	1.23	1.75	36.36%	0.73%
8	290	255	326	1	0	0	M	3.9		9	21	9	0.27	1.34	1.97	42.86%	1.29%
9	410	350	820	0	0	0	F	4.6		12	35	10	0.3	1.19	1.76	34.29%	0.86%
10	450	395	1103	0	0	0	M	4		15	43	11	0.33	1.21	1.79	34.88%	0.77%
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MEAN	TL (mm)	FL (mm)	WT(g)	SKIN	EYE	GILL	Sex	Pia Pro	HEMOR ORGAN	RBC	Tlmm	3X BC	UNIT/mm	KTL	KFL	HCT	LCT
388.5	346.5	811.50	20.0%	10.0%	0.0%		4.38						1.310	1.838	37.25%	0.80%	
STDS	62.0	52.7	343.72	% abn	% abn	% abn	0.75						0.116	0.101	5.58%	0.23%	
SEM	19.6	16.7	108.69				0.24						0.037	0.032	1.77%	0.08%	
CV	15.95%	15.21%	42.36%				17.06%						8.86%	5.49%	14.99%	28.95%	
MEAN	390.0	352.5	817.0	0.0	0.0	0.0	4.2						1.509	2.002	43.75%	1.29%	
MAX	470	410	1335	1	1	0	6						1.190	1.731	25.00%	0.50%	
MIN	290	255	326	0	0	0	3.5						1.0	1.0	10	8	
NO.	10	10	10	10	10	10	10										

Female 1.35 0.06

REPORT: 99-152 D
 SITE: Mason Valley - Cinnamon Pond
 STOCK: Largemouth Bass
 SAMPLE DATE: 08/18/99
 DATA ENTRY DAT: 11/22/99

UNIT: _____
 LOT: _____
 TEMP & TIME: _____
 DO: _____
 INVESTIG: JF, KN

REMARKS:
 Treated municipal effluent
 Electrofished
 BC on all Bass smeared up side of tube - no LCT

FISH	TL (mm)	FL (mm)	WT(g)	SKIN	EYE	GILL	Sex	Pla Pro	HEMOR ORGAN			WOLF STEREOSCOPE		
									Nem - light	RBC	TLmm	3X BC	UNIT/mm	KTL
1	246	240	265	0	0	0	F	6.7	18	50	1.78	1.92	36.00%	
2	206	200	140	0	0	0	M	5.5	19	49	1.60	1.75	38.78%	
3	143	140	60	0	0	0	U	6	22	52	2.05	2.19	42.31%	
4	110	108	16	1	0	0	U	5.8	5	10	1.20	1.27	50.00%	
5	143	138	37	1	0	0	U	6.2	18	42	1.27	1.41	42.86%	
6	110	107	18 mort	1	0	0	U		3	6	1.35	1.47	50.00%	
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MEAN	TL (mm)	FL (mm)	WT(g)	SKIN	EYE	GILL	Sex	Pla Pro	HEMOR ORGAN	WOLF STEREOSCOPE	KTL	KFL	HCT	LCT
MEAN	159.7	155.5	89.33	50.0%	0.0%	0.0%		6.04	Nem - light	RBC	TLmm	3X BC	UNIT/mm	
STDS	54.9	53.4	97.46	% abn	% abn	% abn		0.45	Nem - light					
SEM	22.4	21.8	39.79					0.20						
CV	34.41%	34.36%	109.10%					7.46%						
MEDN	143.0	139.0	48.5	0.5	0.0	0.0		6.0						
MAX	246	240	265	1	0	0		6.7						
MIN	110	107	16	0	0	0		5.5						
NO.	6	6	6	6	6	6		5						

REPORT: 99-152 E
 SITE: Mason Valley - Miller's Marsh
 STOCK: Largemouth Bass
 SAMPLE DATE: 08/19/99
 DATA ENTRY DAT 11/22/99

UNIT:
 LOT:
 TEMP & TIME:
 DO:
 INVESTIG: JF KN

REMARKS:
 Power Plant effluent
 Beach Seine
 BC on all Bass smeared up side of tube - no LCT

FISH	TL (mm)	FL (mm)	WT(g)	SKIN	EYE	GILL	Sex	Pia Pro	HEMOR ORGAN	WOLF STEREOSCOPE			KTL	KFL	HCT	LCT
										RBC	TLmm	3X BC				
1	138	130	29	0	0	0	U	6.5	15	30	25	1.10	1.32	50.00%		
2	110	105	20	0	0	0	U		12			1.50	1.73	48.00%		
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MEAN	TL (mm)	FL (mm)	WT(g)	SKIN	EYE	GILL	Sex	Pia Pro	HEMOR ORGAN	RBC	TLmm	3X BC	UNIT/mm	KTL	KFL	HCT	LCT
MEAN	124.0	117.5	24.50	0.0%	0.0%	0.0%		6.50						1.303	1.524	49.00%	#DIV/0!
STD	19.8	17.7	6.36	% abn	% abn	% abn		#DIV/0!						0.282	0.288	1.41%	#DIV/0!
SEM	14.0	12.5	4.50					#DIV/0!						0.200	0.204	1.00%	#DIV/0!
CV	15.97%	15.04%	25.98%					#DIV/0!						21.66%	18.92%	2.88%	#DIV/0!
MEDN	124.0	117.5	24.5	0.0	0.0	0.0		6.5									
MAX	138	130	29	0	0	0		6.5						1.503	1.728	50.00%	0.00%
MIN	110	105	20	0	0	0		6.5						1.103	1.320	48.00%	0.00%
NO.	2	2	2	2	2	2		1						2	2	2	0

REPORT: 99-152 F
 SITE: Mason Valley - Part Slough
 STOCK: Carp
 SAMPLE DATE: 08/19/99
 DATA ENTRY DAT: 11/22/99

UNIT: _____
 LOT: _____
 TEMP & TIME: _____
 DO: _____
 INVESTIG: JF KN

REMARKS: Walker River water
 Gill Net

FISH	TL (mm)	FL (mm)	WT(g)	SKIN	EYE	GILL	Sex	Pla Pro	HEMOR ORGAN	WOLF STEREOSCOPE			KTL	KFL	HCT	LCT
										RBC	Tlum	3X BC				
1	340	312	490	2	0	0	M	4		22	60	10	1.25	1.61	36.67%	0.50%
2	342	325	498	2	0	0	F	3.75		18	48		1.24	1.45	37.50%	
3	376	338	750	1	0	0	F	4		13	30		1.41	1.94	43.33%	
4	334	297	515	1	0	0	M	5		17	38		1.38	1.97	44.74%	
5	331	311	475	2	0	0	M	3.5		11	29		1.31	1.58	37.93%	
6	330	299	483	1	0	0	M	3.8		21	42	7	1.34	1.81	50.00%	0.50%
7	345	306	580	1	0	0	M	3.2		18	45		1.41	2.02	40.00%	
8	328	300	458	1	0	0	M	3.2		15	49	8	1.30	1.70	30.61%	0.49%
9	342	307	519	2	0	0	F	3.9		21	60	8	1.30	1.79	35.00%	0.40%
10	340	302	542	1	0	0	M	3.3		19	46		1.38	1.97	41.30%	
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MEAN	TL (mm)	FL (mm)	WT(g)	SKIN	EYE	GILL	Sex	Pla Pro	HEMOR ORGAN	RBC	Tlum	3X BC	UNIT/mm	KTL	KFL	HCT	LCT
MEAN	340.8	309.7	531.00	100.0%	0.0%	0.0%		3.76						1.333	1.784	39.71%	0.47%
STDS	13.7	12.9	84.60	% abn	% abn	% abn		0.55						0.063	0.194	5.47%	0.05%
SEM	4.3	4.1	26.75					0.17						0.020	0.061	1.73%	0.02%
CV	4.01%	4.16%	15.93%					14.59%						4.70%	10.90%	13.77%	10.27%
MEAN	340.0	306.5	506.5	1.0	0.0	0.0		3.8						1.412	2.024	50.00%	0.50%
STDS	376	338	750	2	0	0		5						1.245	1.451	30.61%	0.40%
SEM	376	297	458	1	0	0		3.1						1.245	1.451	30.61%	0.40%
CV	328	297	458	10	10	10		10						10	10	10	4

REPORT: 99-152 G
 SITE: Mason Valley - Widgeon Pond
 STOCK: Largemouth Bass
 SAMPLE DATE: 08/19/99
 DATA ENTRY DAT: 11/22/99

UNIT: _____
 LOT: _____
 TEMP & TIME: _____
 DO: _____
 INVESTIG: JF KN

REMARKS:
 Walker River water
 Gill Net
 Bass held for > 24 hrs (in net) prior to sampling
 Bass plasma collected in hematocrit tubes

FISH	TL (mm)	FL (mm)	WT(g)	SKIN	EYE	GILL	Sex	Pla Pro	HEMOR ORGAN			WOLF STEREOSCOPE	UNIT/mm	KTL	KFL	HCT	LCT
									ORGAN	RBC	TLmm						
1	360	348	763	1	0	0	F		Nem-heavy	23	60	1.64	1.81	38.33%			
2	322	310	627	0	2	1	F	7.1	Nem-light	15	38	1.88	2.10	39.47%			
3	310	305	633	1	1	0	M	5.6	Nem-light	20	54	2.12	2.23	37.04%			
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MEAN	TL (mm)	FL (mm)	WT(g)	SKIN	EYE	GILL	Sex	Pla Pro	HEMOR ORGAN	WOLF STEREOSCOPE	UNIT/mm	KTL	KFL	HCT	LCT
MEAN	330.7	321.0	674.33	66.7%	66.7%	33.3%		6.35				1.879	2.049	38.28%	
STDS	26.1	23.5	76.85	% abn	% abn	% abn		1.06				0.245	0.216	1.22%	#DIV/0!
SEM	15.1	13.6	44.37					0.75				0.141	0.125	0.70%	#DIV/0!
CV	7.89%	7.33%	11.40%					16.70%				13.02%	10.53%	3.18%	#DIV/0!
MEDN	322.0	310.0	633.0	1.0	1.0	0.0		6.4				2.125	2.231	39.47%	0.00%
MAX	360	348	763	1	2	1		7.1				1.635	1.810	37.04%	0.00%
MIN	310	305	627	0	0	0		5.6				3	3	3	0
NO.	3	3	3	3	3	3		2							

