

Metadata for StomachContents_orig.mdb

The California Department of Fish and Game (CDFG) database "StomachContents_orig.mdb" maintains stomach-content analysis data of striped bass and other predatory fish. The "Database Information" section provides details on the database and QAQC analysis. The "Data Summary" section provides a synopsis of the data within the database.

Database Information

Database details are as follows:

- Created on Tuesday, February 09, 1999 11:13:54 AM
- Size ~ 4 MB
- 15 tables (main tables are "Fish", "Stomach", "Length")
- 23 queries (most of which created this report)
- 5 forms (for data entry)

Table "Fish" has 28 fields; only the fields *StomachID*, *Date*, *PredatorCode*, and *RecoveryLocation* contain relevant data. *StomachID* is a unique identification number, which was assigned post-data entry to each predatory fish (n=3,153). *Date* refers to the collection date (mm/dd/yyyy) of the sample. *PredatorCode* is unique number assigned to each predatory fish species. *RecoveryLocation* is the location of capture of the predatory fish.

Eighty *StomachID* (fish) were flagged as missing data in either the *Date*, or *PredatorCode*, or *RecoveryLocation* fields (Table 1).

- 78 have no data in the field *Date*
- 44 have no data in the field *PredatorCode*
- 76 have no data in the field *RecoveryLocation*
- 40 have no data in all three fields (and no data in tables "Stomach" and "Length" as well) [Note: It is possible this happened when assigning the *StomachID* number (that is, a number was assigned to an empty row.)]

Table 1. Stomach ID's with missing data in table "Fish"

Stomach ID	Date	Predator Code	Recovery Location	Stomach ID	Date	Predator Code	Recovery Location	Stomach ID	Date	Predator Code	Recovery Location
106		3	CC	629	05/21/92			976		3	
107		3	CC	630				977			
108		3		631				978			
109		3		640				979			
169		3		669				980			
298			m	685	09/27/88	3		982			
465				686				983			
466			CC	699				1651		3	
467				720				1652		3	
470				729				1653		3	
487				738				1654		3	
497				740				1655		3	
498				797		3		1656		3	
499				824		3		1657		3	
500				825		3		1658		3	
504				826		3		1659		3	
511				831		3		1668		3	
547				832		3		1669		3	
556				833		3		1670		3	
569				834		3		1671		3	
576				835		3		1672		3	
597				848				1673		3	
602				898				1674		3	
606				907		3		1675		3	
616				909		3		1676		3	
619				959				1677		3	
623				975							

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Table "Stomach" has five fields: *StomachID*, *General*, *Specific*, *Count*, *Key*. *StomachID* relates to the field of the same name in table "Fish". *General* and *Specific* fields describe each prey item. The *Count* field pertains to the number of items found in the category. (This was the intent at the time the database was designed. Count field now contains numbers 8888 and 9999, possibly related to fish salvage.) The *Key* field is a unique number assigned post-data entry.

Discrepancies are as follows.

- 33 *StomachID* contain no data in both the *General* and *Specific* fields (10 of the 33 *StomachID*'s appear more than once, *StomachID* = 122, 135, 146, 156, 166, 171, 180, 184, 195, 245)
- 8 *StomachID* contain data in the *General* field but not in the *Specific* field
- 214 *StomachID* contain data in the *Specific* field but not in the *General* field

Table "Length" has eight fields; only the fields *StomachID* and *Length* contain relevant data. *StomachID* relates to the field of the same name in table "Fish". The *Length* field contains the predator fork length (FL) measured in millimeters (mm). Discrepancies are as follows.

- Table "Length" contains 3,033 entries—four *StomachID* (78, 469, 1497, 1499) are duplicate entries (one with length, and one without) and four *StomachID* (116, 117, 118, 1654) have no length

Other items of note are as follows.

- The sex of each predator was not recorded (39 = unknown, 2,994 are blank)
- The age of each predator was not recorded (although one largemouth bass (*StomachID* = 2374) lists an age of 3 and one striped bass (*StomachID* = 1516) lists an age of 46)
- "m" was entered once in the field *RecoveryLocation* (table "Fish")
- In the *General* field (table "Stomach"), the following six fish families do not "group" when performing a "Group By" query. In addition, "Bait" does not "group". It is not clear why this happens.
 1. Atherinidae
 2. Centrarchidae
 3. Clupeidae
 4. Cottidae
 5. Gobiidae
 6. Percichthyidae

Data Summary

Stomach contents of seven different piscivorous -fish species (predatory fish) were collected (and analyzed) from 1987 to 1995 and in 1998 (Tables 2 and 3). The majority of stomachs were from striped bass. Samples were collected throughout the entire year in 1993, 1994, and 1995. For all other years, samples were collected between April or May and June. In 1988, samples also were collected between August and October. Note: only one stomach was collected in 1998.

Table 2. Number of stomachs sampled per predator. Percent of total provide for comparison.

Predator Common Name	Scientific Name	Predator Code	Number of Stomachs Sampled	Percent of Total Sampled
Brown Bullhead	<i>Ameiurus nebulosus</i>	5	2	0.1%
Channel Catfish	<i>Ictalurus punctatus</i>	6	103	3.3%
Largemouth Bass	<i>Micropterus salmoides</i>	22	565	17.9%
Smallmouth Bass	<i>Micropterus dolomieu</i>	36	4	0.1%
Squawfish ¹	<i>Ptychocheilus grandis</i>	10	181	5.7%
Striped Bass	<i>Morone saxatilis</i>	3	2,140	67.9%
White Catfish	<i>Ameiurus catus</i>	4	114	3.6%
Not Recorded	N/A	N/A	44	1.4%

¹Now referred to as Sacramento pikeminnow

Total = 3,153

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Table 3. Number of each predator sampled per year. Month sampling started and ended provided for comparison between years.

Year	Sampling Period		Number of Each Fish Species (predator) Sampled per Year								Yearly Totals
	Month Start	Month End	Not Recorded	Brown Bullhead	Channel Catfish	Largemouth Bass	Smallmouth Bass	Squawfish ¹	Striped Bass	White Catfish	
	Not Recorded		42						36		78
1987	May	June							9		9
1988	May	October			3		1	84	153	42	283
1989	April	June						16	29	10	55
1990	May	June						14	76	3	93
1991	April	June						31	153	10	194
1992	April	June	1					33	278		312
1993	January	December			24	68	1		711	1	805
1994	January	December	1	2	40	273	1	1	474	47	839
1995	January	December			36	224	1	2	221		484
1998	May	May								1	1

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Predator fork lengths were measured to the nearest millimeter (mm). Of the 3,153 predators, 3,025 were measured (Table 4). The average fork length for all predators never exceeded 400 mm. The length-range of striped bass was the broadest of any predator (165 – 1,060 mm FL).

Table 4. Predator minimum, maximum, and average fork length.

Predator Common Name	Number Measured	Minimum Fork Length (mm)	Maximum Fork Length (mm)	Average Fork Length (mm)
Brown Bullhead	2	333	345	339
Channel Catfish	102	235	580	391
Largemouth Bass	565	192	567	334
Smallmouth Bass	4	270	365	309
Squawfish ¹	180	215	570	392
Striped Bass	2,059	165	1,060	365
White Catfish	113	170	449	284

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Collection of many striped bass and largemouth bass made possible the construction of length-frequency charts (Figures 1 and 2). Almost 80% of striped bass were between 250 and 449 mm FL. Almost 87% of largemouth bass were between 250 and 399 mm FL. Thirty-seven percent (n=209) of largemouth bass were between 300 and 349 mm FL.

Figure 1. Striped bass length-frequency.

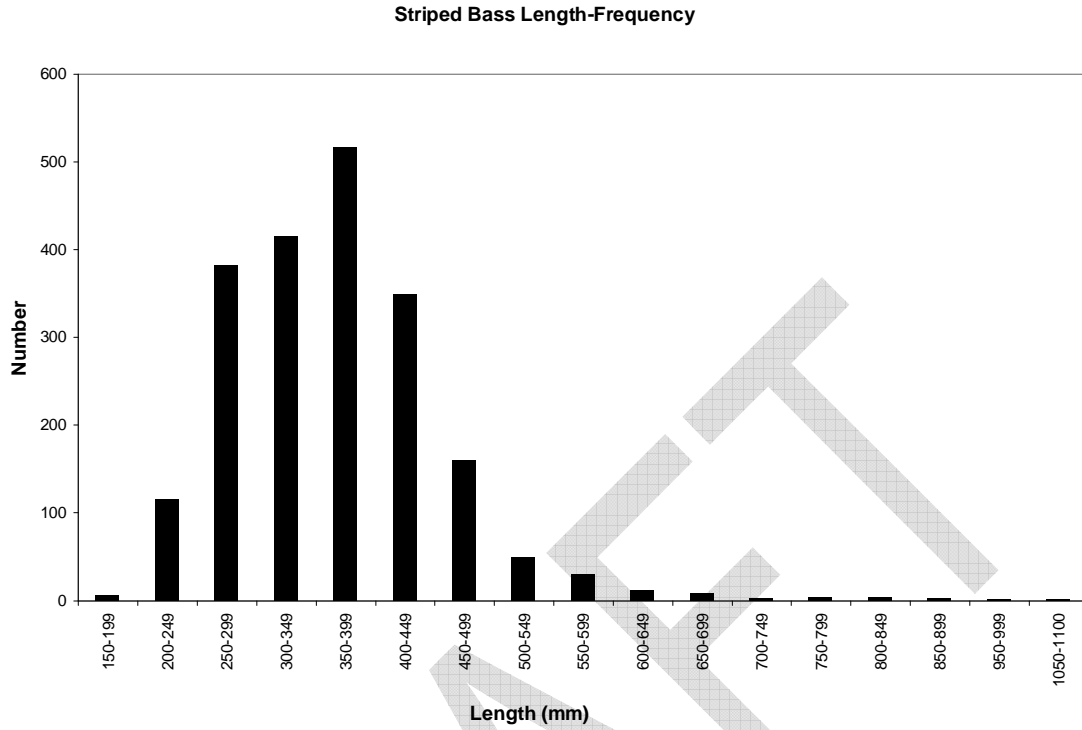
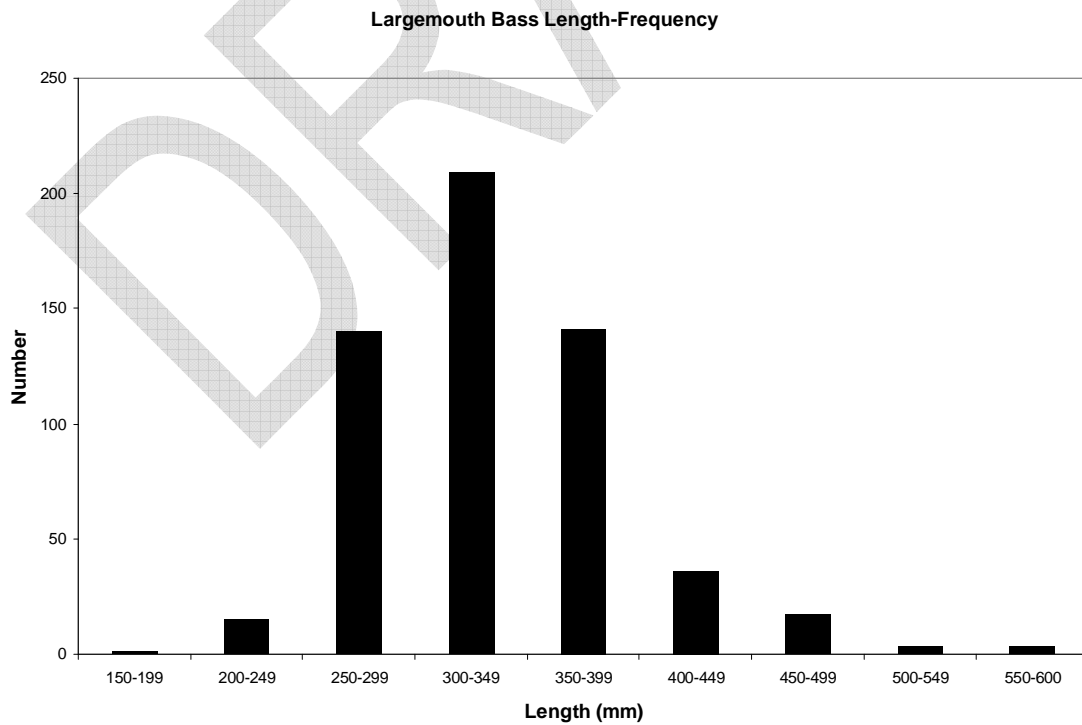


Figure 2. Largemouth bass length-frequency.



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Predators were collected from 40 different geographical areas within the San Francisco Estuary (Table 5). (Note: no further details about the recovery locations were provided in the database. Recovery location names are as they appear in the database.)

The majority of striped bass were collected in Clifton Court Forebay (CCF). About 43% of largemouth bass were collected in Middle River. Most squawfish were collected in the Montezuma Slough area.

Table 5. Recovery location for each predator.

Recovery Location Names	Number of Each Fish Species (predator) Sampled by Location							
	Not Recorded	Brown Bullhead	Channel Catfish	Largemouth Bass	Smallmouth Bass	Squawfish ¹	Striped Bass	White Catfish
Not Recorded	41						35	
CC	1						2	
ccc 1				1				
ccc 2				1				
ccc 4		1		1				
ccc cb/4				1				
ccc mc 1								1
ccc mc 1/2				5				
ccc mc 3				2				
ccc mc 3/4			3	4				
ccc mw2							1	
ccc ne 6							2	
ccchw			1	1				
ccchw1			8	6				19
ccchw2			2	4				9
ccchw3			5	1				12
ccchw4		1		4				3
cccmc3				3				
CCF			8	8	1	1	1,138	2
ccf area 1							42	
ccf area 2				1			5	
ccf area 3			1	2			3	1
ccf area 4			8	7			3	
CCF Area 5							17	
ccf area 6			2				32	
Contra Costa Canal			3	15			19	2
Grant Line Canal			10	90			59	
Head of Old River	1		15	40	3	1	62	
m	1							
Middle River			13	244			13	
montezuma slough							10	
Montezuma Slough Down Stream						37	89	29
montezuma slough downstream						15	324	3
Montezuma slough Upstream						126	255	33
Old River			23	92		1	29	
OLRA			1	2				
OLRB				20				
TBP GLC				3				
TBP HORB				1				
TBP MIDRB				1				
TBP MIDRB2				5				

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Stomach contents were classified into one of 11 general categories (Table 6). Every general food item was identified at least once in striped bass stomachs.

Table 6. General food categories.

General Category Food Items	Number of Food Items Identified in Each General Category							
	Not Recorded	Brown Bullhead	Channel Catfish	Largemouth Bass	Smallmouth Bass	Squawfish ¹	Striped Bass	White Catfish
Bait							2	
Eggs							1	
Fish			3	48	1	25	541	5
Fish Unknown	1	3	64	422	3	114	1,959	41
Invert Known	1		79	213	1	35	971	59
Invert Unknown			3	7		9	69	18
Non Fish Vertebrate				5		4	10	
Miscellaneous		1	11	77		30	358	16
Other							3	
Shrimp				1		1	22	
Vegetation		1	80	337	1	58	989	76

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General food items were further classified into specific categories (Appendix 1). The number of stomachs (N) identified as having a specific food item was tallied per predatory fish species. Percent frequency of occurrence (% of Freq) was calculated using the following equation.

$$\text{Percent Frequency of Occurrence} = \left(\frac{\text{number of stomachs with specific food item}}{\text{number of stomachs analyzed}} \right) * 100$$

Percent frequency of occurrence for "Empty" indicated the percent of empty stomachs for each predator.

Prey fish from 13 families were identified (Appendix 1). Whenever possible, prey fish were identified to species. Invertebrate prey items were identified into one of 33 specific categories. Food items classified as vegetation were identified into one of 25 specific categories

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Appendix 1. General and specific food items identified in predatory fish stomachs (Note: number below predator name is the number of stomachs analyzed for that predator.)

Number of Stomachs Containing Food Item per Each Predator Species																	
Food Item General (in bold) Food Item Specific (below)		Not Recorded		Brown Bullhead		Channel Catfish		Largemouth Bass		Smallmouth Bass		Squawfish		Striped Bass		White Catfish	
		N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq
Empty		44		2		103		565		4		181		2,140		114	
Empty						3	2.9	49	8.7	1	25.0	47	26.0	173	8.1	19	16.7
Atherinidae		N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq
Inland silverside								1	0.2					4	0.2		
Centrarchidae		N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq
Bluegill								3	0.5					1	0.05		
Redear Sunfish								2	0.4								
Warmouth								1	0.2								
Unidentifiable centrarchid								3	0.5					2	0.1	1	0.9
Clupeidae		N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq
American shad								1	0.2			1	0.6	10	0.5		
Threadfin shad								5	0.9					53	2.5		
American shad scales														1	0.05		
Threadfin shad scales														1	0.05		
Unidentifiable clupeid								1	0.2					11	0.5		
Cottidae		N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq
Pacific staghorn sculpin																	
Prickly sculpin								2	0.4			1	0.6	2	0.1		

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Number of Stomachs Containing Food Item per Each Predator Species

Number of Stomachs Containing Food Item per Each Predator Species												
	Not Recorded	Brown Bullhead	Channel Catfish	Largemouth Bass	Smallmouth Bass	Squawfish	Striped Bass	White Catfish				
Food Item General (in bold)	44	2	103	565	4	181	2,140	114				
Food Item Specific (below)												
Unidentifiable cottid		1	1.0	2	0.4	2	1.1	1	0.05			
Cyprinidae	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq
Carp							1	0.05				
Golden shiner				6	1.1		2	0.1				
Splittail							1	0.05				
Unidentifiable cyprinid							1	0.05				
Gasterosteidae	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq
Threespine stickleback						6	3.3	207	9.7	3	2.6	
Threespine stickleback bodies & bones							1	0.05				
Gobiidae	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq
Chameleon goby				10	1.8	1	25.0	9	5.0	48	2.2	
Yellowfin goby				1	0.2			1	0.6	42	2.0	1
Unidentifiable gobiid				5	0.9			3	1.7	18	0.8	
Ictaluridae	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq
Brown bullhead							1	0.6				
White catfish				2	0.4							
Unidentifiable ictalurid				1	0.2				1	0.05		
Percichthyidae	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq
Striped bass			1	1.0	1	0.2	1	0.6	50	2.3		
Scales							6	0.3				

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Number of Stomachs Containing Food Item per Each Predator Species

Food Item General (in bold) Food Item Specific (below)	Number of Stomachs Containing Food Item per Each Predator Species											
	Not Recorded	Brown Bullhead	Channel Catfish	Largemouth Bass	Smallmouth Bass	Squawfish	Striped Bass	White Catfish				
	44	2	103	565	4	181	2,140	114				
Unidentifiable percichthyid							1	0.05				
Percidae	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq
Bigscale logperch				1			7	0.3				
Petromyzontidae	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq
River lamprey							1	0.05				
Unidentifiable petromyzontid							8	0.4				
Poeciliidae (in database as Gambusia)	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq
Western mosquitofish							2	0.1				
Salmonidae	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq
Chinook salmon							5	0.2				
Steelhead rainbow trout							1	0.05				
Fish Unknown	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq
Bones			4	3.9	24	4.2	6	3.3	38	1.8	6	5.3
Digested					2	0.4			553	25.8		
Digested Material			7	6.8	27	4.8	10	5.5	12	0.6	2	1.8
Eggs					3	0.5	1	0.6	3	0.1		
Fish Body									8	0.4		
Flesh			1	1.0	17	3.0	6	3.3	13	0.6	2	1.8
Fish Meat									2	0.1		
Larvae (w/yoke sac)									1	0.05		

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Number of Stomachs Containing Food Item per Each Predator Species

Food Item General (in bold) Food Item Specific (below)																
	Not Recorded	Brown Bullhead	Channel Catfish	Largemouth Bass	Smallmouth Bass	Squawfish	Striped Bass	White Catfish								
	44	2	103	565	4	181	2,140	114								
Other fish parts	1	2.3	1	50.0	23	22.3	140	24.8	2	50.0	18	9.9	485	22.7	1	0.9
Scales					9	8.7	31	5.5	1	25.0	71	39.2	571	26.7	19	16.7
Teeth		1	50.0				4	0.7					5	0.2	2	1.8
Unidentifiable		1	50.0	20	19.4	165	29.2			2	1.1	212	9.9	8	7.0	
Unidentifiable w/egg mass													1	0.05		
Vertebral column				9	1.6								55	2.6	1	0.9
Eggs	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq
Shad													1	0.05		
Invert Known	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq
Amphipods			38	36.9	53	9.4	1	25.0	4	2.2	373	17.4	18	15.8		
Annelid					1	0.2					23	1.1				
Chironomids											4	0.2				
Chironomids			11	10.7	3	0.5					39	1.8	7	6.1		
Cladocerans					1	0.2					11	0.5				
Clam			3	2.9	3	0.5					27	1.3	2	1.8		
Coleoptera Larvae											4	0.2				
Copepod											1	0.05				
Crab											7	0.3	2	1.8		
crayfish			8	7.8	94	16.6					7	0.3				
Crayfish parts											1	0.05				
Crustaceans			1	1.0	3	0.5					10	5.5	119	5.6	10	8.8
Daphnids			1	1.0	3	0.5							13	0.6	1	0.9

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	Not Recorded	Brown Bullhead	Channel Catfish	Largemouth Bass	Smallmouth Bass	Squawfish	Striped Bass	White Catfish
Food Item General (in bold)	44	2	103	565	4	181	2,140	114
Food Item Specific (below)								
Decapod				7	1.2		6	0.3
Decapod parts							2	0.1
Diptera							1	0.05
Hymenoptera Larvae							1	0.05
Insect		8	7.8	25	4.4	5	114	5.3
Isopod				2	0.4	1	7	0.3
leech		1	1.0	5	0.9		3	0.1
Mysids				5	0.9	12	133	6.2
Nematode				2	0.4		7	0.3
Neo shells							1	0.05
Neomysis							1	0.05
Neos							49	2.3
Ostracods							1	0.05
Rotifers							2	0.1
Shrimp							2	0.1
snail		4	3.9	1	0.2		1	0.05
tapeworm							1	0.05
Worm	1	2.3	3	2.9	4	0.7	1	0.6
Worms							9	0.4
Unidentifiable		1	1.0	1	0.2	2	1	0.05
Invert Unknown	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq
Unidentifiable	1	1.0	1	0.2	1	0.6	29	1.4
Annelid							1	0.05
							2	1.8

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	Not Recorded	Brown Bullhead	Channel Catfish	Largemouth Bass	Smallmouth Bass	Squawfish	Striped Bass	White Catfish			
Food Item General (in bold)	44	2	103	565	4	181	2,140	114			
Food Item Specific (below)											
Coleoptera Larvae							1	0.05			
Digested Material							3	0.1			
Insect						4	2.2	2	0.1	1	0.9
Pincher claws				1	0.2			1	0.05		
Unidentifiable		2	1.9	5	0.9	4	2.2	32	1.5	15	13.2
Miscellaneous	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	% of Freq
Unidentifiable				1	0.2						
Digested							1	0.05			
Digested Material				8	1.4	24	13.3	198	9.3	4	3.5
dirt		1	1.0	9	1.6			4	0.2		
Eggs								3	0.1		
Hair								2	0.1		
OTHER		9	8.7	26	4.6			2	0.1	9	7.9
Paint Chip								1	0.0		
Paint Chips				2	0.4			5	0.2		
Plastic								1	0.05		
Rocks				4	0.7			45	2.1		
Sand				3	0.5	1	0.6	40	1.9	1	0.9
Tar pieces								1	0.05		
Unidentifiable	1	50.0	1	1.0	24	4.2	5	2.8	55	2.6	1.8
Non Fish Vertebrate	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	% of Freq
hairs							2	1.1	8	0.4	

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Number of Stomachs Containing Food Item per Each Predator Species

Food Item General (in bold)													
Food Item Specific (below)													
Unidentifiable													
Other	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	
Mucus													
Shrimp	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	
Crangon													
Grass Blades													
Unidentifiable													
Bait	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	
Anchovy													
Shrimp													
Vegetation	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	
Algae			13	12.6	26	4.6	8	4.4	129	6.0	11	9.6	
Amphipods									2	0.1			
Bark									10	0.5			
Blades									7	0.3			
Digested Material					1	0.2		1	0.6	1	0.05	2	1.8
Elodea			4	3.9	20	3.5		1	0.6	39	1.8	4	3.5
Fibers					1	0.2		2	1.1	31	1.4	2	1.8
grass					8	1.4		12	6.6	16	0.7	4	3.5
Grass Blades										6	0.3		
Grass like strands										10	0.5		

Metadata for StomachContents_orig.mdb

	Number of Stomachs Containing Food Item per Each Predator Species									
	Not Recorded	Brown Bullhead	Channel Catfish	Largemouth Bass	Smallmouth Bass	Squawfish	Striped Bass	White Catfish		
Food Item General (in bold)	44	2	103	565	4	181	2,140	114		
Food Item Specific (below)										
Leaves			1	1.0	30	5.3				
Melosira			14	13.6	15	2.7				
moss			3	2.9	1	0.2				
Mysids										
Plants										
Seed pod										
Seeds										
spirogyra										
Stems										
Sticks			3	2.9	19	3.4				
Unidentifiable			20	19.4	115	20.4				
Weeds			13	12.6	56	9.9	1	25.0		
Wood		1	50.0	3	2.9	26	4.6			
Wood bits										
Unidentifiable			1	1.0						
No General Category	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq	N	% of Freq
(none given)			1	1.0			43	2.0		
Unidentifiable							2	0.1		