A photograph of a boat on a river. In the foreground, a black Yamaha outboard motor is visible on the left, and a white cylindrical object is partially visible. The boat's deck is made of aluminum. In the background, a large yellow dredger is operating on the water. The sky is clear and blue.

# NOAA FISHERIES MANDATED FISH COMMUNITY AND DREDGE ENTRAINMENT MONITORING IN THE DELTA'S FEDERAL NAVIGATION CHANNELS: 2006-2009

Mari-Gold Environmental Consulting  
and  
Novo Aquatic Sciences

# National Marine Fisheries Service Biological Opinions

- ▣ Sacramento Deep Water Ship Channel Maintenance Dredging and Bank Protection project, August 29, 2006
- ▣ Stockton Deep Water Ship Channel Maintenance Dredging and Levee stabilization Project, April 4, 2006

# ACOE Response:

- ▣ Fish entrainment and fish community monitoring plan for the 2006 Stockton and Sacramento deepwater ship channel maintenance dredging project

# Monitoring Methodology

- ▣ Fish Community Sampling: Bottom Trawling
- ▣ Dredge Entrainment Sampling: Ponds and Screens

# Fish Community Sampling



# Project Area

## Dredge Reach & DMP Locations

- 2006
- 2007
- 2008
- 2009
- DMP



Image adapted from USACE SF District – Delta LTMS Program

# Overall Fish Community Catch

Rank	n	Proportion	Common Name	Origin
1	18,383	0.5733	white catfish	Introduced
2	5,025	0.1567	threadfin shad	Introduced
3	3,082	0.0961	striped bass	Introduced
4	2,233	0.0696	American shad	Introduced
5	1,499	0.0467	channel catfish	Introduced
6	918	0.0286	longfin smelt	Native
7	154	0.0048	wakasagi	Introduced
8	137	0.0043	yellowfin goby	Introduced
9	106	0.0033	white sturgeon	Native
10	94	0.0029	Shokihaze goby	Introduced
11	89	0.0028	shimofuri goby	Introduced
12	72	0.0022	starry flounder	Native
13	63	0.0020	tule perch	Native
14	36	0.0011	delta smelt	Native
15	29	0.0009	prickly sculpin	Native
16	19	0.0006	splittail	Native
17	17	0.0005	warmouth	Introduced
18	15	0.0005	common carp	Introduced
19	14	0.0004	blue catfish	Introduced
20	13	0.0004	lamprey	Native
21	10	0.0003	Sacramento blackfish	Native
22	9	0.0003	bluegill	Introduced
22	9	0.0003	brown bullhead	Introduced
23	5	0.0002	unidentified goby	Introduced
24	4	0.0001	Pacific staghorn sculpin	Native
25	3	0.0001	black crappie	Introduced
25	3	0.0001	white crappie	Introduced
26	2	0.0001	green sturgeon	Native
26	2	0.0001	redeer sunfish	Introduced
26	2	0.0001	Sacramento pikeminnow	Native
27	1	0.0000	bigscale logperch	Introduced
27	1	0.0000	inland silverside	Introduced
27	1	0.0000	largemouth bass	Introduced

Total: 32,067

Species: 32 (12 Native)

# Sturgeon

## Reach Location & Year Encountered

-  2006
-  2007
-  2008
-  2009



Man-Made Channel	
n	Year
1	2007
5	2009

Rio Vista	
n	Year
3	2006

Sandy Beach	
n	Year
3	2006

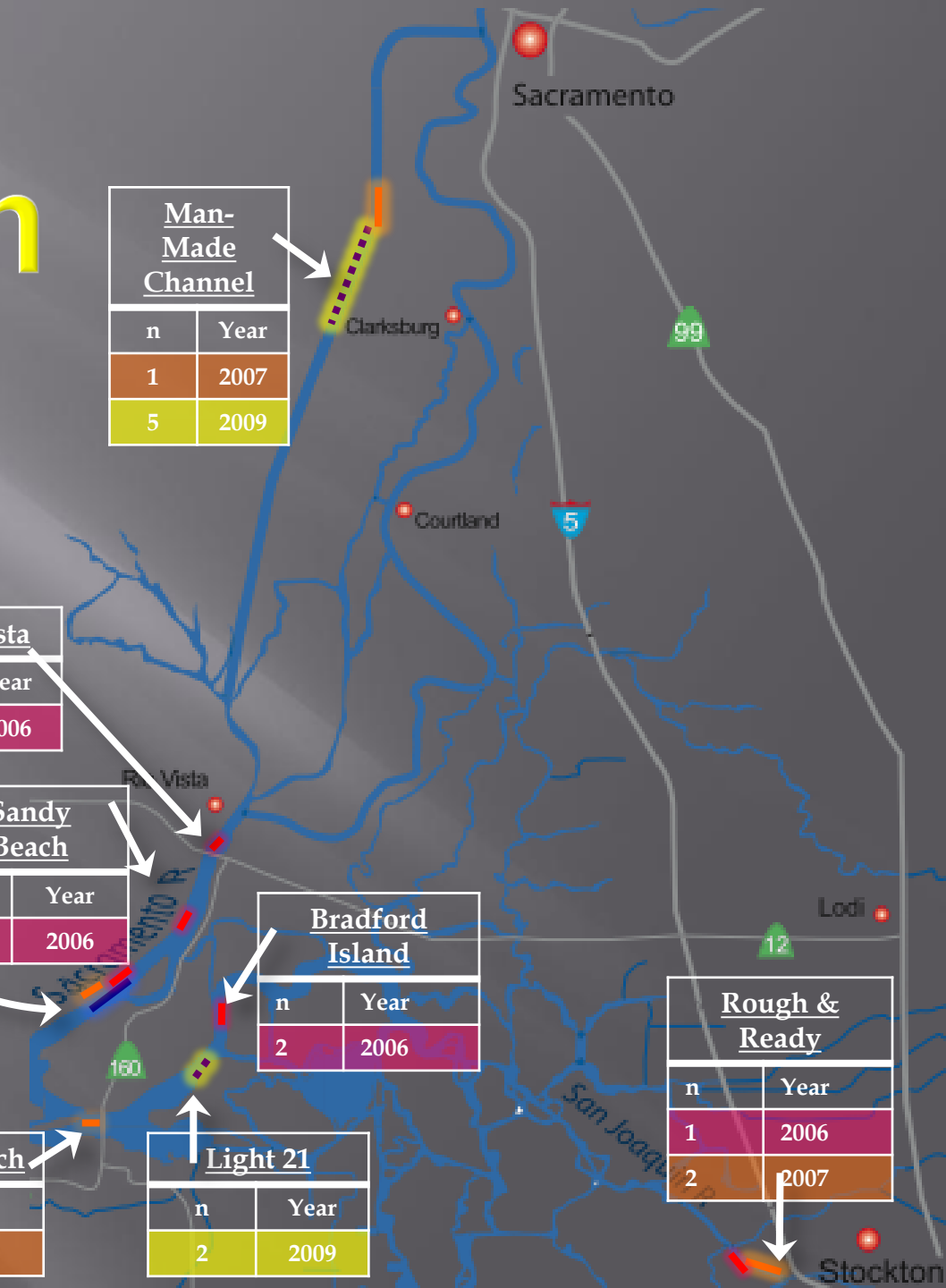
Decker Island	
n	Year
75	2006
2 (*GS)	2006
2	2007
7	2008

Bradford Island	
n	Year
2	2006

Rough & Ready	
n	Year
1	2006
2	2007

Scour/Antioch	
n	Year
3	2007

Light 21	
n	Year
2	2009



(\*GS) indicates green sturgeon; otherwise white sturgeon



# Delta Smelt

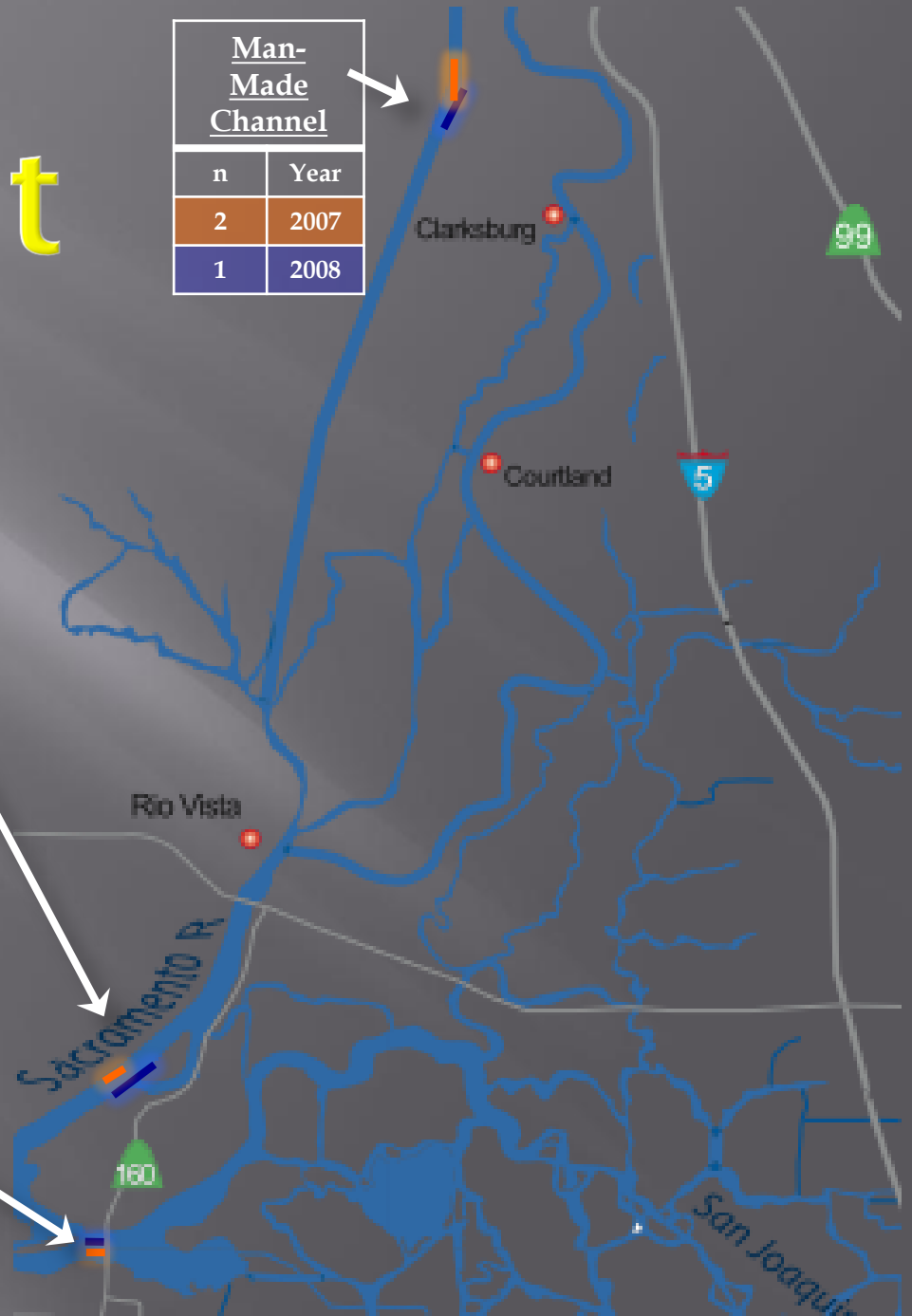
## Reach Location & Year Encountered

 2007  
 2008

Man-Made Channel	
n	Year
2	2007
1	2008

Decker Island	
n	Year
8	2007
21	2008

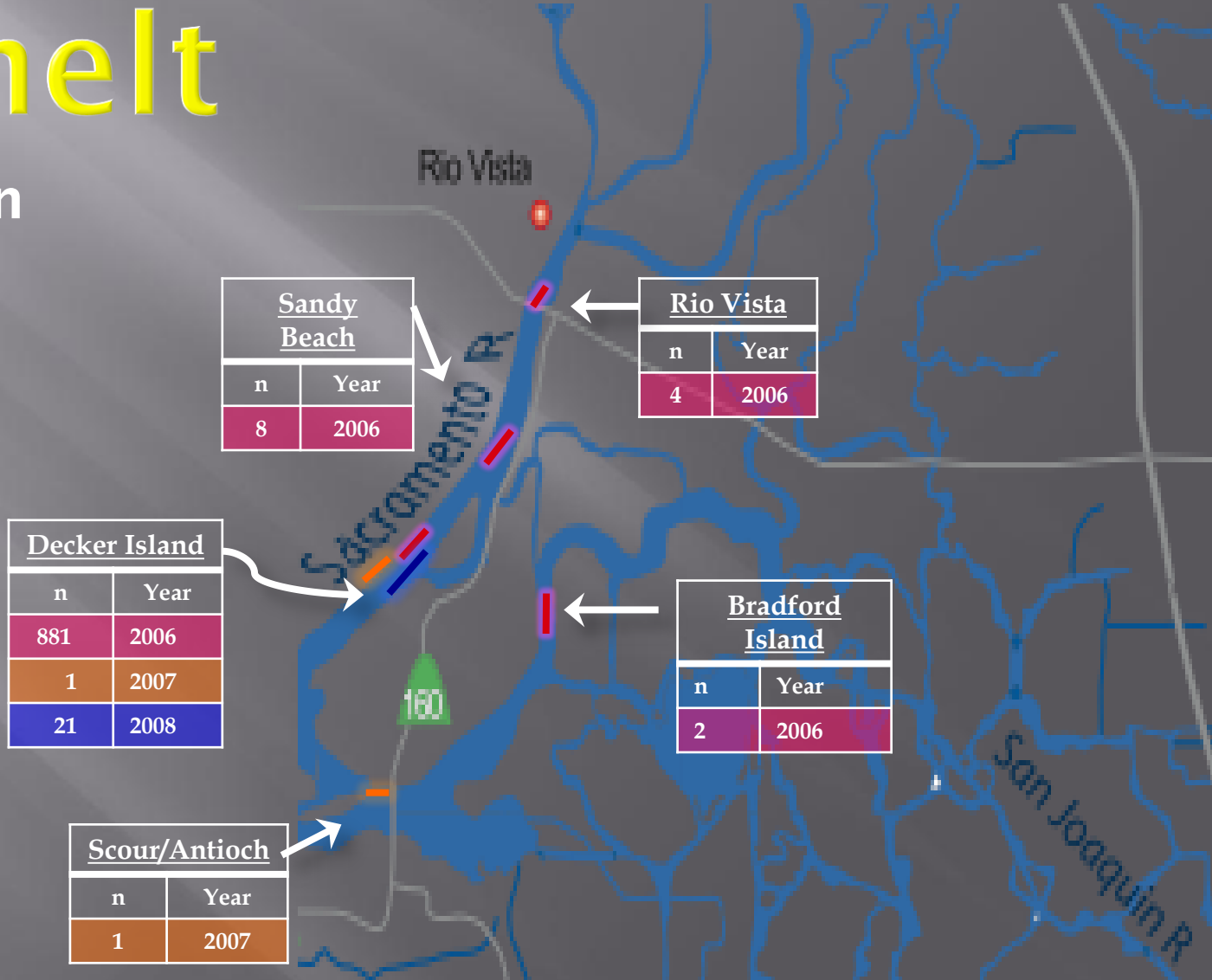
Scour/Antioch	
n	Year
1	2007
3	2008



# Longfin Smelt

## Reach Location & Year Encountered

- █ 2006
- █ 2007
- █ 2008



# Lamprey

## Reach Location & Year Encountered



Decker Island	
n	Year
21	2006
1	2007
14	2008

Scour/Antioch	
n	Year
1	2008

Sandy Beach	
n	Year
3	2006
2	2008

Rio Vista	
n	Year
3	2006

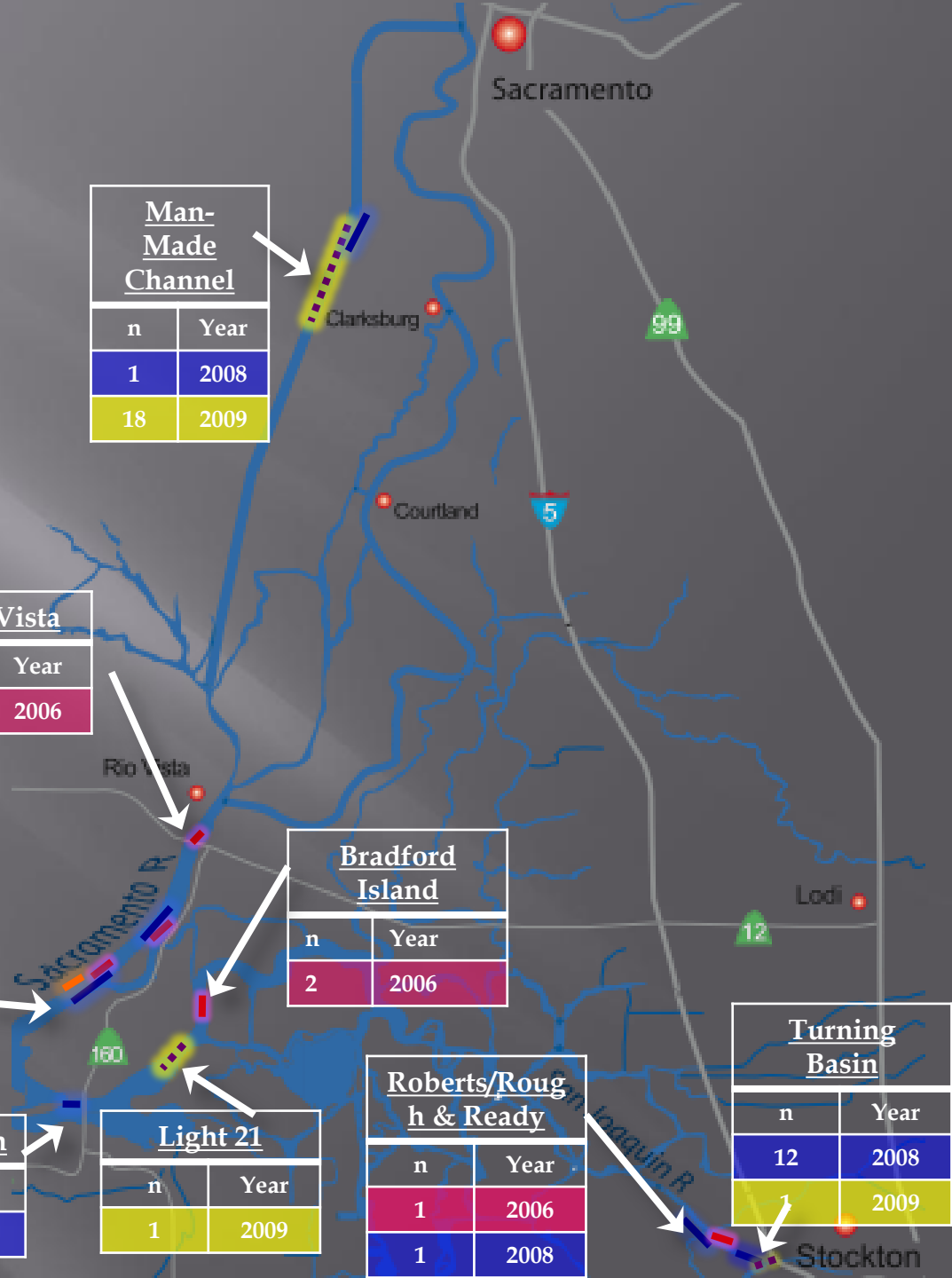
Light 21	
n	Year
1	2009

Man-Made Channel	
n	Year
1	2008
18	2009

Bradford Island	
n	Year
2	2006

Roberts/Rough & Ready	
n	Year
1	2006
1	2008

Turning Basin	
n	Year
12	2008
1	2009



# Splittail

## Reach Location & Year Encountered

-  2006
-  2007
-  2008
-  2009

Man-Made Channel	
n	Year
3	2009

Rio Vista	
n	Year
2	2006

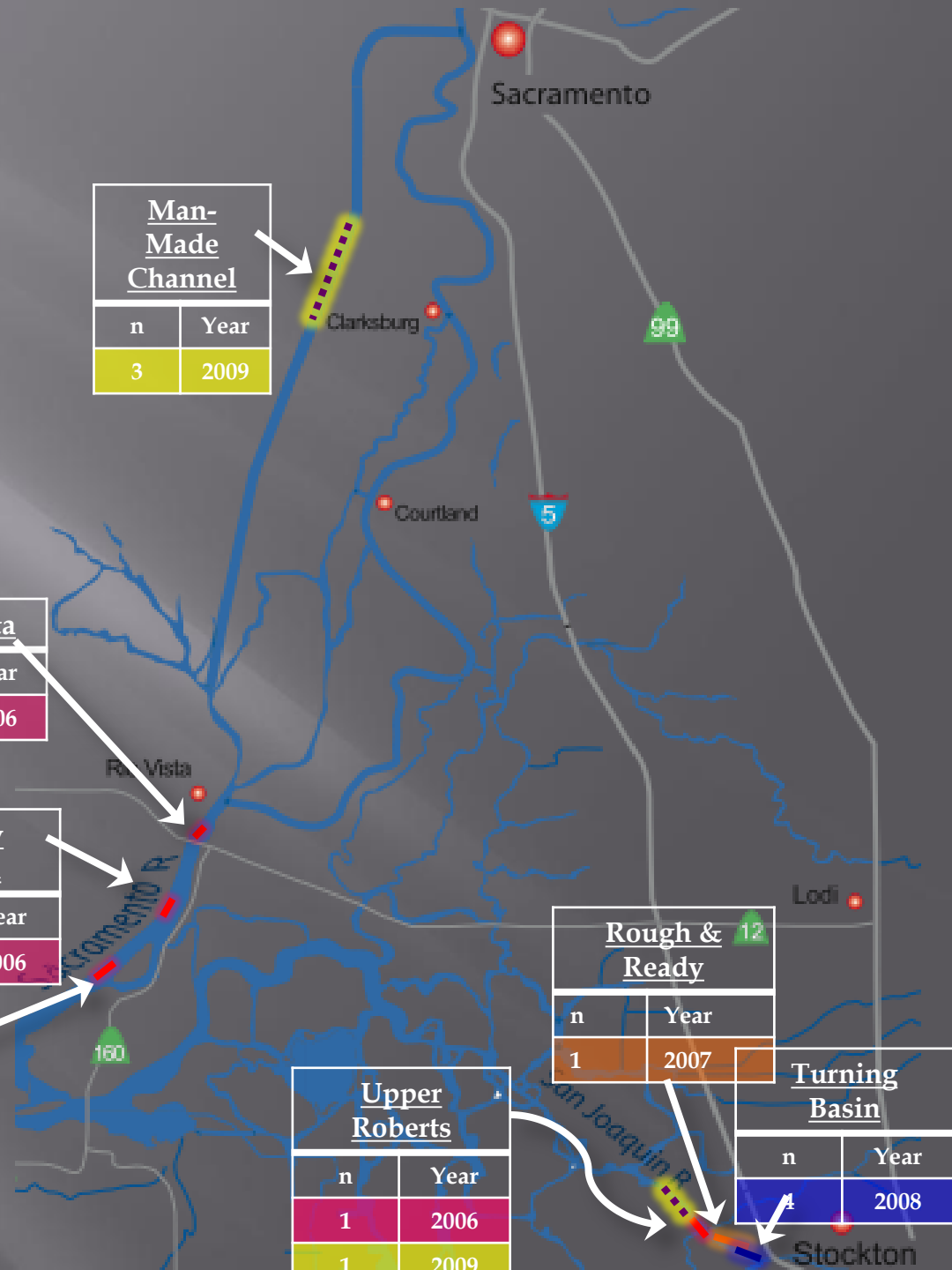
Sandy Beach	
n	Year
5	2006

Decker Island	
n	Year
2	2006

Upper Roberts	
n	Year
1	2006
1	2009

Rough & Ready	
n	Year
1	2007

Turning Basin	
n	Year
4	2008



# Sampling Pond



# Entrainment Screen



# Dredge Entrainment Sampling

<b>Rank</b>	<b>n</b>	<b>Proportion</b>	<b>Common Name</b>	<b>Origin</b>
1	267	0.3683	shimofuri goby	Introduced
2	226	0.3117	channel catfish	Introduced
3	92	0.1269	white catfish	Introduced
4	67	0.0924	lamprey	Native
5	29	0.0400	Shokihaze goby	Introduced
6	23	0.0317	yellowfin goby	Introduced
7	5	0.0069	brown bullhead	Introduced
7	5	0.0069	striped bass	Introduced
8	2	0.0028	bluegill	Introduced
8	2	0.0028	Pacific staghorn sculpin	Native
8	2	0.0028	prickly sculpin	Native
8	2	0.0028	warmouth	Introduced
9	1	0.0014	American shad	Introduced
9	1	0.0014	threadfin shad	Introduced
9	1	0.0014	wakasagi	Introduced

Total: 725

Species: 15 (3 Native)

# Delta Fish Not Encountered

Species	Origin	Utilizes Channel Bottom Habitat	Rare in the Delta
Sacramento sucker <i>Catostomus occidentalis</i>	Native	No	No
steelhead <i>Onchorhynchus mykiss</i>	Native	No	Yes
Chinook salmon <i>Onchorhynchus tshawytscha</i>	Native	No	Yes
hitch <i>Lavinia exilicauda</i>	Native	No	Yes
riffle sculpin <i>Cottus gulosus</i>	Native	No	No
hardhead <i>Mylopharodon conocephalus</i>	Native	No	Yes
threespine stickleback <i>Gasterosteus aculeatus</i>	Native	No	No
topsmelt <i>Atherinops affinis</i>	Native	No	No
California roach <i>Hesperoleucus symmetricus</i>	Native	No	No
speckled dace <i>Rhinichthys osculus</i>	Native	No	No
American eel <i>Anguila rostrata</i>	Introduced	Questionable	Yes
black bullhead <i>Ameiurus melas</i>	Introduced	Questionable	No
pumpkinseed <i>Lepomis gibbosus</i>	Introduced	No	No
green sunfish <i>Lepomis cyanellus</i>	Introduced	No	No
smallmouth bass <i>Micropterus dolemieu</i>	Introduced	No	No
spotted bass <i>Micropterus punctulatus</i>	Introduced	No	No
goldfish <i>Carrasius auratus</i>	Introduced	No	No
western mosquitofish <i>Gambusia affinis</i>	Introduced	No	No
rainwater killifish <i>Lucania parva</i>	Introduced	No	No
fathead minnow <i>Pimephales promelas</i>	Introduced	No	No



# Permitting

- ▣ Dredging
- ▣ Monitoring

# Related Projects

- ▣ Sacramento deepening project
- ▣ Stockton deepening project
- ▣ Delta LTMS

# Conservation

- ▣ Continue Development of BMP's
- ▣ More monitoring
- ▣ Mortality studies of entrained fish

# Unexpected Outcomes

- ▣ Delta Smelt and Longfin Smelt
- ▣ Lamprey
- ▣ Fish salvage

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