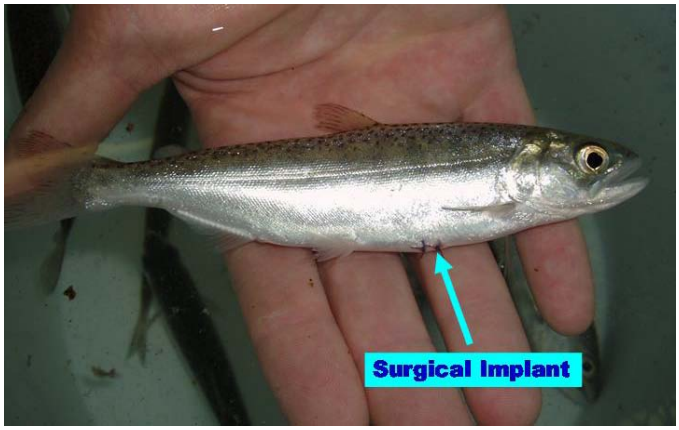
North/Central Delta Salmon Outmigration Study, 2008 - 2009: Predatory Fish Tagging and Mobile Telemetry Survey Results

Striped Bass (Photo: USFWS)



Acoustic-Tagged Chinook Salmon (Photo: Dave Vogel)

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David A. Vogel
Natural Resource Scientists, Inc.
P.O. Box 1210
Red Bluff, CA 96080
dvogel@resourcescientists.com

Introduction

During 2008 – 2009, Natural Resource Scientists, Inc. (NRS) participated in a large-scale juvenile Chinook salmon outmigration study (regional study) in the Sacramento – San Joaquin Delta in coordination with the California Department of Water Resources (DWR), the U.S. Geological Survey (USGS), U.S. Fish and Wildlife Service (USFWS), and the U.S. Bureau of Reclamation. During early phases of the study, NRS tagged predatory fish with acoustic transmitters in the Delta and conducted some mobile telemetry surveys in north Delta channels. Field portions of those tasks were only partially completed because of a stop-work order issued due to the State Bond freeze from December 2008 to July 2009. This interruption in the contract work affected the sequence and timing of total work. However, some data were collected but were not previously analyzed and reported.

The objectives of this document were to:

1) Process and report telemetry data collected within the acoustic receiver arrays[1] deployed throughout the Delta to determine the movements and behavioral characteristics of those predatory fish tagged with transmitters and,

2) Process and report mobile telemetry data collected during the field study prior to the stop-work order.

This report provides the combined results of predatory fish tagging and mobile telemetry surveys. It describes details on methodologies, where and when fish were tagged and released, descriptions of predatory fish movements throughout the Delta study area, and telemetry data collected during mobile telemetry surveys [e.g., tag location (latitude and longitude), tag ID, time of detection, and maps showing tag ID detection locations]. Because the regional study was not completed and analyses of acoustic-tagged juvenile salmon movements have yet to be completed, this document is largely a data report that will complement a potential future report on all study components.

Methods

Acoustic Telemetry Array

Fixed-station acoustic receivers were deployed and maintained by USGS and DWR personnel throughout the Delta but not all of those receivers were used for this predatory fish evaluation. Detailed locations for all those sites are provided by clicking on this Google™ Map (internet connection required). Only those receivers where predator tags were recorded were used for the study. The approximate locations of those receivers are shown in Figure 1 with detailed data provided in the previous Google™ Map.

[1] The U.S. Geological Survey provided data from those receivers where predator tags were detected. Those data sets were used for this task which required further processing by NRS to eliminate any false positive detections.

Figure 1. Locations of the fixed-station acoustic receivers used for predator detections during the 2008 - 2009 study.

Juvenile Salmon Tagging and Release

USGS and USFWS personnel conducted the tagging and release of juvenile salmon for the study. Those methods and data are not provided in this report.

Predatory Fish Tagging

Striped bass (*Morone saxatilis*) and largemouth bass (*Micropterus salmoides*) were captured by hook and line angling, externally tagged, and released at the capture sites in a variety of locations in the north Delta. The Hydroacoustic Technology, Inc. (HTI) Model 795LX acoustic transmitters were similar but larger (13 grams in air, 16 mm diameter x 48 mm long) than the HTI Model 795LE (1.5 grams in air, 9 mm diameter x 21 mm long) transmitters implanted in salmon smolts released during the regional study. The tagging techniques were similar to those described by Miranda et al. (2010). External tag attachment consisted of two plastic-coated stainless steel wires attached to the transmitter with a plastic plate and shrink-wrap tubing. The two wires were inserted through the musculature under the dorsal fin using hypodermic needles and held in place with two round plastic plates on the opposite side of the fish. Extruding wires were trimmed and crimped to hold the plates and transmitter in place (Figure 2). Each transmitter was labeled with the tag code and a phone number for anglers to call should the fish be caught. The predator transmitter batteries lasted for the duration of the study. Each transmitter was individually identifiable and did not overlap with the smolt transmitters. Movements of tagged predatory fish were monitored and recorded using the same fixed-station acoustic receiver network used to monitor movements of acoustic-tagged juvenile salmon (Figure 1).

Figure 2. A striped bass after external attachment of an acoustic transmitter under the dorsal fin.

Mobile Telemetry

Mobile telemetry was performed in some channels within the acoustic receiver array after equipment was installed and fish were released. The locations and relative effort for the mobile telemetry monitoring are provided in the Results Section for Observations on Mobile Telemetry Monitoring. The technique was developed from prior juvenile salmon telemetry studies in the Delta (e.g., Vogel 2010). The process generally involved anchoring a boat and temporarily suspending a cable and hydrophone approximately every ¼ mile in each reach or in the vicinity of potential predatory fish habitat. Operating a HTI Model 295 single-port receiver connected to the hydrophone for about 5 to 10 minutes at a fixed location helped to obtain a sufficient recording of any transmitters within detection range. GPS coordinates were noted for later data processing to document receiver positioning.

Data Processing

The acoustic telemetry receivers generate hourly raw acoustic tag data files (.rat files). These files alone do not provide useful data for analyses and, instead, are processed using the vendor's proprietary software program (MarkTags®) or USGS's variations of that program to evaluate collected data. All raw data were originally collected from the HTI acoustic receivers and processed by USGS staff. NRS staff received a full database with 546,524 detections DWR obtained from USGS. Using an in-house designed software program, USGS staff initially filtered through most false-positives detections of acoustic signals and "scores" were assigned to the good detections. USGS described a "score" as follows:

> Score - A score value that ranges from 0 to infinity that indicates a relative level of certainty in the detection. The more good points in the detection and the cleaner the detection, the higher the score. Detections with lower scores are weaker, less certain, and shorter than detections with higher scores.

However, after sorting and locating all predator tag codes by NRS, a considerably-reduced database of 3,181 tag detections was created. These detections were contained in 2,346 .rat files. Of those 3,181 detections, 54 were not viable. In some cases, even though the detection received a fairly good "score" (at least double-digits), the acoustic signal was not visible in the echograms. This may have been due to cases where 2 double-pulses were picked up or artificial underwater noise was present which could create a false-positive result.

All data were then processed manually by visually examining the echograms of electronically recorded tag detections using HTI's MarkTags® software (Ehrenberg and Steig 2003). This software was used to manually mark positive detections that determined the date and time when acoustic tags passed within detection ranges of submerged acoustic hydrophones. Using the HTI software program, a bookmark file (.bkm) for each valid tag detection was automatically created and consolidated. These consolidated data were used to create maps showing the sequential predator movements in specific regions of the Delta. Because there were multiple hydrophone arrays in many small geographic areas (primarily to ensure complete coverage of wide Delta channels or use of "dual-arrays" deployed for statistical detection probability purposes), some sites were truncated to identify a region (e.g., Chipps/Mallard Islands, San Andreas Shoal). Maps of predator movements within the regional study acoustic array are provided in Appendix A.

Mobile telemetry data were also processed manually by NRS using HTI's MarkTags® software to visually examine each echogram (Ehrenberg and Steig 2003). Of the 279 .rat files created during this portion of the study, 389 positive detections of test fish (acoustic-tagged juvenile salmon) were noted. Again, using HTI's MarkTags software, acoustic signals were marked to determine the date and time of detection by the mobile telemetry acoustic hydrophone. These data can be found in Appendix B.

Results and Discussion

Observations of Acoustic-Tagged Predatory Fish Movements

Acoustic-tagging of predatory fish was anticipated to provide information on striped bass and largemouth within the regional study area and possible affinity of those species to specific locales. In early phases of the study, considerable efforts were made to capture predatory fish over a wide geographic range in the Delta (e.g., within Georgiana Slough, Mokelumne Forks of the Delta, Steamboat and Sutter Sloughs, Miner Slough, Sacramento River in the vicinity of the Delta Cross Channel, False River, Horseshoe Bend, etc). Ultimately, the most productive region where appreciable numbers of these fish could be captured by hook and line angling was northern Cache Slough and within the southern portion of flooded Liberty Island.

During the study, 47 striped bass and 2 largemouth bass were tagged with individually identifiable acoustic transmitters and released at the fish capture locations. The locations of each of those fish release locations are provided by clicking on this Google™ Map (internet connection required). Table 1 provides the information on the tagged predatory fish, including species, fork length in mm, date/time of release, and location of release by landmark and latitude/longitude.

Table 1. Predatory fish tagged with acoustic transmitters during the 2008 – 2009 regional study in the north Delta.

Fish Species	Fork Length (mm)	Date/Time of Release	Location of Release	Latitude	Longitude
Striped Bass	450	11/11/08 13:15	Lower Cache Slough	38.26653	-121.69865
Striped Bass	445	11/18/08 10:13	Lower Cache Slough	38.26939	-121.70163
Striped Bass	430	11/18/08 11:22	Lower Cache Slough	38.26620	-121.69762
Striped Bass	560	11/18/08 13:15	Prospect Island	38.24294	-121.6814
Striped Bass	470	11/18/08 15:51	Georgiana Slough	38.13001	-121.58434
Striped Bass	430	11/19/08 9:25	Lower Cache Slough	38.26484	-121.696
Striped Bass	555	11/19/08 10:07	Lower Cache Slough	38.27110	-121.70243
Striped Bass	515	11/19/08 10:45	Lower Cache Slough	38.26593	-121.69667
Striped Bass	430	11/19/08 11:22	Lower Cache Slough	38.26817	-121.69904
Striped Bass	406	11/19/08 11:25	Miner Slough	38.25490	-121.654717
Largemouth Bass	330	11/20/08 12:15	Georgiana Slough	38.14950	-121.591667
Striped Bass	670	11/24/08 15:30	Mouth of Miner Slough	38.23472	-121.67133
Largemouth Bass	360	11/24/08 15:32	Mouth of Miner Slough	38.23380	-121.66996
Striped Bass	490	11/25/08 9:15	Prospect Island	38.24439	-121.67973
Striped Bass	510	11/25/08 11:08	Lower Cache Slough	38.25624	-121.69078
Striped Bass	540	11/25/08 11:20	Lower Cache Slough	38.25552	-121.68999
Striped Bass	505	11/25/08 11:30	Lower Cache Slough	38.25542	-121.68999
Striped Bass	430	11/25/08 11:40	Lower Cache Slough	38.25529	-121.68959
Striped Bass	505	11/25/08 11:51	Lower Cache Slough	38.25460	-121.68915
Striped Bass	470	11/25/08 12:30	Lower Cache Slough	38.24788	-121.68787
Striped Bass	420	12/2/08 14:40	Lower Cache Slough	38.25611	-121.69235
Striped Bass	440	12/2/08 14:58	Lower Cache Slough	38.25575	-121.69064
Striped Bass	400	12/2/08 15:24	Lower Cache Slough	38.25082	-121.68867
Striped Bass	580	12/2/08 15:36	Lower Cache Slough	38.24889	-121.68838
Striped Bass	660	12/2/08 16:11	Lower Cache Slough	38.25527	-121.68968
Striped Bass	500	12/2/08 16:35	Lower Cache Slough	38.25127	-121.6888
Striped Bass	415	12/3/08 8:44	Lower Cache Slough	38.25611	-121.69225
Striped Bass	430	12/3/08 9:47	Mouth of Prospect Island	38.24265	-121.68177
Striped Bass	405	12/3/08 9:50	Mouth of Prospect Island	38.24311	-121.6813
Striped Bass	685	12/3/08 10:30	Mouth of Prospect Island	38.24357	-121.68034
Striped Bass	540	12/3/08 10:54	Prospect Island	38.24686	-121.67803
Striped Bass	500	12/3/08 13:13	Prospect Island	38.24314	-121.68095
Striped Bass	480	12/4/08 12:23	Lower Prospect Slough	38.24362	-121.68034
Striped Bass	420	12/10/08 10:50	Mouth of Liberty Island	38.24245	-121.68208
Striped Bass	405	12/10/08 11:38	Lower Cache Slough	38.25588	-121.69077
Striped Bass	350	12/10/08 11:55	Lower Cache Slough	38.25320	-121.68873
Striped Bass	470	12/10/08 12:39	Lower Cache Slough	38.24299	-121.68138
Striped Bass	620	12/10/08 13:40	Lower Cache Slough	38.25522	-121.6895
Striped Bass	410	12/10/08 15:23	Lower Cache Slough	38.25577	-121.69032
Striped Bass	650	12/10/08 15:43	Lower Cache Slough	38.25092	-121.68877
Striped Bass	360	12/10/08 15:55	Lower Cache Slough	38.24993	-121.68775
Striped Bass	360	12/10/08 16:36	Mouth of Liberty Island	38.24240	-121.68286
Striped Bass	505	12/17/08 15:20	Mouth of Liberty Island	38.24278	-121.68299
Striped Bass	400	12/17/08 15:30	Mouth of Liberty Island	38.24284	-121.68296
Striped Bass	430	12/17/08 15:38	Mouth of Liberty Island	38.24286	-121.68298
Striped Bass	470	12/18/08 9:26	Mouth of Liberty Island	38.24360	-121.68275
Striped Bass	485	12/18/08 9:50	Mouth of Liberty Island	38.24359	-121.68279
Striped Bass	555	12/18/08 10:03	Mouth of Liberty Island	38.24361	-121.68282
Striped Bass	455	12/18/08 12:02	Mouth of Liberty Island	38.24365	-121.68291

Tagged predatory fish exhibited a wide variety of behaviors based on movements detected by the acoustic-telemetry array throughout the study area. Of the 47 striped bass tagged, 30 were detected by one or more receivers in the regional study's telemetry array; of the two largemouth bass tagged, only one was detected which remained relatively stationary. Striped bass were not stationary and observed migrating long distances throughout the Delta. For example, many striped bass tagged and released near Liberty Island in Cache Slough migrated downstream to Chipps Island, a distance of approximately 22 river miles. Of 29 striped bass released in or near Cache Slough, 23 (79%) migrated downstream to Chipps Island. Of the 24 striped bass reaching Chipps Island (including one fish released in lower Georgiana Slough, 21 (88%) were detected multiple times by the acoustic receivers at the site over long periods (e.g., weeks) and the fish appeared to have an affinity to the area. Of the 24 striped bass detected near Chipps Island, 10 (42%) of the fish were detected to have moved back upstream at least once based on receivers placed in farther upstream locations. Of 29 striped bass released on the Sacramento River side of the Delta, 5 (17%) of the fish were detected to have migrated over to the San Joaquin side of the Delta at least once. Several striped bass migrated from Cache Slough to Chipps Island only to return back to Cache Slough. In four instances, striped bass moved from Cache Slough to Chipps Island, back to Cache Slough, then back to Chipps Island.

Maps with narrative descriptions of the movements for each detected predatory fish are provided in Appendix Figures 1 – 31. These maps provide detailed data on the size of the fish in fork length, acoustic tag codes, date and time of release, and the dates and times of detection at each fixed-station receiver with corresponding locations in the study area. The maps and associated discussion generally progresses from relatively simple fish movements to some of the most complex movements.

Assuming the regional study's processing of juvenile salmon detections are eventually completed, a principal originally-intended result from the statistical analysis of the acoustic receiver data are juvenile salmon survival estimates from each of the instrumented reaches in the Delta. Valid survival estimates generated from the data collected by the acoustic receivers require that false positive detections are not inadvertently used to assume survival of acoustic-tagged salmon passing a receiver. If acoustic-tagged salmon are consumed by a predator and the predator subsequently swims past an acoustic receiver, the dead salmon could be incorrectly identified as a live fish thereby causing false positive detections. These occurrences would result in biased high survival estimates for juvenile salmon. Based on data analyses, these circumstances likely occurred during relatively recent Vernalis Adaptive Management Program (VAMP) acoustic telemetry studies (Vogel 2010, 2011). This issue is one of the greatest challenges in using the existing acoustic telemetry equipment in the Delta and has not yet been resolved. Additionally, if data collected by the existing acoustic receiver network are assumed to be characteristic of juvenile salmon behavior, but in actuality represent predatory fish behavior, subsequent computer models based on those data would be in error. Furthermore, a fundamental question associated with the salmon survival estimates is the stationarity of the predator field and, by association, the stationarity of the survival estimates. If the predators are highly mobile and congregate in different regions in the Delta at different times of the year, then the survival estimates will vary depending on the spatial and temporal variability of the predator fields.

Observations on Mobile Telemetry Monitoring

Table 2 provides the locations and relative effort for mobility telemetry monitoring during the regional study.

Table 2. Mobile telemetry monitoring effort during the regional study.

	Region	Start	End	Notes
1	Georgiana Slough	12/1/2008 11:39	12/1/2008 17:45	Begin at B & W Marina upstream to the Sacramento River.
2	Steamboat Slough	12/5/2008 10:30	12/5/2008 14:02	Begin at Cache Slough confluence upstream to confluence with Sutter Slough.
3	Sutter Slough	12/8/2008 11:34	12/8/2008 15:38	Begin at confluence with Steamboat Slough upstream to confluence with Miner Slough.
4	Miner and Sutter Sloughs	12/9/2008 10:01	12/9/2008 14:12	Begin at mouth of Miner Slough upstream to Sutter Slough then downstream to confluence of Steamboat Slough.
5	Georgiana Slough	12/11/2008 8:39	12/11/2008 13:40	Begin at confluence with Mokelumne River upstream to the Sacramento River.
6	Steamboat Slough	12/15/2008 10:38	12/15/2008 15:23	Begin at mouth of Steamboat Slough upstream to confluence with the Sac. River.
7	Lower Cache Slough	12/16/08 13:05	12/16/08 13:46	Near southern Liberty Island
8	Northern Georgiana Slough	12/19/08 7:39	12/19/08 9:22	Begin 1 mile downstream of release site in middle of bend. Then upstream to .7 miles above release site.
9	Sutter Slough	12/19/08 10:19	12/19/08 12:02	Begin at confluence with the Sacramento River then downstream to confluence with Miner Slough.
10	Georgiana Slough	12/30/08 12:17	12/30/08 15:24	Begin at confluence with the Mokelumne River then upstream to just upstream of Georgiana Slough fish release site.
11	Sutter Slough	12/31/08 10:37	12/31/08 12:35	Begin at confluence of Sutter and Steamboat Sloughs. Then upstream to approx. 1.4 miles downstream of the Sacramento River confluence.
12	Georgiana Slough	1/5/09 13:38	1/5/09 15:42	Begin at confluence with the Mokelumne River then upstream approx. 1.7 miles.
13	Georgiana Slough	1/6/09 11:39	1/6/09 15:21	Begin at mouth of Oxbow Marina upstream to just below fish release site.
14	Georgiana Slough	1/7/09 10:24	1/7/09 11:00	Begin approx. 3.35 river miles downstream of the Sacramento River just below sharp bend. Then downstream to confluence of the Mokelumne River.
15	West Sacramento	1/8/09 9:58	1/8/09 14:35	Begin approx. 40 yards upstream of Tower Bridge downstream approx. 2.7 miles.
16	Miner Slough	1/9/09 8:01	1/9/09 12:06	Begin in Cache Slough at mouth to Miner Slough then upstream to confluence with Sutter Slough.
17	Steamboat Slough	1/12/09 13:02	1/12/09 15:51	Begin at mouth of Steamboat Slough and end approx. 2.7 miles upstream.
18	Sacramento River Nr Freeport	1/13/09 10:14	1/13/09 13:41	Begin at water discharge outfall downstream approx. 3.8 miles.
19	Steamboat Slough	1/14/09 10:16	1/14/09 14:41	Begin at Snug Harbor then upstream approx. 4.2 miles.
20	Steamboat Slough	1/15/09 9:11	1/15/09 12:58	Begin approx. 1/4 mile from previous day upstream to approx. 200 yards from Steamboat Slough Bridge and the Sacramento River.
21	Georgiana Slough	1/19/09 12:33	1/19/09 15:57	Begin at confluence of the Mokelumne River then upstream to Oxbow Estates.
22	Sacramento River	1/20/09 10:40	1/20/09 13:56	Begin at water discharge outfall downstream to town of Clarksburg.
23	Georgiana Slough	1/21/09 9:49	1/21/09 15:18	Begin at Oxbow Estates then upstream to just below fish release site.
24	Georgiana Slough	1/22/09 9:16	1/22/09 12:16	Begin at fish release site then upstream to the Sacramento River.

Figure 3 shows a map with locations where acoustic-tagged juvenile salmon released during the regional study were detected by mobile telemetry. Appendix B provides detailed data on each of those detections, including tag codes and latitude/longitude. A much-more detailed map of the telemetry data is provided by clicking on this Google™ Map (internet connection required).

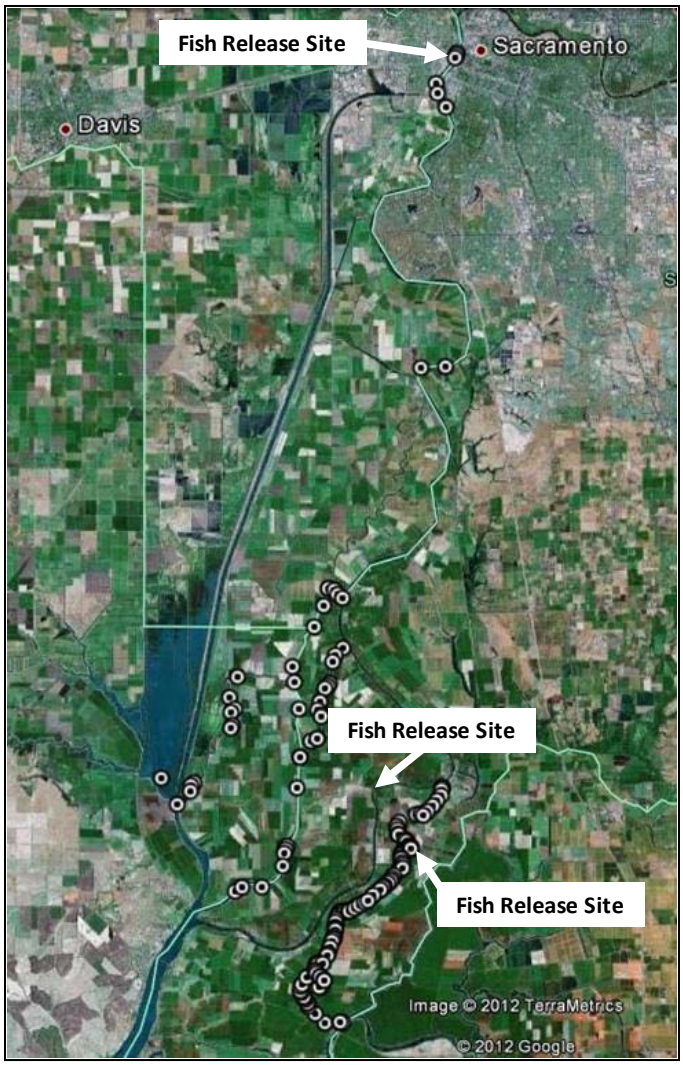

Figure 3. Locations of acoustic-tagged juvenile salmon detected by mobile telemetry surveys conducted during the 2008 – 2009 regional study. Release sites of acoustic-tagged salmon are shown at Sacramento, Ryde, and northern Georgiana Slough. Refer to Appendix B and the above-referenced Google™ Map for detailed data.

Mobile telemetry results obtained in Georgiana Slough were particularly interesting. Based on several surveys conducted in the Slough, it appears there was a very high mortality of acoustic-tagged salmon in that region. A high concentration of tags was found in the general vicinity near and downstream of the salmon release site in northern Georgiana Slough. Prior to the regional study, Natural Resource Scientists, Inc. recommended releasing acoustic-tagged salmon far removed from the general vicinity of a large, deep scour hole on an unusually sharp 90° river bend in northern Georgiana Slough. Concern was expressed that releasing juvenile salmon near that region could result in abnormally high rates of predation on test fish shortly after release. Through prior studies conducted by releasing radio-tagged juvenile salmon (Vogel 2001, 2004)

and acoustic-tagged salmon (Vogel 2008) and sonar readings in the area, that general locality was believed to harbor large numbers of predatory fish in the scour hole and in upstream and downstream areas. This circumstance may partially account for the high numbers of acoustic tags found in that area for extended periods after initial release. It could not be determined if those tags were defecated tags or tags inside predatory fish.

Flow through Georgiana Slough is unidirectional despite the influence of tides. During the three previous studies of releasing radio-tagged juvenile salmon (Vogel 2001, 2004) and acoustic-tagged salmon (Vogel 2008), salmon moved rapidly downstream after release in northern Georgiana Slough with most fish reaching the Mokelumne River confluence in less than 48 hours after release. Examination of the elapsed period between the times of individual salmon released in Georgiana Slough for the regional study and the time of tag detection in Georgiana Slough revealed that a large number of fish were likely eaten by predators or died for unknown reasons. Of 218 tags detected in Georgiana Slough originating from the northern Slough release, 204 (94%) were detected 48 hours or longer after release. The vast majority of those tags were detected still within Georgiana Slough many days after release. Among the 204 tags, the average time from time of release to last detection in the Slough was 257 hours, 50 minutes (S.D. = 171 hours, 50 minutes).

Because other regions of the Delta surveyed by mobile telemetry (Table 2) were subject to tidal influence, fish transit times from release sites to detection locations were more difficult to evaluate compared to Georgiana Slough fish transit times because of tidal seiching causing the fish to move back and forth large distances with the twice daily flood and ebb tides (e.g., Vogel 2004). In addition, the regional study's original plan for mobile telemetry was to frequent many of the same areas repeatedly to determine if some tags may accumulate in certain regions suggesting locations where tags were defecated after consumption by predatory fish. However, the stop-work order mentioned previously truncated the number of occasions those surveys could be conducted.

Conclusions and Recommendations

Data on striped bass movements collected during this study amply demonstrate that these predatory fish are highly migratory throughout the Delta, moving large distances including a very high percentage of striped bass emigrating westerly (downstream) to Chipps Island. This finding contests the assumption that predators tend to be stationary and refutes the reliability of the methodology used to determine juvenile survival estimates. For example, in another study of acoustic-tagged salmon released in the Delta to estimate survival, Perry et al. (2010) screened out only five tags detected to have moved in an upstream direction against the flow, but did not account for the possibility of striped bass eating tagged salmon moving in a downstream direction. All other detections in that study were assumed to be live juvenile salmon.[2] During prior VAMP studies, concerns were expressed that an acoustic-tagged salmon consumed by a predator that subsequently swims past a fixed-station receiver would erroneously be misinterpreted as a live salmon, instead of a dead salmon (or the transmitter) in the predator's stomach (Vogel 2010, 2011). The Chipps Island area in the western Delta was the regional

[2] After accounting for consistent spatiotemporal history of tagged fish moving through the Delta telemetry array.

study's originally-intended terminus to estimate salmon survival through the Delta. Therefore, the results from this predator study and the 2009 and 2010 VAMP striped bass tagging results which showed similar behavior, indicate that caution must be used when estimating juvenile salmon survival to Chipps Island based on acoustic telemetry data. A technological advancement in acoustic transmitters should be actively pursued to provide empirical evidence of when an acoustic-tagged salmon is eaten by a predator to avoid bias in salmon survival estimates.

Mobile telemetry is a useful tool for identifying locations of high predation or other anomalies in acoustic tag detections and fish behavior. The original study design for the regional Delta study was intended to quantify fish survival/mortality within and between long reaches in the Delta, but not specifically where and how mortality occurs. Mobile telemetry was intended to complement the overall study design by locating areas where transmitters were found between the fixed-station acoustic receivers. It was determined that a large number of acoustic-tagged salmon died within Georgiana Slough, presumably attributable to predation but that assumption could not be verified; other factors such as effects of tag implantation may have played a role. Although beyond the scope of this report, the value of mobile telemetry data collected during this study will not be realized until it is integrated with presently-unavailable results of tracking of acoustic-tagged salmon throughout the regional study's telemetry array.

Acknowledgements

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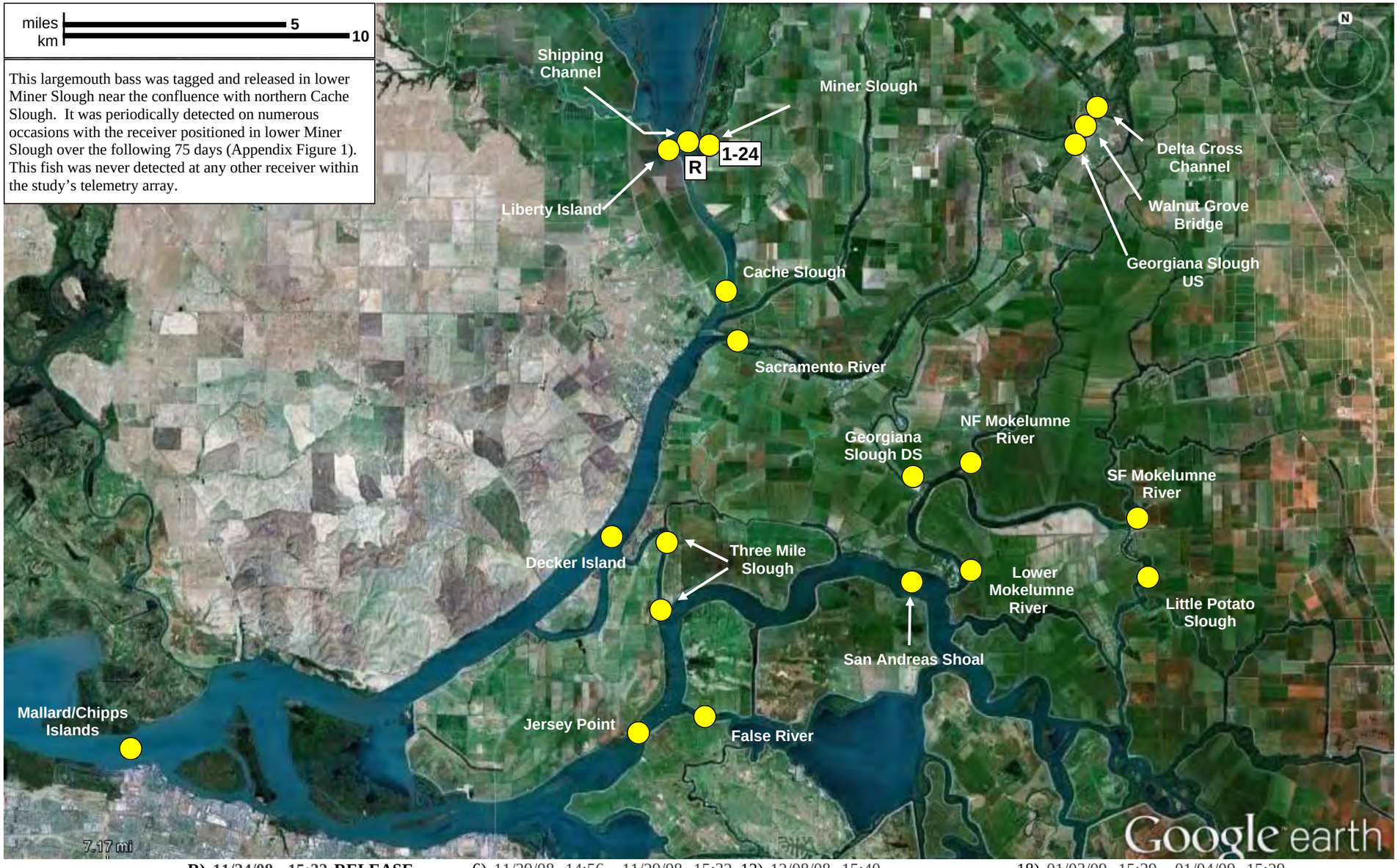
APPENDIX A

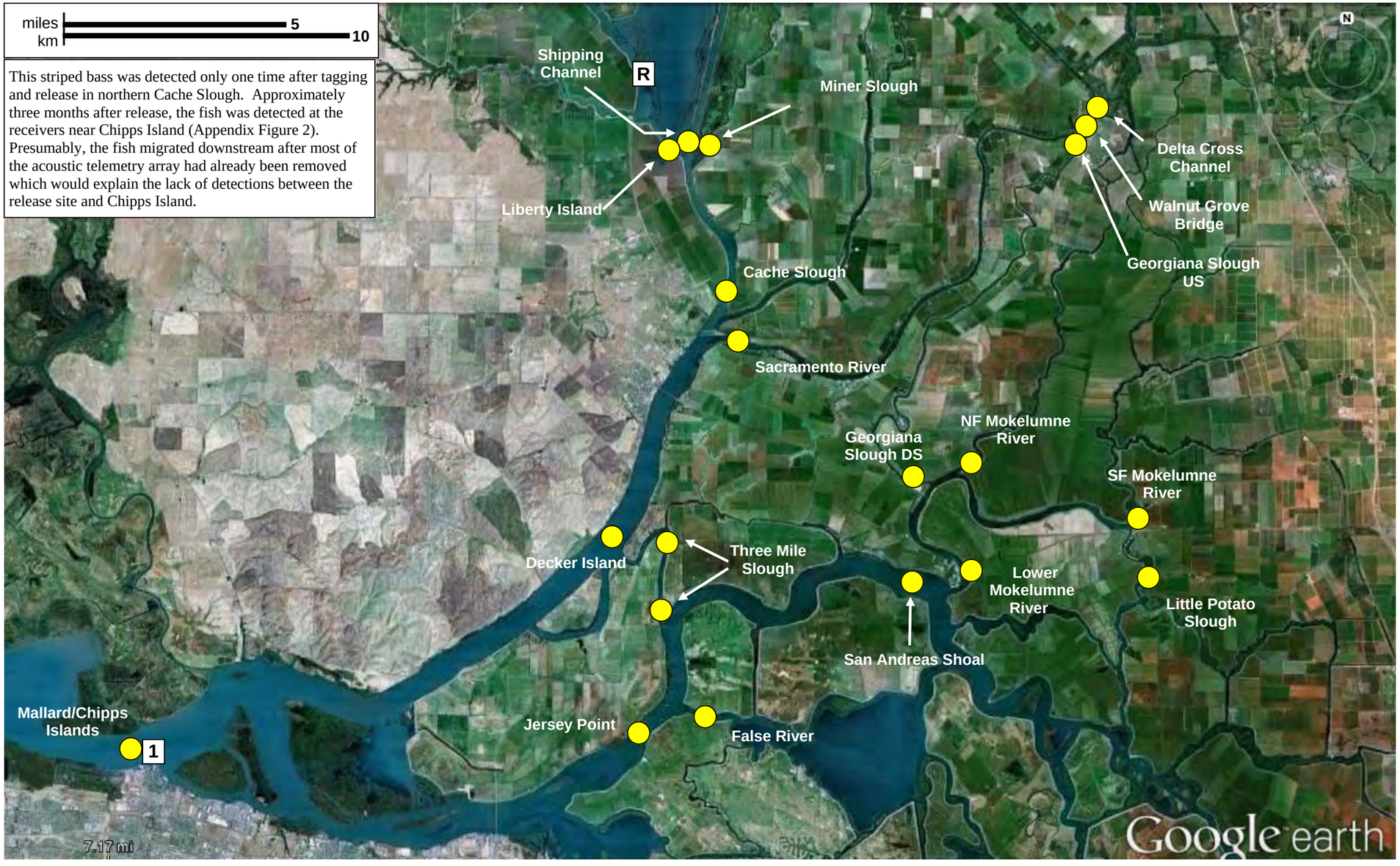
Largemouth Bass (360 mm) Tag Code 5003.09



R)	**11/24/08**	**15:32**	**RELEASE**		6)	11/29/08	14:56	-	11/29/08	15:32	12)	12/08/08	15:40			18)	01/03/09	15:39	-	01/04/09	15:29
1)	11/26/08	10:54	-	11/26/08	12:50	7)	11/30/08	15:48	-	12/01/08	9:54	13)	12/09/08	7:52	-	12/11/08	13:03	19)	01/11/09	10:43	-	01/11/09	12:35
2)	11/27/08	17:54	-	11/27/08	18:01	8)	12/01/08	11:09				14)	12/12/08	8:46	-	12/12/08	11:12	20)	01/14/09	10:41	-	01/15/09	2:02
3)	11/28/08	7:14				9)	12/04/08	12:47	-	12/04/08	15:01	15)	12/14/08	14:20				21)	01/15/09	7:27	-	01/15/09	21:02
4)	11/28/08	10:11				10)	12/06/08	16:57	-	12/07/08	13:03	16)	12/16/08	8:39	-	12/17/08	4:22	22)	01/16/09	0:44	-	01/16/09	17:03
5)	11/28/08	12:28	-	11/28/08	13:01	11)	12/08/08	10:32	-	12/08/08	12:01	17)	12/17/08	7:26	-	12/19/08	7:02	23)	01/20/09	16:47	-	01/20/09	17:08
																		24)	02/02/09	12:56	-	02/03/09	7:09

Appendix Figure 1. Movements of acoustic tagged largemouth bass No. 5003.09 in the Delta during the 2008 - 2009 Regional Study.
R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

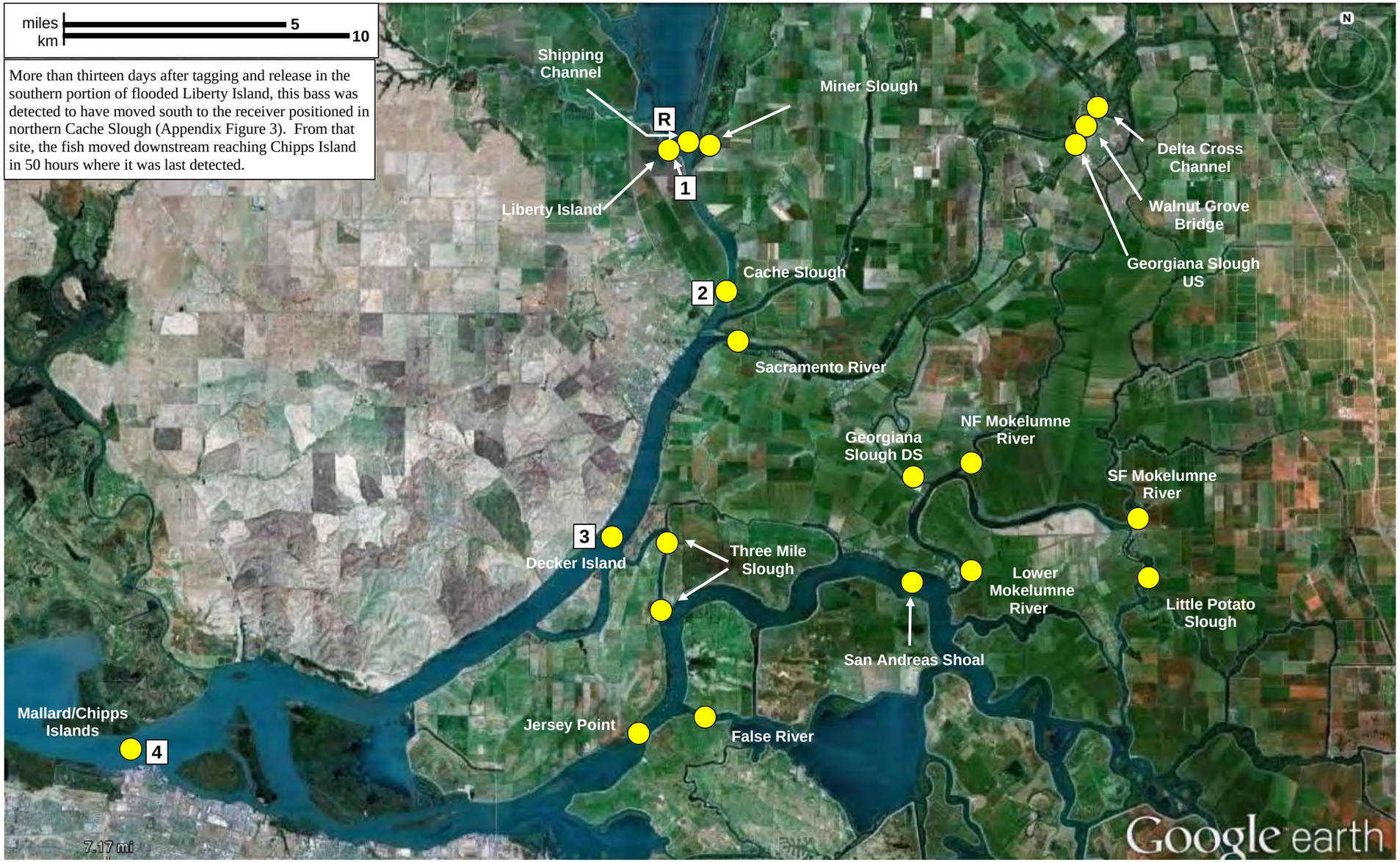
Striped Bass (510 mm) Tag Code 5142.04



R) **11/25/08** **11:08** **RELEASE**
1) 02/23/09 18:02

Appendix Figure 2. Movements of acoustic tagged striped bass No. 5142.04 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

Striped Bass (420 mm) Tag Code 5504.01

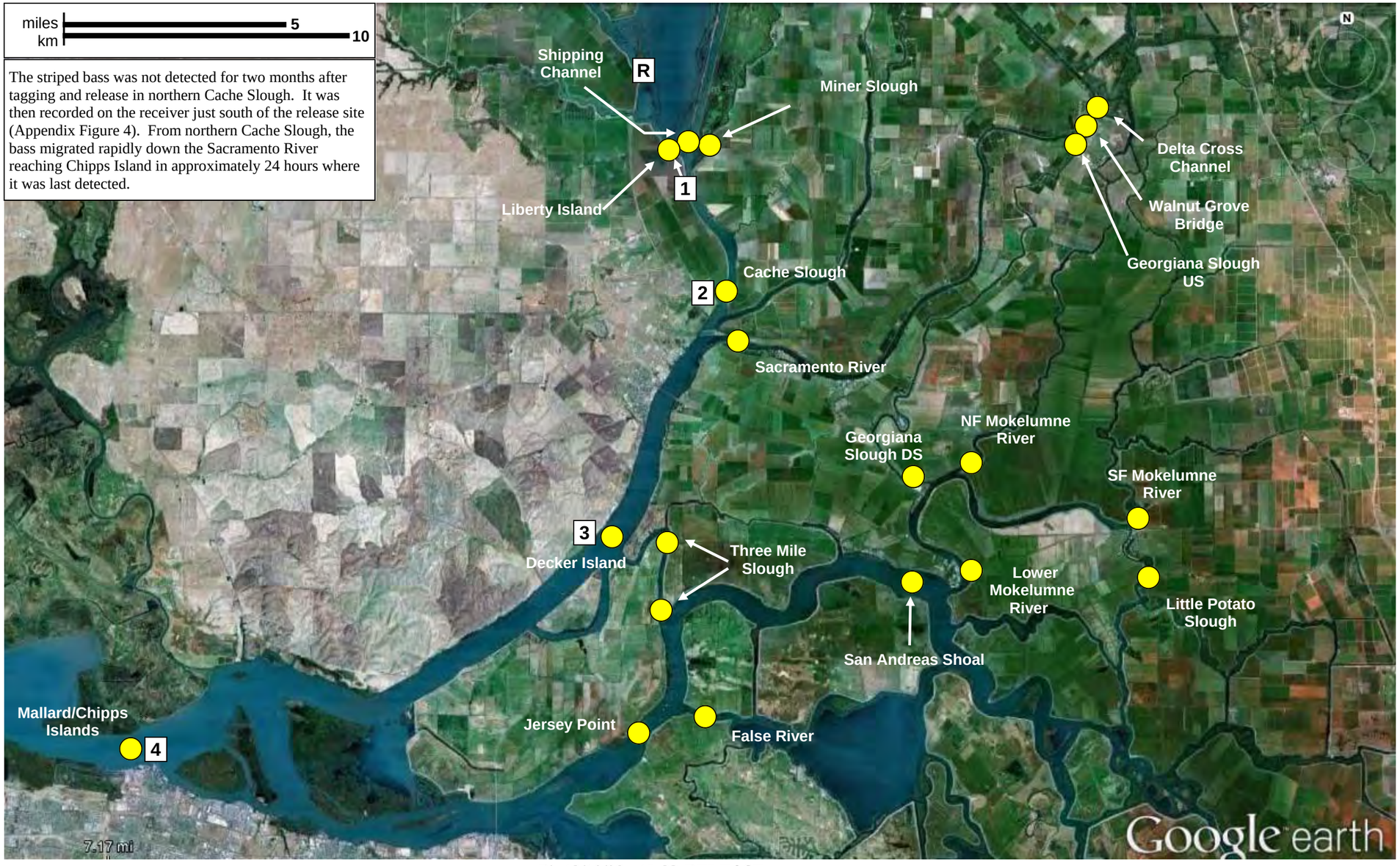


R) 12/18/08 10:03 RELEASE

1)	12/31/08	23:21 -	12/31/08	23:26
2)	01/01/09	1:16 -	01/01/09	1:22
3)	01/01/09	15:17 -	01/01/09	16:00
4)	01/03/09	1:32 -	01/03/09	2:41

Appendix Figure 3. Movements of acoustic tagged striped bass No. 5504.01 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

Striped Bass (410 mm) Tag Code 5163.07

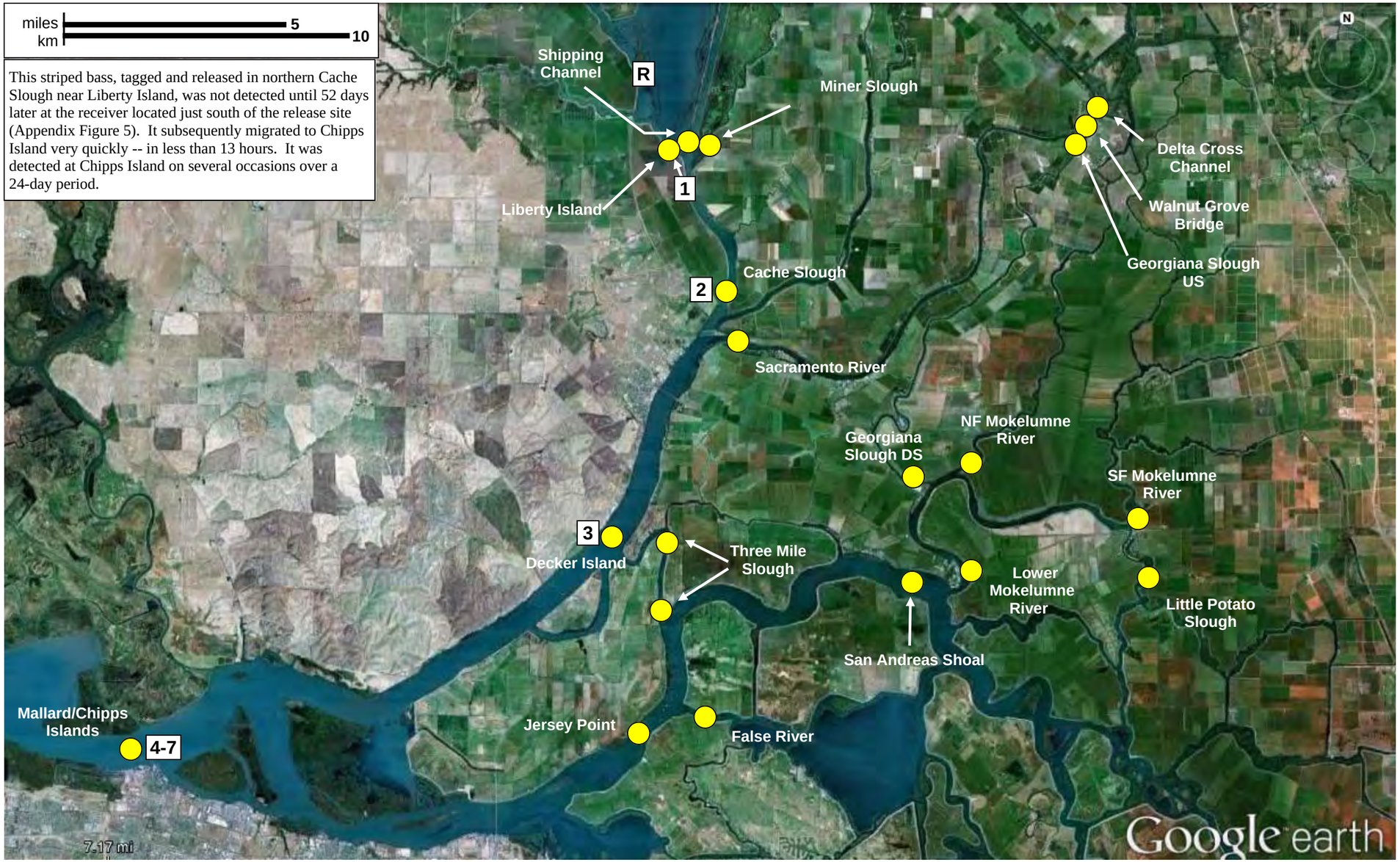


R) 12/10/08 15:23 RELEASE

1)	02/10/09	8:52	-	02/10/09	8:54
2)	02/10/09	10:35	-	02/10/09	10:43
3)	02/10/09	19:23	-	02/10/09	19:36
4)	02/11/09	9:31			

Appendix Figure 4. Movements of acoustic tagged striped bass No. 5163.07 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

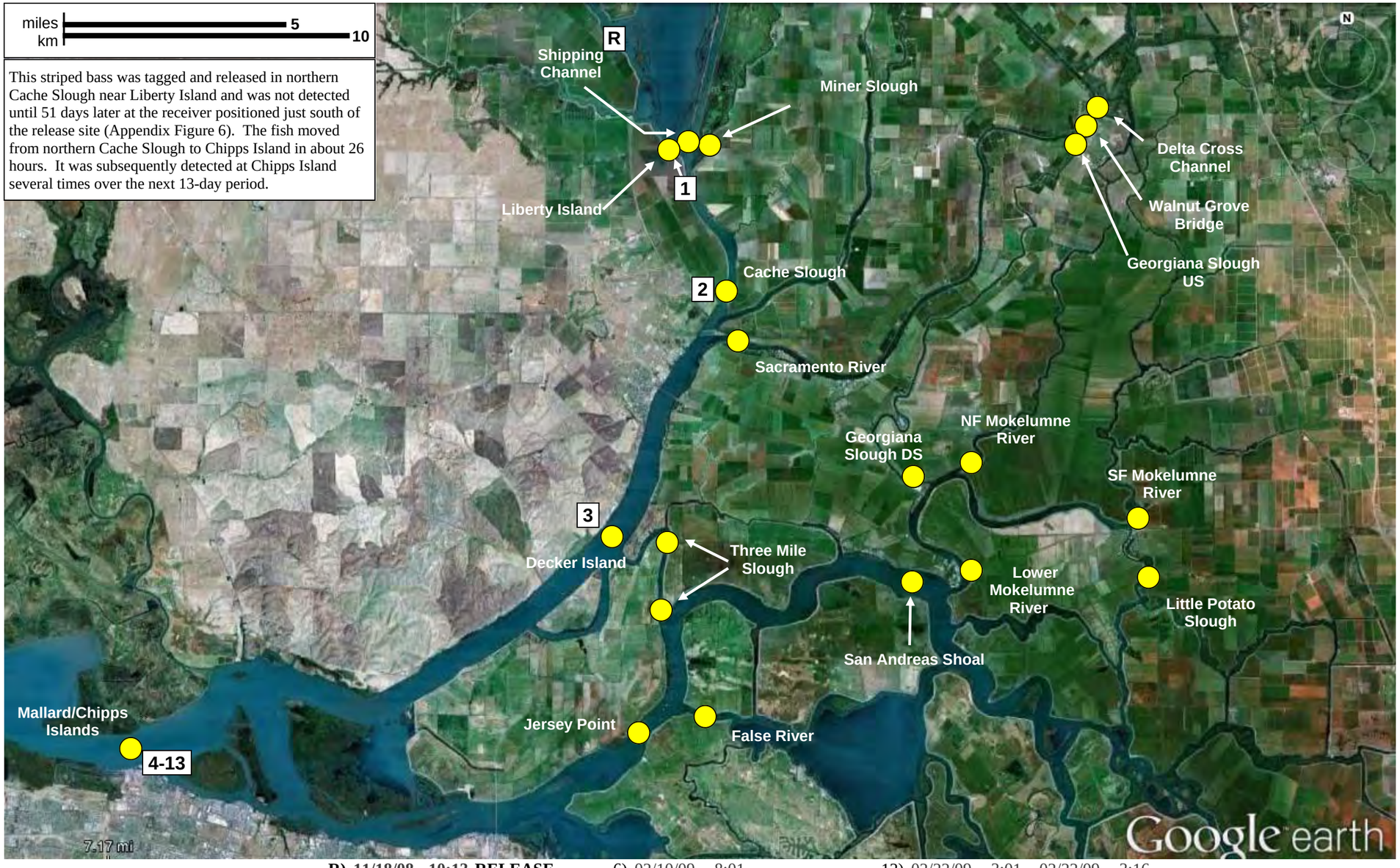
Striped Bass (415 mm) Tag Code 5216.08



R)	**12/03/08**	**8:44**	**RELEASE**		4)	01/26/09	19:21
1)	01/24/09	17:28 -	01/24/09	17:30	5)	02/17/09	6:04
2)	01/24/09	18:47 -	01/24/09	18:52	6)	02/17/09	13:45
3)	01/25/09	6:13 -	01/25/09	6:42	7)	02/18/09	0:46

Appendix Figure 5. Movements of acoustic tagged striped bass No. 5216.08 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

Striped Bass (445 mm) Tag Code 5056.14

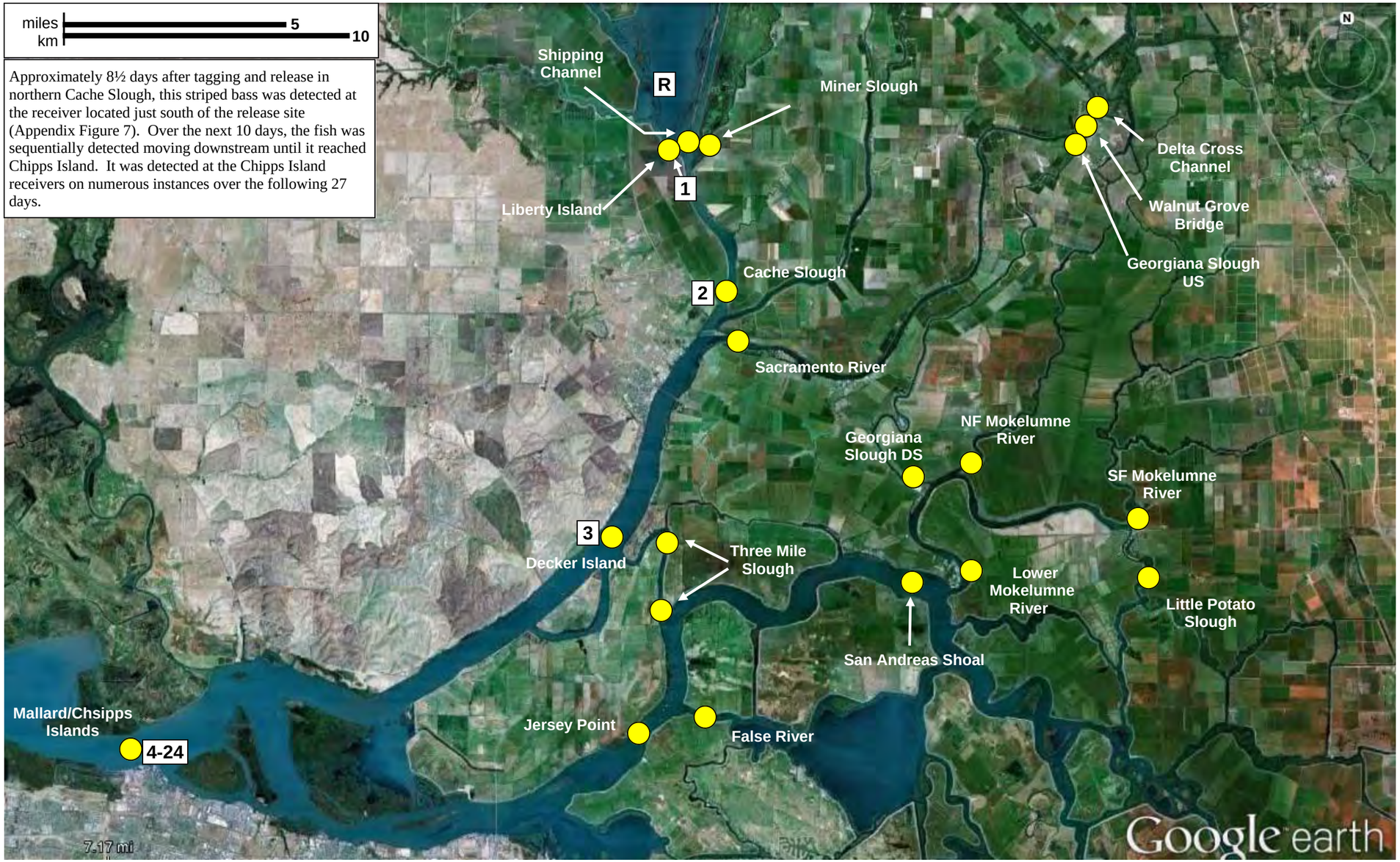


R) 11/18/08 10:13 RELEASE

1) 02/08/09 20:24 - 02/08/09 20:27
2) 02/08/09 21:58 - 02/08/09 22:02
3) 02/09/09 6:49 - 02/09/09 7:06
4) 02/09/09 22:36
5) 02/10/09 1:42
6) 02/10/09 8:01
7) 02/10/09 17:59
8) 02/19/09 2:28
9) 02/19/09 13:57
10) 02/20/09 15:02
11) 02/21/09 11:34 - 02/21/09 11:36
12) 02/22/09 3:01 - 02/22/09 3:16
13) 02/22/09 11:16

Appendix Figure 6. Movements of acoustic tagged striped bass No. 5056.14 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

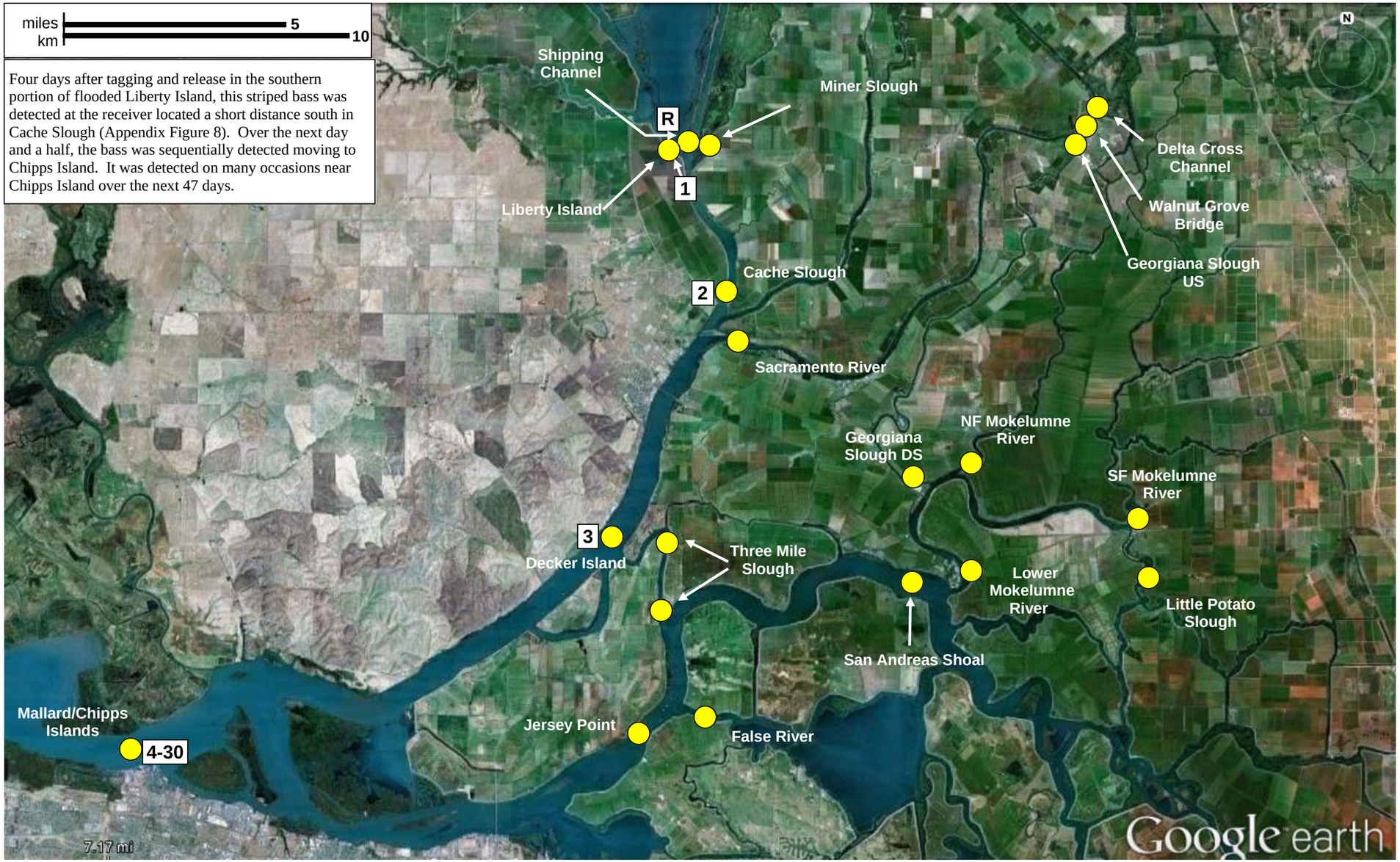
Striped Bass (350 mm) Tag Code 5353.02



R)	**12/10/08**	**11:55**	**RELEASE**		7)	01/08/09	19:24 -	01/08/09	19:36	14)	01/12/09	14:35 -	01/12/09	14:36	21)	01/19/09	18:15 -	01/19/09	20:05
1)	12/19/08	0:22 -	12/19/08	0:25	8)	01/09/09	0:02			15)	01/12/09	18:49			22)	01/24/09	22:13		
2)	12/19/08	2:11 -	12/19/08	2:15	9)	01/09/09	17:43			16)	01/13/09	5:45			23)	01/25/09	0:16 -	01/25/09	0:19
3)	12/19/08	11:05 -	12/19/08	11:38	10)	01/10/09	14:07			17)	01/13/09	8:39			24)	01/25/09	19:26 -	01/25/09	19:27
4)	12/29/08	13:28 -	12/29/08	13:38	11)	01/10/09	16:29 -	01/10/09	16:30	18)	01/13/09	16:08							
5)	12/29/08	21:26			12)	01/11/09	13:27			19)	01/13/09	18:33 -	01/13/09	18:34					
6)	12/30/08	3:51 -	12/30/08	3:58	13)	01/11/09	18:06			20)	01/19/09	7:04							

Appendix Figure 7. Movements of acoustic tagged striped bass No. 5353.02 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

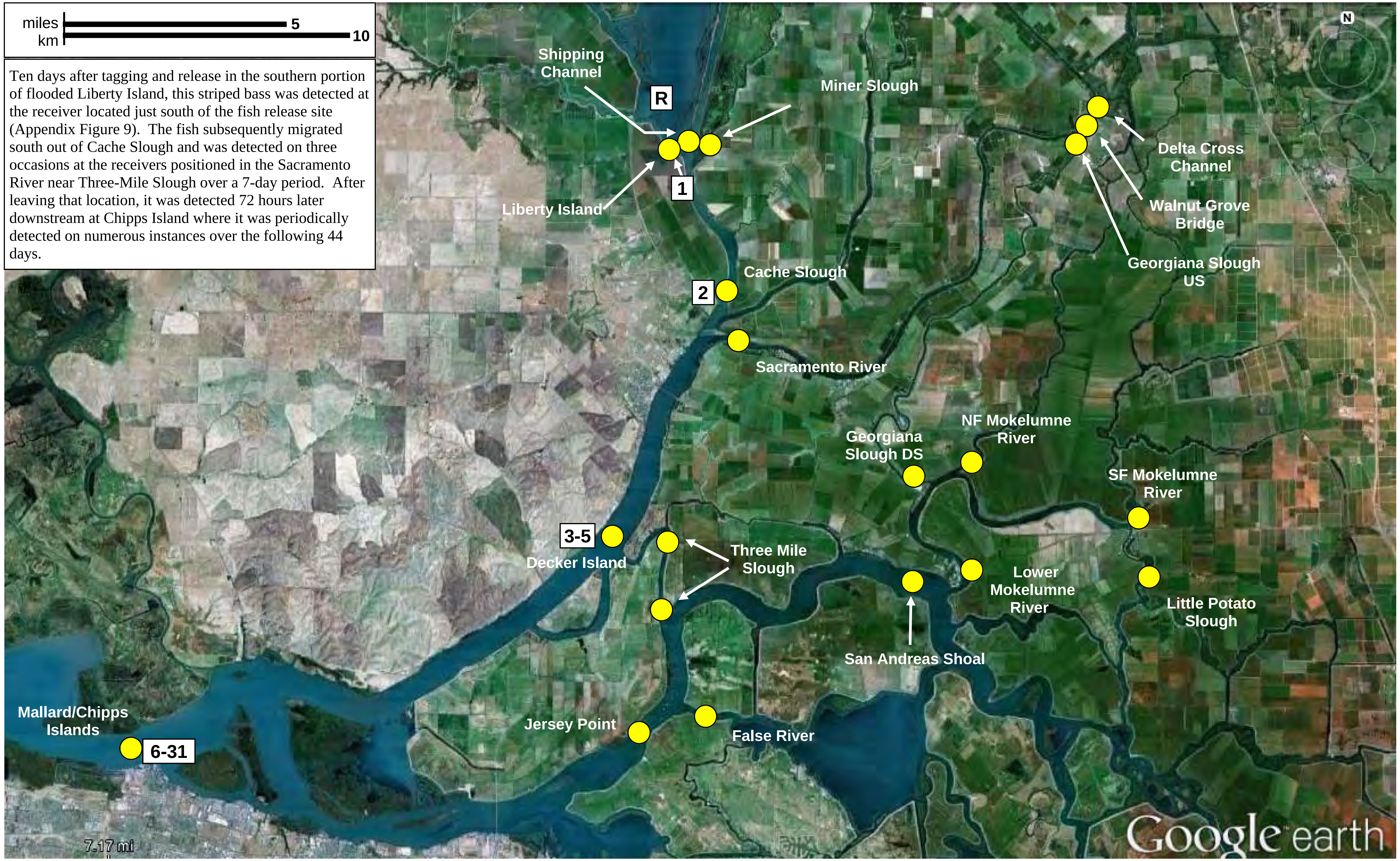
Striped Bass (400 mm) Tag Code 5626.13



R)	**12/17/08**	**15:30**	**RELEASE**			7)	12/28/08	5:04				13)	12/30/08	3:43 -	12/30/08	3:50		19)	01/27/09	22:14				25)	01/31/09	0:20 -	01/31/09	1:48
1)	12/21/08	17:53 -	12/21/08	18:02		8)	12/28/08	8:16 -	12/28/08	8:19		14)	12/30/08	23:19				20)	01/28/09	2:35 -	01/28/09	2:37		26)	02/07/09	20:18		
2)	12/22/08	3:19 -	12/22/08	3:24		9)	12/28/08	11:39				15)	12/31/08	3:40 -	12/31/08	3:42		21)	01/28/09	23:02 -	01/28/09	23:03		27)	02/08/09	1:51 -	02/08/09	2:02
3)	12/22/08	13:10 -	12/22/08	13:41		10)	12/28/08	19:56				16)	12/31/08	23:53				22)	01/29/09	2:15 -	01/29/09	2:19		28)	02/08/09	7:18 -	02/08/09	7:31
4)	12/23/08	6:37				11)	12/29/08	4:09				17)	01/01/09	4:03 -	01/01/09	4:04		23)	01/29/09	22:45 -	01/29/09	22:47		29)	02/08/09	13:08 -	02/08/09	13:09
5)	12/26/08	17:53				12)	12/29/08	21:38				18)	01/02/09	1:53				24)	01/30/09	2:47 -	01/30/09	2:49		30)	02/08/09	15:35		
6)	12/27/08	4:06																										

Appendix Figure 8. Movements of acoustic tagged striped bass No. 5626.13 in the Delta during the 2008 - 2009 Regional Study.
R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

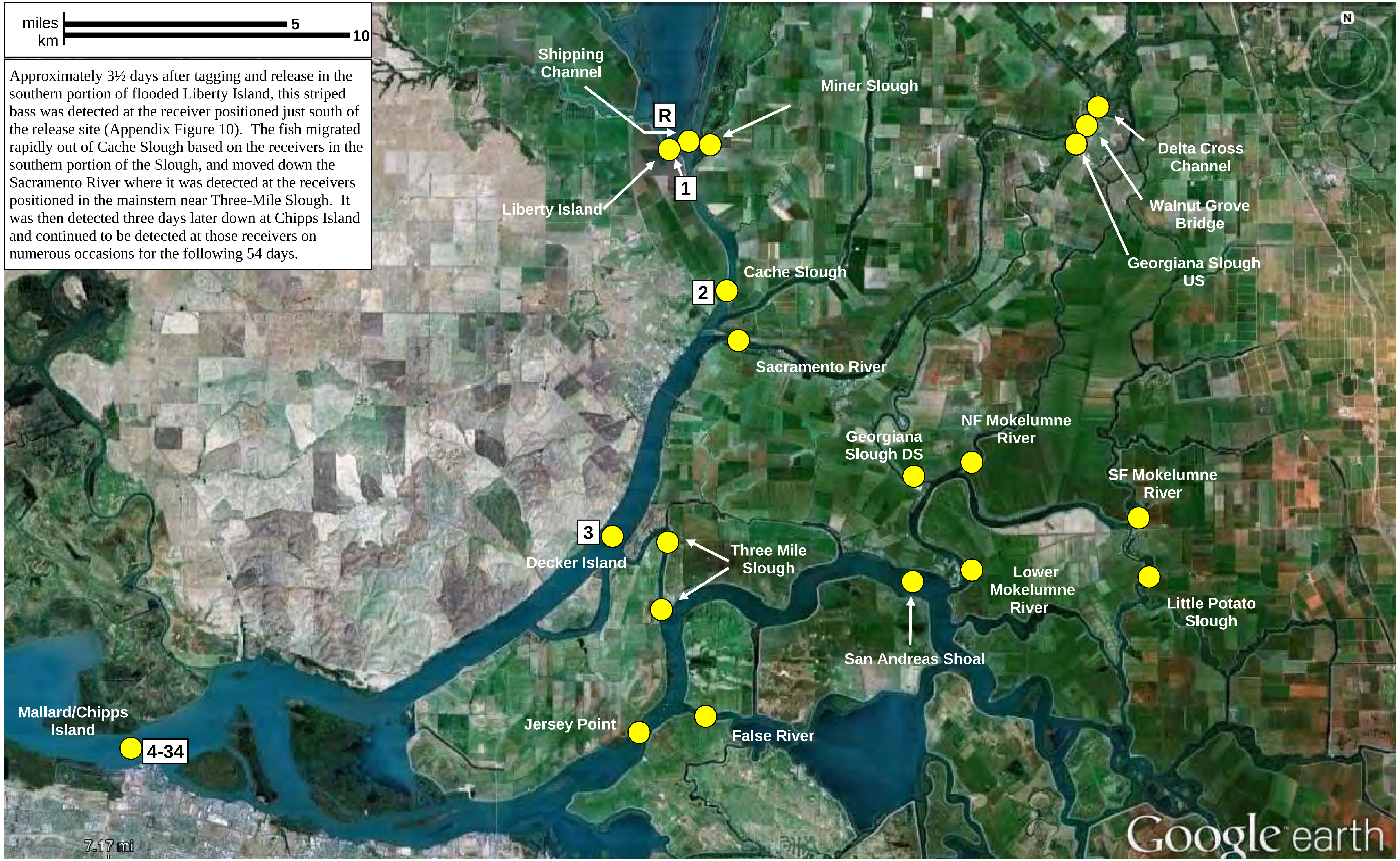
Striped Bass (480 mm) Tag Code 5182.10



R) 12/04/08 12:23 RELEASE	7) 12/30/08 23:51	14) 01/03/09 4:50 - 01/03/09 4:58	21) 01/10/09 19:26	28) 02/08/09 2:05
1) 12/14/08 22:08 - 12/14/08 22:11	8) 12/31/08 2:39	15) 01/04/09 1:38 - 01/04/09 1:42	22) 01/11/09 3:19 - 01/11/09 3:22	29) 02/08/09 7:07
2) 12/15/08 0:09	9) 12/31/08 22:40	16) 01/04/09 4:17 - 01/04/09 4:22	23) 01/11/09 20:29 - 01/11/09 20:30	30) 02/08/09 11:44
3) 12/15/08 21:05 - 12/15/08 21:17	10) 01/01/09 4:55 - 01/01/09 5:03	17) 01/08/09 19:46 - 01/08/09 19:47	24) 01/12/09 3:19 - 01/12/09 3:22	31) 02/08/09 17:25 - 02/08/09 17:27
4) 12/21/08 11:35 - 12/21/08 19:11	11) 01/01/09 23:10	18) 01/09/09 0:01 - 01/09/09 0:06	25) 02/02/09 1:11	
5) 12/22/08 15:04 - 12/22/08 15:30	12) 01/02/09 5:08	19) 01/09/09 19:43	26) 02/02/09 3:12 - 02/02/09 3:14	
6) 12/26/08 0:26	13) 01/03/09 0:19	20) 01/10/09 1:35 - 01/10/09 1:42	27) 02/07/09 19:09	

Appendix Figure 9. Movements of acoustic tagged striped bass No. 5182.10 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

Striped Bass (420 mm) Tag Code 5387.04

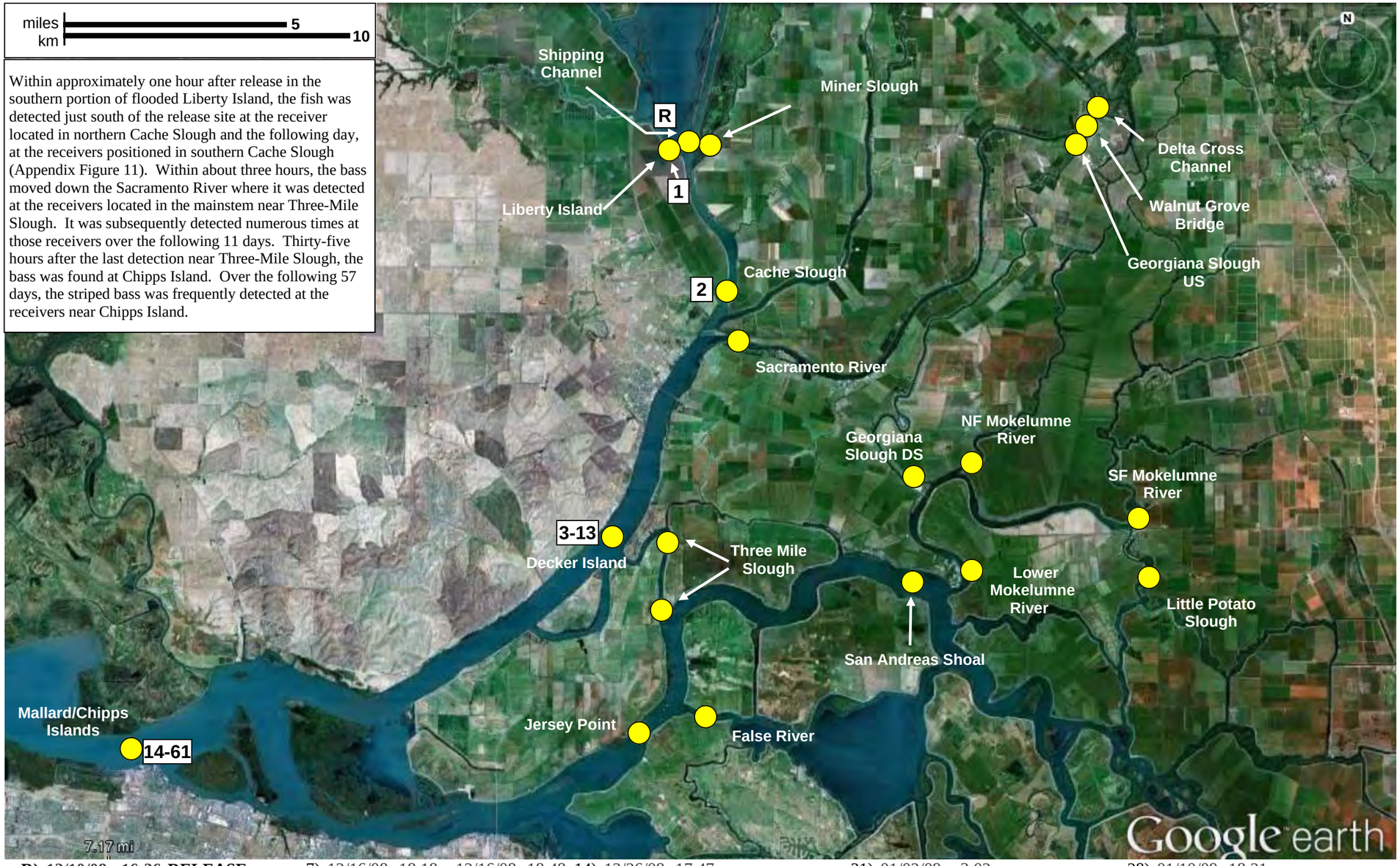


Approximately 3½ days after tagging and release in the southern portion of flooded Liberty Island, this striped bass was detected at the receiver positioned just south of the release site (Appendix Figure 10). The fish migrated rapidly out of Cache Slough based on the receivers in the southern portion of the Slough, and moved down the Sacramento River where it was detected at the receivers positioned in the mainstem near Three-Mile Slough. It was then detected three days later down at Chipps Island and continued to be detected at those receivers on numerous occasions for the following 54 days.

R) 12/10/08 10:50 RELEASE	7) 01/08/09 11:57 - 01/08/09 13:30	14) 01/15/09 19:21 - 01/15/09 19:23	21) 02/03/09 5:29	28) 02/05/09 18:10
1) 12/13/08 20:14 - 12/13/08 20:17	8) 01/11/09 14:38 - 01/11/09 15:37	15) 01/16/09 7:33	22) 02/03/09 14:30	29) 02/05/09 23:36 - 02/05/09 23:41
2) 12/13/08 22:03 - 12/13/08 22:07	9) 01/12/09 5:51	16) 01/16/09 9:51 - 01/16/09 9:55	23) 02/03/09 23:29	30) 02/06/09 20:21 - 02/06/09 20:23
3) 12/14/08 7:16 - 12/14/08 8:07	10) 01/12/09 6:34 - 01/12/09 6:35	17) 01/17/09 9:27 - 01/17/09 10:03	24) 02/04/09 2:03	31) 02/06/09 22:52
4) 12/17/08 13:44 - 12/17/08 14:01	11) 01/12/09 13:26 - 01/12/09 13:28	18) 01/20/09 9:00 - 01/20/09 9:02	25) 02/04/09 4:51	32) 02/08/09 22:18 - 02/08/09 23:50
5) 12/20/08 10:58	12) 01/12/09 19:22 - 01/12/09 19:28	19) 01/20/09 14:27	26) 02/04/09 16:06	33) 02/09/09 13:38
6) 12/20/08 12:10	13) 01/13/09 17:40 - 01/13/09 18:01	20) 02/02/09 23:18	27) 02/04/09 23:34 - 02/04/09 23:38	34) 02/09/09 17:09

Appendix Figure 10. Movements of acoustic tagged striped bass No. 5387.04 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

Striped Bass (360 mm) Tag Code 5256.15



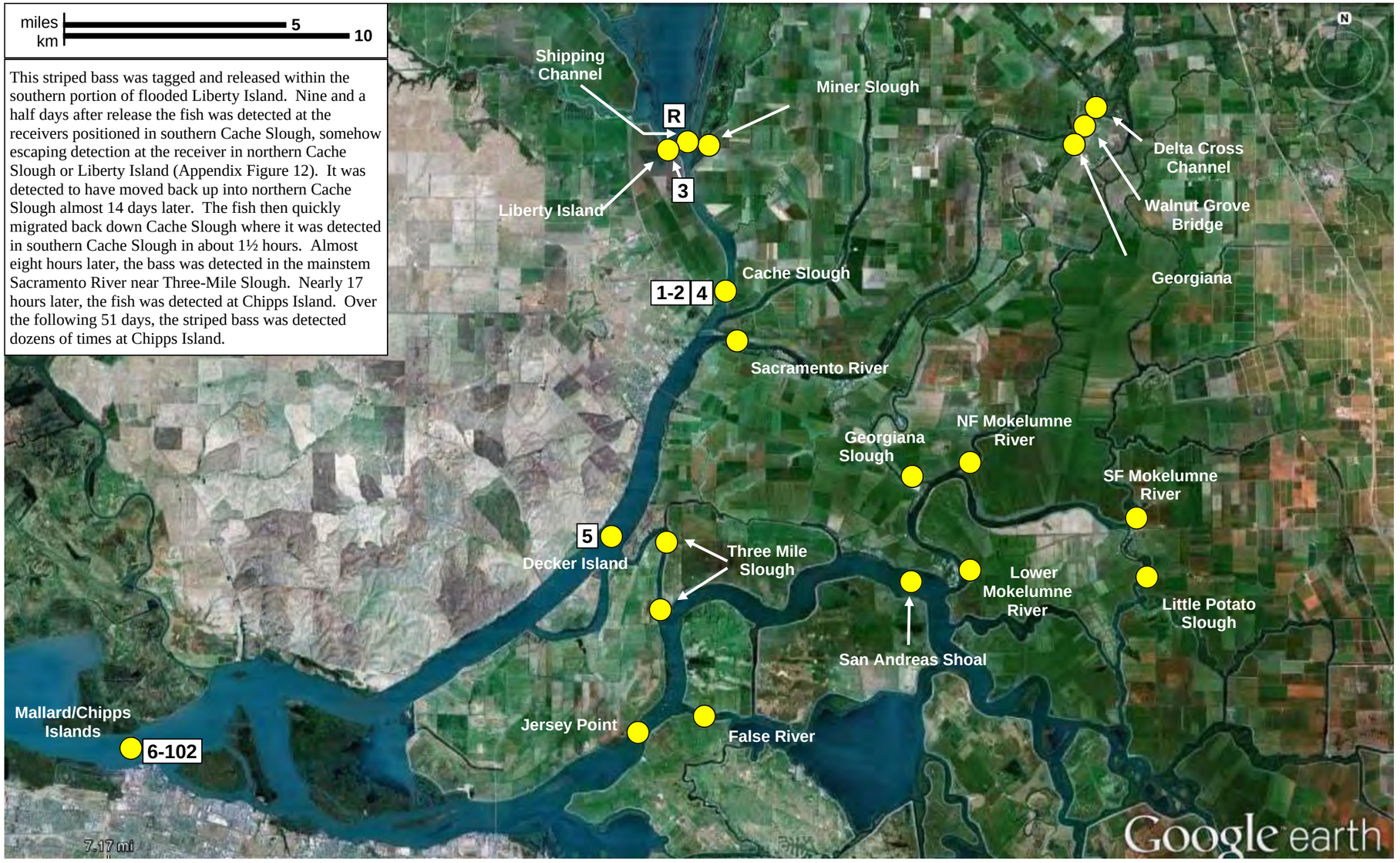
R)	**12/10/08**	**16:36**	**RELEASE**		7)	12/16/08	18:18	-	12/16/08	18:48	14)	12/26/08	17:47			21)	01/02/09	3:02			28)	01/10/09	18:21	
1)	12/10/08	17:49	-	12/10/08	17:53	8)	12/16/08	20:12	-	12/16/08	20:18	15)	12/30/08	14:13	-	12/30/08	14:23	22)	01/06/09	18:45			29)	01/11/09	3:17	-	01/11/09
2)	12/11/08	14:45	-	12/11/08	15:38	9)	12/17/08	19:07	-	12/17/08	21:33	16)	12/30/08	22:11				23)	01/06/09	20:07			30)	01/11/09	19:49	-	01/11/09
3)	12/11/08	18:43	-	12/11/08	18:59	10)	12/18/08	20:49	-	12/18/08	22:44	17)	12/31/08	4:26				24)	01/08/09	17:45			31)	01/12/09	3:23	-	01/12/09
4)	12/14/08	14:54	-	12/14/08	18:07	11)	12/20/08	10:03	-	12/20/08	10:36	18)	12/31/08	22:06				25)	01/09/09	1:08	-	01/09/09	1:09	32)	01/13/09	22:42	-	01/13/09
5)	12/15/08	14:06	-	12/15/08	17:02	12)	12/20/08	13:31	-	12/20/08	13:57	19)	01/01/09	4:37	-	01/01/09	4:40	26)	01/09/09	18:21			33)	01/14/09	2:44	-	01/14/09
6)	12/15/08	19:44	-	12/15/08	20:05	13)	12/25/08	3:46	-	12/25/08	6:44	20)	01/02/09	0:20				27)	01/10/09	2:21	-	01/10/09	2:24	34)	01/14/09	23:53		

Appendix Figure 11. Movements of acoustic tagged striped bass No. 5256.15 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

CONTINUED

35) 01/15/09 2:26
36) 01/23/09 - 01/23/09 23:01
37) 01/24/09 21:07
38) 01/25/09 19:59
39) 01/25/09 1:44
40) 01/26/09 19:06 - 01/26/09 3:22
41) 01/26/09 3:20
42) 01/27/09 20:05
43) 01/27/09 3:32 - 01/27/09 20:52
44) 01/28/09 20:50 - 01/28/09 3:31
45) 01/28/09 3:28
46) 01/29/09 21:33
47) 01/29/09 3:07
48) 01/30/09 22:50
49) 01/30/09 2:59
50) 01/31/09 23:48
51) 02/06/09 1:44
52) 02/07/09 17:27
53) 02/07/09 0:42 - 02/07/09 16:47
54) 02/08/09 16:45
55) 02/08/09 11:34 - 02/08/09 18:09
56) 02/09/09 18:06
57) 02/09/09 3:01
58) 02/09/09 6:18
59) 02/09/09 13:50
60) 02/14/09 17:33
61) 02/21/09 4:27
3:01

Striped Bass (540 mm) Tag Code 5395.02



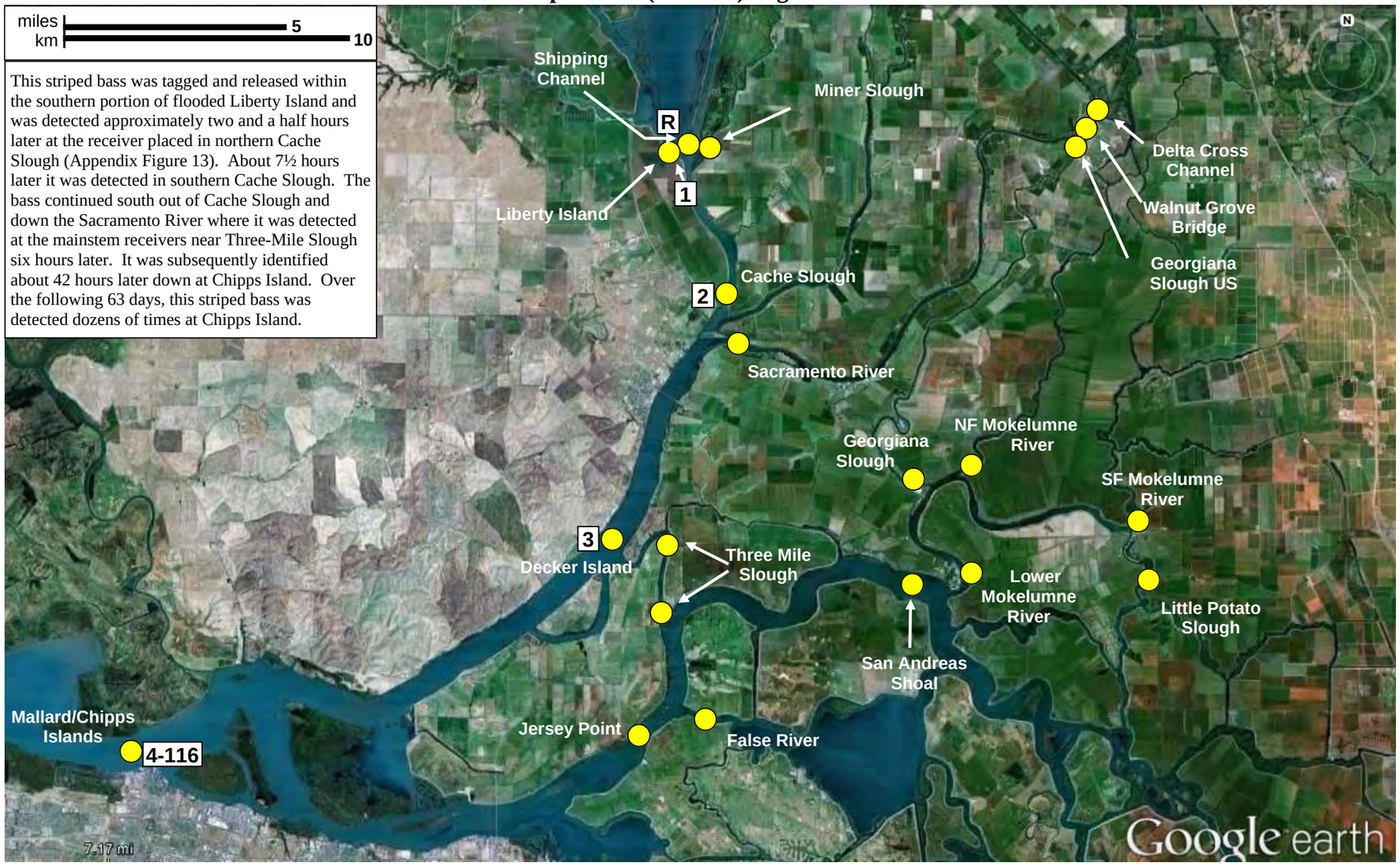
R)	**12/03/08**	**10:54**	**RELEASE**		11)	01/01/09	4:58 -	01/01/09	5:20	22)	01/09/09	17:32			33)	01/13/09	14:57 -	01/13/09	14:59	44)	01/22/09	4:50		
1)	12/12/08	23:07 -	12/12/08	23:15	12)	01/01/09	10:58 -	01/01/09	11:00	23)	01/10/09	11:10 -	01/10/09	11:13	34)	01/13/09	20:20			45)	01/22/09	10:05 -	01/22/09	10:09
2)	12/13/08	1:53			13)	01/01/09	16:58 -	01/01/09	19:54	24)	01/10/09	18:59 -	01/10/09	19:00	35)	01/14/09	6:21 -	01/14/09	6:32	46)	01/22/09	16:27 -	01/22/09	16:29
3)	12/26/08	19:57 -	12/26/08	20:00	14)	01/06/09	7:30			25)	01/11/09	4:57			36)	01/14/09	9:09			47)	01/23/09	2:39 -	01/23/09	2:44
4)	12/26/08	21:35 -	12/26/08	21:40	15)	01/06/09	15:17			26)	01/11/09	6:42			37)	01/14/09	16:05 -	01/14/09	16:14	48)	01/23/09	6:06 -	01/23/09	6:09
5)	12/27/08	5:19 -	12/27/08	5:26	16)	01/07/09	0:37			27)	01/11/09	11:49 -	01/11/09	11:53	38)	01/14/09	21:13			49)	01/23/09	10:16		
6)	12/27/08	22:09			17)	01/07/09	17:02 -	01/07/09	17:03	28)	01/11/09	19:15			39)	01/15/09	6:23			50)	01/23/09	18:17		
7)	12/28/08	2:56 -	12/28/08	2:58	18)	01/08/09	0:25			29)	01/12/09	4:57			40)	01/15/09	9:56 -	01/15/09	9:59	51)	01/24/09	2:22		
8)	12/28/08	8:44 -	12/28/08	9:33	19)	01/08/09	17:02			30)	01/12/09	8:04 -	01/12/09	8:07	41)	01/15/09	17:50 -	01/15/09	17:53	52)	01/25/09	11:58		
9)	12/28/08	10:43 -	12/28/08	11:02	20)	01/09/09	3:43 -	01/09/09	3:59	31)	01/12/09	13:04 -	01/12/09	13:18	42)	01/15/09	20:57 -	01/15/09	20:58	53)	01/25/09	18:28		
10)	01/01/09	0:00 -	01/01/09	0:02	21)	01/09/09	10:49 -	01/09/09	10:53	32)	01/12/09	19:32 -	01/12/09	19:35	43)	01/22/09	2:18			54)	01/26/09	5:37		

Appendix Figure 12. Movements of acoustic tagged striped bass No. 5395.02 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

CONTINUED

55)	01/26/09	12:41			
56)	01/26/09	18:56			
57)	01/27/09	13:50 -	01/27/09	13:51	
58)	01/27/09	18:09 -	01/27/09	18:10	
59)	01/28/09	6:16			
60)	01/28/09	15:06			
61)	01/28/09	18:29			
62)	01/29/09	16:21 -	01/29/09	16:23	
63)	01/29/09	18:56 -	01/29/09	18:59	
64)	01/30/09	5:12			
65)	01/30/09	9:42 -	01/30/09	9:48	
66)	01/30/09	16:59 -	01/30/09	17:02	
67)	01/30/09	19:31 -	01/30/09	19:37	
68)	01/31/09	6:32 -	01/31/09	6:37	
69)	01/31/09	9:01 -	01/31/09	9:03	
70)	01/31/09	18:16 -	01/31/09	20:18	
71)	02/01/09	6:10 -	02/01/09	6:25	
72)	02/01/09	9:48			
73)	02/01/09	19:34 -	02/01/09	19:35	
74)	02/01/09	21:59 -	02/01/09	22:07	
75)	02/02/09	7:24			
76)	02/02/09	10:07			
77)	02/02/09	23:09			
78)	02/03/09	4:06			
79)	02/03/09	12:22			
80)	02/03/09	22:56			
81)	02/04/09	13:23 -	02/04/09	13:26	
82)	02/05/09	2:22 -	02/05/09	2:46	
83)	02/05/09	6:48 -	02/05/09	7:00	
84)	02/05/09	13:46			
85)	02/06/09	3:00			
86)	02/06/09	8:48 -	02/06/09	8:49	
87)	02/06/09	15:24 -	02/06/09	15:25	
88)	02/07/09	3:55			
89)	02/10/09	3:22			
90)	02/10/09	6:46			
91)	02/10/09	19:12			
92)	02/11/09	3:43			
93)	02/11/09	7:33			
94)	02/12/09	4:43			
95)	02/12/09	7:49			
96)	02/12/09	17:25 -	02/12/09	18:43	
97)	02/13/09	6:59			
98)	02/14/09	6:30			
99)	02/14/09	8:20			
100)	02/15/09	8:26			
101)	02/16/09	6:13			
102)	02/16/09	9:32 -	02/16/09	9:38	

Striped Bass (470 mm) Tag Code 5567.01



R) 12/18/08 9:26 RELEASE
1) 12/19/08 11:53 - 12/19/08 12:31
2) 12/19/08 19:55 - 12/19/08 21:01
3) 12/20/08 3:02 - 12/20/08 3:22
4) 12/21/08 21:35
5) 12/22/08 19:21
6) 12/22/08 22:59
7) 12/23/08 16:58 - 12/23/08 17:00
8) 12/24/08 1:36
9) 12/24/08 17:42
10) 12/25/08 2:06
11) 12/25/08 18:12
12) 12/26/08 13:33 - 12/26/08 13:39
13) 12/26/08 16:47
14) 12/27/08 12:19
15) 12/27/08 18:30 - 12/27/08 18:31
16) 12/28/08 4:50
17) 12/28/08 19:42
18) 12/29/08 4:59
19) 12/29/08 10:52 - 12/29/08 12:17
20) 12/29/08 18:40 - 12/29/08 18:41
21) 01/04/09 7:31
22) 01/04/09 12:51
23) 01/05/09 6:08
24) 01/05/09 15:49
25) 01/05/09 22:36
26) 01/06/09 3:46 - 01/06/09 3:49
27) 01/06/09 5:39
28) 01/06/09 16:43 - 01/06/09 16:45
29) 01/06/09 23:39 - 01/06/09 23:49
30) 01/07/09 16:48
31) 01/08/09 0:29 - 01/08/09 0:37
32) 01/08/09 18:55
33) 01/09/09 1:27 - 01/09/09 1:34
34) 01/09/09 22:08 - 01/09/09 23:32
35) 01/12/09 23:02
36) 01/13/09 3:32 - 01/13/09 3:36
37) 01/13/09 10:11 - 01/13/09 10:12
38) 01/13/09 14:47
39) 01/13/09 19:49
40) 01/14/09 7:44 - 01/14/09 8:27
41) 01/14/09 17:10 - 01/14/09 17:30
42) 01/14/09 19:27 - 01/14/09 19:42
43) 01/15/09 8:32 - 01/15/09 9:04
44) 01/16/09 7:15
45) 01/16/09 9:47
46) 01/17/09 7:00 - 01/17/09 7:10
47) 01/17/09 11:59
48) 01/17/09 22:43 - 01/17/09 23:08
49) 01/18/09 6:49 - 01/18/09 6:51
50) 01/18/09 12:52 - 01/18/09 12:54
51) 01/18/09 22:35
52) 01/19/09 1:21 - 01/19/09 1:23
53) 01/19/09 6:14
54) 01/19/09 14:06
55) 01/19/09 23:08 - 01/19/09 23:18

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56) 01/20/09 15:45
57) 01/20/09 23:57
58) 01/21/09 15:50
59) 01/22/09 2:17 - 01/22/09 2:25
60) 01/22/09 6:11 - 01/22/09 7:36
61) 01/22/09 16:21
62) 01/23/09 2:29 - 01/23/09 2:31
63) 01/23/09 6:08
64) 01/24/09 4:45 - 01/24/09 5:30
65) 01/27/09 13:55 - 01/27/09 13:57
66) 01/27/09 18:10 - 01/27/09 18:21
67) 01/28/09 4:58
68) 01/28/09 9:16 - 01/28/09 9:17
69) 01/28/09 12:32 - 01/28/09 12:43
70) 01/28/09 19:57 - 01/28/09 20:05
71) 01/29/09 4:32
72) 01/29/09 9:43 - 01/29/09 9:46
73) 01/29/09 15:21 - 01/29/09 15:35
74) 01/29/09 19:43
75) 01/30/09 5:27
76) 01/30/09 9:28 - 01/30/09 9:30
77) 01/30/09 16:08
78) 01/30/09 20:52
79) 01/31/09 4:48 - 01/31/09 4:57
80) 01/31/09 11:48
81) 01/31/09 17:28
82) 01/31/09 21:40 - 01/31/09 21:41
83) 02/01/09 5:17
84) 02/01/09 11:34
85) 02/02/09 6:23
86) 02/02/09 11:21
87) 02/02/09 21:09 - 02/02/09 21:25
88) 02/03/09 1:17
89) 02/03/09 4:44
90) 02/03/09 12:42
91) 02/04/09 15:14
92) 02/05/09 14:52
93) 02/06/09 1:35
94) 02/06/09 4:51 - 02/06/09 5:00
95) 02/06/09 7:50
96) 02/07/09 10:10
97) 02/07/09 16:23 - 02/07/09 16:32
98) 02/08/09 13:00 - 02/08/09 13:04
99) 02/08/09 17:00
100) 02/09/09 14:31
101) 02/11/09 4:57 - 02/11/09 5:09
102) 02/11/09 15:35
103) 02/12/09 4:27 - 02/12/09 4:35
104) 02/12/09 9:19
105) 02/12/09 17:08
106) 02/12/09 19:07
107) 02/19/09 4:01
108) 02/19/09 9:42
109) 02/19/09 14:45
110) 02/20/09 10:09
111) 02/20/09 15:14 - 02/20/09 15:23
112) 02/21/09 11:44 - 02/21/09 11:49
113) 02/21/09 15:41
114) 02/22/09 3:08
115) 02/22/09 6:04 - 02/22/09 6:09
116) 02/22/09 11:35

Appendix Figure 13. Movements of acoustic tagged striped bass No. 5567.01 in the Delta during the 2008 - 2009 Regional Study.
R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

Striped Bass (405 mm) Tag Code 5321.03

R)	**12/03/08**	**9:50**	**RELEASE**		14)	12/23/08	16:30	-	12/23/08	16:31	28)	12/28/08	19:51			42)	01/05/09	16:10	-	01/05/09	16:13
1)	12/14/08	20:16	-	12/14/08	20:18	15)	12/24/08	2:03	-	12/24/08	2:14	29)	12/29/08	4:45	-	12/29/08	4:54	43)	01/05/09	23:53			
2)	12/14/08	21:54	-	12/14/08	22:00	16)	12/24/08	6:28	-	12/24/08	6:35	30)	12/29/08	19:57				44)	01/06/09	0:16	-	01/06/09	1:36
3)	12/15/08	1:31	-	12/15/08	5:14	17)	12/24/08	8:17				31)	12/30/08	5:41	-	12/30/08	5:52	45)	01/06/09	6:38			
4)	12/19/08	3:12	-	12/19/08	4:47	18)	12/24/08	17:40				32)	12/30/08	11:09				46)	01/06/09	15:05			
5)	12/20/08	15:16				19)	12/25/08	1:47	-	12/25/08	1:57	33)	12/30/08	12:13	-	12/30/08	12:38	47)	01/07/09	0:31	-	01/07/09	0:33
6)	12/20/08	22:44				20)	12/25/08	18:17				34)	12/30/08	20:38				48)	01/07/09	5:03	-	01/07/09	6:45
7)	12/21/08	7:32				21)	12/26/08	13:01				35)	12/31/08	5:39				49)	01/07/09	16:40			
8)	12/21/08	16:11				22)	12/26/08	16:16	-	12/26/08	16:17	36)	12/31/08	21:39				50)	01/08/09	0:25			
9)	12/21/08	23:30				23)	12/27/08	12:44	-	12/27/08	12:48	37)	01/01/09	5:46	-	01/01/09	5:48	51)	01/08/09	17:40			
10)	12/22/08	16:55				24)	12/27/08	18:14				38)	01/01/09	23:28				52)	01/09/09	1:19	-	01/09/09	1:22
11)	12/23/08	1:21				25)	12/28/08	4:48				39)	01/02/09	4:10				53)	01/09/09	18:05			
12)	12/23/08	3:57				26)	12/28/08	8:53	-	12/28/08	9:02	40)	01/04/09	1:50	-	01/04/09	1:56	54)	01/10/09	2:31			
13)	12/23/08	9:42				27)	12/28/08	11:18	-	12/28/08	11:36	41)	01/04/09	4:14	-	01/04/09	4:15	55)	01/10/09	18:46			

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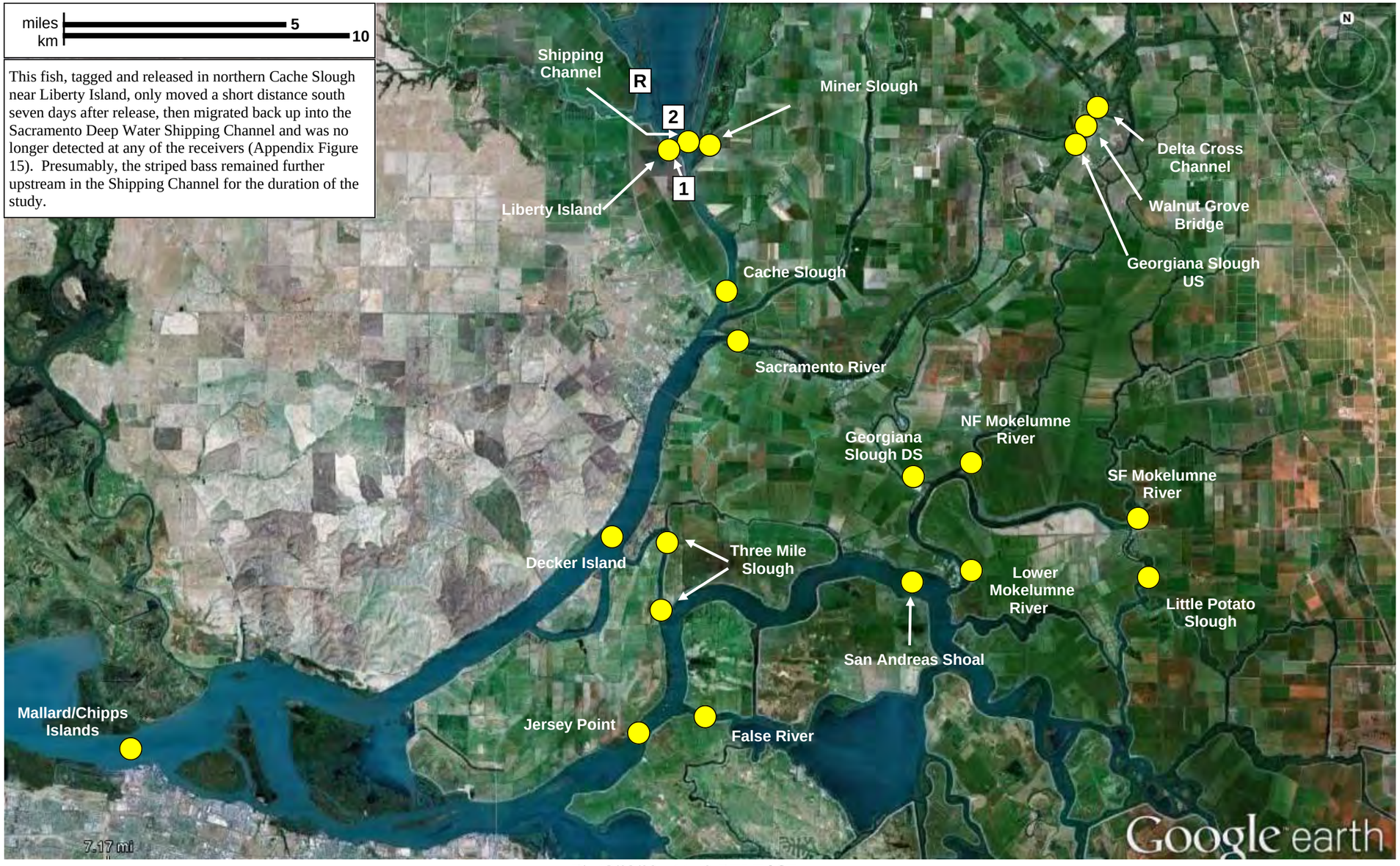
56)	01/11/09	3:36			103)	02/02/09	4:30												
57)	01/11/09		-	01/11/09	8:24	104)	02/03/09		-	02/03/09	18:54								
58)	01/11/09	8:21				105)	02/09/09	17:13											
59)	01/12/09	11:29				106)	02/10/09	21:44											
60)	01/12/09	4:02				107)	02/10/09	1:41											
61)	01/12/09	9:14	-	01/12/09	11:59	108)	02/12/09	8:56											
62)	01/12/09	11:55				109)	02/12/09	11:12											
63)	01/13/09	21:03	-	01/13/09	3:58	110)	02/13/09	14:28											
64)	01/13/09	3:56	-	01/13/09	12:42	111)	02/13/09	2:54	-	02/13/09	12:06								
65)	01/13/09	10:57				112)	02/14/09	12:04											
66)	01/14/09	21:34	-	01/14/09	4:42	113)	02/14/09	4:20											
67)	01/14/09	4:41	-	01/14/09	11:12	114)	02/14/09	18:14											
68)	01/14/09	11:09	-	01/14/09	14:42	115)	02/15/09	23:12											
69)	01/14/09	14:40				116)	02/15/09	14:07	-	02/15/09	17:52								
70)	01/15/09	21:53				117)	02/16/09	17:51											
71)	01/15/09	5:09				118)	02/16/09	14:52											
72)	01/15/09	11:53				119)	02/17/09	19:59											
73)	01/15/09	16:38	-	01/15/09	22:40			15:49											
74)	01/16/09	22:35	-	01/16/09	5:26														
75)	01/16/09	5:24	-	01/16/09	12:09														
76)	01/16/09	12:04																	
77)	01/16/09	18:55																	
78)	01/17/09	22:29																	
79)	01/17/09	5:47																	
80)	01/17/09	13:15	-	01/17/09	20:15														
81)	01/18/09	20:07	-	01/18/09	1:07														
82)	01/18/09	1:05	-	01/18/09	5:50														
83)	01/18/09	5:45	-	01/18/09	14:05														
84)	01/18/09	14:04	-	01/18/09	22:37														
85)	01/19/09	22:29	-	01/19/09	1:20														
86)	01/19/09	1:17																	
87)	01/19/09	6:40	-	01/19/09	15:08														
88)	01/19/09	15:07																	
89)	01/20/09	23:12																	
90)	01/27/09	19:58																	
91)	01/28/09	21:19	-	01/28/09	3:24														
92)	01/28/09	3:22	-	01/28/09	22:07														
93)	01/29/09	22:06	-	01/29/09	2:59														
94)	01/29/09	2:57	-	01/29/09	22:59														
95)	01/30/09	22:58	-	01/30/09	2:34														
96)	01/30/09	2:32																	
97)	01/31/09	22:32	-	01/31/09	3:40														
98)	01/31/09	3:35	-	01/31/09	23:13														
99)	02/01/09	23:11	-	02/01/09	4:08														
100)	02/01/09	3:59	-	02/01/09	13:36														
101)	02/01/09	13:33	-	02/01/09	18:14														
102)	02/01/09	18:13	-	02/01/09	23:46														

Appendix Figure 14. Movements of acoustic tagged striped bass No. 5321.03 in the Delta during the 2008 - 2009 Regional Study.
R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

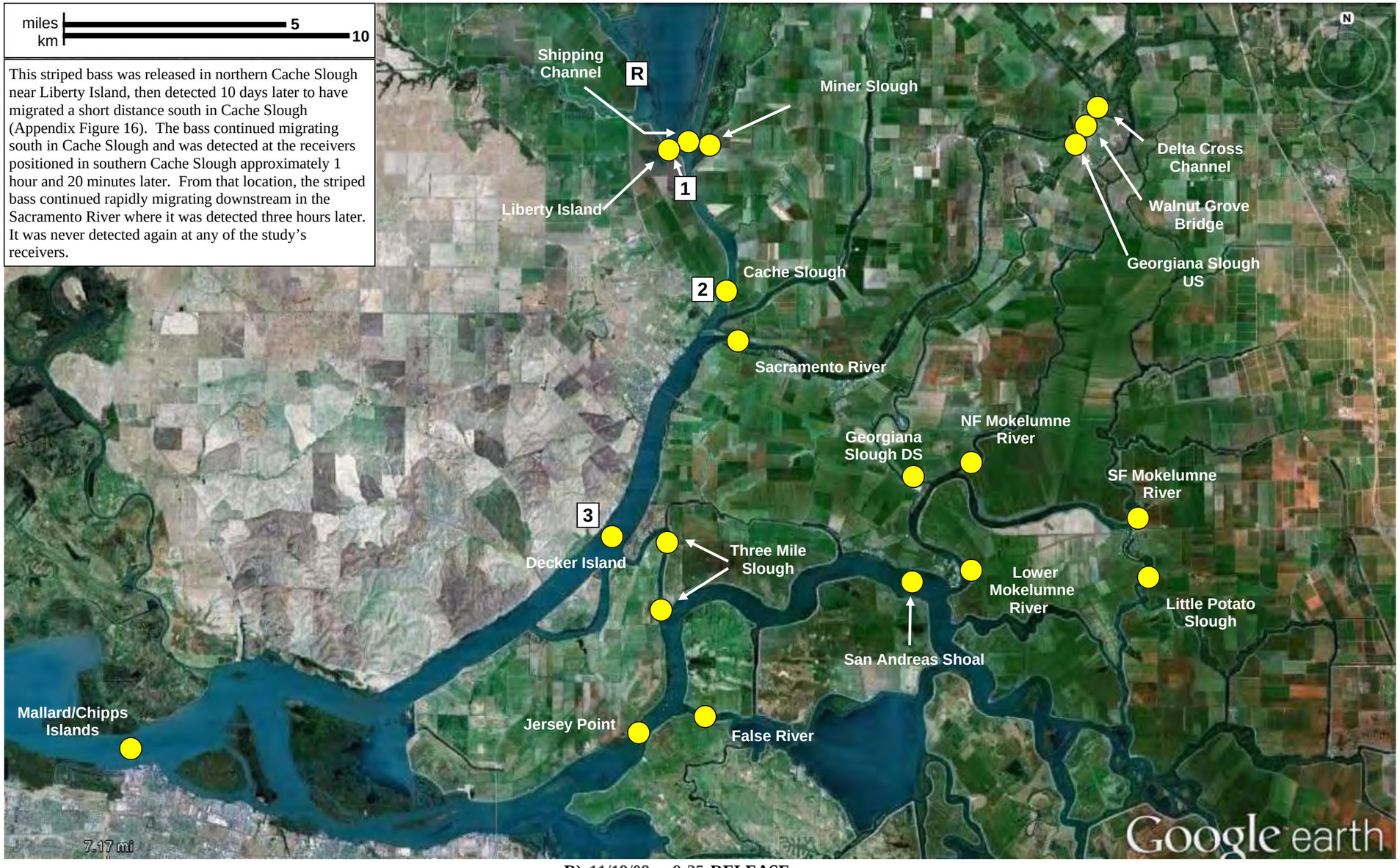
Striped Bass (420 mm) Tag Code 5448.05



R) 12/02/08 14:40 RELEASE
1) 12/09/08 18:01 - 12/09/08 18:06
2) 12/09/08 21:15 - 12/09/08 21:42

Appendix Figure 15. Movements of acoustic tagged largemouth bass No. 5448.05 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

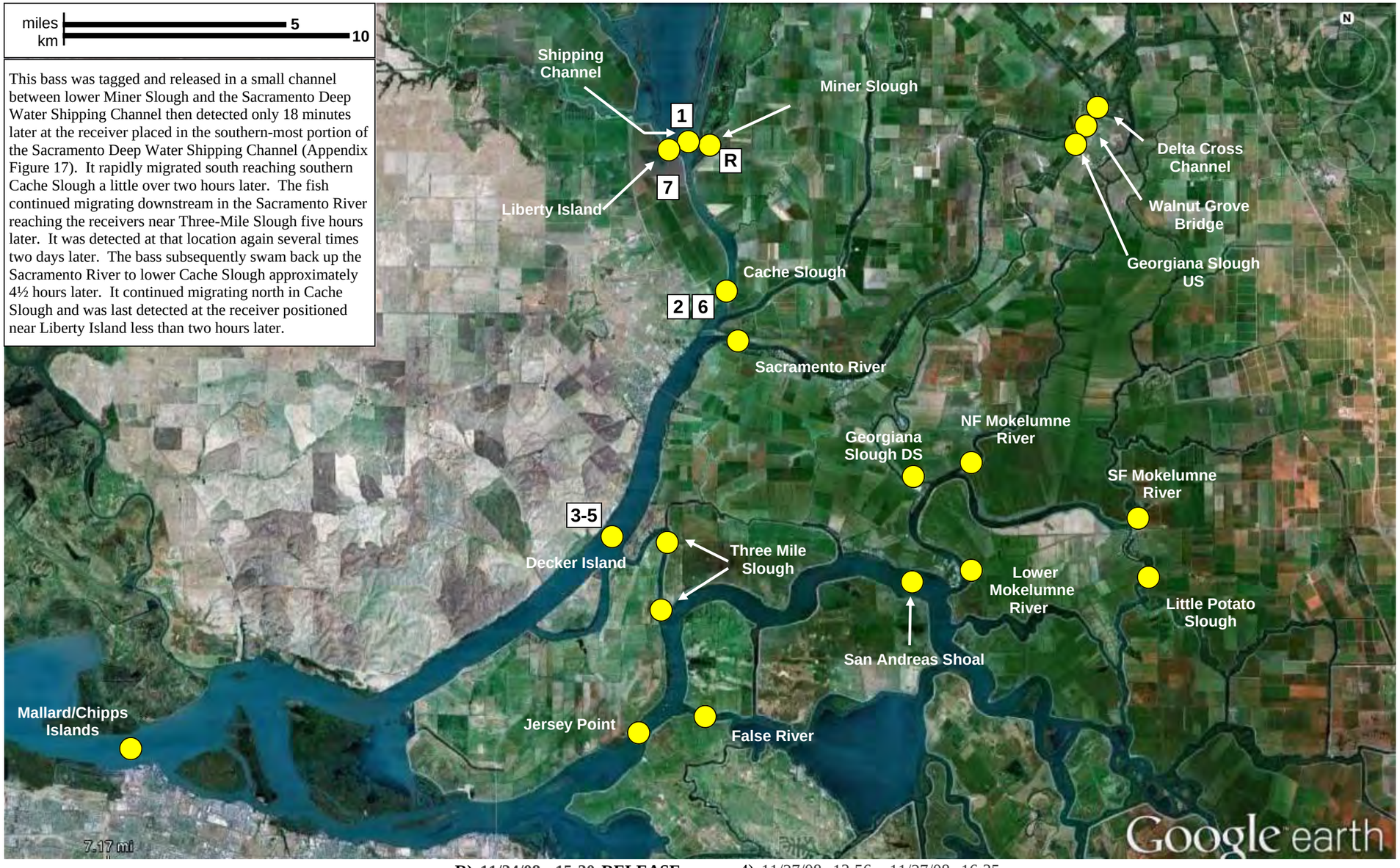
Striped Bass (430 mm) Tag Code 5065.07



R) 11/19/08 9:25 RELEASE
1) 11/29/08 18:20 - 11/29/08 18:23
2) 11/29/08 19:41
3) 11/29/08 22:49 - 11/29/08 23:09

Appendix Figure 16. Movements of acoustic tagged largemouth bass No. 5065.07 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

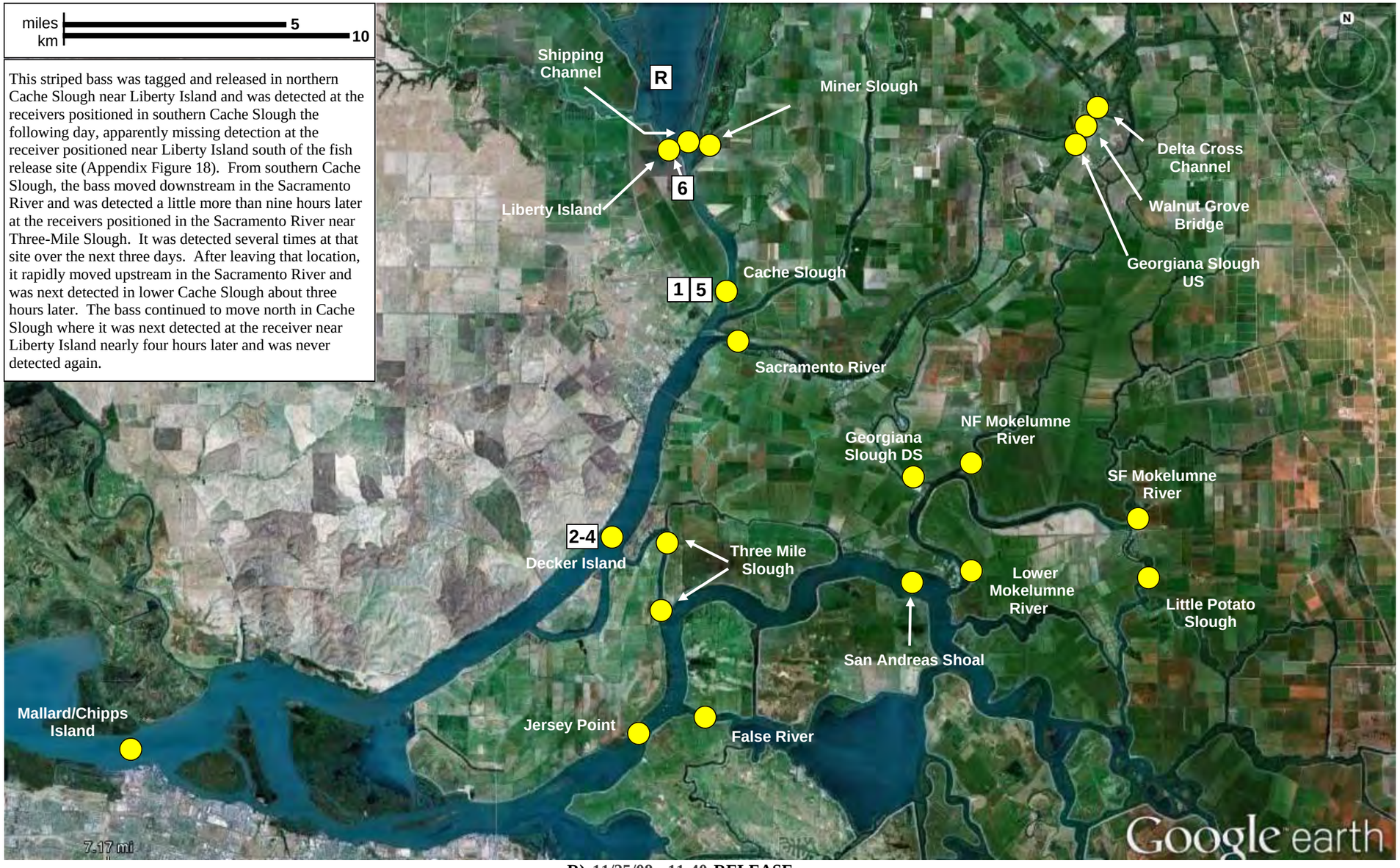
Striped Bass (670 mm) Tag Code 5027.03



R)	**11/24/08**	**15:30**	**RELEASE**		4)	11/27/08	13:56 -	11/27/08 16:35
1)	11/24/08	15:48 -	11/24/08	15:55	5)	11/27/08	22:11 -	11/27/08 23:12
2)	11/24/08	18:01			6)	11/28/08	3:22 -	11/28/08 3:25
3)	11/25/08	3:02 -	11/25/08	4:05	7)	11/28/08	5:12 -	11/28/08 5:16

Appendix Figure 17. Movements of acoustic tagged largemouth bass No. 5027.03 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

Striped Bass (430 mm) Tag Code 5192.02

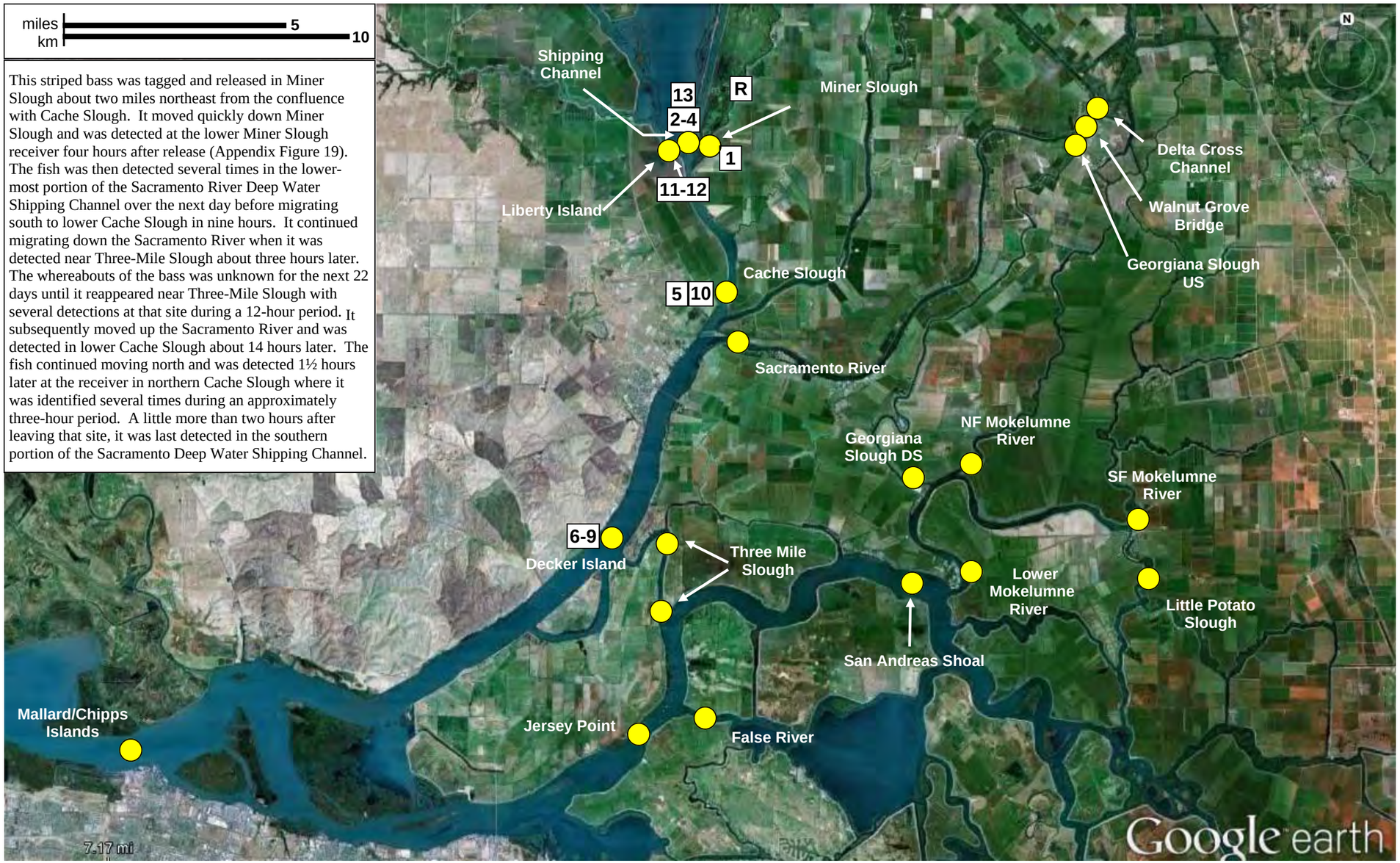


R) 11/25/08 11:40 RELEASE

1)	11/26/08	6:23 -	11/26/08	6:27
2)	11/26/08	15:38 -	11/26/08	16:12
3)	11/28/08	13:32 -	11/28/08	13:50
4)	11/28/08	22:47 -	11/29/08	1:05
5)	11/29/08	4:48 -	11/29/08	4:51
6)	11/29/08	8:32 -	11/29/08	8:40

Appendix Figure 18. Movements of acoustic tagged largemouth bass No. 5192.02 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

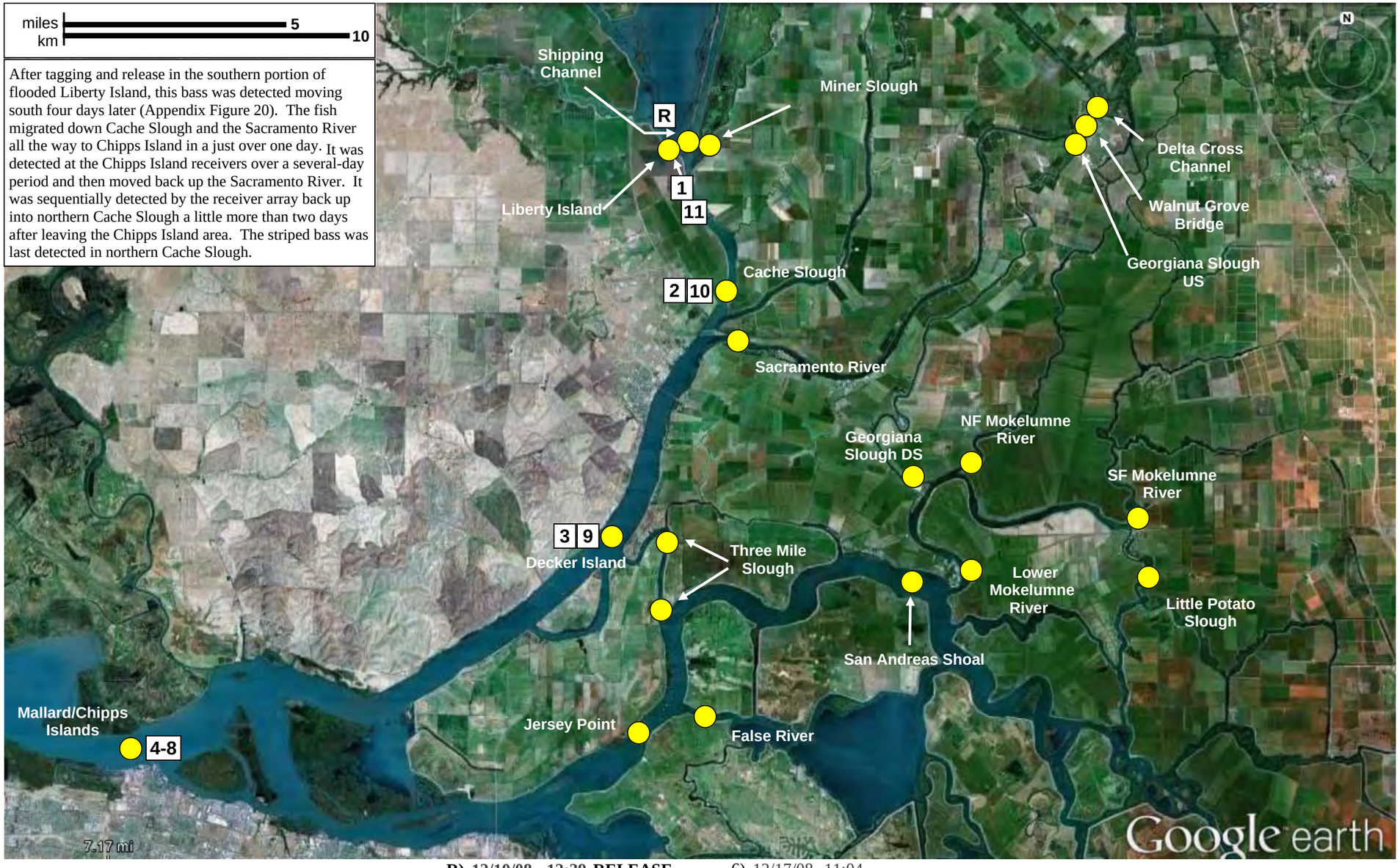
Striped Bass (407 mm) Tag Code 5409.13



R)	**11/19/08**	**11:25**	**RELEASE**		7)	12/13/08	15:50 -	12/13/08	16:03
1)	11/19/08	15:28			8)	12/13/08	19:28 -	12/13/08	21:03
2)	11/19/08	18:11 -	11/20/08	2:50	9)	12/14/08	3:53 -	12/14/08	4:10
3)	11/20/08	4:53 -	11/20/08	6:32	10)	12/14/08	13:52		
4)	11/20/08	15:38			11)	12/14/08	15:25 -	12/14/08	15:30
5)	11/21/08	0:33 -	11/21/08	0:37	12)	12/14/08	18:31 -	12/14/08	18:37
6)	11/21/08	3:47 -	11/21/08	4:06	13)	12/14/08	20:55 -	12/15/08	1:54

Appendix Figure 19. Movements of acoustic tagged largemouth bass No. 5409.13 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

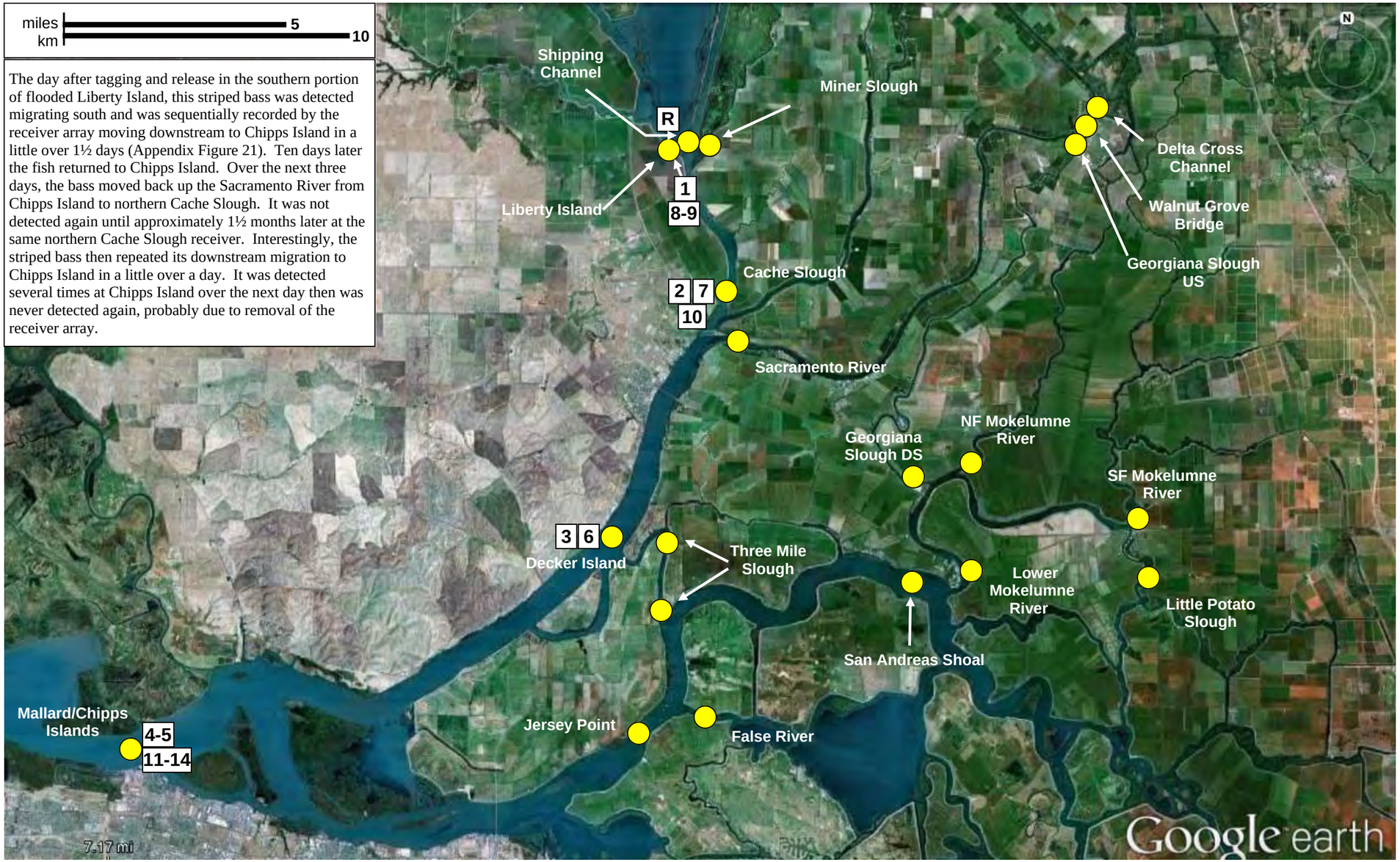
Striped Bass (480 mm) Tag Code 5289.07



R)	**12/10/08**	**12:39**	**RELEASE**		6)	12/17/08	11:04		
1)	12/14/08	22:16 -	12/14/08	22:19	7)	12/19/08	6:13 -	12/19/08	6:18
2)	12/14/08	23:51			8)	12/25/08	22:59 -	12/25/08	23:32
3)	12/15/08	11:37 -	12/15/08	12:09	9)	12/27/08	15:00		
4)	12/16/08	1:04			10)	12/28/08	3:00 -	12/28/08	3:01
5)	12/17/08	7:19			11)	12/28/08	4:46 -	12/28/08	4:50

Appendix Figure 20. Movements of acoustic tagged largemouth bass No. 5289.07 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

Striped Bass (430 mm) Tag Code 5721.01

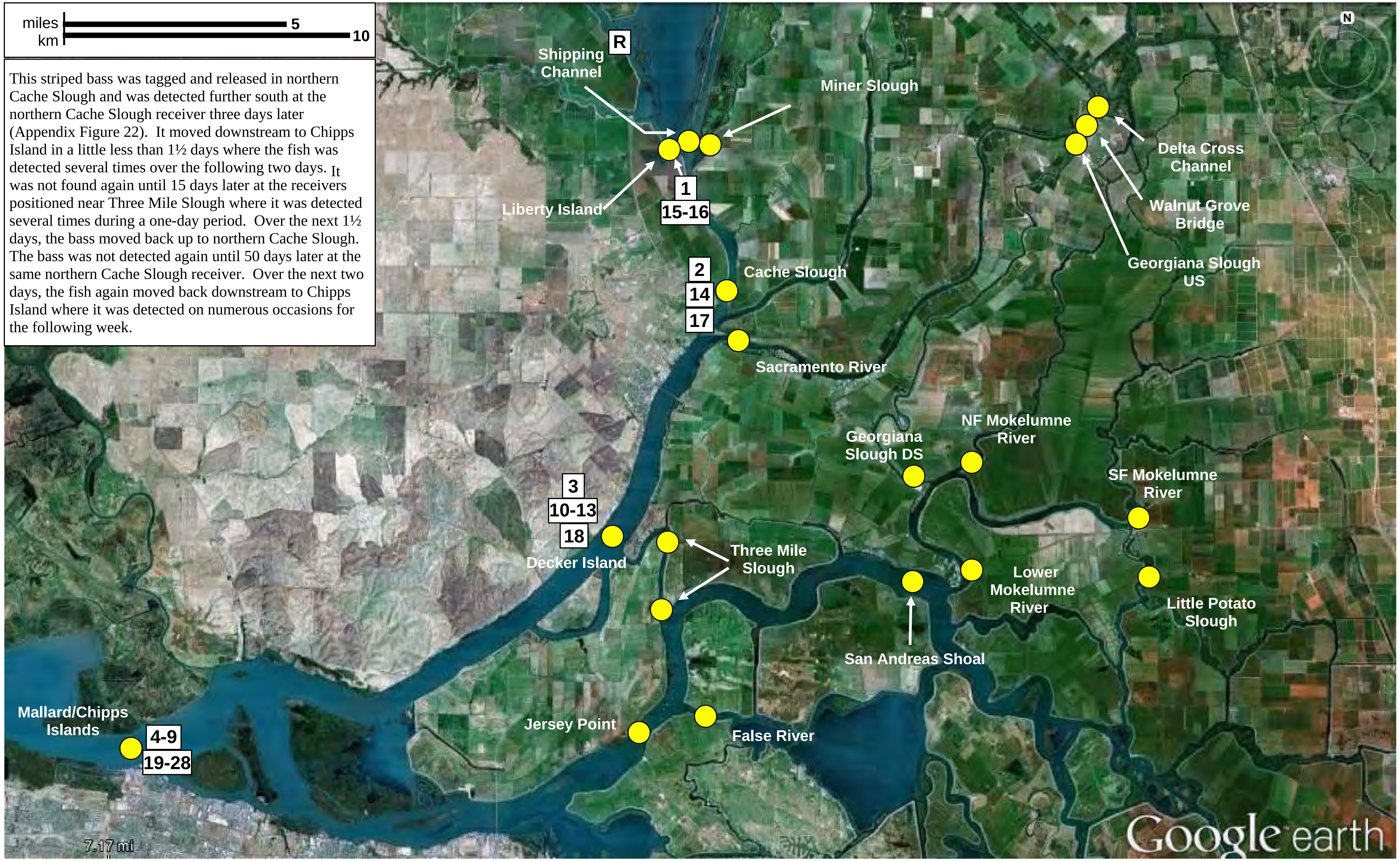


R)	**12/17/08**	**15:38**	**RELEASE**			5)	12/30/08	5:45		10)	02/15/09	12:07 -	02/15/09	12:12
1)	12/18/08	23:17 -	12/18/08	23:21		6)	01/01/09	8:24 -	01/01/09	8:54	11)	02/16/09	16:27	
2)	12/19/08	1:06 -	12/19/08	1:09		7)	01/02/09	4:52 -	01/02/09	4:54	12)	02/16/09	19:28	
3)	12/19/08	9:06 -	12/19/08	10:06		8)	01/02/09	7:22 -	01/02/09	7:26	13)	02/17/09	3:52	
4)	12/20/08	14:06				9)	02/15/09	10:49 -	02/15/09	10:52	14)	02/17/09	10:33	

Appendix Figure 21. Movements of acoustic tagged largemouth bass No. 5721.01 in the Delta during the 2008 - 2009 Regional Study.
R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

Striped Bass (450 mm) Tag Code 5045.13

This striped bass was tagged and released in northern Cache Slough and was detected further south at the northern Cache Slough receiver three days later (Appendix Figure 22). It moved downstream to Chipps Island in a little less than 1½ days where the fish was detected several times over the following two days. It was not found again until 15 days later at the receivers positioned near Three Mile Slough where it was detected several times during a one-day period. Over the next 1½ days, the bass moved back up to northern Cache Slough. The bass was not detected again until 50 days later at the same northern Cache Slough receiver. Over the next two days, the fish again moved back downstream to Chipps Island where it was detected on numerous occasions for the following week.

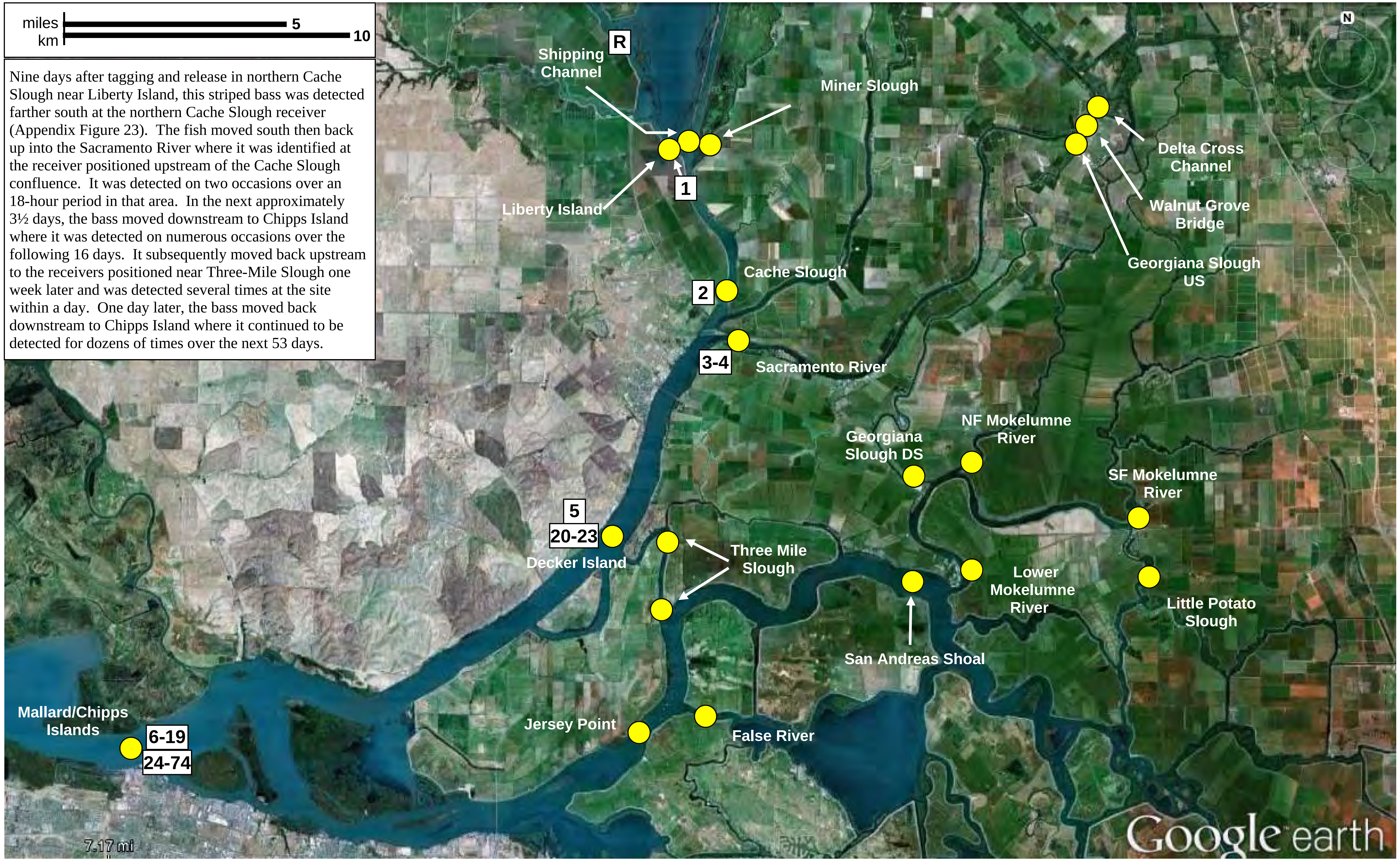


R)	**11/11/08**	**13:15 RELEASE**
1)	11/14/08	8:45
2)	11/14/08	10:51
3)	11/14/08	18:30 - 11/14/08 18:43
4)	11/15/08	0:23 - 11/15/08 0:50
5)	11/15/08	8:38
6)	11/15/08	18:58
7)	11/16/08	7:32 - 11/16/08 8:46
8)	11/16/08	19:26 - 11/16/08 19:44
9)	11/17/08	9:15
10)	12/02/08	5:09 - 12/02/08 5:10
11)	12/02/08	7:47 - 12/02/08 9:30
12)	12/02/08	15:57 - 12/02/08 20:20
13)	12/03/08	4:51 - 12/03/08 5:07
14)	12/04/08	17:06 - 12/04/08 17:09
15)	12/04/08	19:55 - 12/05/08 4:35
16)	01/24/09	20:29 - 01/24/09 20:34
17)	01/25/09	6:00 - 01/25/09 6:07
18)	01/25/09	16:06 - 01/25/09 16:40
19)	01/26/09	22:08
20)	01/27/09	2:27 - 01/27/09 2:30
21)	01/27/09	20:41
22)	01/28/09	4:21 - 01/28/09 4:23
23)	01/28/09	23:34 - 01/28/09 23:35
24)	01/29/09	1:31 - 01/29/09 1:40
25)	02/02/09	14:59
26)	02/02/09	21:11
27)	02/02/09	23:06
28)	02/03/09	13:13

Appendix Figure 22. Movements of acoustic tagged largemouth bass No. 5045.13 in the Delta during the 2008 - 2009 Regional Study.
R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

Striped Bass (430 mm) Tag Code 5086.04

Nine days after tagging and release in northern Cache Slough near Liberty Island, this striped bass was detected farther south at the northern Cache Slough receiver (Appendix Figure 23). The fish moved south then back up into the Sacramento River where it was identified at the receiver positioned upstream of the Cache Slough confluence. It was detected on two occasions over an 18-hour period in that area. In the next approximately 3½ days, the bass moved downstream to Chipps Island where it was detected on numerous occasions over the following 16 days. It subsequently moved back upstream to the receivers positioned near Three-Mile Slough one week later and was detected several times at the site within a day. One day later, the bass moved back downstream to Chipps Island where it continued to be detected for dozens of times over the next 53 days.



R) 11/18/08 11:22 RELEASE
1) 11/27/08 21:18 - 11/27/08 21:22
2) 11/27/08 23:07 - 11/27/08 23:11
3) 11/28/08 3:28
4) 11/28/08 21:23
5) 11/29/08 7:48 - 11/29/08 8:25
6) 12/02/08 23:24
7) 12/03/08 7:10
8) 12/03/08 22:39
9) 12/04/08 6:03 - 12/04/08 6:06
10) 12/11/08 17:56 - 12/11/08 18:03
11) 12/12/08 13:45
12) 12/12/08 17:13
13) 12/13/08 14:46 - 12/13/08 14:54
14) 12/13/08 18:05
15) 12/14/08 15:53
16) 12/14/08 18:29
17) 12/17/08 18:27
18) 12/17/08 21:49
19) 12/18/08 6:33 - 12/18/08 6:36
20) 12/25/08 13:28 - 12/25/08 13:51
21) 12/25/08 20:48
22) 12/26/08 15:13 - 12/26/08 15:14
23) 12/26/08 17:28
24) 12/27/08 22:28
25) 12/28/08 1:29 - 12/28/08 1:30
26) 12/28/08 21:44
27) 12/29/08 3:06 - 12/29/08 3:09
28) 12/29/08 22:15 - 12/29/08 22:24
29) 12/30/08 3:51 - 12/30/08 4:00
30) 12/30/08 23:22 - 12/30/08 23:34
31) 12/31/08 3:37 - 12/31/08 3:39
32) 01/01/09 0:43 - 01/01/09 0:44
33) 01/01/09 2:21 - 01/01/09 2:29
34) 01/02/09 0:47

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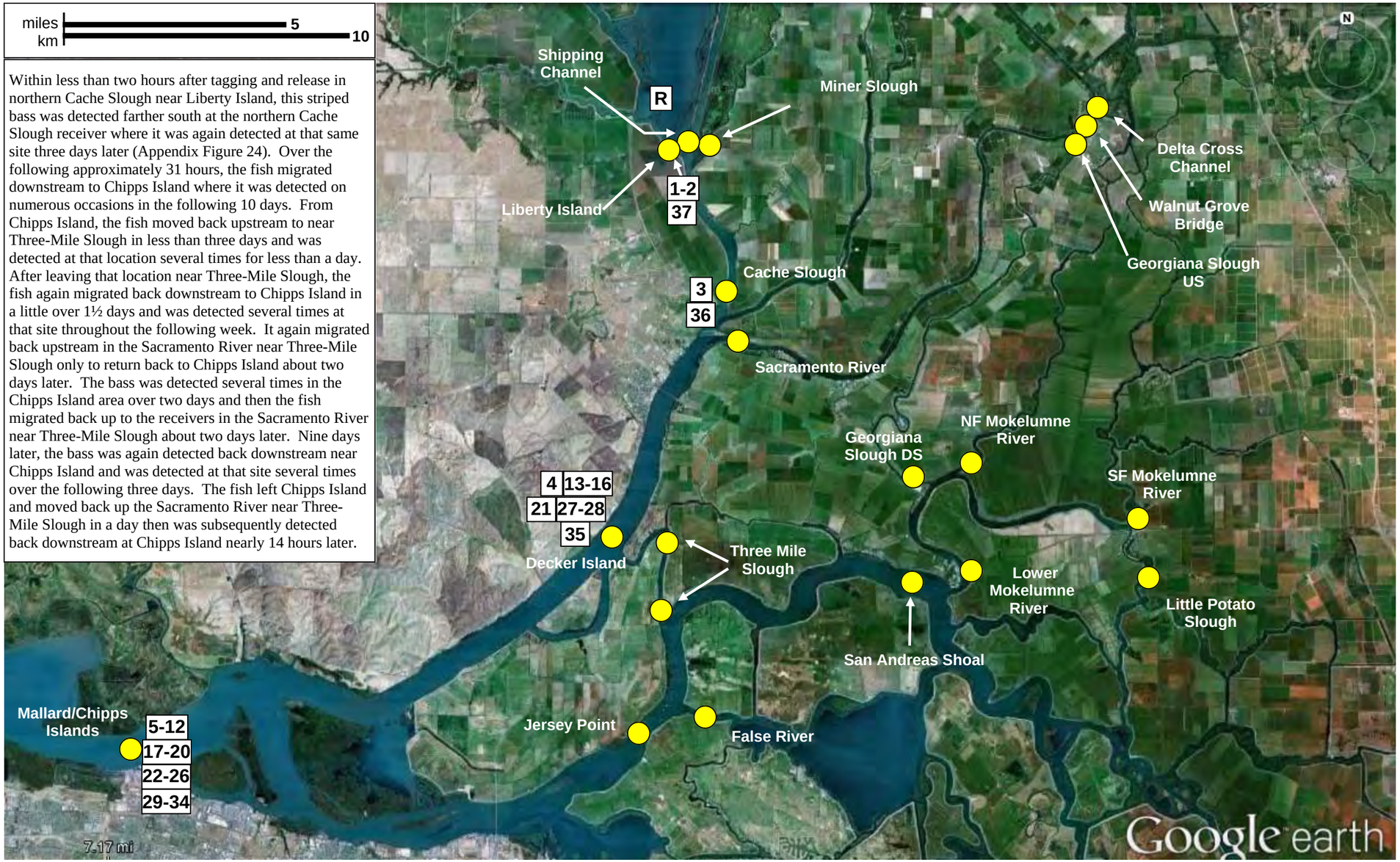
35) 01/02/09 3:20 - 01/02/09 3:21
36) 01/03/09 0:00
37) 01/03/09 5:16
38) 01/04/09 0:34 - 01/04/09 0:35
39) 01/04/09 5:35
40) 01/04/09 14:38 - 01/04/09 14:39
41) 01/04/09 21:49
42) 01/04/09 23:52 - 01/04/09 23:54
43) 01/05/09 6:15 - 01/05/09 6:20
44) 01/05/09 14:56
45) 01/05/09 23:25 - 01/05/09 23:42
46) 01/06/09 3:01 - 01/06/09 3:02
47) 01/06/09 5:17 - 01/06/09 5:32
48) 01/06/09 17:59 - 01/06/09 18:03
49) 01/06/09 21:23 - 01/06/09 21:27
50) 01/07/09 17:22
51) 01/08/09 0:42 - 01/08/09 0:44
52) 01/08/09 18:35 - 01/08/09 18:36
53) 01/09/09 1:41 - 01/09/09 1:44
54) 01/09/09 18:20
55) 01/10/09 13:25
56) 01/10/09 16:00 - 01/10/09 16:01
57) 01/11/09 14:45 - 01/11/09 14:47
58) 01/11/09 17:17 - 01/11/09 17:18
59) 02/03/09 5:28
60) 02/03/09 18:11
61) 02/05/09 17:05 - 02/05/09 17:06
62) 02/06/09 2:43
63) 02/06/09 4:20 - 02/06/09 4:48
64) 02/06/09 7:52 - 02/06/09 7:53
65) 02/11/09 16:42
66) 02/11/09 19:13
67) 02/13/09 7:00
68) 02/15/09 7:25
69) 02/15/09 9:30
70) 02/16/09 5:24 - 02/16/09 5:25
71) 02/16/09 13:44
72) 02/16/09 20:45 - 02/16/09 20:57
73) 02/17/09 18:49
74) 02/18/09 16:09

Appendix Figure 23. Movements of acoustic tagged striped bass No. 5086.05 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

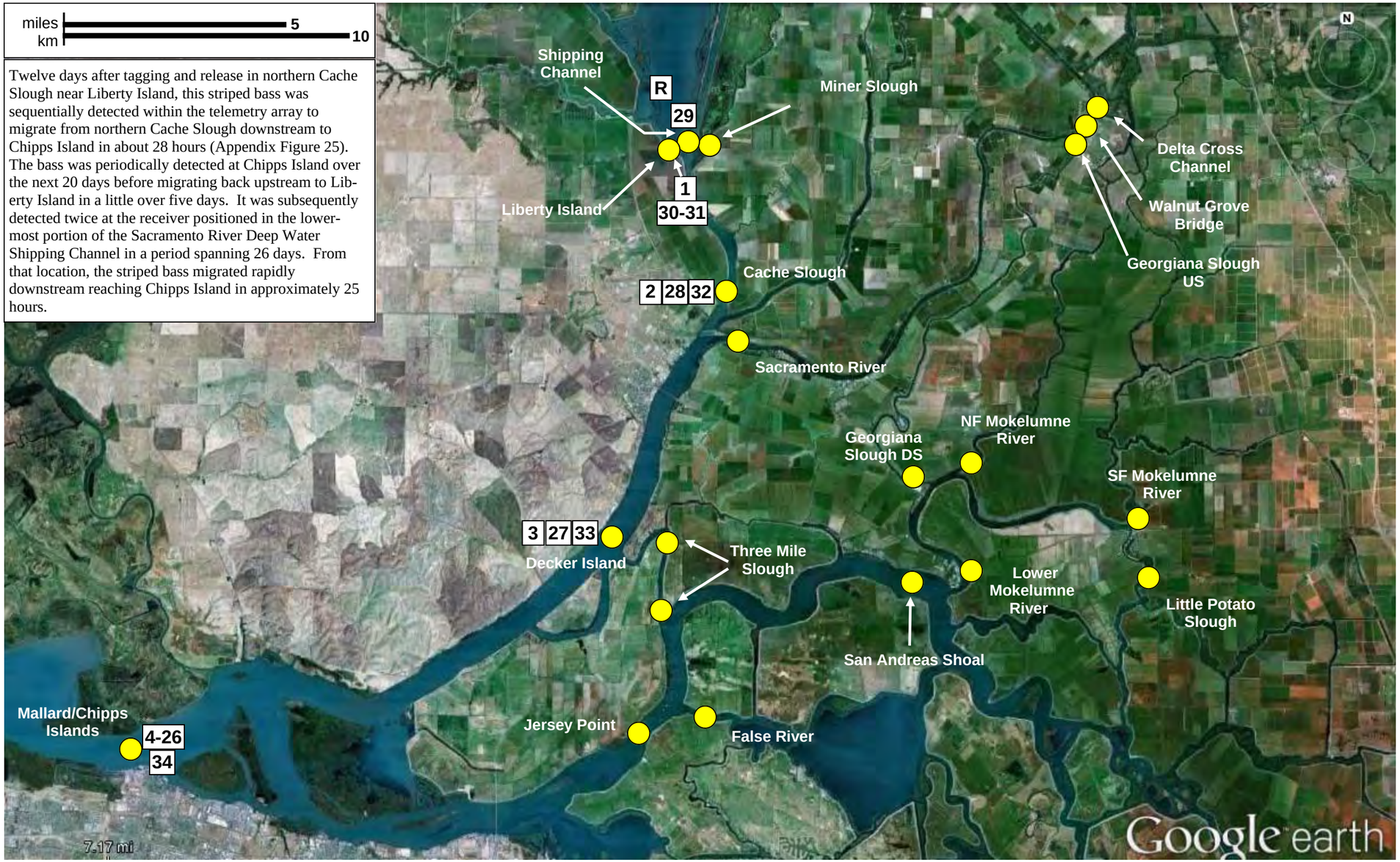
Striped Bass (360 mm) Tag Code 5207.06



R)	**12/10/08**	**15:55**	**RELEASE**			7)	12/17/08	13:53				14)	12/27/08	19:16 -	12/27/08	19:55	21)	01/06/09	11:30 -	01/06/09	14:08	28)	01/12/09	18:01 -	01/12/09	18:28	35)	01/25/09	13:45 -	01/25/09	
1)	12/10/08	17:18 -	12/10/08	22:09		8)	12/17/08	16:12				15)	12/28/08	2:52 -	12/28/08	3:43	22)	01/08/09	19:25			29)	01/21/09	19:15 -	01/21/09	19:25	36)	01/26/09	3:21 -	01/26/09	
2)	12/13/08	18:06 -	12/13/08	18:08		9)	12/21/08	1:02				16)	12/28/08	6:53 -	12/28/08	8:10	23)	01/09/09	0:29 -	01/09/09	0:33	30)	01/22/09	0:10 -	01/22/09	0:16	37)	01/26/09	5:34 -	01/26/09	
3)	12/13/08	19:21 -	12/13/08	19:25		10)	12/21/08	7:16				17)	12/29/08	22:26			24)	01/09/09	19:25			31)	01/22/09	6:22 -	01/22/09	6:41					
4)	12/13/08	21:57 -	12/13/08	22:10		11)	12/22/08	20:17 -	12/22/08	21:17		18)	01/04/09	22:04 -	01/04/09	22:26	25)	01/10/09	1:47 -	01/10/09	1:56	32)	01/22/09	8:17 -	01/22/09	8:28					
5)	12/15/08	1:31				12)	12/24/08	21:55				19)	01/05/09	0:55			26)	01/10/09	23:14 -	01/10/09	23:25	33)	01/22/09	18:03							
6)	12/15/08	21:22 -	12/15/08	21:31		13)	12/27/08	15:30 -	12/27/08	15:59		20)	01/05/09	4:50 -	01/05/09	5:00	27)	01/12/09	16:29 -	01/12/09	16:51	34)	01/24/09	13:06							

Appendix Figure 24. Movements of acoustic tagged striped bass No. 5207.06 in the Delta during the 2008 - 2009 Regional Study.
R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

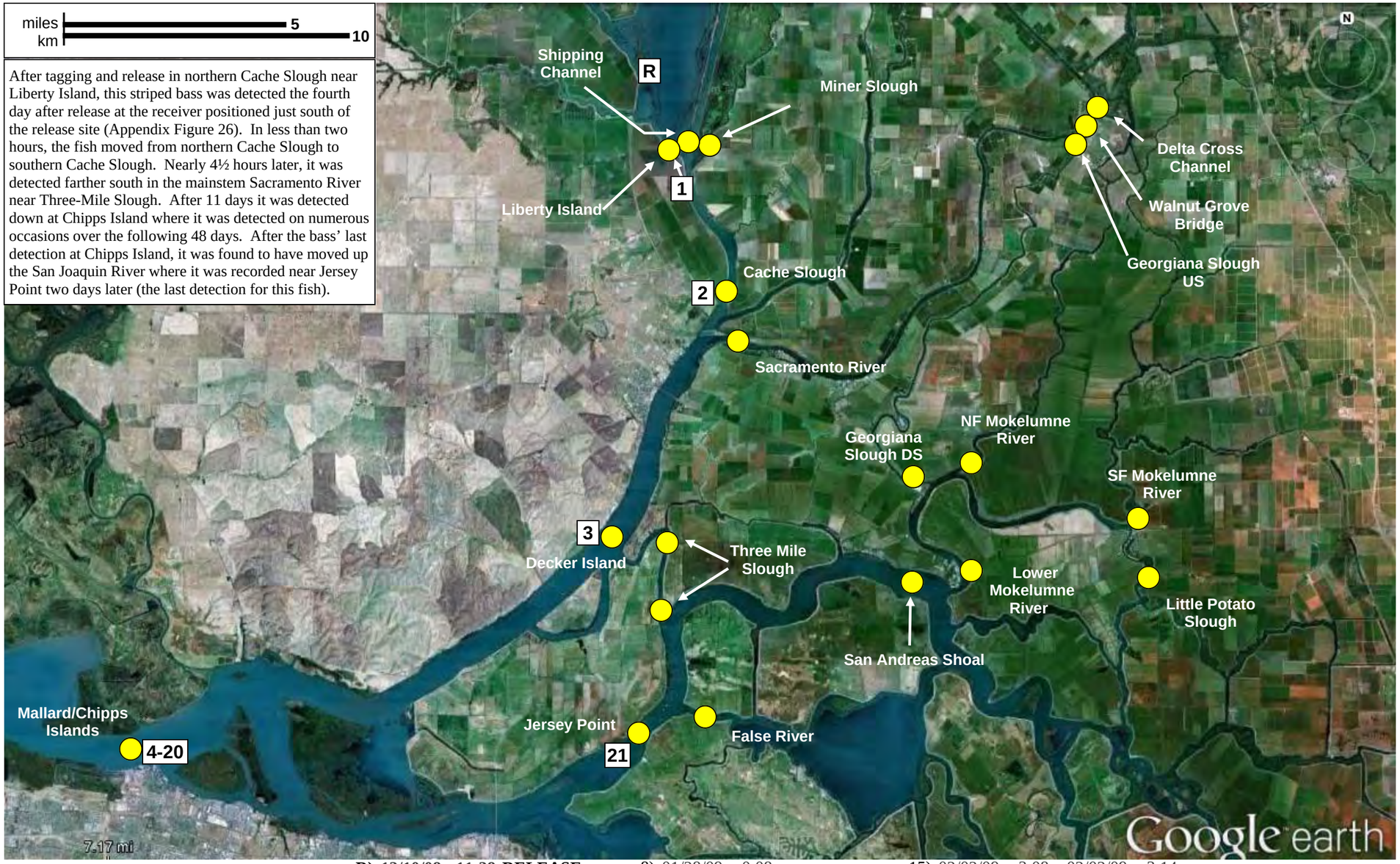
Striped Bass (500 mm) Tag Code 5174.12



R)	**12/02/08**	**16:35**	**RELEASE**		7)	12/19/08	2:27 -	12/19/08	2:56	14)	12/24/08	12:26 -	12/24/08	12:37	21)	01/05/09	10:30 -	01/05/09	11:06	28)	01/13/09	3:34 -	01/13/09	3:35
1)	12/14/08	20:01 -	12/14/08	20:03	8)	12/19/08	5:10			15)	12/24/08	14:56			22)	01/06/09	6:58 -	01/06/09	7:00	29)	01/13/09	6:00		
2)	12/14/08	21:30			9)	12/19/08	15:10			16)	12/25/08	3:56 -	12/25/08	4:08	23)	01/06/09	15:45 -	01/06/09	15:47	30)	01/13/09	7:45 -	01/13/09	13:02
3)	12/15/08	0:32 -	12/15/08	0:49	10)	12/20/08	10:08			17)	12/25/08	7:23			24)	01/06/09	23:25 -	01/06/09	23:34	31)	02/08/09	19:19 -	02/08/09	19:22
4)	12/17/08	0:09 -	12/17/08	0:18	11)	12/20/08	13:01			18)	12/25/08	10:18			25)	01/07/09	16:27			32)	02/08/09	20:42 -	02/08/09	20:47
5)	12/18/08	2:00 -	12/18/08	2:14	12)	12/21/08	10:00			19)	12/26/08	3:34			26)	01/07/09	22:44			33)	02/09/09	0:59 -	02/09/09	6:00
6)	12/18/08	4:46			13)	12/21/08	13:56			20)	12/26/08	13:18 -	12/26/08	14:43	27)	01/12/09	5:16 -	01/12/09	5:35	34)	02/09/09	20:44		

Appendix Figure 25. Movements of acoustic tagged striped bass No. 5174.12 in the Delta during the 2008 - 2009 Regional Study.
R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

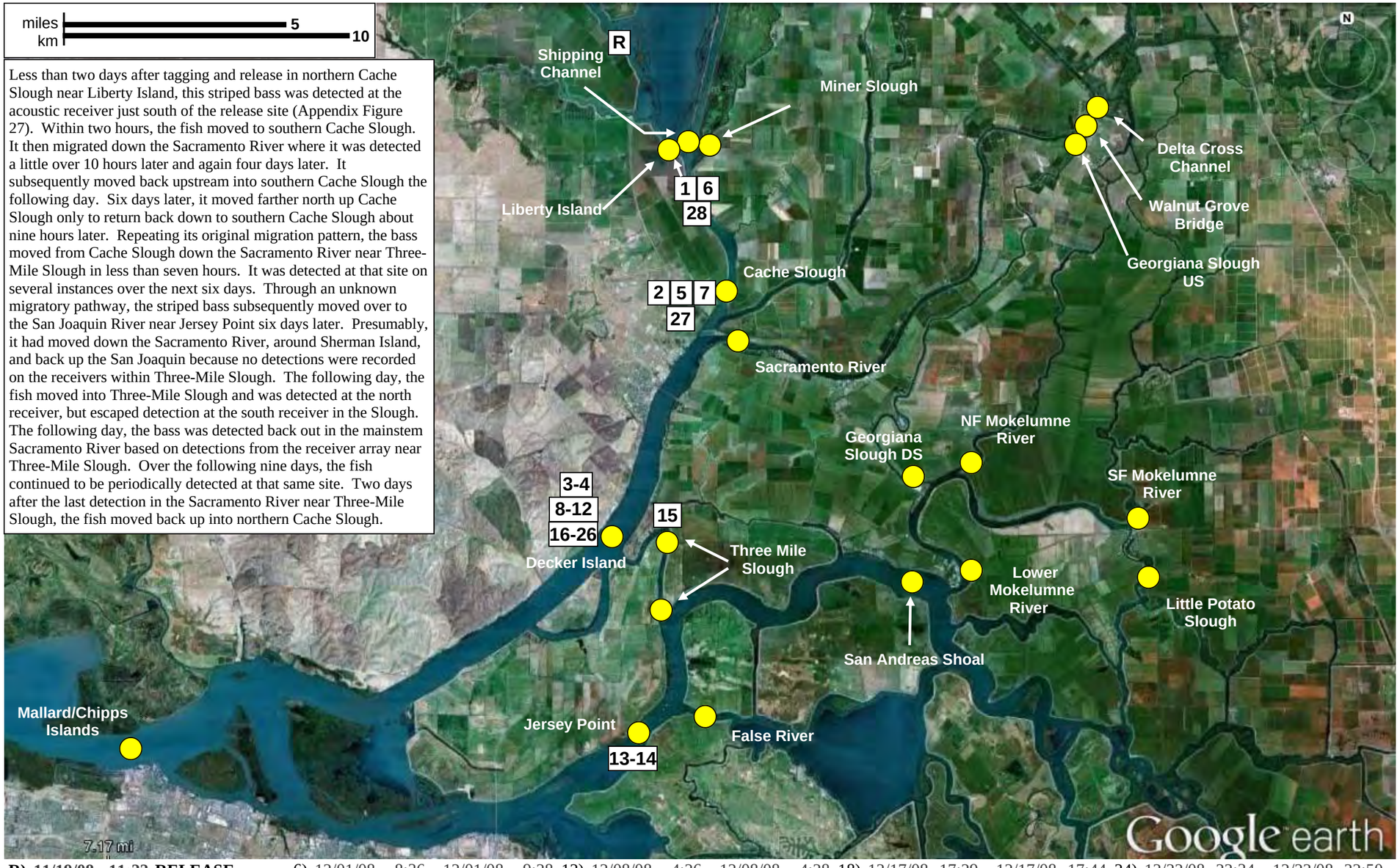
Striped Bass (350 mm) Tag Code 5377.03



R)	**12/10/08**	**11:38**	**RELEASE**		8)	01/28/09	0:08		15)	02/02/09	3:08 -	02/02/09	3:14	
1)	12/14/08	20:41 -	12/14/08	20:43	9)	01/28/09	23:06 -	01/28/09	23:07	16)	02/07/09	19:14		
2)	12/14/08	22:20			10)	01/29/09	2:35 -	01/29/09	2:37	17)	02/08/09	0:12 -	02/08/09	0:15
3)	12/15/08	2:42 -	12/15/08	9:08	11)	01/31/09	0:13 -	01/31/09	0:15	18)	02/08/09	22:47		
4)	12/26/08	21:47			12)	01/31/09	2:46 -	01/31/09	2:49	19)	02/11/09	23:53		
5)	12/27/08	1:01 -	12/27/08	1:05	13)	01/31/09	22:05 -	01/31/09	22:06	20)	02/12/09	1:29 -	02/12/09	1:44
6)	12/27/08	22:48 -	12/27/08	22:49	14)	02/02/09	1:47			21)	02/14/09	3:48		
7)	12/28/08	0:50 -	12/28/08	0:53										

Appendix Figure 26. Movements of acoustic tagged striped bass No. 5377.03 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

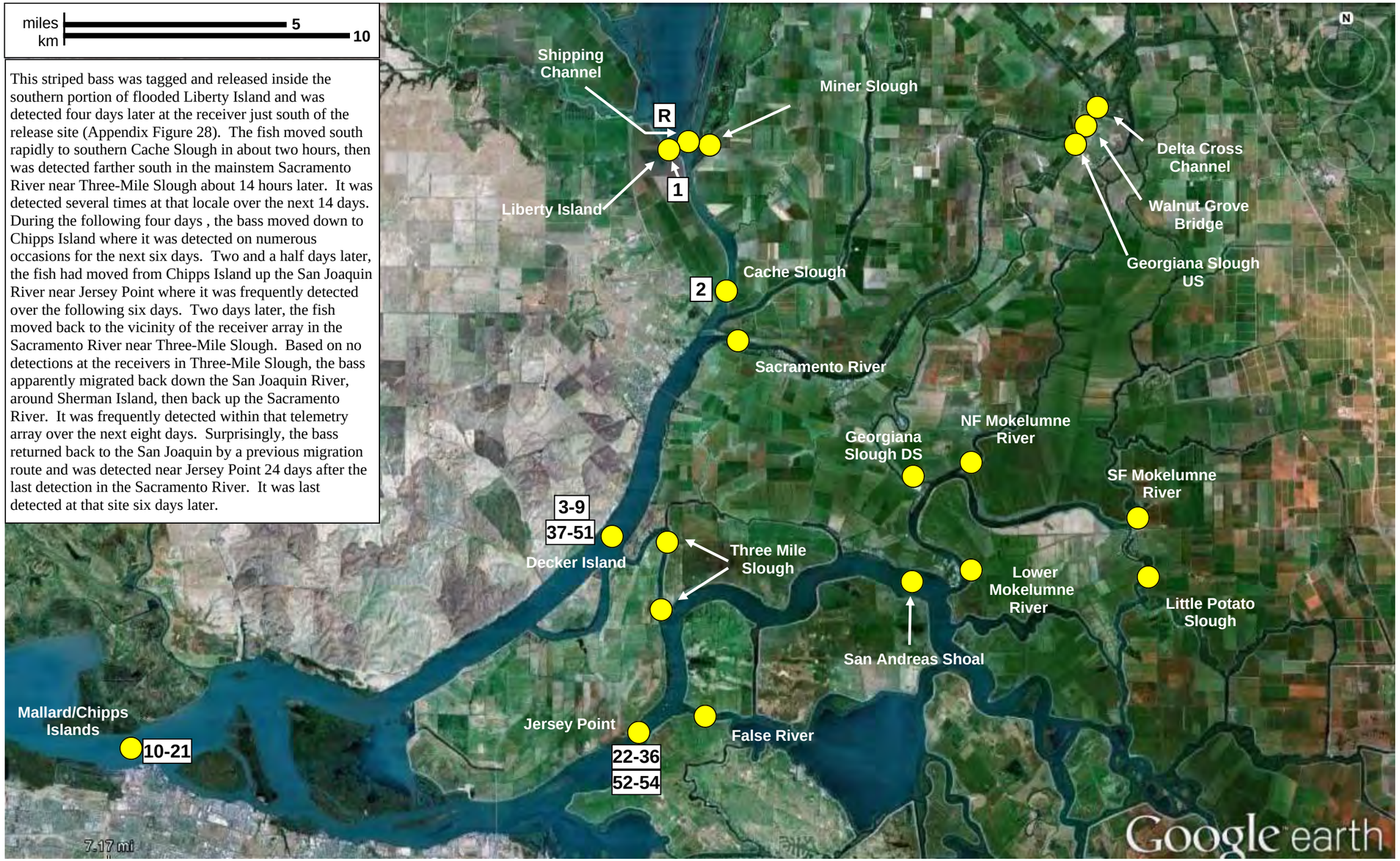
Striped Bass (430 mm) Tag Code 5122.09



R)	**11/19/08**	**11:22**	**RELEASE**		6)	12/01/08	8:36 -	12/01/08	9:28	12)	12/08/08	4:26 -	12/08/08	4:28	18)	12/17/08	17:29 -	12/17/08	17:44	24)	12/22/08	22:34 -	12/22/08	22:50
1)	11/21/08	2:05 -	11/21/08	2:08	7)	12/01/08	18:46			13)	12/14/08	8:43			19)	12/17/08	23:23 -	12/17/08	23:44	25)	12/23/08	4:58 -	12/23/08	5:26
2)	11/21/08	4:05 -	11/21/08	4:09	8)	12/02/08	1:10 -	12/02/08	1:31	14)	12/14/08	10:25 -	12/14/08	14:55	20)	12/20/08	9:52			26)	12/25/08	2:56 -	12/25/08	3:12
3)	11/21/08	14:28 -	11/21/08	14:44	9)	12/05/08	19:56 -	12/05/08	23:39	15)	12/15/08	10:24			21)	12/20/08	11:58 -	12/20/08	13:12	27)	12/27/08	3:08 -	12/27/08	3:09
4)	11/25/08	12:36 -	11/25/08	12:51	10)	12/07/08	19:58 -	12/07/08	20:37	16)	12/16/08	17:37 -	12/16/08	17:54	22)	12/22/08	12:20 -	12/22/08	12:22	28)	12/27/08	5:35 -	12/27/08	5:39
5)	11/26/08	1:27 -	11/26/08	1:30	11)	12/08/08	3:50 -	12/08/08	3:52	17)	12/16/08	21:05 -	12/16/08	21:23	23)	12/22/08	14:39 -	12/22/08	17:05					

Appendix Figure 27. Movements of acoustic tagged striped bass No. 5122.09 in the Delta during the 2008 - 2009 Regional Study.
R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

Striped Bass (430 mm) Tag Code 5249.06



This striped bass was tagged and released inside the southern portion of flooded Liberty Island and was detected four days later at the receiver just south of the release site (Appendix Figure 28). The fish moved south rapidly to southern Cache Slough in about two hours, then was detected farther south in the mainstem Sacramento River near Three-Mile Slough about 14 hours later. It was detected several times at that locale over the next 14 days. During the following four days , the bass moved down to Chipps Island where it was detected on numerous occasions for the next six days. Two and a half days later, the fish had moved from Chipps Island up the San Joaquin River near Jersey Point where it was frequently detected over the following six days. Two days later, the fish moved back to the vicinity of the receiver array in the Sacramento River near Three-Mile Slough. Based on no detections at the receivers in Three-Mile Slough, the bass apparently migrated back down the San Joaquin River, around Sherman Island, then back up the Sacramento River. It was frequently detected within that telemetry array over the next eight days. Surprisingly, the bass returned back to the San Joaquin by a previous migration route and was detected near Jersey Point 24 days after the last detection in the Sacramento River. It was last detected at that site six days later.

R) 12/03/08 9:47 RELEASE

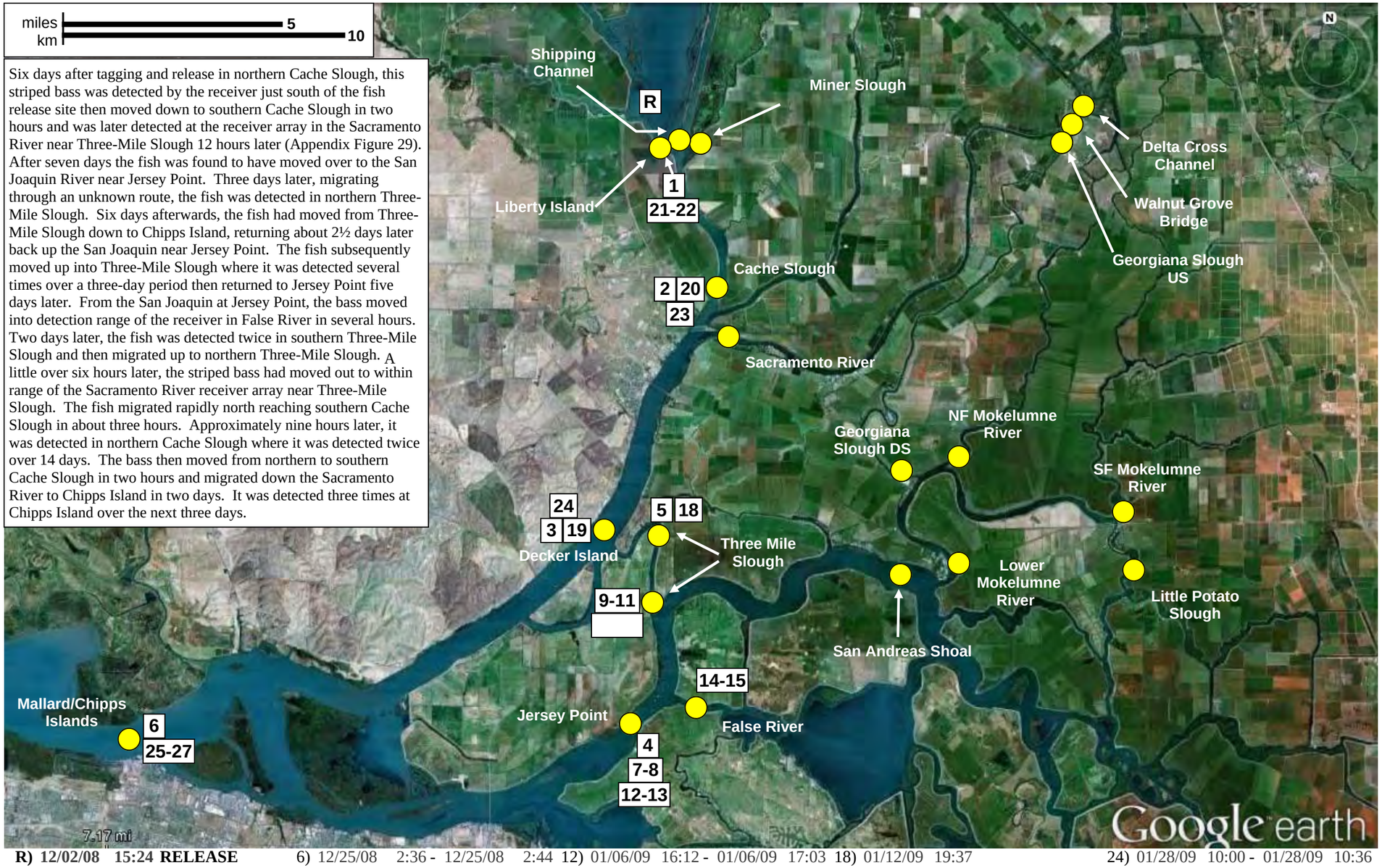
1) 12/07/08 1:17 - 12/07/08 1:22
2) 12/07/08 3:33 - 12/07/08 3:38
3) 12/07/08 17:56 - 12/08/08 2:11
4) 12/19/08 10:23 - 12/19/08 13:17
5) 12/20/08 10:45 - 12/20/08 11:52
6) 12/20/08 13:36
7) 12/21/08 10:39 - 12/21/08 11:17
8) 12/21/08 13:41 - 12/21/08 14:12
9) 12/21/08 16:32
10) 12/25/08 20:38 - 12/25/08 20:49
11) 12/26/08 2:52 - 12/26/08 3:01
12) 12/26/08 7:51
13) 12/26/08 10:17 - 12/26/08 11:10
14) 12/26/08 18:33
15) 12/27/08 13:07
16) 12/27/08 18:16
17) 12/28/08 15:10
18) 12/28/08 17:10
19) 12/30/08 14:16 - 12/30/08 14:22
20) 12/30/08 22:14
21) 12/31/08 4:11 - 12/31/08 4:21
22) 01/02/09 18:53
23) 01/02/09 21:13
24) 01/03/09 6:04 - 01/03/09 6:42
25) 01/04/09 0:56 - 01/04/09 2:01
26) 01/04/09 6:11 - 01/04/09 6:59
27) 01/04/09 11:57 - 01/04/09 20:18
28) 01/05/09 3:02
29) 01/05/09 5:52 - 01/05/09 5:54
30) 01/05/09 14:26 - 01/05/09 15:56
31) 01/05/09 17:55 - 01/05/09 21:57
32) 01/06/09 18:37 - 01/06/09 19:26
33) 01/06/09 21:38
34) 01/07/09 18:38 - 01/07/09 19:08

Appendix Figure 28. Movements of acoustic tagged striped bass No. 5249.06 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

CONTINUED

35) 01/08/09 0:43 - 01/08/09 1:23
36) 01/08/09 16:35 - 01/08/09 17:13
37) 01/10/09 14:57 - 01/10/09 16:55
38) 01/11/09 15:06 - 01/11/09 15:28
39) 01/11/09 17:33 - 01/11/09 18:06
40) 01/12/09 15:39 - 01/12/09 15:58
41) 01/12/09 18:52 - 01/12/09 19:26
42) 01/13/09 6:51 - 01/13/09 7:44
43) 01/13/09 16:23 - 01/13/09 16:45
44) 01/13/09 19:59 - 01/13/09 20:28
45) 01/14/09 6:27 - 01/14/09 6:57
46) 01/14/09 8:46 - 01/14/09 9:39
47) 01/14/09 18:57 - 01/14/09 19:13
48) 01/16/09 8:41 - 01/16/09 10:37
49) 01/17/09 8:20 - 01/17/09 8:49
50) 01/17/09 11:16 - 01/17/09 11:38
51) 01/18/09 9:57 - 01/18/09 11:19
52) 02/11/09 18:01 - 02/11/09 19:10
53) 02/17/09 7:43
54) 02/17/09 13:01 - 02/17/09 13:03

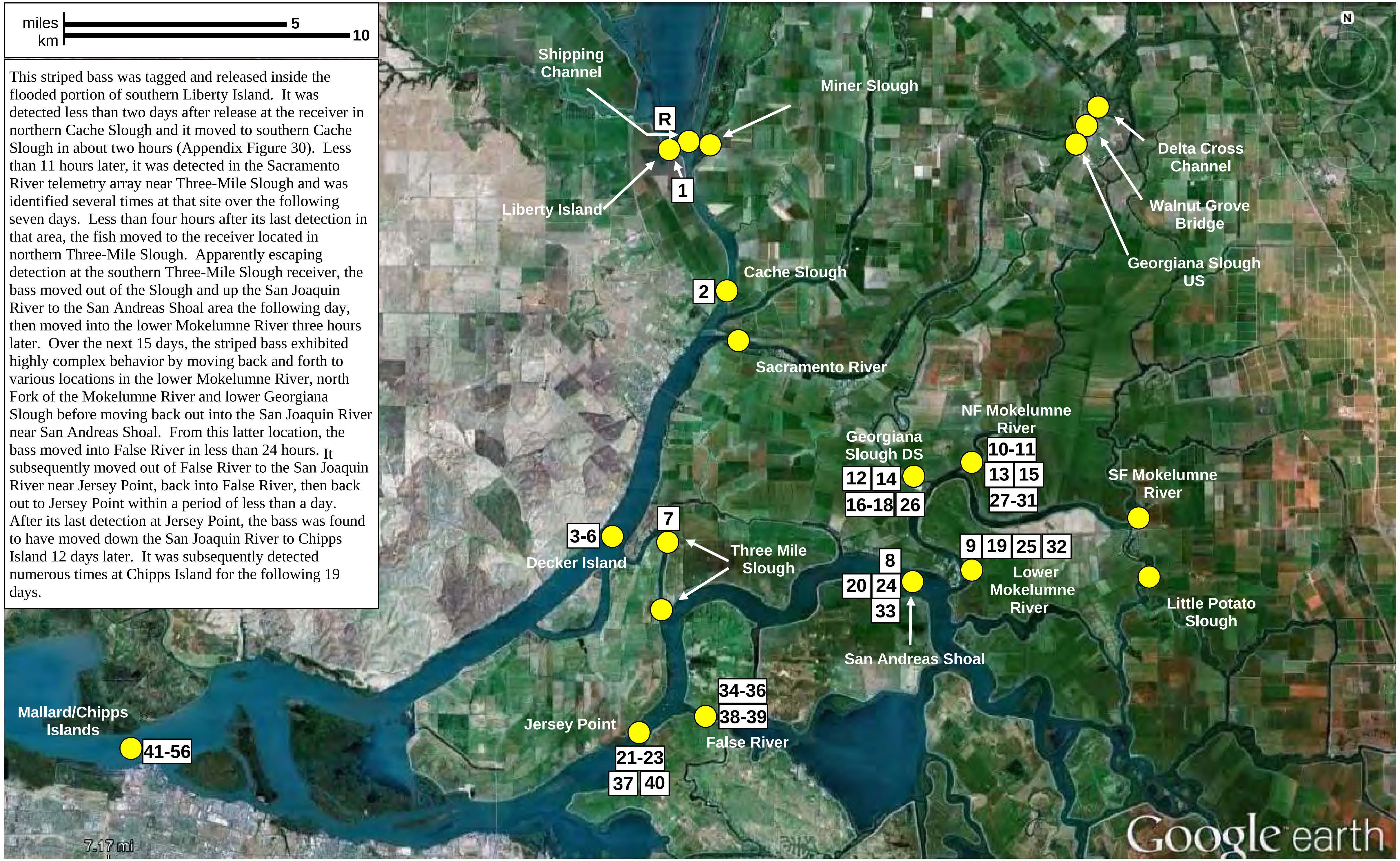
Striped Bass (400 mm) Tag Code 5154.05



R)	**12/02/08**	**15:24**	**RELEASE**		6)	12/25/08	2:36	- 12/25/08	2:44	12)	01/06/09	16:12	- 01/06/09	17:03	18)	01/12/09	19:37			24)	01/28/09	10:00	- 01/28/09	10:36
1)	12/08/08	15:13	- 12/08/08	15:16	7)	12/27/08	16:25	- 12/27/08	18:01	13)	01/06/09	19:48			19)	01/13/09	1:58	- 01/13/09	2:16	25)	01/29/09	21:48		
2)	12/08/08	17:13	- 12/08/08	17:18	8)	12/27/08	22:49	- 12/28/08	1:57	14)	01/06/09	22:03	- 01/06/09	22:19	20)	01/13/09	5:37	- 01/13/09	5:39	26)	01/30/09			
3)	12/09/08	5:16	- 12/09/08	7:03	9)	12/29/08	12:45			15)	01/10/09	8:25	- 01/10/09	9:05	21)	01/13/09	13:55	- 01/13/09	13:58	27)	02/01/09	4:37 13:51	- 02/01/09	13:53
4)	12/16/08	3:48	- 12/16/08	4:19	10)	12/29/08	17:57	- 12/29/08	18:01	16)	01/12/09	7:09			22)	01/27/09	20:08	- 01/27/09	20:11					
5)	12/19/08	0:25			11)	01/01/09	15:23			17)	01/12/09	18:10			23)	01/27/09	22:09	- 01/27/09	22:14					

Appendix Figure 29. Movements of acoustic tagged striped bass No. 5154.05 in the Delta during the 2008 - 2009 Regional Study.
R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

Striped Bass (485 mm) Tag Code 5590.07



This striped bass was tagged and released inside the flooded portion of southern Liberty Island. It was detected less than two days after release at the receiver in northern Cache Slough and it moved to southern Cache Slough in about two hours (Appendix Figure 30). Less than 11 hours later, it was detected in the Sacramento River telemetry array near Three-Mile Slough and was identified several times at that site over the following seven days. Less than four hours after its last detection in that area, the fish moved to the receiver located in northern Three-Mile Slough. Apparently escaping detection at the southern Three-Mile Slough receiver, the bass moved out of the Slough and up the San Joaquin River to the San Andreas Shoal area the following day, then moved into the lower Mokelumne River three hours later. Over the next 15 days, the striped bass exhibited highly complex behavior by moving back and forth to various locations in the lower Mokelumne River, north Fork of the Mokelumne River and lower Georgiana Slough before moving back out into the San Joaquin River near San Andreas Shoal. From this latter location, the bass moved into False River in less than 24 hours. It subsequently moved out of False River to the San Joaquin River near Jersey Point, back into False River, then back out to Jersey Point within a period of less than a day. After its last detection at Jersey Point, the bass was found to have moved down the San Joaquin River to Chipps Island 12 days later. It was subsequently detected numerous times at Chipps Island for the following 19 days.

R) 12/18/08 9:50 RELEASE
1) 12/20/08 0:51 - 12/20/08 0:54
2) 12/20/08 2:45 - 12/20/08 2:49
3) 12/20/08 13:00 - 12/20/08 13:22
4) 12/27/08 3:16 - 12/27/08 3:38
5) 12/27/08 10:05
6) 12/27/08 22:20
7) 12/28/08 2:06
8) 12/29/08 0:13 - 12/29/08 0:18
9) 12/29/08 3:17 - 12/29/08 3:26
10) 12/29/08 13:30
11) 12/29/08 21:55
12) 12/30/08 20:21
13) 12/31/08 11:27
14) 12/31/08 20:49 - 12/31/08 23:11
15) 01/01/09 9:43
16) 01/01/09 19:05 - 01/01/09 20:21
17) 01/02/09 8:59
18) 01/02/09 10:23 - 01/02/09 10:39
19) 01/02/09 14:40 - 01/02/09 15:11
20) 01/02/09 19:02 - 01/02/09 21:58
21) 01/03/09 8:23
22) 01/03/09 11:50 - 01/03/09 13:14
23) 01/09/09 0:19
24) 01/09/09 19:24 - 01/09/09 19:31
25) 01/09/09 22:24 - 01/09/09 23:07
26) 01/10/09 2:13
27) 01/10/09 3:43
28) 01/10/09 8:50 - 01/10/09 9:03
29) 01/10/09 16:59
30) 01/11/09 14:50 - 01/11/09 18:02
31) 01/12/09 6:43 - 01/12/09 8:06
32) 01/13/09 1:34 - 01/13/09 1:43
33) 01/13/09 3:25 - 01/13/09 3:30
34) 01/14/09 0:42
35) 01/14/09 2:06 - 01/14/09 3:27
36) 01/14/09 5:55
37) 01/14/09 9:43 - 01/14/09 14:26
38) 01/14/09 18:24 - 01/14/09 19:01
39) 01/14/09 21:31 - 01/14/09 21:52
40) 01/14/09 22:31 - 01/14/09 22:53
41) 01/26/09 23:38 - 01/27/09 0:18
42) 01/27/09 22:38
43) 01/27/09 22:43
44) 01/28/09 1:19
45) 02/01/09 0:10
46) 02/01/09 3:04 - 02/01/09 3:07
47) 02/09/09 0:22
48) 02/09/09 20:48
49) 02/10/09 2:54
50) 02/10/09 21:21
51) 02/11/09 2:41
52) 02/11/09 9:59
53) 02/12/09 11:46
54) 02/12/09 13:29
55) 02/12/09 22:50
56) 02/14/09 0:21

Appendix Figure 30. Movements of acoustic tagged striped bass No. 5590.07 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.

Striped Bass (470 mm) Tag Code 5016.04

R)	**11/18/08**	**15:51**	**RELEASE**		7)	11/21/08	6:09		14)	11/22/08	4:01	-		21)	12/16/08	3:21			28)	12/27/08	20:36		
1)	11/18/08	15:51			8)	11/21/08	6:10	- 11/21/08 7:54	15)	11/22/08	8:53	- 11/22/08	8:56	22)	12/16/08	16:29	- 12/16/08	16:32	29)	12/29/08	3:50	- 12/29/08	4:15
2)	11/20/08	17:21	- 11/20/08	18:03	9)	11/21/08	7:55		16)	11/22/08	11:00	- 11/22/08	12:11	23)	12/16/08	17:49	- 12/16/08	18:07	30)	01/07/09	11:30	MOBILE	
3)	11/20/08	18:30			10)	11/21/08	8:15		17)	12/12/08	22:18	- 12/12/08	22:28	24)	12/17/08	18:22	- 12/17/08	18:34	31)	01/08/09	19:26	- 01/08/09	19:39
4)	11/20/08	19:43	- 11/20/08	20:02	11)	11/21/08	8:23		18)	12/13/08	9:28	- 12/13/08	17:39	25)	12/22/08	22:49	- 12/22/08	23:09	32)	01/08/09	23:15		
5)	11/21/08	4:41	- 11/21/08	4:44	12)	11/21/08	9:01		19)	12/15/08	18:00	- 12/15/08	19:13	26)	12/26/08	11:20	- 12/26/08	16:39	33)	01/09/09	12:06		
6)	11/21/08	5:25			13)	11/21/08	9:09		20)	12/15/08	23:48			27)	12/27/08	19:25			34)	01/09/09	16:46	- 01/09/09	17:23

CONTINUED

35)	01/20/09	5:16			
36)	01/28/09	2:28	- 01/28/09	3:23	
37)	01/29/09	21:42			
38)	01/30/09	20:31	- 01/30/09	21:02	
39)	02/01/09	23:58			
40)	02/06/09	12:22			
41)	02/07/09	2:54			
42)	02/07/09	5:52			
43)	02/07/09	12:11	- 02/07/09	12:23	
44)	02/07/09	19:13	- 02/07/09	19:41	
45)	02/08/09	1:03	- 02/08/09	1:15	
46)	02/08/09	20:05	- 02/08/09	20:13	
47)	02/09/09	1:42	- 02/09/09	1:51	
48)	02/09/09	8:44	- 02/09/09	9:25	
49)	02/23/09	2:15			

Appendix Figure 31. Movements of acoustic tagged striped bass No. 5016.04 in the Delta during the 2008 - 2009 Regional Study. R=Release site. Fixed-station acoustic receiver locations depicted by yellow dots.