

**Klamath River Green Sturgeon Acoustic Biotelemetry Monitoring
2008 FINAL Technical Memorandum**

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Introduction

The green sturgeon (*Acipenser medirostris*) is an anadromous Pacific Ocean sturgeon found in the coastal waters and rivers of western North America (Moyle 2002). Their distribution ranges from Ensenada, Mexico to the Bering Sea, Alaska (Scott and Crossman 1973; Moyle 2002). The only known spawning streams are the Rogue River in Oregon, and the Sacramento and Klamath Rivers in California. Recent genetic studies have identified two distinct population segments; one from the north and one from the south. Individuals belonging to the northern distinct population segment spawn in the Rogue and Klamath Rivers, while green sturgeon that spawn in the Sacramento River are part of the southern distinct population segment (Israel et al. 2004).

Green sturgeon life history, abundance, and distribution data is limited. Green sturgeon use freshwater primarily for spawning, and are mostly observed in saltwater and brackish estuaries of large coastal rivers (Scott and Crossman 1973; Parks 1978; Houston 1988). However, stream residency has been documented during summer and fall for up to six months in the Klamath and Rogue Rivers (Erickson et al. 2002; Benson et al. 2005). Timing of emigration from the river was related to increased discharge, particularly the first freshets of the autumn and winter (Benson et al. 2005).

Green sturgeon populations in North America are considered vulnerable to endangered (Musick et al. 2000). Presumed spawning populations in the Eel, South Fork Trinity, and San Joaquin rivers have been extirpated within the last 25 to 30 years (Moyle et al. 1995). Mature spawners in other populations are reduced, with mature females numbering in the low hundreds (Musick et al. 2000; Moyle 2002). Furthermore, anthropogenic activities may detrimentally affect green sturgeon populations, particularly dams and hydroelectric projects (Houston 1988; Moyle et al. 1995; Erickson et al. 2002). Flows on the Rogue and Klamath rivers are artificially manipulated, and while the full effects of flow manipulations on sturgeon are not known, they are sensitive to flow conditions for migrational cues (Erickson et al. 2002; Benson et al. 2005) and survival of young-of-the-year is strongly influenced by riverine conditions. Existing data is limited for this species, particularly regarding its abundance, distribution within its range, population dynamics, and ecological requirements. Until these parameters are identified and understood, green sturgeon should be considered rare and a species of special concern, especially due to the extreme vulnerability of sturgeons globally (Houston 1988; Birstein 1993; Birstein et al. 1997; Musick et al. 2000; Moyle 2002).

To the Yurok Tribe, green sturgeon are considered sacred and these large fish are an extremely valuable source of food. The Yurok people have lived along the banks of the Klamath River for millennia, subsisting on the Klamath's once abundant runs of anadromous fish. Water quality and water quantity issues have led to the large scale declines Klamath River salmonids (NRC 2002), and the status of green sturgeon populations are not known. The Yurok Tribe is concerned that declines in green sturgeon numbers may be eminent, and therefore initiated a long term study intended to gather as much information on these revered fish as possible.

From 2002 to 2005 the Yurok Tribal Fisheries Program (YTFP) captured and tagged 56 adult green sturgeon in the Klamath and Trinity Rivers. In 2002 and 2003 we used radio telemetry and focused our study on in-river movements and migrations of green sturgeon (see Benson et al. 2005). Studies conducted in 2004 and 2005 also examined in-river movements, however in these years we used acoustic telemetry which allowed us to focus our study on where green sturgeon go after emigrating from the Klamath River. Green sturgeon from all four study years were internally tagged with either radio or acoustic transmitters, or both. The acoustic transmitters used in 2004 and 2005 had a life expectancy of up to five years, so it is possible that many are still operational. Since 2002, the YTFP has deployed acoustic monitoring receivers throughout the lower Klamath, Trinity, and Salmon rivers in order to track the movements of any returning green sturgeon tagged in the Klamath River. Numerous green sturgeon have also been tagged at various locations in California, Oregon, and Washington, and our receivers will detect any of these fish if they enter the Klamath River. In the spring of 2008 we once again deployed our sonic receiver array. This technical memorandum summarizes our findings from 2008.

Methods

Beginning in April of 2008, we deployed an array of 10 acoustic receivers (Vemco Ltd. VR2 and VR2W) at sites downstream of river kilometer (rkm) 108 (Figure 1). The receivers were deployed at locations where river currents were slow and depths were greater than ten feet. The receivers were attached to a cable that was anchored to the river bottom and connected to the shore. Receivers were downloaded via laptop computer on a bi-monthly basis or opportunistically throughout the study period. We removed the receiver array from the river in December of 2008, with the exception of the Blue Creek (rkm 26) receiver which is deployed on a year round basis. We also deployed two sonic receivers in the Pacific Ocean approximately one kilometer offshore from the Klamath River's mouth (Figure 2). These receivers were deployed on September 29th 2008 and as of January 2009 have yet to be downloaded and will remain deployed year round.

Results

Two tagged green sturgeon were detected by our in-river sonic receiver array. These fish were detected at rkm's 3, 57, 71 and 97 (Table 1). Both green sturgeon migrated upstream in the Spring as river flows were decreasing. One fish emigrated from the river on early June (fish #1), the other left in November with the first significant increase in river discharge (fish #2) (Figure 3). Fish #2 was tagged in the Klamath River in 2005 and fish #1 was tagged in Willipa Bay in 2004.

Also, a green sturgeon that was tagged by the YTFP in 2005 was detected by researchers in Washington State. The fish was a female that was tagged in April of 2005 at rkm 57.

Biologists working in the Columbia River estuary detected this fish in mid-September 2008. It is not uncommon for green sturgeon tagged in the Klamath River to be detected in other areas.

Summary

Two tagged green sturgeon entered the Klamath River in the spring of 2008 as river discharge was decreasing. This is similar to the entry timing and associated discharge patterns observed in previous years (Benson et al. 2005; YTFP, unpublished data). Both fish entered the river and migrated upstream to rkm 57 (Coon Creek Falls) where fish # 1 spent nine days and fish #2 spent fourteen days. After leaving this area they continued to migrate upstream most likely to spawning pools located at, or above, rkm 97. Fish # 1 spent four days upstream of rkm 97 (5/25/08 to 5/29/08) before migrating downstream past the receiver on its way to the ocean. This fish was detected again on 6/4/08 in the estuary as it exited the Klamath River. This behavior (spring emigration) is consistent with our findings from past studies (Benson et al. 2005). Fish #2 spent thirty days (5/26/08 to 6/26/08) in the general vicinity of the receiver located at rkm 97. It spent the remainder of its time in the river somewhere upstream of this location. On 11/3/08 it was detected by the receiver at rkm 97 as it emigrated towards the estuary. Fish #2 was detected on 11/4/08 at rkm 71 and again on 11/5/08 at rkm 3 (estuary) as it emigrated from the Klamath River. This out migration coincided with the first significant rainstorm of autumn which increased the Klamath River's discharge from 3,030 cubic feet per second (cfs) to 11,200 cfs. This behavior is also consistent with our findings from previous studies (Benson et al. 2005). We deployed two receivers in the ocean near the mouth of the Klamath River. In prior years we have detected numerous tagged green sturgeon in this area, which were not downloaded in time to include their detections in this report.

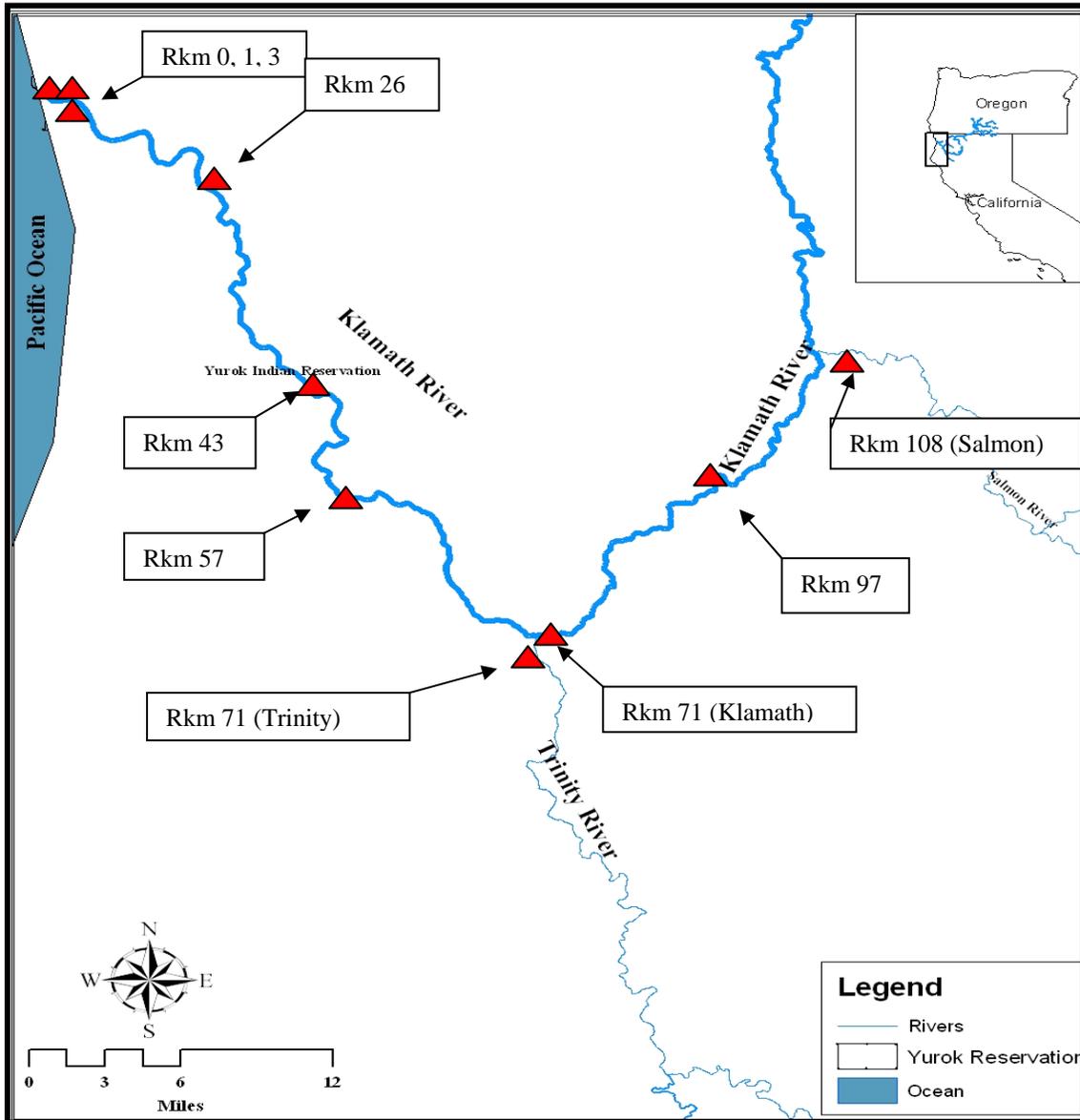


Figure 1: Map of the lower Klamath, Salmon, and Trinity rivers showing sonic receiver locations during the green sturgeon sonic biotelemetry monitoring project of 2008.



Figure 2: Satellite photo showing the mouth of the Klamath River and the Pacific Ocean. Triangles represent the locations of the two sonic receivers which were deployed on September 29th and utilized during the 2008 green sturgeon sonic biotelemetry monitoring project. Photo from Google Earth 2008.

Table 1: Results of 2008 green sturgeon sonic biotelemetry monitoring project. These two fish migrated into the Klamath River and were detected at various locations within the study area. Two dates in the date of detection column indicates that the fish held in that area for the time span shown.

Fish ID	Location (rkm)	Date of Detection
1	3	6/4/2008
	57	5/5/2008-5/14/2008
	97	5/25/2008
	97	5/29/2008
2	3	11/5/2008
	57	5/4/2008-5/20/2008
	71	11/4/2008
	97	5/26/2008-6/25/2008
	97	11/3/2008

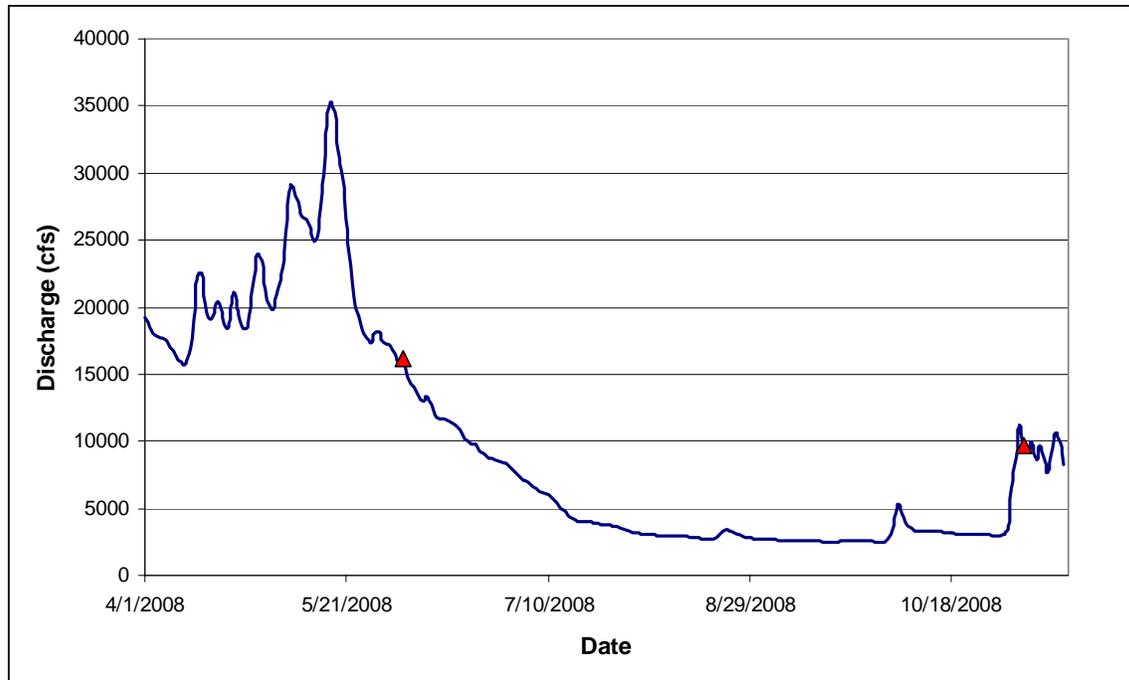


Figure 3: Klamath River discharge measured near Klamath, CA during the tagged green sturgeon outmigration period of 2008. Each triangle on the line represents the last time a sturgeon emigrating from the river was detected on our estuary receiver.

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