Tagging Green Sturgeon with Acoustic Transmitters for Evaluation of Habitat Use Along the Washington Coast

Interim Report
5 February 2021

Prepared for and funded by: U.S. Navy, Commander Pacific Fleet
Submitted to Naval Facilities Engineering Command under Cooperative Agreement #N62473-20-2-0005

Laura B. Heironimus, Matthew T. Sturza and Shaffryn M. Schade
Columbia River Management Unit
Washington Department of Fish and Wildlife
5525 South 11th Street
Ridgefield, WA 98642

Suggested Citation: Heironimus, L.B., M.T. Sturza, and S.M. Schade. 2021. Tagging Green Sturgeon with Acoustic Transmitters for Evaluation of Habitat Use Along the Washington Coast. Interim Report. Prepared for: U.S. Navy, Commander Pacific Fleet. Prepared by Washington Department of Fish and Wildlife under Cooperative Agreement #N62473-20-2-0005. 5 February 2021. 16 pp.

Abstract

Large aggregations of both the Northern distinct population segment (DPS) and ESA-listed Southern DPS of the green sturgeon *Acipenser medirostris* can be found congregating in Washington's coastal estuaries mid-summer. This provides a unique opportunity to capture and study this elusive species. Existing telemetric data indicates that these fish make long migrations along the Pacific Coast with a possible year-round presence in near-shore marine waters along Washington and Oregon's coastline. The U.S. Navy is interested in evaluating the impacts of military training and testing operations to protected species and, for the purpose of this project, is specifically interested in assessing impacts to the threatened Southern DPS of green sturgeon. In August 2020, we implanted acoustic transmitters in 60 green sturgeon captured and released in Grays Harbor and Willapa Bay, Washington. Nearly all (97%) of the newly tagged fish have been detected since the tagging event, the missing detections are likely related to the loss of one receiver at the entrance to Willapa Bay. Thus far no green sturgeon mortalities were detected as a result of this study. Assignment to either the Northern or Southern DPS cannot be visually assessed, therefore, we are awaiting genetic analysis of the fin-clip samples to complete this genetic assignment. Additionally, we are awaiting acoustic data collection from the offshore array, operated by NOAA Fisheries. When both the genetic and acoustic data becomes available, we intend to further evaluate the spatial and temporal extent of green sturgeon detections along the Washington coastline.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
02-05-2021	Monitoring report	10 August 2020 –26 August 2020

4. TITLE AND SUBTITLE
TAGGING GREEN STURGEON WITH ACOUSTIC TRANSMITTERS FOR EVALUATION OF HABITAT USE ALONG THE WASHINGTON COAST

5a. CONTRACT NUMBER
N62470-15-D-8006

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Laura B. Heironimus
Matthew T. Sturza
Shaffryn M. Schade

5d. PROJECT NUMBER
KB16

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Columbia River Management Unit
Washington Department of Fish and Wildlife
5525 South 11th Street
Ridgefield, WA 98642

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Commander, U.S.Pacific Fleet, 250 Makalapa Dr. Pearl Harbor, HI

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSORING/MONITORING AGENCY REPORT NUMBER

12. DISTRIBUTION AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

Large aggregations of both the Northern distinct population segment (DPS) and ESA-listed Southern DPS of the green sturgeon Acipenser medirostris can be found congregating in Washington's coastal estuaries mid-summer. This provides a unique opportunity to capture and study this elusive species. Existing telemetric data indicates that these fish make long migrations along the Pacific Coast with a possible year-round presence in near-shore marine waters along Washington and Oregon's coastline. The U.S. Navy is interested in evaluating the impacts of military training and testing operations to protected species and, for the purpose of this project, is specifically interested in assessing impacts to the threatened Southern DPS of green sturgeon. In August 2020, we implanted acoustic transmitters in 60 green sturgeon captured and released in Grays Harbor and Willapa Bay, Washington. Nearly all (97%) of the newly tagged fish have been detected since the tagging event, the missing detections are likely related to the loss of one receiver at the entrance to Willapa Bay. Thus far no green sturgeon mortalities were detected as a result of this study. Assignment to either the Northern or Southern DPS cannot be visually assessed, therefore, we are awaiting genetic analysis of the fin-clip samples to complete this genetic assignment. Additionally, we are awaiting acoustic data collection from the offshore array, operated by NOAA Fisheries. When both the genetic and acoustic data becomes available, we intend to further evaluate the spatial and temporal extent of green sturgeon detections along the Washington coastline.

15. SUBJECT TERMS					
Acoustic monitoring, Green Sturgeon, Northwest Training and Testing, acoustic transmitters					
16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
			UU	16	Department of the Navy
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			**19b. TELEPONE NUMBER (*Include area code)***
Unclassified	Unclassified	Unclassified			808-471-6391

Table of Contents

Introduction

North American green sturgeon *Acipenser medirostris* are a long-lived, anadromous species, endemic along west coast of North America. They depart their natal watersheds after only a few years, returning upon first spawning, and subsequent spawning events. Their sub-adult and adult live stages are spent mostly in the nearshore ocean and estuarine waters of the Pacific Northwest. Two distinct population segments (DPS) make up the overall population—the Southern DPS, listed as threatened under the Endangered Species Act (ESA; 71 FR 17757, April 7, 2006) and the Northern DPS, identified as a species of concern (Doukakis 2014). Genetic and telemetric data suggest that sub-adult and adult green sturgeon of both DPS aggregate within major coastal estuaries of Washington during the summer months (Moser and Lindley 2007). These summer aggregations provide a unique opportunity to improve our understanding of general life history attributes of both DPS. This project contributes to our understanding of both green sturgeon distinct population segments (DPS).

The U.S. Navy is interested in evaluating impacts of military training and testing operations along the pacific coast on the distribution and survival of species of conservation concern. The primary objectives of this project are to (1) increase the number of fish tagged with PIT and acoustic transmitters and (2) analyze genetic samples to assign tagged fish to a DPS to monitor the distribution of ESA-listed Southern DPS green sturgeon in nearshore marine waters along the Washington coast using the offshore array.

Methods

Fish Capture and Tagging

During August 10–26, 2020, green sturgeon were captured in Grays Harbor and Willapa Bay, Washington during a period when green sturgeon congregate in large numbers and capture rates are high. A contract commercial fisher was hired to assist in capturing fish using sinking gillnets, set stationary and perpendicular to the current whenever possible. The green sturgeon research nets consisted of three panels of between 18–24 cm (7.25, 8.50, and 9.75 inches) stretch mesh made of 6–18 strand monofilament, joined to form a 150-fathom (274 meters) net. Each panel measures 50-fathom (91 meters) by 5-fathom (9 meters). The single wall netting was evenly hung or hung slightly loose (> 2:1 ratio), without trammels or apron.

Nets were soaked during daylight hours, when bird and marine mammal activity can be observed, for approximately half hour sets, timed from the end of set to start of pull. If concentrations of birds or marine mammals were observed, set locations will be moved to avoid gear entanglement. The nets were set at the beginning of the slack tide, and fished no longer than early ebb or flood tide to avoid gear loss. In instances where green sturgeon were observed in the

net prior to the full length being deployed, only 1–2 panels would be deployed in order to reduce the number of fish captured.

Fish sampling

Captured fish were placed in the fish car (developed during the FY2010–2013 Section 6 grant study; Langness et al. 2014) to reduce stress until sampled. Fish were subsequently examined for deformities, erosion, lesions, and tags (DELTS), measured to the nearest cm fork length (FL), measured to the nearest cm girth, tagged with a PIT tag if no tags are present, and photographed. A subsample of fish were weighed to the nearest 0.5 kg. For genetic analysis and assignment of individuals to the Southern or Northern DPS, we removed a small fin clip from the pelvic fin. Additionally, in another subsample of fish we opportunistically collected blood plasma to evaluate sex and maturity through sex-steroid analysis and a fin ray section for age analysis, though the analyses of these collections were not a funded part of this project. Finally, we surgically implanted a V16 69-kHz Vemco acoustic transmitter (10-year battery life) before releasing the fish directly to the bay or estuary.

Sturgeon that appeared to be stressed were returned to the fish car and kept there until equilibrium, breathing, and strength return. When more fish were captured than could safely be held within the confines of the fish car, the additional fish were not tagged with an acoustic transmitter to reduce handling stress and were returned directly to the bay or estuary after sampling.

Acoustic Receiver

During May 5–October 22, 2020, WDFW operated four Vemco VR2TW 69-kHz acoustic receivers at the mouth of Grays Harbor to assess green sturgeon tagging survival and to determine the period of migration of tagged individuals from the estuarine to marine environment (Figure 1). Another two Vemco VR2TX 69-kHz acoustic receivers were set at the mouth of Willapa Bay between August 10–October 15, 2020 (Figure 2). Through a grant funded by NOAA Fisheries, WDFW operated small acoustic receiver arrays in Grays Harbor and the Columbia River estuary and NOAA Fisheries research staff operated a small acoustic array within Willapa Bay to monitor in-estuary habitat use. Additionally, the U.S. Navy funded an offshore array, operated by NOAA Fisheries research staff, that can be used to detect green sturgeon migrations along the coast.

Sampling Permits

The proposed project "Tagging Green Sturgeon with Acoustic Transmitters in Washington Coastal Estuaries" has been granted ESA authorization under the ESA Section 4(d) Rule. While ESA Section 9 prohibits take of listed species, ESA Section 4(d) limits the prohibition of take for specific existing state and local programs, and creates a means for NOAA Fisheries to approve programs if they meet certain standards set out in the rule. The specific standards regarding this

project are set out in Limit 7, "Scientific Research Activities Conducted by The States". The NOAA reference number for this project's authorization is currently "23319".

Preliminary Results

Fish Capture and Tagging

A total of 123 green sturgeon were captured in Washington's coastal estuaries during August 10–26, 2020 using sinking gillnets (Figure 3). Thirty-eight green sturgeon were captured in Willapa Bay during August 10–14, 2020, ranging in size 86–195 cm Fork Length (FL) and 38–76 cm girth (Figure 4). Eighty-five green sturgeon were captured in Grays Harbor during August 17–20 and August 25–26, 2020, ranging in size 102–191 cm FL and 32–80 cm girth (Figure 5). All fish were implanted with a PIT tag and sampled for genetic tissue. We sampled 22 fish for weight and removed a fin ray section from 33 fish. Blood plasma samples were collected from 68 fish. A total of 60 green sturgeon (mean FL 136.9 cm) were implanted with acoustic transmitters (Figure 6); of those, 25 were captured and released in Willapa Bay (Figure 7) and 35 fish were captured and released in Grays Harbor (Figure 8). Of those tagged, 50 transmitters were contributed by the US. Navy and an additional 10 transmitters were contributed by the US Army Corps in Grays Harbor.

Fish Detections

All WDFW operated acoustic receivers that were recovered from the 2020 field season have been downloaded and assessed for green sturgeon detections. Of the four acoustic receivers funded by the U.S. Navy, all but one receiver were recovered. The missing receiver ("Willapa Bay 1"; Figure 2) was lost near the entrance to Willapa Bay and other nearby researchers have been notified in case it turns up. Among the fish that were tagged in Grays Harbor, each individual was detected for a minimum of one month at multiple receivers within the estuary or at the entrance to the bay (suggesting an exit of Grays Harbor to the Pacific Ocean). This detection period suggests no immediate mortalities as a result of the tagging procedure. Detections occurred through October 22

We detected all but two of the fish tagged in Willapa Bay at the recovered receiver that was set at the entrance to the bay ("Willapa Bay 2"; Figure 2). The recovered receiver should include detections within the deeper north channel at the mouth of Willapa Bay. Eight fish that we tagged this summer were detected in both Grays Harbor and Willapa Bay, half of these moved north from Willapa Bay to Grays Harbor and the other half moved south from Grays Harbor to Willapa Bay. This includes one fish that moved progressively south from Grays Harbor, to Willapa Bay, and finally the Columbia River estuary.

Current Project Status

Genetic assignment of tagged fish to DPS has not yet been completed as of this reporting date. The genetics laboratory at University of California Santa Cruz was the preferred option based their development of the unique SNPs analysis specific to green sturgeon; however, the lab was reduced to limited operations as a result of the coronavirus pandemic and then closed for a period of time due to wildfires. Currently, the UC Santa Cruz lab is still not accepting new projects. The genetics laboratory at University of California Davis was the back-up option based on their development of a unique microsatellite analysis specific to green sturgeon; however, this lab is in a similar status as the UC Santa Cruz lab and not currently accepting new projects. We have not been able to identify any other genetics lab with the capability or capacity to take on this project at this time, but hope to analyze these samples in 2021.

Additional acoustic data sources, including the NOAA Fisheries operated receivers in Willapa Bay and most of the offshore array, have not yet been downloaded as of this reporting date. A small number of receivers from the offshore array were downloaded in late August to early September 2020; however, no 2020 tagged green sturgeon tag IDs were detected in the data received by WDFW. This may indicate that the tagged green sturgeon were still within the estuary and had not yet moved back into marine waters as of that download date. We will evaluate the temporal and spatial distribution of the tagged green sturgeon by DPS along the Washington coast using available capture and telemetry data and analyze migratory patterns when more data becomes available.

Acknowledgements

Thanks to Dave Hollingsworth and family for providing a gillnetting boat and invaluable fishing experience to help us locate, capture, and sample all of the study fish. Thanks to the WDFW Region 5 and 6 staff, including James Losee, Jody Pope, Zachary Forster, and Bradley Cady for their project support. Thanks to Drs. David Huff, Joe Smith, Mary Moser, and Steve Corbett of National Marine Fisheries Service Northwest Fisheries Science Center for coordinating and collecting acoustic telemetry data. Thank you to Vanessa Pepi of the U.S. Army Corps of Engineers, Seattle District for providing additional acoustic transmitters for this project. This research was funded by the U.S. Navy, Commander Pacific Fleet, under the Navy's Marine Species Monitoring Program, through a CESU agreement (Cooperative Agreement #N62473-20-2-0005) administered by Naval Facilities Engineering Command (NAVFAC) Southwest. Thanks to Andrea Balla-Holden (PACFLT), Chris Hunt (NAVFAC NW), and Jessica Bredvik (NAVFAC SW) for providing invaluable assistance in making this project successful.

References

Doukakis, P. 2014. Informal status review for the Northern Distinct Population Segment of the North American Green Sturgeon (*Acipenser medirostris*). NOAA Fisheries.

Langness, O.P., P.E. Dionne, C.W. Wagemann, P.A. McHugh, D.L. Warren, M.L. Brown, B.W. James, A.J. Storch, and E.S. Van Dyke. 2014. Green sturgeon distribution and abundance in Washington and Oregon coastal estuaries. Report A in Study of Green Sturgeon in the west coast of the United States. C. Mallette editor. Final report for NOAA Fisheries Protected Species Conservation and Recovery Grant Number NA10NMF720037. 197p.

Moser, M.L., and S.T. Lindley. 2007. Use of Washington estuaries by subadult and adult green sturgeon. Env. Biol. Fish. 79:243–253.

Figures

Figure 1. Six 69-kHz Vemco VR2W acoustic receivers, including two receivers (red markers) funded by the U.S. Navy, were deployed in and near the mouth of Grays Harbor in June 2020 and all were recovered in October 2020.

Figure 2. Two 69-kHz Vemco VR2W acoustic receivers funded by the U.S. Navy were deployed near the mouth of Willapa Bay in May 2020. Only the north channel receiver was recovered in October 2020, the south channel receiver was lost.

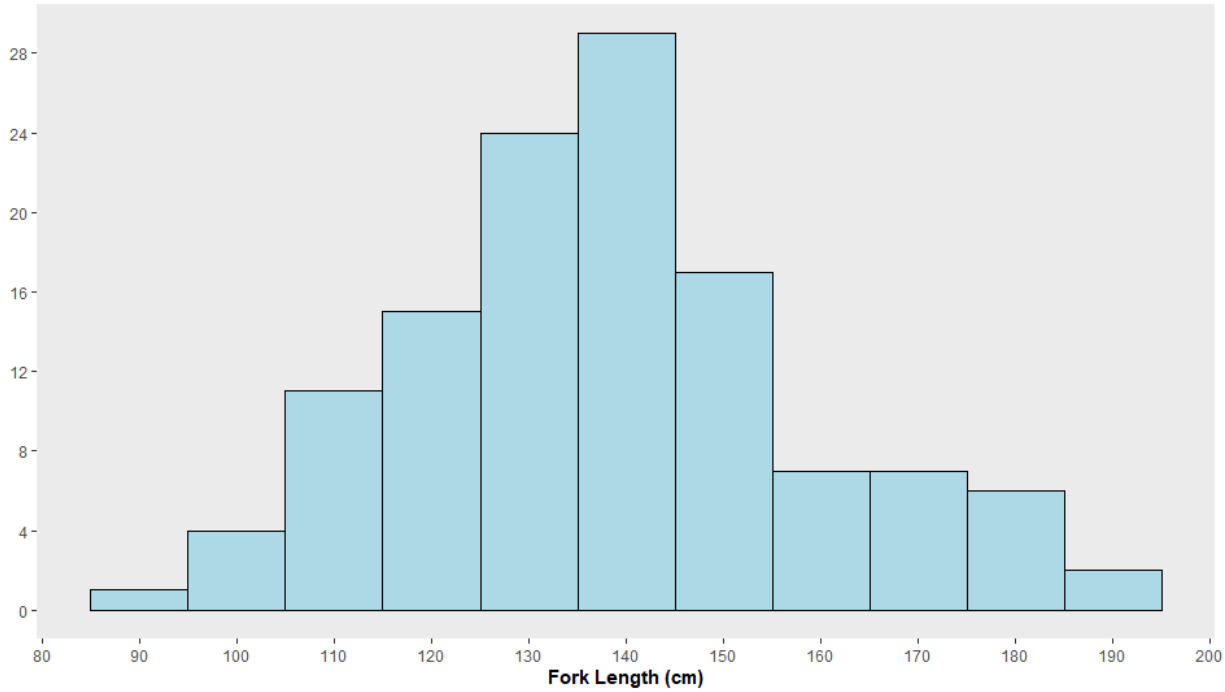

Figure 3. Green sturgeon captured in Willapa Bay and Grays Harbor by fork length (n=123, mean=138.8 cm). Fish were captured using a sinking gillnet between August 10–12, 2020, August 17–20, 2020, and August 25–26, 2020.

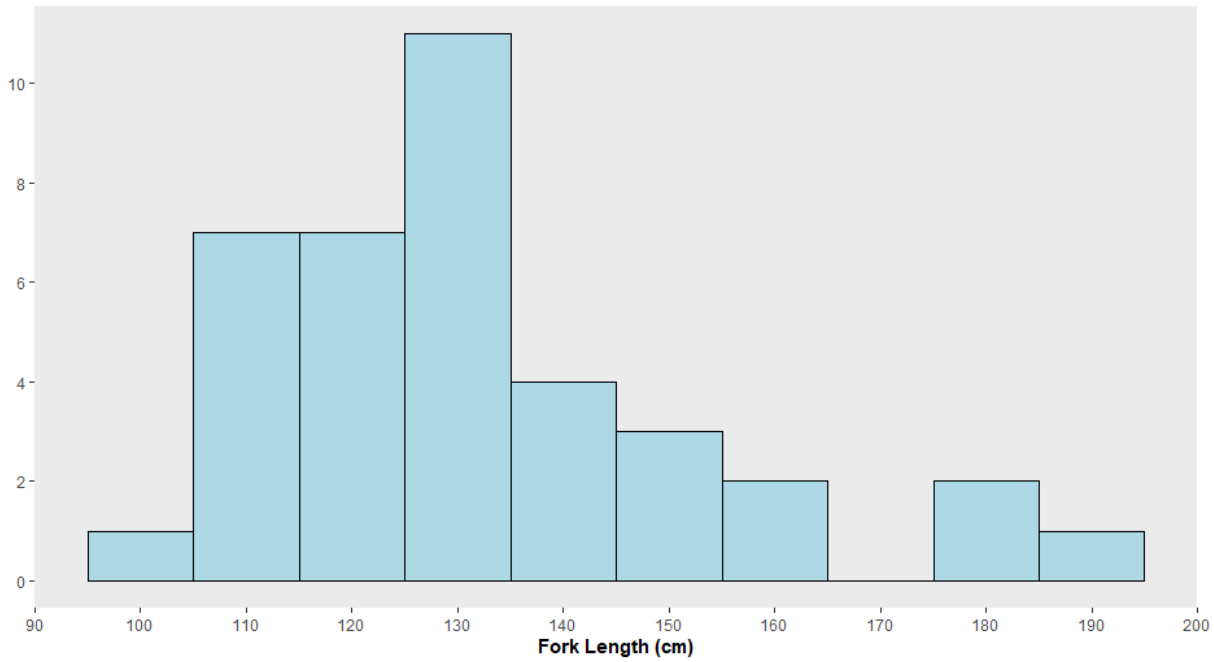

Figure 4. Green sturgeon captured in Willapa Bay by fork length (n=38, mean=132.7 cm). Fish were captured using a sinking gillnet between August 10–12, 2020.

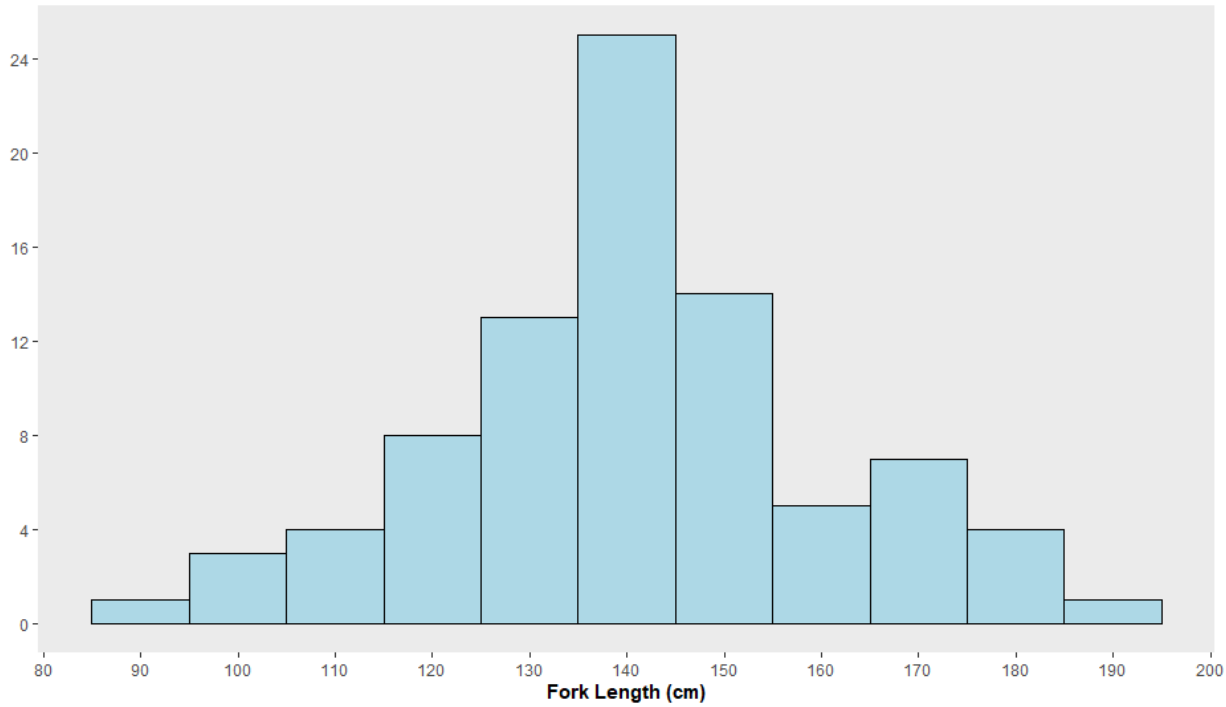

Figure 5. Green sturgeon captured in Grays Harbor by fork length (n=85, mean=141.5 cm). Fish were captured using a sinking gillnet between August 17–20, 2020 and August 25–26, 2020.

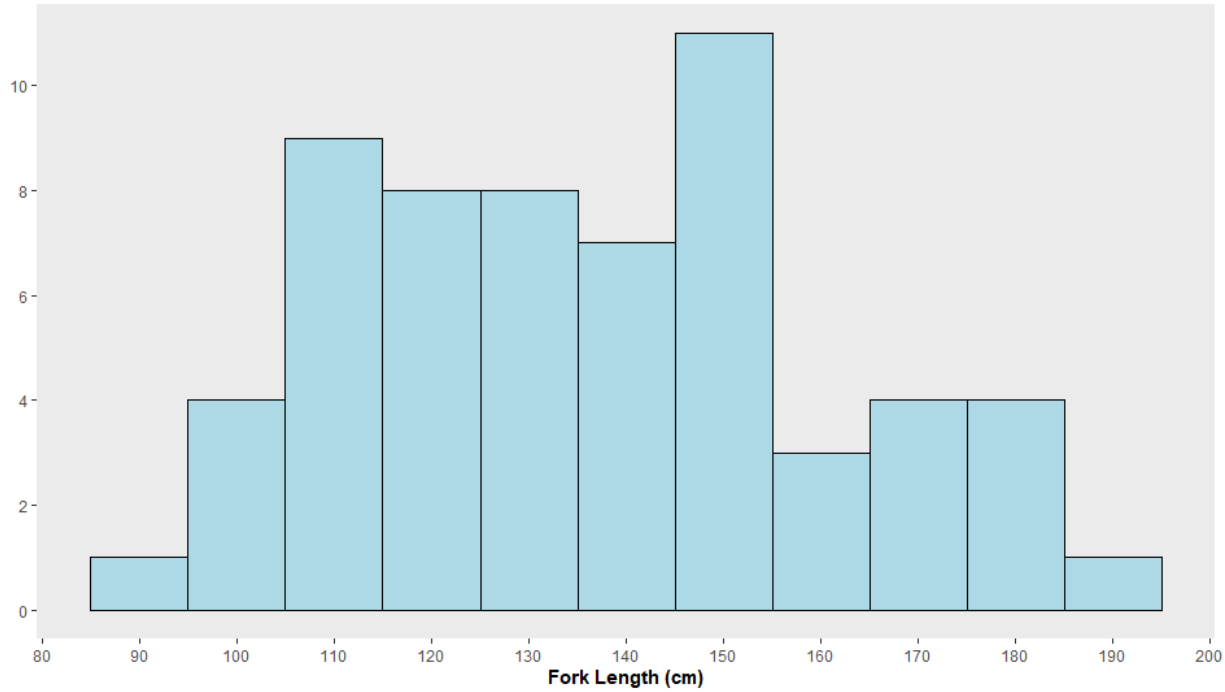

Figure 6. Green sturgeon implanted with an acoustic tag captured in Willapa Bay and Grays Harbor by fork length (n=60, mean=136.9 cm). Fish were captured using a sinking gillnet between August 10–12, 2020, August 17–20, 2020 and August 25–26, 2020.

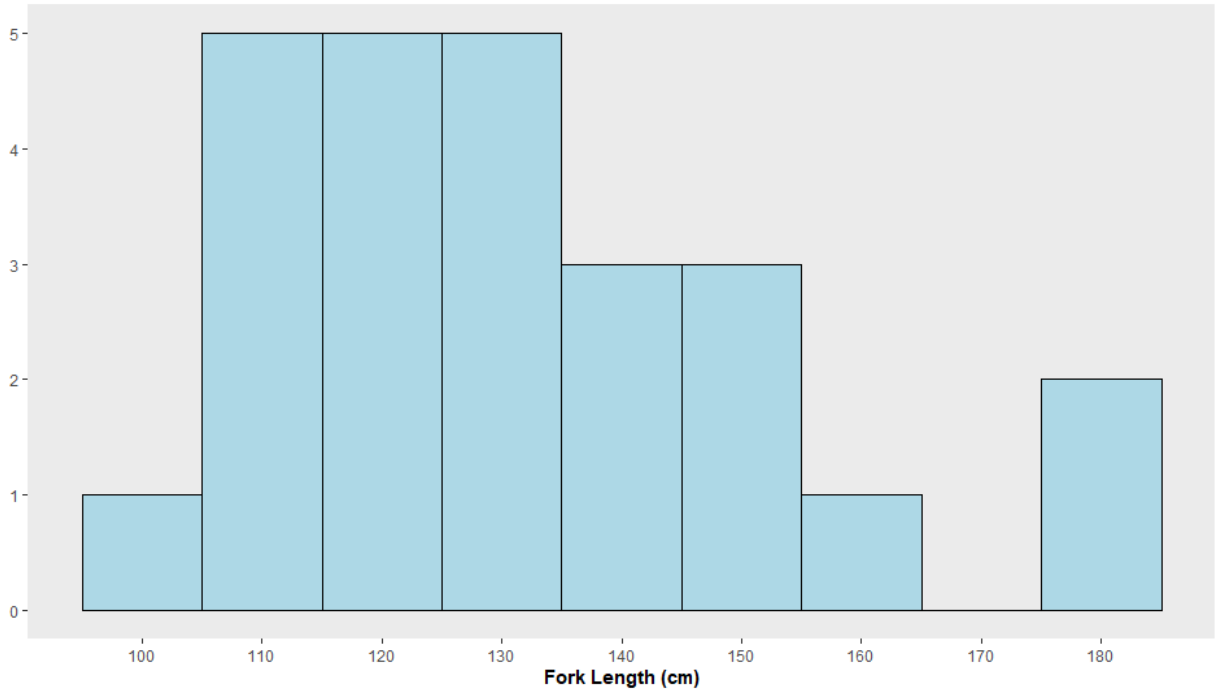

Figure 7. Green sturgeon captured in Willapa Bay and implanted with an acoustic transmitter by fork length (n=25, mean=132.6 cm). Fish were captured using a sinking gillnet between August 10–12, 2020.

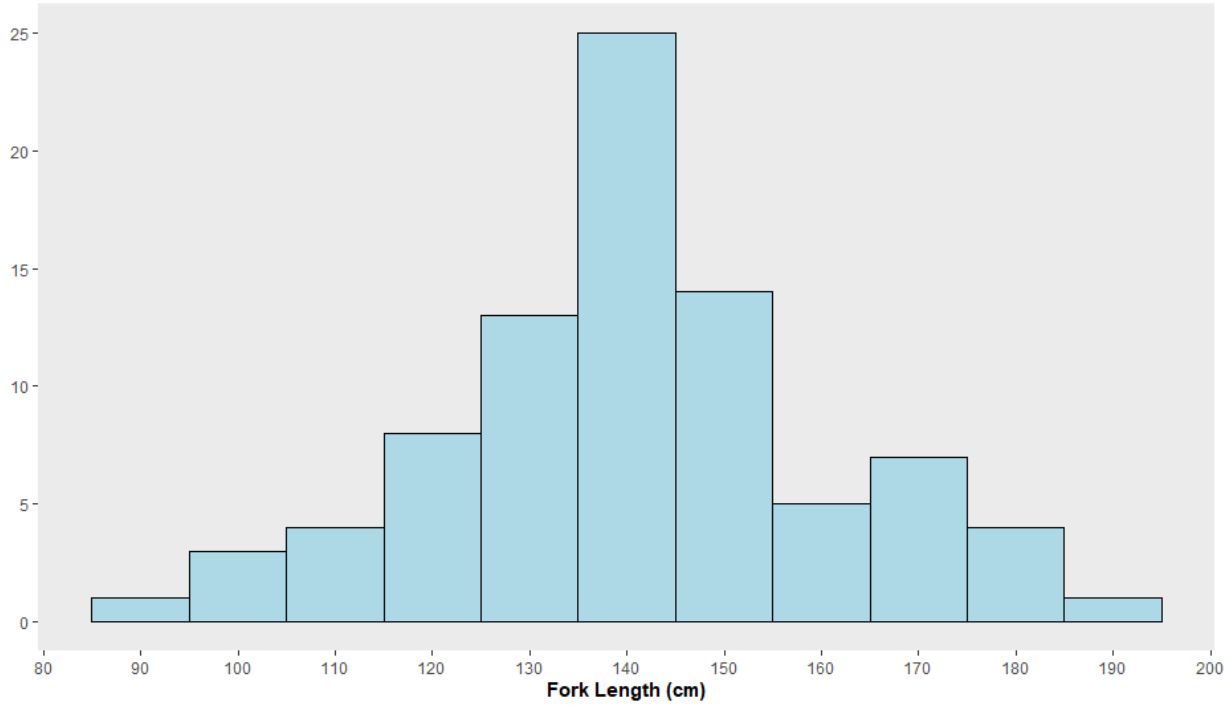

Figure 8. Green sturgeon captured in Grays Harbor and implanted with an acoustic transmitter by fork length (n=35, mean=140.0 cm). Fish were captured using a sinking gillnet between August 17–20, 2020 and August 25–26, 2020.