

# **2019 Field Season Summary for the Sturgeon Population Study**

California Department of Fish and Wildlife  
Bay Delta Region (Stockton)

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Field Season: 19 August 2019 – 26 November 2019

## Introduction

The California Department of Fish and Wildlife (CDFW) has conducted a sturgeon population study intermittently since 1967 and nearly annually since 2005. Part of the study is a “high-value reward” tagging program. Presented here is a summary of the 2019 sturgeon-tagging field season. For summaries of previous seasons, please see the [Sturgeon Study Bibliography](#)<sup>1</sup>.

This study is designed primarily to understand and monitor the White Sturgeon (*Acipenser transmontanus*) fishery, to assess White Sturgeon population dynamics, and to monitor aspects of the Green Sturgeon (*A. medirostris*) population. The tagging portion of the population study provides data on relative and absolute abundance, harvest rate, mortality rate, individual growth rates, and large-scale movement and migration patterns.

Our primary objective during the 2019 field season was to capture, tag, measure, and release in good condition as many White Sturgeon as possible and to document previously tagged sturgeon. As part of an on-going collaboration, our staff also collected sturgeon tissue for the San Francisco Estuary Institute to monitor selenium concentrations in White Sturgeon.

## Methods

The field season began 19 August 2019 and ended 26 November 2019. We captured sturgeon using trammel nets deployed from the CDFW research vessel (R/V) *New Alosa*, fishing mostly in Suisun Bay with the final two days in San Pablo Bay.

After the 2006 season, we altered the sampling methodology to decrease interactions with marine mammals and to improve the condition of captured fish. We continued to implement the altered methods, which included (1) reducing the length of net in the water from 200 fathoms (~366 m) to 100 fathoms (~183 m) and (2) decreasing soak time from about 45 minutes to about 30–35 minutes.

The R/V *New Alosa* is a 42-foot West Coast-style combination-type fishing vessel with a 610 hp Volvo engine capable of cruising at 17 knots. For the 2019 season, the *New Alosa* was berthed at the New Bridge Marina (Antioch, CA) and Vallejo Municipal Marina to finish the season. A typical crew was 4-5 people including a boat operator, a deckhand, and scientific staff and volunteers to collect and record data.

The research vessel was equipped with one 100-fathom (~183 m) trammel net, one hydraulic net reel, two resuscitation tubs, and one tagging station. The boat operator typically ran the boat, operated the net hydraulics, and extracted fish from the net upon retrieval. The deckhand tended the net during deployment and assisted the boat operator

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<sup>1</sup> <https://wildlife.ca.gov/Conservation/Delta/Sturgeon-Study/Bibliography>

by removing fish and debris from the net. Scientific staff measured all sturgeon, disc tagged White Sturgeon roughly  $\geq 100$  cm total length, tagged sturgeon — as time allowed — with Crystal Tag™ PIT (Passive Integrated Transponder) tags, recorded bycatch, collected biological data and (or) samples, and assisted with boat duties as needed.

The net was comprised of four contiguous 25-fathom (45.7 m) long by 2-fathom (3.7 m) deep sections. Each 25-fathom section was made up of a gillnet panel between two panels of trammel net. The gillnet was an Alaska salmon-style webbing made up of multi-strand monofilament twist. The trammel net was made up of three multi-strand twisted nylon braids. The diagonal dimension of the gillnet mesh varied by 25-fathom net section and was assembled in the following order: 8", 7", 6", and 8".

The net was set in locations selected by the boat operator to avoid known snags and unfavorable currents. The net was deployed cross current with the vessel downwind. On average, it took approximately five minutes to set the net. The deployed net was continuously monitored to detect snags, tangles, marine mammal interactions, and to avoid conflicts with other vessels and hazards such as channel markers. The net was set as many times (usually 4-6) as possible each field day.

Data collected during each net set included (1) time of the start and end of the net set & retrieval, (2) latitude & longitude of the start of the net set, (3) water temperature (to nearest 0.5 Celsius) (4) number of pinnipeds in the vicinity of the net and if raiding the net, (5) any vessel interactions, and (6) wind conditions based on the Beaufort scale. Periodically, an ultrasonic acoustic receiver (VR100 receiver and VH165 omnidirectional hydrophone, VEMCO, Nova Scotia, Canada) was deployed for approximately five minutes to determine if any sturgeon carrying long-term telemetry tags were in the vicinity.

Each sturgeon brought on board was immediately removed from the net and either carefully placed in the tagging cradle or placed in a plastic tub filled with water from the netting location. Sturgeon were only placed in the resuscitation tub when they could not be processed immediately (e.g., when several came on-board from the same small section of net).

We checked each sturgeon for existing tags (i.e., PIT, disc, etc.) or evidence of a shed or clipped tag, recorded fork length (FL) to the nearest centimeter (cm), attached a disc-dangler (Petersen) to White Sturgeon 83-188 cm FL, PIT tagged sturgeon as time allowed, and assessed overall general condition (good, fair, or poor) of the fish. The disc tag was placed in the flesh just below the base of the dorsal fin, midway between the anterior and posterior ends of the fin (see photo above, CDFW file photo). Each disc tag was labeled with a reward value of \$50, \$100, or \$150 (see Appendix).



Fish judged to be in poor condition (e.g., weak or absent opercular movements; lack of vigor) were placed in the plastic holding tub for resuscitation and released without a tag as soon as their condition appeared to improve. We checked all sturgeon for signs of having shed a tag — defined as a captured sturgeon that did not have a tag and did not show an obvious sign of having been tagged (i.e., wires present), but did exhibit open sores or scars at the location of tagging.

We collected 2-3 White Sturgeon muscle plugs from the epaxial muscle just posterior to the dorsal fin, stored the plugs on dry ice, and provided the plugs to San Francisco Estuary Institute staff each week.

Bycatch was identified to species, counted, and released as quickly as possible. In addition, Chinook Salmon, California Halibut, and all elasmobranchs were measured (elasmobranchs were also sexed). We noted all marine mammals (Pacific harbor seals and California sea lions) observed within 50 meters of the net and instances of a marine mammal observed raiding the net (i.e., eating or appearing to eat a fish in or taken from the net).

Catch per unit effort (CPUE) was calculated to estimate daily and monthly relative abundance and to compare annual estimates of relative abundance for White Sturgeon. Catch was calculated as the sum of all newly tagged fish, recaptured fish, and non-tagged fish. The unit of effort was 100 net-fathom hour, which is equivalent to a net 100 fathoms long fishing for one hour. Effort was calculated by weighting the soak time (i.e., the amount of time between the end of the net set and the beginning of the net retrieve) by 100% and the amount of time for the net deployment and the net retrieval by 50%.

## Field Season Summary

Most fishing effort and catch was in Suisun Bay; we concluded the season fishing two days in San Pablo Bay. We set the net 168 times over 34 calendar days producing 127.2 hours fishing time (~10,700 net-fathom hours). Average fishing time per set was about  $45 \pm 5.1$  (SD) minutes. Nets were set an average of 5 times per day (range 3-6).

We caught 272 sturgeon this season (269 White Sturgeon, 3 Green Sturgeon). Of the White Sturgeon, 177 were PIT & disc tagged, 55 disc tagged only, and 19 PIT tagged only. Of the Green Sturgeon, 2 were PIT tagged. Of the sturgeon catch, 18 White Sturgeon and 1 Green Sturgeon received no tag of any kind. We recorded no recaptures this season. One White Sturgeon had dorsal scarring indicative of a shed disc tag. This fish was measured, and then received both a disc tag and PIT tag.

## PIT Tagging

Prior to this season, we deployed PIT tags only one other season (in 2007). We reinstated the practice this season given the ease of application, longevity of the application, relative low cost, and benefits as another data source.

## Green Sturgeon

The three captured Green Sturgeon measured 53 (19-Aug), 58 (28-Aug), and 84 (23-Oct) cm FL. All three were caught in Suisun Bay, and the 58 and 84 cm FL fish were PIT tagged.

## Sampling Effort and Catch-per-unit-effort (CPUE)

### Daily and Monthly (Current Field Season)

Average daily CPUE for legal-sized (102-152 cm FL) White Sturgeon was  $1.30 \pm 0.16$  (SE) and for all sizes of White Sturgeon was  $2.51 \pm 0.31$  (SE). Average daily CPUE per net set for all sizes of White Sturgeon was greatest on 29-Aug ( $7.21 \pm 2.82$  (SE); Figure 1).

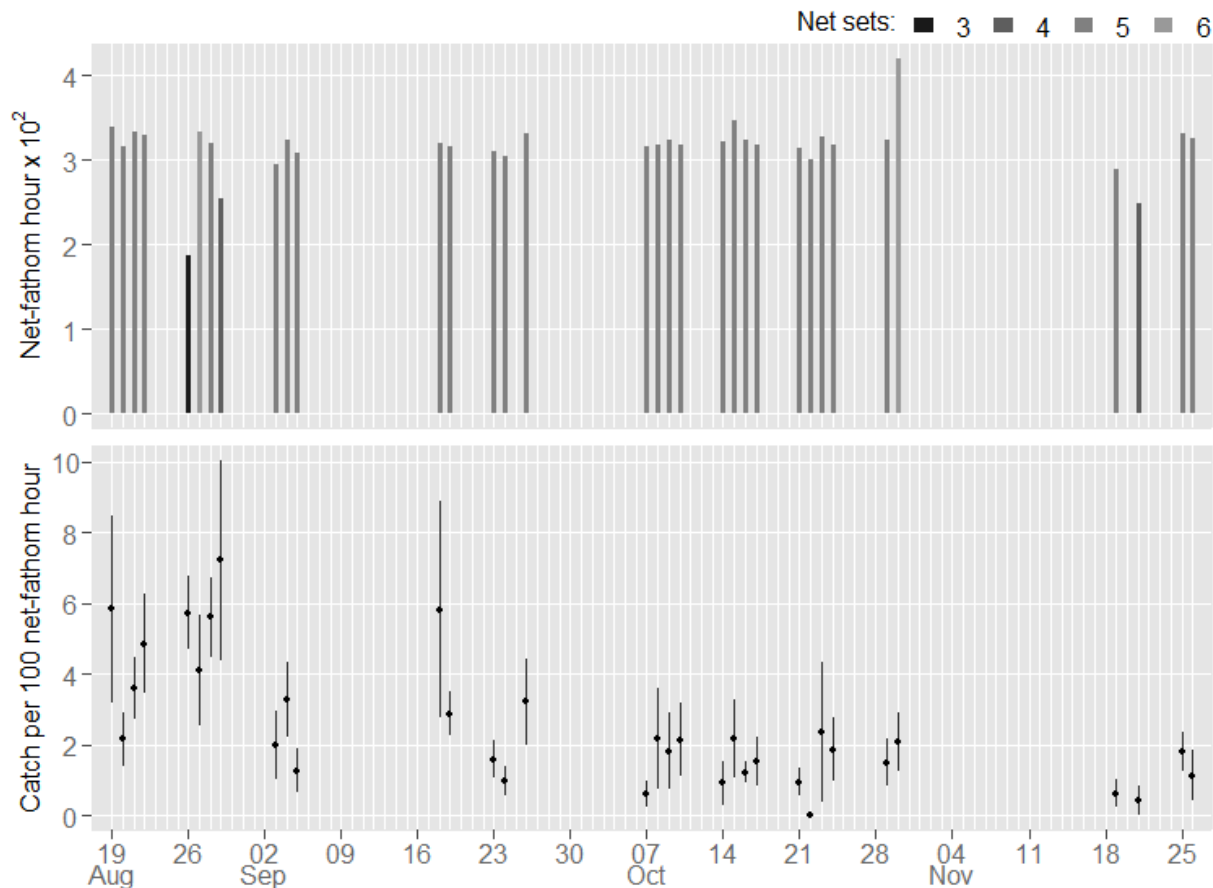


Figure 1 (top) daily effort as net-fathom hour with bars shaded denoting nets sets, (bottom) White Sturgeon average catch (all sizes) per 100 net-fathom hour  $\pm 1$  SE of all net sets that day; Note: the dates shown on x-axis are Mondays (year = 2019).

Average monthly CPUE for all sizes of White Sturgeon declined during our field season: 4.76 (Aug; n=38 net sets); 2.63 (Sep; n=40); 1.53 (Oct; n=71); 1.03 (Nov; n=19). Average catch per 100 net-fathom hour of White Sturgeon within the current slot limit (102-152 cm FL) was  $1.28 \pm 0.13$  (SE), a value below the historical (period) value of 2.5 (the average of averages), but comparable to the prior sampling year (2017, 1.30).

### Annual (All Field Seasons from 1968-present)

Annual median CPUE (n = all net sets per year) has not been greater than zero since 2008. However, the 75<sup>th</sup> percentile was ~1.6 for 2019 (and 2017), a value previously not seen since 2011 (Figure 2, top line of each box).

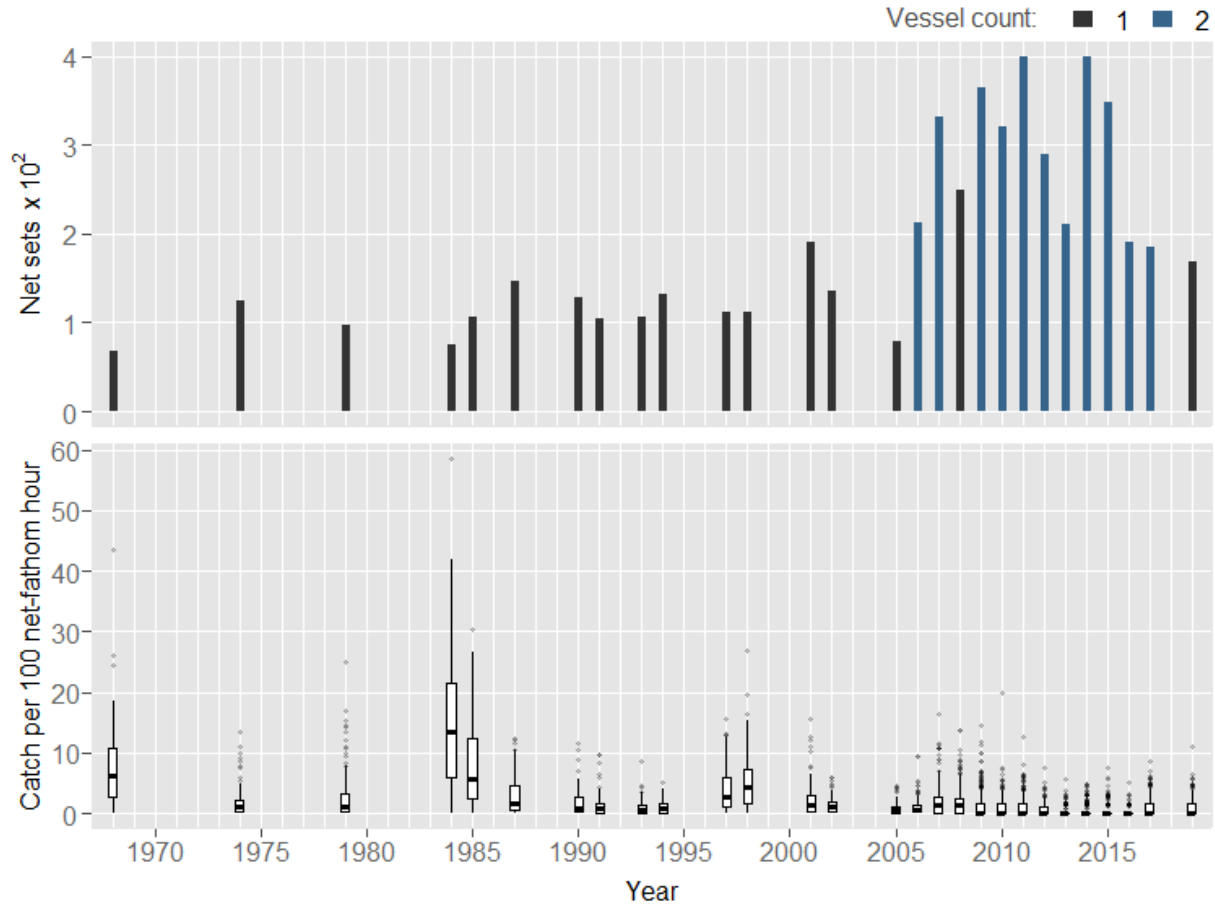


Figure 2 (top) Number of net sets with bars color-coded denoting vessels used (1 or 2), (bottom) box plot of catch per 100 net-fathom hour (calculated per net set) of White Sturgeon within current slot limit (102–152 cm FL) captured during CDFW sturgeon population study tagging operations. Horizontal bar within box denotes median value; no values are < 0.

Effort has been below the period mean (~22,700 net-fathom hour) for the three most-recent sampling seasons (Figure 3). Routine vessel maintenance and redirection of staff to other higher priority projects contributed to decreased effort this season. Further, the R/V *New Alosa* was shared this season with the San Francisco Bay Study project. In recent seasons, both the *Striper II* and *New Alosa* were used for the Sturgeon Population Study, but the R/V *Striper II* was decommissioned in 2017 and is currently awaiting approval for replacement.

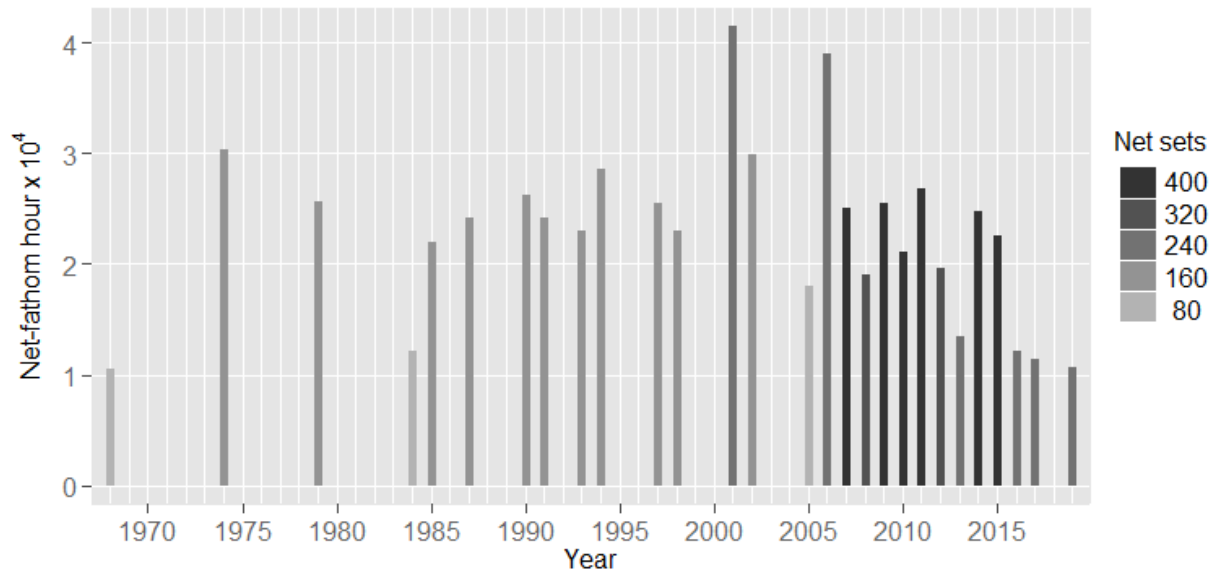


Figure 3 Annual total effort as net-fathom hour with bars shaded to denote number of net sets. Note: in 2007 we reduced trammel net size by half to minimize contact with pinnipeds. Years without bars indicate no sampling.

### Length Frequency

Current and recent White Sturgeon length frequency distributions show (1) strong cohorts from mid-to-late 1990s within the legally-harvestable size range have substantially diminished, (2) continued progression of the strong 2006 cohort toward and within harvestable size, and (3) signs that what should be a modest 2011 cohort is recruiting to the nets (Figure 4).

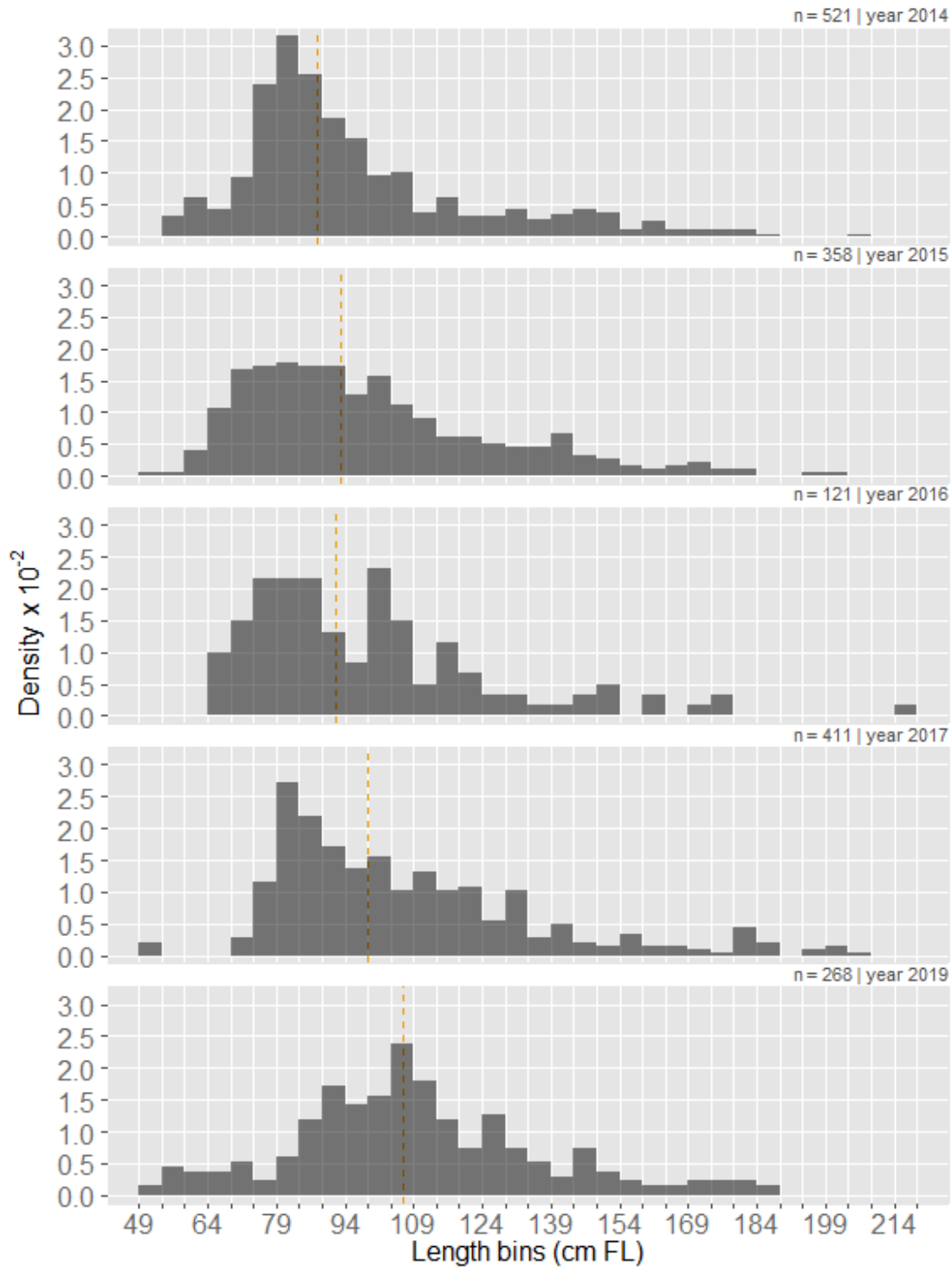


Figure 4 White Sturgeon length frequency distribution for years 2014–2017 & 2019; orange dashed vertical line indicates annual median fork length; 2017 includes 10 fish where fork length was visually estimated and does not include one fish not measured; length bins by 5 cm.



## Bycatch

No bycatch was retained (Table 1). We measured all Chinook Salmon and California Halibut and measured and sexed all elasmobranchs (Table 2). All elasmobranchs were caught in San Pablo Bay.

Table 1 Numbers of other species (bycatch) caught during the 2019 sturgeon tagging season

Species	Scientific Name	Count
7-Gill Shark	<i>Notorhynchus cepedianus</i>	6
Bat Ray	<i>Myliobatis californica</i>	2
Brown Smoothhound	<i>Mustelus henlei</i>	2
California Halibut	<i>Paralichthys californicus</i>	14
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>	30
Leopard Shark	<i>Triakis semifasciata</i>	5
Starry Flounder	<i>Platichthys stellatus</i>	18
Striped Bass	<i>Morone saxatilis</i>	9

Table 2 Length measurement and sex (where recorded) for some other species (bycatch) caught during the 2019 sturgeon tagging season; N = number measured, Med = median, Var = variance; Unk = not recorded; note: salmonid lengths approximated in order to return to the water quickly.

Species	Sex	N	Min	Max	Avg	Med	Var
7-Gill Shark	Female	6	68	105	90.2	95.5	264.6
Brown Smoothhound	Female	1	102	102	102.0	102.0	NA
Leopard Shark	Female	2	110	132	121.0	121.0	242.0
Bat Ray	Male	1	70	70	70.0	70.0	NA
Brown Smoothhound	Male	1	98	98	98.0	98.0	NA
Leopard Shark	Male	3	95	114	101.7	96.0	114.3
Bat Ray	Unk	1	80	80	80.0	80.0	NA
California Halibut	NA	13	44	68	56.5	57.0	63.1
Chinook Salmon	NA	30	48	90	75.1	77.5	99.7

## Pinnipeds

In Suisun Bay, we observed a per-set average of 0.02 ( $\pm$  0.18 SD) sea lions and 0.03 ( $\pm$  0.16 SD) seals within 50 meters of the net. We observed pinnipeds raiding the net during 0% (sea lions) and 0.63% (seals) of net sets. In San Pablo Bay, we encountered no pinnipeds.

## Collaboration

For the San Francisco Estuary Institute, we collected muscle plugs from 81 White Sturgeon between 63-187 cm FL (Figure 5).

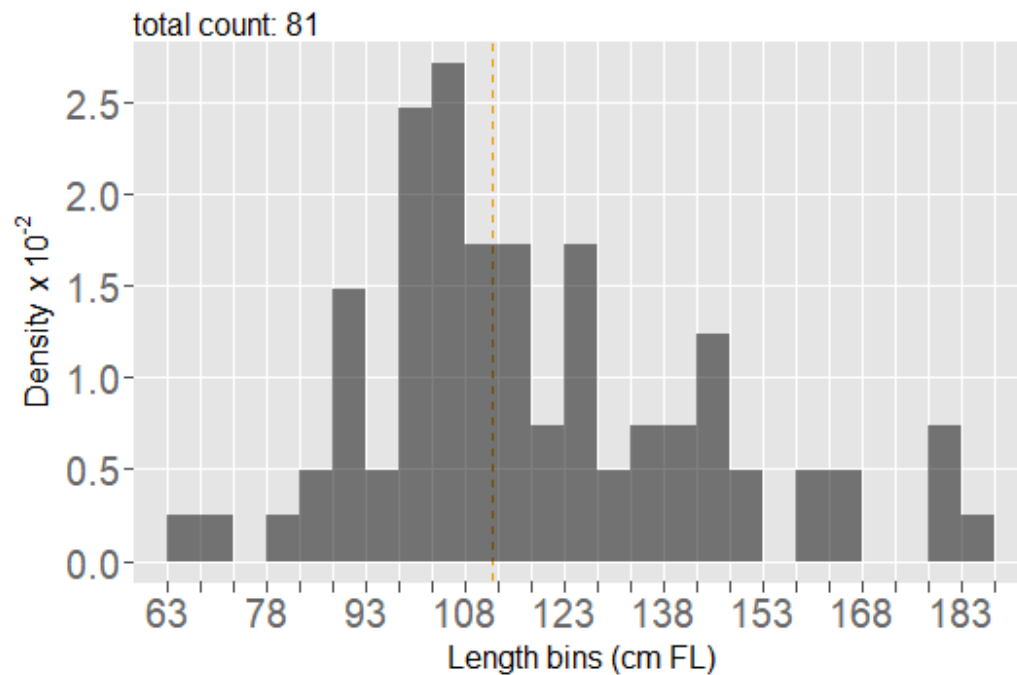


Figure 5 Length frequency of White Sturgeon from which biological samples (muscle plugs) were collected during 2019 tagging operations; orange dashed vertical line indicates median fork length; length bins by 5 cm.

## Acknowledgements

We thank the following personnel and volunteers for their effort this season (alphabetical order by surname): Marc Beccio; David Cao; Ronald Catindig; Jorge Chagoza; Camille Danos; Nicole Eller; Joy Flowers; Ken Flowers; Stephanie Fong; Mike Grady; Kyle Griffiths; Rebecca Heisey; David Hull; Shelly Hunter; Abby Jahn; Jessica Jimenez; Brian Jones; Shahar Jones; Tim Keopadubsy; Spencer Lewis; Paul Macias; Tim Malinach; Ehryn McNulty; Brian Meux; Vanessa Mora; Harrison Morrow; Sara Nece; Ramiro Soto; Erin Strange; Page Vick; Linda Warkentin; and Allison Weber-Stover.

## Appendix

Disc tag numbers released in 2019; N = number of tags in sequence (from, to).

<b>Tag Value</b>	<b>From</b>	<b>To</b>	<b>N</b>
\$ 50	FF2422	FF2498	77
\$ 100	HH2421	HH2456	36
	HH2458	HH2498	41
\$ 150	HF2421	HF2498	78