

Atlantic Sturgeon - General Life Stage/Behavior Descriptions

We are providing this document to complement the data in the NOAA Fisheries GARFO Section 7 Consultation Areas located [here](#).

The general descriptions below define the Atlantic sturgeon life stages and behaviors used in the Consultation Areas.

Stage	Size (mm)	Duration	Description
Eggs	~2mm – 3 mm diameter (Van Eenannnam et al. 1996, p. 773)	Hatching occurs ~3-6 days after egg deposition and fertilization (ASSRT 2007, p. 4)	Fertilized or unfertilized
Yolk-Sac Larvae (YSL)	~6mm – 14 mm (Bath et al. 1981, pp. 714-715)	8-12 days post hatch (ASSRT 2007, p.4)	Negative photo-taxis, nourished by yolk sac
Post Yolk-Sac Larvae (PYL)	~14mm – 37mm (Bath et al. 1981, pp. 714-715)	12-40 days post hatch	Free swimming; feeding; Silt/sand bottom, deep channel; fresh water
Young of Year (YOY)	0.3 grams <410 mm total length	From 40 days to 1 year	Fish that are >3 months and <1 year old; capable of capturing and consuming live food
Juveniles	>410 mm and <760 mm total length	1 year to time at which first coastal migration is made	Fish that are at least 1 year old, are not sexually mature, and do not make coastal migrations
Subadults	>760 mm and <1500 mm total length	From first coastal migration to sexual maturity	Fish that are not sexually mature, but make coastal migrations
Adults	>1500 mm total length	Post-maturation	Fish that are sexually mature

<p>Eggs & Yolk-sac larvae (EYL)-N/A</p>	<p>Eggs are deposited in low salinity water (0.0-0.5 ppt) over hard bottom substrate (e.g., cobble) and become adhesive shortly after fertilization (Murawski and Pacheco 1977, Van den Avyle 1983, Gilbert 1989, Smith and Clugston 1997, Mohler 2003). Hatching occurs in a matter of days. The larval life stage has two phases, yolk-sac larvae (YSL) and post yolk-sac larvae (PYL). The YSL phase lasts approximately 8-12 days, during which larvae are nourished by the yolk sac, are mostly pelagic (e.g., exhibit a “swim-up and drift-down” behavior in hatchery tanks; Mohler 2003), seek refuge in interstitial spaces in hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.), and move away from light (i.e. negative photo-taxis; Kynard and Horgan 2002; Mohler 2003).</p>
<p>Post Yolk-sac Larvae (PYL)-Migrating & Foraging</p>	<p>The PYL stage (days 13-40) begins feeding and free-swimming; the larvae disperse downstream of the spawning/rearing area. Sturgeon larvae are intolerant of saline waters; thus their habitat must be upstream of the salt front, in waters that have a salinity of 0.0-0.5 ppt either year round or seasonally when Atlantic sturgeon spawn (Van Eenennaam et al. 1996, p. 775; EPA 2003, p. xiv; Hilton et. al 2016, p.7). PYL occur in the water column but feed at the bottom of the water column (Mohler 2003; Richardson et al., 2007). They are assumed to use interstitial spaces in hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) as refugia as they move downstream and forage for aquatic insects, insect larvae, and other invertebrates.</p>
<p>Young of year (YOY)-Migrating & Foraging</p>	<p>YOY describes Atlantic sturgeon that are from 40-days post-hatch to 1-year old. YOY Atlantic sturgeon are not tolerant to salinity, and remain above the salt front in the 0.0-0.5 ppt range year-round (Hilton et al. 2016, p. 7). Rearing, migrating, and foraging require continuous flow in main river channels absent of physical barriers (e.g., locks, dams, reservoirs, gear, thermal plumes, turbidity, sound, etc.) to allow passage between the salt front and spawning sites necessary to support seasonal and physiologically-dependent movement, especially in the bottom meter of the water column. Prey items may include aquatic insects, insect larvae, and other invertebrates.</p>
<p>Juvenile-Migrating & Foraging</p>	<p>After their first year (YOY), juvenile Atlantic sturgeon become increasingly tolerant to saline water and may use the full extent of the river (from the river mouth to the upstream limit of tidal effect) to opportunistically forage, particularly in areas with soft substrate (e.g., sand, mud) and a salinity from 0.5 up to as high as 30 ppt. Prey items may include aquatic insects, insect larvae, and other invertebrates. Water depths in the main river channels must be deep enough to ensure continuous flow</p>

	in the main channel, and must be absent physical barriers (e.g., locks, dams, reservoirs, gear, thermal plumes, turbidity, sound, etc.) to ensure growth and development of juveniles.
Subadult-Migrating & Foraging	In general, migrating and foraging subadult Atlantic sturgeon may enter the lower estuary as early as mid-March and remain as late as mid-November (ASSRT 2007, p. 40). They utilize areas from the river mouth to the upstream limit of tidal effect to opportunistically forage with an affinity for the salt front, and particularly in areas with soft substrate (e.g., sand, mud) (Breece et al. 2013, p. 5; Savoy & Pacileo 2003, pp. 1, 3). Prey items may include benthic prey such as mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish such as sand lance. Water depths in the main river channels must be deep enough to ensure continuous flow in the main channel, and must be absent physical barriers (e.g., locks, dams, reservoirs, gear, thermal plumes, turbidity, sound, etc.) to ensure passage and support staging, resting, or holding of subadults.
Adult-Migrating & Foraging	In general, adult Atlantic sturgeon migrate into rivers in the spring (some heading to freshwater spawning grounds) and return to coastal marine waters in the fall. In more southern latitude rivers (e.g., James River), there is a distinct fall spawning run (approximately August - October). Anytime during a spawning migration, sturgeon may opportunistically forage in the full extent of the river (from the river mouth to the upstream spawning areas), with an affinity for the salt front and particularly in areas with soft substrate (e.g., sand, mud) (Breece et al. 2013, p. 5; Savoy & Pacileo 2003, pp. 1, 3). Prey items may include benthic prey such as mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish such as sand lance. Water depths in the main river channels must also be deep enough to ensure continuous flow in the main channel, and must be absent physical barriers (e.g., locks, dams, reservoirs, gear, thermal plumes, turbidity, sound, etc.) to ensure passage between the river mouth and spawning sites.
Adult-Spawning	In general, spawning adult Atlantic sturgeon migrate into rivers in the spring and return to coastal water in the fall. Spawning adults use habitat areas that have low salinity (0.0-0.5 ppt), hard bottom substrate (e.g., rock, cobble, gravel, limestone bedrock, etc.), and suitable water temperature (e.g., between 13 and 26° C). Sturgeon also require well-oxygenated, flowing water absent physical barriers for passage (e.g., locks, dams, reservoirs, gear, thermal plumes, turbidity, sound, etc.) between the river mouth and spawning sites necessary to support staging, resting, or holding of spawning condition adults.
Adult-Staging	Adults may stage around the spawning timeframe downstream of the spawning area, as in the James

	River (Balazik et al. 2012c, p. 1065). Given the various movement patterns Atlantic sturgeon demonstrate in different spawning rivers, it is not clear to what extent staging occurs or, for those fish that do appear to stage, whether it is essential for successful reproduction.
Subadult & Adult-Marine Migrating & Foraging	Subadult and adult Atlantic sturgeon may aggregate in estuarine (seaward of river mouth), bay, sound and ocean areas; and exhibit seasonal coastal movements in the spring and fall. They typically remain within the 50-meter depth contour, but are not limited to that depth. Prey items may include mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish such as sand lance.
Adult & Subadult-Overwintering	Subadult and adult Atlantic sturgeon may aggregate in estuarine (seaward of river mouth), bay, sound and ocean areas over the winter months. They typically remain within the 50-meter depth contour, but are not limited to that depth. Prey items may include mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish such as sand lance.