Summary table of white shrimp (*Penaeus setiferus*) life history information for the Gulf of Mexico. Associations and interactions with environmental and habitat variables are listed with citations.

<table>
<thead>
<tr>
<th>Life Stage</th>
<th>Season</th>
<th>Location</th>
<th>Temp (°C)</th>
<th>Salinity (ppt)</th>
<th>Oxygen (ppm)</th>
<th>Depth (m)</th>
<th>Trophic relationships</th>
<th>Habitat Associations and Interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-spawning adults</strong></td>
<td>Most abundant in late summer and fall</td>
<td>Nearshore waters - overwinter offshore, then move inshore in spring; concentrated off LA, TX, and Tabasco; greatest densities occur</td>
<td>Tolerant of temperatures between 7 and 38 °C</td>
<td>Survival is good between 20-35 ppt in ponds; adults usually exposed to less variability in nature</td>
<td>Usually inhabit nearshore waters &lt;27 m deep; abundant at a depth of 14 m</td>
<td>Omnivorous</td>
<td>Few trawl-caught fish appear to eat white shrimp, major predators may be larger fish</td>
<td></td>
</tr>
<tr>
<td>Citations:</td>
<td>1, 52</td>
<td>1, 3, 26, 27, 36, 52, 57</td>
<td>35, 83, 87</td>
<td>2 ppm or less causes stress</td>
<td>1, 3, 12, 52, 88</td>
<td>1, 38, 39, 40</td>
<td>1</td>
<td>39, 78, 80, 89</td>
</tr>
<tr>
<td><strong>Spawning adults</strong></td>
<td>Mainly spring to late fall, but peaks in the summer (June-July)</td>
<td>Offshore; limited spawning also may occur within estuaries and bays</td>
<td>Prefer abilities for spawning of at least 27 ppt</td>
<td>Spawning occurs offshore over shelf in water to 34 m deep, but mostly &lt;27 m deep; limited spawning may occur within estuaries and bays</td>
<td>Distribution assumed similar to spawning adults above; eggs are demersal and hatch 10-12 hrs after spawning</td>
<td>Omnivorous</td>
<td>Few trawl-caught fish appear to eat white shrimp, major predators may be larger fish</td>
<td></td>
</tr>
<tr>
<td>Citations:</td>
<td>17, 47, 52</td>
<td>3, 52</td>
<td>6</td>
<td>5, 12, 92</td>
<td>1, 38, 39, 40</td>
<td>1</td>
<td>38, 40</td>
<td></td>
</tr>
<tr>
<td><strong>Fertilized eggs (0.28 mm diameter)</strong></td>
<td>Spring to fall; assumed similar to spawning adults above</td>
<td>Offshore over shelf; also may occur within estuaries</td>
<td>Phytoplankton and zooplankton; feeding begins at first protozoal stage</td>
<td>Collected from shore out to 82 m deep</td>
<td>Distribution assumed similar to spawning adults above; eggs are demersal and hatch 10-12 hrs after spawning</td>
<td>Fish and perhaps some zooplankton (e.g., Chaetognatha).</td>
<td>Postlarvae migrate through passes (upper 2m of water column at night and middepths during day) mainly from May-November with a peak in June and a second peak in September</td>
<td></td>
</tr>
<tr>
<td>Citations:</td>
<td>12, 52</td>
<td>12, 52</td>
<td>12</td>
<td>1, 26, 84, 90, 91</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Larvae and pre-settlement postlarvae</strong></td>
<td>Present offshore spring through fall; Peak recruitment of postlarvae into estuaries occurs in June and September.</td>
<td>Mainly offshore over shelf and in passes to estuaries; also within estuaries</td>
<td>Phytoplankton and zooplankton; feeding begins at first protozoal stage</td>
<td>Collected from shore out to 82 m deep</td>
<td>Fish and perhaps some zooplankton (e.g., Chaetognatha).</td>
<td>Postlarvae migrate through passes (upper 2m of water column at night and middepths during day) mainly from May-November with a peak in June and a second peak in September</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Citations:</td>
<td>1, 26, 52, 84</td>
<td>1, 25, 26, 52, 84</td>
<td>25</td>
<td>25</td>
<td>1, 52</td>
<td>52</td>
<td>1, 26, 84, 90, 91</td>
<td></td>
</tr>
</tbody>
</table>
Late post larvae and juveniles:

Present late spring through fall; most abundant in late summer and early fall.

Postlarvae collected 13-31 °

Postlarvae collected between 0.4 and 37 ppt and survive at 40 ppt for 30 days but growth less at 35 than 25 ppt; juveniles prefer <10 ppt and growth in laboratory is retarded at 35-40 ppt.

Juveniles avoid 1.0 and 1.5 ppt water; not lethal until below 1.0 ppm.

Generally occur in shallow water habitats (< 1 m).

Omnivorous, detritus is common in guts but may be of little nutritional value; prey items include annelid worms, peracarid crustaceans, caelend shrimp, diatoms, lab reared growth and survive best on combination animal-vegetal.

Fishes, including spot, killifish, silver perch, black drum, and seatrout, southern flounder, spotted seatrout, eel, croaker, and seabirds.

Densities usually highest in marsh edge and submerged aquatic vegetation followed by marsh ponds and channels, inner marsh, shallow subtidal, and intertidal on nonvegetated bottom, muddy substrates with high organic content(cellected); turbid estuaries.

Generally greater than 1 m and <30 m on the shelf.

Omnivorous, scavengers consume annelids, insects, detritus gastropods, copepods, bryozoans, sponges, corals, fish, filamentous algae, vascular plant stems, and roots.

Plaice (same species listed above that prey on juveniles) are predators in estuaries; predation may be lower after leaving estuary.

Select soft mud or silt substrate over sand and shell; migration from estuaries occurs in late August and September and appears related to shrimp size and environmental conditioning in the estuary (e.g., sharp drops in temperature during fall and winter).

Growth rates of postlarvae increase with temperature between 18 and 32.5 °

As for brown shrimp, predation is likely a major cause of mortality; because white shrimp burrow shallower and less frequently than brown shrimp, they may be more vulnerable to predation.

No mechanistic production model available, but variables identified as important in brown shrimp models may also be important for white shrimp; coastal wetland area, amount of marsh edge, and elevation of the marsh surface appear related to production.

**Sub-adults**

Present summer through fall; most abundant in August and September.

Found in open water of bays and near shore over shelf; concentrated in LA, TX, and MS.

Cold fronts can cause mass mortality; in South Carolina, survival requires minimum temperature of > 6 °

Abundant from 1 to 21 ppt; salinity has little effect on distribution.

Juveniles avoid 1.0 and 1.5 ppt water; oxygen requirement increases with temperature.

Generally greater than 1 m and <30 m on the shelf.

Omnivorous, scavenger consume annelids, insects, detritus gastropods, copepods, bryozoans, sponges, corals, fish, filamentous algae, vascular plant stems and roots.

Plaice (same species listed above that prey on juveniles) are predators in estuaries; predation may be lower after leaving estuary.

Select soft mud or silt substrate over sand and shell; migration from estuaries occurs in late August and September and appears related to shrimp size and environmental conditions in the estuary (e.g., sharp drops in temperature during fall and winter).

Growth rates of postlarvae increase with temperature between 18 and 32.5 °

As for brown shrimp, predation is likely a major cause of mortality; because white shrimp burrow shallower and less frequently than brown shrimp, they may be more vulnerable to predation.

No mechanistic production model available, but variables identified as important in brown shrimp models may also be important for white shrimp; coastal wetland area, amount of marsh edge, and elevation of the marsh surface appear related to production.

**Citations:**

1, 52, 10, 11, 37, 47, 52, 53, 63, 83

2, 1, 52, 83, 86

2, 96, 97, 98

14, 33, 44, 56, 64, 75, 78

5, 7, 2022, 24, 33, 52, 74, 92, 94, 95

5, 15, 21, 22, 33, 40, 52, 65-73, 76, 77, 81, 85, 89

1, 8, 9, 18, 19, 23, 28-31, 33, 34, 41, 42, 44-46, 50, 52, 54, 55, 58-61, 64, 75

2, 1, 52, 21, 22, 33, 40, 52, 65-73, 76, 77, 81, 85, 89

1, 31, 34, 45, 48, 49, 51, 54, 58

5, 15, 21, 22, 40, 52, 65-73, 76, 77, 81, 85, 89

13, 16, 26, 47, 52, 57, 63, 92, 93

5, 15, 21, 22, 40, 52, 65-73, 76, 77, 81, 85, 89

13, 16, 26, 47, 52, 57, 63, 92, 93

5, 15, 21, 22, 40, 52, 65-73, 76, 77, 81, 85, 89

13, 16, 26, 47, 52, 57, 63, 92, 93

5, 15, 21, 22, 40, 52, 65-73, 76, 77, 81, 85, 89

13, 16, 26, 47, 52, 57, 63, 92, 93

5, 15, 21, 22, 40, 52, 65-73, 76, 77, 81, 85, 89

13, 16, 26, 47, 52, 57, 63, 92, 93

5, 15, 21, 22, 40, 52, 65-73, 76, 77, 81, 85, 89

13, 16, 26, 47, 52, 57, 63, 92, 93

5, 15, 21, 22, 40, 52, 65-73, 76, 77, 81, 85, 89

13, 16, 26, 47, 52, 57, 63, 92, 93

5, 15, 21, 22, 40, 52, 65-73, 76, 77, 81, 85, 89

13, 16, 26, 47, 52, 57, 63, 92, 93

5, 15, 21, 22, 40, 52, 65-73, 76, 77, 81, 85, 89

13, 16, 26, 47, 52, 57, 63, 92, 93

Stop
Citations for White Shrimp Habitat Table


58. Nine years of unpublished data from Galveston Bay, TX; these data are similar to those reported by Zimmerman and Minello (1984).


65. Minello, T. J., R. J. Zimmerman and T. C. Czapla 1989. Habitat-related differences in diets of


management in the Gulf of Mexico shrimp trawl fishery. In, "Models and Mass Balance Calculations for the Gulf of Mexico", Proceedings of a workshop sponsored by the EPA and the Gulf of Mexico Program, April 2-4, New Orleans, LA.


