Salinas River Lagoon Fish Distribution

Fall 2025 Tidewater Goby Surveys

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Monterey County Water Resource Agency

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Executive Summary

Tidewater goby surveys along the perimeter of the lower Salinas River Lagoon (from the Highway 1 Bridge downstream) have been ongoing since 2018, generally twice per year (spring and fall).

The fall of 2024 was the first survey that did not result in physical capture of the species, although concurrent eDNA sampling indicated continued presence in the lagoon during that time. The following spring (May, 2025), tidewater goby were once again captured during the seining survey at the established sampling stations, albeit in low numbers, which ranged from 0 to 10 individuals per seine haul. At that time, the fish community in the lagoon was dominated by other species with a broad salinity tolerance, notably including large numbers of arrow goby and juvenile yellowfin goby, which had not been documented in the lagoon in comparable densities before.

To provide information on the status of tidewater goby, the overall change of fish community composition in the lagoon, and to evaluate the use of minnow traps as a complementary sampling technique for tidewater goby, the established monitoring stations along the perimeter of the lower lagoon were sampled by seine in October, 2025. Minnow traps were deployed at a subset of seining locations (in the OSR, on the lagoon side of the slidegate, and along the sandbar) and retrieved after an overnight soak.

Salinity concentrations (measured with a YSI ProSolo Digital Water Quality Meter) were very low throughout the lagoon, not exceeding 0.5 ppt at any of the sampled locations, marking a drastic change compared to the spring survey, when salinity was unusually high. Surface temperatures ranged from 17.0 to 19.7°C and dissolved oxygen from 6.45 to 10.46 mg/l, well within the tolerance range of fish species expected in the lagoon.

For the second time since 2018, no tidewater goby were documented during the seining survey. Due to reductions in other survey efforts (i.e. lagoon fish community surveys), no eDNA surveys were collected during this sampling event, precluding confirmation of their occupancy through alternative methods. The fish community was characterized by only four species: inland silverside, threespine stickleback, mosquitofish, and fathead minnow (which was found only in the Old Salinas River channel [OSR]). Other species that have been abundant in past surveys and in the spring were conspicuously absent.

The circumstance was not ideal to test the efficacy of minnow traps to capture tidewater goby due to the lack of detection using established seining protocol. Regardless, the use of minnow traps as an alternative to seining is not recommended, based on the limited trap catch of species (stickleback) that were captured in abundance by seine in the immediate vicinity of the minnow traps.

Notable observations include uncharacteristically clear water, expansive areas of dense widgeongrass, and ubiquitous reef-like aggregations of tubeworms.

Recommendations for future monitoring include integrating eDNA surveys as a routine component of periodic net/seine surveys, the use of a small, boat-based trawl to assess goby distribution in areas that have not been sampled previously, and the opportunistic visual documentation of the lagoon's bathymetry while the lagoon is breached.

Introduction and Background

Tidewater goby (*Eucyclogobius newberryi*), a small estuarine fish that has been listed as Endangered under the ESA since 1994 (USFS 1994), was thought to be absent from the Salinas River Lagoon since the 1950s, until the species was documented there during a fish survey in 2013, and again in 2014. No fish monitoring surveys were conducted from 2015–2017, but since 2018, periodic surveys (generally each spring, sometimes also in the fall) have monitored the persistence and distribution of tidewater goby in the Salinas River Lagoon (see FISHBIO 2023, FISHBIO 2025a for additional background and a summary of goby occurrence since 2018).

Tidewater goby in the Salinas River Lagoon have experienced notable fluctuations in abundance and distribution, as inferred from presence or absence at various sampling locations in the lower lagoon. Even when tidewater goby we not physically documented (e.g. in October 2024), simultaneous environmental DNA (eDNA) surveys detected tidewater goby DNA. In fact, recent eDNA surveys of the broader hydrologic area from the Pajaro River estuary to Moro Cojo, Watsonville, Bennet, and Elkhorn sloughs (conducted in spring and fall of 2024; see FISHBIO 2025a) indicate that multiple locations in the general area support tidewater goby populations.

Despite recent advancements in our understanding of tidewater goby distribution in the area, questions remain regarding the frequency and occurrence of localized extinctions and recolonization events, or migration of tidewater goby among the relatively isolated patches of habitats with suitable environmental conditions for permanent occupancy. An added challenge to monitoring and studying tidewater goby is that the physical environmental conditions of their habitat are often challenging to sample (dense vegetation and other obstructions can limit the use of seine or dip nets, and soft substrate or deep water can prohibit wading). Consequently, tidewater goby are often, perhaps erroneously, considered to occur predominantly in shallow water and over sandy or muddy bottom areas that can be effectively sampled by beach seine.

To augment the survey methods used for monitoring the status of tidewater goby in the Salinas River Lagoon, minnow traps were deployed at multiple locations overnight, intended to provide comparative data on catch and species composition to seining.

This report provides an overview of survey results from October 2025.

Methods

Tidewater goby collection surveys in the Salinas River Lagoon utilized a 15 x 4 ft beach seine (⅛ inch mesh size) to sample numerous locations throughout the lagoon, distributed from near the sandbar/breach location to the Highway 1 Bridge, as well as in the Old Salinas River (OSR) directly behind the slidegate. Targeted sampling for tidewater goby is conducted following protocols developed by the United States Fish and Wildlife Service (USFWS 2005; Appendix F). After each seine haul, all captured fish are transferred from the seine to an aerated, temporary holding bucket, identified to species level, enumerated, and measured. Following identification and measurement, all sampled fish are released at the site of capture.

In addition, six minnow traps (10x10x18 inches in size; ⅛ inch mesh size; baited with raw shrimp) were deployed in select locations in the OSR (Figure 1), the lagoon outside the slidegate (in areas

too deep and rocky to seine), near dense patches of widgeongrass, and along the sandbar. Minnow traps were deployed between 15:00 and 16:00 on October 23, 2025, baited with 3–4 raw shrimp, and retrieved the following morning.

Figure 1. Minnow traps deployed in the Old Salinas River (left) and the Salinas River Lagoon in October, 2025.

Additional details on seining methods and locations, as well as a comprehensive overview of past occupancy patterns of tidewater goby in the Salinas River Lagoon, can be found in FISHBIO (2022).

Results

Salinity concentrations (measured with a YSI ProSolo Digital Water Quality Meter) were very low throughout the lagoon, not exceeding 0.5 ppt at any of the sampled locations, marking a drastic change compared to the spring survey, when salinity was unusually high, which created favorable conditions for the marine species (e.g. bay pipefish) and those estuarine species with a preference for higher salinities (e.g. arrow gobies). Typically, salinity at the Highway 1 Bridge has remained below 5 ppt during past surveys (sometimes as low as 1–2 ppt), with a marked increase towards the sandbar, but generally not exceeding 10–15 ppt. Surface temperatures and dissolved oxygen were modest during the October sampling event, and well within the tolerance range of fish species expected in the lagoon, ranging from 17.0 to 19.7°C, and 6.45 to 10.46 mg/l, respectively (Table 1).

For the second time since 2018, no tidewater goby could be documented during the seining survey (the other time was October, 2024, but the species was detected during an eDNA survey conducted at the same time; Figure 2).

Interestingly, the fish community documented by seining was characterized by only four species: inland silverside (*Menidia beryllina*), threespine stickleback (*Gasterosteus aculeatus*), mosquitofish (*Gambusia affinis*), and fathead minnow (*Pimephales promelas*). Fathead minnows were sampled only in the OSR, while the other three species were found throughout the lagoon, sometimes in high numbers (Table 1; Figure 3). As the purpose of this survey is not to measure (or count) large numbers of stickleback, silverside, or other non-target species, biologists on site made qualitative determinations on when the catch of non-target species was too high to process individuals. Bulk determination for releasing non-target catch was only made after carefully sorting through the net to look for tidewater goby and other less abundant species.

Table 1. Summary of sampling locations, environmental parameters, and seining catch in the Salinas River Lagoon, October 23–24, 2025.

Area	Coordinates	Temp. (°C)	Salinity (ppt)	DO	Other species (n)	*Ruppia* presence
OSR	36.75004, -121.8011	18.4	0.48	9.46	Fathead minnow (36), Inland silverside (TNTC), Threespine stickleback (TNTC), Mosquitofish (TNTC)	Present
Outside OSR	36.74983, -121.80148	18.4	0.48	8.75	Inland silverside (TNTC), Threespine stickleback (TNTC)	Present
Sandbar (North)	36.75133, -121.80264	18.0	0.49	6.45	Inland silverside (TNTC), Threespine stickleback (TNTC)	Absent
Sandbar (Center)	36.74855, -121.80326	19.7	0.48	9.30	Inland silverside (TNTC), Threespine stickleback (TNTC)	Absent
Sandbar (South)	36.74713, -121.80335	19.5	0.48	8.90	Inland silverside (TNTC), Threespine stickleback (TNTC)	Absent
Southwest Corner	36.74641, -121.80293	16.7	0.47	7.33	Inland silverside (TNTC), Threespine stickleback (TNTC)	Present
NWR Shoreline 1	36.74434, -121.80143	17.0	0.46	7.24	No catch	Present
NWR Shoreline 2	36.74391, -121.80119	17.0	0.46	10.46	Threespine stickleback (2)	Present
NWR Shoreline 3	36.74341, -121.80073	17.0	0.46	8.98	Threespine stickleback (1)	Present
NWR Shoreline 4	36.74167, -121.79911	17.3	0.47	8.16	Threespine stickleback (2)	Present
NWR Shoreline 5	36.73953, -121.79629	17.6	0.46	8.20	No catch	Present
NWR Shoreline 6	36.73903, -121.79545	17.6	0.46	7.94	Threespine stickleback (2)	Present
Highway 1	36.73203, -121.78302	17.8	0.43	8.58	Inland silverside (TNTC), Threespine stickleback (TNTC), Mosquitofish (TNTC)	Present

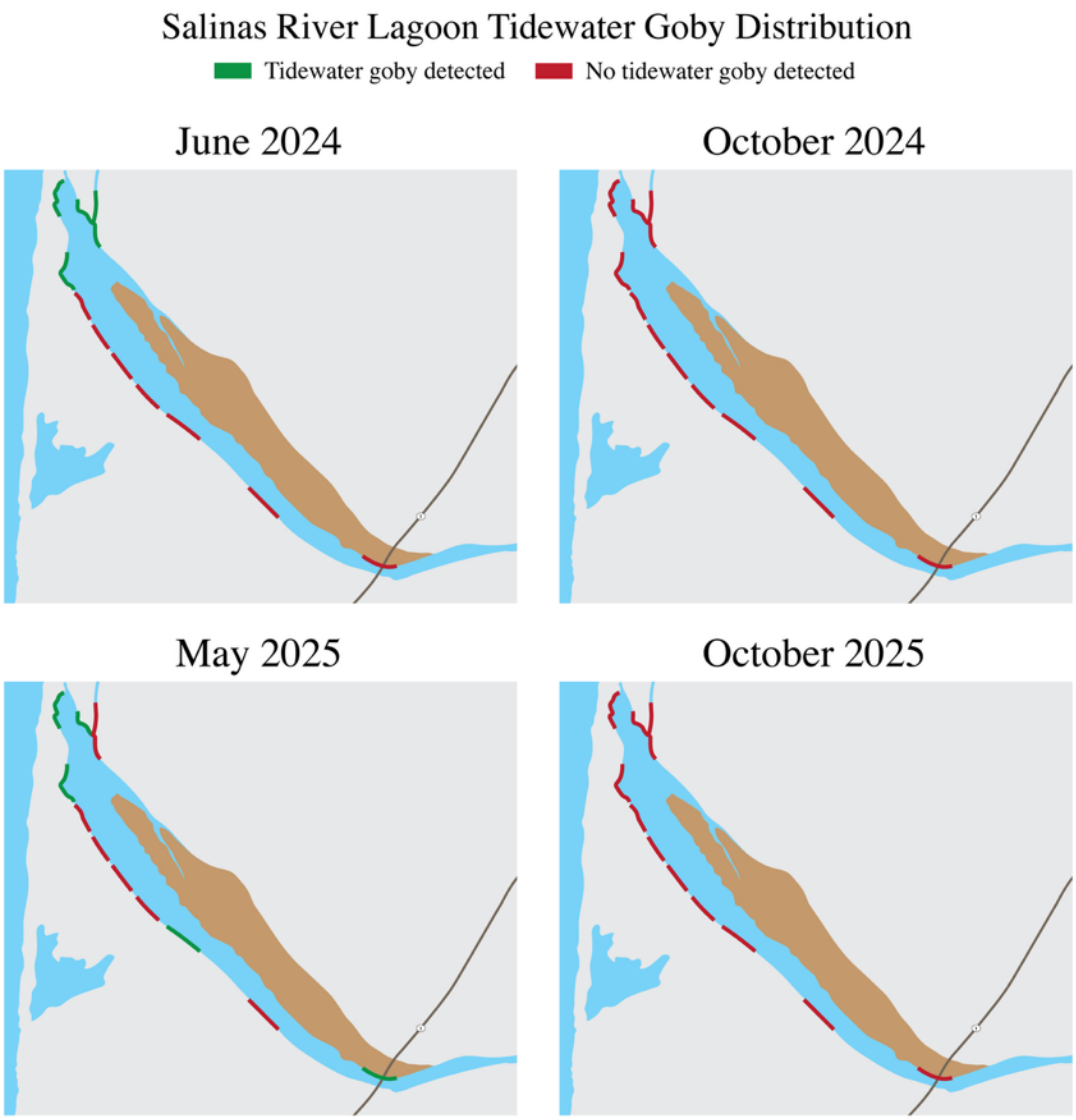

Figure 1. Summary of recent detection records of tidewater gobies in the Salinas River Lagoon in 2024 and 2025, illustrating presence (green) and non-detection (red). Note: Methods and effort are not standardized.

Minnow traps we not effective in capturing the species that were captured in abundance by seine in the immediate vicinity; the only fish captured in the minnow traps were threespine stickleback. Two individuals were captured in one of the two traps deployed in the OSR, and one stickleback was captured in the trap on the lagoon side of the slidegate. The other three traps—one deployed near a patch of widgeongrass just west of the slidegate (pictured in Figure 1) and two at a depth of about 1 m along the sandbar—did not yield any catch.

Figure 3. Catch of inland silverside along the sandbar (center) in October, 2025.

Discussion

The absence of species other than silversides, stickleback, and mosquitofish during the October sampling event was somewhat conspicuous. The salinity in the lagoon was low throughout; even near the sandbar, where the highest salinity concentrations are usually measured, levels were well below 1 ppt. Tidewater goby can survive at such low salinities, as can many of the other euryhaline estuarine species that were captured during the spring survey. However, not seeing any benthic (bottom oriented) species was unexpected. Usually, Pacific staghorn sculpin are nearly omnipresent, juvenile flatfish (such as speckled sanddab and starry flounder) are routinely observed, and freshwater species (pikeminnow, hitch, or even largemouth bass or juvenile carp) are generally documented at locations with lower salinity concentrations (typically occuring near the Highway 1 Bridge). During the May survey, arrow gobies and yellowfin gobies were found in unusually large numbers. All captured yellowfin gobies (162) were juveniles (smaller than 35 mm in length), and past sampling events have only documented adult individuals of this species; none were captured in the fall. It appears likely that the typical freshwater fish community continues to be present in the upstream reaches of the lagoon, but it is not known if the species that require higher concentrations of salinity to persist or thrive have perished, or found refugia in isolated areas of elevated salinity (such as dense saltwater lenses that may form in the deeper areas of the lagoon).

While the circumstance was not ideal to test the efficacy of minnow traps to capture tidewater goby, the use of minnow traps as an alternative to seining is not recommended, based on the limited catch of species that were abundant in the immediate vicinity (stickleback).

Notably, widgeongrass (*Ruppia sp.*), an aquatic plant often considered to provide favorable habitat for tidewater goby, was very abundant and frequently formed dense patches that rendered seining ineffective (Figure 4). Also, although turbidity is not routinely measured during goby surveys in the lagoon, water clarity during the October surveys was notably improved compared to past surveys. Conspicuous and extensive reef-like structures, formed by tubeworms (presumably the Australian tubeworm, *Ficopomatus enigmaticus*), were visible along the southern shoreline, forming a nearly continuous band (Figures 5, 6). Aquatic vegetation and filter feeding organisms

can increase water clarity, either by reducing current and mixing of the water column (allowing previously suspended particles to settle out) or by actively filtering the water, removing and consuming suspended organic matter. The causal relationships that led to the conditions observed during the fall survey, if any, remain unclear.

Figure 4. Small alcove along the southern shoreline of the Salinas River Lagoon, densely vegetated with widgeongrass (*Ruppia sp.*).

Figure 5. Extensive colonies of invasive Australian tubeworm (*Ficopomatus enigmaticus*) were visible and widespread along the southern shore of the Salinas River Lagoon in October, 2025.

Figure 6. A piece of a tubeworm colony recovered from a seine net during the October, 2025, tidewater goby survey.

It appears safe to postulate, however, that the high abundance of widgeongrass and tubeworms must have a profound effect on nutrient dynamics in the lagoon, perhaps affecting multiple trophic levels, including fish. Notable, widgeongrass was absent (i.e. not discernible or documented) during the spring survey, and by October had spread to abundances/densities not previously seen during tidewater goby surveys at this location. Tubeworm colonies had been observed in the lagoon during past surveys, and it is not known if they are increasing in abundance, or if the increased water clarity created the perception that they are currently more widespread than in the past. The nature of the interaction between widgeongrass, tubeworms, and other fauna in the lagoon is poorly understood, but expected to be significant, solely based on the large biomass represented by the species.

Several recommendations are provided to document and investigate biological and physical parameters that will contribute greatly to our understanding of the Salinas River Lagoon ecosystem and that can guide future management, monitoring, and research.

First, we recommend that eDNA samples are collected concurrently with periodic surveys to provide a complementary avenue to assess fish community composition and presence of tidewater goby. In the fall of 2024, tidewater goby could not be captured during the seining surveys, but their DNA was detected in water samples that were collected at the same time. This suggests that

tidewater goby were relatively rare during the preceding fall, but that the species was able to persist despite several periods of prolonged connectivity to the ocean in recent years, including a three-month period immediately preceding the spring survey. Tidewater goby were then again physically documented in the spring of 2025. It has been assumed that extended periods of lagoon closure likely benefit the tidewater goby population in the Salinas River Lagoon by providing stable environmental conditions. In the past, however, such periods were characterized by higher salinity concentrations than observed during the fall survey of 2025. It is not known how tidewater goby are distributed when low salinity is present throughout the lagoon (at least along the shoreline, where measurements are taken during surveys).

How far upstream tidewater goby are distributed in the Salinas River Lagoon has been a long-standing question. Opportunity to sample by hand-held beach seine is limited upstream of the Highway 1 Bridge, where relatively stable (albeit low salinity) refuge habitat may be found. Similarly, the distribution of gobies in the deeper areas of the lagoon is unknown. Tidewater goby have been documented in lagoon habitats to depths of about 5 meters (15 feet; in Big Lagoon, CA; USFWS pers. comm.), but documenting their presence at these depths requires boat-based sampling methods. We strongly recommend a targeted sampling event that uses a small trawl to evaluate goby distribution in deeper habitats and areas in the upstream reaches of the lagoon, ideally in conjunction with concurrent transect-based eDNA sampling (i.e. water is filtered off the bow of the boat to collect eDNA, while a small beam trawl is towed off the stern).

Lastly, while the lagoon remains breached, georeferenced aerial/drone photography should be used during low tide to detail the bathymetry of the lagoon. This is expected to reveal large expanses of relatively featureless shallow water habitat in the lagoon and, conversely, areas of deeper water where haloclines or saltwater lenses may form. These areas are relevant for management because they may serve as refuge habitat for species of concern, but may also harbor larger predatory species. These areas are important to represent in assessments of the fish community and could be the focus of targeted efforts for sample collection during future investigations. In addition, such imagery could reveal the extent of tubeworm colonies in the lagoon, forming a baseline that allows managers to track their spread.

References

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