

**Lower Arroyo Grande Creek and Lagoon
Fishery and Aquatic Resources
Summary 2008 Monitoring Report**

Oceano Dunes State Vehicular Recreation Area

Pismo Dunes Natural Preserve

by
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January 2009

ABSTRACT

The lowest half-mile of Arroyo Grande Creek, including a periodically-closed euryhaline lagoon within and adjacent to Oceano Dunes State Vehicular Recreation Area (SVRA) and Pismo Dunes Natural Preserve (San Luis Obispo County, California), was subject to extreme drying in summer and fall of 2008. Dewatering apparently caused by agricultural groundwater overdraft appeared the cause of significant fish-kills. cursory observations, made during autumn, suggest the drying of the streambed in the survey area (including lagoon) may have been entire for the first time in many years. By outward appearance, the habitat had returned to a "normal" hydrologic configuration at the end of the year, but little if any recolonization by fish had occurred.

Qualitative sampling of the fishery in this area was conducted four times throughout 2008 for the purposes of gathering information about various species' use of the habitats within the State Park, evaluating whether any Park activities may be impacting the fishery and aquatic habitat, and documenting the impacts of habitat disturbance caused by upstream water management activities. Effort varied between samples in 2008 because of dramatically changing hydrologic and habitat conditions, but regularly included seining and usually also electrofishing, dipnetting, and/or direct observation. A total of ten fish species were collected during the 2008 sampling, and several observations were noteworthy: the apparent extirpation of the tidewater goby population established in 2005; observation of several adult steelhead included in a fish kill that affected thousands of fish of various species; and, in December, the fewest numbers of individuals and species ever observed in this area during any sampling effort here since 2003.

INTRODUCTION

Arroyo Grande Creek arises from the mountains of San Luis Obispo County and flows to the Pacific Ocean. Within the watershed is one major reservoir, Lopez Lake storing up to 52,000 acre-feet, that is situated about 15 miles upstream from the ocean. Within the last few miles to the ocean, a low-gradient reach of stream flows through an alluvial agricultural valley and then forms a lagoon behind the beach. The lagoon is closed by a sandbar in most summers, but otherwise flows over the beach to the sea. The terminal half-mile of Arroyo Grande Creek, including the aforementioned lagoon, are part of Oceano Dunes SVRA and Pismo Dunes Natural Preserve. Also adjacent to this reach of stream are a municipal airport and a wastewater treatment plant. Most of the lower reach of the creek is confined between levees, and some riparian vegetation is periodically removed for flood control purposes.

Study Area

Arroyo Grande Creek in and adjacent to Oceano Dunes SVRA and Pismo Dunes Natural Preserve typically consists of three distinct aquatic habitats: an upstream lotic environment characterized by a series of short low-gradient riffles and shallow (maximum depth usually <3 feet) pools, runs, and glides that flows westward; a several-acre L-shaped lagoon (relatively narrow throughout) behind the back-beach that is typically 2 to 6 feet deep and varies in extent depending on tides and high flow events (and is sometimes modified by beavers); and, when the

lagoon is draining to the ocean, a few hundred feet of transitory low-complexity, relatively shallow channel that connects the lagoon to the surf line and is characterized by sand banks and substrate. The northeast/upstream end of the lagoon, and both sides of the upstream lotic reach, are confined by levees. The lagoon is characterized by varying patches of submerged and emergent aquatic vegetation and varying substrates of mud, silt, and gravel. The upper lotic reach is usually characterized by dense riparian vegetation on and overhanging the banks, predominantly small-gravel and sand substrate, and a sparse distribution of large woody debris fragments.

Figure 1 shows the lower half-mile of Arroyo Grande Creek and the relative locations of the habitats described above. "Guiton Crossing" is the approximate upstream limit of State Park ownership, though some observations and collections occurred a few hundred feet upstream from this point on some occasions.

Streamflow was present and generally "normal" in March and December, but was intermittent many summer and fall months. Water quality of lagoon inflow, when present, appeared good; water quality within the lagoon grew increasingly poor until October and December storms provided some flushing and restored inflow. High tides were observed washing seawater into the lagoon in November and December. A staff gage was installed at the lagoon in September, for future objective comparison of changing lagoon water level.

Purpose and Scope

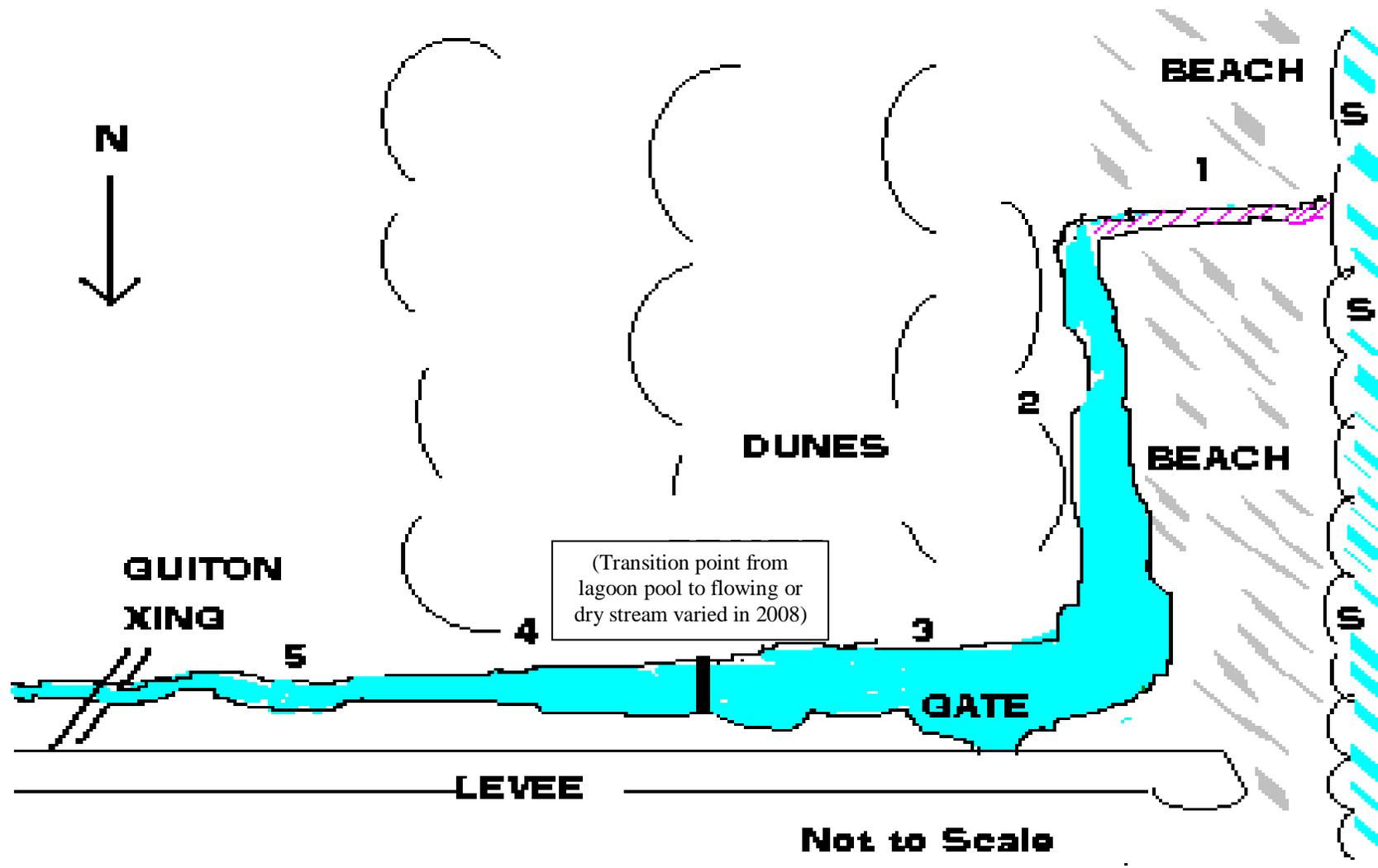
This study was conducted for two primary purposes: 1) to continue the evaluation, commenced in 2003 through 2007 (Rischbieter 2004, 2006, 2007, 2008) of the composition and significance of the fishery in Arroyo Grande Creek associated with State Park habitat; and 2) to gauge the impact (if any) of SVRA vehicle traffic on these aquatic resources, especially in the beach area where vehicles traverse the wetted stream. Towards these goals, aquatic sampling was generally limited to the Park reach of Arroyo Grande Creek. Most information sought was qualitative. Quantitative evaluation was limited to routine estimation of the relative abundance of species collected, and an estimate of numbers of fish affected by the June 19-20, 2008 fish-kill.

MONITORING PROCEDURES

We typically used dipnets, beach seine, direct observation, and electrofishing to observe, collect, and identify fish in each of the habitat zones described above. Only methods appropriate for the location and conditions on each respective survey date were used. More detailed description of activities pursued during each of the four surveys can be found within the summary reports prepared for each individual fish-sampling survey (Rischbieter, various dates). However, the following summary describes typical procedures conducted over the study period.

FIGURE 1. Relative locations of zones of Study Area, lower Arroyo Grande Creek and Lagoon, San Luis Obispo County, 2007.

1- Surf-line Outlet Reach (lotic, intermittent); 2- Back-beach Reach; 3- Levee/Dune-constrained Reach; 4- Backwater when lagoon full; 5- Lotic Reach;
GATE - Under-Levee Discharge from Residential and Wetland Areas; S- Normal Surf Zone



The Back-beach Reach (Figure 1) was subject to 5-10 seine hauls using a beach seine (4' x 30' with 1/16" mesh, and/or 4' x 50' with 3/16" mesh). The hauls usually proceeded sequentially from south-to-north, occasionally including and ending at the Levee/Dune Reach. The seine was typically swept in an arc, with a set pivot-point on shore, and closed and dragged ashore. Longer hauls were conducted on dates when low numbers of fish seemed present. After each haul the seine was checked; if any organisms were present, they were removed, identified, and released. In March, we held the seine static in the Surf-zone Outlet Reach and allowed it to catch drift for a few minutes, sometimes with foot or vehicle traffic occurring upstream.

Electrofishing was also conducted above the head of the lagoon. Effort was usually continuous from a relatively easy access point about 500-1,000 feet downstream of Guiton Crossing upstream to Guiton Crossing and occasionally 100-500 feet beyond. Distance covered and duration of effort was usually dictated by hydrologic conditions: the extent of the lagoon backwater making electrofishing inappropriate, and the existence of surface flow upstream from the lagoon pool. The author carrying the electrofisher was accompanied by two netters; immobilized fish were lifted with dipnets and, if they appeared noteworthy or representative specimens, they were placed into a bucket for recovery, identification, and release. Roughly 1,000 seconds of electrofishing current was usually applied throughout this reach; settings were routinely 60 Hertz at 100-200 Volts DC. No electrofishing was conducted in the remnant September pools because of apparent presence of California Red-legged frogs.

RESULTS

Ten species of fish were collected over the four survey dates. Species collected, relative locations of collection for each species, general relative maturity of each species collected, and survey dates are summarized in Table 1. Except for those salvaged dead (mostly steelhead delivered to DFG biologist), all fish collected were returned alive to the approximate location of capture. One moribund goby retained in March was preserved and retained for delivery to a UCLA fisheries geneticist for additional study, should he require additional specimens for his research, per Recovery Permit terms and conditions.

During the March survey, the aforementioned goby and two young-of-year post-larval staghorn sculpin were collected in the Surf-zone Outlet Reach. This is noteworthy because fish seem infrequently present in this area, and on this occasion it is also worth noting these three specimens were collected upstream of the area open to fording vehicles, drifting downstream.

The June survey presented the first observation of adult steelhead during our scheduled surveys here. Unfortunately, all seen succumbed to rapidly drying conditions described elsewhere in this report. Several juvenile steelhead collected in the lagoon also likely did not survive the drying and stagnating conditions. In one stretch upstream from the Park, comprised of two beaver dams with shrinking ponds and a connecting trickle of riffle, we observed 10 dead adult (~20-26" total length) and one juvenile steelhead, about 35 dead adult Sacramento sucker (~12-18"), and thousands of dead small fish (~1-3") of various species. Many hundreds or thousands of

TABLE 1. Fish of lower Arroyo Grande Creek and Lagoon: species collected, status, collection dates, approximate collection locations, and general relative abundance of life history stages observed, 2008.

<u>SPECIES</u>	<u>STATUS</u>	<u>MAR 21,</u> <u>2008</u>	<u>JUN 20,</u> <u>2008</u>	<u>*SEP 16,</u> <u>2008</u>	<u>DEC 22,</u> <u>2008</u>	<u>COMMENTS</u>
California roach <i>Lavinia symmetricus</i>	n	u5	--	--	--	Only one individual, 56mm TL, collected in 2008.
steelhead <i>Oncorhynchus mykiss</i>	N	u5	Oo3, u5	--	--	Dead adult steelhead relatively numerous upstream 6/19; live adult seen in lagoon not actually captured.
Sacramento sucker <i>Catostomus occidentalis</i>	n	O5, u5	u2, a5	--	u5	Spawning pairs observed in MAR -- southernmost known reproducing population.
threespine stickleback <i>Gasterosteus aculeatus</i>	N	Oo5	Aa2,Aa5	Oo3,Oo4	--	First absence ever recorded here (DEC).
prickly sculpin <i>Cottus asper</i>	N	Oo5	Uu5, u2	Oo3, u4	u5	Only two individuals seen in DEC.
staghorn sculpin <i>Leptocottus armatus</i>	N	u1,a2,o5	o2	--	--	Unusual "upstream" occurrence in MAR.
tidewater goby <i>Eucyclogobius newberryi</i>	N	U1, U4	Oo2	--	--	Most-upstream distribution ever observed here (MAR), but population presumed extirpated by SEPT.
starry flounder <i>Platvichthys stellatus</i>	N	u2	u2	**	--	*Only a dead specimen found in SEPT.
largemouth bass <i>Micropterus salmoides</i>	I	--	U3, u2	--	--	Live adult observed in lagoon was not actually captured.
mosquitofish <i>Gambusia affinis</i>	I	--	--	Oo3	--	

KEY Status: **N** = Native to watershed; **n** = Native to California, but likely introduced to watershed; **I** = Introduced
Zones Where Found (Figure 1): **1** - Surf-line Outlet Reach (only present during April date); **2** - Back-beach Reach; **3** - Levee/Dune-constrained Reach;
4 - "Beaver Pond" Backwater (only 2 survey dates*); **5** - Lotic Reach (intermittent in June and September).
* - There was extraordinarily little surface water present to collect from on this date: Zones 1 and 2 were completely dry; negligible sampling in Zone 5 (no electrofishing) on this date because of minimal habitat and observed presence of adult frogs.
Abundance (UPPER CASE = Adults; lower case = Young-of-Year): **A/a** - Abundant or Common; **O/o** - Occasionally Collected; **U/u** - Infrequently Collected

additional small fish remained trapped in these shrinking pools and succumbed in subsequent days. We observed birds and evidence of other scavengers consuming hundreds of the small fish in a matter of hours.

Several frogs were cursorily observed during the September survey. Reports from regional organizations familiar with surveys related to nearby flood control channel maintenance reported that numerous California red-legged frogs were present in the area this summer. The lagoon and creek continue to support substantial numbers of migratory waterfowl. Wading shorebirds, both predators and scavengers, were frequently observed both resting and stalking in the waters of the lagoon.

Beaver activity appeared to affect fish habitat. No beavers were seen, and a long-standing dam in the middle of the lagoon (originally constructed in 2005) was gone this year. However, the beaver(s) initiated dams in other upstream locations, and two in particular upstream from the Park seemed to contribute to the June fish kill by being an impediment to downstream fish passage.

No water quality measurements were taken, but lagoon water quality was obviously impaired when freshwater inflow was low or absent. Significant mats of aquatic vegetation, accompanied by a stench of decomposition and anaerobic substrate conditions, were present in September. A hydrogen sulfide odor was common when muddy substrates were disturbed, indicating anaerobic benthic conditions.

A staff gage was installed in September 2008, when the lagoon was virtually dry, near the “inside” (east) of the lagoon’s “L-bend” to allow comparison of relative water stage information during future surveys. From this reference point, changes in the water elevation(s) of the lagoon now can be documented and considered in the context of the various habitat changes that are generally observed to wax and wane. Depth changes of several feet were observed by Park staff.

DISCUSSION

The 2008 surveys of Arroyo Grande Creek are noteworthy primarily for the dearth of fish present and collected, and particularly for documentation of the severe mortality affecting two listed species due to extensive, rapid, and prolonged dewatering. After seemingly flourishing in 2007, tidewater goby are likely extirpated from this watershed. Equally notably, the first observation of live adult steelhead here that coincided with survey timing was also coincident with a severe fish-kill that decimated all species present in a period of a few days.

The year-ago report in this series (Rischbieter 2008) described what appeared, at the time, to be the worst habitat and fishery conditions observed over our survey history (dating back to 2003). Unfortunately, 2008 hydrologic conditions (and resultant impact on aquatic fauna) were even worse than 2007. This is reflected in a review of the species documented in recent calendar years (Table 2); even though 2008 may cursorily appear to have supported more species, the

TABLE 2. Fish species collected in lower Arroyo Grande Creek and Lagoon, by DPR staff, by calendar year 2003-2008 (# of surveys): **X** = collected, -- = not observed.

<u>SPECIES</u>	<u>STATUS</u>	<u>2003</u> (2)	<u>2004</u> (5)	<u>2005</u> (4)	<u>2006</u> (4)	<u>2007</u> (4)	<u>2008</u> (4)	<u>COMMENTS</u>
California roach <i>Lavinia symmetricus</i>	n	X	X	X	X	X	X	Largest was 132mm total length (TL; June, 2006).
speckled dace <i>Rhinichthys osculus</i>	N	X	X	--	X	X	--	Generally uncommon in study area catch.
Sacramento sucker <i>Catostomus occidentalis</i>	n	X	X	X	X	X	X	Range extension of spawning population.
steelhead <i>Oncorhynchus mykiss</i>	N	X	X	X	X	--	X	Only juveniles collected; adults occasionally found dead.
mosquitofish <i>Gambusia affinis</i>	I	--	X	X	X	--	X	
topsmelt <i>Antherinops affinis</i>	N	--	X	X	--	--	--	
threespine stickleback <i>Gasterosteus aculeatus</i>	N	X	X	X	X	X	X	Normally ubiquitous, but none found in December 2008.
black crappie <i>Pomoxis nigromaculatus</i>	I	X	--	--	--	--	--	Very uncommon in study area catch
green sunfish <i>Lepomis cyanellus</i>	I	--	X	--	--	--	--	Very uncommon in study area catch
bluegill <i>Lepomis cyanellus</i>	I	--	X	X	--	--	--	Very uncommon in study area catch
largemouth bass <i>Micropterus salmoides</i>	I	X	X	X	X	--	X	
black bullhead <i>Ameiurus melas</i>	I	--	--	--	X	--	--	Carcass found only – no live specimens.
prickly sculpin <i>Cottus asper</i>	N	X	X	X	X	X	X	Largest was 181mm TL (June, 2006).
staghorn sculpin <i>Leptocottus armatus</i>	N	--	X	X	X	X	X	
striped mullet <i>Mugil cephalus</i>	N	--	X	--	--	--	--	Abundant young-of-year observed once: November, 2004.
starry flounder <i>Platichthys stellatus</i>	N	X	X	X	X	X	X	Largest collected was 215mm TL (April, 2007).
tidewater goby <i>Eucyclogobius newberryi</i>	N	--	--	X	X	X	X	Population established in 2005 may now be extirpated.

KEY Status: N = Native to watershed; n = Native to California, but likely introduced to watershed; I = Introduced to California

additional species observed in 2008 were non-native mosquitofish and bass. Additional information and discussion related to each of the four surveys can be found within the four summary reports prepared for each individual fish sampling survey (Rischbieter, various dates).

The severity of the fish-kill observed in June, especially the degree to which adult steelhead were impacted, seems to have had more than one contributing factor. 2008 presented an unusually dry Spring, and unseasonably-low streamflows may have been insufficient to allow return passage of adult steelhead past several beaver dams down to the ocean. Thus they were trapped in the stream later in the season than they normally would've otherwise; these mature and, for the most part, good-condition fish (ca. 600+ mm lengths) then succumbed to a rapid elimination of surface flow and falling "beaver pond" water level that reportedly occurred within a day. The day of the stream drying-up was also the peak of a particularly extreme heat wave in the Oceano area. However, large-scale irrigation groundwater pumping from nearby wells is the likely direct cause of the rapidity of the interruption in Arroyo Grande Creek surface flow. The percolation of standing pools into the substrate was also observed to be a rapid process, apparently greatly exceeding any conceivable rate of evaporation.

Staghorn sculpin, relatively common and abundant most years, seemed to disappear in 2007 but returned in moderately low numbers in 2008. The size of staghorn sculpin collected in March again suggests the lagoon provides a location for this marine species' spawning and rearing; some observed in the surf-line outlet reach (near where vehicles most frequently, efficiently, and legally ford the stream) is not unprecedented but noteworthy because one original purpose of this monitoring was to gain insight as to whether high traffic volume in the SVRA (including vehicles fording the seasonal lagoon outlet) might be affecting fish or their habitat.

Posted closure signs seemed effective at generally eliminating public encroachment into closed lagoon areas, based on observation on the survey dates of few if any straying tire tracks. Any possibility of impact was further reduced by the early and persistent closure of the lagoon's sandbar this year. Though we have concluded that fish typically do not occupy the intermittent and transitory Surf-line Outlet Reach, this reach provides access for staghorn sculpin and other species to occasionally travel, in either direction, between marine and freshwater/euryhaline habitats.

Recommendations

Continued fishery monitoring in this area will provide an opportunity to document recolonization of the restored lagoon pool and upstream areas. This would be useful information for resource managers, and surveys are anticipated to be conducted three or four times in 2009. Timing of 2009 surveys could be most insightful if they are generally scheduled in consideration of occurrence of significant hydrologic events such as following periods of flood, lagoon closing/opening, and any extended periods of low or no flow.

The current closure zone protects the aquatic resources well, but should continue to periodically be reviewed to ensure its effectiveness given the seasonally-changing configuration of the stream and lagoon. It should generally be aligned so as to include as much length and area of active

streambed as reasonably possible, to the degree practicable and consistent with necessary Park operations.

The one goby mortality (juvenile) collected in March remains in possession, preserved, because it became moribund after handling and release. Consistent with federal Recovery Permit conditions, it will be held for delivery to Dr. Dave Jacobs at UCLA, if needed as part of an ongoing genetic study. The recovery permit secured for this work further allows collection of up to 47 additional goby specimens from Arroyo Grande Creek to be contributed to that genetic study, but Dr. Jacobs collaboratively secured an adequate sample from this location in February, 2008. If goby recolonize Arroyo Grande Creek in the future, the need for additional samples to compare “old” and “new” populations will be coordinated through the U.S. Fish and Wildlife Service.

Park staff can provide useful information by remaining observant and recording unusual biological sightings and changes in hydrologic conditions. Flow estimates recorded during each sampling episode, usually cursorily estimated by eye, is probably sufficient for fishery monitoring purposes. However, because Arroyo Grande Creek appears seasonally dewatered by human activities, there may be future interest in more precisely measuring flow for legal or regulatory reasons.

Additional information can be gathered from the staff gage installed in September, 2008. Park staff periodically but irregularly compile a “log sheet” with anecdotal observations of lagoon condition, which now typically includes staff gage readings. In the future, it might be insightful to collect this information with some regularity (such as weekly). Regular, repeated observations of lagoon condition and stage can give insight to habitat volume, quality, dynamics, and other trends and tendencies. Regular observations of lagoon inflow are helpful too. Also, it probably would be useful to “survey in” the staff gage and establish its actual elevation (above mean sea level). To do so would require identification or establishment of a known elevation reference point, and a corresponding pin or line should be physically established on Milepost #1.

Future observations of unusual, large, or abundant fish observed (such as fish occasionally found dead) should be photographed, and representative specimens preserved by freezing¹; any other natural or man-made disturbances to water quality or aquatic habitat should also be documented to an appropriate degree (fuel or sewage spills, flood channel maintenance or vegetation removal, etc.). Regular observations will also be useful to aid the water quality and soil monitoring study currently being implemented, and overall they can help ensure the continued effective management and protection of the aquatic resources of Arroyo Grande Creek and Oceano Dunes SVRA.

ACKNOWLEDGEMENTS

The California Department of Parks and Recreation is grateful for the assistance provided by several staff and volunteers during data collection on the four survey dates. Staff of California

¹ Handling and storage of listed species, such as steelhead, legally requires coordination with NOAA Fisheries and/or the California Department of Fish and Game.

State Parks' Off-Highway Motor Vehicle Division (Oceano Dunes District) who assisted during one or more survey efforts include: Ronnie Glick, Joanna Iwanicha, Greg Wilvert, Ben Wagner, Jamie Miller, and Amber Clark. John Sayers and Vince Cicero of State Parks' San Luis Obispo Coast District also assisted. On behalf of California State Parks, the author also appreciated the volunteer help of Steph Wald and Shellie Hamilton (Arroyo Grande Watershed Forum and Central Coast Salmon Enhancement), Rebecca Sloan (TRA Environmental Sciences, Inc.), and student Sam Glick. Most of these individuals also took the time to review and comment on draft survey summary reports.

The staff gage installed was provided by resource staff from Calaveras Big Trees State Park, where it was surplus.

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