Tijuana River National Estuarine Research Reserve (TRNERR)

Program Manager Reports
Report Period: July 1, 2023 through December 31, 2023

TASK: OVERSIGHT AND IMPLEMENTATION OF RESERVE OPERATIONS

Chris Peregrin, TRNERR Reserve Manager, California State Parks

Report will be given at the meeting.

TASK: EDUCATION PROGRAM

Anne Marie Tipton, TRNERR Education Coordinator, California State Parks

1. Implementation of Education Programs

A. *Formal and Non-formal Teacher Training*

Education staff conducted a Tijuana Estuary Explorers training for two teachers in September. It was a hybrid training with two one-hour virtual sessions and one one-hour in-person session.

There were four M.A.R.S.H. (Marsh Awareness with Resources for Slough Habitats) orientation training sessions with five teachers total.

In partnership with Parks California, Education staff conducted a special training for an organization that serves refugees with twelve young adult instructors in December. It included our new docent Camille Locke who has developed an art therapy program with guided meditation using a singing bowl and watercolor painting.

B. *Student-centered Formal and Informal programs*

Start There were three elementary, two middle, and three high school programs in the second half of the year. Elementary programs are either M.A.R.S.H. or Tijuana Estuary Explorers. One of the original education programs of the Tijuana Estuary, M.A.R.S.H., was developed to introduce students to basic wetland and upland ecology and cultural history. The program has two components that vary depending on the grade. Tijuana Estuary Explorers" is an in-class and field trip program, targeted at 3rd - 6th grade, incorporates reading, writing, and science into four comprehensive activities about the Tijuana Estuary and its watershed.

Middle and high school program activities are selected from 10-12 rotations that are based on SWMP and other monitoring and restoration efforts. The most popular rotations are weather station and water quality, using analogue measures, and invasives service-learning, where students get to remove invasive exotic plants. Classes came from the local San Diego Unified School District.

The Education Coordinator continued carrying out the 3 virtual programs through California State Parks, Parks Online Resources for Teachers and Students (PORTS). The Reserve delivered one high school level Detecting a Changing Climate (DACC), four Can Salt Marshes Help Fight Climate Change to middle schoolers, and 19 Salt Marsh Secrets to elementary students. The programs were conducted as PORTS on-demand programs serving individual classrooms. A total of 844 students were reached through these programs.

The Reserve's virtual programs developed for PORTS are available on their own landing page on the PORTS website: https://www.ports-ca.us/PORTSon-demand/tijuana-estuary-natural-preserve.

C. *Interpretation*
EC Tipton did the Reserve's first program at the San Diego County Campground at the entrance to Border Field State Park. It was a Snowy Plover program on July 29, 2023 with 34 people. The Reserve hoped to provide programs in August and September but there were potable water and overland sewage issues.

Education staff provided a program for twenty-five 7-12th grade refugee girls, mostly from Syria. EC Tipton asked them personal resilience prompts during the upland plant activity and many of them wrote in in Arabic, a first in our memory. It was great to compare Mediterranean climate plant communities with them while referencing their home countries.

D. *Visitor Services*
Visitor Center attendance was 4,344 during this reporting period.

2. Production of Outreach Materials (18mos)
Reserve Education Staff produced an e-newsletter every month of this reporting period including highlighting volunteers, other special events, and accomplishments. TRNERR volunteers were recruited to write species spotlights for the eNews as well as for social media posts.

3. Volunteer Capacity Building
The Volunteer Coordinator and Education Specialist worked to plan and host Tijuana River Action Month together with the Stewardship and Coastal Training Programs and the Tijuana River Action Network partners (*see Stewardship and CTP*).

4. Environmental education and interpretive capacity and leadership roles
EC Tipton attended San Diego Museum Council meetings.

Task: COASTAL TRAINING PROGRAM (CTP)
Dr. Kristen Goodrich, TRNERR CTP Coordinator,
Southwest Wetlands Interpretive Association

1. Deliver training and technical assistance to coastal decision-makers

CTP delivered several trainings in this reporting period including those integrated in the inaugural Marine Debris Leadership Academy (MDLA) supported by the ResiDuos project ("Improving socio-ecological resilience through marine debris prevention and removal in the U.S.-Mexico") funded by the U.S.-Mexico-Canada Agreement and NOAA's Marine Debris Program. Through an eight-week program (across months July and August) that emphasized dimensions of adaptive leadership including expanding ways of knowing, spanning boundaries, and developing and deepening relationships, more than 40 local leaders were brought together as a binational cohort to amplify their efforts in addressing solid waste and marine debris challenges in both the U.S. and Mexico sections of the Tijuana River watershed. Trainings focused on behavior change, in partnership with NOAA's Digital Coast, and conflict transformation, in partnership with the National Conflict Resolution Center as well as other topics on transboundary management of solid waste and marine debris. In efforts to respond to need and interest in offering subsequent (and recurring) MDLAs, CTP explored coalition-building opportunities in partnership with CA Sea Grant in this reporting period. Additionally, in October, a nature-based solutions for coastal hazards 101 virtual training was delivered to CZM staff at California Coastal Commission, Conservancy, and BCDC as a result of NOAA OCM and California CTP collaboration. Additional offerings based on the needs assessment among agency staff will continue to be explored in the next reporting period among the NERRS-CZM-NOAA-OCM collaborative.

CTP continued to lead and collaborate on several NERRS Science Collaborative (NSC) transfer grant projects. During this reporting period for the NSC transfer project 'Transferring Knowledge to Understand the NERRS Niche in Addressing Marine Debris,' (NERRS' Niche) CTP conducted monthly Core Team meetings, began drafting a roadmap for the national system, met with the Project Advisory Committee and conducted two Knowledge Transfer Workshops, including at the NERRS/NERRA annual meeting in November. Another NSC transfer project, 'Engaging with Cultural Ecosystem Services Across the National Estuarine Research Reserve System' (CES), with He'eia, Kachemak Bay, and Wells NERRs, offered multiple webinars on different themes regarding the inclusion of cultural ecosystem services (CES) strategies in reserve management during which CTP presented on issues specific to TRNERR and its community connections. CTP also participates in the Resilient Roads and Reserves project to leverage California Reserves' experiences to inform how they, their state partner agencies, other California coastal managers, and the whole NERRS can better engage in planning processes involving dual management concerns for flood-vulnerable roads and adjacent coastal habitats. CTP continues to serve as collaborative lead on the Habitat Heartbeats project, assessing management applications for bivalve biosensors.

Additionally, CTP is coordinating the development of the Binational Emergency Response Guide (BERG) as a component of the ResiDUOS project. The establishment of a BERG emerged as a prioritized initiative through collaborative efforts among U.S. and Mexico agencies and stakeholders, facilitated by CTP during multiple binational workshops. This increased engagement has enhanced understanding of the local, state,

and federal response frameworks essential for facilitating a coordinated, well-managed, and prompt emergency response to incidents of debris-related flooding. Concurrently, CTP, in partnership with Waste for Life, Centro de Comunidad, and other organizations and supported by the Binational Resilience Initiative at the San Diego Foundation, continues to coordinate binational and interdisciplinary aspects of the ReCREA project, including playing a role to interpret, translate, and connect community needs, interdisciplinary academic and technical expertise, and application to coastal decision-making to inform broader solid waste management solutions in the region.

In this reporting period, CTP facilitated the discussions and signing of a Memorandum of Understanding (MOU) with the San José del Cabo estuary, represented by Los Cabos Coastkeeper. This agreement between 'Sister Estuaries' aims to enhance collaboration, foster environmental protection, and revitalize the exchange of information and experiences for the mutual benefit of both estuarine systems and the surrounding communities.

CTP offered continuous technical assistance to coastal decision-makers in local governments in both the U.S. and Mexico. This resulted in green infrastructure approaches being adopted in the Baja California state regulations, achieved through close collaboration with the Consejo Estatal de Protección al Ambiente. CTP also provided guidance to the City of Imperial Beach in its NFWF coastal resilience projects.

During this reporting period, CTP conducted several presentations for various audiences, including (but not limited to):

- Minute 320 binational working group regarding the Binational Emergency Response Guide
- Sectoral Subcommittee on Environment and Sustainable Development regarding Green Infrastructure in Tijuana
- Expoambiente 2023 organized by the Secretariat of Environment and Sustainable Development of Baja California
- Local schools, in coordination with TRNERR's Education program, on the history of habitat restoration efforts through TRNERR's non-profit association
- TRNERR's Advisory Council reporting on outcomes of the MDLA and gathering input on the BERG
- Water Education for Latino Leaders (WELL) UnTapped Fellowship during a site visit regarding binational engagement and management challenges at TRNERR
- Headwaters to Ocean (H2O) Conference as closing plenary
- Sea Grant Extension National Assembly on collective care in the climate adaptation profession

Additional, and varied, technical assistance was provided to coastal decision-makers in this reporting period, including facilitating meetings, providing survey and evaluation assistance, offering field experiences including to the California Coastal Commission in October during a meeting held in Imperial Beach, and assisting organizations with grant writing, plan/policy revisions, and strategic/action planning. A complete catalog of technical assistance and ongoing projects and partnerships can be found here.

In September, the CTP Coordinator was invited to represent the Reserves and coastal management programs, and by extension, NOAA, at the White House Summit on Building Climate Resilient Communities. A synthesis of insights informed the NCA5 report and highlighted key takeaways related to reducing climate risk through nature. They largely reflect OCM/NERRS values and work on-the-ground, including an emphasis on social infrastructure and boundary spanning and integrate messages and calls to action around the importance of partnership- and capacity-building as well as immediate needs such as efficient permitting processes for nature-based solutions. CTP has and will continue to share through its networks to help decision-makers nationwide develop effective climate resilience strategies and solutions. The synthesis is linked in the White House NCA5 fact sheet.

The CTP Coordinator continues to serve as Vice President of the National Estuarine Research Reserve Association and on various regional advisory bodies including the San Diego Regional Climate Collaborative (SDRCC) as well as other NERR system-level working groups including on topics of plastics, human dimensions, equity, and disaster resilience. The CTP Associate currently represents TRNERR on the steering committee supporting the 7th annual State of Biodiversity workshop, symposium, and assessment report in collaboration with SDRCC, San Diego Association of Governments, and the San Diego Natural History Museum. Notably, the CTP Coordinator and Associate now serve as site custodians to TRNERR as part of National Geographic's Preserving Legacies project. This project is an effort to empower communities around the globe to protect cultural and natural heritage by increasing their capacity for climate resilience. Including TRNERR, there are currently ten sites enlisted; TRNERR is the sole site in the United States and unique in its landscape typology. Strategic planning for integrating the Preserving Legacies efforts across other CTP initiatives including CES, enhancing cultural dimensions of a vulnerability assessment for Border Field State Park with California State Parks and Scripps Institution of Oceanography, philanthropic interests in building capacity in a trinational watershed, and in implementation of the Tijuana Estuary Tidal Restoration Program.

Finally, several manuscripts were in preparation and submitted in this reporting period, including (1) 'Grounded and Engaged Research as a Cross-Border Bridge: Reflections from the Binational Tijuana River Watershed' as part of the *Oxford Handbook of Grounded and Engaged Normative Theory*; and (2) 'Centering knowledge co-production in sustainability science: Why, How, and When' to a special issue of *Oceanography*.

2. Report training and technical assistance outcomes

In this reporting period, after training delivery, CTP administered post-workshop evaluations and collected and analyzed data. During the transition of the national CTP performance monitoring database, CTP staff developed an internal database system for tracking. Staff continues to populate the detailed technical assistance catalog that reflects offerings from FY16 to present. The catalog includes a separate worksheet with ongoing (i.e., multi-year) CTP technical assistance.

Additionally, in this reporting period, CTP, along with the Stewardship and Education programs, coordinated the annual Tijuana River Action Month (TRAM) in both the Mexican and U.S. sections of the watershed. During this reporting period, TRAM consisted of 13 events in Tijuana and Tecate and 4 in San Diego, totaling 17; involved the participation of 34 organizations; and resulted in 1,272 volunteers collecting 52,310 lbs of trash, 821 lbs of recycling, and 91 waste tires, working across approx. 20 acres. Evaluation from training provided during the MDLA was also collected and reported.

TASK: STEWARDSHIP PROGRAM

Lorena Warner-Lara, TRNERR Assistant Reserve Manager,
California State Parks

1. Protection and Restoration of the Tijuana River Valley

Engineering/Environmental Resources Group Inc. exported approximately 20,000 cubic yards of sediment from the processing pad and excavated approximately 22,000 cubic yards of deposition material from the Goat Canyon Sediment Basin in Fall 2023.

The Reserve Manager and Assistant Manager continue working on the Nelson Sloan Quarry Restoration Project with State Coastal Conservancy, San Diego County Parks, and consultant (Dudek) on final design and permitting. This project will help with long-term stabilization of Goat Canyon activities and can provide a receiving site for future sediment excavated from the Tijuana Estuary Tidal Restoration Program (TETRP).

2. Sensitive plant and animal species habitat protected
The Stewardship Program maintained fencing and signage along dunes and coastal bluffs with US Fish and Wildlife Service.

3. Critical monitoring needs identified to maintain habitat health and monitor impacts to sensitive species and restoration projects
The Stewardship Program facilitated continued monitoring of the CA least tern and Western snowy plover in the dune habitat of the Reserve. Regular plover and tern monitoring will begin again in March 2024. This work is largely accomplished through a contract with a private consultant and through our partnership with the US Fish and Wildlife Service staff at Tijuana Slough National Wildlife Refuge.

Supported survey work for annual monitoring of CA gnatcatcher and least Bell's vireo in the Goat Canyon drainage and Bunker Hill. Monitoring will begin again in February/March 2024.

4. On-going restoration and enhancement projects continue trajectory toward healthy vegetation communities and integrate into functional ecosystem components with continued outreach opportunities
During this period, the Retired Annuitant Environmental Scientist, the Manager and Assistant Reserve Manager continued to work with Stewardship staff to develop skills and understanding of projects to support healthy vegetation communities. One of the Stewardship Maintenance Aide positions is funded through a combination of funds from the NOAA Marine Debris and the CA State Parks Wildlife and Forest Resilience programs. The other is a split position between the Stewardship (CA State Parks) and Research (SWIA) programs funded by this NOAA operations award. The Assistant Reserve Manager also works as an Environmental Scientist for the Stewardship Program, however, is not funded by this award but is partially counted as match.

Retired Annuitant Environmental Scientist and Stewardship Maintenance Aides continued maintenance of priority restoration sites.

Assistant Reserve Manager continued to work with the Reserve Manager and Research Coordinator, SWIA Project Manager, USFWS, and project team to support the Tijuana Estuary Tidal Restoration Program (TETRP) II Phase I. During this reporting period, the Project Team worked to secure a grant application for final design, regulatory permits, and pre-restoration monitoring, as well as to support another grant for project implementation. Under the Preferred Alternative, approximately 68 acres of coastal wetlands and 15 acres of native transitional and upland habitat would be restored within the Tijuana Estuary on portions of both Border Field State Park and the Tijuana Slough National Wildlife Refuge. (*see also Oversight and Implementation and Research*)

The fourteenth annual Tijuana River Action Month (TRAM), a series of education and stewardship events held during September and October to benefit the Tijuana River Watershed, ran from September 16th to October 14th and was mostly in-person. TRAM 2023 featured **17 events** and included clean-ups, an environmental justice tour of the

river valley, environmental workshops, habitat restoration and a youth watershed art build. A total of **1,272 people** participated and cleared over **53,000 pounds of debris** and **91 tires** from approximately **20 acres** (some by heavy equipment). An electronics collection in Mexico yielded 0.7 tons. Some events were adapted due to Tropical Storm Hilary. Reserve staff from the Stewardship, Education, and Coastal Training Programs were all involved in the facilitation of TRAM with CTP heading up the work in Tijuana and Tecate. Events in the US were done in partnership with TRNERR (cross-sectoral), CSP, USFWS, SWIA, Surfrider Foundation San Diego Chapter, Friends of Friendship Park (Binational Friendship Garden), Spirit Runners, County of San Diego Parks and Recreation, Camp Surf YMCA, I Love a Clean San Diego, Jamul Indian Village, Ocean Connectors, IB Arts Bureau, and the California State Parks Foundation. Mexican partners included Proyecto Fronterizo de Educación Ambiental, Mujeres Lluvia Del Sur, el gobierno de Tecate, Ecocimarrones, Jardín Binacional, MY World México, Sintoldes, Haciendo Eco, Reto por el planeta, DesembolsateBC y Recrea, Club de Leones Tecate, Mujer VERDE Tecate, UABC, Conalep, Cetis 25, Cobach Tecate, TAPTI AC y CICEA. Funding from the NOAA Marine Debris Program helped make this year's TRAM possible.

During this period, the CSP San Diego Coast District Natural Resources Staff attempted to continue work on a stewardship project focused on site protection, invasive plant control, seed collection, propagation for restoration of rare plant habitat for Orcutt's liveforever (*Dudleya attenuata ssp. attenuata*) within the Reserve. However, due to a prolonged rainy season and subsequent water quality issues, compounded by border fence construction on Monument Mesa, access to the park and that project area was near impossible. Staff successfully accessed the site for four days July-August and brush cut and handpulled globe daisy (*Glebionis coronaria*) from the planted area; but the area again became inaccessible after Tropical Storm Hilary in August.

During this period, the Volunteer Coordinator, Stewardship Maintenance Aides, and the USFWS Acting Refuge Manager worked with the Reserve's weekly Stewardship Volunteers to maintain trails and a healthy native habitat primarily around the visitor center and the northern part of the Reserve.

5. Identify public access and safety issues within the Reserve

Stewardship staff supported the Reserve Manager in coordination with public and Reserve partners to identify high priority access issues and, where feasible, worked to maintain and enhance public access at key locations throughout the Reserve.

TASK: INVASIVE PLANT CONTROL

Lorena Warner-Lara, TRNERR Assistant Reserve Manager, California State Parks

1. High quality nesting habitat for CA Least Tern and Western Snowy Plover

No actions during this reporting period. Treatment of ice plant is typically completed in January/February.

2. High Quality Habitat for Riparian Birds

CSP Retired Annuitant Environmental Scientist and the Stewardship Maintenance Aides continued work to increase the footprint of primary treated areas and follow-up on previously treated areas. The main plants treated were castor bean (*Ricinus communis*), tree tobacco (*Nicotiana glauca*), giant reed (*Arundo donax*) and Tamarisk (*Tamarix ramosissima*) throughout the Goat Canyon drainage this period. Manual removal strategies, including hand pulling, saw, weed-wacker, and mower were used in addition to Roundup Pro Concentrate, and Pathfinder II, post-emergent, broad-spectrum herbicides.

In September 2023, under a contract with California State Parks, the American Conservation Experience trimmed over 400ft of trails, removed 212 cubic yards of fuel from around the Tijuana Estuary Visitor Center area (the equivalent of over five 40 cubic yard dumpsters full of fuel), and created defensible spaces for TRNERR buildings and carved over 600 ft of firebreak lines. This project was funded by and is part of the Wildfire and Forest Resilience Program which will remove 2.4 net acres of giant reed over 4 years to reduce fuel loading and continuity, and to improve habitat structure for the Least Bell's Vireo. This year however, access was restricted to the Arundo work site due to a malfunctioning pump station in the river valley and sewage contamination and flooding in Border Field State Park and work had to be shifted to the northern part of the Reserve. Work was supervised by the Reserve's Stewardship Maintenance Aide, R.Lopez and the CSP San Diego Coast District Natural Resources Staff.

Some annual forbs were mowed before herbicide treatment, as well as 3 to 5 acres of black mustard (*Brassica nigra*). Annual weeds were hand pulled around native plantings. Other plants treated included Russian thistle (Salsola tragus), crystalline iceplant (*Mesembryanthemum crystallinum*), mustard (*Brassica nigra*), globe daisy (*Glebionis coronaria*), stinging nettle (*Urtica urens*), bristly ox-tongue (*Helminthotheca echioides*), lens-pod white top (*Lepidium draba*), Stinkwort (*Dittrichia graveolens*), tocalote (*Cantaurea melitensis*) and fennel (*Foeniculum vulgare*).

Appropriate native plants including Arroyo Willow *(Salix lasiolepis),* Sycamore *(Plantanus racemosa),* Cottonwood *(Populus fremontii),* Coast live Oak (*Quercus agrifolia*), Bishop Pine (*Pinus muricata ssp. anthonii*), Torrey pine (*Pinus torreyana*), Tecate Cypress (*Hesperocyparis forbesii*), Mexican Elderberry (*Sambucus nigra*), Toyon (*Heteromeles arbutifolia*), Laurel sumac (*Malosma laurina*), San Diego sagewort (*Artemisia palmeri*), Spiny rush (*Juncus acutus ssp. leopoldii*), shrubs, and grasses were planted to maintain plant cover.

TASK: TEACHERS ON THE ESTUARY

Anne Marie Tipton, TRNERR Education Coordinator, California State Parks

1. Educators increase their knowledge of and appreciation of estuarine and watershed environments, as well as the necessary skills, to act as stewards of estuarine and watershed resources.

No trainings were conducted during this reporting period.

TASK: RESEARCH COORDINATION AND IMPLEMENTATION

Dr. Crooks, TRNERR Research Coordinator,
Southwest Wetlands Interpretive Association

1. Research by TRNERR staff increases local knowledge

R.Booth also leads our volunteer program, and manages volunteer involvement in our research and monitoring. This includes participation in the State of California's Marine Biotoxin Monitoring Program, assistance with field work such as vegetation monitoring and minnow trapping, and analysis of sediment samples in the laboratory.

TRNERR employees are supported in part by this award (NOAA and matching funds from the State of California and the National Fish and Wildlife Foundation), as well as leveraged external funding. A contract with M.Cordrey, a former Research Associate, advances our GIS and SWMP efforts. The research done by Reserve staff is outlined below.

2. The Reserve offers attractive opportunities for researchers

Research projects are listed in the Research and Monitoring Database. Some examples include:

- Science Collaborative projects. L.Miller (San Diego State University) is a PI on the project, Habitat Heartbeats, which is expanding on the use of biosentinel shellfish. TRNERR is also are participating in the multi-Reserve projects HiTIDER, NAMASTE, and MAREA.
- The Reserve is collaborating with a team of SDSU researchers (from the Geography, Engineering, and Public Health Departments), who are examining pollutants and hydrodynamics in the estuary, using deployed sensors (including tryptophan and dissolved organic matter) as well as field sampling. The team is working closely with Xylem / Sontek on this, and work has included use of a remote-controlled SonTek RiverSurveyor to map bathymetry near the river mouth.
- Participation in the region-wide estuarine monitoring as part of Bight '23, led by the Southern California Coastal Water Research Project. This included assessment of a variety of indicators, such as:
    - Fauna (fish and invertebrates) using cores, seines, and minnow traps
    - eDNA
    - Vegetation
    - Sediment grain size, nutrients, contaminants, and toxicity
    - Microplastics
    - Water chemistry

In addition, Dr. Crooks and Dr. Uyeda are involved in advising or supporting a number of graduate student research projects. Dr. Crooks is chair for students at the University of San Diego, and both Dr. Crooks and Dr. Uyeda serve on thesis committees. The Reserve also supports a variety of intern projects. Dr. Uyeda has been involved in supporting these projects:

- E.Gallegos, an Environmental Systems intern from UCSD, is compiling cordgrass records at the Tijuana estuary from 1989 to the present. His goal is to assess changes in cordgrass height and cover through time.
- S.Herndon, an undergraduate at UC Los Angeles, participated in an informal internship at the Tijuana Estuary from July - September 2023 under the supervision of Dr. Uyeda. Herndon examined the observations within the Southern California Coastal Community Interactions project, an iNaturalist project that contains observations of predator-prey interactions. Herndon carefully added text tags to each of the 1000+ observations to allow analysis of the types of interactions documented. In addition, Herndon generated visualizations of the timing of these predator-prey interactions and created lists of the top prey items observed for each major predator. S.Herndon has begun to write up her results as a journal article.
- R.Stiling, a current MS student at UC San Diego, completed her Environmental Systems internship at the Tijuana Estuary in 2022 under the supervision of Dr. Uyeda. Stiling examined the plant species that had previously been documented to be present in the salt marsh by Dr. E.Purer, a researcher active in the 1930s and 40s. Rebecca used iNaturalist to locate observations of the species Dr. Purer had documented in the 1930s, and searched in the field for the species that were missing. Rebecca and Dr. Uyeda are currently working on preparing a manuscript on the results of this study in collaboration with Dr. Crooks and D.Smith from CA State Parks.
- R.Partee, an Environmental Systems student at UC San Diego, used the iNaturalist database to complete her senior internship at the Tijuana Estuary under the supervision of Dr. Uyeda. Her research project was focused on how birds use the willow trees that were deposited in the estuary after being killed upstream by invasive beetles. This woody debris provided a unique structure that is not typically present within the low-lying vegetation of the marsh. In addition to mapping the woody debris using high-resolution imagery and setting her own camera trap, Partee used iNaturalist to carefully review all the photographed examples of bird usage of woody debris in the marsh. Partee examined each observation and found that raptors tended to be photographed on debris that was taller, vertically oriented, and within the marsh (rather than in open water). Non-raptors tended to be photographed on lower, more horizontally oriented, and in open water. This is noteworthy because it could be used to prioritize removal of woody debris that could be used as a perch for raptors to prey on marsh birds, particularly the endangered Ridgway's rail. Partee recently presented her research as a scientific poster at the Environmental Systems Symposium and Alumni Reunion and at the Tijuana Estuary Lunchtime Staff Sharing.

3. Restoration offers opportunities for coupled science / management

The next phase of the Tijuana Estuary Tidal Restoration Program (TETRP) is moving forward. There is now funding for final design, permitting, and pre-restoration monitoring. The TETRP Science Advisory Team (SAT), after a hiatus, has been re-engaged and a meeting for early 2024 is being planned. The SAT will help the TETRP team with embedding experimental approaches into the restoration. The primary uncertainties being addressed are creek formation with and without the creation of "starter" channels, and how slope affects to development of marsh vegetation communities.

The TRNERR Research Program is also examining the development of vegetation communities in the restored South San Diego Bay Salt Ponds, with a particular focus on how elevated water levels during the 2015-2016 El Niño affected restoration success. This is part of a broader assessment of using extreme events like El Niño as a potential preview of climate change impacts.

4. TRNERR is used as a reference site

TRNERR is a reference site included in the mitigation monitoring program for the impacts of the San Onofre Nuclear Generating Station (SONGS). A round of fish and invertebrate sampling was conducted during the fall, led by University of California Santa Barbara scientists. Data from TRNERR SWMP loggers is also used as part of the performance assessment for the restored site in northern San Diego County. In general, results from the Tijuana Estuary were concerning as very low abundances of fish and invertebrates were found, likely indicating fish / shellfish kills associated with eutrophication driven by prolonged sewage input. This appears to be particularly problematic when these inputs occur during the dry season (this is one of the first times in several decades the Reserve has seen prolonged sewage inputs during the summer, caused by sewage infrastructure failures.

There is also a mitigation project being planned for a part of the Otay River in the South San Diego Bay National Wildlife Refuge. It is likely that the Tijuana Estuary will be a reference site for this project, and TRNERR is providing input to the USFWS, the Coastal Commission and their science advisors, and consultants on reference site selection.

5. Communication of key research findings and perspectives

During this reporting period, the Reserve presented to a variety of audiences in a variety of venues. These include:

- The October Coastal Commission meeting, held in Imperial Beach. Working closely with NOAA and Commission staff, Reserve staff was able to take the Commissioners on a field trip, highlighting problems and our approaches to adaptive management (including TETRP). The Reserve Manager also presented at the meeting, and worked with Commission staff to develop letters the Commissioners presented to the state and federal government about the Tijuana River sewage crisis.
- Staff provided a tour of the Reserve for the Sea Grant Extension Assembly

meeting.
- Dr. Crooks participates in the Los Peñasquitos Lagoon Restoration Planning (with separate funding)
- Dr. Crooks works with the Southern California Wetlands Recovery Project to develop a regional monitoring program (with EPA WDPG funding to the State Coastal Conservancy).
- TRNERR updated its sister estuary MOU with Los Cabos Coast Coastkeeper, for the San Jose del Cabo estuary.
- Dr. Crooks presented a webinar on tropicalization at the State Library Webinar series.
- SWIA and the Reserve are featured in an article in High Country News
- Dr. Crooks presented at the IOOS 2023 Fall Meeting.
- Dr. Crooks attended at was part of a panel presentation at a State Parks Estuaries meeting in Santa Cruz.
- Dr. Crooks presented on eutrophication and hypoxia to the San Diego Regional Water Quality Control Board.

Dr. Uyeda is also serving on the organizing committee of Love Your Wetlands Day at Kendall-Frost marsh. Uyeda coordinates the marsh walk portion of the event, in which the general public picks up trash within the marsh as part of a guided tour. Uyeda is also organizing a series of scientific talks, so that volunteers collecting trash also have the opportunity to learn about marsh ecology from local estuarine scientists. Love Your Wetlands Day takes place in February.

6. Reporting and Database Entry
Database was updated as necessary.

TASK: IMPLEMENTATION OF THE SYSTEM-WIDE MONITORING PROGRAM
Dr. Crooks, TRNERR Research Coordinator,
Southwest Wetlands Interpretive Association

1. High quality meteorological and water quality data
NOAA SWMP funding allows SWIA and TRNERR to leverage partnerships to maintain a robust monitoring program that addresses issues relevant to the Reserve specifically, and the region as a whole. Our partners and funders include California State Parks, the USFWS, the State Coastal Conservancy, the Los Peñasquitos Lagoon Foundation, and the National Fish and Wildlife Foundation.

The Reserve operates three stations in the Tijuana River Estuary, two of them formal SWMP and one is associated with TETRP (and is being maintained in accordance with SWMP protocols). One of these sites, Boca Rio, is associated with an enhanced suite of monitoring conducted by Reserve partners (see above). This includes a web camera deployed as part of the High Performance Wireless Research and Education Network (HPWREN). Two sites are monitored in South San Diego Bay, both SWMP. TRNERR Research also maintains three telemetered sites in Los Peñasquitos Lagoon, which are

also being operated in accordance with SWMP protocols. This data is available at torreypines.trnerr.org.

These data are used for a variety of research and management efforts, including management of tidal inlets (see CHRP section as well). Monitoring data are also being used to inform active restoration planning and post-construction monitoring, including TETRP, SONGS mitigation monitoring, South San Diego Bay salt ponds restoration, and Los Peñasquitos Lagoon restoration as part of a TMDL (Total Maximum Daily Load) associated with excess sediment and freshwater.

Dr. Crooks continues to serves as Chair of SWMP Oversight Committee, which helps ensure that high-quality data is produced by the Reserves.

2. Understanding of long-term vegetation dynamics and SSAM-1

TRNERR conducted semi-annual vegetation monitoring in the fall, with the aid of volunteers. These sites include transects sampled using SWMP biomonitoring protocols. TRNERR Research also compiled our long-term data in support of the Science Collaborative NAMASTE project. Vegetation monitoring is also occurring as part of our restoration-related work.

3. Integration of monitoring with education and outreach programming

SWMP remains a centerpiece of TOTE activities, and the Reserve is planning for a training in the spring (see Education program report for more details). SWMP is also used in outreach activities, described above (Task 1: Outcome 5).

TASK: PROFESSIONAL DEVELOPMENT, TRAINING, PRESENTING
Dr. Crooks, TRNERR Research Coordinator,
Southwest Wetlands Interpretive Association

1. NERRs Integration and Leadership Development

The Research Coordinator, Manager, CTP Associate, SWIA Administrative Lead, and a Sea Grant intern attended the NERRS/NERRA annual meeting in New Jersey. This allowed information sharing and allowed for improved local, regional, and national perspectives.

2. Staff Development

This task did not occur during this reporting period.

3. TRNERR Staff Program Support and Enhancement

Travel associated with field work and meetings occurred during this reporting period.

TASK: INVASIVE SPECIES - APPLICATION OF RESEARCH TO MANAGEMENT
Dr. Crooks, TRNERR Research Coordinator,
Southwest Wetlands Interpretive Association

1. Improved understanding and management of local invaders

A central element of the SWMP vegetation monitoring is to examine the distribution and abundance of invasive plants, which is going to be used in the development of a planting plan for the TETRP site. Dr. Crooks is also adjunct faculty in the Department of Environmental and Ocean Sciences at the University of San Diego, and advises students who are working on invasive species.

Of particular interest in the general context of biological invasions is the phenomenon of tropicalization, the appearance of warm-water species in cooler climates (see also Task 1). On the Pacific Coast, San Diego and the Tijuana Estuary will likely be one of the first places these species are seen, so TRNERR is developing approaches for detecting and tracking these species. This includes the use of community science platforms (e.g., iNaturalist) and our routine long-term monitoring (see Task 2).

2. Improved regional, national, and international information sharing

The 11th meeting of Society for the Study of Marine Bioinvasions was held in Baltimore Maryland, in May, 2023. Dr. Crooks is Co-President of the society, and is currently reviewing manuscripts from the conference and is planning for the next meeting, to be held in Portugal in 2025.

TASK: MARGARET A. DAVIDSON FELLOWSHIP SUPPORT

Dr. Crooks, TRNERR Research Coordinator,
Southwest Wetlands Interpretive Association

1. Successful implementation of Davidson Fellowship

TRNERR's current Davidson Fellow, N.Grayson from the Scripps Institution of Oceanography, has shifted her project (with guidance from Dr. Crooks), and is now working on a study of a "lost" invertebrate in the estuary: the sea pansy *Renilla koellikeri*. Grayson has successfully sequenced the genome and transcriptome of this local octocoral in an area where it still exists. This work is being done in the context of exploration for natural products and biomedicine (an understudied ecosystem service). As part of her project, N.Grayson is helping to characterize the biopotential of San Diego's coastal waters, including the Reserve.

TASK: RESEARCH AND MONITORING SUPPORT

Dr. Crooks, TRNERR Research Coordinator,
Southwest Wetlands Interpretive Association

1. Facilitation of research, monitoring, and other Reserve-based activities

This did not occur during this reporting period.